NATIONAL MARINE FISHERIES SERVICE REPORT

National Marine Fisheries Service (NMFS) Northwest Region will briefly report on recent regulatory developments relevant to groundfish fisheries and issues of interest to the Pacific Fishery Management Council (Council).

NMFS Northwest Fisheries Science Center (NWFSC) will also briefly report on groundfish-related science and research activities.

Council Task:

Discussion.

Reference Materials:

1. Agenda Item E.1.a, Attachment 1: *Federal Register Notices* Published Since the Last Council Meeting.
2. Agenda Item E.1.a, Attachment 2: Letter from Frank Lockhart Declaring Petrale Sole Overfished.

Agenda Order:

a. Regulatory Activities — Frank Lockhart
b. Fisheries Science Center Activities — Elizabeth Clarke
c. Reports and Comments of Management Entities and Advisory Bodies
d. Public Comment
e. Council Discussion

PFMC
02/16/10

Agenda Item E.1.a
Attachment 1
March 2010

FEDERAL REGISTER NOTICES

Groundfish and Halibut Notices
October 28, 2009 through February 16, 2010
Documents available at NMFS Sustainable Fisheries Website

http://www.nwr.noaa.gov/Groundfish-Halibut/Groundfish-Fishery-Management Groundfish
http://www.nwr.noaa.gov/Groundfish-Halibut/Pacific-Halibut Halibut

74 FR 55468. Inseason adjustments to biennial groundfish management measures in Pacific Coast Groundfish Fishery; request for comments 10/28/09

74 FR 56805. Intent to prepare EIS for 2011-2012 Pacific Coast Groundfish Fishery biennial harvest specifications and management measures; request for comments 11/03/09

74 FR 57117. 2009 management measures for petrale sole in Pacific Coast Groundfish Fishery 11/04/09

74 FR 63751. Notice of Availability for the draft EIS on the Trawl Rationalization Program (Amendment 20) 12/04/09

74 FR 65480. 2010 harvest specifications and management measures for petrale sole in Pacific Coast groundfish fishery 12/10/09

74 FR 67137. Reapportionment of surplus Pacific whiting allocation in Pacific Coast groundfish fishery; request for comments 12/18/09

75 FR 4812. Availability of draft EIS on Intersector Allocations, Amendment 21 to Pacific Coast Groundfish Fishery Management Plan 01/29/10

75 FR 4684. Data Collection for the Pacific Coast Groundfish Fishery Trawl Rationalization Program 01/29/10

75 FR 4810. Environmental Impact Statements and Regulations. EIS No. 20090407, ERP No. D-NOA-L91034-00, Rationalization of the Pacific Coast Groundfish Limited Entry Trawl Fishery, Amendment 20 Implementation, WA, OR, and CA - 1/29/10

75 FR 5745. Proposal to approve and implement changes to Pacific Halibut Catch-Sharing Plan for regulatory Area 2A off Washington, Oregon and California; request for comments 02/04/10

PFMC
02/16/10

Agenda Item E.1.a
Attachment 2
March 2010

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Sustainable Fisheries Division F/NWR2
7600 Sand Point Way N.E., Bldg. 1
Seattle, WA 98115-0070

FEB 09 2010

RECEIVED
FEB 11 2010
PFMC

Dr. Donald McIsaac, Executive Director
Pacific Fishery Management Council
7700 NE Ambassador Place, Suite 101
Portland, Oregon 97220

Dear Dr. McIssac:

This letter is to formally notify the Pacific Fishery Management Council (Council) that the most recent stock assessment of petrale sole, conducted in 2009, indicated that the ratio between the biomass and the overfished threshold (B/B_{LIMIT}) has fallen below a value of one, and petrale sole is considered overfished. The National Marine Fisheries Service (NMFS) understands that the Council is in the process of considering revisions to the Bmsy and the overfishing threshold for petrale sole. However, regardless of any revisions, the stock is still considered overfished at this time. The overfished determination is a change in status as listed in the NMFS Species Information System database. The Council was made aware of the change in the overfished determination for petrale sole at its November 2009 meeting.

As you know, the Council recommended and NMFS implemented interim management measures effective January 1, 2010, that would benefit the stock and help facilitate rebuilding. Because this determination on petrale sole is new for 2010, the Council will be crafting a rebuilding plan as Amendment 16-5 to the Groundfish Fishery Management Plan through the 2011-2012 Management Measures and Harvest Specifications process. Through this process the Council will provide recommendations and supporting analysis for the changes that NMFS will evaluate for implementation.

We look forward to working with the Council on this important issue. Please contact me if you have any questions.

Sincerely,

Frank D. Lockhart
Assistant Regional Administrator

Pacific Whiting Fishery Summary, All Sectors, 2009

	Tribal				Shore-Based		
	Mothership	**Shoreside**	**Mothership**	**Catcher/ Processors**	**EFP[1]**	**Non-EFP**	**TOTAL**
Whiting allocation (mt)	*31,789 (original allocation 50,000)*		*24,034 (original allocation 19,665)*	*35,376 (original allocation 27,859)*	*40,738 (original allocation 34,414)*		*131,937*
ROUNDFISH (mt)							
Pacific whiting	13,453	8,928	24,091	34,620	40,522	249	121,863
Pacific cod	0.51	0.09	0.00	0.00	0.01		0.61
Lingcod	1.87	1.99	0.63	0.01	0.87		5.37
Sablefish	0.02	0.03	0.01	0.17	47.63		47.856
FLATFISH (mt)							
Dover sole	0.10	0.052	0.00	0.02	0.01		0.182
English sole	0.17	0.01	0.00	0.00	0.00		0.175
Petrale sole	0.00	0.00	0.00	0.00	0.02		0.02
Arrowtooth	0.85	2.19	1.41	0.26	3.30		8.01
Starry flounder	0.00	0.00	0.00	0.00	0.00		0
Other flatfish	0.37	0.10	0.00	0.10	0.76		1.327
ROCKFISH (mt)							
POP	0.09	0.33	1.40	0.06	4.70		6.58
Shortbelly	0.00	0.00	0.00	0.00	0.05		0.05
Widow	0.10	0.31	24.90	0.96	108.64		134.91
Canary	1.71	0.20	0.60	0.23	2.31		5.05
Chilipepper	0.00	0.00	0.01	0.00	2.45		2.46
Splitnose	0.00	0.00	0.01	0.08	1.14		1.23
Yellowtail	6.88	8.64	162.42	7.71	74.56		260.21
Shortspine thornyhead	0.12	0.00	0.00	0.38	0.13		0.63
Longspine thornyhead	0.00	0.00	0.00	0.00	0.00		0
Thornyhead,unident.	0.00	0.00	0.00	0.00	0.00		0
Darkblotched	0.00	0.00	0.20	0.11	0.87		1.18
Yelloweye	0.00	0.00	0.00	0.00	0.00		0
Black	0.00	0.02	0.00	0.00	0.00		0.017
All other rockfish	1.24	0.44	0.80	8.47	2.19		13.14
REMAINING GROUNDFISH							
Spiny Dogfish	127.97	99.48	6.78	27.81	19.91		281.95
All other groundfish	0.28	14.14	0.09	0.00	0.57		15.08
PROHIBITED SPECIES (numbers)							
Chinook salmon	821	1,321	296	22	279		2,739
Coho salmon	8	49	12	0.00	37		106
Chum salmon	11	0.00	41	0.00	2		54
Pink salmon	0.00	129	2	0.00	26		157
Sockeye salmon	0.00	0.00	0.00	0.00	0.00		0
Salmon, unident.	0.00	0.00	0.00	0.00	107		107
Steelhead	0.00	0.00	0.00	0.00	0.00		0
Pacific Halibut	12	5	39	2	35		93
Dungeness crab	0.00	0.00	0.00	0.00	104		104
NON-GROUNDFISH SPECIES (mt)							
American shad	0.24	0.07	0.79		3.30		4.4
Pacific herring	0.00	0.00	0.02		0.01		0.03
Squid (unidentified)	502.55	94.53	4.25	39.19	3.30		643.82
Jack Mackerel	0.00	0.00	0.00	1.40	0.35		1.75
Pacific Mackerel	0.00	0.00	0.00	0.00	0.01		0.01
Pacific Sardine	0.00	0.0	0.00	0.00	0.88		0.88
Mackerel (unidentified)	0.00	0.06	0.00	0.00	0.01		0.01
All other non-groundfish	0.97	0.00	0.14	12.08	8.08		21.27

[1] Weights include estimates of catch that was dumped at-sea

Agenda Item E.2
Situation Summary
March 2010

STOCK ASSESSMENT PLANNING FOR 2013-2014 MANAGEMENT MEASURES

The Council approved Amendment 17 to the Pacific Coast Groundfish Fishery Management Plan (FMP) as a means of providing for a biennial management cycle, more opportunity for public input, regulatory efficiencies, and various improvements in the management process. In this process there is a year in which assessments are done to inform decisions for the following biennial management cycle, followed by a year for deciding the new groundfish harvest specifications and management measures. This agenda item concerns planning for new groundfish stock assessments that are anticipated to be done in 2011, which will be used to decide the harvest specifications and management measures for 2013 and 2014 groundfish fisheries.

In the past, the Council has focused on overfished species and stocks experiencing directed fishing as priority candidates for stock assessment, and has shown interest in at least one new species as a stock assessment target. As an additional consideration, the Groundfish Management Team (GMT) has developed relative vulnerability scores for all Groundfish FMP species (Agenda Item E.2.b, GMT Report). Using the Productivity and Susceptibility Assessment methodology that has been developed for national use, the GMT ranked the relative vulnerability of FMP species to overexploitation. These vulnerability scores, in conjunction with other metrics such as the amount of available data to inform an assessment, how out of date an assessment might be, and recommendations for improving assessments from past Stock Assessment Review (STAR) panels and the Scientific and Statistical Committee (SSC) may be useful in developing stock assessment priorities.

The decision on which stocks to assess next year entails whether the assessment should be a full assessment that requires peer review by a STAR Panel or an update assessment that requires only a review by the Council's SSC. Council policy on this subject is to schedule no more than ten full assessments in a given year with no more than two full assessments reviewed at each STAR Panel. Therefore, a maximum of five STAR panels should be considered for next year. Dr. Elizabeth Clarke, Division Director at the National Marine Fisheries Service (NMFS) Northwest Fisheries Science Center (NWFSC), will report on proposed stock assessments and a proposed 2011 stock assessment review schedule for the next biennial fishery management cycle (Agenda Item E.2.b, Attachment 1).

There are two terms of reference that guide the stock assessment process; one which specifies how the next assessment process should occur and defines the roles and responsibilities of various entities contributing to this process and one which guides the development of rebuilding analyses that are used to develop harvest specifications and rebuilding plans for overfished species. Both terms of reference used last year are included as Agenda Item E.2.a, Attachments 1 and 2, respectively. The Council may want to modify these terms of reference for the next assessment cycle.

The Council is to consider the input from NMFS, the advisory bodies, and the public before providing a preliminary decision on 2011-2012 stock assessment priorities by species, type of assessment (full or update), and language for the draft Terms of Reference for both the Groundfish Stock Assessment and Review Process and Groundfish Rebuilding Analyses. The Council is scheduled to make final decisions on stock assessment planning at their June meeting.

Council Action:

1. **Adopt for Public Review the List of Stocks To Be Assessed in 2011.**
2. **Adopt for Public Review the Preliminary Terms of Reference for the Groundfish Stock Assessment and Review Process For 2011-2012.**
3. **Adopt for Public Review the 2011 Stock Assessment Review Schedule.**
4. **Adopt for Public Review the Preliminary Terms of Reference for Groundfish Rebuilding Analyses.**

Reference Materials:

1. Agenda Item E.2.a, Attachment 1: Terms of Reference for the Groundfish Stock Assessment and Review Process for 2009-2010.
2. Agenda Item E.2.a, Attachment 2: Terms of Reference for Groundfish Rebuilding Analyses.
3. Agenda Item E.2.b, NMFS Report: Possible Schedule for West Coast Groundfish Assessments in 2011 and Beyond.
4. Agenda Item E.2.b, GMT Report: GMT Report on Assigning Vulnerability Scores to All Species in the Groundfish FMP.

Agenda Order:

a. Agenda Item Overview — John DeVore
b. Reports and Comments of Management Entities and Advisory Bodies
c. Public Comment
d. **Council Action:** Adopt for Public Review the Preliminary Terms of Reference, List of Stocks to be Assessed, and Stock Assessment Review Schedule

PFMC
02/18/10

Agenda Item E.2.a
Attachment 1
March 2010

TERMS OF REFERENCE

FOR THE

GROUNDFISH STOCK ASSESSMENT AND REVIEW PROCESS FOR 2009-2010

DECEMBER 2008

Roster published by the Pacific Fishery Management Council pursuant to National Oceanic and Atmospheric Administration contract number NA05NMF4410008.

TERMS OF REFERENCE FOR THE
GROUNDFISH STOCK ASSESSMENT AND REVIEW PROCESS FOR 2009-2010

Introduction

The purpose of this document is to convey expectations and responsibilities for various participants in the groundfish stock assessment review (STAR) process, and outline the guidelines and procedures for a peer review process for the Pacific Fishery Management Council. The STAR panel process is designed to establish a peer review process as referenced in the 2006 Reauthorization of the Magnuson-Stevens Fishery Conservation and Management Act, which states that " the Secretary and each Regional Fishery Management Council may establish a peer review process for that Regional Fishery Management Council for scientific information used to advise the Regional Fishery Management Council about the conservation and management of the fishery (see Magnuson-Stevens Act section 302(g)(1)(E)). If a peer review process is established, it should investigate the technical merits of stock assessments and other scientific information used by the Council's Scientific and Statistical Committee (SSC). The peer review process is not a substitute for the SSC and should work in conjunction with the SSC." This document will be included in the Council's Statement of Organization, Practices and Procedures as part of the review process that will verify the scientific advice from the SSC.

Parties involved in implementing the peer review process described here are the Pacific Fishery Management Council members (Council), Council staff, and members of the Council's Advisory Bodies, including the SSC, the Groundfish Management Team (GMT), the Groundfish Advisory Subpanel (GAP), the National Marine Fisheries Service (NMFS), state agencies, and interested persons. The STAR process is a key element in an overall process designed to review the technical merits of stock assessments and other scientific information used by the SSC. This process will allow the Council to make timely use of new fishery and survey data, to analyze and understand these data as completely as possible, to provide opportunity for public comment, and to assure that the results are as accurate and error-free as possible.

This current edition of the Terms of Reference reflects many recommendations from previous participants in the STAR process, including STAR panel members, SSC members, stock assessment teams (STATs), Council staff, and Council advisory groups. Nevertheless, no set of guidelines can be expected to deal with every contingency, and all participants should anticipate the need to be flexible and to address new issues as they arise.

Hilborn and Walters (1992) define stock assessments as involving "the use of various statistical and mathematical calculations to make quantitative predictions about the reactions of fish populations to alternative management choices." In this document, the term "stock assessment" includes activities, analyses and reports, beginning with data collection and continuing through to scientific recommendations and information presented to the Council and its advisors. Stock assessments provide the fundamental basis for management decisions on groundfish harvests. To best serve that purpose, stock assessments should attempt to identify and quantify major uncertainties, balance realism and parsimony, and make best use of the available data.

STAR Goals and Objectives

The goals and objectives for the groundfish assessment and review process are to:

a) Ensure that groundfish stock assessments provide the kinds and quality of information required by the Council process.
b) Satisfy the Magnuson-Stevens Fisheries Conservation and Management Act (MSA) and other legal requirements.
c) Provide a well-defined, Council-oriented process that ensures groundfish stock assessments are the "best available" scientific information, and facilitates use of the information by the Council. In this context, "well-defined" means with a detailed calendar, explicit responsibilities for all participants, and specified outcomes and reports.
d) Provide an independent external review of groundfish stock assessment work.
e) Increase understanding and acceptance of groundfish stock assessment and review work by all members of the Council family.
f) Identify research needed to improve assessments, reviews, and fishery management in the future.
g) Use assessment and review resources effectively and efficiently.

All parties have a stake in assuring adequate technical review of stock assessments. NMFS, as the designee of the Secretary of Commerce, must determine that the best scientific advice has been used when it approves fishery management recommendations made by the Council. The Council uses advice from the SSC to determine whether the information on which it will base its recommendation is the "best available" scientific advice. Fishery managers and scientists providing technical documents to the Council for use in management need to assure that the work is technically correct. Program reviews, in-depth external reviews, and peer-reviewed scientific publications are used by federal and state agencies to provide quality assurance for the basic scientific methods used to produce stock assessments. However, the time-frame for this sort of review is not suited to the routine examination of assessments that are, generally, the primary basis for a harvest recommendation.

The Council and the Secretary Commerce have primary responsibility to create and foster a successful STAR process. The Council will oversee the process and involve its standing advisory committees, especially the SSC. NMFS will provide a coordinator to facilitate and assist in overseeing the process. Together they will consult with all interested parties to plan, prepare terms of reference, and develop a calendar of events and a list of deliverables for final approval by the Council. NMFS and the Council will share fiscal and logistical responsibilities.

Stock Assessment Priorities

Stock assessments for west coast groundfish are conducted to assess abundance, trends, and appropriate harvest levels for these species. Assessments use statistical population models to analyze and integrate a variety of survey, fishery, and biological data. Due to the large number of groundfish species that have never been assessed, it is the goal of the Council to increase substantially the number of assessed stocks. A constraint on reaching that objective is the Council's multi-year management regime, which limits assessment activities to odd years only (e.g., 2009).

The SSC recommended and the Council adopted in April 2006 a new process to initiate development of criteria for prioritizing stock assessments that may include such factors as: 1) economic or regional importance, 2) overfished status, 3) demographic sensitivity, 4) time elapsed since the last assessment (NMFS encourages assessments be updated at least once every 5 years), 5) data richness, 6) potential risk to the stock from the current or foreseeable management regime, and 7) qualitative trends from fishery-independent surveys (if available), etc. In establishing stock assessment priorities a number of factors are considered, including:

1. Assessments should take advantage of new information, especially indices of abundance from fishery-independent surveys.
2. Overfished stocks that are under rebuilding plans should be evaluated to ensure that progress towards achieving stock recovery is adequate.
3. Any stock assessment that is considered for use in management should be submitted through normal Council channels and reviewed at STAR panel meetings.
4. The proposed stocks for assessment should be discussed by the Council at least a year in advance to allow sufficient time for assembly of relevant assessment data and for arrangement of STAR panels.

Terms of Reference for STAR panels and Their Meetings

The principal responsibilities of the STAR panel are to review stock assessment documents, data inputs, analytical models, and to provide complete STAR panel reports for all reviewed species. The objective of the STAR panel review is to complete a detailed evaluation of the results of a stock assessment, which puts the panel in a good position to advance the best available scientific information to the Council. The STAR panel's work includes:

1. reviewing draft stock assessment documents and any other pertinent information (e.g., previous assessments and STAR panel reports, if available);
2. working with STAT Teams to ensure assessments are reviewed as needed;
3. documenting meeting discussions; and
4. reviewing revised stock assessment documents before they are forwarded to the SSC.

In most circumstances a STAR Panel will include a chair appointed from the SSC's Groundfish Subcommittee and three other experienced stock assessment analysts. Of these three other members, at least one should be familiar with west coast groundfish stock assessment practices and at least one should be appointed from the Center for Independent Experts (CIE). Selection of STAR panelists should aim for balance between outside expertise and in-depth knowledge of west coast fisheries, data sets available for those fisheries, and modeling approaches applied to west coast groundfish species. Reviewers should not have financial or personal conflict of interests. The majority of panelists should be experienced stock assessment scientists (i.e., individuals who have done stock assessments using current methods). STAR panelists should be knowledgeable about the specific modeling approaches being reviewed, which in most cases will be statistical age- and/or length-structured assessment models. Every attempt should be made to identify one reviewer that can consistently attend all panels. It is recognized that the pool of qualified reviewers is limited, and that staffing of STAR panels is subject to constraints that may make it difficult to achieve these objectives. In addition to panel members, STAR meetings will include GMT and GAP advisors with responsibilities described in their terms of reference. STAR panels normally meet for one week.

In general no more than 2 full assessments will be reviewed by a STAR panel. In exceptional circumstances this number may be exceeded, if the SSC and NMFS Stock Assessment Coordinator (SAC) conclude that it is advisable, feasible, and/or necessary to do so. When separate assessments are conducted at the sub-stock level (i.e., black rockfish) each assessment will be considered a full assessment for review purposes. Contested assessments, in which alternative assessments are brought forward by competing STAT teams using different modeling approaches, will typically require additional time (or panel members) to review adequately, and should be scheduled accordingly. While contested assessments are likely to be rare, they can be accommodated in the STAR panel review process. STAR panels should thoroughly evaluate each analytical approach, comment on the relative merits of each, and, when conflicting results are obtained, attempt to identify the reasons for the differences. STAR panels are charged with selecting a preferred base model, which will be more difficult when there are several modeling approaches from which to choose.

The STAR panel chair is responsible for: 1) developing an agenda for the STAR panel meeting, 2) ensuring that STAR panel members and STAT teams follow the Terms of Reference, 3) participating in the review of the assessment, 4) guiding the STAR panel and STAT team to mutually agreeable solutions, and 5) coordinating review of final assessment documents.

The STAR panel, STAT Team, GAP and GMT advisors, and all interested parties are legitimate meeting participants that must be accommodated in discussions. It is the STAR panel chair's responsibility to manage discussions and public comment so that work can be completed.

The STAR panel's terms of reference solely concern technical aspects of the stock assessment. It is therefore important that the panel should strive for a risk neutral perspective in its reports and deliberations. Assessment results based on model scenarios that have a flawed technical basis, or are questionable on other grounds, should be identified by the panel and excluded from the set upon which management advice is to be developed. It is recognized that a broad range of results should be reported to better define the scope of the accepted model results. The STAR panel should comment on the degree to which the accepted model scenarios describe and quantify the major sources of uncertainty, and the degree to which the probabilities associated with these scenarios are technically sound. The STAR panel may also provide qualitative comments on the probability of various model results, especially if the panel does not believe that the probability distributions calculated by the STAT capture all major sources of uncertainty.

Recommendations and requests to the STAT Team for additional or revised analyses must be clear, explicit and in writing. A written summary of discussion on significant technical points and lists of all STAR panel recommendations and requests to the STAT Team are required in the STAR panel's report. This should be completed (at least in draft form) prior to the end of the meeting. It is the chair and panel's responsibility to carry out any follow-up review work that is required.

Under ideal circumstances, the STAT Team and STAR panel should strive to reach a mutual consensus on a single base model, but it is essential that uncertainty in the analysis be captured and communicated to managers. A useful way of accomplishing this objective is to bracket the base model along what is deemed to be the dominant dimension of uncertainty (e.g., spawner-recruit steepness or R_0, natural mortality rate, survey catchability, recent year-class strength, weights on conflicting CPUE series, etc.). Alternative models should show contrast in their management implications, which in practical terms means that that they should result in different estimates of current stock size, stock depletion, and acceptable biological catch (ABC).

Once a base model has been bracketed on either side by alternative model scenarios, which capture the overall degree of uncertainty in the assessment, a 2-way decision table analysis (states-of-nature versus management action) is the preferred way to present the repercussions of uncertainty to management. An attempt should be made to develop alternative model scenarios such that the base model is considered twice as likely as the alternative models, i.e., the ratio of probabilities should be 25:50:25 for the low stock size alternative, the base model, and the high stock size alternative (Figure 1). Potential methods for assigning probabilities include using the statistical variance of the model estimates of stock size, posterior Monte Carlo simulation, or expert judgment, but other approaches are encouraged as long as they are fully documented. Bracketing of assessment results could be accomplished in a variety of ways, but as a matter of practice the STAR panel should strive to identify a single preferred base model when possible, so that averaging of extremes doesn't become the *de facto* choice of management.

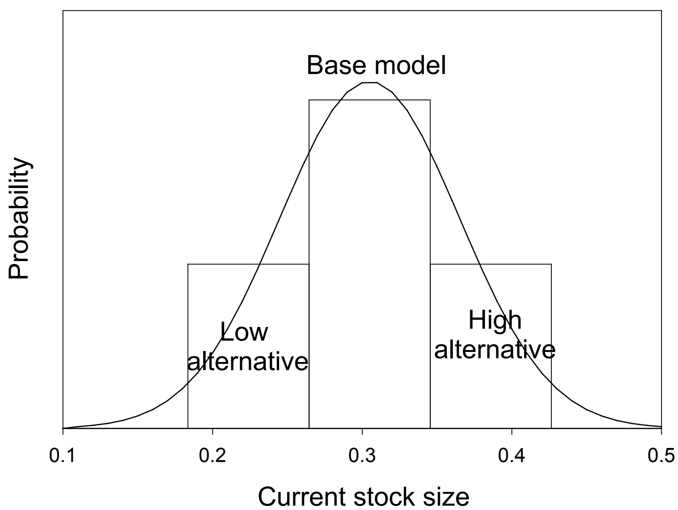

Figure 1. Example of assigning probabilities to alternative models using uncertainty in the estimate of current stock size.

To the extent possible, additional analyses required in the stock assessment should be completed during the STAR panel meeting. It is the obligation of the STAR panel chair, in consultation with other panel members, to prioritize requests for additional STAT Team analyses. Moreover, in situations where a STAT team arrives with a well-considered, thorough assessment, it may be that the panel can conclude its review in less time than has been allotted to the meeting (i.e., early dismissal of a STAT Team is an option for well-constructed assessments). If follow-up work by the STAT Team is required after the review meeting, then it is the panel's responsibility to track STAT Team progress. In particular, the chair is responsible for communicating with STAT Teams (by phone, e-mail, or any convenient means) to determine if the revised stock assessment and documents are complete and ready to be used by managers in the Council family. If stock assessments and reviews are not complete at the end of the STAR panel meeting, then the work must be completed prior to the SSC meeting where the post-STAR draft assessment is reviewed. Any post-STAR drafts of the stock assessment must be reviewed by the STAR panel or the chair if delegated that authority by the STAR panel. Assessments cannot be given to Council staff for distribution unless first endorsed by the STAR panel chair. Likewise, the final draft that is published in the Council's Stock Assessment and Fishery Evaluation (SAFE) document must also be approved by the STAR panel chair prior to being accepted by Council staff.

The STAR panel's primary duty is to conduct a peer review of an assessment that is presented by a STAT Team; STAR panel meetings are not workshops. In the course of this review, the panel may ask for a reasonable number of sensitivity runs, additional details of existing assessments, or similar items from the STAT team. It would not be unusual for this evaluation to result in a change to the initial base model, provided both the STAR panel and the STAT team agree. The STAR panels are expected to be judicious in their requests of the STAT teams, recognizing that some issues uncovered during review are best flagged as research priorities, and dealt with more effectively and comprehensively between assessments. The STAR panel may also request additional analysis based on an alternative approach. However, the STAR panel is not authorized to conduct an alternative assessment representing its own views that are distinct from those of the STAT Team, nor can it impose an alternative assessment on the Team. Similarly, the panel should not impose as a requirement their preferred methodologies when such is a matter of professional opinion. Rather, if the panel finds that an assessment is inadequate, it should document and report that opinion and, in addition, suggest remedial measures that could be taken by the STAT team prior to the scheduled mop-up panel review to rectify whatever perceived shortcomings may exist. The SSC will make a final recommendation on whether an assessment should be reviewed during the mop-up panel.

STAT Teams and STAR panels are required to make a good-faith attempt to resolve any areas of disagreement during the meeting. Occasionally, fundamental differences of opinion remain between the STAR panel and STAT Team that cannot be resolved by discussion. In such cases, the STAR panel must document the areas of disagreement in its report. In exceptional circumstances, the STAT team may choose to submit a supplemental report supporting its view, but in the event that such a step is taken, an opportunity must be given to the STAR panel to prepare a rebuttal. These documents will then be appended to the STAR panel report as part of the record of the review meeting. Likewise, STAR panel members may have fundamental disagreements that cannot be resolved during the STAR panel meeting. In such cases, STAR panel members may prepare a minority report that will become part of the record of the review meeting. The SSC will then review all information pertaining to STAR panel or STAR panel/STAT team disputes, and issue its recommendation.

The STAR panel is responsible for determining if a stock assessment document is sufficiently complete according to Appendix B. It is also the panel's responsibility to identify assessments that cannot be reviewed or completed for any reason. The panel's decision that an assessment is complete should be made by consensus. If a panel cannot reach agreement, then the nature of the disagreement must be described in the panel's report. Moreover, if a stock assessment is deemed to be stable in its approach to data analysis and modeling, the STAR panel should recommend that the assessment be considered as an update during the next stock assessment cycle.

For some species the available data will be insufficient to calculate reliable estimates of F_{MSY} (or its proxy), B_{MSY} (or its proxy), ending biomass or unfished biomass, etc. Typically, results from a "data-poor" assessment are unable to produce all of the required reporting elements outlined in Appendix B (Outline for Groundfish Stock Assessment Documents). In particular, estimation of current exploitable biomass and/or stock depletion may be impossible, although both quantities are essential components of the Council's current 40-10 groundfish harvest policy. Nonetheless, information that is potentially useful to management is often generated in a data-poor assessment, e.g., current spawning potential ratio (SPR). Therefore, in situations where the STAT team is unable to produce a full assessment with all the model outputs required by the Council's default harvest control rule, a "Data Report" can be developed that summarizes all the pertinent findings of the stock assessment. To the extent practicable Appendix B will serve as a guide to the contents of a Data Report.

It is the responsibility of the STAR panel, in consultation with the STAT Team, to consider the validity of inferences that can be drawn from an analysis presented in a Data Report. If useful but incomplete results have been developed, the panel should review the reliability and appropriateness of the methods used to draw conclusions about stock status and/or exploitation potential and either recommend or reject the analysis on the basis of its ability to introduce useful information into the management process. If the STAR panel believes that important information has been developed, it should forward its findings and conclusions to the SSC and Council for consideration during the setting of ABCs and optimum yields (OYs). The current harvest control rule cannot be applied using the results from a Data Report. However, these results can be used for management decision-making. For example, a Data Report could provide information on the trend in abundance and hence changes from status quo management. A key section of the Data Report is that on research needed to improve the assessment. Highlighting research priorities in a Data Report should increase the likelihood that future stocks assessments will satisfy the Groundfish Stock Assessment Terms of Reference.

The STAR panel chair is expected to attend Council meetings and GMT meetings (when requested) and where stock assessments and harvest projections are discussed to explain the reviews and provide other technical information and advice. The chair, in coordination with the STAT team, is responsible for providing the Stock Assessment Coordinator and Council staff with a suitable electronic version of the panel report.

Suggested Template for STAR Panel Report

1. Summary of the STAR panel meeting containing:
   A. Name and affiliation of STAR panel members;
   B. List of analyses requested by the STAR panel, the rationale for each request, and brief summary of the STAT response to the request; and
   C. Description of base model and alternative models used to bracket uncertainty.
2. Comments on the technical merits and/or deficiencies in the assessment and recommendations for remedies.
3. Explanation of areas of disagreement regarding STAR panel recommendations:
   A. Among STAR panel members (including concerns raised by GAP and GMT representatives); and
   B. Between the STAR panel and STAT Team.
4. Unresolved problems and major uncertainties, e.g., any special issues that complicate scientific assessment, questions about the best model scenario.
5. Management, data, or fishery issues raised by the GMT or GAP representatives during the STAR panel.
6. Prioritized recommendations for future research and data collection.

Terms of Reference for Groundfish STAT Teams

In order to be sufficient for peer review, the STAT team will carry out its work according to these terms of reference and the calendar for groundfish stock assessments.

All relevant stock assessment workshops should be attended by all STAT team members. The STAT Team shall include in both the STAR panel draft and final assessment all data sources that include the species being assessed, identify which are used in the assessment, and provide the rationale for data sources that are excluded. The STAT Team is obliged to keep the GAP representative informed of the specific data being used in the stock assessment. The STAT team is expected to initiate contact with the GAP representative at an early stage in the process, and to be prepared to respond to concerns about the data that might be raised. The STAT Team should also contact the GMT representative for information about changes in fishing regulations that may influence data used in the assessment.

STAT teams are strongly encouraged to develop assessments in a collaborative environment, such as by forming working groups, holding pre-assessment workshops, and consulting with other stock assessment scientists. STAT teams are also encouraged to also organize independent meetings with industry and interested parties to discuss issues, questions, and data. Each STAT Team will appoint a representative to coordinate work with the STAR panel. Barring exceptional circumstances, all STAT team members should attend the STAR panel meeting.

Each STAT Team conducting a full assessment will appoint a representative who will be available to attend the Council meeting where the SSC is scheduled to review the assessment, and will typically give presentations of the assessment to the SSC and to other Council advisory bodies. In addition, the STAT Team should be prepared to respond to GMT requests for model projections during the GMT's development of ABC and OY alternatives.

The STAT Team is responsible for preparing three versions of the stock assessment document: 1) a complete "draft" including an executive summary (except for decision tables) for discussion at the stock assessment review meeting; 2) a "revised draft" for distribution to the Council and advisory bodies for discussions about preliminary ABC and OY levels; 3) a "final" version to be published in the SAFE report. Post-STAR panel drafts must be reviewed by the STAR panel prior to being submitted to Council staff, but these reviews are limited to editorial issues, verifying that the required elements are included according to the Terms of Reference, and confirming that the document reflects the discussions and decisions made during the STAR panel. Other than changes authorized by the SSC, only editorial and other minor alterations should be made between the "revised draft" and "final" versions. The STAT Team will provide "draft" assessment documents to the STAR panel chair, Council staff, and the NMFS SAC three weeks in advance of the STAR panel meeting to allow timely review of the draft assessment to ensure the required elements of a draft assessment are included according to the Terms of Reference. If the draft assessment is judged complete, the NMFS groundfish SAC will distribute the draft assessment and relevant supporting materials to the STAR panel, Council staff, the SSC Groundfish subcommittee, and GMT and GAP representatives at least two weeks prior to the STAR panel meeting.

Complete, fully-developed assessments are critical to the STAR panel process. Draft assessments will be evaluated for completeness prior to the STAR panel meeting, and assessments that do not satisfy minimum criteria will not be reviewed. The full draft assessment document should be available for distribution three weeks prior to the STAR panel meeting to determine if it is sufficient for review. The STAR panel chair, Council staff, and the NMFS SAC will make an initial recommendation, which will then be reviewed by the SSC Groundfish Subcommittee members, if it is determined that the draft assessment is not sufficiently complete. In such cases, a list of deficiencies will be provided to the STAT Team to allow completion of the draft assessment prior to distribution to the STAR panel. The draft document should include all elements listed in Appendix B except the: 1) decision table, 2) harvest projections, 3) population abundance tables, 4) point-by-point responses to current STAR panel recommendations, and 5) acknowledgements. Incomplete assessments or those provided after the requisite deadlines in Appendix A will be either moved to the mop-up panel, or postponed to a subsequent assessment cycle. In general, the mop-up panel will not be able to review more than two assessments, so the options are limited for assessments that are not completed on time.

The STAT Team is responsible for bringing computerized data and working assessment models to the review meeting in a form that can be analyzed on site. STAT Teams should take the initiative in building and selecting candidate models and should have several complete models ready to present to the STAR panel and be prepared to discuss the merits of each. The STAT team should identify a candidate base model, fully documented in the draft assessment, for STAR panel consideration. Fully developed assessments that are properly documented should require less time to review and approve than poorly constructed, incomplete assessments.

In most cases, the STAT Team should produce a complete draft of the assessment within three weeks of the end of the STAR panel meeting, including any internal agency review. In any event, the STAT Team must finalize the assessment document before the briefing book deadline for the Council meeting at which the assessment is scheduled for review.

The STAT Team and the STAR panel may disagree on technical issues regarding an assessment, but a complete stock assessment must include a point-by-point response by the STAT Team to each of the STAR panel's recommendations. Estimates and projections representing all sides of the disagreement need to be presented to, reviewed by, and commented upon by the SSC.

For stocks that are projected to fall below overfished thresholds, the STAT Team must complete a rebuilding analysis according to the SSC's Terms of Reference for Groundfish Rebuilding Analyses. It is recommended that this analysis be conducted using the rebuilding software developed by Dr. Andre Punt (aepunt@u.washington.edu). The STAT Team is also responsible for preparing a document that summarizes the results of the rebuilding analysis.

Electronic versions of final assessment documents, rebuilding analyses, parameter files, data files, and key output files will be sent by the STAT Teams to Council staff and the SAC for inclusion in a stock assessment archive. Any tabular data that are inserted into the final documents in and object format should also be submitted in alternative forms (e.g., spreadsheets), which allow selection of individual data elements.

Terms of Reference for Stock Assessment Updates

The STAR process is designed to provide a comprehensive, independent review of a stock assessment. In other situations a less comprehensive review of assessment results is desirable, particularly in situations where a "model" has already been critically examined and the objective is to simply update the model by incorporating the most recent data. In this context a model refers not only to the population dynamics model *per se*, but to the particular data sources that are used as inputs to the model, the statistical framework for fitting the data, and the analytical treatment of model outputs used in providing management advice, including reference points, the ABC and OY. These terms of reference establish a procedure for a limited but still rigorous review for stock assessment models that fall into this latter category. However, it is recognized that what in theory may seem to be a simple update, may in practice result in a situation that is impossible to resolve in an abbreviated process. In these cases, it may not be possible to update the assessment – rather the assessment may need to be revised in the next full assessment review cycle.

Qualification

The SSC will determine whether a stock assessment qualifies as an update under these terms of reference. Recommendation by a STAR panel or the SSC that a full assessment is suitable for an update will be a principal criterion in this determination. To qualify, a stock assessment must carry forward its fundamental structure from a model that was previously reviewed and endorsed by a STAR panel. In practice this means similarity in: a) the particular sources of data used, b) the analytical methods used to summarize data prior to input to the model, c) the software used in programming the assessment, d) the assumptions and structure of the population dynamics model underlying the stock assessment, e) the statistical framework for fitting the model to the data and determining goodness of fit, f) the procedure for weighting of the various data components, and g) the analytical treatment of model outputs in determining management reference points, including F_{MSY}, B_{MSY}, and B_0. A stock assessment update is appropriate in situations where no significant change in these seven factors has occurred, other than extending time series of data elements within particular data components used by the model (e.g., adding information from a recently completed survey and an update of landings). Extending CPUE time series based on fitted models (i.e., GLM models) will require refitting the model and updating all values in the time series. Assessments using updated CPUE time series qualify as updates if the CPUE standardization models follow applicable criteria for assessment models described above. In practice there will always be valid reasons for altering a model, as defined in this broad context, although, in the interests of stability, such changes should be resisted as much as possible. Instead, significant alterations should be addressed in the next subsequent full assessment and review.

Composition of the Review panel

The Groundfish Subcommittee of the SSC will conduct the review of a stock assessment update. A lead reviewer for each updated assessment will be designated by the chair of the Groundfish Subcommittee from among its membership, and it will be the lead reviewer's responsibility to ensure the review is completed properly and that a written report of the proceedings is produced. In addition, the GMT and the GAP will designate one person each to participate in the review.

Review Format

All stock assessment updates will be reviewed during a single meeting of the SSC Groundfish Subcommittee scheduled early in the assessment cycle. This meeting may precede or follow a normally scheduled SSC meeting. The review process will be as follows. The STAT team preparing the update will distribute the updated stock assessment to the review panelists at least two weeks prior to the review meeting. In addition, Council staff will provide panelists with a copy of the last stock assessment reviewed under the full STAR process, as well as the previous STAR panel report. Review of stock assessment updates is not expected to require analytical requests or model runs during the meeting, although large or unexpected changes in model results may necessitate some model exploration. The review will focus on two crucial questions: 1) has the assessment complied with the terms of reference for stock assessment updates and 2) are new input data and model results sufficiently consistent with previous data and results that the updated assessment can form the basis of Council decision-making. If either of these criteria is not met, then a full stock assessment will be required.

STAT Team Deliverables

Since there will be limited opportunities for revision during the review meeting, it is the STAT team's responsibility to provide the panel with a completed update at least two weeks prior to the meeting. To streamline the process, the team can reference whatever material it chooses, including that presented in the previous stock assessment (e.g., a description of methods, data sources, stock structure, etc.). However, it is essential that any new information being incorporated into the assessment be presented in enough detail, so that the Groundfish Subcommittee can determine whether the update satisfactorily meets the Council's requirement to use the best available scientific information. Of particular importance will be a retrospective analysis showing the performance of the model with and without the updated data streams. Likewise, a decision table that highlights the consequences of alternative states of nature would be useful to the Council in adopting annual specifications. Similarly, if any minor changes to the "model" structure are adopted, above and beyond updating specific data streams, a sensitivity analysis to those changes will be required.

In addition to documenting changes in the performance of the model, the STAT Team will be required to present key assessment outputs in tabular form. Specifically, the STAT Team's final update document should include the following:

- Title page and list of preparers;

- Executive Summary (see Appendix C);
- Introduction;
- Documentation of updated data sources;
- Short description of overall model structure;
- Complete base-run results, including a tabular summary of total and spawning stock biomass and recruitment time series;
- Uncertainty analysis, including retrospective analysis, decision table, etc.; and
- 10 year harvest projections under the default harvest policy.

Groundfish Subcommittee Report

The Groundfish Subcommittee will issue a report that will include the following items:

- Name and affiliation of panelists;
- Comments on the technical merits and/or deficiencies of the update;
- Explanation of areas of disagreement among panelists and between the panel and STAT team; and
- Recommendation regarding the adequacy of the updated assessment for use in management.

Council Staff Responsibilities

A Council staff officer will be assigned to coordinate, monitor and document the STAR process. The Council staff officer will be responsible for timely issuance of meeting notices and distribution of stock assessment documents, stock summaries, meeting minutes, and other appropriate documents. The Council staff officer will monitor compliance with the Terms of Reference for the 2009-10 groundfish STAR process. The Council staff officer will coordinate materials and presentations for Council meetings relevant to final Council adoption of groundfish stock assessments. Council staff will also collect and maintain file copies of reports from each STAR Panel (containing items specified in the STAR Panel Terms of Reference), the outline for groundfish stock assessment documents, SSC, GMT, and GAP comments and reports, letters from the public, and any other relevant information. At a minimum, the stock assessments (STAT reports, STAR Panel reports, and stock summaries) should be published and distributed in the Council annual SAFE document.

A primary role for the Council staff officer assigned to the 2009-10 STAR process will be to monitor STAR Panel and SSC activities to ensure compliance with these Terms of Reference. The Council staff officer will coordinate with the STAR Panel chair and the NMFS SAC in a review of STAT documents to assure they are received on time, are consistent with the Terms of Reference, and are complete. If the STAT materials are obviously not in compliance with the Terms of Reference, the Council staff officer will return the materials to STAT authors with a list of deficiencies, a notice that the deadline has expired, or both. The Council staff officer will attend all STAR panel meetings to ensure continuity and adherence to the Stock Assessment Terms of Reference. The Council staff officer will identify inconsistencies with the Terms of Reference that occur during STAR Panels and work with the STAR Panel chair to develop solutions and to correct them. The Council staff officer will review the Executive Summary for consistency with the Terms of Reference. Inconsistencies will be identified and the authors requested to make appropriate revisions in time for the appropriate SSC and GMT meetings, when an assessment is considered. The Council staff officer will also coordinate and monitor SSC review of stock assessments and STAR Panel reports to ensure compliance with these Terms of Reference and the independent review requirements of Council Operating Procedure 4. The Council staff officer will also identify one STAR Panel member with experience conducting west coast groundfish stock assessments.

National Marine Fisheries Service Responsibilities

NMFS Northwest Fisheries Science Center (NWFSC) will provide a SAC to work with the Council, other agencies, groups, or interested persons that carry out assessment work to assist in organizing the STAT and STAR Panels. Since most assessments are conducted by NMFS STATs, the SAC will work with assessment authors to develop a draft list of assessments to be considered by the Council. The SAC also will develop a draft STAR Panel schedule for review by the Council. The SAC will identify two independent STAR panelists following criteria for reviewer qualifications. The SAC will make every effort to identify one independent reviewer that can attend all STAR Panels to provide consistency among reviews. The costs associated with these two reviewers will be borne by

NOAA Fisheries. The SAC will coordinate with STAT authors to facilitate delivery of materials by scheduled deadlines and in compliance with other requirements of these Terms of Reference, to the extent possible and with the assistance of the assigned Council staff officer and the STAR Panel chair.

Following any modifications to the stock assessments resulting from STAR Panel reviews and prior to SSC review, the SAC will assist the Council staff officer in reviewing the Executive Summary for consistency with the Terms of Reference. Inconsistencies will be identified and the authors requested to make appropriate revisions in time for the appropriate SSC and GMT meetings.

STAT Team Responsibilities

The STAT is responsible for conducting a complete and technically sound stock assessment that conforms to accepted standards of quality, and make sure that work is carried out in a timely fashion according to the calendar and terms of reference. The STAT will conduct its work and activities in accordance with the Terms of Reference for Groundfish STAT Teams. The final product of the STAT will be a stock assessment document that follows the outline specified in Appendix B.

GMT Responsibilities

The GMT is responsible for identifying and evaluating potential management actions based on the best available scientific information. In particular, the GMT makes ABC and OY recommendations to the Council based on estimated stock status, uncertainty about stock status, and socioeconomic and ecological factors. The GMT will use stock assessments, STAR panel reports, and other information in making their recommendations. The GMT's preliminary ABC recommendation will be developed at a meeting that includes representatives from the SSC, STAT Teams, STAR panels, and GAP. A GMT representative(s) will be appointed by the chair of the GMT to track each stock assessment, and will serve as advisor to the STAT Team and STAR panel. The GMT representative will participate in review discussions, but will not serve as a member of the panel. The GMT representative should be prepared to advise the STAT Team and STAR panel on changes in fishing regulations that may influence data used in the assessment and the nature of the fishery in the future.

The GMT will not seek revision or additional review of the stock assessments after they have been reviewed by the STAR panel. The GMT chair will communicate any unresolved issues to the SSC for consideration. Successful separation of scientific (i.e., STAT Team and STAR panels) from management (i.e., GMT) work depends on stock assessment documents and STAR reviews being completed by the time the GMT meets to discuss preliminary ABC and OY levels. However, the GMT can request additional model projections, based on reviewed model scenarios, in order to develop a full evaluation of potential management actions.

GAP Responsibilities

The chair of the GAP will appoint a representative to track each stock assessment and attend the STAR panel meeting. The GAP representative will serve as advisor to the STAT Team and STAR panel. It is especially important that the GAP representative be included in the STAT team's discussion and review of all the data sources being used in the assessment, prior to development of the stock assessment model. It is the responsibility of the GAP representative to insure that industry concerns about the adequacy of data being used by the STAT Team are expressed at an early stage in the process. The GAP representative will participate in review discussions as an advisor to the STAR panel, in the same capacity as the GMT advisor.

The GAP representative, along with STAT and SSC representatives, will attend the GMT meeting at which ABC recommendations are made. The GAP representative will also attend subsequent GMT, Council, and other necessary meetings where the assessment is discussed.

The GAP representative may provide appropriate data and advice to the STAR panel and GMT and will report to the GAP on STAR panel and GMT meeting proceedings.

SSC Responsibilities

The SSC will participate in the stock assessment review process and will provide the Council and its advisory bodies with technical advice related to the stock assessments and the review process. The SSC will assign one of its members to act as chair of each STAR panel. Following the STAR panel meeting, the STAR panel chair will review the revised stock assessment and STAR panel report for consistency with the Terms of Reference. This member is not only expected to attend the assigned STAR panel meeting, but also the GMT meeting at which ABC recommendations are made (should the need arise), and Council meetings when groundfish stock assessment agenda items are discussed (see calendar in Appendix A). Specifically, if requested, the STAR panel chair will present the STAR panel report to the GMT if it requires assistance in interpreting the results of a stock assessment. In addition, the chair will present the panel's report at SSC and Council meetings. However, to insure independence in the SSC's review of stock assessments and STAR panel proceedings, SSC members who served on a STAT Team or STAR panel for a particular stock assessment are required to recuse themselves when that stock assessment is reviewed by the SSC, except to answer questions or present factual information. Other SSC members will be assigned the roles of discussion lead and rapporteur. The SSC's review constitutes a final independent check of the stock assessment that takes into consideration both the stock assessment and the STAR panel report.

It is the SSC's responsibility to review and endorse any additional analytical work requested by the GMT after the stock assessment has been reviewed by the STAR panels. In addition, the SSC will review and advise the GMT and Council on projected ABCs and OYs and, in addition, will serve as arbitrator to resolve disagreements between the STAT Team and the STAR panel.

Appendix A: 2009-2010 Stock Assessment Review Calendar

Panel	Dates	Location	Species 1	Species 2	Pre-STAR Draft Deadline a/	Post-STAR Briefing Book Deadline b/
Whiting	Feb. 3-6	Seattle, WA	Pacific Whiting	NA	Jan. 12	Feb. 18
1	May 4-8	Newport, OR	Petrale sole	Splitnose	Apr. 13	May 27
Updates	June 10-11	June Council meeting	POP, Darkblotched	Canary, Cowcod	NA	May 27
2	July 13-17	Santa Cruz, CA	Bocaccio	Widow	June 22	Aug. 26
3	July 27-31	Seattle, WA	Lingcod	Cabezon	July 6	Aug. 26
4	Aug. 3-7	Seattle, WA	Yelloweye	Greenstriped	July 13	Aug. 26
Mop-Up	Sept. 28-Oct. 1	Seattle, WA	TBD	TBD	Sep. 7	Oct. 14

a/ Pre-STAR draft assessments are due to Council staff and the NMFS SAC three weeks in advance of the STAR meeting. This allows one week to correct deficiencies prior to distribution to the STAR panel members two weeks in advance of the STAR panel.

b/ Post-STAR draft assessments to be reviewed by the SSC are due to Council staff two weeks in advance of the SSC meeting. This due date is a guideline since, in some cases (e.g., Pacific whiting), there is not enough time to prepare the post-STAR draft in time for the briefing book deadline.

Appendix B: Outline for Groundfish Stock Assessment Documents

This is an outline of items that should be included in stock assessment reports for groundfish managed by the Pacific Fishery Management Council. The outline is a working document meant to provide assessment authors with flexible guidelines about how to organize and communicate their work. All items listed in the outline may not be appropriate or available for each assessment. Also, items flagged with asterisks (*) are optional for draft assessment documents prepared for STAR panel meetings but should be included in the final document. In the interest of clarity and uniformity of presentation, stock assessment authors and reviewers are encouraged (but not required) to use the same organization and section names as in the outline. It is important that time trends of catch, abundance, harvest rates, recruitment and other key quantities be presented in tabular form to facilitate full understanding and follow-up work.

A. Title page and list of preparers – the names and affiliations of the stock assessment team (STAT) either alphabetically or as first and secondary authors

B. Executive Summary (see attached template and example in Appendices C and D).

C. Introduction
   1. Scientific name, distribution, the basis for the choice of stock structure, including regional differences in life history or other biological characteristics that should form the basis of management units.
   2. A map depicting the scope of the assessment and identifying boundaries for fisheries or data collection strata.
   3. Description of fisheries for this species off Canada or Alaska, including references to any recent assessments of those stocks.
   4. Important features of life history that affect management (e.g., migration, sexual dimorphism, bathymetric demography).
   5. Important features of current fishery and relevant history of fishery.
   6. Summary of management history (e.g., changes in mesh sizes, trip limits, or other management actions that may have significantly altered selection, catch rates, or discards).
   7. Management performance – a table or tables comparing acceptable biological catches, optimum yields, landings, and catch (i.e., landings plus discard) for each area and year

D. Assessment
   1. Data
      a. Landings by year and fishery, historical catch estimates, discards (generally specified as a percentage of total catch in weight and in units of mt), catch-at-age, weight-at-age, abundance indices (typically survey and CPUE data), data used to estimate biological parameters (e.g., growth rates, maturity schedules, and natural mortality) with coefficients of variation (CVs) or variances if available. Include complete tables and figures and date of extraction.
      b. Sample size information for length and age composition data by area, year, gear, market category, etc., including both the number of trips and fish sampled.
      c. All data sources that include the species being assessed, which are used in the assessment, and provide the rationale for data sources that are excluded.
   2. History of modeling approaches used for this stock – changes between current and previous assessment models
      a. Response to STAR panel recommendations from the most recent previous assessment.
      b. Report of consultations with GAP and GMT representatives regarding the use of various data sources in the stock assessment.
   3. Model description
      a. Complete description of any new modeling approaches.
      b. Definitions of fleets and areas.
      d. Assessment program with last revision date (i.e., date executable program file was compiled).
      e. List and description of all likelihood components in the model.
      f. Constraints on parameters, selectivity assumptions, natural mortality, assumed level of age reader agreement or assumed ageing error (if applicable), and other assumed parameters.
      g. Description of stock-recruitment constraints or components.
      h. Description of how the first year that is included in the model was selected and how the population

state at the time is defined (e.g., B_0, stable age structure, etc.).

i. Critical assumptions and consequences of assumption failures.

4. Model selection and evaluation
   a. Evidence of search for balance between model realism and parsimony.
   b. Comparison of key model assumptions, include comparisons based on nested models (e.g., asymptotic vs. domed selectivities, constant vs. time-varying selectivities).
   c. Summary of alternate model configurations that were tried but rejected.
   d. Likelihood profile for the base-run (or proposed base-run model for a draft assessment undergoing review) configuration over one or more key parameters (e.g., M, h, Q) to show consistency among input data sources.
   e. Residual analysis for the base-run configuration (or proposed base-run model in a draft assessment undergoing review) e.g., residual plots, time series plots of observed and predicted values, or other approaches. Note that model diagnostics *are* required in draft assessments undergoing review.
   f. Convergence status and convergence criteria for the base-run model (or proposed base-run).
   g. Randomization run results or other evidence of search for global best estimates.
   h. Evaluation of model parameters. Do they make sense? Are they credible?
   i. Are model results consistent with assessments of the same species in Canada and Alaska? Are parameter estimates (e.g., survey catchability) consistent with estimates for related stocks?
   5. Point-by-point response to the STAR panel recommendations.* (Not required in draft assessment undergoing review.)
6. Base-run(s) results
   a. Table listing all explicit parameters in the stock assessment model used for base runs, their purpose (e.g., recruitment parameter, selectivity parameter) and whether or not the parameter was actually estimated in the stock assessment model.
   b. Population numbers at age × year × sex (if sex-specific M, growth, or selectivity) (May be provided as a text file).* (Not required in draft assessment undergoing review.)
   c. Time-series of total, summary, and spawning biomass, depletion relative to B_0, recruitment and fishing mortality or exploitation rate estimates (table and figures).
   d. Selectivity estimates (if not included elsewhere).
   e. Stock-recruitment relationship.
7. Uncertainty and sensitivity analyses. The best approach for describing uncertainty and the range of probable biomass estimates in groundfish assessments may depend on the situation. Important factors to consider include:
   a. Parameter uncertainty (variance estimation conditioned on a given model, estimation framework, data set choice, and weighting scheme), including likelihood profiles of important assessment parameters (e.g., natural mortality). This also includes expressing uncertainty in derived outputs of the model and estimating CVs by an appropriate methods (e.g., bootstrap, asymptotic methods, Bayesian approaches, such as MCMC).
   b. Sensitivity to data set choice and weighting schemes (e.g., emphasis factors), which may also include a consideration of recent patterns in recruitment.
   c. Sensitivity to assumptions about model structure, i.e., model specification uncertainty.
   d. Retrospective analysis, where the model is fitted to a series of shortened input data sets, with the most recent years of input data being dropped.
   e. Historical analysis (plot of actual estimates from current and previous assessments).
   f. Subjective appraisal of the magnitude and sources of uncertainty.
   g. If a range of model runs is used to characterize uncertainty it is important to provide some qualitative or quantitative information about relative probability of each.
   h. If possible, ranges depicting uncertainty should include at least three runs: (a) one judged most probable; (b) at least one that depicts the range of uncertainty in the direction of lower current biomass levels; and (c) one that depicts the range of uncertainty in the direction of higher current biomass levels. The entire range of uncertainty should be carried through stock projections and decision table analyses.

E. <u>Reference points (biomass and exploitation rate).</u>
1. Unfished spawning stock biomass, summary age biomass, and recruitment.

2. Reference points based on $B_{40\%}$ (spawning biomass, SPR, exploitation rate, equilibrium yield).
3. Reference points based on default SPR proxy (spawning biomass, SPR, exploitation rate, equilibrium yield).
4. Reference points based on MSY (if estimated) (spawning biomass, SPR, exploitation rate, equilibrium yield).
5. Equilibrium yield curve showing various B_{MSY} proxies (see attached example).

F. Harvest projections and decision tables* (Not required in draft assessment undergoing review.)
   1. Harvest projections and decision tables (i.e., a matrix of states of nature versus management action) should cover the plausible range of uncertainty about current biomass and the full range of candidate fishing mortality targets used for the stock or requested by the GMT. These should at least include calculation of the ABC based on F_{MSY} (or its proxy) and the OY that is implied under the Council's 40:10 harvest policy. Ideally, the alternatives described in the decision table will be drawn from a probability distribution which describes the pattern of uncertainty regarding the status of the stock and the consequences of alternative future management actions. Where alternatives are not formally associated with a probability distribution, the document needs to present sufficient information to guide assignment of approximate probabilities to each alternative. Decision tables should follow the format of the example Executive Summary for canary rockfish (Appendix D of this document) in which the columns represent the states of nature and the rows the management decisions. In most cases, management decisions will represent the sequence of catches obtained by applying the Council 40-10 harvest policy to each state of nature; however other alternatives may be suggested by the GMT as being more relevant to Council decision-making. For example, when recent catches are much less than the OY, there may be more interest in status quo projections.
   2. Information presented should include biomass, stock depletion, and yield projections of ABC and OY for ten years into the future, beginning with the first year for which management action could be based upon the assessment.

G. Regional management considerations.
   1. Discuss whether a regional management approach make sense for the species from a biological perspective.
   2. If there are insufficient data to analyze a regional management approach, what are the research and data needs to answer this question?

H. Research needs (prioritized).

I. Acknowledgments-include STAR panel members and affiliations as well as names and affiliations of persons who contributed data, advice or information but were not part of the assessment team. * (Not required in draft assessment undergoing review.)

J. Literature cited.

K. An appendix with the complete parameter and data in the native code of the stock assessment program. (For a draft assessment undergoing review, these listings can be provided as text files or in spreadsheet format.)

Appendix C: Template for Executive Summary Prepared by STAT Teams

Stock: species/area, including an evaluation of any potential biological basis for regional management

Catches: trends and current levels-include table for last ten years and graph with long term data

Data and assessment: date of last assessment, type of assessment model, data available, new information, and information lacking

Unresolved problems and major uncertainties: any special issues that complicate scientific assessment, questions about the best model scenario, etc.

Reference points: management targets and definition of overfishing, including the harvest rate that brings the stock to equilibrium at $B_{40\%}$ (the B_{MSY} proxy) and the equilibrium stock size that results from fishing at the default harvest rate (the F_{MSY} proxy).

Stock biomass: trends and current levels relative to virgin or historic levels, description of uncertainty-include table for last 10 years and graph with long term estimates

Recruitment: trends and current levels relative to virgin or historic levels-include table for last 10 years and graph with long term estimates

Exploitation status: exploitation rates (i.e., total catch divided by exploitable biomass, or the annual SPR harvest rate) – include a table with the last 10 years of data and a graph showing the trend in fishing mortality relative to the target (y-axis) plotted against the trend in biomass relative to the target (x-axis).

Management performance: catches in comparison to ABC and OY values for the most recent 10 years (when available), overfishing levels, actual catch and discard.

Forecasts: ten-year forecasts of catch, summary biomass, spawning biomass, and depletion.* (Not required in draft assessments undergoing review.)

Decision table: projected yields (ABC and OY), spawning biomass, and stock depletion levels for each year.* (Not required in draft assessments undergoing review.)

Research and data needs: identify information gaps that seriously impede the stock assessment.

Rebuilding Projections: principal results from rebuilding analysis if the stock is overfished.* This section should be included in the Final/SAFE version assessment document but is not required for draft assessments undergoing review. See Rebuilding Analysis Terms of Reference for detailed information on rebuilding analysis requirements.

Summary Table: as detailed in the attached example.

Hilborn, R., and C. J. Walters. 1992. Quantitative fisheries stock assessment: Choice, dynamics and uncertainty. Chapman and Hall.

Appendix D: Example of a Complete Stock Assessment Executive Summary

Executive Summary

Stock

This assessment reports the status of the canary rockfish (*Sebastes pinniger*) resource off the coast of the United States from southern California to the U.S.-Canadian border using data through 2006. The resource is modeled as a single stock. Spatial aspects of the coast-wide population are addressed through geographic separation of data sources/fleets where possible and consideration of residual patterns that may be a result of inherent stock structure. There is currently no genetic evidence that there are distinct biological stocks of canary rockfish off the U.S. coast and very limited tagging data to describe adult movement, which may be significant across depth and latitude. Future efforts to specifically address regional management concerns will require a more spatially explicit model that likely includes the portion of the canary rockfish stock residing in Canadian waters off Vancouver Island.

Catches

Catch of canary rockfish is first reported in 1916 in California. Since that time, annual catch has ranged from 46.5 mt in 2004 to 5,544 in 1982 and totaled almost 150,000 mt over the time-series. Canary rockfish have been primarily caught by trawl fleets, on average comprising ~85% of the annual catches, with the Oregon fleet removing as much as 3,941 mt in 1982. Historically just 10% of the catches have come from non-trawl commercial fisheries, although this proportion reached 24% and 358 mt in 1997. Recreational removals have averaged just 6% of the total catch, historically, but have become relatively more important as commercial landings have been substantially reduced in recent years. Recreational catches reached 59% of the total with 30 mt caught in 2003. Total catches after 1999 have been reduced by an order of magnitude in an attempt to rebuild a stock determined to be overfished on the basis of the 1999 assessment.

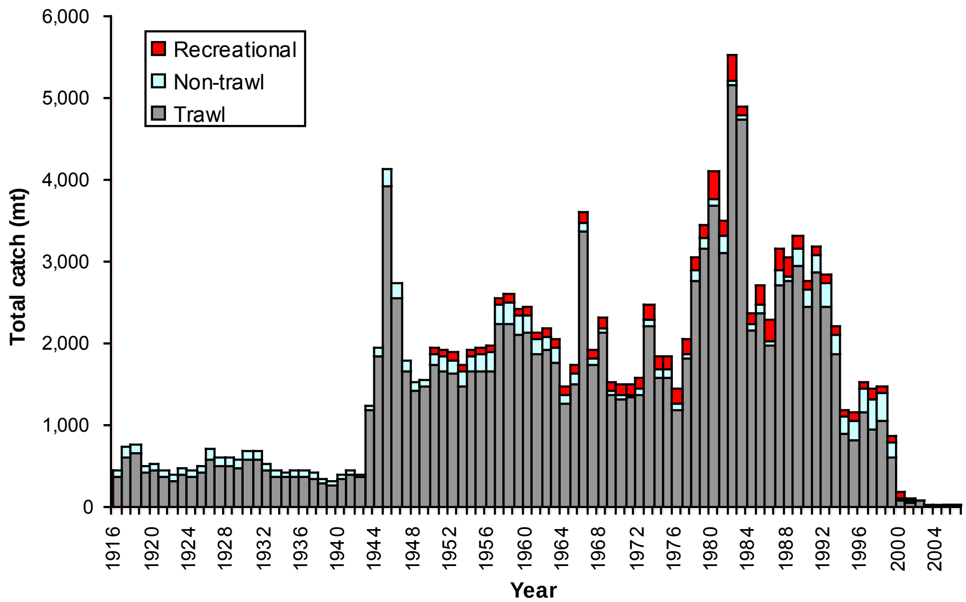

Figure a. Canary rockfish catch history by major source, 1916-2006.

Table a. Recent commercial fishery catches (mt) by fleet.

Year	Southern California trawl	Northern California trawl	Oregon trawl	Washington trawl	Southern California non-trawl	Northern California non-trawl	Oregon-Washington non-trawl	At-sea whiting bycatch
1997	31.96	142.66	589.85	203.44	29.78	73.80	254.42	3.63
1998	8.41	149.45	716.05	203.01	23.33	57.25	250.13	5.47
1999	7.36	96.25	387.85	139.97	8.53	28.59	123.97	5.63
2000	1.71	11.24	46.62	32.66	2.52	5.50	10.25	2.35
2001	1.44	9.43	33.13	19.65	1.60	4.96	11.00	4.05
2002	0.36	14.62	32.60	33.29	0.02	0.08	3.15	5.24
2003	0.23	0.31	5.02	6.24	0.00	0.08	6.89	0.93
2004	0.61	1.95	7.67	7.73	0.02	0.06	4.68	5.22
2005	0.72	2.84	4.91	25.90	0.06	0.09	1.79	1.44
2006	3.57	2.28	2.91	15.64	0.00	0.00	3.11	1.09

Data and Assessment

This assessment used the Stock Synthesis 2 integrated length-age structured model. The model includes catch, length- and age-frequency data from 11 fishing fleets, including trawl, non-trawl and recreational sectors. Biological data is derived from both port and on-board observer sampling programs. The National Marine Fisheries Service (NMFS) triennial bottom trawl survey and Northwest Fisheries Science Center (NWFSC) trawl survey relative biomass indices and biological sampling provide fishery independent information on relative trend and demographics of the canary stock. The Southwest Fisheries Science Center (SWFSC)/NWFSC/Pacific Whiting Conservation Cooperative (PWCC) coast-wide pre-recruit survey provides a source of recent recruitment strength information.

New analysis of the triennial survey data led to separating the series into two parts (1980-1992, 1995-2004) to allow for potential changes in catchability due to timing of survey operations. Accommodation of potential changes in fishery selectivity due to management actions including the adoption of canary-specific trip limits in 1995, small-footrope requirements in 1999, closure of the RCA in 2002 and use of selective flatfish trawl starting in 2005 was also added in this assessment. These and other changes have resulted in a change in the estimate of current stock status and large increase in the perception of uncertainty regarding this quantity in comparison to the most recent 2005 and earlier assessments.

The base case assessment model includes parameter uncertainty from a variety of sources, but underestimates the considerable uncertainty in recent trend and current stock status. For this reason, in addition to asymptotic confidence intervals (based upon the model's analytical estimate of the variance near the converged solution), two alternate states of nature regarding stock productivity (via the steepness parameter of the stock-recruitment relationship) are presented. The base case model (steepness = 0.51) is considered to be twice as likely as the two alternate states (steepness = 0.35, 0.72) based on the results of a meta-analysis of west coast rockfish (M. Dorn, personal communication). In order to best capture this source of uncertainty, all three states of nature will be used as probability-weighted input to the rebuilding analysis.

Stock biomass

Canary rockfish were relatively lightly exploited until the early 1940's, when catches increased and a decline in biomass began. The rate of decline in spawning biomass accelerated during the late 1970s, and finally reached a minimum (13% of unexploited) in the mid 1990s. The canary rockfish spawning stock biomass is estimated to have been increasing since that time, in response to reductions in harvest and above average recruitment in the preceding decade. However, this trend is very uncertain. The estimated relative depletion level in 2007 is 32.4% (~95% asymptotic interval: 24-41%, ~75% interval based on the range of states of nature: 12-56%), corresponding to 10,544 mt (asymptotic interval: 7,776-13,312 mt, states of nature interval: 4,009-17,519) of female spawning biomass in the base model.

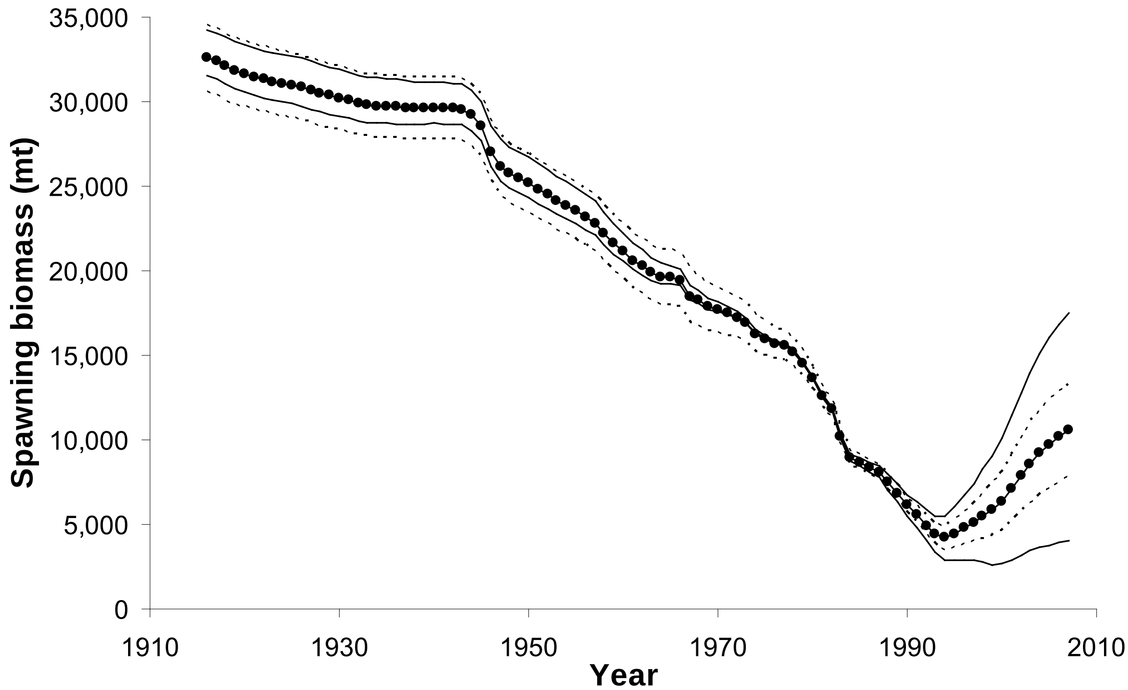

Figure b. Estimated spawning biomass time-series (1916-2007) for the base case model (round points) with approximate asymptotic 95% confidence interval (dashed lines) and alternate states of nature (light lines).

Table b. Recent trend in estimated canary rockfish spawning biomass and relative depletion level.

Year	Spawning biomass (mt)	~95% confidence interval	Range of states of nature	Estimated depletion	~95% confidence interval	Range of states of nature
1998	5,499	4,177-6,820	2,761-8,241	16.9%	NA	8.1-26.2
1999	5,826	4,296-7,357	2,610-9,073	17.9%	NA	7.6-28.8
2000	6,364	4,618-8,111	2,644-10,144	19.5%	NA	7.7-32.2
2001	7,149	5,190-9,109	2,918-11,477	22.0%	NA	8.5-36.4
2002	7,910	5,750-10,070	3,184-12,779	24.3%	NA	9.3-40.6
2003	8,603	6,264-10,942	3,417-13,985	26.4%	NA	10.0-44.4
2004	9,226	6,736-11,715	3,628-15,076	28.3%	NA	10.6-47.9
2005	9,749	7,140-12,359	3,795-16,019	29.9%	NA	11.1-50.9
2006	10,183	7,482-12,884	3,918-16,825	31.3%	23.1-39.4	11.4-53.4
2007	10,544	7,776-13,312	4,009-17,519	32.4%	24.1-40.7	11.7-55.6

Recruitment

The degree to which canary rockfish recruitment declined over the last 50 years is closely related to the level of productivity (stock-recruit steepness) modeled for the stock. High steepness values imply little relationship between spawning stock and recruitment, while low steepness values cause a strong correlation. After a period of above average recruitments, recent year-class strengths have generally been low, with only 1999 and 2001 producing large estimated recruitments (the 2007 recruitment is based only on the stock-recruit function). There is little information other than the pre-recruit index to inform the assessment model about recruitments subsequent to 2002, so those estimates will likely be updated in future assessments. As the larger recruitments from the late 1980s and early 1990s move through the population in future projections, the effects of recent poor recruitment will tend to slow the rate of recovery.

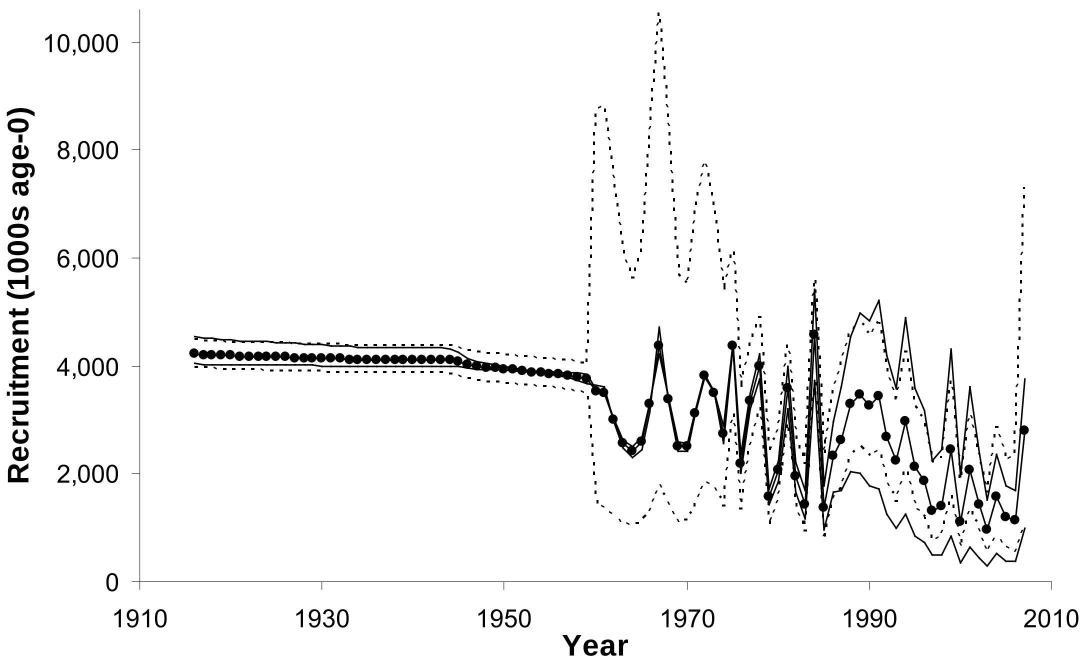

Figure c. Time series of estimated canary rockfish recruitments for the base case model (round points) with approximate asymptotic 95% confidence interval (dashed lines) and alternate states of nature (light lines).

Table c. Recent estimated trend in canary rockfish recruitment.

Year	Estimated recruitment (1000s)	~95% confidence interval	Range of states of nature
1998	1,391	841-2,299	484-2,453
1999	2,449	1,606-3,735	841-4,318
2000	1,099	638-1,893	351-1,938
2001	2,061	1,359-3,124	643-3,613
2002	1,432	905-2,267	447-2,383
2003	955	547-1,667	302-1,515
2004	1,565	854-2,869	520-2,373
2005	1,182	627-2,231	390-1,771
2006	1,144	548-2,389	367-1,699
2007	2,807	1,078-7,313	991-3,745

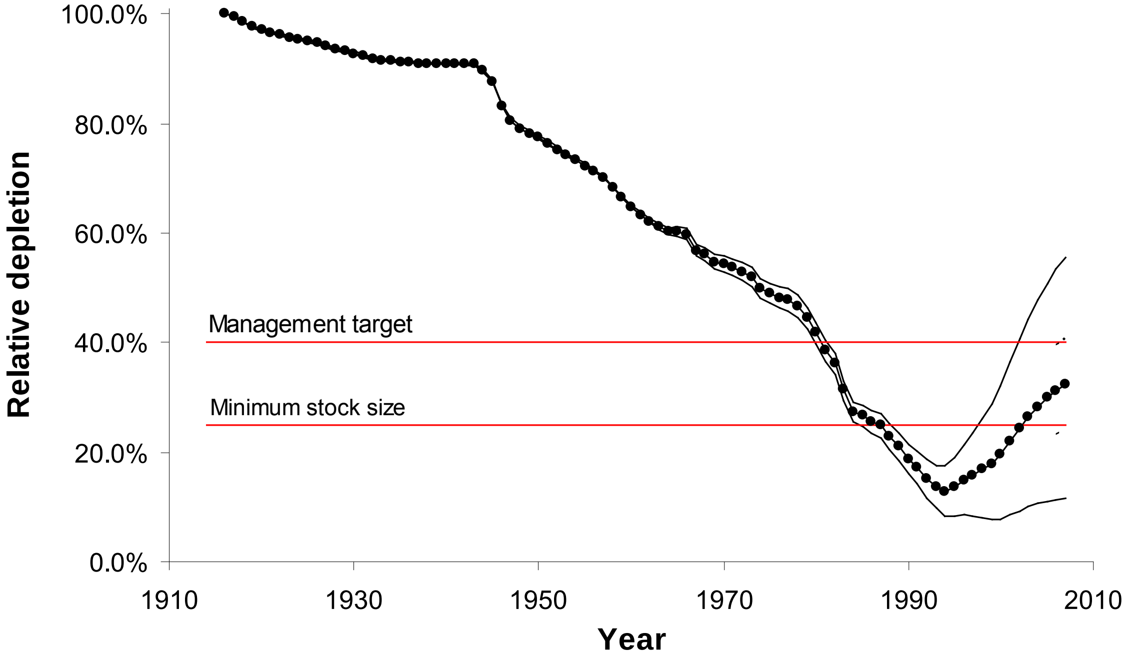

Figure d. Time series of depletion level as estimated in the base case model (round points) with approximate asymptotic 95% confidence interval (2006-2007 only, dashed lines) and alternate states of nature (light lines).

Reference points

Unfished spawning stock biomass was estimated to be 32,561 mt in the base case model. This is slightly smaller than the equilibrium value estimated in the 2005 assessment. The target stock size ($SB_{40\%}$) is therefore 13,024 mt. Maximum sustained yield (MSY) applying current fishery selectivity and allocations (a 'bycatch-only' scenario) was estimated in the assessment model to occur at a spawning stock biomass of 12,394 mt and produce an MSY catch of 1,169 mt (SPR = 52.9%). This is nearly identical to the yield, 1,167 mt, generated by the SPR (54.4%) that stabilizes the stock at the $SB_{40\%}$ target. The fishing mortality target/overfishing level (SPR = 50.0%) generates a yield of 1,161 mt at a stock size of 11,161 mt.

When selectivity and allocation from the mid 1990s (1994-1998) was applied, to mimic reference points under a targeted fishery scenario, the yield increased to 1,578 mt from a slightly smaller stock size (12,211 mt), but a similar rate of exploitation (SPR=52.5%). This is due to higher relative selection of older and larger fish when the fishery was targeting instead of avoiding canary rockfish. These values are appreciably higher than those from previous assessment models due primarily to the difference in steepness.

Exploitation status

The abundance of canary rockfish was estimated to have dropped below the $SB_{40\%}$ management target in 1981 and the overfished threshold in 1987. In hindsight, the spawning stock biomass passed through the target and threshold levels at a time when the annual catch was averaging more than twice the current estimate of the MSY. The stock remains below the rebuilding target, although the spawning stock biomass appears to have been increasing since 1999. The degree of increase is very sensitive to the value for steepness (state of nature), and is projected to slow as recent (and below average) recruitments begin to contribute to the spawning biomass. Fishing mortality rates in excess of the current F-target for rockfish of $SPR_{50\%}$ are estimated to have begun in the late 1970s and persisted through 1999. Recent management actions appear to have curtailed the rate of removal such that overfishing has not occurred since 1999, and recent SPR values are in excess of 95%. Relative exploitation rates (catch/biomass of age-5 and older fish) are estimated to have been less than 1% since 2001. These patterns are largely insensitive to the three states of nature.

Table d. Recent trend in spawning potential ratio (SPR) and relative exploitation rate (catch/biomass of age-5 and older fish).

Year	Estimated SPR (%)	Range of states of nature	Relative exploitation rate	Range of states of nature
1997	31.6%	16.9-41.9	0.0889	0.0607-0.1652
1998	33.2%	16.8-44.3	0.0873	0.0576-0.1778
1999	48.9%	26.1-61.0	0.0506	0.0323-0.1146
2000	84.0%	65.7-89.7	0.0112	0.0070-0.0271
2001	89.7%	76.5-93.5	0.0067	0.0041-0.0165
2002	92.2%	81.9-95.1	0.0050	0.0031-0.0126
2003	95.4%	88.3-97.2	0.0023	0.0014-0.0058
2004	96.3%	90.6-97.8	0.0020	0.0012-0.0051
2005	96.3%	90.5-97.7	0.0021	0.0013-0.0055
2006	96.5%	90.7-97.9	0.0019	0.0011-0.0049

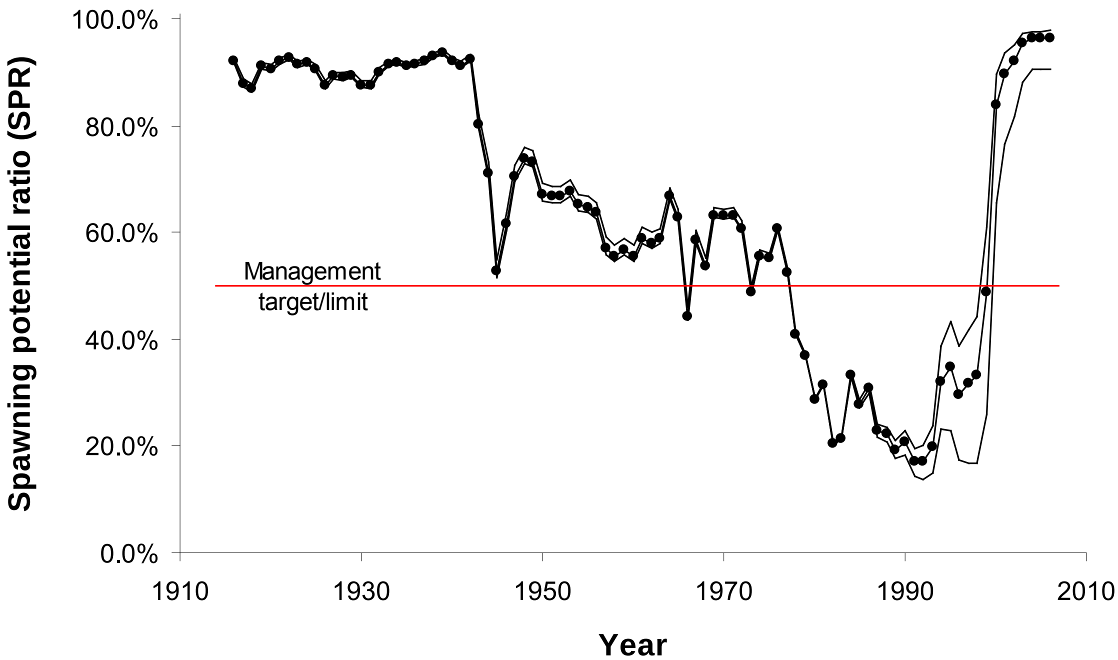

Figure e. Time series of estimated spawning potential ratio (SPR) for the base case model (round points) and alternate states of nature (light lines). Values of SPR below 0.5 reflect harvests in excess of the current overfishing proxy.

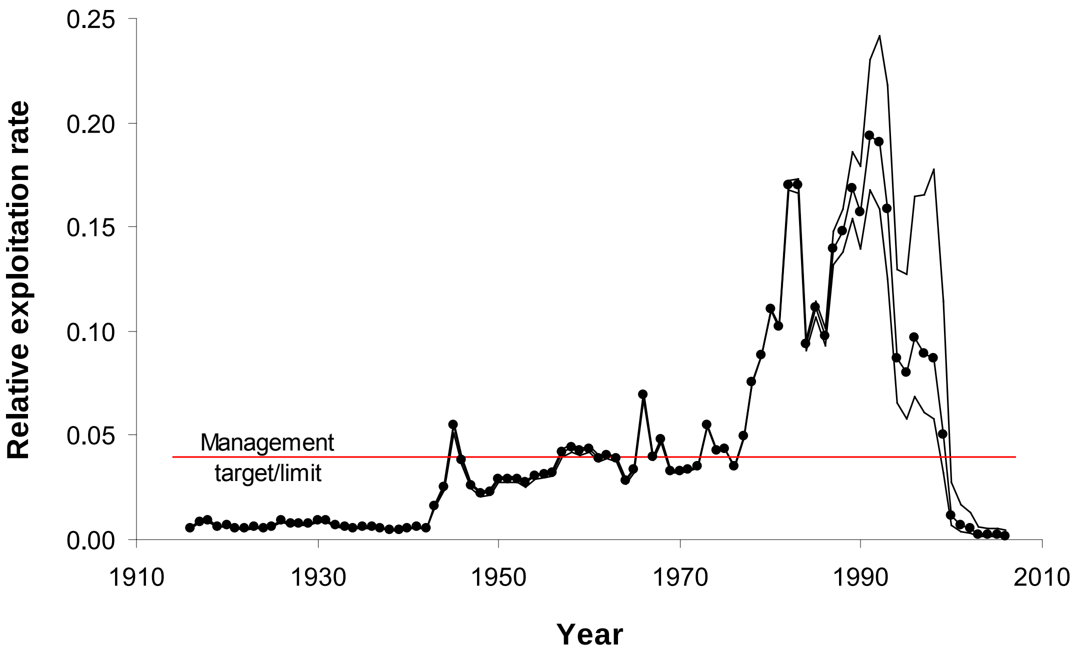

Figure f. Time series of estimated relative exploitation rate (catch/age 5 and older biomass, lower panel) for the base case model (round points) and alternate states of nature (light lines). Values of relative exploitation rate in excess of horizontal line are above the rate corresponding to the overfishing proxy from the base case.

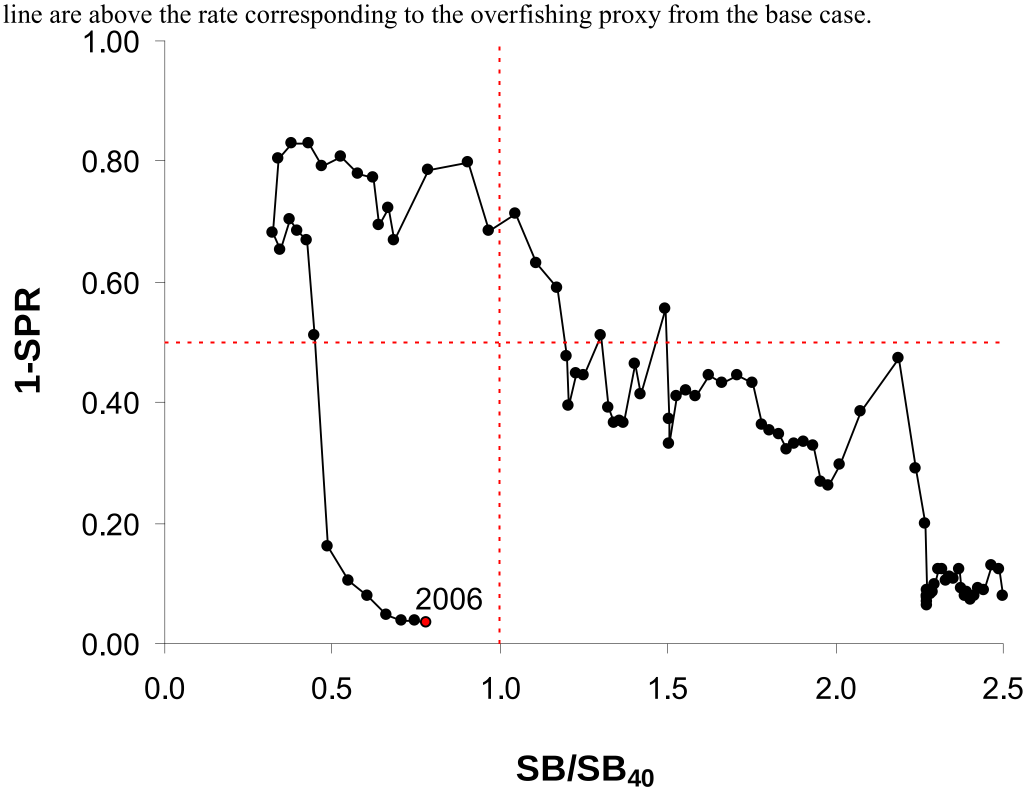

Figure g. Estimated spawning potential ratio relative to the proxy target of 50% vs. estimated spawning biomass relative to the proxy 40% level from the base case model. Higher biomass occurs on the right side of the x-axis, higher exploitation rates occur on the upper side of the y-axis.

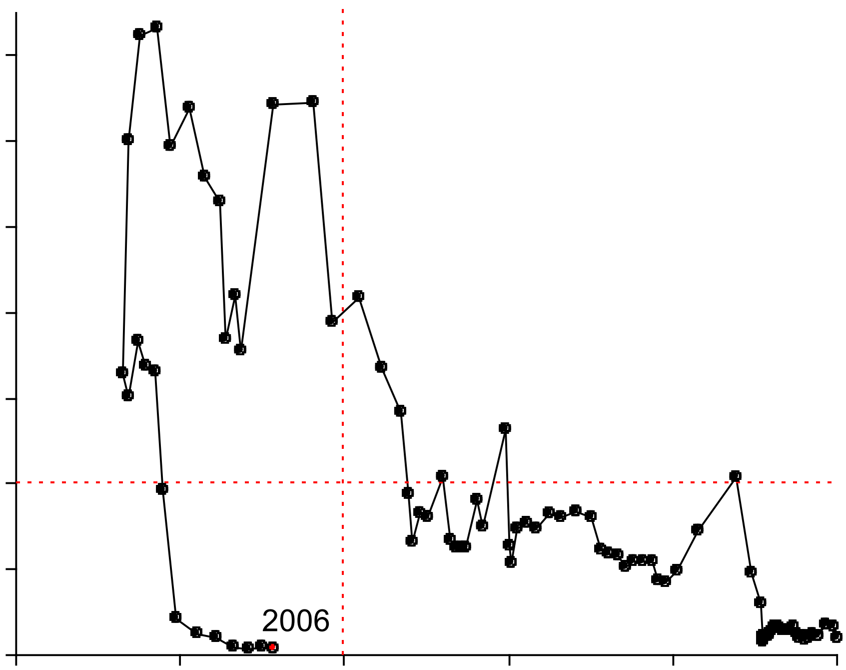

Figure g. Phase plot of estimated fishing intensity vs. relative spawning biomass for the base case model. Fishing intensity is the relative exploitation rate divided by the level corresponding to the overfishing proxy (0.040). Relative spawning biomass is annual spawner abundance divided by the 40% rebuilding target.

Management performance

Following the 1999 declaration that the canary rockfish stock was overfished the canary OY was reduced by over 70% in 2000 and by the same margin again over the next three years. Managers employed several tools in an effort to constrain catches to these dramatically lower targets. These included: reductions in trip/bag limits for canary and co-occurring species, the institution of spatial closures, and new gear restrictions intended to reduce trawling in rocky shelf habitats and the coincident catch of rockfish in shelf flatfish trawls. In recent years, the total mortality has been near the OY, but well below the ABC. Since the overfished determination in 1999, the total 7-year catch (644 mt) has been only 13% above the sum of the OYs for 2000-2006. This level of removals represents only 35% of the sum of the ABCs for that period. The total 2006 catch (47 mt) is <1% of the peak catch that occurred in the early 1980s.

Table e. Recent trend in estimated total canary rockfish catch and commercial landings (mt) relative to management guidelines.

Year	ABC (mt)	OY (mt)	Commercial landings (mt)[1]	Total Catch (mt)
1997	1,220[2]	1,000[2]	1,113.8	1,478.8
1998	1,045[2]	1,045[2]	1,182.4	1,494.2
1999	1,045[2]	857[2]	665.7	898.0
2000	287	200	60.6	208.4
2001	228	93	42.8	133.6
2002	228	93	48.6	106.8
2003	272	44	8.5	51.0
2004	256	47.3	10.7	46.5
2005	270	46.8	10.9	51.4
2006	279	47	8.2	47.1

[1]Excludes all at-sea whiting, recreational and research catches.
[2]Includes the Columbia and Vancouver INPFC areas only.

Unresolved problems and major uncertainties

Parameter uncertainty is explicitly captured in the asymptotic confidence intervals reported throughout this assessment for key parameters and management quantities. These intervals reflect the uncertainty in the model fit to the data sources included in the assessment, but do not include uncertainty associated with alternative model configurations, weighting of data sources (a combination of input sample sizes and relative weighting of likelihood components), or fixed parameters. Specifically, there appears to be conflicting information between the length- and age-frequency data regarding the degree of stock decline, making the model results sensitive to the relative weighting of each. This issue is explored in the assessment, but cannot be fully resolved at this time. The relationship between the degree of dome in the selectivity curves and the increase in female natural mortality with age remains a source of uncertainty that is included in model results, as it has been in previous assessments for canary rockfish. Uncertainty in the steepness parameter of the stock-recruitment relationship is significant and will likely persist in future assessments; this uncertainty is included in the assessment and rebuilding projections through explicit consideration of the three states of nature.

Forecasts

The forecast reported here will be replaced by the rebuilding analysis to be completed in September-October 2007 following SSC review of the stock assessment. In the interim, the total catch in 2007 and 2008 is set equal to the OY (44 mt). The exploitation rate for 2009 and beyond is based upon an SPR of 88.7%, which approximates the harvest level in the current rebuilding plan. Uncertainty in the rebuilding forecast will be based upon the three states of nature for steepness and random variability in future recruitment deviations for each rebuilding simulation. Current medium-term forecasts predict slow increases in abundance and available catch, with OY values for 2009 and 2010 increasing by nearly four times the value of 44 mt from the 2005 assessment. This is largely attributable to the revised perception of steepness, based on meta-analysis of other rockfish species. The following table shows the projection of expected canary rockfish catch, spawning biomass and depletion.

Table f. Projection of potential canary rockfish ABC, OY, spawning biomass and depletion for the base case model based on the SPR= 0.887 fishing mortality target used for the last rebuilding plan (OY) and $F_{50\%}$ overfishing limit/target (ABC). Assuming the OY of 44 mt is met in 2007 and 2008.

Year	ABC (mt)	OY (mt)	Age 5+ biomass (mt)	Spawning biomass (mt)	Depletion
2007	973	44	25,995	10,544	32.4%
2008	978	44	26,417	10,840	33.3%
2009	981	162	26,859	11,072	34.0%
2010	980	162	26,995	11,194	34.4%
2011	992	164	27,018	11,254	34.6%
2012	1,026	169	27,440	11,266	34.6%
2013	1,074	177	27,985	11,260	34.6%
2014	1,124	185	28,656	11,280	34.6%
2015	1,171	193	29,445	11,368	34.9%
2016	1,214	200	30,332	11,545	35.5%
2017	1,253	207	31,297	11,812	36.3%
2018	1,290	213	32,317	12,156	37.3%

Decision table

Because canary rockfish is currently managed under a rebuilding plan, this decision table is only intended to better compare and contrast the base case with uncertainty among states of nature. The results of the rebuilding plan will integrate these three states of nature as well as projected recruitment variability. Further, various alternate probabilities of rebuilding by target and limit time-periods as well as fishing mortality rates will be evaluated in the rebuilding analysis. Relative probabilities of each state of nature are based on a meta-analysis for steepness of west coast rockfish (M. Dorn, AFSC, personal communication). Landings in 2007-2008 are 44 mt for all cases. Selectivity and fleet allocations are projected at the average 2003-2006 values.

Table g. Decision table of 12-year projections for alternate states of nature (columns) and management options (rows) beginning in 2009. Relative probabilities of each state of nature are based on a meta-analysis for steepness of west coast rockfish (M. Dorn, AFSC, personal communication). Landings in 2007-2008 are 44 mt for all cases. Selectivity and fleet allocations are projected at the average 2003-2006 values.

			State of nature					
			Low steepness (0.35)		Base case (steepness = 0.51)		High steepness (0.72)	
Relative probability			0.25		0.5		0.25	
Management decision	Year	Catch (mt)	Depletion	Spawning biomass (mt)	Depletion	Spawning biomass (mt)	Depletion	Spawning biomass (mt)
Rebuilding SPR 88.7% catches from low steepness state of nature	2009	56	12.0%	4,099	34.0%	11,072	59.0%	18,583
	2010	56	12.0%	4,100	34.5%	11,236	60.1%	18,932
	2011	56	11.9%	4,078	34.8%	11,339	60.8%	19,156
	2012	59	11.8%	4,042	35.0%	11,396	61.2%	19,270
	2013	62	11.7%	4,003	35.1%	11,436	61.3%	19,313
	2014	65	11.6%	3,979	35.3%	11,502	61.4%	19,343
	2015	67	11.6%	3,984	35.7%	11,638	61.7%	19,423
	2016	70	11.7%	4,025	36.4%	11,866	62.2%	19,590
	2017	72	12.0%	4,102	37.4%	12,188	63.0%	19,852
	2018	74	12.3%	4,209	38.7%	12,591	64.1%	20,199
Rebuilding SPR 88.7% catches from base case	2009	162	12.0%	4,099	34.0%	11,072	59.0%	18,583
	2010	162	11.8%	4,058	34.4%	11,194	60.0%	18,890
	2011	164	11.7%	3,994	34.6%	11,254	60.5%	19,069
	2012	169	11.4%	3,914	34.6%	11,266	60.8%	19,138
	2013	177	11.2%	3,831	34.6%	11,260	60.7%	19,135
	2014	185	11.0%	3,762	34.6%	11,280	60.7%	19,118
	2015	193	10.9%	3,719	34.9%	11,368	60.8%	19,150
	2016	200	10.8%	3,710	35.5%	11,545	61.2%	19,266
	2017	207	10.9%	3,733	36.3%	11,812	61.8%	19,475
	2018	213	11.0%	3,781	37.3%	12,156	62.8%	19,767
Rebuilding SPR 88.7% catches from high steepness state of nature	2009	273	12.0%	4,099	34.0%	11,072	59.0%	18,583
	2010	271	11.7%	4,014	34.2%	11,150	59.8%	18,845
	2011	272	11.4%	3,905	34.3%	11,164	60.3%	18,978
	2012	277	11.0%	3,780	34.2%	11,130	60.3%	19,001
	2013	285	10.7%	3,654	34.0%	11,079	60.2%	18,951
	2014	293	10.3%	3,542	34.0%	11,055	60.0%	18,891
	2015	300	10.1%	3,459	34.1%	11,100	59.9%	18,880
	2016	307	9.9%	3,408	34.5%	11,235	60.2%	18,953
	2017	313	9.9%	3,389	35.2%	11,461	60.7%	19,122
	2018	319	9.9%	3,394	36.1%	11,763	61.5%	19,374
Status quo (catch = 44 mt)	2009	44	12.0%	4,099	34.0%	11,072	59.0%	18,583
	2010	44	12.0%	4,104	34.5%	11,241	60.1%	18,937
	2011	44	11.9%	4,088	34.9%	11,349	60.8%	19,166
	2012	44	11.8%	4,057	35.0%	11,411	61.2%	19,285
	2013	44	11.7%	4,024	35.2%	11,456	61.4%	19,334
	2014	44	11.7%	4,005	35.4%	11,529	61.5%	19,371
	2015	44	11.7%	4,018	35.8%	11,673	61.8%	19,459
	2016	44	11.9%	4,069	36.6%	11,911	62.3%	19,635
	2017	44	12.1%	4,157	37.6%	12,244	63.2%	19,908
	2018	44	12.5%	4,277	38.9%	12,660	64.3%	20,268

Research and data needs

Progress on a number of research topics would substantially improve the ability of this assessment to reliably and precisely model canary rockfish population dynamics in the future and provide better monitoring of progress toward rebuilding:

1. Expanded Assessment Region: Given the high occurrence of canary rockfish close to the US-Canada border, a joint US-Canada assessment should be considered in the future.
2. Many assessments are deriving historical catch by applying various ratios to the total rockfish catch prior to the period when most species were delineated. A comprehensive historical catch reconstruction for all rockfish species is needed, to compile a best estimated catch series that accounts for all the catch and makes sense for the entire group.
3. Habitat relationships: The historical and current relationship between canary rockfish distribution and habitat features should be investigated to provide more precise estimates of abundance from the surveys, and to guide survey augmentations that could better track rebuilding through targeted application of newly developed survey technologies. Such studies could also assist determining the possibility of dome-shaped selectivity, aid in evaluation of spatial structure and the use of fleets to capture geographically-based patterns in stock characteristics.
4. Meta-population model: The spatial patterns show patchiness in the occurrence of large vs. small canary; reduced occurrence of large/old canary south of San Francisco; and concentrations of canary rockfish near the US-Canada border. The feasibility of a meta-population model that has linked regional sub-populations should be explored as a more accurate characterization of the coast-wide population's structure. Tagging of other direct information on adult movement will be essential to this effort.
5. Increased computational power and/or efficiency is required to move toward fully Bayesian approaches that may better integrate over both parameter and model uncertainty.
6. Additional exploration of surface ages from the late 1970s and inclusion into or comparison with the assessment model, or re-aging of the otoliths could improve the information regarding that time period when the stock underwent the most dramatic decline. Auxiliary biological data collected by ODFW from recreational catches and hook-and-line projects may also increase the performance of the assessment model in accurately estimating recent trends and stock size.
7. Due to inconsistencies between studies and scarcity of appropriate data, new data is needed on both the maturity and fecundity relationships for canary rockfish.
8. Re-evaluation of the pre-recruit index as a predictor of recent year class strength should be ongoing as future assessments generate a longer series of well-estimated recent recruitments to compare with the coast-wide survey index.
9. Meta-analysis or other summary of the degree of recruitment variability and the relative steepness for other rockfish and groundfish stocks should be ongoing, as this information is likely to be very important for model results (as it is here) in the foreseeable future.

Rebuilding projections

The rebuilding projections will be presented in a separate document after the assessment has been reviewed in September 2007.

Table h. Summary of recent trends in estimated canary rockfish exploitation and stock levels from the base case model; all values reported at the beginning of the year.

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Commercial landings (mt)[1]	1,182.4	665.7	60.6	42.8	48.6	8.5	10.7	10.9	8.2	NA
Total catch (mt)	1,494.2	898.0	208.4	133.6	106.8	51.0	46.5	51.4	47.1	NA
ABC (mt)	1,045[2]	1,045[2]	287	228	228	272	256	270	279	172
OY	1,045[2]	857[2]	200	93	93	44	47.3	46.8	47.0	44
SPR	33.2%	48.9%	84.0%	89.7%	92.2%	95.4%	96.3%	96.3%	96.5%	NA
Exploitation rate (catch/age 5+ biomass)	0.0873	0.0506	0.0112	0.0067	0.0050	0.0023	0.0020	0.0021	0.0019	NA
Age 5+ biomass (mt)	17,125	17,733	18,659	20,078	21,275	22,333	23,583	24,402	25,317	25,995
Spawning biomass (mt)	5,499	5,826	6,364	7,149	7,910	8,603	9,226	9,749	10,183	10,544
~95% Confidence interval	4,177-6,820	4,296-7,357	4,618-8,111	5,190-9,109	5,750-10,070	6,264-10,942	6,736-11,715	7,140-12,359	7,482-12,884	7,776-13,312
Range of states of nature	2,761-8,241	2,610-9,073	2,644-10,144	2,918-11,477	3,184-12,779	3,417-13,985	3,628-15,076	3,795-16,019	3,918-16,825	4,009-17,519
Recruitment (1000s)	1,391	2,449	1,099	2,061	1,432	955	1,565	1,182	1,144	2,807
~95% Confidence interval	841-2,299	1,606-3,735	638-1,893	1,359-3,124	905-2,267	547-1,667	854-2,869	627-2,231	548-2,389	1,078-7,313
Range of states of nature	484-2,453	841-4,318	351-1,938	643-3,613	447-2,383	302-1,515	520-2,373	390-1,771	367-1,699	991-3,745
Depletion	16.9%	17.9%	19.5%	22.0%	24.3%	26.4%	28.3%	29.9%	31.3%	32.4%
~95% Confidence interval	NA	NA	NA	NA	NA	NA	NA	NA	23.1-9.4	24.1-40.7
Range of states of nature	8.1-26.2	7.6-28.8	7.7-32.2	8.5-36.4	9.3-40.6	10.0-44.4	10.6-47.9	11.1-50.9	11.4-53.4	11.7-55.6

[1]Excludes all at-sea whiting, recreational and research catches.
[2]Includes the Columbia and Vancouver INPFC areas only.

Table i. Summary of canary rockfish reference points from the base case model. Values are based on 1994-1998 fishery selectivity and allocation to better approximate the performance of a targeted fishery rather than a bycatch-only scenario.

Quantity	Estimate	~95% Confidence interval	Range of states of nature
Unfished spawning stock biomass (SB_0, mt)	32,561	30,594-34,528	34,262-31,498
Unfished 5+ biomass (mt)	86,036	NA	91,980-82,744
Unfished recruitment (R_0, thousands)	4,210	3,961-4,458	4,540-4,035
Reference points based on $SB_{40\%}$			
MSY Proxy Spawning Stock Biomass ($SB_{40\%}$)	13,024	12,237-13,811	12,599-13704.7
SPR resulting in $SB_{40\%}$ ($SPR_{SB40\%}$)	54.4%	54.4-54.4	45.8-68.5
Exploitation rate resulting in $SB_{40\%}$	0.0457	NA	0.0277-0.0600
Yield with $SPR_{SB40\%}$ at $SB_{40\%}$ (mt)	1,574	1,477-1,672	996-2,034
Reference points based on SPR proxy for MSY			
Spawning Stock Biomass at SPR (SB_{SPR})(mt)	11,161	10,487-11,835	1,654-14,053
$SPR_{MSY\text{-}proxy}$	50.0%	NA	NA
Exploitation rate corresponding to SPR	0.0528	NA	0.0524-0.0539
Yield with $SPR_{MSY\text{-}proxy}$ at SB_{SPR} (mt)	1,572	1,476-1,668	238-1,962
Reference points based on estimated MSY values			
Spawning Stock Biomass at *MSY* (SB_{MSY}) (mt)	12,211	11,529-12,893	9,524-15,042
SPR_{MSY}	52.5%	52.1-52.8	37.0-70.5
Exploitation Rate corresponding to SPR_{MSY}	0.0487	NA	0.0254-0.0794
MSY (mt)	1,578	1,481-1,675	1,002-2,104

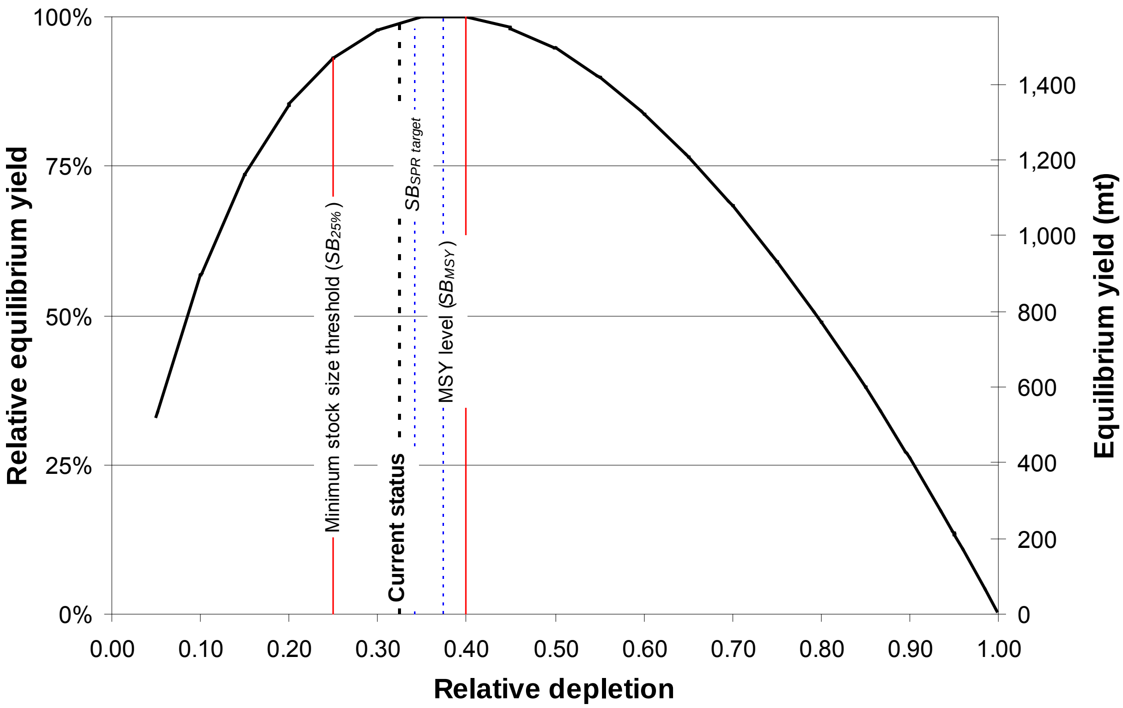

Figure h. Equilibrium yield curve (derived from reference point values reported in table i) for the base case model. Values are based on 1994-1998 fishery selectivity and allocation to better approximate the performance of a targeted fishery rather than a bycatch-only scenario.

Agenda Item E.2.a
Attachment 2
March 2010

SSC TERMS OF REFERENCE FOR GROUNDFISH REBUILDING ANALYSIS

DRAFT REVISED VERSION (MAY 2008)

PACIFIC FISHERY MANAGEMENT COUNCIL
7700 NE AMBASSADOR PLACE, SUITE 101
PORTLAND, OR 97220
(503) 820-2280
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Note: This version of the Terms of Reference does not include any changes that might be needed owing to the implementation of ACLs, as how ACLs will be implemented is currently not known.

Table of Comments

1. Introduction

Amendment 11 to the Groundfish Fishery Management Plan (FMP) established a harvest control rule for determining optimum yields (OYs). The 40:10 policy was designed to prevent stocks from falling into an overfished condition. Part of the amendment established a default overfished threshold equal to 25% of the unexploited population size[1] (B_0), or 50% of B_{MSY}, if known. By definition, groundfish stocks falling below that level are designated to be in an overfished state ($B_{25\%} = 0.25 \times B_0$[2]). To prevent stocks from deteriorating to that point, the policy specified a precautionary threshold equivalent to 40% of B_0. The policy requires that OY, when expressed as a fraction of the allowable biological catch (ABC), be progressively reduced at stock sizes less than $B_{40\%}$. Because of this linkage, $B_{40\%}$ has sometimes been interpreted to be a proxy measure of B_{MSY}, i.e., the stock biomass that results when a stock is fished at F_{MSY}. In fact, theoretical results support the view that a robust biomass-based harvesting strategy would be to maintain stock size at about 40% of the unfished level (Clark 1991, 2002). In the absence of a credible estimate of B_{MSY}, which can be very difficult to estimate (MacCall and Ralston 2002), $B_{40\%}$ is a suitable proxy to use as a rebuilding target.

Under the Magnuson-Stevens Act (MSA), it is required that rebuilding plans need to be developed for stocks that have been designated to be in an overfished state. Amendment 12 of the Groundfish FMP provided a framework within which rebuilding plans for overfished groundfish resources could be established. Amendment 12 was challenged in Federal District Court and found not to comply with the requirements of the MSA because rebuilding plans did not take the form of an FMP, FMP amendment, or regulation. In response to this finding, the Council developed Amendment 16-1 to the Groundfish FMP which covered three issues, one of which was the form and content of rebuilding plans.

The Council approach to rebuilding depleted groundfish species, as described in rebuilding plans, was re-evaluated and adjusted under Amendment 16-4 in 2006 so they would be consistent with a recent opinion rendered by the Ninth Circuit Court of Appeals in *Natural Resources Defense Council, Inc. and Oceana, Inc.* v. *National Marine Fisheries Service, et al.,* 421 F.3d 872 (9th Cir. 2005), and with National Standard 1 of the MSA. The court affirmed the MSA mandate that rebuilding periods "be as short as possible, taking into account the status and

[1] The absolute abundance of the mature portion of a stock is loosely referred to here in a variety of ways, including: population size, stock biomass, stock size, spawning stock size, spawning biomass, spawning output; i.e., the language used in this document is sometimes inconsistent and/or imprecise. However, the best fundamental measure of population abundance to use when establishing a relationship with recruitment is spawning output, defined as the total annual output of eggs (or larvae in the case of live-bearing species), accounting for material effects (if these are known). Although spawning biomass is often used as a surrogate measure of spawning output, for a variety of reasons a non-linear relationship often exists between these two quantities (Rothschild and Fogarty 1989; Marshall *et al*. 1998). Spawning output should, therefore, be used to measure the size of the mature stock when possible.

[2] Estimates of stock status are typically obtained by fitting statistical models of stock dynamics to survey and fishery data. In recent years, the bulk of stock status determinations have been based on Stock Synthesis II, an age- and size-structured population dynamics model (Methot 2005, 2007). Stock assessment models can be fitted using Maximum Likelihood or Bayesian methods. For both types of estimation methods, a stock is considered to be in an overfished state if the best point estimate of stock size is less than 25% of unfished stock size. This corresponds to the maximum likelihood estimate for estimation methods based on Maximum Likelihood methods, to the maximum of the posterior distribution (MPD) for estimation methods in which penalties are added to the likelihood function, and to the mode of the posterior distribution for Bayesian analyses.

biology of any overfished stocks of fish, the needs of fishing communities, recommendations by international organizations in which the United States participates, and the interaction of the overfished stock of fish within the marine ecosystem" (Section 304(e)). The court opinion also recognized that some harvest of overfished species could be accommodated under rebuilding plans to avoid disastrous economic impacts to West Coast fishing communities dependent on groundfish fishing. This harvest can only be incidental and unavoidable in fisheries targeting healthy stocks and, under Amendment 16-4 rebuilding plans, more emphasis was placed on shorter rebuilding times and the trade-off between rebuilding periods and associated socioeconomic effects.

Rebuilding Plans include several components, one of which is a rebuilding analysis. Simply put, a rebuilding analysis involves projecting the status of the overfished resource into the future under a variety of alternative harvest strategies to determine the probability of recovery to B_{MSY} (or its proxy $B_{40\%}$) within a pre-specified time-frame.

2. Overview of the Calculations Involved in a Rebuilding Analysis

This document presents guidelines for conducting a basic groundfish rebuilding analysis that meets the minimum requirements that have been established by the Council's Scientific and Statistical Committee (SSC), those of Amendment 16-1 of the Groundfish FMP, and those arising from the 9th Circuit Court decision. It also outlines the appropriate documentation that a rebuilding analysis needs to include. These basic calculations and reporting requirements are essential elements in all rebuilding analyses to provide a standard set of base-case computations, which can then be used to compare and standardize rebuilding analyses among stocks. The steps when conducting a rebuilding analysis are:

1. Estimation of B_0 (and hence B_{MSY} or its proxy).
2. Selection of a method to generate future recruitment.
3. Specification of the mean generation time.
4. Calculation of the minimum possible rebuilding time, T_{MIN}.
5. Identification and analysis of alternative harvest strategies and rebuilding times.

The specifications in this document have been implemented in a computer package developed by Dr André Punt (University of Washington). This package can be used to perform rebuilding analyses for routine situations. However, the SSC encourages analysts to explore alternative calculations and projections that may more accurately capture uncertainties in stock rebuilding than the standards identified in this document, and which may better represent stock-specific concerns. In the event of a discrepancy between the generic calculations presented here and a stock-specific result developed by an individual analyst, the SSC groundfish subcommittee will review the issue and recommend which results to use.

The SSC also encourages explicit consideration of uncertainty in projections of stock rebuilding, including comparisons of alternative states of nature using decision tables to quantify the impact of model uncertainty (see Section 8 below).

3. Estimation of B_0

B_0, defined as mean unexploited spawning output, can be estimated from the fit of some form of spawner-recruit model or empirically using the estimates of recruitment from the stock assessment. Most of the recent assessments of west coast groundfish have been based on stock assessments that integrate the estimation of the spawner-recruit model with the estimation of other population dynamic parameters. These stock assessments therefore link the recruitments for the early years of the assessment period with the average recruitment corresponding to B_0. Estimates of B_0 from empirical methods will not be the same as those estimated as an embedded parameter within an assessment model. As a result, the estimate of B_0 from the stock assessment model should be the default for the B_0 used in rebuilding analyses when the stock assessment integrates the spawner-recruit model. Justification for the use an empirical estimate of B_0 is therefore needed when a direct estimate of B_0 is available from a stock assessment model, and the difference in B_0 estimates must also be documented. Stock assessment models which integrate the estimation of the spawner-recruit model also provide estimates of B_{MSY}. However, at this time, the SSC recommends that these estimates not be used as the target for rebuilding. Rather, the rebuilding target should be taken to be $0.4B_0$ in all cases.

For the purpose of estimating B_0 empirically, analysts should select a sequence of years, within which recruitment is believed to be reasonably representative of the natality from an unfished stock. The average recruitment for these years can then be multiplied by the spawning output-per-recruit in an unfished state (which depends on growth, maturity, fecundity and natural mortality) to estimate equilibrium unfished spawning output. In selecting the appropriate sequence of years, analysts have generally utilized years in which stock size was relatively large, in recognition of the paradigm that groundfish recruitment is positively correlated with spawning stock size (Myers and Barrowman 1996). Moreover, due to the temporal history of exploitation in the West Coast groundfish fishery (see Williams 2002), this has typically led to consideration of the early years from an assessment model[3]. Thus, for example, in the case of widow rockfish, the time period within which recruitments were selected when estimating B_0 was 1958-62 (He *et al*. 2003).

An alternative view of the recruitment process is that it depends to a much greater degree on the environment than on adult stock size. For example, the decadal-scale regime shift that occurred in 1977 (Trenberth and Hurrell 1994) is known to have strongly affected ecosystem productivity and function in both the California Current and the northeast Pacific Ocean (Roemmich and McGowan 1995; MacCall 1996; Francis *et al*. 1998; Hare *et al*. 1999). With the warming that ensued, West Coast rockfish recruitment appears to have been adversely affected (Ainley *et al*. 1993; Ralston and Howard 1995). Thus, if recruitment was environmentally forced, it would be more sensible to use the full time series of recruitments from the stock assessment model to estimate B_0. These two explanatory factors are highly confounded for West Coast groundfish, i.e., generally high biomass/favourable conditions prior to 1980 and low biomass/unfavourable

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[3] Individual recruitments estimated from age-structured stock assessment models do not all exhibit the same precision or accuracy. Recruitments estimated at the very beginning of the modeled time period may suffer from mis-specification of the initial condition of the population (e.g., an assumed equilibrium age structure). Likewise, recruitments estimated at the end of the sequence may be imprecise due to partial recruitment of recent year classes. Thus, it may be advisable to trim the beginning and/or ending year-classes to address this problem

conditions combined with increasing fishing impacts on groundfish stocks thereafter. Using all recruitments to estimate B_0 will therefore usually result in a lower value of B_0 (and hence target spawning output) than when an abbreviated series of recruitments is taken from early in the time series.

There is no incontrovertible evidence to favour one of these two hypotheses over the other. For example, both theoretical and observational considerations support the view that groundfish recruitment will decline with spawning output (e.g., Myers and Barrowman 1996; Brodziak *et al*. 2001). On the other hand, recent advances in our understanding of the North Pacific Ocean indicate that profound changes have occurred in the marine ecosystem since the turn of the last century (PICES 2005). In fact, an argument can be made that the effects of environmental and density-dependent factors on the spawner-recruit relationship are additive (e.g., Jacobson and MacCall 1995), which may allow us to quantitatively determine the relative importance of these two factors in the future.

For each of these two empirical methods of estimating B_0, the actual distribution for B_0 can be approximated by re-sampling recruitments, from which the probability of observing any particular stock biomass can be obtained. This approach was taken in the original bocaccio rebuilding analysis (MacCall 1999), where it was concluded that the first year biomass was unlikely to have occurred if the entire sequence of recruitments were used to determine B_0.

4. Selection of a Method to Generate Future Recruitment

On can project the population forward once the method for generating future recruitment has been specified, given the current state of the population from the most recent stock assessment (terminal year estimates of numbers at age and their variances) and the rebuilding target. There are several ways of generating future recruitment, but they fundamentally reduce to two basic kinds of approaches. These are: (1) base future recruitments on an empirical evaluation of spawner-recruit estimates and (2) use the results of a fitted spawner-recruit model (e.g., the Beverton-Holt or Ricker curves). To date, rebuilding analyses have been conducted using both approaches, and both are acceptable, as long as due consideration is given to the advantages and disadvantages of both. Ideally, reference points (e.g., B_0, B_{MSY} and F_{MSY}) and the results from projections should be compared to better assess the actual extent of uncertainty associated with these quantities.

4.1 Fitting a Spawner-Recruit Model

It is possible generate future recruitments by fitting spawner-recruit models to the full time series of spawner-recruit data. SS2-based assessments all assume a structural spawner-recruit model, either estimating or pre-specifying the steepness of the curve[4]. Ideally, the use of spawner-recruit models allows the data (or prior information) to determine the extent of compensation rather than assuming either one of two extremes (constant recruitment or constant recruits/spawner), and is also more internally consistent if the original assessment assumed a particular form of spawner-

[4] The "steepness" of a spawner-recruit curve is related to the slope at the origin and is a measure of a stock's productive capacity. It is expressed as the proportion of virgin recruitment that is produced by the stock when reduced to $B_{20\%}$, and ranges between 0.2 and 1.0.

recruit model. However, this approach can be criticized because stock productivity is constrained to behave in a pre-specified manner according to the particular spawner-recruit model chosen, and there are different models to choose from, including the Beverton-Holt and Ricker formulations. These two models can produce very different reference points, but are seldom distinguishable statistically. Moreover, there are statistical issues when a spawner-recruit model is estimated after the assessment is conducted, including: (1) time-series bias (Walters 1985), (2) the "errors in variables problem" (Walters and Ludwig 1981), and (3) non-homogeneous variance and small sample bias (MacCall and Ralston 2002). Thus, analyses based on a spawner-recruit model should include a discussion of the rationale for the selection of the spawner-recruit model used (e.g. estimated within the assessment model, estimated outside of the model based on the estimates of spawning output and recruitment), and refer to the estimation problems highlighted above and whether they are likely to be relevant and substantial for the case under consideration. A rationale for the choice of spawner-recruit model should also be provided. In situations where steepness is based on a spawner-recruit meta-analysis (e.g., Dorn 2002), the reliability of the resulting relationship should be discussed.

4.2 Empirical Approaches

There are two ways to use empirical estimates of recruitment from a stock assessment to generate future recruitment, both of which utilize estimates at the tail end of the time series (i.e., the most recent estimates). These two methods have formed the basis of several rebuilding analyses that have been accepted by the SSC.

(1) Recent recruitment is standardized to the amount of the spawning output (recruits-per-spawner, R/S_i). Annual R/S_i is then randomly re-sampled and multiplied by S_i to obtain year-specific stochastic values of R_i.
(2) Recent recruitments are randomly re-sampled to determine the year-specific stochastic values of R_i.

Note that use of R/S_i as the basis for projecting the population forward ties recruitment values in a directly proportional manner to spawning output; if spawning output doubles, resulting recruitment will also double, all other things being equal. As the stock rebuilds, this becomes an increasingly untenable assumption because there is no reduction in reproductive success at very high stock sizes, which is to say there is no compensation (i.e., steepness = 0.2). In contrast, re-sampling R_i values, results in errors in the opposite direction. Namely, recruitment does not increase as stock size increases as would be expected of most rebuilding stocks. This type of calculation effectively implies perfect compensation (i.e., steepness = 1). Thus, these two ways of projecting the population forward (using re-sampled R_i or re-sampled R/S_i) bracket the range of population responses that are likely to occur in the real world. The method selected to generate future recruitment should ensure that potential recruitment values are consistent with stock sizes between the current level and the rebuilding target, i.e., they would be considered plausible throughout the duration of rebuilding projection.

5. Determination of the Minimum and Maximum Times to Recovery

The minimum time to recovery (denoted T_{MIN}) is defined as the median time for a stock to recover to the target stock size, starting from the time when a rebuilding plan was actually implemented (usually the year after the stock was declared overfished) to when the target level is first achieved, assuming no fishing occurs. Next, the mean generation time should be calculated as the mean age of the net maturity function. A complication that can occur in the calculation of mean generation time, as well as B_0 (see above), is when growth and/or reproduction have changed over time. In such instances, the parameters governing these biological processes should typically be fixed at their most recent, contemporary, values, as this best reflects the intent of "prevailing environmental conditions" as stated in the NMFS Guidelines for National Standard 1. Exceptions may occur if there are good reasons for an alternative specification (e.g., using growth and maturity schedules that are characteristic of a stock that is close to B_{MSY}).

Although no longer used directly in Council decision-making for overfished stocks, rebuilding analyses should report the maximum time to recovery (denoted T_{MAX}). T_{MAX} is ten years if T_{MIN} is less than 10 years. If T_{MIN} is greater than or equal to 10 years, T_{MAX} is equal to T_{MIN} plus one mean generation. Likewise, rebuilding analyses should report an estimate of the median number of years needed to rebuild to the target stock size if all future fishing mortality is eliminated from the first year for which the Council is making a decision about[5] ($T_{F=0}$). This will typically differ from T_{MIN}.

Finally, when a stock rebuilding plan has been implemented for some time and recruitments have been estimated from an assessment, it may be that explicit, year-specific estimates of recruitment are available for the earliest years of the rebuilding time period. In such instances, rebuilding forecasts should be conducted setting the recruitments from the start of the rebuilding plan to the current year based on the estimates from the most recent assessment, rather than through re-sampling methods (see above).

6. Harvest During Rebuilding

The Council is required to rebuild overfished stocks in a time period that is as short as possible, but can extend this period to take into account the needs of fishing communities. The simplest rebuilding harvest strategy to simulate and implement is a constant harvest rate or "fixed F" policy. All rebuilding analyses should, therefore, consider fixed F strategies. Other strategies are possible, including constant catch and phase-in strategies, in which catch reductions are phased-in before the OYs transition to a fixed F strategy. In these latter cases, analysts should always assess whether fishing mortality rates exceed F_{MSY} (or its proxy), as this would constitute overfishing.

Analysts should consider a broad range of policy alternatives to give the Council sufficient scope on which to base a decision. The following represent a minimum set of harvest policies that should be reported:

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[5] This year will generally not be the current year, but rather the year following the current two-year cycle.

1. The spawning potential ratio[6] listed in the Rebuilding Plan in the FMP (Amendment 16-4 for the stocks that are currently overfished) [only stocks already under rebuilding plans].
2. The spawning potential ratio corresponding to the optimum yields adopted for the current year (or biennium) [only stocks already under rebuilding plans].
3. The spawning potential ratio on which the current optimum yields were based [only stocks already under rebuilding plans; this spawning potential ratio will differ from that in 2) if the stock assessment has changed substantially since the last assessment].
4. The spawning potential ratio which will rebuild the stock to the target level with 0.5 probability by the T_{TARGET} specified in the FMP [only stocks already under rebuilding plans].
5. The spawning potential ratio which will rebuild the stock to the target level with 0.5 probability by the T_{MAX} specified in the FMP [only stocks already under rebuilding plans].
6. The spawning potential ratio which will rebuild the stock to the target level with 0.5 probability by the T_{MAX} calculated using the most recent biological and fishery information.
7. The ABC and 40:10 control rules.
8. No harvest.
9. Spawning potential ratios which achieve recovery to the target level with 0.5 probability for years between $T_{\mathrm{F=0}}$ and T_{MAX}. These spawning potential ratios should be selected by calculating the median rebuilding times under the most conservative rebuilding strategy (i.e., $T_{\mathrm{F=0}}$) and the most liberal, allowable rebuilding strategy (i.e. T_{MAX}) and then selecting intermediate time intervals in even quartile increments. That is, if $T_{\mathrm{F=0}}$ is 20 years and T_{MAX} = 60 years, then the intermediate alternatives would have rebuilding times of 30, 40 and 50 years, respectively.

These polices should be implemented within the projection calculations in the year for which the Council is making a decision. For example, for assessments conducted in 2009 (using data up to 2008), the harvest decisions pertain to OYs for 2011 and 2012. In this case, the catches for 2009 and 2010 should be set to the OYs established by the Council for those years.

Many other harvest policies could be implemented by the Council, based on whatever circumstances may mitigate against a constant harvest rate approach. Consequently, analysts should be prepared to respond to requests by the Council for stock-specific projections on an individual case-by-case basis.

7. Evaluating Progress Towards Rebuilding

There are no agreed criteria for assessing the adequacy of the progress towards rebuilding for species that are designated to be in an overfished state and are under a Rebuilding Plan. The SSC currently reviews each stock on a case-by-case basis, considering the following two questions: (1) have cumulative catches during the period of rebuilding exceeded the cumulative OY that was available, and (2) what is the difference between the year in which recovery is predicted to

[6] The Spawning Potential Ratio (SPR) is a measure of the expected spawning output-per-recruit, given a particular fishing mortality rate and the stock's biological characteristics, i.e., there is a direct mapping of SPR to F (and *vice versa*). SPR can therefore be converted into a specific fishing mortality rate in order to calculate OYs.

occur under the current SPR (T_{REBUILD}) and the current adopted T_{TARGET}? If the difference between T_{REBUILD} and T_{TARGEST} is minor, progress towards rebuilding will be considered to be adequate. In contrast, if the difference between T_{REBUILD} and T_{TARGET} is major, it will be necessary to define a new T_{TARGET}. As an initial step in this direction, a new maximum time to rebuild T_{MAX}^{N} will be computed based on the specifications outlined in Section 5. Analysts will be asked to assess whether the currently adopted SPR will readily rebuild the stock before T_{MAX}^{N}.

Adequacy of progress will be evaluated when the SSC groundfish subcommittee reviews the draft rebuilding plans. Analysts should provide the information needed to address the two questions listed above. If the SSC agrees that progress is not sufficient, the draft rebuilding analysis documents will need to be updated to include T_{MAX}^{N} and the probability that the currently adopted harvest rate (SPR) will rebuild the stock before T_{MAX}^{N}.

8. Decision Analyses / Considering Uncertainty

The calculation of T_{MIN} and the evaluation of alternative harvest strategies involve projecting the population ahead taking account of uncertainty about future recruitment. There are several reasons for considering model and parameter uncertainty when conducting a rebuilding analysis. For example, if several assessment model scenarios were considered equally plausible by the assessment authors or, alternatively, one model was preferred by the assessment authors and another was preferred by the STAR Panel.

The uncertainty associated other parameters, such as the rate of natural mortality and the current age-structure of the population, can also be taken into account. This can be achieved in a variety of ways. For example, if the uncertainty relates to the parameters within one structural model, this uncertainty can be reflected by basing projections on a number of samples from a distribution which reflects this uncertainty (such as a Bayesian posterior distribution or bootstrap samples). Alternatively, projections can be conducted for each model and the results appropriately weighted when producing the final combined results if the uncertainty pertains to alternative structural models.

A decision table is an appropriate means to express the implications of uncertainty in model structure when an "integrated" approach, as outlined in the previous paragraph, is not adopted. Construction of decision tables when projections are based on a constant harvest rate policy is, however, not entirely straightforward. One way to achieve this is to conduct projections for each alternative model in turn and record the median (or mean) time-trajectory of catches. The decision table is then based on projections with a set of pre-specified time-series of catches. If probabilities were assigned to each alternative model by the assessment authors and STAR Panel, these must be reported with the decision table.

9. Documentation

It is important for analysts to document their work so that any rebuilding analysis can be repeated by an independent investigator at some point in the future. Therefore, all stock assessments and rebuilding analyses should include tables containing the specific data elements that are needed to adequately document the analysis. Clear specification of the exact assessment scenario(s) used as the basis for the rebuilding analysis is essential. Therefore, linkages with the most recent stock assessment document should be clearly delineated (e.g., through references to tables or figures). This is important because assessments often include multiple scenarios that usually have important implications with respect to stock rebuilding.

The minimum information that should be presented in a rebuilding analysis is:

- Date on which the analysis was conducted, and specifications for the software used for the analysis (including the version number), along with an example of the program's input file, ideally for the base (most likely) case. Documentation and basis for the number of simulations on which the analyses are based should also be provided. The software and data files on which the rebuilding analyses are based should archived with the stock assessment coordinator.
- Rebuilding parameters. For each alternative model, a table (see Table 1 for an example based on canary rockfish) should be produced which lists: (a) the year in which the rebuilding plan commenced, (b) the present year, (c) the first year that the evaluated harvest policy calculates OY, (d) T_{MIN}, (e) mean generation time, (f) T_{MAX}, (g) $T_{F=0}$, (h) the estimate of B_0 and the target recovery level, (i) the current SPR, (j) the current T_{TARGET} and (k) the estimate of current stock size.
- Results of harvest policy projections (see, for examples, Tables 2-5; Figures 1-3). The following information should be provided for each harvest policy evaluated: (a) the year in which recovery to the target level occurs with 0.5 probability, (b) the SPR for the first year of the projection period, (c) the probably of recovery by the current $T_{TARGET,}$ (d) the probably of recovery by the current T_{MAX}, (e) tables of median time-trajectories (from the present year to T_{MAX}) of: (i) spawning output relative to the target level, (ii) probability of being at or above the target level, (iii) ABC, and (iv) optimum yield. Median time-trajectories of SPR should be provided for the projection based on the 40:10 rule and any phase-in harvest policies that have been specified.
- The information needed to assess progress towards rebuilding (e.g. catches and OYs during the rebuilding period) and any additional information based on the review of adequacy of progress by the SSC (e.g. T^{N}_{MAX}).
- Median and 95% intervals for: (a) summary / exploitable biomass, (b) spawning output (in absolute terms and relative to the target level), (c) recruitment, (d) catch, (e) landings (if different from catch), (f) ABC, and (g) SPR for the actual harvest strategy selected by the Council.
- The rationale for the approach used to estimate B_0 and to generate future recruitment.
- The biological information on which the projections are based (show results for each alternative model):
  - Natural mortality rate by age and sex.
  - Individual weight by age and sex.
  - Maturity by age.
  - Fecundity by age.
  - Selectivity-at-age by sex (and fleet).
  - Population numbers (by age and sex) for the year the rebuilding plan commenced.
  - Population numbers (by age and sex) for the present year.

- o How fishing mortality was allocated to fleet for rebuilding analyses based on multiple fleets.

Notes:

- Much of the biological information will be stored in the input file for the projection software and doesn't need to be repeated unless there is good reason to do so.
- For cases in which the projections take account of uncertainty about the values for the biological parameters (e.g., using the results from bootstrapping or samples from a Bayesian posterior distribution), some measure of the central tendency of the values (e.g., the mode or median) should be provided and the individual parameter values should be archived with the stock assessment coordinator.
- Rebuilding analyses may be based on selectivity-at-age vectors constructed by combining estimates over fleets. If this is the case, the rebuilding analysis needs to document how the composite selectivity-at-age vector was constructed.

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Table 1. Summary of rebuilding reference points for canary rockfish (based on Stewart (2007)).

Parameter	Values
Year declared overfished	2000
Current year	2007
First OY year	2009
T_{MIN}	2019
Mean generation time	22
T_{MAX}	2041
$T_{F=0}$ (beginning in 2009)	2019
B_0	32,561
Rebuilding target ($B_{40\%}$)	13,024
Current SPR	0.887
Current T_{TARGET}	2063
SB_{2007}	10,544

Table 2. Results of rebuilding alternatives for canary rockfish (based on Stewart (2007)).

	Run #			
	1	2	3	4
50% prob. recovery by:	2019	2021	2035	2041
SPR_{TARGET}	100%	88.7%	62.0%	59.2%
2009 OY (mt)	0.0	155.2	636.9	700.0
2009 ABC (mt)	936.9	936.9	936.9	936.9
2010 OY (mt)	0.0	155.0	623.1	683.1
2010 ABC (mt)	941.4	935.4	916.7	914.2
Probability of recovery				
2071 (T_{MAX})	97.1%	84.6%	73.5%	70.0%
2048 (T_{MIN})	76.4%	75.0%	64.8%	56.9%
2053 ($T_{F=0}$ from 2007)	79.4%	75.3%	67.9%	61.3%
2063 (T_{TARGET})	91.4%	78.8%	72.0%	66.8%

Table 3. Probability of recovery for four rebuilding alternatives for canary rockfish (based on Stewart (2007)). Note that after 25 years the table is compressed.

	Run #			
	1	2	3	4
2007	0.250	0.250	0.250	0.250
2008	0.250	0.250	0.250	0.250
2009	0.250	0.250	0.250	0.250
2010	0.250	0.250	0.250	0.250
2011	0.250	0.250	0.250	0.250
2012	0.250	0.250	0.250	0.250
2013	0.250	0.250	0.250	0.250
2014	0.250	0.250	0.250	0.250
2015	0.250	0.250	0.250	0.250
2016	0.251	0.250	0.250	0.250
2017	0.284	0.257	0.250	0.250
2018	0.407	0.288	0.250	0.250
2019	0.550	0.366	0.250	0.250
2020	0.660	0.473	0.256	0.251
2021	0.702	0.561	0.260	0.256
2022	0.732	0.633	0.267	0.261
2023	0.742	0.681	0.279	0.267
2024	0.746	0.707	0.290	0.275
2025	0.749	0.725	0.309	0.281
2026	0.749	0.735	0.321	0.293
2027	0.749	0.742	0.341	0.300
2028	0.750	0.746	0.358	0.313
2029	0.750	0.746	0.376	0.324
2030	0.750	0.747	0.402	0.336
2031	0.750	0.749	0.424	0.348
2041	0.750	0.750	0.586	0.500
2051	0.781	0.751	0.671	0.601
2061	0.895	0.776	0.714	0.660
2071	0.971	0.846	0.735	0.700

Table 4. Median spawning biomass (mt) for four rebuilding alternatives for canary rockfish (based on Stewart (2007)). Note that after 25 years the table is compressed.

	Run #			
	1	2	3	4
2007	10,544	10,544	10,544	10,544
2008	10,841	10,841	10,841	10,841
2009	11,073	11,073	11,073	11,073
2010	11,258	11,197	11,010	10,985
2011	11,383	11,260	10,880	10,831
2012	11,463	11,274	10,701	10,627
2013	11,524	11,268	10,501	10,403
2014	11,607	11,280	10,318	10,197
2015	11,751	11,351	10,186	10,041
2016	11,987	11,508	10,133	9,964
2017	12,328	11,765	10,163	9,969
2018	12,738	12,089	10,251	10,029
2019	13,181	12,432	10,357	10,113
2020	13,685	12,838	10,520	10,247
2021	14,236	13,293	10,721	10,419
2022	14,773	13,731	10,909	10,583
2023	15,350	14,210	11,130	10,775
2024	15,941	14,674	11,345	10,966
2025	16,500	15,133	11,515	11,105
2026	17,015	15,536	11,679	11,251
2027	17,517	15,959	11,852	11,391
2028	18,045	16,348	11,999	11,515
2029	18,600	16,811	12,211	11,699
2030	19,093	17,183	12,329	11,799
2031	19,528	17,519	12,432	11,877
2041	23,511	20,635	13,491	12,751
2051	26,282	22,743	14,238	13,357
2061	27,862	24,058	14,655	13,689
2071	28,903	24,832	15,097	14,073

Table 5. Median catches (mt) for four rebuilding alternatives for canary rockfish (based on Stewart (2007)). Note that after 25 years the table is compressed.

	Run #			
	1	2	3	4
2007	0.0	44.0	44.0	44.0
2008	0.0	44.0	44.0	44.0
2009	0.0	155.2	636.9	700.0
2010	0.0	155.0	623.1	683.1
2011	0.0	157.5	621.9	680.2
2012	0.0	163.7	635.4	693.4
2013	0.0	171.5	654.9	713.1
2014	0.0	179.7	675.9	734.4
2015	0.0	186.9	691.6	750.1
2016	0.0	193.4	705.3	763.1
2017	0.0	198.7	713.8	770.8
2018	0.0	205.1	724.3	780.5
2019	0.0	210.6	733.9	789.5
2020	0.0	216.8	744.3	798.9
2021	0.0	222.0	753.8	807.8
2022	0.0	228.3	765.2	818.8
2023	0.0	234.0	769.3	821.3
2024	0.0	239.0	778.8	830.7
2025	0.0	245.3	786.9	837.4
2026	0.0	250.0	795.2	845.3
2027	0.0	257.0	807.6	856.9
2028	0.0	261.7	814.0	862.9
2029	0.0	267.3	821.5	868.6
2030	0.0	272.3	830.5	877.2
2031	0.0	276.5	836.3	882.5
2041	0.0	318.0	897.1	938.2
2051	0.0	346.9	937.3	972.9
2061	0.0	365.2	967.1	1,002.9
2071	0.0	377.7	985.9	1,019.3

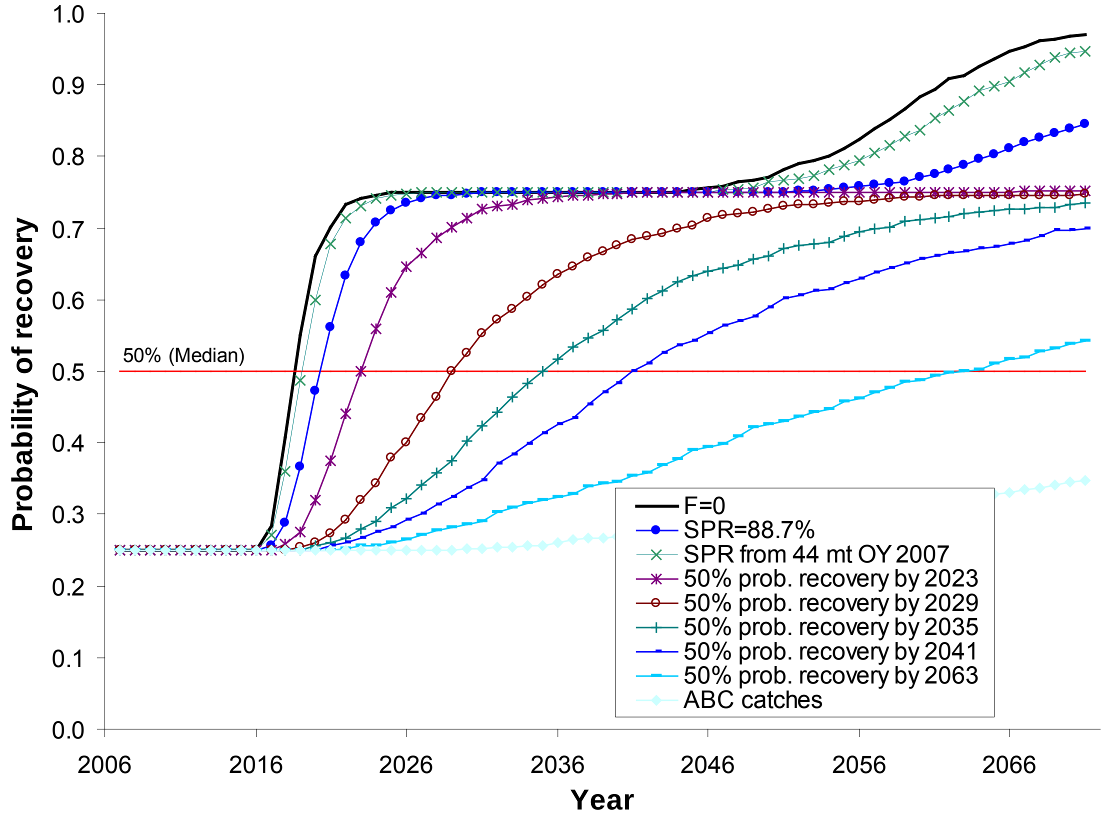

Figure 1. Probability of recovery for nine rebuilding alternatives for canary rockfish.

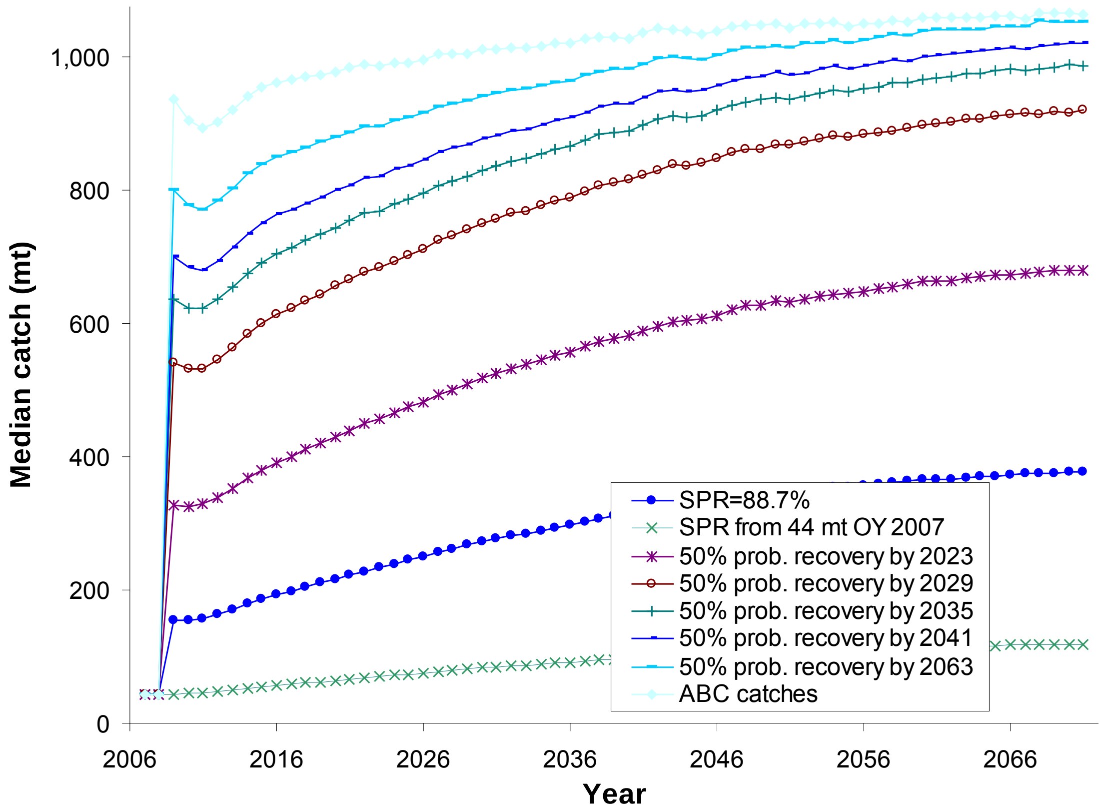

Figure 2. Projected median catch (mt) for nine rebuilding alternatives for canary rockfish.

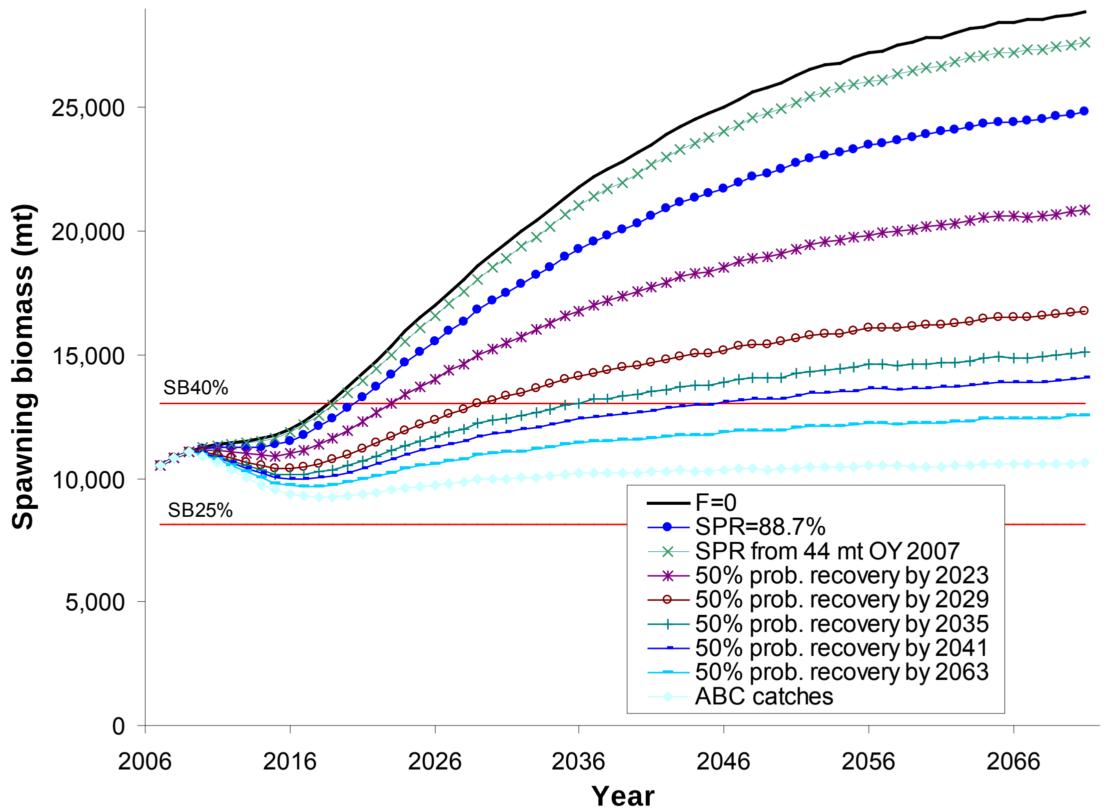

Figure 3. Projected median spawning biomass (mt) for nine rebuilding alternatives for canary rockfish.

Draft Summary Minutes

Yelloweye Rockfish Survey Design Workshop

Pacific Fishery Management Council
Large Conference Room
7700 N.E. Ambassador Place
Suite 101
Portland, Oregon
(503) 820-2280

December 1, 2009

Workshop Participants:

Dr. Ian Stewart, National Marine Fisheries Service Northwest Fisheries Science Center
Dr. Owen Hamel, National Marine Fisheries Service Northwest Fisheries Science Center
Dr. Bruce Leaman, International Pacific Halibut Commission
Mr. Claude Dykstra, International Pacific Halibut Commission
Dr. Ray Webster, International Pacific Halibut Commission
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Ms. Jessica Moll, Oregon Department of Fish and Wildlife
Mr. Craig Good, Oregon Department of Fish and Wildlife
Mr. Bob Hannah, Oregon Department of Fish and Wildlife
Dr. Theresa Tsou, Washington Department of Fish and Wildlife
Dr. Henry Cheng, Washington Department of Fish and Wildlife
Mr. Farron Wallace, Washington Department of Fish and Wildlife
Mr. Corey Niles, Washington Department of Fish and Wildlife
Mr. Colby Brady, The Makah Tribe
Mr. Mike Burner, Pacific Fishery Management Council
Ms. Kelly Ames, Pacific Fishery Management Council
Mr. John DeVore, Pacific Fishery Management Council

A workshop to discuss survey designs for yelloweye rockfish was held December 1, 2009 in Portland, Oregon. Representatives from the Makah Tribe, Northwest Fisheries Science Center (NWFSC), International Pacific Halibut Commission (IPHC), Washington Department of Fish and Wildlife (WDFW), Oregon Department of Fish and Wildlife (ODFW), and the Pacific Fishery Management Council (PFMC) were in attendance. Workshop participants reviewed the 2009 yelloweye rockfish stock assessment and considered current efforts to improve the design of the extended IPHC rockfish survey, which is used as an index of relative abundance in the yelloweye assessment. Attention focused primarily on efforts by WDFW and ODFW to expand the IPHC longline survey for Pacific halibut to further investigate rocky reef habitat as well as work conducted by WDFW using a remotely operated vehicle (ROV). The following report is a summary of the workshop and the recommendations to the Council.

The workshop commenced with a review of the 2009 yelloweye rockfish stock assessment, presented by Dr. Ian Stewart (NWFSC). Key sources of fishery independent data in the assessment are the IPHC longline survey for Pacific halibut and the National Marine Fisheries Service (NMFS) trawl survey. Separate indices of abundance were developed for the Washington and Oregon IPHC longline surveys. In addition, time series of yelloweye rockfish abundance in the triennial and NWFSC combined trawl surveys were estimated and incorporated into the base model. Catch, length-frequency, and conditional age-at-length data from six fisheries were used in the assessment (i.e., commercial and recreational fisheries in each of the three states). The fishery-dependent relative abundance indices used in the model were developed from recreational fisheries data and were unchanged from the last assessment done in 2007. Considerable uncertainty regarding the time-series of historical catches was identified as a key source of uncertainty in the assessment. In particular, the historical harvests from Washington may be biased low, a concern likely to be addressed when the next assessment is completed.

Next, a review of the IPHC longline survey for Pacific halibut was presented by Dr. Bruce Leaman. Waters off Washington and Oregon (IPHC Area 2A) were first surveyed by the IPHC in 1995 and 1997. The survey was redesigned and the current methodology has been in effect since 1998. This survey methodology was employed in Washington and Oregon in 1999 and from 2001-2009. The standardized survey consists of a regular distribution of stations on a ten nautical mile by ten nautical mile grid within a nominal depth range of 20 to 275 fathoms. The survey uses conventional Pacific halibut gear consisting of 1,800 foot skates (i.e., a unit of longline gear) with 100 hooks per skate; 18-foot spacing between the 24-inch to 48-inch gangions; and number three (16/0) circle hooks baited with 1/3 to 1/4 pounds of #2 chum salmon. The number of skates deployed per station per year in waters off Washington and Oregon has varied from five to eight. During setting operations, the depth at the start of each skate is recorded. Starting in 2007, more detailed environmental data has been collected at each station using a SeaCat SBE-19*plus* water column profiler including depth, temperature, salinity, dissolved oxygen, pH, and chlorophyll a concentration.

Historically, bycatch information on the IPHC survey was recorded using a hook count methodology where at-sea samplers recorded the species caught on 20 consecutive hooks from each skate. Typically, these counts were performed at or near the beginning of a skate. Since 2002, IPHC at-sea samplers have tagged all retained rockfish caught during the survey by station. Generally, all yelloweye rockfish are retained in the Washington and Oregon charter regions. When the survey trips were landed, dockside samplers from the Pacific States Marine Fisheries Commission, WDFW, and ODFW conducted biological sampling including length, weight, sex, and removal of the otoliths to obtain age information. Since 2006, rockfish were tagged by skate and thus can be related to the beginning of the skate depth recorded during each set. Samples collected during the IPHC longline survey are the most informative source of biological data in the yelloweye rockfish assessment.

Dr. Leaman also presented information on IPHC survey catchability by area. During the 20 hook count process, at-sea samplers record species on hooks and whether whole baits or bait skin/empty hooks are retrieved which is used to infer potential differences in catchability relative to a coastwide standard. The Washington and Oregon survey efforts typically have a fewer number of baits returning compared to other areas (British Columbia and Alaska) and the coastwide estimates. As such, correction factors have been applied to standardize Pacific halibut CPUE by area.

The IPHC is currently exploring modifications to the current survey design in order to reduce the coefficient of variation associated with Pacific halibut catches in Washington and Oregon. These modifications could include additional grid stations, which may change interactions with rockfish and thus influence inputs to the yelloweye rockfish stock assessment.

Dr. Henry Cheng presented an overview of the enhanced rockfish survey which has been conducted in coordination with the annual IPHC longline survey for Pacific halibut since 2006. This survey uses the same standardized Pacific halibut gear employed in the IPHC longline survey; however, the number of skates is reduced to three in order to constrain catches of yelloweye rockfish to below the research set-aside amount (note: the yelloweye OY is so low and constraining to fishing opportunities that research catch is a significant removal of yield that can affect fishing opportunities). The survey design employs adaptive sampling at fixed stations. The primary goal of the WDFW enhanced rockfish survey is to lower the uncertainty of the estimated mean CPUE of yelloweye rockfish on the IPHC longline survey. Additional objectives have been explored throughout the years as follows:

- **2006:** Investigate the spatial distribution of yelloweye rockfish in rocky habitat outside of the IPHC survey area;
- **2007:** Investigate spatial changes of yelloweye rockfish distribution;
- **2008:** Investigate the spatial attacking bait behavior of Pacific halibut, dogfish, and yelloweye rockfish;
- **2009:** Investigate the relationship between environmental changes and yelloweye rockfish CPUE.

The proposed goal for the 2010 WDFW enhanced rockfish survey is to investigate seasonal changes in yelloweye rockfish CPUE.

Mr. Bob Hannah from ODFW reviewed the 2008 enhanced rockfish survey completed in coordination with the IPHC longline survey for Pacific halibut. Like the WDFW survey, three skates of standardized IPHC survey gear were deployed. The ODFW survey, however, employs a stratified random survey design, with stations selected within rocky reef habitat as defined by the Council's essential fish habitat analysis. Buffers (3.75 nautical miles) surround the IPHC survey stations in order to prevent interference (e.g., competition) from the rockfish stations. Although the variability of a randomized design may be larger than that of a fixed station design, ODFW recognized that there will be no station selection bias, nor potential for localized depletion. For these reasons they favored retaining the randomized design, albeit with very small sample sizes and lack of direct comparability with WDFW results. Additionally, a paired station experiment was conducted to investigate the possibility of localized depletion at standard IPHC longline survey stations. A Wilcoxon signed rank test was used to compare catch per skate of yelloweye rockfish between the paired stations and no significant difference was found. The investigators concluded that if localized depletion is occurring, it is not a strong effect.

Mr. Farron Wallace (WDFW) reviewed work completed by WDFW in 2008 for developing a non-lethal yelloweye rockfish survey. The objective of the survey was to estimate yelloweye rockfish densities along the track of the 2007 WDFW enhanced rockfish stations surrounding IPHC station 1082 using an ROV. Video from the ROV has been processed and data analysis is underway. The overall conclusion was that ROV surveys were a promising survey technique for yelloweye rockfish given that they were easily distinguished in the video and did not seem to react to the presence of the ROV.

Recommendations for Extractive Rockfish Surveys

For 2010, WDFW and ODFW are scheduled to continue the enhanced rockfish surveys in coordination with the IPHC stock assessment survey for Pacific halibut. WDFW scientists propose to continue the adaptive sampling approach as used in previous years. Additional objectives for 2010 include investigating whether yelloweye rockfish CPUE varies seasonally by re-surveying selected IPHC stations in the fall (September) and comparing those data to historical catch data from the summer (June/July). It was generally recognized that these efforts would not result in a more precise IPHC index for Washington for use in 2011. However, the effort could inform variability in historical survey catches.

ODFW intends to conduct a stratified random survey, with stations selected within rocky reef habitat defined in the essential fish habitat analysis, similar to the 2008 design. Investigators expressed difficulty in selecting additional random stations, given the lack of available rocky reef habitat and the buffers (3.75 nautical miles) around the IPHC survey stations. It was recommended that the investigators work with IPHC to explore the logistics of fishing the rockfish stations after the IPHC stations, instead of implementing a buffer zone. It was also thought that yelloweye surveys could occur less frequently than annual given the species longevity and low productivity. The paired sample design to investigate depletion will not be repeated in 2010.

Stock assessment authors present at the workshop expressed a desire to have common sample designs for the WDFW and ODFW enhanced surveys. However, no conclusion was reached at the workshop on the preferred methodology for extractive surveys. It was generally concluded that neither design had a large enough sample size to produce precise indices of abundance. Participants thought it would be very important to convey this information to managers. Specifically, current IPHC survey methods will not appreciably reduce uncertainty in current status for the yelloweye rockfish stock in the near future. Increasing sample size may be feasible operationally; however, it would require more yelloweye impacts than what could reasonably be accommodated in the research set-aside. Fixed stations also present a challenge if yelloweye rockfish exhibit strong site fidelity and thus would be subject to local depletion. The current stock assessment model assumption is that adult yelloweye rockfish are site-attached and do not move appreciably among the three states whereas larval dispersal is widespread; assumptions that are well-supported in the scientific literature.

Participants also explored the selectivity issues surrounding the survey gear employed in both the IPHC and rockfish surveys. The current survey gear uses relatively large hooks and bait, since it is designed to catch Pacific halibut. A workshop participant noted that traditional fisheries for rockfish used different gear including Portuguese gear, dingle bar, and longline gear associated with the sablefish fishery (i.e., generally smaller hooks), as well as different baits (e.g., squid or octopus). Additionally, participants discussed whether yelloweye length data collected on IPHC longline surveys in British Columbia (IPHC Area 2B) and Southeast Alaska (IPHC Area 2C) could be used to inform selectivity. No recommendations were made regarding survey gear for yelloweye rockfish surveys; these issues will continue to be explored by investigators and stock assessment scientists.

Participants also noted the difficulty in identifying rocky reef habitat suitable for conducting a rockfish survey. Habitat data off the coast of Washington is particularly sparse. Further, anecdotal evidence suggests that some rocky reef areas identified through the essential fish habitat process in Oregon may not actually represent rocky substrate. Participants agreed that the ability to design a rockfish survey located on rocky reef habitat will improve as habitats for waters off all states are further mapped.

Recommendation for Non-Extractive Survey Techniques

The workshop participants discussed the challenges of continuing and expanding extractive research projects, given future projected low annual catch limits, even after the yelloweye rockfish stock is rebuilt. As such, the workshop participants recommended that the Council create an ad hoc committee tasked with developing a coastwide non-extractive visual survey methodology for yelloweye rockfish. Workshop discussions focused primarily on ROV technologies, though participants were interested in exploring other visual survey methodologies (e.g., AUV). The ad hoc committee's recommended survey design should be forwarded to the Council's Scientific and Statistical Subcommittee for final review and approval.

All participants agreed that a coastwide visual survey would be ideal, however impossible given current resources. As such, the participants recommended that all three states collaborate on granting and alternate years in which the states are surveyed. As an initial step, the ROV could survey the IPHC stations that have historically caught yelloweye rockfish in Washington and Oregon. The objective would be to generate estimates of yelloweye rockfish abundance as well as characterize the habitat surrounding the IPHC stations. A better understanding of the species associations, oceanic, biological and habitat characteristics surrounding current IPHC stations may help explain the annual variability in yelloweye rockfish catches. Since the IPHC survey does not extend into California, participants were also interested in investigating the area north of 40°10 N. latitude, where the majority of yelloweye rockfish catch in California occurs.

Agenda Item E.2.a
Supplemental Attachment 4
March 2010

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TERMS OF REFERENCE

FOR THE

GROUNDFISH
STOCK ASSESSMENT AND REVIEW PROCESS FOR 2011~~09~~-2012~~0~~

DRAFT

~~DECEMBER~~ MARCH 4, 2010~~08~~

Roster published by the Pacific Fishery Management Council pursuant to National Oceanic and Atmospheric Administration contract number NA05NMF4410008.

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TERMS OF REFERENCE FOR THE
GROUNDFISH STOCK ASSESSMENT AND REVIEW PROCESS FOR 2011~~09~~-2012~~0~~

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Introduction

The purpose of this document is to outline the guidelines and procedures for the Pacific Fishery Management Council's groundfish stock assessment review (STAR) process and to clarify~~convey~~ expectations and responsibilities ~~for~~ of the various participants. ~~in the groundfish stock assessment review (STAR) process, and outline the guidelines and procedures for a peer review process for the Pacific Fishery Management Council.~~ The STAR ~~panel~~ process ~~is~~ has been designed to establish a procedure for peer review ~~process~~ as referenced in the 2006 Reauthorization of the Magnuson-Stevens Fishery Conservation and Management Act, which states that “~~”~~the Secretary and each Regional Fishery Management Council may establish a peer review process for that Regional Fishery Management Council for scientific information used to advise the Regional Fishery Management Council about the conservation and management of the fishery (see Magnuson-Stevens Act section 302(g)(1)(E)). If a peer review process is established, it should investigate the technical merits of stock assessments and other scientific information used by the Council's Scientific and Statistical Committee (SSC). The peer review process is not a substitute for the SSC and should work in conjunction with the SSC.” This document will be included in the Council's Statement of Organization, Practices and Procedures as documentation ~~part~~ of the review process that will verify the scientific advice from the SSC.

Parties involved in implementing the peer review process described here are the Pacific Fishery Management Council members (Council), Council staff, ~~and~~ members of ~~the~~ Council~~'s~~ Advisory Bodies, including the SSC, the Groundfish Management Team (GMT), and the Groundfish Advisory Subpanel (GAP), the National Marine Fisheries Service (NMFS), state agencies, and interested persons. The STAR process is a key element in an overall process designed to review the technical merits of stock assessments and other relevant scientific information used by the SSC. This process will allow the Council to make timely use of new fishery and survey data, ~~to~~ analyze and understand these data as completely as possible, ~~to~~ provide opportunity for public comment, and ~~to~~ assure that the results are as accurate and error-free as ~~possible~~feasible.

This current edition of the Terms of Reference reflects many recommendations from previous participants in the STAR process, including STAR panel members, SSC members, stock assessment teams (STATs), Council staff, and Council advisory groups. Nevertheless, no set of guidelines can be expected to deal with every contingency, and all participants should anticipate the need to be flexible and ~~to~~ address new issues as they arise.

Hilborn and Walters (1992) define stock assessments as ~~involving~~ “the use of various statistical and mathematical calculations to make quantitative predictions about the reactions of fish populations to alternative management choices.” In this document, the term "stock assessment" includes activities, analyses and reports, beginning with data collection and continuing through to scientific recommendations ~~and information~~ presented to the Council and its advisors. Stock assessments provide the fundamental basis for management decisions on groundfish harvests. To best serve that purpose, stock assessments should attempt to identify and quantify major uncertainties, balance realism and parsimony ~~,~~and make best use of the available data.

History of the STAR process

Prior to 1996, stock assessments were examined at a very early stage during ad-hoc stock assessment review meetings (one per year). SSC and GMT members often participated in these ad-hoc meetings and provided additional review of completed stock assessments during Council meetings. In July 1995, NMFS convened an independent, external review of West Coast Groundfish Assessments. The report concluded that: 1) uncertainties associated with assessment advice were understated; 2) technical review of groundfish assessments should be more structured and involve more outside peers; and 3) the distinction between scientific advice and management decisions was blurred. In response, in 1996, the groundfish tock assessment review process was expanded to include: 1) terms of reference for the review meeting; 2) an outline for the contents of stock assessments; 3) external anonymous reviews of previous assessments; and 4) a review meeting report. In 1997, the process was further expanded. At a planning meeting in December 1996, it was agreed that agencies (including NMFS and state agencies) conducting stock assessments were responsible for assuring assessments were technically sound and adequately reviewed. A Council-oriented review process was developed that included agencies, the GMT, GAP and other interested members of the Council family. The process was jointly funded by the Council and NMFS, with NMFS hosting the newly-termed STAR panel meetings. In November, 1998, a joint session of the SSC, GMT and GAP produced a list of recommended changes for 1999, including: 1) increasing the SSC's involvement; 2) limiting the number of assessments to be reviewed; 3) increasing the involvement of external participants; 4) guidelines for timeliness in completing and submitting assessments; and 5) guidelines for the duration of STAR panel meetings and the time required to adequately review assessments. …

STAR Goals and Objectives

The goals and objectives for the groundfish assessment and review process are to:

a) Meet the Magnuson-Stevens Fisheries Conservation and Management Act (MSA) and other legal requirements.
b) Follow a detailed calendar and explicit responsibilities for all participants to produce required outcomes and reports.
c) Ensure that groundfish stock assessments provide quality information required by the Council process.
d) Provide an independent external review of groundfish stock assessment models.
e) Ensures that groundfish stock assessments are the "best available" scientific information and facilitate use of the information by the Council.
f) Use assessment and review resources effectively and efficiently.
g) Increase understanding of groundfish stock assessment and review process by all members of the Council family.
h) Identify research needed to improve assessments, reviews, and fishery management in the future.

a) ~~Ensure that groundfish stock assessments provide the kinds and quality of information required by the Council process.~~
b) ~~Satisfy the Magnuson-Stevens Fisheries Conservation and Management Act (MSA) and other legal requirements.~~
c) ~~Provide a well-defined, Council-oriented process that ensures groundfish stock assessments are the "best available" scientific information, and facilitates use of the information by the Council. In this context, "well-defined" means with a detailed calendar, explicit responsibilities for all participants, and specified outcomes and reports.~~
d) ~~Provide an independent external review of groundfish stock assessment work.~~
e) ~~Increase understanding and acceptance of groundfish stock assessment and review work by all members of the Council family.~~
f) ~~Identify research needed to improve assessments, reviews, and fishery management in the future.~~
g) ~~Use assessment and review resources effectively and efficiently.~~

All parties have a stake in assuring adequate technical review of stock assessments. NMFS, as the designee of the Secretary of Commerce, must determine that the best scientific advice has been used when it approves fishery management recommendations made by the Council. The Council uses advice from the SSC to determine whether the information on which it will base its recommendation is the "best available" scientific advice. Fishery managers and scientists providing technical documents to the Council for use in management need to assure that the work is technically correct. Program reviews, in-depth external reviews, and peer-reviewed scientific publications are used by federal and state agencies to provide quality assurance for the basic scientific methods used to produce stock assessments. However, the time-frame for this sort of review is not suited to the routine examination of assessments that are, generally, the primary basis for a harvest recommendation.

The Council and the Secretary Commerce have primary responsibility to create and foster a successful STAR process. The Council will oversee the process and involve its standing advisory committees, especially the SSC. NMFS will provide a coordinator to facilitate and assist in overseeing the process. Together they will consult with all interested parties to plan, prepare terms of reference, and develop a calendar of events and a list of deliverables for final approval by the Council. NMFS and the Council will share fiscal and logistical responsibilities and both should ensure that there are no conflicts of interest in the process[1].

[1] The proposed NS2 guidelines state: "Peer reviewers who are federal employees must comply with all applicable federal ethics requirements. Peer reviewers who are not federal employees must comply with the following provisions. Peer reviewers must not have any real or perceived conflicts of interest with the scientific information, subject matter, or work product under review, or any aspect of the statement of work for the peer review. For purposes of this section, a conflict of interest is any financial or other interest which conflicts with the service of the individual on a review panel because it: (A) Could significantly impair the reviewer's objectivity; or (B) Could

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Stock Assessment Priorities

Stock assessments for west coast groundfish are conducted to assess abundance, trends, and appropriate harvest levels for these species. Assessments use statistical population models to analyze and integrate a variety of survey, fishery, and biological data. Due to the large number of groundfish species that have never been assessed, it is the goal of the Council to substantially increase ~~substantially~~ the number of assessed stocks. A constraint on reaching that objective is the Council's multi-year management regime, which limits primary assessment activities to odd years only (e.g., 2011~~09~~), with the exception of Pacific hake.

In April 2006, the SSC recommended, and the Council adopted, a new process to develop criteria to prioritize species for stock assessment based on: 1) economic or social importance of the species, 2) overfished status, 3) demographic sensitivity (resilience), 4) time elapsed since the last assessment (NMFS advises assessments to be updated at least every 5 years), 5) amount of data available, 6) potential risk to the stock from the current or foreseeable management regime, and 7) qualitative trends from surveys (if available), etc. Overfished stocks that are under rebuilding plans should be evaluated to ensure adequate progress towards achieving stock recovery
~~The SSC recommended and the Council adopted in April 2006 a new process to initiate development of criteria for prioritizing stock assessments that may include such factors as: 1) economic or regional importance, 2) overfished status, 3) demographic sensitivity, 4) time elapsed since the last assessment (NMFS encourages assessments be updated at least once every 5 years), 5) data richness, 6) potential risk to the stock from the current or foreseeable management regime, and 7) qualitative trends from fishery-independent surveys (if available), etc. In establishing stock assessment priorities a number of factors are considered, including:~~

The proposed stocks for assessment should be discussed by the Council at least a year in advance to allow sufficient time for assembly of relevant assessment data and for arrangement of STAR panels. Any stock assessment that is considered for use in management should be submitted through normal Council channels and reviewed at STAR panel meetings, and therefore must be completed in time for that process to occur.

1. ~~Assessments should take advantage of new information, especially indices of abundance from fishery-independent surveys.~~
2. ~~Overfished stocks that are under rebuilding plans should be evaluated to ensure that progress towards achieving stock recovery is adequate.~~
3. ~~Any stock assessment that is considered for use in management should be submitted through normal Council channels and reviewed at STAR panel meetings.~~
4. ~~The proposed stocks for assessment should be discussed by the Council at least a year in advance to allow sufficient time for assembly of relevant assessment data and for arrangement of STAR panels.~~

Terms of Reference for STAR panels and Their Meetings

The objective of the STAR panel is to complete a detailed evaluation of a stock assessment to advance the best available scientific information to the Council. The responsibilities of the STAR panel include:

1. Review draft stock assessment documents, data inputs, and analytical models along with other pertinent information (e.g., previous assessments and STAR panel reports, when available);
2. Work with STAT Teams to ensure assessments are reviewed properly;
3. Document meeting discussions;
4. Provide complete STAR panel reports for all reviewed species;

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create an unfair competitive advantage for a person or organization. (C) Except for those situations in which a conflict of interest is unavoidable, and the conflict is promptly and publicly disclosed, no individual can be appointed to a review panel if that individual has a conflict of interest that is relevant to the functions to be performed. Conflicts of interest include, but are not limited to, the personal financial interests and investments, employer affiliations, and consulting arrangements, grants, or contracts of the individual and of others with whom the individual has substantial common financial interests, if these interests are relevant to the functions to be performed. Potential reviewers must be screened for conflicts of interest in accordance with the procedures set forth in the NOAA Policy on Conflicts of Interest for Peer Review subject to OMB's Peer Review Bulletin."

5. Review revised stock assessment documents before they are forwarded to the SSC.

The principal responsibilities of the STAR panel are to review stock assessment documents, data inputs, analytical models, and to provide complete STAR panel reports for all reviewed species. The objective of the STAR panel review is to complete a detailed evaluation of the results of a stock assessment, which puts the panel in a good position to advance the best available scientific information to the Council. The STAR panel's work includes:

1. reviewing draft stock assessment documents and any other pertinent information (e.g., previous assessments and STAR panel reports, if available);
2. working with STAT Teams to ensure assessments are reviewed as needed;
3. documenting meeting discussions; and
4. reviewing revised stock assessment documents before they are forwarded to the SSC.

In most circumstances a STAR Panel will include a chair appointed from the SSC's Groundfish Subcommittee and three other experienced stock assessment analysts. Of these three other members, at least one should be familiar with west coast groundfish stock assessment practices and at least one should be appointed from the Center for Independent Experts (CIE). Selection of STAR panelists should aim for balance between outside expertise and in-depth knowledge of west coast fisheries, data sets available for those fisheries, and modeling approaches applied to west coast groundfish species. Reviewers should not have financial or personal conflicts of interests, as detailed above. The majority of panelists should be experienced stock assessment scientists (i.e., individuals who have done stock assessments using current methods). STAR panelists should be knowledgeable about the specific modeling approaches being reviewed, which in most cases will be statistical age- and/or length-structured assessment models. Every attempt should be made to identify one reviewer that can consistently attend all panels in an assessment cycle. It is recognized that the pool of qualified reviewers is limited, and that staffing of STAR panels is subject to constraints that may make it difficult to achieve these objectives. In addition to panel members, STAR meetings will include GMT and GAP advisors with responsibilities described in their terms of reference and a council staff member to help advise the STAR panel and take notes on the meeting. STAR panels normally meet for one week.

In general no more than 2 full Tier 1 assessments will be reviewed by a STAR panel. In exceptional circumstances this number may be exceeded, if the SSC and NMFS Stock Assessment Coordinator (SAC) conclude that it is advisable, feasible, and/or necessary to do so. This number may also be exceeded when the STAR panel is reviewing data poor (Tier 2) stock assessments. When completely separate assessments are conducted at the sub-stock level (i.e., black rockfish) each assessment will be considered a full assessment for review purposes. Contested assessments, in which alternative assessments are brought forward by competing STAT teams using different modeling approaches, will typically require additional time (or panel members) to review adequately, and should be scheduled accordingly. While contested assessments are likely to be rare, they can be accommodated in the STAR panel review process. STAR panels should thoroughly evaluate each analytical approach, comment on the relative merits of each, and, when conflicting results are obtained, attempt to identify the reasons for the differences. STAR panels are charged with selecting a preferred base model, which will be more difficult when there are several modeling approaches from which to choose.

The STAR panel chair is responsible for: 1) developing an agenda for the STAR panel meeting, 2) ensuring that STAR panel members and STAT teams follow the Terms of Reference, 3) participating in the review of the assessment, 4) guiding the STAR panel and STAT team to mutually agreeable solutions, and 5) coordinating review of final assessment documents.

The STAR panel, STAT Team, GAP and GMT advisors, and all interested parties are legitimate meeting participants that must be accommodated in discussions. It is the STAR panel chair's responsibility to manage discussions and public comment so that work can be completed.

The STAR panel's terms of reference solely concern technical aspects of the stock assessment. It is therefore important that the panel should strive for a risk neutral perspective in its reports and deliberations. Assessment results based on model scenarios or data that have a flawed technical basis, or are questionable on other grounds, should be identified by the panel and excluded from the set upon which management advice is to be developed. It is recognized that no model scenario or data set will be perfect or issue free; therefore, a broad range of results should be reported to better define the scope of the accepted model results. The STAR panel should comment on the degree to which the accepted model scenarios describe and quantify the major sources of uncertainty, and the degree to which the probabilities associated with these modelscenarios are technically sound. The STAR panel may also provide qualitative comments on the probability of various model results, especially if the panel does not believe think that the probability distributions calculated by the STAT capture all major sources of uncertainty. These comments may be used to supersede the standard method for calculating uncertainty to set ABCs based on multiplying the OFL by a buffer.

Recommendations and requests to the STAT Team for additional or revised analyses must be clear, explicit and in writing. A written summary of discussion on significant technical points and lists of all STAR panel requests and recommendations and requests to the STAT Team are required in the STAR panel's report. This, which should be completed (at least in draft form) prior to the end of the meeting. It is the chair and panel's responsibility to carry out any follow-up review work that is required.

Under ideal circumstances, the STAT Team and STAR panel should strive to reach a mutual consensus on a single base model, but it is essential that uncertainty in the analysis be captured and communicated to managers. A useful way of accomplishing this objective is to bracket the base model along what is deemed to be the dominant dimension of uncertainty (e.g., spawner-recruit steepness, the virgin level of recruitment or R_0, natural mortality rate, survey catchability, recent year-class strength, weights on conflicting CPUE series, etc.). Alternative models should show contrast in their management implications, which in practical terms means that that they should result in different estimates of current stock size, stock depletion, and the overfishing level (OFL).and acceptable biological catch (ABC).

MCMC integration, where possible, is an alternate method for reporting uncertainty about the base case model.

Once a base model has been bracketed on either side by alternative model scenarios, which capture the overall degree of uncertainty within the assessment, a 2-way decision table analysis (states-of-nature versus management action) is the preferred way to present the repercussions of uncertainty to management. An attempt should be made to develop alternative model scenarios such that the base model is considered twice as likely as the alternative models, i.e., the ratio of probabilities should be 25:50:25 for the low stock size alternative, the base model, and the high stock size alternative (Figure 1). Potential methods for assigning probabilities include using the statistical variance of the model estimates of stock size, posterior Monte Carlo simulation, or expert judgment, but other approaches are encouraged as long as they are fully documented. Bracketing of assessment results could be accomplished in a variety of ways, but as a matter of practice the STAR panel should strive to identify a single preferred base model when possible, so that averaging of extremes doesn't become the *de facto* choice of management. An ideal bracketing of the base model is one for which the geometric mean of the high and low stock size alternative model final biomass levels approximates the base model biomass level. If the bracketing models are far from this ideal, the three levels should be reconsidered and either one or more of them adjusted, or a justification of the non-lognormal structure of alternatives be given. Similarly, if more than one dimension is used to characterize uncertainty, resulting in, for example, a 3 by 3 uncertainty table, careful consideration of how the complete table brackets the uncertainty should be undertaken.

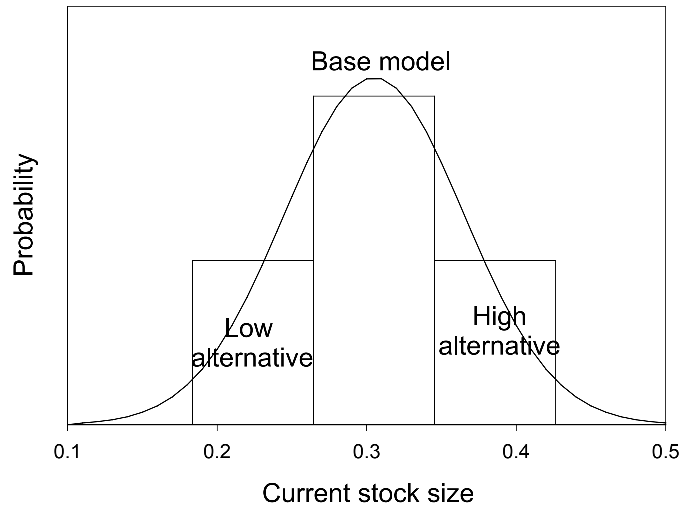

Figure 1. Example of assigning probabilities to alternative models using uncertainty in the estimate of current stock size (in log space).

To the extent possible, additional analyses required ~~in the stock assessment~~by the STAR panel should be completed by the STAT team during the STAR panel meeting. It is the obligation of the STAR panel chair, in consultation with other panel members, to prioritize requests for additional ~~STAT Team~~ analyses. Moreover, in situations where a STAT team arrives with a well-considered, thorough assessment, it may be that the panel can conclude its review in less time than has been allotted to the meeting (i.e., early dismissal of a STAT Team is an option for well-constructed assessments). If follow-up work by the STAT Team is required after the review meeting, then it is the panel's responsibility to track STAT Team progress. In particular, the chair is responsible for communicating with STAT Teams (by phone, e-mail, or any convenient means) to determine if the revised stock assessment and documents are complete and ready to be used by managers in the Council family. If stock assessments and reviews are not complete at the end of the STAR panel meeting, then the work must be completed prior to the SSC meeting where the post-STAR draft assessment is reviewed. Any post-STAR drafts of the stock assessment must be reviewed by the STAR panel or the chair if delegated that authority by the STAR panel. Assessments cannot be given to Council staff for distribution unless first endorsed by the STAR panel chair. Likewise, the final draft that is published in the Council's Stock Assessment and Fishery Evaluation (SAFE) document must also be approved by the STAR panel chair prior to being accepted by Council staff.

The STAR panel's primary duty is to conduct a peer review of an assessment that is presented by a STAT Team; STAR panel meetings are not workshops. In the course of this review, the panel may ask for a reasonable number of sensitivity runs, additional details of existing assessments, or similar items from the STAT team. It would not be unusual for this evaluation to result in a change to the initial base model, provided both the STAR panel and the STAT team agree. The STAR panels are expected to be judicious in their requests of the STAT teams, recognizing that some issues uncovered during review are best flagged as research priorities, and dealt with more effectively and comprehensively between assessments. The STAR panel may also request additional analysis based on an alternative approach. However, the STAR panel is not authorized to conduct an alternative assessment representing its own views that are distinct from those of the STAT Team, nor can it impose an alternative assessment on the Team. Similarly, the panel should not impose as a requirement their preferred methodologies when such is a matter of professional opinion. Rather, if the panel finds that an assessment is inadequate, it should document and report that opinion and, in addition, suggest remedial measures that could be taken by the STAT team prior to the scheduled mop-up panel review to rectify whatever perceived shortcomings may exist. The SSC will make a final recommendation on whether an assessment should be reviewed during the mop-up panel.

STAT Teams and STAR panels are required to make a~~ good faith ~~n honest attempt to resolve any areas of disagreement during the meeting. Occasionally, fundamental differences of opinion remain between the STAR panel and STAT Team that cannot be resolved by discussion. In such cases, the STAR panel must document the areas of disagreement in its report. In exceptional circumstances, the STAT team may choose to submit a supplemental report supporting its view, but in the event that such a step is taken, an opportunity must be given to the STAR panel to prepare a rebuttal. These documents will then be appended to the STAR panel report as part of the record of the review meeting. Likewise, STAR panel members may have fundamental disagreements that cannot be resolved during the STAR panel meeting. In such cases, STAR panel members may prepare a minority report that will become part of the record of the review meeting. The SSC will then review all information pertaining to STAR panel or STAR panel/STAT team disputes, and issue its recommendation.

The STAR panel is responsible for determining if a stock assessment document is sufficiently complete according to Appendix B. It is also the panel's responsibility to identify assessments that cannot be reviewed or completed for any reason. The panel's decision that an assessment is complete should be made by consensus. If a panel cannot reach agreement, then the nature of the disagreement must be described in the panel's report. Moreover, if a stock assessment is deemed to be stable in its approach to data analysis and modeling, the STAR panel should recommend that the assessment be considered as an update during the next stock assessment cycle.

For some species the available data will be insufficient to calculate reliable estimates of F_{MSY} ~~(or its proxy),~~and B_{MSY} (or theirits proxiesy), ending ~~biomass or~~ and/or unfished biomasses, etc. Typically, results from a "data-poor" assessment are unable to produce all of the required reporting elements outlined in Appendix B ~~(Outline for Groundfish Stock Assessment Documents)~~. In particular, estimation of current exploitable biomass and/or stock depletion may be impossible, although both quantities are essential components of the Council's current 40-10 groundfish harvest policy. Nonetheless, information that is potentially useful to management is often generated in a data-poor assessment, e.g., current spawning potential ratio (SPR). Therefore, in situations where the STAT team is unable to produce a full assessment with all the model outputs required by the Council's default harvest control rule, a "Data Report" can be developed that summarizes all the pertinent findings of the stock assessment. To the extent practicable Appendix B will serve as a guide to the contents of a Data Report[osh1].

It is the responsibility of the STAR panel, in consultation with the STAT Team, to consider the validity of inferences that can be drawn from an analysis presented in a Data Report. If useful but incomplete results have been developed, the panel should review the reliability and appropriateness of the methods used to draw conclusions about stock status and/or exploitation potential and either recommend or reject the analysis on the basis of its ability to introduce useful information into the management process. If the STAR panel believes that important ~~information has been developed~~results have been generated, it should forward its findings and conclusions to the SSC and Council for consideration during the setting of OFLs, ABCs and ~~optimum yields (OYs).~~ACLs. The current harvest control rule cannot be applied using the results from a Data Report, but these~~.~~ ~~However, these~~ results can be used for management decision-making. For example, a Data Report could provide information on the trend in abundance and hence changes from status quo management. A key section of the Data Report is that on research needed to improve the assessment. Highlighting research priorities in a Data Report should increase the likelihood that future stocks assessments will satisfy the Groundfish Stock Assessment Terms of Reference.

When requested, t~~T~~he STAR panel chair is expected to attend Council meetings and GMT meetings ~~(when requested)~~ and where stock assessments and harvest projections are discussed, ~~to~~ explain the reviews and provide ~~other~~ technical information and advice. The chair, in coordination with the STAT team, is responsible for providing the Stock Assessment Coordinator and Council staff with a suitable electronic version of the panel report.

Suggested Template for STAR Panel Report

1. Summary of the STAR panel meeting containing:
   A. Names and affiliations of STAR panel members;
   B. List of analyses requested by the STAR panel, the rationale for each request, and brief summary of the STAT response to the request; and
   C. Description of base model and alternative models used to bracket uncertainty.
2. Comments on the technical merits and/or deficiencies in the assessment and recommendations for remedies.
3. ~~Explanation of a~~Areas of disagreement regarding STAR panel recommendations:
   A. Among STAR panel members (including concerns raised by GAP and GMT representatives); and
   ~~B.~~ Between the STAR panel and STAT ~~Team~~(s).

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4. Unresolved problems and major uncertainties, e.g., any special issues that complicate scientific assessment, questions about the best model scenario.
5. Management, data, or fishery issues raised by the GMT or GAP representatives during the STAR panel.
6. Prioritized recommendations for future research and data collection.

While explaining areas of disagreement the following questions should be discussed at the STAR panel:

a) Are there any differences in opinion about the use of/inclusion or exclusion of data?
b) Are there any differences in opinion about the choice of base model?
c) Are there any differences in opinion about the characterization of uncertainty (through bracketing models or Bayesian integration)?

After the STAT team has had a chance to comment on the STAR panel report, it should be also determined whether there are differences in opinion regarding how the STAR panel report characterizes any of the recommendations?

Terms of Reference for Groundfish STAT Teams

In order to be sufficient for peer review, the STAT team should~~will~~ carry out its work according to these terms of reference and the calendar for groundfish stock assessments.

All STAT members should attend the relevant stock assessment workshops. In the assessment document the STAT should overview all data sources for the species assessed, identify the ones being used in the assessment, and provide the rationale for data sources being excluded. The STAT is expected to initiate contact with the GAP representative at an early stage in the process, keep the GAP representative informed of the data being used and be prepared to respond to concerns about the data that might be raised. The STAT Team should also contact the GMT representative for information about changes in fishing regulations that may influence data used in the assessment.

STATs are strongly encouraged to develop assessments in a collaborative environment by forming working groups, holding pre-assessment workshops, and consulting with other stock assessment scientists. STATS should coordinate early in the process with state representatives and other data stewards to ensure timely requests of data. STATs are also encouraged to organize independent meetings with industry and interested parties to discuss issues, questions, and data. Each STAT Team should appoint a representative to coordinate with the STAR panel. Barring exceptional circumstances, all STAT team members should attend the STAR panel meeting.

Each STAT conducting a full assessment should appoint a representative who will be available to attend the Council meeting where the SSC is scheduled to review the assessment and give presentations of the assessment to the SSC and to other Council advisory bodies. In addition, the STAT Team should be prepared to respond to GMT requests for model projections during the GMT's development of ACL alternatives.

The STAT Team is responsible for preparing three versions of the stock assessment document:

1) A "draft" including an executive summary (except for decision tables) for discussion at the stock assessment review meeting;
2) A "revised draft" for distribution to the Council and advisory bodies for discussions about preliminary OFLs, ABCs and ACLs;
3) A "final version" to be published in the SAFE report.

~~All relevant stock assessment workshops should be attended by all STAT team members. The STAT Team shall include in both the STAR panel draft and final assessment all data sources that include the species being assessed, identify which are used in the assessment, and provide the rationale for data sources that are excluded. The STAT Team is obliged to keep the GAP representative informed of the specific data being used in the stock assessment. The STAT team is expected to initiate contact with the GAP representative at an early stage in the process, and to be prepared to respond to concerns about the data that might be raised. The STAT Team should also contact the GMT representative for information about changes in fishing regulations that may influence data used in the assessment.~~

~~STAT teams are strongly encouraged to develop assessments in a collaborative environment, such as by forming working groups, holding pre-assessment workshops, and consulting with other stock assessment scientists. STAT~~

teams are also encouraged to also organize independent meetings with industry and interested parties to discuss issues, questions, and data. Each STAT Team will appoint a representative to coordinate work with the STAR panel. Barring exceptional circumstances, all STAT team members should attend the STAR panel meeting.

Each STAT Team conducting a full assessment will appoint a representative who will be available to attend the Council meeting where the SSC is scheduled to review the assessment, and will typically give presentations of the assessment to the SSC and to other Council advisory bodies. In addition, the STAT Team should be prepared to respond to GMT requests for model projections during the GMT's development of ABC and OY alternatives.

The STAT Team is responsible for preparing three versions of the stock assessment document: 1) a complete "draft" including an executive summary (except for decision tables) for discussion at the stock assessment review meeting; 2) a "revised draft" for distribution to the Council and advisory bodies for discussions about preliminary ABC and OY levels; 3) a "final" version to be published in the SAFE report. Post-STAR panel drafts must be reviewed by the STAR panel prior to being submitted to Council staff, but. Tthese reviews are limited to editorial issues, verifying that the required elements are included according to the Terms of Reference, and confirming that the document reflects the discussions and decisions made during the STAR panel. Other than changes authorized by the SSC, only editorial and other minor alterations should be made between the "revised draft" and "final" versions.

The STAT team should provide a draft assessment documents to the STAR panel chair, Council staff, and the NMFS SAC three weeks prior to the STAR panel meeting to allow timely review of the draft assessment to determine if it is sufficient for review according to the Terms of Reference. The draft assessment document should include all elements listed in Appendix B except for the: 1) decision table, 2) harvest projections, 3) population abundance tables, 4) point-by-point responses to current STAR panel recommendations, and 5) acknowledgements. If the draft assessment is judged complete, the NMFS groundfish SAC will distribute the draft assessment and relevant supporting materials to the STAR panel, Council staff, the SSC Groundfish subcommittee, and GMT and GAP representatives two weeks prior to the STAR panel meeting. If assessment document is not sufficiently complete, a list of deficiencies should be provided to the STAT Team to allow completion of the draft assessment prior to distribution to the STAR panel. If the assessment document does not meet minimum criteria it will not be reviewed. Incomplete assessments or those provided after the requisite deadlines in Appendix A will be either moved to the mop-up panel, or postponed to a subsequent assessment cycle. Usually, the mop-up panel will not be able to review more than two assessments; therefore, the options are limited for assessments that are not completed on time.

The STAT team is responsible for bringing data in digital format and model files to the review meeting so that they could be analyzed on site. STAT teams should have several models ready to present to the STAR panel and be prepared to discuss the merits of each. The STAT team also should identify a candidate base model, fully-developed and well-documented in the draft assessment, for STAR panel review.

In most cases, the STAT team should produce a revised draft of the assessment document within three weeks of the end of the STAR panel meeting (including any internal agency review. The assessment document must be finalized before the briefing book deadline for the Council meeting, at which the assessment is scheduled for review.

The STAT Team and the STAR panel may disagree on technical issues regarding an assessment, and a complete stock assessment document must include a point-by-point response of the STAT Team to each of the STAR panel's recommendations. Assessment model estimates and projections representing all sides of the disagreement need to be presented to, reviewed by, and commented upon by the SSC.
The STAT Team will provide "draft" assessment documents to the STAR panel chair, Council staff, and the NMFS SAC three weeks in advance of the STAR panel meeting to allow timely review of the draft assessment to ensure the required elements of a draft assessment are included according to the Terms of Reference. If the draft assessment is judged complete, the NMFS groundfish SAC will distribute the draft assessment and relevant supporting materials to the STAR panel, Council staff, the SSC Groundfish subcommittee, and GMT and GAP representatives at least two weeks prior to the STAR panel meeting.

Complete, fully-developed assessments are critical to the STAR panel process. Draft assessments will be evaluated for completeness prior to the STAR panel meeting, and assessments that do not satisfy minimum criteria will not be reviewed. The full draft assessment document should be available for distribution three weeks prior to the STAR panel meeting to determine if it is sufficient for review. The STAR panel chair, Council staff, and the NMFS SAC

~~will make an initial recommendation, which will then be reviewed by the SSC Groundfish Subcommittee members, if it is determined that the draft assessment is not sufficiently complete. In such cases, a list of deficiencies will be provided to the STAT Team to allow completion of the draft assessment prior to distribution to the STAR panel. The draft document should include all elements listed in Appendix B except the: 1) decision table, 2) harvest projections, 3) population abundance tables, 4) point-by-point responses to current STAR panel recommendations, and 5) acknowledgements. Incomplete assessments or those provided after the requisite deadlines in Appendix A will be either moved to the mop-up panel, or postponed to a subsequent assessment cycle. In general, the mop-up panel will not be able to review more than two assessments, so the options are limited for assessments that are not completed on time.~~

~~The STAT Team is responsible for bringing computerized data and working assessment models to the review meeting in a form that can be analyzed on site. STAT Teams should take the initiative in building and selecting candidate models and should have several complete models ready to present to the STAR panel and be prepared to discuss the merits of each. The STAT team should identify a candidate base model, fully documented in the draft assessment, for STAR panel consideration. Fully developed assessments that are properly documented should require less time to review and approve than poorly constructed, incomplete assessments.~~

~~In most cases, the STAT Team should produce a complete draft of the assessment within three weeks of the end of the STAR panel meeting, including any internal agency review. In any event, the STAT Team must finalize the assessment document before the briefing book deadline for the Council meeting at which the assessment is scheduled for review.~~

~~The STAT Team and the STAR panel may disagree on technical issues regarding an assessment, but a complete stock assessment must include a point-by-point response by the STAT Team to each of the STAR panel's recommendations. Estimates and projections representing all sides of the disagreement need to be presented to, reviewed by, and commented upon by the SSC.~~

For stocks that are projected to fall below overfished thresholds, the STAT Team must complete a rebuilding analysis according to the SSC's Terms of Reference for Groundfish Rebuilding Analyses. It is recommended that this analysis be conducted using the rebuilding software developed by Dr. Andre Punt (aepunt@u.washington.edu). The STAT Team is also responsible for preparing a document that summarizes the results of the rebuilding analysis.

Electronic versions of final assessment documents, rebuilding analyses, parameter files, data files, and key output files will be sent by the STAT Teams to Council staff and the SAC for inclusion in a stock assessment archive. Any tabular data that are inserted into the final documents in an~~d~~ object format should also be submitted in alternative forms (e.g., spreadsheets), which allow selection of individual data elements.

[osh2]

Terms of Reference for Stock Assessment Updates

The STAR process is designed to provide a comprehensive, independent review of a stock assessment. ~~In other~~However, when a model has already been critically examined and is simply updated by incorporating the moces recent data, a ~~situations a less comprehensive~~rigorous review ~~of assessment results is desirable, particularly in situations where a "model" has already been critically examined and the objective is to simply update the model by incorporating the most recent data~~is required. In this context a model refers not only to the population dynamics model *per se*, but to the particular data sources that are used as inputs to the model, the statistical framework for fitting the data, and the analytical treatment of model outputs used in providing management advice, including reference points, the OFL and ABC ~~and OY~~. These terms of reference establish a procedure for a limited but still rigorous review for stock assessment models that fall into this latter category. However, it is recognized that what in theory may seem to be a simple update, may in practice result in a situation that is impossible to resolve in an abbreviated process. In these cases, it may not be possible to update the assessment ~~— rather -~~, and the assessment may need to be revised in the next full assessment review cycle.

Qualification

The SSC will determine whether a stock assessment qualifies as an update under these terms of reference. Recommendation by a STAR panel or the SSC that a full assessment is suitable for an update will be a principal criterion in this determination. To qualify, a stock assessment must carry forward its fundamental structure from a model that was previously reviewed and endorsed by a STAR panel. In practice this means similarityA stock assessment update is appropriate in situations where no substantial change has occured in: a) the particular sources of data used, b) the analytical methods used to summarize data prior to input to the model, c) the software used in programming the assessment, d) the assumptions and structure of the population dynamics model underlying the stock assessment, e) the statistical framework for fitting the model to the data and determining goodness of fit, f) the procedure for weighting of the various data components, and g) the analytical treatment of model outputs in determining management reference points, including F_{MSY}, B_{MSY}, and B_0.– A stock assessment update is appropriate in situations where no significant change in these seven factors has occurred, other than extending time series of data elements within particular data components used by the model (e.g., adding information from a recently completed survey and an update of landings). Extending CPUE time series based on fitted models (i.e., GLM models) will require refitting the model and updating all values in the time series. Assessments using updated CPUE time series qualify as updates if the CPUE standardization models follow applicable criteria for assessment models described above. In practice there will always be valid reasons for altering a model, as defined in this broad context, although, in the interests of stability, such changes should be resisted as much as possible. Instead, significant alterations should be addressed in the next subsequent full assessment and review.

Composition of the Review panel

The Groundfish Subcommittee of the SSC will conduct the review of a stock assessment update. A lead reviewer for each updated assessment will be designated by the chair of the Groundfish Subcommittee from among its membership, and it will be the lead reviewer's responsibility to ensure the review is completed properly and that a written report of the proceedings is produced. In addition, the GMT and the GAP will designate one person each to participate in the review.

Review Format

All stock assessment updates will be reviewed during a single meeting of the SSC Groundfish Subcommittee scheduled early in the assessment cycle. This meeting may precede or follow a normally scheduled SSC meeting. The review process will be as follows. TheFor the review, the STAT team preparing the update will distribute the updated stock assessment to the review panelists at least two weeks prior to the review meeting. In addition, Council staff will provide panelists with a copy of the last stock assessment reviewed under the full STAR process, as well as the previous along with the STAR panel report. Review of stock assessment updates is not expected to require analytical requests or model runs during the meeting, although large or unexpected changes in model results may necessitate some model exploration. The review will focus on two crucial questions: 1) Hhas the assessment complied with the terms of reference for stock assessment updates? and 2) Aare new input data and model results sufficiently consistent with previous data and results that the updated assessment can form the basis of Council decision-making?. If either of these criteria is not metthe answer to either of these two questions is negative, then a full stock assessment wouldill be required.

STAT Team Deliverables

Since there will be limited opportunities for revision during the review meeting, it is theThe STAT team's is responsibileity forto providigne the panel with a completed update at least two weeks prior to the meeting. To streamline the review process, the team can reference whatever material it chooses, including that presented in the previous stock assessment (e.g., a description of methods, data sources, stock structure, etc.). However, it is essential that any new information being incorporated into the assessment be presented in enough sufficient detail, so that the Groundfish Subcommittee can determine whether the update satisfactorily meets the Council's requirement to use the best available scientific information. Of particular importance willThere must be a retrospective analysis showing the performance of the model with and without the updated data streams. Likewise, as well as a decision table that highlights the consequences of alternative states of nature would be useful to the Council in adopting annual specifications. The decision table, in most circumstances, should be the same as in the previous assessment, and in all cases a decision table that mimics that included in the previous assessment should be presented for comparison. Similarly, if anyIf minor changes to the "model" structure are adopted, above and beyond updating specific data streams, a sensitivity analysis to those changes are will alsobe required. The

In addition to documenting changes in the performance of the model, the STAT Team will beis required to present key assessment outputs in tabular form. ~~Specifically, the STAT Team's~~The final update document should include ~~the following~~:

1. Title page and list of preparers;
2. Executive Summary (see Appendix C);
3. Introduction;
4. Documentation of updated data sources;
5. Short description of overall model structure;
6. Complete base-run results, including a tabular summary of total and spawning stock biomass and recruitment time series;
7. Uncertainty analysis, including retrospective analysis, decision table, etc.; and
8. 10 year harvest projections under the default harvest policy.

Groundfish Subcommittee Report

The Groundfish Subcommittee will issue a report that will include the following items:

1. Name and affiliation of panelists;
2. Comments on the technical merits and/or deficiencies of the update;
3. Explanation of areas of disagreement among panelists and between the panel and STAT team~~; and~~
4. Recommendation regarding the adequacy of the updated assessment for use in management.

Council Staff Responsibilities

A Council staff officer will be assigned to coordinate, monitor and document the STAR process. The Council staff officer will be responsible for timely issuance of meeting notices and distribution of stock assessment documents, stock summaries, meeting minutes, and other appropriate documents. The Council staff officer will monitor compliance with the Terms of Reference for the 2011~~09~~-12~~0~~ groundfish STAR process. The Council staff officer will coordinate materials and presentations for Council meetings relevant to final Council adoption of groundfish stock assessments. Council staff will also collect and maintain file copies of reports from each STAR Panel (containing items specified in the STAR Panel Terms of Reference), the outline for groundfish stock assessment documents, SSC, GMT, and GAP comments and reports, letters from the public, and any other relevant information. At a minimum, the stock assessments (~~STAT reports~~Assessment documents, STAR Panel reports, and stock summaries) should be published and distributed in the Council annual SAFE document.

A primary role for the Council staff officer assigned to the ~~2009-10~~2011-12 STAR process ~~will be~~is to monitor STAR Panel and SSC activities to ensure compliance with these Terms of Reference. The Council staff officer will coordinate with the STAR Panel chair and the NMFS SAC in a review of STAT documents to assure they are received on time,~~ are~~ consistent with the Terms of Reference, and~~ are~~ complete. If the STAT materials are ~~obviously~~ not in compliance with the Terms of Reference, the Council staff officer will return the materials to ~~STAT~~ assessment authors with ~~a~~either a list of deficiencies, a notice that the deadline has expired, or both. The Council staff officer will attend all STAR panel meetings to ensure continuity and adherence to the Stock Assessment Terms of Reference. The Council staff officer will identify inconsistencies with the Terms of Reference that occur during STAR Panels and work with the STAR Panel chair to develop solutions~~ and~~ to correct them. The Council staff officer will review the Executive Summary for consistency with the Terms of Reference. When i~~I~~nconsistencies are~~will be~~ identified,~~ and~~ the assessment authors requested to make appropriate revisions in time for the appropriate SSC and GMT meetings, when an assessment is considered. The Council staff officer will also coordinate and monitor SSC review of stock assessments and STAR Panel reports to ensure compliance with these Terms of Reference and the independent review requirements of Council Operating Procedure 4. The Council staff officer will also identify a~~ one~~ STAR Panel member with experience conducting west coast groundfish stock assessments.

National Marine Fisheries Service Responsibilities

NMFS Northwest Fisheries Science Center (NWFSC) will provide a SAC to work with the Council, other agencies, groups, or interested persons that carry out assessment work or~~ to~~ assist in organizing the STAT and STAR Panels. Since most assessments are conducted by NMFS STATs, the SAC will work with assessment authors to develop a draft list of assessments to be considered by the Council. The SAC also will develop a draft STAR Panel schedule for review by the Council. The SAC will identify two independent STAR panelists following criteria for reviewer qualifications. The SAC will make every effort to identify one independent reviewer that can attend all STAR Panels to provide consistency among reviews. The costs associated with these two reviewers will be borne by NOAA Fisheries. The SAC will coordinate with STAT~~ authors~~ to facilitate delivery of materials by scheduled deadlines and in compliance with other requirements of these Terms of Reference, to the extent possible and with the assistance of the assigned Council staff officer and the STAR Panel chair.

Following any modifications to the stock assessments resulting from STAR Panel reviews and prior to SSC review, the SAC will assist the Council staff officer in reviewing the Executive Summary for consistency with the Terms of Reference. When i~~I~~nconsistencies ~~will be~~are identified, ~~and the ~~authors will be requested to make appropriate revisions in time for the appropriate SSC and GMT meetings.

STAT Team Responsibilities

The STAT is responsible for conducting a complete and technically sound stock assessment that conforms to accepted standards of quality~~, and make sure that work is carried out in a timely fashion according to the calendar and terms of reference~~ and in accordance with these Terms of Reference. ~~The STAT will conduct its work and activities in accordance with the Terms of Reference for Groundfish STAT Teams. ~~The final product of the STAT will be a stock assessment document that follows the outline specified in Appendix B. The terminal year for a stock assessment should be the year in which the stock assessment is conducted. For the 2011 stock assessments, therefore, the terminal year should be 2011.

GMT Responsibilities

The GMT is responsible for identifying and evaluating potential management actions based on the best available scientific information. In particular, the GMT makes ABC and OY recommendations to the Council based on estimated stock status, uncertainty about stock status, and socioeconomic and ecological factors. The GMT will use stock assessments, STAR panel reports, and other information ~~in making~~to make their recommendations. The GMT's preliminary ABC recommendation will be developed at a meeting that includes representatives from the SSC, STAT Teams, STAR panels, and GAP. A GMT representative(s) will be appointed by the chair of the GMT to track each stock assessment, and will serve as advisor to the STAT Team and STAR panel. The GMT representative will participate in review discussions, but will not serve as a member of the panel. The GMT representative should be prepared to advise the STAT Team and STAR panel on changes in fishing regulations that may influence data used in the assessment and the nature of the fishery in the future.

The GMT will not seek revision or additional review of the stock assessments after they have been reviewed by the STAR panel. The GMT chair will communicate any unresolved issues to the SSC for consideration. Successful separation of scientific (i.e., STAT Team and STAR panels) from management (i.e., GMT) work depends on stock assessment documents and STAR reviews being completed by the time the GMT meets to discuss preliminary OFL, ABC and ~~ OY ~~ACL levels. However, the GMT can request additional model projections~~, based on reviewed model scenarios~~, in order to develop a full evaluation of potential management actions.

GAP Responsibilities

The chair of the GAP will appoint a representative to track each stock assessment and attend the STAR panel meeting. The GAP representative will serve as advisor to the STAT Team and STAR panel. It is especially important that the GAP representative be included in the STAT team's discussion and review of all the data sources being used in the assessment, prior to development of the stock assessment model. It is the responsibility of the GAP representative to insure that industry concerns ~~about the~~regarding the adequacy of data being used by the STAT Team are expressed at an early stage in the process. The GAP representative will participate in review discussions as an advisor to the STAR panel, in the same capacity as the GMT advisor. The GAP representative may provide appropriate data and advice to the STAR panel and GMT and will report the the GAP on STAR panel and GMT meeting proceedings.

The GAP representative, along with STAT and SSC representatives, will attend the GMT meeting at which OFL and ABC recommendations are made. The GAP representative will also attend subsequent GMT, Council, and other necessary meetings where the assessment is discussed.

~~The GAP representative may provide appropriate data and advice to the STAR panel and GMT and will report to the GAP on STAR panel and GMT meeting proceedings.~~

SSC Responsibilities

The SSC will participate in the stock assessment review process and ~~will~~ provide the Council and its advisory bodies with technical advice related to the stock assessments and the review process. The SSC will assign one of its members to act as chair of each STAR panel. Following the STAR panel meeting, the STAR panel chair will review the revised stock assessment and STAR panel report for consistency with the Terms of Reference. The chair~~is~~ ~~member~~ is not only expected to attend the assigned STAR panel meeting, but also the GMT meeting at which ACL~~BC~~ recommendations are made (should the need arise), and Council meetings when groundfish stock assessment agenda items are discussed (see calendar in Appendix A). I~~Specifically, i~~f requested, the STAR panel chair will present the STAR panel report to the GMT and assist with~~if~~ ~~it requires assistance in~~ interpreting the results of a stock assessment. In addition, the chair will present the panel's report at SSC and Council meetings. However, to insure independence in the SSC's review of stock assessments and STAR panel proceedings, SSC members who served on a STAT Team or STAR panel for a particular stock assessment are required to recuse themselves when that stock assessment is reviewed by the SSC, except to answer questions or present factual information. Other SSC members will be assigned the roles of discussion lead and rapporteur. The SSC's review constitutes a final independent check of the stock assessment that takes into consideration both the stock assessment and the STAR panel report.

It is the SSC's responsibility to review and endorse any additional analytical work requested by the GMT after the stock assessment has been reviewed by the STAR panels. In addition, the SSC will review and advise the GMT and Council on projected OFLs, ABCs and ~~OYs~~ ACLs and, in addition, will serve as arbitrator to resolve disagreements between the STAT Team and the STAR panel.

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Appendix A: 2009-2010 Stock Assessment Review Calendar

Panel	Dates	Location	Species 1	Species 2	Pre-STAR Draft Deadline a/	Post-STAR Briefing Book Deadline b/
Whiting	~~Feb. 3-6~~	~~Seattle, WA~~	~~Pacific Whiting~~	~~NA~~	~~Jan. 12~~	~~Feb. 18~~
1	~~May 4-8~~	~~Newport, OR~~	~~Petrale sole~~	~~Splitnose~~	~~Apr. 13~~	~~May 27~~
Updates	~~June 10-11~~	~~June Council meeting~~	~~POP, Darkblotched~~	~~Canary, Cowcod~~	~~NA~~	~~May 27~~
2	~~July 13-17~~	~~Santa Cruz, CA~~	~~Bocaccio~~	~~Widow~~	~~June 22~~	~~Aug. 26~~
3	~~July 27-31~~	~~Seattle, WA~~	~~Lingcod~~	~~Cabezon~~	~~July 6~~	~~Aug. 26~~
4	~~Aug. 3-7~~	~~Seattle, WA~~	~~Yelloweye~~	~~Greenstriped~~	~~July 13~~	~~Aug. 26~~
Mop-Up	~~Sept. 28-Oct. 1~~	~~Seattle, WA~~	~~TBD~~	~~TBD~~	~~Sep. 7~~	~~Oct. 14~~

a/ Pre-STAR draft assessments are due to Council staff and the NMFS SAC three weeks in advance of the STAR meeting. This allows one week to correct deficiencies prior to distribution to the STAR panel members two weeks in advance of the STAR panel.
b/ Post-STAR draft assessments to be reviewed by the SSC are due to Council staff two weeks in advance of the SSC meeting. This due date is a guideline since, in some cases (e.g., Pacific whiting), there is not enough time to prepare the post-STAR draft in time for the briefing book deadline.

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Appendix B: Outline for Groundfish Stock Assessment Documents

This is an outline of items that should be included in stock assessment reports for groundfish managed by the Pacific Fishery Management Council. The outline is a working document meant to provide assessment authors with flexible guidelines about how to organize and communicate their work. All items listed in the outline may not be appropriate or available for each assessment. Also, items ~~flagged~~ with asterisks (*) are optional for draft assessment documents prepared for STAR panel meetings but should be included in the final document. In the interest of clarity and uniformity of presentation, stock assessment authors and reviewers are encouraged (but not required) to use the same organization and section names as in the outline. It is important that time ~~trends~~ seriesof catch, abundance, harvest rates, recruitment and other key quantities be presented in tabular form to facilitate full understanding and follow-up work.

A. Title page and list of preparers – the names and affiliations of the stock assessment team (STAT) either alphabetically or as first and secondary authors

B. Executive Summary (see attached template and example in Appendices C and D respectively).

C. Introduction
   1. Scientific name, distribution, the basis for the choice of stock structure, including regional differences in life history or other biological characteristics that should form the basis of management units.
   2. A map depicting the scope of the assessment and identifying boundaries for fisheries or data collection strata.
   ~~3. Description of fisheries for this species off Canada or Alaska, including references to any recent assessments of those stocks.~~
   ~~4.~~3. Important features of life history that affect management (e.g., migration, sexual dimorphism, bathymetric demography).
   ~~5.~~4. Important features of current fishery and relevant history of fishery.
   ~~6.~~5. Summary of management history (e.g., changes in mesh sizes, trip limits, or other management actions that may have significantly altered selection, catch rates, or discards).
   ~~7.~~6. Management performance – a table or tables comparing acceptable biological catches, optimum yields, landings, and catch (i.e., landings plus discard) for each area and year
   7. Description of fisheries for this species off Canada or Alaska, including references to any recent assessments of those stocks.

D. Assessment
   1. Data
      a. Landings by year and fishery, historical catch estimates, discards (generally specified as a percentage of total catch in weight and in units of mt), catch-at-age, weight-at-age, abundance indices (typically survey and CPUE data), data used to estimate biological parameters (e.g., growth rates, maturity schedules, and natural mortality) with coefficients of variation (CVs) or variances if available. Include complete tables and figures and date of extraction.
      b. Sample size information for length and age composition data by area, year, gear, market category, etc., including both the number of trips and fish sampled.
      c. All data sources that include the species being assessed, which are used in the assessment, and provide the rationale for data sources that are excluded.
   2. History of modeling approaches used for this stock – changes between current and previous assessment models
      a. Response to STAR panel recommendations from the most recent previous assessment.
      b. Report of consultations with GAP and GMT representatives regarding the use of various data sources in the stock assessment.
   3. Model description
      a. Complete description of any new modeling approaches.
      b. Definitions of fleets and areas.
      d. Assessment program with last revision date (i.e., date executable program file was compiled).
      e. List and description of all likelihood components in the model.
      f. Constraints on parameters, selectivity assumptions, natural mortality, assumed level of age reader agreement or assumed ageing error (if applicable), and other assumed parameters.

   g. Description of stock-recruitment constraints or components.
   h. Description of how the first year that is included in the model was selected and how the population state at the time is defined (e.g., B_0, stable age structure, etc.).
   i. Critical assumptions and consequences of assumption failures.
4. Model selection and evaluation
   a. Evidence of search for balance between model realism and parsimony.
   b. Comparison of key model assumptions, include comparisons based on nested models (e.g., asymptotic vs. domed selectivities, constant vs. time-varying selectivities).
   c. Summary of alternate model configurations that were tried but rejected.
   d. Likelihood profile for the base-run (or proposed base-run model for a draft assessment undergoing review) configuration over one or more key parameters (e.g., M, h, Q) to show consistency among input data sources.
   e. Residual analysis for the base-run configuration (or proposed base-run model in a draft assessment undergoing review) e.g., residual plots, time series plots of observed and predicted values, or other approaches. Note that model diagnostics *are* required in draft assessments undergoing review.
   f. Convergence status and convergence criteria for the base-run model (or proposed base-run).
   g. Randomization run results or other evidence of search for global best estimates.
   h. Evaluation of model parameters. Do they make sense? Are they credible?
   i. Are model results consistent with assessments of the same species in Canada and Alaska? Are parameter estimates (e.g., survey catchability) consistent with estimates for related stocks?
5. Point-by-point response to the STAR panel recommendations.* (Not required in draft assessment undergoing review.)
6. Base-run(s) results
   a. Table listing all explicit parameters in the stock assessment model used for base runs, their purpose (e.g., recruitment parameter, selectivity parameter) and whether or not the parameter was actually estimated in the stock assessment model.
   b. Population numbers at age × year × sex (if sex-specific M, growth, or selectivity) (May be provided as a text file).* (Not required in draft assessment undergoing review.)
   c. Time-series of total, 1+ (if age 1s are in the model), summary, and spawning biomass (and/or spawning output), depletion relative to B_0, recruitment and fishing mortality or exploitation rate estimates (table and figures).
   d. Selectivity estimates (if not included elsewhere).
   e. Stock-recruitment relationship.
   f. OFL , ABC and ACL (and/or ABC and OY or HG) for recent years
   g. Clear description of units for all outputs.
   h. Clear description of how discard is included in yield estimates.
7. Uncertainty and sensitivity analyses. The best approach for describing uncertainty and the range of probable biomass estimates in groundfish assessments may depend on the situation. Important factors to consider include:
   a. Parameter uncertainty (variance estimation conditioned on a given model, estimation framework, data set choice, and weighting scheme), including likelihood profiles of important assessment parameters (e.g., natural mortality). This also includes expressing uncertainty in derived outputs of the model and estimating CVs by an appropriate methods (e.g., bootstrap, asymptotic methods, Bayesian approaches, such as MCMC).
   b. Sensitivity to data set choice and weighting schemes (e.g., emphasis factors), which may also include a consideration of recent patterns in recruitment.
   c. Sensitivity to assumptions about model structure, i.e., model specification uncertainty.
   d. Retrospective analysis, where the model is fitted to a series of shortened input data sets, with the most recent years of input data being dropped.
   e. Historical analysis (plot of actual estimates from current and previous assessments).
   f. Subjective appraisal of the magnitude and sources of uncertainty.
   g. If a range of model runs is used to characterize uncertainty it is important to provide some qualitative or quantitative information about relative probability of each.
   h. If possible, ranges depicting uncertainty should include at least three runs: (a) one judged most probable; (b) at least one that depicts the range of uncertainty in the direction of lower current biomass levels; and (c) one that depicts the range of uncertainty in the direction of higher current

biomass levels. The entire range of uncertainty should be carried through stock projections and decision table analyses.

E. Reference points (biomass and exploitation rate).
1. Unfished spawning stock biomass, summary age biomass, and recruitment.
2. Reference points based on $B_{40\%}$ (spawning biomass, SPR, exploitation rate, equilibrium yield).
3. Reference points based on default SPR proxy (spawning biomass, SPR, exploitation rate, equilibrium yield).
4. Reference points based on MSY (if estimated) (spawning biomass, SPR, exploitation rate, equilibrium yield).
5. Equilibrium yield curve showing various B_{MSY} proxies (see attached example).

F. Harvest projections and decision tables* (Not required in draft assessment undergoing review.)
1. Harvest projections and decision tables (i.e., a matrix of states of nature versus management action) should cover the plausible range of uncertainty about current biomass and the full range of candidate fishing mortality targets used for the stock or requested by the GMT. These should at least include calculation of the ~~ABC~~ OFL based on F_{MSY} (or its proxy) and the maximum ~~OY~~ ACL that is implied under the Council's 40:10 harvest policy. Include OFL(encountered), OFL(retained) and OFL(dead) if different due to discard and discard mortality. Ideally, the alternatives described in the decision table will be drawn from a probability distribution which describes the pattern of uncertainty regarding the status of the stock and the consequences of alternative future management actions. Where alternatives are not formally associated with a probability distribution, the document needs to present sufficient information to guide assignment of approximate probabilities to each alternative. Decision tables should follow the format of the example Executive Summary for canary rockfish (Appendix D of this document) in which the columns represent the states of nature and the rows the management decisions. In most cases, management decisions will represent the sequence of catches obtained by applying the Council 40-10 harvest policy to each state of nature; however other alternatives may be suggested by the GMT as being more relevant to Council decision-making. For example, when recent catches are much less than the OY, there may be more interest in status quo projections.
2. Information presented should include biomass, stock depletion, and yield projections of ABC and OY for ten years into the future, beginning with the first year for which management action could be based upon the assessment.

G. Regional management considerations.
1. Discuss whether a regional management approach make sense for the species from a biological perspective.
2. If there are insufficient data to analyze a regional management approach, what are the research and data needs to answer this question?

H. Research needs (prioritized).

I. Acknowledgments-include STAR panel members and affiliations as well as names and affiliations of persons who contributed data, advice or information but were not part of the assessment team. * (Not required in draft assessment undergoing review.)

J. Literature cited.

K. An appendix with the complete parameter and data in the native code of the stock assessment program. (For a draft assessment undergoing review, these listings can be provided as text files or in spreadsheet format.)

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Appendix C: Template for Executive Summary Prepared by STAT Teams

Stock: species/area, including an evaluation of any potential biological basis for regional management

Catches: trends and current levels-include table for last ten years and graph with long term data

Data and assessment: date of last assessment, type of assessment model, data available, new information, and information lacking

Unresolved problems and major uncertainties: any special issues that complicate scientific assessment, questions about the best model scenario, etc.

Reference points: management targets and definition of overfishing, including the harvest rate that brings the stock to equilibrium at $B_{40\%}$ (the B_{MSY} proxy) and the equilibrium stock size that results from fishing at the default harvest rate (the F_{MSY} proxy).

Stock biomass: trends and current levels relative to virgin or historic levels, description of uncertainty-include table for last 10 years and graph with long term estimates

Recruitment: trends and current levels relative to virgin or historic levels-include table for last 10 years and graph with long term estimates

Exploitation status: exploitation rates (i.e., total catch divided by exploitable biomass, or the annual SPR harvest rate) – include a table with the last 10 years of data and a graph showing the trend in fishing mortality relative to the target (y-axis) plotted against the trend in biomass relative to the target (x-axis).

Management performance: catches in comparison to OFL, ABC and OY/ACL values for the most recent 10 years (when available), overfishing levels, actual catch and discard. Include OFL(encountered), OFL(retained) and OFL(dead) if different due to discard and discard mortality.

Forecasts: ten-year forecasts of catch, summary biomass, spawning biomass, and depletion.* (Not required in draft assessments undergoing review.)

Decision table: projected yields (ABC and OY), spawning biomass, and stock depletion levels for each year.* (Not required in draft assessments undergoing review.)

Research and data needs: identify information gaps that seriously impede the stock assessment.

Rebuilding Projections: reference to the principal results from rebuilding analysis if the stock is overfished.* This section should be included in the Final/SAFE version assessment document but is not required for draft assessments undergoing review. See Rebuilding Analysis Terms of Reference for detailed information on rebuilding analysis requirements.

Summary Table: as detailed in the attached example.

Hilborn, R., and C. J. Walters. 1992. Quantitative fisheries stock assessment: Choice, dynamics and uncertainty. Chapman and Hall.

Executive Summary

Stock

This assessment reports the status of the canary rockfish (*Sebastes pinniger*) resource off the coast of the United States from southern California to the U.S.-Canadian border using data through 2006. The resource is modeled as a single stock. Spatial aspects of the coast-wide population are addressed through geographic separation of data sources/fleets where possible and consideration of residual patterns that may be a result of inherent stock structure. There is currently no genetic evidence that there are distinct biological stocks of canary rockfish off the U.S. coast and very limited tagging data to describe adult movement, which may be significant across depth and latitude. Future efforts to specifically address regional management concerns will require a more spatially explicit model that likely includes the portion of the canary rockfish stock residing in Canadian waters off Vancouver Island.

Catches

Catch of canary rockfish is first reported in 1916 in California. Since that time, annual catch has ranged from 46.5 mt in 2004 to 5,544 in 1982 and totaled almost 150,000 mt over the time-series. Canary rockfish have been primarily caught by trawl fleets, on average comprising ~85% of the annual catches, with the Oregon fleet removing as much as 3,941 mt in 1982. Historically just 10% of the catches have come from non-trawl commercial fisheries, although this proportion reached 24% and 358 mt in 1997. Recreational removals have averaged just 6% of the total catch, historically, but have become relatively more important as commercial landings have been substantially reduced in recent years. Recreational catches reached 59% of the total with 30 mt caught in 2003. Total catches after 1999 have been reduced by an order of magnitude in an attempt to rebuild a stock determined to be overfished on the basis of the 1999 assessment.

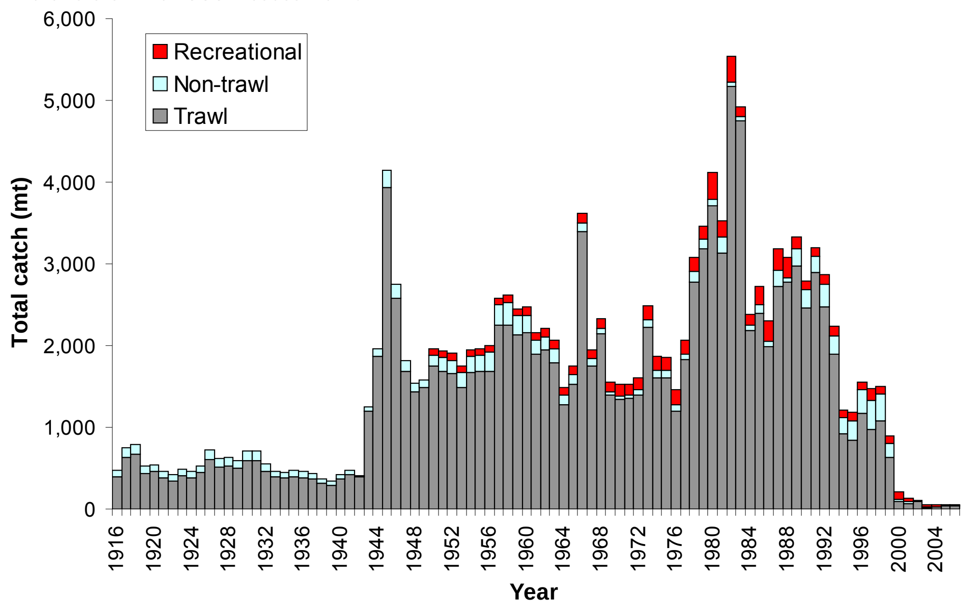

Figure a. Canary rockfish catch history by major source, 1916-2006.

Table a. Recent commercial fishery catches (mt) by fleet.

Year	Southern California trawl	Northern California trawl	Oregon trawl	Washington trawl	Southern California non-trawl	Northern California non-trawl	Oregon-Washington non-trawl	At-sea whiting bycatch
1997	31.96	142.66	589.85	203.44	29.78	73.80	254.42	3.63
1998	8.41	149.45	716.05	203.01	23.33	57.25	250.13	5.47
1999	7.36	96.25	387.85	139.97	8.53	28.59	123.97	5.63
2000	1.71	11.24	46.62	32.66	2.52	5.50	10.25	2.35
2001	1.44	9.43	33.13	19.65	1.60	4.96	11.00	4.05
2002	0.36	14.62	32.60	33.29	0.02	0.08	3.15	5.24
2003	0.23	0.31	5.02	6.24	0.00	0.08	6.89	0.93
2004	0.61	1.95	7.67	7.73	0.02	0.06	4.68	5.22
2005	0.72	2.84	4.91	25.90	0.06	0.09	1.79	1.44
2006	3.57	2.28	2.91	15.64	0.00	0.00	3.11	1.09

Data and Assessment

This assessment used the Stock Synthesis 2 integrated length-age structured model. The model includes catch, length- and age-frequency data from 11 fishing fleets, including trawl, non-trawl and recreational sectors. Biological data is derived from both port and on-board observer sampling programs. The National Marine Fisheries Service (NMFS) triennial bottom trawl survey and Northwest Fisheries Science Center (NWFSC) trawl survey relative biomass indices and biological sampling provide fishery independent information on relative trend and demographics of the canary stock. The Southwest Fisheries Science Center (SWFSC)/NWFSC/Pacific Whiting Conservation Cooperative (PWCC) coast-wide pre-recruit survey provides a source of recent recruitment strength information.

New analysis of the triennial survey data led to separating the series into two parts (1980-1992, 1995-2004) to allow for potential changes in catchability due to timing of survey operations. Accommodation of potential changes in fishery selectivity due to management actions including the adoption of canary-specific trip limits in 1995, small-footrope requirements in 1999, closure of the RCA in 2002 and use of selective flatfish trawl starting in 2005 was also added in this assessment. These and other changes have resulted in a change in the estimate of current stock status and large increase in the perception of uncertainty regarding this quantity in comparison to the most recent 2005 and earlier assessments.

The base case assessment model includes parameter uncertainty from a variety of sources, but underestimates the considerable uncertainty in recent trend and current stock status. For this reason, in addition to asymptotic confidence intervals (based upon the model's analytical estimate of the variance near the converged solution), two alternate states of nature regarding stock productivity (via the steepness parameter of the stock-recruitment relationship) are presented. The base case model (steepness = 0.51) is considered to be twice as likely as the two alternate states (steepness = 0.35, 0.72) based on the results of a meta-analysis of west coast rockfish (M. Dorn, personal communication). In order to best capture this source of uncertainty, all three states of nature will be used as probability-weighted input to the rebuilding analysis.

Stock biomass

Canary rockfish were relatively lightly exploited until the early 1940's, when catches increased and a decline in biomass began. The rate of decline in spawning biomass accelerated during the late 1970s, and finally reached a minimum (13% of unexploited) in the mid 1990s. The canary rockfish spawning stock biomass is estimated to have been increasing since that time, in response to reductions in harvest and above average recruitment in the preceding decade. However, this trend is very uncertain. The estimated relative depletion level in 2007 is 32.4% (~95% asymptotic interval: 24-41%, ~75% interval based on the range of states of nature: 12-56%), corresponding to 10,544 mt (asymptotic interval: 7,776-13,312 mt, states of nature interval: 4,009-17,519) of female spawning biomass in the base model.

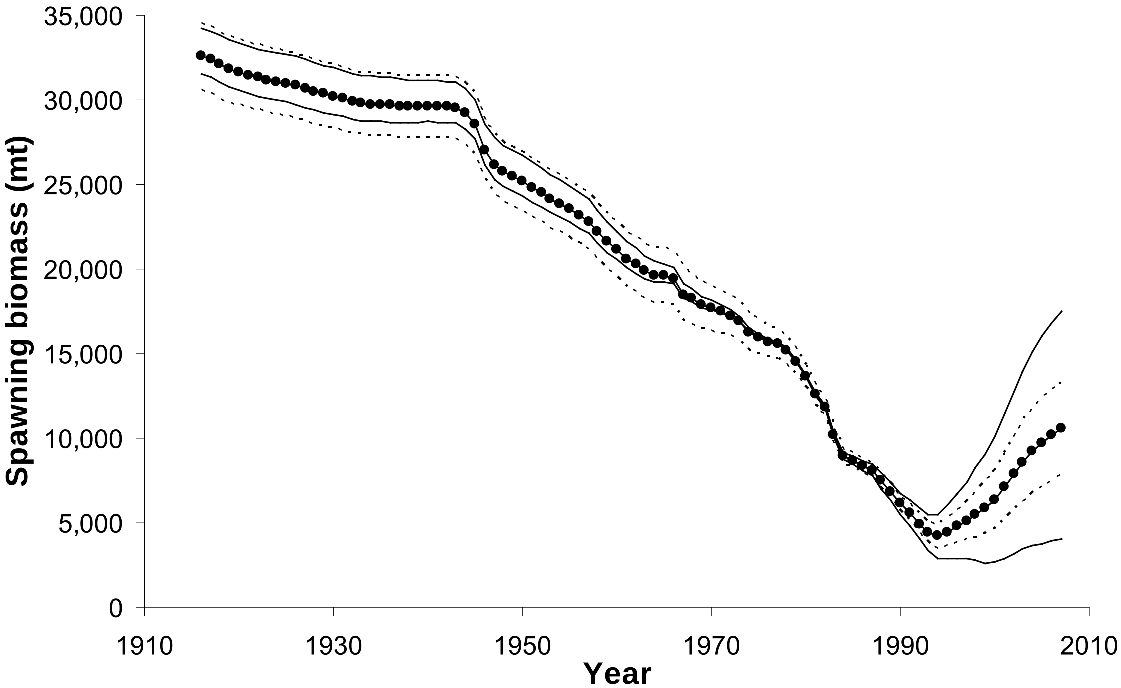

Figure b. Estimated spawning biomass time-series (1916-2007) for the base case model (round points) with approximate asymptotic 95% confidence interval (dashed lines) and alternate states of nature (light lines).

Table b. Recent trend in estimated canary rockfish spawning biomass and relative depletion level.

Year	Spawning biomass (mt)	~95% confidence interval	Range of states of nature	Estimated depletion	~95% confidence interval	Range of states of nature
1998	5,499	4,177-6,820	2,761-8,241	16.9%	NA	8.1-26.2
1999	5,826	4,296-7,357	2,610-9,073	17.9%	NA	7.6-28.8
2000	6,364	4,618-8,111	2,644-10,144	19.5%	NA	7.7-32.2
2001	7,149	5,190-9,109	2,918-11,477	22.0%	NA	8.5-36.4
2002	7,910	5,750-10,070	3,184-12,779	24.3%	NA	9.3-40.6
2003	8,603	6,264-10,942	3,417-13,985	26.4%	NA	10.0-44.4
2004	9,226	6,736-11,715	3,628-15,076	28.3%	NA	10.6-47.9
2005	9,749	7,140-12,359	3,795-16,019	29.9%	NA	11.1-50.9
2006	10,183	7,482-12,884	3,918-16,825	31.3%	23.1-39.4	11.4-53.4
2007	10,544	7,776-13,312	4,009-17,519	32.4%	24.1-40.7	11.7-55.6

Recruitment

The degree to which canary rockfish recruitment declined over the last 50 years is closely related to the level of productivity (stock-recruit steepness) modeled for the stock. High steepness values imply little relationship between spawning stock and recruitment, while low steepness values cause a strong correlation. After a period of above average recruitments, recent year-class strengths have generally been low, with only 1999 and 2001 producing large estimated recruitments (the 2007 recruitment is based only on the stock-recruit function). There is little information other than the pre-recruit index to inform the assessment model about recruitments subsequent to 2002, so those estimates will likely be updated in future assessments. As the larger recruitments from the late 1980s and early 1990s move through the population in future projections, the effects of recent poor recruitment will tend to slow the rate of recovery.

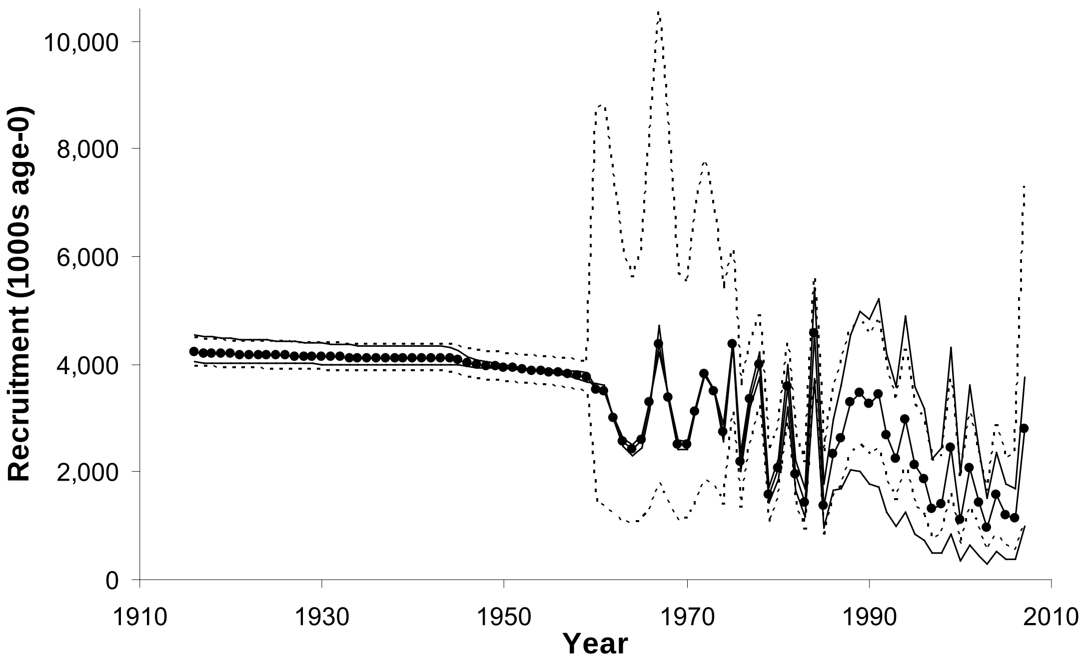

Figure c. Time series of estimated canary rockfish recruitments for the base case model (round points) with approximate asymptotic 95% confidence interval (dashed lines) and alternate states of nature (light lines).

Table c. Recent estimated trend in canary rockfish recruitment.

Year	Estimated recruitment (1000s)	~95% confidence interval	Range of states of nature
1998	1,391	841-2,299	484-2,453
1999	2,449	1,606-3,735	841-4,318
2000	1,099	638-1,893	351-1,938
2001	2,061	1,359-3,124	643-3,613
2002	1,432	905-2,267	447-2,383
2003	955	547-1,667	302-1,515
2004	1,565	854-2,869	520-2,373
2005	1,182	627-2,231	390-1,771
2006	1,144	548-2,389	367-1,699
2007	2,807	1,078-7,313	991-3,745

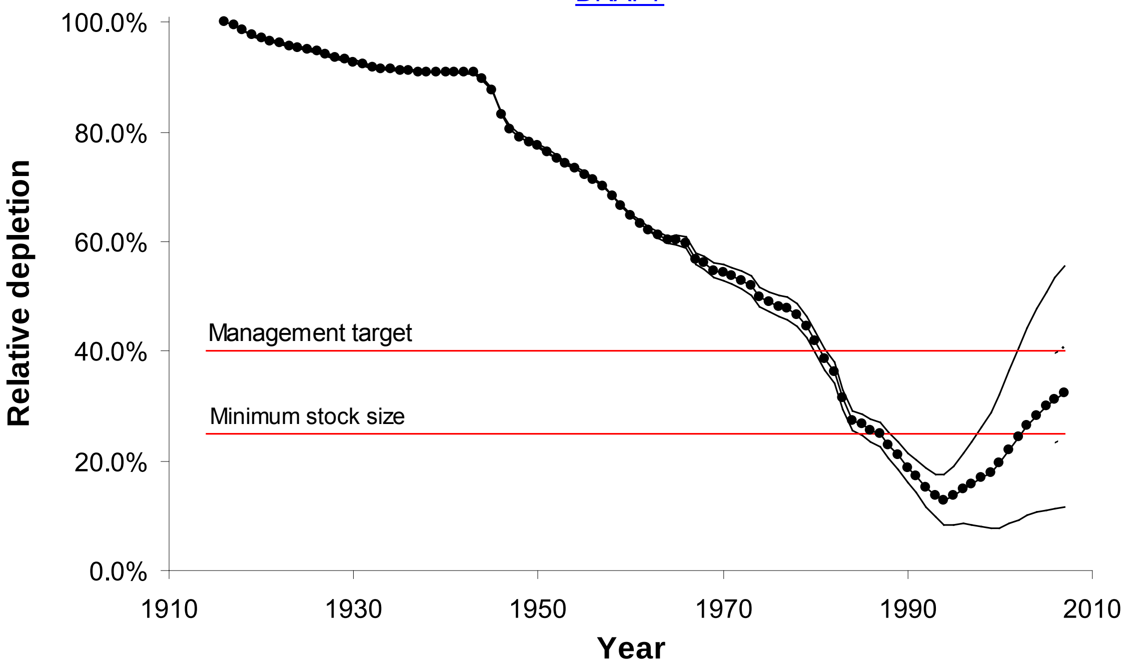

Figure d. Time series of depletion level as estimated in the base case model (round points) with approximate asymptotic 95% confidence interval (2006-2007 only, dashed lines) and alternate states of nature (light lines).

Reference points

Unfished spawning stock biomass was estimated to be 32,561 mt in the base case model. This is slightly smaller than the equilibrium value estimated in the 2005 assessment. The target stock size ($SB_{40\%}$) is therefore 13,024 mt. Maximum sustained yield (MSY) applying current fishery selectivity and allocations (a 'bycatch-only' scenario) was estimated in the assessment model to occur at a spawning stock biomass of 12,394 mt and produce an MSY catch of 1,169 mt (SPR = 52.9%). This is nearly identical to the yield, 1,167 mt, generated by the SPR (54.4%) that stabilizes the stock at the $SB_{40\%}$ target. The fishing mortality target/overfishing level (SPR = 50.0%) generates a yield of 1,161 mt at a stock size of 11,161 mt.

When selectivity and allocation from the mid 1990s (1994-1998) was applied, to mimic reference points under a targeted fishery scenario, the yield increased to 1,578 mt from a slightly smaller stock size (12,211 mt), but a similar rate of exploitation (SPR=52.5%). This is due to higher relative selection of older and larger fish when the fishery was targeting instead of avoiding canary rockfish. These values are appreciably higher than those from previous assessment models due primarily to the difference in steepness.

Exploitation status

The abundance of canary rockfish was estimated to have dropped below the $SB_{40\%}$ management target in 1981 and the overfished threshold in 1987. In hindsight, the spawning stock biomass passed through the target and threshold levels at a time when the annual catch was averaging more than twice the current estimate of the MSY. The stock remains below the rebuilding target, although the spawning stock biomass appears to have been increasing since 1999. The degree of increase is very sensitive to the value for steepness (state of nature), and is projected to slow as recent (and below average) recruitments begin to contribute to the spawning biomass. Fishing mortality rates in excess of the current F-target for rockfish of $SPR_{50\%}$ are estimated to have begun in the late 1970s and persisted through 1999. Recent management actions appear to have curtailed the rate of removal such that overfishing has not occurred since 1999, and recent SPR values are in excess of 95%. Relative exploitation rates (catch/biomass of age-5 and older fish) are estimated to have been less than 1% since 2001. These patterns are largely insensitive to the three states of nature.

Table d. Recent trend in spawning potential ratio (SPR) and relative exploitation rate (catch/biomass of age-5 and older fish).

Year	Estimated SPR (%)	Range of states of nature	Relative exploitation rate	Range of states of nature
1997	31.6%	16.9-41.9	0.0889	0.0607-0.1652
1998	33.2%	16.8-44.3	0.0873	0.0576-0.1778
1999	48.9%	26.1-61.0	0.0506	0.0323-0.1146
2000	84.0%	65.7-89.7	0.0112	0.0070-0.0271
2001	89.7%	76.5-93.5	0.0067	0.0041-0.0165
2002	92.2%	81.9-95.1	0.0050	0.0031-0.0126
2003	95.4%	88.3-97.2	0.0023	0.0014-0.0058
2004	96.3%	90.6-97.8	0.0020	0.0012-0.0051
2005	96.3%	90.5-97.7	0.0021	0.0013-0.0055
2006	96.5%	90.7-97.9	0.0019	0.0011-0.0049

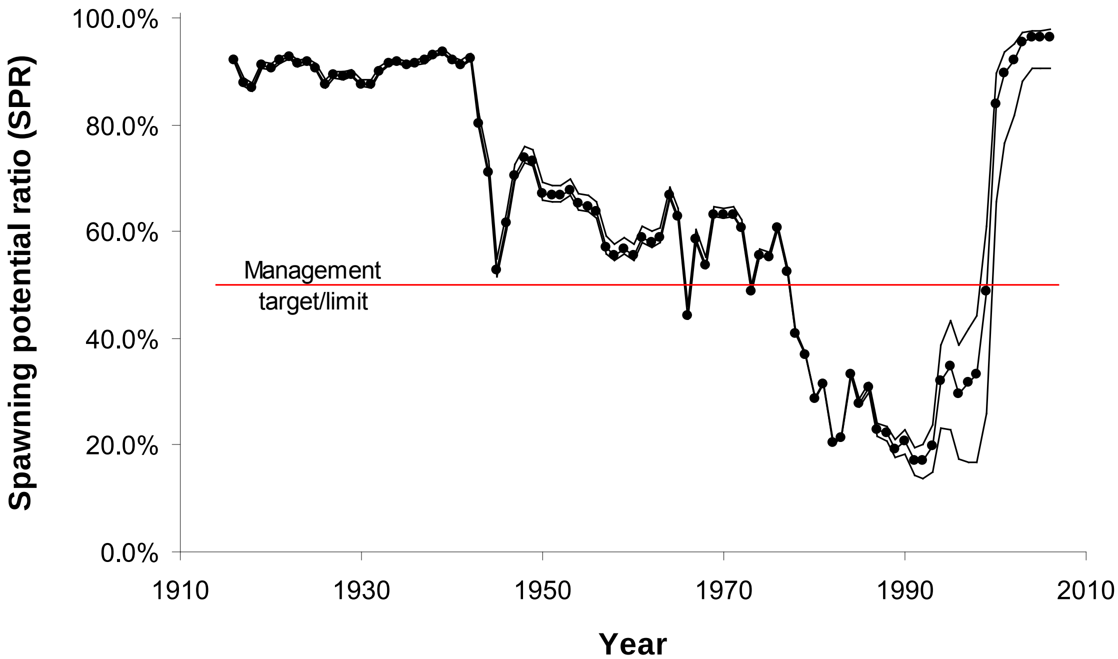

Figure e. Time series of estimated spawning potential ratio (SPR) for the base case model (round points) and alternate states of nature (light lines). Values of SPR below 0.5 reflect harvests in excess of the current overfishing proxy.

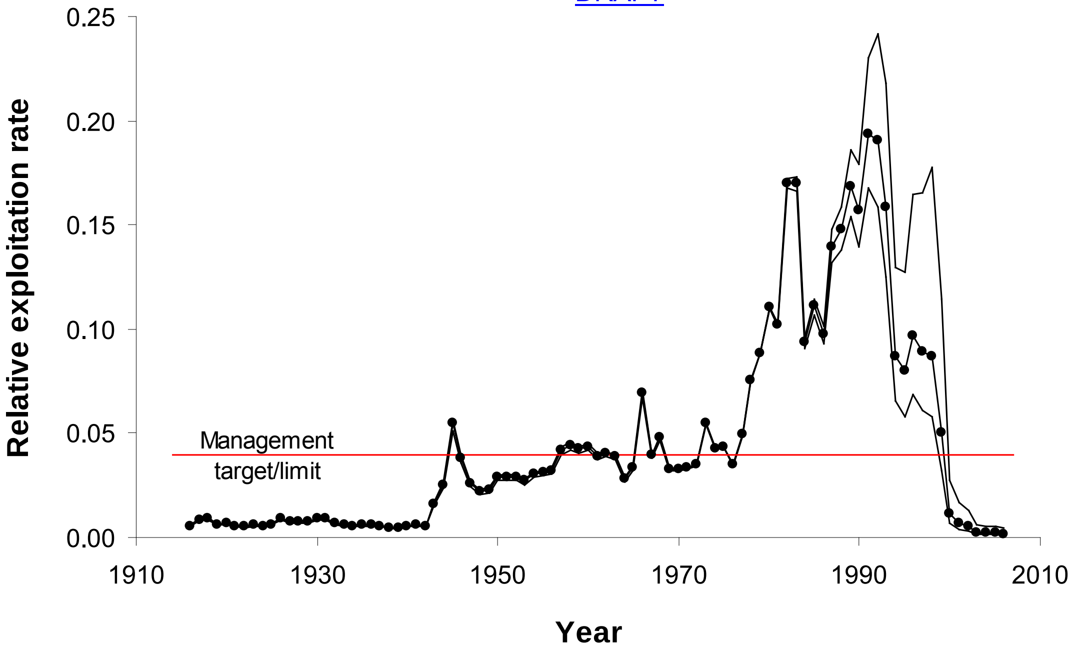

Figure f. Time series of estimated relative exploitation rate (catch/age 5 and older biomass, lower panel) for the base case model (round points) and alternate states of nature (light lines). Values of relative exploitation rate in excess of horizontal line are above the rate corresponding to the overfishing proxy from the base case.

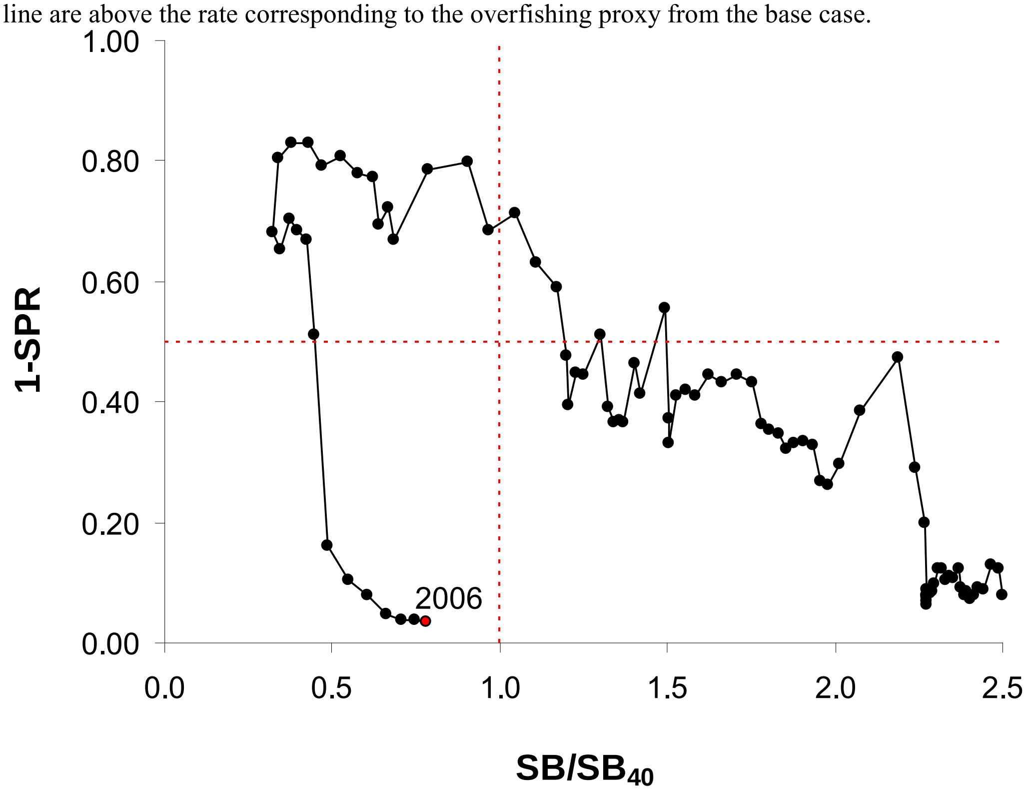

Figure g. Estimated spawning potential ratio relative to the proxy target of 50% vs. estimated spawning biomass relative to the proxy 40% level from the base case model. Higher biomass occurs on the right side of the x-axis, higher exploitation rates occur on the upper side of the y-axis.

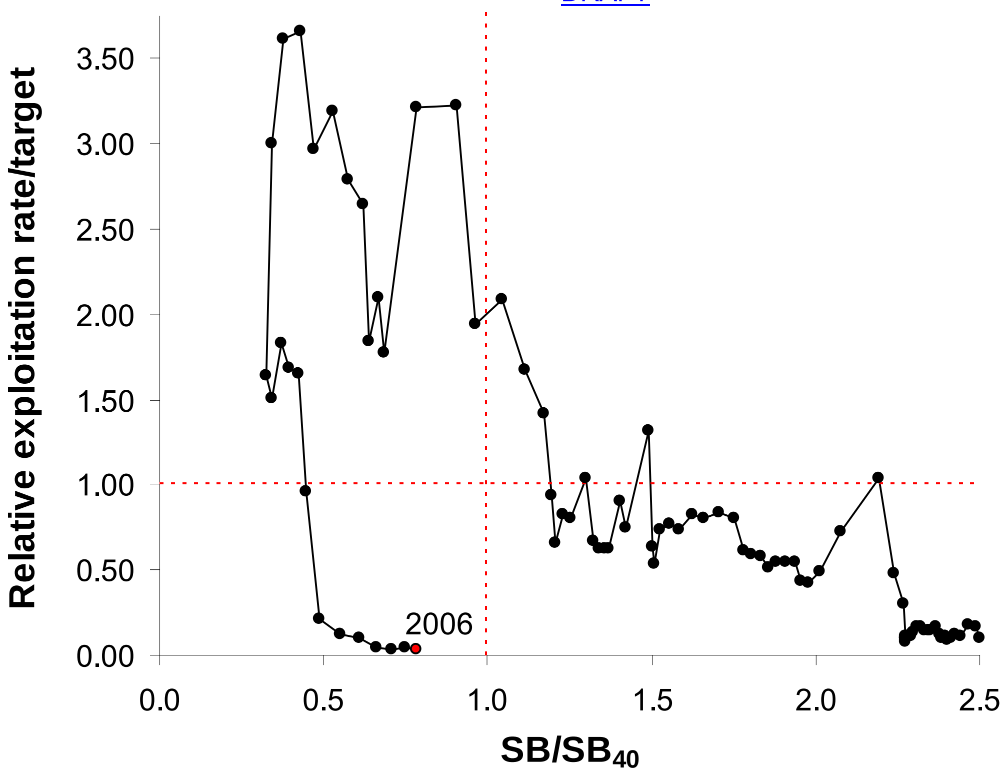

Figure g. Phase plot of estimated fishing intensity vs. relative spawning biomass for the base case model. Fishing intensity is the relative exploitation rate divided by the level corresponding to the overfishing proxy (0.040). Relative spawning biomass is annual spawner abundance divided by the 40% rebuilding target.

Management performance

Following the 1999 declaration that the canary rockfish stock was overfished the canary OY was reduced by over 70% in 2000 and by the same margin again over the next three years. Managers employed several tools in an effort to constrain catches to these dramatically lower targets. These included: reductions in trip/bag limits for canary and co-occurring species, the institution of spatial closures, and new gear restrictions intended to reduce trawling in rocky shelf habitats and the coincident catch of rockfish in shelf flatfish trawls. In recent years, the total mortality has been near the OY, but well below the ABC. Since the overfished determination in 1999, the total 7-year catch (644 mt) has been only 13% above the sum of the OYs for 2000-2006. This level of removals represents only 35% of the sum of the ABCs for that period. The total 2006 catch (47 mt) is <1% of the peak catch that occurred in the early 1980s.

Table e. Recent trend in estimated total canary rockfish catch and commercial landings (mt) relative to management guidelines.

Year	ABC (mt)	OY (mt)	Commercial landings (mt)[1]	Total Catch (mt)
1997	1,220[2]	1,000[2]	1,113.8	1,478.8
1998	1,045[2]	1,045[2]	1,182.4	1,494.2
1999	1,045[2]	857[2]	665.7	898.0
2000	287	200	60.6	208.4
2001	228	93	42.8	133.6
2002	228	93	48.6	106.8
2003	272	44	8.5	51.0
2004	256	47.3	10.7	46.5
2005	270	46.8	10.9	51.4
2006	279	47	8.2	47.1

[1]Excludes all at-sea whiting, recreational and research catches.
[2]Includes the Columbia and Vancouver INPFC areas only.

Unresolved problems and major uncertainties

Parameter uncertainty is explicitly captured in the asymptotic confidence intervals reported throughout this assessment for key parameters and management quantities. These intervals reflect the uncertainty in the model fit to the data sources included in the assessment, but do not include uncertainty associated with alternative model configurations, weighting of data sources (a combination of input sample sizes and relative weighting of likelihood components), or fixed parameters. Specifically, there appears to be conflicting information between the length- and age-frequency data regarding the degree of stock decline, making the model results sensitive to the relative weighting of each. This issue is explored in the assessment, but cannot be fully resolved at this time. The relationship between the degree of dome in the selectivity curves and the increase in female natural mortality with age remains a source of uncertainty that is included in model results, as it has been in previous assessments for canary rockfish. Uncertainty in the steepness parameter of the stock-recruitment relationship is significant and will likely persist in future assessments; this uncertainty is included in the assessment and rebuilding projections through explicit consideration of the three states of nature.

Forecasts

The forecast reported here will be replaced by the rebuilding analysis to be completed in September-October 2007 following SSC review of the stock assessment. In the interim, the total catch in 2007 and 2008 is set equal to the OY (44 mt). The exploitation rate for 2009 and beyond is based upon an SPR of 88.7%, which approximates the harvest level in the current rebuilding plan. Uncertainty in the rebuilding forecast will be based upon the three states of nature for steepness and random variability in future recruitment deviations for each rebuilding simulation. Current medium-term forecasts predict slow increases in abundance and available catch, with OY values for 2009 and 2010 increasing by nearly four times the value of 44 mt from the 2005 assessment. This is largely attributable to the revised perception of steepness, based on meta-analysis of other rockfish species. The following table shows the projection of expected canary rockfish catch, spawning biomass and depletion.

Table f. Projection of potential canary rockfish ABC, OY, spawning biomass and depletion for the base case model based on the SPR= 0.887 fishing mortality target used for the last rebuilding plan (OY) and $F_{50\%}$ overfishing limit/target (ABC). Assuming the OY of 44 mt is met in 2007 and 2008.

Year	ABC (mt)	OY (mt)	Age 5+ biomass (mt)	Spawning biomass (mt)	Depletion
2007	973	44	25,995	10,544	32.4%
2008	978	44	26,417	10,840	33.3%
2009	981	162	26,859	11,072	34.0%
2010	980	162	26,995	11,194	34.4%
2011	992	164	27,018	11,254	34.6%
2012	1,026	169	27,440	11,266	34.6%
2013	1,074	177	27,985	11,260	34.6%
2014	1,124	185	28,656	11,280	34.6%
2015	1,171	193	29,445	11,368	34.9%
2016	1,214	200	30,332	11,545	35.5%
2017	1,253	207	31,297	11,812	36.3%
2018	1,290	213	32,317	12,156	37.3%

Decision table

Because canary rockfish is currently managed under a rebuilding plan, this decision table is only intended to better compare and contrast the base case with uncertainty among states of nature. The results of the rebuilding plan will integrate these three states of nature as well as projected recruitment variability. Further, various alternate probabilities of rebuilding by target and limit time-periods as well as fishing mortality rates will be evaluated in the rebuilding analysis. Relative probabilities of each state of nature are based on a meta-analysis for steepness of west coast rockfish (M. Dorn, AFSC, personal communication). Landings in 2007-2008 are 44 mt for all cases. Selectivity and fleet allocations are projected at the average 2003-2006 values.

Table g. Decision table of 12-year projections for alternate states of nature (columns) and management options (rows) beginning in 2009. Relative probabilities of each state of nature are based on a meta-analysis for steepness of west coast rockfish (M. Dorn, AFSC, personal communication). Landings in 2007-2008 are 44 mt for all cases. Selectivity and fleet allocations are projected at the average 2003-2006 values.

			State of nature					
			Low steepness (0.35)		Base case (steepness = 0.51)		High steepness (0.72)	
Relative probability			0.25		0.5		0.25	
Management decision	Year	Catch (mt)	Depletion	Spawning biomass (mt)	Depletion	Spawning biomass (mt)	Depletion	Spawning biomass (mt)
Rebuilding SPR 88.7% catches from low steepness state of nature	2009	56	12.0%	4,099	34.0%	11,072	59.0%	18,583
	2010	56	12.0%	4,100	34.5%	11,236	60.1%	18,932
	2011	56	11.9%	4,078	34.8%	11,339	60.8%	19,156
	2012	59	11.8%	4,042	35.0%	11,396	61.2%	19,270
	2013	62	11.7%	4,003	35.1%	11,436	61.3%	19,313
	2014	65	11.6%	3,979	35.3%	11,502	61.4%	19,343
	2015	67	11.6%	3,984	35.7%	11,638	61.7%	19,423
	2016	70	11.7%	4,025	36.4%	11,866	62.2%	19,590
	2017	72	12.0%	4,102	37.4%	12,188	63.0%	19,852
	2018	74	12.3%	4,209	38.7%	12,591	64.1%	20,199
Rebuilding SPR 88.7% catches from base case	2009	162	12.0%	4,099	34.0%	11,072	59.0%	18,583
	2010	162	11.8%	4,058	34.4%	11,194	60.0%	18,890
	2011	164	11.7%	3,994	34.6%	11,254	60.5%	19,069
	2012	169	11.4%	3,914	34.6%	11,266	60.8%	19,138
	2013	177	11.2%	3,831	34.6%	11,260	60.7%	19,135
	2014	185	11.0%	3,762	34.6%	11,280	60.7%	19,118
	2015	193	10.9%	3,719	34.9%	11,368	60.8%	19,150
	2016	200	10.8%	3,710	35.5%	11,545	61.2%	19,266
	2017	207	10.9%	3,733	36.3%	11,812	61.8%	19,475
	2018	213	11.0%	3,781	37.3%	12,156	62.8%	19,767
Rebuilding SPR 88.7% catches from high steepness state of nature	2009	273	12.0%	4,099	34.0%	11,072	59.0%	18,583
	2010	271	11.7%	4,014	34.2%	11,150	59.8%	18,845
	2011	272	11.4%	3,905	34.3%	11,164	60.3%	18,978
	2012	277	11.0%	3,780	34.2%	11,130	60.3%	19,001
	2013	285	10.7%	3,654	34.0%	11,079	60.2%	18,951
	2014	293	10.3%	3,542	34.0%	11,055	60.0%	18,891
	2015	300	10.1%	3,459	34.1%	11,100	59.9%	18,880
	2016	307	9.9%	3,408	34.5%	11,235	60.2%	18,953
	2017	313	9.9%	3,389	35.2%	11,461	60.7%	19,122
	2018	319	9.9%	3,394	36.1%	11,763	61.5%	19,374
Status quo (catch = 44 mt)	2009	44	12.0%	4,099	34.0%	11,072	59.0%	18,583
	2010	44	12.0%	4,104	34.5%	11,241	60.1%	18,937
	2011	44	11.9%	4,088	34.9%	11,349	60.8%	19,166
	2012	44	11.8%	4,057	35.0%	11,411	61.2%	19,285
	2013	44	11.7%	4,024	35.2%	11,456	61.4%	19,334
	2014	44	11.7%	4,005	35.4%	11,529	61.5%	19,371
	2015	44	11.7%	4,018	35.8%	11,673	61.8%	19,459
	2016	44	11.9%	4,069	36.6%	11,911	62.3%	19,635
	2017	44	12.1%	4,157	37.6%	12,244	63.2%	19,908
	2018	44	12.5%	4,277	38.9%	12,660	64.3%	20,268

Research and data needs

Progress on a number of research topics would substantially improve the ability of this assessment to reliably and precisely model canary rockfish population dynamics in the future and provide better monitoring of progress toward rebuilding:

1. Expanded Assessment Region: Given the high occurrence of canary rockfish close to the US-Canada border, a joint US-Canada assessment should be considered in the future.
2. Many assessments are deriving historical catch by applying various ratios to the total rockfish catch prior to the period when most species were delineated. A comprehensive historical catch reconstruction for all rockfish species is needed, to compile a best estimated catch series that accounts for all the catch and makes sense for the entire group.
3. Habitat relationships: The historical and current relationship between canary rockfish distribution and habitat features should be investigated to provide more precise estimates of abundance from the surveys, and to guide survey augmentations that could better track rebuilding through targeted application of newly developed survey technologies. Such studies could also assist determining the possibility of dome-shaped selectivity, aid in evaluation of spatial structure and the use of fleets to capture geographically-based patterns in stock characteristics.
4. Meta-population model: The spatial patterns show patchiness in the occurrence of large vs. small canary; reduced occurrence of large/old canary south of San Francisco; and concentrations of canary rockfish near the US-Canada border. The feasibility of a meta-population model that has linked regional sub-populations should be explored as a more accurate characterization of the coast-wide population's structure. Tagging of other direct information on adult movement will be essential to this effort.
5. Increased computational power and/or efficiency is required to move toward fully Bayesian approaches that may better integrate over both parameter and model uncertainty.
6. Additional exploration of surface ages from the late 1970s and inclusion into or comparison with the assessment model, or re-aging of the otoliths could improve the information regarding that time period when the stock underwent the most dramatic decline. Auxiliary biological data collected by ODFW from recreational catches and hook-and-line projects may also increase the performance of the assessment model in accurately estimating recent trends and stock size.
7. Due to inconsistencies between studies and scarcity of appropriate data, new data is needed on both the maturity and fecundity relationships for canary rockfish.
8. Re-evaluation of the pre-recruit index as a predictor of recent year class strength should be ongoing as future assessments generate a longer series of well-estimated recent recruitments to compare with the coast-wide survey index.
9. Meta-analysis or other summary of the degree of recruitment variability and the relative steepness for other rockfish and groundfish stocks should be ongoing, as this information is likely to be very important for model results (as it is here) in the foreseeable future.

Rebuilding projections

The rebuilding projections will be presented in a separate document after the assessment has been reviewed in September 2007.

Table h. Summary of recent trends in estimated canary rockfish exploitation and stock levels from the base case model; all values reported at the beginning of the year.

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Commercial landings (mt)[1]	1,182.4	665.7	60.6	42.8	48.6	8.5	10.7	10.9	8.2	NA
Total catch (mt)	1,494.2	898.0	208.4	133.6	106.8	51.0	46.5	51.4	47.1	NA
ABC (mt)	1,045[2]	1,045[2]	287	228	228	272	256	270	279	172
OY	1,045[2]	857[2]	200	93	93	44	47.3	46.8	47.0	44
SPR	33.2%	48.9%	84.0%	89.7%	92.2%	95.4%	96.3%	96.3%	96.5%	NA
Exploitation rate (catch/age 5+ biomass)	0.0873	0.0506	0.0112	0.0067	0.0050	0.0023	0.0020	0.0021	0.0019	NA
Age 5+ biomass (mt)	17,125	17,733	18,659	20,078	21,275	22,333	23,583	24,402	25,317	25,995
Spawning biomass (mt)	5,499	5,826	6,364	7,149	7,910	8,603	9,226	9,749	10,183	10,544
~95% Confidence interval	4,177-6,820	4,296-7,357	4,618-8,111	5,190-9,109	5,750-10,070	6,264-10,942	6,736-11,715	7,140-12,359	7,482-12,884	7,776-13,312
Range of states of nature	2,761-8,241	2,610-9,073	2,644-10,144	2,918-11,477	3,184-12,779	3,417-13,985	3,628-15,076	3,795-16,019	3,918-16,825	4,009-17,519
Recruitment (1000s)	1,391	2,449	1,099	2,061	1,432	955	1,565	1,182	1,144	2,807
~95% Confidence interval	841-2,299	1,606-3,735	638-1,893	1,359-3,124	905-2,267	547-1,667	854-2,869	627-2,231	548-2,389	1,078-7,313
Range of states of nature	484-2,453	841-4,318	351-1,938	643-3,613	447-2,383	302-1,515	520-2,373	390-1,771	367-1,699	991-3,745
Depletion	16.9%	17.9%	19.5%	22.0%	24.3%	26.4%	28.3%	29.9%	31.3%	32.4%
~95% Confidence interval	NA	NA	NA	NA	NA	NA	NA	NA	23.1-9.4	24.1-40.7
Range of states of nature	8.1-26.2	7.6-28.8	7.7-32.2	8.5-36.4	9.3-40.6	10.0-44.4	10.6-47.9	11.1-50.9	11.4-53.4	11.7-55.6

[1]Excludes all at-sea whiting, recreational and research catches.
[2]Includes the Columbia and Vancouver INPFC areas only.

Table i. Summary of canary rockfish reference points from the base case model. Values are based on 1994-1998 fishery selectivity and allocation to better approximate the performance of a targeted fishery rather than a bycatch-only scenario.

Quantity	Estimate	~95% Confidence interval	Range of states of nature
Unfished spawning stock biomass (SB_0, mt)	32,561	30,594-34,528	34,262-31,498
Unfished 5+ biomass (mt)	86,036	NA	91,980-82,744
Unfished recruitment (R_0, thousands)	4,210	3,961-4,458	4,540-4,035
Reference points based on $SB_{40\%}$			
MSY Proxy Spawning Stock Biomass ($SB_{40\%}$)	13,024	12,237-13,811	12,599-13704.7
SPR resulting in $SB_{40\%}$ ($SPR_{SB40\%}$)	54.4%	54.4-54.4	45.8-68.5
Exploitation rate resulting in $SB_{40\%}$	0.0457	NA	0.0277-0.0600
Yield with $SPR_{SB40\%}$ at $SB_{40\%}$ (mt)	1,574	1,477-1,672	996-2,034
Reference points based on SPR proxy for MSY			
Spawning Stock Biomass at SPR (SB_{SPR})(mt)	11,161	10,487-11,835	1,654-14,053
$SPR_{MSY\text{-}proxy}$	50.0%	NA	NA
Exploitation rate corresponding to SPR	0.0528	NA	0.0524-0.0539
Yield with $SPR_{MSY\text{-}proxy}$ at SB_{SPR} (mt)	1,572	1,476-1,668	238-1,962
Reference points based on estimated MSY values			
Spawning Stock Biomass at *MSY* (SB_{MSY}) (mt)	12,211	11,529-12,893	9,524-15,042
SPR_{MSY}	52.5%	52.1-52.8	37.0-70.5
Exploitation Rate corresponding to SPR_{MSY}	0.0487	NA	0.0254-0.0794
MSY (mt)	1,578	1,481-1,675	1,002-2,104

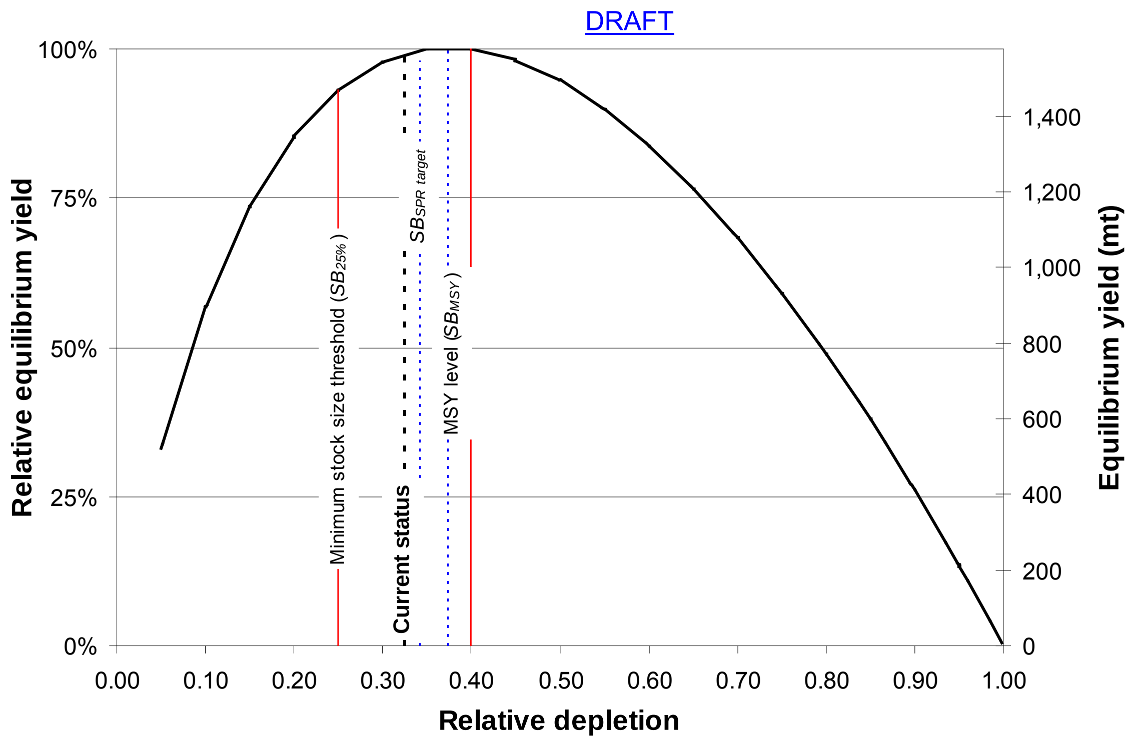

Figure h. Equilibrium yield curve (derived from reference point values reported in table i) for the base case model. Values are based on 1994-1998 fishery selectivity and allocation to better approximate the performance of a targeted fishery rather than a bycatch-only scenario.

GROUNDFISH MANAGEMENT TEAM (GMT) REPORT ON ASSIGNING VULNERABILITY SCORES TO ALL SPECIES IN THE GROUNDFISH FISHERY MANAGEMENT PLAN (FMP)

The GMT evaluated the vulnerability (V) of all groundfish species found in the groundfish FMP in order to address the following goals contained in Amendment 23 of the FMP:

1) Defining species as either "in the fishery", an "ecosystem component", or neither.
2) Identify stock complexes for management purposes
3) Quantify buffers for ultimately determining ACLs from OFLs and ABCs.

There are several factors that potentially complicate the use of vulnerability scores in the formulation of ACL buffers, so the GMT set aside this task for future consideration.

Regarding goals 1 and 2, the GMT chose the productivity-susceptibility analysis (PSA) of Patrick et al. (2009) to quantify vulnerability. The PSA approach defines vulnerability in two dimensions: 1) productivity, which characterizes the life history of each stock and 2) the susceptibility, or the potential a stock is impacted by the fishery (ies) in question. There are 10 productivity and 12 susceptibility attributes scored on a three point scale representing bins of low, medium, and high (Table 1). In addition to scoring the attributes, one also scores the data quality intended to capture the confidence the scorer has in the attribute bin score (1-5 scale, with more confidence represented as a lower score). Once the average scores across all attributes are calculated, an x-y plot is produced to visualize productivity versus susceptibility. Vulnerability is defined as the Euclidean distance from the origin in the plot (Patrick et al. 2009).

The PSA analysis is a generalized and flexible approach to defining vulnerability that allows the user to specify bin definitions/values, and attribute weighting to allow the analysis to capture the most pertinent aspects of productivity and susceptibility among the species in question. The GMT updated the definition of the "management strategy" susceptibility attribute bins to reflect specific qualities of managing U.S. west coast groundfishes while capturing the general ideas of relative susceptibility from the Patrick et al. 2009 bin definitions (Table 1). Default bin definitions/values for the other attributes were maintained.

The GMT considered an alternative attribute weighting scheme for some species rather than the default weighting system provided in Patrick et al. (2009) (Table 1). In some cases, the maximum length and/or fecundity productivity attributes were downweighted by half because these attributes were inconsistently indicative of productivity across groundfishes in the FMP. The management strategy susceptibility attribute was upweighted 50% because the GMT felt this attribute contributed to susceptibility more strongly than other attributes. Two susceptibility attributes ("F relative to M" and "Relative Spawning Biomass") are derived stock assessment quantities, so the team decided not to use the scores of these attributes for non-assessed stocks, thus weighting their contribution as zero when a Council-approved assessment was not available.

The GMT took an iterative approach to assign productivity and susceptibility scores for each of the species considered. All individuals on the GMT received species to score. The major sources used to inform scoring were available stock assessments, Cailliet et al (2001), Love et al. (2002), the Pacific Shark Research Center (Moss Landing Marine Laboratories) elasmobranch life history matrix[1], and Fishbase[2]. Given the range of experience on the GMT with each species, team members were encourage to score all attributes, but record the data quality to reflect their belief in their score. Once all species were scored, the team evaluated some examples to ensure a consistent scoring approach prevailed (especially among the more subjective susceptibility attributes), rectified any discrepancies uncovered, and indentified species with poor data quality scores for further scoring consideration. The team then assigned two groups of two members to review and update either the productivity or susceptibility scorings. Teams were assigned based on their expertise in each of the vulnerability dimensions. Once this update was made, the team reviewed and finalized the PSA scores. The PSA for groundfish in the FMP are provided in Table 2 and visualized in Figure 1.

Areas of concern on the PSA plot were determined to help interpret scores (Figure 1). Patrick et al. (2009) noted that vulnerability scores above 1.8 were often associated with species undergoing overfishing or in an overfished state. A more detailed analysis of their results indicates a vulnerability of 2.0 was more generally associated with species currently considered overfished. Given species currently overfished are often in rebuilding phases with associated reductions in the current susceptibility to fisheries, susceptibility scores based on current conditions may underestimate the relationship between vulnerability and becoming overfished. To gain better resolution in the relationship between vulnerability and being in an overfished state, the susceptibilities of species currently designated 'overfished' were re-scored to reflect conditions under major population decline (defined as reference year 1998 and found at the end of Table 1). This exercise delineated an upper vulnerability of 2.4 (Figure 1).

The following guidance in interpreting vulnerability scores is offered given the above insight:

- $V \geq 2.4$ indicate species of major concern.
- $2.0 \leq V < 2.4$ indicate species of high concern
- $1.8 \leq V < 2.0$ indicate species of medium concern
- $V < 1.8$ indicate species of low concern.

In order to lower vulnerability, one has the greatest influence in altering susceptibility scores (vertical axis) via management. Productivity scores (horizontal scores) are unlikely to change, unless improvements in the data quality alter scoring.

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[1] http://psrc.mlml.calstate.edu/recommended-reading-list/life-history-data-matrix/ October 2009
[2] http://www.fishbase.org August 2009

Figure 2 illustrates the data quality for species productivity and susceptibility. Data quality scores range from 1 to 5, with 5 being the poorest data quality. The plotted horizontal and vertical lines at a score of 3 indicate the midpoint between 1 and 5; this line is treated as a pivot to interpret data quality as more or less informed. Therefore, values near or above 3 are considered of poor quality.

Applying PSA to management interests

Once both the PSA score and its data quality are calculated, one can begin to address the goals specified in Amendment 23. We will briefly address the first two goals and examples of applying the groundfish PSA.

"In the fishery", "Ecosystem Component", or Neither?

PSAs give direct insight into the relationship of a species to a fishery, and therefore can address the most appropriate designation as defined in amended National Standard 1 of the Magnuson-Stevens Fishery Conservation and Management Act. Most species in the FMP have PSA scores indicating significant interaction with fisheries, though there are a few that may more appropriately be deemed as ecosystem components. For example, shortbelly rockfish have low vulnerability (V=1.13) and no target or retention fishery, fitting the definition of an ecosystem component. Other examples of species fitting this designation (low vulnerability and fishery potential) are the calico, freckled, halfbanded, Puget Sound, and pygmy rockfishes (see 'Proposed Stock Designation' column in Table 1).

Likewise, there are two species that fit neither the "in the fishery" or "ecosystem components" definition. Dusky and dwarf-red rockfish are not found in significant numbers within the area covered by the groundfish FMP, and thus are not susceptible to the fisheries, nor in numbers significant enough to be considered ecosystem components. Both accounts support the need for removal from the FMP. Additionally, the PSA could be used to identify other species not already contained in the FMP, but vulnerable to being overfished (thus "in the fishery"). Such species with high vulnerabilities could be appropriate additions to the FMP. Given the possibility of emergent and/or developing fisheries, identification of such species is an ongoing relevant consideration.

Identifying stock complexes

In order to identify stock complexes using vulnerabilities, current complexes were re-evaluated via cluster analysis in the following manner: a) clustering species based on latitudinal and depth distribution, b) clustering within distributional grouping based on productivity and susceptibility scores and c) evaluating the final clusters in terms of fishery interactions. All rockfish currently in complexes were analyzed together. The current 'other fish' and 'other flatfish' complexes were analyzed separately.

We approached defining stock complexes by species co-occurrence as well as by its vulnerability. This requires classifying a species core depth and latitudinal range. The Pacific Coast Ocean Observing System website[3] was used to identify core minimum and maximum depth and latitudinal distributions. For each cluster analysis, a k-medoids

[3] https://www.webapps.nwfsc.noaa.gov/pacoos/faces/FishData.jsp

partitioning analysis using Euclidean distances applying silhouette and Hubert's gamma cluster validity diagnostics was used (Cope and Punt 2009). Clusters were made first on the latitudinal and depth variables and separated into ecological groups. These groups were then clustered by productivity and susceptibility scores. Results for the final complexes are given in Tables 3 and 4 and summarized in Table 1 (see 'Proposed complex').

Several notable changes are apparent from the previous complex designations. The biggest differences are the inclusions of shallow and deep shelf rockfish complexes (Table 3) and an Elasmobranch complex (Table 4) separated from the 'Other fish' complex. The remaining species in the 'Other fish' category demonstrate two disparate ecological distributions, necessitating two additional complexes. The 'Other flatfish' contains the same species as before, but with an added layer based on ecological distribution. Additional changes include a few rockfish that switched complexes (Table 1).

The PSA contributes further by identifying vulnerability groupings within each co-occurring complex. Most of the members of the rockfish complexes show medium to high vulnerabilities, but none are above V=2.4. The group with the greatest vulnerability is the nearshore trio of China, copper, and quillback rockfishes, all of which are longer-lived, deeper-dwelling nearshore rockfishes. In general, there is no significant relationship of vulnerability with latitudinal distribution, though the deeper species contain relatively the most species with high vulnerabilities. The 'Other Flatfish' complex is composed exclusively of flatfishes with low vulnerability, while the newly proposed 'Elasmobranch' complex contains species with mostly medium to high vulnerabilities. The deep elasmobranch group demonstrates the greatest vulnerability within this complex.

Additional applications of PSA to groundfish management

The PSA results offer further applications relevant to the support of groundfish management beyond the two goals outlined above. Vulnerability scores can help rapidly identify species of interest for either scientific emphasis or management attention. Data quality scores can identify species in need of basic biological or fisheries data, helping to prioritize data collection. And productivity and/or susceptibility scores may lend additional information to the setting of catch levels in data-limited situations.

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Table 1. List of productivity and susceptibility attributes with bin definitions and score weightings for different species groups and those with and without Council-approved assessments. Default weights for all attributes are 2.

	Bins			Weight (0 - 4)		
Productivity Attributes	High (3)	Moderate (2)	Low (1)	Elasmobranchs	Flatfish	Rockfish & other fish
r	>0.5	0.5-0.16	<0.16	2	2	2
Maximum Age	< 10 years	10 - 30 years	> 30 years	2	2	2
Maximum Size	< 60 cm	60-150 cm	> 150 cm	1	2	1
von Bertalanffy Growth Coefficient (k)	> 0.25	0.15-0.25	< 0.15	2	2	2
Estimated Natural Mortality	> 0.40	0.20-0.40	< 0.20	2	2	2
Measured Fecundity	> 10e4	10e2-10e3	< 10e2	2	2	1
Breeding Strategy	0	between 1 and 3	≥4	2	2	2
Recruitment Pattern	highly frequent recruitment success (≥ 8 per decade)	moderately frequent recruitment success (>1 & <8 per decade)	infrequent recruitment success (≤ 1 per decade)	2	2	2
Age at Maturity	< 2 years	2-4 years	> 4 years	2	2	2
Mean Trophic Level	<2.5	2.5-3.5	>3.5	2	2	2
Susceptibility Attributes	**Low (1)**	**Moderate (2)**	**High (3)**	**No Assessment**	**Assessment**	
Management Strategy	Proactive management; sort requirements; individual specification; discard monitoring; biological data; representative fishery-independent indices	Reactive management; decent catch records; some assessment data; weak spatial knowledge; weakly informed indices	High catch uncertainty; low assessment data; no sorting; inadequate discard monitoring; low confidence in control rule	3	3	
Areal Overlap	< 25% of stock occurs in the area fished	Between 25% and 50% of the stock occurs in the area fished	> 50% of stock occurs in the area fished	2	2	
Geographic Concentration	stock is distributed in > 50% of its total range	stock is distributed in 25% to 50% of its total range	stock is distributed in < 25% of its total range	2	2	
Vertical Overlap	< 25% of stock occurs in the depths fished	Between 25% and 50% of the stock occurs in the depths fished	> 50% of stock occurs in the depths fished	2	2	
F relative to M	<0.5	0.5 - 1.0	>1	2	0	
Relative Spawning Biomass	B is > 40% of B0 (or maximum observed from time series of biomass estimates)	B is between 25% and 40% of B0 (or maximum observed from time series of biomass estimates)	B is < 25% of B0 (or maximum observed from time series of biomass estimates)	2	0	
Seasonal Migrations	Seasonal migrations decrease overlap with the fishery	Seasonal migrations do not substantially affect the overlap with the fishery	Seasonal migrations increase overlap with the fishery	2	2	
Schooling/Aggregation and Other Behavioral Responses	Behavioral responses decrease the catchability of the gear	Behavioral responses do not substantially affect the catchability of the gear	Behavioral responses (e.g. schooling) increase the catchability of the gear	2	2	
Morphology Affecting Capture	Species shows low selectivity to the fishing gear.	Species shows moderate selectivity to the fishing gear.	Species shows high selectivity to the fishing gear.	2	2	
Survival After Capture and Release	Survival probability > 67%	33% < survival probability < 67%	Survival probability < 33%	2	2	
Desirability/Value of the Fishery	stock is not highly valued or desired by the fishery	stock is moderately valued or desired by the fishery	stock is highly valued or desired by the fishery	2	2	
Fishery Impact to EFH or Habitat in General for Non-targets	Adverse effects absent, minimal or temporary	Adverse effects more than minimal or temporary but are mitigated	Adverse effects more than minimal or temporary and are not mitigated	2	2	

Table 2. Overall scores and results of the Productivity-Susceptibility Analysis (PSA), core minimum and maximum latitudinal and depth ranges (used in the cluster analyses), proposed stock designation, and species complex assignments for each species in the groundfish FMP. InF: in the fishery; EC: ecosystem component; N: neither. Green: V<1.8; Orange: 1.8≤V<2.0; Red: V≥2.0.

Stock identity	Stock Name	Productivity	Data Quality	Susceptibility	Data Quality	Vulnerability	Preferred latitude minimum	Preferred latitude maximum	Preferred depth minimum	Preferred depth maximum	Proposed Stock Designation	Current Complex	Proposed Complex
1	Arrowtooth Flounder	1.95	1.90	1.60	2.96	1.21	42.8	55	50	500	InF		
2	Aurora rockfish	1.33	2.11	2.29	1.19	2.10	32.5	46.3	300	500	InF	Slope rockfish	Slope rockfish
3	Bank rockfish	1.25	2.00	2.00	2.00	2.02	27.5	39.5	100	270	InF	Slope rockfish	Shelf rockfish- deep
4	Big Skate	1.37	2.68	2.14	2.57	1.99	34.5	46	50	200	InF	Other fish	Elasmobranchs-shallow
5	Black rockfish	1.33	2.00	2.00	1.44	1.94	38	54	0	55	InF		
6	Black-and-yellow rockfish	1.89	1.89	2.29	1.33	1.70	34.5	39.5	1	18	InF	Nearshore rockfish	Nearshore rockfish
7	Blackgill rockfish	1.22	1.78	2.08	1.40	2.08	36.7	42	250	600	InF	Slope rockfish	Slope rockfish
8	Blackspotted rockfish	1.17	2.83	1.71	1.48	1.97	42	60	150	450	InF		Slope rockfish
9	Blue rockfish	1.39	1.89	2.20	1.52	2.01	33	46.5	25	90	InF	Nearshore rockfish	Nearshore rockfish
10	Bocaccio	1.28	2.11	1.88	1.56	1.93	32.5	42	100	250	InF		
11	Bronzespotted rockfish	1.22	1.94	2.16	1.92	2.12	31	37	200	290	InF	Shelf rockfish	Shelf rockfish- deep
12	Brown rockfish	1.61	2.33	2.43	1.48	1.99	23	38	1	120	InF	Nearshore rockfish	Nearshore rockfish
13	Butter Sole	2.45	2.80	2.05	3.52	1.18	34.3	55	2	150	InF	Other flatfish	Other flatfish- shallow
14	Cabezon	1.72	1.89	2.08	1.42	1.68	34	46	0	25	InF	Other fish	Other fish- shallow
15	Calico rockfish	1.75	2.44	1.95	2.05	1.57	28	37.6	60	120	EC	Nearshore rockfish	
16	California scorpionfish	1.83	2.00	1.80	1.44	1.41	22.9	34.4	2	50	InF		
17	California Skate	1.21	3.21	2.14	2.57	2.12	32.5	39	18	671	InF	Other fish	Elasmobranchs-deep
18	Canary rockfish	1.28	1.78	2.04	1.56	2.01	34.5	54	50	250	InF		
19	Chameleon rockfish	1.39	2.61	2.24	2.81	2.03	33.6	34.5	174	274	InF	Shelf rockfish	Shelf rockfish- deep
20	Chilipepper	1.83	1.78	1.68	1.36	1.35	32.5	39.3	50	250	InF		
21	China rockfish	1.33	2.22	2.48	1.48	2.23	36	59.5	18	92	InF	Nearshore rockfish	Nearshore rockfish
22	Copper rockfish	1.36	2.11	2.57	1.48	2.27	32	34.5	0	90	InF	Nearshore rockfish	Nearshore rockfish
23	Cowcod	1.06	1.44	1.88	1.88	2.13	32.5	34.5	150	244	InF		
24	Curlfin Sole	2.45	3.80	2.10	3.52	1.23	31	55	7	90	InF	Other flatfish	Other flatfish- shallow
25	Darkblotched rockfish	1.39	1.67	2.04	1.24	1.92	34.5	54.3	140	210	InF		
26	Dover Sole	1.80	1.90	1.96	2.56	1.54	34	48	200	500	InF		
27	Dusky rockfish	1.28	2.33	0.00	0.00	1.99	54	60	100	300	N	Shelf rockfish	Remove from FMP
28	Dwarf-red rockfish	1.83	3.17	0.00	0.00	1.54	32.5	34.4	58	167	N	Shelf rockfish	Remove from FMP
29	English Sole	2.25	2.10	1.92	2.64	1.19	32.5	60	0	250	InF		
30	Finescale codling	1.72	3.89	1.75	2.38	1.48	23	55	500	950	InF	Other fish	Other fish- deep
31	Flag rockfish	1.33	2.61	2.05	1.48	1.97	30	37.8	60	200	InF	Shelf rockfish	Shelf rockfish- shallow
32	Flathead sole	2.30	2.40	1.76	2.86	1.03	36.5	65	0	366	InF	Other flatfish	Other flatfish- deep
33	Freckled rockfish	1.78	3.17	1.95	1.48	1.55	27.2	34	44	180	EC	Shelf rockfish	

Table 2 (continued)

Stock identity	Stock Name	Productivity	Data Quality	Susceptibility	Data Quality	Vulnerability	Preferred latitude		Preferred depth		Proposed Stock Designation	Current Complex	Proposed Complex
							minimum	maximum	minimum	maximum			
34	Gopher rockfish	1.56	2.22	2.00	1.64	1.76	32.5	39.5	12	37	InF	Nearshore rockfish	Nearshore rockfish
35	Grass rockfish	1.61	2.67	2.29	1.48	1.89	30	43	0	15	InF	Nearshore rockfish	Nearshore rockfish
36	Greenblotched rockfish	1.28	1.78	2.24	1.71	2.12	28	38	61	396	InF	Shelf rockfish	Shelf rockfish- deep
37	Greenspotted rockfish	1.39	2.44	2.14	1.90	1.98	28	36.7	90	179	InF	Shelf rockfish	Shelf rockfish- shallow
38	Greenstriped rockfish	1.28	1.56	1.76	2.00	1.88	31	54	100	250	InF	Shelf rockfish	Shelf rockfish- deep
39	Halfbanded Rockfish	2.00	1.89	1.95	2.00	1.38	27.7	38	60	150	EC	Shelf rockfish	
40	Harlequin Rockfish	1.31	2.83	1.95	3.00	1.94	49	60	100	350	InF	Shelf rockfish	Shelf rockfish- deep
41	Honeycomb Rockfish	1.36	2.50	2.10	2.76	1.97	27	34.5	45	60	InF	Shelf rockfish	Nearshore rockfish
42	Kelp greenling	1.83	2.11	2.04	1.52	1.56	34.5	55	0	20	InF	Other fish	Other fish- shallow
43	Kelp rockfish	1.83	2.11	2.12	1.48	1.62	32	38	18	24	InF	Nearshore rockfish	Nearshore rockfish
44	Leopard shark	1.26	1.89	2.00	2.57	2.00	32.5	42	0	4	InF	Other fish	Elasmobranchs-shallow
45	Lingcod	1.75	2.22	1.92	1.96	1.55	34.5	58	100	150	InF		
46	Longnose skate	1.53	1.95	1.80	2.64	1.68	46	53.5	100	150	InF		
47	Longspine Thornyhead	1.47	1.67	1.00	2.40	1.53	33	55	500	1300	InF		
48	Mexican Rockfish	1.50	3.17	2.00	2.95	1.80	22.5	36.3	100	256	InF	Shelf rockfish	Shelf rockfish- deep
49	Olive rockfish	1.69	2.22	2.33	1.48	1.87	34.3	39	0	75	InF	Nearshore rockfish	Nearshore rockfish
50	Pacifc cod	2.11	2.11	2.00	1.57	1.34	40	65	50	300	InF		
51	Pacific ocean perch	1.44	2.50	1.67	2.43	1.69	42	55	100	450	InF		
52	Pacific grenadier	1.44	2.50	1.95	1.95	1.82	38	55	1500	2825	InF	Other fish	Other fish- deep
53	Pacific sanddab	2.40	3.80	2.10	2.76	1.25	22.8	55	50	150	InF	Other flatfish	Other flatfish- shallow
54	Pacific whiting	2.00	2.22	2.36	2.04	1.69	24.5	50	50	500	InF		
55	Petrale sole	1.70	1.50	2.44	1.80	1.94	38	49	50	300	InF		
56	Pink Rockfish	1.33	2.72	2.14	3.10	2.02	27.8	35	80	366	InF	Shelf rockfish	Shelf rockfish- deep
57	Pinkrose Rockfish	1.31	2.72	1.67	2.48	1.82	28.9	34.4	150	320	InF	Shelf rockfish	Shelf rockfish- deep
58	Puget Sound Rockfish	1.89	2.39	2.14	2.29	1.59	42	58.1	11	366	EC		
59	Pygmy Rockfish	1.78	2.67	1.95	2.48	1.55	32.5	60	60	150	EC	Shelf rockfish	
60	Quillback rockfish	1.31	2.06	2.43	1.48	2.22	34.5	60	44	66	InF	Nearshore rockfish	Nearshore rockfish
61	Ratfish	1.63	2.89	2.05	2.71	1.72	28.5	58	100	150	InF	Other fish	Elasmobranchs-shallow
62	Redbanded Rockfish	1.28	2.39	2.05	2.48	2.02	34.5	60	150	450	InF	Slope rockfish	Slope rockfish
63	Redstripe Rockfish	1.31	2.50	2.33	2.57	2.16	42	60	150	275	InF	Shelf rockfish	Shelf rockfish- deep
64	Rex sole	2.05	2.70	1.86	3.67	1.28	28	62	50	450	InF	Other flatfish	Other flatfish- deep
65	Rock greenling	1.78	2.67	2.29	1.48	1.77	34	64.6	0	80	InF		
66	Rock sole	1.95	3.00	1.95	3.86	1.42	32	55	0	300	InF	Other flatfish	Other flatfish- deep

Table 2 (continued)

Stock identity	Stock Name	Productivity	Data Quality	Susceptibility	Data Quality	Vulnerability	Preferred latitude minimum	Preferred latitude maximum	Preferred depth minimum	Preferred depth maximum	Proposed Stock Designation	Current Complex	Proposed Complex
67	Rosethorn Rockfish	1.19	1.94	2.05	2.86	2.09	34.5	60	100	300	InF	Shelf rockfish	Shelf rockfish- deep
68	Rosy Rockfish	1.61	3.11	2.29	3.52	1.89	31	40	40	150	InF	Shelf rockfish	Shelf rockfish- shallow
69	Rougheye rockfish	1.17	1.78	2.33	3.19	2.27	42	60	150	450	InF	Slope rockfish	Slope rockfish
70	Sablefish	1.61	1.78	1.88	1.88	1.64	28	55	200	1200	InF		
71	Sand sole	2.35	2.80	2.05	3.95	1.23	33.5	55	0	73	InF	Other flatfish	Other flatfish- shallow
72	Sharpchin rockfish	1.36	1.94	2.24	3.71	2.05	36.5	60	100	350	InF	Slope rockfish	Shelf rockfish- deep
73	Shortbelly rockfish	1.94	1.89	1.40	1.12	1.13	34.5	48.5	150	200	EC		Ecocsystem component
74	Shortraker rockfish	1.22	2.17	2.38	2.90	2.25	48.5	58.5	100	600	InF	Slope rockfish	Slope rockfish
75	Shortspine thornyhead	1.33	2.22	1.68	2.00	1.80	32	50	100	850	InF		
76	Silvergrey rockfish	1.22	1.78	1.95	2.19	2.02	42	60	100	300	InF	Shelf rockfish	Shelf rockfish- deep
77	Soupfin shark	1.11	1.42	1.71	3.33	2.02	32.5	38	2	471	InF	Other fish	Elasmobranchs-deep
78	Speckled rockfish	1.33	2.22	2.29	2.52	2.10	32	38	76	152	InF	Shelf rockfish	Shelf rockfish- shallow
79	Spiny Dogfish	1.11	1.00	1.98	3.24	2.13	30	55	0	350	InF		Elasmobranchs-deep
80	Splitnose rockfish	1.28	1.78	1.60	2.00	1.82	32.5	54.3	150	450	InF	Slope rockfish	Slope rockfish
81	Squarespot rockfish	1.61	2.94	2.24	2.29	1.86	30	38	36	150	InF	Shelf rockfish	Shelf rockfish- shallow
82	Starry flounder	2.15	2.60	1.56	1.84	1.02	33.7	70	0	150	InF		
83	Starry rockfish	1.25	2.11	2.14	2.38	2.09	23	36.5	60	150	InF	Shelf rockfish	Shelf rockfish- shallow
84	Stripetail rockfish	1.39	2.56	1.81	2.48	1.80	33	49	10	350	InF	Shelf rockfish	Shelf rockfish- deep
85	Swordspine rockfish	1.33	2.33	2.00	2.19	1.94	31	32.5	60	200	InF	Shelf rockfish	Shelf rockfish- shallow
86	Tiger rockfish	1.25	2.50	2.10	2.19	2.06	41	55	55	274	InF	Shelf rockfish	Shelf rockfish- deep
87	Treefish rockfish	1.67	2.33	2.10	2.05	1.73	28	34.5	3	60	InF	Nearshore rockfish	Nearshore rockfish
88	Vermilion rockfish	1.22	1.67	2.02	2.24	2.05	28	43	50	150	InF	Shelf rockfish	Shelf rockfish- shallow
89	Widow rockfish	1.31	1.44	2.16	2.08	2.05	38	54	100	350	InF		
90	Yelloweye rockfish	1.22	1.44	1.92	2.00	2.00	38	54	91	180	InF		
91	Yellowmouth rockfish	1.61	1.89	2.38	2.33	1.96	42	58.5	275	366	InF	Slope rockfish	Slope rockfish
92	Yellowtail rockfish	1.33	1.78	1.88	2.00	1.88	42	48	90	180	InF		
10_H	Cowcod, S. levis	1.06	1.44	2.68	2.36	2.57	32.5	34.5	150	244			
18_H	Yelloweye rockfish	1.22	1.44	2.80	2.00	2.53	38	54	91	180			
23_H	Canary rockfish	1.28	1.78	2.84	1.56	2.52	34.5	54	50	250			
25_H	Bocaccio	1.28	2.11	2.72	1.56	2.43	32.5	42	100	250			
51_H	Darkblotched rockfish	1.39	1.67	2.76	1.24	2.39	34.5	54.3	140	210			
92_H	Pacific ocean perch	1.39	2.06	2.32	2.04	2.08	32.8	55	100	450			

Table 3. Four proposed rockfish complexes with vulnerability groupings informed by ecological distribution, PSA score, and fisheries. Cells in gray are 'northern' species. Vulnerability levels are low (V<1.8), medium (1.8≤V<2.0), and high (≥2.0).

Species	Vulnerability Score	Vulnerability Level
NEARSHORE		
China rockfish	2.23	High
Quillback rockfish	2.22	High
Copper rockfish	2.27	High
Blue rockfish	2.01	Medium/High
Brown rockfish	1.99	Medium/High
Grass rockfish	1.89	Medium
Honeycomb Rockfish	1.97	Medium
Olive rockfish	1.87	Medium
Black-and-yellow rockfish	1.70	Low
Gopher rockfish	1.76	Low
Kelp rockfish	1.59	Low
Treefish rockfish	1.73	Low
SHELF- SHALLOW		
Speckled rockfish	2.10	High
Starry rockfish	2.09	High
Vermilion rockfish	2.05	High
Yellowtail rockfish	1.88	Medium
Flag rockfish	1.97	Medium
Greenspotted rockfish	1.98	Medium
Rosy Rockfish	1.89	Medium
Squarespot rockfish	1.86	Medium
Swordspine rockfish	1.94	Medium
SHELF- DEEP		
Redstripe Rockfish	2.16	High
Rosethorn Rockfish	2.09	High
Sharpchin rockfish	2.05	High
Silvergrey rockfish	2.02	High
Tiger rockfish	2.06	High
Bank rockfish	2.02	High
Bronzespotted rockfish	2.12	High
Chameleon rockfish	2.03	High
Pink Rockfish	2.02	High
Greenstriped rockfish	1.88	Medium
Harlequin Rockfish	1.94	Medium
Stripetail rockfish	1.80	Medium
Greenblotched rockfish	1.92	Medium
Mexican Rockfish	1.80	Medium
Pinkrose Rockfish	1.82	Medium
SLOPE		
Redbanded Rockfish	2.02	High
Rougheye rockfish	2.27	High
Yellowmouth rockfish	1.96	High
Aurora rockfish	2.10	High
Blackgill rockfish	2.08	High
Shortraker rockfish	2.25	High
Splitnose rockfish	1.82	Medium

Table 4. Proposed species complexes with vulnerability groupings informed by ecological distribution, PSA score, and fisheries. Vulnerability levels are low (V<1.8), medium (1.8≤V<2.0), and high (≥2.0).

Species	Vulnerability	
	Score	Level
SHALLOW		
Butter Sole	1.18	Low
Curlfin Sole	1.23	Low
Pacific sanddab	1.25	Low
Sand sole	1.23	Low
DEEP		
Flathead sole	1.03	Low
Rex sole	1.28	Low
Rock sole	1.42	Low

Species	Vulnerability	
	Score	Level
OTHER FISH- SHALLOW		
Cabezon	1.68	Low
Kelp greenling	1.62	Low
OTHER FISH- DEEP		
Finescale codling	1.48	Low
Pacific grenadier	1.82	Medium
ELASMOBRANCHS- SHALLOW		
Big Skate	1.99	Medium/High
Leopard shark	2.00	Medium/High
Ratfish	1.72	Low
ELASMOBRANCHS- DEEP		
California Skate	2.12	High
Soupfin shark	2.02	High
Spiny Dogfish	2.13	High

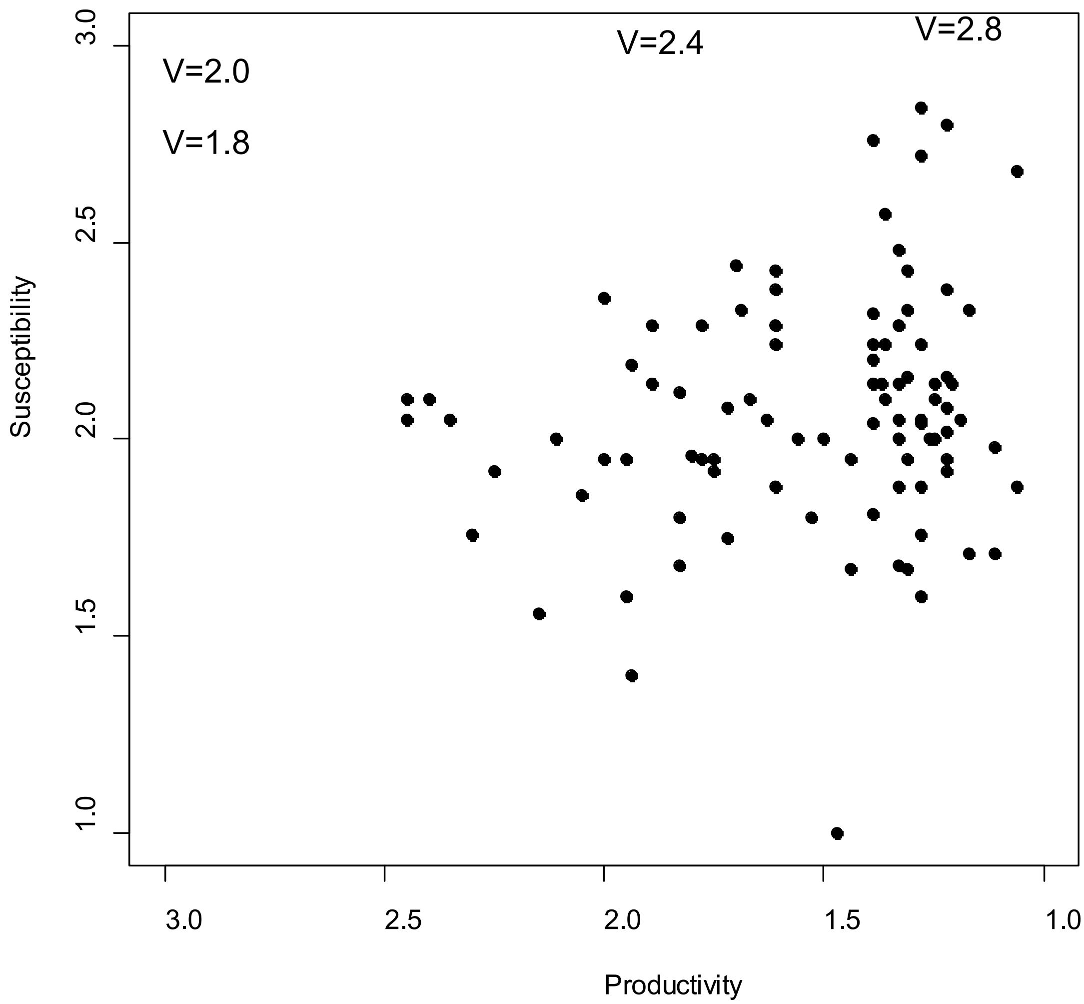
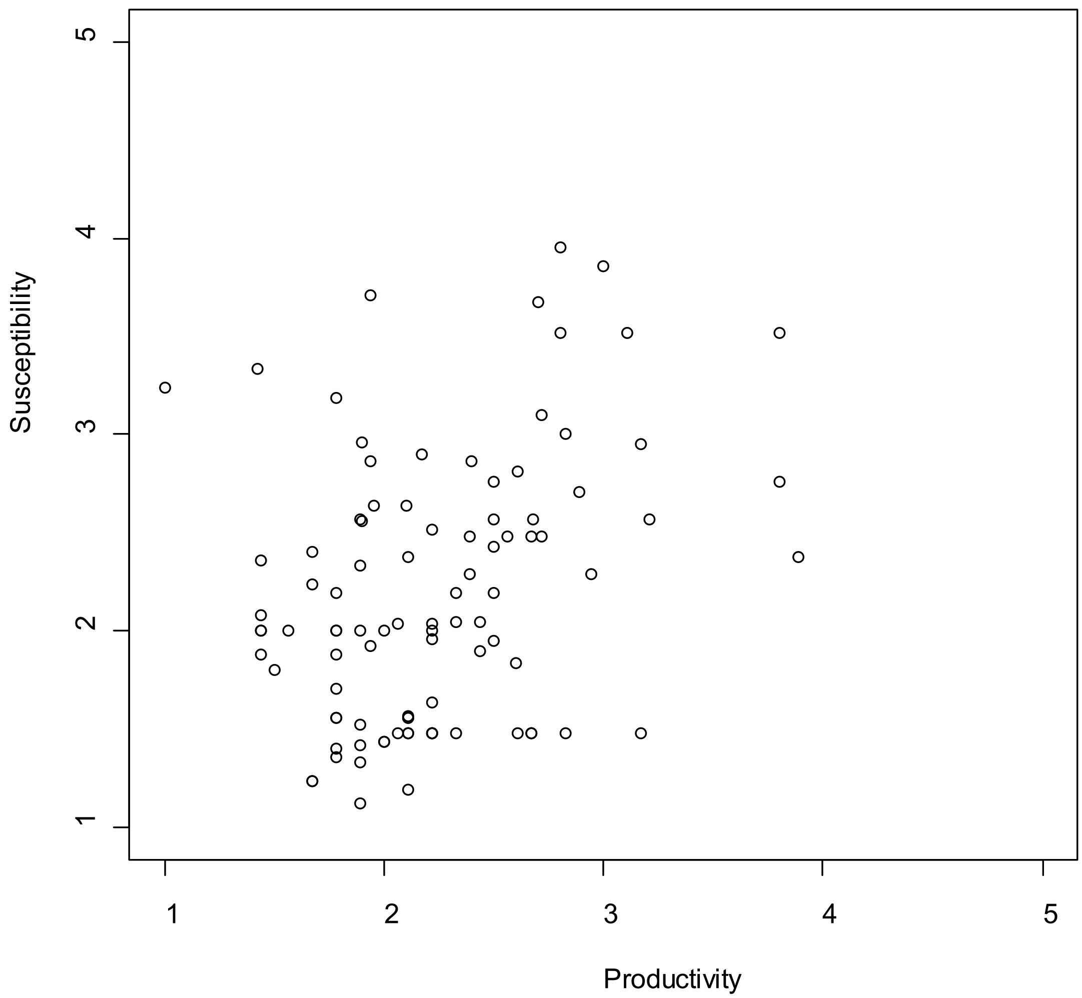


Figure 1. Productivity-Susceptibility Analysis (PSA) plot for species in the west coast groundfish FMP. Contours delineate areas of relative vulnerability (V, i.e. distance from the origin), with the highest vulnerability stocks above the solid red line (V = 2.4), high vulnerability above the orange broken line (V=2), medium vulnerability above the green dotted line (V=1.8) and the lowest vulnerability below the green dotted line. The maximum vulnerability (V=2.8) is indicated with the solid black line. Solid circles are based on current PSA scores. Open circles are based on PSA scores circa 1998. Numbers refer to the species identifier in Table 2.



5
4
3
2
1
Susceptibility
1
2
3
4
5
Productivity

POSSIBLE SCHEDULE FOR WEST COAST GROUNDFISH ASSESSMENTS IN 2011 AND BEYOND

As part of the biennial groundfish assessment cycle, the Northwest Fisheries Science Center (NWFSC) routinely works with the Southwest Fisheries Science Center (SWFSC) and others to prepare an initial draft list of species for consideration in the upcoming assessment cycle, along with a potential schedule for STAR panels. Table 1 provides an overview of assessment status for previously assessed species, along with other species for which first-time assessments are proposed. The first three columns report the year, type (full or update), and model used for the most recent assessment, where applicable. The middle four columns include the initial recommendations for 2011 assessment consideration. The final three columns are intended to provide some additional information on future workload that would be required to maintain assessments for major species that are adequate, with respect to NMFS's 5-year window since the last review.

Benchmark, or full, assessments which include STAR Panel review, are proposed for Pacific hake (whiting), Dover sole, Pacific ocean perch (POP), petrale sole, sablefish, spiny dogfish, blackgill rockfish, rex sole, greenspotted rockfish, and widow rockfish. The proposed lead for the first 6 species is the NWFSC, with the SWFSC leading the last 4. Three of these species have not previously been assessed. Spiny dogfish has been proposed previously and it received one of the highest vulnerability scores in the GMT's recently conducted analysis. The vulnerability score for greenspotted rockfish is at the high end of the GMT's precautionary range, and the SWFSC has already expended considerable effort in organizing and analyzing data for this species. Rex sole has a rather low vulnerability score; however, it is the prominent unassessed species in the Other Flatfish complex, for which considerable survey data are available. Blackgill rockfish is another highly vulnerable species, which is a major species in the Southern Slope Rockfish complex and has not been assessed since the first effort in 2005.

Both sablefish and Dover sole received low vulnerability scores from the GMT. However, they are critical species to the slope fisheries, and when last assessed in 2007 and 2005, respectively, their panels identified numerous modeling issues which should be addressed. Additionally, the NWFSC shelf-slope survey data cannot be fully included for either species unless a full assessment is conducted. The three remaining proposed full assessments are for the rebuilding species petrale sole, Pacific ocean perch, and widow rockfish. Considerable interest was expressed this past Fall in having another full assessment conducted for petrale sole in the next cycle, in order to address some unresolved data and modeling issues, as well as to explore the development of commercial CPUE indices. The last benchmark assessment for POP was conducted in 2003, and it is the only species with an individual ABC whose recent assessments have not been conducted using Stock Synthesis. A full assessment of widow rockfish was conducted in 2009, which indicated that the stock should be rebuilt soon. However the STAR panel identified further exploration of model properties and alternative formulations as a priority.

Given these full assessments, four assessment updates are anticipated, for the rebuilding species bocaccio, canary, darkblotched and yelloweye rockfishes. Since minimal new data will be available with which to assess cowcod status, the SWFSC will prepare a data report, in keeping with the SSC's recommendations in June 2009. Additionally, a NMFS Technical Memorandum addressing the status of bronzespotted rockfish is being prepared by the SWFSC.

The growing weight of conducting assessments on a schedule which the agency considers adequate to keep them current is illustrated in the last three columns. Even with the assessments proposed here for 2011, a total of 15 species will have assessments which are more than 5 years old by 2013. Even with the speculative list of 9 full and 10 updated assessments in 2013, the assessments for 7 other species will pass the 5-year mark before 2015 (and 5 of those before 2013). And this substantial load, for both conducting and reviewing assessments does not include the development of new assessments for more data-limited species.

A potential schedule for conducting reviews of the 2011 assessments is presented in Table 2.

Table 1. Possible schedule for west coast groundfish assessments in 2011 and beyond.

Species	Last Assessment			2011				2013		Adequate Through
	Year	Full / Update	Model	Full	Update	*Rebuilding Analyses*	Affiliation	Full	Update	
Number of assessments				*10*	*4*	*7*		*9*	*10*	
P. hake (Whiting)	2010	Full	TBD	X			NWFSC	X		2015
Bocaccio rockfish	2009	Full	SS v 3		X	*X*	SWFSC		X	2014
Canary rockfish	2009	Update	SS v 3		X	*X*	NWFSC	X		2014
Chilipepper rockfish	2007	Full	SS v2						X	2012
Cowcod	2009	Update	SS v2		* status rept		SWFSC		X	2014
Greenstriped rockfish	2009	Full	SS v3							2014
Widow rockfish	2009	Full	SS v3	X		*X*	SWFSC		X	2014
Yelloweye rockfish	2009	Full	SS v3		X	*X*	NWFSC		X	2014
Yellowtail rockfish	2005	Update	ADMB					X		2010
Lingcod	2009	Full	SS v3							2014
Arrowtooth	2007	Full	SS v2						X	2012
English sole	2007	Update	SS v2						X	2012
Petrale sole	2009	Full	SS v3	X		*X*	NWFSC		X	2014
Starry flounder	2005	Full	SS v2							2010
Pacific ocean perch	2009	Update	ADMB	X		*X*	NWFSC		X	2014
Darkblotched rockfish	2009	Update	SS v3		X	*X*	NWFSC	X		2014
Bank rockfish	2000	"Full"	SS v1					X		2005
Blackgill rockfish	2005	Full	SS v2	X			SWFSC			2010
Shortspine thornyhead	2005	Full	SS v2					X		2010
Longspine thornyhead	2005	Full	SS v2					X		2010
Sablefish	2007	Full	SS v2	X			NWFSC			2012
Dover sole	2005	Full	SS v2	X			NWFSC			2010
Black rockfish - N	2007	Full	SS v2					X		2012
Black rockfish - S	2007	Full	SS v2					X		2012
Cabezon	2009	Full	SS v3							2014
Cal. Scorpionfish	2005	Full	SS v2							2010
Gopher rockfish	2005	Full	SS v2							2010
Kelp greenling	2005	Full	SS v2							2010
Longnose skate	2007	Full	SS v2						X	2012
Blue rockfish	2007	Full	SS v2							2012
Splitnose rockfish	2009	Full	SS v3							2014
Spiny Dogfish				X			NWFSC			new
Rex sole				X			SWFSC			new
Sanddabs										
Bronzespotted rockfish					# tech memo in progress		SWFSC			
Greenspotted rockfish				X			SWFSC			new

* status report would compare total mortality with the projections form the rebuilding analysis

Table 2. Potential Dates, Species Groupings, and Locations for 2011 STAR Panels.

	Dates	Species 1	Species 2	Location
Whiting	Feb.	Pacific hake / Whiting	N/A	Seattle, WA
Panel 1	Early May	Widow rockfish	Spiny dogfish	Newport, OR
Panel 2	June	Pacific ocean perch	open	Seattle, WA
Panel 3	mid-July	Petrale sole	Rex Sole	?
Panel 4	late-July	Sablefish	Dover sole	Seattle, WA
Panel 5	Early August	Greenspotted rf	Blackgill rockfish	Santa Cruz, CA
Updates	mid-June	bocaccio, canary, cowcod (data report only), darkblotched, yelloweye rockfishes		TBD

Agenda Item E.2.b
Supplemental GAP Report
March 2010

GROUNDFISH ADVISORY SUBPANEL REPORT ON STOCK ASSESSMENT PLANNING FOR 2013-2014 MANAGEMENT MEASURES

The Groundfish Advisory Subpanel (GAP) recommends that the Council adopt the proposed schedule for groundfish assessments (E.2.b Table 2) with the addition of Kelp Greenling, provided that there is enough data, resources, and personnel to undertake that additional assessment. Kelp Greenling is an important nearshore species which has not had a full update since 2005.

PFMC
03/07/10

GROUNDFISH MANAGEMENT TEAM REPORT ON STOCK ASSESSMENT PLANNING FOR 2013-2014 MANAGEMENT MEASURES

The Groundfish Management Team (GMT) reviewed the latest Terms of Reference (TOR) for Groundfish Stock Assessments and Review Panels (Agenda Item E.2.a, Attachment 1), the National Marine Fisheries Service Report (E.2.b, NMFS Report), and Draft Summary Minutes for the Yelloweye Rockfish Survey Design Workshop (Agenda Item E.2.a, Supplemental Attachment 3) under this agenda item and provides the following comments for Council consideration.

Terms of Reference

GMT Participation

The TOR states, "the STAT is expected to initiate contact with the GAP representative at an early stage in the process, keep the GAP representative informed of the data being used and be prepared to respond to concerns about the data that might be raised. The STAT Team should also contact the GMT representative for information about changes in fishing regulations that may influence data used in the assessment." The GMT recommends modifying this language to state that the STAT team is also expected to initiate contact with the GMT representative and respond to any data issues that might be raised. The GMT also recommends that language be added to the TOR instructing assessment authors to forward data inputs (landings, indices, etc.), including source descriptions and geographic ranges, to GMT members with sufficient time for review and comments prior to distribution of the draft assessment to STAR Panel members. This would give assessment authors more time to incorporate state comments, edits, and ensure data accuracy.

National Standard 1 Considerations

In response to Amendment 23 the GMT may have additional modifications for the TOR in June (e.g., language on prioritizing stocks or reporting considerations to capture scientific uncertainty).

Proposed List of Species /STAR Panel Schedule Considerations

Prioritization of stocks

The potential schedule for STAR Panels is listed in Table 2 of the NMFS Report (Agenda Item E.2.b). The Panel proposed for June (Panel 2) has a vacancy with only a Pacific ocean perch (POP) assessment scheduled for review.

If the Council wishes to add new species to the list of assessments, the GMT identified the following species that could be at risk of overfishing based on life history characteristics: China, copper, quillback, rougheye, and shortraker rockfish. The Productivity and Susceptibility Analysis (PSA) scores for these species are highest of all those examined indicating they are more vulnerable to overexploitation. We also note that China, copper, and quillback rockfish are vulnerable to the nearshore fishery and may be useful as indicator stocks for the minor nearshore rockfish complexes. Likewise, rougheye or shortraker could serve as indicators for the minor slope complexes. They are also highly sought after in the marketplace.

Workshops

Pre-assessment workshops

In prior assessment cycles, pre-assessment workshops were held to gather input from industry and public. The pre-assessment workshops allowed broader discussion of input data and model structure. STAR Panel meetings are normally fully prescribed, not allowing for major changes/additions to data and modeling. The GMT recommends the use of the pre-assessment workshops as a tool to reduce the need for mop-up panels.

Yelloweye Survey Workshop

The GMT reviewed the Draft Summary Minutes for the Yelloweye Rockfish Survey Design Workshop (Agenda Item E.2.a, Supplemental Attachment 3). The GMT agrees with the workshop participants' recommendation to create an ad-hoc committee tasked with developing a non-extractive yelloweye rockfish survey. The GMT also recommends that the Council consider including members of the Technical Subcommittee of the US and Canada, which also has a yelloweye rockfish workgroup, as part of the ad-hoc committee.

The GMT notes the yelloweye rockfish STAT Team recommended that the enhanced rockfish surveys conducted by Washington Department of Fish and Wildlife and Oregon Department of Fish and Wildlife have a common sample design, yet the workshop participants did not reach consensus on a preferred design. Further, issues surrounding gear selectivity were discussed at the workshop and should be explored in further detail. The GMT recommends that the Council task the ad-hoc committee with providing survey design guidance and the utility of using these surveys to inform the assessment.

The GMT also thinks that it is important to continue to include the International Pacific Halibut Commission (IPHC) in these workshops and STAR Panel processes for yelloweye rockfish, given the importance of IPHC survey data in the assessment and their available survey platform.

PFMC
03/07/10

Agenda Item E.2.b
Supplemental SSC Report
March 2010

SCIENTIFIC AND STATISTICAL COMMITTEE REPORT ON STOCK ASSESSMENT PLANNING FOR 2013-2014 MANAGEMENT MEASURES

Proposed list of stocks for review

The Scientific and Statistical Committee (SSC) reviewed the list of stock assessments proposed by NMFS for the 2013-14 management cycle. While generally supportive of the proposed list, the SSC has a number of comments as follows.

A status report is being recommended for cowcod, as there is no new information that would affect the stock assessment or the rebuilding analysis. A status report would compare estimates of discard with projections from the model as a way to evaluate rebuilding progress, and is considered different than an update (which incorporates new data without changing the model). A status report would require no new model runs, unlike an update, and is appropriate given the uniquely data-poor situation for cowcod.

The SSC agrees that an assessment of spiny dogfish is a priority. The productivity-susceptibility analysis (PSA) suggests that spiny dogfish is a highly vulnerable species, which reinforces the need for an assessment. However it should be confirmed that critical data sets from all involved agencies will be available to conduct the assessment.

The SSC encourages an assessment of rex sole, which has not been assessed previously. The SSC recommends that the scope of the rex sole assessment be expanded to include the remaining members of the other flatfish complex (e.g., Pacific sanddabs). The rex sole assessment would likely use a full age-structured model, while the other flatfish would likely need to be assessed using simpler trend analyses. There are advantages of bundling a full assessment with related species: 1) data extracts and analysis of survey data can be done with little additional effort, 2) issues related to species identification of landings in the complex can be addressed comprehensively, rather than on a species-by-species basis, and 3) if done properly, information on the relatively data-rich species can help inform the assessments of the data-poor species.

The SSC discussed the potential for adding an assessment of kelp greenling to the list. The 2005 assessment of kelp greenling in Oregon was accepted by the Stock Assessment Review (STAR) Panel, but was considered highly uncertain. The assessment of kelp greenling in California was not accepted for management purposes. New data sets available for kelp greenling may increase the likelihood of useful assessment results, but further investigation into available information is needed before making a decision.

Due to the major data and modeling issues identified in recent STAR Panel review, a full assessment is recommended for whiting in the next assessment cycle. Some problems encountered during the whiting STAR Panel review could potentially be avoided if a separate Terms of Reference (TOR) were developed with Canada specifically for the whiting review.

Terms of reference for stock assessments and rebuilding analyses

Revised drafts of the TOR for the STAR process and rebuilding analyses were developed by the SSC groundfish subcommittee for Council consideration. Revisions to the rebuilding TOR were all editorial. Additions to the STAR process terms of reference in the appended document include:

1) a section on the history of the STAR process,
2) a section on conflict of interest for STAR Panel members reflecting guidance in the proposed National Standard Two guidelines,
3) additional advice on bracketing runs for decision tables,
4) recommendations for better (and earlier) communication between the STAT and data stewards,
5) a paragraph clarifying potential points of agreement/disagreement between STAR Panels and the STAT, and ensuring the STAR Panel report is viewed by the STAT,
6) requirements for reporting overfishing levels (OFLs) and acceptable biological catch (ABC).

The SSC endorsed these proposed changes. Several further revisions are needed to deal with issues that arose in the previous management cycle. First, while STAR Panels should evaluate the appropriateness of the F_{MSY} proxies used for calculating OFL and ABC, supporting analyses are needed for recommendations on changes in target harvest rates. The TOR will be updated on guidance on how this will be done. Secondly, a more comprehensive discussion is needed to advise the STAR Panels on the merits of removing data from the assessment model. While removal of inappropriate data sets should remain an option for STAR Panels, the decision to do this should not be made lightly, and should be fully evaluated. These revisions will be incorporated into the draft document for adoption at the June Council meeting.

PFMC
03/07/10

PACIFIC WHITING HARVEST SPECIFICATIONS FOR 2010

The Pacific whiting fishery management process is unlike that for other Federally-managed west coast groundfish for 2010 fisheries, for which catch specifications and management measures were adopted by the Council at the June 2008 Council meeting for the two-year period 2009-2010. For example, specifications are done annually at the March Council meetings and stock assessments are done immediately prior to the Council decision.

The Council deferred a decision on setting harvest specifications and management measures for the 2010 Pacific whiting fisheries pending the development and review of a new stock assessment to occur during February 2010. Two new Pacific whiting assessments were prepared this winter (Agenda Item E.3.a, Attachments 1 and 2) and reviewed by a joint U.S.-Canadian assessment review panel during February 2010 (Agenda Item E.3.a, Attachment 3). The Executive Summary of these assessments are included in the briefing book and the assessments in their entirety are found in the CD copy of meeting materials, along with other materials that will be reviewed by the Scientific and Statistical Committee (SSC). The Council should consider the advice of the assessment review panel, the SSC, and other advisors before adopting an assessment for use in management decision-making. The assessment, once approved, will be used to set 2010 Pacific whiting harvest specifications and management measures.

Further, beginning in 2004, this transboundary stock was managed jointly with the Department of Fisheries and Oceans, Canada, in the spirit of a new process described in a treaty that has been signed and ratified, but awaits final rulemaking. The primary tenets of the treaty include a joint U.S.-Canada annual assessment and management process (which will presumably be implemented next year), a research commitment, and a harvest sharing agreement providing 73.88 percent of the coastwide optimum yield (OY) for U.S. fisheries and 26.12 percent for Canadian fisheries.

The Council is tasked with setting an acceptable biological catch (ABC) and OY for Pacific whiting that will be used to manage 2010 fisheries. (Management measures to properly prosecute the fishery will be decided at this meeting under the Inseason Adjustments Agenda Item E.5 when bycatch balance with other fisheries is considered). Considerations for deciding 2010 Pacific whiting harvest specifications include the stock's current and projected status with respect to the overfished threshold and the international agreement with Canada. Unless there is a change in the research, non-whiting fishery bycatch, and tribal set-asides, once the OY is set, the apportionment within the non-tribal fisheries is set automatically via the existing intersector allocation (i.e., 42 percent for the shoreside whiting sector, 24 percent for the at-sea mothership whiting sector, and 34 percent for the at-sea catcher-processor whiting sector).

The Council originally set aside 50,000 mt of whiting for 2009 and 2010 tribal whiting fisheries at the June 2008 Council meeting, with 42,000 mt set aside for the Makah Tribe and 8,000 mt set aside for the Quileute Indian Tribe. Last year the Makah Tribe agreed to reduce their 2009 fishery set-aside from 42,000 mt to 17.5 percent of the U.S. OY (23,789 mt). An additional 8,000 mt was set aside for the Quileute Tribe to accommodate their plans to prosecute a whiting fishery in 2009, which ultimately did not occur. The Council should consider tribal requests before adopting a set-aside of Pacific whiting yield to accommodate 2010 tribal whiting fisheries.

Council Action:

1. **Adopt a 2010 Pacific whiting stock assessment.**
2. **Adopt a 2010 ABC and OY for Pacific whiting.**
3. **Adopt a Pacific whiting set-aside to accommodate 2010 tribal whiting fisheries.**

Reference Materials:

1. Agenda Item E.3.a, Attachment 1: Executive Summary of Assessment and Management advice for Pacific hake in U.S. and Canadian waters in 2010.
2. Agenda Item E.3.a, Attachment 2: Executive Summary of Stock Assessment of Pacific Hake, Merluccius productus, (a.k.a. Whiting) in U.S. and Canadian Waters in 2010.
3. Agenda Item E.3.a, Attachment 3: Pacific Whiting – The Joint U.S.-Canada STAR Panel Report.

Agenda Order:

a. Agenda Item Overview — John DeVore
b. Reports and Comments of Management Entities and Advisory Bodies
c. Public Comment
d. **Council Action:** Adopt Final 2010 Stock Assessment, Allowable Biological Catch, and Optimum Yield (Management Measures will be adopted under Agenda Item E.5)

PFMC
02/18/10

Assessment and Management advice for Pacific hake in U.S. and Canadian waters in 2010

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February 15, 2010

- Draft document for peer review: Started on Wednesday, January 7, 2010
- Draft report submitted to NMFS for Pre-review January, 18, 2010
- Draft report submitted to STAR panel for review on January 25, 2010
- Corrections sent in on January 26, 2010

-STAR Panel Feb 8-10, travel on Feb 7
-Revise document and produce projections and decision table for SSC, Feb 11, 2010
-Sent off final version for SSC briefing book on Feb, 15, 2010

Contents

Executive summary

Stock

This assessment reports the status of the coastal Pacific hake (or Pacific whiting, *Merluccius productus*) resource off the west coast of the United States and Canada. Smaller populations of hake occur in the major inlets of the northeast Pacific Ocean, including the Strait of Georgia, Puget Sound, and the Gulf of California. However, the coastal stock is distinguished from the inshore populations by larger body size and seasonal migratory behavior. The coastal population is modeled as a single stock, and the landings data from the United States and Canadian fishing fleets are combined.

Catches

Combined US and Canadian Catches for Pacific hake have averaged 221.7 thousand metric tons (mt) from 1966 to 2008. Recent coast wide landings have been above the long-term average with 297mt and 322mt taken in the 2007 and 2008 fisheries. The Optimal Yield for the 2009 fishery was 184,000 mt and the total U.S. and Canadian combined landings was 176,671 mt; this is roughly 96% of the 2009 OY (Table c).

Data and assessment

This assessment uses a model known as TINSS, which is an age-structured assessment model that directly estimates management variables C^* (the maximum sustainable yield) and F^* (the fishing mortality rate that produces C^*). The model was implemented in the AD Model Builder software and is based on the methods in Martell et al. (2008). The structural assumptions are similar to that of Stock Synthesis (SS) model that is used by the National Marine Fisheries Service: a Beverton-Holt stock recruitment relationship is assumed, it is assumed that the population was at an unfished state in 1966, and the model is conditioned on historical catch information. The data for TINSS was extracted from the input files use for Stock Synthesis and the catch and catch-age information from U.S. and Canadian fisheries are aggregated into a single fishery. The selectivity curve for this aggregate fishery is assumed to be asymptotic and follows a logistic distribution. I also assume logistic selectivity curve for the fisheries independent acoustic trawl survey where the age-at-50% vulnerability is fixed at 2.0 years and the standard deviation is 0.45 years. In contrast to previous assessments, this assessment attempts to reduce the amount of prior information on key population parameters and subjective weighting of data that ultimately defines the catch advice. Model parameters were estimated using both maximum likelihood methods and Bayesian methods. Catch advice is based on a Bayesian view of the model parameters, where the joint posterior distribution was constructed using the Metropolis Hastings algorithm that is built into the ADMB software (version 9.0 downloaded from `http://admb-project.org/downloads`).

There was a substantial change in the likelihood kernel used for the age-composition data between the assessments Martell (2008) and Martell (2009). In the Martell (2008) assessment, a robust normal approximation to the multinomial distribution was used as the likelihood for the age composition data. This is the same likelihood function that is used in Multifan CL (see Fournier et al., 1990; Martell et al., 2008). In the Martell (2009) assessment I adopted a less subjective

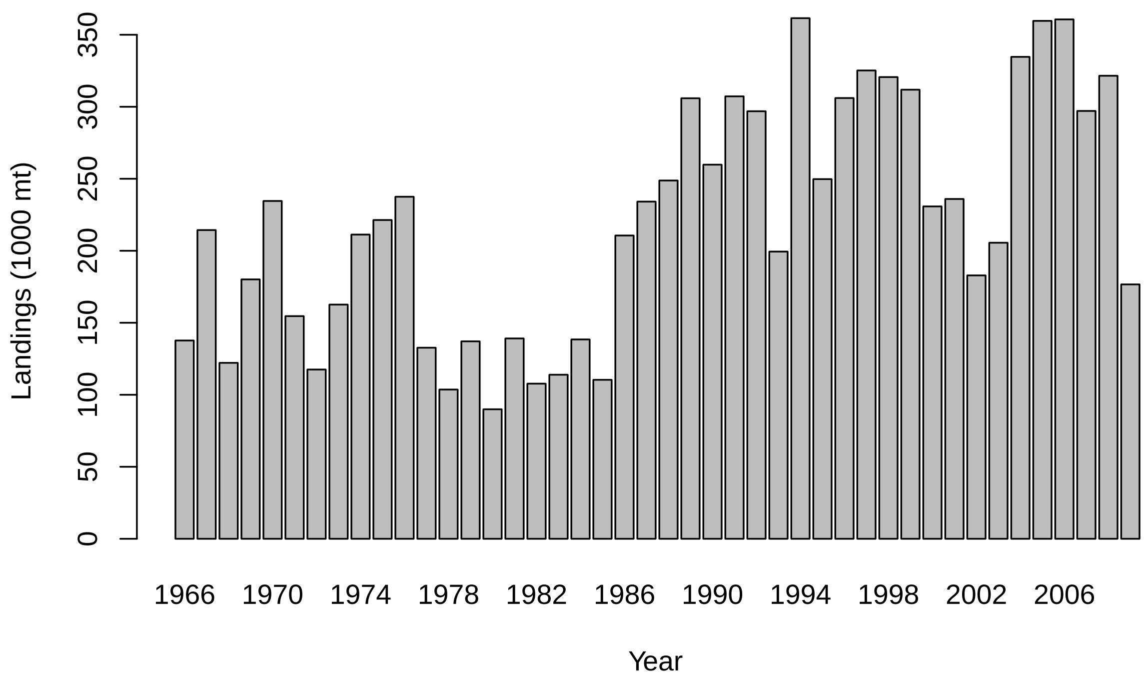


Figure a: Total combined US and Canadian Pacific hake landings between 1966 and 2009 used in the stock assessment model.

approach and used the multivariate logistic kernel (see Richards and Schnute, 1998) where the conditional maximum likelihood estimate of the variance was used to weight the age-composition data in the commercial fishery samples. The age composition data from the acoustic survey samples were given zero weight based on recommendations from the 2010 STAR panel.

Catch advice for the 2010 fishery is extremely sensitive to the 2009 acoustic biomass survey data point. Removing the 2009 survey data point from the assessment lowers the 2010 ABC estimate by almost 50%. The 2009 acoustic biomass survey is highly suspect due to the large abundance of humboldt squid present during the course of the survey; as such the STAR panel felt that this survey may have a different Q based on post processing of the data. For this years assessment the STAR panel recommended that the 2009 survey biomass estimate be omitted from the statistical fitting criterion.

Reference points

Three different reference points are provided in this assessment: reference points based on maximum sustainable yield calculations, reference points based on reducing spawning stock biomass to 40% of its unfished state, and reference points based on reducing the spawning potential ratio to 40%. The median unexploited equilibrium female spawning stock biomass SB_o is estimated at 1.931 million mt, with a 95% credible interval of 1.411-2.88 million mt. The median estimate of total biomass between the ages of 1 and 15+ years is 4.868 million mt with a 95% credible interval of 3.456-7.496 million mt. The median estimate of unfished age-1 recruits is 3.145 billion (95% credible interval of 1.84-5.779 billion).

MSY based reference levels

Management reference points based on maximum sustainable yield (MSY based reference points) result in a median estimate of female spawning stock biomass SB_{msy} of 773,000 mt with a long term equilibrium yield of 301,000 mt (Table h). The resulting spawning potential ratio is 0.53 , which is considerably higher than the normal proxy level of 0.4. Also, the exploitation fraction, which is defined as the catch divided by the age-3+ biomass, is 0.267 .

$\text{SB}_{40\%}$ proxy

Using 40% of the unfished spawning stock biomass as a management target results in similar reference point estimates as the MSY reference levels. The target spawning stock biomass is 773,000 mt, and the corresponding spawning potential ratio is 0.54 . The long-term equilibrium yield and exploitation fractions are estimated at 300,000 mt and 0.265 , respectively (Tbale h).

$\text{SPR}_{40\%}$ proxy

Management targets based on reducing the spawning potential ratio to 40% of its unfished state are much more aggressive in comparison to the estimated MSY and $\text{SB}_{40\%}$ policies (see comparison in Figure b). In this case the median estimate of target spawning stock biomass is 412,000 mt when the spawning potential ratio is reduced to 0.4. In order to achieve such a reduction the exploitation fraction is 0.498 and the corresponding yield is 266,000 mt. In short, the estimated

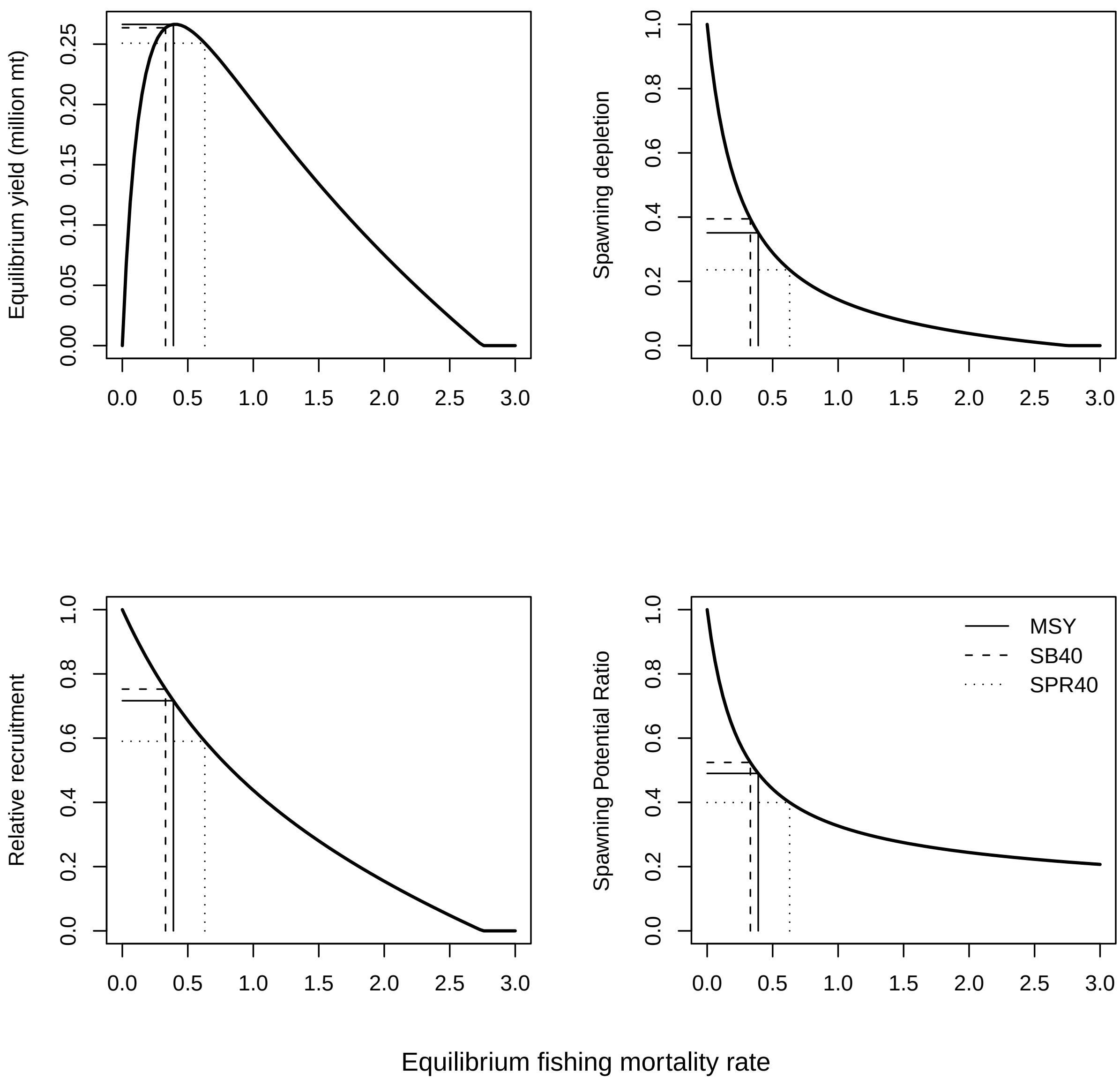


Figure b: Relationship between equilibrium fishing mortality rate and yield, recruitment, spawning biomass depletion and spawning potential ratio for Pacific hake based on maximum likelihood estimates of model parameters. Vertical and horizontal lines correspond to reference points based on MSY, SB_{40} and SPR_{40} management targets.

selectivity curve is such that a large fraction of age-2 to age-4 fish have a chance to spawn before the recruit to the fishing gear; therefore, very high fishing mortality rates are required to reduce the spawning potential ratio to 0.4.

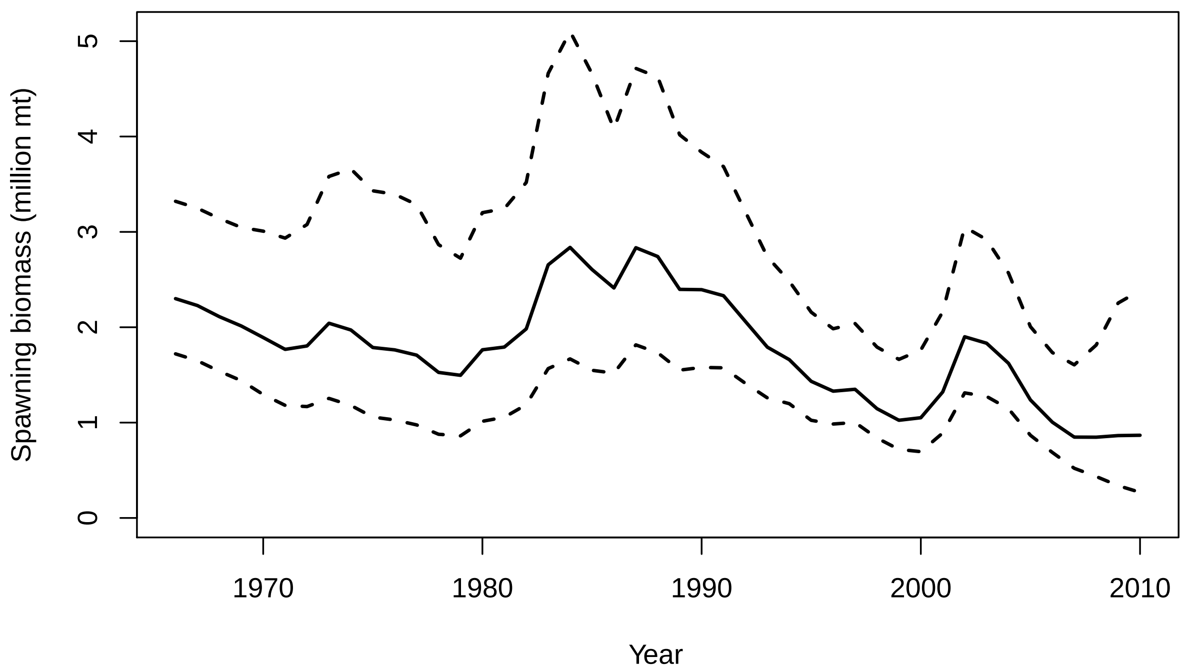


Figure c: Median estimates of female spawning stock biomass with 95% credible intervals.

Stock biomass

Median estimates of spawning stock biomass were relatively stable between 1966 and 1980, followed by and increase in the mid 1980s that was associated with the strong 1980 and 1984 year classes. Since the late 1980s, trends in spawning stock biomass declined to a low in 2000, then rapidly increased as the strong 1999 cohort became sexually mature (Figure c). By 2002, the estimated median spawning stock biomass rebuilt to near unfished levels (Table a). Current estimates of depletion for the beginning of the 2010 fishery is 38% and the 95% credible interval ranges between 17% and 73%.

Recruitment

Median estimate of historical age-1 recruits for Pacific hake indicate very large cohorts for the 1977, 1980, 1984, and 1999 year classes. In addition to the extremely large cohorts, above average age-1 recruitment events also occurred in 1971, 1974, 1987, and 1991. With the exception of the 1999 year class recruitment in the last 10 years has been below the long-term mean and recruitment in 2008 and 2009 is estimated to be below the long-term median (Figure e). The strongest cohort since 2000 appears to the the 2005 year class, and in the 2009 survey this year

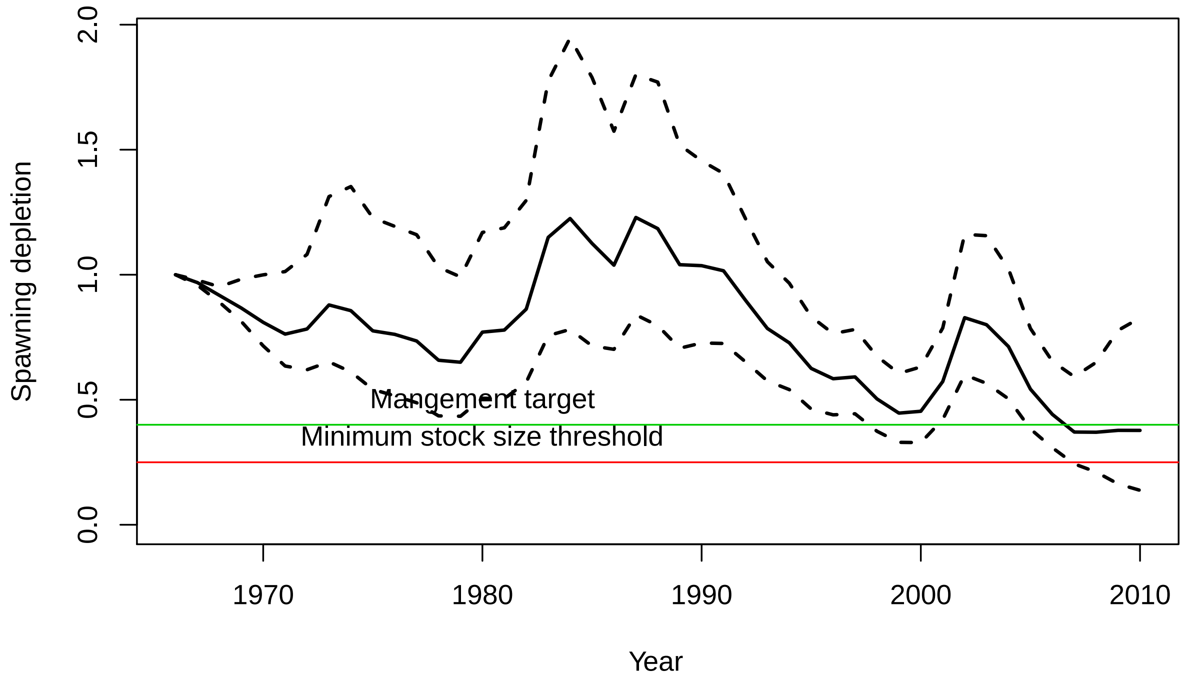


Figure d: Median estimates of spawning stock depletion with 95% credible intervals. Management target and minimum stock size thresholds are defined as 40% and 25% of the unfished spawning stock biomass.

Table a: Recent trends in estimated female spawning stock biomass (million mt) and depletion level based on 5000 systematic samples from the joint posterior distribution.

	Female biomass			**Depletion**		
Year	median	5%	95%	median	5%	95%
2001	1.31	0.95	1.98	0.57	0.44	0.75
2002	1.89	1.39	2.83	0.83	0.63	1.10
2003	1.83	1.34	2.71	0.80	0.59	1.09
2004	1.62	1.21	2.40	0.71	0.53	0.97
2005	1.24	0.92	1.86	0.54	0.41	0.74
2006	1.00	0.72	1.59	0.44	0.33	0.61
2007	0.85	0.56	1.45	0.37	0.26	0.55
2008	0.85	0.48	1.61	0.37	0.23	0.59
2009	0.87	0.39	1.89	0.38	0.19	0.70
2010	0.87	0.34	1.99	0.38	0.17	0.73

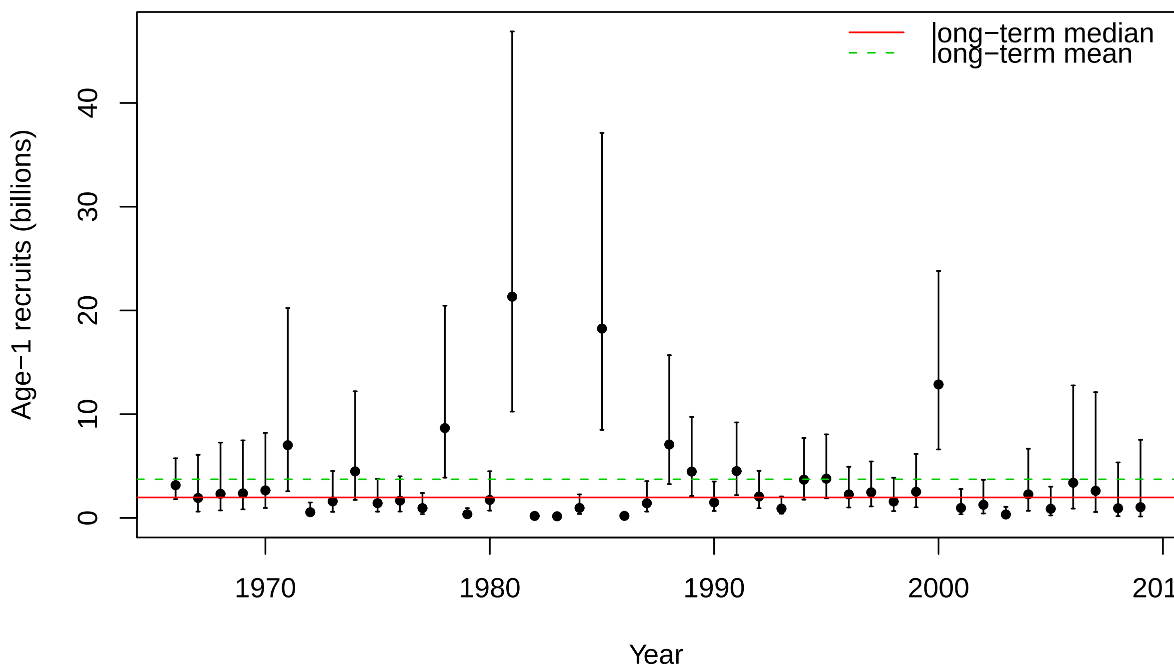


Figure e: Median estimates of age-1 recruits and associated 2.5% and 97.5% quantiles (vertical bars) based on 5000 systematic samples from the joint posterior distribution. Long-term average and median recruitments are shown by the horizontal lines.

class made up roughly 45% of individuals ages-2 to age 15+, followed by 31% of the 2006 year class. The 1999 year class, now age-10, is a mere 7.85% of the total numbers-at-age in the acoustic survey data. The median estimate of unfished age-1 recruits is 3.145 billion , and in the last 10 years median estimates have ranged between 0.34 billion in 2003 to 12.87 billion in 2000 (Table b).

Exploitation status

Trends in the spawning potential ration has been well below the target SPR (based on MSY reference points where SPR_{MSY} = 0.53 , Figure f). Since 2003 exploitation rates have increases and in the 2008 fishery were estimated to be above the target SPR exploitation rate. Large reductions for the 2009 OY appears to have changed the increasing trend in exploitation and is estimated to be slightly below the target value. There is a great deal of uncertainty in the estimate of absolute exploitation rates due to the large uncertainty in the over all population scale.

Another measure that has been previously used to measure exploitation status in the Pacific hake fishery is the exploitation fraction, which is defined here as the catch divided by the 3+

Table b: Recent estimated trends in age-1 recruits for Pacific hake. Quantiles are based on 5000 systematic samples from the joint posterior distribution.

	Age-1 recruits (billions)		
Year	median	2.5%	97.5%
2000	12.87	6.61	23.80
2001	0.97	0.36	2.79
2002	1.27	0.44	3.68
2003	0.34	0.11	1.07
2004	2.28	0.69	6.67
2005	0.88	0.24	3.02
2006	3.39	0.91	12.78
2007	2.62	0.57	12.12
2008	0.94	0.17	5.35
2009	1.04	0.15	7.53

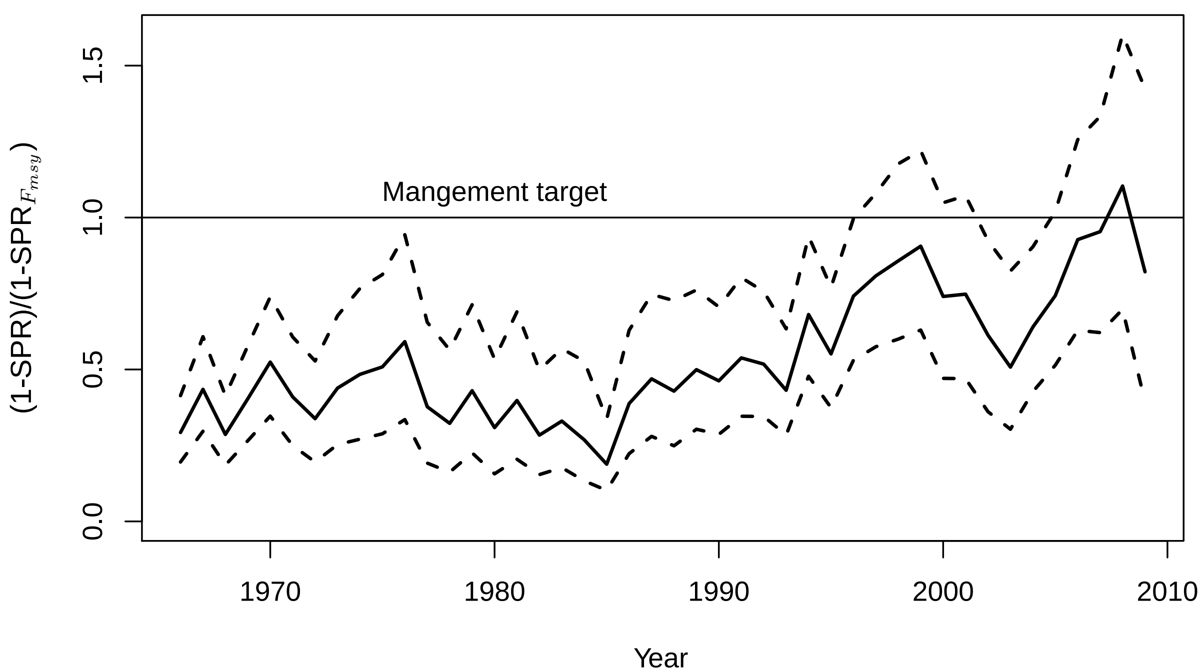


Figure f: Recent trends in median spawning potential ratio (solid line) relative to SPR at F^* and 95% credible intervals (dotted line). Note that the maximum likelihood estimate of SPR$_{MSY}$ = 0.53 .

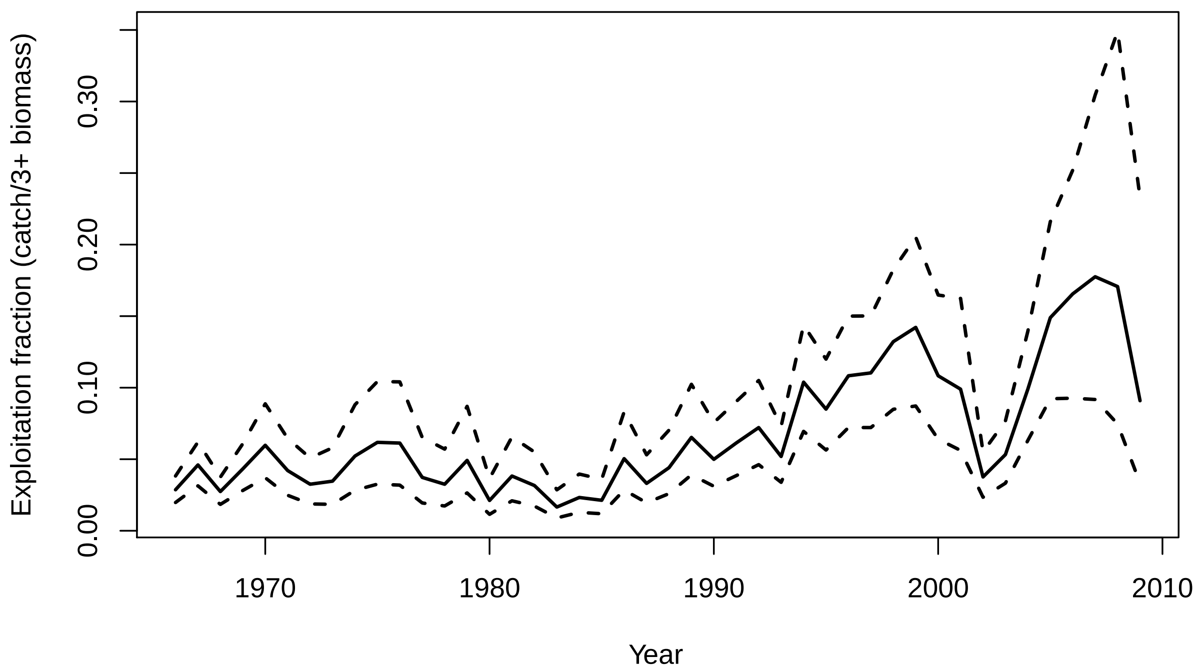


Figure g: Recent trends in the median exploitation fraction (catch divided by age 3+ biomass, solid line) with 95% credible intervals (dotted line).

biomass. Trends in the exploitation fraction (Figure g) mirror that of the SPR based mortality rates (Figure f).

The full history of fishing mortality relative to the fishing mortality based on F_{msy} and trends in spawning stock biomass relative to SB_{msy} is shown in Figure h. Median estimates of fishing mortality and spawning stock biomass are very near optimal levels based on MSY reference points. However, there is considerable uncertainty in the current status of the stock as shown by the contours in Figure h. The area of the "fried egg" in each quadrant is roughly proportional to the probability that the stock is below $\mathrm{SB}_{\mathrm{MSY}}$ ($<$ 0.5 probabliity) and that fishing mortality exceeds F^* ($<$0.5 probability).

Management performance

A treaty between the United States and Canada has been in place since 2003, but is not fully implemented, establishes that U.S. and Canadian shares of the coast-wide allowable biological catch ABC) at 73.88% and 26.12%, respectively. Since the late 1970s annual quotas have been the primary management tool in place to limit catch of Pacific hake by foreign and domestic fisheries. In the past 10 years catches have been below the coast-wide ABC (Table c) and only in

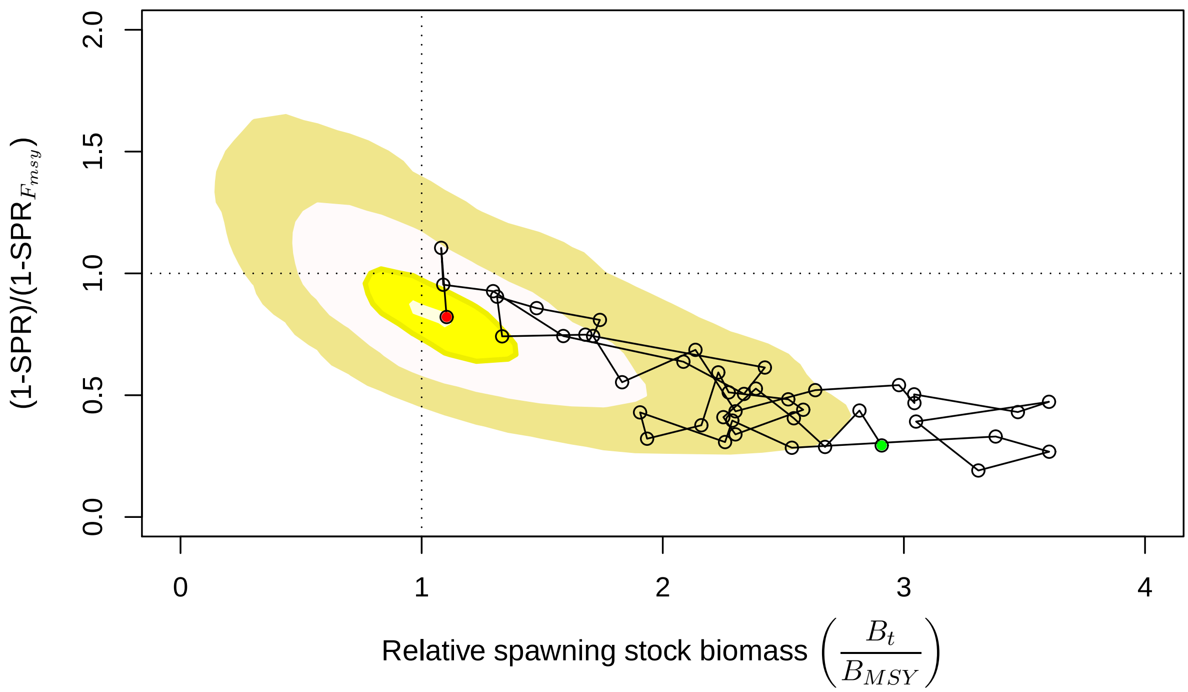


Figure h: Phase plot of the median relative fishing intensity versus the median relative spawning stock biomass. Contour levels (2.5%, 25%, 75%, and 97.5%) represent the uncertainty in 2009 .

2002 did the catch exceed optimal yields (OY) by 12.9%. In the past 3 years failures to obtain the full OY have been due to by-catch limits in the U.S. fisheries and fish not showing up in the traditional fishing grounds in Canadian waters. Note also that management in the Canadian zone permits annual carry overs if there is left over quota in the following fishing season; therefore the statistics in Table c may also have landings $>$ than OY due to the carry over.

Table c: Recent trend in Pacific hake management performance.

Year	Landings	OY (mt)	ABC (mt)	Landings/OY (%))
2000	230,820	290,000	290,000	79.6
2001	235,962	238,000	238,000	99.1
2002	182,911	162,000	208,000	112.9
2003	205,582	228,000	235,000	90.2
2004	334,672	501,073	514,441	66.8
2005	359,661	364,197	531,124	98.8
2006	360,683	364,842	661,680	98.9
2007	297,098	328,358	612,068	90.5
2008	321,546	364,842	400,000	88.1
2009	176,671	184,000	254,000	96.0

Forecasts

Forecasts are generated by applying the 40:10 harvest control rule to the maximum likelihood results. It is assumed that the estimated coast wide selectivity curve corresponds to the U.S.–Canada allocation agreement of 73.88% and 26.12%. Two alternative overfishing limits/targest were explored in generating stock forecasts: 1) an $F_{40\%}$ policy where the target fishing mortality rate reduces the spawning potential ratio to 40% of its unfished state, and 2) and F_{msy} (or F^*) policy where the target fishing mortality rate maximizes long-term sustainable yield (Table d). Note that estimates of $F_{40\%}$ are greater than estimates of F_{msy} (see Figure b).

Maximum likelihood catch options based on the 40:10 harvest control rule and the $F_{40\%}$ target start at 415,000 mt in 2010 which results in an estimated depletion level of 20% in 2011. Catch options based on the 40:10 adjustment and the F^* target start at 249,000 mt and result in a projected depletion level of 24% in 2011. With no strong year-classes recruiting to the fishery in the next few years (the 2005 year class is currently estimated to be below the long-term mean), projected spawning biomass are anticipated to decline even with relatively small OY's for the 2010 fishery.

Decision table

Catch streams for the decision table are based on the 40:10 harvest control rule using median values of $F_{40\%}$ reference point and the less conservative F^* reference point (see rows 1–3 and 4–6 in Table e, respectively). Alternative constant catch streams of 100,000, 150,000, 184,000, 235,000, 339,000, and 400,000 are also provided for comparison. The results in Table e are interpreted as

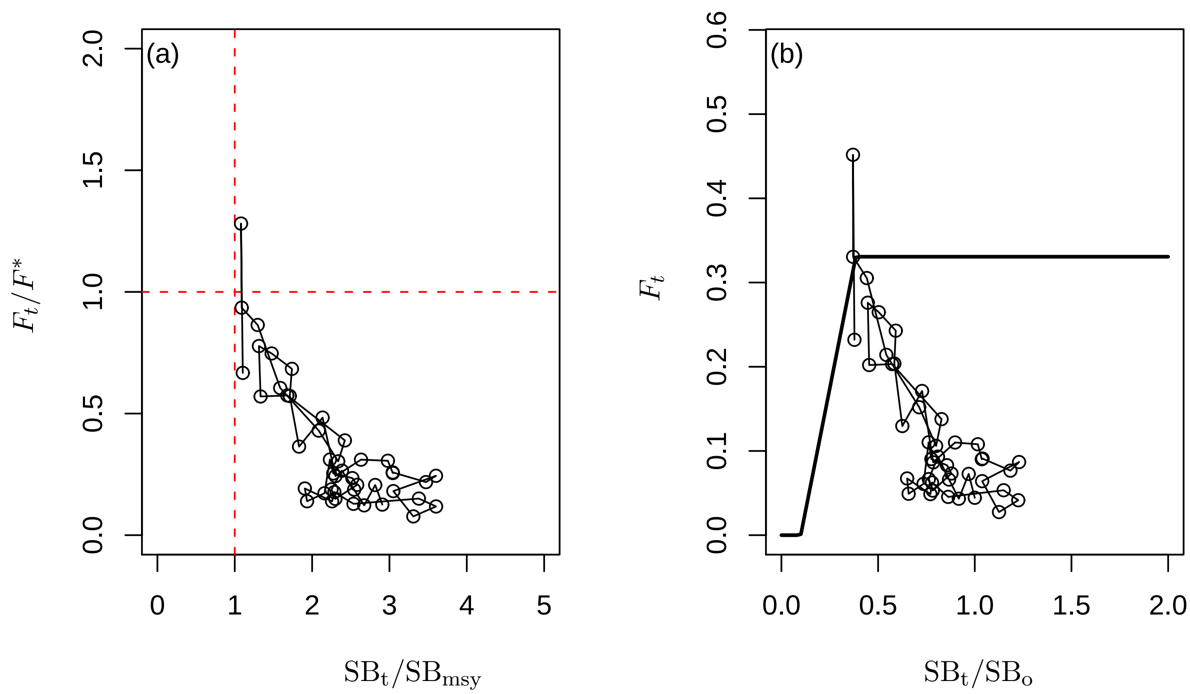


Figure i: Median estimates of the spawning stock biomass relative to the unfished spawning stock biomass versus the fishing mortality rate relative to F^* (a). In panel (b) the inferred 40:10 harvest control rule (thick line) based on the maximum likelihood estimate of F^* and the spawning stock biomass depletion levels versus median estimates of historical fishing mortality rates.

Table d: Three year projections of maximum likelihood-based Pacific Hake ABC, OY, female spawning biomass, spawning biomass depletion level, and relative SPR values based on the 40:10 harvest control rule with F_{40} (top three rows) and F^* (bottom three rows) overfishing targets.

Year	ABC	OY	SBt	Depletion	(1-SPR)/(1-SPR$_{Target=40}$)	(1-SPR)/(1-SPR$_{F_{msy}}$)
2010	415731	362912	1.17	0.29	0.98	1.24
2011	282972	191902	0.82	0.20	0.88	1.11
2012	235449	140541	0.73	0.18	0.84	1.06
2010	249148	217494	1.17	0.29	0.78	0.98
2011	207567	162360	0.98	0.24	0.73	0.92
2012	180878	132097	0.89	0.22	0.71	0.89

follows: given a 2010 OY of 150,000 mt the projected median estimate (50th percentile) of female spawning stock biomass in 2011 is 0.81 million mt, which corresponds to a depletion level of 35% and a projected SPR value of 0.49 relative to the SPR$_{40\%}$ target level. Catch advice greater than 100,000 mt results in further declines in projected female spawning stock biomass. Uncertainty in projected spawning stock biomass is large with estimated depletion levels of $<$20% at the 5th percentile and greater than 50% at the 95th percentile.

The default proxy of SPR$_{40\%}$ for maximum sustainable yield for Pacific hake is estimated to be less conservative from a fishing mortality perspective. Equilibrium yields are estimated to be maximized (i.e., MSY) at SPR values of 0.53, which corresponds to the F^* harvest policy, with a much more conservative overfishing/target fishing mortality rate. Relative spawning potential ratios for the alternative catch options under the SPR$_{40\%}$ proxy and F^* policies are shown in Table f.

Research and data needs

There are still some unresolved problems that seriously impede the stock assessments each year:

- Insufficient time to adequately review and analyze the assessment data before the STAR panel meeting; this has occurred in the past two years due to the protracted length of the fishery.
- Insufficient contrast in the acoustic survey data to clearly resolve the tradeoff between productivity and population scale (see Appendix C).
- Most recent acoustic biomass survey may be contaminated (biased upwards) due to the large quantities of humboldt squid (*Dosidicus gigas*) present during the survey. Currently there is no way to distinguish hake from humboldt squid using acoustics. An informative prior for the scaling parameter (q) in the 2009 survey will be required in future assessments if this point is to be used in future assessments.
- Acoustic survey selectivity is highly uncertain and confounded with estimates of C^* and M. This years STAR panel felt the age-composition data from the acoustic survey are biased and should not be used in the assessment. This is consistent with the high conditional maximum likelihood estimates of the variance in the residuals for the acoustic survey age comps in comparison to the fishery age-comps.
- There is insufficient time between the finalizing of stock assessment data and preparing stock assessment documents and catch advice (less than 10 days this year). This short time frame leads to rushed assessments that are more prone to error.
- 2009 mean weight-at-age data is needed to properly update this assessment.

Summary table

A summary of the Pacific hake reference points based on the joint posterior distribution is provided in Table h. Note that biomass based reference points are based on the most recent estimates of weights-at-age.

Table e: Decision table with three year projections of posterior distributions for Pacific hake female spawning stock biomass, depletion, and relative spawning potential ratio (1-SPR)/(1-SPR$_{Target=0.4}$; values $>$ 1 denote overfishing). Catch streams from 2010 to 2012 are based 1) on the 40:10 harvest control rule and median values of F$_{40\%}$, 2) median values of F^* and the 40:10 harvest control rule, and 3) arbitrary constant catch levels of 100,000, 150,000, 184,000, 235,000, 339,000, and 400,000 mt.

Coast wide catch	(mt)	Female spawning biomass (million mt)					Spawning depletion (SB_t/SB_o)					Relative SPR (1-SPR)/(1-SPR$_{Target=40}$)				
Year	OY	5th	25th	50th	75th	95th	5th	25th	50th	75th	95th	5th	25th	50th	75th	95th
2010	617700	0.34	0.60	0.86	1.20	1.99	0.17	0.28	0.37	0.49	0.73	0.80	0.98	1.02	1.05	1.09
2011	281900	0.29	0.41	0.54	0.72	1.13	0.14	0.19	0.23	0.30	0.43	0.66	0.85	0.94	1.00	1.07
2012	193100	0.26	0.36	0.46	0.61	0.96	0.12	0.16	0.20	0.25	0.38	0.53	0.78	0.89	0.99	1.09
2010	341900	0.34	0.60	0.86	1.20	1.99	0.17	0.28	0.37	0.49	0.73	0.53	0.69	0.78	0.86	0.97
2011	254700	0.33	0.51	0.69	0.95	1.55	0.16	0.23	0.30	0.39	0.57	0.51	0.65	0.74	0.83	0.94
2012	201100	0.30	0.46	0.61	0.84	1.36	0.15	0.21	0.26	0.34	0.50	0.47	0.63	0.73	0.82	0.94
2010	100000	0.34	0.60	0.86	1.20	1.99	0.17	0.28	0.37	0.49	0.73	0.17	0.28	0.37	0.49	0.74
2011	100000	0.32	0.58	0.84	1.17	1.94	0.16	0.27	0.36	0.48	0.71	0.16	0.26	0.35	0.48	0.75
2012	100000	0.31	0.57	0.82	1.16	1.92	0.15	0.26	0.36	0.47	0.71	0.16	0.27	0.36	0.49	0.76
2010	150000	0.34	0.60	0.86	1.20	1.99	0.17	0.28	0.37	0.49	0.73	0.25	0.38	0.49	0.64	0.90
2011	150000	0.29	0.56	0.81	1.14	1.91	0.15	0.25	0.35	0.47	0.70	0.23	0.37	0.49	0.65	0.96
2012	150000	0.26	0.52	0.77	1.12	1.87	0.12	0.24	0.33	0.45	0.69	0.24	0.39	0.52	0.69	1.02
2010	184000	0.34	0.60	0.86	1.20	1.99	0.17	0.28	0.37	0.49	0.73	0.29	0.44	0.56	0.72	0.98
2011	184000	0.27	0.54	0.79	1.13	1.89	0.14	0.25	0.34	0.46	0.69	0.28	0.44	0.57	0.75	1.08
2012	184000	0.22	0.49	0.74	1.08	1.84	0.11	0.22	0.32	0.44	0.68	0.29	0.46	0.61	0.80	1.17
2010	235000	0.34	0.60	0.86	1.20	1.99	0.17	0.28	0.37	0.49	0.73	0.35	0.52	0.66	0.82	1.08
2011	235000	0.24	0.51	0.76	1.10	1.86	0.12	0.23	0.33	0.45	0.68	0.34	0.53	0.68	0.87	1.23
2012	235000	0.16	0.44	0.69	1.04	1.80	0.08	0.20	0.30	0.42	0.66	0.36	0.56	0.74	0.95	1.40
2010	339000	0.34	0.60	0.86	1.20	1.99	0.17	0.28	0.37	0.49	0.73	0.46	0.66	0.80	0.96	1.22
2011	339000	0.18	0.45	0.71	1.04	1.81	0.09	0.21	0.31	0.42	0.66	0.46	0.69	0.86	1.07	1.63
2012	339000	0.02	0.34	0.59	0.94	1.74	0.01	0.15	0.25	0.38	0.63	0.49	0.75	0.95	1.21	1.66
2010	400000	0.34	0.60	0.86	1.20	1.99	0.17	0.28	0.37	0.49	0.73	0.52	0.72	0.86	1.02	1.29
2011	400000	0.15	0.42	0.67	1.00	1.77	0.07	0.19	0.29	0.41	0.64	0.52	0.77	0.95	1.18	1.66
2012	400000	0.00	0.28	0.54	0.89	1.74	0.00	0.13	0.23	0.36	0.62	0.56	0.84	1.06	1.37	1.66

Table f: Decision table for relative spawning potential ratios with three year projections using two alternative SPR reference points. Note that the maximum likelihood estimate for the Spawning Potential Ratio when fishing at F_{msy} is 0.53.

Coast wide catch (mt)		Relative SPR (1-SPR)/(1-SPR$_{F_{msy}}$)					Relative SPR (1-SPR)/(1-SPR$_{Target=40}$)				
Year	OY	5th	25th	50th	75th	95th	5th	25th	50th	75th	95th
2010	617700	0.94	1.16	1.31	1.47	1.80	0.80	0.98	1.02	1.05	1.09
2011	281900	0.82	1.06	1.20	1.36	1.64	0.66	0.85	0.94	1.00	1.07
2012	193100	0.69	0.97	1.14	1.32	1.63	0.53	0.78	0.89	0.99	1.09
2010	341900	0.76	0.98	1.04	1.07	1.15	0.53	0.69	0.78	0.86	0.97
2011	254700	0.72	0.91	0.99	1.04	1.11	0.51	0.65	0.74	0.83	0.94
2012	201100	0.67	0.87	0.97	1.04	1.13	0.47	0.63	0.73	0.82	0.94
2010	100000	0.23	0.36	0.49	0.65	0.98	0.17	0.28	0.37	0.49	0.74
2011	100000	0.22	0.34	0.47	0.63	0.97	0.16	0.26	0.35	0.48	0.75
2012	100000	0.22	0.35	0.48	0.64	1.00	0.16	0.27	0.36	0.49	0.76
2010	150000	0.33	0.50	0.65	0.84	1.19	0.25	0.38	0.49	0.64	0.90
2011	150000	0.31	0.49	0.65	0.85	1.25	0.23	0.37	0.49	0.65	0.96
2012	150000	0.32	0.51	0.68	0.89	1.33	0.24	0.39	0.52	0.69	1.02
2010	184000	0.39	0.58	0.74	0.94	1.30	0.29	0.44	0.56	0.72	0.98
2011	184000	0.37	0.58	0.75	0.97	1.40	0.28	0.44	0.57	0.75	1.08
2012	184000	0.39	0.61	0.80	1.04	1.53	0.29	0.46	0.61	0.80	1.17
2010	235000	0.47	0.69	0.86	1.06	1.43	0.35	0.52	0.66	0.82	1.08
2011	235000	0.46	0.70	0.90	1.14	1.62	0.34	0.53	0.68	0.87	1.23
2012	235000	0.48	0.74	0.96	1.24	1.83	0.36	0.56	0.74	0.95	1.40
2010	339000	0.61	0.86	1.05	1.25	1.65	0.46	0.66	0.80	0.96	1.22
2011	339000	0.62	0.90	1.13	1.40	2.01	0.46	0.69	0.86	1.07	1.63
2012	339000	0.66	0.98	1.24	1.60	2.25	0.49	0.75	0.95	1.21	1.66
2010	400000	0.68	0.94	1.13	1.34	1.75	0.52	0.72	0.86	1.02	1.29
2011	400000	0.70	1.00	1.24	1.54	2.17	0.52	0.77	0.95	1.18	1.66
2012	400000	0.75	1.09	1.38	1.79	2.37	0.56	0.84	1.06	1.37	1.66

Table g: Summary of recent trends in Pacific hake exploitation and stock levels.

Quantity	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Coast wide landings (mt)	235,962	182,911	205,582	334,672	359,661	360,683	297,098	321,547	176,730	NA
ABC (mt)	238,000	208,000	235,000	514,441	531,124	661,680	612,068	400,000	253,582	NA
OY (mt)	238,000	162,000	228,000	501,073	364,197	364,842	328,358	364,842	184,000	NA
Relative SPR										
(1-SPR)/(1-SPRfmsy)	0.75	0.61	0.51	0.64	0.74	0.93	0.95	1.1	0.82	
2.50%	0.48	0.36	0.3	0.42	0.5	0.63	0.6	0.69	0.4	
97.50%	1.05	0.91	0.81	0.9	1.01	1.26	1.32	1.57	1.39	
Vulnerable Biomass (million mt)	1.46	1.93	2.70	2.66	1.98	1.45	1.14	0.95	0.94	1.01
3+Biomass (million mt)	1.92	4.20	3.34	2.94	2.08	1.84	1.35	1.45	1.40	1.24
Spawning biomass (million mt)	2.08	2.61	3.78	3.65	3.25	2.48	2.01	1.7	1.69	1.75
2.50%	1.39	1.8	2.66	2.57	2.31	1.74	1.38	1.04	0.87	0.65
97.50%	3.49	4.38	6.18	5.92	5.25	4.11	3.58	3.28	3.62	4.4
Age-1 Recruits	12.97	0.96	1.24	0.33	2.25	0.86	3.44	2.61	0.93	1.06
2.50%	7.04	0.35	0.42	0.11	0.72	0.24	0.91	0.56	0.16	0.15
97.50%	24.32	2.68	3.77	1.06	6.77	2.94	12.06	11.92	5.36	7.81
Depletion	0.45	0.57	0.83	0.8	0.71	0.54	0.44	0.37	0.37	0.38
2.50%	0.33	0.42	0.6	0.57	0.5	0.38	0.31	0.24	0.21	0.16
97.50%	0.63	0.79	1.16	1.16	1.02	0.79	0.65	0.59	0.65	0.78

Table h: Summary of the Pacific hake reference points based 5000 samples from the joint posterior distribution. Reference points for MSY levels are based on the most recent estimates of growth.

Quantity	Median	2.5% percentile	97.5% percentile
-Unfished female SBo (million mt)	1.931	1.411	2.88
-Unfished total biomass	4.868	3.456	7.496
-Unfished 3+ biomass	4.048	2.952	6.062
-Unfished age-1 recruits (billions)	3.145	1.84	5.779
REFERENCE POINTS based on SB $_{40\%}$			
-MSY proxy female spawning biomass $SB_{40\%}$	0.773	0.564	1.152
-SPR resulting in $SB_{40\%}$	0.54	0.472	0.634
-Exploitation fraction (ct/Bt3) resulting in $SB_{40\%}$	0.265	0.197	0.358
-Yield with $SB_{40\%}$	0.3	0.208	0.469
REFERENCE POINTS based on SPR $_{40\%}$			
-Female spawning biomass at $SPR_{40\%}$	0.412	0.039	0.645
-SPR	0.4	0.4	0.4
-Exploitation fraction (ct/Bt3) resulting in $SPR_{40\%}$	0.498	0.349	0.841
-Yield with $SPR_{40\%}$	0.266	0.029	0.436
REFERENCE POINTS based on MSY			
-Female spawning biomass at MSY	0.773	0.504	1.234
-SPR at MSY	0.539	0.411	0.67
-Exploitation fraction (ct/Bt3) at MSY	0.267	0.172	0.418
-MSY	0.301	0.207	0.474

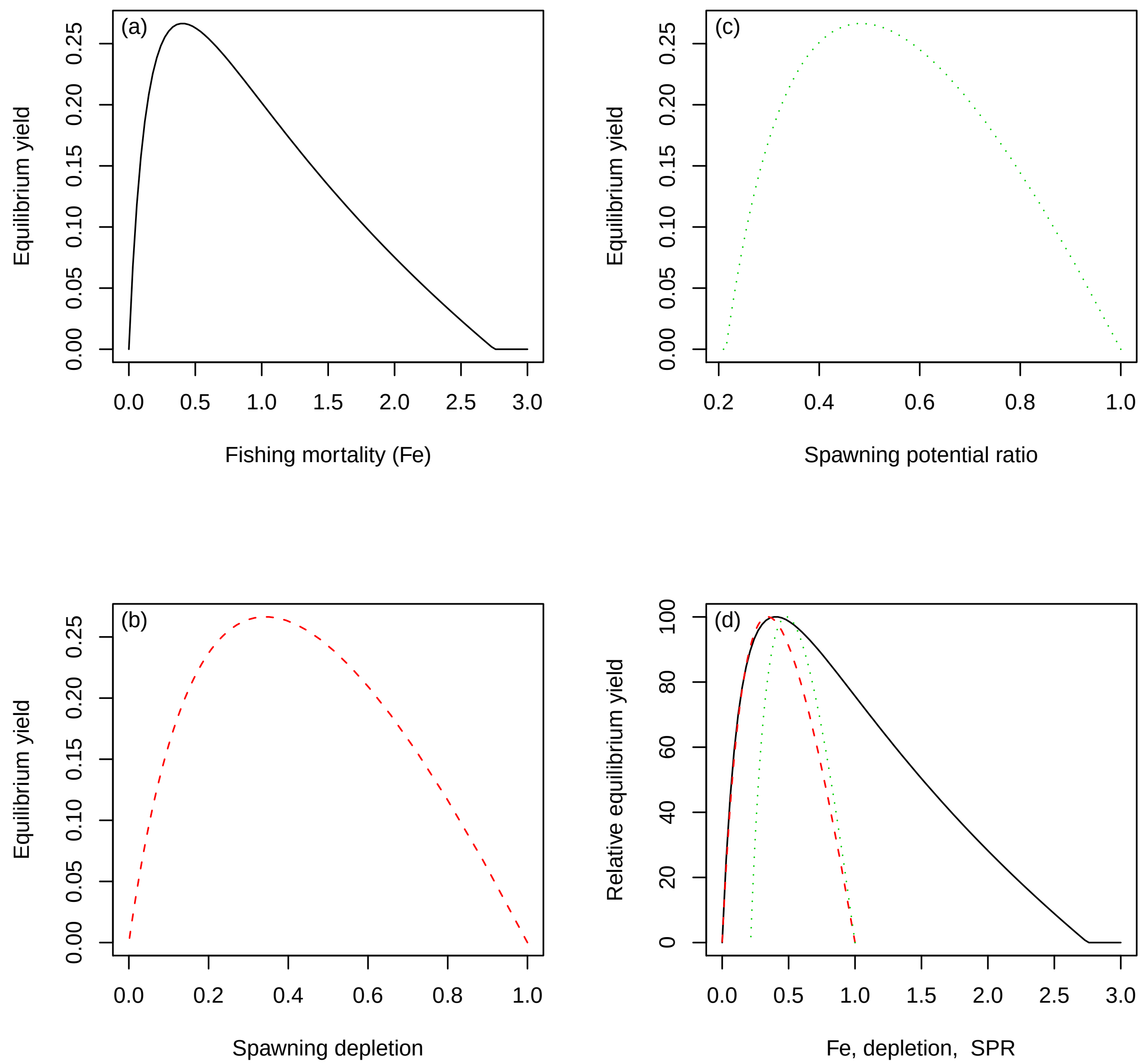


Figure j: Equilibrium yield curves versus instantaneous fishing mortality rate (a), relative depletion of spawning stock biomass (b), spawning potential ratio (c), and the relative equilibrium yields versus alternative performance measures (d). Note that F^* policy and the $\mathrm{SB}_{40\%}$ policy result in similar maximum, whereas the $\mathrm{SPR}_{40\%}$ policy would achieve roughly 20% of the maximum yield.

1 Introduction

1.1 Management

The Pacific hake (*Merluccius productus*) is a transboundary stock which is jointly managed by Canada and the USA. A treaty dealing with joint management was signed in 2003. The treaty specifies a number of committees and procedures for stock assessment and management. However, these are yet to be fully implemented. In the mean time, scientists from the USA and Canada have endeavored to continue the assessment process in the spirit of the treaty. In the current Pacific hake agreement, the United States is allocated 73.88% of the total coast-wide harvest and Canada 26.12% of the total coast-wide harvest.

1.2 Fishery

The directed Pacific hake fishery uses pelagic trawl gear to harvest fish and there is a small amount of hake by-catch taken in groundfish trawl fisheries. In Candian waters there has been a recent shift in the location of the fishery over the past 3 years to a more northerly location in Queen Charlotte Sound and in the Strait of Juan de Fuca in comparison to the traditional area off southwest Vancouver Island.

The following fisheries description was extracted from Stewart and Hamel (2010). Canadian Pacific hake catches were fully utilized in the 2005 fishing season with 85,284 mt and 15,178 mt taken by the domestic and joint venture fisheries, respectively. In 2006, the joint-venture and domestic fisheries harvested 13,700 mt and 80,000 mt, respectively. During the 2007 fishing season, Canadian fisheries harvested 85% of the 85,373 mt allocation. In 2008, Canadian fisheries harvested 78% of the 95,297 mt allocation with jointventure and domestic sectors catching 3,590 mt and 70,160 mt, respectively. During the 2009 season, no catches were made under joint-venture agreement. The Canadian domestic fishery harvested 55,620 mt in 2009, or 115.7% of the Canadian OY. DFO managers allow a 15% discrepancy between the quota and total catch. The quota may be exceeded by up to 15% in any given year, which is then deducted from the quota for the subsequent year.

The 2009 U.S. fishery caught 121,110 mt, or 89.1% of the U.S. OY. See Stewart and Hamel (2010) for more detailed description of the U.S. fishery in 2009 and previous years.

1.3 Problems with historical assessments

Previous assessments of Pacific hake (*Merluccius productus*) have been troubled by the lack of contrast in the acoustic survey data that allow for the estimation of the unfished biomass (B_o) and the steepness of the stock recruitment relationship. To cope with the lack of information in the acoustic survey data, the assessments have proceeded by fixing the value (h) of steepness for stock recruitment relationship and presented two alternative scenarios for the acoustic survey scaling parameter q. Fixing these parameters is necessary due to the lack of contrast in the acoustic survey data; however, it also results in a gross under-estimation of the uncertainty in model results and estimates of the reference points used in the determination of Acceptable Biological Catch (ABC).

At present, uncertainty in parameters that define the harvest control rule is only represented by the uncertainty associated with selectivity parameters in the various commercial fisheries as well as the acoustic survey itself. The parameters that define the underlying production function include the instantaneous natural mortality rate (M), the steepness of the stock recruitment relationship (h) and a measure of population scale (usually the unfished spawning stock size or B_o). In previous assessments, h and M are fixed, and the population scale is determined by the combined effects of selectivity in the acoustic survey and the survey scaler q (which is fixed at two different values). For example for a given value of q, estimates of the unfished biomass increase as the acoustic survey selectivity becomes more dome-shaped, and vice-versa.

Historically, management advice has been based on the application of the 40-10 harvest control rule. Three critical pieces of information were required to apply the harvest control rule: 1) an estimate of F_{MSY} and B_{MSY} which is approximated by F_{40} and B_{40}, respectively, 2) an estimate of the current level of depletion in the spawning stock biomass, and 3) a biomass forecast based on historical recruitment or the underlying stock recruitment relationship. Accurate estimates of F_{MSY} require accurate estimates of M and h, which are difficult to obtain in many (if not all) fisheries assessments; therefore a proxy F_{40} (which is the fishing mortality rate that reduces the spawning potential ratio to 40% of its unfished state) was used to approximate F_{MSY}. This approximation has been shown to achieve nearly 80% of the maximum yield over a wide range of stock recruitment parameters with a variety of stock recruitment models (Clark, 1991, 2002). Similarly, B_o was also difficult to estimate; therefore, the spawning potential ratio (SPR) is used as a measure of mortality rates. The current level of depletion is determined by comparing the ratio of present day spawning biomass to the estimated unfished spawning biomass. Finally, the forecast was based on current levels of depletion and estimates of h.

There are a few unresolved problems and inconsistencies in the input data for Stock Synthesis (SS) or any other age-structured model that incorporates the survey age-composition data. First there is a large inconsistency between information in the age-compositions and the acoustic survey biomass index. The age compositions suggest a buildup of biomass through the late 1980s owing to the strong 1980 and 1984 cohorts, yet the biomass index is relatively flat during this time period. Furthermore, (Helser et al., 2008) documented a clear contradiction in the age-composition information between the US, Canadian and Fisheries independent surveys. Each of these independent data sets contradict each other in terms of information content with respect to estimated model parameters in the assessment model that was used in 2008.

In contrast to previous assessments for Pacific hake, this assessment attempts to reduce the amount of prior information that is used on key population parameters that ultimately defines the harvest control rule and catch advice. To do this, I have implemented a age-structured model that is parameterized from a management oriented perspective, where the leading parameters are C^* and F^* . The assessment herein is based on the same assessment conducted by Martell (2009). I assume that the stock is at its unfished state in 1966, recruitment follows a Beverton-Holt stock-recruitment relationship, and the model is conditioned on the historical catch information. A total of 51 model parameters are conditionally estimated. I make no prior assumptions about the survey q, and no direct prior assumptions about the steepness of the stock recruitment relationship. The model parameterization is such that there is an implied prior for the steepness of the stock recruitment function; however, this prior is very diffuse in comparison to previous assessments (i.e., steepness was fixed in 2007). In this assessment, catch data from U.S. and Canadian operations are aggregated into a single fishery, and it is assumed that selectivity curve for the aggregate fishery and the acoustic trawl survey is asymptotic and time invariant.

Changes to this years assessment include: omitting the 1986 and 2009 acoustic biomass survey index, omitting all survey age-composition data, and partitioning the fisheries independent time series into two periods from 1977-1992 and 1995-2007 with two separate q's.

2 Methods

A summary of the input data and complete technical description of the model is provided in Appendix A and B, respectively. For technical details on the acoustic trawl surveys, please refer to Fleischer et al. (2005). For a more detailed description of the fishery and historical management of the fishery see Helser and Martell (2007b) for more details. The purpose of this section is three fold: 1) summarize the modeling approach, 2) provide documentation for informative prior distributions, and 3) provide a technical description on how the reference points and catch advice is formulated.

2.1 Modeling approach

The principle difference between the assessment here, and that of last years assessment using Stock Synthesis (SS), is that the leading parameters in this model pertain to the management parameters F^* (the fishing mortality rate that produced the maximum sustainable yield) and C^* (the maximum sustainable yield). Whereas, SS estimates the unfished biomass B_o and the steepness of the stock recruitment relationship h.

The approach was to fit and age-structured population dynamics model to time series information on relative abundance, and proportions-at-age in the commercial fishery using a Bayesian estimation framework. The commercial catch and age-composition information from Canada and the U.S. has been combined to represent a single fishery. The aggregation of the commercial catch data has the potential to create a bias in the predicted-age composition because it assumes that the age-specific fishing mortality rates between the two countries has been relatively consistent over time. Furthermore, the combining of the age-composition data is done using a weighted average, where the weights are based on the proportion of US or CAN landings by weight rather than by numbers.

The objective function contains 4 major components: 1) the negative loglikelihood of the relative abundance data, 2) the negative loglikelihood of the catch-at-age proportions in the commercial fishery, 3) the prior distributions for model parameters, and 4) two penalty functions that constrain the estimates of steepness to lie between 0.2 and 1, and to prevent annual exploitation rates from exceeding 1. Note that the value of the penalty functions was 0 for all samples from the posterior distribution. The joint posterior distribution is defined by equation (T19.6). This distribution was numerically approximated using the Markov Chain Monte Carlo routines built into AD Model Builder (Otter Research, 2008). Posterior samples were drawn systematically every 400 iterations from a chain of length 2,000,0000 (the first 2000 samples were dropped to allow for sufficient burnin). Convergence was diagnosed using various test provided in the R-package CODA (R Development Core Team, 2006), as well as, running medians and visual inspection of the trace plots. Where possible, we provide comparisons between the maximum likelihood estimates and median estimates from the marginal posterior distributions. Catch advice is based on the samples from the joint posterior distribution (T19.6).

2.1.1 Input data used

The input data that were used to estimate model parameters are provided in appendix A. First, TINSS is conditioned on the total landings where the fishing mortality rate each year is determined by solving the instantaneous Baranov catch equation using the observed total landings and the estimated vulnerable biomass. The Baranov catch equation is solved using a derivative based root finding method (see equations T18.9 and T18.10 in appendix B). The model is fit to the Acoustic biomass survey (Table 11), assuming that these data are proportional to the vulnerable biomass seen by the survey and observation errors are lognormal. Selectivity to the acoustic survey gear was assumed to follow a logistic distribution and age-2 fish were assumed to be 50% vulnerable with a standard deviation of 0.45 years.

The model is also fit to combined U.S. and Canadian proportions-at-age from 1977 to 2009 (Table 13). To combine the proportion-at-age data, proportions-at-age from the U.S. and Canadian fisheries were constructed using a weighted average, where the weights are given by the proportion of the total landings in the U.S. or Canadian fisheries. The model was not fit to the observed proportions-at-age in the acoustic biomass survey (these data are provided in Table 12) as the STAR panel felt that these data were not representative of the population age-structure. Lastly, the empirical weight-at-age data were used to convert numbers-at-age to weight-at-age and these data are provided in Table 14. Note that no new weight-at-age data were available at the time of conducting this assessment; therefore, the observed mean weight-at-age in the 2008 fishery were carried forward to the 2009 fishery.

2.1.2 Assumptions

There is no *a priori* assumption about the scaling parameter for the acoustic biomass survey (q), and the biomass index was treated as a relative abundance index that is directly proportional to the survey vulnerable biomass as the beginning of the year. The acoustic biomass index was split into two separate time periods (i.e., two separate q) to account for the incomplete spatial coverage between 1977-1992 and the complete spatial coverage since 1995. It is assumed that the observation errors in the relative abundance index are lognormally distributed. Fishing mortality in the assessment model is conditioned on the observed total catch weight (combined US and Canada catch), and it is assumed that total catch is known and reported without error. I further assume that fishing mortality and natural mortality occur simultaneously. Age-composition information is assumed to come from a multivariate logistic distribution where the predicted proportion-at-age is a function of the predicted population age-structure and the age specific vulnerability to the fishing gear. The likelihood for the age-composition data was evaluated at the conditional maximum likelihood estimate of the variance (i.e., no subjective weighting scheme was used to scale likelihood for the age-composition information). No aging errors were assumed in this assessment.

Historical observations on mean weight-at-age shows systematic changes, where the average weights-at-age have declined from the mid 1970s and increased again slightly late 1990s (Figure 1). A number of the historical cohorts have a growth trajectories that initially increase from age-2 to age-8 then decline or stay relatively flat (e.g., 1977 cohort in Figure 1). Given these data,

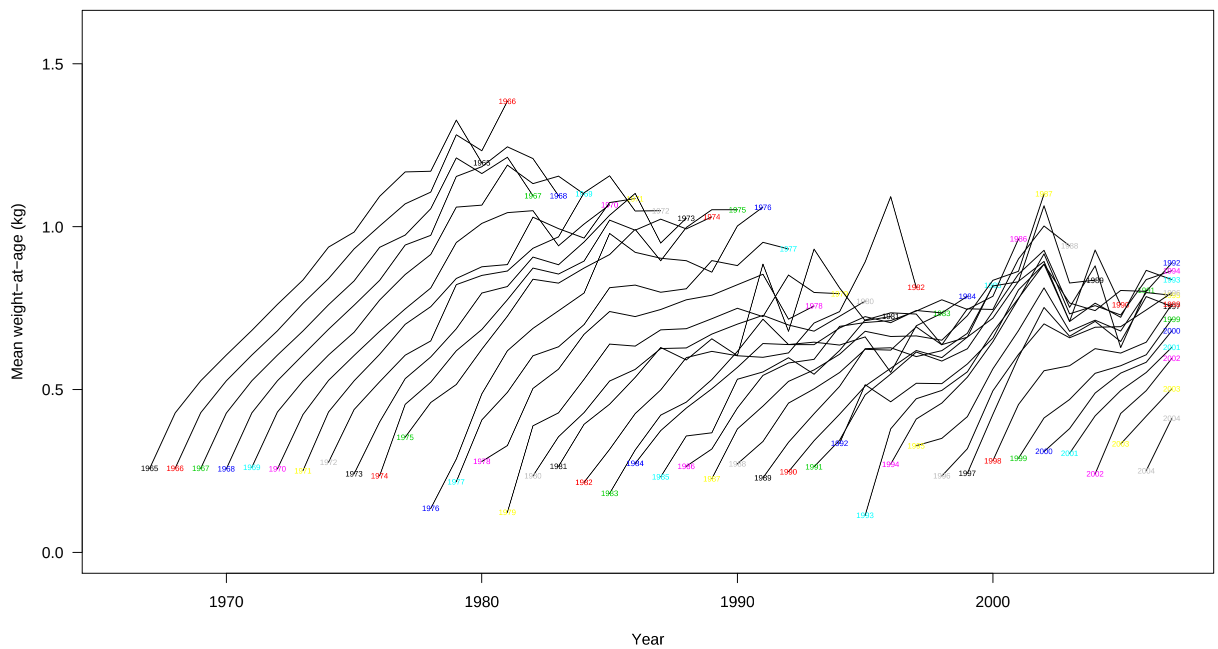


Figure 1: Observed mean weights-at-age by cohort in the commercial catch. Text labels for each line represent the cohort year.

there are at least three alternative explanations for the observed decreases in mean weight-at-age: 1) changes in condition factor associated with food availability, 2) intensive size selective fishing mortality with differential fishing mortality rates on faster growing indivuals, and 3) apparent changes in selectiviity over time. All three of these variables are confounded, and it is not possible to capture decreasing weight-at-age using the von Bertalanffy growth model and a fixed allometric relationship between length and weight. As such, the assessment model herein uses the observed mean weight-at-age data from the commercial fishery to scale population numbers to biomass.

The structural assumptions of the model assume that recruitment follows a Beverton-Holt type model and the process error terms are represented by a vector of deviation parameters (ω_j) that are assumed to be lognormally distributed. Both fishing mortality and natural mortality are assumed to occur simultaneously; instantaneous fishing mortality is based on the Baranov catch equation where the analytical solution for F_t is found using an iterative Newton-Rhaphson method with a fixed number of iterations to ensure the proper derivative information is carried forward in the autodiff libraries. Selectivity, or vulnerability-at-age, to the fishing gear is assumed to be age-specific, time-invariant, and is represented by an asymptotic logistic function (T16.5). Age-specific fecundity is assumed to be proportional to the product of body-weight and the proportion-at-age that are sexually mature.

2.2 Prior distributions

The underlying production function is defined by three key population parameters (C^* , F^* , and M) and the parameters that define age-specific selectivity ($v_a = f(\hat{a}_h, \hat{\gamma})$). Informative lognormal prior distributions were used for C^* , F^* , and M where the log means and log standard deviations are given in Table 1. These prior distributions were developed on an *ad hoc* basis and not necessarily derived from meta-analytic work that is the typical source of prior information.

Table 1: Prior distributions for model parameters.

Parameter	prior density	range	μ	σ	a	b
C^*	lognormal	(0.01-3.0)	0.200	0.5		
F^*	lognormal	(0.01-0.9)	0.35	0.262		
M	lognormal	(0.05-0.9)	0.23	0.1		
$\hat{a}$	uniform	(0.0-14.0)				
$\hat{\gamma}$	uniform	(0.05-5.0)				
$\bar{a}$	fixed	2.5				
$\bar{\gamma}$	fixed	0.45				
ρ	beta	(0.01-0.99)			3	12
φ	gamma	(0.02-100)			7.5	5.78

The global scaling parameter in this model is C^* ; the maximum long-term sustainable yield. Since 1966, the average annual landings removed from this population is 218,963.5 mt, and in the last decade 282,408.7 mt. We assume a rather diffuse lognormal prior for C^* with median value corresponding to 200,000 mt and a standard deviation of 500,000 mt. This represents a 95% confidence interval of roughly 75,000 mt to 532,000 mt. Assigning a prior density for C^* is nearly equivalent to assigning a prior density for the global scaling parameter q.

A lognormal prior was assumed for M with a mean corresponding to 0.23 (which is the assumed fixed value in Helser and Martell (2007b)) and a standard deviation of 0.1. This roughly corresponds to a 95% confidence interval of 0.19 and 0.28 for M, which is lower than the range reported in (e.g., Table 10 in Bailey et al., 1982, has values greater than 0.3 from 7 of 8 studies).

Uniform improper prior distributions were assumed for the selectivity parameters for the commercial fishery. The parameters are bounded between 0 and 14 years for the age at 50% vulnerability and 0.05 and 5.0 for the standard deviation in age at 50% vulnerability.

In comparison with Helser and Martell (2007b), a prior probability for F^* is nearly equivalent to a prior probability for steepness h. A lognormal prior was assumed for F^* , with a mean corresponding to 0.35 and a standard deviation of 0.262 (corresponds to a 95% confidence interval of 0.21 and 0.59). To derive the prior for F^* , a steady state age-structured model was developed to calculate spawning potential ratio based on growth parameters from Francis et al. (1982), a natural mortality rate of 0.23, and a logistic selectivity curve ($\hat{a} = 3.13, \hat{\gamma} = 0.8$). Arbitrarily, it was assumed that production is maximized somewhere between SPR=0.3 and SPR=0.45, and the corresponding values for F_{30} and F_{45} were then calculated. Based on the growth-maturity, natural mortality, and assumed selectivity the values correspond to $F_{30} = 0.48$ and $F_{45} = 0.25$, which were then assumed to be the 10th and 90th percentiles for a lognormal distribution. Note that the Spawning potential ratio curve is insensitive to the assumed value of steepness (Figure 2) and that F_{40} is the assumed proxy for F^* that is used by the Pacific Fisheries Management Council.

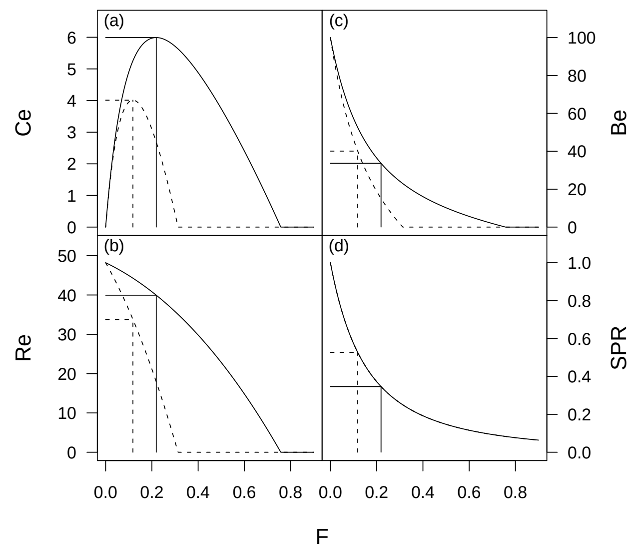


Figure 2: Relationship between equilibrium fishing mortality rate and yield (a), recruitment (b), biomass(c) and spawner per recruit(d) with an assumed value of h = 0.75 and $h = 0.5$. The vertical lines in each panel represent estimates of F^* (solid lines), F_{45}, and F_{30} (dotted lines). Note that the y axis scaling is arbitrary (i.e. B_o was assumed at 4 units of biomass).

The transition from (C^* ,F^*)⇒(B_o, h), that is carried out using the algorithm described in Table 16, implies a prior density for the steepness parameter in the stock recruitment relationship. The implied prior density for h used in this assessment is shown in Figure 3. Note that in the Beverton-Holt stock recruitment model, values of h range between 0.2 and 1.0, where 0.2 implies that recruitment is nearly proportional to spawner/egg production, and 1.0 implies that recruitment is unrelated to spawner/egg production. The implied prior for h is sensitive to two key model components: the assumed prior distribution for F^* , and the age at which fish recruit to the fishery relative to the age at which fish mature. Larger values of F^* imply a more productive stock and higher values of h for given selectivity and maturity schedules. Similarly, if fish recruit to the fishery prior to maturing then the levels of recruitment compensation (or h) must increase for a given value of F^* . Therefore, a critical piece of information is the maturity-at-age and weight-at-age schedules used to develop the age-specific fecundity relationship.

2.3 Reference points and catch advice

Catch advice in this model is based on the 40:10 harvest control rule with F_{40} as the target fishing mortality rate. I also provide catch advice using F^* as the target fishing mortality rate. Unless otherwise stated, the reference point calculations and catch advice is based on the most recent information about growth (Table 14) and maturity-at-age information from Dorn and Saunders (1997).

The reference points for the harvest control rule are F_{40} and SB_{40} . In this assessment F^*

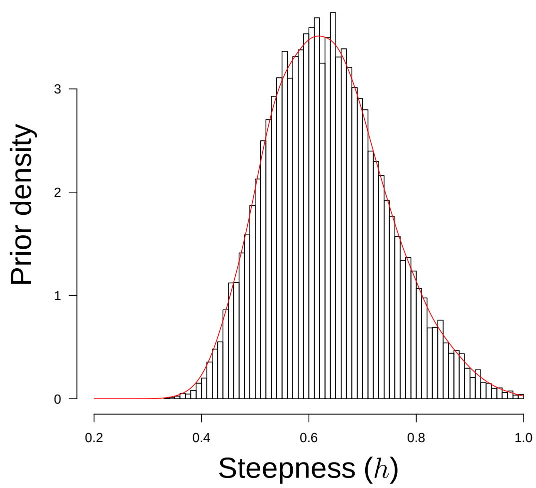


Figure 3: Implied prior for the steepness parameter in the stock recruitment relationship. Note that steepness is derived from the leading parameters Θ; therefore, any assumed prior information for Θ results in an implied prior for derived quantities such as h.

is estimated as a leading parameter, and SB_{40} is 40% of the unfished spawning biomass (SB_{o}). An alternative (but as it turns out, less conservative) harvest rule would be to use $\mathrm{SB}_{\mathrm{MSY}}$ as the reference point in the harvest control rule, where $\mathrm{SB}_{\mathrm{MSY}}$ =$R_e\phi_e$ evaluated at F^* and C^* .

Catch advice was generated by projecting the stock abundance forward to 2011 by applying catch options between 0 and 750,000 mt tons over 25 equally spaced intervals and then calculating various management objectives for each of the 5,000 samples from the joint posterior distribution. It was assumed in each simulated projection that the total catch option was fully utilized and implemented without error. In the stock projections, age-1 recruits for 2008-2011 were generated using the underlying Beverton-Holt stock recruitment model with annual lognormal recruitment deviates with standard deviation equal to the current estimate of standard deviation in the process errors (τ).

A decision table for catch advice (ABC options) was developed using measures of overfishing (probability that the ABC option will result in a fishing mortality rate that exceeds F^*), and four measures of spawning stock depletion. The first measure is the probability that the spawning stock biomass in 2010 will be less than the spawning stock biomass in 2009, and the second measure is the probability that the spawning stock biomass in 2010 will be less than $\mathrm{SB}_{\mathrm{MSY}}$. The third measure is the probability that the spawning stock biomass will be less than SB_{40} , and the fourth measure is the probability that the spawning stock biomass will fall below SB_{25}. For each sample from the joint posterior distribution the projection model loops over 25 increments of this ABC ranging from 0 to 750,000 mt and then calculates the corresponding fishing mortality rates and levels of spawning stock depletion. We then score the fishing rate and spawning stock depletion on a 0 or 1 scale (0 not overfishing or spawning stock biomass greater than or equal to management target) and fit a binomial (link logit) model versus ABC option to these data. The result is a sigmoid like curve or the cumulative probability of an ABC option versus management objective can be assessed.

Table 2: Alternative model descriptions and short hand notation for the evaluating the impact of the 2009 data on catch advice.

Label	Shorthand	Description
Model.1	C	2009 total catch data only included
Model.2	CA	Catch and 2009 fishery age data included
Model.3	CI	Catch and 2009 survey biomass index included
Model.4	CAI	Catch, fishery age, and survey biomass index only
Model.5	CIS	Catch, survey biomass index and survey age data included
Model.6	CAS	Catch, fishery age, and survey age data included
Model.7	CAIS	Catch, fishery age, survey biomass index, survey age (full model)

For specified levels of risk, ABC options for each management objective are then provided in a decision table. This cumulative probability distribution is also compared to the cumulative density function of catch advice produced by the 40/10 harvest control rule.

2.4 Sensitivity of ABC to new data

The TINSS assessment model was also run with alternative data configurations to show the impact of adding the 2009 data on 2010 ABC values. A summary of the alternative models and the shorthand notation is provided in Table 2. For each data configuration specified, projected 2010 ABC values, based on the 40:10 adjustment are calculated and compared against the full data (Model.7). I also examine how estimates of C^* , F^* , the survey catchability coefficient (q) and M are influenced by the new data collected in 2009 .

3 Results

3.1 Maximum likelihood estimates

Maximum likelihood estimates of the vulnerable biomass, fishing mortality rates, age-1 recruits and historical landings are summarized in Fig. 4. During the late 1960 and 1970s, annual landings averaged 169,000 tons and the corresponding fishing mortalities were less than 0.13 per year. During the 1980s catches increased from 90,000 tons to just over 300,000 tons and the fishing mortality rates during this period averaged less than 0.09 per year. Two exceptionally strong cohorts (1980, 1984) were responsible for a large increase in the vulnerable biomass during this time period. The vulnerable biomass peaked in the mid 1980s declined steadily to a low of 1.41 million tons in 2000 (Table 3). During this time period, there were no significant recruitment events (Fig. 4c), and also during this time period annual landings increased from 110,000 tons in 1985 to nearly 312,000 tons in 1999. The 1999 cohort was an exceptional year class, and the vulnerable biomass more than doubled from 1.41 millon tons in 2000 to 2.70 million tons in 2003 as a result. Catches declined as this year class recruited to the fishery, resulting in a reduction in fishing mortality to 0.16 in 2002. Catches increased again, reaching 360,000 tones in 2005 and 2006 resulting in an sharp increase in fishing mortality. As the 1999 year class passed through the fishery and was not replaced with another exceptional year class, catches remained high. Vulnerable and spawning biomass reached their historical minima following the 2008 fishery, and estimated fishing mortality in 2008 reached a record high of 0.58.

The 2009 OY was reduced to 184,000 metric tons for the 2009 fishery, and a combined 176,671 metric tons were landed by all sectors. The significant decrease in the 2009 OY resulted in an estimated fishing mortality rate of 0.30 and an exploitation fraction (catch divided by 3+biomass) of 0.13 in last years fishery. Estimated spawning stock biomass declined slightly from 1.23 million metric tons in 2009 to 1.18 million metric tons projected for the 2010 fishery. Vulnerable biomass increased slightly from 0.94 million mt in 2009, to 1.01 million mt in 2010 (Table 3).

Table 3: Maximum likelihood estimates of vulnerable biomass (B_t), spawning biomass (SB_t) and depletion, landings (C_t millions mt), instantaneous fishing mortality rates (F_t), 2+ and 3+ biomass ($B_{t,2+}, B_{t,3+}$), and total catch over 2+ and 3+ biomass ($C_t/B_{t,2+}$, $C_t/B_{t,3+}$), from 1966 to the begining of 2010 .

Year	B_t	SB_t	SB_t/SB_0	C_t	F_t	$B_{t,2+}$	$B_{t,3+}$	$C_t/B_{t,2+}$	$C_t/B_{t,3+}$
1966	3.59	4.05	1.00	0.14	0.05	4.71	4.22	0.03	0.03
1967	3.45	3.90	0.96	0.21	0.08	4.57	4.08	0.05	0.05
1968	3.26	3.67	0.91	0.12	0.05	4.19	3.88	0.03	0.03
1969	3.14	3.47	0.86	0.18	0.07	3.95	3.58	0.05	0.05
1970	2.87	3.21	0.79	0.23	0.10	3.72	3.33	0.06	0.07
1971	2.61	2.98	0.74	0.15	0.08	3.52	3.09	0.04	0.05
1972	2.50	3.00	0.74	0.12	0.06	4.14	3.02	0.03	0.04
1973	2.63	3.34	0.83	0.16	0.08	3.95	3.86	0.04	0.04
1974	2.96	3.27	0.81	0.21	0.09	3.61	3.34	0.06	0.06
1975	2.64	2.93	0.72	0.22	0.10	3.62	2.94	0.06	0.08
1976	2.39	2.85	0.70	0.24	0.13	3.35	3.14	0.07	0.08
1977	2.41	2.74	0.68	0.13	0.07	3.20	2.84	0.04	0.05
1978	2.22	2.46	0.61	0.10	0.06	2.66	2.58	0.04	0.04
1979	2.12	2.42	0.60	0.14	0.08	3.44	2.27	0.04	0.06
1980	2.11	2.87	0.71	0.09	0.06	3.53	3.47	0.03	0.03
1981	2.61	2.94	0.73	0.14	0.07	3.12	2.99	0.04	0.05
1982	2.56	3.24	0.80	0.11	0.05	5.88	2.80	0.02	0.04
1983	2.77	4.34	1.07	0.11	0.06	5.67	5.63	0.02	0.02
1984	4.18	4.69	1.16	0.14	0.04	4.94	4.91	0.03	0.03
1985	4.25	4.36	1.08	0.11	0.03	4.44	4.33	0.02	0.03
1986	3.44	4.03	0.99	0.21	0.07	6.59	3.51	0.03	0.06
1987	3.33	4.75	1.17	0.23	0.10	5.93	5.90	0.04	0.04
1988	4.11	4.61	1.14	0.25	0.08	5.00	4.75	0.05	0.05
1989	3.75	4.06	1.00	0.31	0.10	5.02	3.96	0.06	0.08
1990	3.31	4.06	1.00	0.26	0.10	5.20	4.41	0.05	0.06
1991	3.43	3.98	0.98	0.31	0.12	4.51	4.28	0.07	0.07
1992	3.16	3.52	0.87	0.30	0.12	4.27	3.53	0.07	0.08
1993	2.64	3.08	0.76	0.20	0.10	3.67	3.31	0.05	0.06

Table 3: *(continued)*

Year	B_t	SB_t	SB_t/SB_0	C_t	F_t	$B_{t,2+}$	$B_{t,3+}$	$C_t/B_{t,2+}$	$C_t/B_{t,3+}$
1994	2.56	2.87	0.71	0.36	0.19	3.21	3.00	0.11	0.12
1995	2.23	2.45	0.61	0.25	0.14	2.79	2.51	0.09	0.10
1996	1.84	2.29	0.57	0.31	0.23	3.12	2.43	0.10	0.13
1997	1.80	2.32	0.57	0.33	0.27	3.04	2.55	0.11	0.13
1998	1.63	1.96	0.49	0.32	0.29	2.45	2.08	0.13	0.15
1999	1.45	1.72	0.43	0.31	0.31	2.08	1.84	0.15	0.17
2000	1.41	1.72	0.42	0.23	0.23	2.20	1.75	0.11	0.13
2001	1.46	2.17	0.54	0.24	0.24	4.43	1.92	0.05	0.12
2002	1.93	3.22	0.79	0.18	0.16	4.38	4.20	0.04	0.04
2003	2.70	3.17	0.78	0.21	0.11	3.58	3.34	0.06	0.06
2004	2.66	2.83	0.70	0.33	0.16	2.99	2.94	0.11	0.11
2005	1.98	2.13	0.53	0.36	0.24	2.58	2.08	0.14	0.17
2006	1.45	1.70	0.42	0.36	0.36	1.98	1.84	0.18	0.20
2007	1.14	1.37	0.34	0.30	0.39	1.87	1.35	0.16	0.22
2008	0.95	1.29	0.32	0.32	0.58	1.78	1.45	0.18	0.22
2009	0.94	1.23	0.30	0.18	0.30	1.53	1.40	0.12	0.13
2010	1.01	1.18	0.29			1.39	1.24		

The maximum likelihood estimate of the 2010 spawning stock biomass is 1.50 millon tons (0.75 million metric tons for female spawning stock biomass), which corresponds to a depletion level of 0.35 (Fig. 5ab, Table 3). This is well below the management target of 0.4. By comparison, the estimated level of depletion in the assessment by Helser and Martell (2007b) was 0.309.

In this assessment we assume a constant age-selectivity curve for both the commercial and acoustic surveys (Fig. 6c). This is markedly different from previous assessments and other assessments run in parallel (i.e., Stock Synthesis) where selectivity is allowed to vary over specified time blocks. The conditional maximum likelihood estimates of the standard errors for the age-composition data is 1.85 for the commercial age composition data. These are very large errors in the age-composition information. When the survey age-composition data was included in the assessment, the conditional maximum likelihood estimate of the variance was nearly 3 times that of the commercial data; more emphasis (in terms of contribution to the likelihood component) is placed on the commercial age-composition information. For the acoustic trawl survey, there is reasonable correspondence in the observed and predicted age-comps for the 1980 and 1984 cohorts (Figs. 7-8). Since 1998, residual values in the acoustic survey age-composition are much smaller, and primarily negative for younger ages and positive for intermediate ages. Prior to the expansion of the acoustic biomass survey in 1995, age-composition data are likely biased due to the restricted spatial coverage.

In the commercial fishery, a time-invariant asymptotic selectivity curve was assumed and surprisingly good fits were obtained to the older age-classes in the commercial catch-age proportions (Figs. 9-10), with the exception of the persistent under-estimate of the proportions-at-age in the plus group in the late 1970s (this owes to an initialization of the numbers-at-age using a stable age distribution with a $Z = M$). The largest residual variation in the commercial age-composition data occurred in ages 2 and 14 (Fig. 11). The model tends to under estimate the 1980 and 1984

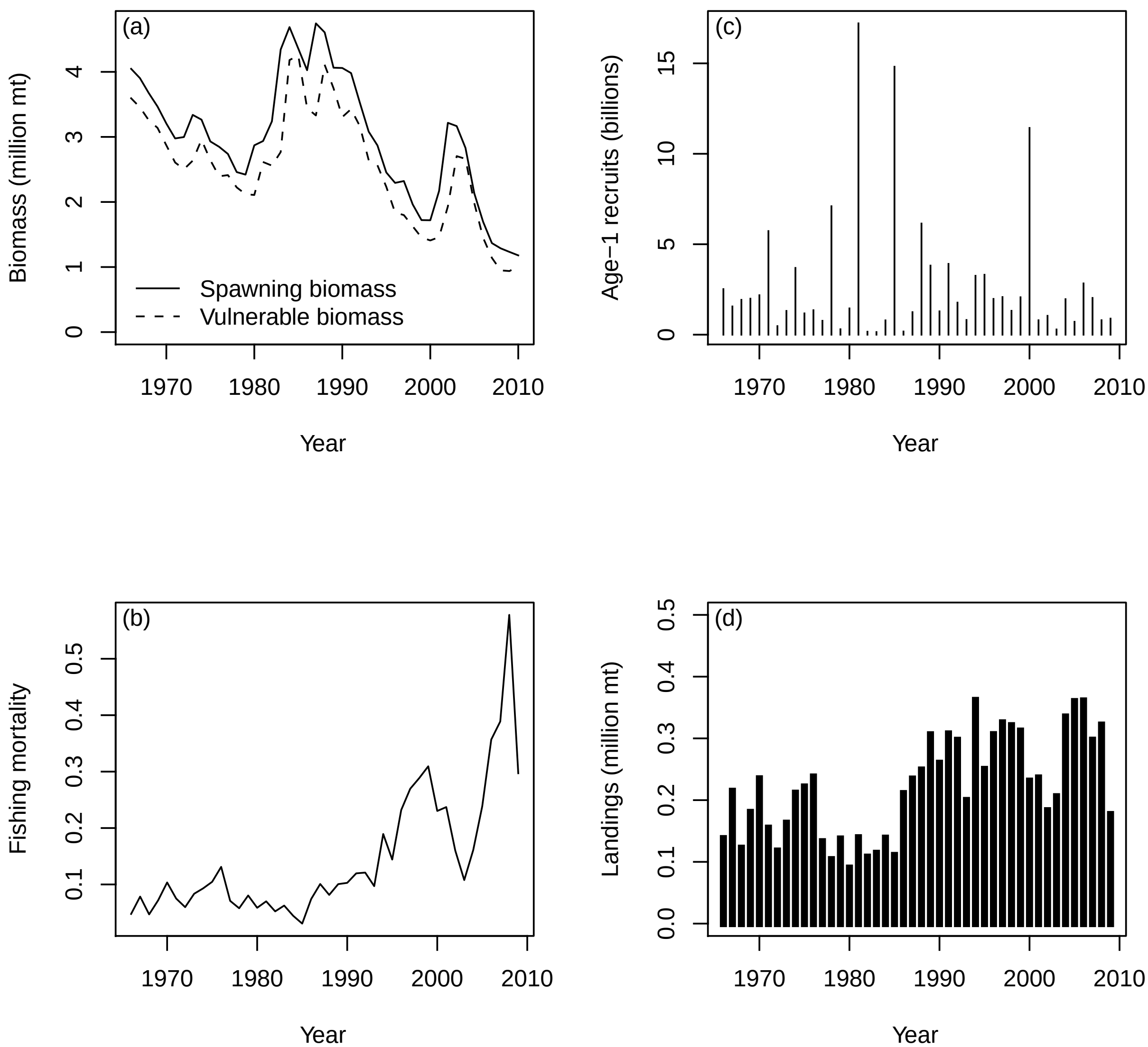


Figure 4: Maximum likelihood estimates of vulnerable and spawning biomass (panel a), fishing mortality (b), age-1 recruits (c) and the observed historical landings (d) for U.S. and Canadian fisheries combined.

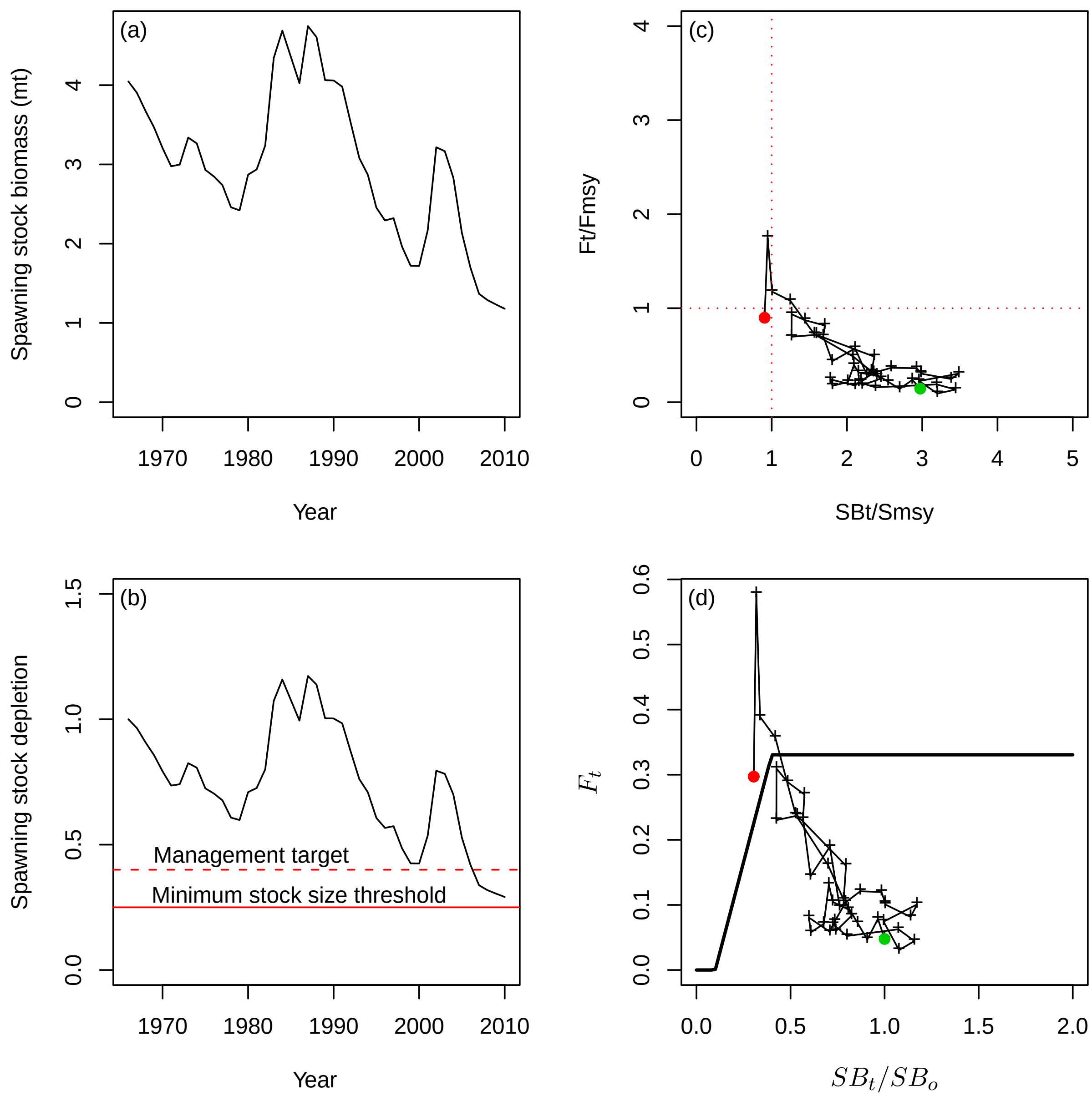


Figure 5: Maximum likelihood estimates of spawning stock biomass (a), spawning biomass depletion (b), the ratio of fishing mortality rates to C^* versus the spawning stock biomass to S_{msy} (c) and the harvest control rule (d). Note that the spawning stock biomass calculations include both male and females.

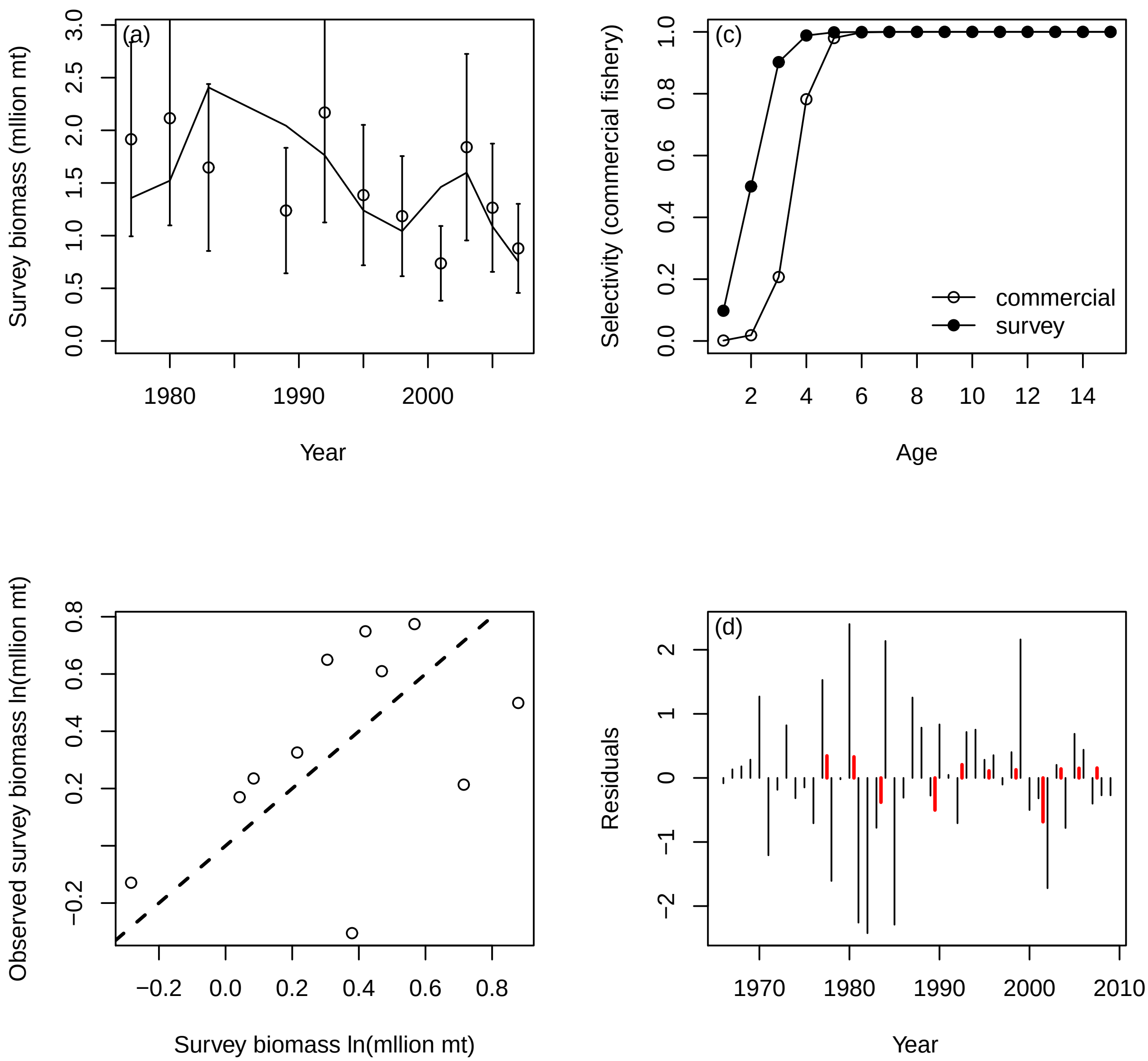


Figure 6: Predicted and observed survey biomass estimates (panel a-b, 1:1 line shown in panel b) based on the maximum likelihood fit to the data. Approximate 95% confidence intervals are shown for the survey points in panel (a) based on the estimated standard deviation in the survey. The estimated selectivity curves for commercial and survey selectivity (c), and the residuals between abundance indices (thick bars in panel d) and recruitemnt deviations (thin bars in panel d).

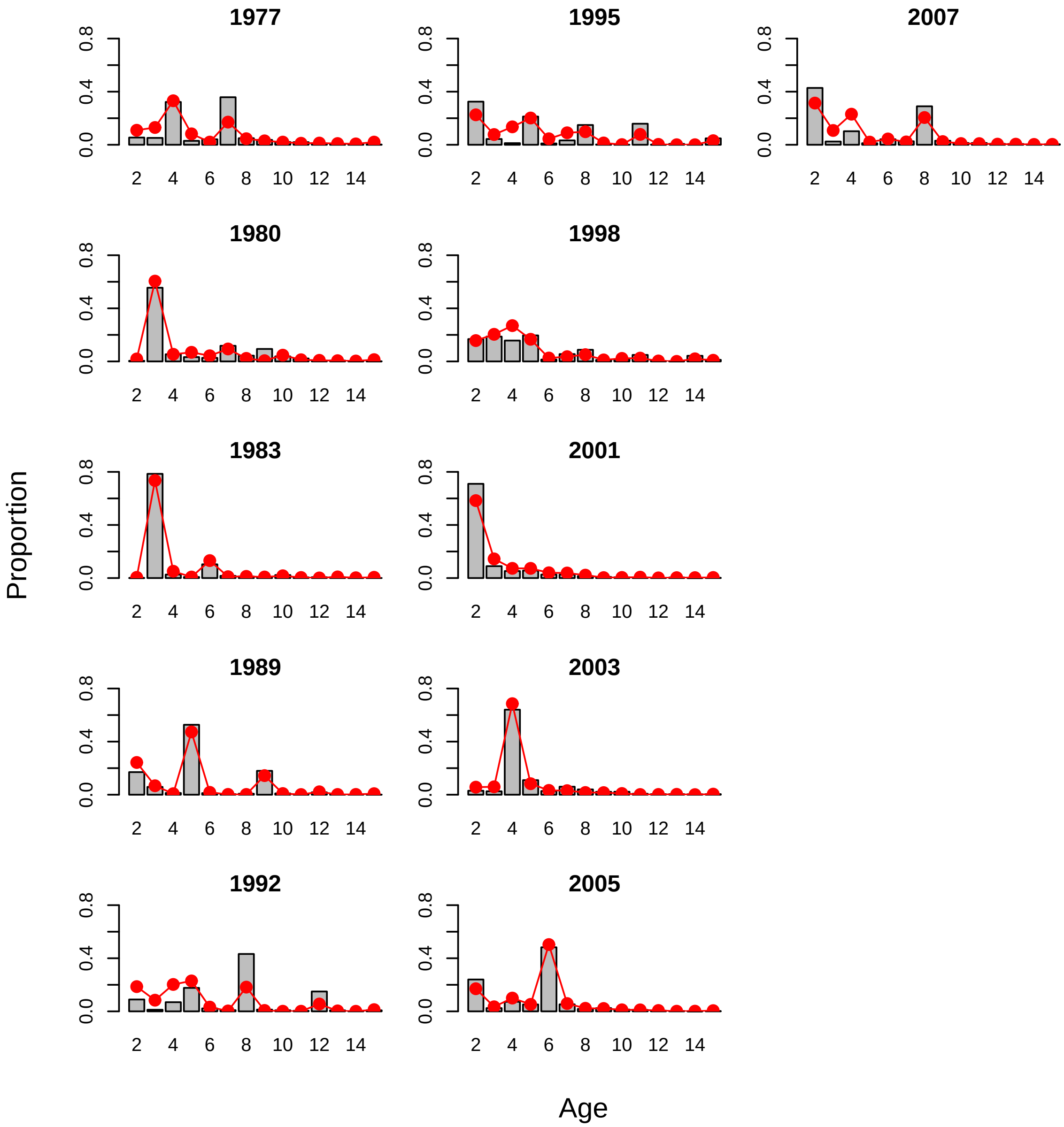


Figure 7: Observed (bars) and predicted (lines) proportions-at-age in the acoustic trawl surveys.

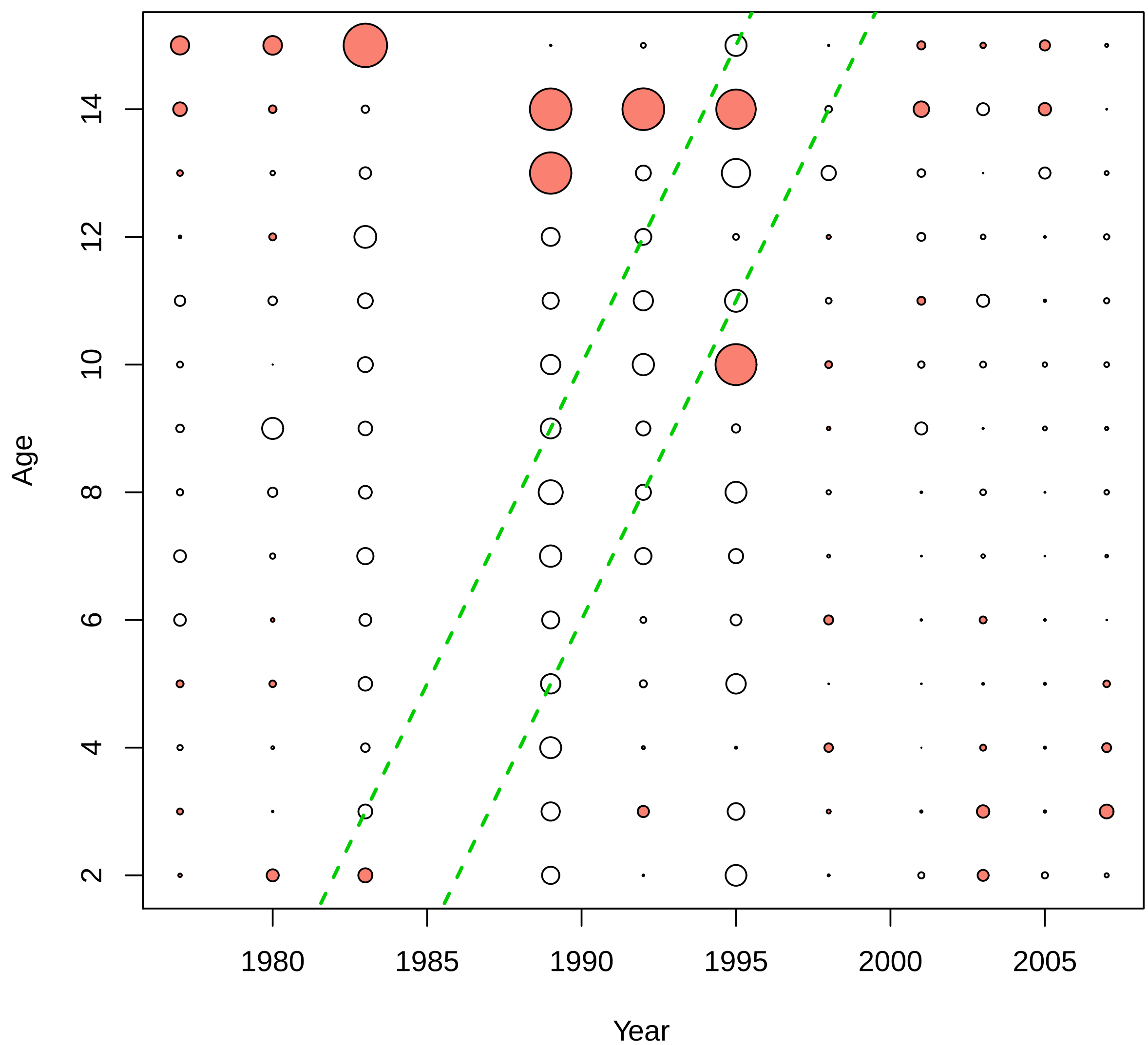


Figure 8: Bubble plots of the multivariate logistic residuals for the proportions-at-age in the acoustic trawl surveys. Diameter of the circle is proportional to the natural log of the residual, open circles are positive residuals (i.e., observed is greater than predicted). Dashed lines track the 1980 and 1984 cohorts.

cohorts at age-2 and over estimate the 1982 and 1985 cohorts at age-2. For the plus group, after 1984 there is no strong positive or negative residuals and no persistent pattern that would better suggest a dome-shaped selectivity curve; however, this residual pattern is in part determined by the instantaneous natural mortality rate M and lower values of M would lend more support for a hypothesis of a dome-shaped selectivity curve in the commercial fishery. Observed proportions-at-age are nearly all positive for the 2001 fishery with the exception of age-14. In 2000-2001, fish did not show up in the Canadian zone and the Canadian fleet operated in non-traditional fishing grounds in the north and landed older fish in comparison to the US fishery.

Overall, the constant selectivity assumption fits the commercial catch-age data reasonably well (Fig 9). The marked pattern in the residuals that appeared to correspond to an aging error pattern around above average cohorts prior to the 1980 cohort in seen in the previous assessment (Martell, 2009) now appears to be gone (Fig 11). This difference is likely due to not fitting the survey age-composition data, as previous assessments have noted contradictory information in the age-composition information (Helser and Martell, 2007a). Also there are some negative residuals for age-15+ from 1977 to 1983; these residuals arise due to the initialization of the numbers-at-age in 1966 where I assumed a stable age-distribution. Finally, in 2001 hake failed to show up in the traditional fishing grounds in Canada. The commercial fleet operated in non-traditional waters further to the North (Queen Charlotte sound) and landed much larger/older hake in comparison to the US fleet. This change in distribution of fishing operations is not very apparent in the residual patterns in 2001 because the aggregated age-proportions are dominated by the U.S. age comp data (Fig. 11).

3.2 Impact of 2009 data on 2010 ABC values

Prior to the 2010 STAR panel review, I evaluated the impact of the 2009 data on the projected ABC for the 2010 fishery. During the course of the STAR panel review, the 2009 data point was thrown out for this years assessment as well as all historical age-composition data collected in the acoustic biomass survey. The following two paragraphs describes the results of including the 2009 data prior to the STAR panel review.

The 2009 acoustic biomass index has the largest influence on estimated ABC values for the 2010 fishery (Figure 12). Projected ABC values for the 2010 fishery based on maximum likelihood parameter estimates and the 2009 landings data only are estimated at 171,612 mt. In other words, ignoring all other data (fishery age-comps, survey age-comps and the biomass index from the 2009 survey) results in the lowest ABC value for the 2010 fishery. The addition of the age composition data from the commercial fisheries in US and Canada (i.e., model.2) increase the 2010 ABC value to 218,039 mt. The addition of the survey age composition data (model.6) further increases the ABC value to 230,813 mt. All models that include the 2009 survey biomass index in the objective function result in a substantial increase in the 2010 ABC values, from 496,345 mt to 513,907 mt. The full model (using all available 2009 data, model.7) results in an ABC value of 497,466 mt.

Across the seven alternative data configurations explored, estimates of F^* and M are remarkably stable (Figure 13). Estimates of C^* were more variable with values ranging from 250,000 mt to 289,000 mt when the survey biomass index was excluded or included, respectively. Similarly, conditional maximum likelihood estimates of the survey catchability coefficient (negatively correlated with C^*) also ranged from 0.525 to 0.446 when the survey biomass index was included or

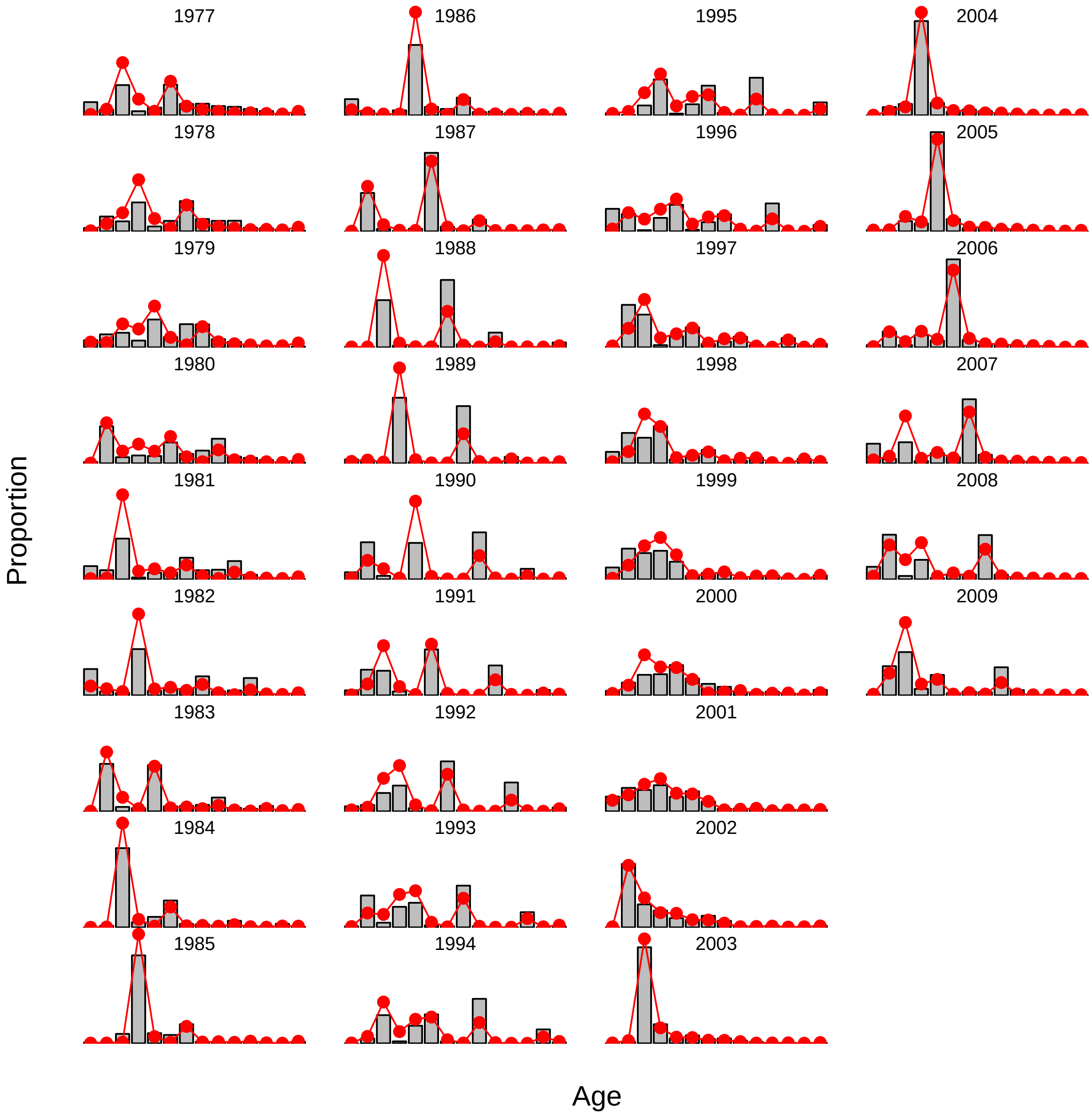


Figure 9: Observed (bars) and predicted (lines) proportions-at-age in the commercial age compositions.

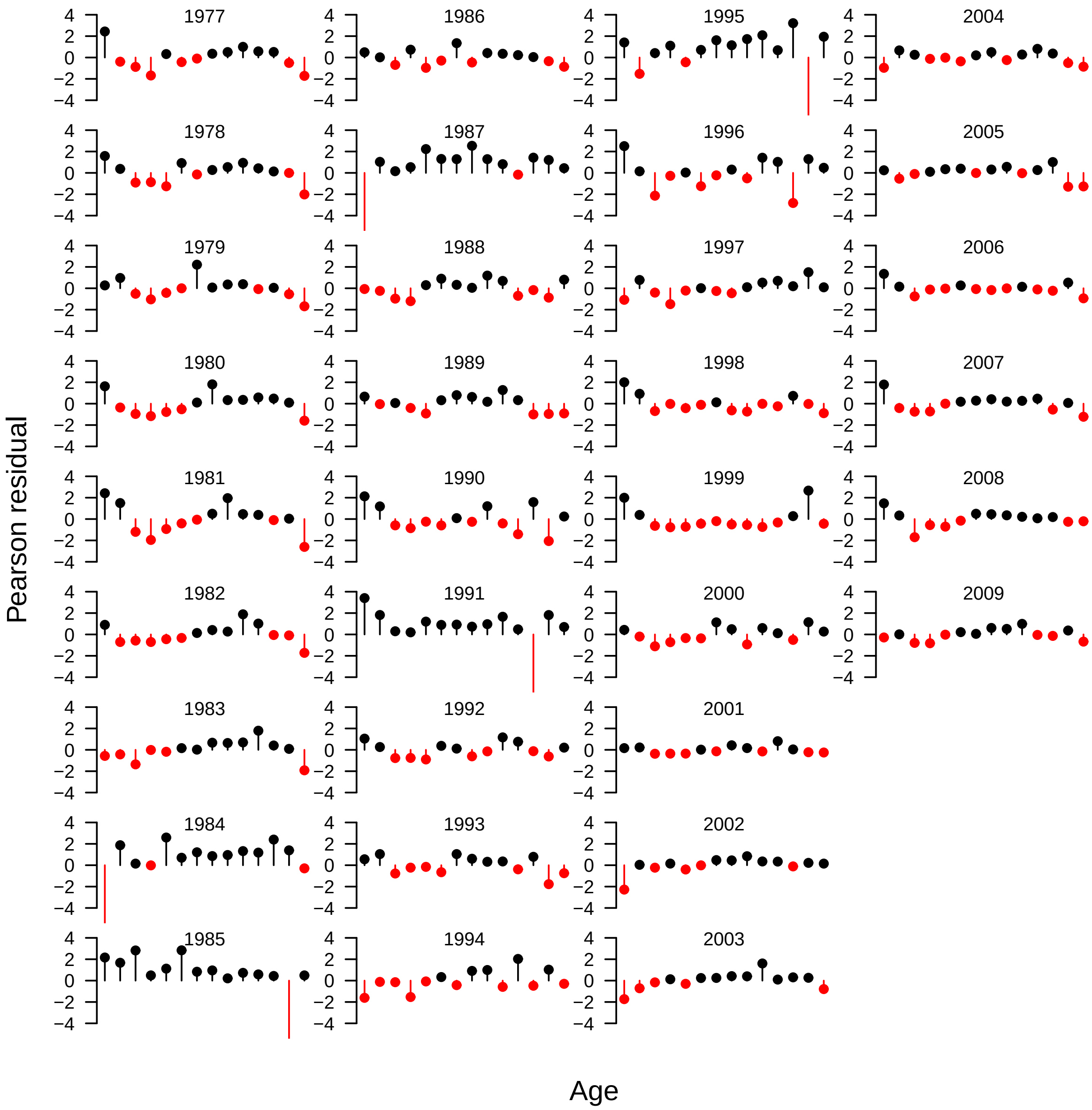


Figure 10: Pearson residuals for the proportions-at-age in the commercial age compositions.

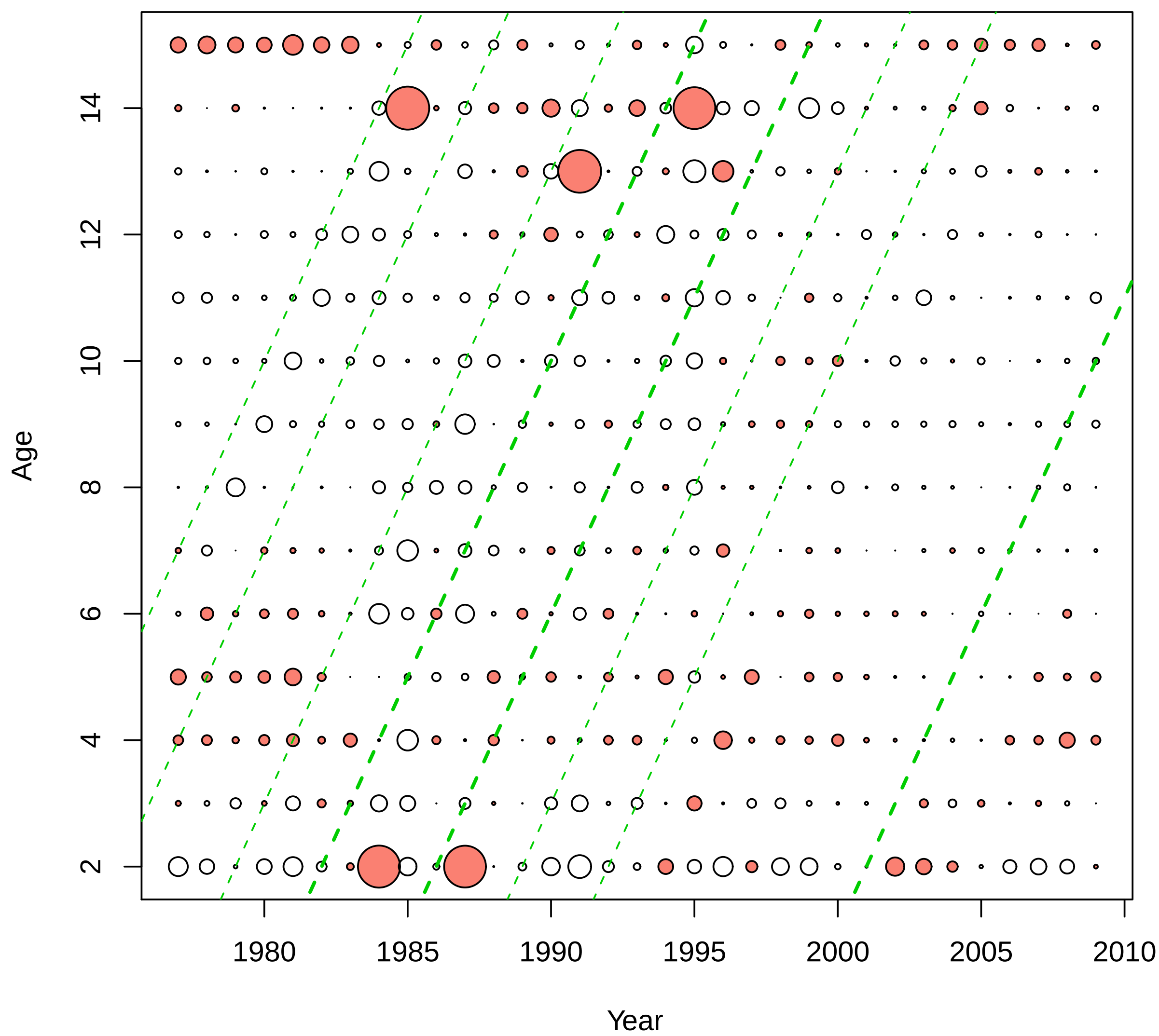


Figure 11: Bubble plots of pearson residuals for the proportions-at-age in the commercial age compositions. Dashed lines follow above average cohorts and the 1980, 1984 and 1999 cohorts are shown in bold dashed lines, positive residuals shown as transparent circles, negative residuals are shaded.

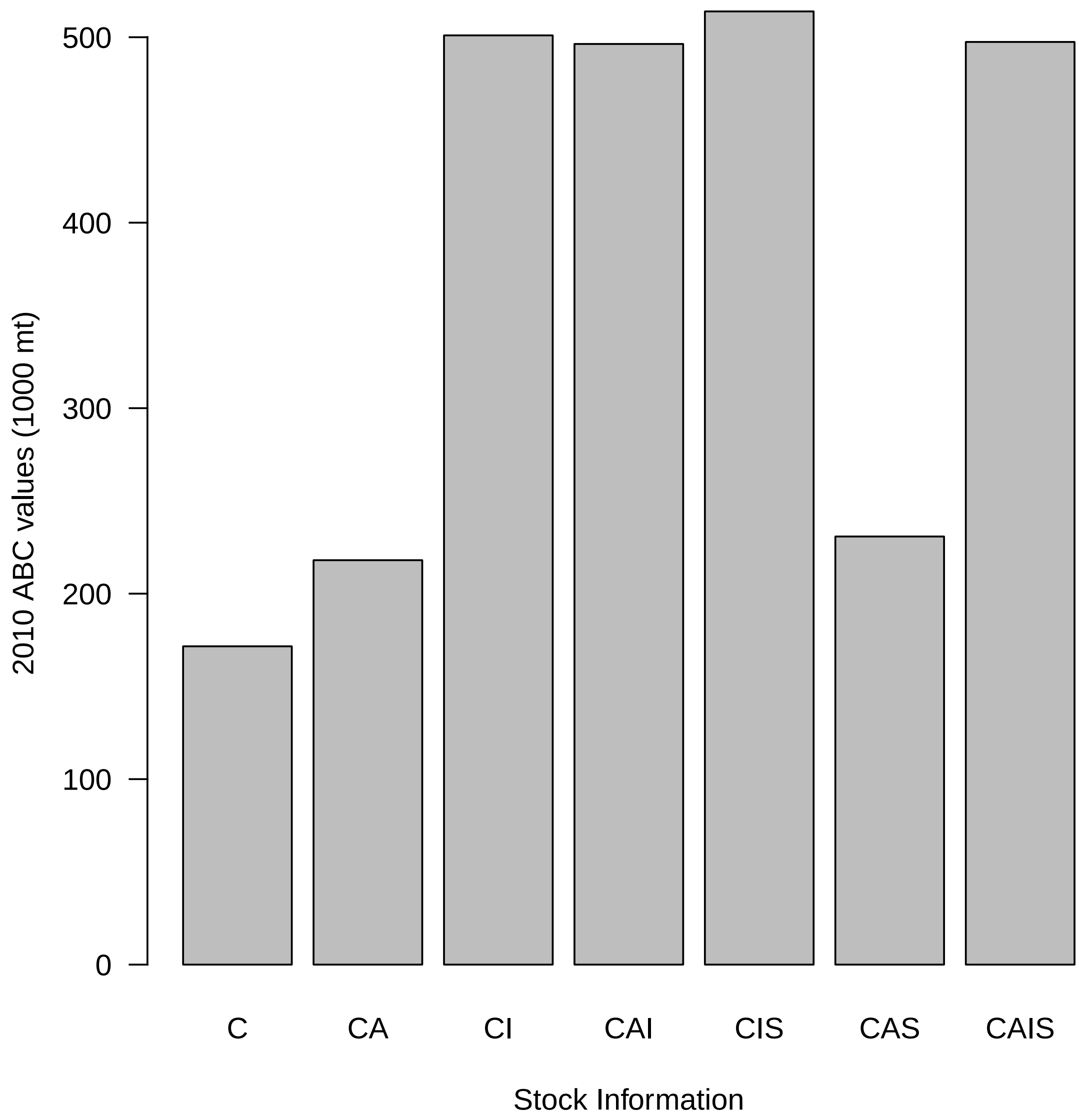


Figure 12: The impact of introducing the new 2009 data into the stock assessment model on ABC values for 2010 calculated using the 40:10 adjustment. Key: fishery **C**atch, fishery **A**ge comps, biomass **I**ndex, and **S**urvey age comps.

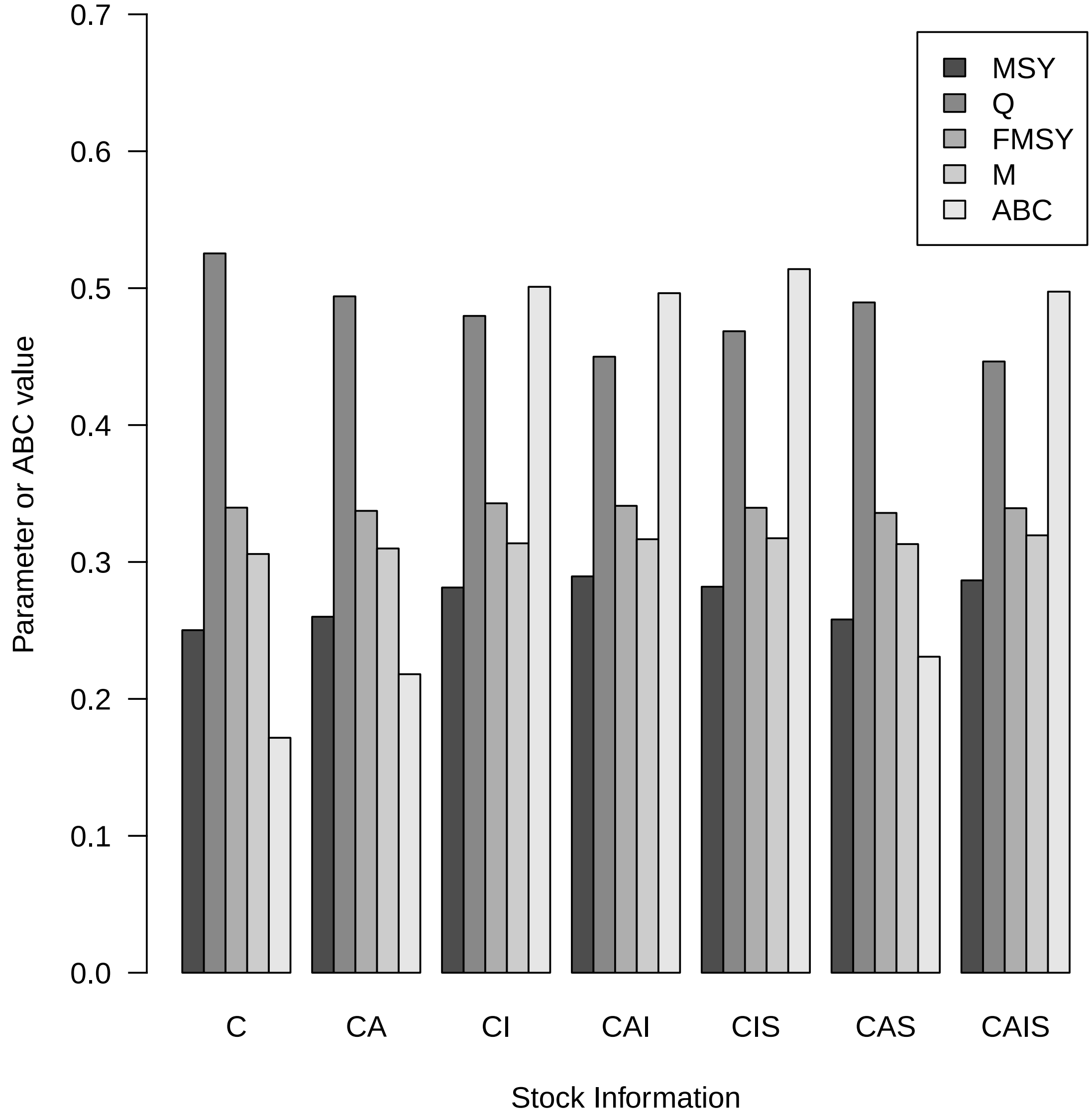


Figure 13: The impact of introducing the new 2009 data into the stock assessment model on estimates of C^* (million mt), F^* , M, survey catchability (Q) and ABC (million mt) values for 2010. Key: fishery **C**atch, fishery **A**ge comps, biomass **I**ndex, and **S**urvey age comps.

excluded from the assessment. The large changes in these scaling parameters (q and C^*) have profound affects on the estimates of 2010 ABC values (Figure 13).

3.3 Results from posterior integration

As reported in Martell et al. (2008), there is still insufficient trend information, and an apparent contradiction between the age-composition and trend information to reliably estimate overall population scale and productivity parameters (in this case C^* and F^* , and in previous assessments B_o and h). The relative abundance indices are relatively flat, with a slight downward trend between 1986 and 2000, an increase in 2003 followed by a decline through 2007, and most recently an increase from 879,000 mt in 2007 to 1,460,000 mt in 2009. There appears to be insufficient information to resolve parameter confounding between B_o and h, especially when age composition information is included in the analysis.

The marginal posterior density for F^* reflects the assumed prior information for F^* (Fig. 14). The median estimate for C^* is 0.304 million mt (Table 4), which is higher than the assumed prior median of 0.200 million mt and there appears to be some information in the data about the lower bound for C^* (Fig. 14). This information, however, is confounded with estimates of F^* and the instantaneous natural mortality rate (Table 5).

Median estimates of M=0.273 are also much higher than the assumed prior mean of 0.23 (Table 4). Information to estimate M comes from the age-composition information and is slightly positively correlated with the age at 50% vulnerability parameters ($\hat{a}$ and $\bar{a}$) in the selectivity curves. Note that if a dome-shaped selectivity curve was assumed, then estimates of M would likely decrease owing to the disappearance of older animals due to reduced selectivity. The median estimate of the age at 50% recruitment to the commercial gears is 3.6 years (Table 4). Also, note that survey selectivity parameter were fixed in this assessment. The median estimate of the variance ratio ρ is 0.219 (in comparison to 0.278 in last years assessment) and the inverse of the total variance φ^{-2} is 0.818 which corresponds to standard deviations of 0.265 and 0.954 for the observation errors and process errors, respectively (Table 4 and Table 6). There is a negative correlation between the inverse total error φ^{-2} and the proportion of observation error ρ. As values of ρ increases more of the total error is allocated to observation error in the surveys and the proportion of the process error remains relatively stable (i.e., information in the age-composition data are informative about process errors, Fig. 15).

Trends in the median estimates of vulnerable biomass and spawning stock biomass are exactly the same as the maximum likelihood estimates; however, in absolute terms the median estimates are slightly higher than the maximum likelihood estimates (Fig. 16a). Thus, uncertainty in biomass estimates is not normally distributed. In comparison to Helser and Martell (2007b), uncertainty is much greater in this assessment owing to the large amount of uncertainty admitted in the global scaling parameter (C^*) and productivity parameter (F^*). Although the survey catchability coefficient (q) is not directly comparable with the assumed values in Helser and Martell (2007b), the range of uncertainty in this assessment is much larger than the two options explored in previous assessments (Table 6).

Trends in historical recruitment are also comparable with Helser and Martell (2007b), and the median estimates are slightly higher than the maximum likelihood estimates (Fig. 17). The overall uncertainty in annual recruitment is also proportional to the overall uncertainty in the global scaling as well as uncertainty in the estimates of M. The largest cohorts in the past are the 1980, 1984, and 1999, and the 2005 cohort is estimated to be slightly below the long term mean historical recruitment but above the long-term median recruitment. There is a substantial amount of uncertainty in the estimates of age-1 recruits, and this uncertainty owes to the assumed uncer-

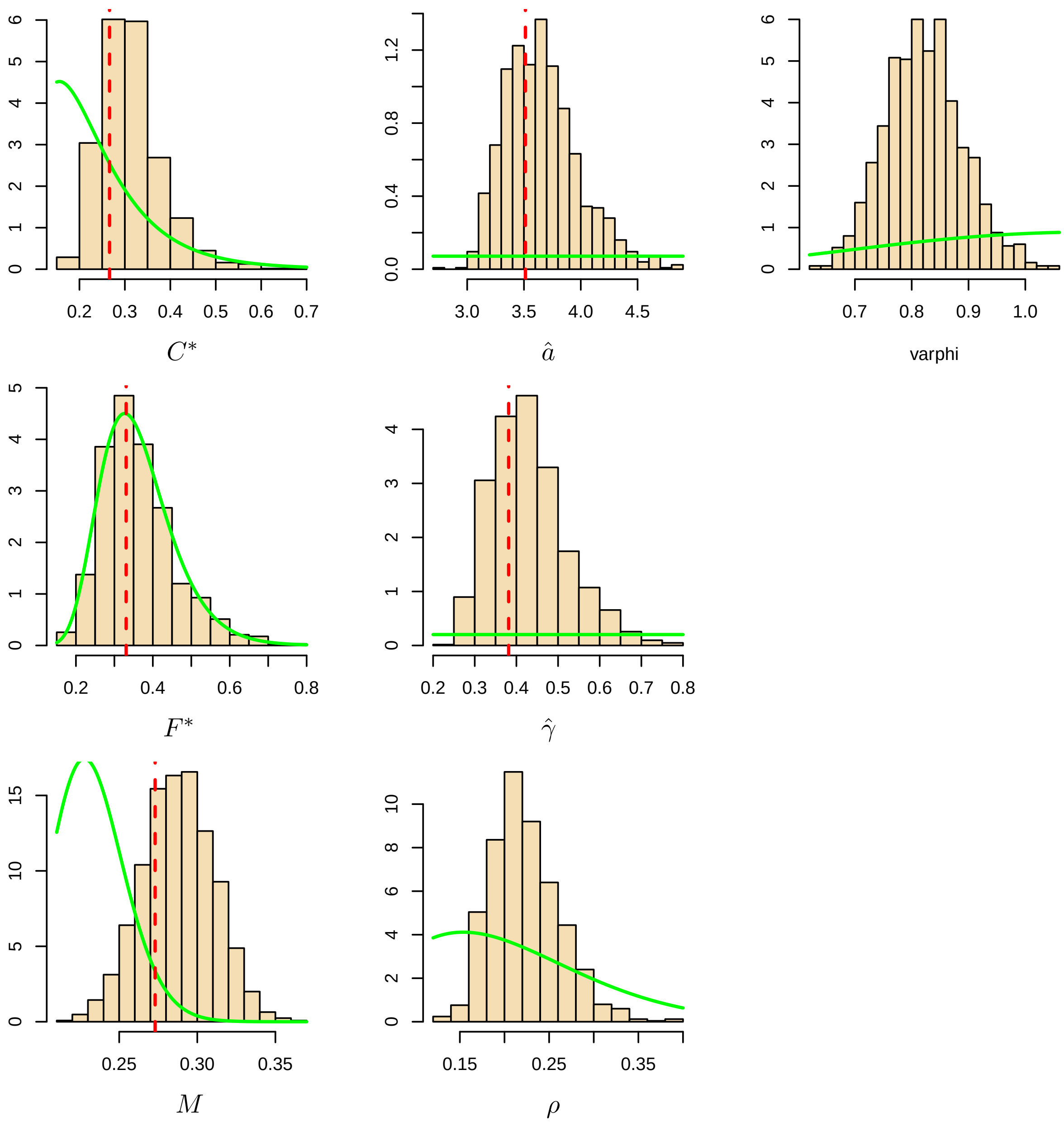


Figure 14: Marginal posterior (histograms) and prior distributions (lines) for key model parameters. Means and variances for the prior distributions are summarized in Table 1.

Table 4: Maximum likeliood estimates (MLE) of model parameters with asymptotic estimates of the standard deviation and median estimates with corresponding 2.5% and 97.5% quantiles from the marginal posterior distributions. Medians and quantiles are based on 5,000 samples from the joint posterior distribution.

	MLE		**Marginal densities**		
	Mean	Std	Median	2.5%	97.5%
C^*	0.266	0.049	0.304	0.209	0.480
F^*	0.331	0.083	0.349	0.216	0.587
M	0.273	0.022	0.287	0.244	0.334
$\hat{a}$	3.513	0.292	3.616	3.141	4.379
$\hat{\gamma}$	0.381	0.081	0.416	0.287	0.638
$\bar{a}$	0.216	0.037	2.000	2.000	2.000
$\bar{\gamma}$	0.882	0.074	0.450	0.450	0.450
ρ	−0.084	0.491	0.219	0.160	0.310
φ^{-2}	0.134	0.465	0.818	0.696	0.961

Table 5: Correlation among key model parameters based on 5,000 samples from the posterior distribution.

	C^*	F^*	M	$\hat{a}$	$\hat{\gamma}$	$\bar{a}$	$\bar{\gamma}$	ρ	φ^{-2}
C^*	1.000								
F^*	0.378	1.000							
M	0.535	−0.050	1.000						
$\hat{a}$	−0.274	0.014	0.151	1.000					
$\hat{\gamma}$	−0.270	0.002	0.060	0.956	1.000				
$\bar{a}$	0.014	−0.026	0.212	0.173	0.124	1.000			
$\bar{\gamma}$	−0.008	−0.042	−0.040	−0.012	−0.021	−0.030	1.000		
ρ	−0.222	−0.014	−0.195	0.078	0.089	−0.207	0.114	1.000	
φ^{-2}	−0.112	−0.015	−0.018	−0.039	−0.037	0.106	−0.085	−0.453	1

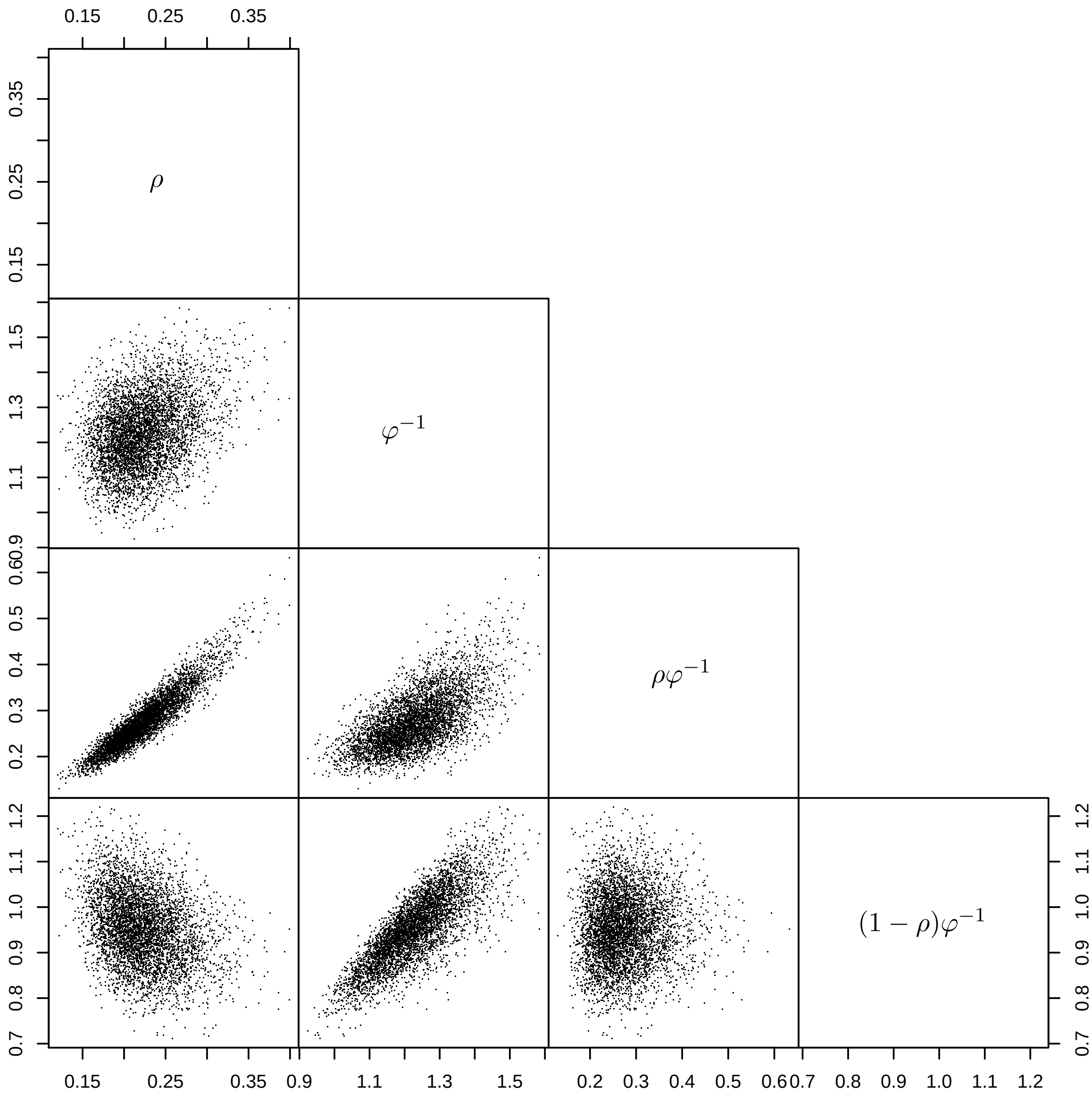
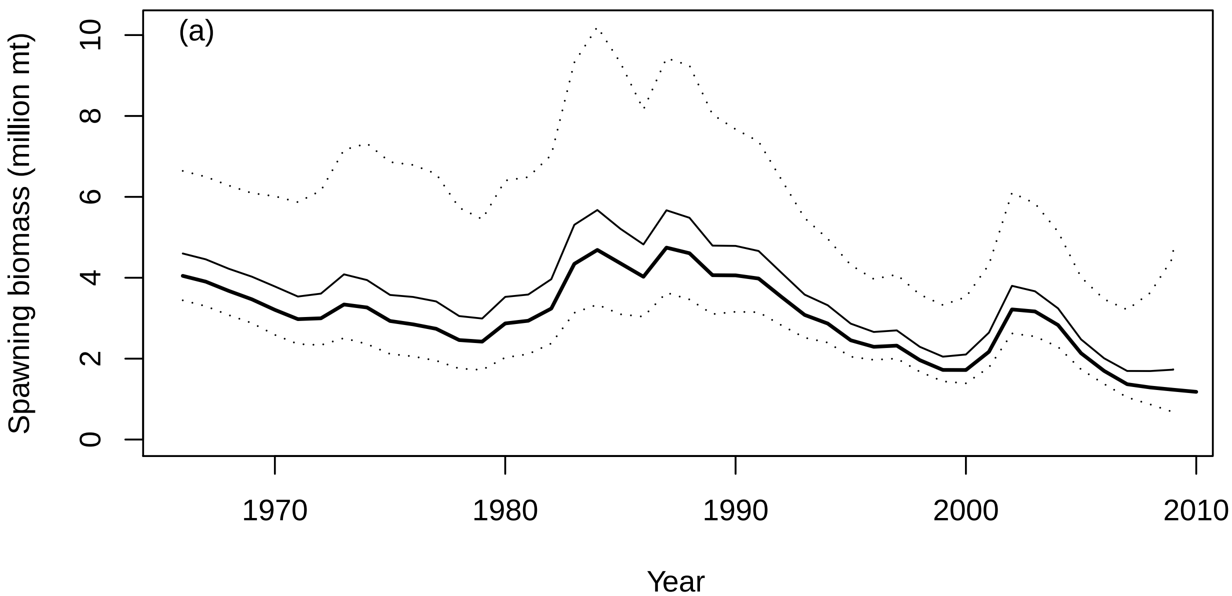


Figure 15: Pair plot of 5000 systematic samples from the joint posterior distribution of the variance components, where the standard deviation in observation and process errors is given by $\rho\varphi^{-1}$ and $(1-\rho)\varphi^{-1}$, respectively.



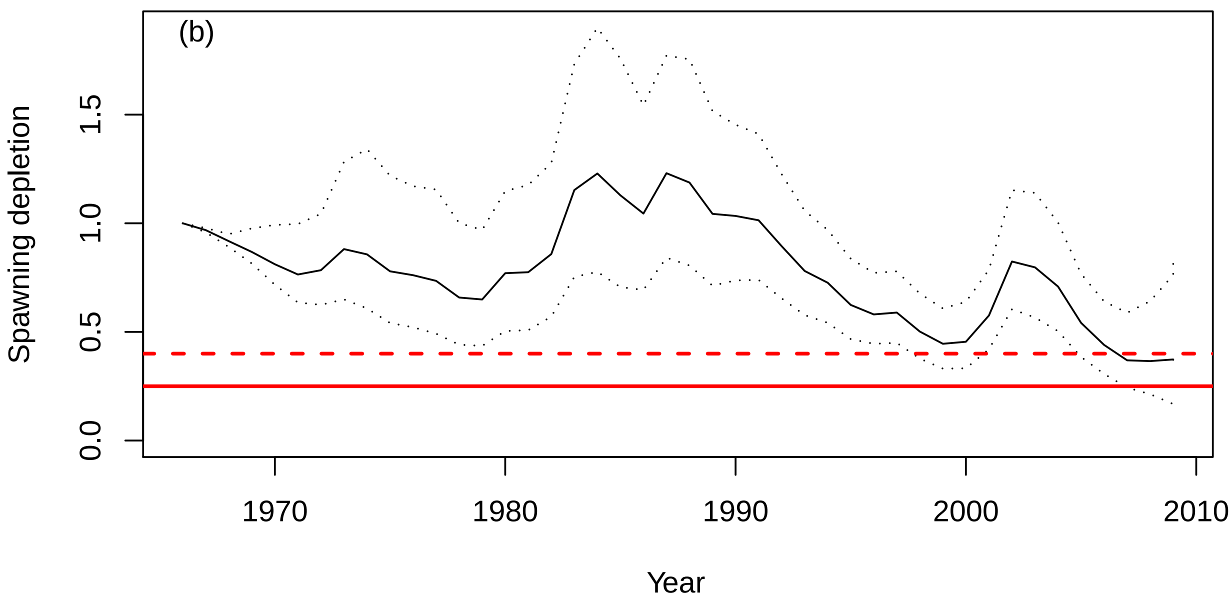


Figure 16: Maximum likelihood estimates (thick line) and median estimates (thin line) of the spawning stock biomass (a) and spawning stock depletion level with 40% and 25% horizontal reference lines (b). The dotted lines represent the 0.025 and 0.975 quantiles based on 5,000 systematic samples from the joint posterior distribution.

Table 6: Modal and median estimates of derived quantities of management interest. Medians and quantiles are based on 5,000 systematic samples from the joint positerior distribution, and the modal estimates correspond to the maximum likelihood estimates.

Derived quantity & Reference piont	Mode	Median	5%	95%
Survey catchability coefficient (q)	0.461	0.387	0.265	0.521
Steepness (h)	0.538	0.516	0.41	0.653
Spawning stock depletion (2010)	0.304	0.371	0.171	0.733
2010 ABC from 40/10 rule	0.22	0.333	0.035	0.906
Unfished total biomass (B_0)	5.015	5.725	4.335	8.11
Unfished 3+ biomass ($B_{0,3+}$)	4.218	4.805	3.725	6.627
Unfished spawning stock biomass (SB_0)	4.047	4.6	3.581	6.325
Unfished female spawning biomass	2.023	2.3	1.791	3.162
Spawning stock biomass at MSY (SB_{MSY})	1.361	1.579	1.137	2.297
Female spawning biomass at MSY	0.68	0.79	0.569	1.148
Spawning stock biomass in 2010 (million mt)	1.179	1.735	0.695	4.119
Female spawning stock biomass in 2010 (million mt)	0.59	0.867	0.348	2.06
Standard deviation in surveys (σ)	0.246	0.265	0.195	0.386
Standard deviation in process errors (τ)	0.889	0.949	0.825	1.082

tainty in the instantaneous natural mortality rate (M). In comparison to previous assessments the average long-term recruitment is higher; however, both the MLE and median estimates of M are substantially higher than the previously assumed value of 0.23.

The residual pattern from the acoustic abundance index was consistent across all 5,000 samples from the joint posterior distribution (Fig. 18). The 1989 and 2001 acoustic survey biomass estimates are roughly 50% below the predicted biomass. The greatest residual variation is in the 2007 biomass estimate, and this uncertainty is partly attributed to the uncertainty in recent recruitment. The median estimate of the survey catchability coefficient q was 0.387 with a 5% and 95% credible intervals of 0.265 and 0.521, respectively (Table 6). Note however, that this q is for the entire survey time series (excluding the 1986 and 2009) points and is shown here for comparative purposes with previous assessments that assumed a single q. The two separate q are not show here due to time constraints in assembling this document for the PFMC and the SSC briefing book.

The median estimate of the female spawning stock biomass in 2010 is 0.867 million mt (Table 6) and the modal estimate is 0.59 million mt. Less than 5% of 2009 spawning stock biomass it consists of the 1999 cohort (Fig. 19b) and as much as 70% of it consists of the smaller cohorts produced in 2004 and later. Absent any significant recruitment, the spawning stock biomass is expected to decline rapidly as the 1999 cohort continues to disappear.

Catch advice based on the 40:10 harvest control rule (ABC in 2010) and F^* as the target reference point is highly uncertain, ranging from 35,000 mt to 733,000 mt (5$^{\mathrm{th}}$th and 95$^{\mathrm{th}}$ percentiles, Table 6). The median estimate for the 40/10 rule is 333,000 mt and the modal estimate is 220,000 mt. The marginal posterior samples for the 2010 ABC based on the 40/10 adjustment is highly skewed with a long tail and reflects the huge amount of uncertainty in the 2010 vulnerable biomass estimate.

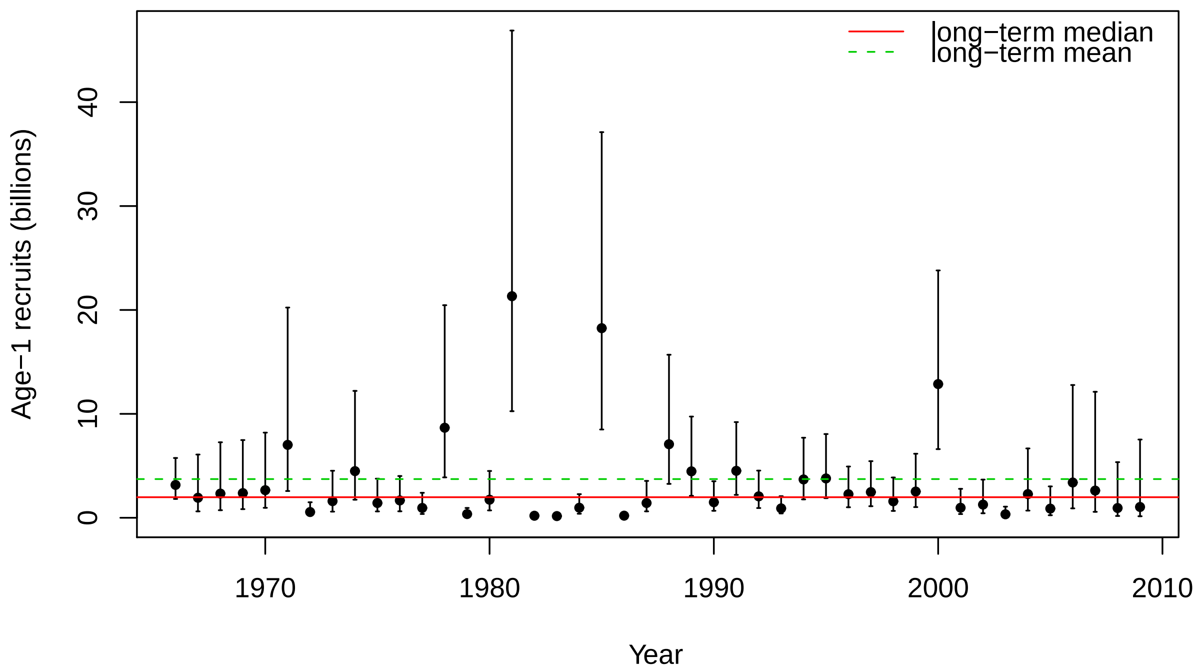


Figure 17: Median (circles) estimates of age-1 recruits, error bars represent the 0.025 and 0.975 quantiles based on 5,000 systematic samples from the joint posterior distribution. Long term average and median recruitment levels are shown as dashed and solid horizontal lines, respectively.

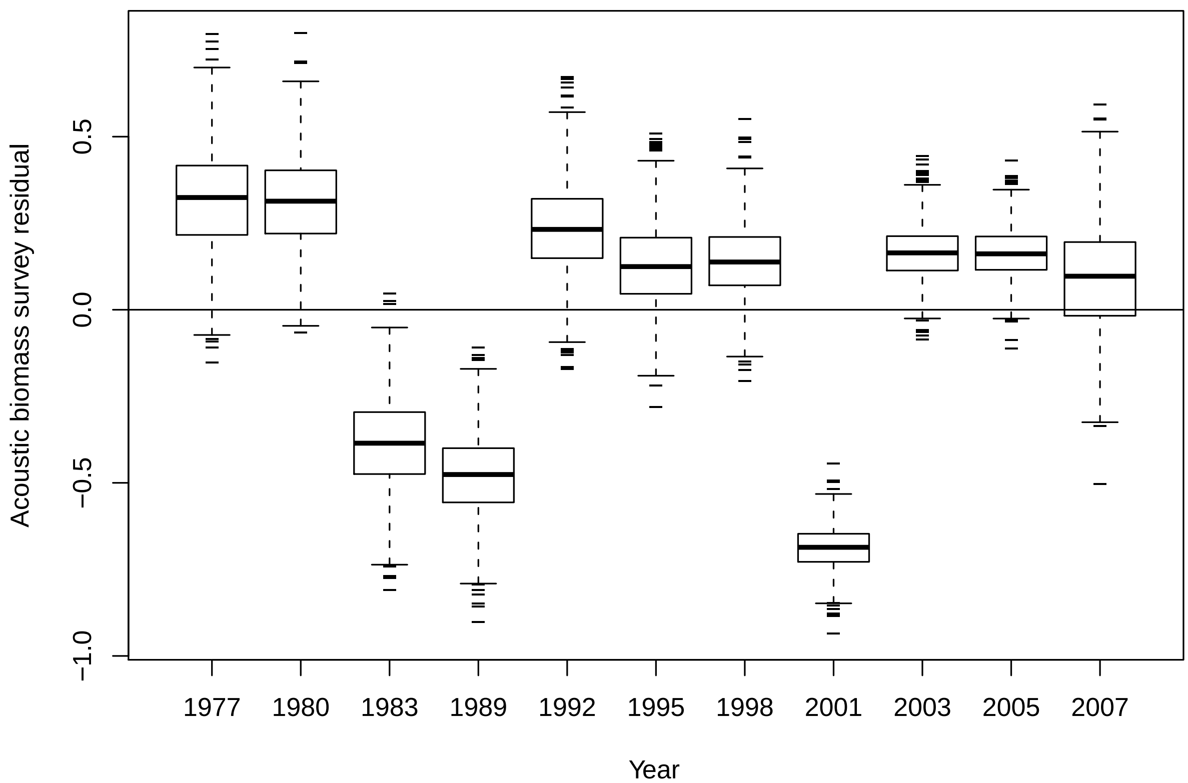


Figure 18: Boxplots of the marginal posteriors for the residuals in the acoustic survey.

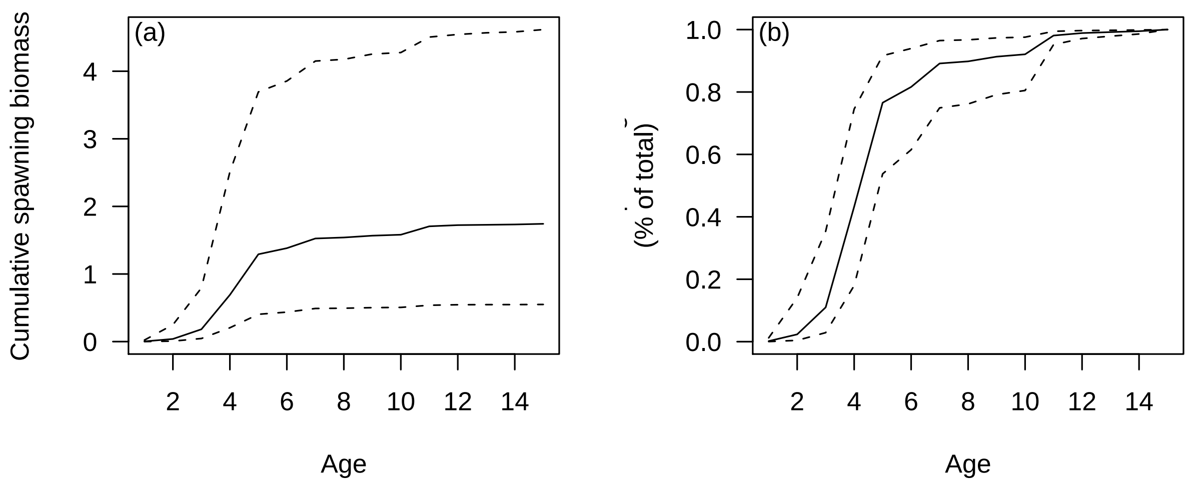


Figure 19: Cumulative spawning stock biomass at-age in 2009. Panel (a) is the cumulative total biomass where the solid line represents the median estimate, and the dashed lines represent the 0.025 and 0.975 quantiles. The cumulative spawning biomass-at-age relative to the total biomass is shown in panel (b).

3.4 Risk analysis

Five different criteria were examined in developing risk profiles for various catch options in 2009. The first criterion is the probability of the fishing mortality rate exceeding the estimated value of F^* (Fig. 20a). First, let 0.25, 0.5 and 0.75 probabilities represent definitions of risk averse, risk neutral, and risk prone, respectively. The preliminary risk averse ABC option for the 2010 fishing season based on exceeding the target fishing rate of F^* is 218,000 mt (Table 7). The preliminary risk neutral and risk prone ABC options are 344,000 and 470,000 mt, respectively. The second criterion is the probability of the spawning stock declining between 2010 and 2011 (Fig. 20b). Under this criterion the risk averse to risk prone ABC options are 0, 51,000 and 238,000 mt, respectively (Table 7 column 3). The third criterion examines the probability that the spawning stock biomass in 2011 will fall below the estimate of $\mathrm{SB}_{\mathrm{MSY}}$ (Fig 20c). Under this criterion the probability of the spawning stock falling below $\mathrm{SB}_{\mathrm{MSY}}$ is fairly high with no fishery (P$<$0.35); the risk neutral and risk prone policies call for ABCs of 262,000 and 792,000 mt (Table 7).

In summary, catch options in excess of 344,000 mt result in a fairly significant probability of overfishing (P $\geq$ 0.5), further declines in spawning stock biomass over present levels, and a significant probability of reducing the spawning stock biomass below $\mathrm{SB}_{\mathrm{MSY}}$ (P $\geq$ 0.6).

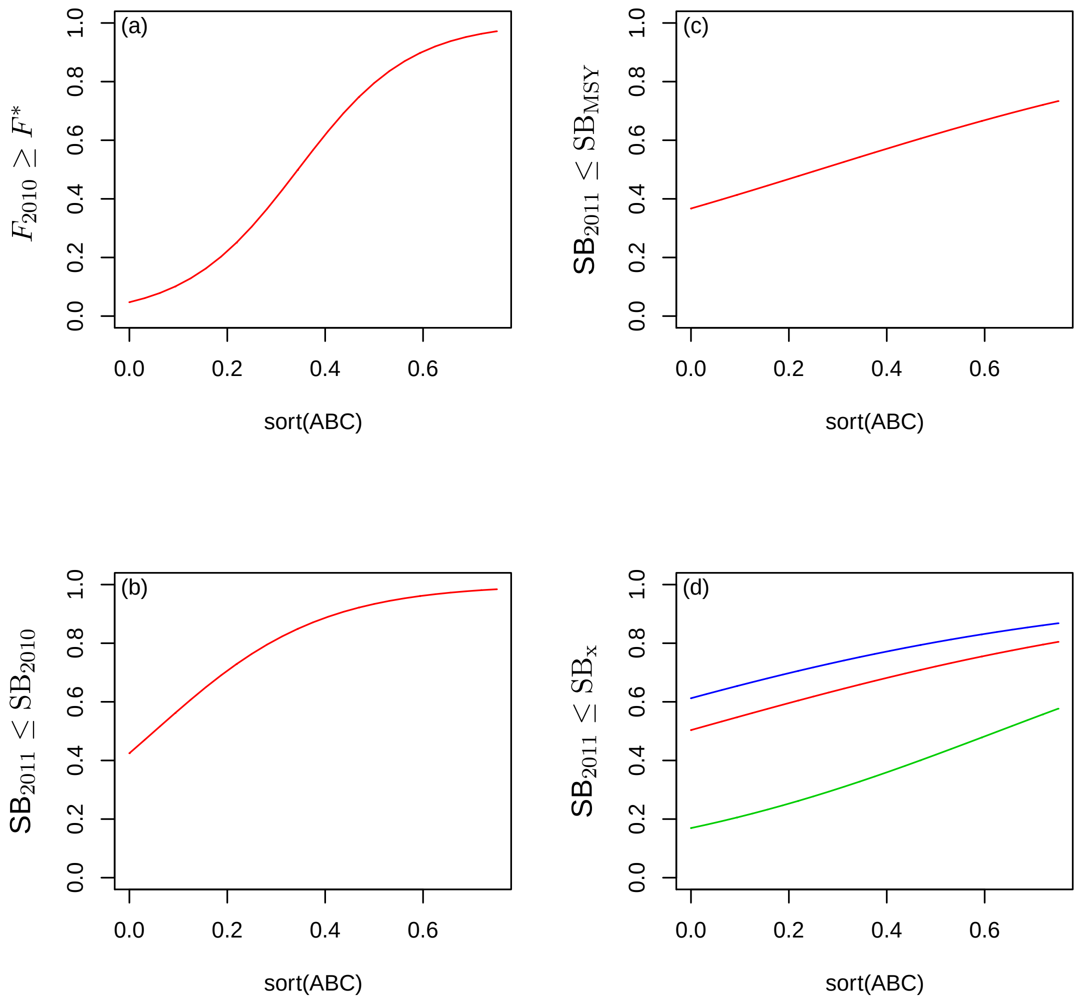


Figure 20: Probability of $F_{2010} > F^*$ (panel a) versus ABC option, (b) probability of a decline in spawning biomass ($\mathrm{SB}_{2010} < \mathrm{SB}_{2009}$) versus ABC option, (c) probability of the SB_{2010} falling below $\mathrm{SB}_{\mathrm{msy}}$, and (d) probability of SB_{2010} falling below SB_{25} (bottom line) or SB_{40} (middle line) and the probability of the SB_{2010} is below SB_{2000} (top line) which corresponds to the lowest biomass estimate in previous assessments.

3.5 Retrospective analysis

Retrospective analysis was conducted to examine the sensitivity of spawning biomass, fishing mortality rates and age-1 recruits to to the addition of new data (Figure 21). There is a slight retrospective bias in spawning stock biomass in years when data is excluded; there is a downward retrospective bias in spawning biomass. For example, as data are removed from estimates of

Table 7: Decision table for catch advice. The risk level represents the probability of exceeding a specified management target for a given ABC option. The interpretation of this table is as follows; if the management goal is not to exceed the target fishing mortality rate of F^* in 2009 with a 0.25 probability, then the ABC option should be set at 0.067 million mt or less. If the management target is prevent further decline in spawning stock biomass with a 0.5 probability then the ABC should be set at 0.111 million mt or less.

Risk level	$F_{2010} \geq F^*$	$SB_{2011} \leq SB_{2010}$	$SB_{2011} \leq SB_{MSY}$	$SB_{2011} \leq SB_{40}$	$SB_{2011} \leq SB_{25}$
0.05	0.007	0.000	0.000	0.000	0.000
0.10	0.092	0.000	0.000	0.000	0.000
0.15	0.145	0.000	0.000	0.000	0.000
0.20	0.185	0.000	0.000	0.000	0.081
0.25	0.218	0.000	0.000	0.000	0.194
0.30	0.247	0.000	0.000	0.000	0.294
0.35	0.273	0.000	0.000	0.000	0.384
0.40	0.298	0.000	0.067	0.000	0.468
0.45	0.321	0.017	0.166	0.000	0.549
0.50	0.344	0.051	0.262	0.000	0.628
0.55	0.367	0.085	0.359	0.100	0.707
0.60	0.391	0.120	0.458	0.209	0.788
0.65	0.415	0.156	0.561	0.324	0.873
0.70	0.442	0.195	0.671	0.446	0.963
0.75	0.470	0.238	0.792	0.581	1.062
0.80	0.504	0.286	0.930	0.735	1.176
0.85	0.543	0.345	1.098	0.921	1.313
0.90	0.597	0.424	1.321	1.169	1.496
0.95	0.682	0.550	1.681	1.569	1.791

spawning stock biomass in 2002 become smaller. As more data has accumulated the strength of the 1999 cohort continues to increase as indicated by the estimates of age-1 recruits in the year 2000 (Figure 21). Due to the fixed selectivity curve, it is possible that the strength of recent cohorts (e.g., 2005 cohort) could increase over time as these fish fully recruit to the fishing gear.

Including the 2009 data (not shown in Fig 21) has markedly increased estimates of overall population scale, and dramatically reduced estimates of historical fishing mortality rates (Figure 21). The 2005 cohort appears to be getting larger as this cohort recruits to the fishing gear.

Retrospective estimates of unfished spawning stock biomass SB_o and the parameters that defined the underlying production also show very little in the way of trends as data are sequentially removed from the analysis (Figure 22). Estimates of SB_o are relatively stable as data from 2000 and onward are included in the assessment, and estimates of M are also relatively stable. Steepness, which is a derived quantity in this assessment and a function of selectivity, has been relatively stable with slight increases based on the last 5 years of data. Overall, the retrospective analysis suggest that the underlying production function is relatively stable, and change in estimates of spawning stock biomass is due to retrospective changes in age-1 recruits.

3.6 Sensitivity to priors

The following sensitivity runs were done prior to the STAR panel meeting and have not been repeated due to time constraints to get this into the SSC and PFMC briefing book.

3.6.1 Prior for ρ

In the previous assessment of TINSS (Martell, 2008, 2009) a major influence on the estimates of unfished biomass in 1966 was the relative weighting of the age-composition data and the assumed variances in the recruitment deviations and observation errors. The assessment herein makes fewer subjective assumptions about how much weight to place on the age-composition data, and the catch advice is partially influenced by the assumed prior distribution on the variance ratio ρ that partitions the total error in to observation and process error components. The assumed beta prior for ρ has an expected value of 0.2 (i.e., 20% of the total error is observation error), and a standard deviation of 0.1. As the assumed proportion of observation errors increases the overall catch advice decreases (Table 8). Estimated rate parameters (e.g., M and F^*) are relatively insensitive to the assumed prior distribution for ρ; however M does decline slightly as more of the error is assumed to be observation error. The global scaling parameters (e.g., C^* and unfished spawning stock biomass) is somewhat sensitive to the assumed value of ρ; catch advice varies by less than 130,000 tons over a wide range of hypotheses about ρ.

3.6.2 Prior for F^*

I also examined the sensitivity of maximum likelihood estimates of the catch advice, based on the 40/10 adjustment, to alternative assumptions about the prior distribution for F^* (see Fig. 23). Increasing or decreasing the mean value for the F^* prior by 20% and maintaining the same standard deviation of the lognormal prior results in a ABC estimate that is roughly 75,000 mt higher or lower, respectively. Increasing the prior standard deviation from 0.262 to 0.5 results in a minor

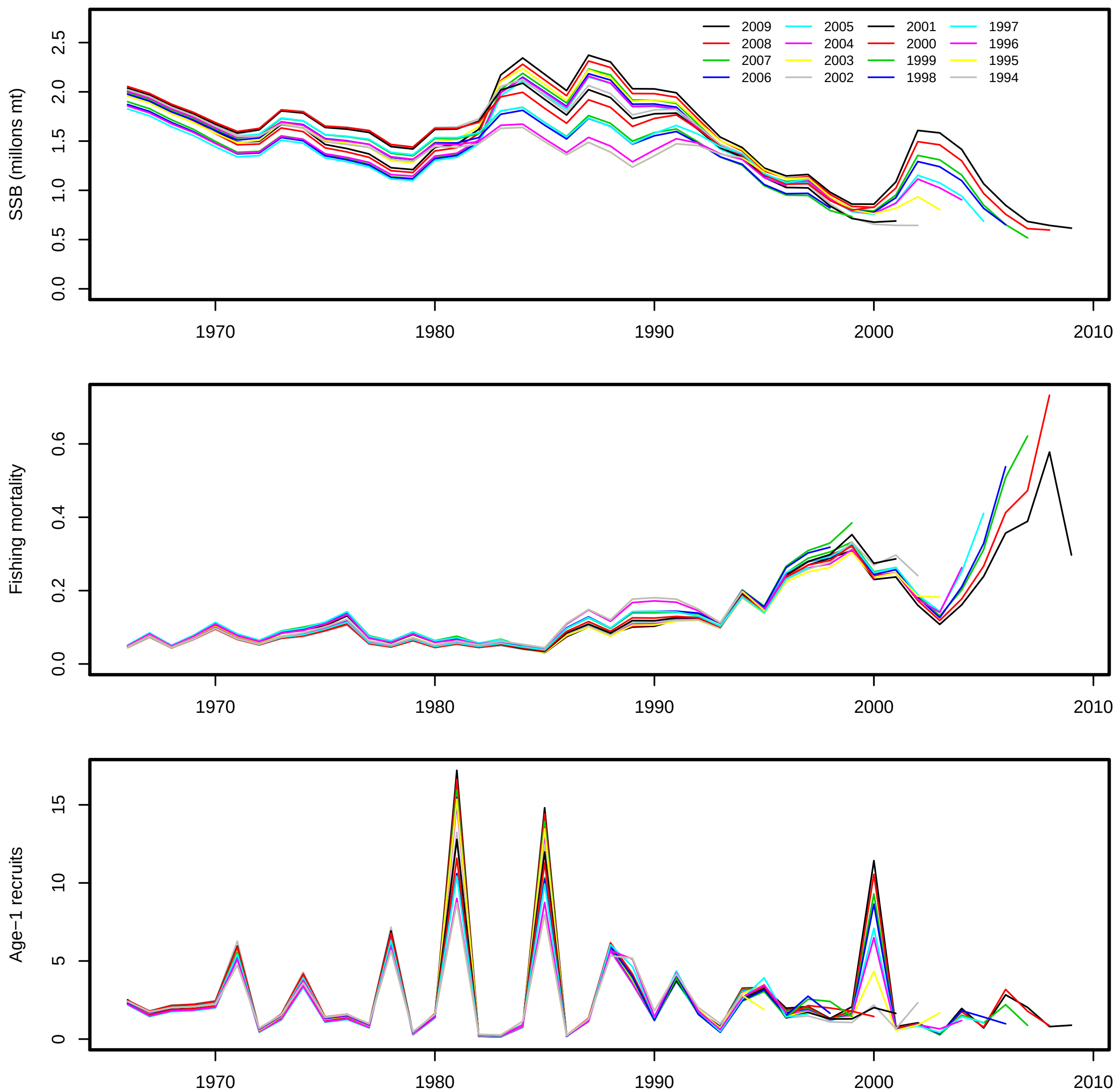


Figure 21: Retrospective maximum likelihood estimates of spawning stock biomass, instantaneous fishing mortality and age-1 recruits based on removal of data from 2009 to 1994.

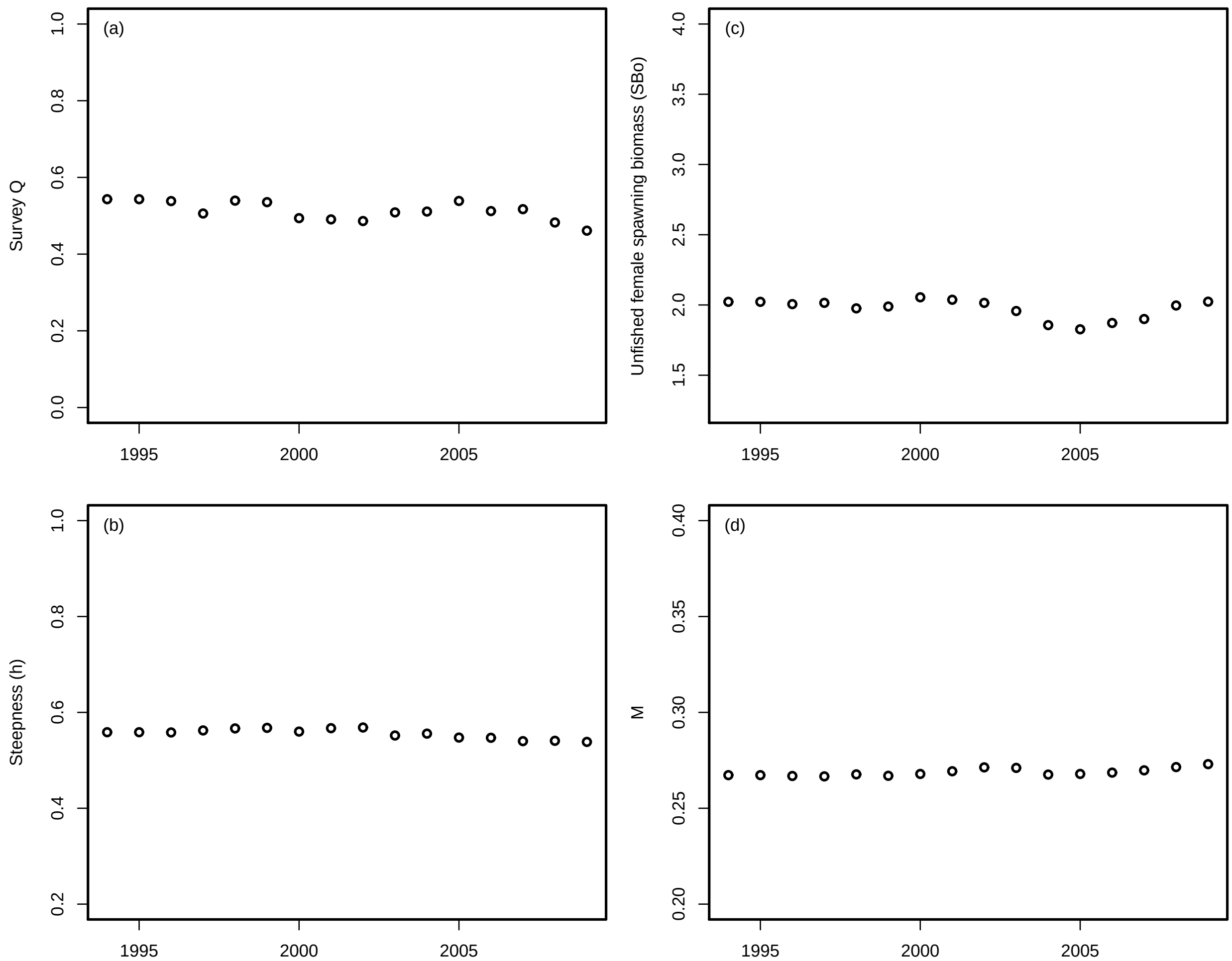


Figure 22: Retrospective maximum likelihood estimates of key parameters. Note that the y-axis for the unfished female spawning stock biomass spans the historical range of biomass estimates in 1966 from stock assessments dating back to 1991.

Table 8: Maximum likelihood estimates of unfished female spawning stock biomass (SB_o), C^*, instantaneous natural mortality rate (M) and Acceptable Biological Catch (ABC t) versus assumed expected value of ρ with a standard deviation equal to 0.1 in the prior distribution.

$E(\rho), \sigma_\rho = 0.1$	SB_o (million mt)	C^* (million mt)	M	40/10 ABC (mt)	ΔABC
0.1	2.373	0.289	0.320	509,017	11,571
0.2	2.354	0.287	0.319	497,446	-
0.3	2.297	0.278	0.317	462,812	(34,634)
0.4	2.221	0.267	0.315	416,559	(80,887)
0.5	2.145	0.256	0.312	370,110	(127,336)

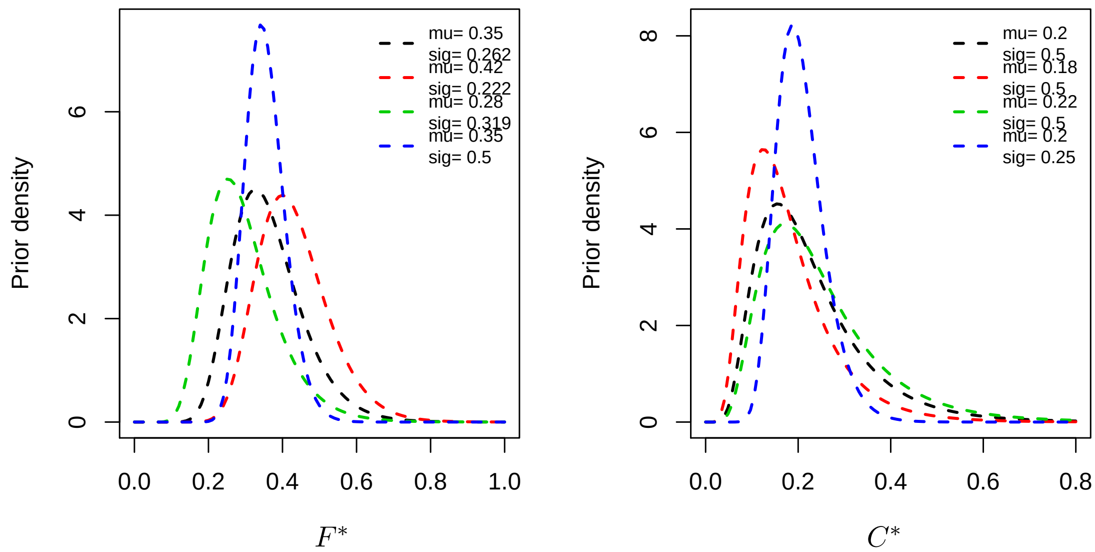


Figure 23: Alternative prior distributions for F^* and C^* in the sensitivity analysis presented in Tables 9 and 10. Note that the black distribution corresponds to the assumed distribution that was used to generate the catch advice.

Table 9: Sensitivity of catch advice (40/10 ABC in metric tons) to alternative prior distributions for F^* . Note the results here correspond to the MLE estimates.

Prior parameters						
μ	σ	C^* (million mt)	F^*	M	40/10 ABC(mt)	ΔABC
0.35	0.262	0.287	0.339	0.319	497,446	-
0.28	0.319	0.309	0.406	0.318	572,316	(74,870)
0.42	0.222	0.260	0.275	0.322	421,503	75,943
0.35	0.5	0.279	0.319	0.320	473,901	23,545

increase of 23,545 mt. Overall, the catch advice is fairly robust to the specified prior distribution for F^* (Table 9) in comparison to the influence of the 2009 biomass index on the 2010 ABC values.

3.6.3 Prior for C^*

Catch advice was slightly sensitive to the assumed mode of the prior distribution for C^* . As the mode of the prior distribution for C^* was decreased by 20% from 208,000 metric tons to 167,000 metric tons, the 2010 catch advice (maximum likelihood estimate of ABC based on the 40/10 rule) decreased from 497,446 tons to 466,642 tons (roughly and 6.2% decease in ABC). As the mode of the prior for C^* was increased by 20% to 250,000 metric tons, the catch advice increased by 26,749 metric tons (roughly a 5.3% increase in ABC, Table 10). Maximum likelihood estimates of C^* were also sensitive to the mode of the prior distribution, but estimates of F^* and M were relatively insensitive.

Table 10: Sensitivity of catch advice (40/10 ABC in metric tons) to alternative prior distributions for C^* . Results correspond to the maximum likelihood estimates.

Prior parameters							
mode	μ	σ	C^* (million mt)	F^*	M	ABC	ΔABC
0.208	0.268	0.5	0.287	0.339	0.319	497,446	-
0.167	0.214	0.5	0.275	0.331	0.318	466,642	(30,804)
0.250	0.322	0.5	0.296	0.346	0.321	524,195	26,749
0.208	0.365	0.75	0.297	0.347	0.321	525,787	28,341

3.6.4 Prior for M

Management advice and the global scaling are extremely sensitive to the assumed prior value for the instantaneous natural mortality rate. There is a fairly strong positive correlation between M and C^* and virtually no correlation between M and F^* (Table 5). As the mean of the prior for M increases, the overall scaling of the population increases along with the catch advice. For example changing the mean of the prior for M from 0.23 to 0.28 results in an increase in C^* from 287,000 mt to 327, mt. The catch advice for 2010 increases from 220,276 mt to 607,032 mt. Reducing the standard deviation for the prior on M from 0.1 to 0.05 results in a overall reduction in C^* from 287,000 to 229,000 mt, and the catch advice based on the 40/10 adjustment is 320,788 mt and spawning biomass depletion in 2010 is estimated at 42%.

4 Discussion

Uncertainty in previous assessments of Pacific hake was under-represented due to the use of assumed fixed values for the steepness of the stock recruitment relationship and survey catchability coefficients. This assessment attempts to integrate over this uncertainty by using less informative prior information for these key parameters. The relative abundance indices alone lack sufficient information to resolve confounding between the global scaling and stock productivity (see appendix C for more discussion on this subject). Addition of the age-composition information further confounds this problem because there appears to be some conflict between expected trends in abundance due to the exceptional 1980 and 1984 cohorts and the downward trend in abundance between the 1986 and 1989 survey points. Helser et al. (2008) also reported similar contradictions in the age composition information between the US and Canadian fishery as well as the fisheries independent survey. Previous assessments have omitted the 1986 survey due to pre- and post-survey calibration problems. However, it appears that the 1986 survey point is consistent with trends inferred from the age-composition data, but the 1989 survey point is inconsistent with these trends. Also, the 2001 survey points is considerably low relative to estimated trends in abundance.

In the previous assessment by Martell (2008), the catch advice was extremely sensitive to the relative weighting of the age-composition information. Minor changes in the assumed effective sample size (e.g., from 10 to 33) resulted in a near doubling of the catch advice (e.g., 142,000 mt to 305,000 mt). In this assessment, I've attempted to remove this subjectivity by using a less informative likelihood for the age-composition data, where the conditional maximum likelihoods of the variance terms are used to weight the age-composition information (see Schnute and Richards, 1995, for more details on this method). The standard procedure of using the mulitinomial distribution and iterative re-weighting procedures (as described in MCALLISTER and IANELLI, 1997) for weighting age-composition fails in cases where there is complete contradictions in 2 or more independent sets of proportion-at-age data. When independent sets of age-composition information are contradictory, the iterative re-weighting procedure fails to converge to an effective sample size.

It is clear that there have been changes in selectivities over time for the commercial gears in the two different countries. Evidence for this is not hard to find; for example, interannual variation in northward migration has profound effects of selectivity, age-specific estimates of F continue to increase for strong cohorts in the VPA models (Sinclair and Grandin, 2008). Treating the selectivity curves as constant over time (whether or not a logistic or dome-shaped selectivity curve is assumed) will obviously affect estimates of relative cohort strengths. Under the mulitinomial likelihood of last years assessment, down weighting the age-composition data was necessary to reduce the amount of retrospective bias, but this down weighting was completely subjective. The multivariate logistic model is much more robust to weighting problems as this likelihood kernel can be evaluated at its conditional maximum likelihood estimate of the variance; this is also known as a concentrated likelihood (Harvey, 1990).

Perhaps the most controversial issue this year is the acoustic biomass survey index. There are some indications that this index is bias upwards due to the vast amounts of humboldt squid present off the west coast. At this time this draft was prepared, there has been an significant increase in the upward scaling of the absolute biomass estimates over last years assessment. Removing the 2009 biomass index has profound affects on the 2010 catch advice. Using all the available data including the age-composition information from both the commercial fisheries and the acoustic biomass survey, but ignoring the 2009 survey biomass index results in more than a 50% reduction in the catch advice for the 2010 fishery. At the time of preparing this manuscript (February 15, 2010), I have chosen to weight the 2009 survey data equally as all other survey years and expect that the STAR panel review will ask for additional runs with alternative weighting schemes for the 2009 (or other survey years) fishery.

Acknowledgments

I thank Owen Hamel, Ian Stewart, and Chris Grandin for providing and updating the data for the 2008 fishery. I'm also grateful to Barry Akerman, Greg Workman and Robyn Forrest for discussions about recent data, modeling and this years fishery. Also, congratulations to Shannon Mann, your baby girl is beautiful!

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A Input data

Table 11: Combined historical landings (mt) for the U.S. and Can. fisheries, mean age of the catch, and survey abundance indices (millions mt) from the acoustic-trawl survey.

Year	C_t	$\bar{a}$	I_t	Year	C_t	$\bar{a}$	I_t
1966	137700			1988	248804	7.22	
1967	214375			1989	305916	6.97	1.238
1968	122180			1990	259792	6.90	
1969	180131			1991	307258	6.72	
1970	234584			1992	296910	7.51	2.169
1971	154612			1993	199435	6.82	
1972	117546			1994	361529	7.84	
1973	162639			1995	249770	8.24	1.385
1974	211259			1996	306075	7.01	
1975	221360			1997	325215	6.05	
1976	237521			1998	320619	5.30	1.185
1977	132693	6.82	1.915	1999	311855	5.36	
1978	103639	7.11		2000	230820	6.50	
1979	137115	6.84		2001	235962	5.47	0.737
1980	89936	7.03	2.115	2002	182911	4.91	
1981	139121	6.67		2003	205582	4.94	1.840
1982	107734	6.53		2004	334672	5.40	
1983	113924	6.13	1.647	2005	359661	6.18	1.265
1984	138441	5.76		2006	360683	6.51	
1985	110401	5.84		2007	297098	6.48	0.879
1986	210617	6.55	2.857	2008	321546	5.91	
1987	234147	6.35		2009	176671	5.93	1.460

Table 12: Age-composition (reported in percentages) of the combined U.S. and Can. commercial catch from 1977-2009. Age-15 represents a plus group.

Year	age.2	age.3	age.4	age.5	age.6	age.7	age.8	age.9	age.10	age.11	age.12	age.13	age.14	age.15
1977	9.11	3.93	20.86	2.85	5.32	21.12	7.83	7.99	6.36	5.85	4.38	2.96	0.76	0.68
1978	2.30	10.19	6.86	19.91	3.34	7.20	20.84	8.46	7.22	7.30	2.47	2.10	1.31	0.50
1979	4.95	8.96	10.03	4.66	19.19	7.12	15.98	15.84	5.64	3.77	1.62	1.03	0.65	0.58
1980	0.93	25.46	4.21	5.43	5.05	14.38	6.52	8.78	16.95	4.61	3.76	2.31	0.89	0.71
1981	9.12	6.28	28.09	1.29	4.54	4.76	14.88	6.27	6.64	12.60	3.12	1.24	0.97	0.21
1982	18.14	2.59	1.70	31.90	3.26	4.57	4.51	13.10	2.74	3.39	11.96	1.10	0.69	0.36
1983	0.03	32.74	3.04	2.18	31.89	3.45	3.75	4.44	9.53	2.43	1.79	3.77	0.73	0.24
1984	0.00	1.04	54.65	3.54	7.23	18.51	2.38	2.08	1.43	4.53	0.95	0.79	2.44	0.41
1985	0.68	0.63	6.52	60.70	7.04	5.81	13.24	1.16	0.69	0.71	1.35	0.28	0.00	1.19
1986	11.16	3.12	0.78	3.41	48.53	5.80	4.40	12.21	2.29	2.66	1.45	2.66	0.44	1.10
1987	0.00	26.47	1.63	0.39	1.79	54.09	3.23	1.66	8.07	0.39	0.18	0.55	0.98	0.57
1988	0.29	0.29	32.55	1.21	0.70	1.08	46.47	2.13	0.99	10.17	0.19	0.42	0.13	3.38
1989	2.68	2.25	0.96	45.23	1.03	0.46	0.61	39.46	1.53	0.68	4.45	0.09	0.12	0.46
1990	4.86	25.56	2.41	0.23	25.11	0.66	0.17	0.10	32.39	0.39	0.02	7.24	0.01	0.85
1991	3.48	17.69	16.94	2.71	0.73	31.67	1.21	0.13	0.13	20.61	0.39	0.00	3.68	0.64
1992	3.52	4.42	12.66	17.77	2.18	0.75	34.46	0.62	0.13	0.39	19.89	0.50	0.04	2.67
1993	0.73	21.97	3.21	14.16	16.97	1.43	0.75	28.77	0.81	0.11	0.04	10.46	0.05	0.55
1994	0.04	3.38	19.46	1.38	12.18	20.01	1.31	0.48	30.70	0.24	0.41	0.03	9.61	0.77
1995	1.52	0.17	6.78	24.76	1.20	7.60	20.45	1.77	0.31	25.92	0.24	0.38	0.00	8.91
1996	15.52	11.98	0.80	9.26	18.30	1.14	6.30	11.76	0.72	0.48	19.21	0.02	0.12	4.41
1997	0.33	29.28	22.56	1.51	7.69	13.79	2.35	3.83	7.34	1.56	0.18	6.38	0.88	2.32
1998	7.90	20.98	17.64	25.66	2.67	5.13	9.25	0.97	1.73	3.90	0.43	0.11	3.06	0.57
1999	8.16	21.17	18.10	19.68	12.13	2.45	4.37	4.59	0.97	1.61	2.67	0.67	0.71	2.72
2000	3.12	8.78	14.15	14.58	20.90	11.70	7.92	5.87	2.01	2.07	2.56	1.49	1.09	3.76
2001	10.19	16.17	14.72	18.01	10.02	13.87	6.83	1.82	1.96	2.05	1.19	1.10	0.92	1.16
2002	0.04	43.73	15.85	11.58	6.38	5.11	8.00	4.47	1.00	0.86	1.22	0.17	0.48	1.12
2003	0.06	0.99	66.26	13.19	3.41	5.51	3.03	3.42	1.93	0.98	0.30	0.53	0.11	0.28
2004	0.04	5.69	7.80	64.99	8.64	2.40	3.94	2.90	1.32	1.27	0.33	0.30	0.17	0.22
2005	0.87	0.48	7.04	5.50	68.40	8.41	2.18	2.84	1.98	1.04	0.81	0.26	0.04	0.15
2006	1.60	10.93	1.61	8.60	4.73	60.66	5.06	1.79	1.97	1.24	0.93	0.47	0.15	0.25
2007	13.53	3.06	14.55	1.56	7.07	4.19	44.18	5.91	1.84	1.86	1.23	0.43	0.46	0.15
2008	8.64	30.77	2.32	13.43	0.94	3.55	3.33	30.52	3.21	1.09	0.89	0.54	0.33	0.44
2009	0.72	20.12	29.83	4.45	14.07	1.42	2.60	2.21	19.35	3.62	0.50	0.43	0.39	0.30

Table 13: Age-composition (percent) from acoustic surveys from 1977-2009. Note that age-15 represents a plus group. Proportions-at-age were constructed by multiplying the conditional age-length data by the length frequencies and collapsing over each size interval.

Year	age.2	age.3	age.4	age.5	age.6	age.7	age.8	age.9	age.10	age.11	age.12	age.13	age.14	age.15
1977	5.31	4.41	23.03	2.71	4.68	39.08	7.21	5.10	3.84	2.45	1.35	0.55	0.17	0.11
1980	0.16	27.80	2.84	5.60	4.84	23.14	6.23	16.63	6.84	3.84	0.92	0.78	0.18	0.20
1983	0.36	64.90	1.50	1.25	20.05	1.75	2.17	1.92	3.25	1.15	0.87	0.70	0.14	0.00
1986	40.10	1.29	0.54	2.28	41.70	4.55	2.85	5.02	0.52	0.49	0.13	0.43	0.06	0.02
1989	7.25	2.35	0.79	56.08	1.15	0.67	0.94	27.39	1.18	0.16	1.87	0.00	0.00	0.17
1992	10.21	1.73	9.12	19.69	2.37	0.86	38.46	1.29	0.67	0.34	13.89	0.67	0.00	0.71
1995	33.02	4.07	1.25	20.71	1.08	3.73	14.85	0.31	0.00	15.78	0.04	0.72	0.00	4.46
1998	13.50	19.82	15.12	18.89	1.54	4.37	10.21	1.64	0.94	6.31	0.14	0.55	5.08	1.89
2001	69.78	10.41	5.79	5.42	2.57	2.49	1.52	0.50	0.52	0.34	0.21	0.20	0.05	0.21
2003	3.01	2.53	64.05	10.95	2.75	6.01	3.96	2.20	2.23	0.73	0.43	0.44	0.31	0.42
2005	21.57	2.27	7.24	5.30	50.03	5.49	1.86	2.61	1.48	1.17	0.49	0.27	0.04	0.19
2007	35.45	2.39	10.19	1.19	4.57	3.01	33.88	3.62	1.74	1.71	0.92	0.80	0.37	0.17
2009	0.33	31.36	45.45	1.90	7.10	0.59	1.10	1.47	7.85	1.73	0.53	0.31	0.27	0.02

Table 14: Assumed mean weights-at-age in the commercial catch.

Year	age 2	age 3	age 4	age 5	age 6	age 7	age 8	age 9	age 10	age 11	age 12	age 13	age 14	age 15
1966	0.258	0.428	0.527	0.606	0.681	0.762	0.837	0.935	0.988	1.079	1.155	1.213	1.269	1.590
1967	0.258	0.428	0.527	0.606	0.681	0.762	0.837	0.935	0.988	1.079	1.155	1.213	1.269	1.590
1968	0.258	0.428	0.527	0.606	0.681	0.762	0.837	0.935	0.988	1.079	1.155	1.213	1.269	1.590
1969	0.258	0.429	0.527	0.606	0.681	0.762	0.837	0.935	0.988	1.079	1.154	1.212	1.268	1.591
1970	0.256	0.428	0.527	0.606	0.680	0.763	0.837	0.935	0.989	1.079	1.155	1.213	1.269	1.589
1971	0.261	0.428	0.527	0.606	0.682	0.762	0.838	0.936	0.988	1.079	1.156	1.213	1.269	1.591
1972	0.256	0.431	0.527	0.606	0.680	0.761	0.837	0.935	0.987	1.077	1.153	1.211	1.267	1.592
1973	0.251	0.423	0.526	0.606	0.680	0.765	0.836	0.935	0.991	1.081	1.155	1.214	1.270	1.582
1974	0.277	0.431	0.528	0.606	0.685	0.760	0.840	0.937	0.987	1.079	1.159	1.215	1.271	1.600
1975	0.241	0.438	0.527	0.604	0.676	0.759	0.833	0.932	0.983	1.073	1.145	1.204	1.261	1.593
1976	0.235	0.400	0.524	0.608	0.679	0.775	0.835	0.936	1.002	1.093	1.162	1.223	1.277	1.554
1977	0.354	0.454	0.533	0.605	0.700	0.748	0.853	0.944	0.974	1.070	1.168	1.218	1.274	1.653
1978	0.135	0.460	0.523	0.600	0.649	0.754	0.812	0.915	0.973	1.054	1.106	1.169	1.231	1.573
1979	0.217	0.287	0.515	0.619	0.686	0.822	0.841	0.951	1.060	1.154	1.211	1.282	1.327	1.435
1980	0.279	0.407	0.487	0.624	0.684	0.796	0.850	0.877	1.010	1.066	1.184	1.163	1.233	1.196
1981	0.123	0.328	0.491	0.619	0.725	0.776	0.816	0.864	0.884	1.043	1.189	1.245	1.213	1.385
1982	0.235	0.389	0.503	0.604	0.688	0.838	0.873	0.907	0.934	1.029	1.049	1.132	1.209	1.095
1983	0.264	0.355	0.428	0.563	0.631	0.742	0.827	0.854	0.883	0.969	0.994	0.941	1.155	1.095
1984	0.215	0.393	0.429	0.531	0.670	0.699	0.796	0.873	0.894	0.953	1.104	0.965	1.008	1.100
1985	0.181	0.316	0.455	0.526	0.639	0.740	0.813	0.979	0.914	1.020	1.035	1.155	1.074	1.067
1986	0.273	0.314	0.426	0.537	0.562	0.633	0.724	0.821	0.921	0.992	0.989	1.102	1.048	1.086
1987	0.232	0.374	0.422	0.499	0.629	0.626	0.683	0.746	0.799	0.903	0.895	1.023	0.950	1.049
1988	0.264	0.358	0.443	0.461	0.598	0.591	0.628	0.687	0.775	0.809	0.896	0.998	0.993	1.026
1989	0.226	0.317	0.367	0.502	0.531	0.617	0.656	0.670	0.717	0.790	0.896	0.860	1.052	1.030
1990	0.272	0.379	0.443	0.532	0.568	0.617	0.604	0.604	0.701	0.749	0.822	0.880	1.002	1.052
1991	0.229	0.341	0.449	0.543	0.554	0.641	0.716	0.599	0.885	0.728	0.724	0.854	0.952	1.060
1992	0.248	0.338	0.458	0.525	0.582	0.598	0.638	0.638	0.612	0.679	0.698	0.851	0.716	0.932
1993	0.263	0.343	0.426	0.502	0.560	0.593	0.547	0.638	0.645	0.704	0.931	0.679	0.798	0.756
1994	0.335	0.344	0.424	0.510	0.552	0.608	0.694	0.620	0.689	0.636	0.739	0.812	0.725	0.794
1995	0.114	0.515	0.484	0.511	0.626	0.623	0.679	0.706	0.713	0.724	0.662	0.892	0.711	0.772
1996	0.271	0.379	0.462	0.547	0.565	0.628	0.621	0.663	0.712	0.736	0.705	0.553	1.092	0.724
1997	0.328	0.409	0.472	0.519	0.615	0.620	0.601	0.692	0.665	0.741	0.732	0.743	0.696	0.813
1998	0.234	0.350	0.458	0.497	0.518	0.587	0.598	0.619	0.637	0.651	0.776	0.638	0.735	0.734
1999	0.243	0.318	0.417	0.538	0.554	0.578	0.625	0.661	0.672	0.748	0.727	0.746	0.661	0.786
2000	0.282	0.424	0.496	0.564	0.647	0.677	0.658	0.740	0.719	0.818	0.746	0.835	0.786	0.820
2001	0.289	0.454	0.599	0.608	0.681	0.778	0.780	0.806	0.854	0.832	0.831	0.901	0.863	0.962
2002	0.310	0.413	0.558	0.752	0.702	0.812	0.916	0.885	0.885	0.927	0.893	1.064	1.002	1.100
2003	0.304	0.380	0.469	0.573	0.664	0.659	0.679	0.732	0.709	0.766	0.752	0.709	0.827	0.941
2004	0.241	0.419	0.489	0.550	0.626	0.709	0.691	0.713	0.758	0.765	0.742	0.880	0.928	0.836
2005	0.333	0.426	0.497	0.550	0.573	0.611	0.647	0.693	0.679	0.728	0.721	0.804	0.629	0.761
2006	0.251	0.418	0.497	0.552	0.584	0.607	0.646	0.786	0.745	0.798	0.838	0.868	0.802	0.805
2007	0.241	0.408	0.512	0.580	0.618	0.639	0.641	0.697	0.779	0.743	0.776	0.796	0.805	0.863
2008	0.211	0.366	0.516	0.592	0.646	0.672	0.692	0.719	0.759	0.842	0.802	0.795	0.800	0.789
2009	0.211	0.366	0.516	0.592	0.646	0.672	0.692	0.719	0.759	0.842	0.802	0.795	0.800	0.789

B Model description and documentation

The stock assessment model used herein consists of 4 major components: 1) a component for initializing the model based on steady-state conditions, 2) a component for updating the state variables, 3) a component that relates the state variables to observations on relative abundance and composition information, and 4) a statistical criterion for evaluating how likely these data are for a given set of model parameters. We have broken the description of the assessment model into these four components and use a series of tables to document model equations. Symbols and their definitions are defined in Table 15; furthermore, we have divided the estimated parameter set into life-history parameters Φ and population parameters Θ for clarity.

I have adopted a management oriented approach tho the parameterization of the age-structured model where the leading parameters that define population scale and productivity correspond to MSY (hereafter C^*) and Fmsy (hereafter F^*). The basic idea here is to change the question to how likely are the data given C^* and F^* and derive the corresponding B_o and slope of the stock recruitment relationship rather than the traditional approach of estimating these values directly. There are a few statistical advantages of using this approach (i.e., reduced confounding between the leading parameters Schnute and Richards, 1998), but perhaps the biggest advantage is to increase the transparency by which the application of informative priors influence model results (Martell et al., 2008).

Table 15: Description of symbols and indices used in TINSS

Symbol	Description
Indices	
i, j, k, l	index for age,year, fleet, and size interval
Estimated population parameters (Θ)	
F^*	Optimal fishing mortality rate
C^*	Maximum sustainable yield
M	Instantaneous natural mortality rate
a_{h_k}	Age at 50% selectivity
γ_k	Standard deviation in selectivity
Estimated life-history parameters (Φ)	
l_∞	mean asymptotic length
k	growth coefficient
t_o	age at 0 length
a, b	parameters for length-weight relationship
λ_1, λ_2	parameters for standard deviation in length-at-age
Derived variables	
B_o	unfished steady-state biomass
κ	recruitment compensation ratio (Goodyear, 1980)
R_e	equilibrium age-1 recruitment
$\iota_i, \hat{\iota}_i$	survivorship to age i, unfished and fished
ϕ_E, ϕ_e	eggs per recruit, unfished and fished
ϕ_B, ϕ_b	vulnerable biomass per recruit, unfished and fished
ϕ_q	vulnerable biomass available to the fishery

B.1 Model initialization

To initialize the model, we must first derive B_o and κ from C^* and F^* as well as other life-history parameters Φ and the vulnerability schedule. In other words, first we must transform the management parameters C^* and F^* into population parameters B_o and κ. This transformation starts with the equilibrium yield equation (e.g. Fig 24a), differentiating this function with respect to F_e, setting this equation equal to 0 and solving for κ (for the full derivation see Martell et al., 2008). Next substitute κ back into the equilibrium recruitment equation to obtain estimates of the unfished biomass B_o.

An alternative way to envision this transformation is to think about it graphically. For any given model (e.g., a simple production model or a complex age-structure model) we can derive a system of equation that results in the equilibrium yield for any specified equilibrium fishing mortality rate. This same system of equations can also be used to derived equilibrium values of recruitment (e.g., Fig 24b), equilibrium biomass (e.g., Fig 24c) and the spawners per recruit (Fig. 24d). The traditional approach would then differentiate the catch equation with respect to F_e, solve this expression for F_e to determine the corresponding value of F^* , then substitute the corresponding F^* into the catch equation and calculate C^* conditional on estimates of B_o and κ. What differs in the management oriented approach is that we estimate C^* and F^* directly and then derive B_o and κ conditional on the estimates of C^* and F^* .

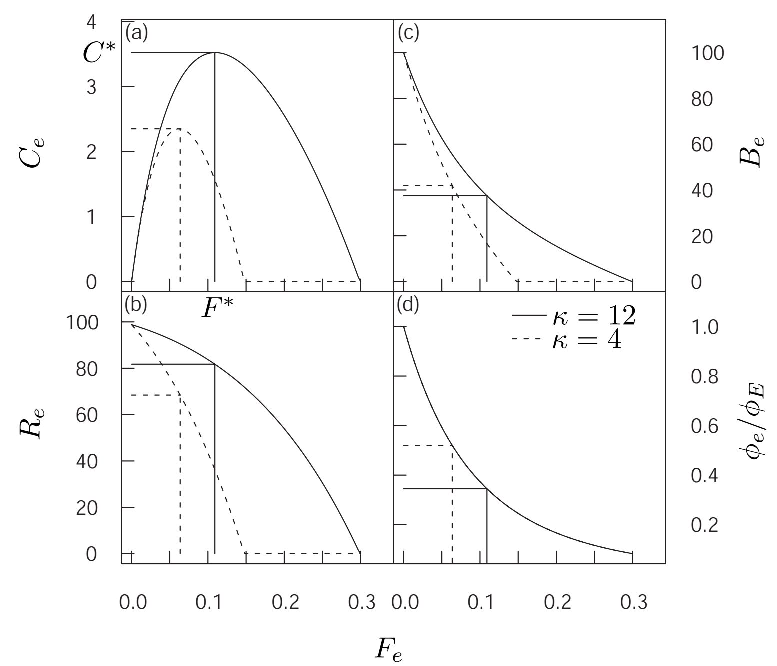


Figure 24: Relationship between equilibrium values for yield (a), recruitment (b), biomass (c) and spawners per recruit (d) versus instantaneous fishing mortality rate for a hypothetical stock with high ($\kappa = 12$) and low ($\kappa = 4$) recruitment compensation parameters.

The system of equation used to derive B_o and κ are laid out in Table 16. The purpose of laying out the equations in a tabular format is two fold, 1) documentation of the model structure and 2) to provide an algorithm or pseudo code in which to implement the model. First given initial estimates of the life-history parameters Φ (T16.2), calculate the corresponding age-schedule information (T16.3)–(T16.6). Note that this does not assume that growth or maturity is constant over time, only that some average, or steady state, growth occurred for the cohorts that are used to initialize the numbers-at-age. Next, calculate the survivorship (T16.7) of an individual recruit based on the instantaneous natural mortality rate M. These survivorship functions (T16.7) and (T16.8) are used to calculate the per recruit incidence functions for unfished and fished conditions, respectively. An incidence function is the sum of age-specific schedules that express the population units on a per recruit basis. For example the total biomass per recruit is given by (T16.10) and the total unfished biomass is the product $R_o\phi_E$. For notational purposes the prefix ϕ denotes an incidence function and the corresponding subscript denotes the type of incidence function (see Table 15 for definitions); we also use upper and lower case subscripts to denote unfished and fished conditions, respectively.

The eggs per recruit for unfished and fished conditions are defined by (T16.9), the biomass per recruit by (T16.10), and the vulnerable biomass per recruit available to the fishery is defined by (T16.11). Note that we assume both natural and fishing mortality operate simultaneously and ϕ_q represents the Barnov catch equation. To derive κ, we differentiate

$$C_e = F_e R_e \phi_q \quad (1)$$

with respect to F_e and solve this equation for κ. Using the chain rule, the derivative of (1) is

$$\frac{\partial C_e}{\partial F_e} = R_e\phi_q + F_e\phi_q\frac{\partial R_e}{\partial F_e} + F_e R_e\frac{\partial \phi_q}{\partial F_e} \quad (2)$$

To derive the recruitment compensation parameter (T16.12) it is necessary to substitute (T16.11) and (T16.13) into (2), set the corresponding expression equal to zero and then solve for κ. The partial derivatives for (T16.12) are defined in Table 17. Equation (T16.13) is the equilibrium recruits that corresponds to the equilibrium fishing mortality rate F_e and (T16.14) corresponds to the unfished biomass.

B.1.1 Initialization with multiple fleets

Although the catch data are aggregated into a single fleet for this assessment, the following describes an algorithm for implementing the management oriented approach for multiple fleets that have different age-specific fishing mortality rates. In essence, the algorithm derives F-multipliers for each fleet.

The catch equation (1) considers a single fishery with a unique vulnerability-at-age curve. In the case of multiple fisheries with different vulnerability-at-age curves, it is necessary to allocate the proportion of the total fishing mortality (F^*) to each fleet such that the sum of catches from each fleet is equal to C^* . For example, consider two separate fishing fleets A and B and assume that fleet A harvest younger fish that fleet B and that the allocation of C^* is assigned equally to each fleet. In this case a higher proportion of F^* would be assigned to fleet B because this fleet harvest fewer, older fish, in comparison to fleet A which harvest more abundant younger fish. Thus, if some sort of allocation agreement exists between two or more fleets, a multiplier on the fishing mortality rate must be used to allocate the total catch among these fleets. For a given allocation arrangement (e.g., where the fraction of C^* assigned to fleet k is denoted as Λ_k), the equilibrium catch of fleet k can be represented as:

$$\Lambda_k C^* = \tau_k F^* R_e \phi_q^{(k)} \tag{3}$$

where τ_k is the fleet specific multiplier on F^* , R_e is defined in (T16.13), and $\phi_q^{(k)}$ is the fleet specific vulnerable biomass per recruit which is defined as

$$\begin{aligned} \phi_q^{(k)} &= \sum_i \frac{\hat{\iota}_i w_i v_{i,k}}{Z_i}\left(1 - e^{-Z_i}\right), \\ \text{where} \quad Z_i &= M + F^* \sum_k \tau_k v_{i,k}, \\ \hat{\iota}_i &= \begin{cases} 1 & i = 1 \\ \hat{\iota}_{i-1} e^{-Z_{i-1}} & i > 1. \end{cases} \end{aligned} \tag{4}$$

Note that τ_k appears multiple times in (4) in the Z_i and $\hat{\iota}_i$ terms, as well as the derivation of R_e (see eq. T16.13), and there is no analytical solution for τ_k (at least that we could find using symbolic math languages). Therefore, τ_k must be solved for iteratively. Solving (3) for τ_k results in an update of τ_k:

$$\tau_k = \frac{\Lambda_k C^*}{R_e F^* \phi_q^{(k)}} \tag{5}$$

A simple algorithm to numerically calculate τ_k proceeds as follows

1. set initial values of the fishing multiplier equal to the allocation proportion: $\tau_k = \Lambda_k$ (Note that if the vulnerability-at-age curves are the same for each fleet, then τ_k is exactly equal to Λ_k, i.e., the vulnerable biomass per recruit is the same for all fleets).

2. calculate the age-specific total mortality rates for all fleets combined

$$Z_i = M + F^* \sum_k \tau_k v_{i,k}.$$

3. calculate survivorship ($\hat{\iota}_i$), and per-recruit incidence functions that lead to R_e (eqs. T16.8–T16.13) based on the age-specific total mortality rate in step 2.

4. for each fleet k, calculate the vulnerable biomass per-recruit ($\phi_q^{(k)}$) using (4).

5. update τ_k using (5), and repeat steps 2-5 until estimates of τ_k converge (Note this take 6-20 iterations depending on how different the vulnerability-at-age curves are for each fleet.

6. Check that the sum catches for each fleet equal C^* .

The algorithm outline above is based on the allocation arrangement among the various fleets (Λ_k) and is not intended to optimize the allocation arrangement based on differences in vulnerability among the various fishing fleets. This is an entirely different policy issue that is not addressed here. If there is no formal allocation arrangement, then historical catch proportions to each fleet could be used as a starting point for values of Λ_k. Recall, that the approach adopted here is to simple express the population parameters B_o and κ as analytical functions of management parameters C^* and F^* .

B.2 Updating state variables

Equations used to update the state variables are defined in Table 18. We aggregate the catch data from the CAN and US fisheries into a single catch time series (T18.1) and treat both fisheries as a single fishery with the same selectivity pattern over time. This data simplification reduces the number of estimated parameters but further assumes that the relative mortalities imposed by the two different fisheries has been constant over time. We also aggregate the catch-age samples from the commercial fisheries ($A_{i,j}$) into a single catch age matrix. Catch-age data for the US portion of the fishery are available back to 1976, and age-composition information for the CAN portion of the fishery are available back to 1988. The age-compositions were combined from 1988 to 2006 using a weighted average, where the weights are the proportions landed by each nation.

Process errors are represented as a vector of annual recruitment deviations ω_j which are assumed to be lognormal with an estimated variance τ^2. These annual deviations are estimated parameters and included in the objective function calculation with a bias correction term for the log-normal distribution (T19.1).

The relative abundance data (I_j) corresponds to the abundance index derived from the acoustic surveys, and here we assume these indices are proportional to abundance and use the conditional maximum likelihood estimate of the scaling parameter in the calculation of the residuals (T18.13). I assume that observation errors in the acoustic survey data are lognormal and the likelihood function for acoustic survey data are given by (T19.2).

Residuals between the observed proportions and predicted proportions-at-age for each fleet (the joint US and CAN fleet and the fisheries independent surveys) were assumed to come from a multivariate logistic distribution. Age composition information are generally thought to arise from a multinomial distribution where the probability of sampling a fish of a given age is conditioned on the product of proportions-at-age in the population and the probability of sampling a fish age-i given the sampling gear. However, the multinomial likelihood kernel generally results in errors that are unrealistically small due to the large samples taken for ageing (Schnute and Richards, 1995). The advantage of the multivariate logistic distribution is that the likelihood kernel can be weighted by the conditional maximum likelihood estimate of the variance; this is given by the mean squared error of the residual terms $\eta_{i,j,k}$ for each fleet k. The likelihood of the age composition information for both fleets k (commercial and acoustic survey) is given by (T19.3).

Table 16: Steady-state age-structured model assuming unequal vulnerability-at-age, age-specific natural mortality, age-specific fecundity and Beverton-Holt type recruitment.

Parameters

$$\Theta = (C^*, F^*, M, \hat{a}, \hat{\gamma}); \quad C^* > 0; F^* > 0; M > 0 \tag{T16.1}$$

$$\Phi = (l_\infty, k, t_o, a, b, \dot{a}, \dot{\gamma}) \tag{T16.2}$$

Age-schedule information

$$l_i = l_\infty(1 - \exp(-k(a - t_o))) \tag{T16.3}$$

$$w_i = a(l_i)^b \tag{T16.4}$$

$$v_i = (1 + \exp((\hat{a} - a)/\hat{\gamma}))^{-1} \tag{T16.5}$$

$$f_i = w_i(1 + \exp((\dot{a} - a)/\dot{\gamma}))^{-1} \tag{T16.6}$$

Survivorship

$$\iota_i = \begin{cases} 1, & i = 1 \\ \iota_{i-1}e^{-M}, & i > 1 \\ \dfrac{\iota_{i-1}}{1 - e^{-M}}, & i = A \end{cases} \tag{T16.7}$$

$$\hat{\iota}_i = \begin{cases} 1, & i = 1 \\ \hat{\iota}_{i-1}e^{-M-F^*v_{i-1}}, & i > 1 \\ \dfrac{\hat{\iota}_{i-1}}{1 - e^{-M-F^*v_i}}, & i = A \end{cases} \tag{T16.8}$$

Incidence functions

$$\phi_E = \sum_{i=1}^{\infty} \iota_i f_i, \quad \phi_e = \sum_{i=1}^{\infty} \hat{\iota}_i f_i \tag{T16.9}$$

$$\phi_B = \sum_{i=1}^{\infty} \iota_i w_i, \quad \phi_b = \sum_{i=1}^{\infty} \hat{\iota}_i w_i v_i \tag{T16.10}$$

$$\phi_q = \sum_{i=1}^{\infty} \frac{\hat{\iota}_i w_i v_i}{M + F^* v_i}\left(1 - e^{(-M-F^*v_i)}\right) \tag{T16.11}$$

Derived variables

$$\kappa = \frac{\phi_E}{\phi_e} - \frac{F^*\phi_q \dfrac{\phi_E}{\phi_e^2}\dfrac{\partial \phi_e}{\partial F^*}}{\phi_q + F^*\dfrac{\partial \phi_q}{\partial F^*}} \tag{T16.12}$$

$$R_e = \frac{C^*}{F^*\phi_q} \tag{T16.13}$$

$$B_o = \phi_B \frac{R_e(\kappa - 1)}{\kappa - \phi_E/\phi_e} \tag{T16.14}$$

Table 17: Partial derivatives, based on components in Table 16, required for the derivation of κ and B_o using the Beverton-Holt recruitment model.

Mortality & Survival

$$Z_i = M + F^* v_i \tag{T17.1}$$

$$S_i = 1 - e^{-Z_i} \tag{T17.2}$$

Partial for survivorship

$$\frac{\partial \hat{\iota}_i}{\partial F^*} = \begin{cases} 0, & i = 1 \\ e^{-Z_{i-1}} \left(\frac{\partial \hat{\iota}_{i-1}}{\partial F^*} - \hat{\iota}_{i-1} v_{i-1} \right), & i > 1 \\ \frac{e^{-Z_{i-1}}}{1 - e^{-Z_i}} \left(\frac{\partial \hat{\iota}_{i-1}}{\partial F^*} - \hat{\iota}_{i-1} v_{i-1} \right) - \hat{\iota}_{i-1} e^{-Z_{i-1}} v_i e^{-Z_i}, & i = A \end{cases} \tag{T17.3}$$

Partials for incidence functions

$$\frac{\partial \phi_e}{\partial F^*} = \sum_{i=1}^{\infty} f_i \frac{\partial \hat{\iota}_i}{\partial F^*} \tag{T17.4}$$

$$\frac{\partial \phi_q}{\partial F^*} = \sum_{i=1}^{\infty} \frac{w_i v_i S_i}{Z_i} \frac{\partial \hat{\iota}_i}{\partial F^*} + \frac{\hat{\iota}_i w_i v_i^2}{Z_i} \left(e^{-Z_i} - \frac{S_i}{Z_i} \right) \tag{T17.5}$$

Partial for recruitment

$$\frac{\partial R_e}{\partial F^*} = \frac{R_o}{\kappa - 1} \frac{\phi_E}{\phi_e^2} \frac{\partial \phi_e}{\partial F^*} \tag{T17.6}$$

Table 18: Statistical catch-age model using the Baranov catch equation and C^* and F^* as leading parameters.

Data

$$C_j = C_j^{\mathrm{US}} + C_j^{\mathrm{CA}} \tag{T18.1}$$

$$I_j, A_{i,j,k} \tag{T18.2}$$

Parameters

$$\Theta = (C^*, F^*, M, \hat{a}, \hat{\gamma}, \bar{a}, \bar{\gamma}, \{\omega_j\}_{j=1}^{J-1}, \rho, \vartheta^2) \tag{T18.3}$$

$$\sigma^2 = \rho\vartheta^2, \quad \tau^2 = (1-\rho)\vartheta^2, \quad \sum_t \omega_t = 0 \tag{T18.4}$$

Unobserved states

$$N_{i,j}, B_j, E_j, F_j \tag{T18.5}$$

Initial states (t=1)

$$N_{i,j} = B_o/\phi_B \iota_i \tag{T18.6}$$

State dynamics (t>1)

$$E_j = \sum_i N_{i,j} f_i \tag{T18.7}$$

$$Z_{i,j} = M + F_j v_i \tag{T18.8}$$

$$\hat{C}_j = \sum_i \frac{N_{i,j} w_i F_j v_i \left(1 - e^{-Z_{i,j}}\right)}{Z_{i,j}} \tag{T18.9}$$

$$F_{j_{i+1}} = F_{j_i} - \frac{\hat{C}_j - C_j}{\hat{C}'_j} \tag{T18.10}$$

$$N_{i,j} = \begin{cases} \dfrac{s_o E_{j-1}}{1+\beta E_{j-1}} \exp(\omega_j - 0.5\tau^2) & i = 1 \\ \\ N_{i-1,j-1} \exp(-Z_{i-1,j-1}) & i > 1 \end{cases} \tag{T18.11}$$

$$B_j = \sum_i N_{i,j} w_i v_i \tag{T18.12}$$

Residuals

$$\epsilon_j = \ln\left(\frac{I_j}{B_j}\right) - \frac{1}{n}\sum_{j \in I_j} \ln\left(\frac{I_j}{B_j}\right) \tag{T18.13}$$

$$\eta_{i,j,k} = \ln(p_{i,j,k}) - \ln(\bar{p}_{i,j,k}) - \frac{1}{I-1}\sum_{i=2}^{I} [\ln(p_{i,j,k}) - \ln(\bar{p}_{i,j,k})] \tag{T18.14}$$

Table 19: Likelihoods and priors used in the statistical estimation of Θ from Table 18.

Negative log-likelihoods

$$\ell(\Theta)_1 = \sum_{j=1}^{J-1} \left[\ln(\tau) + \frac{(\omega_j + 0.5\tau^2)^2}{2\tau^2} \right] \tag{T19.1}$$

$$\ell(\Theta)_2 = \sum_{j \in I_j} \left[\ln(\sigma) + \frac{\epsilon_j^2}{2\sigma^2} \right] \tag{T19.2}$$

$$\ell(\Theta)_3 = \sum_{k} \left\{ (I-2)J_{j\in k} \ln \left(\frac{1}{(J_{j\in k}-2)I} \sum_{j=1}^{J_{j\in k}} \sum_{i=2}^{I} \eta_{i,j,k}^2 \right) \right\} \tag{T19.3}$$

$$\ell(\Theta) = \sum_{i=1}^{3} \ell(\Theta)_i \tag{T19.4}$$

Constraints

$$\kappa > 1.0 \tag{T19.5}$$

Posterior distribution

$$P(\Theta) \propto \exp[-\ell(\Theta)] p(C^*) p(F^*) p(M) p(\rho) p(\vartheta^2) \tag{T19.6}$$

C Lagged Recruitment Growth Survival Model

For comparison a much simpler biomass dynamics model was fit to the survey biomass index data only (Table 20). The model, which is referred to as the lagged recruitment growth survival model (LRGS) is documented in Hilborn and Mangel (1997). In this assessment I assume the unfished conditions in 1966, 3+ biomass are fully recruited to the fishery and sexually mature, and that the acoustic biomass index is directly proportional to the 3+ biomass in the stock. The model is conditioned on the historical landings from both the Canadian and U.S. fisheries combined, and is an observation error only model (there are no estimated recruitment anomalies). The joint posterior distribution (defined as the sum of ℓ and the priors defined in Table 20) was numerically integrated using the Metropolis Hastings Algorithm that is built into the ADMB software (Otter Research, 2008). A total of 4 model parameters were estimated.

Using the LRGS model maximum likelihood estimates of depletion given all the survey data is 0.39, and the 50 percentile is 0.447. Proxy reference points are assumed to correspond to a 3+ biomass depletion of 40%, and catch advice based on the 40:10 adjustment and the maximum likelihood estimates of model parameters is 194,931 mt. Based on parameters sampled from the joint posterior distribution ABC values for the 2010 fishery are estimated at 395,370 mt (95% credible interval of 82,796 mt to 1,856,400 mt).

There is considerable uncertainty in the estimate of unfished 3+ biomass with the median estimate at 2.68 million mt (95% credible interval 1.33-714 million mt) and this uncertainty is largely associated with the large variance in the assumed prior distributions for B_o, κ, and S in the LRGS model (Figure 26). The relative abundance information lack sufficient contrast to resolve the uncertainty in the overall scale of the population and how productive it is. Statistically, the best fit to the relative abundance data is probably a straight line given this simple model structure. In the case of the LRGS model there is a fairly strong positive correlation between unfished biomass and the growth survival term S. In other words, the biomass and catch data are just as likely to come from a small productive population or a large unproductive population.

Table 20: Lagged Recruitment Growth Survival Model where the assumed age at recruitment (k) is 3 years.

Data

$$C_t \tag{T20.1}$$

$$I_t \tag{T20.2}$$

$$k = 3 \tag{T20.3}$$

Estimated parameters

$$\theta = \{B_o, \kappa, S, \tau\}, \quad \text{where:} \quad \kappa > 1; 0 < S < 1 \tag{T20.4}$$

Initial states $t = 1966$

$$B_t = B_o \tag{T20.5}$$

$$a = \kappa(1 - S) \tag{T20.6}$$

$$b = (\kappa - 1)/B_o \tag{T20.7}$$

Dynamic states$t > 1966$

$$B_{t+1} = SB_t + R_t - C_t \tag{T20.8}$$

$$R_t = \begin{cases} B_o(1 - S) & \text{if} \quad t \leq 1966 + k \\ \dfrac{aB_{t-k}}{1 + bB_{t-k}} & \text{if} \quad t > 1966 + k \end{cases} \tag{T20.9}$$

Residuals

$$\epsilon_t = \ln(I_t) - \ln(B_t) - \frac{1}{n} \sum_{t \in I} \ln(I_t) - \ln(B_t) \tag{T20.10}$$

Negative loglikelihood and priors

$$\ell = -0.5n \ln(\tau) + 0.5\tau \sum_{t \in I} \epsilon_t^2 \tag{T20.11}$$

$$P(B_o) \sim \text{lognormal}(\ln(2.5), 0.75) \tag{T20.12}$$

$$P(\kappa) \sim \text{lognormal}(\ln(30), 0.5) \tag{T20.13}$$

$$P(S) \sim \text{beta}(\alpha = 15.0, \beta = 4.0) \tag{T20.14}$$

$$P(\tau) \sim \text{gamma}(\alpha = 1.1, \beta = 1.1) \tag{T20.15}$$

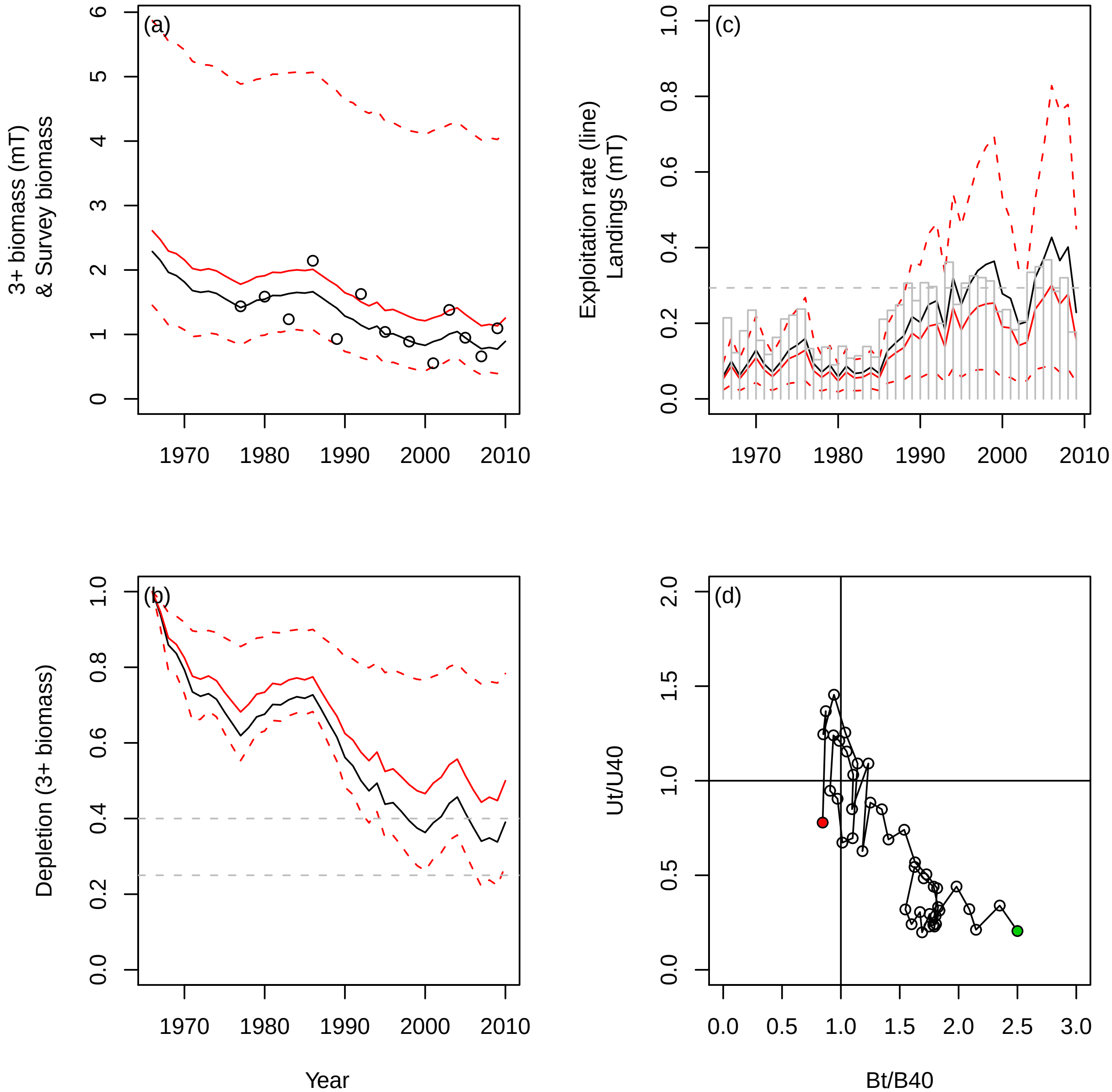


Figure 25: Summary estimates of biomass, depletion, exploitation rate and stock status based on the LRGS model. Maximum likelihood estimates shown in black and quantiles (0.05, 0.5, 0.95) estimates based on the joint posterior distribution shown in red (or grey if black and white). In panel (a) the biomass index survey data are scaled to the maximum likelihood estimate, depletion (panel b) assumes unfished state in 1966, and exploitation rate (c) is based on catch divided by 3+ biomass. U40 is the exploitation rate that would reduce the 3+ biomass to 40% of its unfished state.

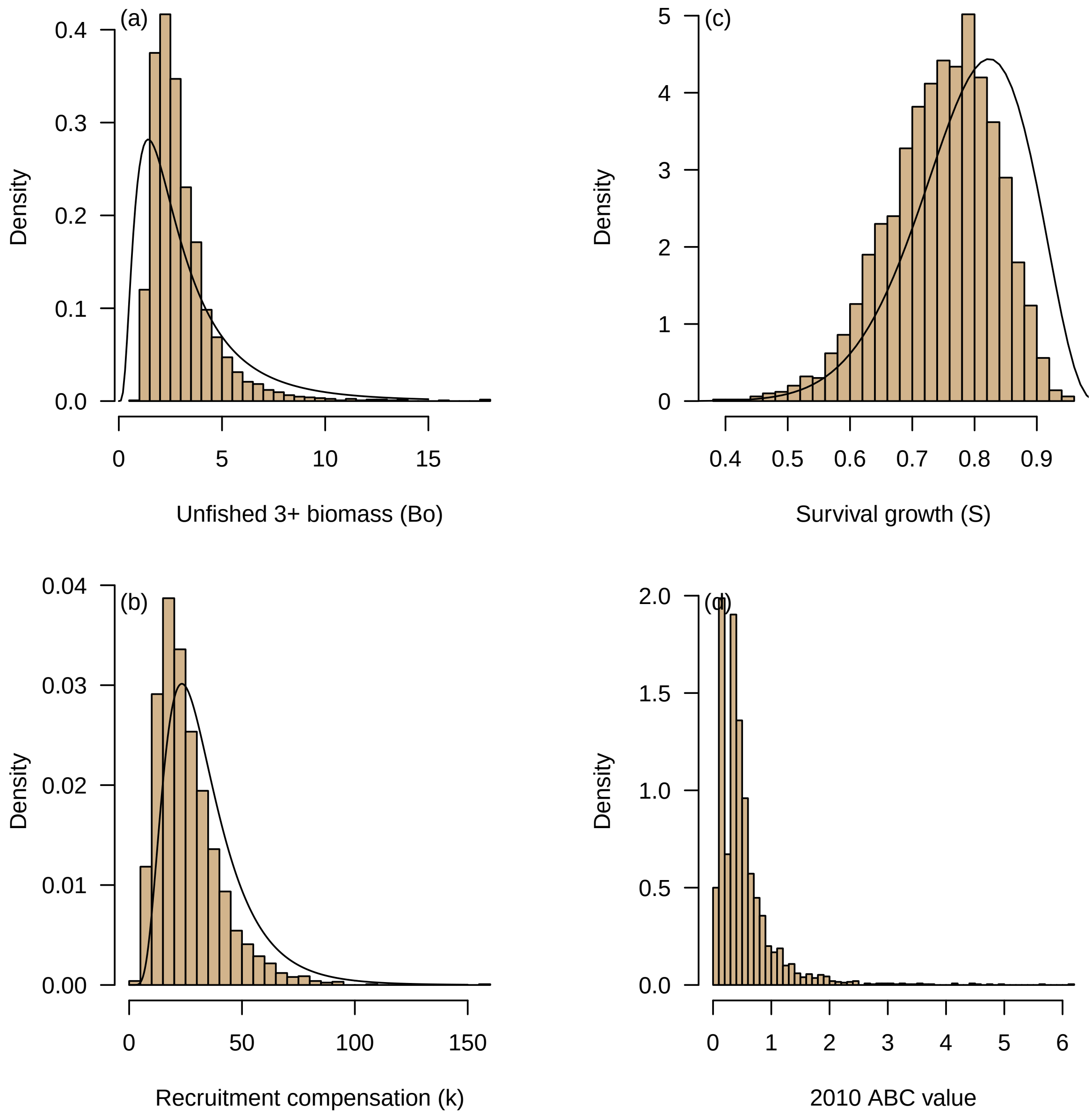
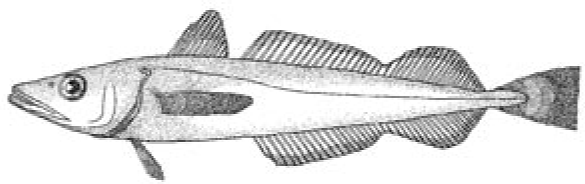


Figure 26: Marginal posterior densities (shown as bars) for unfished 3+ biomass (a), recruitment compensation (b), and the survival growth parameter (c) in the LRGS biomass dynamics model. Prior densities for each parameter is shown as a line, and the resulting marginal posterior density for the 2010 catch advice using 40% of the 3+ biomass as a target reference point in the 40-10 harvest control rule.

Stock Assessment of Pacific Hake, *Merluccius productus*, (a.k.a. Whiting) in U.S. and Canadian Waters in 2010



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Executive Summary

Stock

This assessment reports the status of the coastal Pacific hake (or Pacific whiting, *Merluccius productus*) resource off the west coast of the United States and Canada. The coastal stock of Pacific hake is currently the most abundant groundfish in the California Current system. Smaller populations of hake occur in the major inlets of the northeast Pacific Ocean, including the Strait of Georgia, Puget Sound, and the Gulf of California. However, the coastal stock is distinguished from the inshore populations by larger body size and seasonal migratory behavior. The coastal population is modeled as a single stock, but the United States and Canadian fishing fleets are treated separately in order to capture some of the spatial variability in Pacific hake distribution, size- and age-structure, as well as fishery selectivity.

Catches

Coast-wide fishery landings of Pacific hake averaged 221 thousand mt from 1966 to 2009, with a low of 90 thousand mt in 1980 and a peak of 361 thousand mt in 2006. Recent coast-wide landings from 2004-2008 were above the long term average. Landings in this period were predominately comprised of fish from the large 1999 year class. In 2008, the fishery began harvesting considerable numbers of the then emergent 2005 year class. In response to projection of a continued decline in abundance from the 2009 stock assessment, landings were reduced to 177 thousand metric tons. These catches were again dominated by the 2005 year class with some contribution from an emergent 2006 year class and relatively small numbers of the 1999 cohort. The United States has averaged 165 thousand mt, or 74.5% of the average total landings over the time series, with Canadian catch averaging 56 thousand mt. The 2009 landings had a slightly different distribution between nations, with 68.5% harvested by the United States fishery. In the current stock assessment the terms catch and landings are used interchangeably; estimates of discard within the target fishery are included, but discarding of Pacific hake in non-target fisheries is not. Total discard is estimated to be less than 1% of landings and therefore is likely to be negligible with regard to the population dynamics.

Table a. Recent commercial fishery landings (1000s mt).

Year	US at-sea	US shore-based	US Tribal	US total	Canadian foreign and JV	Canadian shore-based	Canadian total	Total
2000	116	86	7	208	16	6	22	231
2001	102	73	7	182	22	32	54	236
2002	63	46	23	132	0	51	51	183
2003	67	51	25	143	0	62	62	206
2004	90	89	31	210	59	65	124	335
2005	150	74	35	259	15	85	100	360
2006	134	97	35	267	14	80	94	361
2007	121	73	30	225	7	66	73	297
2008	166	50	32	248	4	70	74	322
2009	58	41	22	121	0	56	56	177

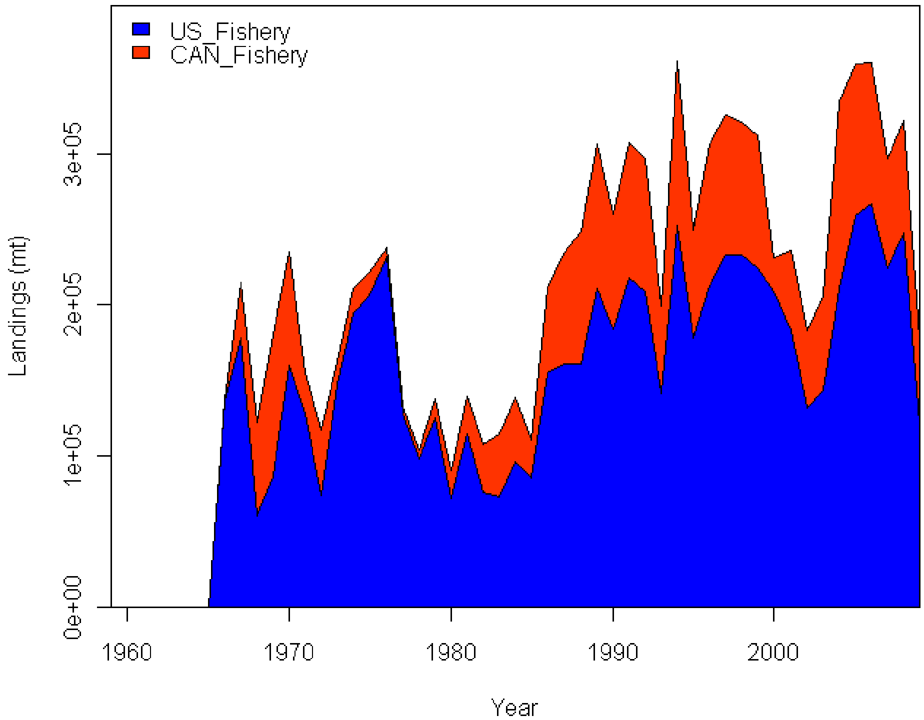

Figure a. Total Pacific hake landings used in the assessment by nation, 1960-2009 (Canadian landings are represented by the lighter region above the darker U.S. values).

Data and assessment

The 2010 assessment includes the same basic sources of data as the 2009 model. These have been supplemented with: 2009 catch estimates from the U.S. and Canada; the 2009 Acoustic survey biomass index, length and conditional age-at-length compositions, length and conditional age-at-length compositions from the 2009 U.S. and Canadian fisheries, and the 2009 juvenile index. Additional changes made in this assessment are: evaluated for the first time of bycatch rates of juvenile hake in the pink shrimp trawl fishery as a potential recruitment index, and removal of historical length-frequency distributions from California in the 1960s which were added for the 2009 assessment, but ultimately identified as adding no appreciable contribution to model results. An important aspect of the data for this assessment is the amount of uncertainty associated with the 2009 acoustic survey. For the base case model we have assumed a standard error (in log-space) of 0.5, the same level as has been used for historical acoustic surveys, and larger then the value (0.25) used for more recent surveys. This choice reflects the difficulty experienced during the 2009 survey in positively identifying hake from Humboldt squid in the acoustic backscatter.

Age-structured assessment models of various forms have been used to assess Pacific hake since the early 1980's, using total fishery landings, fishery length and age compositions and survey abundance indices. In 2006, the hake assessment model was converted from an ADMB model developed by Dorn (Dorn et al. 1998) to Stock Synthesis (SS, Methot, 2005). Updated versions of Stock Synthesis have been used each year since 2006; the current (2010) model is implemented in SS v3.1 (Methot 2009). No major structural changes to the modeling approach or implementation have been added for 2010.

Stock biomass

The base model indicates that the Pacific hake female spawning biomass declined rapidly after a peak in 1984 (3.78 million mt) until 2000 (0.55 million mt). This long period of decline was followed by a brief increase to a peak of 1.31 million mt in 2003 as the large 1999 year class matured. In 2010 (beginning of year), spawning biomass is estimated to be the lowest in the time-series, 0.41 million mt, however this estimate is quite uncertain, with asymptotic 95% confidence intervals ranging from 0.22 to 0.59 million mt. This level equates to approximately 31% of the estimated unfished spawning biomass (SB_0). Estimates of uncertainty in current relative depletion range from 17%-45% of unfished biomass. The estimate of spawning biomass for 2009 is 0.48 million mt, higher than the estimate of 0.43 million mt from the 2009 assessment, reflecting an upward revision in the estimated absolute scale of the hake stock, largely attributable to an increase in the estimate of the 2005 year class. Unexploited equilibrium biomass decreased slightly from 1.37 million metric tons in the 2009 assessment to 1.33 this year, with an approximate 95% confidence interval from 1.15 to 1.50. The recent peak of spawning biomass in 2003 generated by the 1999 year class is now estimated to have reached 99% of the unexploited equilibrium whereas the estimate from the 2009 assessment was 102% of that equilibrium level.

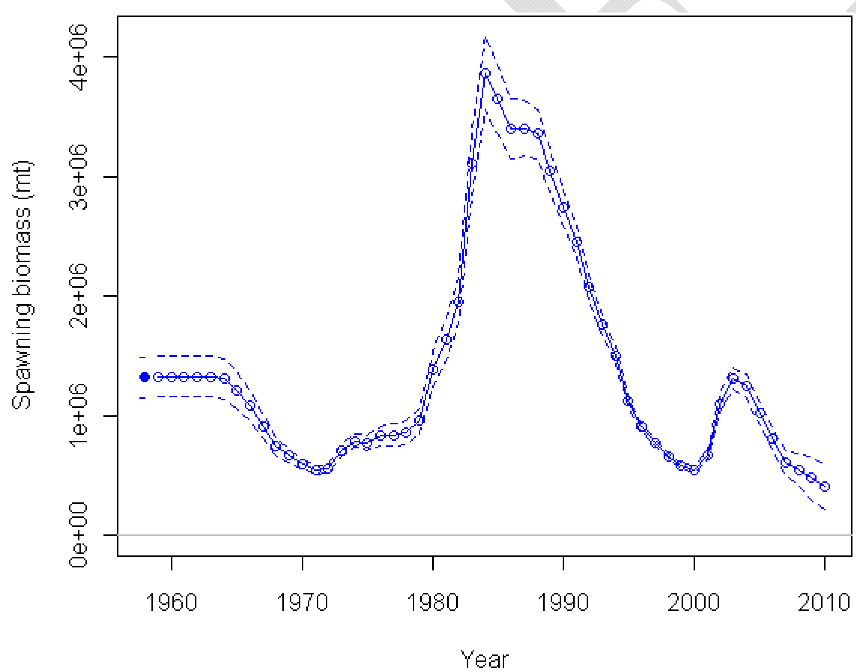

Figure b. Estimated female spawning biomass time-series with approximate asymptotic 95% confidence intervals.

Table b. Recent trend in estimated Pacific hake biomass and depletion level.

Year	Total biomass (million mt)	Age 3+ biomass (million mt)	Female spawning biomass (million mt)	~95% confidence interval	Estimated depletion	~95% confidence interval
2001	2.83	1.29	0.67	0.63 - 0.71	50%	44% - 57%
2002	3.05	2.95	1.10	1.02 - 1.17	83%	71% - 94%
2003	3.00	2.87	1.31	1.22 - 1.41	99%	85% - 113%
2004	2.72	2.65	1.25	1.15 - 1.35	94%	81% - 108%
2005	2.30	2.06	1.02	0.93 - 1.12	77%	66% - 88%
2006	1.88	1.72	0.80	0.71 - 0.90	61%	51% - 71%
2007	1.64	1.21	0.61	0.50 - 0.71	46%	37% - 55%
2008	1.43	1.25	0.55	0.40 - 0.69	41%	30% - 52%
2009	1.13	1.08	0.48	0.30 - 0.65	36%	22% - 49%
2010	1.04	0.84	0.41	0.22 - 0.59	31%	17% - 44%

Recruitment

Estimates of historical Pacific hake recruitment indicate a very large year class in 1980. Secondary large recruitment events occurred in 1977, 1984 and 1999, with 1970, 1973, 1987, 1990 and 2005 being substantially larger than adjacent years. The 1999 year class was estimated to be the largest in 15 years (11.77 billion, 95% interval: 10.98 - 12.61 billion) and to have supported fishery catches from 2002 through 2007. Uncertainty in estimated recruitments is substantial, especially for recent years, as indicated by the asymptotic 95% confidence intervals. Recruitment to age 0 before 1962 is assumed to be equal to the long-term mean recruitment. Age-0 recruitment in 2005 appears slightly higher than was estimated in the 2009 assessment but despite a wide range of uncertainty is not of the same scale as the largest historical recruitments and will not be sufficient to support the fishery for as long as the 1999 cohort. The 2006 year class is estimated to be the third largest since the 1999 cohort (1.34 billion), but still well below the unexploited equilibrium level of 1.95 billion. Recruitments subsequent to 2008 are drawn exclusively from the stock-recruit curve, with correspondingly high levels of uncertainty.

Table c. Recent estimated trend in Pacific hake recruitment.

Year	Estimated recruitment (billions age-0)	~95% confidence interval
2001	0.92	0.82 - 1.04
2002	0.01	<0.01 - 0.02
2003	1.68	1.38 - 2.04
2004	0.20	0.15 - 0.28
2005	2.90	2.09 - 4.02
2006	1.34	0.90 – 2.00
2007	0.01	0.01 - 0.02
2008	0.88	0.13 - 5.90
2009	1.84	0.26 - 12.80
2010	1.81	0.26 - 12.61

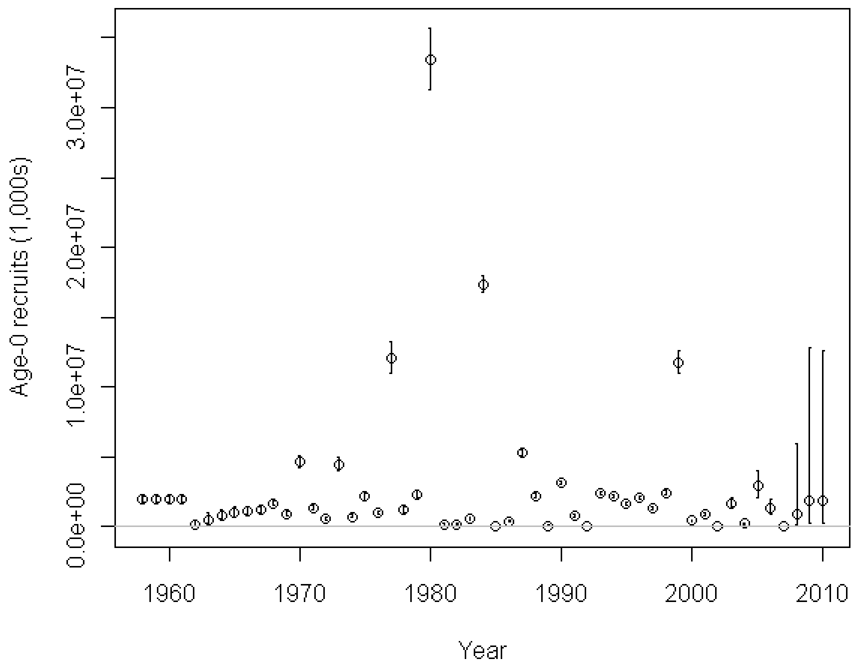

Figure c. Estimated recruitment time-series with approximate asymptotic 95% confidence intervals.

Reference points

Two types of reference points are reported in this assessment: those based on the population parameters at the beginning of the modeled time period and those based on the most recent time period in a 'forward projection' mode of calculation. This distinction is important since temporal variability in growth and other parameters can result in different reference point calculations across alternative chronological periods. All strictly biological reference points (e.g., unexploited spawning biomass) are calculated based on the unexploited conditions at the start of the model, whereas management quantities (*MSY*, SB_{msy}, etc.) are based on the current growth and maturity schedules and are marked throughout this document with an asterisk (*).

Unexploited equilibrium Pacific hake spawning biomass (SB_0) is estimated to be 1.33 million mt (~ 95% confidence interval: 1.15-1.50 million mt), with a mean expected recruitment of 1.95 billion age-0 hake (~ 95% confidence interval: 1.72-2.22). The *MSY*-proxy target biomass ($SB_{40\%}$) is estimated to be 0.53 million mt and the minimum biomass threshold ($SB_{25\%}$) is 0.33 million mt. *MSY* is estimated to be 279,071* mt, produced by a female spawning biomass of 292,432* mt, and reflecting the high value (0.88) estimated for steepness of the stock-recruit curve. The equilibrium *MSY*-proxy harvest rate ($F_{40\%}$) yield under the base model is estimated to be 262,957* mt, occurring at a spawning biomass of 453,986* mt. The equilibrium yield at the biomass target ($SB_{40\%}$) is estimated to be 247,589* mt, occurring at a spawning biomass of 530,545* mt given current life history parameters.

Exploitation status

The spawning potential ratio for Pacific hake has been below the proxy target of 40% for the history of this fishery, but the ratio is uncertain and estimated to have been very close to 1.0 in 2008 (0.96%). Pacific hake are presently in the precautionary zone with regard to biomass level (31% of unfished spawning biomass in 2010) and below, at 80% of (in 2009), the target SPR rate. The full exploitation history in terms of both the biomass and F targets is portrayed graphically via a phase-plot.

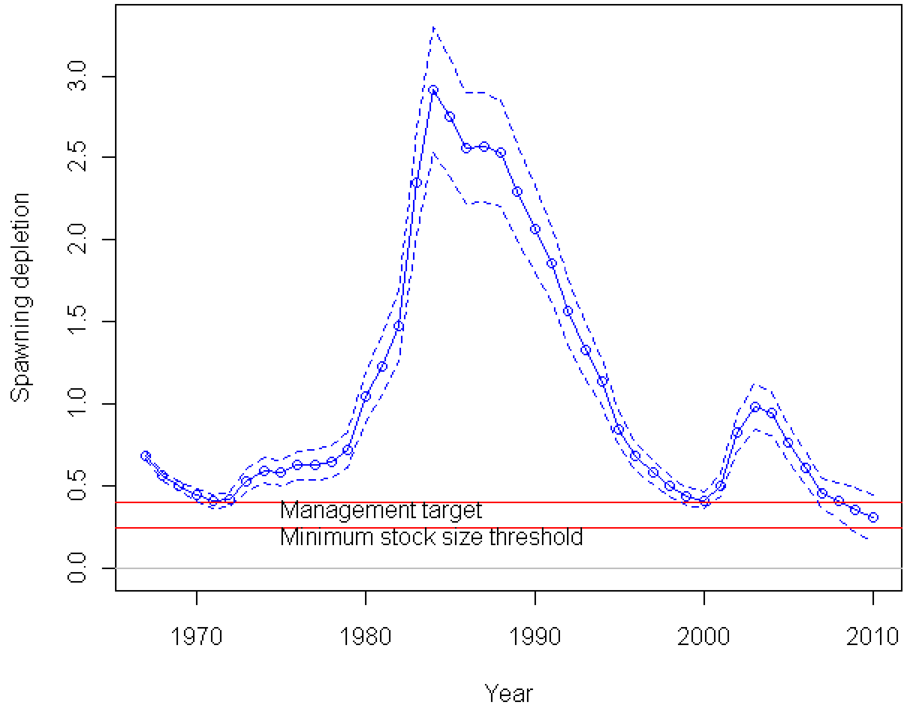

Figure d. Time-series of estimated spawning depletion, 1967-2010.

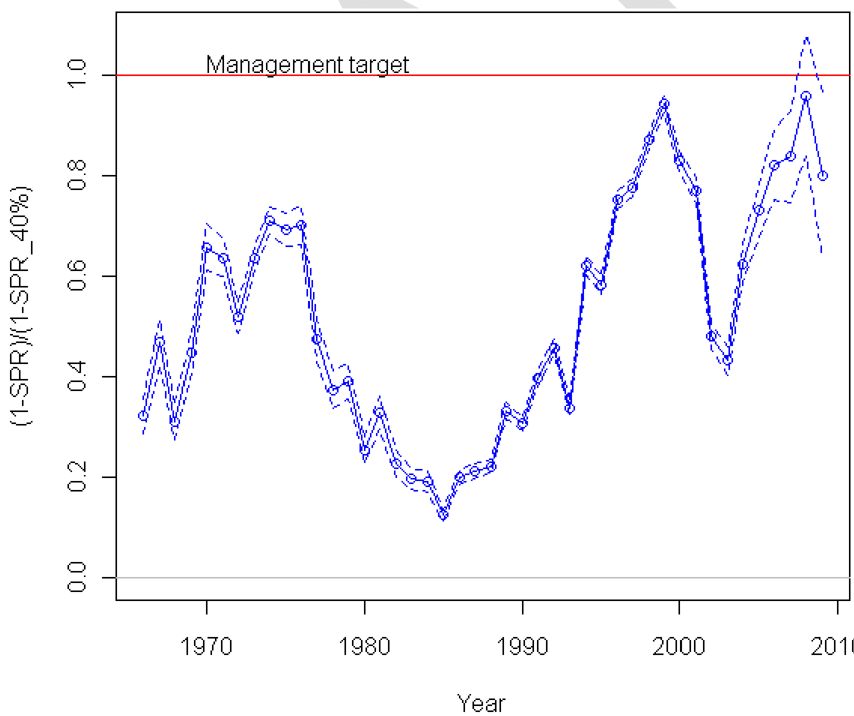

Figure e. Trend in relative spawning potential ratio through 2009 (1-SPR/1-SPR$_{Target=0.4}$).

Table d. Recent trend in relative spawning potential ratio ($1\text{-}SPR/1\text{-}SPR_{Target=0.4}$) and exploitation fraction (catch/3+biomass). Values for 2010 are part of the forecast results.

Year	Relative SPR ratio	~95% confidence interval	Exploitation fraction	~95% confidence interval
2000	0.83	0.81 - 0.85	0.20	0.19 - 0.21
2001	0.77	0.75 - 0.80	0.18	0.17 - 0.19
2002	0.48	0.46 - 0.51	0.06	0.06 - 0.07
2003	0.43	0.40 - 0.46	0.07	0.07 - 0.08
2004	0.62	0.59 - 0.66	0.13	0.12 - 0.14
2005	0.73	0.68 - 0.79	0.17	0.16 - 0.19
2006	0.82	0.75 - 0.89	0.21	0.18 - 0.24
2007	0.84	0.75 - 0.93	0.24	0.20 - 0.29
2008	0.96	0.84 - 1.08	0.26	0.19 - 0.33
2009	0.80	0.64 - 0.96	0.16	0.10 - 0.23

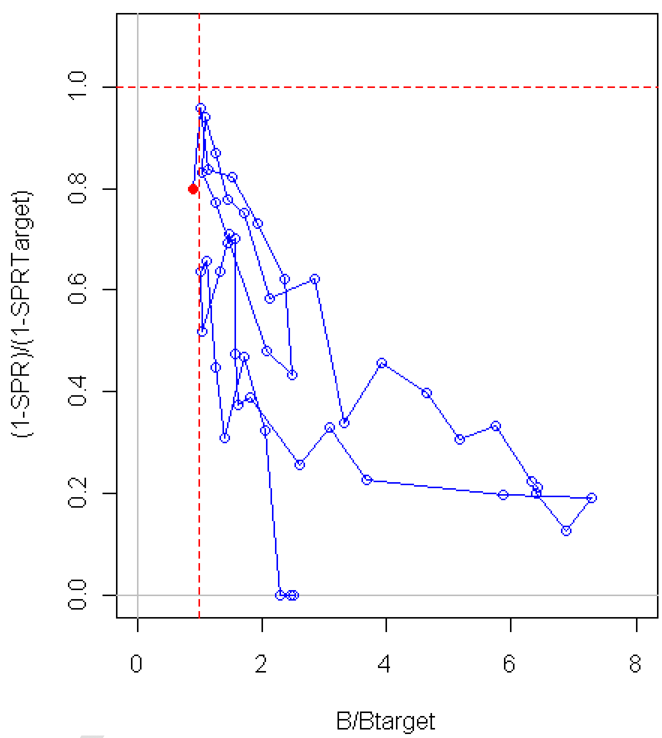

Figure f. Temporal pattern (phase plot) of relative spawning potential ratio ($1\text{-}SPR/1\text{-}SPR_{Target=0.4}$) vs. estimated spawning biomass relative to the proxy 40% level, 1960-2009. The filled circle denotes 2009 and the line connects years through the time-series.

Management performance

Since implementation of the Magnuson-Stevens Fishery Conservation and Management Act in the U.S. and the declaration of a 200 mile fishery conservation zone in Canada in the late 1970's, annual quotas have been the primary management tool used to limit the catch of Pacific hake in both zones by foreign and domestic fisheries. Scientists from both countries have collaborated through the Technical Subcommittee of the Canada-US Groundfish Committee (TSC), and there has been informal agreement on the adoption of an annual fishing policy. During the 1990s, however, disagreement between the U.S. and Canada on the division of the acceptable biological catch (ABC) between the two countries led to quota overruns; 1991-1992 quotas summed to 128% of the ABC and quota overruns averaged 114% from 1991-1999. Since 2000, total catches have been below coast-wide ABCs. A recent treaty between the United States and Canada (2003), which has not yet been fully implemented, establishes U.S. and Canadian shares of the coast-wide allowable biological catch at 73.88% and 26.12%, respectively.

In recent years, failure to extract the entire OY available to the fishery in U.S. waters has been a result of extremely restrictive bycatch limits on overfished rockfish species, particularly widow and canary rockfishes. In 2008, there was a voluntary ‘stand-down’ during the period of highest bycatch rates as the fleet approached the bycatch limit, and the U.S. fishery ultimately achieved 92% of its OY. Two important changes influenced the 2009 fishery: 1) the OY was reduced by just less than 50%, and 2) the U.S. mothership, catcher-processor and shore-based sectors were assigned sector specific, and much larger, bycatch limits. Although Canadian catches exceeded their allocation fraction of the total OY, and the primary U.S. sectors were very close to allocations, some of the tribal allocation remained uncaught and so the total catch was 96.0% of the OY and 69.7% of the ABC.

Table e. Recent trend in Pacific hake management performance.

Year	Total landings (mt)	Coast-wide (U.S. + Canada) OY (mt)	Coast-wide (U.S. + Canada) ABC (mt)
2000	230,820	290,000	290,000
2001	235,962	238,000	238,000
2002	182,911	162,000	208,000
2003	205,582	228,000	235,000
2004	334,672	501,073	514,441
2005	359,661	364,197	531,124
2006	360,683	364,842	661,680
2007	297,098	328,358	612,068
2008	321,547	364,842	400,000
2009	176,730	184,000	253,582

Unresolved problems and major uncertainties

As in 2009, this assessment includes the uncertainty associated with several important model parameters, including acoustic survey catchability (q), the steepness (or productivity, h) of the stock-recruitment relationship, as well as the degree of recruitment variability (σ_R). This uncertainty is integrated into the Bayesian results presented in the decision table. However, it is a gross underestimate of the true uncertainty in current stock status and future projections due to known model misspecification represented by poor residual patterns to size data, sensitivity to the relative weighting of data sources and model structure (treatment of sex-specific growth, fleet structure, spatial issues, and others). Further, the 2009 acoustic survey estimated a relatively large biomass, which is contradictory to fishery dependent information and very uncertain due to the presence of large numbers of Humboldt squid, making the unambiguous assignment of backscatter to Pacific hake very difficult, and there was reduced survey effort in Canadian waters. Estimates of current stock status are very sensitive to the degree of uncertainty in this index, yet there are currently no data for directly quantifying uncertainty in the process of scoring acoustic backscatter. Historical issues identified in previous assessments including the appropriate variance to assign to acoustic survey years that did not survey the waters off northern Canada and the representativeness of trawl sampling for the acoustic backscatter also remain.

Many of these issues may be resolved for the 2011 assessment, when a full reanalysis of historical acoustic survey data will be available. However, the Pacific hake stock displays the highest degree of recruitment variability of any west coast groundfish resulting in large and rapid changes in stock biomass. This volatility, coupled with a dynamic fishery displaying targeting of strong incoming cohorts and a biannual fishery independent acoustic survey, will continue to result in highly uncertain estimates of current stock status and even less certain projections of stock trajectory in future stock assessments.

Forecasts

Forecasts are generated applying the 40:10 control rule and coast-wide catch allocation of 73.88% and 26.12% to the U.S. and Canada, respectively, to maximum likelihood results. Extremely wide confidence intervals for forecast quantities reflect uncertainty in recent and future year-class strengths as well as current biomass levels. Alternative management actions are presented in a decision table based on MCMC integration of the posterior distribution for model quantities. The stock is projected to continue to decline in the near future for all 2010 catch levels above 50,000 mt, with declines estimated to be slightly steeper for the Bayesian results (as was the case in the 2009 assessment; likely due to bias in the maximum likelihood estimator for the degree of recruitment variability). A catch level greater than 200,000 mt is projected to result in at least a 50% probability of the stock declining below the $SB_{25\%}$ minimum biomass threshold in 2011.

Table f. Three-year projections of maximum likelihood-based Pacific hake ABC, OY, spawning biomass and depletion for the base case model based on the 40:10 harvest control rule and the $F_{40\%}$ overfishing limit/target.

Year	ABC (mt)	OY (mt)	Female spawning biomass (millions mt)	~95% confidence interval	Estimated depletion	~95% confidence interval
2010	253,517	224,975	0.41	0.22 - 0.59	31%	17% - 44%
2011	226,067	181,462	0.34	0.12 - 0.55	25%	10% - 41%
2012	221,866	181,185	0.34	0.01 - 0.68	26%	1% - 51%

Table g. Decision table with three year projections of posterior distributions for Pacific hake female spawning biomass, depletion (both of at the beginning of the year, before fishing takes place) and relative spawning potential ratio (1-SPR/1-$SPR_{Target=0.4}$; values greater than 1.0 denote overfishing). Catch alternatives are based on: 1) arbitrary constant catch levels of 50,000, 100,000, 150,000 and 200,000 mt (rows a, b, c, and e), 2) the status quo OY from 2009 (row d), and 3) the values estimated via the 40:10 harvest control rule and the $F_{40\%}$ overfishing limit/target for the base case MLE model (row f; from Table f above).

Management Action			States of nature														
			Female spawning biomass (millions mt) posterior interval					Estimated depletion posterior interval					Relative spawning potential ratio posterior interval				
	Year	Catch	5th	25th	50th	75th	95th	5th	25th	50th	75th	95th	5th	25th	50th	75th	95th
	2010	50,000	0.27	0.34	0.39	0.46	0.58	20%	25%	30%	35%	43%	0.27	0.33	0.37	0.43	0.51
a	2011	50,000	0.25	0.33	0.40	0.47	0.63	19%	25%	30%	35%	46%	0.24	0.31	0.35	0.41	0.50
	2012	50,000	0.25	0.33	0.42	0.52	0.86	19%	25%	31%	39%	63%	0.20	0.28	0.34	0.40	0.51
	2010	100,000	0.27	0.34	0.39	0.46	0.58	20%	25%	30%	35%	43%	0.47	0.56	0.62	0.69	0.80
b	2011	100,000	0.23	0.31	0.37	0.45	0.61	17%	23%	28%	34%	45%	0.43	0.54	0.62	0.70	0.83
	2012	100,000	0.21	0.29	0.37	0.48	0.81	15%	22%	28%	36%	60%	0.39	0.53	0.61	0.72	0.88
	2010	150,000	0.27	0.34	0.39	0.46	0.58	20%	25%	30%	35%	43%	0.62	0.72	0.79	0.87	0.98
c	2011	150,000	0.21	0.29	0.35	0.43	0.59	16%	21%	26%	32%	43%	0.59	0.73	0.82	0.92	1.06
	2012	150,000	0.16	0.24	0.33	0.44	0.77	12%	19%	25%	32%	57%	0.55	0.73	0.84	0.97	1.16
	2010	184,000	0.27	0.34	0.39	0.46	0.58	20%	25%	30%	35%	43%	0.70	0.81	0.88	0.96	1.07
d	2011	184,000	0.19	0.27	0.33	0.41	0.57	14%	20%	25%	31%	42%	0.69	0.84	0.93	1.03	1.18
	2012	184,000	0.13	0.22	0.30	0.41	0.74	10%	16%	22%	30%	54%	0.65	0.85	0.98	1.11	1.31
	2010	200,000	0.27	0.34	0.39	0.46	0.58	20%	25%	30%	35%	43%	0.74	0.85	0.92	0.99	1.10
e	2011	200,000	0.18	0.26	0.33	0.40	0.56	14%	19%	25%	30%	41%	0.73	0.88	0.97	1.08	1.23
	2012	200,000	0.12	0.20	0.29	0.39	0.73	9%	15%	21%	29%	53%	0.69	0.90	1.03	1.17	1.38
	2010	224,975	0.27	0.34	0.39	0.46	0.58	20%	25%	30%	35%	43%	0.79	0.90	0.97	1.04	1.15
f	2011	181,462	0.17	0.25	0.31	0.39	0.55	13%	19%	24%	29%	40%	0.70	0.85	0.95	1.05	1.21
	2012	181,185	0.12	0.20	0.29	0.39	0.72	8%	15%	21%	29%	53%	0.66	0.86	0.99	1.14	1.35

Research and data needs

The majority of the research recommendations remain unchanged from the 2009 assessment, however extensive efforts to address full reanalysis of the acoustic survey time series and provide reasonable variance estimates (especially for those years when the survey did not extend to northern Canadian waters) as well as estimates of the numbers at length sex and age for constructing a 2-sex assessment model have been underway since early 2009. Acquisition of the underlying data from the Alaska Fisheries Science Center and historical archives as well as creating of new software for processing these data was required for this work to proceed. These efforts will result in the ability to reevaluate all major aspects of the stock assessment for 2011.

1) Reanalyze the historical acoustic survey time-series and calculate annual variance estimates incorporating uncertainties in spatial variability, sampling variability and target strength uncertainty.

2) Evaluate a sex-specific model and use of split-sex selectivity for the survey and the U.S. and Canadian fisheries.

3) Evaluate whether modeling the distinct at-sea and shore-based fisheries in the U.S. and Canada resolves some lack of fit in the compositional data.

4) Investigate aspects of the life history characteristics for Pacific hake and their possible effects on the interrelationship of growth rates and maturity at age. This should include additional data collection of maturity states and fecundity, as current information is limited.

5) Evaluate the quantity and quality of biological data prior to 1988 from the Canadian fishery for use in developing length and conditional age-at-length compositions.

6) Compare spatial distributions of hake across all years and between bottom trawl and acoustic surveys to estimate changes in catchability/availability across years. The two primary issues are related to the changing spatial distribution of the survey as well as the environmental factors that may be responsible for changes in the spatial distribution of hake and their influences on survey catchability and selectivity.

7) Conduct further exploration of ageing imprecision and the effects of large cohorts via simulation and blind source age-reading of samples with differing underlying age distributions – with and without dominant year classes.

8) Investigate alternative methods of parameterizing as well as alternative time blocking and/or restricted annual changes for fishery selectivity. Investigate reasons for changes in selectivity over time to validate estimated selectivity patterns.

9) Develop alternative indices for juvenile or young (0 and/or 1 year old) Pacific hake.

Table h. Summary of recent trends in Pacific hake exploitation and stock levels; all values reported at the beginning of the year.

Quantity	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Coast-wide landings (mt)	235,962	182,911	205,582	334,672	359,661	360,683	297,098	321,547	176,730	NA
ABC (mt)	238,000	208,000	235,000	514,441	531,124	661,680	612,068	400,000	253,582	NA
OY (1000s mt)	238,000	162,000	228,000	501,073	364,197	364,842	328,358	364,842	184,000	NA
Relative SPR: (1-SPR/1-$SPR_{Target=0.4}$)	0.77	0.48	0.43	0.62	0.73	0.82	0.84	0.96	0.80	NA
~95% interval	0.75 - 0.80	0.46 - 0.51	0.40 - 0.46	0.59 - 0.66	0.68 - 0.79	0.75 - 0.89	0.75 - 0.93	0.84 - 1.08	0.64 - 0.96	NA
Total biomass (millions mt)	2.83	3.05	3.00	2.72	2.30	1.88	1.64	1.43	1.13	1.04
3+ biomass (millions mt)	1.29	2.95	2.87	2.65	2.06	1.72	1.21	1.25	1.08	0.84
Spawning biomass (millions mt)	0.67	1.10	1.31	1.25	1.02	0.80	0.61	0.55	0.48	0.41
~95% interval	0.63 - 0.71	1.02 - 1.17	1.22 - 1.41	1.15 - 1.35	0.93 - 1.12	0.71 - 0.90	0.50 - 0.71	0.40 - 0.69	0.30 - 0.65	0.22 - 0.59
Recruitment (billions age-0)	0.92	0.01	1.68	0.20	2.90	1.34	0.01	0.88	1.84	1.81
~95% interval	0.82 - 1.04	<0.01 - 0.02	1.38 - 2.04	0.15 - 0.28	2.09 - 4.02	0.90 – 2.00	0.01 - 0.02	0.13 - 5.90	0.26 - 12.80	0.26 - 12.61
Depletion	50%	83%	99%	94%	77%	61%	46%	41%	36%	31%
~95% interval	44% - 57%	71% - 94%	85% - 113%	81% - 108%	66% - 88%	51% - 71%	37% - 55%	30% - 52%	22% - 49%	17% - 44%

Table i. Summary of Pacific hake reference points. *MSY related values reflect current growth patterns.

Quantity	Estimate	~95% Confidence interval
Unfished female spawning biomass (SB_0, millions mt)	1.33	1.15 - 1.50
Unfished total biomass (millions mt)	3.14	2.73 - 3.55
Unfished 3+ biomass (millions mt)	2.79	2.43 - 3.16
Unfished recruitment (R_0, billions)	1.95	1.72 - 2.22
Reference points based on $SB_{40\%}$		
MSY Proxy female spawning biomass ($SB_{40\%}$ mt)	530,545	461,712 - 599,378
SPR resulting in $SB_{40\%}$ ($SPR_{SB40\%}$)	0.46	0.42 - 0.50
Exploitation fraction resulting in $SB_{40\%}$	0.21	0.18 - 0.24
Yield at $SB_{40\%}$ (mt)	247,589	202,005 - 293,173
Reference points based on SPR proxy for MSY		
Female spawning biomass at $SPR_{MSY\text{-}proxy}$ (SB_{SPR} mt)	453,986	376,045 - 531,927
$SPR_{MSY\text{-}proxy}$	0.40	NA
Exploitation fraction corresponding to SPR	0.26	NA
Yield with $SPR_{MSY\text{-}proxy}$ at SB_{SPR} (mt)	262,957	217,483 - 308,431
Reference points based on estimated MSY values		
Female spawning biomass at *MSY* (SB_{MSY} mt)	292,432	182,607 - 402,256
SPR_{MSY}	0.27	0.14 - 0.40
Exploitation fraction corresponding to SPR_{MSY}	0.41	0.20 - 0.63
MSY (mt)	279,071	211,315 - 346,827

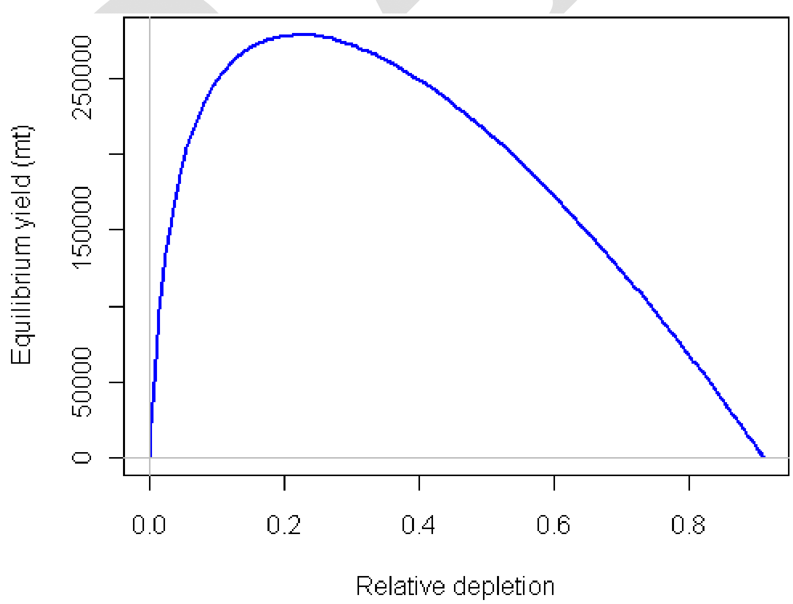

Figure h. Equilibrium yield curve for the base case model. Note that values will differ from table h above where iteration was performed to ensure that the U.S.-Canadian catch allocation was maintained.

1. Introduction

Prior to 1997, separate Canadian and U.S. assessments were submitted to each nation's assessment review process. This practice resulted in differing yield options being forwarded to each country's managers for this shared trans-boundary fish stock. Multiple interpretations of Pacific hake status made it difficult to coordinate an overall management policy. Since 1997 the Stock Assessment and Review (STAR) process for the Pacific Fishery Management Council (PFMC) has evaluated assessment models and the PFMC council process, including NOAA Fisheries, has generated management advice that has been largely utilized by both nations. The Joint US-Canada treaty on Pacific Hake was formally ratified in 2006 (signed in 2007) by the United States as part of the reauthorization of the Magnuson-Stevens Fishery Conservation and Management Act, and has been considered in force (according to Canada) since June 25, 2008. However, as of this writing the treaty has not been fully implemented. Under this treaty, Pacific hake (a.k.a. Pacific whiting) stock assessments are to be prepared by the Hake Technical Working Group comprised of U.S. and Canadian scientists and reviewed by a Scientific Review Group (SRG), with memberships as appointed by both parties to the agreement. In the interim, analysts from both nations have continued to work in collaboration, but using largely independent modeling approaches. The current (2010) U.S. assessment retains the structure and features of the 2009 assessment, but is updated to include new data available from the 2009 fishery and acoustic survey. A number of issues raised during and since the 2009 assessment, as well as several new data sources are also evaluated via sensitivity analyses to the base model. A more extensive exploration of the assessment model and data is anticipated as part of the 2011 assessment, once a full re-analysis of the acoustic survey data has been conducted.

1.1 Stock structure and life history

Pacific hake (*Merluccius productus*), also referred to as Pacific whiting, is a semi-pelagic schooling species distributed along the west coast of North America generally ranging from 25^0 N. to 55^0 N. latitude. It is among 13 species of hake from the genus, *Merluccius* (being the majority of the family *Merluccidae)*, which are distributed worldwide in both hemispheres of the Atlantic and Pacific oceans and collectively have constituted nearly two million mt of catch annually (Alheit and Pitcher 1995). The coastal stock of Pacific hake is currently the most abundant groundfish population in the California Current system. Smaller populations of this species occur in the major inlets of the North Pacific Ocean, including the Strait of Georgia, Puget Sound, and the Gulf of California. Historical electrophoretic studies indicate that Strait of Georgia and the Puget Sound populations are genetically distinct from the coastal population (Utter 1971). Genetic differences have also been found between the coastal population and hake off the west coast of Baja California (Vrooman and Paloma 1977). The coastal stock is also distinguished from the inshore populations by larger body size and seasonal migratory behavior.

The coastal stock of Pacific hake typically ranges from the waters off southern California to Queen Charlotte Sound. Distributions of eggs, larvae, and infrequent observations of spawning aggregations indicate that Pacific hake spawning occurs off south-central California during January-March. Due to the difficulty of locating major offshore spawning concentrations, details of spawning behavior of hake remains poorly understood (Saunders and McFarlane 1997). In spring, adult Pacific hake migrate onshore and to the north to feed along the continental shelf and slope from northern California to Vancouver Island. In summer, Pacific hake form extensive midwater aggregations in association with the continental shelf break, with highest densities located over bottom depths of 200-300 m (Dorn 1991, 1992). Pacific hake feed on euphausiids, pandalid shrimp, and pelagic schooling fish (such as eulachon and Pacific herring) (Livingston and Bailey 1985). Larger Pacific hake become increasingly piscivorous, and Pacific herring are commonly a large component of hake diet off Vancouver Island. Although Pacific hake are cannibalistic, the geographic separation of juveniles and adults usually prevents cannibalism from being an important factor in their population dynamics (Buckley and Livingston 1997).

Older (age 5+), larger, and predominantly female hake exhibit the greatest northern migration each season. During El Niño events, a larger proportion of the stock migrates into Canadian waters, apparently due to intensified northward transport during the period of active migration (Dorn 1995, Agostini et al. 2006). El Niño conditions also result in range extensions to the north, as evidenced by reports of hake off of southeast Alaska during these warm water years. Throughout the warm period experienced in 1990s, there were changes in typical patterns of hake distribution. Spawning activity was recorded north of California. Frequent reports of unusual numbers of juveniles off of Oregon to British Columbia suggest that juvenile settlement patterns also shifted northwards in the late 1990s (Benson et al. 2002, Phillips et al. 2007). Because of this shift, juveniles may have been subjected to increased cannibalistic predation and fishing mortality. Subsequently, La Nina conditions in 2001 resulted in a southward shift in the stock's distribution, with a much smaller proportion of the population found in Canadian waters in the 2001 survey. Hake were distributed across the entire range of the survey in 2003, 2005, 2007 (Figure 1) after displaying a very southerly distribution in 2001. Although a few adult hake (primarily from the 1999 cohort) were observed north of the Queen Charlotte Islands in 2009 (Figure 2) most of the stock appears to have been distributed off Oregon and Washington.

1.2 Ecosystem considerations

Pacific hake are an important contributor to ecosystem dynamics in the Eastern Pacific due to their relatively large total biomass and predatory behavior. The role of hake predation in the regulation of other groundfish species is likely to be important (Harvey et al. 2008), although difficult to measure. Hake migrate farther north during the summer during relatively warm water years and their local ecosystem role therefore differs year-to-year depending on environmental conditions. Recent research indicates that hake distributions may be growing more responsive to temperature, and that spawning and juvenile hake may be occurring farther north (Phillips et al. 2007; Ressler et al. 2007). Given long-term climate-change projections and changing distributional patterns, considerable uncertainty exists in any forward projections of stationary stock productivity and dynamics.

Hake are also important prey items for many piscivorous species including lingcod (*Ophiodon elongatus*) and jumbo flying squid (also known as Humboldt squid, *Dosidicus gigas*). In recent years, the lingcod stock has rebuilt rapidly from an overfished level and jumbo flying squid have substantially extended their range northward from more tropical waters to the west coast of North America. Recent observations of jumbo flying squid from hake fishermen as well as recreational fishermen, and scientists in the U.S. and Canada reflect a very large increase in squid abundance as far north as southeast Alaska (e.g., Gilly et al., 2006; Field et al., 2007) during the same portions of the year that hake are present. Although the relative biomass of these squid and the cause of this range extension are not completely known, squid predation on pacific hake is likely to have increased substantially. There is evidence from the Chilean hake (a similar gadid species) fishery that squid may have a large and adverse impact on abundance, due to direct predation of individuals of all sizes (Alarcón-Muñoz et al., 2008). Squid predation as well as secondary effects on schooling behavior and distribution of Pacific hake may become important to this assessment in the future, however it is unlikely that the current data sources will be able to detect squid related changes in population dynamics (such as an increase in natural mortality) until well after they have occurred, if at all. There is considerable ongoing research to document relative abundance, diet composition and habitat utilization of jumbo flying squid in the California current ecosystem (e.g., J. Field, SWFSC, and J. Stewart, Hopkins Marine Station, personal communication, 2010; Gilly et al., 2006; Field et al., 2007) which should be considered in future assessments.

1.3 Fisheries

The fishery for the coastal population of Pacific hake occurs along the coasts of northern California, Oregon, Washington, and British Columbia primarily during April-November. The fishery is conducted almost exclusively with midwater trawls. Most fishing activity occurs over bottom depths of 100-500 m, while offshore extensions of fishing activity have occurred in recent years to prevent bycatch of depleted rockfish and salmon. The history of the coastal hake fishery is characterized by rapid changes brought about by the development of substantial foreign fisheries in 1966, joint-venture fisheries by the early 1980's, and domestic fisheries in 1990's (Table 1).

Large-scale harvesting of Pacific hake in the U.S. zone began in 1966 when factory trawlers from the Soviet Union began targeting Pacific hake. During the mid 1970's, factory trawlers from Poland, Federal Republic of Germany, the German Democratic Republic and Bulgaria also participated in the fishery. During 1966-1979, the catch in U.S. waters is estimated to have averaged 137,000 t per year (Table 1, Figure 3). A joint-venture fishery was initiated in 1978 between two U.S. trawlers and Soviet factory trawlers acting as mother ships (the practice where the catch from several boats is brought back to the larger, slower ship for processing and storage until the return to land). By 1982, the joint-venture catch surpassed the foreign catch, and by 1989, the U.S. fleet capacity had grown to a level sufficient to harvest the entire quota, and no foreign fishing was allowed, although joint-venture fisheries continued for another two years. In the late 1980's, joint ventures involved fishing companies from Poland, Japan, former Soviet Union, Republic of Korea and the People's Republic of China.

Historically, the foreign and joint-venture fisheries produced fillets as well as headed and gutted products. In 1989, Japanese mother ships began producing surimi from Pacific hake using a newly developed process to inhibit myxozoan-induced proteolysis. In 1990, domestic catcher-processors and mother ships entered the Pacific hake fishery in the U.S. zone. Previously, these vessels had engaged primarily in Alaskan walleye pollock (*Theragra chalcogramma*) fisheries. The development of surimi production techniques for pollock was expanded to include Pacific hake as a viable alternative. Similarly, shore-based processors of Pacific hake had been constrained by a limited domestic market for Pacific hake fillets and headed and gutted products. The construction of surimi plants in Newport and Astoria, Oregon, led to a rapid expansion of shore-based landings in the U.S. fishery in the early 1990's. In 1991, the joint-venture fishery for Pacific hake in the U.S. zone ended because of the increased level of participation by domestic catcher-processors and mother ships, and the growth of shore-based processing capacity. In contrast, Canada allocates a portion of the Pacific hake catch to joint-venture operations once shore-side capacity is filled.

The sectors involved in the Pacific hake fishery in Canada exhibit a similar historical pattern, although phasing out of the foreign and joint-venture fisheries has proceeded more slowly relative to the U.S. (Table 1). Since 1968, more Pacific hake have been landed than any other species in the groundfish fishery on Canada's west coast. Prior to 1977, the fishing vessels from the former Soviet Union caught the majority of Pacific hake in the Canadian zone, with Poland and Japan accounting for much smaller landings. After declaration of the 200-mile extended fishing zone in 1977, the Canadian fishery was divided among shore-based, joint-venture, and foreign fisheries. In 1992, the foreign fishery ended, but the demand of Canadian shore-based processors remained below the available yield, thus the joint-venture fishery continues today, although no joint-venture fishery took place in 2002, 2003, or 2009. The majority of the shore-based landings of the coastal hake stock is processed into surimi, fillets, or mince by processing plants at Ucluelet, Port Alberni, and Delta, British Columbia. Although significant aggregations of hake are found as far north as Queen Charlotte Sound, in most years the fishery has been concentrated below 49° N. latitude off the south coast of Vancouver Island, where there are sufficient quantities of fish in proximity to processing plants.

1.4 Management of Pacific hake

Since implementation of the Magnuson-Stevens Fishery Conservation and Management Act in the U.S. and the declaration of a 200-mile fishery conservation zone in Canada in the late 1970's, annual harvest quotas have been the primary management tool used to limit the catch of Pacific hake. Scientists from both countries have historically collaborated through the Technical Subcommittee of the Canada-U.S. Groundfish Committee (TSC), and there have been informal agreements on the adoption of annual fishing policies. During the 1990s, however, disagreements between the U.S. and Canada on the allotment of the acceptable biological catch (ABC) between U.S. and Canadian fisheries led to quota overruns; 1991-1992 quotas summed to 128% of the ABC, while the 1993-1999 combined quotas were 107% of the ABC on average. In the current Pacific hake agreement, the United States is allocated 73.88% of the total coast-wide harvest and Canada 26.12%.

In the last decade, the optimal yields (OYs, harvest targets) for Pacific hake have been set well below the Allowable Biological Catches (ABCs, harvest limits) and the total coastwide catch has tracked the harvest targets reasonably closely (Table 2). In 2002, after Pacific hake was declared overfished by the U.S., the catch of 183 thousand metric tons exceeded the OY; however it was still below the ABC of 208 thousand mt. In 2004, after Pacific hake was declared rebuilt, and when the large 1999 cohort was at near-peak biomass, the catch fell well short of the OY of 501 thousand mt. This OY was based on the 40:10 harvest control rule (the “40:10 HCR”; this rule consists of applying an $F_{40\%}$ policy and decreasing the catch linearly when the stock drops below 40% of unfished equilibrium spawning output such that catch would be equal to zero at a relative spawning depletion of 10%) and was very close to the ABC of 514 thousand mt; larger than the largest catch ever realized. Constraints imposed by bycatch of canary and widow rockfishes limited the commercial U.S. OY to 259 thousand mt. U.S. catch has not substantially exceeded the harvest guideline for the U.S. zone in any recent year, indicating that in-season management procedures have been effective.

1.4.1 United States

In the U.S. zone, participants in the directed fishery are required to use pelagic trawls with a codend mesh that is at least 7.5 cm (3 inches). Regulations also restrict the area and season of fishing to reduce the bycatch of Chinook salmon and several depleted rockfish stocks. More recently, yields in the U.S. zone have been restricted to levels below optimum yields due to bycatch of overfished rockfish species, primarily widow and canary rockfishes, in the Pacific hake fishery. At-sea processing and night fishing (midnight to one hour after official sunrise) are prohibited south of 42° N. latitude. Fishing is prohibited in the Klamath and Columbia River Conservation zones, and a trip limit of 10,000 pounds is established for Pacific hake caught inside the 100-fathom contour in the Eureka INPFC area. During 1992-1995, the U.S. fishery opened on April 15; however in 1996 the opening date was changed to May 15. Shore-based fishing is allowed after April 1 south of 42° N. latitude, but is limited to 5% of the shore-based allocation being taken prior to the opening of the main shore-based fishery. The main shore-based fishery opens on June 15. Prior to 1997, at-sea processing was prohibited by regulation when 60 percent of the harvest guideline was reached. The current allocation agreement, effective since 1997, divides the U.S. non-tribal harvest guideline among factory trawlers (34%), vessels delivering to at-sea processors (24%), and vessels delivering to shore-based processing plants (42%). Since 1996, the Makah Indian Tribe has conducted a separate fishery with a specified allocation in it’s "usual and accustomed fishing area”, and for the first time in 2009 there was a separate Quileute tribal allocation.

1.4.2 Industry actions

Shortly after the 1997 allocation agreement was approved by the PFMC, fishing companies owning factory trawlers with west coast groundfish permits established the Pacific Whiting Conservation Cooperative (PWCC). The primary role of the PWCC is to allocate the factory trawler quota among its members. Anticipated benefits of the PWCC include more efficient allocation of resources by fishing companies, improvements in processing efficiency and product quality, and a reduction in waste and bycatch rates relative to the former “derby” fishery in which all vessels competed for a fleet-wide quota. The PWCC also initiated recruitment research to support hake stock assessment. As part of this effort, PWCC sponsored a juvenile recruit survey in the summers of 1998 and 2001, which since 2002 has become an ongoing collaboration with NMFS. In 2009, the PWCC contracted a review of the 2009 stock assessment which is discussed in further detail below.

1.5 Overview of Recent Fisheries

1.5.1 United States

In 2005 and 2006, the coast-wide ABCs were 531,124 and 661,680 mt respectively. The OYs for these years were set at 364,197 and 364,842 and were nearly fully utilized. For the 2007 fishing season the PFMC adopted a 612,068 mt ABC and a coast-wide OY of 328,358 mt. This coast-wide OY continued to be set considerably below the ABC in order to avoid exceeding bycatch limits for overfished rockfish. In 2008, the PFMC adopted an ABC of 400,000 mt and a coast-wide OY of 364,842 mt, based upon the 2008 stock assessment. This ABC was set below the overfishing level indicated by the stock assessment, and therefore the difference between the ABC and OY was substantially less than in prior years. However, the same bycatch constraints caused a mid-season closure in the U.S. in both 2007 and 2008 and resulted in final landings being below the OY in both years.

Based on the 2009 whiting assessment, the Pacific council adopted a U.S.-Canada coast-wide ABC of 253,582 mt, and a U.S. ABC of 187,346 mt. The council adopted a U.S.-Canada coast-wide OY of 184,000 mt and a U.S. OY of 135,939 mt, reflecting the agreed-upon 73.88% of the OY apportioned to U.S. fisheries and 26.12% to Canadian fisheries. Within the U.S. fishery, the 135,939 mt OY was divided among the target whiting sectors after accounting for tribal and research/bycatch set-asides. The original Makah tribal allocation was 42,000 mt, and the Quileute tribal allocation was 8,000 mt. However, the Makah Tribal Representatives indicated their intent to harvest only 23,789 mt, and proposed that the remaining 18,211 mt of their allocation to be divided among the rest of the U.S. Fishery. The Quinault and Hoh tribes did not request an allocation in 2009. In 2009, 4,000 mt was set aside for research catch along with bycatch in non-hake fisheries. Among U.S. sectors, at-sea catcher/processors received 34 percent (34,051 mt), motherships received 24 percent (24,034 mt), and the shore-based fishery received 42 percent (42,063 mt) of the target (non-tribal) whiting sector share. On December 7, 2009, 1,325 mt were re-apportioned from the shore-based sector (now with an allocation of 40,738 mt) to the catcher/processor sector (35,376 mt).

Bycatch limits were assigned to each sector of the fishery for the first time in 2009. For the combined non-tribal Pacific whiting sectors in 2008 were as follows: 250 mt of widow rockfish catcher/processor: 85 mt; mothership: 60 mt; shorebased: 105 mt), 18 mt of canary rockfish (catcher/processor: 6.1 mt; mothership: 4.3 mt; shorebased: 7.6 mt), and 25 mt of darkblotched rockfish (catcher/processor: 8.5 mt; mothership: 6 mt; shorebased: 10.5 mt).

The official dates of fishing included a standard spring start with continued fishing opportunity through the end of 2009. By sector, seasons were: mothership sector, May 15 to June 1 (when the allocation was reached); catcher/processor sector, May 15 until the end of the year; Shore-based sector: June 15 to July 7 (when the allocation was expected to be reached) north of 42° N. latitude; April 1 to May 14 between 42°-40°30’ N. latitude; April 15 to May 41 south of 40°30’ N. latitude.

The shore-based sector caught 40,681 mt, or 99.8% of its remaining quota after in-season reallocations during the summer. The at-sea mothership sector caught 24,091 mt, or 100.2% of its remaining quota after in-season reallocations in a short season in late spring. The at-sea catcher/processor sector caught 34,620 mt, or 97.9% of its remaining quota after in-season reallocations with fishing beginning in the fall and continuing until mid-December. Tribal catches totaled 21,719 mt, or 68.3% of the quota allocated. In total, the 2009 U.S. fishery caught 121,110 mt, or 89.1% of the U.S. OY. Bycatch limits were not exceeded by any sector of the U.S. fishery.

1.5.2 Canada

DFO managers allow a 15% discrepancy between the quota and total catch. The quota may be exceeded by up to 15% in any given year, which is then deducted from the quota for the subsequent year. Conversely, if less than the quota is taken, up to 15% can be carried over into the next year. For instance, an apparent overage in 1998 was due to carry-over from 1997 when 9% of the quota was not taken; this policy has not resulted in catch exceeding the coast-wide OY in the past 6 years (Table 2).

Canadian Pacific hake catches were fully utilized in the 2005 fishing season with 85,284 mt and 15,178 mt taken by the domestic and joint venture fisheries, respectively. In 2006, the joint-venture and domestic fisheries harvested 13,700 mt and 80,000 mt, respectively. During the 2007 fishing season, Canadian fisheries harvested 85% of the 85,373 mt national allocation. In 2008, Canadian fisheries harvested 78% of the 95,297 mt national allocation with joint-venture and domestic sectors catching 3,590 mt and 70,160 mt, respectively. During the 2009 season, no catches were made under joint-venture agreement. The Canadian domestic fishery harvested 55,620 mt in 2009, or 115.7% of the Canadian OY.

2. Available data sources

Data from the primary fishery dependent and independent sources fit directly in the stock assessment model include:

- Total catch from the U.S. and Canadian fisheries (1966-2009).
- Length compositions from the U.S. fishery (1975-2009) and Canadian fishery (1988-2009).
- Age compositions from the U.S. fishery (1973-1974) and Canadian fishery (1977-1987). These are the traditional age compositional data generated by applying fishery length compositions to an age-length key. Use of this approached was necessary to fill in gaps for those years in which biological samples could not be re-acquired from standard procedures.
- Conditional age-at-length compositions from the U.S. fishery (1975-2009) and Canadian fishery (1988-2009).
- Biomass indices, length compositions and conditional age-at-length composition data from the Joint US-Canadian integrated acoustic and trawl survey (1977, 1980, 1983, 1986, 1989, 1992, 1995, 1998, 2001, 2003, 2005, 2007, and 2009). The 1986 acoustic survey biomass estimate, length and age data are retained in the current model (as in 2009), however these data have been the topic of considerable discussion due to calibration issues (the 1986 data were removed from the model by the 2004 STAR panel and re-included by the 2008 STAR panel).

Some sources were not included in the final base model, but were explored and included in sensitivity runs:

- NWFSC/SWFSC/PWCC coast-wide juvenile hake and rockfish survey (2001-2009). These data remain contradictory to the fishery and acoustic survey composition data and are therefore again effectively tuned out of the model.

- Bycatch of Pacific hake in the trawl fishery for pink shrimp off the coast of Oregon, 2004-2005, 2007-2008. This time-series was too short to add appreciable information to the stock assessment, but anecdotal reports have indicated the presence of hake in the shrimp fishery, and since these are primarily juvenile hake there is the potential that this source of data could be used as an index of abundance.
- Length data collected in Santa Barbara for the years 1963-1970 (Jow, 1973). These data were included in the 2009 assessment, but were found to contribute no appreciable information to the stock assessment.

Some sources were not included, but had been explored during the course of the 2008 assessment, including:

- CalCOFI larval hake production index, 1951-2006. The data source was previously explored and rejected as a potential index of hake spawning stock biomass, and has not been revisited since the 2008 stock assessment.

The assessment model also used biological relationships derived from external analysis of auxiliary data; these were unchanged from the 2009 assessment and include:

- Proportion of individual female hake mature by size.
- Natural mortality rate (ages 2-13).
- Allometric growth relationship of mean weight at size.
- Growth parameters including the length of age-2 fish and the CVs of length at age for the youngest and oldest fish.
- Aging error matrices based on cross-read otoliths (unchanged from the 2009 assessment).

2.1 Fishery-dependent data

2.1.1 Total catch

The catch of Pacific hake for 1966-2009 by nation and fishery is shown in Table 1. Catches in U.S. waters for 1966-1980 are from Bailey et al. (1982). Prior to 1977, the at-sea catch was reported by foreign nationals without independent verification by observers. Bailey et al. (1982) suggest that the catch from 1968 to 1976 may have been under-reported because the apparent catch per vessel-day for the foreign fleet increased after observers were placed on foreign vessels in the late 1970's. An alternate model run to evaluate the sensitivity to this assumption was produced for the 2008 assessment. For 1981-2008, the shore-based landings are from Pacific Fishery Information Network (PacFIN). Foreign and joint-venture catches for 1981-1990 and domestic at-sea catches for 1991-2009 are estimated from the AFSC’s and, subsequently, the NWFSC's at-sea hake observer programs.

At-sea discards are included in the foreign, joint-venture, at-sea domestic landings estimates in the U.S. zone. Discards have been recently estimated for the shore-based non-whiting fishery but are nominal relative to the total fishery catch. The majority of vessels in the U.S. shore-based fishery have operated under experimental fishing permits that required them to retain all catch and bycatch for sampling by plant observers. Canadian joint-venture catches are monitored by at-sea observers, which are placed on all processing vessels. Observers use volume/density methods to estimate total catch. Domestic Canadian landings are recorded by dockside monitors using total catch weights provided by processing plants. Catch data from Canadian fisheries have been provided by Chris Grandin (DFO, Pacific Biological Station, Nanaimo, B.C.).

2.1.2 Fishery biological data

Biological information from the U.S. at-sea commercial Pacific hake fishery was extracted from the NORPAC database. This yielded length, weight and age information from the foreign and joint venture fisheries from 1975-1990, and from the domestic at sea fishery from 1991-2009. Specifically these data included sex-specific length and age data which observers collect by selecting fish randomly from each haul for biological data collection and otolith extraction. Biological samples from the U.S. shore-based fishery were collected by port samplers where there are substantial landings of Pacific hake: primarily Newport, Astoria, Crescent City, and Westport, from 1991-2009. Port samplers routinely take one sample per offload (or trip) consisting of 100 randomly selected fish for individual length and weight and 20 randomly selected fish for otolith extraction. The sampling unit for the shore-based fishery is the trip, while the haul is used for the at-sea fishery. Since detailed haul-level information is not recorded on trip landings documentation in the shore-based fishery, and hauls sampled in the at-sea fishery can not be aggregated to a comparable trip level, there is no least common denominator for aggregating at-sea and shore-based fishery samples. As a result, samples sizes are simply summed over hauls and trips for U.S. fishery length- and age-compositions, and each fishery is weighted according to the proportion of its catch. Detailed sampling information including the numbers of hauls sampled, lengths collected, and otoliths aged in the foreign, joint-venture and domestic at-sea and shore-based fisheries are presented in Table 3.

Length data from the early United States fishery (4,550 lengths) was recorded at Santa Barbara between 1963 and 1970 (Jow, 1973) were included as seasonal length compositions in the 2009 stock assessment. As there was no information on the number of trips or hauls sampled, initial input sample sizes were set at one-tenth the number of length samples in each year and season. These data were removed from the 2010 assessment as they contributed no appreciable information to the model and the selectivity parameters performed poorly during MCMC integration (Hamel and Stewart, 2009).

The Canadian shore-based fishery is subject to 10% observer coverage. On observed trips, otoliths (for ageing) and lengths are sampled from Pacific hake caught in the first haul of the trip, with length samples taken on subsequent hauls. Sampled weight from which biological information is collected must be inferred from year-specific length-weight relationships. For unobserved trips, port samplers obtain biological data from the landed catch. Observed domestic haul-level information is then aggregated to the trip level to be consistent with the unobserved trips that are sampled in ports. Canadian domestic fishery biological samples are available from 1996-2009.

For the Canadian at-sea joint-venture fishery, an observer aboard the factory ship records the codend weight for each codend transferred from a companion catcher boat. Length samples are collected every second day of fishing operations, and otoliths are collected once a week. Length and age samples are taken randomly from a given codend. Since the weight of the sample from which biological information is taken is not recorded, sample weight must be inferred from a weight-length relationship applied to all lengths taken and summed over haul. Length and age information is available from the joint-venture fishery from 1988-2009. As in the case with the U.S. at-sea fishery, the basic sampling unit in the Canadian joint-venture fishery is the haul. Detailed sampling information for the Canadian fisheries is presented in Table 4.

Length and age data were analyzed based on the sampling protocols used to collect them, and expanded to estimate the corresponding statistic from entire landed catch by fishery and year when sampling occurred. In general, the analytical steps can be summarized as follows:

1) Count lengths (or ages) in each size (or age) bin for each haul in the at-sea fishery and for each trip in the shore-based fishery, generating “raw” frequency data.
2) Expand the raw frequencies from the haul or trip level to account for the catch weight and weight sampled in each trip.
3) Expand the summed frequencies by fishery sector to account for the total landings.
4) Calculate sample sizes (number of samples) and normalize to proportions that sum to unity within each year.

To complete step (2), it was necessary to derive a multiplicative expansion factor for the observed raw length frequencies of the sample. This expansion factor was calculated for each sample corresponding to the ratio of the total catch weight in a haul or trip divided by the total sampled weight from which biological samples were taken within the haul or trip. In cases where there was not an estimated sample weight (more common in the Canadian domestic shore-based trips), a predicted weight of the sample was computed by applying a year-specific length-weight relationship to each length in the sample, then summing these weights. Anomalies that could emerge when very small numbers of fish lengths are collected from very large landings were avoided by constraining expansion factors to not exceed the 95^{th} percentile of all expansion factors calculated for each year and fishery. The expanded lengths (N at each length times the expansion factor for the sample) were then summed within each fishery sector, and then weighted a second time by the relative proportion of catches by fishery within each year and nation. Finally, the year-specific length frequencies were summed over fishery sector and normalized so that the sum of all lengths in a single year and nation was equal to unity. The total sample size (# samples) from all sectors by year is used as the multinomial sample size input to the stock assessment model.

In recent U.S. fisheries, between 9% and 19% of all shore-based landings has been sampled, compared to between 41% and 95% of the at-sea catch (Table 5). In both sectors, the fraction sampled has generally increased over time. The percentage of sampled harvest has been more variable in the Canadian fisheries over the same time period (Table 6). All recent age data have been included in the model as conditional age-at-length compositions. As in the 2009 assessment, 18 (out of more than 2,600) individual conditional age-at-length compositions were not used due to unrealistic age-at-size compositions (Pearson residuals > 50). These generally represented small samples sizes and purported very old but small or very young but large hake. Sample sizes for conditional age-at-length compositions for the U.S. and Canadian fisheries are given in Tables 7 and 8, respectively.

U.S. fishery length and implied age compositions representing fish caught in both the at-sea and shore-based fisheries are shown in Figures 4-5 and Figure 6-7, respectively. Implied age compositions are the proportions at age arrived at after collapsing the conditional age at length compositions over the length margin (appropriately weighted). There are differences between the length compositions of the at-sea and shore-based domestic fisheries, suggesting that, in the future, an attempt should be made to model them separately. In general, the composite U.S. fishery length and age compositions confirm the well known pattern of year-class strengths, including the extra-dominant 1980, dominant 1977, 1984 and 1999, and secondary 1970, 1973, 1987 and 1990 year classes moving through the size structure (Figure 6-7). The most recent length and age compositional data from the 2008-2009 U.S. fishery and the 2009 acoustic survey also indicate the presence of a relatively strong 2005 year class. Apparent also in 2009 is the emergence of another pronounced cohort at age 3 (the 2006 year class) and the continued presence of a small number of fish from the 1999 year-class, now age 10 (Figures 6-7). Conditional age-at-length compositions suggest that the sizes of hake caught in the U.S. fishery have changed over time, possibly due to growth, selectivity or both. This is particularly evident with the appearance of larger fish before 1990 and a shift to smaller fish between 1995 and 2000. These features are explored in the population dynamics model.

As with the U.S. fleet sectors, differences in length compositions between the Canadian joint-venture and domestic fleets among some of the years warrant future exploration of fitting the fisheries separately. The composite Canadian fishery length compositions (Figures 8 and 9) and age compositions (Figures 10 and 11) indicate that the Canadian fleets exploit larger and older hake. A particularly interesting feature of these length compositions is that the Canadian fleet prosecuted a seemingly fast growing 1994 year class of hake in 1995 (age 1), 1996 (age 2) and subsequent years. It is unclear whether this is due to size- vs. age-based selectivity; however, it is well known that larger (and older) hake migrate further northward annually (Dorn, 1995). The 2001 and 2002 Canadian length compositions appear to be anomalies. In recent years the 1999 year class has dominated the catch of the Canadian fleets, strong and increasing presence of the 2005 year class in the Canadian fisheries in 2008 and 2009. As in the U.S. fishery, Canadian age and length compositions show some temporal pattern in the range of fish exploited by the fishery.

U.S. and Canadian fishery length and conditional age-at-length compositions constitute the bulk of compositional data in this assessment and provide information on recruitment strength, growth and growth variability. As such, the model is actually fitting the conditional age-at-length compositions, but fits are shown to the "implied" age compositions (fits are simply collapsed in the margin of proportions at age) for convenience. Since age-composition data available for pre-2006 hake assessments extended further back in time than the currently documented conditional age-at-length data, the older age data are retained in the assessment model in their original form to augment information on recruitment earlier in the time series (U.S. fishery = 1973-1974, Canadian fishery = 1977-1987). Status of the raw data for these compositional observations remains to be determined, and they should be fully re-analyzed or discarded pending future evaluation.

2.1.3 Bycatch in the pink shrimp fishery

Historical fishery dependent data sources available for the Pacific hake assessment provide little information on the strength of incoming year classes due to changes in targeting behavior that depend on cohort strengths and geographic availability, and the avoidance of juvenile hake (ages 0-1 and in many years also including age 2) due to market factors. However, juvenile hake are frequently encountered by the trawl fishery for pink shrimp, which operates primarily in the waters off Oregon (NWFSC, 2009; Hannah and Jones, 2009). This fleet carries observers employed by the West Coast Groundfish Observer Program (WCGOP). As part of this assessment, the estimated bycatch of juvenile hake in the pink shrimp fishery were examined in order to determine whether they might provide an alternate index of recent year-class strength prior to clear signal in the fishery.

The sampling protocols for the WCGOP are documented in the WCGOP observer training manual:
(www.nwfsc.noaa.gov/research/divisions/fram/observer/observermanual/observermanual.cfm), and the fleet coverage plan:
(www.nwfsc.noaa.gov/research/divisions/fram/observer/observersamplingplan.pdf). The WCGOP observed this fishery during 2004, 2005, 2007, and 2008, 2009 (however the data are not yet available for the entire 2009 calendar year); the fleet was not observed in 2006. The WCGOP only observes vessels with Oregon state pink shrimp licenses and California state northern pink shrimp trawl vessel licenses. Washington pink shrimp trawlers are not observed by the WCGOP, as the state has not yet issued a ruling allowing federal observer coverage of its state managed fisheries. However, Oregon licensed pink shrimp vessels can and do fish in waters off Washington. State-issued pink shrimp trawl licenses are selected for observation using stratified random sampling without replacement. Vessels with pink shrimp permits were assigned to a port group based upon the location of their landings in the previous year. Within each port group, permits are then randomly selected for coverage. California shrimp vessels were selected for a two-month period. Oregon pink shrimp vessels were selected for a one-month period due to the high number of vessels and trips. The pink shrimp trawl fleet is one of WCGOP's lower priorities for observer coverage, as their incidental take of groundfish species is much lower than other observed fisheries. As such, only 4.6-10.1% of pink shrimp fishery landings are observed annually (Table 9).

Prior to 2009, WCGOP observers did not collect individual length measurements for Pacific hake encountered in the pink shrimp fishery. In order to determine whether larger hake may be occasionally included with juvenile hake in the bycatch of this fishery we examined the distribution of mean individual weights for all shrimp hauls sampled during 2004-April 2009 (Figure 12). The presence of a small number of fish larger than one-third to one-half of a pound suggest that not all larger hake are removed by all types of excluder devices utilized in this fishery. Without length-frequency information for each haul, it is therefore impossible to delineate between juvenile hake and adults in the historical data (although this will be possible in the future, since lengths are now being collected). This delineation could not be approximated with the 2009 hake lengths collected, due to the small number (198) and the lack of any hake greater than age-1 (Figure 13). The length frequency distribution for two additonal species with similar body morphologies to Pacific hake (lingcod and sablefish) are included, the aggregate does reflect the presence of infrequent individual fish greater than about 20 cm and as large as 64 cm (Figue 14).

In order to attempt to derive information on juvenile hake from the pink shrimp fishery, we compiled several products: the total estimated discards of hake by year (expanded to the entire fleet level), the observed discards (expanded only within observed trips), discard rates per trip and per unit shrimp catch as well as estimated discards only for trips with less than a 0.5 lb average individual body weight. All of these methods for summarizing bycatch produced very similar relative time-series, with no obvious differences between rates or absolute estimates; further, the exclusion of hauls discarding hake greater than 0.5 lbs also had little effect on estimated discards, indicating this was a relatively infrequent events and/or such hauls did not comprise the majority of shrimp tows (Figure 15).

The summary index produced from this analysis reflects only trips with average individual weight less than 0.5 lbs (Table 10, Figure 16). The magnitude of the observation for 2007 is relatively large, however confidence intervals represent bootstrapped variance only in the sampling process itself. There are several factors that are likely more important to the proportionality of this index with juvenile hake abundance than the sampling variance. The most important of these factors are the geographic distribution of the hake fishery and ongoing modifications by fishermen (specifcally to avoid hake and other finfish) to fishing behavior, the excluders and the net panels used in this fishery. Specifically, age-1 hake comprising the bulk of the shrimp bycatch hake seem to be present over a broad geographic region from southern/central California as far north as the Canadian border in some years. The observer data comes only from the Oregon shrimp fleet, and that fleet accesses a very specific habitat (both depth and bottom substrate) conducive to high catch rates of pink shrimp, and will often move in response to increased finfish bycatch. The presence of large quantities of finfish (often hake) in shrimp catches slows the sorting process and is generally undesirable (R. Hannah, ODFW, personal communication). Fishermen have responded to increased cathes of hake by adding panels to the nets and changing the spacing, type and configuration of excluder devices, particularly in 2008 when observed discard was low (Hannah and Jones, 2009). All these factors may result in an inabilty to create a proportional index of juvenile hake from the shrimp fishery. In the future, when and if the gear and behavior in the shrimp fishery becomes stable and consistent sampling for length has been performed for several years the proportionality of this index may improve, although the spatial issues may remain. For the present assessment we evaluate the index reported above as a sensitivity analysis to the base case model.

2.2 Fishery independent data

2.2.1 Acoustic survey

The joint U.S. and Canadian integrated acoustic and trawl survey has been the primary fishery independent tool used to assess the distribution, abundance and biology of coastal Pacific hake, *Merluccius productus*, along the west coasts of the United States and Canada (Fleischer et al. 2005). From 1977-1992, surveys in U.S. waters were conducted every three years by the Alaska Fisheries Science Center (AFSC). The 1995, 1998, and 2001 coast-wide surveys were carried out jointly by AFSC and the Pacific Biological Station (PBS) of the Canadian Department of Fisheries and Oceans (DFO). Following 2001, the responsibility for the U.S. portion of the survey was transferred to the Fishery Resource Analysis and Monitoring (FRAM)

Division of NOAA's Northwest Fisheries Science Center (NWFSC). Following the transfer, the survey was scheduled on a biennial basis, with joint acoustic surveys conducted by FRAM and PBS in 2003, 2005, 2007 and 2009. The acoustic survey biomass estimates (age 2+) and confidence intervals for 1977-2009 are shown in Figure 17.

The distribution of Pacific hake can vary greatly between acoustic surveys. It appears that northward migration patterns are related to the strength of subsurface flow of the California Current (Agostini et al. 2006) and upwelling conditions (Benson et al. 2002). Distributions of hake backscatter plotted for each acoustic survey since 1995 illustrate the variable spatial patterns (Figure 1, Figure 2). The 1998 acoustic survey stands out and shows an extremely northward occurrence that is thought to be tied to the strong 1997-1998 El Nino. In contrast, the distribution of hake during the 2001 survey was very compressed into the lower latitudes off the coast of Oregon and Northern California. In 2003, 2005 and 2007 the distributions generally followed the "normal" coast-wide pattern. In 2009, the majority of the hake distribution was found in U.S. waters (Figure 2).

As with the fishery data, acoustic survey length and conditional age-at-length compositions were used to reconstruct the age structure of the hake observed by this survey. In general, biological samples taken by midwater trawls were post-stratified based on geographic proximity and similarity in size composition. Estimates of numbers (or biomass) of hake at length (or age) for individual cells were summed for each transect to derive a coast-wide estimate. Details of this procedure can be found in Fleischer et al. (2005). Each sample was given equal weight without regard to the total catch weight. The composite length frequency was used to characterize the hake size distribution along each transect and predict the expected backscattering cross section for Pacific hake based on the fish size-target strength (TS) relationship TS_{db} = 20logL-68 (Traynor 1996). Recent target strength work (Henderson and Horne 2007), based on in-situ and ex-situ measurements, suggests a regression intercept of 4-6 dB lower than that of Traynor. A lower intercept to the TS-to-length regression suggests that an individual hake reflects 2.5-4 times less acoustic energy, implying considerably more biomass than that of Traynor's equation. Both estimates of the TS-to-length regression use night time in-situ measurements. Hake may have different behavior characteristics at night than during the daytime when the acoustic survey is conducted. The biomass estimates continue to be based on Traynor's TS-to-length regression, which has been used historically to interpret the acoustic survey data. Additional *in situ* measurements on hake TS need to be collected *during daytime*, and the depth dependence of the hake TS needs to be investigated. The uncertainty in the TS regression is not accounted for in the survey biomass uncertainty estimates.

The 2009 survey was conducted aboard the NOAA vessel *Miller Freeman* and the DFO (Canadian) vessel *Ricker* from spanning the continental slope and shelf areas along the west coast from south of Monterey California to the Dixon Entrance area. A total of 123 line transects, generally oriented east-west and spaced at 10 or 20 nm intervals, were completed (Figure 2). During the 2009 acoustic survey, aggregations of coastal Pacific hake were detected nearly continuously from Southern Oregon through the middle of Vancouver Island, with very few hake observed in Canadian waters. Mid-water trawls are deployed throughout the survey to indentify the species composition of the backscatter as well as the size composition of Pacific hake and to collect biological information (i.e., age composition, sex). This sampling revealed the presence of four clear cohorts in the hake population: individuals of age 3, 4, 6, and 10 corresponding to the 2006, 2005, 2003 and 1999 year classes. The 2009 Pacific hake age-2+ biomass index was just over 1.46 million mt, the second highest since 1992. Humboldt squid were present in very large numbers and represented the second most common species in the acoustic survey trawl catch by weight (47% after hake at 50%). This led to difficulty in unambiguously assigning regions of backscatter to Pacific hake, and led the survey team to conclude that there was substantially more variance associated with the biomass estimate in 2009 than in previous recent years. Further, due to limited sea time, transects in Canadian waters were more sparse than recent surveys, and did not always follow the standard parallel design. Acoustic survey sampling information including the number of hauls, lengths taken, and hake aged are provided in Tables 11. Conditional age-at-length proportions (Table 12) are shown in Figure 18 and summarized into the marginal age distributions in Figures 19-20. Length-frequency distributions for the acoustic survey are shown in Figures 21-22.

For previous stock assessments, estimates of variability were calculated for the 2003, 2005 and 2007 surveys based on the Jolly-Hampton estimator (1989) with CVs on the order of 25%. This takes spatial variability of the acoustic backscatter into account but leaves other sources of observation error, including sampling variability (haul to haul variation in size/age) and target strength unaccounted for. Increased uncertainty in the index due to the prevalence of squid, their uncertain target strength, and uncertainty in the estimation of relative numbers of squid and hake in the backscatter indicate a larger SE is appropriate for the 2009 index. Expert opinion elicited from the acousticians lead to using twice the SE in log-space for 2009 as for earlier years. This happens to be the same SE in log-space (0.5) as is used for the years for which the survey did not extent all the way up the coast of British Columbia (Table 11), and therefore an estimated expansion factor is needed. The survey in 1992 has historically been assigned a SE of 0.25, since it did reach the northern end of Vancouver Island, however it did not survey to the Canada-Alaska border as have more recent surveys. Error bars shown around point estimates of biomass are not estimated but rather based on reliability of the survey in a given year and are used as input in SS (SE[log-space]=0.5 in 1977-1989, 0.25 in 1992-2007, 0.5 in 2009). The 1986 survey index is assigned a SE of 0.5, despite the fact that pre- and post-cruise acoustic calibration experiments resulted in different values and no correction for this has been made (the data point has been removed and returned to the model during previous STAR panels).

In the course of previous stock assessments there has been considerable discussion regarding the extent to which acoustic survey selectivity may be dome-shaped. Dome-shaped selectivity implies a greater proportion of older hake in the population than observed in the survey. Reasons for dome-shaped selectivity could be due to a number of factors, including net avoidance by older hake and differential distribution of older fish near the bottom or at deeper depths. This was investigated for the 2008 assessment by comparing the numbers at age in both the acoustic and bottom trawl surveys between 1977-2001, as data for these two surveys overlapped spatially and temporally. Hake catches (in number) from the triennial bottom trawl survey were summed at each age, and assumed to be representative of the underlying population age structure. These were then compared to the catch in numbers at age taken from hauls in the acoustic survey. Results indicate empirical support for dome-shaped acoustic survey selectivity (Figure 23). A comparison of the ratio of acoustic survey numbers at age to the sum of the acoustic and triennial bottom trawl survey numbers at age (normalized to have a peak of unity), indicate that only 2 out of the nine years had asymptotic-like selectivity patterns. The remaining nine years show curves that peak at about ages 5-7, decline between 0.2-0.9 at ages 11-13, and further decline between <0.1-0.7 at ages 14-15+. For ages 14-15+, the mean is about 0.5 (when normalized) for all years. The weight of evidence suggests dome-shaped selectivity, although the results are not definitive, as the shape of the selectivity curve for the triennial survey is not precisely known.

The acoustic survey catchability coefficient, *q*, has historically been quite uncertain. This parameter globally scales population biomass higher if *q* is lower and lower if *q* is higher, and thus uncertainty in *q* reflects the uncertainty in the absolute scale of the hake population. Early assessments that used the acoustic survey in age-structured assessments (Dorn et al. 1999) asserted *q*=1.0 and treated the parameter as a fixed quantity (In fact ABCs and OYs until 2003 were predicated upon that assumption). Helser et al. (2004) conducted a likelihood profile over the value of *q* as well as estimated it freely in the model, and found values of *q* in the range of 0.38 to 0.6, depending on model structure. In general, the best fit to the data is achieved when *q* is estimated to be low; however, allowing *q* for an acoustic survey to be substantially lower than 1.0 (whether through estimation or specification) has been met with some resistance. The 2004-2007 assessments presented two models with differing *q*'s in order to bracket the range of uncertainty in the acoustic survey catchability coefficient. In 2008, an attempt was made to integrate out the uncertainty in *q* while incorporating uncertainty in the shape of the acoustic survey selectivity curve. In both the 2009 assessment and the current assessment, *q* is freely estimated.

2.2.2 Bottom trawl surveys

The Alaska Fisheries Science Center conducted a triennial bottom trawl survey along the west coast of North America from 1977 to 2001 (Wilkins et al. 1998). This survey was repeated for a final time by the Northwest Fisheries Science Center in 2004. In 1999, the Northwest Fisheries Science Center began to take responsibility for bottom trawl surveys off of the West Coast, and, in 2003, the Northwest Fisheries Science Center survey was extended shoreward to a depth of 30 fathoms to match the shallow limit of the triennial survey (Keller et al., 2008). Despite similar seasonal timing of the two surveys, the 2003 and subsequent annual surveys differ from the triennial survey in size/horsepower of the chartered fishing vessels and bottom trawl gear used. As such, the two were determined (at a workshop on the matter in 2006) to be separate surveys which cannot be combined into one. In addition, the presence of significant densities of hake both offshore and to the north of the area covered by the trawl survey, coupled with the questionable effectiveness of bottom trawls in catching mid-water schooling hake, limits the usefulness of this survey to assess the hake population. For these reasons, the neither the triennial nor the Northwest Fisheries Science Center shelf trawl survey are used in this assessment. However, age-composition data from the triennial survey are used, in conjunction with age-composition data from the acoustic survey, to evaluate the selectivity pattern associated with the acoustic survey external to the assessment model. Results of this analysis are described above.

2.2.3 Pre-recruit survey

NOAA’s Southwest Fisheries Science Center (SWFSC) has conducted an annual survey since 1983 to estimate the relative abundance of pelagic juvenile rockfish off central California coast (36.50°–38.33° N.). The survey was designed to measure the annual relative abundance of pelagic juvenile rockfishes (*Sebastes* spp.), but also captures YOY Pacific hake (Sakuma et al. 2006). Standardized 15 minute midwater trawls were conducted at a series of standard stations, using a headrope depth of 30 m and a 9.5 mm mesh liner. The survey was expanded substantially in 2004 to cover a much larger spatial area (i.e., from San Diego to Point Delgada: 32.75°–40.00° N.). Since 1999, the NWFSC and Pacific Whiting Conservation Cooperative (PWCC), in coordination with the SWFSC Rockfish survey have conducted an expanded survey to improve targeting of juvenile hake and rockfish. The SWFSC/NWFSC/PWCC pre-recruit survey uses a midwater trawl with an 86' headrope and ½" codend with a 1/4" liner to obtain samples of juvenile hake and rockfish (identical to that used in the SWFSC Juvenile Rockfish Survey). Trawling was done at night with the head rope at 30 m at a speed of 2.7 kt. Some trawls were made before dusk to compare day/night differences in catch. Trawl tows of 15 minutes duration at target depth were conducted along transects at 30 nm intervals along the coast. Stations were located along each transect, at bottom depths of 50, 100, 200, 300, and 500 m. Since 2001, side-by-side comparisons were made between the vessels used for the survey.

In 2008 a Delta-GLM was applied to catch data from the SWFSC/NWFSC/PWCC midwater trawl data. The Delta-GLM approach is a type of mixture distribution analysis which models zero and non-zero information from catch data separately (Pennington 1983, Stefansson 1996). The delta-GLM accounted for year, depth, and latitude × survey. However, during tuning of the model, the resultant time series was essentially tuned out of the assessment model. A simpler ANOVA was used in the 2009 assessment (Ralston, 2007). The ANOVA-based standardization accounts for a year × latitude interaction, depth, vessel (or survey), and period effects. The survey effect in both models accounts for potential differences between the NWFSC-PWCC survey and SWFSC survey catch data while the latitudinal effect attempts to capture changes in relative abundance of young-of-year hake. In particular, between 2001 and 2004, peak relative abundance shifted from approximately 38 to 42 degrees latitude.

Trends in the coast-wide index and associated 95% intervals are shown in Figure 24 and Table 14. The survey shows a large value in 2004 compared to the surrounding years, followed by very low values in 2005 through 2008. This is in stark contrast to the fishery and survey data which suggest a strong 2005 year class and a weak 2004 year class. This mismatch has led to the variance for this survey being inflated until it contributed nothing to previous assessments. The observed 2009 pre-recruit index is again very low, however it will take a relatively long time series, before correlation with recruitments implied by fishery and acoustic survey data can improve even if recent years track future estimates closely. Given the brevity of the coast-wide pre-recruit time series, and the lack of a very large (e.g., 1999, 1984, 1980, 1977) recruitment event, it is difficult to judge the future utility of this survey. A sensitivity analysis to the inclusion of this index is reported as was done for the 2009 assessment.

2.3 Externally analyzed data

2.3.1 Maturity

The fraction mature by size was estimated with a logistic regression (for the 2006 assessment) using data from Dorn and Saunders (1997). These data consisted of 782 individual ovary collections based on visual maturity determinations by observers (Figure 25). The highest variability in the percentage of each length bin that was mature within an age group occurred at ages 3 and 4, with virtually all age-one fish immature and age 4+ hake mature. Within ages 3 and 4, the proportion of mature hake increased with larger sizes such that only 25% were mature at 31 cm while 100% were mature at 41 cm. Maturity in hake probably varies both as a function of length and age, however, in this assessment, the relationship is modeled as a function of length. Less then 10% of the fish smaller than 32 cm are predicted to be mature, while 100% maturity is predicted by 45 cm.

2.3.2 Natural mortality

The natural mortality rate used in recent Pacific hake stock assessments is a fixed value of 0.23 per year to age 13, with estimated increases in M at age 14 and 15+. The value of 0.23 was obtained by tracking the decline in abundance of a year class from one acoustic survey to the next (Dorn et. al 1994). Pacific hake longevity data, natural mortality rates reported for Merluciids in general, and previously published estimates for Pacific hake natural mortality indicate that natural morality rates in the range 0.20-0.30 could be considered plausible for Pacific hake (Dorn 1996). In the 2008 assessment, we also considered Hoenig's (1983) method for estimating natural mortality (M), assuming a maximum age of 22 (attributing a single observation at age 25 to ageing error or anomaly), The relationship between maximum age and M was recalculated using data available in Hoenig (1982) and assuming a log-log relationship (Hoenig, 1983), while forcing the exponent on maximum age to be -1. The recalculation was done so that uncertainty about the relationship could be evaluated, and the exponent was forced to be -1 because theoretically, given any proportional survival, the age at which that proportion is reached is inversely related to M (when free, the exponent is estimated to be -1.03). The median value of M via this method was 0.193. Two measures of uncertainty about the regression at the point estimate were calculated. The standard error, which one would use assuming that all error about the regression is due to observation error (and no bias occurred) and the standard deviation, which one would use assuming that the variation about the regression line was entirely due to actual variation in the relationship (and no bias occurred). The truth is undoubtedly somewhere in between these two extremes (the issue of bias not withstanding). The value of the standard error in log space was 0.094, translating to a standard error in normal space of about 0.02. The value of the standard deviation in log space was 0.571, translating to a standard deviation in normal space of about 0.1. Thus Hoenig's method suggests that a prior distribution for M with mean of 0.193 and standard deviation between 0.02 and 0.1 would be appropriate if it were possible to accurately estimate M from the data, all other parameters and priors were correctly specified, and all correlation structure was accounted for (note that SS does not currently allow for priors in log-normal space). The fixed value of M has been evaluated annually in this assessment via a likelihood profile.

2.3.3 Aging error

With the transfer of Pacific hake ageing to the NWFSC in 2001, an effort was made to evaluate age reader agreement and calibrate readers at the Cooperative Aging Project (CAP, Newport, Oregon) and Department of Fisheries and Oceans (DFO). A total of 991 ages from otoliths collected over the years 2001-2007 were compared between the Cooperative Aging Project and DFO or read more than once by one of the labs. As expected, agreement was greater for younger fish than for older fish. This exchange was used to estimate the ageing imprecision matrix applied in the 2008 assessment. AFSC ageing prior to 2001 relied on similar protocols, but roughly 20% of the otoliths that were difficult to read were 'reconciled', or read by multiple readers and discussed before final age determination was assigned. Because no comparisons between AFSC and more recent ageing, nor duplicate reconciled ages from the AFSC were available in 2008, the level of ageing imprecision for that lab was assigned 50% of the imprecision estimated for CAP and the topic flagged for further investigation.

Subsequent to the 2008 assessment, 1,773 age estimates were compared between the CAP and AFSC for otoliths collected throughout the time-series but prior to 2001. These estimates allowed estimation of the degree of ageing imprecision for the AFSC reconciled ages. Ageing imprecision was quantified for use in the stock assessment model according to the maximum likelihood method of Punt et al. (2008), as was done in the 2008 assessment. This method estimates bias and precision of the observed age from the "true" age, assuming an unbiased sample in the observed data. There were insufficient samples to estimate bias; however, precision was estimated and quantified as the standard deviation of observed age from true age. Values of imprecision at age estimated directly were found to be of similar magnitude to those from the CAP, and substantially larger then the 50% values used in the 2008 assessment. Figure 26 shows the relationship for individual age reads by AFSC, based on the sample of historically aged otoliths re-read by CAP.

With this much larger available data set, the 2009 assessment included an additional process influencing the ageing of hake: cohort-specific ageing error related to the relative strength of a year-class. This process reflects a tendency for uncertain age determinations to be assigned to predominant year classes. The result is a tendency towards reduced mis-ageing of strong year classes, and perhaps increased mis-ageing of neighbor year-classes. To account for this process in the model, we simply created year-specific ageing-error matrices (or vectors of standard deviations), where the standard deviations of strong year classes were reduced by a constant proportion. In the 2009 assessment, this proportion was determined empirically by comparing double read error rates for strong year classes with rates for other year classes (Figure 27). The result suggested that strong year classes only had 55% of the read-to-read disagreement in ageing as other year classes (Figure 28). In each year, that proportion (0.55) was applied for the strong year classes (for ages 3-15) as a multiplicative factor to the base ageing error vectors of standard deviations. For relatively strong but not dominant year classes, a proportion of 0.80 was applied.

This approach has not been revised in the 2010 assessment; however we provide sensitivity analyses to the assumptions. In particular, on sensitivity assume no cohort effect on aging error, and another uses varying multiplicative factors with original standard deviation to more exactly match the observed or assumed average change in disagreement (0.55 or 0.8).

2.3.4 Size at age

There is considerable variability in observed length-at-age among the historical acoustic surveys. The processes governing variation in observed length-at-age may include changes in size-selectivity over time, effects on the population due to size-selective fishing, and variation in growth rates over time. In order to explore this latter effect, alternative growth models were fit during the 2006 assessment to the length-at-age data collected in the acoustic surveys through 2005 (assuming size-selectivity in the acoustic surveys has been constant over time). The first of these models was a simple time-varying growth model, where the growth coefficient (*K*) was allowed to vary over time. This assumed that all extant cohorts are subject to the same time varying changes in metabolic rates (presumably associated with changes in available food). Two other growth models assumed that growth is density-dependent within cohort. In the second model, asymptotic size (and thus overall growth rate) was cohort specific. In the third model, *K* was cohort specific. Of the three alternative growth models, the model with cohort-specific L_∞ (asymptotic size) values explained more of the variation in the length-age data than the time varying *K* model and cohort *K* model (Figure 29). In particular, cohort-based L_∞ begins relatively high (> 55 cm) prior to 1980 and then appears to decline rapidly as the very large 1980 and 1984 year class grow. Expected size at age, based on the cohort based L_∞ parameter, is above the expected size for the other models in the 1977, 1980, and 1983 survey data. Likewise, cohort based *K* declines rapidly between the mid 1970s and mid 1980s. These cohort-based models did not assume any cumulative affects of size-selective fisheries.

A similar exploratory growth analysis was conducted on other sources of age data including the acoustic survey (1977-2007), AFSC triennial bottom trawl survey (1977-2003), and the U.S. at sea hake fishery (1973-2006). In particular, a hierarchical von Bertalanffy growth model was fit separately to each data source, which treated cohort as a random linear effect with the growth coefficients, L_∞ and *K*. The scale parameter (t_0) was estimated as the mean fixed effect. Markov Chain Monte Carlo simulation in WinBUGs (Bayesian inference Using Gibbs Sampling, Thomas et al. 1992; Spiegelhalter et al. 1999) was used to estimate the marginal posterior density of the cohort specific L_∞ and *K* parameters, which were plotted sequentially by cohort (Figure 23). The results illustrate striking consistency in the change in L_∞ and *K* parameters over time (by cohort) from each data source and confirm the observations described above. In the 2009 assessment we implemented time varying *K* and asymptotic size, but allow each to assume only two or three distinct values across the timeframe of the model to match the observed changes. In order to stabilize modeling of growth, size at age 2 is constant throughout.

A final analysis was conducted, using the same hierarchical model, to investigate differences in sex-specific growth of hake. A plot of the bivariate posterior density of 1,000 MCMC samples of L_∞ and *k* reveal that female hake grow to a significantly larger asymptotic size (L_∞) but at a slower rate (*k*) than males (Figure 31). While the present base model does not model hake by sex, it is expected that the next assessment (in 2011) will be based upon a separate-sex model that will be able to account for differential fishery selectivity by sex. To properly represent the cumulative effects of size-selective fisheries in this approach, the cohort-based growth model should be integrated into the assessment model itself. This would provide a fruitful area of research for improving SS. Since this feature is not currently implemented in SS, blocks were created aggregating various years in which it was anticipated the cohort affects on growth would be manifested (See *Model Selection and Evaluation* below).

The treatment of growth parameters has not been revised for the current assessment from the approach used in 2009.

3. Stock assessment

3.1 Modeling history

Age-structured assessment models of various forms have been used to assess Pacific hake since the early 1980s, using total fishery landings, fishery length and age compositions, and abundance indices. Modeling approaches have evolved as new analytical techniques have been developed. Initially, a cohort analysis tuned to fishery CPUE was used (Francis et al. 1982). Later, the cohort analysis was tuned to NMFS triennial acoustic survey estimates of absolute abundance at age (Francis and Hollowed 1985, Hollowed et al. 1988a). In 1989, the hake population was modeled using a statistical catch-at-age model (Stock Synthesis) that utilized fishery catch-at-age data and survey estimates of population biomass and age-composition data (Dorn and Methot, 1991). The model was then converted to AD Model Builder (ADMB) in 1999 by Dorn et al. (1999), using the same basic population dynamics equations. This allowed the assessment to take advantage of ADMB's post-convergence routines to calculate standard errors (or likelihood profiles) for any quantity of interest. Beginning in 2001, Helser et al. (2001, 2003, and 2004) used the same ADMB model to assess the hake stock and examine important assessment modifications and assumptions, including the time varying nature of the acoustic survey selectivity and catchability. The acoustic survey catchability coefficient (q) has been, and continues to be, one of the major sources of uncertainty in the model. Due to the lengthened acoustic survey biomass trends, the assessment model in 2004 was able to freely estimate the acoustic survey q. These estimates were substantially below the assumed value of q=1.0 from earlier assessments. The 2004 and 2005 assessments presented uncertainty in the final model result as a range of biomass. The lower end of the biomass range was based upon the conventional assumption that the acoustic survey q was equal to 1.0, while the higher end of the range represented a q=0.6 assumption.

In 2006, the coastal hake stock was modeled using the Stock Synthesis modeling framework (SS2 Version 1.21, December, 2006) written by Dr. Richard Methot (Northwest Fisheries Science Center) in AD Model Builder. Conversion of the previous hake model into SS2 was guided by three principles: 1) incorporate less *derived* data, favoring the inclusion of unprocessed data where possible, 2) explicitly model the underlying hake growth dynamics, and 3) pursue parsimony in model complexity. "Incorporating less *derived* data" entailed fitting observed data in their most elemental form. For instance, no pre-processing to convert length data to age compositional data was performed. Also, incorporating conditional age-at-length data for each fishery and survey, allowed explicit estimation of expected growth, dispersion about that expectation, and its temporal variability, all conditioned on selectivity. In 2006 and 2007, as in 2004 and 2005, assessments presented two models (which were assumed equally likely) in an attempt to bracket the range of uncertainty in the acoustic survey catchability coefficient, q. The lower end of the biomass range was again based upon the conventional assumption that the acoustic survey q was equal to 1.0, while the higher end of the range allowed estimation of q with a fairly tight prior about q = 1.0 (effective q = 0.6 - 0.7). In the 2008 assessment, also conducted in SS2 (Version 2.00n), an effort was made to include the uncertainty in q, as well as additional uncertainty regarding the acoustic survey selectivity and the natural mortality rate (M) of older fish (ages 14 and 15+) within a single model. As a result, a broader range of uncertainty is presented via probability distributions and risk profiles using Markov Chain Monte Carlo simulation. Further refinements included, for the first time, incorporation of age-reading error matrices.

In the 2009 model, conducted in SS v3.02b (Methot, 2009), we built upon the 2008 model, adding new data and refining the modeling of ageing imprecision. New data in the 2009 assessment included: Historical length data from Santa Barbara, California (1963-1970); 2008 catches from the U.S. and Canada; 2008 length and conditional age-at-length compositions from the U.S.; and the 2008 juvenile index. The 2009 assessment model incorporated further uncertainty in the degree of recruitment variability (σ_R) as well as more flexible time-varying fishery selectivity. Additionally, the 2009 assessment incorporated further refinements to the ageing-error matrices, including both updated data and cohort-specific reductions in ageing error to reflect "lumping" effects due to strong year classes. The 2009 model continued to integrate uncertainty in acoustic survey q and selectivity and in M for older fish.

In the current (2010) model, conducted in SS v3.1 (Methot, 2009), we have used the same basic data sources and model structure as in the 2009 assessment.

3.2 Industry-contracted review of the 2009 assessment

A review of the 2009 Pacific hake stock assessment was conducted in 2009 by Quantitative Resource Assessment LLC (Dr. Mark Maunder, 2009). The review was thorough and suggested a number of improvements to the model, most of which are feasible, but some of which are not. In particular, Dr. Maunder suggested two main changes to the assessment: 1) Explicit modeling of sex structure (i.e. treating males and females separately in the model and the data), and 2) Splitting the data into more fisheries, in part to improve the modeling of selectivity and changes in selectivity over time. Of additional concern was the treatment of the acoustic survey data for years when geographic coverage was incomplete as well as the assumption that trawl sampling (the biological data) and acoustic backscatter (the acoustic index) necessarily arise from the same selectivity process. Dr. Maunder emphasized that due to actual differences in growth between the sexes, most of the other suggested improvements would be far less helpful without a split-sex model.

We agree that a split-sex model would be an important improvement to the current model and are working towards that end. However, there was insufficient time to re-analyze the acoustic (and fishery) data as sex-specific inputs before the 2010 assessment. This along with other re-analysis of the historical acoustic survey time-series will be done for the 2011 assessment. In the meantime, we conducted, among our sensitivity analyses, four sensitivities specifically suggested by Dr. Maunder after an informal meeting (November 2009):

1) A sex-structured model with sex-specific growth but fitting to sex aggregated data.
2) A run where the acoustic survey is modeled as fully selecting all individuals age two and above but the composition data from the acoustic survey is treated as a separate survey with domed-shaped selectivity.
3) A run with both the selectivity and catchability of the acoustic survey allowed to differ between the early (1977-1992) and late (1995-2009) survey periods.
4) A run where the model starts in 1995.

3.3 Response to 2009 STAR Panel recommendations

1. *The Panel recommends the investigation of how the biological sampling in the acoustic survey occurs to determine whether these data are representative of the backscatter in the survey.*

Response: Midwater or bottom trawls are made during survey operations in order to classify the observed acoustic quantity and to gather the length and age data needed to scale the acoustic data into units of biomass. The locations of these trawl deployments are not systematic, but rather opportunistic, depending on the local acoustic observations, recent and anticipated trawl effort, and other logistical constraints (time available for trawling, time required to process the catch, weather and sea conditions, etc.). Due primarily to logistic and time constraints, not all scattering aggregations can be sampled. Typically, one to three trawl sets are made per day during the survey. While the biological sampling is not completely random, the trawls tend to occur at points of the most density, and the trawls are thus representative of about 99% of the hake observed by the acoustic survey. A larger issue may be the differences between the selectivity of the acoustics and the trawls. This issue is explored in a sensitivity analysis.

2. *The panel recommends and investigation of how the biological samples are processed and applied to the acoustic estimates, including the post-stratification of length samples.*

Response:

<u>*Trawl information*</u>: During the trawl, trawl headrope depths are recorded with a conductivity-temperature-depth (CTD) instrument. The time allowed at the target depth will be determined by the scientist and logged, aiming to collect enough hake samples (~ 300 or more) and/or other species for the purpose of mixed catch analysis and acoustic signature verification.

<u>*Biological information from trawl sampling*</u>: Pacific hake were subsampled (roughly 350) to determine length composition by sex. When fewer than roughly 300 to 400 Pacific hake were caught, they were sampled completely from a trawl catch. About 50 samples from the 350 samples are also measured for length, sex, sexual maturity, individual weight, and age determined with collected otoliths. Further subsampling (~10 out of these 50 specimens) is performed to collect stomachs for hake diet analysis.

<u>*Stratification*</u>*:* Since hake distribution is highly patchy and non-homogenous, to obtain a more robust estimate of echo intensity distribution and reduce the variability from trawl to trawl, we need to conduct a *stratification* process: grouping the trawls with a similar statistical distribution signature to form different *strata*, sometimes called composite catch samples. Each acoustic region defined and explained in Sec. 3.1 will be assigned to a particular *stratum*, or composite catch sample, based on the geographic proximity of the hauls and the acoustic signatures (intensity distribution – patchiness and frequency response).

To cluster the hauls into strata, we use a two-sample Kolmogorov-Smirnov (KS-2) statistic (Campbell, 1974). The KS-2 is a *Cumulative Distribution Function* (CDF) based statistical analysis of the length distributions of each trawl pair, which compares the probability density functions of two sample distributions and computes their maximum difference (Fig. 3). The asymptotic significance level becomes very accurate for large sample sizes, and is believed to be reasonably accurate for sample sizes n_1 and n_2 such that

$$\frac{n_1 n_2}{n_1 + n_2} \geq 4 \text{ or } \min(n_1, n_2) \geq 8 .$$

3. *The panel recommends that the raw data in the acoustic survey, including the length samples, be appropriately assembled to allow statistical analysis of these data as well as appropriate stratification*.

Response: This work is ongoing and will be available for the 2011 assessment.

4. *The Panel recommends that a Management Strategy Evaluation approach be used to evaluate whether the current 40-10 harvest control rule is sufficient to produce the management advice necessary to ensure the sustainable use of the Pacific hake stock with its dramatically episodic recruitment. The 40-10 rule assumes that simply reducing catches in a linear fashion as stock biomass declines will be sufficient to guide the fishery back towards the target spawning biomass level. However, with the fishery being dependent upon a single declining cohort just reducing the catch may achieve the status quo but it rebuilding will not occur without new recruitment.*

Although the STAT agrees with this recommendation, due to changes in assessment duties and the ongoing incomplete treaty agreement this extensive analysis will be best addressed by a joint U.S.-Canadian STAT under the treaty terms of reference.

4.1 *Related to Recommendation 4, the operating model developed for the Management Strategy Evaluation should evaluate how well the different assessment models recapture true population dynamics. At issue is whether a simpler model such as ADAPT / VPA performs better or worse than a more complex model such as SS2.*

As above.

5*. Future assessment models should explore gender- and length-based selection processes, in recognition that the gender differ in growth and that many of the more influential dynamic processes that operate in the fishery and length-based but are currently considered from and age-based perspective (for example selectivity).*

This goal was beyond the scope of available resources for the 2010 assessment.

6. When the raw acoustic survey data become available there should be a re-evaluation of the treatment of pre-1995 acoustic survey data and index values. For example, the biomass index implied by the area covered by the pre-1995 surveys should be compared with the total biomass *from the full area covered by the post-1995 surveys. The difference between these two indices has implications for the magnitude of the survey catchability coefficient prior to 1995.*

Acquisition of historical survey data and re-analysis of these data with regard to sampling design and variance estimates, the target strength relationship, and selection of trawl sets is ongoing and much new information is expected to be available for the 2011 assessment. Specifically, the following efforts are ongoing by the Acoustics Team at NWFSC:

1. In situ hake daytime target strength (TS) data collection using Drop Acoustic Information SYstem (DAISY). Preliminary analysis indicated that the in situ hake daytime TS data followed the regression formula (38 kHz) originally suggested by Traynor (1992) better than that suggested by Henderson and Horne (2007). However, we feel that more work is needed to make a definitive conclusion on what is the most appropriate regression formula to use for hake biomass estimate.
2. With the help from colleagues at the AFSC, we have historical acoustic data in digital form and are capable of applying the TS formula we have been used for the recent hake surveys (Traynor, 1992) to the data that used old TS formula (-35 dB per kilogram). Although we are not able to provide the re-processed historical hake biomass estimates for this years STAR panel, we should be able to provide alternative historical hake biomass estimates for the 2010 assessment.
3. It is also expected that by next year we should be able to provide the variance analysis for hake biomass estimates using Objective Mapping technique (Kriging) for both historical and recent hake acoustic data.

7. *There should be further exploration of geographical variations in fish densities and relationships with average age and the different fisheries, possibly by including spatial-structure into future assessment models.*

This goal was beyond the scope of available resources for the 2010 assessment.

8. *There should be exploration of possible environmental effects on recruitment and the acoustic survey.*

This goal was beyond the scope of available resources for the 2010 assessment.

3.4 2010 Model description

This assessment retains the same basic structure and treatment of the data as was applied in 2009. The assessment used the Stock Synthesis modeling framework written by Dr. Richard Methot at the NWFSC. The Stock Synthesis application provides a general framework for modeling fish stocks that permits the complexity of population dynamics to vary in response to the quantity and quality of available data. In the current assessment model, the Pacific hake population is assumed to be a single coast-wide stock along the Pacific coast of the United States and Canada. Sexes are combined within all data sources, including fishery and survey size/age compositions, as well as in the model structure. The accumulator age for the internal dynamics of the population is set at 15 years, well beyond the expectation of asymptotic growth. The length structure is explicitly modeled in one cm increments between 9 cm (the minus group) and 70 cm (the plus group) in the population; however the data are aggregated at a minimum value of 20 cm. The modeled period includes the years 1960-2009 (last year of available data), with forecasts extending to 2011. The population was assumed to be in equilibrium with no fishing mortality prior to the first year of the model. There were no large-scale commercial fisheries for hake until the arrival of foreign fleets in the mid to late 1960s, however the exact level of hake removals prior to 1966 (the first catches included in the assessment) is unknown.

The model structure, including parameter specifications, bounds and prior distributions (where applicable) is summarized Table 15. The assessment model includes two national fisheries: the U.S. and Canadian trawl fisheries. Although the U.S. at-sea and shore-based fisheries, as well as the Canadian JV and domestic fisheries could be modeled separately for reasons mentioned above, there was insufficient time to explore this topic for the current assessment. Therefore, in this assessment (as has been done in all recent assessments) sectors within each nation's fleets were combined; estimated selectivity changes over time will therefore reflect changes in the distribution of catch among sectors as well as fishing behavior within sectors. The selectivity curves for the acoustic survey and the U.S. and Canadian fisheries were modeled as functions of age using the double normal function (option 20 in SS). This is a change from the 2008 model which used the double logistic formulation for the fisheries; the double normal parameterization has the same number of parameters and has been found to be more stable over a range of assessment applications for U.S. west coast groundfish. Selectivity curves for all fleets are allowed to be dome-shaped (as in previous assessments) and fishery selectivity curves were allowed to vary over time to account for temporal changes in fishery operations (distant water fleets, domestic fleets, etc.) as well as shifts in selectivity as the fishery focused exploitation on abundant cohorts.

Growth is modeled as a von Bertalanffy function in this assessment. Although model misspecification is present due to sexually dimorphic growth patterns (Figure 31), there was insufficient time to do the analysis necessary to develop the sex-specific data needed as input to a complete sex-specific model formulation for 2010. External analyses conducted as part of recent assessments (2006, 2007), as well as evaluation of model fits to conditional age-at-length data has shown strong evidence of changes in hake growth curves over time. The 2008 model allowed the size at age 12 and the von Bertalanffy K parameter to vary among two discrete time blocks. Specifying time-invariant growth has, and continues to result in, a decline of several hundred units in the negative log likelihood as well as marked degradation of the model residual pattern over all data sources. In this assessment, we extend the block structure used in 2008 to accommodate faster observed growth for the 1999 year class. Two blocks were used for the parameter defining length at age 12, 1960-1983 and 1984-2008, which allowed the model to account for the larger asymptotic fish size and the general prevalence of larger fish observed during the early period. Four blocks of years were used to partition the growth parameter k: a common k-value was estimated for the periods 1960-1979 and 1987-1998, with distinct k-values estimated for the periods 1980-1986 and 1999-2008. The 1980-1986 period was intended to allow the model to accommodate the slightly smaller body size of age 4-6 year old fish during those years (Figure 30). The blocks were constrained, via a relatively tight prior distribution on the temporal change in growth, so that estimated values would be time-invariant unless a strong signal was present in the data. Size at age 2 and the parameters describing the distribution of length at each age were fixed at values estimated directly from the data. These choices improved the stability of growth estimation while still allowing the model to accommodate major patterns in growth. A more rich characterization of growth will be possible only with a split-sex formulation. The temporal structure of hake growth in terms of the expected size at age is characterized as an early period from 1960 to the early 1980s where expected maximum size (i.e., length at age 12) is high relative to the subsequent period from the mid 1980s to 2008, with a decline in growth rates (i.e., smaller expected size at age for ages 4-6) during the early-to-mid 1980s. In the most recent block, 1999-2009, growth increases above baseline rates but the expected maximum size continues to be lower.

In modeling temporal changes in fishery selectivity, we employed the same approach used in recent assessments and developed a block structure consistent with the empirical data, but attempted to retain parsimony by allowing blocks only for those parameters and time periods where they made an appreciable improvement in model fit. Specifically, the U.S. fishery was allowed more flexibility, as it has been observed to target specific cohorts and have variable access to the oldest fish in the population, which frequently migrate the farthest north during the fishing season. For the U.S. fishery, both the peak and ascending width parameters were allowed to vary among 8 periods: 1960-1980, 1981-1984, 1985-1988, 1989-1992, 1993-1996, 1997-2000, 2001-2004, and 2005-2009. Final selectivity was allowed to vary among 2 periods: 1960-1983, and 1984-2009 (three periods were included in the 2009 assessment, but parameter performance during MCMC was poor and there was no effect on model results of removing the more recent block.). The Canadian fishery selectivity was slightly less flexible than the U.S. (as has been the case in recent assessments), given that targeting of large cohorts does not occur until the fish are several years older. The Canadian fishery ascending width parameter was allowed to vary among 5 periods: 1960-1984, 1985-1988, 1989-2000, 2001-2004 and 2005-2008. The Canadian fishery peak parameter was allowed to vary among 7 periods: 1966-1980, 1981-1984, 1985-1988, 1989-1992, 1993-2000, 2001-2004 and 2005-2008.

For the base model, the instantaneous rate of natural mortality (*M*) is assumed to be time-independent and equal to 0.23 y^{-1} for ages 2-13, and then allowed to increase linearly to a freely estimated value at age 15+. The stock-recruitment function was a Beverton-Holt parameterization, with the log of the mean unexploited recruitment freely estimated. This assessment used a beta prior for stock-recruit steepness (*h*) applied to previous assessments. This prior is based on the median (0.79), 20th (0.67) and 80th (0.87) percentiles from Myers et al. (1999) meta-analysis of the family Gadidae. Year-specific recruitment deviations were estimated from 1962-2008. This structure was based upon inspection of year-specific standard deviations relative to the estimated value of σ_R. The constraint and bias-correction standard deviation, σ_R, for recruitment variability is estimated in this assessment. Maturity and fecundity relationships are assumed to be time-invariant and fixed values remain unchanged from recent assessments (Figure 32).

Multinomial sample sizes for the length composition and conditional age-at-length data used in this assessment are based on the number of hauls or trips sampled for the commercial at-sea and shore-based fisheries, respectively, and the number of tows in the research surveys. Input sample sizes were iterated prior to the final 2009 assessment by examining the relationship between effective sample size estimated in the model and the observed input sample sizes. Ratios of effective to input sample size remained close to 1.0, indicating the final model was fitting the data about as well as the input values implied. It was decided during the course of the 2009 STAR review that, in light of poor residual patterns to the size data, additional iterative reweighting would not be performed. As has been the case for all recent assessments, the acoustic survey standard deviations for the survey index were not iterated, although the RMSE from the base case model was somewhat larger than the mean of the input standard deviations. The base case model employed equal emphasis factors (lambdas=1.0) for all likelihood components.

3.5 Modeling results

3.5.1 Bridge from 2009 results

This assessment transitioned to the newest version of Stock Synthesis (SS v.3.1) and therefore, a comparison was performed to evaluate differences in model results, if any, from the 2009 assessment attributable to changes in the software. The exact same model structure and data through 2008 produced no visible change in time-series of expected quantities, indicating all changes in the 2010 results were to be a function of newly included data (Figure 33). The 2010 model was then updated in a step-wise manner as new data were acquired (and the largely irrelevant historical California length data were removed). The final results are described fully below.

3.5.2 Model selection and evaluation

Acoustic survey catchability (q) has been viewed as the principal axis of uncertainty in the hake assessment for a number of years. This choice has reflected a lack of clear signal for catchability in the data sets available to hake and the situation where very small changes in model fit and likelihood result in very dramatic changes in management advice as a function of the estimate or assumed value for q. Likelihood profiles (see sensitivity analyses below) indicated more information on survey catchability and less sensitivity to the estimated value than in previous assessments.

Extensive evaluation of fishery selectivity time-period blocking structure was performed during the 2009 assessment. With simple time-period structures the model was found to be very sensitive to the choice of which parameters were allowed to vary over time and when the changes were allowed to occur. A general pattern emerged over hundreds of model runs that the sensitivity to these choices was reduced as more flexibility (in parameters and time-periods) was introduced. For this reason, the blocking structure in the 2009 model was somewhat more complex than in the last several assessment models (however it is more similar to the approach of smoothed annual variations in selectivity used in assessments prior to 2006). Sensitivity analyses to recent time-blocks for the 2010 model are reported below.

Arbitrary constraint on the degree of recruitment variability (σ_R) was found to be especially important to the scale of the problem for the 2009 assessment. For this reason the parameter was freely estimated. This allowed use of the value most consist with the model time series of estimated recruitments. This choice is stable in a maximum likelihood framework only when there is sufficient signal in the data to avoid the true global minima for the parameter, zero. In the case of hake this is not a relevant concern, as the data clearly indicate the largest variability in year-class strength observed for west coast groundfish, however the maximum likelihood estimate of the parameter may be biased due to the reliance on point estimates for individual recruitment deviations rather than integrals, as would normally be the case when estimating a hierarchical variance parameter. However, when Bayesian integration is performed, this parameter can be considered a standard hierarchical variance parameter, the integration of which incorporates substantial uncertainty present in the model estimates.

Sample sizes for all compositional data were iteratively reweighted to prior to the 2009 STAR panel. This approach represents an effort to make the combined process and observation error attributed to the data consistent with the model's ability to fit those data. During the 2009 review the conclusion was reached that reweighting should not be continued in light of residual patterns present in the data. For this reason, the final 2009 base case model was not reweighted beyond the initial values achieved prior to the panel, despite major changes in the model structure during the panel. We did not iteratively reweight the base case model for 2010, because we did not reanalyze the sources of process error due to changes in selectivity and/or growth over time, pending full reanalysis of the treatment of these factors for 2011. Input and effective sample sizes remained similar to the results from 2009 and are reported in Table 16. Sensitivity to the relative weighting of the compositional data is reported below. A topic of considerable importance for this assessment is the relative precision assigned to the 2009 acoustic survey index. The base case relies on the assumption of a SE (in log-space) of 0.5 for the 2009 index reflecting the greater uncertainty associated with the presence of large numbers of Humboldt squid making attribution of backscatter regions to hake very difficult as well as the reduced survey effort and change in survey design (many non-parallel transects) in Canadian waters. Sensitivity analyses using alternate values for the 2009 survey SE are reported below.

3.5.3 Assessment model results

Estimates of individual growth and natural mortality for fish above age 13 remain largely unchanged from the 2009 assessment (Figures 34, 35).

The fit of the modeled time series to the acoustic survey biomass index is shown in Figure 36. The assessment model fit to the acoustic survey biomass time series is quite reasonable, given the variability assigned to each point, but the 2009 index appears to be much higher than any predicted value observed in model evaluation. The RMSE was slightly larger than the mean input SD (Table 16). During all survey years, the predicted biomasses are within asymptotic 95% confidence intervals, and recent residuals show no strong pattern in sign.

Selectivity at age is estimated for the U.S. and Canadian fisheries by time block (Figures 37-38), and for the acoustic survey (Figure 39). The acoustic survey selectivity was estimated but constrained to be time invariant. This curve fully selects the cohort born in 1999, but not the 2005 and 2006 year-classes. The selectivity patterns for both the U.S. and Canadian fisheries appear reasonable, tracking the entry of dominant cohorts in the late 1980s and especially the 1999 year class. U.S. fishery selectivity increased for younger aged fish as the dominant 1980 and 1984 year classes became vulnerable to exploitation during the late 1980s and early 1990s. As these cohorts grew into the older age structure and persisted in the fishable stock U.S. fishery selectivity increased on the older ages, seen as an increase in the descending limb. Canadian fishery selectivity curves also show targeting of stronger cohorts through time, the most pronounced being the 1999 year class which entered the fishery at a time of low overall biomass.

Given the volume of conditional age-at-length data being fit in this assessment, it is efficient to evaluate these fits via the implied fit to the aggregated marginal age compositions. In addition to being easier to inspect by eye, these plots are more familiar for those accustomed to diagnosing model fit from a variety of modeling platforms. For this reason, we plot the implied marginal fits for each data source: the U.S. fishery (Figure 40), Canadian fishery (Figures 41) and acoustic survey (Figure 42). The very large dominant cohorts present in the data from all sources are tracked closely by model predictions throughout. Unscaled residuals (there is no consistent way to approximate sample sizes, and therefore the relative scale of the residuals, for the implied marginal fits) are presented in Figures 43-45.

Model fits to all length-composition data are shown via observed and predicted length frequency distributions, and Pearson residual plots. Figures are divided by fleet: the U.S. fishery (Figures 46-47), Canadian fishery (Figures 48-49) and acoustic survey (Figures 50-51). In general, model predictions are consistent with the observed length compositions in terms of hitting the modes of the distribution and range of sizes exploited.

As was the case in the 2009 assessment, consistent patterns are present in the residuals to the fit to size composition data in this assessment. These are may be due to two (or more) factors: selectivity specifications that assume a smooth selectivity function across age, when cohort targeting is known to occur; and misspecification of growth/sex-ratio as the assessment model is single-sex, but significant dimorphic growth is known to occur. It will be important to re-evaluate these patterns when the underlying data and the trade-offs between growth and selectivity are revisited in future assessments. The model also underestimated the proportion of the most frequent length classes from the 1999 year class in 2004-2007, perhaps due to its inability to model the growth process for that cohort independently from the surrounding cohorts.

The model fit the Canadian fishery length composition data very poorly in 2001-2002, (check years). These two anomalous observations have been the source of considerable discussion during past assessments and remain a mystery. The model was also not able to accommodate well the catches of smaller hake in 1995-1998. This suggests that hake spawned in Canadian waters in 1994 and were exploited by the Canadian fleet as young fish. Benson et al. (2002) confirm this pattern of spawning in Canadian waters. This pattern has not been observed in the Canadian fishery during any other period.

Predicted lengths for the acoustic survey were also generally on the modes with the observed size compositions. But in a number of years (1980, 1995, and 2005) the model was unable to effectively reproduce the observed bi-modal structure (Figure 50-51). The 1999 year class in 2007 is fully selected and thus the model fits the modal structure of the size composition well. In contrast, the 2005 year class, evident as 31 cm fish in the 2007 size compositions, is not fit particularly well as these fish are not fully selected to the survey, and the model appears to be splitting the difference in an attempt to fit both the 2003 and 2005 year classes.

Figures 52-57 show the base model output time trajectories of spawning biomass, total biomass, 3+ biomass, recruitment, numbers-at-age, relative depletion, relative spawning potential ratio (1-SPR/1-SPR40%). Summary Pacific hake biomass (age 3+) before the beginning of the model or fishing (< 1960) is estimated to be 2.9 million mt. The base model indicates that the Pacific hake female spawning biomass declined rapidly after a peak in 1984 (3.78 million mt) until 2000 (0.55 million mt). This long period of decline was followed by a brief increase to a peak of 1.31 million mt in 2003 as the large 1999 year class matured (Table 17, Figure 52). In

2010 (beginning of year), spawning biomass is estimated to be the lowest in the time-series, 0.41 million mt, however this estimate is quite uncertain, with asymptotic 95% confidence intervals ranging from 0.22 to 0.59 million mt. This level equates to approximately 31% of the estimated unfished spawning biomass (SB_0). Estimates of uncertainty in current relative depletion range from 17%-45% of unfished biomass. The estimate of spawning biomass for 2009 is 0.48 million mt, higher than the estimate of 0.43 million mt from the 2009 assessment, reflecting an upward revision in the estimated absolute scale of the hake stock, largely attributable to an increase in the estimate of the 2005 year class (Figure 33). Unexploited equilibrium biomass decreased slightly from 1.37 million metric tons in the 2009 assessment to 1.33 this year, with an approximate 95% confidence interval from 1.15 to 1.50. The recent peak of spawning biomass in 2003 generated by the 1999 year class is now estimated to have reached 99% of the unexploited equilibrium whereas the estimate from the 2009 assessment was 102% of that equilibrium level. The trend in spawning biomass is similar to that for summary biomass (Figure 53, Table 17). Approximate asymptotic intervals about the MLE for spawning biomass and recruitment for the entire times series are given in Table 18.

Estimates of historical Pacific hake recruitment indicate a very large year class in 1980 (Table 17, 19, Figure 54). Secondary large recruitment events occurred in 1977, 1984 and 1999, with 1970, 1973, 1987, 1990 and 2005 being substantially larger than adjacent years. The 1999 year class was estimated to be the largest in 15 years (11.77 billion, 95% interval: 10.98 - 12.61 billion) and to have supported fishery catches from 2002 through 2007. Uncertainty in estimated recruitments is substantial, especially for recent years, as indicated by the asymptotic 95% confidence intervals (Figure 54). Recruitment to age 0 before 1962 is assumed to be equal to the long-term mean recruitment. Age-0 recruitment in 2005 appears slightly higher than was estimated in the 2009 assessment but despite a wide range of uncertainty is not of the same scale as the largest historical recruitments and will not be sufficient to support the fishery for as long as the 1999 cohort. The 2006 year class is estimated to be the third largest since the 1999 cohort (1.34 billion), but still well below the unexploited equilibrium level of 1.95 billion. With an estimated steepness value of 0.88, a large degree of recruitment variability, and a stock that has never been below 30% of unfished spawning biomass there is little discernable relationship between the spawning stock and the subsequent recruitment (Figure 58). Recruitments subsequent to 2008 are drawn exclusively from the stock-recruit curve, with correspondingly high levels of uncertainty (Figure 59).

3.5.4 Model uncertainty

Uncertainty is reported via asymptotic intervals for the maximum likelihood estimates, sensitivity and retrospective analyses. Further quantification of uncertainty is provided via MCMC integration of the base case assessment model for use in the decision table of forecast projections under alternative management actions. These methods still provide an underestimate of the true uncertainty in stock size and reference points because they cannot accommodate uncertainty in structural choices or the relative weighting of data sets in addition to other known contributors to assessment uncertainty.

Also not explicitly included in the uncertainty reported for this assessment are the potential effects of model misspecification visible through relatively poor residual patterns to the size data. These patterns have persisted (and possibly grown worse) since the Stock Synthesis model was constructed for the 2006 assessment. They are likely caused to the lack of treatment of dimorphic growth feeding back through estimation of growth and selectivity parameters. These patterns indicate a distinct need for re-analysis of the underlying data, and revision of the model. It is impossible to predict how such changes will alter our perception of stock status, but the effects may be large. As such, the results of this assessment, pending the proposed changes for 2011 should be interpreted as an underestimation of the true uncertainty in current stock status and the reference points reported below.

3.5.5 Reference points

Because of temporal changes in growth, there are two types of reference points reported in this assessment: those based on the assumed population parameters at the beginning of the modeled time period and those based on the most recent time period in a 'forward projection' mode of calculation. This distinction is important since temporal variability in growth and other parameters can result in different reference point calculations across alternative chronological periods. All strictly biological reference points (e.g., unexploited spawning biomass) are calculated based on the unexploited conditions at the start of the model, whereas management quantities (*MSY*, SB_{msy}, etc.) are based on the current growth and maturity schedules and are marked throughout this document with an asterisk (*).

Unexploited equilibrium Pacific hake spawning biomass (SB_0) is estimated to be 1.33 million mt (~ 95% confidence interval: 1.15-1.50 million mt), with a mean expected recruitment of 1.95 billion age-0 hake (~ 95% confidence interval: 1.72-2.22). The *MSY*-proxy target biomass ($SB_{40\%}$) is estimated to be 0.53 million mt and the minimum biomass threshold ($SB_{25\%}$) is 0.33 million mt. *MSY* is estimated to be 279,071* mt, produced by a female spawning biomass of 292,432* mt, and reflecting the high value (0.88) estimated for steepness of the stock-recruit curve. The equilibrium *MSY*-proxy harvest rate ($F_{40\%}$) yield under the base model is estimated to be 262,957* mt, occurring at a spawning biomass of 453,986* mt. The equilibrium yield at the biomass target ($SB_{40\%}$) is estimated to be 247,589* mt, occurring at a spawning biomass of 530,545* mt given current life history parameters.

The full exploitation history is portrayed graphically in Figure 60, which shows for each year (1966-2009) the calculated relative spawning potential ratio (1-SPR/1-SPR40%) and spawning biomass level (B) relative to their corresponding targets, F40% and B40%, respectively. As indicated in Figure 60 (and Table 17), the spawning potential ratio for Pacific hake has been below the proxy target of 40% for the history of this fishery, but the ratio is uncertain and estimated to have been very close to 1.0 in 2008 (0.96%). Pacific hake are presently in the precautionary zone with regard to biomass level (31% of unfished spawning biomass in 2010) and below, at 80% of (in 2009), the target SPR rate. The full exploitation history in terms of both the biomass and F targets is portrayed graphically via a phase-plot.

3.5.6 Model projections

Forecasts are generated applying the 40:10 control rule and coast-wide catch allocation of 73.88% and 26.12% to the U.S. and Canada, respectively to maximum likelihood results (Table 20). Extremely wide confidence intervals for forecast quantities reflect uncertainty in recent and future year-class strengths as well as current biomass levels. Stock biomass is projected to decline under the current harvest control rule.

As in previous assessments, alternative management actions are presented in a decision table based on MCMC integration of the posterior distribution for model quantities. The MCMC chain was run for 10,000,000 iterations with the first 10,000 discarded to eliminate ‘burn-in’ effects. Every 10,000th subsequent value was retained, resulting in 1,000 samples from the posterior distributions for model parameters and derived quantities. Stationarity of the posterior distribution for model parameters was assessed via a suite of standard diagnostic tests. The objective function, as well as growth, mortality, stock-recruit (including recruitment deviations), and catchability parameters all had maximum autocorrelation at lag-1 values < 11%, and correlation-corrected effective sample sizes ranged from 763-1000. Neither the Geweke nor the Hiedelberger and Welch statistics for these parameters exceeded critical values more frequently than expected via random chance. Selectivity parameters showed slightly less rapid mixing, with two parameters (U.S. peak fishery selectivity in 2005-2009 and U.S. ascending width of fishery selectivity in 2005-2009) exhibiting autocorrelation > 11% (33%, 36%) and correspondingly low correlation-corrected effective sample sizes (Figure 61). Trace plots of thinned samples from the posterior revealed that longer MCMC chains with additional thinning would correct these issues (Figure 62). This behavior is attributable to the high degree of correlation between the ascending limb and peak value for U.S. fishery selectivity where either parameter could be sufficient to represent strong targeting of very young fish. As has been the case in previous hake assessments, these selectivity parameters were uncorrelated with management-related quantities such as current status.

Time-series plots of the posterior distributions for female spawning biomass, age-0 recruitment, relative depletion and relative SPR are shown in Figures 63-66. Interval widths are generally quite similar to those based on the MLE values, although there is no imposed constraint on symmetry and so quantities like female spawning biomass tend to have a larger upper interval than lower. The median of the posterior distribution for current (2009) reference points is slightly more pessimistic than the MLE values; the median value of the 2009 relative depletion is 30%, compared to 31% from the MLE. The ~95% credibility interval for current depletion, 19-46%, is also quite close to the confidence interval based on the Hessian matrix of 17%-44%. Table 21 presents 3-year stochastic projections using the MLE-based OY catch-stream (40:10 correction applied to the $SPR_{MSY\text{-}proxy\ target=0.4}$ harvest rate accounting for the U.S. to Canadian catch allocation, 73.88%/26.12%) along with arbitrary constant catch levels from 50,000 to 200,000 mt, as well as the 2009 *status quo* catch level (184,000 mt). The results of the MCMC posterior sample were combined with the 2010-2012 catch streams and results summarized as posterior intervals of spawning biomass, relative depletion, and relative spawning potential ratio, 1-SPR/1-$SPR_{Target=0.4}$, where values greater than 1.0 denote overfishing. Spawning biomass has a 50% chance of decreasing slightly over the next three years if coast-wide catches are roughly 50,000 per year or more. When the projected OY is removed, forecasted spawning biomass has a 50% chance of declining from 0.39 million mt in 2010 to 0.31 million mt in 2011. This corresponds to spawning depletion declining, with a 50% probability, to 24%, just below the 25% minimum spawning biomass threshold relative to unfished conditions. The 50% probability of achieving values for relative spawning potential ratio very close to 1.0 reflect that the posterior interval for spawning biomass is slightly more pessimistic than the MLE estimate on which the OY is based.

3.5.7 Sensitivity and retrospective analyses

A number of sensitivity analyses and likelihood profiles were conducted to test the effect of select assumptions on the model results. These results, as well as retrospective analyses, (both within and among assessments) are presented below.

The first set of sensitivities evaluated the sensitivity of model results to the SE applied to the 2009 acoustic survey biomass index. The base case model applied a value of 0.5, reflecting the large uncertainty in delineating hake from Humboldt squid as well as the reduced survey coverage in Canadian waters. Use of values smaller than 0.5 (0.25, 0.3, and 0.4) forced the model to increase the 2009 population size in order to fit the data point better, but did not appreciably change other parameters (Table 22). This led to the estimate of current depletion being closely linked to the SE applied to the 2009 survey index with more precision resulting in a less depleted stock.

The next set of sensitivities included those that the STAT team felt were illustrative of issues that had been raised in past assessments:

1) Include bycatch index from the pink shrimp fishery (and iteratively re-weight this index)
2) Include pre-recruit index (and iteratively re-weight this index)
3) Estimate natural mortality (through age 13)
4) Use alternate cohort ageing error adjustment
5) No cohort ageing error adjustment
6) Add fishery selectivity blocks for 2008-2009
7) Iteratively re-weight all data components

The first two of these represent the use of two independent indices of recent year-class strength, the bycatch index from the shrimp fishery and the pre-recruit survey index. Neither had an appreciable effect on the results, due to the mismatch between both series and recent recruitments estimated from other sources (Table 23). When SEs were inflated to reflect the inconsistencies of the surveys, they both resulted in values greater than 1.75 (Table 16). The estimate of natural mortality (*M*) was very close to the fixed value used for the base case; therefore it also had little effect on model results. Changes to the approach to cohort ageing error (allowing the degree of reduction in mis-ageing of dominant cohorts to scale with the SD by age) or removing all cohort-specific ageing error also had little effect on model results, although the latter produced somewhat poorer fits to the age data. Because fishery selectivity (both U.S. and Canadian) has been allowed to vary among 4-year blocks, it seemed reasonable to evaluate combining 2008 and 2009 into an additional block (a single-year block is not generally reliably estimated); however this does truncate the previous block to three years. This alternative model did fit the data slightly better, but resulted in no change to current depletion. Finally, to explore the conflicting signal remaining in the length, age and survey data were iteratively re-weighted all data sources included in the model (this was done prior to the 2009 assessment, but the conclusion was reached that it should not be repeated until poor residual patterns had been addressed). This alternative model resulted in a reduction in current depletion to 25%, and a much degraded fit to the 2009 survey index.

The next set of sensitivities included those that had been suggested by Mark Maunder (Quantitative Resource Assessment LLC) following his review of the 2009 Pacific hake assessment (see section *3.2 Industry-contracted review of the 2009 assessment* above):

8) Split Acoustic index and acoustic survey trawl selectivity
9) Split male and female growth (and old M)
10) Split acoustic survey q into two periods (through 1992 and 1995-present)
11) Start model in (a) 1994 or (b) 1995

The results of these sensitivities are reported in Table 24. The most dramatic result was achieved by starting the modeled period in 1994 or 1995, resulting in 2010 depletion levels of 142% and 13% respectively. These alternative models illustrate the substantial uncertainty in a shortened time-series.

There was seemingly more information in the available data to inform the estimation of *q* over a range of reasonable values than in previous assessments (Figure 67). Further, the sensitivity of current status to the value estimated for survey catchability was reduced (Figure 68). By estimating the parameter, and integrating over it during MCMC, this source of uncertainty is captured in the model results, however, it should not be surprising if the estimated value is substantially updated in future assessments as model structure changes and the acoustic survey time-series becomes longer.

The profile over steepness shows a likelihood surface favoring higher values, but with no significant difference in model fit among a range of values from 0.7-1.0 (Figure 69). Although this had little impact on estimates of current status (Figure 70), it will have very large implications for the estimated MSY harvest levels, indicating that the estimate of this quantity (and perhaps the concept itself) has little value for a species with highly variable recruitment dynamics.

The profile over M (through age 13) shows a likelihood surface between $M = 0.17$ and $M = 0.29$, with less than a 10-point change in log-likelihood over that range (Figure 71). For that range, estimates of current spawning biomass range from 0.3 to 0.59 million mt and historical estimates ranged substantially over the period of peak biomass from the 1980 and 1984 cohorts (Figure 72). However, depletion estimates ranged only from 0.28 to 0.31.

The retrospective analysis was conducted by systematically removing the terminal years' data sequentially for five years. Results of this analysis do not show consistent trends in the estimate of 2009 spawning stock biomass (Figure 73), although they do illustrate the large amount of uncertainty in current stock status and abundance. As has been observed in previous assessments, the strength of the 1999 year class appears to have been somewhat revised downward through time by sequentially adding new data and this has an appreciable effect on spawning biomass estimates for recent years.

A comparison of the models put forward for management since 1991 clearly shows that there has been considerable uncertainty in the Pacific hake stock biomass and status (Figure 74). Model-to-model variability (especially in the early portion of the time-series) is larger than the uncertainty reported in any single model, and this pattern does not appear to dampen as subsequent assessments are developed.

4. Acknowledgements

We thank the following individuals who contributed technical assistance, analysis tools, data, or comments to this assessment: Marlene Bellman, Dezhang Chu, Steve Deblois, John Field, Chris Grandin, Robert Hannah, Jim Hastie, Eliza Heery, Brenda Irwin, Mark Karnowski, Robert Le Goff, Patrick McDonald, Richard Methot, Stacey Miller, Steven Ralston, Becky Renko, Julie Stewart, Ian Taylor, Rebecca Thomas, Vanessa Tuttle and John Wallace. Thank you to Jan Jacobs, Mark Maunder, Rod Moore, and Dan Waldeck, for constructive discussion and critical review of current and future assessment and data approaches. John Devore, Jim Hastie, Stacey Miller, and the STAR panel chair provided preliminary review of this document.

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6. Tables

Table 1. Annual catches of Pacific hake (1000s mt) in U.S. and Canadian waters by foreign, joint venture (JV), and domestic at-sea, shore-based and tribal fisheries, 1966-2009.

	U.S						Canada				
Year	Foreign	JV	At-sea	Shore-based	Tribal	Total U.S.	Foreign	JV	Domestic	Total Canada	Total
1966	137.00	0.00	0.00	0.00	0.00	137.00	0.70	0.00	0.00	0.70	137.70
1967	168.70	0.00	0.00	8.96	0.00	177.66	36.71	0.00	0.00	36.71	214.38
1968	60.66	0.00	0.00	0.16	0.00	60.82	61.36	0.00	0.00	61.36	122.18
1969	86.19	0.00	0.00	0.09	0.00	86.28	93.85	0.00	0.00	93.85	180.13
1970	159.51	0.00	0.00	0.07	0.00	159.58	75.01	0.00	0.00	75.01	234.58
1971	126.49	0.00	0.00	1.43	0.00	127.91	26.70	0.00	0.00	26.70	154.61
1972	74.09	0.00	0.00	0.04	0.00	74.13	43.41	0.00	0.00	43.41	117.55
1973	147.44	0.00	0.00	0.07	0.00	147.51	15.13	0.00	0.00	15.13	162.64
1974	194.11	0.00	0.00	0.00	0.00	194.11	17.15	0.00	0.00	17.15	211.26
1975	205.65	0.00	0.00	0.00	0.00	205.66	15.70	0.00	0.00	15.70	221.36
1976	231.33	0.00	0.00	0.22	0.00	231.55	5.97	0.00	0.00	5.97	237.52
1977	127.01	0.00	0.00	0.49	0.00	127.50	5.19	0.00	0.00	5.19	132.69
1978	96.83	0.86	0.00	0.69	0.00	98.37	3.45	1.81	0.00	5.27	103.64
1979	114.91	8.83	0.00	0.94	0.00	124.68	7.90	4.23	0.30	12.44	137.12
1980	44.02	27.54	0.00	0.79	0.00	72.35	5.27	12.21	0.10	17.58	89.94
1981	70.37	43.56	0.00	0.84	0.00	114.76	3.92	17.16	3.28	24.36	139.12
1982	7.09	67.46	0.00	1.02	0.00	75.58	12.48	19.68	0.00	32.16	107.73
1983	0.00	72.10	0.00	1.05	0.00	73.15	13.12	27.66	0.00	40.77	113.92
1984	14.72	78.89	0.00	2.72	0.00	96.33	13.20	28.91	0.00	42.11	138.44
1985	49.85	31.69	0.00	3.89	0.00	85.44	10.53	13.24	1.19	24.96	110.40
1986	69.86	81.64	0.00	3.46	0.00	154.96	23.74	30.14	1.77	55.65	210.62
1987	49.66	106.00	0.00	4.80	0.00	160.45	21.45	48.08	4.17	73.70	234.15
1988	18.04	135.78	0.00	6.88	0.00	160.70	38.08	49.24	0.83	88.16	248.86
1989	0.00	203.58	0.00	7.42	0.00	211.00	29.75	62.62	2.56	94.93	305.93
1990	0.00	170.97	4.71	8.12	0.00	183.80	3.81	68.31	4.02	76.15	259.95
1991	0.00	0.00	196.91	20.60	0.00	217.51	5.61	68.13	16.18	89.92	307.42
1992	0.00	0.00	152.45	56.13	0.00	208.58	0.00	68.78	20.05	88.83	297.40
1993	0.00	0.00	99.10	42.12	0.00	141.22	0.00	46.42	12.36	58.78	200.00
1994	0.00	0.00	179.07	73.66	0.00	252.73	0.00	85.16	23.78	108.94	361.67
1995	0.00	0.00	102.62	74.97	0.00	177.59	0.00	26.19	46.19	72.38	249.97
1996	0.00	0.00	112.78	85.13	15.00	212.90	0.00	66.78	26.40	93.17	306.08
1997	0.00	0.00	121.17	87.41	24.84	233.42	0.00	42.57	49.23	91.79	325.22
1998	0.00	0.00	120.45	87.86	24.51	232.82	0.00	39.73	48.07	87.80	320.62
1999	0.00	0.00	115.26	83.42	25.84	224.52	0.00	17.20	70.13	87.33	311.86
2000	0.00	0.00	116.09	85.83	6.5	208.42	0.96	15.06	6.38	22.4	230.82
2001	0.00	0.00	102.13	73.47	6.77	182.38	0.00	21.65	31.94	53.59	235.96
2002	0.00	0.00	63.26	45.71	23.15	132.11	0.00	0.00	50.77	50.77	182.91
2003	0.00	0.00	67.47	51.26	24.76	143.49	0.00	0.00	62.09	62.09	205.58
2004	0.00	0.00	90.26	89.38	30.85	210.48	0.00	58.89	65.35	124.24	334.67
2005	0.00	0.00	150.4	74.15	35.3	259.84	0.00	15.18	85.28	100.46	360.68
2006	0.00	0.00	134	97.23	35.47	267	0.00	13.71	80.01	93.76	361
2007	0.00	0.00	121	73	29.85	225	0.00	6.78	65.80	72.57	297.10
2008	0.00	0.00	166	50	32	248	0.00	3.59	70.16	73.75	321.55
2009	0.00	0.00	58.71	40.68	21.72	121.11	0.00	0.00	55.62	55.62	176.73
Average:						164.52				56.17	220.69

Table 2. Recent trend in Pacific hake management performance.

Year	Total landings (mt)	Coast-wide (U.S. + Canada) OY (mt)	Coast-wide (U.S. + Canada) ABC (mt)
2000	230,820	290,000	290,000
2001	235,962	238,000	238,000
2002	182,911	162,000	208,000
2003	205,582	228,000	235,000
2004	334,672	501,073	514,441
2005	359,661	364,197	531,124
2006	360,683	364,842	661,680
2007	297,098	328,358	612,068
2008	321,547	364,842	400,000
2009	176,730	184,000	253,582

Table 3. U.S. fishery sampling information by sector showing the number of hauls or trips, lengths and ages sampled each year. Note that only the 2008 and 2009 values have been updated for this assessment.

	At-sea			Shore-based		
Year	Number of hauls with lengths	Number of lengths	Number of ages	Number of trips with lengths	Number of lengths	Number of ages
1975	13	486	332	NA	NA	NA
1976	249	48,433	4,077	NA	NA	NA
1977	1,071	140,338	7,693	NA	NA	NA
1978	1,135	122,531	5,926	NA	NA	NA
1979	1,539	170,951	3,132	NA	NA	NA
1980	811	101,528	4,442	NA	NA	NA
1981	1,093	135,333	4,273	NA	NA	NA
1982	1,142	169,525	4,601	NA	NA	NA
1983	1,069	163,992	3,219	NA	NA	NA
1984	2,035	237,004	3,300	NA	NA	NA
1985	2,061	259,583	2,450	NA	NA	NA
1986	3,878	467,932	3,136	NA	NA	NA
1987	3,406	428,732	3,185	NA	NA	NA
1988	3,035	412,277	3,214	NA	NA	NA
1989	2,581	354,890	3,041	NA	NA	NA
1990	2,039	260,998	3,112	NA	NA	NA
1991	817	94,685	1,333	17	1,273	934
1992	836	72,294	2,175	49	3,152	1,062
1993	442	31,887	1,196	36	1,919	845
1994	649	41,143	1,775	80	4,939	1,457
1995	470	29,035	690	57	3,388	1,441
1996	557	32,133	1,333	47	3,330	1,123
1997	681	47,863	1,147	67	4,272	1,759
1998	803	47,511	1,158	63	3,979	2,021
1999	2,268	49,192	1,047	92	4,280	1,452
2000	2,199	48,153	1,257	81	2,490	1,314
2001	2,239	48,426	2,111	106	4,290	1,983
2002	1,821	39,485	1,695	94	3,890	1,582
2003	1,915	37,772	1,761	101	3,866	1,561
2004	2,797	57,014	1,875	129	7,170	1,440
2005	3,064	62,944	2,451	108	6,166	1,160
2006	2,824	58,094	2,058	156	8,974	1,547
2007	2,810	57,817	2,094	126	7,035	1,398
2008	3,403	55,331	3,337	87	5,670	1,129
2009	1,738	27,029	1,667	95	6.934	1,419

Table 4. Canadian fishery sampling information by sector showing the number of hauls or trips, lengths and ages sampled each year. Note that 2008 values represent the sum of sampling for both sectors.

	Joint-venture			Domestic		
Year	Number of hauls with lengths	Number of lengths	Number of ages	Number of trips with lengths	Number of lengths	Number of ages
1988	129	75,767	1,557	NA	NA	NA
1989	157	56,202	1,353	NA	NA	NA
1990	152	33,312	1,024	NA	NA	NA
1991	567	97,205	1,057	NA	NA	NA
1992	429	60,391	1,786	NA	NA	NA
1993	500	70,522	1,228	NA	NA	NA
1994	875	122,871	2,196	NA	NA	NA
1995	183	20,552	1,747	NA	NA	NA
1996	813	99,228	1,526	10	449	0
1997	414	16,957	1,430	297	42,296	150
1998	468	45,117	1,113	265	29,850	454
1999	66	8,663	812	314	42,119	1,568
2000	352	45,946	1,536	23	2,151	0
2001	284	26,817	1,424	126	14,937	111
2002	NA	NA	NA	1890	13,611	1,831
2003	NA	NA	NA	338	24,898	1,386
2004	595	60,025	1,102	124	7,716	1,581
2005	58	5,206	292	267	17,252	1,415
2006	126	9,417	334	212	15,576	1,170
2007	47	4,050	0	172	8,991	965
2008	--	--	--	188	12,281	1,950
2009	NA	NA	NA	342	29,423	1,411

Table 5. U.S. fishery sampling information by sector and year. Note that only 2008 and 2009 values have been updated for this assessment.

	At-sea			Shore-based		
Year	Sampled weight (mt)	Total weight (mt)	Percent sampled	Sampled weight (mt)	Total weight (mt)	Percent sampled
1975	47	205,654	<0.1%	NA	NA	NA
1976	4,165	231,331	1.8%	NA	NA	NA
1977	4,239	127,013	3.3%	NA	NA	NA
1978	4,769	97,683	4.9%	NA	NA	NA
1979	6,797	123,743	5.5%	NA	NA	NA
1980	10,074	71,560	14.1%	NA	NA	NA
1981	9,846	113,921	8.6%	NA	NA	NA
1982	23,956	74,553	32.1%	NA	NA	NA
1983	27,110	72,100	37.6%	NA	NA	NA
1984	13,603	93,611	14.5%	NA	NA	NA
1985	11,842	81,545	14.5%	NA	NA	NA
1986	24,602	151,501	16.2%	NA	NA	NA
1987	22,349	155,653	14.4%	NA	NA	NA
1988	21,499	153,822	14.0%	NA	NA	NA
1989	20,560	203,578	10.1%	NA	NA	NA
1990	16,264	175,685	9.3%	NA	NA	NA
1991	15,833	196,905	8.0%	683	20,600	3.3%
1992	17,781	152,449	11.7%	1,964	56,127	3.5%
1993	11,306	99,103	11.4%	1,619	42,119	3.8%
1994	13,959	179,073	7.8%	4,461	73,656	6.1%
1995	9,833	102,624	9.6%	3,224	74,965	4.3%
1996	13,813	112,776	12.2%	3,036	85,127	3.6%
1997	17,264	121,173	14.2%	4,670	87,410	5.3%
1998	17,370	120,452	14.4%	4,231	87,856	4.8%
1999	47,541	115,259	41.2%	6,740	83,419	8.1%
2000	48,482	116,090	41.8%	7,735	85,828	9.0%
2001	43,459	102,129	42.6%	8,524	73,474	11.6%
2002	37,252	63,258	58.9%	7,089	45,708	15.5%
2003	38,067	67,473	56.4%	7,676	55,335	13.9%
2004	53,411	90,258	59.2%	10,918	96,229	11.3%
2005	66,356	150,400	44.1%	8,997	85,914	10.5%
2006	60,435	97,403	62.0%	13,646	115,980	11.8%
2007	64,230	107,489	59.8%	12,231	72,663	16.8%
2008	157,850	166,000	95.1%	17,202	50,000	34.4%
2009	29,523	58,718	50.3%	18,422	40,681	45.3%

Table 6. Canadian fishery sampling information by sector and year. Note that only 2009 values have been updated for this assessment.

	Joint-venture			Domestic		
Year	Sampled weight (mt)	Total weight (mt)	Percent sampled	Sampled weight (mt)	Total weight (mt)	Percent sampled
1988	2,210	49,243	4.49%	NA	NA	NA
1989	2,767	62,618	4.42%	NA	NA	NA
1990	3,078	68,313	4.51%	NA	NA	NA
1991	11,840	68,133	17.38%	NA	NA	NA
1992	8,901	68,779	12.94%	NA	NA	NA
1993	9,012	46,422	19.41%	NA	NA	NA
1994	15,490	85,162	18.19%	NA	NA	NA
1995	3,857	26,191	14.73%	NA	NA	NA
1996	14,891	66,779	22.30%	68	26,395	0.26%
1997	8,340	42,565	19.59%	267	49,227	0.54%
1998	9,638	39,728	24.26%	247	48,074	0.51%
1999	2,079	17,201	12.09%	426	70,132	0.61%
2000	6,811	15,059	45.23%	268	6,382	4.20%
2001	6,072	21,650	28.05%	5,625	31,935	17.61%
2002	NA	NA	NA	9,110	50,769	17.94%
2003	NA	NA	NA	14,968	62,090	24.11%
2004	15,563	58,892	26.43%	3,568	65,345	5.46%
2005	1,713	15,178	11.29%	7,467	85,284	8.76%
2006	2,811	13,715	20.50%	14,080	80,011	17.60%
2007	1,043	6,780	15.39%	4,678	65,803	7.11%
2008	697	3,592	19.40%	5,342	70,165	7.61%
2009	NA	NA	NA	16,626	55,562	29.92%

Table 7. U.S. fishery sample sizes for conditional age-at-length data. Values represent the number of hauls contributing from the at-sea sector and the number of trips from the shore-based fishery. Note: only the 2008 and 2009 values have been updated for this assessment.

Length (cm)	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986
20			1		1	1	5					
21			1	2		3	9					
22		1		2		2	13					
23	1	1		4		1	23					
24	1	1		4		2	25	2				1
25	1	3		10	1	1	29	5				
26	2	1		10	2		40	11	1		1	
27	2	4		9	2	1	34	9		1		
28	1	5		14	4	1	22	12			1	
29	3	4		7	10	1	21	18	6		2	1
30	5	4		4	21	1	16	37	10		1	5
31	3	6	2	2	27		12	38	11	3	3	8
32	5	8			30	3	6	52	23	1	3	19
33	2	9	4		46	4	9	62	23	2	3	22
34	4	10	5		33	9	12	66	35	6	2	49
35	4	7	12		24	19	16	62	39	12	1	41
36	5	13	28	3	17	38	28	55	51	25	1	42
37	5	23	56	7	19	66	49	59	55	41	2	40
38	3	26	71	17	12	74	59	48	62	72	7	39
39	2	45	99	51	11	84	78	50	58	112	16	36
40	6	58	114	88	17	89	94	62	62	121	43	51
41	10	53	146	129	25	83	84	66	69	135	78	85
42	9	55	141	176	36	93	85	86	77	125	107	114
43	9	56	160	171	44	88	88	94	72	112	121	119
44	10	54	160	158	65	100	101	99	69	93	124	110
45	8	47	147	165	72	111	101	100	69	82	115	113
46	9	47	142	148	74	114	107	99	75	83	101	105
47	7	39	132	144	84	96	114	103	74	74	79	100
48	10	42	128	154	83	90	122	111	70	67	63	83
49	8	44	136	143	76	85	122	116	69	66	58	67
50	4	57	123	147	83	90	105	101	71	50	52	77
51	5	62	135	156	89	87	113	112	59	49	25	59
52	6	60	140	184	85	92	107	100	66	43	24	51
53		69	146	178	86	94	116	106	66	28	17	52
54	2	64	147	186	78	105	96	104	61	20	15	44
55	4	58	161	176	70	102	80	86	57	11	11	27
56		67	139	156	66	102	65	85	44	5	3	31
57	1	65	131	115	58	102	56	81	32	5	4	24
58	1	62	94	103	41	88	39	48	32	4	3	11
59	2	57	95	60	47	52	34	53	17	7		11
60	1	56	73	60	22	60	36	37	22	2	1	7
61		48	60	45	26	39	30	28	15		1	8
62		45	52	41	16	27	20	17	9	4		7
63		30	46	27	12	25	20	21	12	4		3
64		36	42	26	8	26	16	21	6	2		6
65		33	23	18	13	19	8	18	6	1		5
66		33	17	14	11	12	10	9	4			6
67		33	15	18	6	11	10	10	4	1		4
68	1	28	18	13	8	9	5	6	5	2	1	3
69	1	25	17	10	4	7	7	6	1	3		4
70		71	62	60	16	14	15	14	12	9		25

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Table 7. Continued.

Length (cm)	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
20					2				1			
21					2							
22					1							
23					1							
24												
25												
26		1										
27						1						
28				2		2						
29		1	2	6		5						
30			3	5	1	6		1		1		
31		1	9	15	2	8	4			6		
32		2	15	22	5	5	1		1	9		2
33	3	2	15	24	13	3	5	1		17		4
34	6	3	8	45	23	4	5		1	23	1	1
35	16	3	10	51	32	3	17	3		30	1	5
36	29	3	13	76	33	6	31	9		30	7	13
37	60	15	9	84	39	22	42	19	2	23	16	17
38	79	56	17	94	37	23	45	42	4	27	32	30
39	88	101	40	98	46	58	49	64	2	33	47	36
40	97	129	79	104	50	66	44	70	6	38	59	50
41	104	141	120	95	55	78	38	66	18	35	77	56
42	112	141	129	96	59	84	50	73	31	36	83	73
43	121	145	125	93	58	82	57	81	33	50	84	97
44	117	153	127	91	54	81	64	99	38	65	70	102
45	113	152	125	82	53	81	65	99	37	73	71	90
46	106	150	130	88	53	81	63	98	36	74	57	77
47	102	137	133	82	47	84	58	95	39	72	53	51
48	92	123	118	84	48	84	62	90	38	64	41	43
49	83	81	98	73	44	82	46	91	37	59	28	25
50	59	68	74	72	36	73	30	63	33	47	27	17
51	40	45	49	74	18	59	22	34	25	30	21	7
52	31	34	40	58	9	39	9	25	23	29	11	3
53	18	22	35	43	6	35	4	15	13	10	11	3
54	14	15	27	34	6	26	7	13	10	12	5	2
55	8	14	14	20	7	20	6	8	8	7	1	4
56	5	8	15	15	2	15	1	4	6	4	3	1
57	5	13	8	14	3	15	2	5	4	1	1	
58	3	11	8	14	2	9		6	6	3	1	1
59	2	4	7	11	3	9	1	2	3	3	1	1
60	5	6	3	14		7		3	1	1	1	
61	3	5	6	15	3	5	2	1	1	2	1	
62	6	1		9	3	5		1	2	2		1
63	1		3	9	3	2		1	1	1	1	
64	2	4	1	8		3		1		1		
65	3	3	1	8	2	2		2		1		1
66	1	4	2	8	5	2					1	
67	2			6	2			1		1		
68	3	2	4	6	2	2		1				
69	1	3		7	1		1	1				
70	5	12	4	20	8	6	1	3	1	2	2	

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Table 7. Continued.

Length (cm)	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
20								1	4		
21								1			
22								1	1		1
23								2	1	1	1
24								4		3	2
25								6		2	2
26								7	1	6	
27			1					11	3	7	2
28		2						11	6	6	3
29	2	2						10	8	9	
30	8	3	6					9	11	8	1
31	8	3	7	1		1		7	17	17	
32	9	2	15					14	39	24	2
33	19	1	19				1	28	41	41	9
34	29	2	28	1			2	51	41	56	16
35	41	2	32	2			4	96	57	53	35
36	38	6	50	11	2			107	45	65	53
37	41	18	55	19	2	1	2	128	49	104	84
38	54	16	61	45	6	7	3	187	60	155	92
39	60	24	56	80	25	23	6	275	42	172	116
40	53	36	61	113	61	45	25	298	46	187	138
41	59	43	97	128	133	90	49	328	72	186	146
42	49	56	100	117	199	133	125	248	126	144	156
43	77	85	100	100	227	216	242	187	155	124	136
44	70	86	112	85	203	227	309	112	235	178	141
45	84	89	121	63	156	225	318	72	319	199	112
46	63	106	136	53	106	177	267	45	332	242	132
47	63	120	136	61	67	105	199	18	315	287	136
48	47	100	153	65	49	79	114	8	259	256	118
49	31	95	118	74	33	39	72	2	173	238	107
50	17	75	86	76	33	26	46	8	124	172	77
51	13	55	59	68	17	8	31	3	74	127	53
52	9	34	50	55	15	12	9	6	53	96	38
53	6	17	37	48	5	5	11	4	31	75	30
54	3	17	34	38	7	3	6	1	19	40	20
55		9	10	27	4	2	3	2	14	32	11
56		12	8	17	3	2	4	1	9	23	15
57	3	4	11	13		2	3	1	16	16	7
58	2	3	1	7		2	1	2	4	10	10
59		5	2	4	1	1	2	1	6	8	7
60	1	4	4	4		2		3	6	6	3
61	2	2	1	2			1	2	2	4	5
62	1	4		3		1		5	1	6	4
63		1		1					5	3	
64				2					1	1	3
65		2	1	1	1				1	1	1
66				1			1		1	3	1
67						1					
68							1			1	
69											1
70				1					4		1

Table 8. Canadian fishery sample sizes for conditional age-at-length data. Values represent the number of hauls contributing from the joint-venture sector and the number of trips from the domestic fishery.

Length (cm)	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997
20										
21										
22										
23								1		
24								2		
25								2		
26								1		
27								1		
28								1		
29										
30										
31									2	
32									2	
33							1	1	3	
34						1			3	
35	1						1		4	
36						1	1		8	
37	1				1		1		9	
38	1		2		1				12	1
39	3		3	1	2				7	7
40	4	2	3	1	3	5			8	10
41	4	5	4	1	9	10	6	1	6	17
42	4	6	5	3	15	14	10	6	14	21
43	5	6	6	6	22	17	20	11	15	22
44	5	6	4	14	27	17	24	18	22	22
45	5	6	4	16	29	18	28	21	24	23
46	5	6	4	16	29	18	29	21	24	23
47	5	6	4	16	29	18	30	21	24	23
48	5	6	4	16	29	18	31	21	24	23
49	5	6	4	16	29	18	30	21	23	22
50	5	6	5	16	27	17	28	21	23	22
51	5	6	5	16	28	13	28	21	22	18
52	5	6	6	13	16	12	27	17	17	18
53	5	6	4	13	15	4	23	17	11	14
54	5	4	5	8	12	5	18	14	12	9
55	4	5	3	4	7	1	21	11	4	5
56	4	4	4	8	4		12	7	7	2
57	4	4	4	3	4		9	5	7	3
58	4	3	3	5	4	5	6	9	6	
59	3	2	4	3	1		8	6	1	1
60	3	2	3	2	3		6	4	4	1
61	2	1	2	2			5	4	4	
62	1	3	4	2	1		3	1	1	
63	1	3	4		2		2	2		
64	1	2	2	1			3	3		1
65	1	1	2				5	1	2	
66		1	1	1			1	1	1	
67		2	2					1		
68				1					1	1
69			1	1				1		
70	1	4	1	1	1		2	1		

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Table 8. Continued.

Length (cm)	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
20	1									1		
21		1										
22		1										
23		2									1	
24											1	
25											1	
26		2									1	
27											2	
28	1										2	
29		1					1				2	
30		1					1				2	
31		3	1	1							4	
32		5				2	1				6	1
33		10				2	1				7	
34	1	7	1				2			1	7	3
35		10	3				1			2	8	2
36	4	16	4			1	1				7	4
37	8	17	5		1		2				7	6
38	10	19	6				2	2		1	8	6
39	17	26	5				3		1	1	12	5
40	18	27	9			1	11	1	2	4	7	10
41	19	30	13	1		3	20	3	5	7	12	8
42	25	35	14	3		11	26	12	13	13	11	13
43	24	36	14	4	8	14	31	17	16	15	20	17
44	25	35	17	6	3	14	32	19	41	19	27	19
45	25	37	16	11	5	15	32	20	51	24	36	21
46	25	38	18	15	11	15	32	20	73	26	41	24
47	25	38	19	18	15	15	32	20	82	29	42	22
48	23	34	19	20	22	15	31	19	81	30	40	25
49	21	35	19	20	24	15	31	17	71	33	45	21
50	22	31	20	20	25	15	31	12	70	31	40	24
51	17	27	18	20	26	13	27	12	59	23	42	21
52	8	22	16	20	26	13	18	2	45	23	34	22
53	8	14	17	19	26	11	17	5	24	17	29	21
54	6	11	15	18	26	11	13	7	26	21	21	16
55	2	9	9	19	26	9	11	6	10	10	22	12
56	2	6	10	17	25	7	5	4	12	12	13	11
57	3	2	6	17	25	6	7	2	6	9	17	5
58	2	4	6	17	21	8	3	2	6	12	7	4
59	1	4	8	12	13	5	1	1	7	8	8	5
60		1	4	9	18	5	5		7	6	3	2
61		1	4	7	12	3	2	1	6	2	7	
62		1		4	12	1	1			4	3	2
63	1		2	2	7	1	2		1	2	1	
64		1	1	2	2	1		1	2	3	2	1
65				3	1	1	1	1	2	2		
66		2	1	1	2		1		1	2		
67			1	2	1						1	
68					1	1	1			3		
69							1			1		
70			1						1	2		

Table 9. Summary of the WCGOP coverage in the trawl fishery for pink shrimp, 2004-2008.

Year	Number of trips	Number of hauls	Number of vessels	Observed pink shrimp landings (mt)	Total pink shrimp landings (mt)	Coverage rate (%)
2004	52	912	20	661	6,534	10.1%
2005	38	509	23	369	8,020	4.6%
2007	63	951	30	665	9,418	7.1%
2008	55	840	31	586	12,521	4.7%

Table 10. Observed bycatch of hake (< 0.5 lbs mean individual weight) in the pink shrimp fishery, 2004-2008. SEs represent bootstrapped uncertainty associated only with the sampling frame.

Year	Observed hake discard (mt)	SD ln(value)
2004	11.67	0.32
2005	25.83	0.24
2007	116.58	0.13
2008	27.65	0.25

Table 11. Acoustic survey sampling information, 1977-2009.

Year	Inshore limit (m)	Offshore limit (m)	Northern limit (°N)	Number of hauls with hake biological samples	Number of lengths	Number of ages
1977	91	457	50.0	85	11,695	4,262
1980	55	457	50.0	49	8,296	2,952
1983	55	366	49.5	35	8,614	1,327
1986	55	366	49.5	43	12,702	2,074
1989	55	366	50.0	22	5,606	1,730
1992	55	366	51.7	43	15,852	2,184
1995	50	1,500	55.0	69	22,896	2,118
1998	50	1,500	55.0	84	33,347	2,417
2001	50	1,500	55.0	49	16,442	2,536
2003	50	1,500	55.0	71	19,357	3,007
2005	50	1,500	55.0	49	13,644	1,905
2007	50	1,500	55.0	130	15,756	2,915
2009	50[1]	1,500[2]	55.0	61	11,346	2,609

[1]Some transects were aborted at depths > 50m in Canadian waters.
[2]Some transects extended beyond 1,500m regardless of hake presence in Canadian waters.

Table 12. Acoustic survey sample sizes for conditional age-at-length data. Values represent the number of hauls.

Length (cm)	1977	1980	1983	1986	1989	1992	1995	1998	2001	2003	2005	2007	2009
20													
21													
22													
23													
24						2		1				3	
25						2		3		1		2	
26	1					2		2				4	
27					1	4		4	2			7	
28	1					2	2	10		1	1	8	
29	1	1		2		5	1	13			1	15	
30	1			3		7	2	16	3	2	4	17	2
31	2			6		7	4	20	8	2	6	18	1
32	3			8		8	9	23	14	4	7	17	2
33	4		2	8	1	8	13	23	17	4	10	20	4
34	3	4	4	9	3	8	15	31	20	8	8	20	13
35	9	7	3	9	4	7	21	31	20	8	10	16	16
36	14	9	5	11	6	6	20	30	20	8	9	15	32
37	16	10	7	8	8	6	17	36	17	9	10	13	43
38	14	12	8	10	7	5	14	39	13	14	8	11	42
39	17	10	9	5	9	8	6	50	10	14	10	10	46
40	20	12	13	6	10	7	11	44	17	29	6	16	45
41	22	11	11	12	15	10	15	55	14	43	22	14	46
42	24	10	11	21	20	24	26	62	18	56	28	27	42
43	29	12	9	21	20	28	40	66	22	55	36	36	43
44	34	13	13	20	20	36	45	64	17	59	41	38	41
45	40	16	12	21	20	38	49	57	29	61	42	43	40
46	41	18	13	21	20	39	53	49	29	53	41	44	33
47	45	19	12	17	18	37	50	51	30	55	39	54	31
48	48	21	13	18	16	34	47	46	30	43	32	49	26
49	48	24	12	16	16	30	38	31	28	41	27	46	27
50	45	22	12	16	10	22	27	22	27	32	23	37	28
51	47	22	11	16	8	18	17	9	25	28	12	30	21
52	46	21	10	11	9	14	14	5	26	24	12	22	16
53	44	19	9	13	6	6	10	6	24	19	9	22	12
54	40	18	8	8	5	3	7	4	25	12	5	12	9
55	38	17	6	9	2	4	5	2	18	12	3	12	9
56	31	19	5	4	2	5	6	2	13	7	5	6	8
57	33	16	7	4		4	3	3	10	6	2	6	7
58	27	11	2	3	3	3	5	5	10	5	1	7	7
59	19	14	3	3	2	1	2		7	3	1	5	5
60	18	7	1	4	2	1	2	1	8	6		6	4
61	16	4	2	3		1	1	2	5	2		3	2
62	11	3	2	2		2	4		3	5			1
63	11	2	1		1	3	2		2				1
64	10	2		3	1		1		4	2	1	4	1
65	8	3	1	1	1		2		3	2	1		1
66	8	2	1				2		2	2		2	
67	8	2		1			2		1	2			1
68	7	4		1					2		1		1
69	4	3	1	1	1		1	1	4	2	1		
70	7	3		1	2		3		4	6	6	2	1

Table 13. Acoustic survey biomass estimates (excluding fish of age-0 and age-1, and including all post-survey spatial expansion correction factors) and assumed SEs of the log-index, 1977-2009.

Year	Biomass estimate (1000s mt)	SE ln(value)
1977	1,915	0.50
1980	2,115	0.50
1983	1,647	0.50
1986	2,857	0.50
1989	1,238	0.50
1992	2,169	0.25
1995	1,385	0.25
1998	1,185	0.25
2001	737	0.25
2003	1,840	0.25
2005	1,265	0.25
2007	879	0.25
2009	1,462	0.50

Table 14. Pre-recruit survey relative estimates of numbers at age-0 and SEs of the log-index based on a jackknife variance estimation procedure.

Year	Numbers age-0	SE ln(value)
2001	770.38	0.42
2002	329.00	0.22
2003	735.90	0.31
2004	1531.60	0.27
2005	355.65	0.26
2006	192.34	0.17
2007	63.31	0.13
2008	128.28	0.17
2009	114.78	0.15

Table 15. Summary of model parameters in the base case assessment model.

Parameter	Number estimated	Bounds (low, high)	Prior (Mean, SD) (single value = fixed)	Value (MLE)
Stock and recruitment				
Ln(R_0)	1	(11,21)	uniform	14.485
Steepness (*h*)	1	(0.2,1.0)	~Beta(0.777,0.113)	0.877
Recruitment variability (σ_R)	1	(1.0,2.0)	uniform	1.29
Ln(Recruitment deviations): 1962-2009	48	(-7, 7)	~Ln(N(0, σ_r))	*
Ln(Forecast recruitment deviations: 2010-2012)	3	(-7, 7)	~Ln(N(0, σ_r))	0.0
Individual growth and mortality				
Natural mortality (*M*, to age 13)	-	NA	0.23	0.23
Natural mortality (*M*, ramp to value at age 15)	1	(0.2,0.8)	uniform	0.624
Length at age 2 (cm)	-	NA	32	32
von Bertalanffy *K*	1	(0.1,0.7)	uniform	0.301
Exponential offset to *K*, 1980-1986	1	(-2,2)	~N(0,0.01)	-0.134
Exponential offset to *K*, 1999-2008	1	(-2,2)	~N(0,0.01)	0.194
Length at age 12 (cm)	1	(30,70)	uniform	53.21
Exponential offset to length at age 12, 1984-2008	1	(-2,2)	~N(0,0.01)	-0.054
CV of length at age 2	-	NA	0.066	0.066
CV of length at age 12	-	NA	0.062	0.062
Weight-length slope	-	NA	0.000007	0.000007
Weight-length exponent	-	NA	2.9624	2.9624
Length at 50% maturity (cm)	-	NA	36.89	36.89
Logistic maturity slope	-	NA	-0.48	-0.48
Eggs produced per gram intercept	-	NA	1.0	1.0
Eggs produced per gram slope	-	NA	0.0	0.0
Catchability and selectivity (double normal)				
Acoustic survey:				
Ln(*Q*) - catchability	1	(-5,0.5)	uniform	-0.063
Time-invariant age-based selectivity	3	varied	uniform	**
U.S. Fishery:				
Time-invariant age-based selectivity	3	varied	uniform	**
Additive offsets to ascending, peak and final parameters	15	(-10,10)	uniform	**
Canadian Fishery:				
Time-invariant age-based selectivity	3	varied	uniform	**
Additive offsets to ascending, and peak parameters	10	(-10,10)	uniform	**

Total: 44 + 51 recruitment deviations = 95 estimated parameters.

* See tables below for recruitment estimates. ** Too many to report here, see Appendix B for all parameter estimates.

Table 16. Model tuning specifications by source.

Type of data	Source	Input adjustment	Average input after adjustment	Average effective N or RMSE
Survey	Acoustic	+0.0	0.37	0.59
	Pre-recruit (*removed from base*)	+1.53	1.76	1.77
	Shrimp bycatch (*removed from base*)	+1.84	2.07	2.08
Length	Acoustic	x 1.41	77.9	81.3
	U.S. fishery	x 0.09	158.0	153.9
	Canadian fishery	x 1.04	102.5	100.2
Age	Acoustic	x 3.27	48.0	49.1
	U.S. fishery	x 1.70	77.4	104.9
	Canadian fishery	x 1.78	21.0	39.2

Table 17. Time-series of population estimates from the base case model.

Year	Total biomass (millions mt)	Age 3+ biomass (millions mt)	Female spawning biomass (millions mt)	Depletion	Age-0 recruits (billions)	1-SPR / 1-SPR40%	SPR	Exploitation fraction
1960	3.14	2.79	1.33	100%	1.95	0.0	1.00	0.0
1961	3.14	2.79	1.33	100%	1.95	0.0	1.00	0.0
1962	3.13	2.79	1.33	100%	0.1	0.0	1.00	0.0
1963	3.05	2.79	1.33	100%	0.46	0.0	1.00	0.0
1964	2.83	2.79	1.31	100%	0.81	0.0	1.00	0.0
1965	2.58	2.48	1.22	100%	0.99	0.0	1.00	0.0
1966	2.36	2.21	1.09	99%	1.13	0.32	0.81	0.06
1967	2.05	1.87	0.91	92%	1.24	0.47	0.72	0.11
1968	1.76	1.55	0.74	82%	1.68	0.31	0.81	0.08
1969	1.64	1.40	0.67	69%	0.92	0.45	0.73	0.13
1970	1.55	1.27	0.60	56%	4.63	0.66	0.61	0.18
1971	1.53	1.20	0.54	50%	1.33	0.64	0.62	0.13
1972	1.78	1.13	0.56	45%	0.52	0.52	0.69	0.10
1973	1.92	1.70	0.71	41%	4.44	0.64	0.62	0.10
1974	2.00	1.74	0.79	42%	0.72	0.71	0.57	0.12
1975	2.15	1.54	0.77	53%	2.14	0.69	0.58	0.14
1976	2.13	1.94	0.83	59%	0.99	0.70	0.58	0.12
1977	2.15	1.76	0.84	58%	12.07	0.47	0.72	0.08
1978	2.52	1.87	0.86	63%	1.2	0.37	0.78	0.06
1979	3.42	1.80	0.95	63%	2.3	0.39	0.77	0.08
1980	3.97	3.53	1.39	65%	33.39	0.25	0.85	0.03
1981	5.30	3.58	1.64	72%	0.09	0.33	0.80	0.04
1982	7.89	3.59	1.96	105%	0.17	0.23	0.86	0.03
1983	8.59	8.57	3.11	123%	0.57	0.20	0.88	0.01
1984	8.68	8.53	3.87	148%	17.37	0.19	0.89	0.02
1985	8.44	7.62	3.65	235%	0.01	0.13	0.92	0.01
1986	8.90	6.66	3.39	291%	0.39	0.20	0.88	0.03
1987	8.20	8.16	3.40	275%	5.27	0.21	0.87	0.03
1988	7.53	7.24	3.35	256%	2.22	0.22	0.87	0.03
1989	6.99	6.22	3.04	256%	0.08	0.33	0.80	0.05
1990	6.20	5.89	2.74	253%	3.18	0.31	0.82	0.04
1991	5.40	5.25	2.46	229%	0.79	0.40	0.76	0.06
1992	4.67	4.23	2.08	207%	0.01	0.46	0.73	0.07
1993	3.89	3.77	1.76	185%	2.4	0.34	0.80	0.05
1994	3.29	3.17	1.50	157%	2.18	0.62	0.63	0.11
1995	2.68	2.27	1.13	133%	1.62	0.58	0.65	0.11
1996	2.32	1.96	0.91	113%	2.09	0.75	0.55	0.16
1997	2.02	1.72	0.77	85%	1.28	0.78	0.53	0.19
1998	1.81	1.47	0.66	68%	2.45	0.87	0.48	0.22
1999	1.68	1.34	0.58	58%	11.77	0.94	0.43	0.23
2000	2.02	1.16	0.55	50%	0.43	0.83	0.50	0.20
2001	2.83	1.29	0.67	44%	0.92	0.77	0.54	0.18
2002	3.05	2.95	1.10	41%	0.01	0.48	0.71	0.06
2003	3.00	2.87	1.31	50%	1.68	0.43	0.74	0.07
2004	2.72	2.65	1.25	83%	0.20	0.62	0.63	0.13
2005	2.30	2.06	1.02	99%	2.90	0.73	0.56	0.17
2006	1.88	1.72	0.80	94%	1.34	0.82	0.51	0.21
2007	1.64	1.21	0.61	77%	0.01	0.84	0.50	0.24
2008	1.43	1.25	0.55	61%	0.88	0.96	0.42	0.26
2009	1.13	1.08	0.48	46%	1.84	0.80	0.52	0.16
2010	1.04	0.84	0.41	41%	1.81	NA	NA	NA

Table 18. Time-series of ~95% confidence intervals for female spawning biomass, relative depletion estimates, age-0 recruits, relative spawning potential ratio (1-SPR/1-$SPR_{Target=0.4}$) and exploitation fraction (catch/3+biomass) from the base case model.

Year	Female spawning Biomass (millions mt)	Depletion	Age-0 recruits (billions)	(1-SPR) / (1-SPR_{target})	SPR	Exploitation fraction
1960	1.15 - 1.50	NA	1.72 - 2.22	NA	NA	NA
1961	1.15 - 1.50	NA	1.72 - 2.22	NA	NA	NA
1962	1.15 - 1.50	NA	0.02 - 0.43	NA	NA	NA
1963	1.15 - 1.50	NA	0.22 - 0.95	NA	NA	NA
1964	1.14 - 1.48	NA	0.52 - 1.25	NA	NA	NA
1965	1.06 - 1.37	NA	0.70 - 1.38	NA	NA	NA
1966	0.96 - 1.21	NA	0.91 - 1.40	0.29 - 0.36	0.79 - 0.83	0.06 - 0.07
1967	0.81 - 1.01	0.67-0.71	1.05 - 1.48	0.43 - 0.51	0.69 - 0.74	0.10 - 0.13
1968	0.67 - 0.82	0.54-0.58	1.50 - 1.88	0.28 - 0.34	0.79 - 0.83	0.07 - 0.09
1969	0.61 - 0.72	0.47-0.53	0.79 - 1.07	0.41 - 0.49	0.71 - 0.76	0.12 - 0.14
1970	0.56 - 0.64	0.41-0.49	4.26 - 5.04	0.61 - 0.70	0.58 - 0.63	0.17 - 0.20
1971	0.51 - 0.58	0.37-0.45	1.19 - 1.50	0.60 - 0.67	0.6 - 0.64	0.12 - 0.14
1972	0.52 - 0.59	0.37-0.47	0.44 - 0.63	0.49 - 0.55	0.67 - 0.71	0.10 - 0.11
1973	0.66 - 0.75	0.47-0.60	4.01 - 4.92	0.61 - 0.66	0.6 - 0.63	0.09 - 0.10
1974	0.73 - 0.85	0.52-0.67	0.62 - 0.84	0.68 - 0.74	0.56 - 0.59	0.11 - 0.13
1975	0.70 - 0.83	0.50-0.66	1.90 - 2.40	0.66 - 0.73	0.56 - 0.6	0.13 - 0.16
1976	0.75 - 0.91	0.54-0.71	0.85 - 1.15	0.66 - 0.74	0.56 - 0.6	0.11 - 0.13
1977	0.74 - 0.93	0.54-0.72	10.97 - 13.28	0.43 - 0.52	0.69 - 0.74	0.07 - 0.08
1978	0.76 - 0.96	0.55-0.74	1.02 - 1.40	0.34 - 0.41	0.75 - 0.8	0.05 - 0.06
1979	0.84 - 1.07	0.61-0.83	2.03 - 2.60	0.35 - 0.43	0.74 - 0.79	0.07 - 0.09
1980	1.23 - 1.54	0.89-1.20	31.28 - 35.63	0.23 - 0.28	0.83 - 0.86	0.02 - 0.03
1981	1.46 - 1.81	1.06-1.41	0.04 - 0.23	0.30 - 0.36	0.78 - 0.82	0.03 - 0.04
1982	1.76 - 2.15	1.27-1.68	0.11 - 0.25	0.20 - 0.25	0.85 - 0.88	0.03 - 0.03
1983	2.85 - 3.38	2.03-2.66	0.48 - 0.68	0.17 - 0.22	0.87 - 0.9	0.01 - 0.01
1984	3.56 - 4.17	2.53-3.30	16.77 - 17.99	0.17 - 0.21	0.87 - 0.9	0.01 - 0.02
1985	3.37 - 3.93	2.39-3.11	<0.01 - 0.03	0.11 - 0.14	0.92 - 0.93	0.01 - 0.02
1986	3.14 - 3.65	2.22-2.89	0.33 - 0.46	0.18 - 0.21	0.87 - 0.89	0.03 - 0.03
1987	3.17 - 3.63	2.23-2.90	5.08 - 5.47	0.20 - 0.23	0.86 - 0.88	0.03 - 0.03
1988	3.15 - 3.56	2.21-2.85	2.10 - 2.35	0.21 - 0.24	0.86 - 0.87	0.03 - 0.04
1989	2.87 - 3.22	2.00-2.59	0.05 - 0.12	0.32 - 0.35	0.79 - 0.81	0.05 - 0.05
1990	2.59 - 2.89	1.80-2.33	3.05 - 3.30	0.29 - 0.32	0.81 - 0.82	0.04 - 0.05
1991	2.33 - 2.59	1.62-2.09	0.72 - 0.86	0.38 - 0.41	0.75 - 0.77	0.06 - 0.06
1992	1.98 - 2.18	1.37-1.77	<0.01 - 0.05	0.44 - 0.47	0.72 - 0.73	0.07 - 0.07
1993	1.68 - 1.84	1.16-1.49	2.29 - 2.52	0.33 - 0.35	0.79 - 0.8	0.05 - 0.06
1994	1.44 - 1.57	0.99-1.28	2.06 - 2.30	0.60 - 0.64	0.61 - 0.64	0.11 - 0.12
1995	1.08 - 1.17	0.74-0.96	1.52 - 1.73	0.57 - 0.60	0.64 - 0.66	0.11 - 0.11
1996	0.87 - 0.94	0.60-0.77	1.96 - 2.22	0.73 - 0.77	0.54 - 0.56	0.15 - 0.16
1997	0.74 - 0.79	0.51-0.65	1.18 - 1.39	0.76 - 0.79	0.52 - 0.54	0.18 - 0.20
1998	0.64 - 0.69	0.44-0.56	2.29 - 2.61	0.85 - 0.89	0.47 - 0.49	0.21 - 0.23
1999	0.56 - 0.60	0.38-0.49	10.98 - 12.61	0.92 - 0.96	0.42 - 0.45	0.22 - 0.24
2000	0.52 - 0.58	0.36-0.47	0.38 - 0.50	0.81 - 0.85	0.49 - 0.51	0.19 - 0.21
2001	0.63 - 0.71	0.44-0.57	0.82 - 1.04	0.75 - 0.80	0.52 - 0.55	0.17 - 0.19
2002	1.02 - 1.17	0.71-0.94	<0.01 - 0.02	0.46 - 0.51	0.7 - 0.73	0.06 - 0.07
2003	1.22 - 1.41	0.85-1.13	1.38 - 2.04	0.40 - 0.46	0.72 - 0.76	0.07 - 0.08
2004	1.15 - 1.35	0.81-1.08	0.15 - 0.28	0.59 - 0.66	0.6 - 0.65	0.12 - 0.14
2005	0.93 - 1.12	0.66-0.88	2.09 - 4.02	0.68 - 0.79	0.53 - 0.59	0.16 - 0.19
2006	0.71 - 0.90	0.51-0.71	0.90 – 2.00	0.75 - 0.89	0.46 - 0.55	0.18 - 0.24
2007	0.50 - 0.71	0.37-0.55	0.01 - 0.02	0.75 - 0.93	0.44 - 0.55	0.20 - 0.29
2008	0.40 - 0.69	0.30-0.52	0.13 - 5.90	0.84 - 1.08	0.35 - 0.5	0.19 - 0.33
2009	0.30 - 0.65	0.22-0.49	0.26 - 12.80	0.64 - 0.96	0.42 - 0.62	0.10 - 0.23
2010	0.22 - 0.59	0.17-0.44	0.26 - 12.61	NA	NA	NA

Table 19. Estimated numbers at age (millions).

Year	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15+
1960	1.95	1.55	1.23	0.98	0.78	0.62	0.49	0.39	0.31	0.25	0.20	0.16	0.12	0.10	0.08	0.11
1961	1.95	1.55	1.23	0.98	0.78	0.62	0.49	0.39	0.31	0.25	0.20	0.16	0.12	0.10	0.08	0.11
1962	0.10	1.55	1.23	0.98	0.78	0.62	0.49	0.39	0.31	0.25	0.20	0.16	0.12	0.10	0.08	0.11
1963	0.46	0.08	1.23	0.98	0.78	0.62	0.49	0.39	0.31	0.25	0.20	0.16	0.12	0.10	0.08	0.11
1964	0.81	0.37	0.06	0.98	0.78	0.62	0.49	0.39	0.31	0.25	0.20	0.16	0.12	0.10	0.08	0.11
1965	0.99	0.64	0.29	0.05	0.78	0.62	0.49	0.39	0.31	0.25	0.20	0.16	0.12	0.10	0.08	0.11
1966	1.13	0.78	0.51	0.23	0.04	0.62	0.49	0.39	0.31	0.25	0.20	0.16	0.12	0.10	0.08	0.11
1967	1.24	0.89	0.62	0.40	0.18	0.03	0.47	0.37	0.29	0.23	0.18	0.14	0.11	0.09	0.07	0.11
1968	1.68	0.99	0.71	0.49	0.31	0.14	0.02	0.35	0.26	0.20	0.15	0.11	0.09	0.07	0.06	0.09
1969	0.92	1.33	0.78	0.56	0.38	0.24	0.11	0.02	0.26	0.19	0.14	0.10	0.08	0.06	0.04	0.08
1970	4.63	0.73	1.06	0.62	0.44	0.29	0.18	0.08	0.01	0.18	0.13	0.09	0.06	0.04	0.03	0.06
1971	1.33	3.68	0.58	0.82	0.47	0.33	0.21	0.13	0.05	0.01	0.10	0.06	0.04	0.02	0.02	0.04
1972	0.52	1.06	2.92	0.45	0.62	0.35	0.23	0.15	0.08	0.03	0.00	0.05	0.03	0.02	0.01	0.03
1973	4.44	0.42	0.84	2.29	0.35	0.48	0.26	0.17	0.10	0.05	0.02	0.00	0.03	0.01	0.01	0.02
1974	0.72	3.53	0.33	0.65	1.74	0.26	0.34	0.18	0.11	0.06	0.03	0.01	0.00	0.01	0.01	0.01
1975	2.14	0.57	2.81	0.25	0.49	1.28	0.18	0.23	0.11	0.07	0.03	0.02	0.00	0.00	0.01	0.01
1976	0.99	1.70	0.46	2.16	0.19	0.36	0.91	0.12	0.15	0.07	0.04	0.02	0.01	0.00	0.00	0.01
1977	12.07	0.79	1.35	0.35	1.63	0.14	0.25	0.61	0.08	0.09	0.04	0.02	0.01	0.00	0.00	0.00
1978	1.20	9.59	0.62	1.05	0.27	1.24	0.11	0.19	0.43	0.05	0.06	0.02	0.01	0.01	0.00	0.00
1979	2.30	0.95	7.62	0.49	0.82	0.21	0.94	0.08	0.14	0.31	0.04	0.04	0.02	0.01	0.00	0.00
1980	33.39	1.83	0.76	5.98	0.38	0.63	0.16	0.70	0.06	0.10	0.21	0.03	0.03	0.01	0.01	0.00
1981	0.09	26.53	1.45	0.60	4.70	0.30	0.49	0.12	0.53	0.04	0.07	0.15	0.02	0.02	0.01	0.01
1982	0.17	0.07	21.08	1.15	0.47	3.67	0.23	0.37	0.09	0.38	0.03	0.05	0.10	0.01	0.01	0.01
1983	0.57	0.13	0.06	16.71	0.91	0.37	2.87	0.18	0.28	0.07	0.28	0.02	0.03	0.07	0.01	0.01
1984	17.37	0.45	0.11	0.05	13.22	0.72	0.29	2.23	0.14	0.21	0.05	0.20	0.02	0.02	0.05	0.01
1985	0.01	13.80	0.36	0.08	0.04	10.43	0.56	0.23	1.71	0.10	0.16	0.04	0.15	0.01	0.02	0.04
1986	0.39	0.01	10.96	0.28	0.07	0.03	8.18	0.44	0.18	1.33	0.08	0.12	0.03	0.11	0.01	0.03
1987	5.27	0.31	0.01	8.64	0.22	0.05	0.02	6.32	0.34	0.13	1.01	0.06	0.09	0.02	0.09	0.02
1988	2.22	4.19	0.25	0.01	6.78	0.17	0.04	0.02	4.83	0.26	0.10	0.76	0.05	0.07	0.02	0.07
1989	0.08	1.77	3.33	0.19	0.00	5.29	0.14	0.03	0.01	3.65	0.19	0.08	0.57	0.03	0.05	0.04
1990	3.18	0.06	1.40	2.62	0.15	0.00	4.00	0.10	0.02	0.01	2.74	0.14	0.06	0.43	0.03	0.06
1991	0.79	2.52	0.05	1.11	2.00	0.11	0.00	3.02	0.08	0.02	0.01	2.07	0.11	0.04	0.33	0.05
1992	0.01	0.63	2.00	0.04	0.83	1.50	0.08	0.00	2.24	0.06	0.01	0.01	1.54	0.08	0.03	0.23
1993	2.40	0.01	0.50	1.57	0.03	0.62	1.10	0.06	0.00	1.63	0.04	0.01	0.00	1.13	0.06	0.14
1994	2.18	1.91	0.01	0.39	1.22	0.02	0.47	0.82	0.05	0.00	1.21	0.03	0.01	0.00	0.85	0.11
1995	1.62	1.73	1.52	0.01	0.29	0.89	0.02	0.32	0.56	0.03	0.00	0.81	0.02	0.00	0.00	0.54
1996	2.09	1.29	1.37	1.16	0.01	0.21	0.64	0.01	0.22	0.38	0.02	0.00	0.56	0.01	0.00	0.26
1997	1.28	1.66	1.02	1.04	0.85	0.00	0.15	0.41	0.01	0.14	0.24	0.01	0.00	0.36	0.01	0.13
1998	2.45	1.02	1.32	0.78	0.77	0.61	0.00	0.09	0.25	0.00	0.07	0.13	0.01	0.00	0.20	0.06
1999	11.77	1.94	0.81	1.00	0.57	0.54	0.39	0.00	0.05	0.12	0.00	0.03	0.06	0.00	0.00	0.11
2000	0.43	9.35	1.54	0.61	0.72	0.39	0.33	0.22	0.00	0.02	0.05	0.00	0.01	0.02	0.00	0.04
2001	0.92	0.34	7.43	1.17	0.45	0.50	0.25	0.20	0.12	0.00	0.01	0.02	0.00	0.01	0.01	0.01
2002	0.01	0.73	0.27	5.79	0.83	0.30	0.32	0.16	0.13	0.08	0.00	0.01	0.01	0.00	0.00	0.01
2003	1.68	0.00	0.58	0.22	4.39	0.61	0.21	0.23	0.11	0.09	0.05	0.00	0.00	0.01	0.00	0.01
2004	0.20	1.33	0.00	0.46	0.16	3.25	0.44	0.15	0.17	0.08	0.07	0.04	0.00	0.00	0.01	0.00
2005	2.90	0.16	1.06	0.00	0.34	0.11	2.22	0.30	0.11	0.11	0.06	0.05	0.03	0.00	0.00	0.01
2006	1.34	2.31	0.13	0.80	0.00	0.24	0.08	1.46	0.19	0.06	0.07	0.03	0.03	0.02	0.00	0.00
2007	0.01	1.06	1.83	0.10	0.58	0.00	0.16	0.05	0.87	0.11	0.04	0.04	0.02	0.02	0.01	0.00
2008	0.88	0.01	0.84	1.36	0.07	0.40	0.00	0.10	0.03	0.50	0.06	0.02	0.02	0.01	0.01	0.01
2009	1.84	0.70	0.01	0.61	0.94	0.04	0.24	0.00	0.05	0.01	0.24	0.03	0.01	0.01	0.01	0.01
2010	1.81	1.46	0.55	0.00	0.45	0.66	0.03	0.15	0.00	0.03	0.01	0.13	0.02	0.01	0.01	0.01

Table 20. Three-year projections of maximum likelihood-based Pacific hake ABC, OY, spawning biomass and depletion for the base case model based on the 40:10 harvest control rule and the $F_{40\%}$ overfishing limit/target.

Year	ABC (mt)	OY (mt)	Female spawning biomass (millions mt)	~95% confidence interval	Estimated depletion	~95% confidence interval
2010	253,517	224,975	0.41	0.22 - 0.59	31%	17% - 44%
2011	226,067	181,462	0.34	0.12 - 0.55	25%	10% - 41%
2012	221,866	181,185	0.34	0.01 - 0.68	26%	1% - 51%

Table 21. Decision table with three year projections of posterior distributions for Pacific hake female spawning biomass, depletion (both of at the beginning of the year, before fishing takes place) and relative spawning potential ratio (1-SPR/1-$SPR_{Target=0.4}$; values greater than 1.0 denote overfishing). Catch alternatives are based on: 1) arbitrary constant catch levels of 50,000, 100,000, 150,000 and 200,000 mt (rows a, b, c, and e), 2) the status quo OY from 2009 (row d), and 3) the values estimated via the 40:10 harvest control rule and the $F_{40\%}$ overfishing limit/target for the base case MLE model (row f; from Table f above).

Management Action			States of nature: Female spawning biomass (millions mt) posterior interval					Estimated depletion posterior interval					Relative spawning potential ratio posterior interval				
	Year	Catch	5th	25th	50th	75th	95th	5th	25th	50th	75th	95th	5th	25th	50th	75th	95th
	2010	50,000	0.27	0.34	0.39	0.46	0.58	20%	25%	30%	35%	43%	0.27	0.33	0.37	0.43	0.51
a	2011	50,000	0.25	0.33	0.40	0.47	0.63	19%	25%	30%	35%	46%	0.24	0.31	0.35	0.41	0.50
	2012	50,000	0.25	0.33	0.42	0.52	0.86	19%	25%	31%	39%	63%	0.20	0.28	0.34	0.40	0.51
	2010	100,000	0.27	0.34	0.39	0.46	0.58	20%	25%	30%	35%	43%	0.47	0.56	0.62	0.69	0.80
b	2011	100,000	0.23	0.31	0.37	0.45	0.61	17%	23%	28%	34%	45%	0.43	0.54	0.62	0.70	0.83
	2012	100,000	0.21	0.29	0.37	0.48	0.81	15%	22%	28%	36%	60%	0.39	0.53	0.61	0.72	0.88
	2010	150,000	0.27	0.34	0.39	0.46	0.58	20%	25%	30%	35%	43%	0.62	0.72	0.79	0.87	0.98
c	2011	150,000	0.21	0.29	0.35	0.43	0.59	16%	21%	26%	32%	43%	0.59	0.73	0.82	0.92	1.06
	2012	150,000	0.16	0.24	0.33	0.44	0.77	12%	19%	25%	32%	57%	0.55	0.73	0.84	0.97	1.16
	2010	184,000	0.27	0.34	0.39	0.46	0.58	20%	25%	30%	35%	43%	0.70	0.81	0.88	0.96	1.07
d	2011	184,000	0.19	0.27	0.33	0.41	0.57	14%	20%	25%	31%	42%	0.69	0.84	0.93	1.03	1.18
	2012	184,000	0.13	0.22	0.30	0.41	0.74	10%	16%	22%	30%	54%	0.65	0.85	0.98	1.11	1.31
	2010	200,000	0.27	0.34	0.39	0.46	0.58	20%	25%	30%	35%	43%	0.74	0.85	0.92	0.99	1.10
e	2011	200,000	0.18	0.26	0.33	0.40	0.56	14%	19%	25%	30%	41%	0.73	0.88	0.97	1.08	1.23
	2012	200,000	0.12	0.20	0.29	0.39	0.73	9%	15%	21%	29%	53%	0.69	0.90	1.03	1.17	1.38
	2010	224,975	0.27	0.34	0.39	0.46	0.58	20%	25%	30%	35%	43%	0.79	0.90	0.97	1.04	1.15
f	2011	181,462	0.17	0.25	0.31	0.39	0.55	13%	19%	24%	29%	40%	0.70	0.85	0.95	1.05	1.21
	2012	181,185	0.12	0.20	0.29	0.39	0.72	8%	15%	21%	29%	53%	0.66	0.86	0.99	1.14	1.35

Table 22. Select likelihoods, parameters and estimated quantities for sensitivity analyses to the precision of the 2009 acoustic biomass estimate. Likelihood values in italics are not comparable.

	Base (2009 SE log-space = 0.5)	SE log-space = 0.40	SE log-space = 0.30	SE log-space = 0.25
Change in negative log-likelihood				
Total	0.00	*0.90*	*2.40*	*3.60*
Survey data	0.00	*0.40*	*0.87*	*1.00*
Length data	0.00	-0.14	-0.52	-0.96
Age data	0.00	1.00	3.30	5.30
Parameters				
Number	95	95	95	95
Ln(R_0)	14.49	14.49	14.5	14.5
Steepness (h)	0.88	0.88	0.88	0.88
M (ages 0-13)	0.23	0.23	0.23	0.23
M (age 15+)	0.62	0.62	0.62	0.62
Acoustic catchability (Q)	0.94	0.95	0.95	0.95
Length at age 12	53.21	53.21	53.21	53.21
Von Bertalanffy K	0.30	0.30	0.30	0.30
Reference points				
SB_0 (million mt)	1.33	1.34	1.34	1.35
2010 Depletion	31%	33%	38%	43%

Table 23. Select likelihoods, parameters and estimated quantities for additional sensitivity analyses. Likelihood values in italics are not comparable.

	Base	Shrimp fishery bycatch index	Pre-recruit index	M estimated	Alt cohort age-error	No cohort age-error	Fishery sel. blocks 08-09	Iteratively reweight
Change in negative log-likelihood								
Total	0.00	*4.90*	*10.50*	-0.10	648.80	9,042	-42.10	*10,173*
Survey data	0.00	*4.79*	*9.77*	0.14	0.30	-0.05	-0.61	*1.40*
Length data	0.00	-0.19	0.01	-0.01	13.69	32.51	-6.39	*-1.65*
Age data	0.00	0.60	1.80	0.00	635.50	9,014	-33.80	*10,130*
Parameters								
Number	95	96	96	96	95	95	99	95
Ln(R_0)	14.49	14.49	14.48	14.55	14.48	14.50	14.50	14.48
Steepness (h)	0.88	0.88	0.88	0.88	0.87	0.85	0.88	0.88
M (ages 0-13)	0.23	0.23	0.23	0.24	0.23	0.23	0.23	0.23
M (age 15+)	0.62	0.62	0.62	0.63	0.58	0.64	0.63	0.62
Acoustic catchability (Q)	0.94	0.94	0.94	0.92	0.95	0.96	0.83	0.97
Length at age 12	53.21	53.21	53.20	53.20	53.20	53.18	53.18	53.21
Von Bertalanffy K	0.3	0.30	0.30	0.30	0.30	0.30	0.30	0.30
Reference points								
SB_0 (million mt)	1.33	1.33	1.32	1.36	1.33	1.35	1.34	1.31
2010 Depletion	31%	31%	30%	30%	28%	29%	31%	25%

Table 24. Select likelihoods, parameters and estimated quantities for requested sensitivity analyses. Likelihood values in italics are not comparable.

	Base	Split-sex growth	Split sel. For acoutic / trawl	Split acoustic *Q* 92/95	Start in 1994	Start in 1995
Change in negative log-likelihood						
Total	0.00	640.90	-3.20	-2.80	*-16,646*	*-19,268*
Survey data	0.00	-0.69	-3.03	-2.35	*2.52*	*4.85*
Length data	0.00	-87.10	0.06	0.47	*-674.37*	*-744.36*
Age data	0.00	1,020	-0.40	-0.60	*-15,651*	*-18,191*
Parameters						
Number	95	91	97	96	43	42
Ln(R_0)	14.49	14.53	14.49	14.49	15.66	14.46
Steepness (*h*)	0.88	0.88	0.88	0.88	0.84	0.83
M (ages 0-13)	0.23	0.23	0.23	0.23	0.23	0.23
M (age 15+)	0.62	0.77-F 0.42-M	0.62	0.63	0.20	0.33
Acoustic catchability (*Q*)	0.94	0.89	0.75	0.67 1.08	0.43	0.79
Length at age 12	53.21	55-F 50-M	53.2	53.21	50.45	50.26
Von Bertalanffy *K*	0.3	0.28-F 0.40-M	0.30	0.30	0.35	0.36
Reference points						
SB_0 (million mt)	1.33	1.48	1.33	1.34	1.26	1.07
2010 Depletion	31%	30%	30%	27%	142%	13%

7. Figures

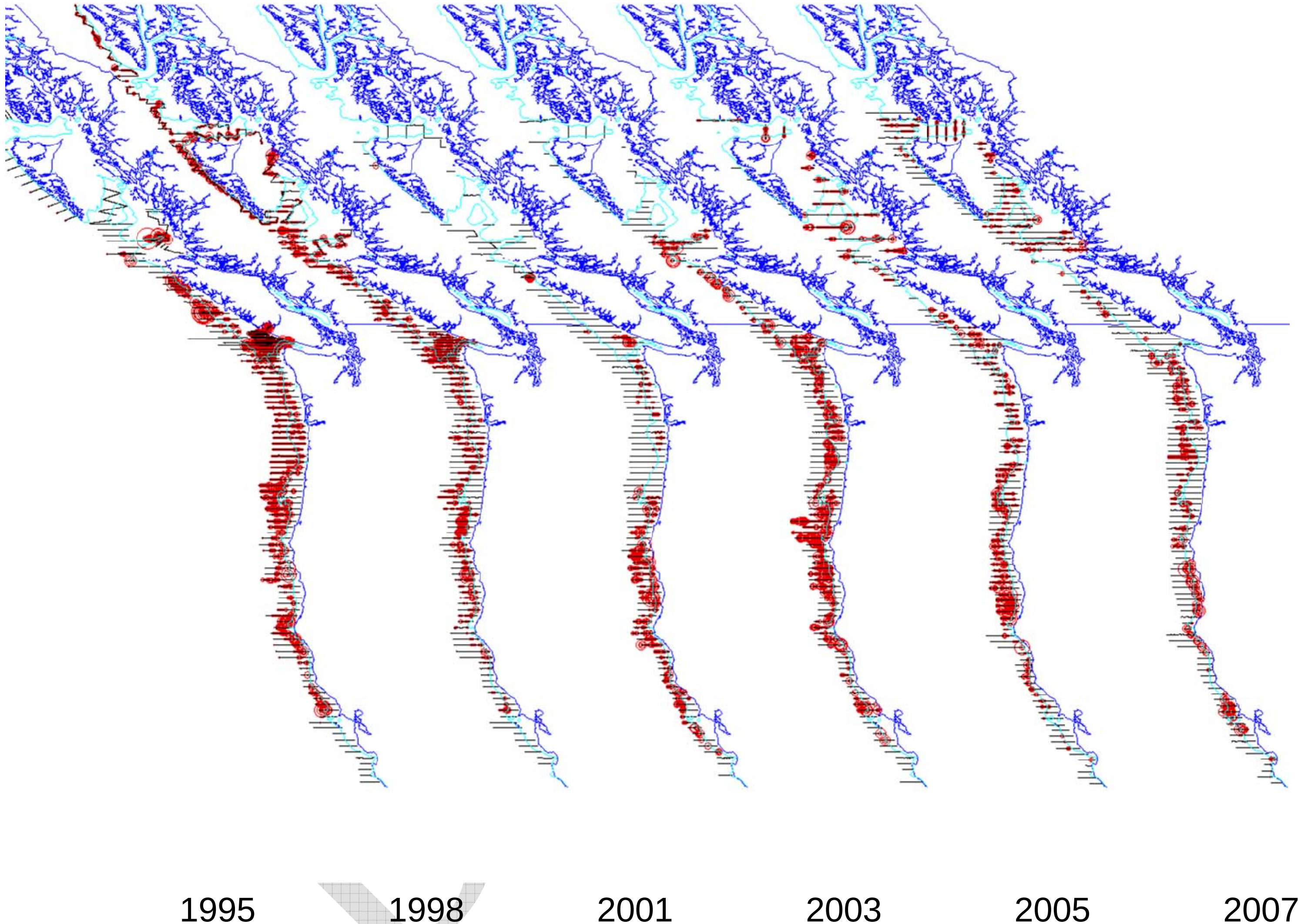

Figure 1. Occurrence of acoustic area backscattering attributable to Pacific hake in the last six (1995-2007) joint US-Canada acoustic surveys. Diameter of circles is proportional to measured backscatter levels.

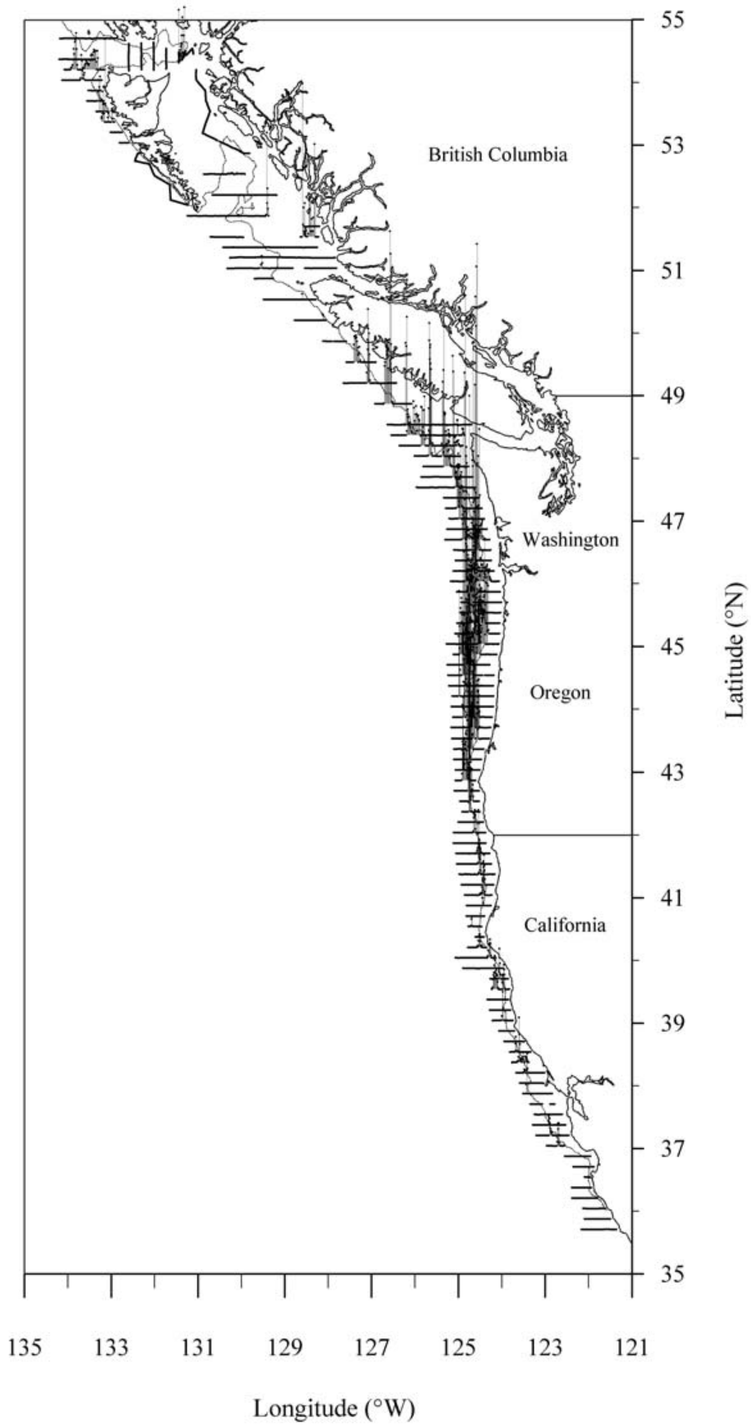

Figure 2. Distribution of acoustic backscattering attributed to Pacific hake along transects surveyed during the 2009 integrated acoustic and trawl survey. Thick lines represent transects, and the height of the light vertical lines is proportional to backscatter value.

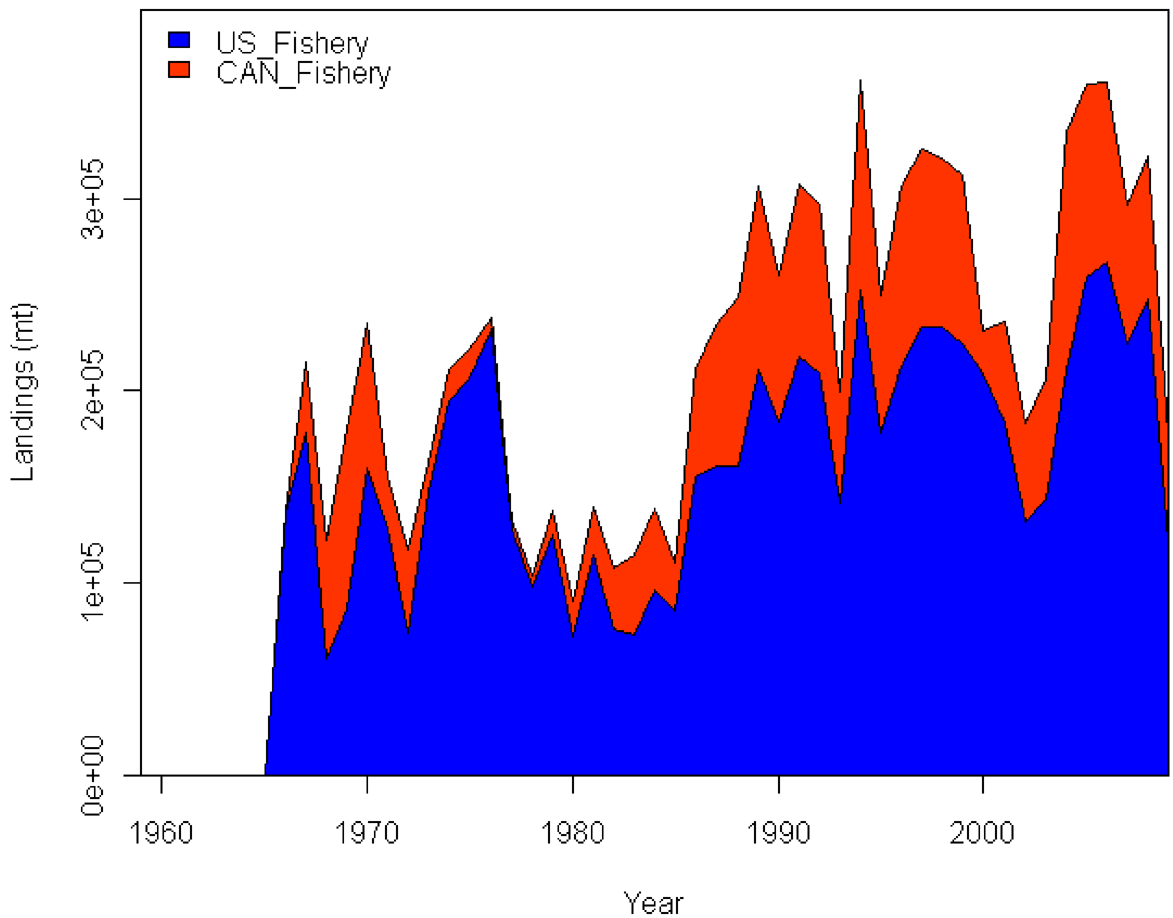

Figure 3. Total Pacific hake landings used in the assessment by nation, 1960-2009 (Canadian landings are represented by the lighter region above the darker U.S. values).

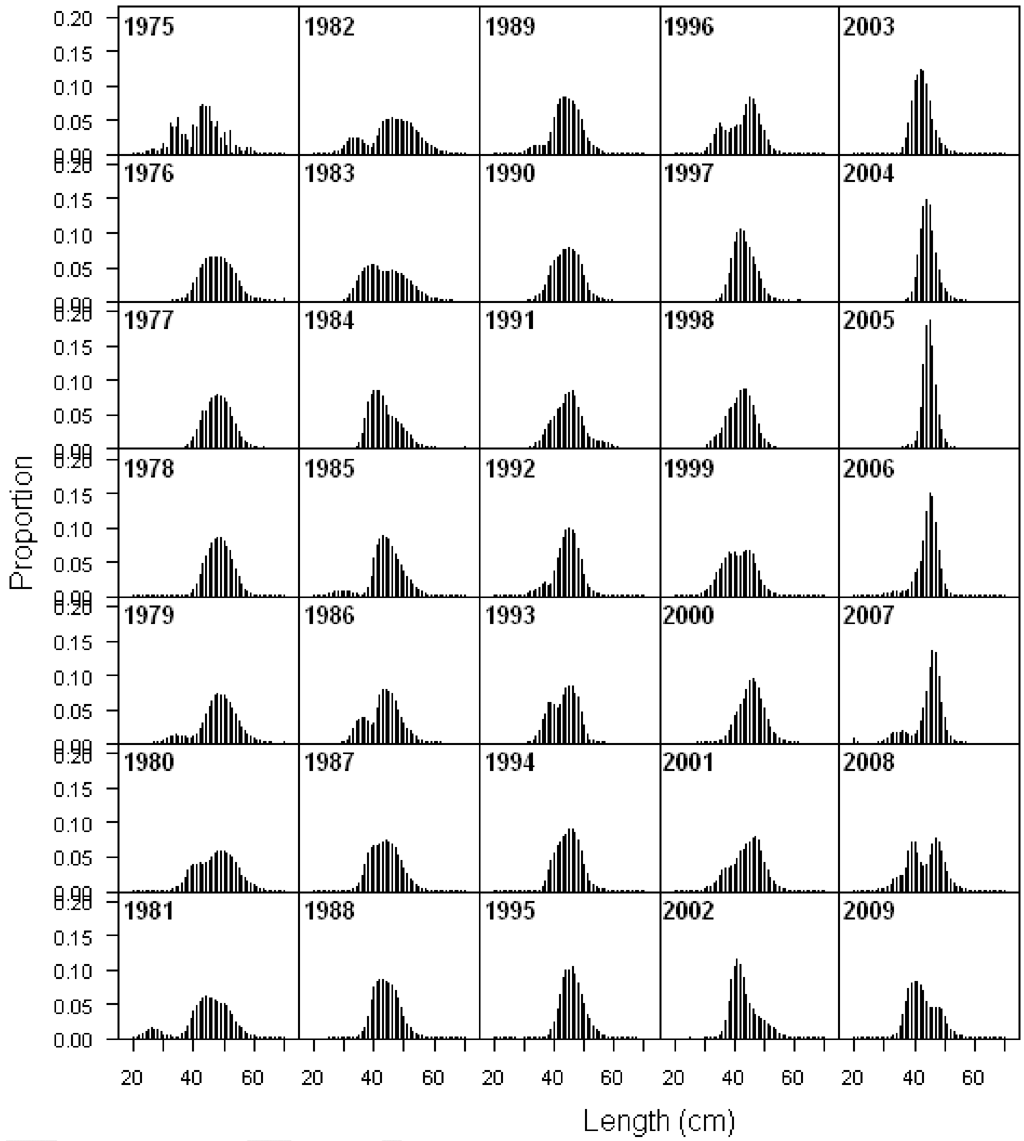

Figure 4. Plot of U.S. fishery (at-sea and shore-based combined) length compositions, 1975-2009.

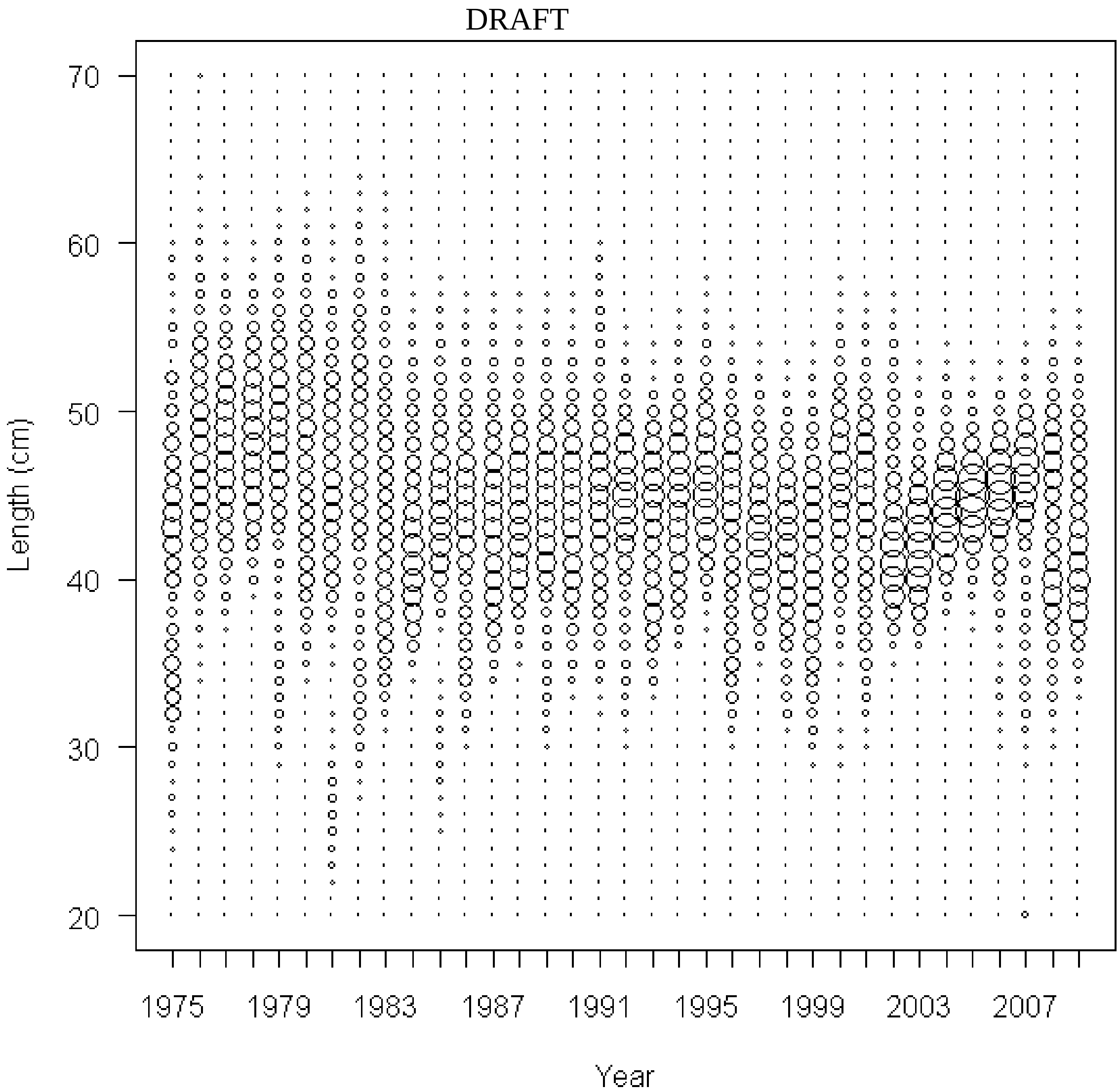

Figure 5. Plot of U.S. fishery (at-sea and shore-based combined) length compositions, 1975-2009. Diameter of circles is scaled to a maximum proportion of 0.19 and proportions sum to 1.0 in each year.

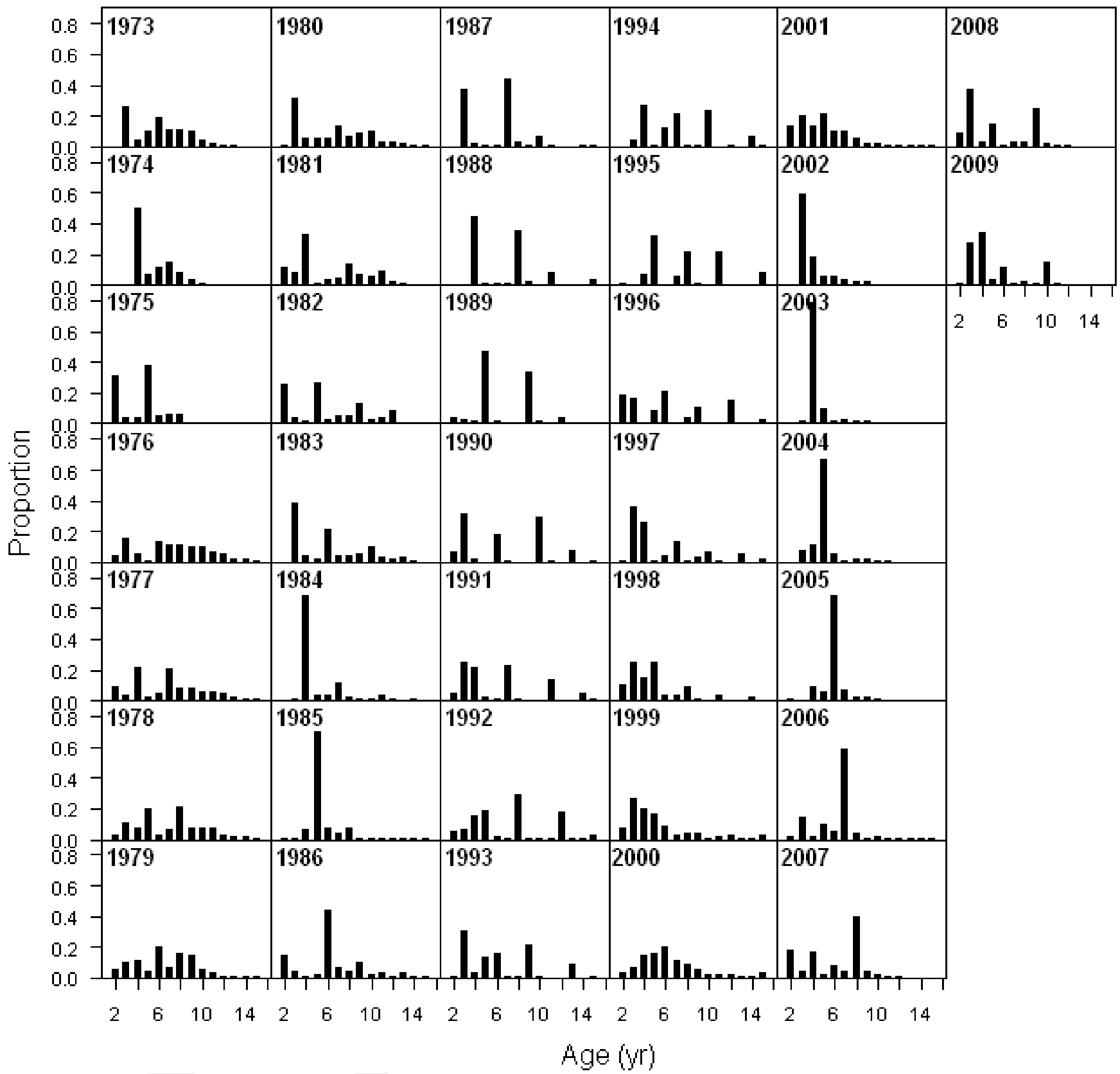

Figure 6. Plot of U.S. fishery (at-sea and shore-based combined) age compositions, 1973-2009.

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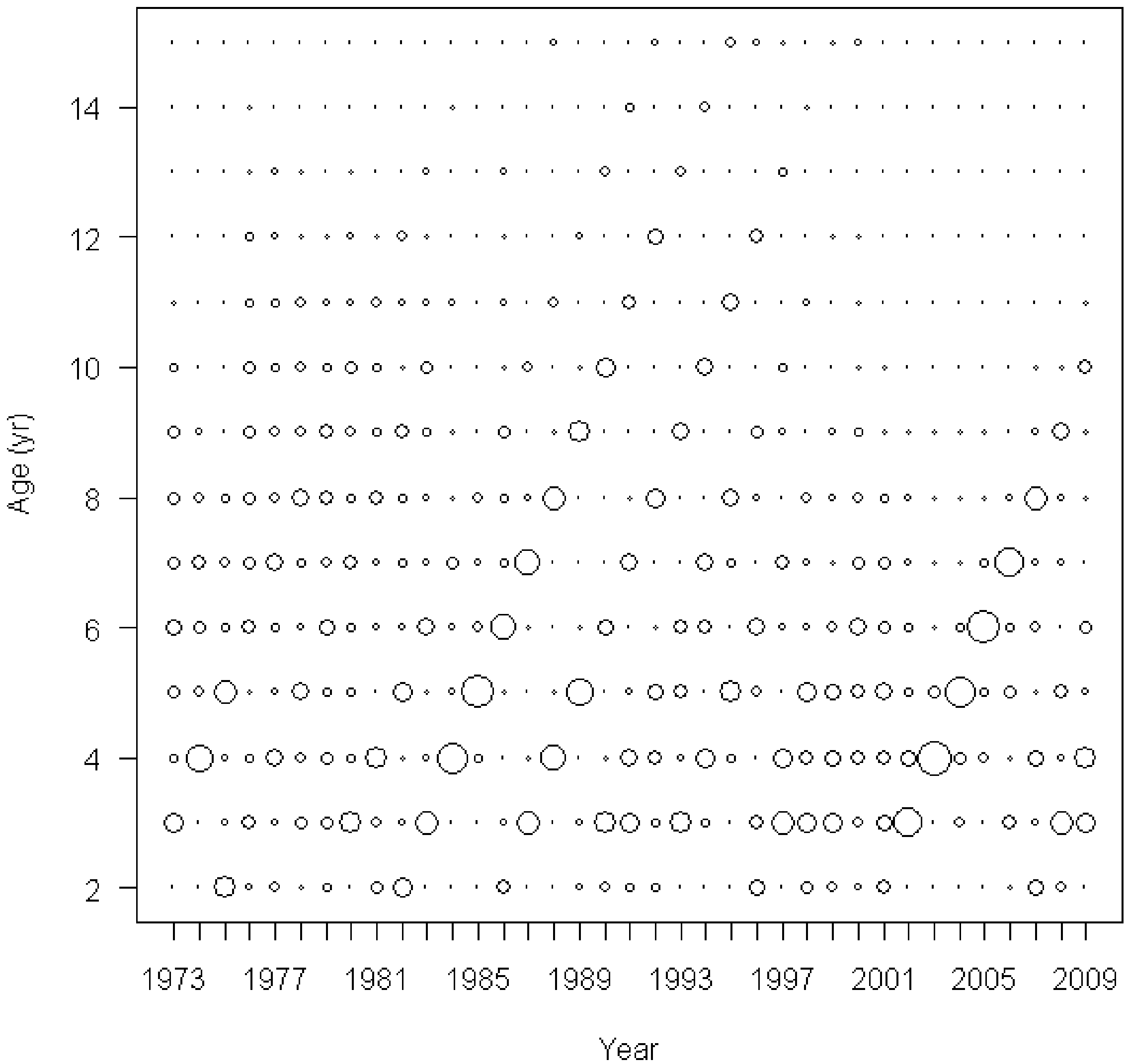

Figure 7. Plot of U.S. fishery (at-sea and shore-based combined) age compositions, 1973-2009. Diameter of circles is scaled to a maximum proportion of 0.78 and proportions sum to 1.0 in each year.

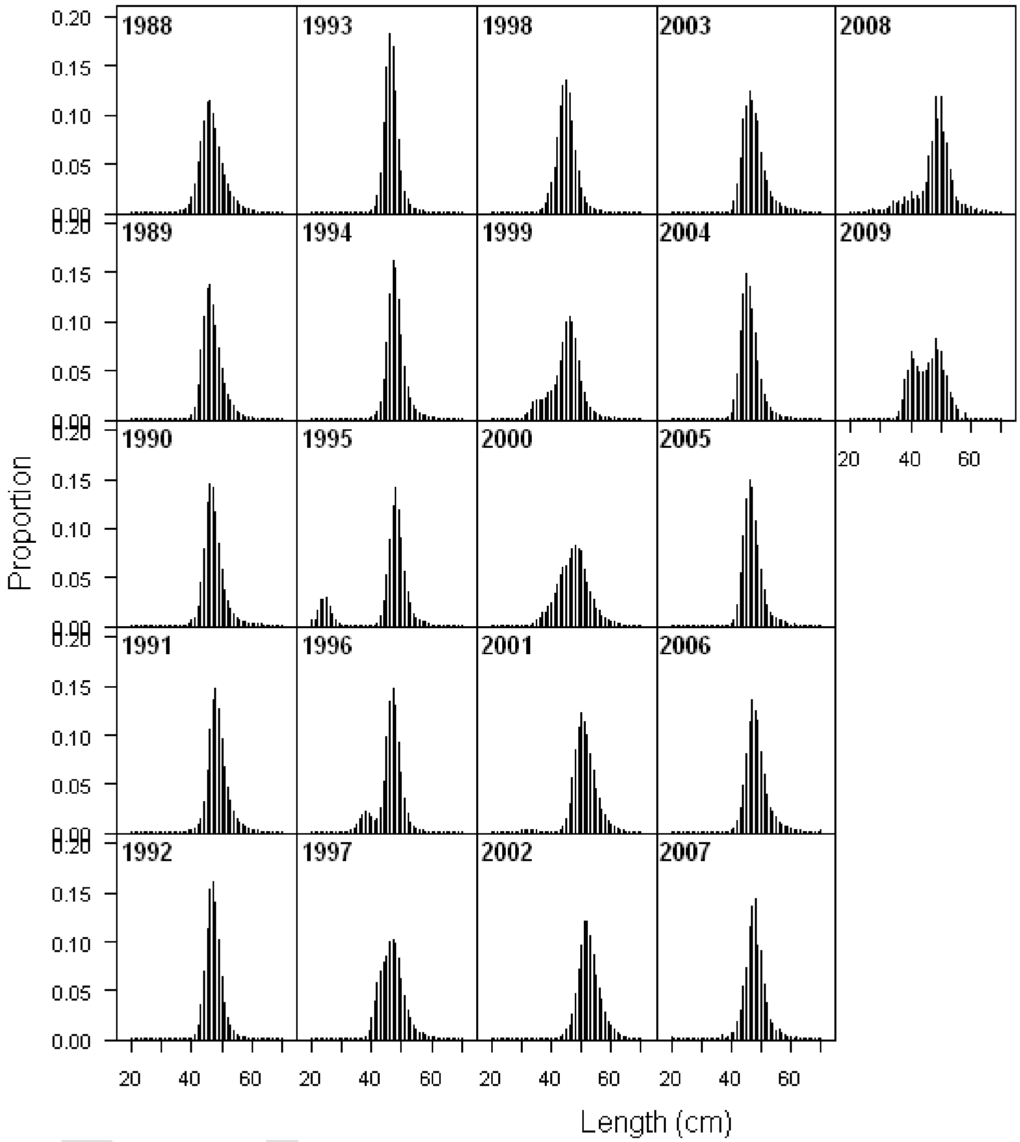

Figure 8. Plot of Canadian fishery (joint-venture and domestic combined) length compositions, 1988-2009.

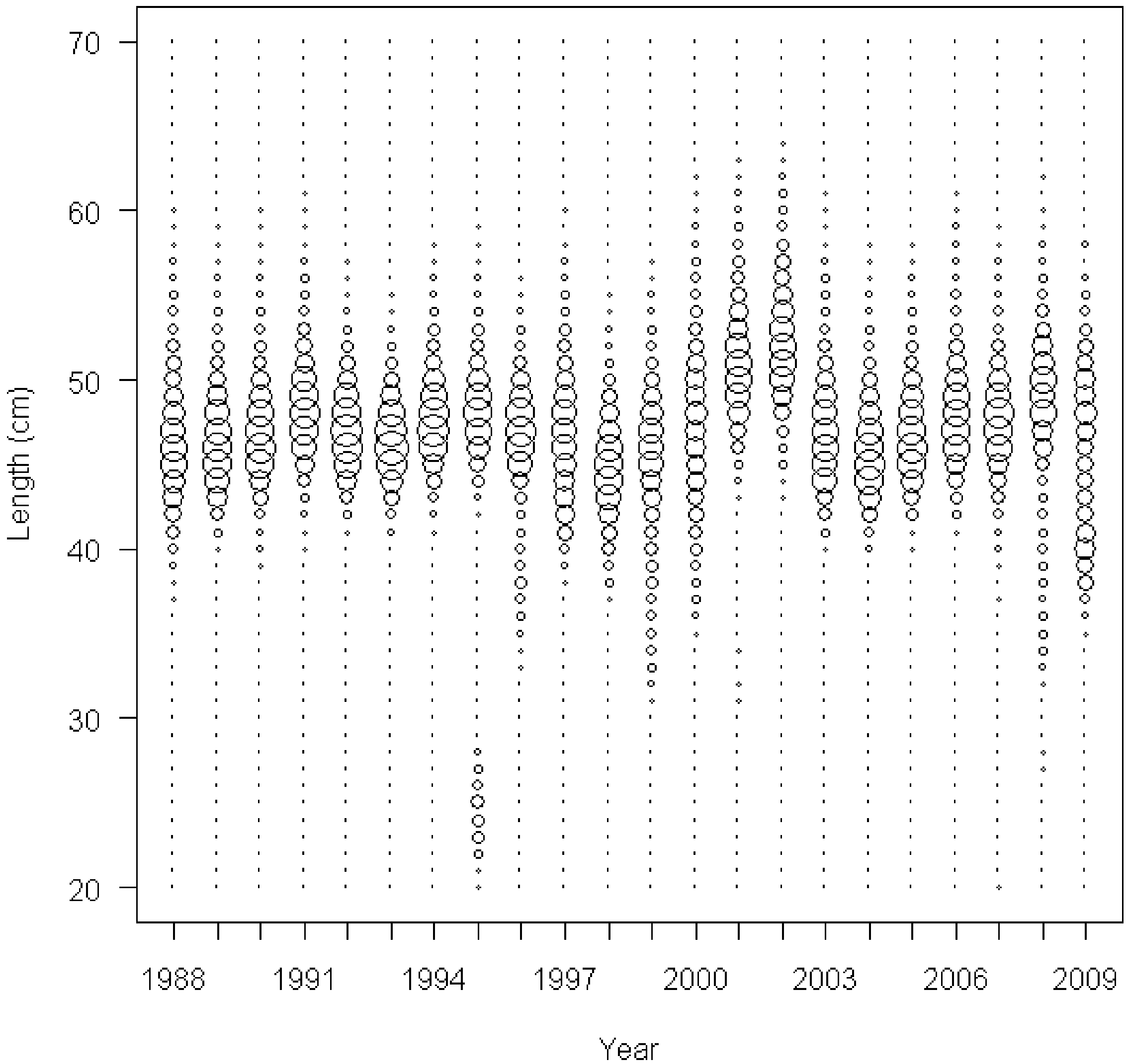

Figure 9. Plot of Canadian fishery (joint-venture and domestic combined) length compositions, 1988-2009. Diameter of circles is scaled to a maximum proportion of 0.18 and proportions sum to 1.0 in each year.

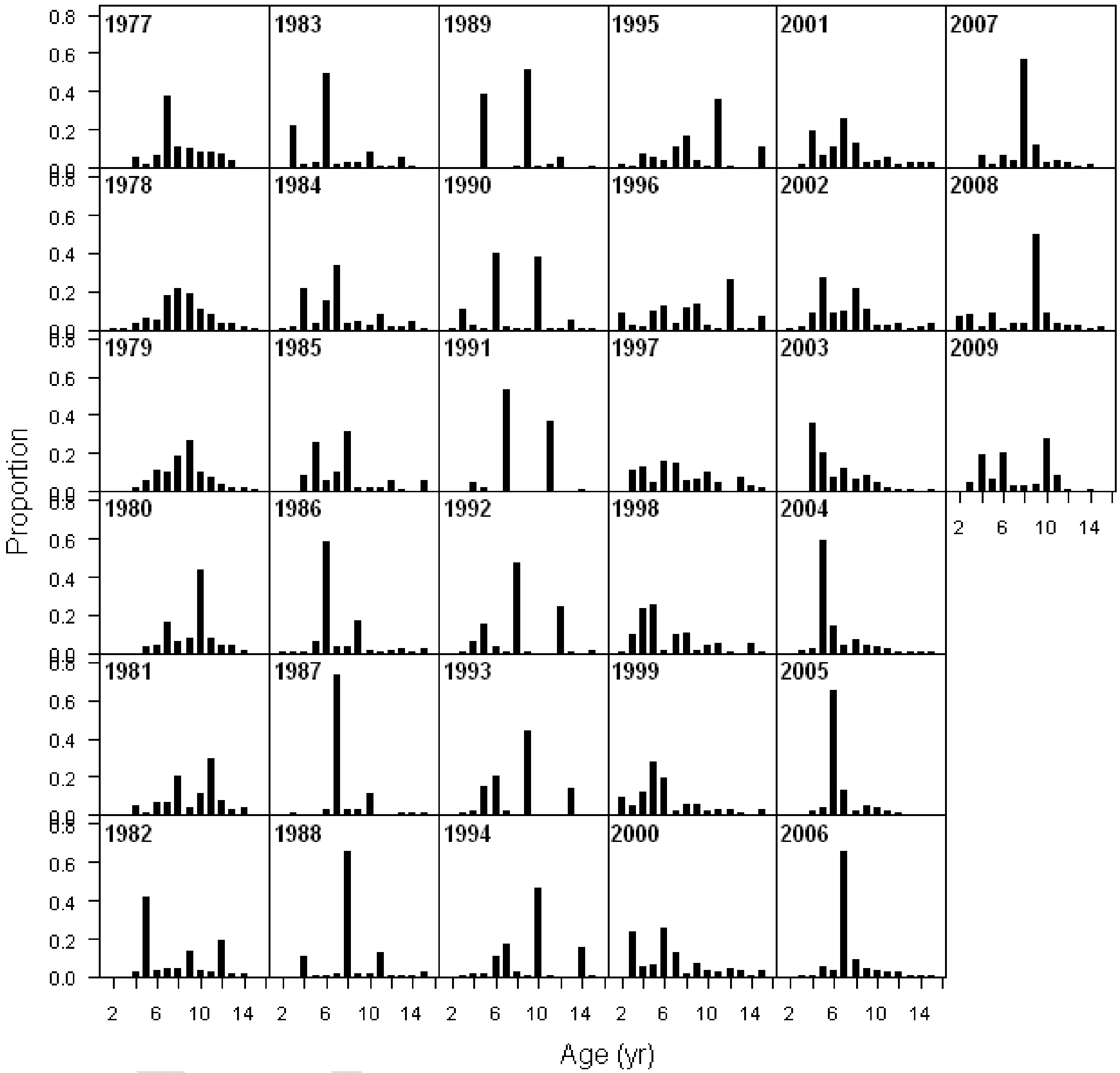

Figure 10. Plot of Canadian fishery (joint-venture and domestic combined) age compositions, 1977-2009.

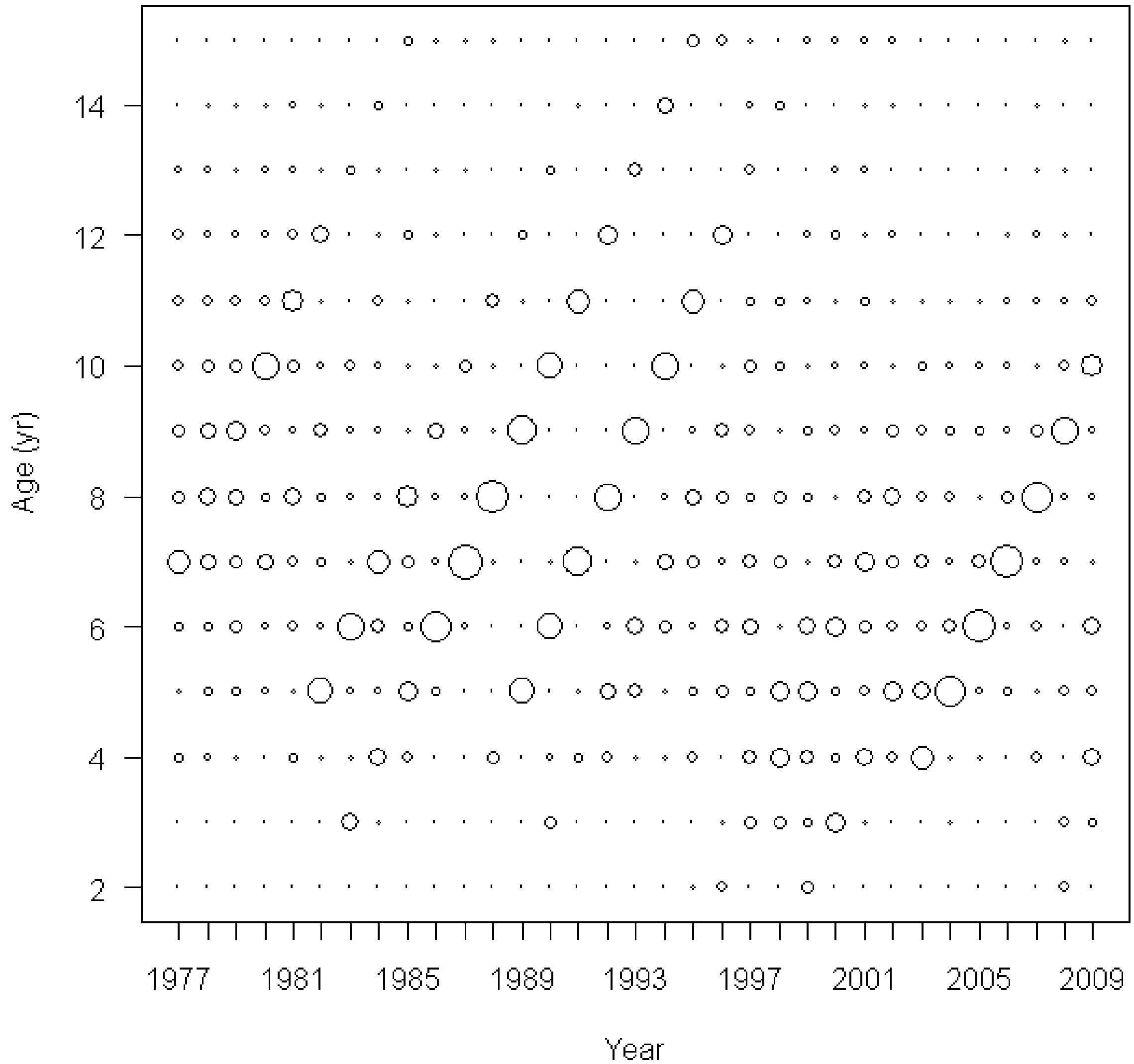

Figure 11. Plot of Canadian fishery (joint-venture and domestic combined) age compositions, 1988-2009. Diameter of circles is scaled to a maximum proportion of 0.73 and proportions sum to 1.0 in each year.

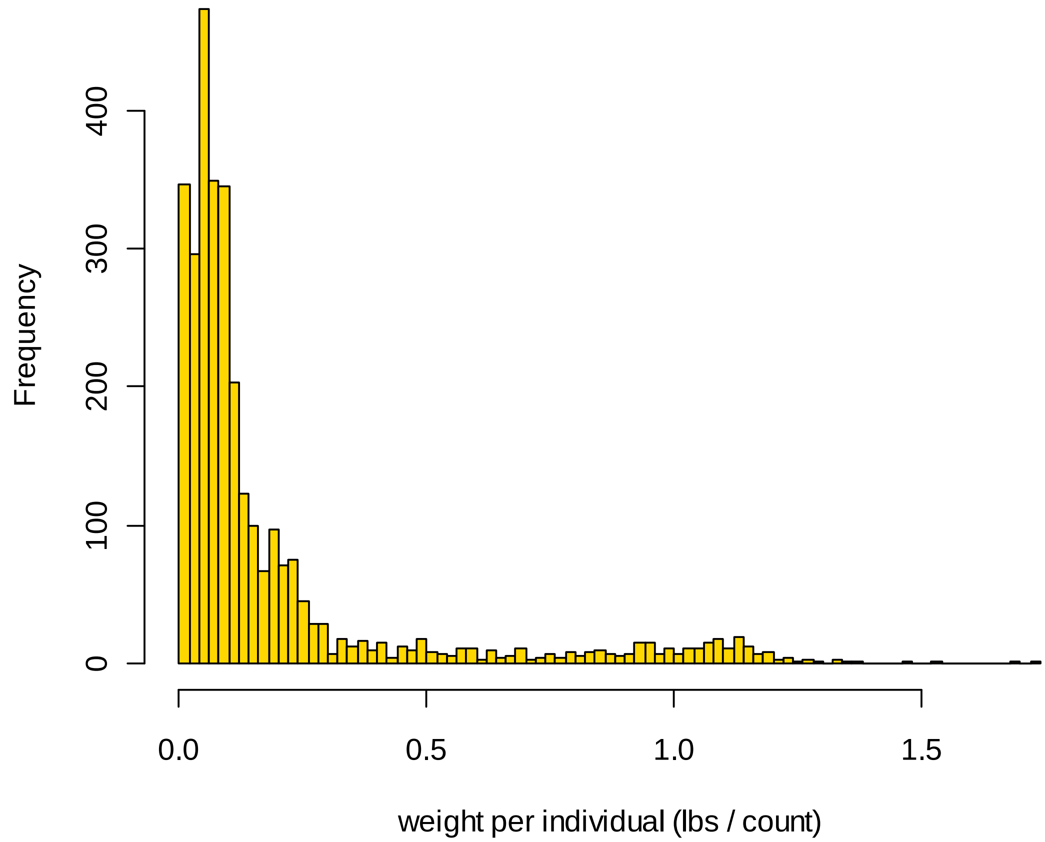

Figure 12. Distribution of average individual weight by haul for all hake sampled by WCGOP observer program 2004-2009.

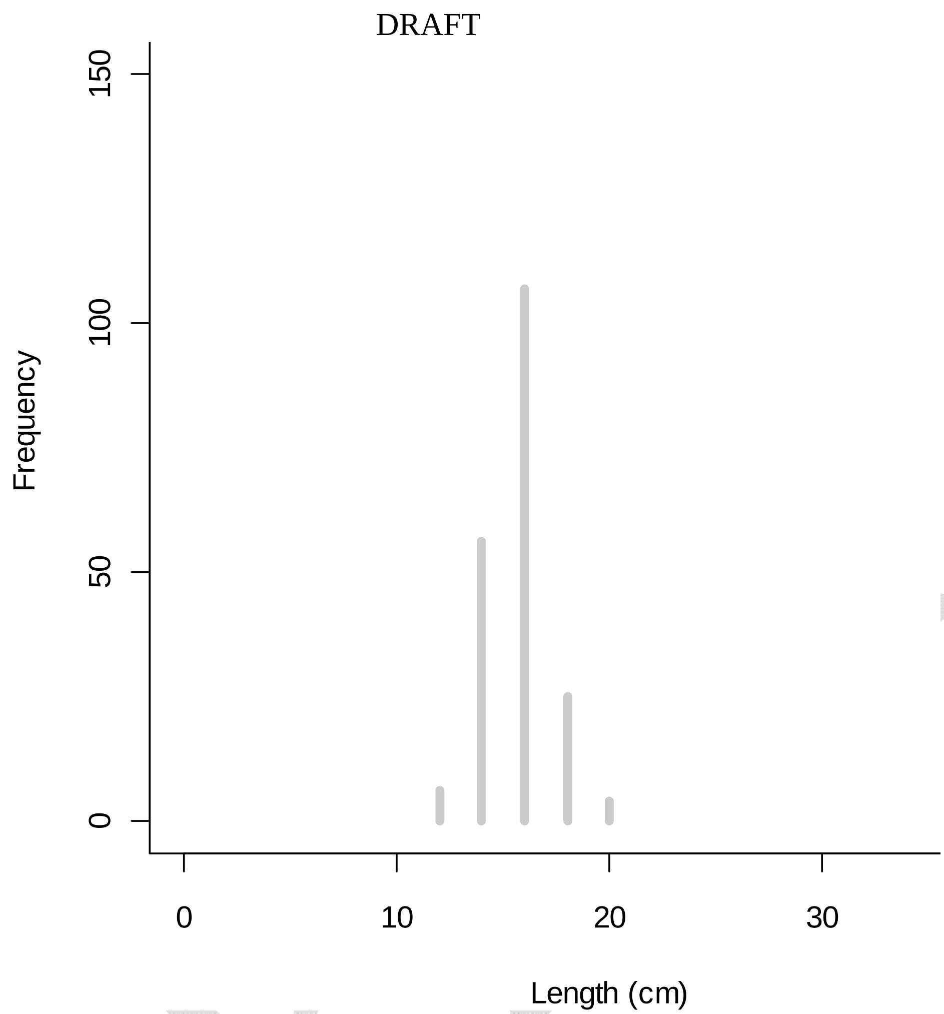

Figure 13. Length frequency distribution (unweighted) for hake measured by WCGOP observer program in January-April 2009 (N=198).

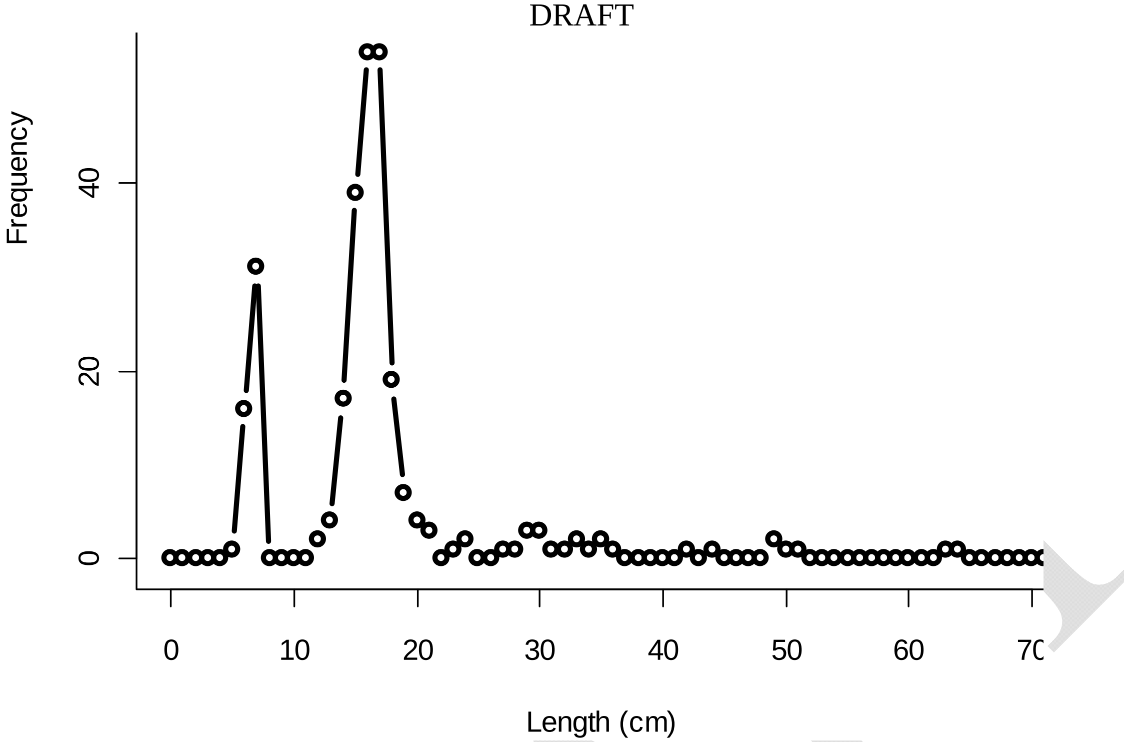

Figure 14. Length frequency distribution (unweighted) for hake, lingcod and sablefish measured by WCGOP observer program in January 2004 - April 2009 (N=278).

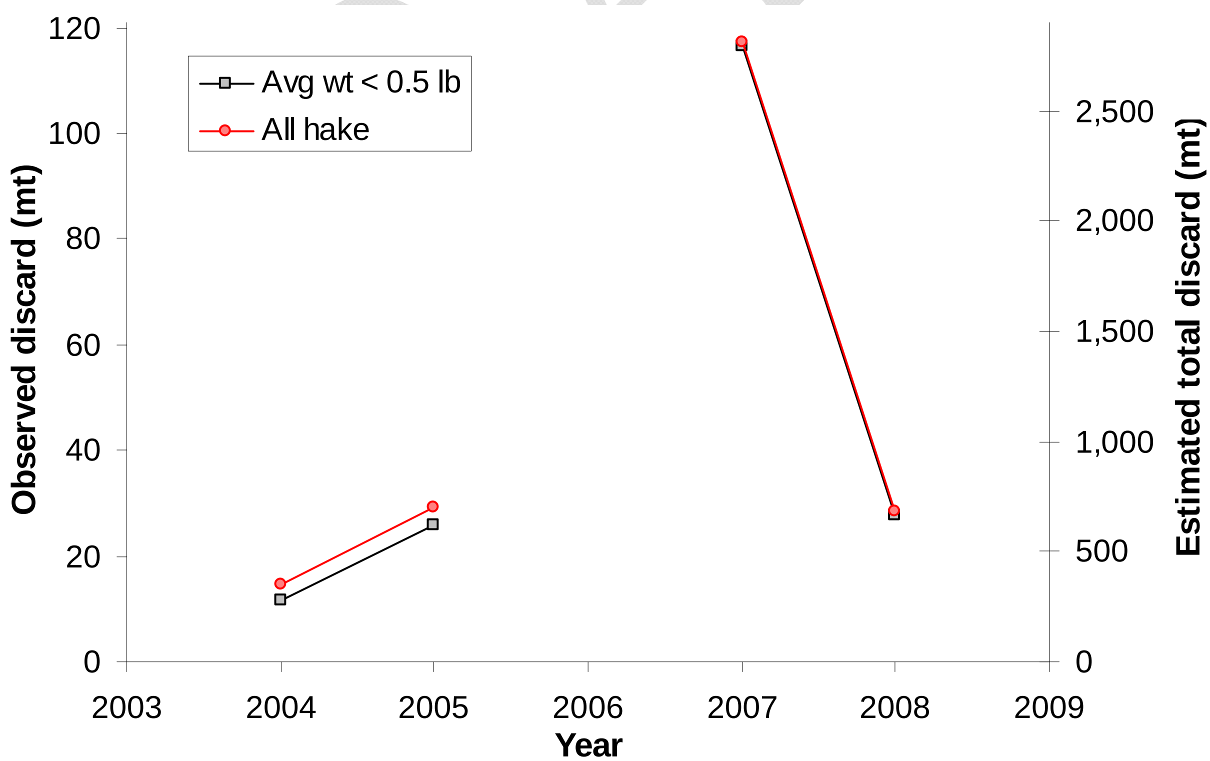

Figure 15. Time series of estimated discard of pink shrimp from WCGOP.

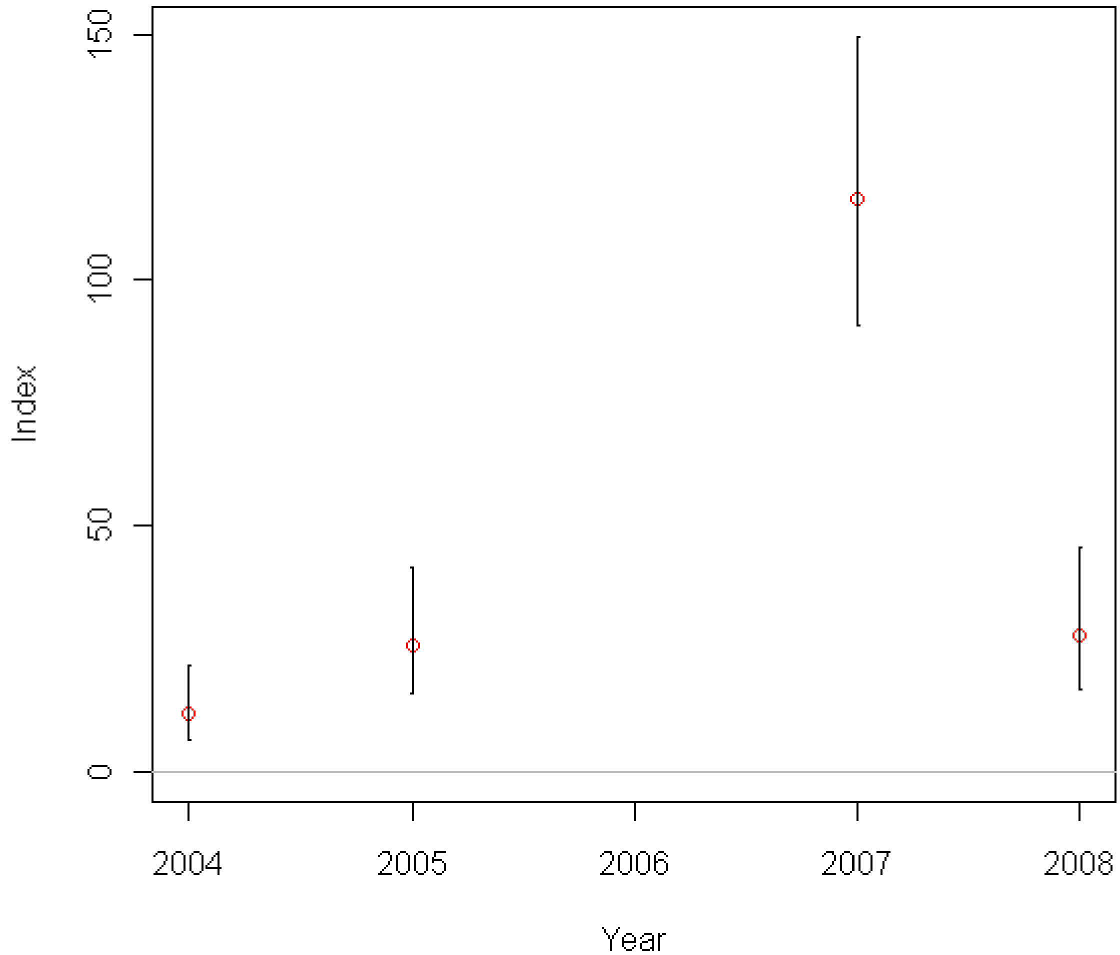

Figure 16. Index of juvenile hake abundance for evaluation in the stock assessment. Approximate 95% confidence intervals are based on an assumption of lognormal error and reflect only the sampling variance calculated directly from the observer data.

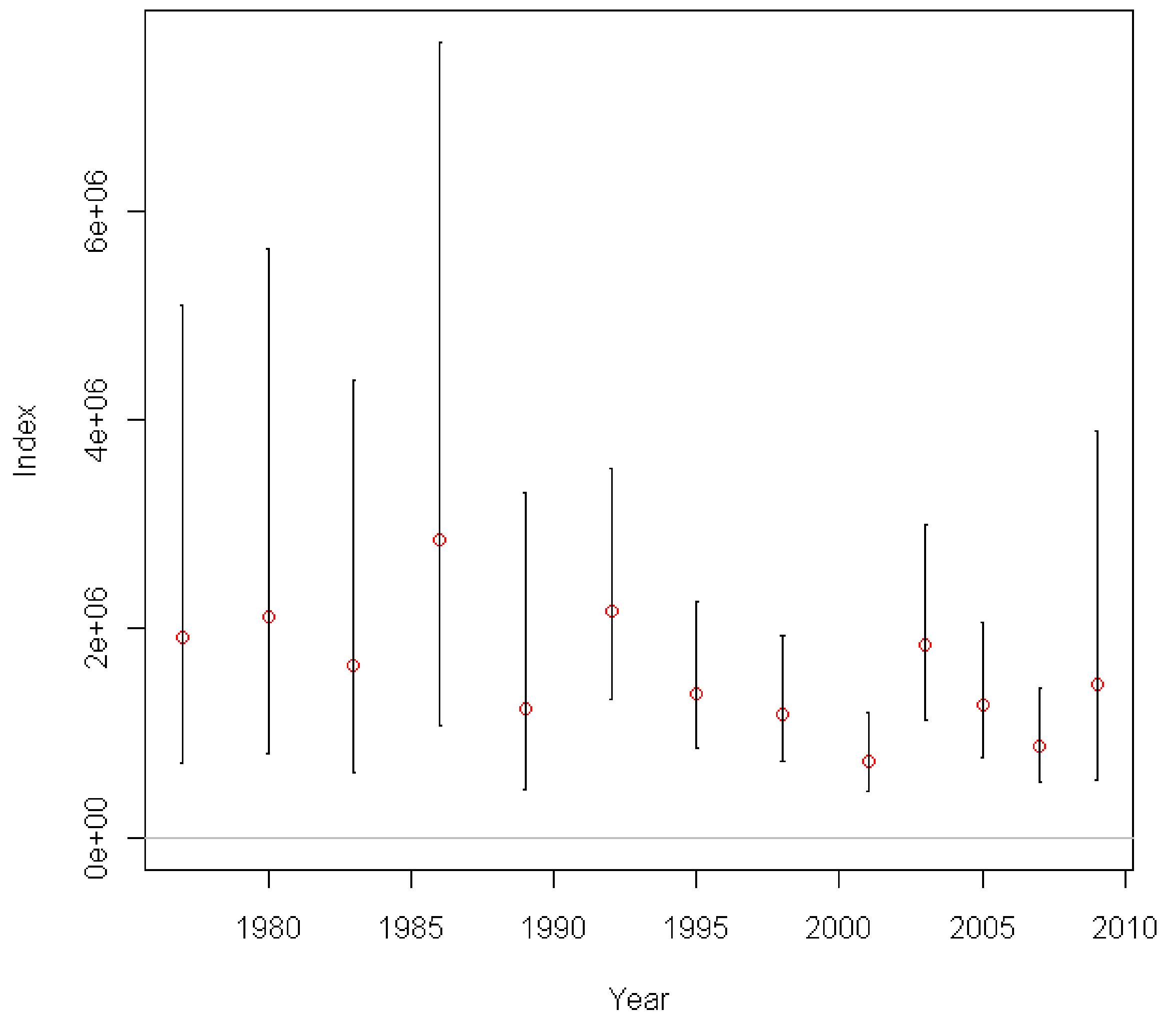

Figure 17. Time series of acoustic survey age 2+ biomass estimates, 1977-2009. Approximate 95% confidence intervals are based on an assumption of lognormal error and an assumed SE log(value) = 0.50: 1977-1989, 2009 and SE log(value) = 0.25: 1992-2007.

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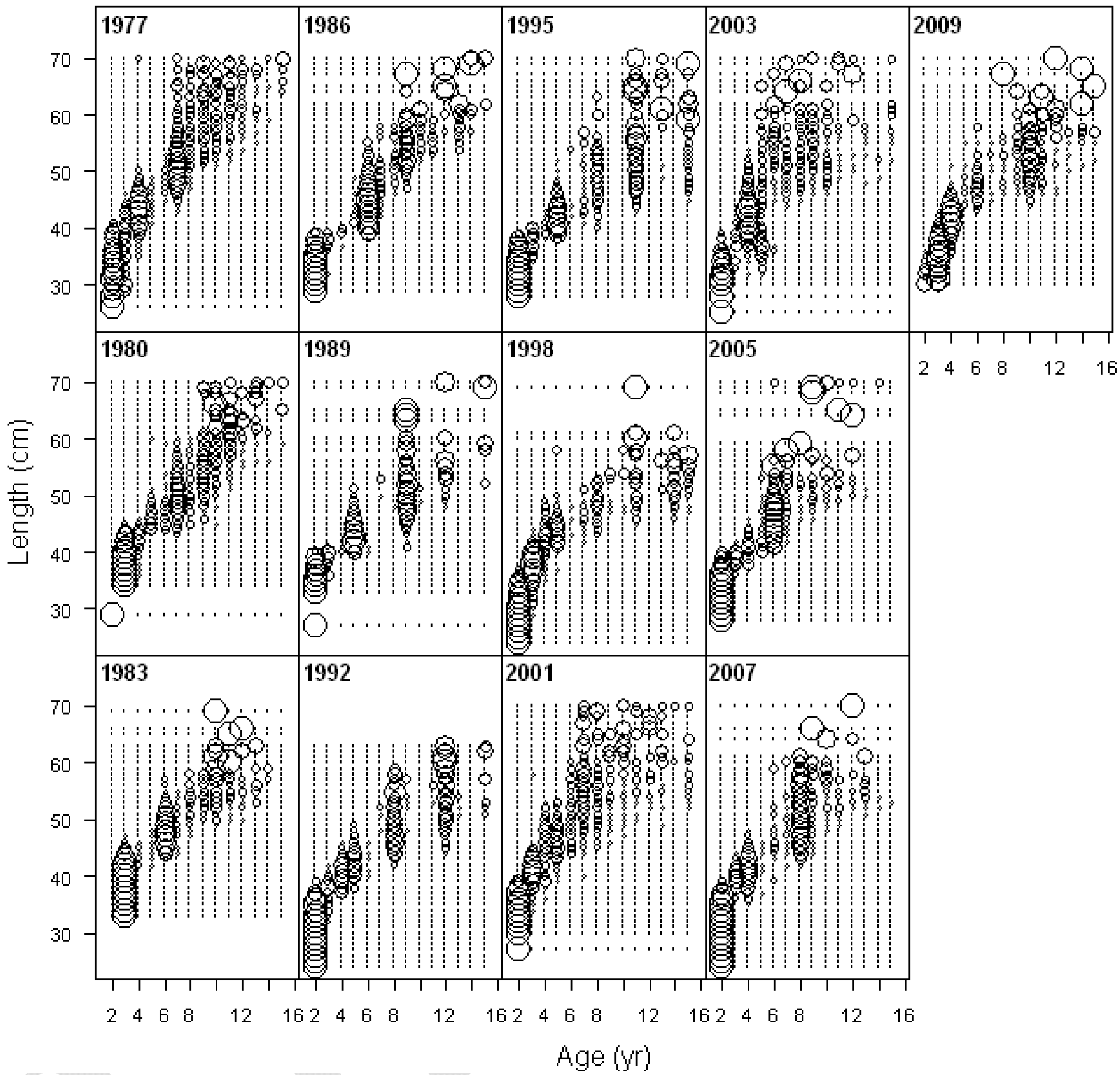

Figure 18. Conditional age-at-length compositions from the acoustic survey. Diameter of circles is scaled to a maximum proportion of 0.99 and proportions sum to 1.0 in each length.

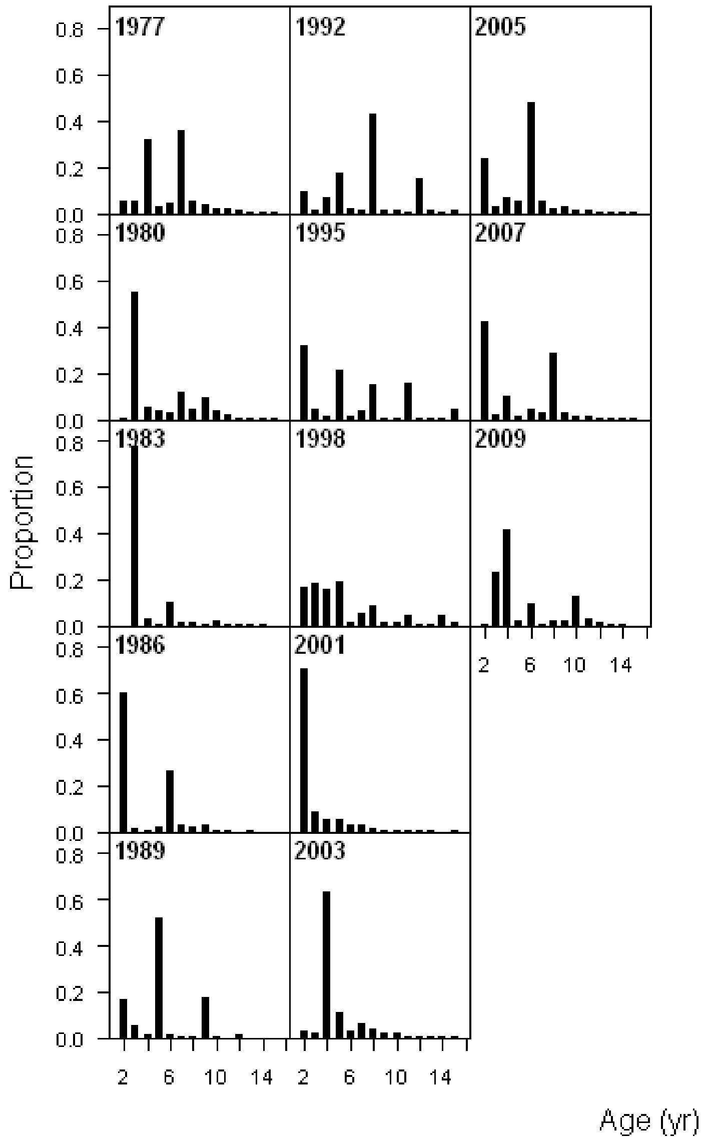

Figure 19. Plot of acoustic survey age compositions of Pacific hake off the west coast of the U.S and Canada, 1977-2009.

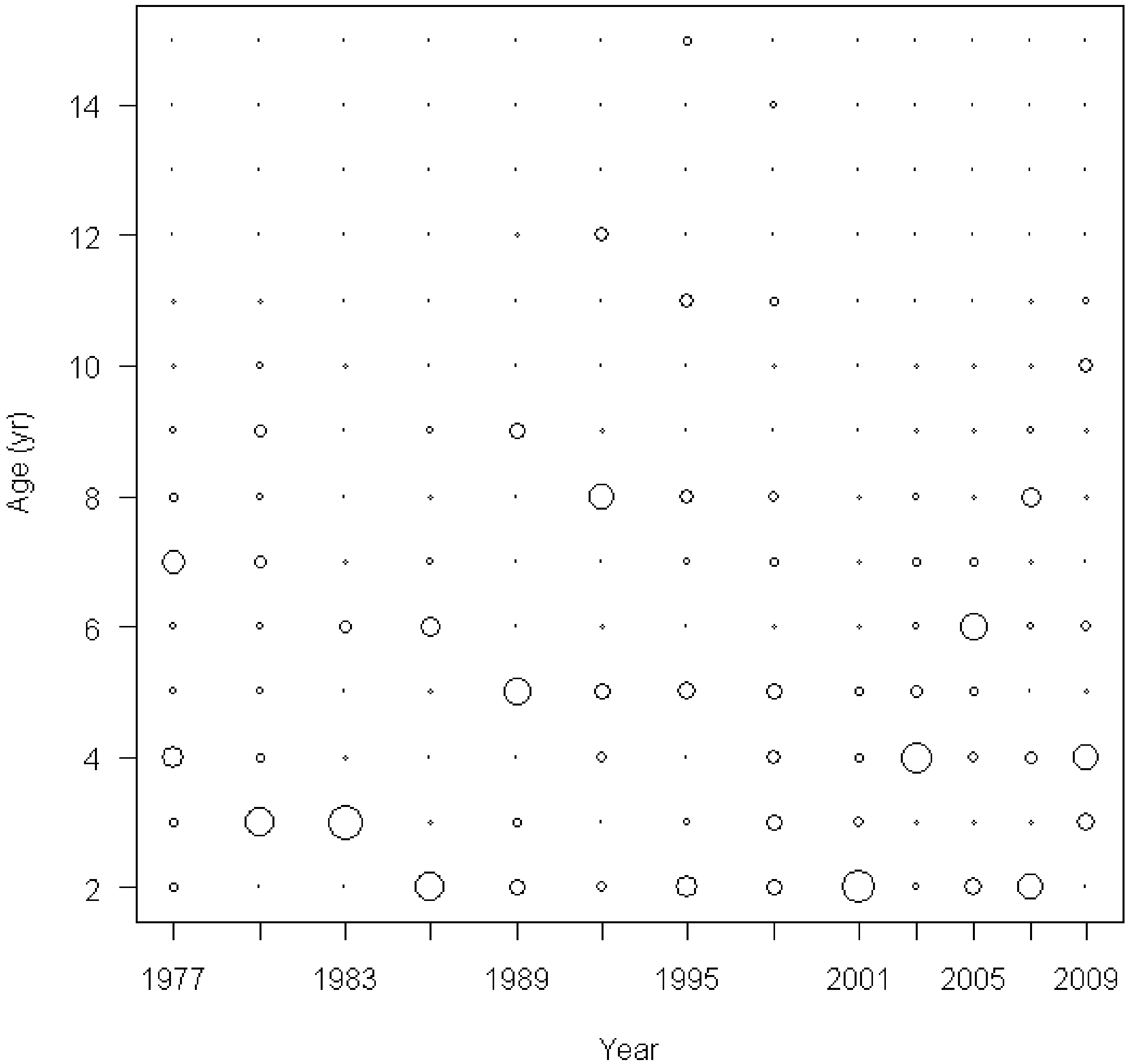

Figure 20. Plot of acoustic survey age compositions of coastal Pacific hake off the west coast of the U.S. and Canada, 1977-2009. Diameter of circles is scaled to a maximum proportion of 0.78 and proportions sum to 1.0 in each year.

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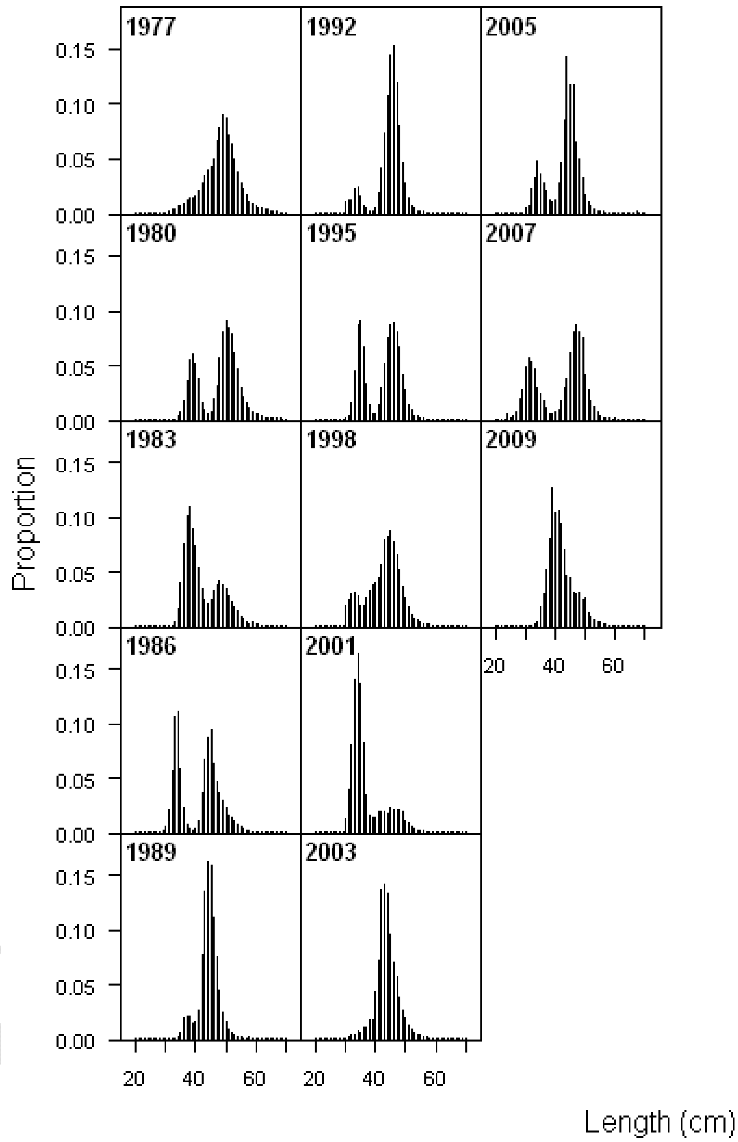

Figure 21. Plot of acoustic survey size compositions of coastal Pacific hake off the west coast of the U.S. and Canada, 1977-2009.

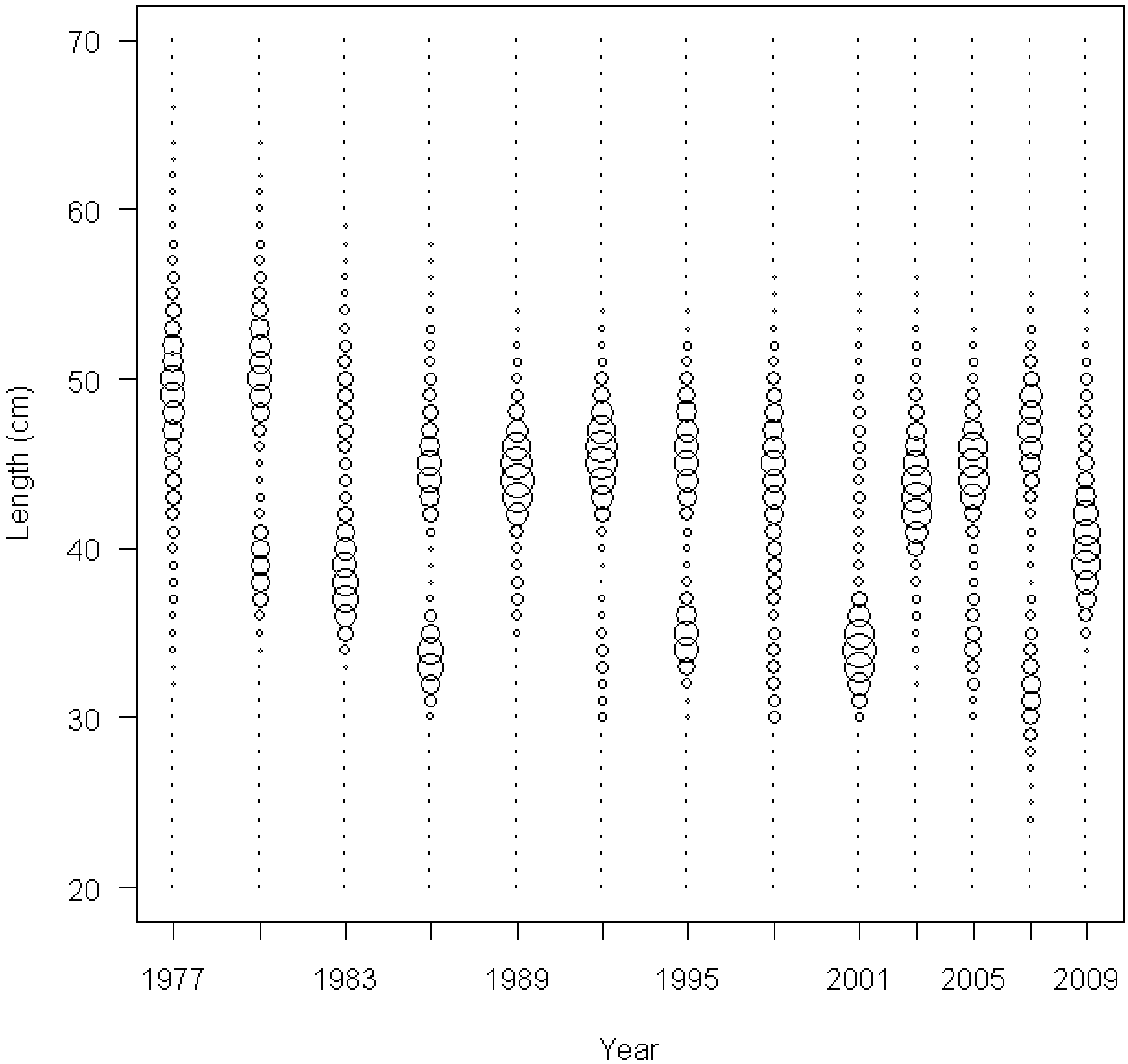

Figure 22. Plot of acoustic survey size compositions of coastal Pacific hake off the west coast of the U.S. and Canada, 1977-2009. Diameter of circles is scaled to a maximum proportion of 0.16 and proportions sum to 1.0 in each year.

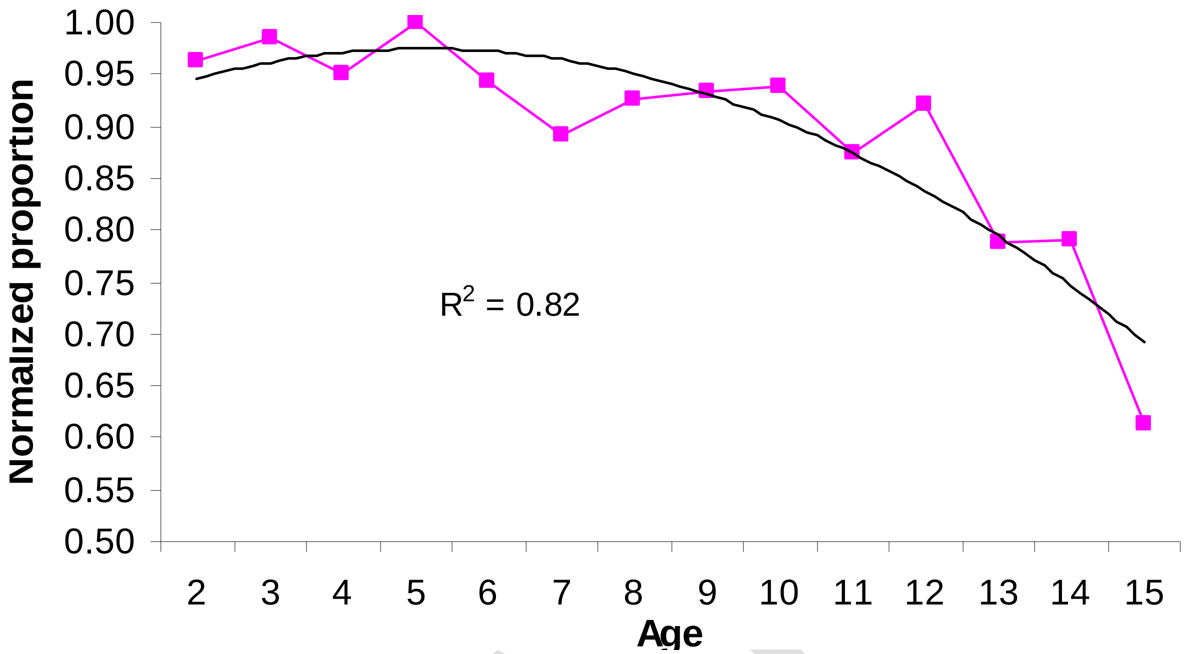

Figure 23. Plot of normalized (divided by maximum value) average (1977-2001) ratio of expanded acoustic survey numbers at age to the sum of acoustic survey and triennial bottom trawl survey expanded numbers at age. This analysis was conducted to explore empirical evidence for dome-shaped selectivity in the acoustic survey.

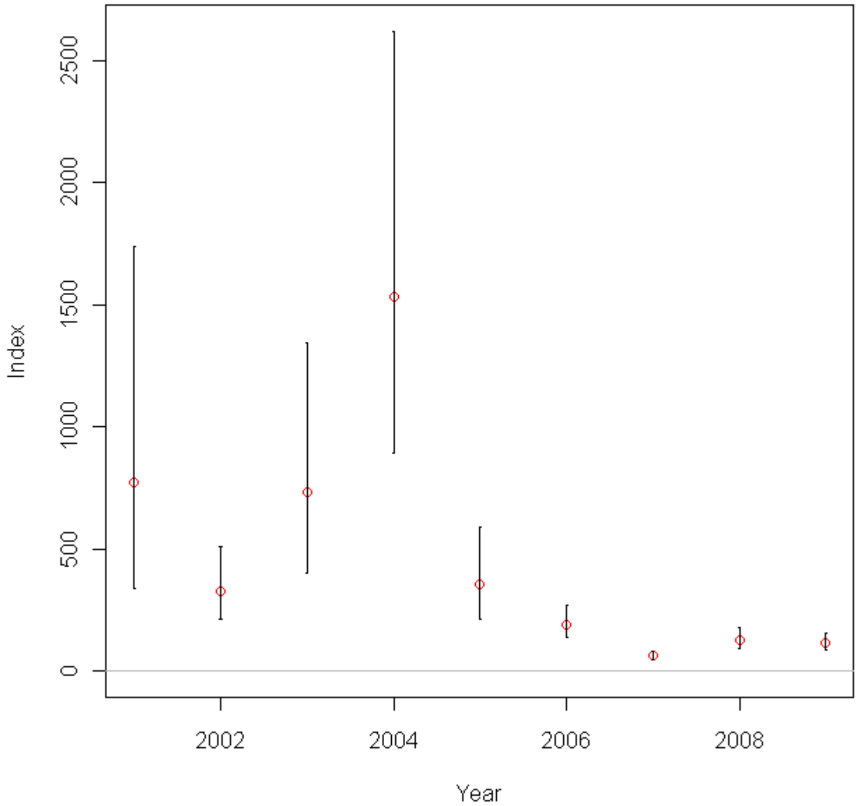

Figure 24. Time-series of the coast-wide Pacific hake pre-recruit survey indices based on data collected from SWFSC Santa Cruz and the joint PWCC-NMFS surveys.

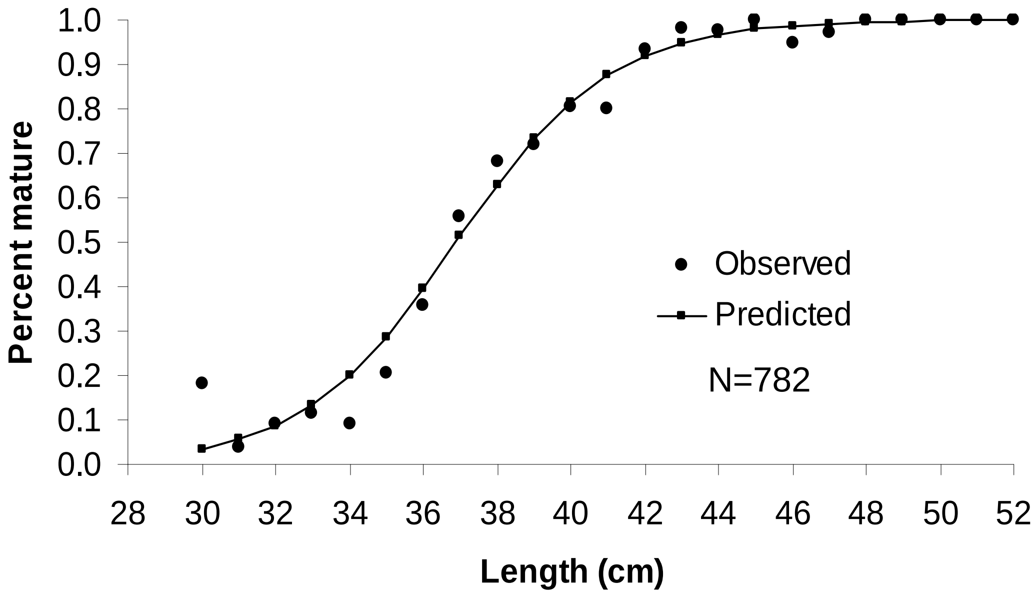

Figure 25. Observed and fitted values for percent mature at length.

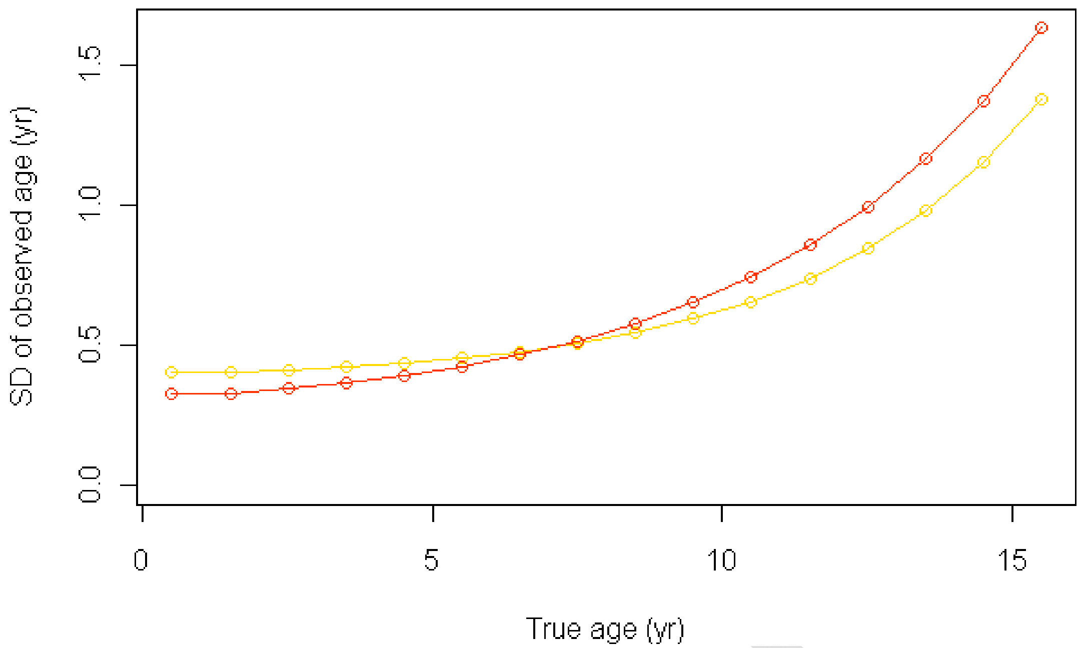

Figure 26. The estimated standard deviation of observed age as a function of true age for the pre-2001 AFSC ageing lab (upper line for younger ages and lower line for older ages) and the Cooperative Ageing Program and Department of Fisheries and Oceans Canada which have read all ages since 2001.

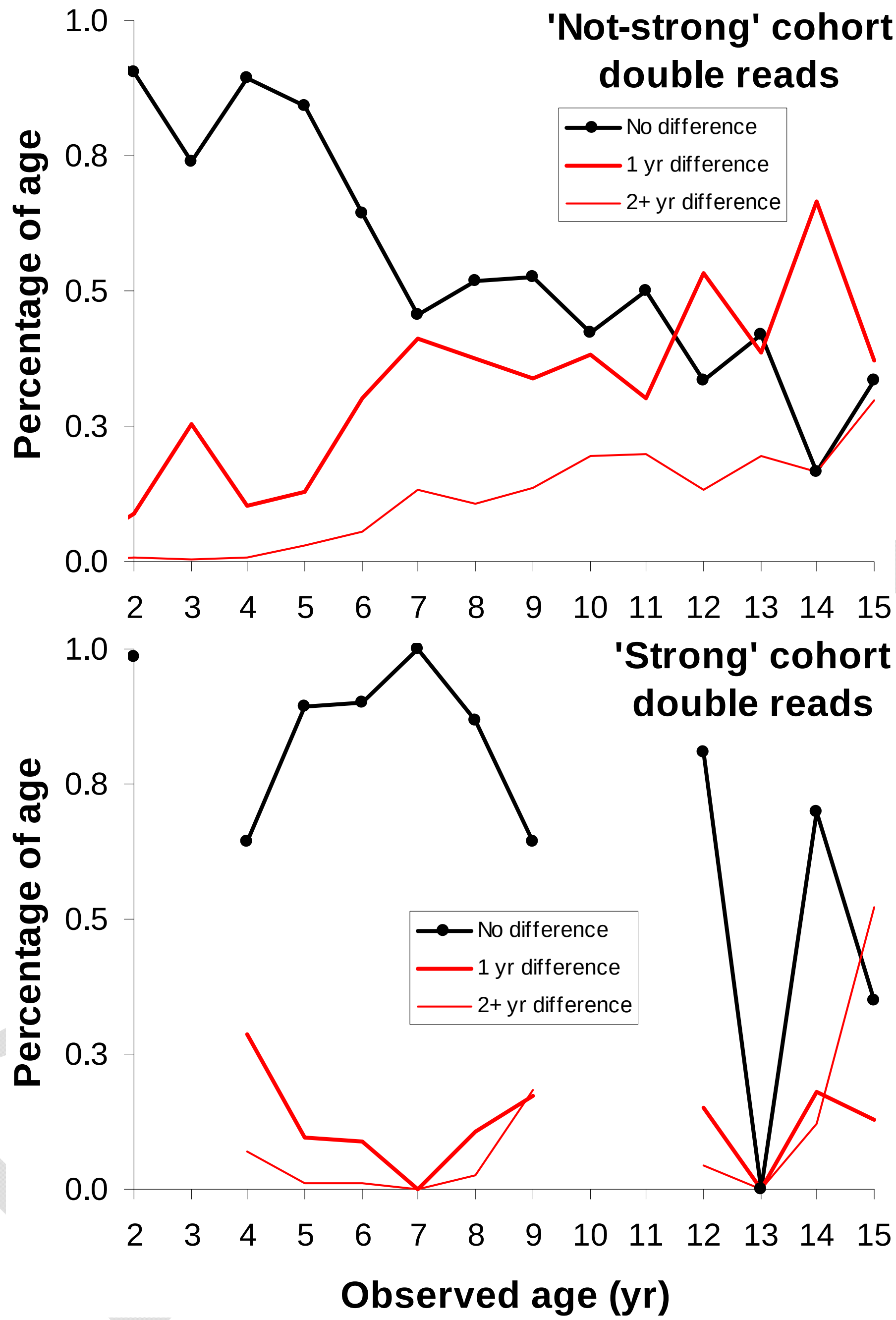

Figure 27. Comparison of age-reading agreement from 2,820 double-read otoliths collected between 1986 and 2008. ‘Strong’ cohorts included 1977, 1980, 1984 and 1999.

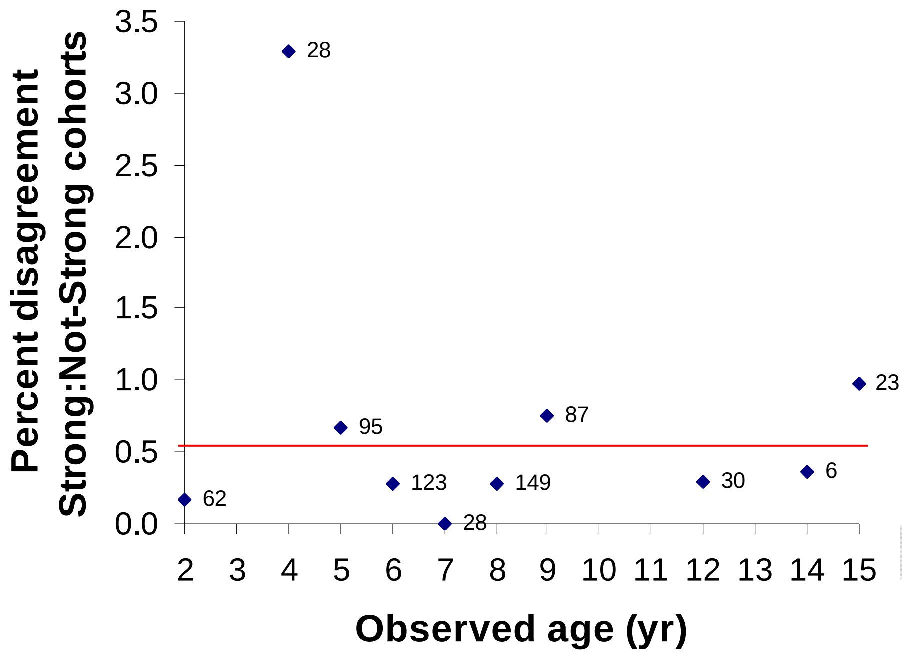

Figure 28. Comparison of age-reading percent disagreement for 'strong' cohorts (1977, 1980, 1984 and 1999) and weaker cohorts. Horizontal line indicates the weighted regression estimated using the minimum sample size (shown next to the points) between the two types of cohorts for each age.

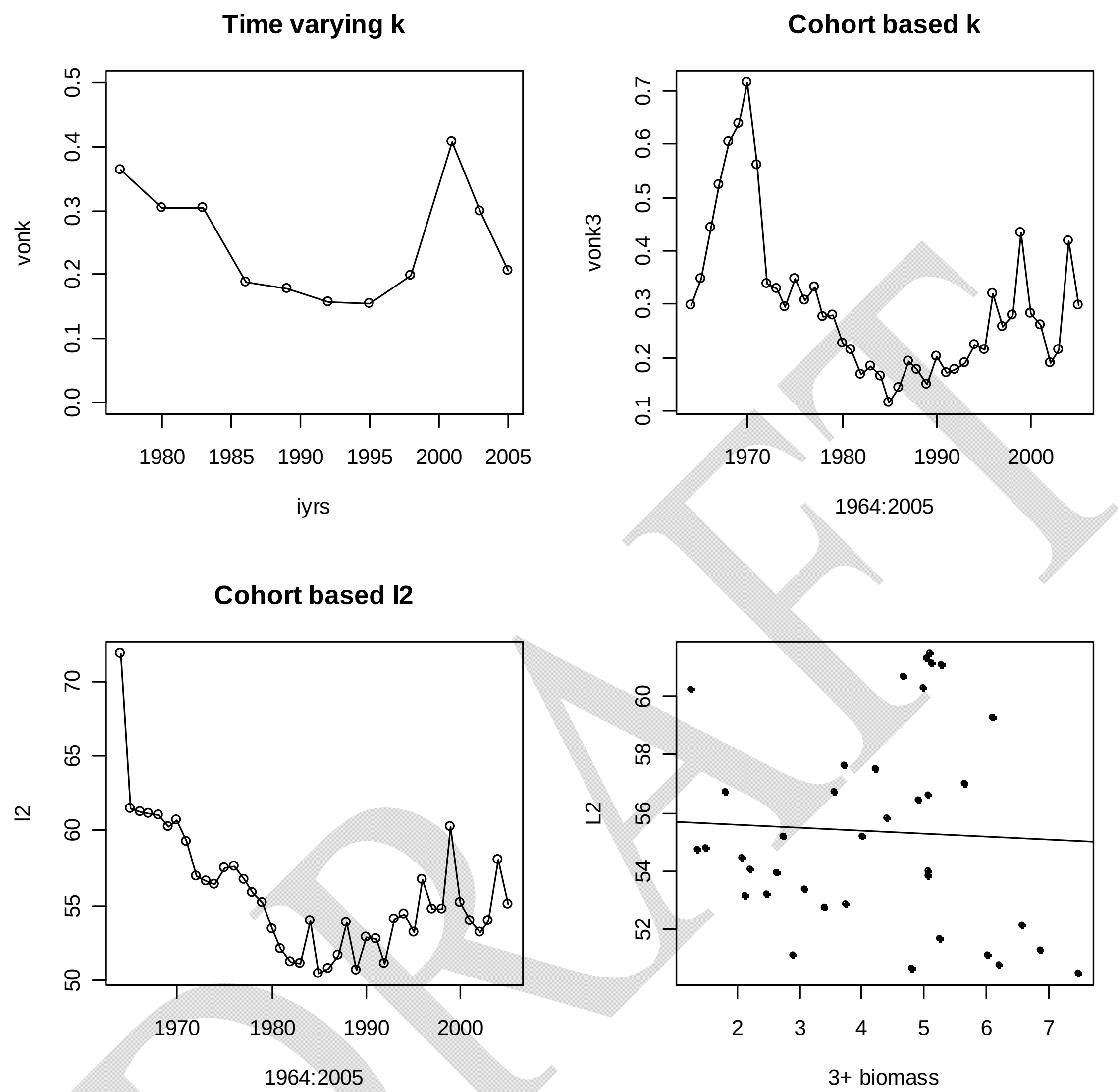

Figure 29. Time varying and cohort based fits (external to the assessment model) of the von Bertalanffy growth model to Pacific hake age data from the acoustic survey, 1977-2005. Analyses were conducted as part of the 2006 assessment.

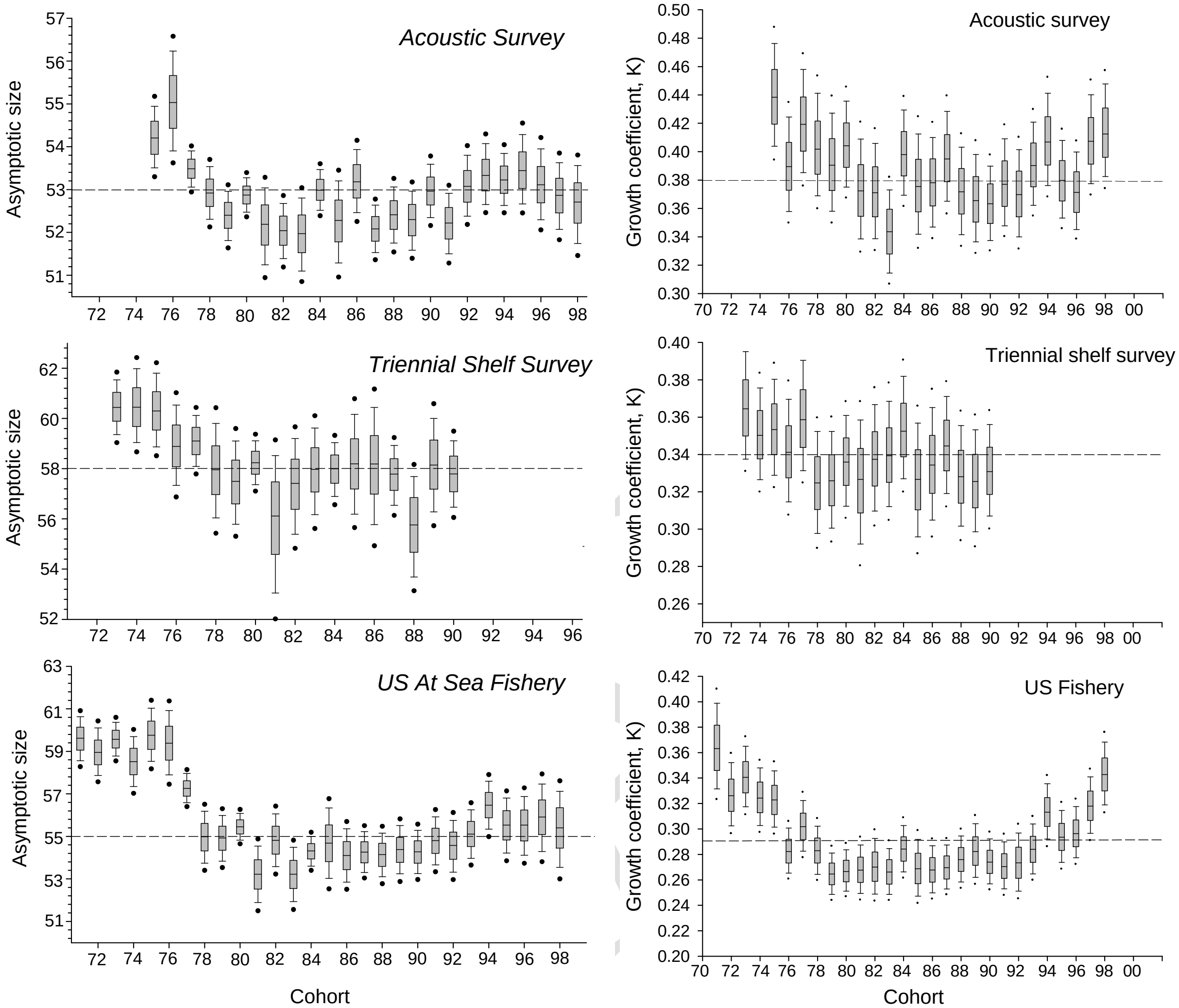

Figure 30. Results of a hierarchical von Bertalanffy growth model fit to three difference sources of Pacific hake growth data. A von Bertalanffy growth model was fit to each of the three data sources with age at length data combined and cohort treated as a random variable. The results show an early consistent decline in asymptotic size and instantaneous growth coefficient, k, in the early 1980s. Box whisker plots show the marginal posterior density of growth parameters, L_{max} and K, for each cohort and the dotted line gives the overall mean parameter estimate.

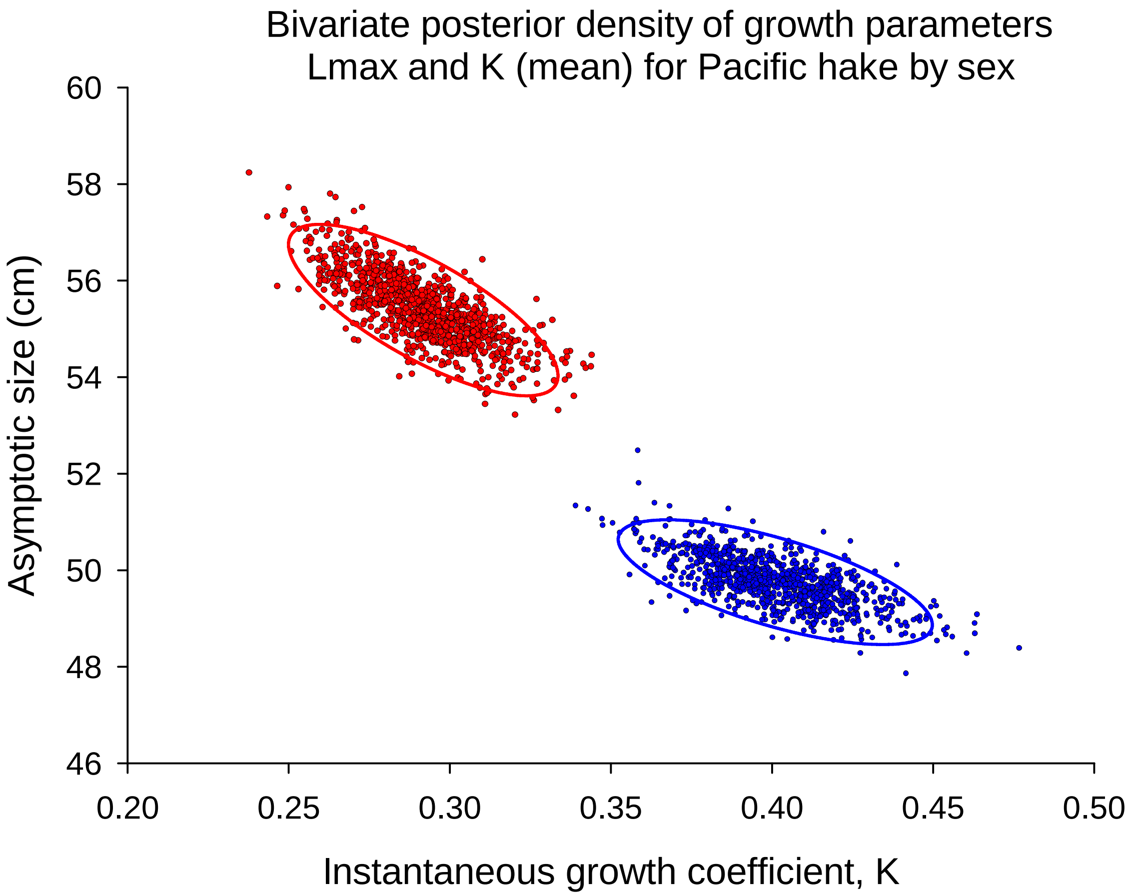

Figure 31. Results of a hierarchical von Bertalanffy growth model fit to Pacific hake growth data from the acoustic survey (all years, 1977-2007). A von Bertalanffy growth model was fit separately to each sex and cohort treated as a random variable. The results show that female pacific hake achieve a significantly larger size the males, but also growth at a slower rate. The dots show the bivariate distribution of L_{max} and K from a sample of 1,000 draws from the joint posterior density and the solid ellipses give the 95% posterior interval.

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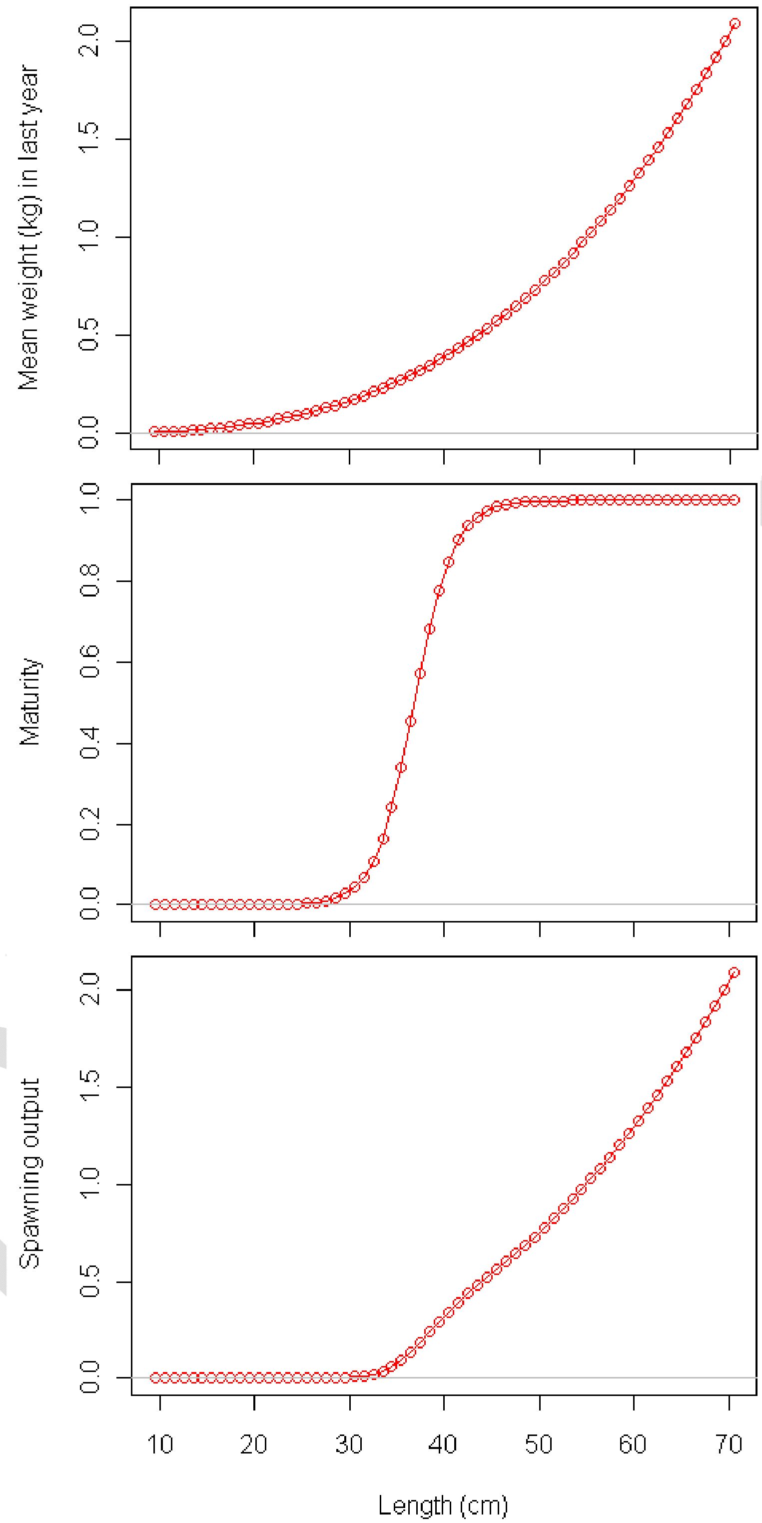

Figure 32. Biological relationships assumed in the hake model.

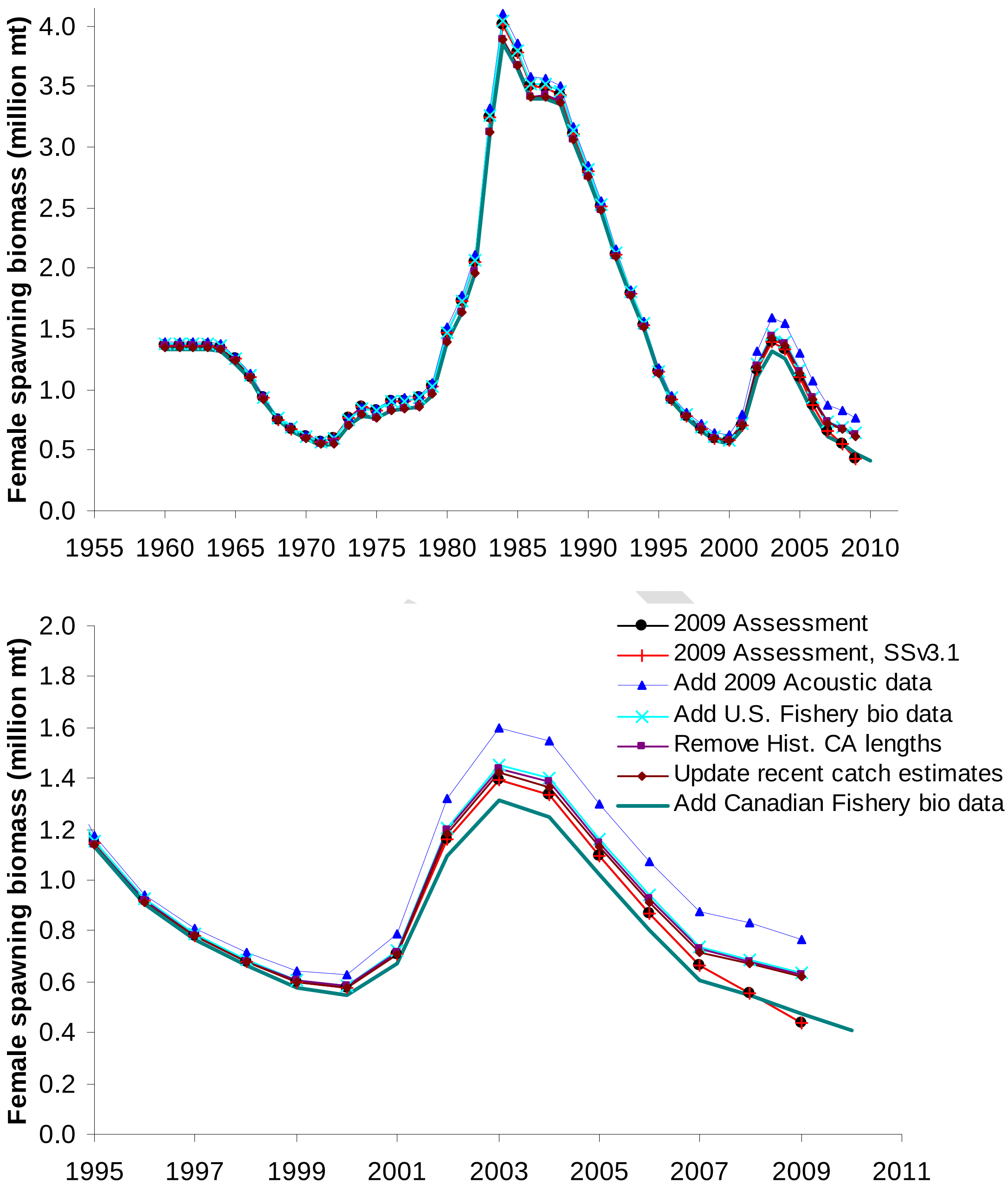

Figure 33. Bridge from 2009 to 2010 stock assessment model showing the full (upper panel) and most recent portion (lower panel) of the time-series.

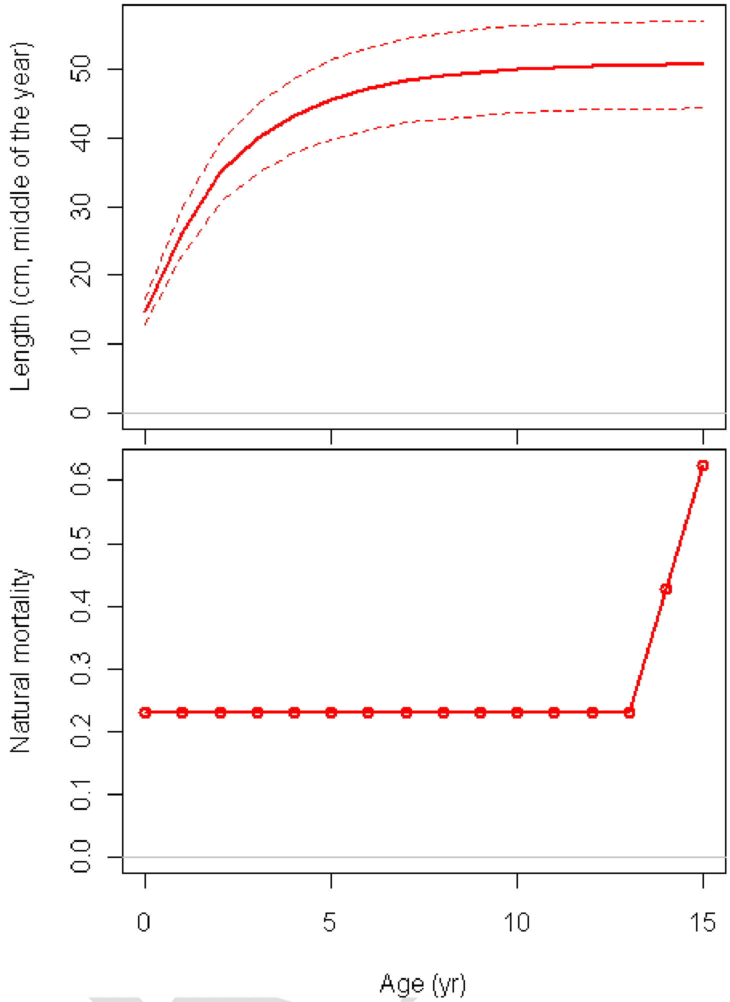

Figure 34. Current growth (2009) and mortality (time-invariant) relationships estimated in the hake model.

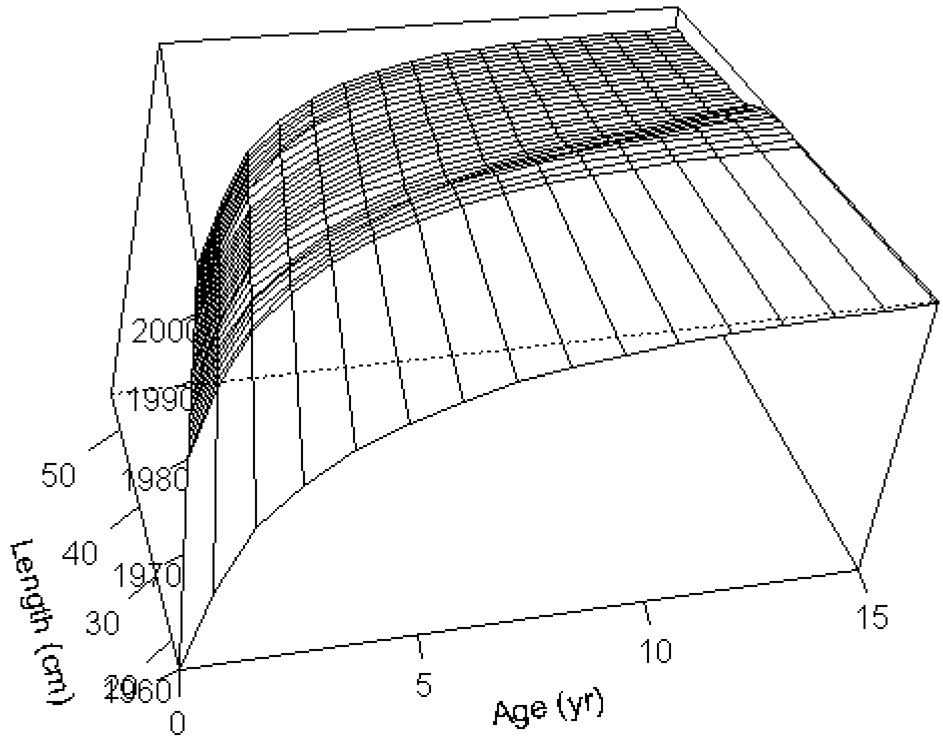

Figure 35. Time-varying growth estimated in the hake model.

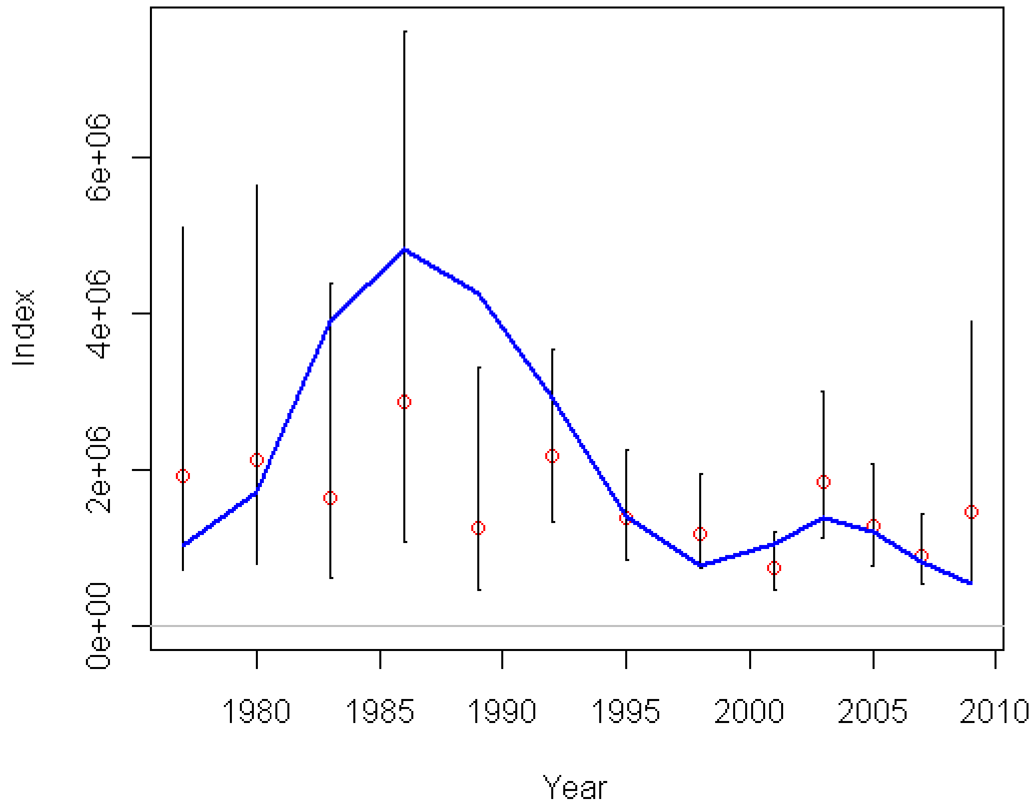

Figure 36. Predicted fit to the acoustic survey biomas index.

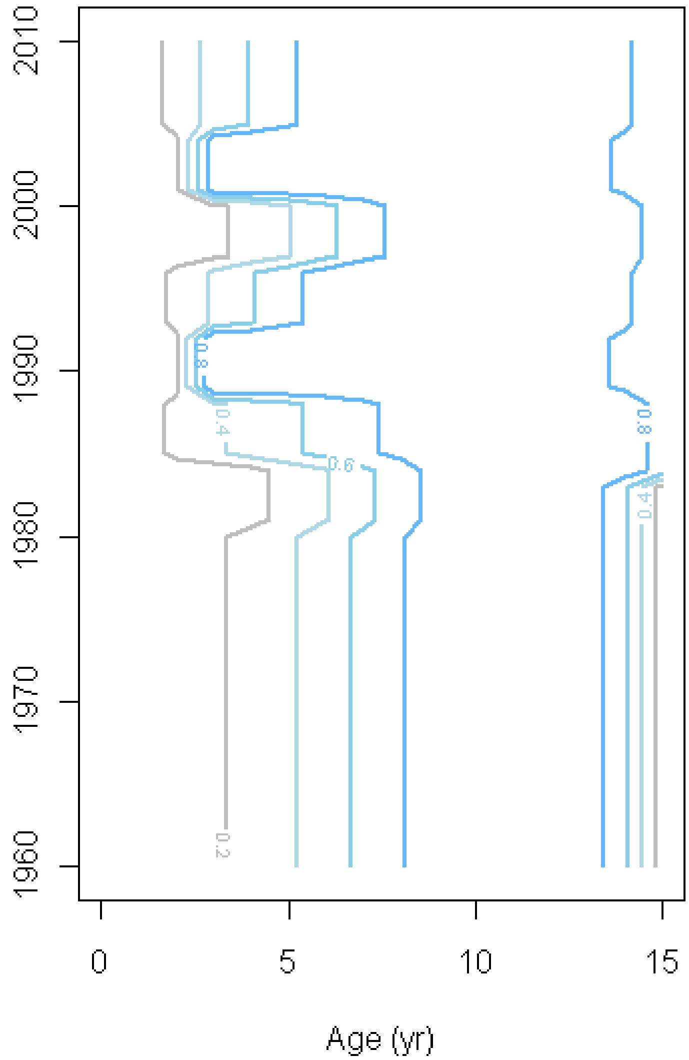

Figure 37. Estimated selectivity curves (contours indicate relative selectivity at age and year, each year has at least one age that is fully selected) for different time blocks in the U.S. fishery. Ascending width, peak, and final parameters were estimated, and ascending width, peak, and final parameters were allowed to vary among time-blocks.

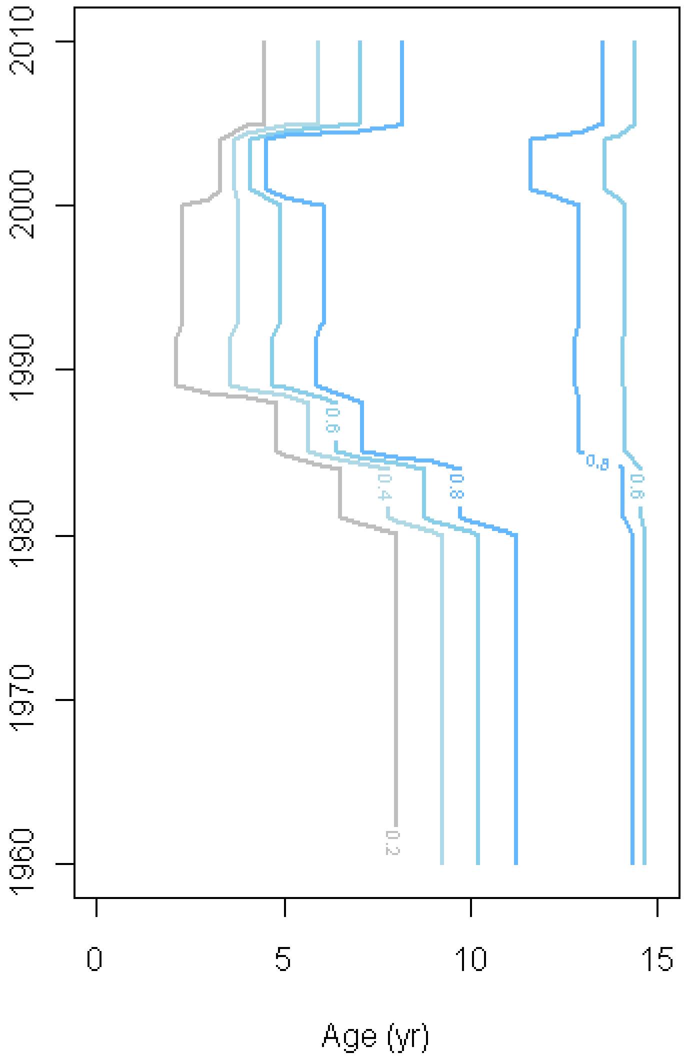

Figure 38. Estimated selectivity curves (contours indicate relative selectivity at age and year, each year has at least one age that is fully selected) for different time blocks in the Canadian fishery. Ascending width, peak, and final parameters were estimated, and ascending width, and peak parameters were allowed to vary among time-blocks.

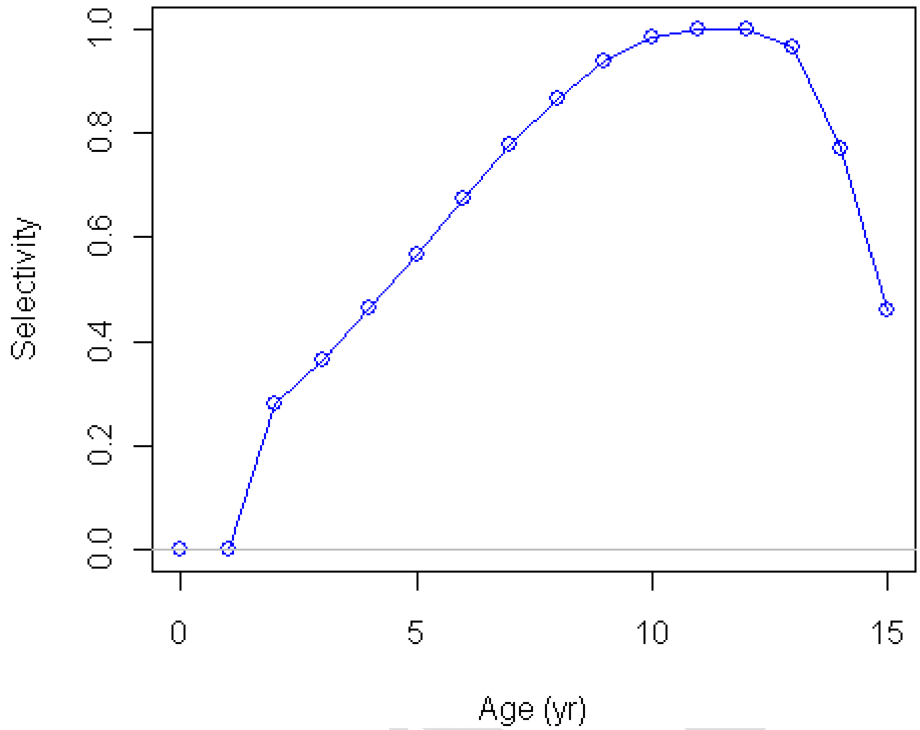

Figure 39. Estimated time-invariant selectivity curve for the acoustic survey. The ascending width, location of the peak and selectivity at age 15 were freely estimated.

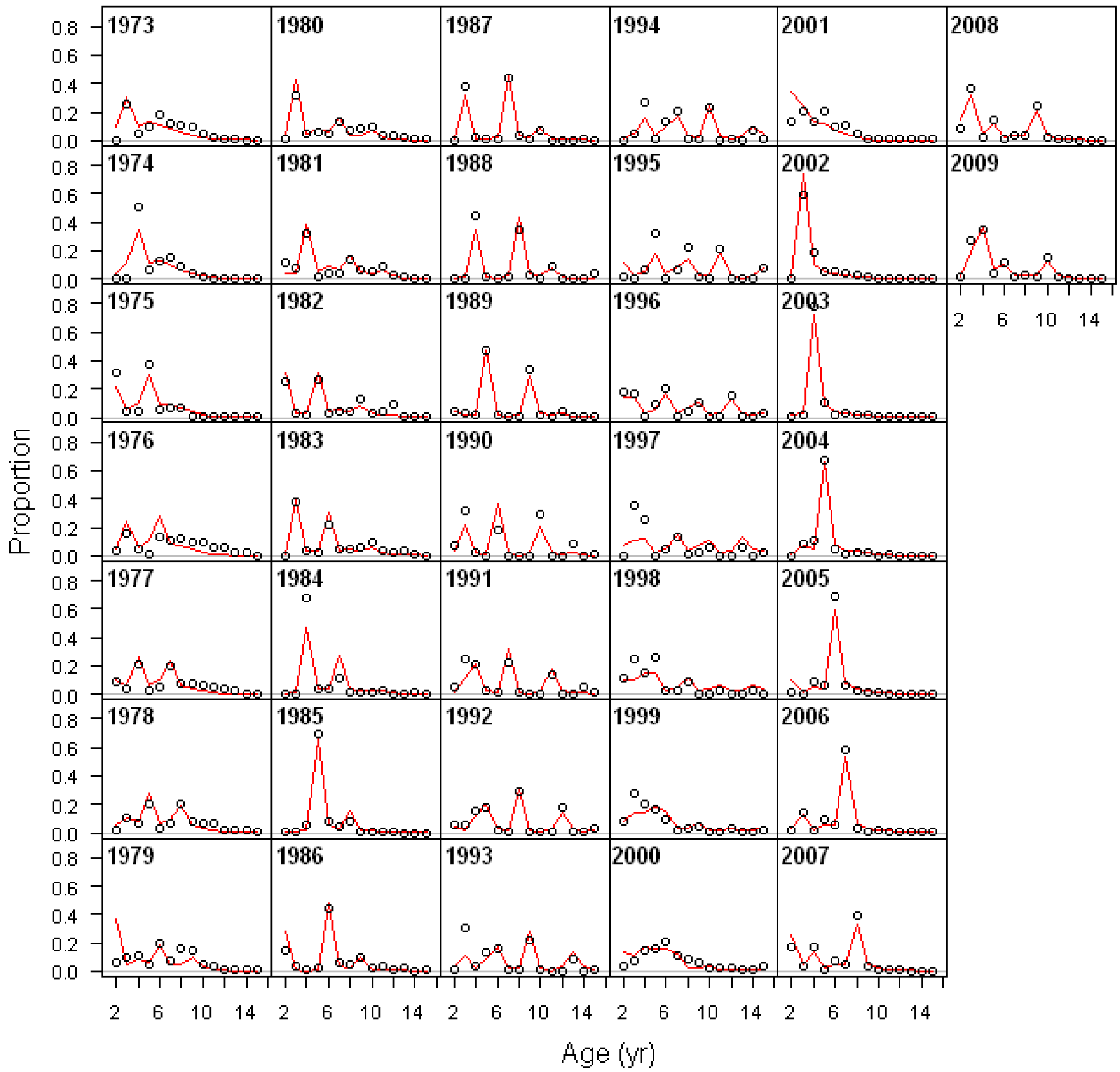

Figure 40. Predicted (implied, except for 1973-1974) fits to the observed U.S. fishery age composition data.

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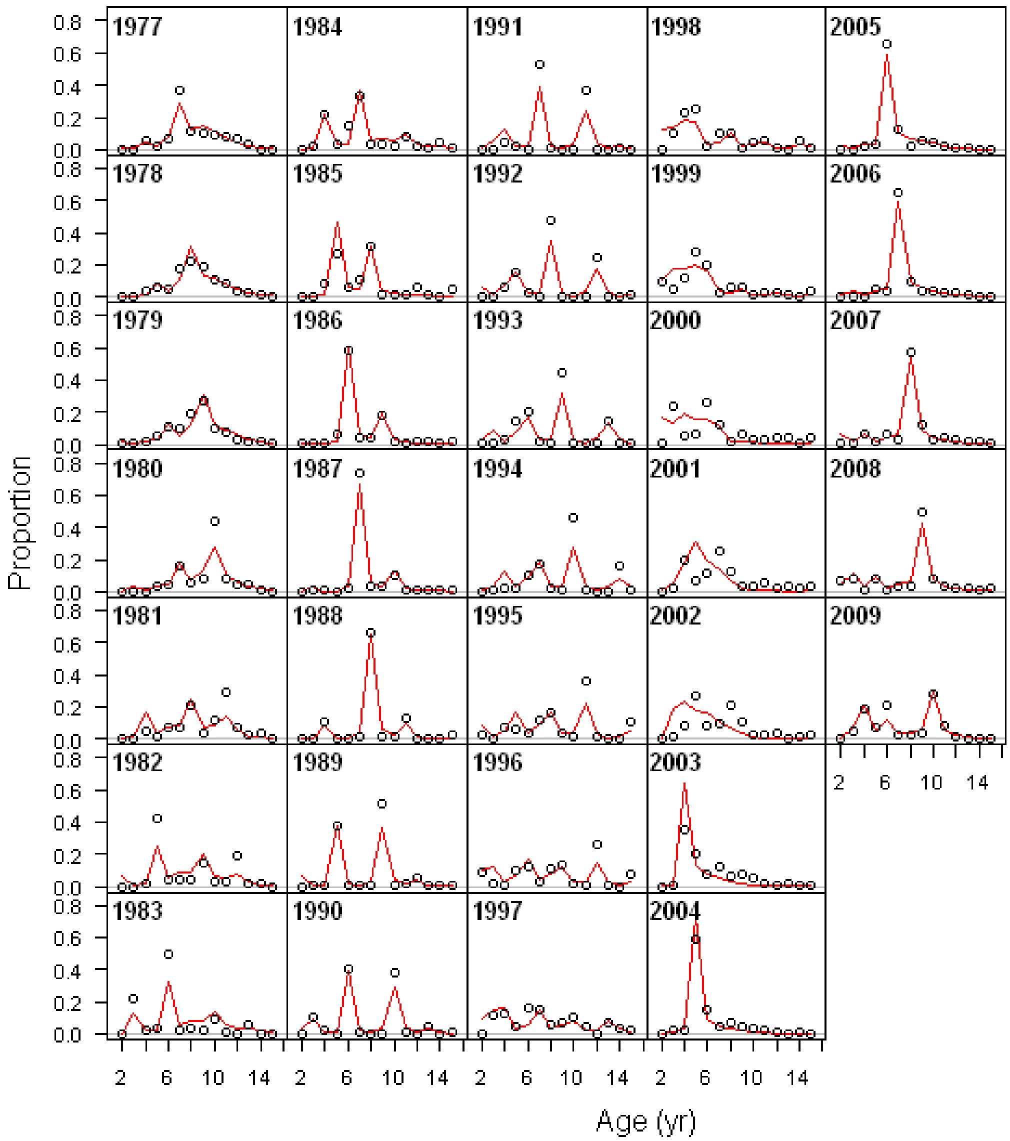

Figure 41. Predicted fits (1977-1987, implied 1988-2009) to the observed Canadian fishery age composition data.

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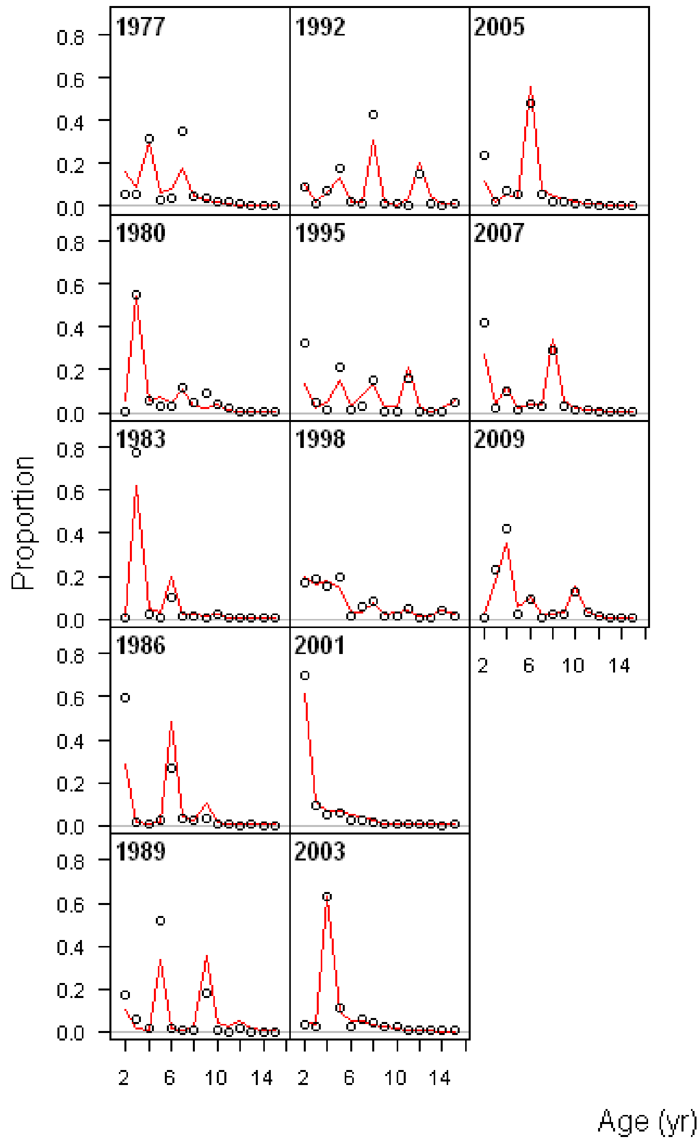

Figure 42. Predicted (implied) fits to the observed acoustic survey age composition data.

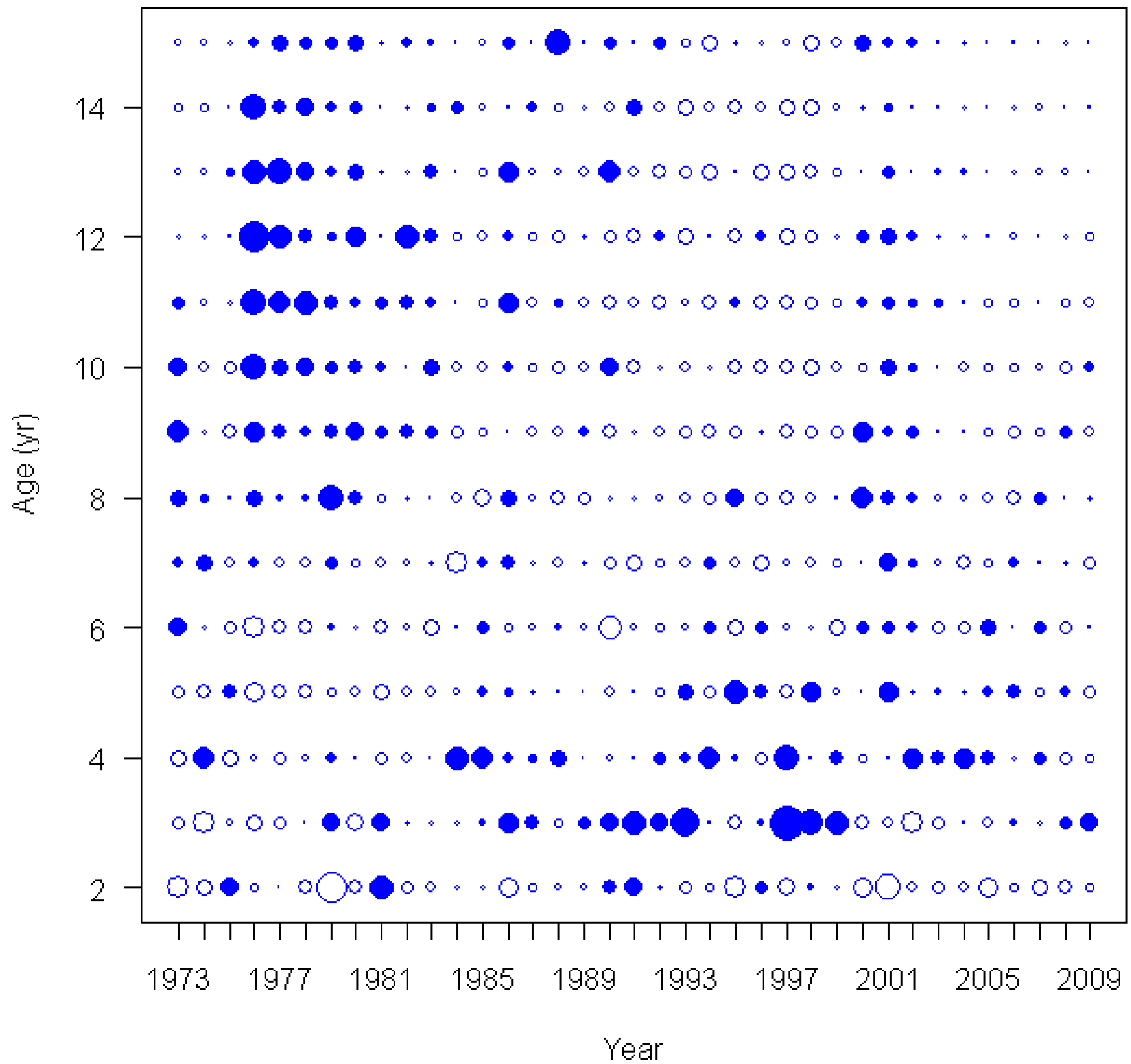

Figure 43. Unscaled residuals from the predicted (implied, except for 1973-1974) fits to the observed U.S. fishery age composition data.

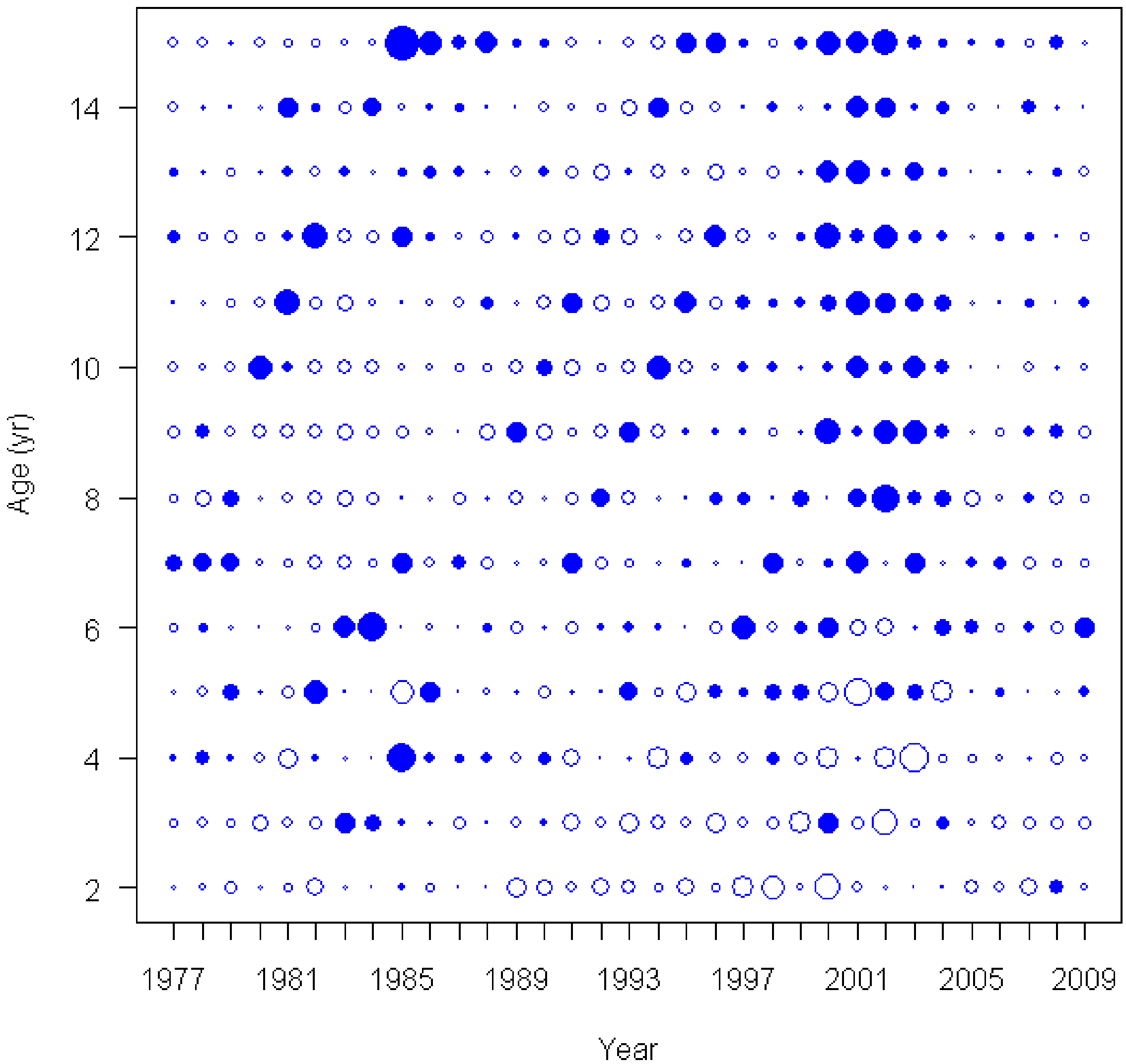

Figure 44. Unscaled residuals from the predicted fits (1977-1987, implied 1988-2009) to the observed Canadian fishery age composition data.

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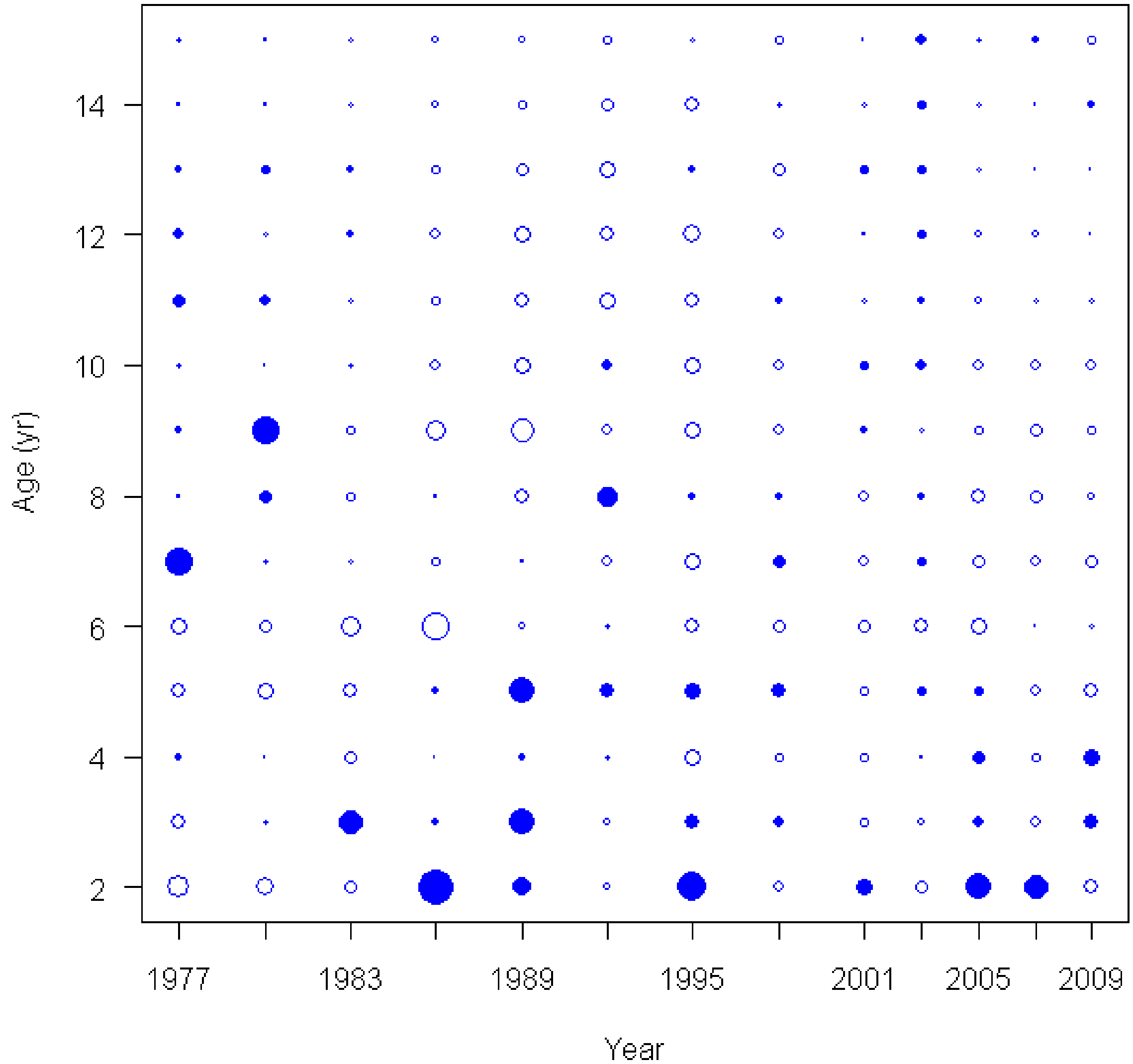

Figure 45. Unscaled residuals from the predicted (implied) fits to the observed acoustic survey age composition data.

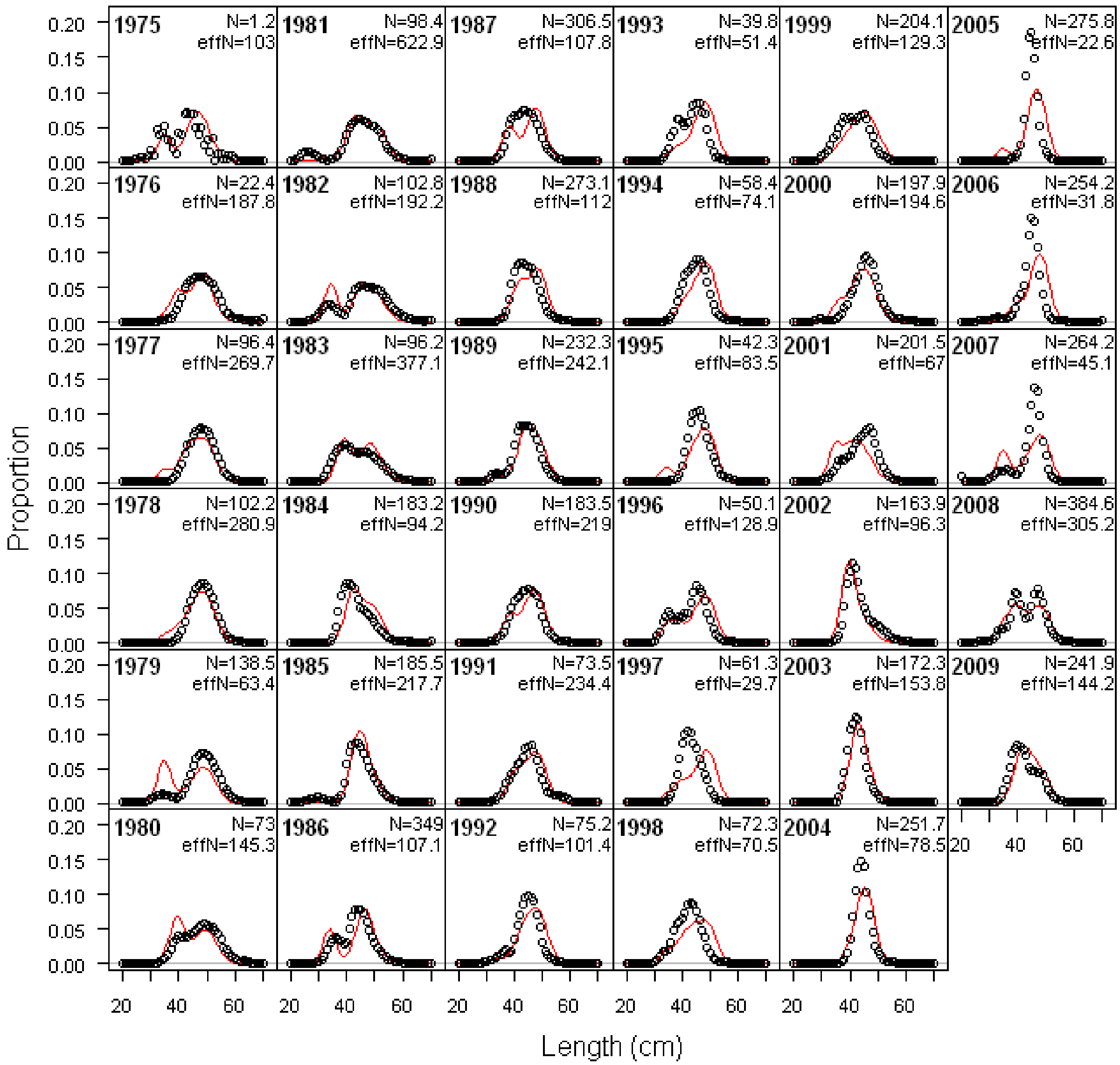

Figure 46. Predicted fits to the observed U.S. fishery length composition data.

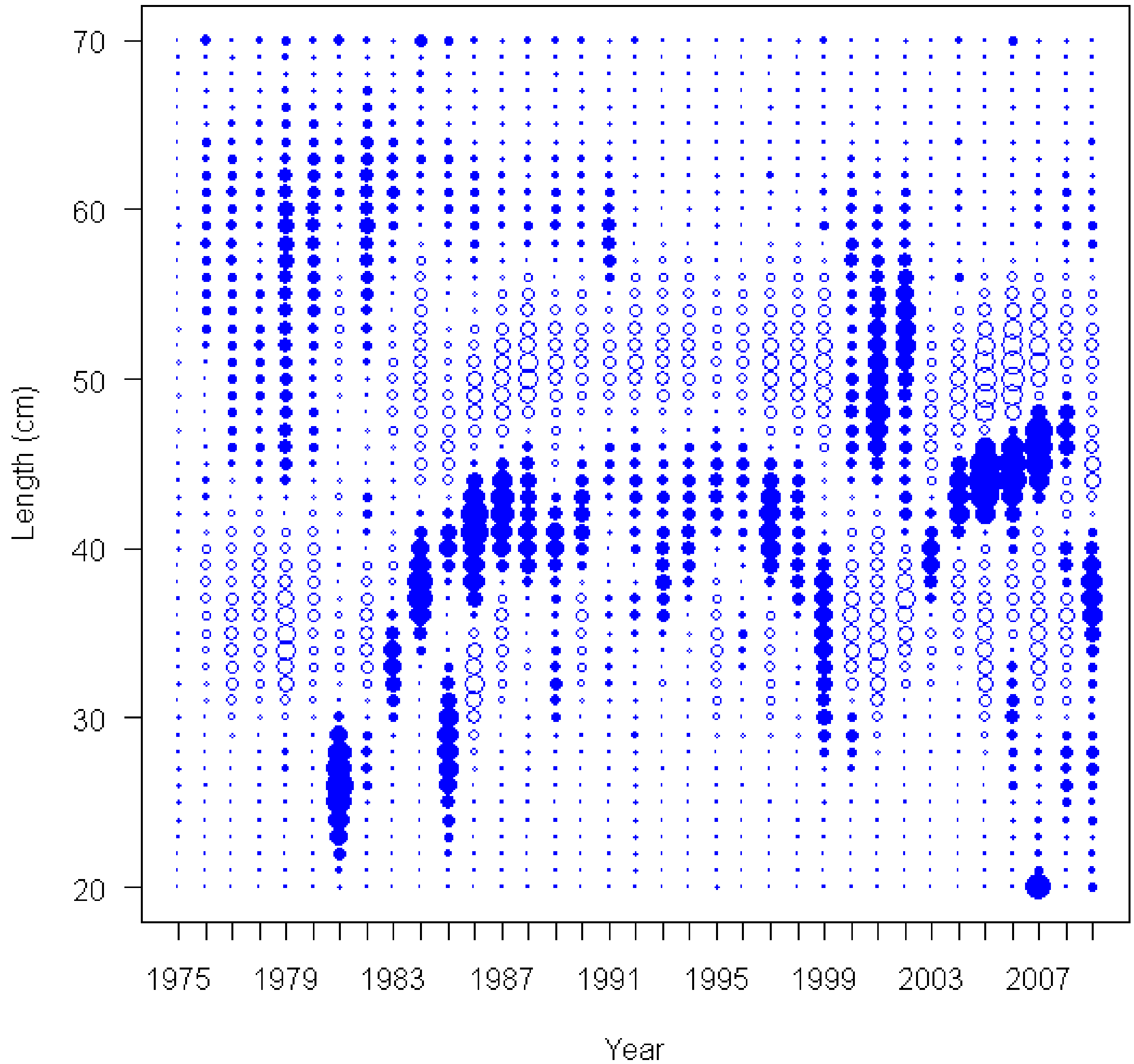

Figure 47. Pearson standardized residuals (observed - predicted) for model fits to the U.S. fishery length composition data. Maximum bubble size = 7.07; filled circles represent positive values.

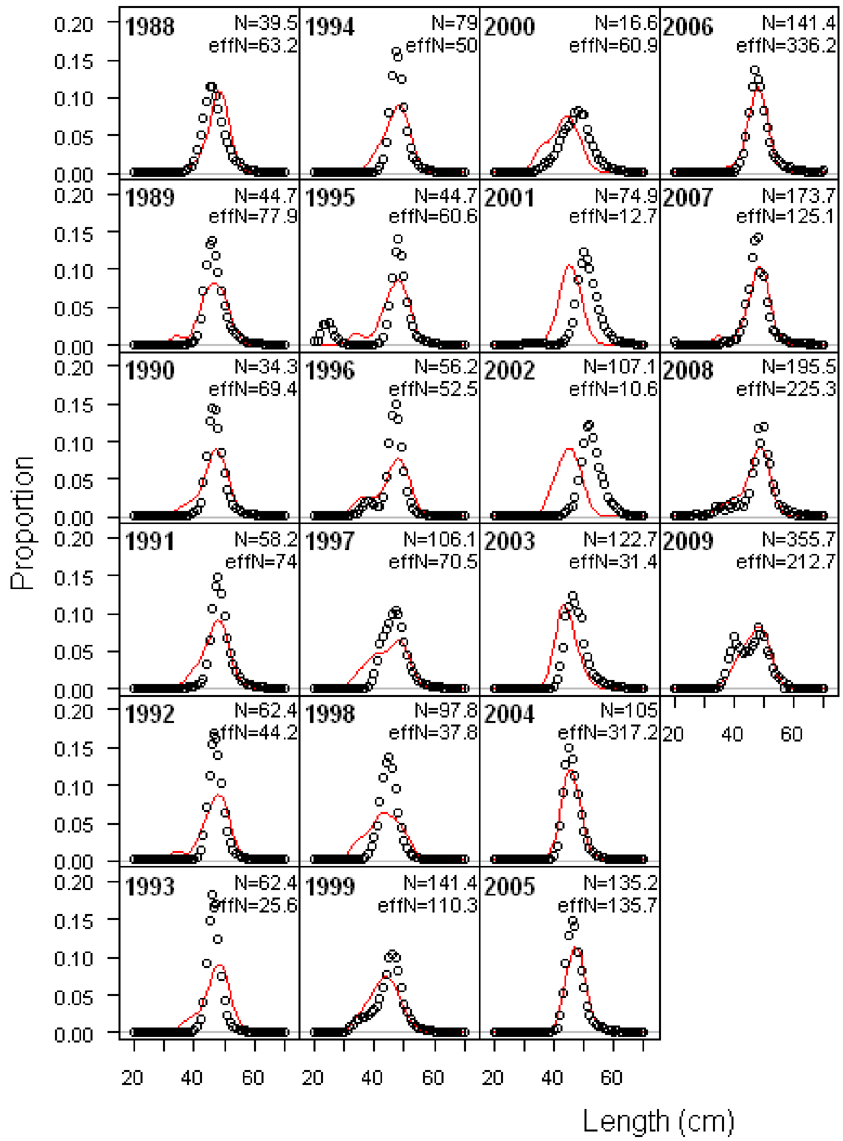

Figure 48. Predicted fits to the observed Canadian fishery length composition data.

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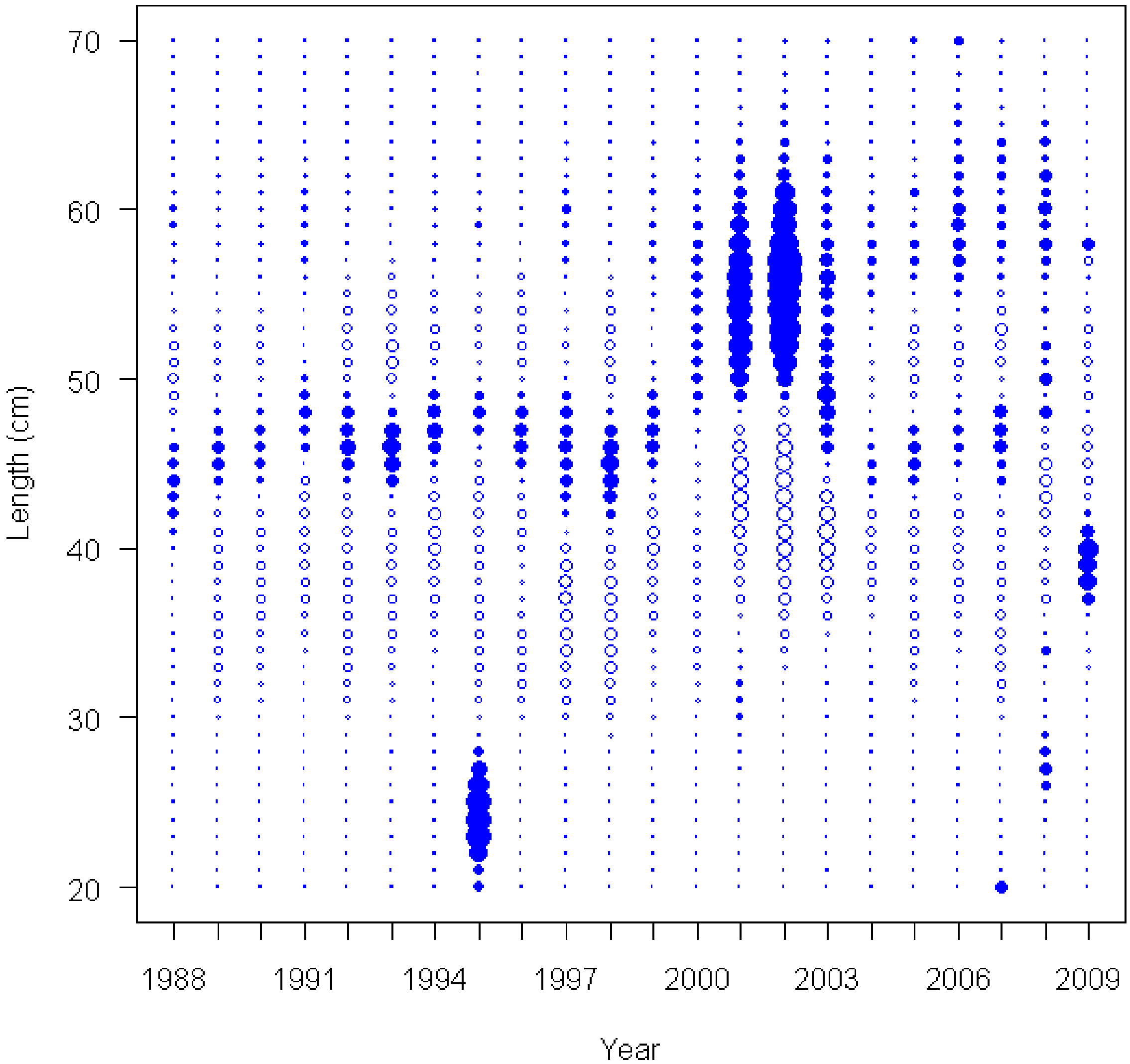

Figure 49. Pearson standardized residuals (observed - predicted) for model fits to the Canadian fishery length composition data. Maximum bubble size = 10.83; filled circles represent positive values.

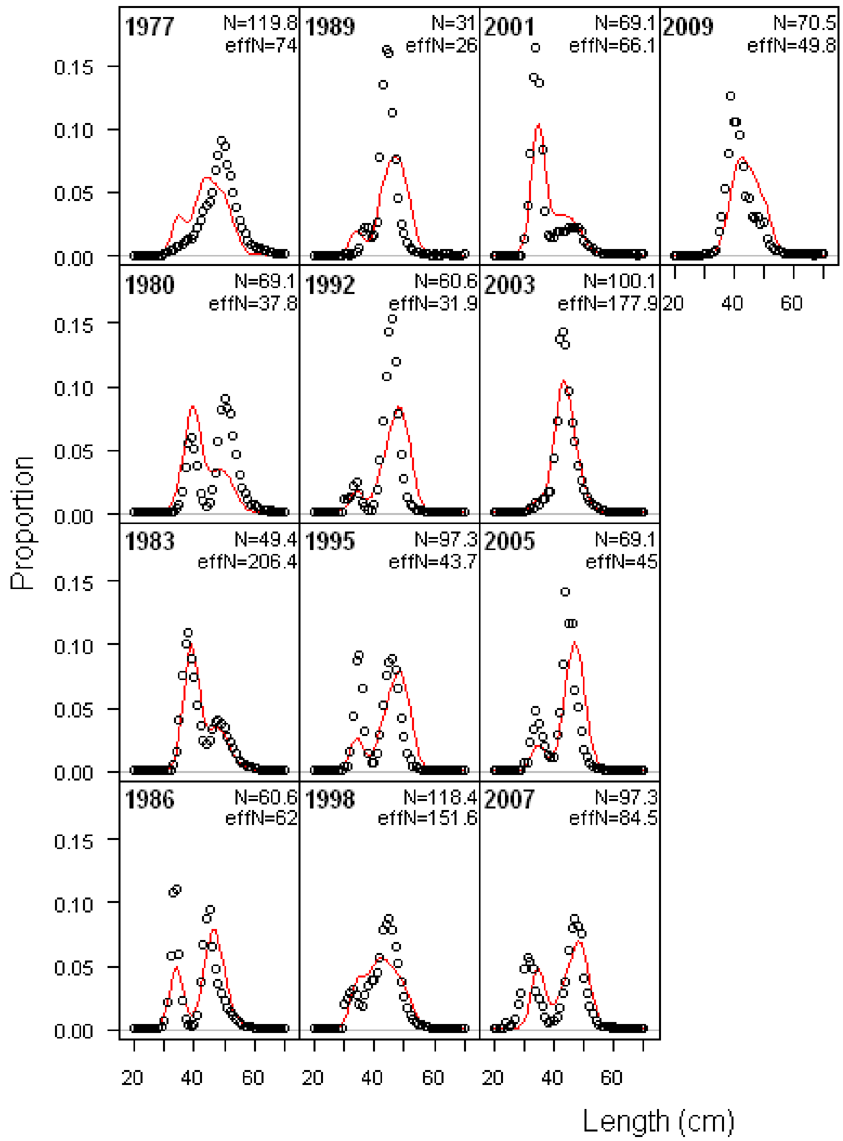

Figure 50. Predicted fits to the observed acoustic survey length composition data.

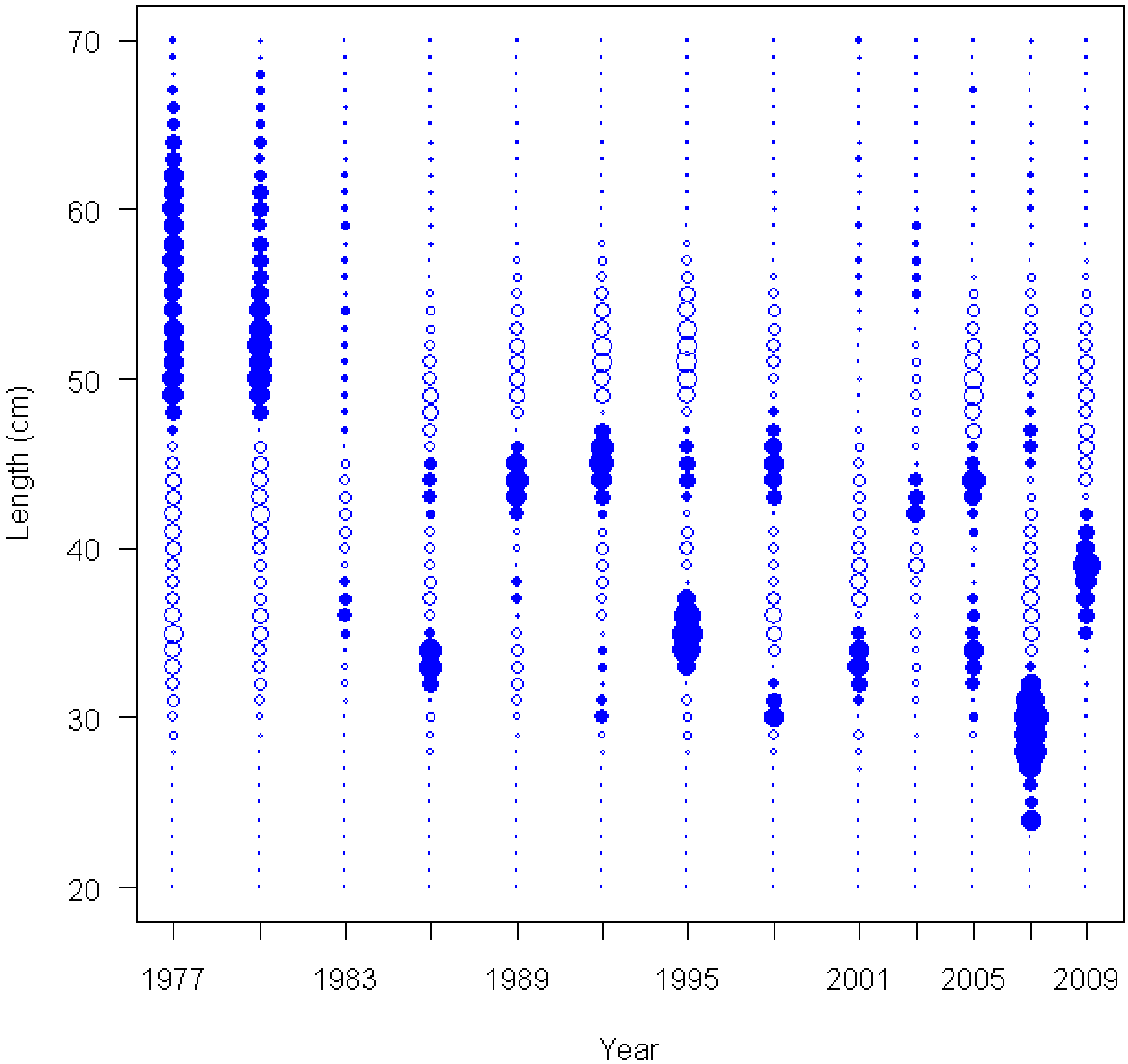

Figure 51. Pearson standardized residuals (observed - predicted) for model fits to the acoustic survey length composition data. Maximum bubble size = 4.8; filled circles represent positive values.

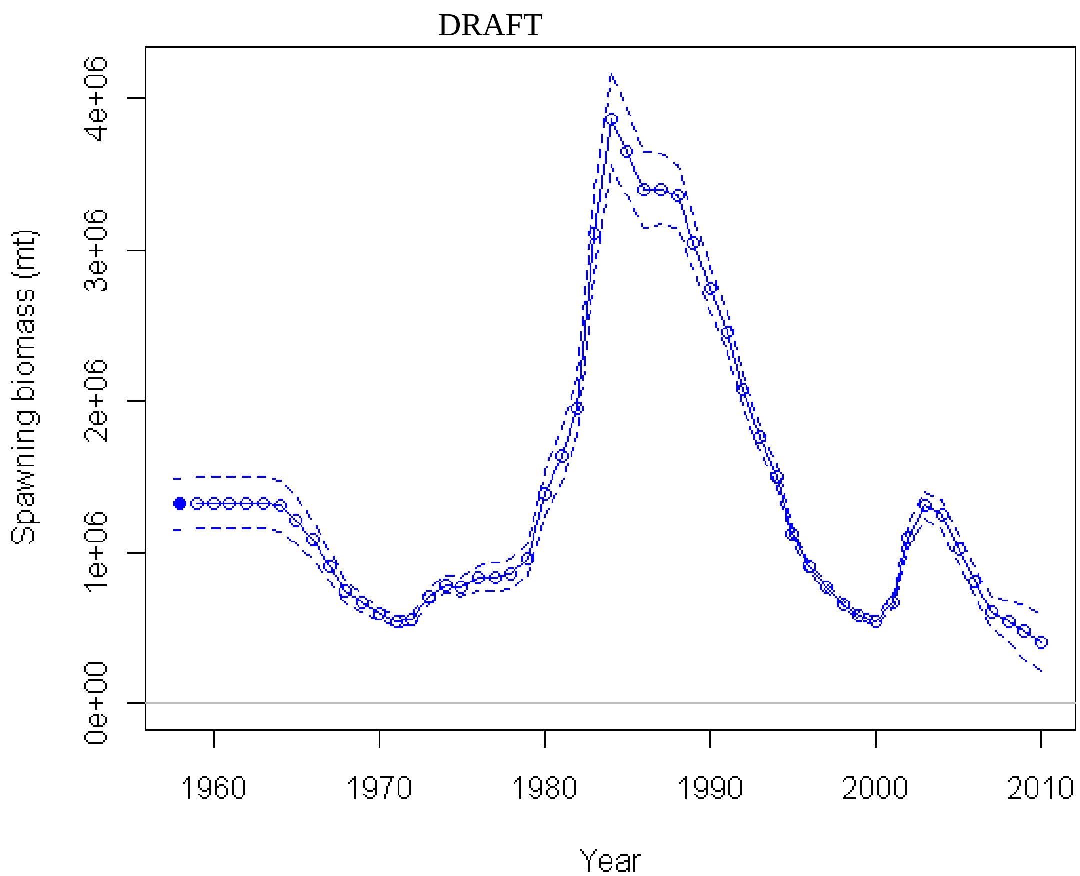

Figure 52. Estimated female spawning biomass time-series with approximate asymptotic 95% confidence intervals.

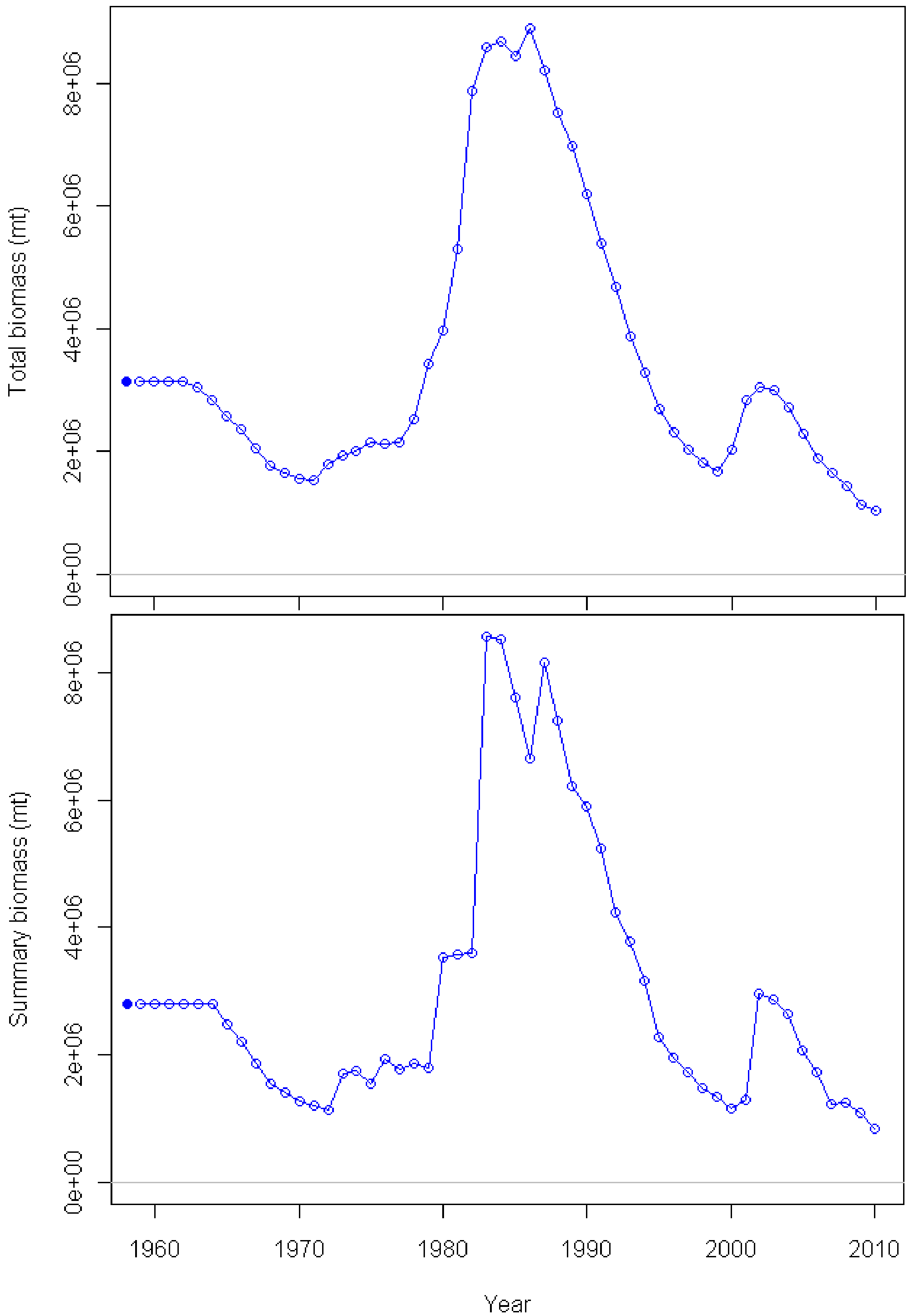

Figure 53. Estimated time-series of Pacific hake total (top panel) and summary biomass (age 3+; bottom panel).

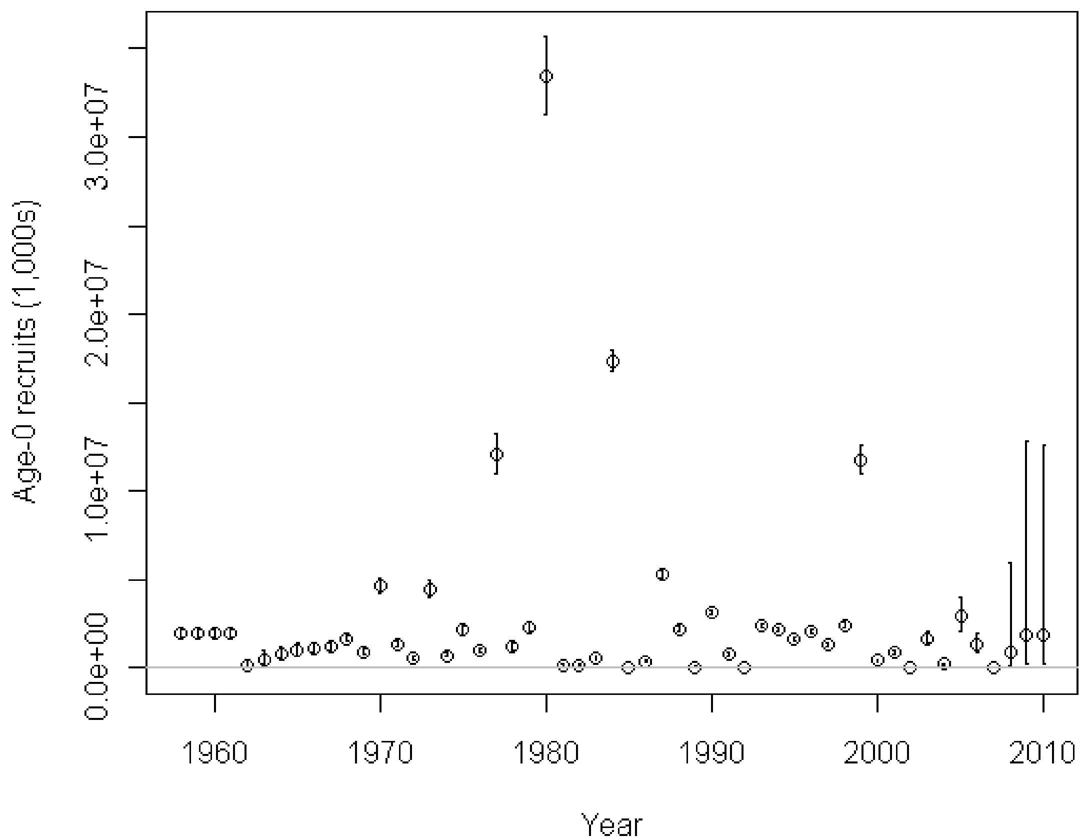

Figure 54. Estimated recruitment time-series with approximate asymptotic 95% confidence intervals.

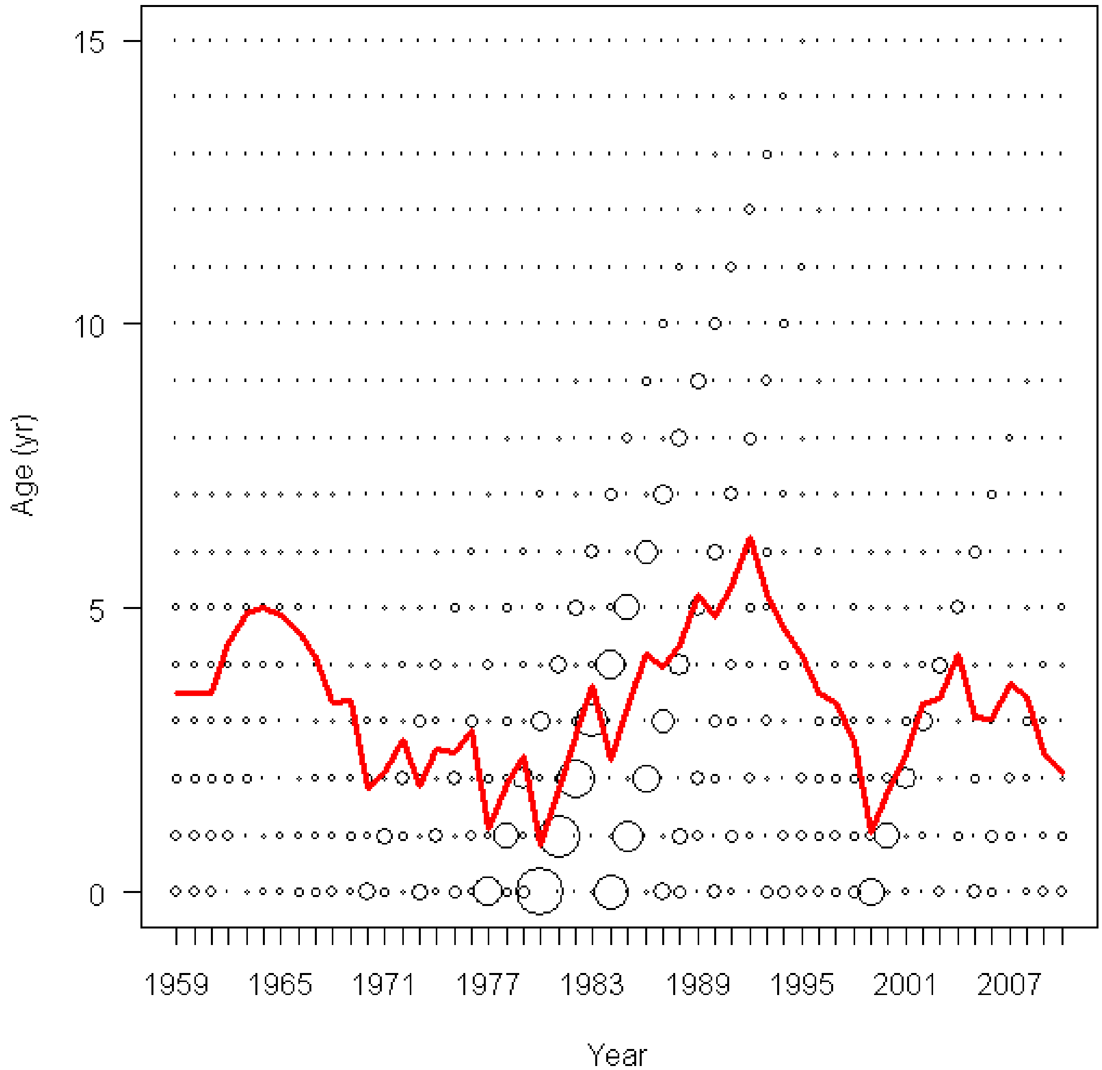

Figure 55. Estimated numbers at age time-series in the base case model. Maximum bubble size indicates 33.4 billion age-0 recruits in 1980, line represents the mean age in the population.

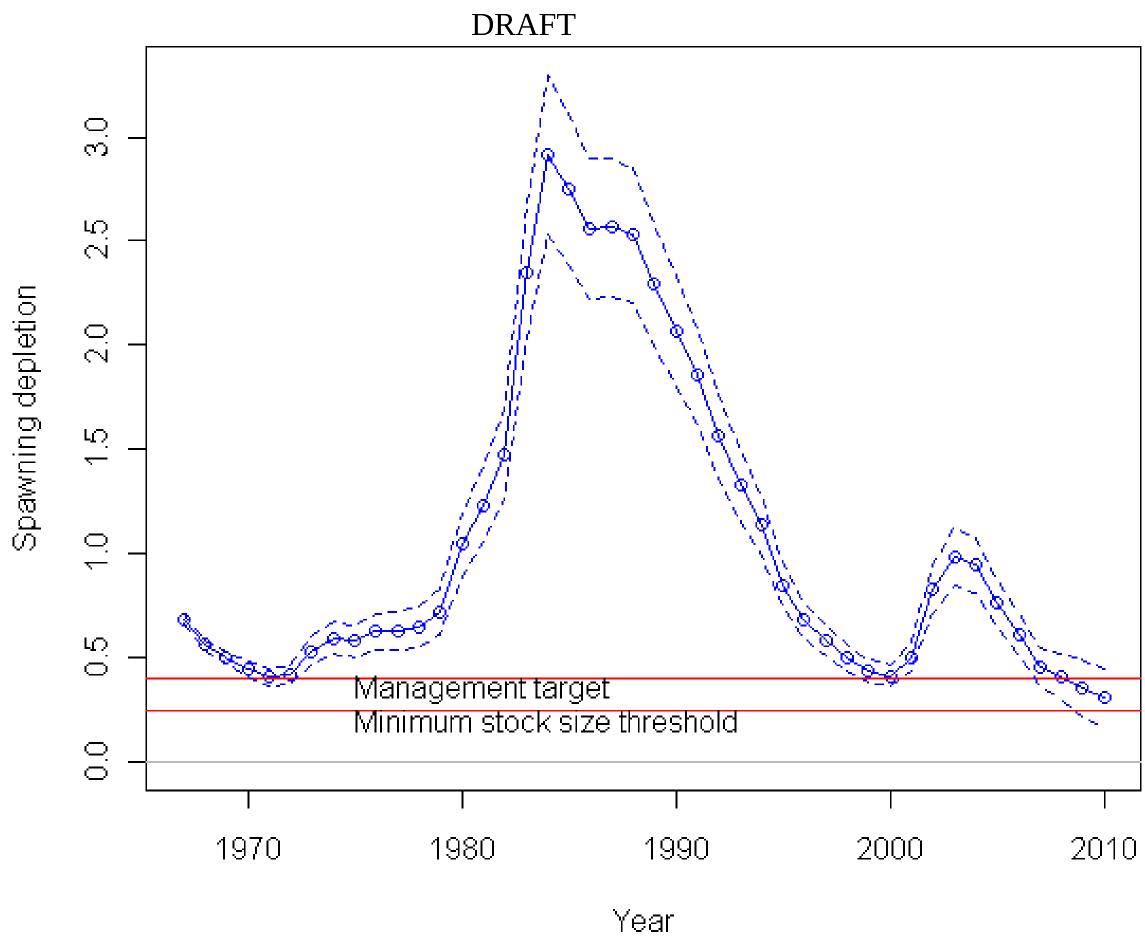

Figure 56. Time-series of estimated depletion, 1967-2010.

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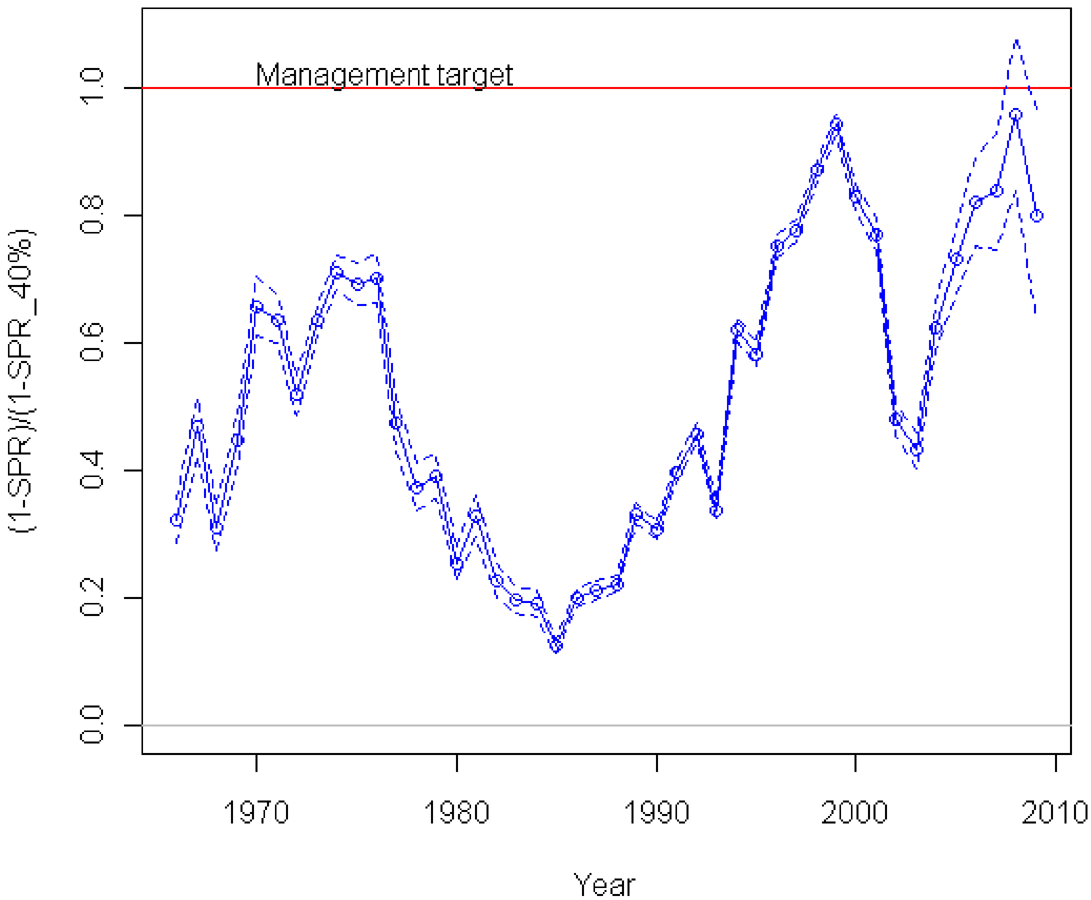

Figure 57. Time-series of relative spawning potential ratio (1-SPR/1-SPR$_{Target=0.4}$).

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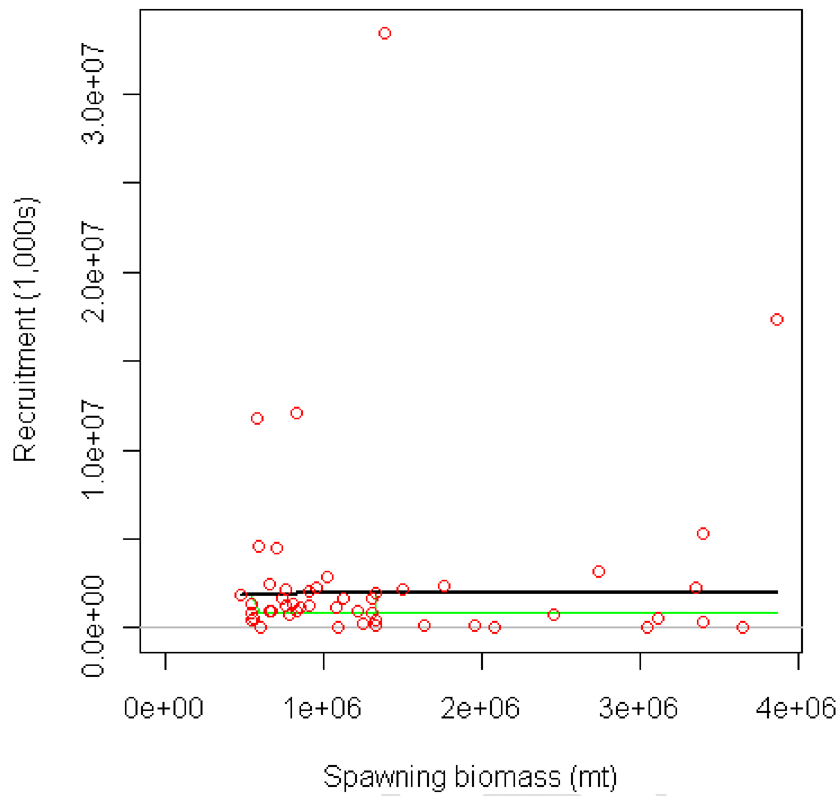

Figure 58. Estimated stock-recruit relationship. Lines represent the bias-corrected expectation (upper line) and median (lower line).

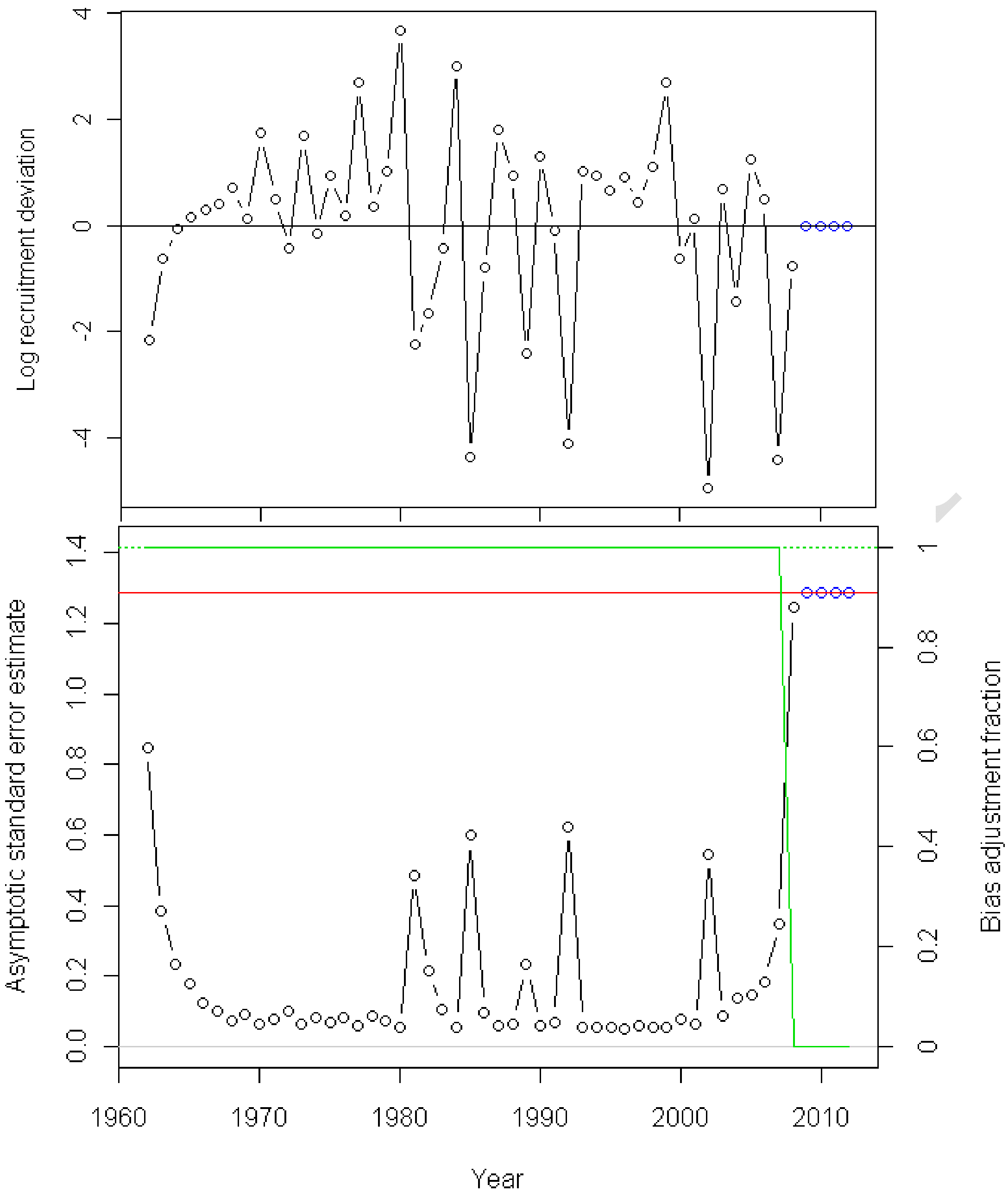

Figure 59. Estimates of Pacific hake recruitment deviations (top panel), and asymptotic standard errors for the deviations (bottom panel). Horizontal line in bottom panel indicates the estimate of the standard deviation of log recruitment deviations (σ_r).

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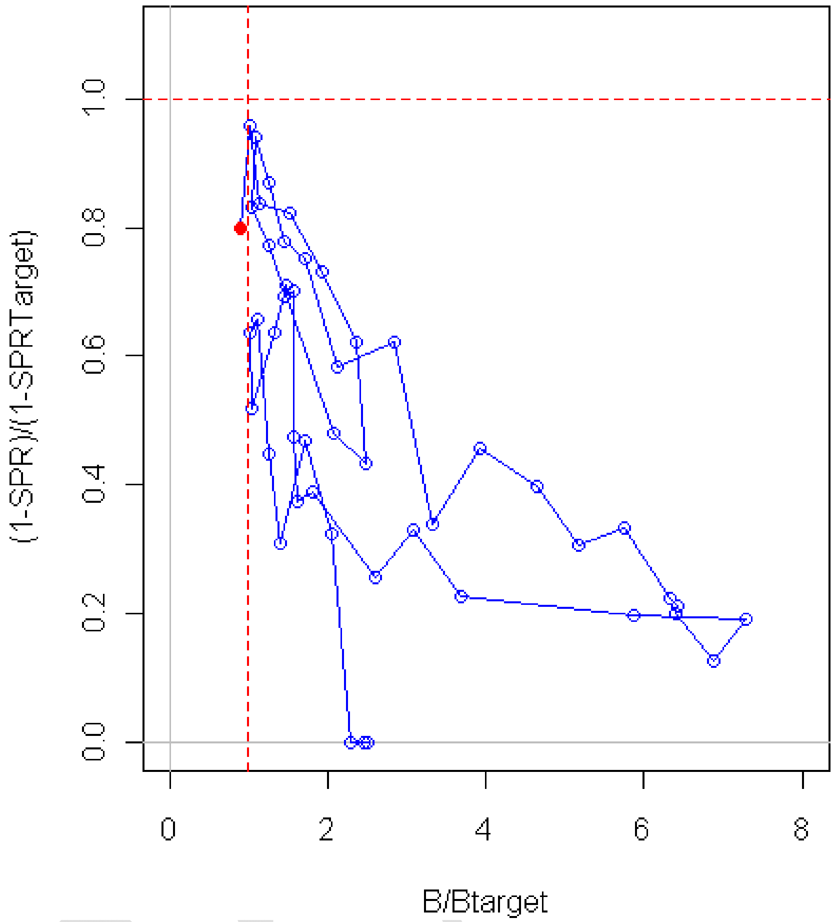


Figure 60. Temporal pattern (phase plot) of relative spawning potential ratio (1-SPR/1-$SPR_{Target=0.4}$) vs. estimated spawning biomass relative to the proxy 40% level, 1960-2009. Current (2009) performance relative to targets is shown as solid dot.

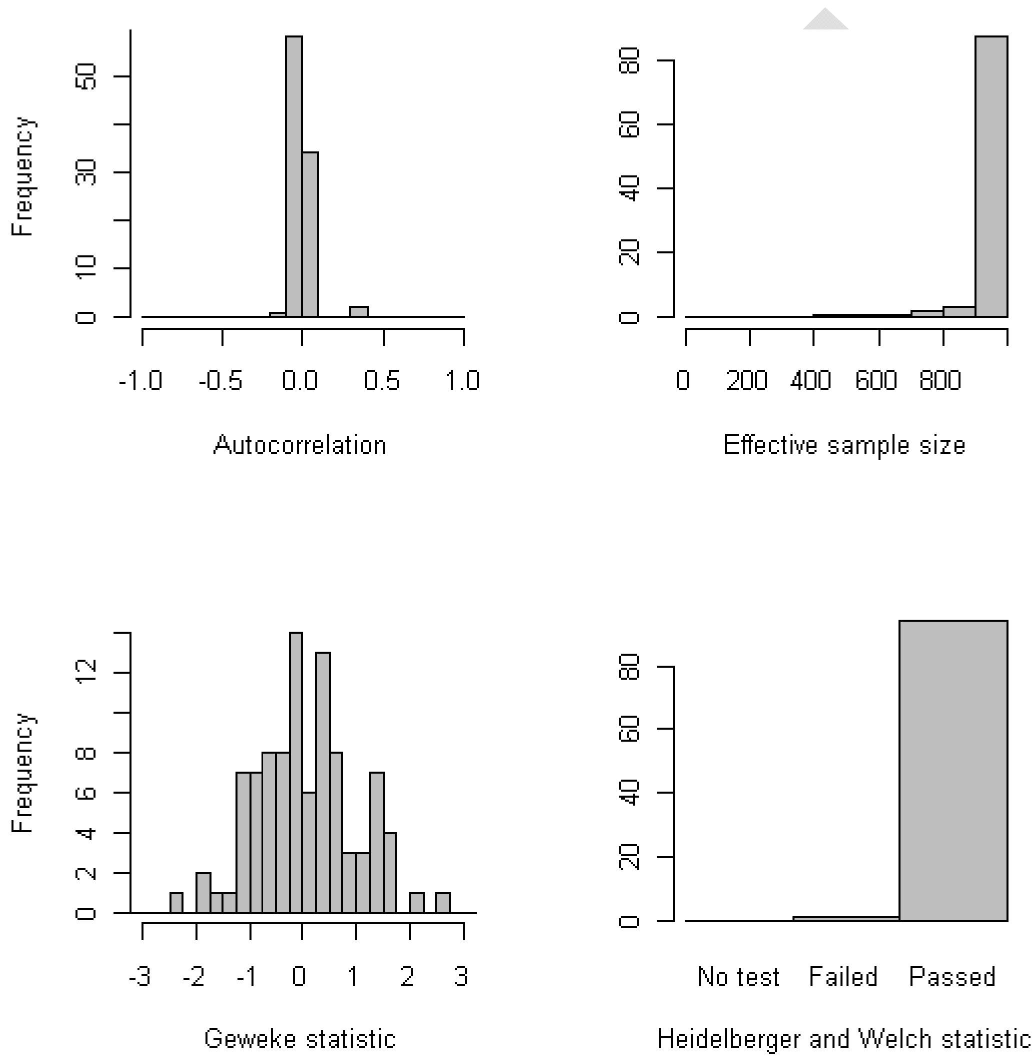


Figure 61. Summary of MCMC diagnostics for the objective function, as well as growth, mortality, stock-recruit (including recruitment deviations), catchability and selectivity parameters.

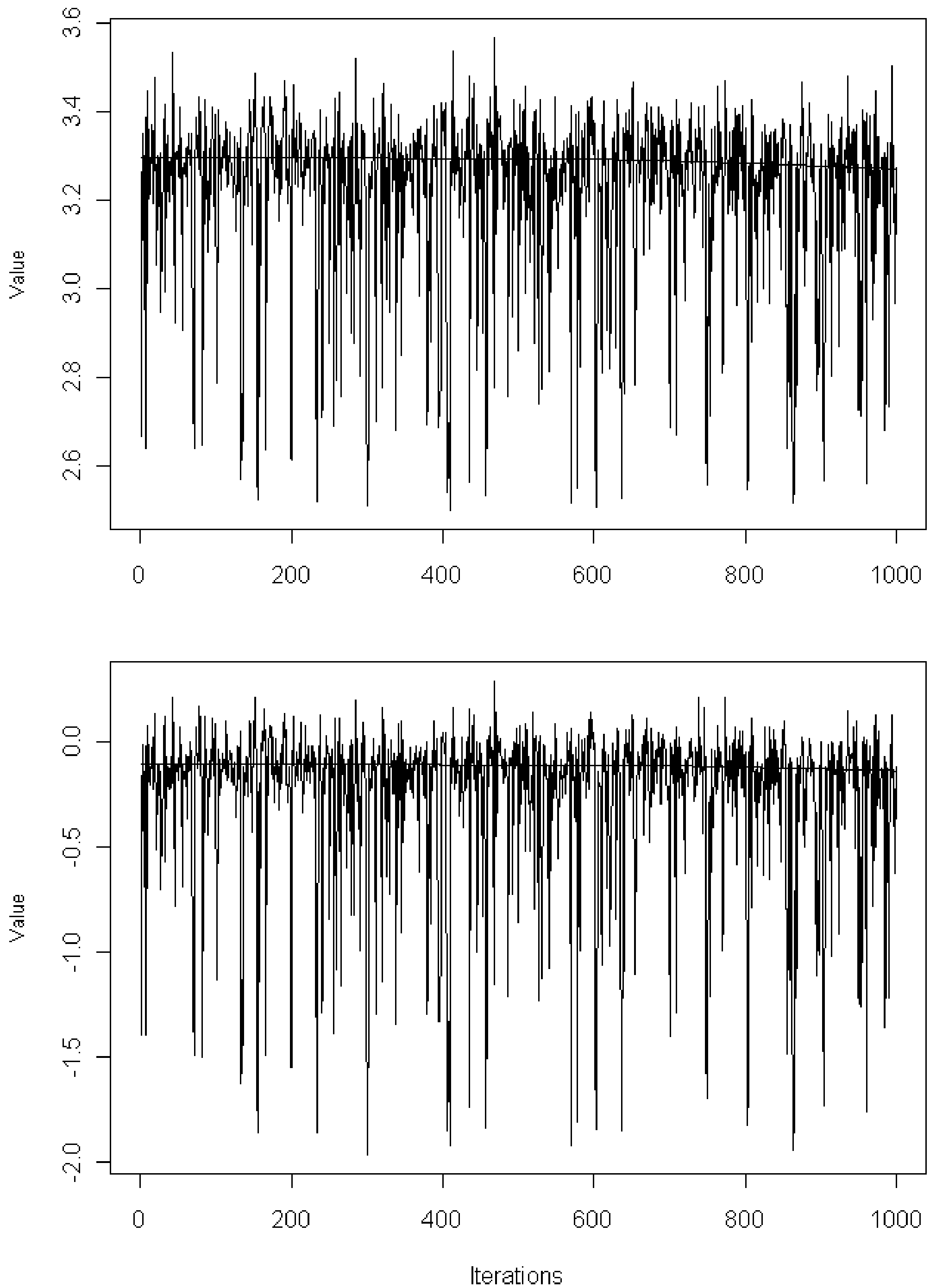


Figure 62. Trace plot for the two selectivity parameters with highest autocorrelation.

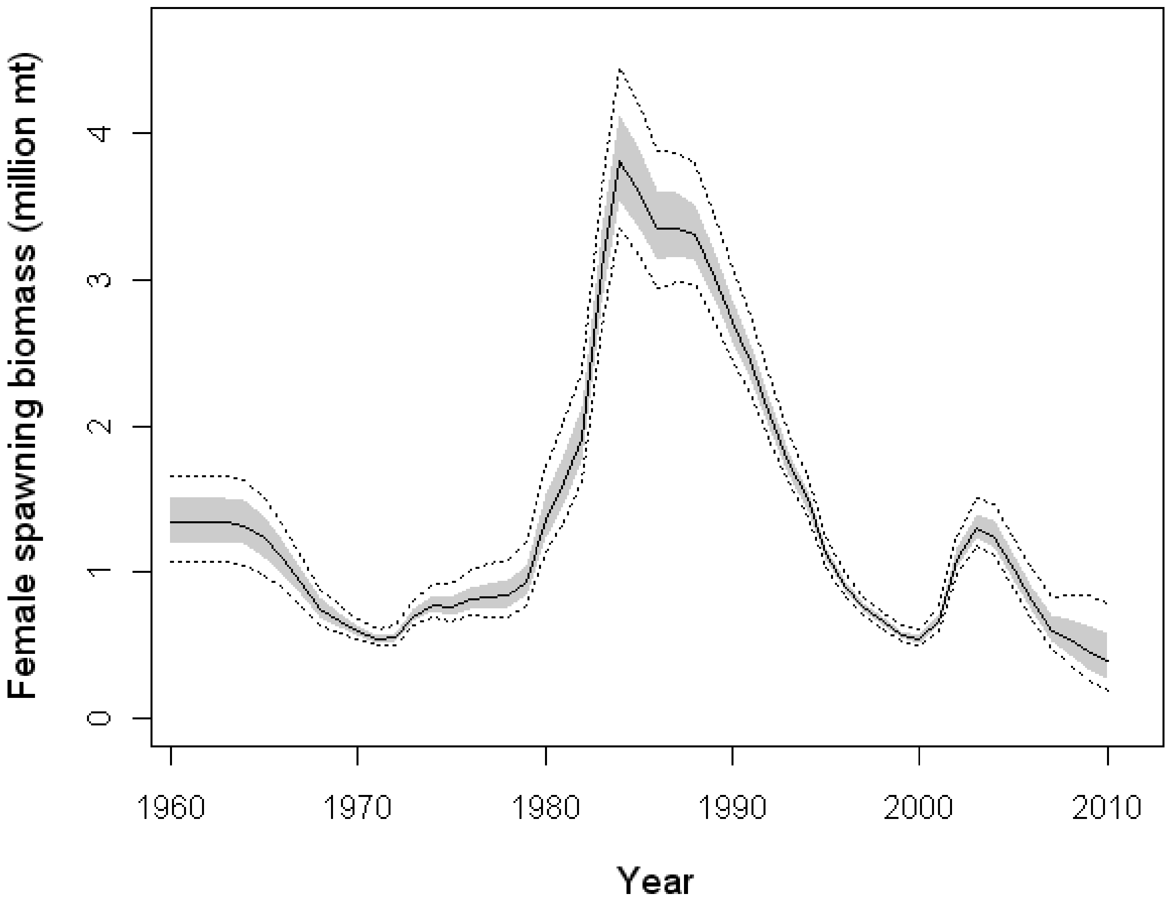


Figure 63. Time-series of posterior intervals for female spawning biomass; dark line indicates the median value, shaded region the ~95% credibility interval and dashed lines the minimum and maximum values present in the posterior distribution.

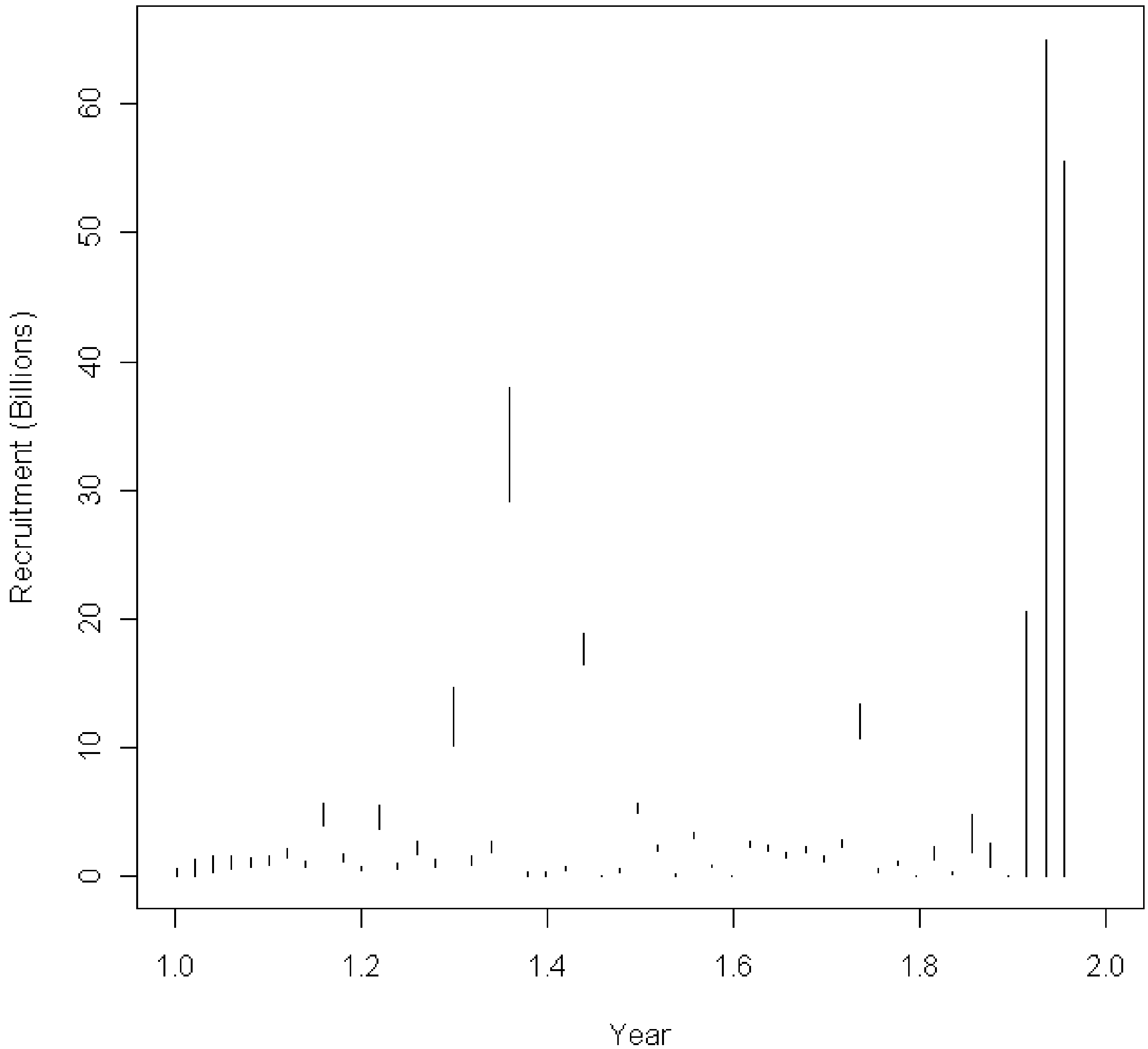


Figure 64. Time-series of posterior intervals (posterior range from minimum to maximum values) for age-0 recruitment.

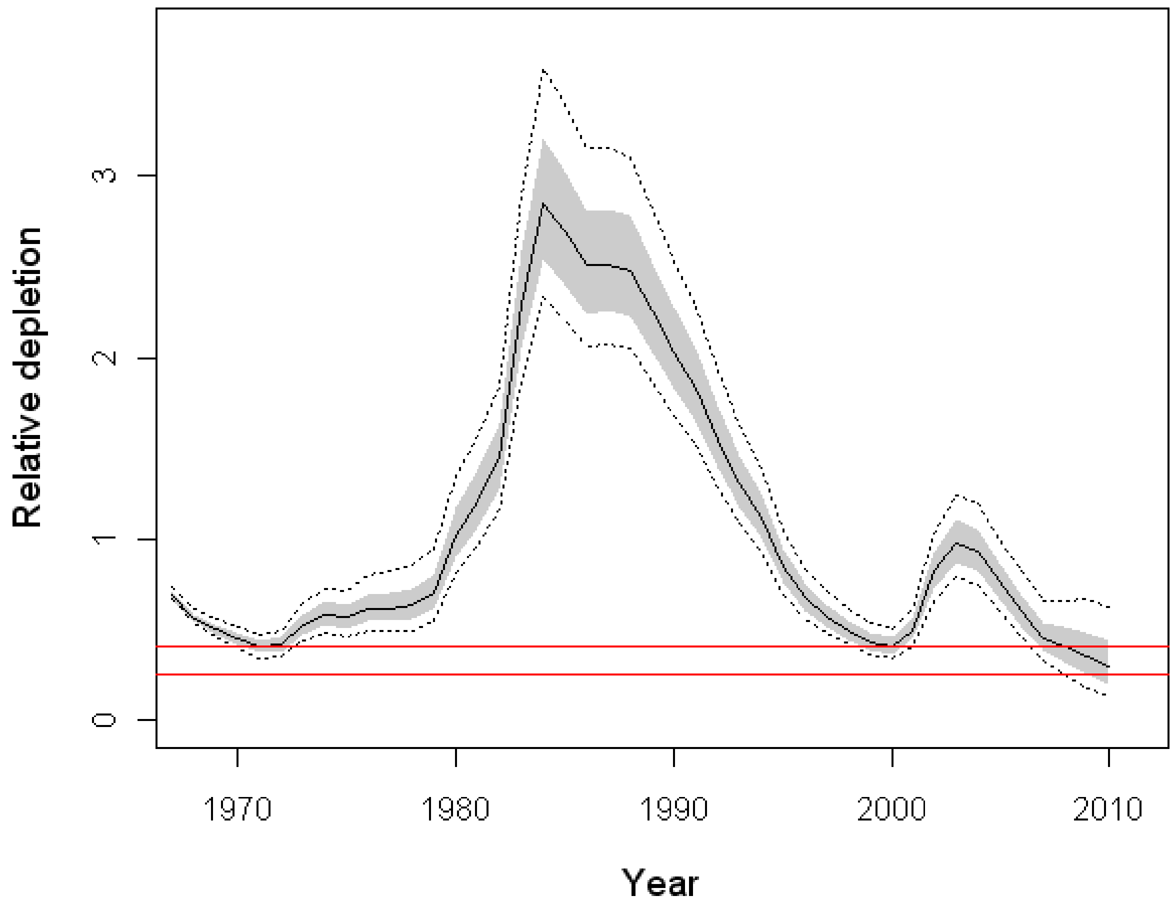


Figure 65. Time-series of posterior intervals for relative depletion; dark line indicates the median value, shaded region the ~95% credibility interval and dashed lines the minimum and maximum values present in the posterior distribution. Horizontal lines indicates the $SB_{40\%}$ biomass target and $SB_{25\%}$ biomass limit levels.

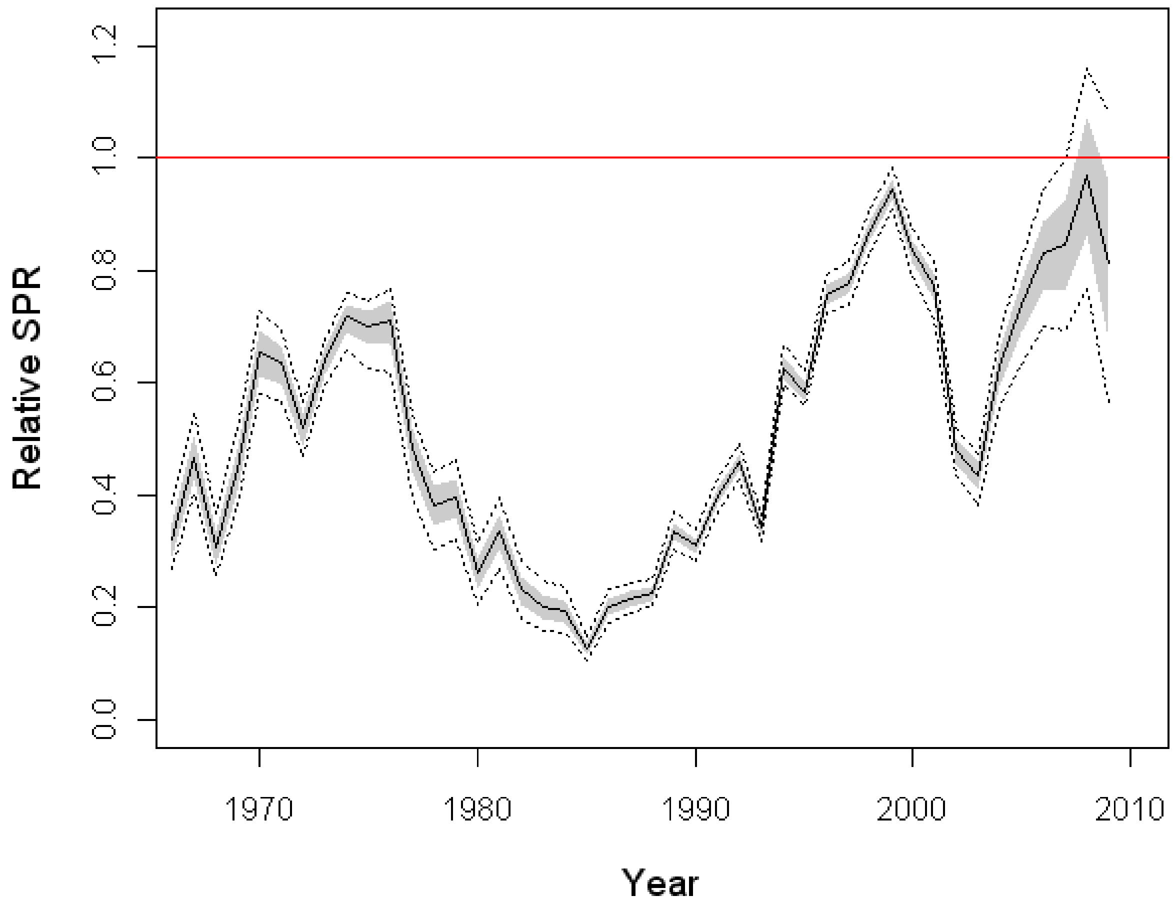


Figure 66. Time-series of posterior intervals for relative SPR, ($1\text{-SPR}/1\text{-SPR}_{Target=0.4}$); dark line indicates the median value, shaded region the ~95% credibility interval and dashed lines the minimum and maximum values present in the posterior distribution. Horizontal line indicates the overfishing threshold.

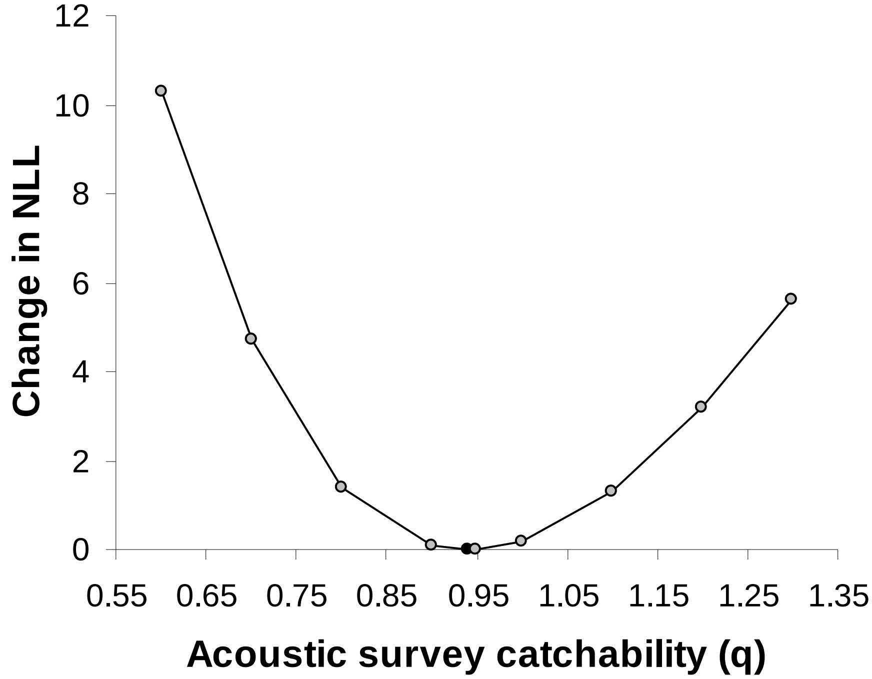


Figure 67. Likelihood profile for alternate values for acoustic survey catchability. Dark circle indicates the maximum likelihood estimate.

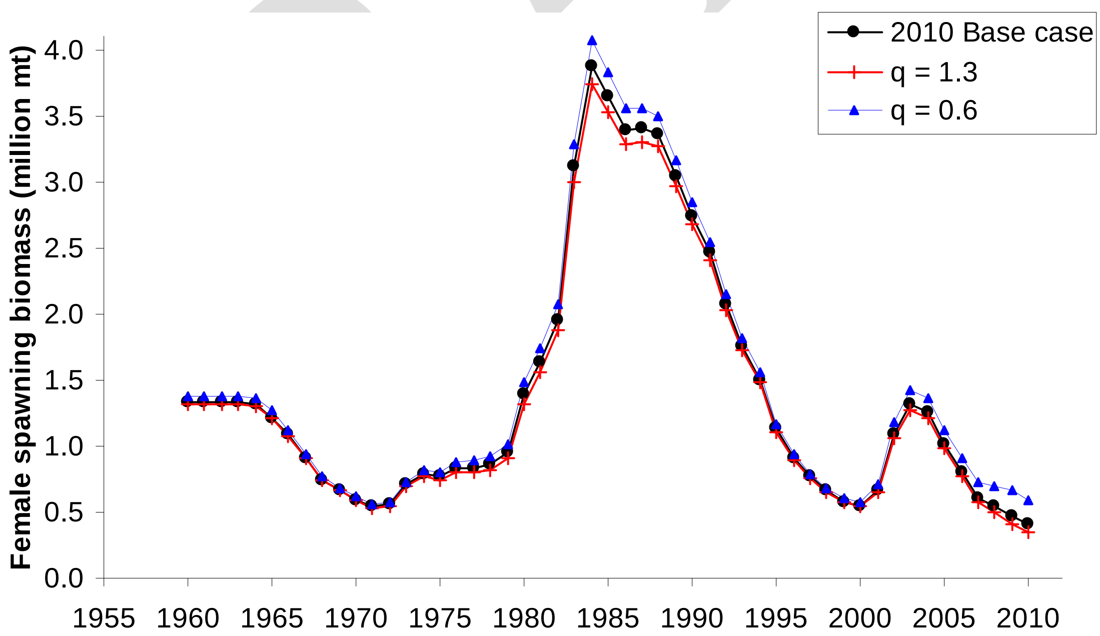


Figure 68. Results of sensitivity analysis to the estimated value for acoustic survey catchability (estimated value = 0.94).

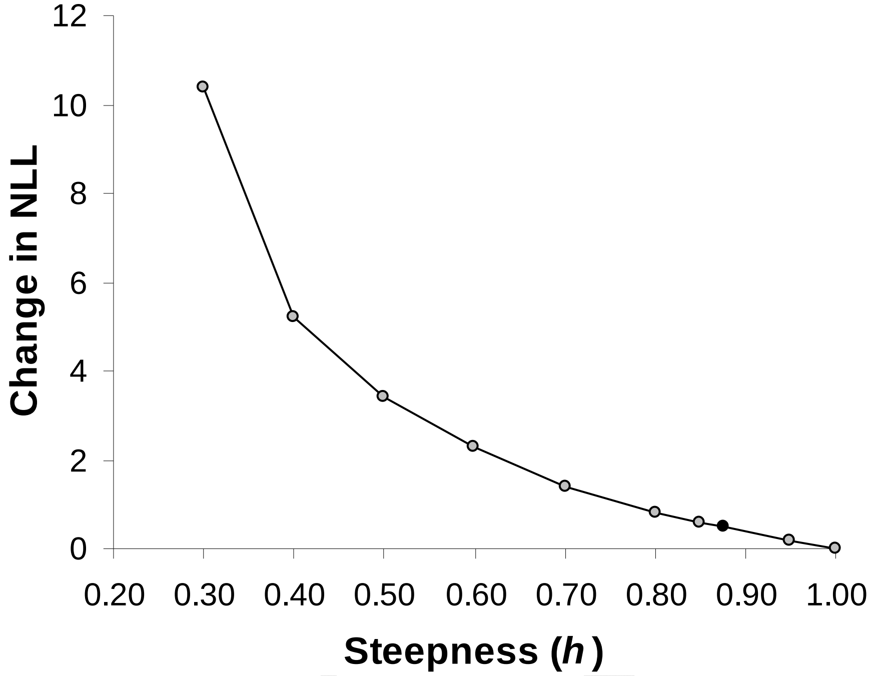


Figure 69. Likelihood profile for alternate values for the steepness (*h*) of the stock-recruitment function. Dark circle indicates the maximum likelihood estimate. The maximum likelihood estimate reflects the contribution of the prior probability distribution and therefore does not occur at the minimum value on this figure, which was calculated without the contribution of the prior.

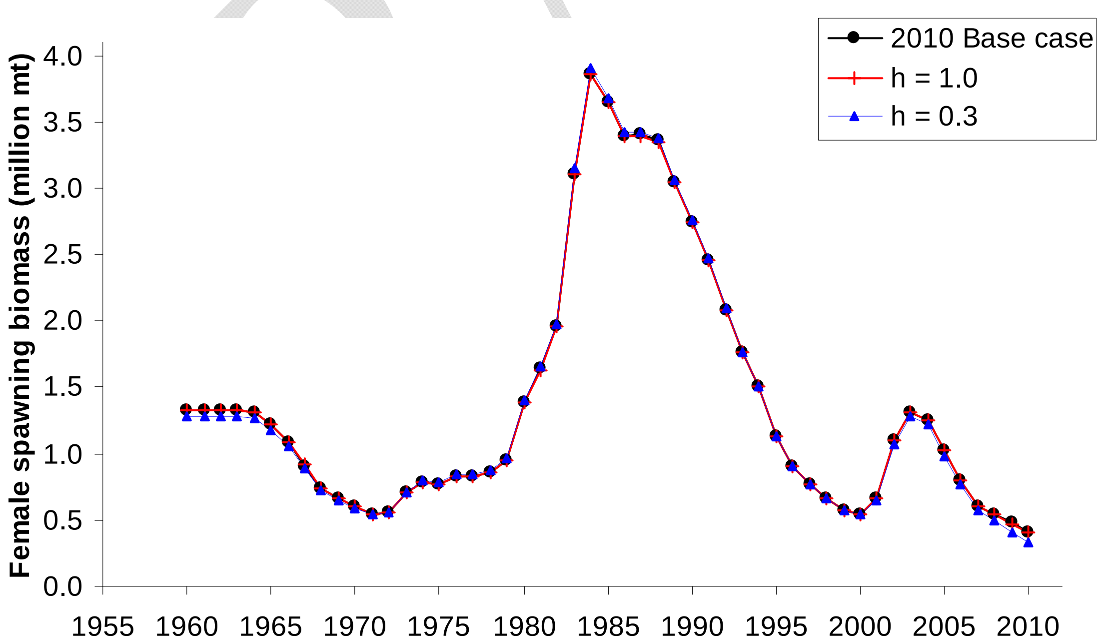


Figure 70. Results of sensitivity analysis to the estimated value for acoustic survey catchability (estimated value = 0.88).

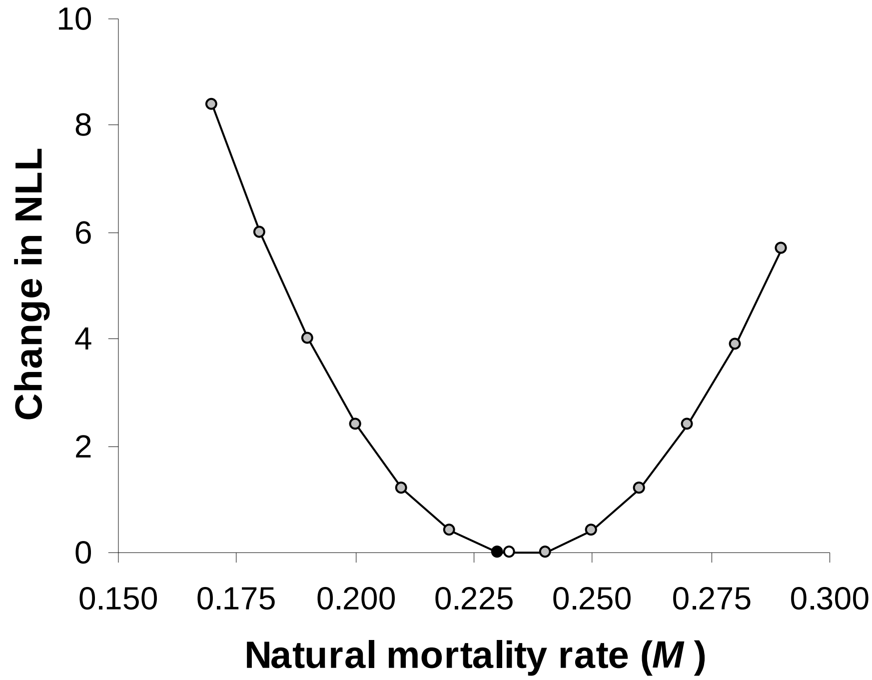


Figure 71. Likelihood profile for the natural mortality rate (*M*) through age 13. Dark circle indicates the fixed value used in the base case, and the open circle the maximum likelihood estimate.

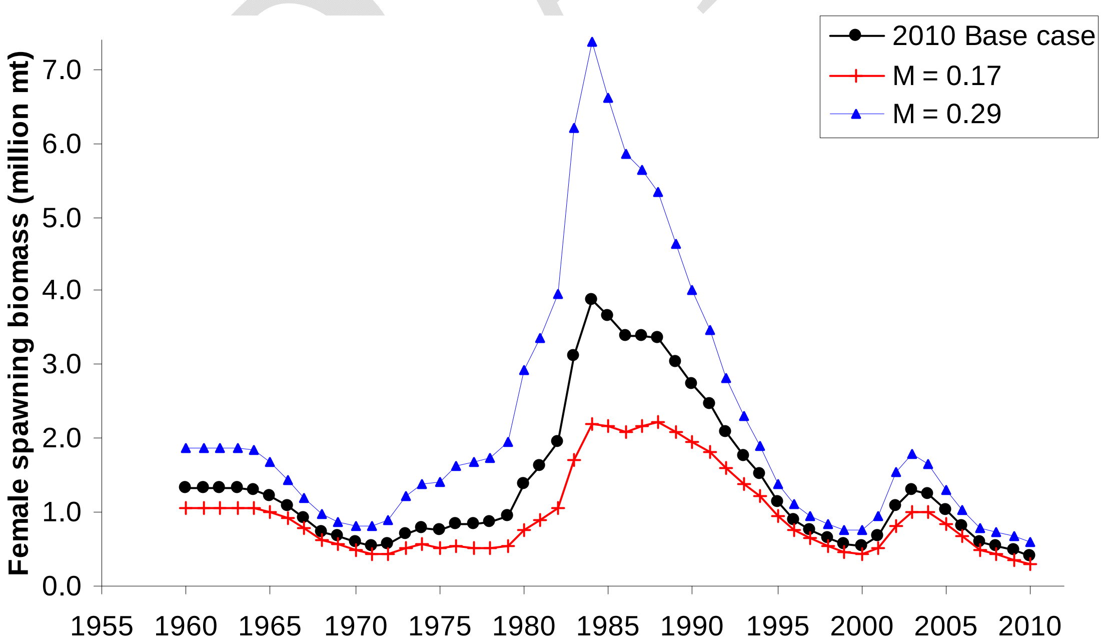


Figure 72. Results of sensitivity analysis to the fixed value for natural mortality rate (0.23).

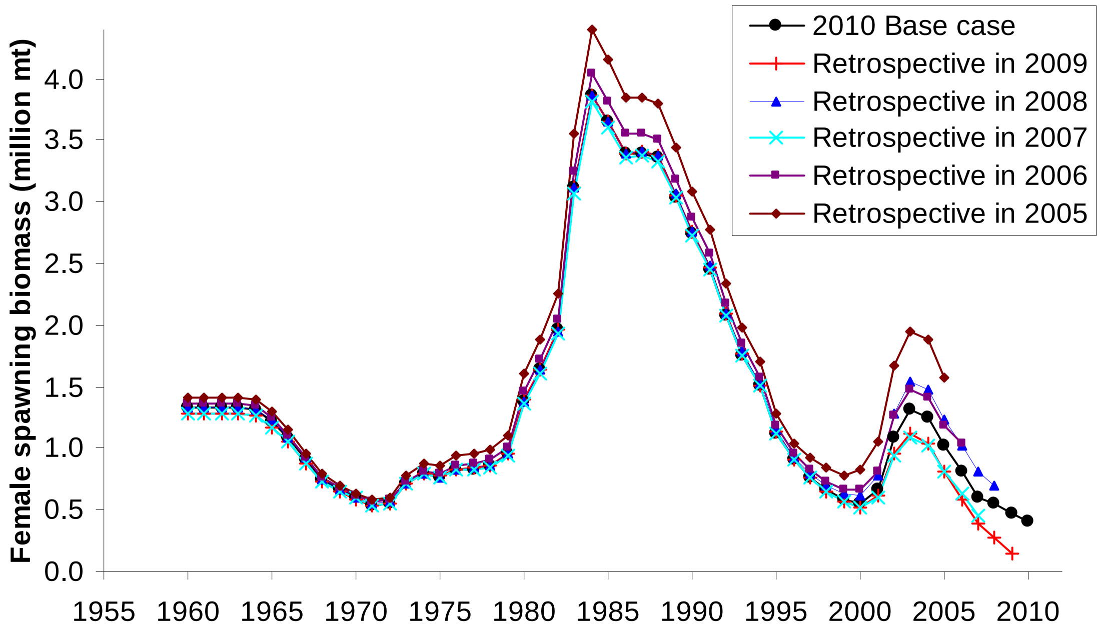


Figure 73. Retrospective pattern over the terminal years 2009 to 2005 as data from each terminal year are sequentially removed from the model.

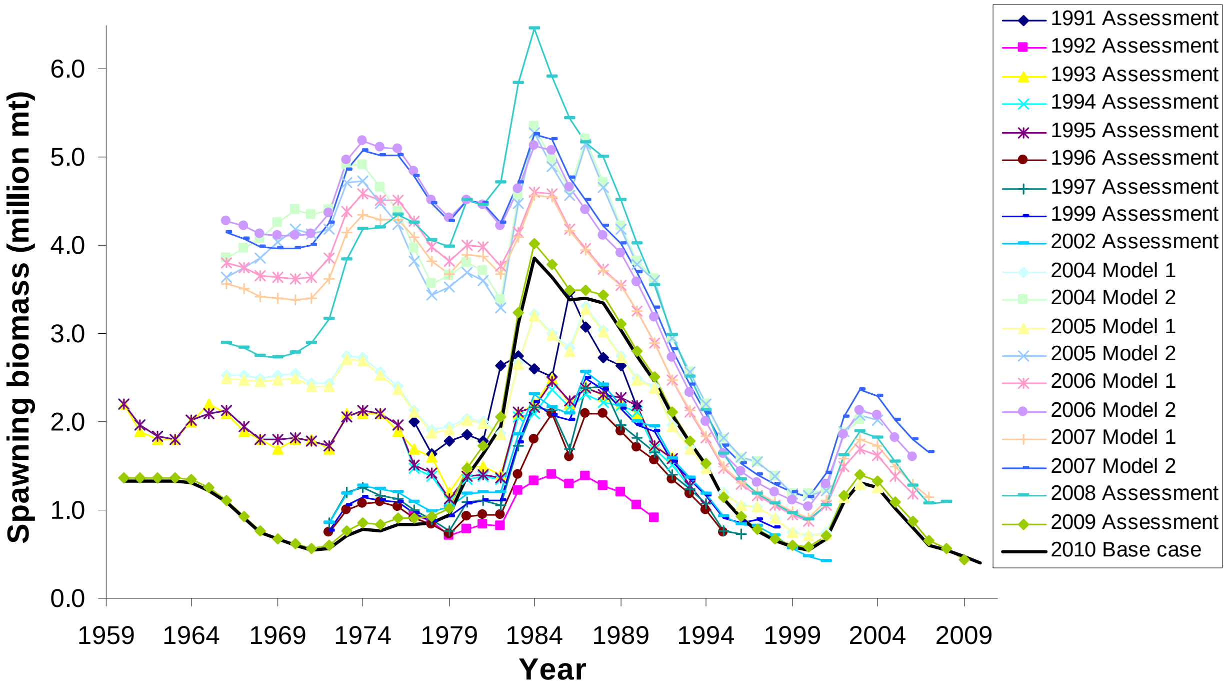


Figure 74. Retrospective comparing 2010 model results with previous stock assessments since 1991 (updates in 1998, 2000, 2001, 2003 are not included).

8. Appendix A. List of all estimated parameters

Parameter	Value
NatM_p_2_Fem_GP_1	0.62
L_at_Amax_Fem_GP_1	53.21
VonBert_K_Fem_GP_1	0.30
L_at_Amax_Fem_GP_1_BLK1mult_1984	-0.05
VonBert_K_Fem_GP_1_BLK2mult_1980	-0.13
VonBert_K_Fem_GP_1_BLK2mult_1999	0.19
SR_R0	14.49
SR_steep	0.88
SR_sigmaR	1.29
Main_RecrDev_1962	-2.19
Main_RecrDev_1963	-0.61
Main_RecrDev_1964	-0.06
Main_RecrDev_1965	0.15
Main_RecrDev_1966	0.29
Main_RecrDev_1967	0.39
Main_RecrDev_1968	0.70
Main_RecrDev_1969	0.11
Main_RecrDev_1970	1.73
Main_RecrDev_1971	0.50
Main_RecrDev_1972	-0.44
Main_RecrDev_1973	1.68
Main_RecrDev_1974	-0.14
Main_RecrDev_1975	0.94
Main_RecrDev_1976	0.17
Main_RecrDev_1977	2.67
Main_RecrDev_1978	0.36
Main_RecrDev_1979	1.01
Main_RecrDev_1980	3.67
Main_RecrDev_1981	-2.23
Main_RecrDev_1982	-1.64
Main_RecrDev_1983	-0.43
Main_RecrDev_1984	2.99
Main_RecrDev_1985	-4.36
Main_RecrDev_1986	-0.80
Main_RecrDev_1987	1.80
Main_RecrDev_1988	0.94
Main_RecrDev_1989	-2.42
Main_RecrDev_1990	1.30
Main_RecrDev_1991	-0.09
Main_RecrDev_1992	-4.09
Main_RecrDev_1993	1.03
Main_RecrDev_1994	0.93
Main_RecrDev_1995	0.65
Main_RecrDev_1996	0.91
Main_RecrDev_1997	0.43

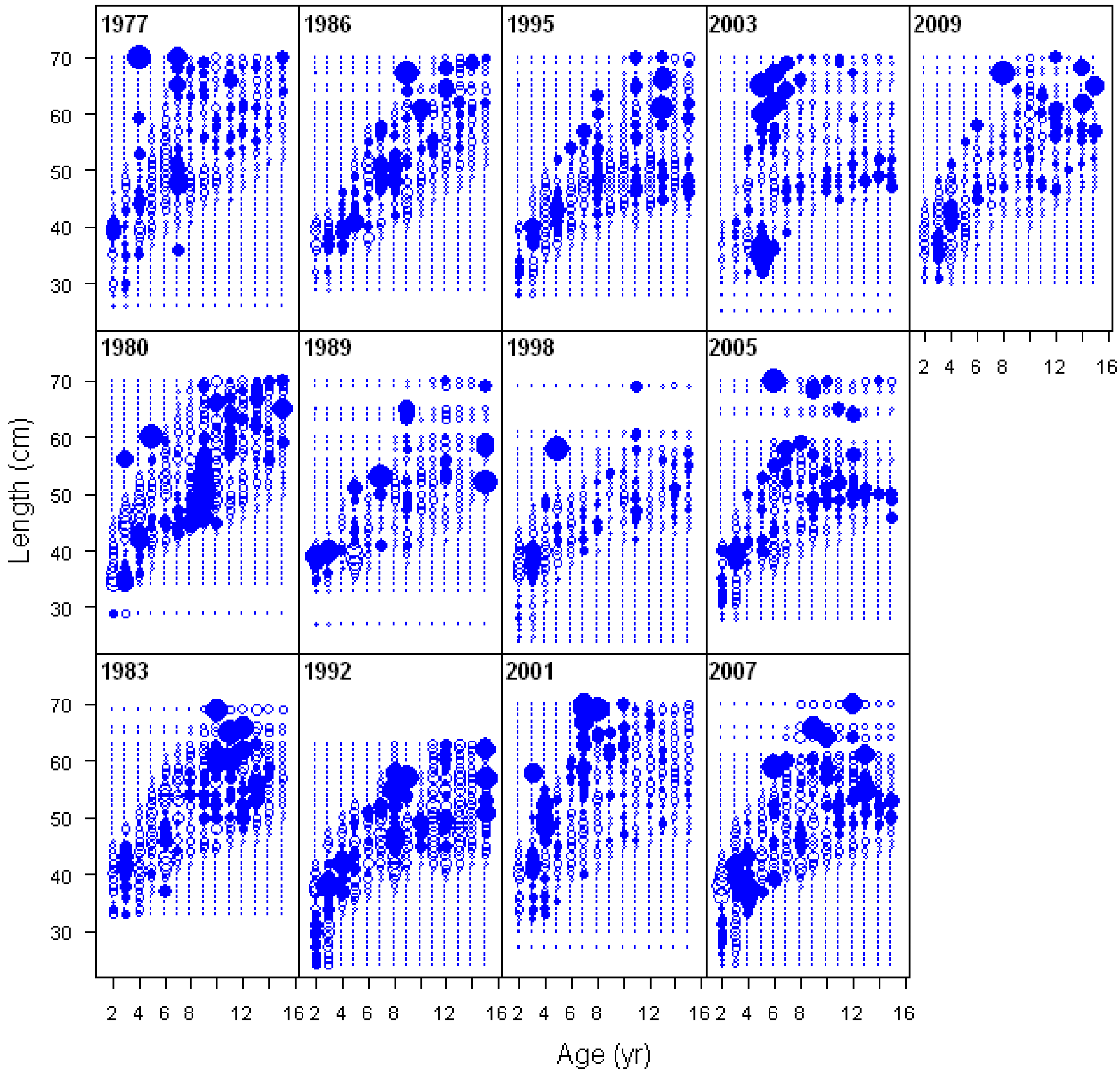
Main_RecrDev_1998	1.09
Main_RecrDev_1999	2.67
Main_RecrDev_2000	-0.63
Main_RecrDev_2001	0.11
Main_RecrDev_2002	-4.94
Main_RecrDev_2003	0.67
Main_RecrDev_2004	-1.43
Main_RecrDev_2005	1.23
Main_RecrDev_2006	0.46
Main_RecrDev_2007	-4.41
Main_RecrDev_2008	-0.68
Late_RecrDev_2009	0.00
ForeRecr_2010	0.00
ForeRecr_2011	0.00
ForeRecr_2012	0.00
Q_base_3_Acoustic_Survey	-0.06
AgeSel_1P_1_US_Fishery	10.93
AgeSel_1P_3_US_Fishery	-0.60
AgeSel_1P_6_US_Fishery	-2.21
AgeSel_2P_1_CAN_Fishery	13.06
AgeSel_2P_3_CAN_Fishery	2.05
AgeSel_2P_6_CAN_Fishery	-0.33
AgeSel_3P_1_Acoustic_Survey	11.03
AgeSel_3P_3_Acoustic_Survey	4.16
AgeSel_3P_6_Acoustic_Survey	-0.16
AgeSel_1P_1_US_Fishery_BLK3add_1981	0.00
AgeSel_1P_1_US_Fishery_BLK3add_1985	0.46
AgeSel_1P_1_US_Fishery_BLK3add_1989	-7.91
AgeSel_1P_1_US_Fishery_BLK3add_1993	-3.17
AgeSel_1P_1_US_Fishery_BLK3add_1997	-0.92
AgeSel_1P_1_US_Fishery_BLK3add_2001	-7.63
AgeSel_1P_1_US_Fishery_BLK3add_2005	-3.25
AgeSel_1P_3_US_Fishery_BLK4add_1960	4.17
AgeSel_1P_3_US_Fishery_BLK4add_1981	3.84
AgeSel_1P_3_US_Fishery_BLK4add_1985	4.85
AgeSel_1P_3_US_Fishery_BLK4add_1993	3.86
AgeSel_1P_3_US_Fishery_BLK4add_1997	3.89
AgeSel_1P_3_US_Fishery_BLK4add_2001	0.51
AgeSel_1P_3_US_Fishery_BLK4add_2005	3.92
AgeSel_1P_6_US_Fishery_BLK5add_1984	3.20
AgeSel_2P_1_CAN_Fishery_BLK6add_1981	-1.47
AgeSel_2P_1_CAN_Fishery_BLK6add_1985	-4.67
AgeSel_2P_1_CAN_Fishery_BLK6add_1989	-5.00
AgeSel_2P_1_CAN_Fishery_BLK6add_1993	-4.80
AgeSel_2P_1_CAN_Fishery_BLK6add_2001	-8.26
AgeSel_2P_1_CAN_Fishery_BLK6add_2005	-2.77
AgeSel_2P_3_CAN_Fishery_BLK7add_1960	0.70
AgeSel_2P_3_CAN_Fishery_BLK7add_1989	1.03

AgeSel_2P_3_CAN_Fishery_BLK7add_2001	-1.99
AgeSel_2P_3_CAN_Fishery_BLK7add_2005	0.97

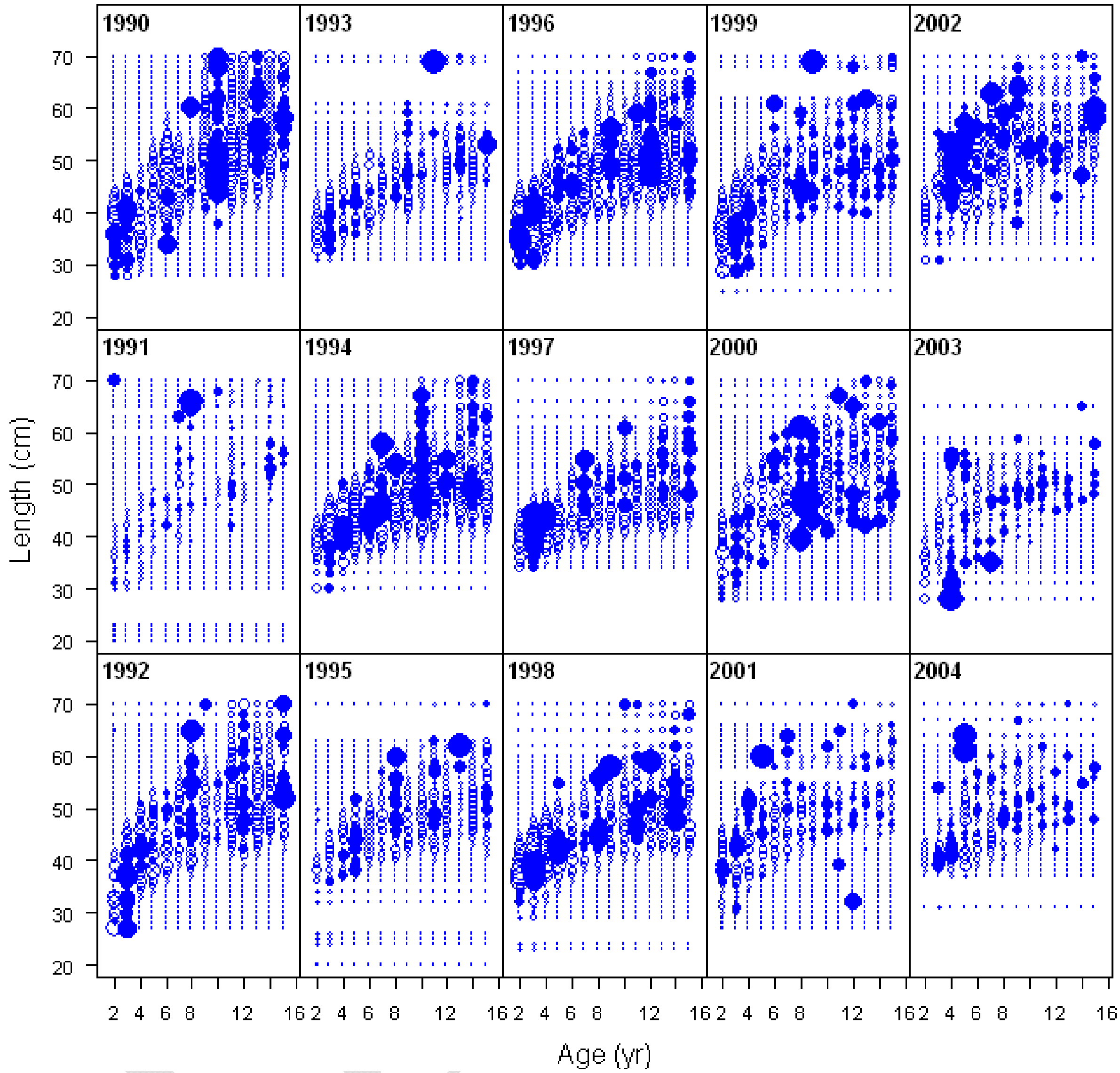
9. Appendix B. Residuals and diagnostics for conditional age-at-length data

The following figures are intended to provide a more detailed look at the fit to the conditional age-at-length data by year and fleet. Both Pearson residuals (scaled by fleet across all years) and summary plots of the predicted and observed average age at size and SD of age at size are presented.

Acoustic survey residuals:



U.S. fishery residuals:



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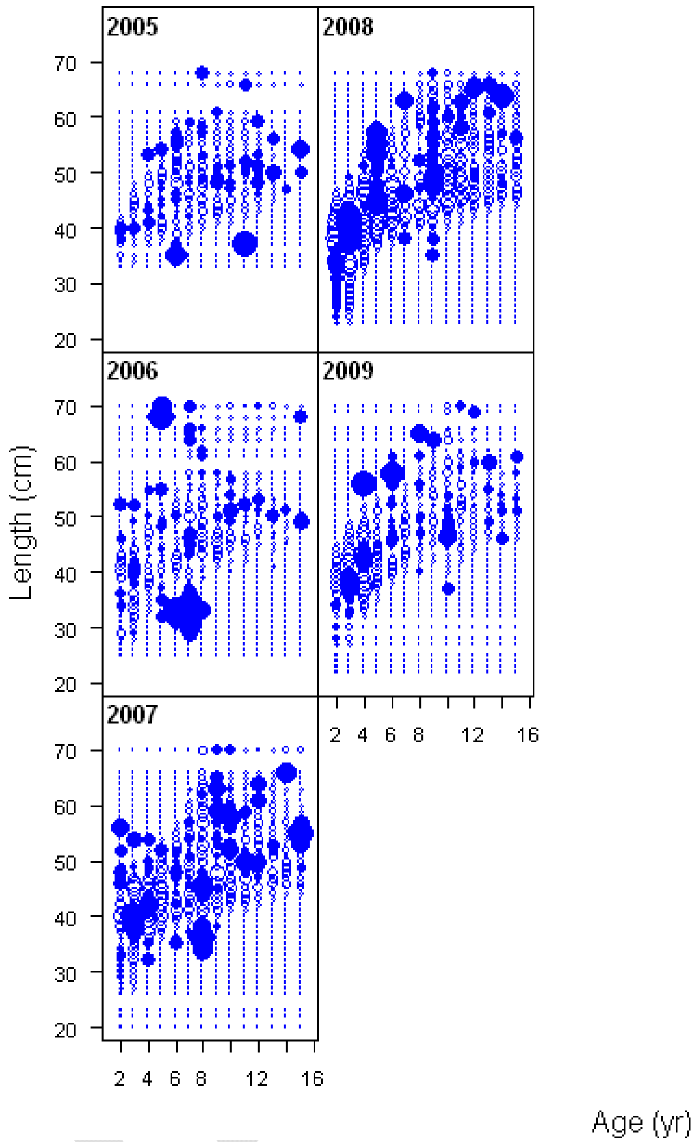
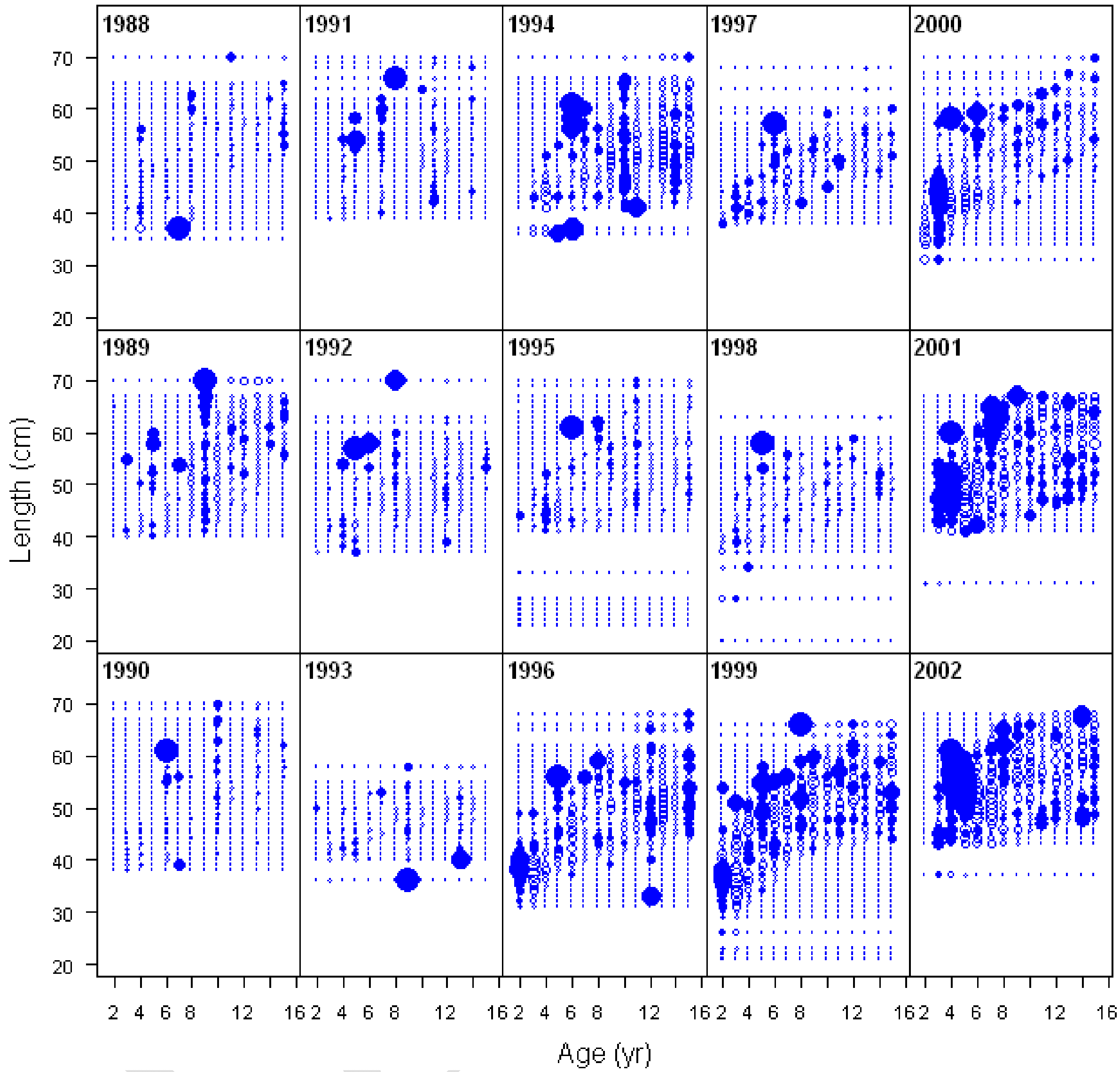
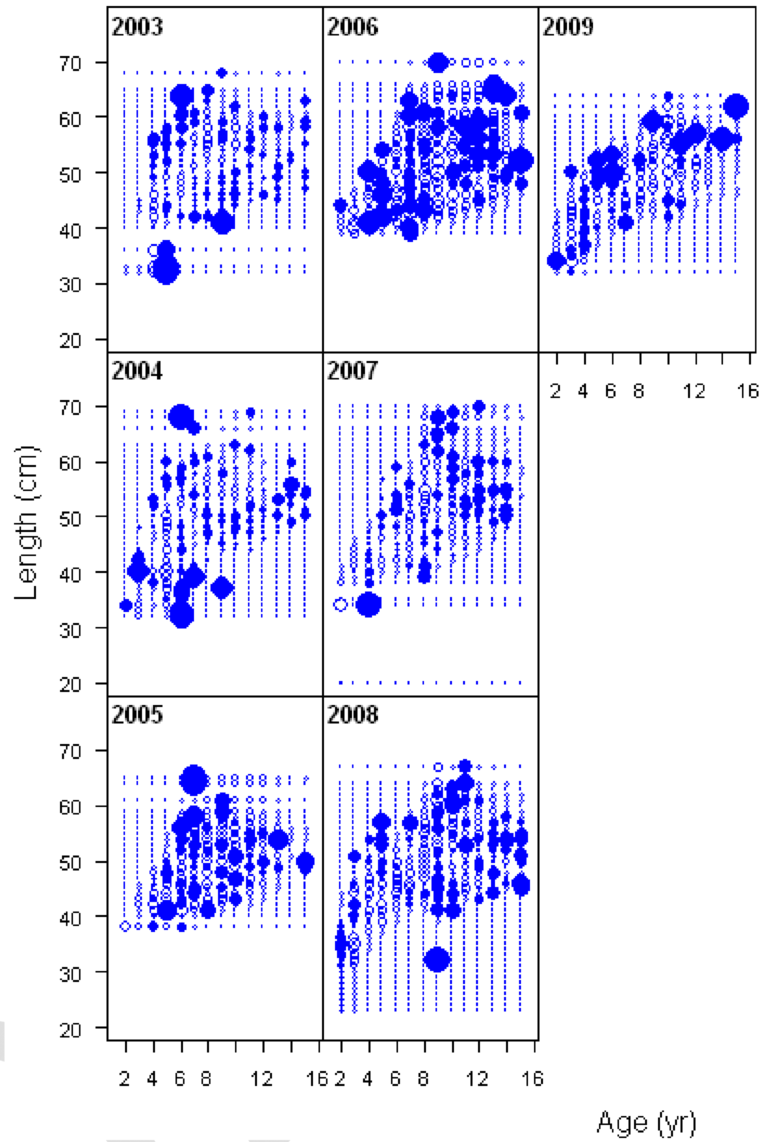


2005
2008
2006
2009
2007
Length (cm)
70
60
50
40
30
20
2
4
6
8
12
16
Age (yr)

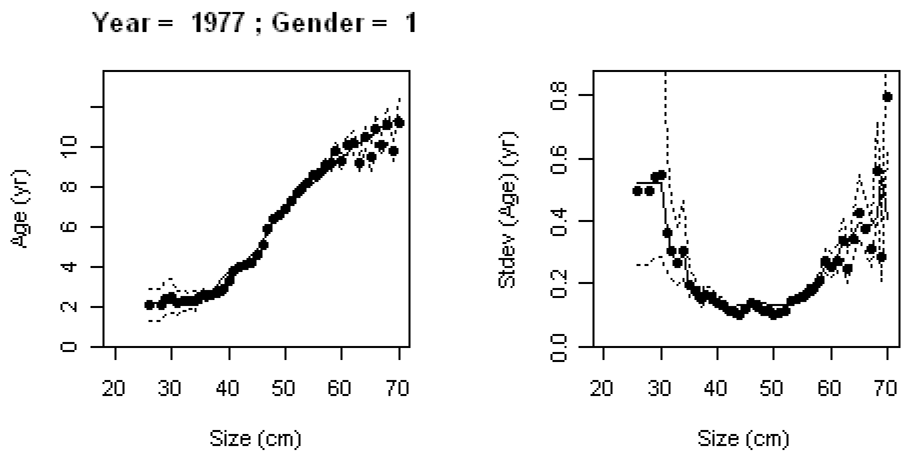
Canadian fishery residuals:

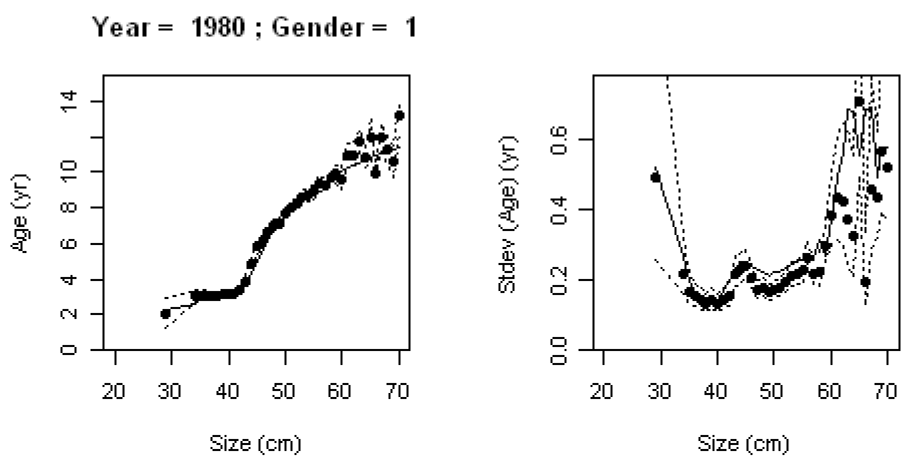


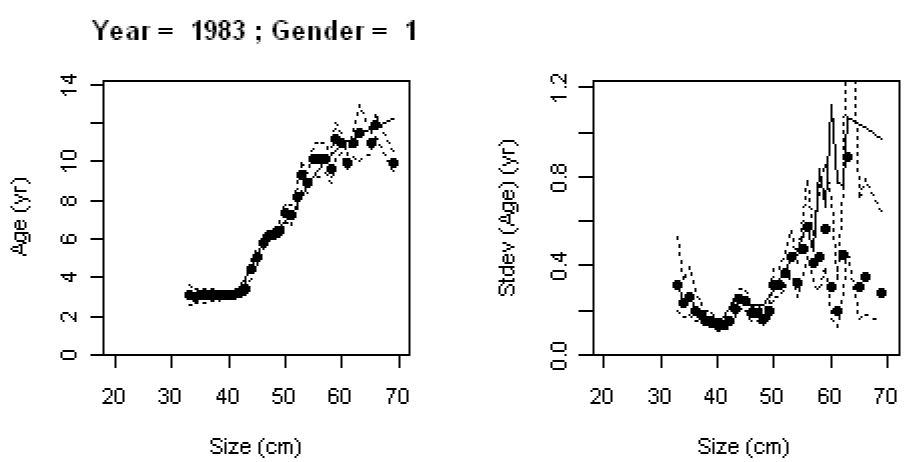
DRAFT

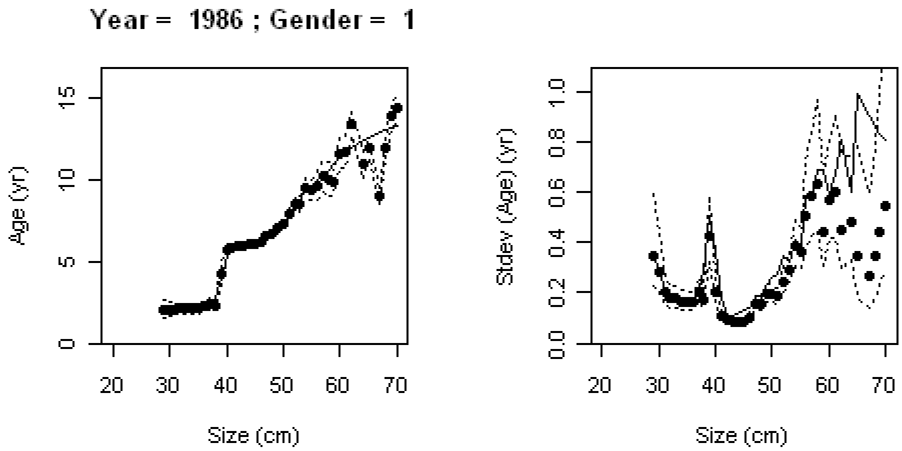

2003
2006
2009
2004
2007
2005
2008
Length (cm)
Age (yr)
20
30
40
50
60
70
2
4
6
8
12
16

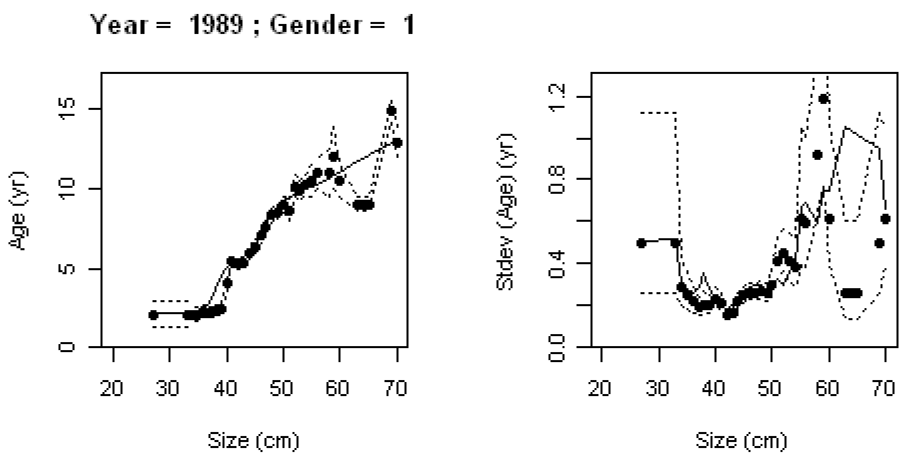
Acoustic survey summary plots:

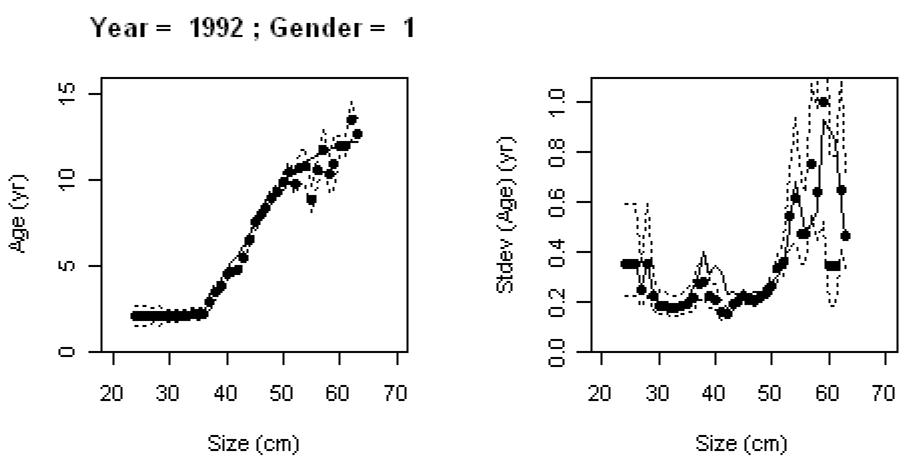




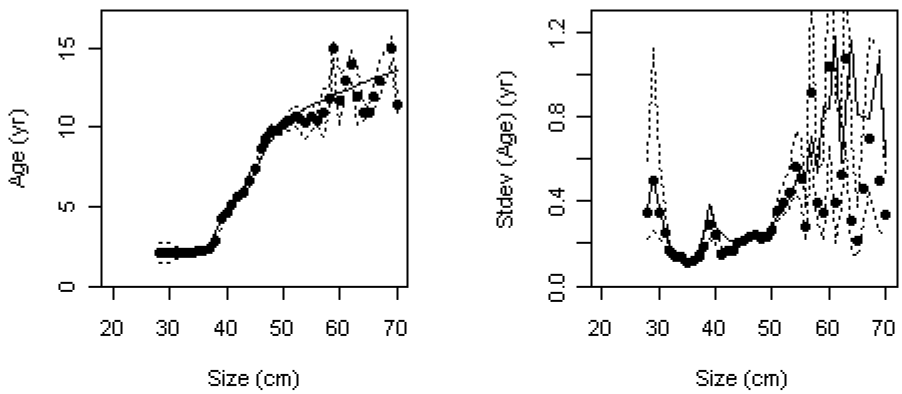



Year = 1986 ; Gender = 1
Age (yr)
Size (cm)
Stdev (Age) (yr)
Size (cm)

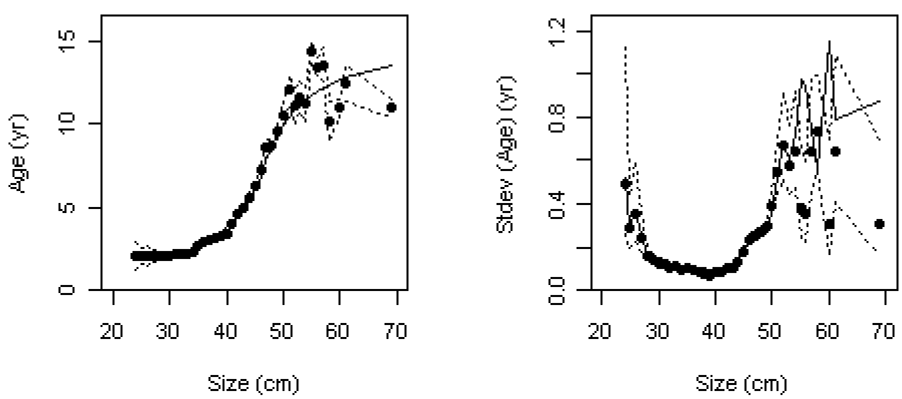

Year = 1989 ; Gender = 1
Age (yr)
Size (cm)
Stdev (Age) (yr)
Size (cm)


Year = 1992 ; Gender = 1
Age (yr)
Size (cm)
Stdev (Age) (yr)
Size (cm)

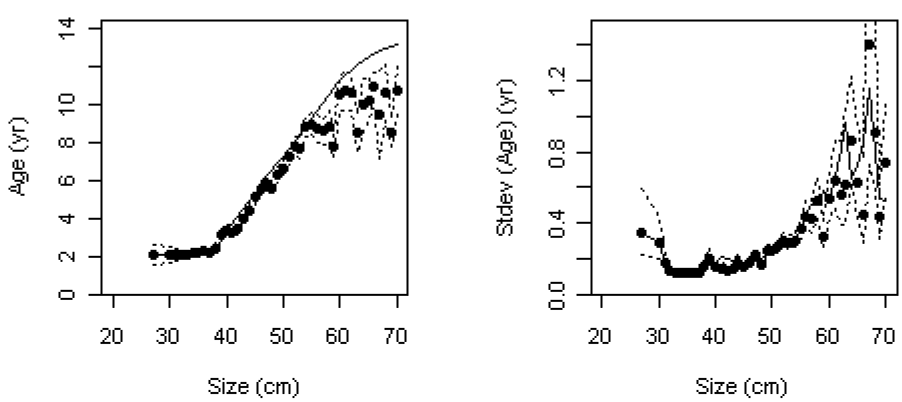
Year = 1995 ; Gender = 1



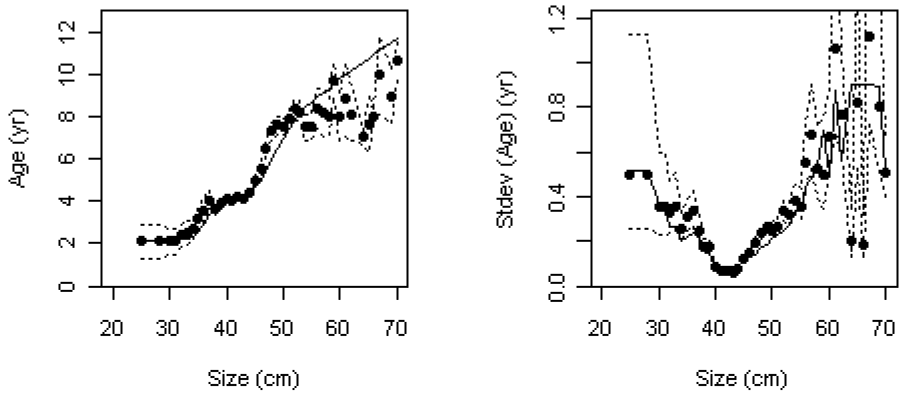
Year = 1998 ; Gender = 1



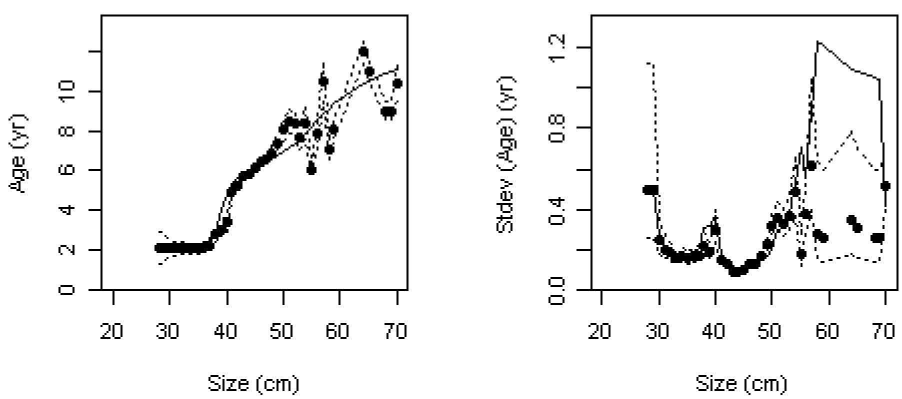
Year = 2001 ; Gender = 1



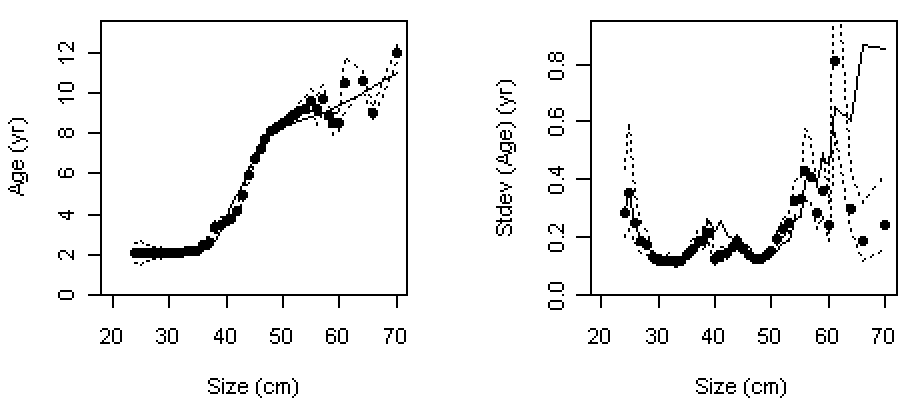
Year = 2003 ; Gender = 1

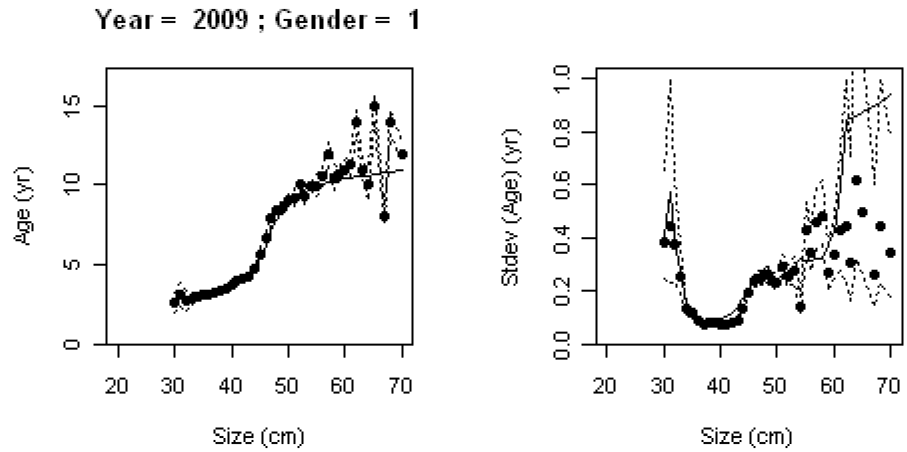


Year = 2005 ; Gender = 1

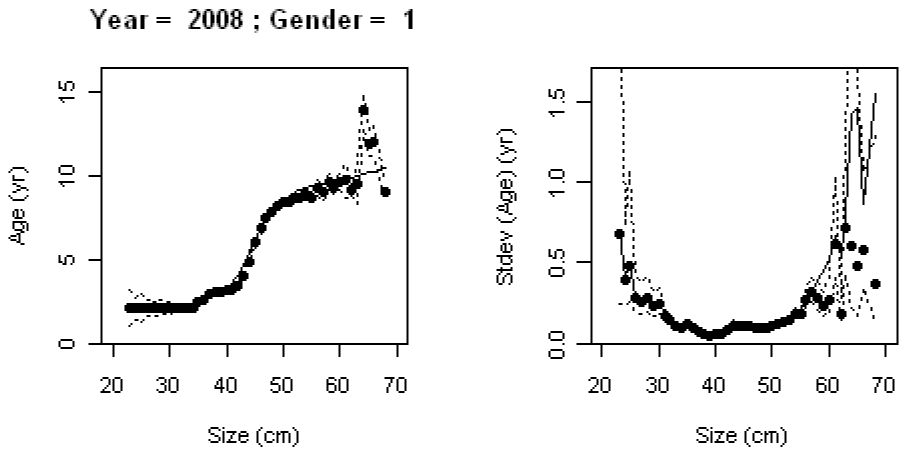


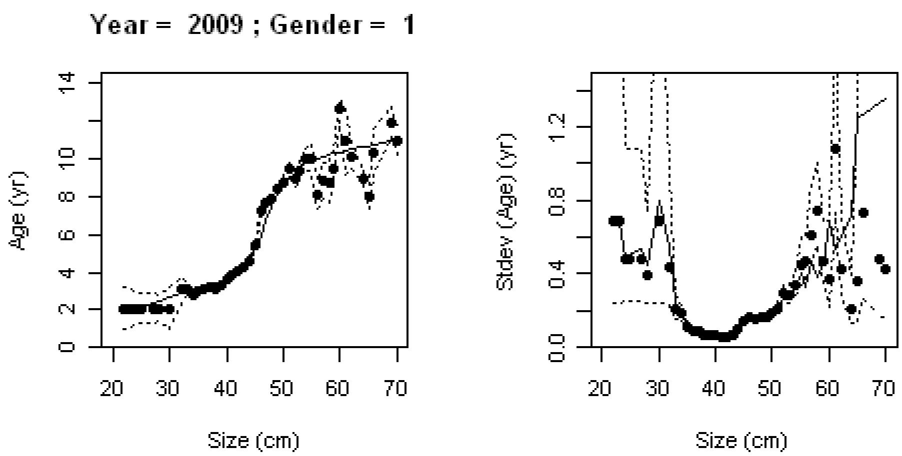
Year = 2007 ; Gender = 1

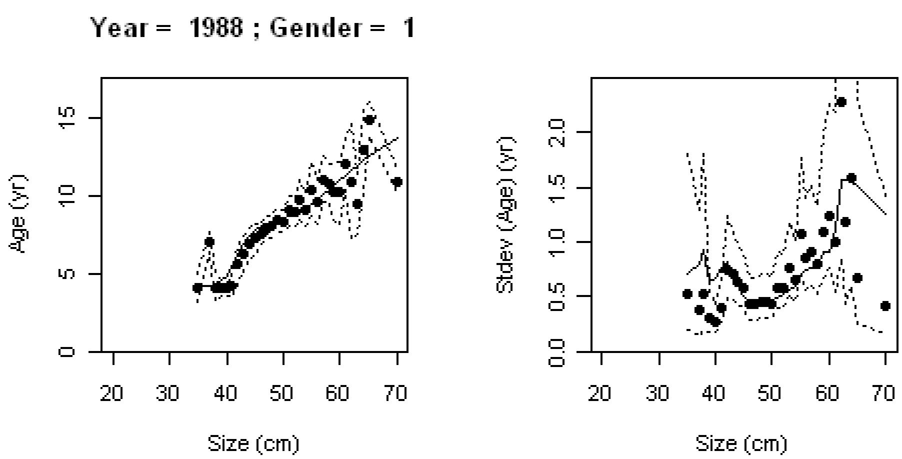


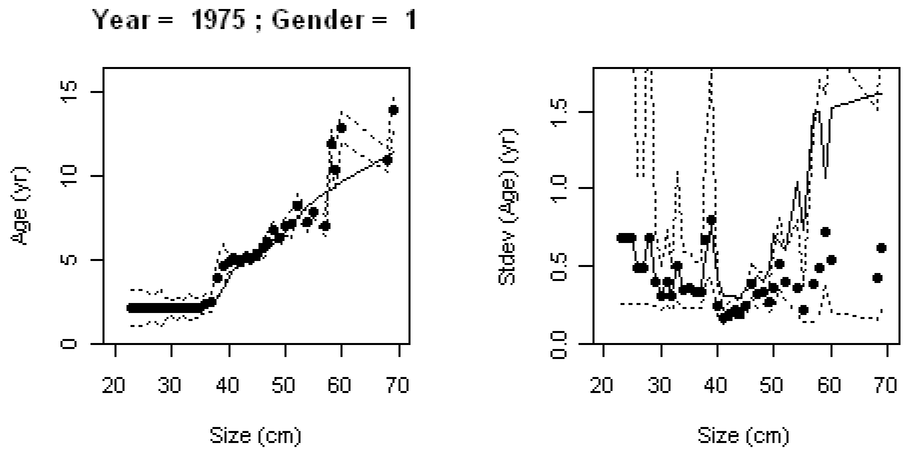

Year = 2009 ; Gender = 1
Age (yr)
Size (cm)
Stdev (Age) (yr)
Size (cm)

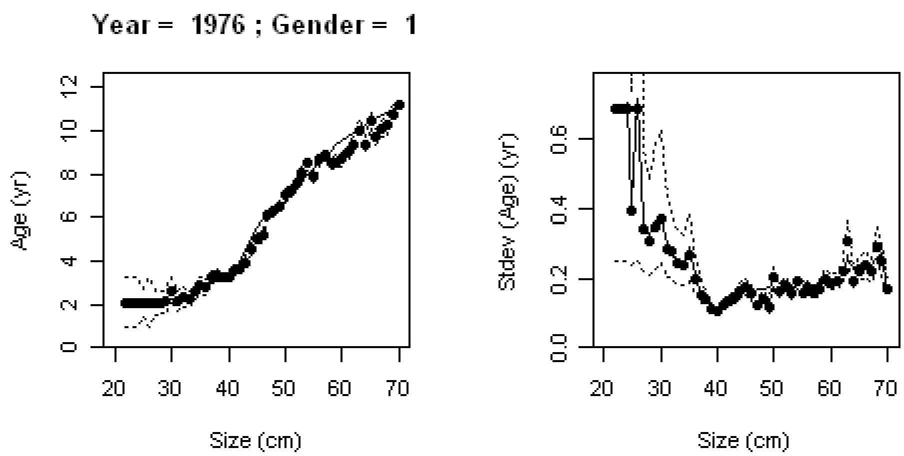
U.S. fishery summary plots:

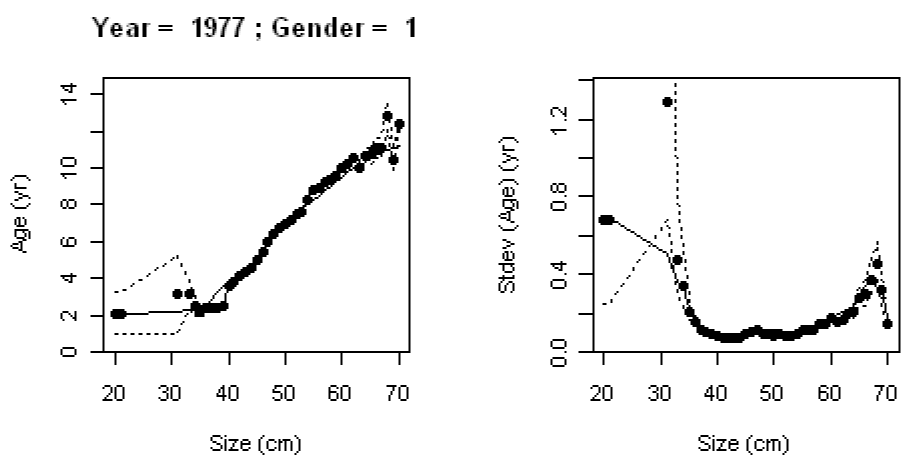

Year = 2008 ; Gender = 1
Age (yr)
Size (cm)
Stdev (Age) (yr)
Size (cm)

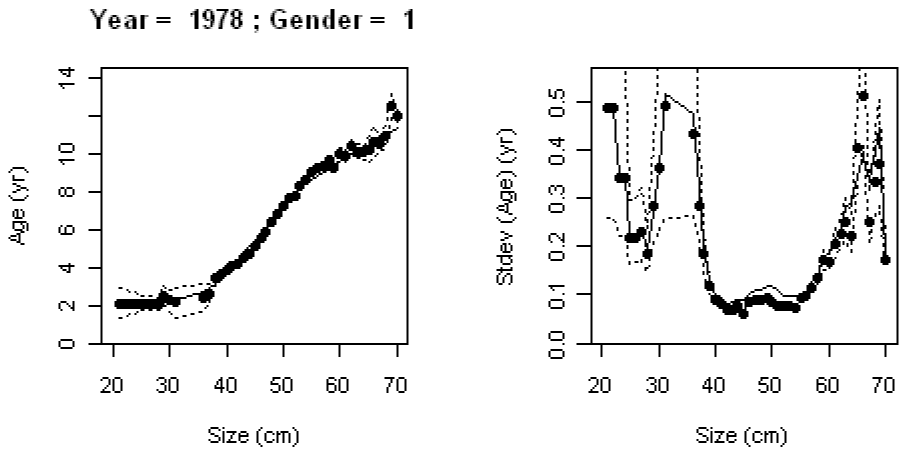

Year = 2009 ; Gender = 1
Age (yr)
Size (cm)
Stdev (Age) (yr)
Size (cm)

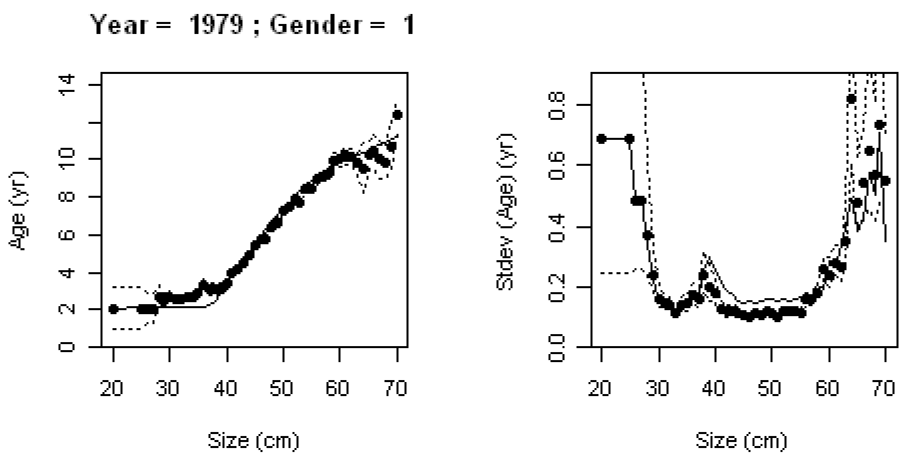

Year = 1988 ; Gender = 1
Age (yr)
Size (cm)
Stdev (Age) (yr)
Size (cm)

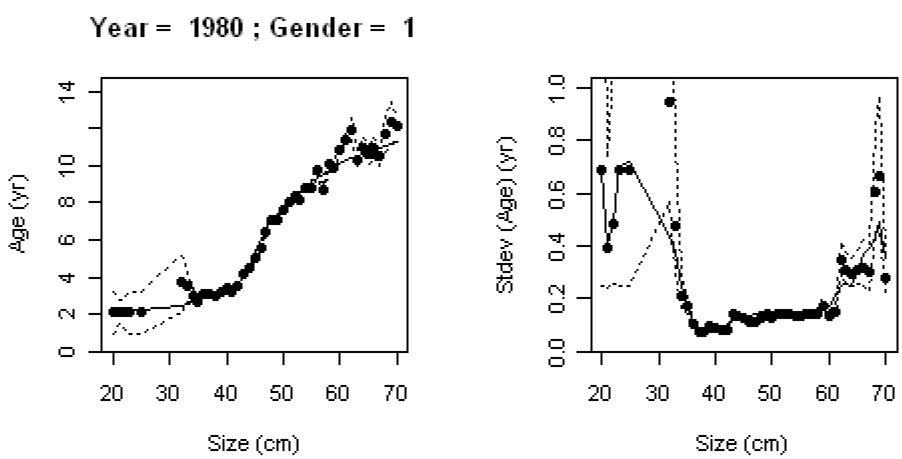

Year = 1975 ; Gender = 1
Age (yr)
Size (cm)
Stdev (Age) (yr)
Size (cm)

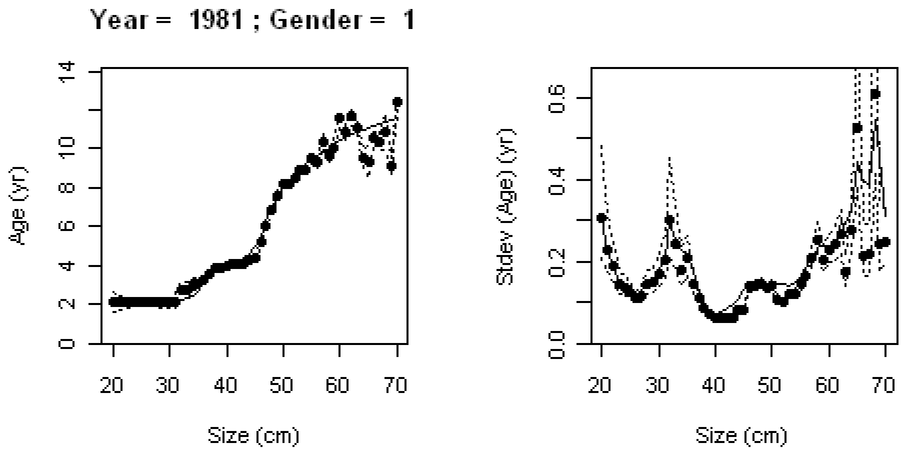

Year = 1976 ; Gender = 1
Age (yr)
Size (cm)
Stdev (Age) (yr)
Size (cm)

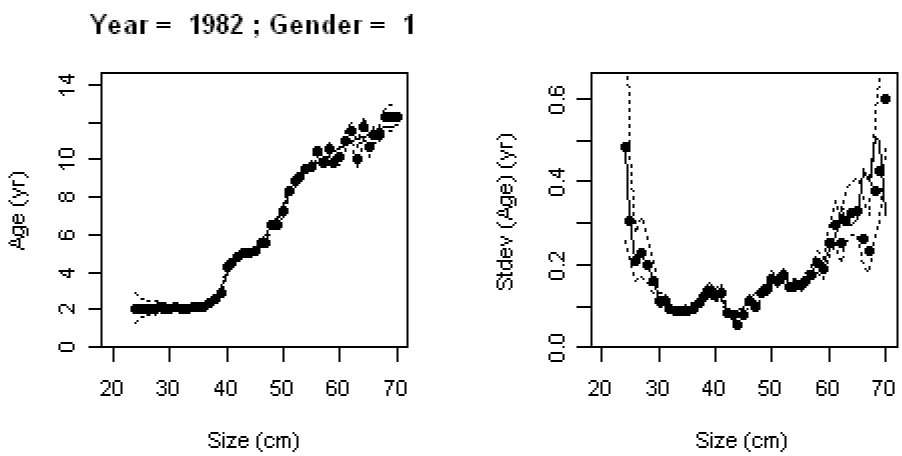

Year = 1977 ; Gender = 1
Age (yr)
Size (cm)
Stdev (Age) (yr)
Size (cm)

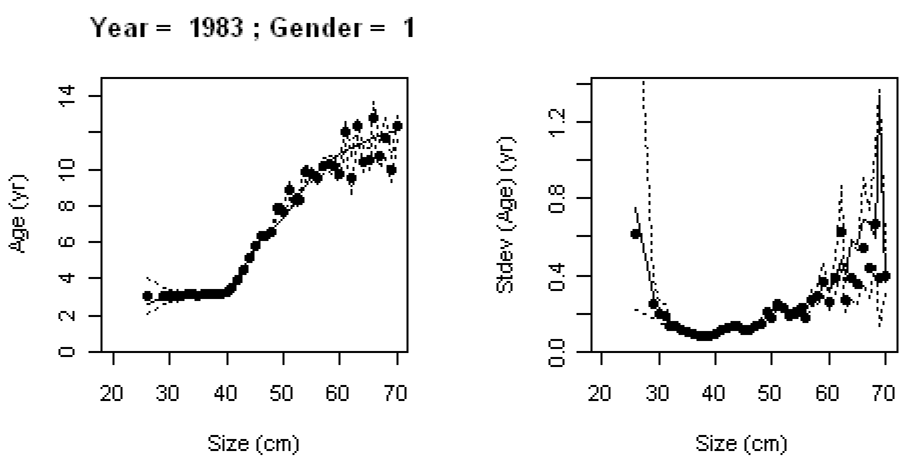

Year = 1978 ; Gender = 1
Age (yr)
Size (cm)
Stdev (Age) (yr)
Size (cm)

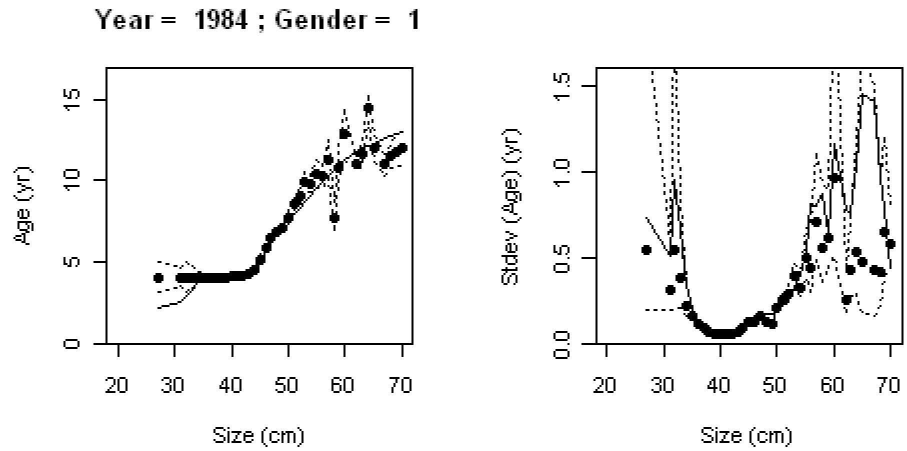

Year = 1979 ; Gender = 1
Age (yr)
Size (cm)
Stdev (Age) (yr)
Size (cm)

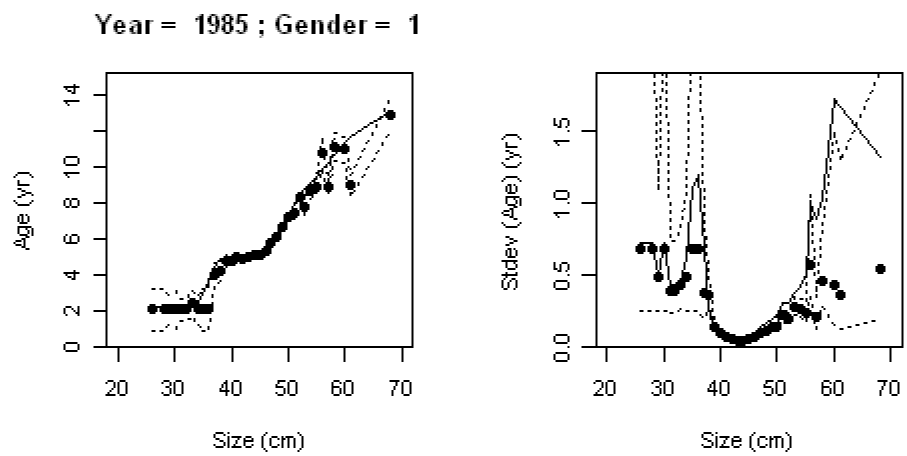

Year = 1980 ; Gender = 1
Age (yr)
Size (cm)
Stdev (Age) (yr)
Size (cm)

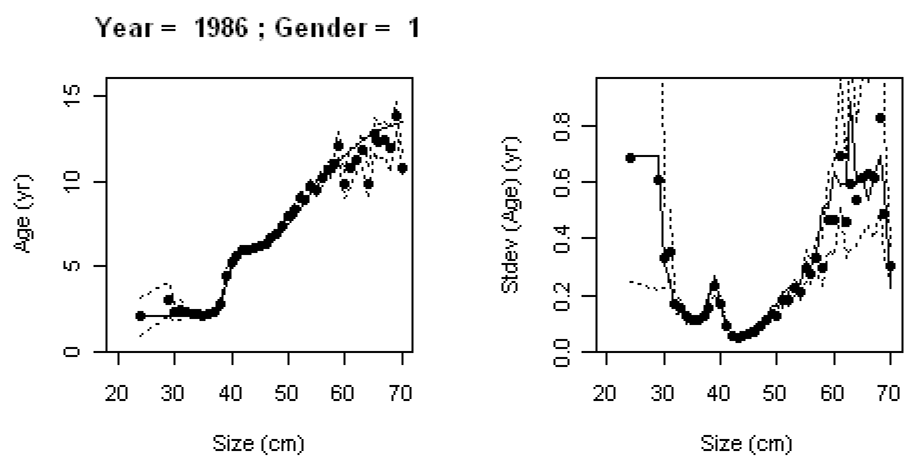

Year = 1981 ; Gender = 1
Age (yr)
Size (cm)
Stdev (Age) (yr)
Size (cm)

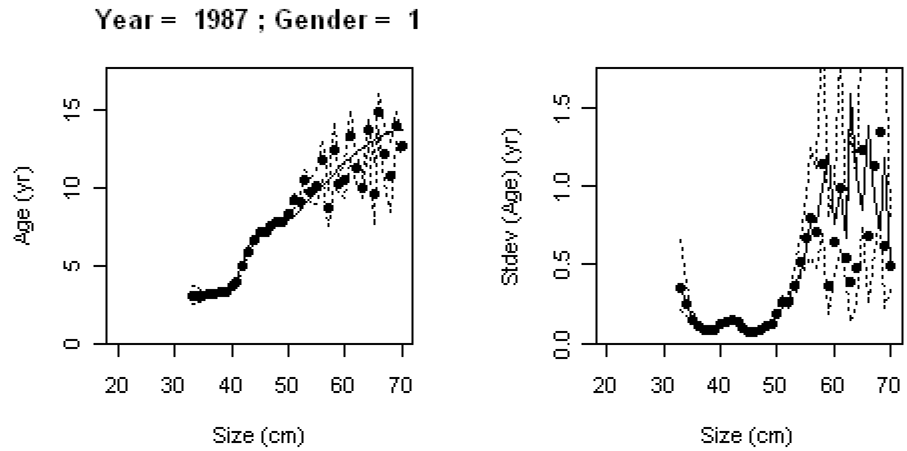

Year = 1982 ; Gender = 1
Age (yr)
Size (cm)
Stdev (Age) (yr)
Size (cm)

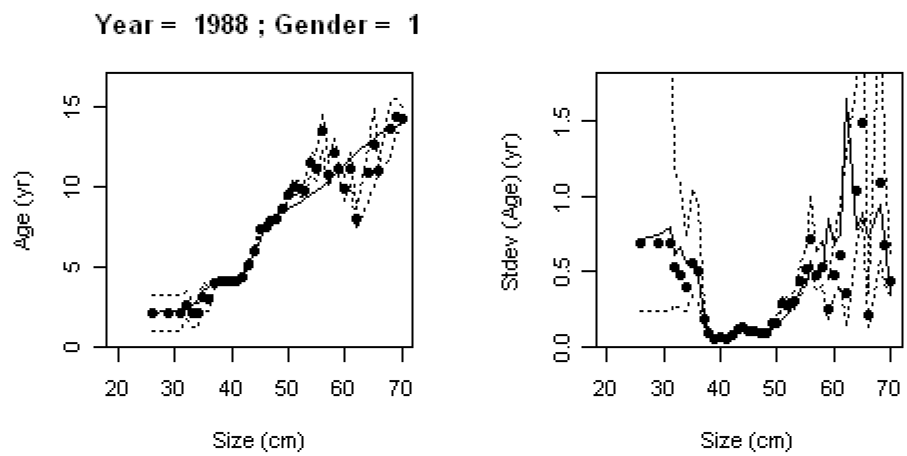

Year = 1983 ; Gender = 1
Age (yr)
Size (cm)
Stdev (Age) (yr)
Size (cm)

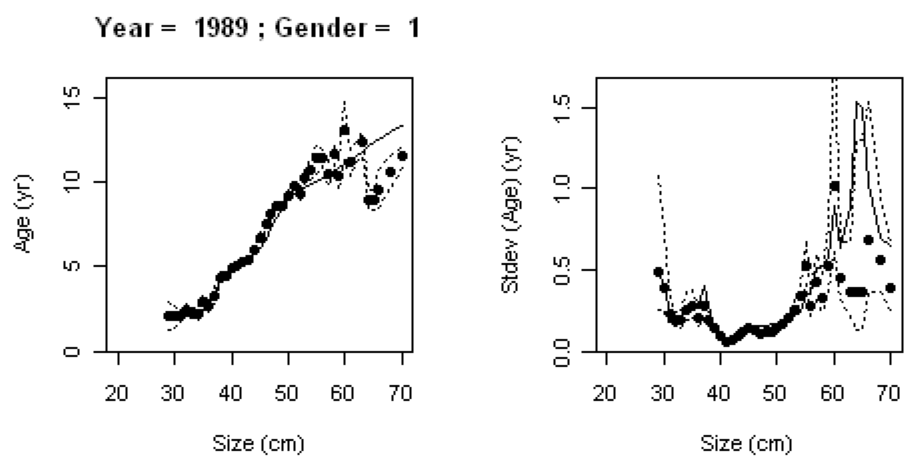

Year = 1984 ; Gender = 1
Age (yr)
Size (cm)
Stdev (Age) (yr)
Size (cm)


Year = 1985 ; Gender = 1
Age (yr)
Size (cm)
Stdev (Age) (yr)
Size (cm)

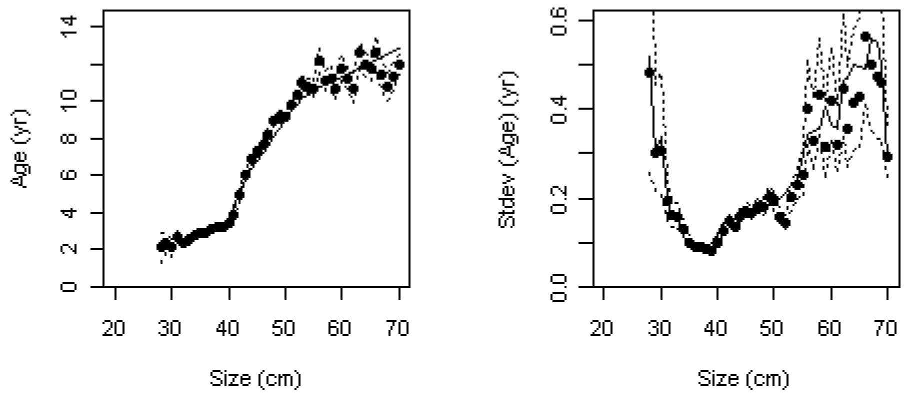

Year = 1986 ; Gender = 1
Age (yr)
Size (cm)
Stdev (Age) (yr)
Size (cm)


Year = 1987 ; Gender = 1
Age (yr)
Stdev (Age) (yr)
Size (cm)
Size (cm)

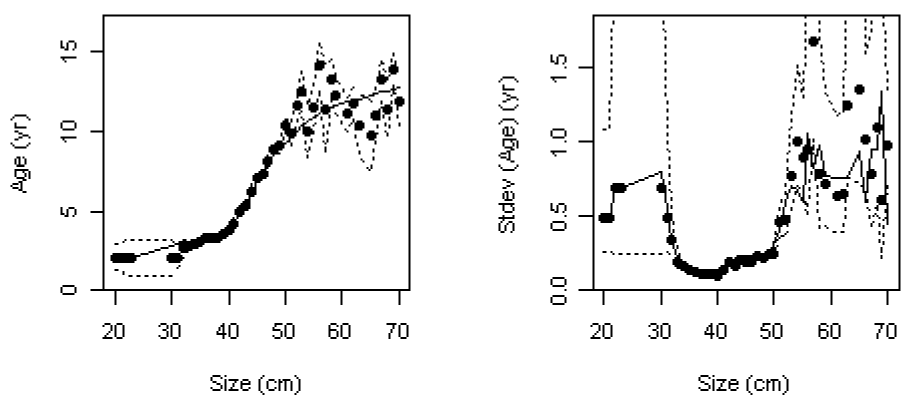

Year = 1988 ; Gender = 1
Age (yr)
Stdev (Age) (yr)
Size (cm)
Size (cm)


Year = 1989 ; Gender = 1
Age (yr)
Stdev (Age) (yr)
Size (cm)
Size (cm)

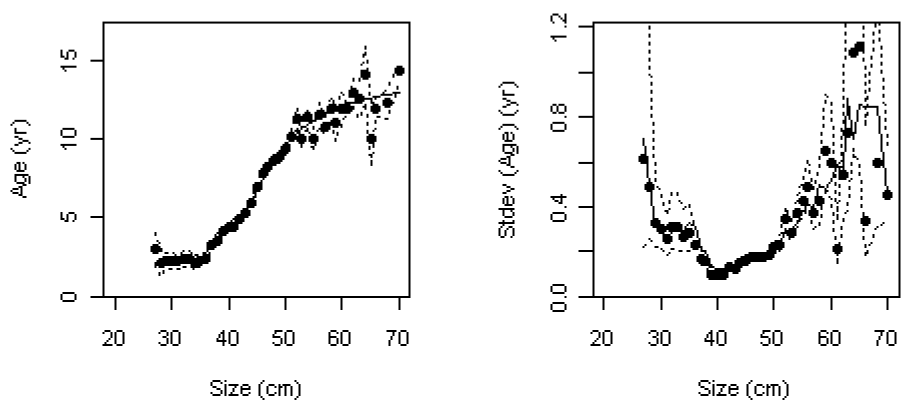
Year = 1990 ; Gender = 1

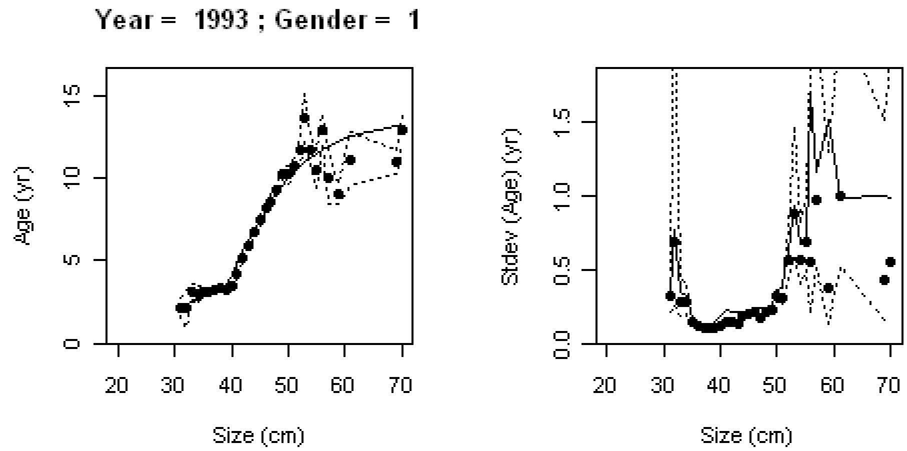


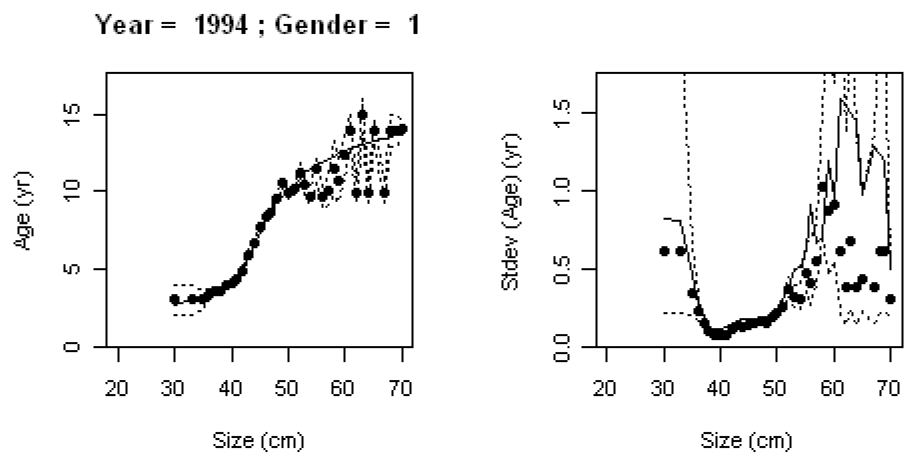
Year = 1991 ; Gender = 1

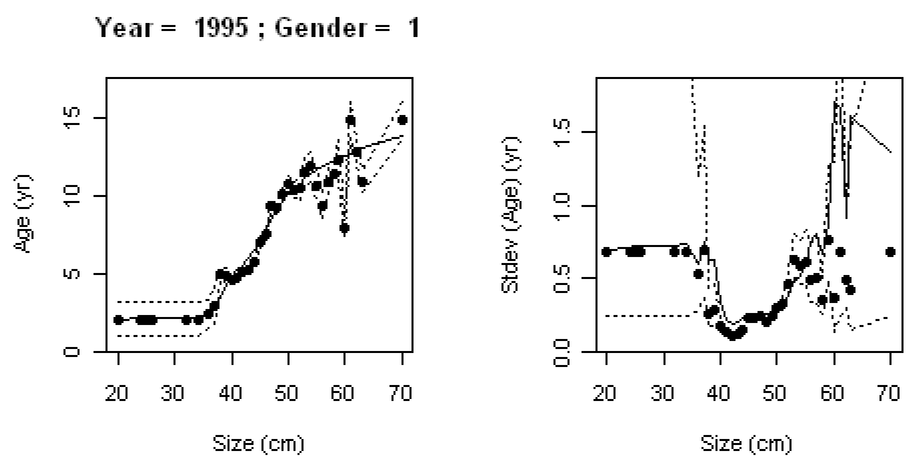


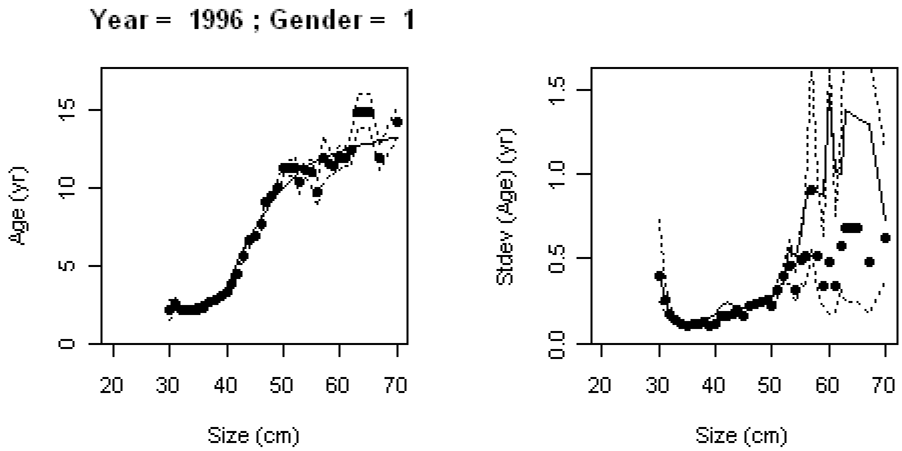
Year = 1992 ; Gender = 1

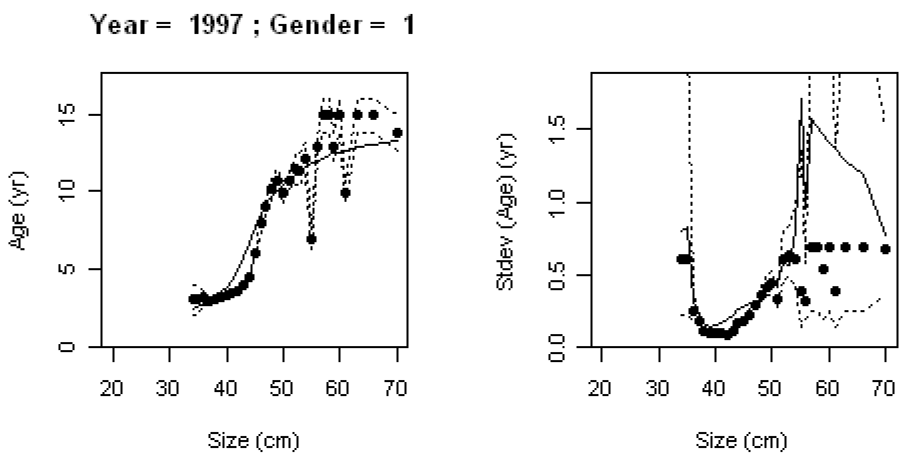


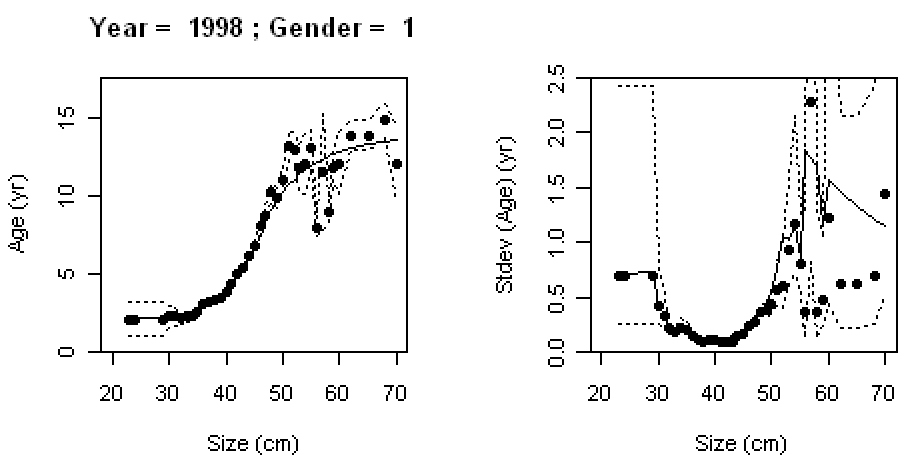

Year = 1993 ; Gender = 1
Age (yr)
Size (cm)
Stdev (Age) (yr)
Size (cm)


Year = 1994 ; Gender = 1
Age (yr)
Size (cm)
Stdev (Age) (yr)
Size (cm)

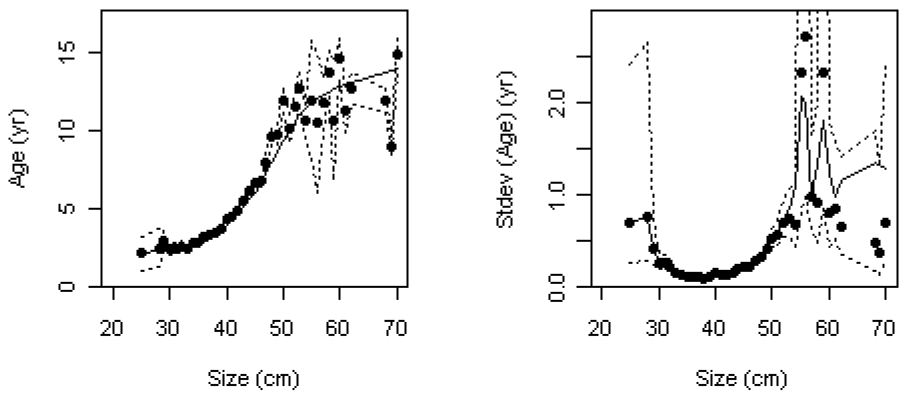

Year = 1995 ; Gender = 1
Age (yr)
Size (cm)
Stdev (Age) (yr)
Size (cm)


Year = 1996 ; Gender = 1
Age (yr)
Size (cm)
Stdev (Age) (yr)
Size (cm)

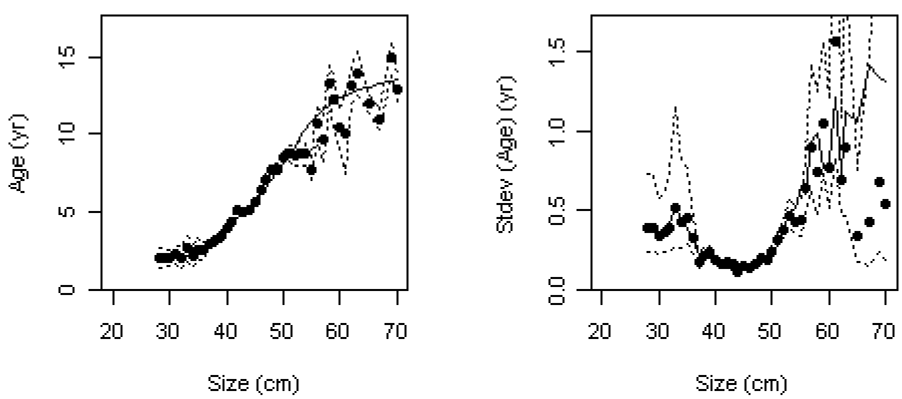

Year = 1997 ; Gender = 1
Age (yr)
Size (cm)
Stdev (Age) (yr)
Size (cm)


Year = 1998 ; Gender = 1
Age (yr)
Size (cm)
Stdev (Age) (yr)
Size (cm)

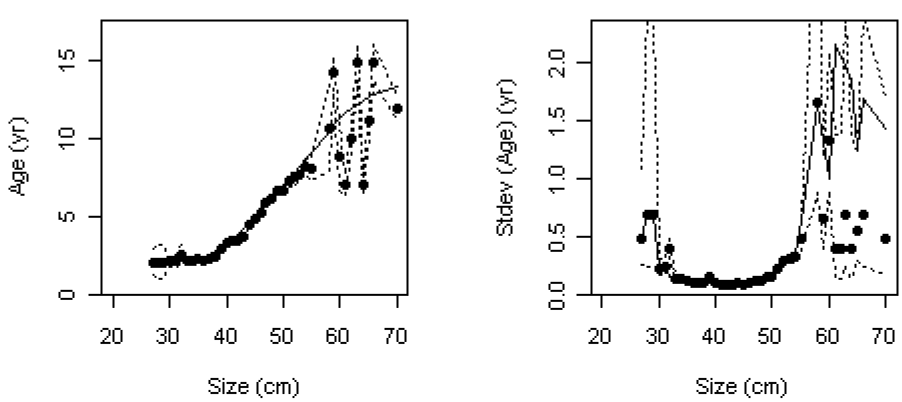
Year = 1999 ; Gender = 1

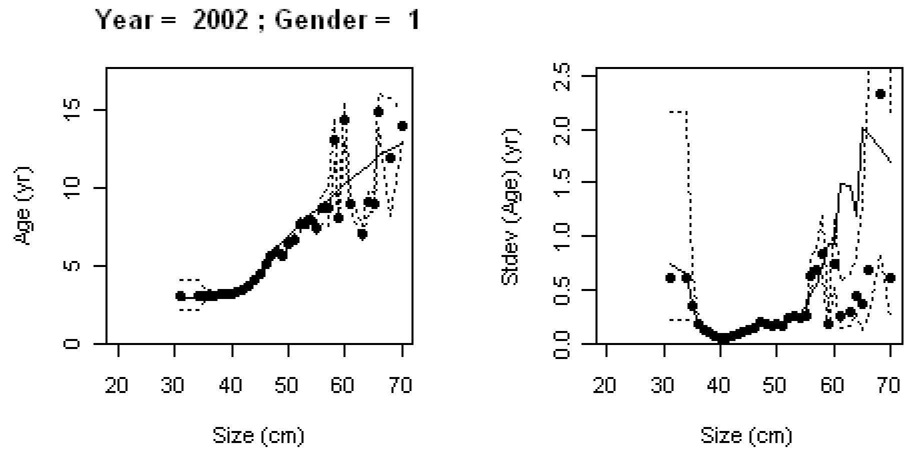


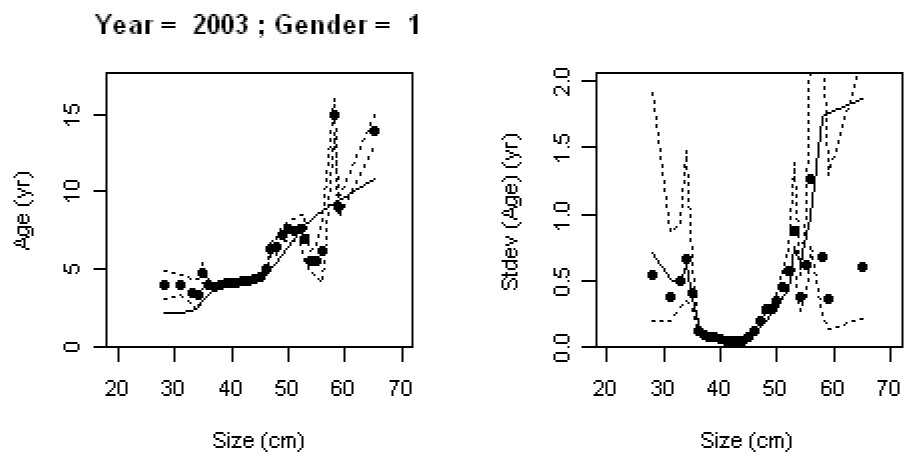
Year = 2000 ; Gender = 1

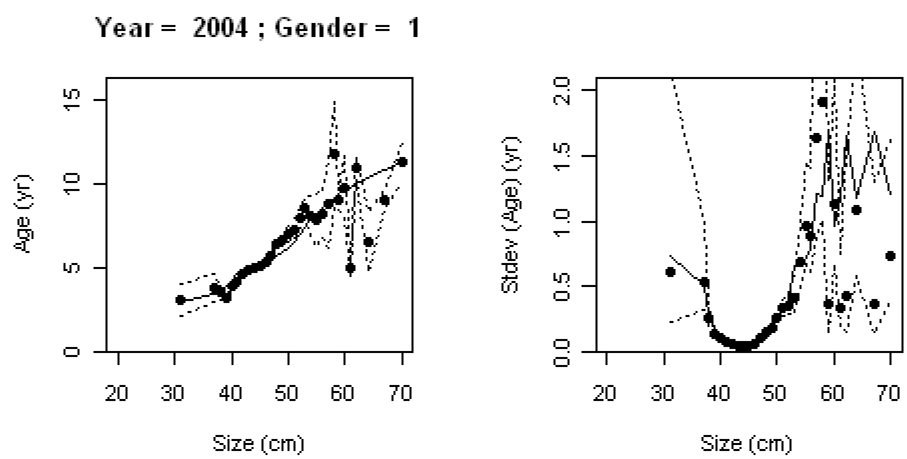


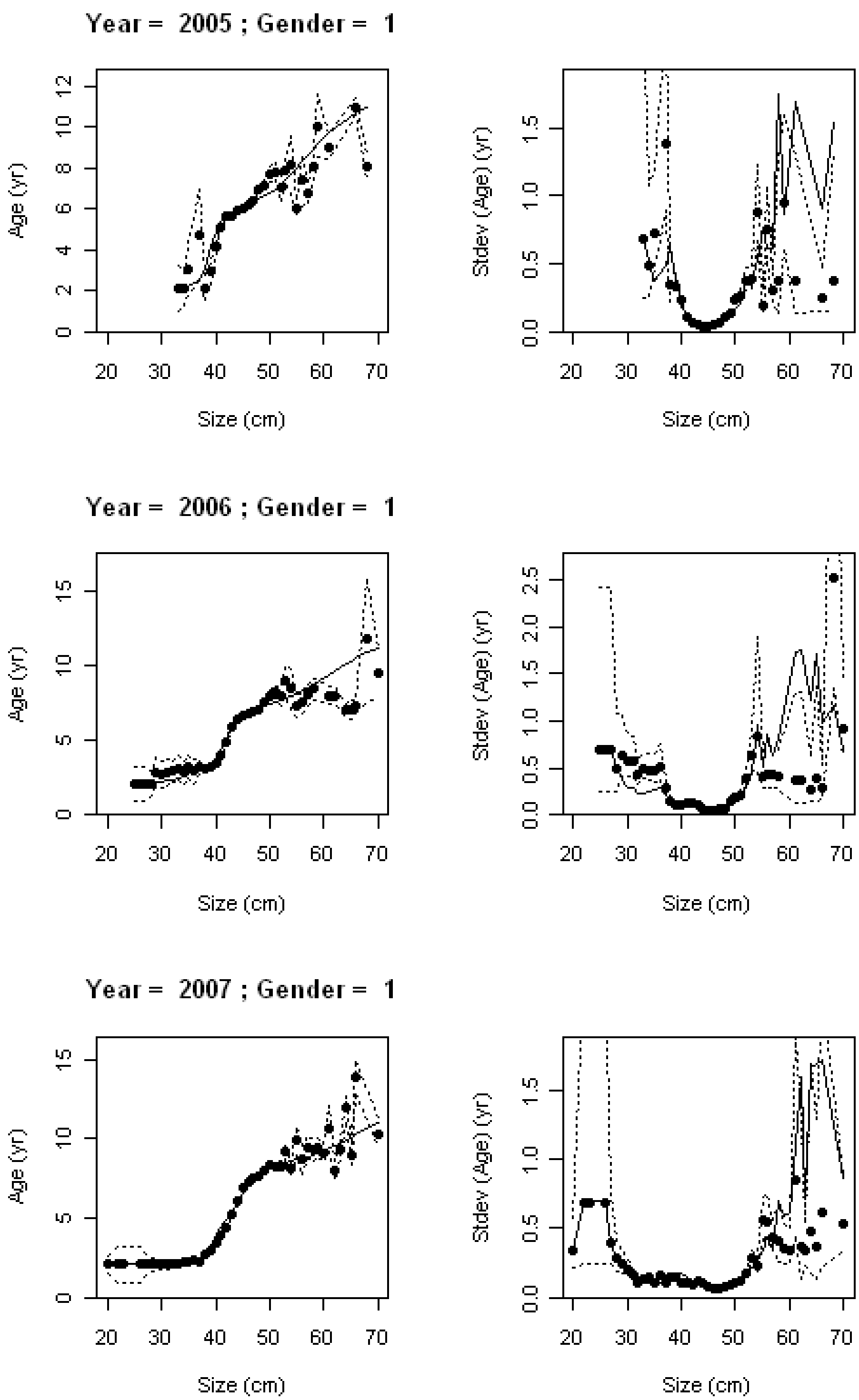
Year = 2001 ; Gender = 1



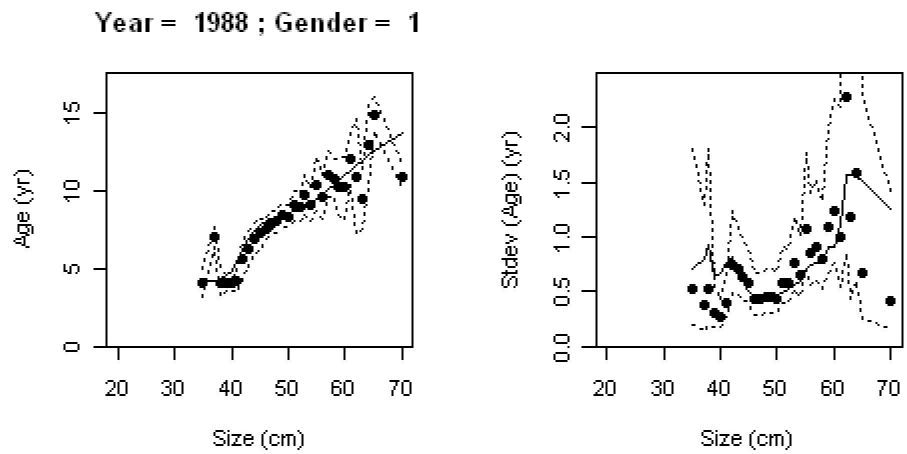

Year = 2002 ; Gender = 1
Age (yr)
Stdev (Age) (yr)
Size (cm)
Size (cm)

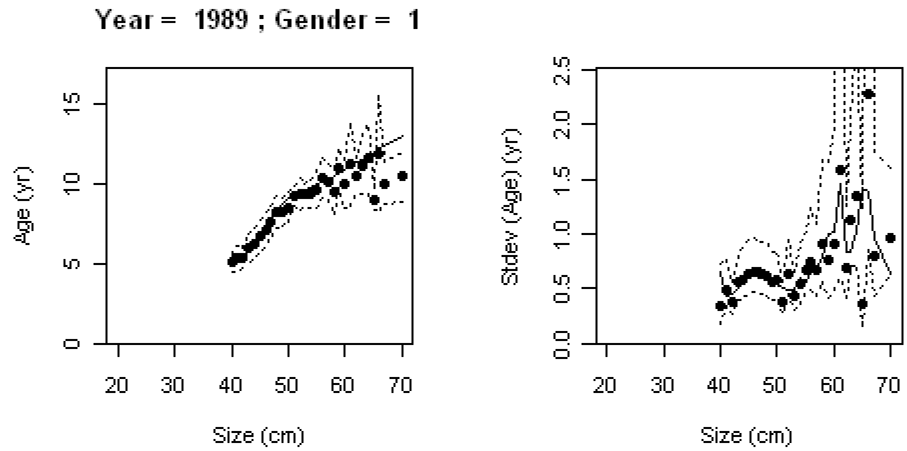

Year = 2003 ; Gender = 1
Age (yr)
Stdev (Age) (yr)
Size (cm)
Size (cm)

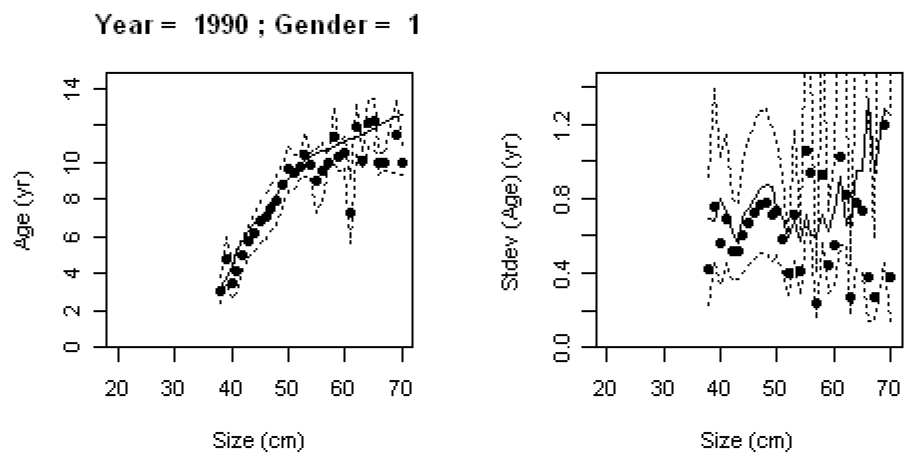

Year = 2004 ; Gender = 1
Age (yr)
Stdev (Age) (yr)
Size (cm)
Size (cm)

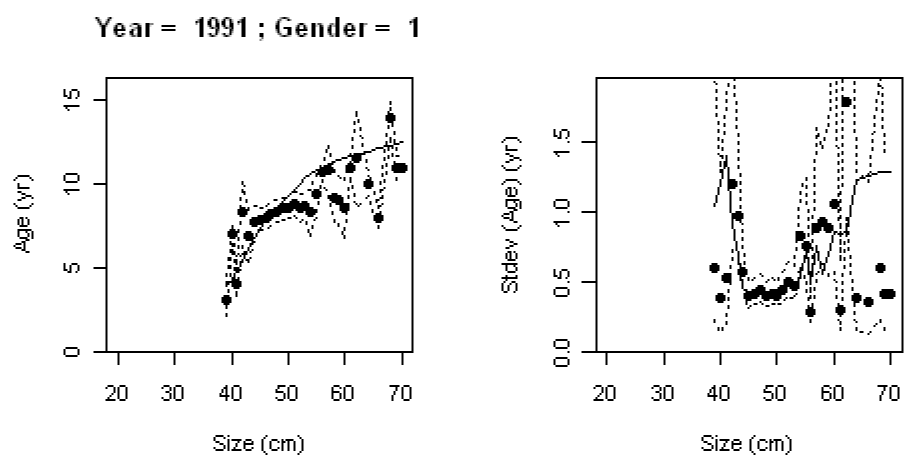

Year = 2005 ; Gender = 1
Age (yr)
Size (cm)
Stdev (Age) (yr)
Size (cm)
Year = 2006 ; Gender = 1
Age (yr)
Size (cm)
Stdev (Age) (yr)
Size (cm)
Year = 2007 ; Gender = 1
Age (yr)
Size (cm)
Stdev (Age) (yr)
Size (cm)

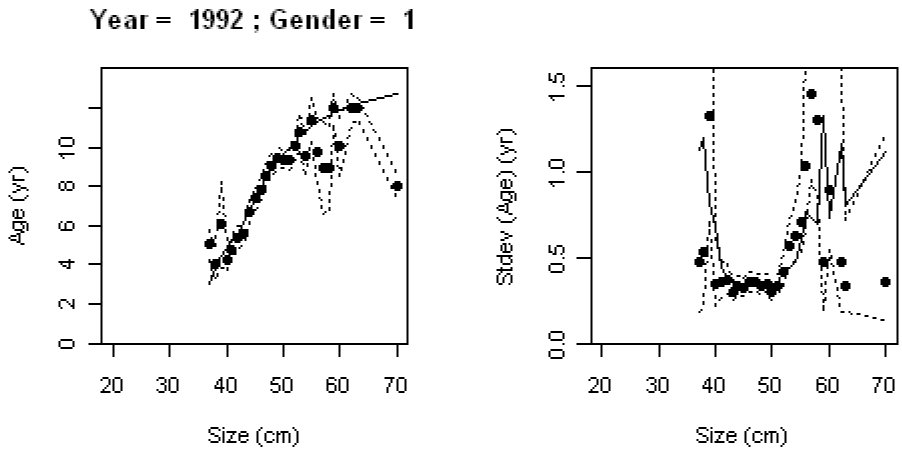
Canadian fishery summary plots:

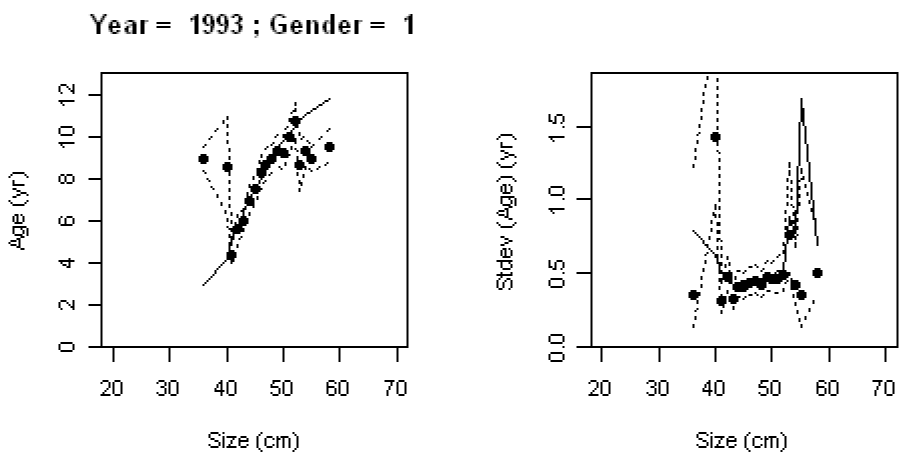

Year = 1988 ; Gender = 1
Age (yr)
0
5
10
15
20
30
40
50
60
70
Size (cm)
Stdev (Age) (yr)
0.0
0.5
1.0
1.5
2.0
20
30
40
50
60
70
Size (cm)

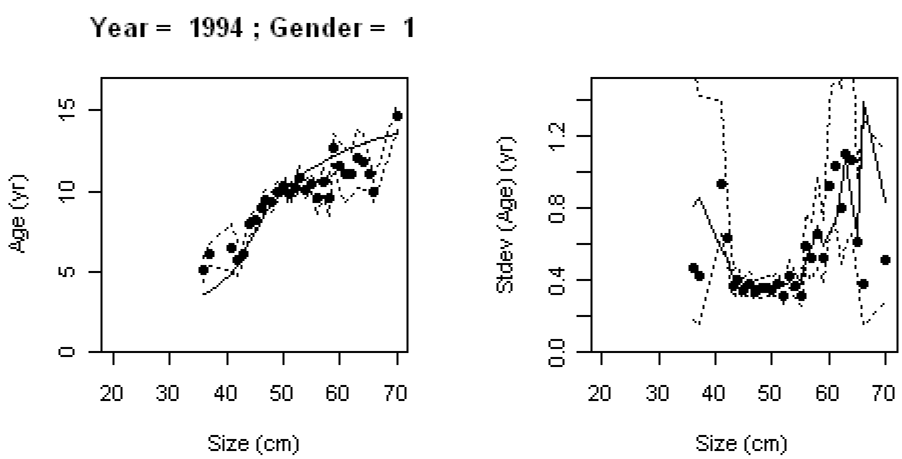

Year = 1989 ; Gender = 1
Age (yr)
Size (cm)
Stdev (Age) (yr)
Size (cm)

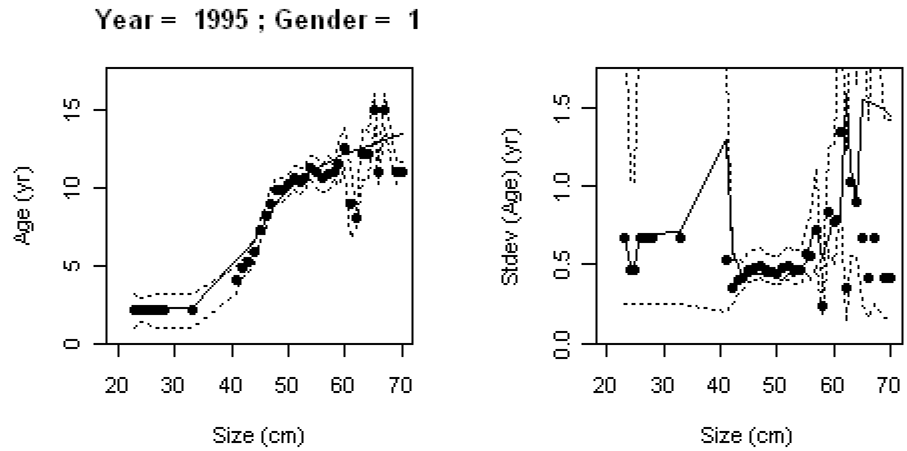

Year = 1990 ; Gender = 1
Age (yr)
Size (cm)
Stdev (Age) (yr)
Size (cm)

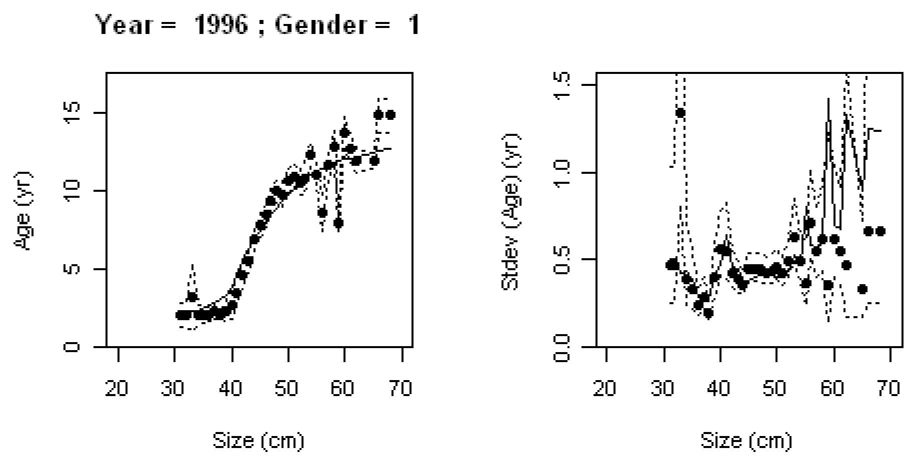

Year = 1991 ; Gender = 1
Age (yr)
Size (cm)
Stdev (Age) (yr)
Size (cm)

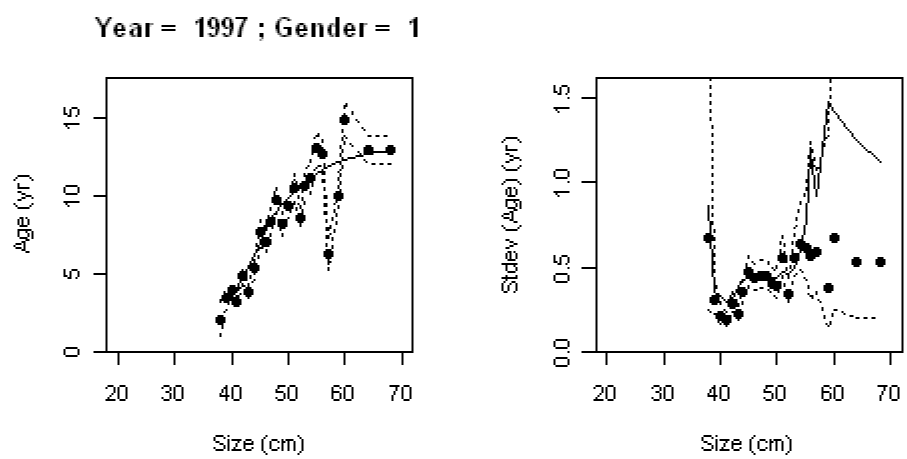

Year = 1992 ; Gender = 1
Age (yr)
Size (cm)
Stdev (Age) (yr)
Size (cm)


Year = 1993 ; Gender = 1
Age (yr)
Size (cm)
Stdev (Age) (yr)
Size (cm)

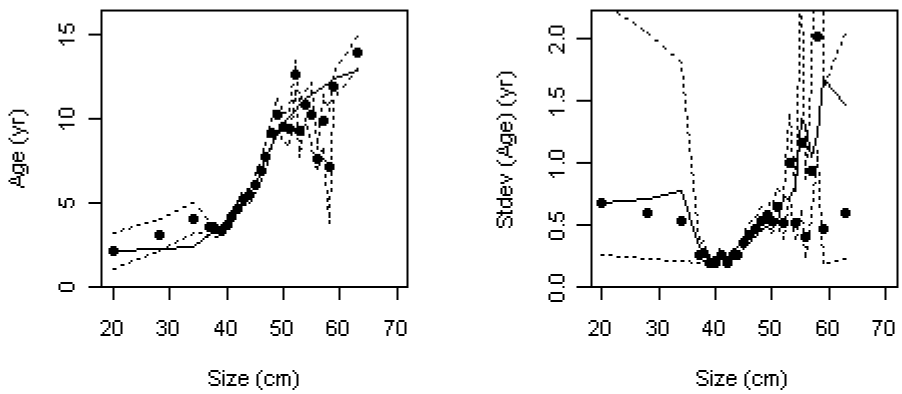

Year = 1994 ; Gender = 1
Age (yr)
Size (cm)
Stdev (Age) (yr)
Size (cm)


Year = 1995 ; Gender = 1
Age (yr)
Size (cm)
Stdev (Age) (yr)
Size (cm)

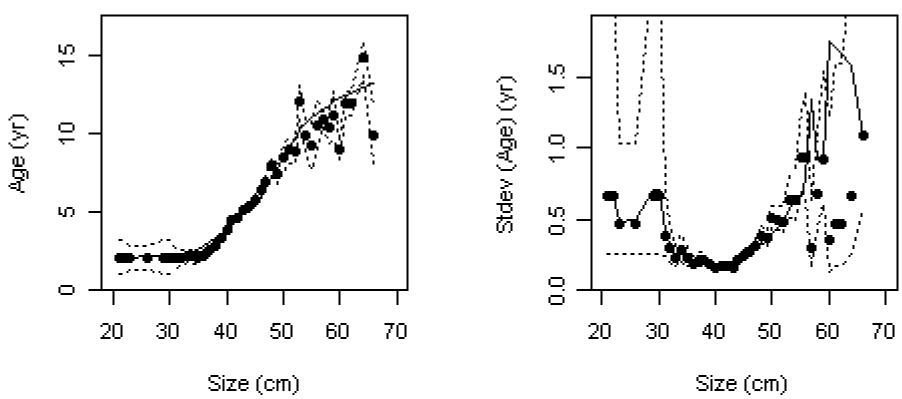

Year = 1996 ; Gender = 1
Age (yr)
Size (cm)
Stdev (Age) (yr)
Size (cm)


Year = 1997 ; Gender = 1
Age (yr)
Size (cm)
Stdev (Age) (yr)
Size (cm)

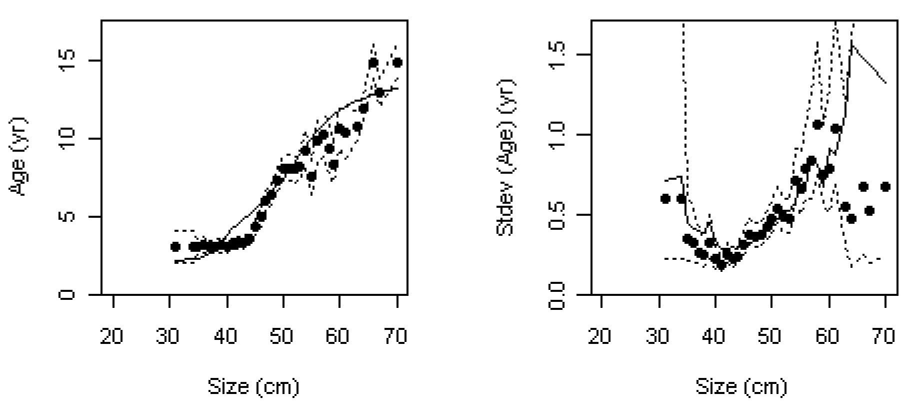
Year = 1998 ; Gender = 1



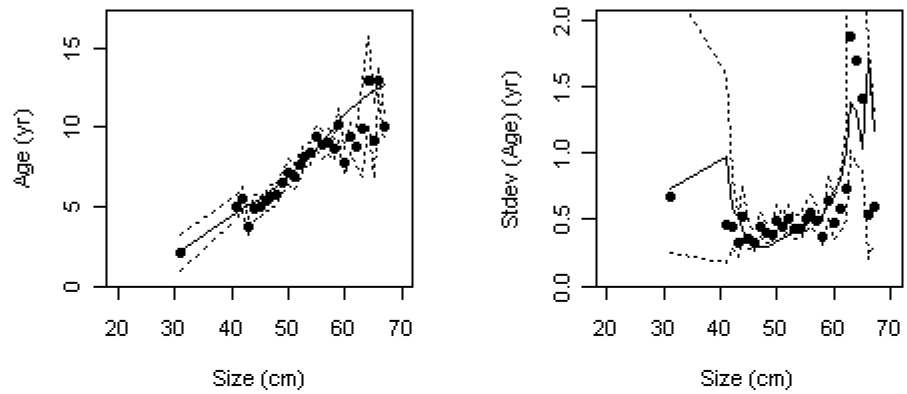
Year = 1999 ; Gender = 1



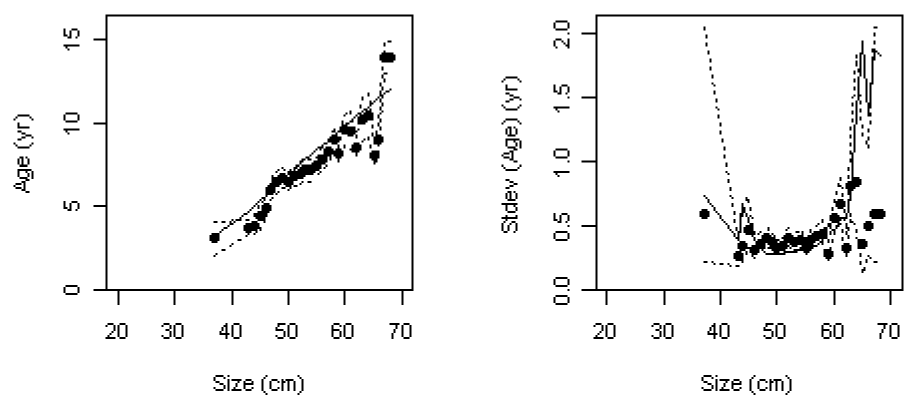
Year = 2000 ; Gender = 1



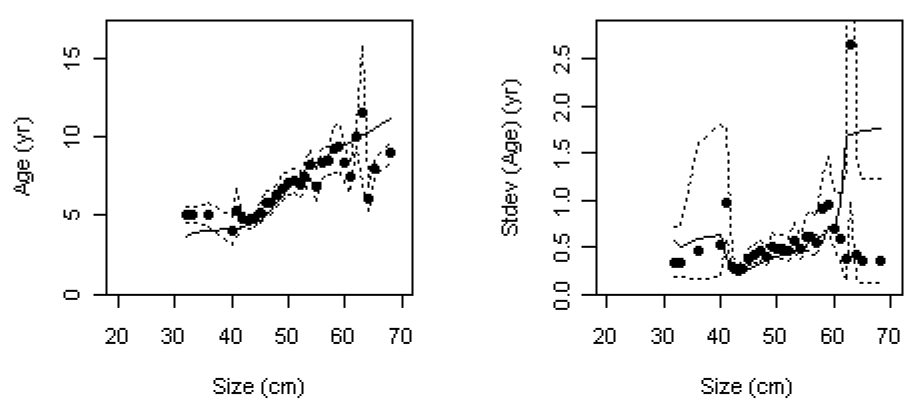
Year = 2001 ; Gender = 1

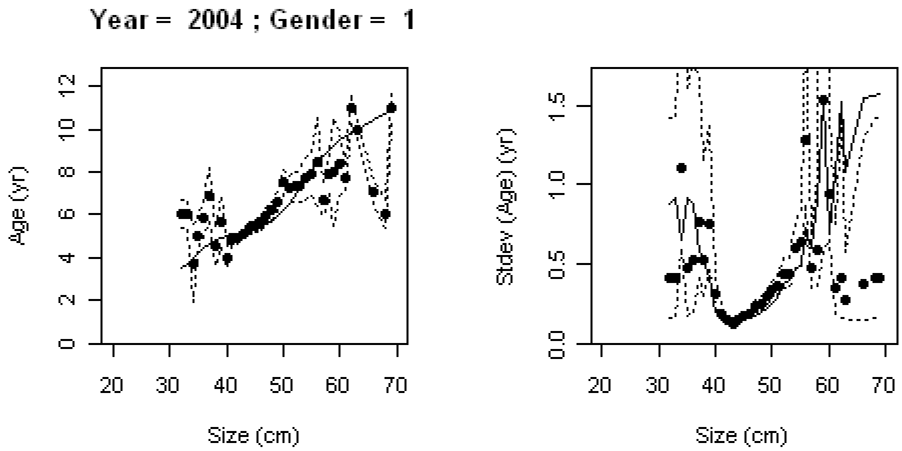


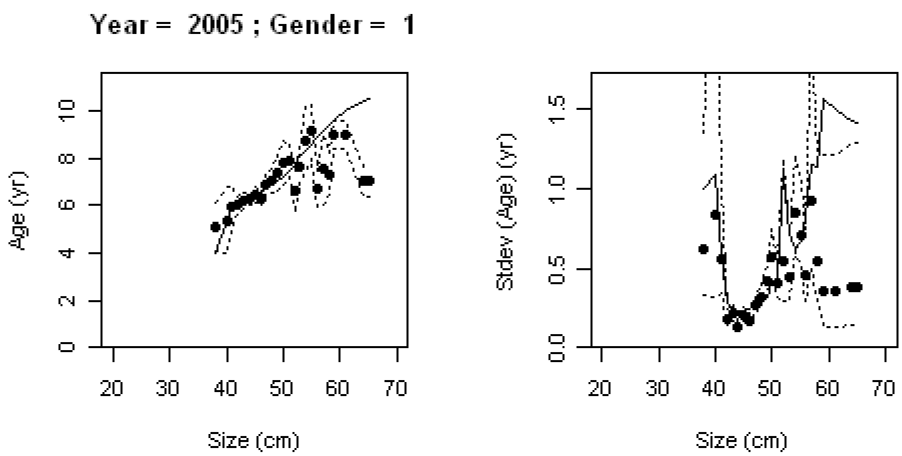
Year = 2002 ; Gender = 1

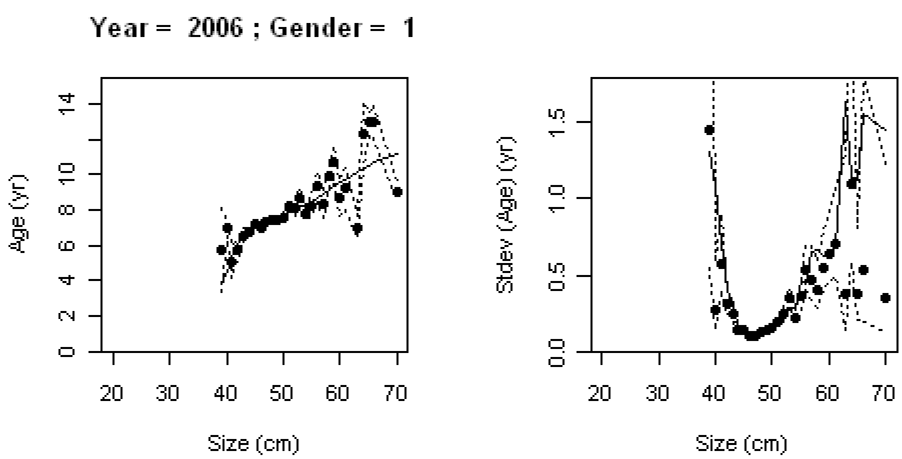


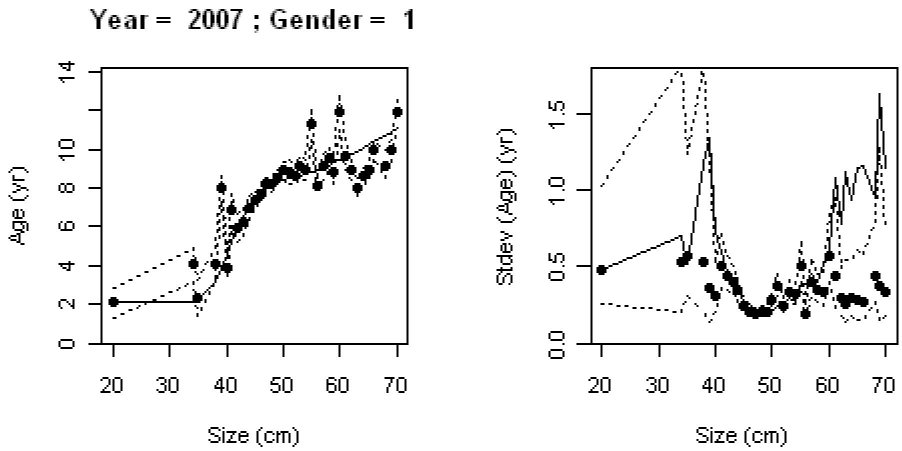
Year = 2003 ; Gender = 1

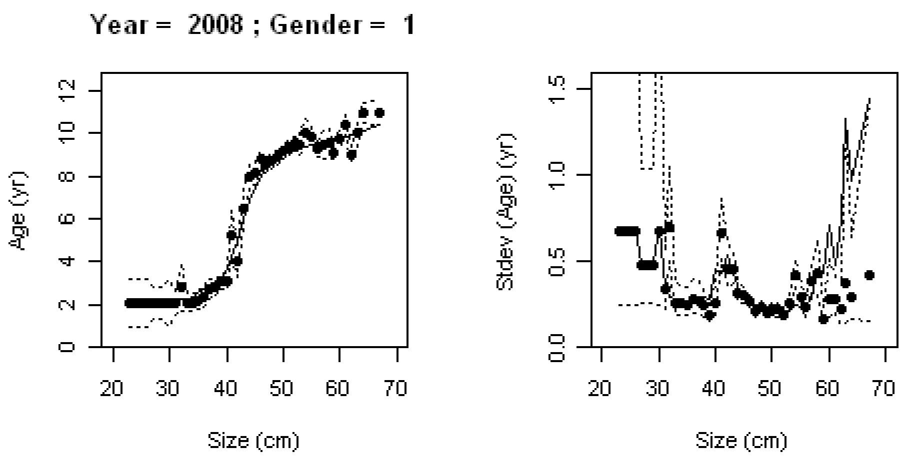


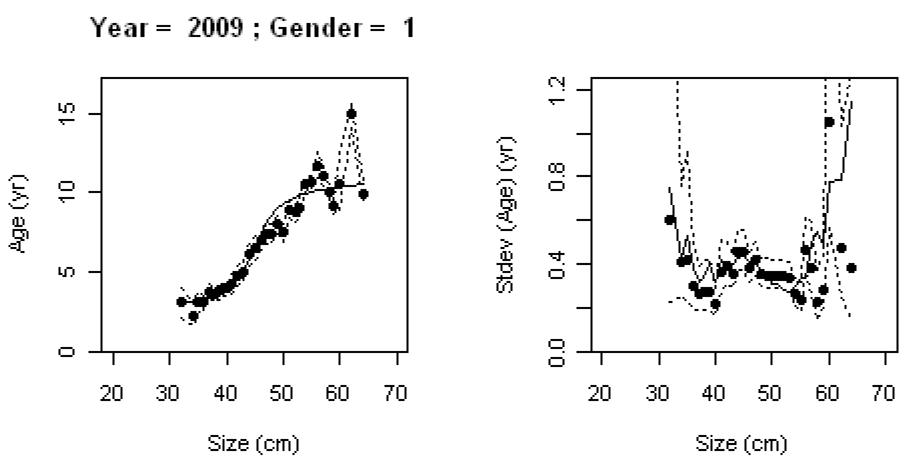

Year = 2004 ; Gender = 1
Age (yr)
Size (cm)
Stdev (Age) (yr)
Size (cm)


Year = 2005 ; Gender = 1
Age (yr)
Size (cm)
Stdev (Age) (yr)
Size (cm)


Year = 2006 ; Gender = 1
Age (yr)
Size (cm)
Stdev (Age) (yr)
Size (cm)


Year = 2007 ; Gender = 1
Age (yr)
Stdev (Age) (yr)
Size (cm)
Size (cm)


Year = 2008 ; Gender = 1
Age (yr)
Stdev (Age) (yr)
Size (cm)
Size (cm)


Year = 2009 ; Gender = 1
Age (yr)
Stdev (Age) (yr)
Size (cm)
Size (cm)

10. Appendix C. Model input files

Stock synthesis model input files generating the base case assessment reported in this document.

Starter File:

```
# 2010 base case hake starter file

hake_data.SS          # Data file
hake_control.SS       # Control file

0          # Read initial values from .par file: 0=no,1=yes
1          # DOS display detail: 0,1,2
2          # Report file detail: 0,1,2
0          # Detailed checkup.sso file (0,1)
0          # Write parameter iteration trace file during minimization
0          # Write cumulative report: 0=skip,1=short,2=full
0          # Include prior likelihood for non-estimated parameters
0          # Use Soft Boundaries to aid convergence (0,1) (recommended)
0          # N bootstrap datafiles to create
25         # Last phase for estimation
1          # MCMC burn-in
1          # MCMC thinning interval
0          # Jitter initial parameter values by this fraction
-1         # Min year for spbio sd_report (neg val = styr-2, virgin state)
-2         # Max year for spbio sd_report (neg val = endyr+1)
0          # N individual SD years
0.0000001 # Ending convergence criteria
0          # Retrospective year relative to end year
3          # Min age for summary biomass
1          # Depletion basis: denom is: 0=skip; 1=rel X*B0; 2=rel X*Bmsy; 3=rel X*B_styr
1.0        # Fraction (X) for Depletion denominator (e.g. 0.4)
1          # (1-SPR)_reporting:  0=skip; 1=rel(1-SPR); 2=rel(1-SPR_MSY); 3=rel(1-SPR_Btarget); 4=notrel
1          # F_std reporting: 0=skip; 1=exploit(Bio); 2=exploit(Num); 3=sum(frates)
0          # F_report_basis: 0=raw; 1=rel Fspr; 2=rel Fmsy ; 3=rel Fbtgt

999 # end of file marker
```

Forecast file:

```
# 2010 Base case hake forecast controls

1          # Forecast: 0=none;1=F(SPR);2=F(MSY)3=F(Btgt);4=F(endyr);5=Ave F(enter yrs); 6=read Fmult
2008       # First year for averaging selex used in forecast (e.g. 2004; or use -x to be rel endyr)
2008       # Last year for averaging selex to use in forecast
1          # Benchmarks:0=skip, 1=calc Fspr, Fbtgt, Fmsy
2          # MSY: 0=none,1=F(SPR),2=calc F(MSY),3=F(Btgt),4=set to F(endyr)
0.4        # SPR target (e.g. 0.40)
0.4        # Biomass target (e.g. 0.40)
3          # Number of forecast years
1    # Read advanced options add indents below if 1
0          # Puntalyzer output: 0=no,1=yes
-1         # Rebuilder:  first year catch could have been set to zero (Ydecl)
-1         # Rebuilder:  year for current age structure (Yinit)
1          # Control rule method (1=west coast adjust catch; 2=adjust F)
0.4        # Control rule Biomass level for constant F (as frac of Bzero, e.g. 0.40)
0.1        # Control rule Biomass level for no F (as frac of Bzero, e.g. 0.10)
1          # Control rule fraction of Flimit (e.g. 0.75)
0 # basis for maxcatch
0          # Implementation error: 0=none, 1=add error to forecast (not coded yet)
0.1        # Placeholder: SD of log(realized F/target F) in forecast (not coded yet)
2          # fleet allocation (in terms of F) (1=use endyr pattern, no read; 2=read below)
0.62 0.38 # relative F for forecast when using F;  seasons; fleets within season
0          # Number of manual forecast catches to input
# basis for forecatch:  1=retained catch; 2=total dead catch (if line above > 0)
# Year Seas Fleet Catch
```

```
999 # End forecast file

Control file:
# 2010 base case hake control file

# Morphs
1       # N growth patterns
1       # N sub morphs within patterns

# Time block setup
7       # Number of block designs for time varying parameters

1       # Blocks in design 1: Length at age 12
2       # Blocks in design 2: VBK
7       # Blocks in design 3: US peak
7       # Blocks in design 4: US ascending width
1       # Blocks in design 5: US final
6       # Blocks in design 6: CAN peak
4       # Blocks in design 7: CAN ascending width

1984 2009 # Block design 1: Length at age 12
1980 1986 # Block design 2: VBK
1999 2009

1981 1984 # Block design 3: US peak
1985 1988
1989 1992
1993 1996
1997 2000
2001 2004
2005 2009
1960 1980 # Block design 4: US ascending width
1981 1984
1985 1988
1993 1996
1997 2000
2001 2004
2005 2009
1984 2009 # Block design 5: US final
1981 1984 # Block design 6: CAN peak
1985 1988
1989 1992
1993 2000
2001 2004
2005 2009
1960 1984 # Block design 7: CAN ascending width
1989 2000
2001 2004
2005 2009

# Mortality and growth specifications
0.5     # Fraction female (birth)
1       # M setup: 0=single parameter,1=breakpoints,2=Lorenzen,3=age-specific;4=age-specific,seasonal interpolation
2       # Number of M breakpoints
13 15   # Ages at M breakpoints
1       # Growth model: 1=VB with L1 and L2, 2=VB with A0 and Linf, 3=Richards, 4=Read vector of L@A
2       # Age for growth Lmin
12      # Age for growth Lmax
0.0     # Constant added to SD of LAA (0.1 mimics SS2v1 for compatibility only)
0       # Variability of growth: 0=CV~f(LAA), 1=CV~f(A), 2=SD~f(LAA), 3=SD~f(A)
1       # Maturity option: 1=length logistic, 2=age logistic, 3=read vector of age-maturity
1       # First age allowed to mature
1       # Fecundity option
0       # Hermaphro_Option
1       # MG parm offset option: 1=none, 2= M,G,CV_G as offset from GP1, 3=like SS2v1
1       # MG parm adjust method 1=do V1.23 approach, 2=use logistic transform between bounds approach
```

# Lo # bnd	Hi bnd	Init value	Prior mean	Prior type	Prior SD	Param phase	Env var	Use dev	Dev minyr	Dev maxyr	Dev SD	Block design	block switch	
0.1	0.4	0.23	0.23	-1	99	-5	0	0	0	0	0	0	0	# M to age 13
0.2	0.8	0.63	0.23	-1	99	4	0	0	0	0	0	0	0	# M at age 15
20	40	32.0	32	-1	99	-5	0	0	0	0	0	0	0	# Length at age 2
40	65	53.0	50	-1	99	4	0	0	0	0	0	1	0	# Length at age 12
0.1	0.5	0.33	0.3	-1	99	4	0	0	0	0	0	2	0	# VBK
0.03	0.16	0.066	0.1	-1	99	-5	0	0	0	0	0	0	0	# CV of length at age 2
0.03	0.16	0.062	0.1	-1	99	-5	0	0	0	0	0	0	0	# CV of length at age 12

Add 2+2*gender lines to read the wt-Len and mat-Len parameters

-3	3	7.0E-06	7.0E-06	-1	99	-50	0	0	0	0	0	0	0	# W-L slope
-3	3	2.9624	2.9624	-1	99	-50	0	0	0	0	0	0	0	# W-L exponent
-3	43	36.89	36.89	-1	99	-50	0	0	0	0	0	0	0	# L at 50% maturity
-3	3	-0.48	-0.48	-1	99	-50	0	0	0	0	0	0	0	# Logistic maturity slope
-3	3	1.0	1.0	-1	99	-50	0	0	0	0	0	0	0	# Eggs/gm intercept
-3	3	0.0	0.0	-1	99	-50	0	0	0	0	0	0	0	# Eggs/gm slope

pop lines For the proportion assigned to each area

0	2	1	1	-1	99	-50	0	0	0	0	0	0	0	# placeholder only
0	2	1	1	-1	99	-50	0	0	0	0	0	0	0	# placeholder only
0	2	1	1	-1	99	-50	0	0	0	0	0	0	0	# placeholder only
0	2	1	1	-1	99	-50	0	0	0	0	0	0	0	# placeholder only

Block parameter setup
1 # 0=one par for all; 1= one par for each

# Lo # bnd	Hi bnd	Init value	Prior mean	Prior type	Prior SD	Param phase
# Length at age 12						
-1	1	-0.05	0	0	0.01	4
# VBK						
-1	1	-0.14	0	0	0.01	4
-1	1	0.10	0	0	0.01	4

Seasonal effects on biology parameters
0 0 0 0 0 0 0 0 0 0 # placeholder only

Spawner-recruit parameters
3 # S-R function: 1=B-H w/flat top, 2=Ricker, 3=standard B-H, 4=no steepness or bias adjustment

# Lo # bnd	Hi bnd	Init value	Prior mean	Prior type	Prior SD	Param phase	
12	18	15.4	15	-1	99	4	# Ln(R0)
0.2	1	0.85	0.777	2	0.113	4	# Steepness with Myers' prior
1.0	1.6	1.1	1.1	-1	99	6	# Sigma-R
-5	5	0	0	-1	99	-50	# Env link coefficient
-5	5	0	0	-1	99	-50	# Initial eqilibrium recruitment offset
0	2	0	1	-1	99	-50	# Autocorrelation in rec devs

```
0 # index of environmental variable to be used
0 # env target
1 # rec dev type

# Recruitment deviations
1962        # Start year standard recruitment devs
2008        # End year standard recruitment devs
1           # Rec Dev phase

1 # Read 11 advanced recruitment options: 0=no, 1=yes
0           # Start year for early rec devs
-9          # Phase for early rec devs
6           # Phase for forecast recruit deviations
1           # Lambda for forecast recr devs before endyr+1
1961        # Last recruit dev with no bias_adjustment
1962        # First year of full bias correction (linear ramp from year above)
2007        # Last year for full bias correction in_MPD
2008        # First_recent_yr_nobias_adj_in_MPD
1           #_prior_for_max_bias_adj_in_MPD
0           # period of cycle in recruitment
-7          # Lower bound rec devs
7           # Upper bound rec devs
0           # Read init values for rec devs

# Fishing mortality setup
0.1         # F ballpark for tuning early phases
1999        # F ballpark year
1           # F method:  1=Pope's; 2=Instan. F; 3=Hybrid
0.9         # Max F or harvest rate (depends on F_Method)
# Init F parameters by fleet
#LO    HI    INIT    PRIOR    PR_type    SD    PHASE
0      1     0.0     0.01     -1         99    -50
0      1     0.0     0.01     -1         99    -50

# Catchability setup
# A=do power: 0=skip, survey is prop. to abundance, 1= add par for non-linearity
# B=env. link: 0=skip, 1= add par for env. effect on Q
# C=extra SD: 0=skip, 1= add par. for additive constant to input SE (in ln space)
# D=type: <0=mirror lower abs(#) fleet, 0=no par Q is median unbiased, 1=no par Q is mean unbiased, 2=estimate par for ln(Q)
#            3=ln(Q) + set of devs about ln(Q) for all years. 4=ln(Q) + set of devs about Q for indexyr-1
# E=Units: 0=numbers, 1=biomass
# F=err_type 0=lognormal, >0=T-dist. DF=input value
# A B C D E F
# Create one par for each entry > 0 by row in cols A-D
0    0    0    0    1    0  # US fishery
0    0    0    0    1    0  # Can Fishery
0    0    0    2    1    0  # Acoustic survey
0    0    0    2    0    0  # Juv survey
0    0    0    0    1    0  # CA 1
0    0    0    0    1    0  # CA 2
0    0    0    0    1    0  # CA 3
0    0    0    0    1    0  # CA 4
0    0    0    2    0    0  # shrimp bycatch

#LO    HI     INIT         PRIOR  PR_type  SD    PHASE
-3     0.5    -0.3566749   0      -1       0.4   5    # Acoustic survey
-15    0      -8.0         0      -1       99    -5   # Pre-recruit survey
-15    0      -12.0        0      -1       99    -5   # shrimp bycatch

#_SELEX_&_RETENTION_PARAMETERS
# Size-based setup
# A=Selex option: 1-24
# B=Do_retention: 0=no, 1=yes
# C=Male offset to female: 0=no, 1=yes
# D=Mirror selex (#)
# A B C D
# Size selectivity
```

```
0       0       0       0       # US Fishery
0       0       0       0       # CAN Fishery
0       0       0       0       # Acoustic survey
32      0       0       0       # Pre-recruit survey - index density independent recruitment
0       0       0       0       # Hist CA fishery 1st quarter
0       0       0       0       # Hist CA fishery 2nd quarter
0       0       0       0       # Hist CA fishery 3rd quarter
0       0       0       0       # Hist CA fishery 4th quarter
0       0       0       0       # shrimp bycatch
# Age selectivity
20      0       0       0       # US Fishery
20      0       0       0       # CAN Fishery
20      0       0       0       # Acoustic survey
10      0       0       0       # Pre-recruit survey - index density independent recruitment
20      0       0       0       # Hist CA fishery 1st quarter
15      0       0       5       # Hist CA fishery 2nd quarter
15      0       0       5       # Hist CA fishery 3rd quarter
15      0       0       5       # Hist CA fishery 4th quarter
11      0       0       0       # shrimp bycatch

# Selectivity parameters
# Lo    Hi      Init    Prior   Prior   Prior   Param   Env     Use     Dev     Dev     Dev     Block
        block
# bnd   bnd     value   mean    type    SD      phase   var     dev     minyr   maxyr   SD      design
        switch
# US Fishery Age-based double Normal selectivity
5.0     15      6.0     8.0     -1      99      2       0       0       0       0       0       3
        1       # Peak age
-9.0    3.0     -2.0    -1.5    -1      99   -5 0       0       0       0       0       0       0
        # Top (logistic)
-4.0    10.0    3.0     3.0     -1      99      2       0       0       0       0       0       4
        1       # Asc. width (exp)
-9.0    15.0    8.0 2.0 -1      99   -2 0       0       0       0       0       0       1       # Desc.
width (exp)
-2000   5.0     -1002   -1.0    -1      99  -50 0       0       0       0       0       0       0
        # Initial = 0.0 < age 2
-5.0    2.0     -1.0    .45     -1      99      2       0       0       0       0       0       5
        1       # Final (logistic)
# Canadian Fishery Age-based double Normal selectivity
5.0     15      8.0     8.0     -1      99      2       0       0       0       0       0       6
        1       # Peak age
-9.0    3.0     -2.0    -1.5    -1      99      -5      0       0       0       0       0       0
        0       # Top (logistic)
-2.0    15.0    3.0     3.0     -1      99      2       0       0       0       0       0       7
        1       # Asc. width (exp)
-9.0    15.0    8.0 2.0 -1      99   -2 0       0       0       0       0       0       1       # Desc.
width (exp)
-2000   5.0     -1002   -1.0    -1      99  -50 0       0       0       0       0       0       0
        # Initial = 0.0 < age 2
-5.0    5.0     -1.0    .45     -1      99      2       0       0       0       0       0       0
        1       # Final (logistic)
# Acoustic Survey Age-based double Normal selectivity
5.0     15      6.0     8.0     -1      99      2       0       0       0       0       0       0
        0       # Peak age
-9.0    3.0     -2.0    -1.5    -1      99      -5      0       0       0       0       0       0
        0       # Top (logistic)
-2.0    9.0     4.0     3.0     -1      99      2       0       0       0       0       0       0
        0       # Asc. width (exp)
-9.0    9.0   3.0 2.0   -1      99      -2      0       0       0       0       0       0
        # DESC WIDTH exp
-2000   5.0     -1002   -1.0    -1      99      -50     0       0       0       0       0       0
        0       # Initial = 0.0 < age 2
-5.0    5.0     -0.0    .45     -1      99      2       0       0       0       0       0       0
        0       # Final (logistic)
# Hist CA fishery 1st quarter Age-based Double Normal selectivity
1       15      5.0     8.0     -1      99      -5      0       0       0       0       0       0
        0       # Peak age
```

```
-9.0    3.0     -2.0    -1.5    -1      99      -5      0       0       0       0       0       0
        0       # Top (logistic)
-9.0    9.0     0       3.0     -1      99      -5      0       0       0       0       0       0
        0       # Asc. width (exp)
-9.0    9.0  3.0 2.0    -1      99      -5      0       0       0       0       0       0
        # Desc. width (exp)
-10     5.0     -8      -1.0    -1      99   -5 0       0       0       0       0       0       0
        # Initial = 0.0 < age 2
-5      5       4.99    0.45    -1      99   -5 0       0       0       0       0       0       0
        # Final (logistic)
# shrimp bycatch
0       2       1       1       -1      99  -50 0       0       0       0       0       0       0
        # minage
0       2       1       1       -1      99  -50 0       0       0       0       0       0       0
        # maxage

# Selectivity block parameter setup
0 # 0=one parameter for all; 1=one parameter for each
# Lo    Hi      Init    Prior   Prior   Prior   Param
# bnd   bnd     value   mean    type    SD      phase
 -10    10      0       0       -1      99      3

1 # Block adjust method: 1=standard; 2=logistic trans to keep in base parm bounds
0 # Tagging flag: 0=no tagging parameters,1=read tagging parameters

### Likelihood related quantities ###
1 # Do variance/sample size adjustments by fleet (1)
#US   CAN  Ac   Pre CA1  CA2  CA3  CA4  shp # Component
 0   0   0   0  0   0   0   0   0  # Constant added to index CV
 0   0   0   0  0   0   0   0   0  # Constant added to discard SD
 0   0   0   0  0   0   0   0   0  # Constant added to body weight SD
 0.09 1.04 1.41 0  0   0   0   0   0  # multiplicative scalar for length comps
 1.70 1.78 3.27 0  0   0   0   0   0  # multiplicative scalar for agecomps
 0   0   0   0  0   0   0   0   0  # multiplicative scalar for length at age obs

30      # Discard df
30      # Mean weight df
1       # Lambda phasing: 1=none, 2+=change beginning in phase 1
1       # Growth offset likelihood constant for Log(s): 1=include, 2=not

6 # N changes to default Lambdas = 1.0
# Component codes:
#  1=Survey, 2=discard, 3=mean body weight
#  4=length frequency, 5=age frequency, 6=Weight frequency
#  7=size at age, 8=catch, 9=initial equilibrium catch
#  10=rec devs, 11=parameter priors, 12=parameter devs
#  13=Crash penalty
# Component fleet/survey  phase  value  wtfreq_method
 1 4 1 0.0 1 # Pre-recruit survey data fleet 4
 4 5 1 0.0 1 # CA hist lens
 4 6 1 0.0 1 # CA hist lens
 4 7 1 0.0 1 # CA hist lens
 4 8 1 0.0 1 # CA hist lens
 1 9 1 0.0 1 # shrimp bycatch

0 # SD reporting switch
999 # End control file
```

Data file:

```
# 2010 hake base case data file

### Global model specifications ###
1960    # Start year
2009    # End year
1       # Number of seasons/year
12      # Number of months/season
1       # Spawning occurs at beginning of season
```

```
2		# Number of fishing fleets
7		# Number of surveys
1		# Number of areas
US_Fishery%CAN_Fishery%Acoustic_Survey%Prerec_Survey%Hist_CA1%Hist_CA2%Hist_CA3%Hist_CA4%shrimp
0.5 0.5 0.5 0.0001 0.125 0.375 0.625 0.875 0.5 #_surveytiming_in_season
1 1 1 1 1 1 1 1		1 # Area of each fleet
1 1		# Units for catch by fishing fleet: 1=Biomass(mt),2=Numbers(1000s)
0.01 0.01 # SE of log(catch) by fleet for equilibrium and continuous options
1		#_Ngenders
15		#_Nages

### Catch section ###
# Initial equilibrium catch (landings + discard) by fishing fleet
0 0  #_init_equil_catch_for_each_fishery

44 # Number of lines catch data
# Landed catch (only) time series by fleet
# Catch(by fleet) YearSeason
# US		CAN
137000	700	1966	1
177662	36713	1967	1
60819	61361	1968	1
86280	93851	1969	1
159575	75009	1970	1
127913	26699	1971	1
74133	43413	1972	1
147513	15126	1973	1
194109	17150	1974	1
205656	15704	1975	1
231549	5972	1976	1
127502	5191	1977	1
98372	5267	1978	1
124680	12435	1979	1
72352	17584	1980	1
114760	24361	1981	1
75577	32157	1982	1
73150	40774	1983	1
96332	42109	1984	1
85439	24962	1985	1
154964	55653	1986	1
160448	73699	1987	1
160698	88106	1988	1
210996	94920	1989	1
183800	75992	1990	1
217505	89753	1991	1
208576	88334	1992	1
141222	58213	1993	1
252729	108800	1994	1
177589	72181	1995	1
212901	93174	1996	1
233423	91792	1997	1
232817	87802	1998	1
224522	87333	1999	1
208418	22402	2000	1
182377	53585	2001	1
132115	50796	2002	1
143492	62090	2003	1
210487	124185	2004	1
259199  100462	2005	1
266957  93726	2006  1
224529  72569	2007  1
247797  73750	2008  1
121110	55620	2009	1

26 #_N_cpue_and_surveyabundance_observations
# Year seas index obs se(log)
# Acoustic survey
```

1977 1 3 1915000 0.5
1980 1 3 2115000 0.5
1983 1 3 1647000 0.5
1986 1 3 2857000 0.5
1989 1 3 1238000 0.5
1992 1 3 2169000 0.25
1995 1 3 1385000 0.25
1998 1 3 1185000 0.25
2001 1 3 737000 0.25
2003 1 3 1840000 0.25
2005 1 3 1265000 0.25
2007 1 3 879000 0.25
2009 1 3 1462043 0.5

Pre-recruit index

2001	1 4	770.38	0.4158
2002	1 4	329.00	0.2237
2003	1 4	735.90	0.3070
2004	1 4	1531.60	0.2744
2005	1 4	355.65	0.2602
2006	1 4	192.34	0.1712
2007	1 4	63.31	0.1290
2008	1 4	128.28	0.1671
2009	1 4	114.78	0.1468

Shrimp bycatch index

2004	1 9 11.67 0.315
2005	1 9 25.83 0.243
2007	1 9 116.58 0.127
2008	1 9 27.65 0.254

2 #_discard_type
0 #_N_discard_obs
0 #_N_meanbodywt_obs

Population size structure
3 # Length bin method: 1=Use data bins,
 # 2=generate from min/max/width read below
 # 3=Read count and vector below
62 # Count of population bins
Lower edge of bins
9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70

-1	# Minimum proportion for compressing tails of observed compositional data
0.001	# Constant added to expected frequencies
0	# Combine males and females at and below this bin number

51 #_N_LengthBins
Lower edge of bins
20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70

95 #_N_Length_obs
#Yr Seas Flt/Svy Gender Part Nsamp datavector(female-male)
US fishery

1975	1	1	0	0	13	0.0000	0.0000	0.0000	0.1310	0.4138	0.4138	0.6101
	0.6101	0.3291	0.7411	1.5447	0.9566	4.6455	4.0107	4.1898	5.3717	3.0869	2.8926	2.0167
	1.0373	4.3164	4.0849	7.0859	7.4219	7.1653	7.1658	4.9095	4.0224	5.0698	2.3889	3.2625
	1.2916	3.4063	0.0000	1.1843	1.0342	0.3465	0.4138	0.8734	0.9032	0.3465	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.1310	0.1742	0.0000				
1976	1	1	0	0	249	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0016
	0.0000	0.0056	0.0033	0.0383	0.0461	0.0619	0.0983	0.2605	0.2710	0.4635	0.5851	0.9688
	1.7104	2.6494	3.7108	5.1325	5.6852	6.3574	6.5997	6.6614	6.7014	6.7809	6.7467	6.3412
	6.0203	5.7434	5.0318	4.0850	2.9869	2.1415	1.3175	1.1743	0.7971	0.5916	0.4178	0.3714
	0.2021	0.3217	0.1198	0.0626	0.1229	0.0766	0.0428	0.4921				

1977	1	1	0	0	1071	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0018	0.0134	0.0376	0.0706	0.1661	0.4152	0.6903
	1.1624	1.8450	2.7529	4.3062	5.5899	5.8003	7.0414	7.6587	8.0144	8.2014	8.0120	7.8118
	7.2003	6.2315	4.7967	3.7873	2.7235	1.7045	1.2366	0.8199	0.5163	0.3222	0.2985	0.1799
	0.1885	0.1195	0.0886	0.0573	0.0324	0.0296	0.0462	0.0296				
1978	1	1	0	0	1135	0.0000	0.0137	0.0335	0.0204	0.0187	0.0129	0.0269
	0.0195	0.0268	0.0177	0.0119	0.0196	0.0000	0.0052	0.0068	0.0000	0.0232	0.0374	0.1341
	0.4019	1.1005	1.8736	3.2463	4.8921	6.2182	7.2486	8.1810	8.5122	8.8032	8.7842	8.3771
	7.6130	6.8721	5.5053	3.9908	2.9505	1.7999	1.1040	0.6053	0.4234	0.2603	0.2115	0.1333
	0.0826	0.1005	0.0837	0.0252	0.0539	0.0204	0.0118	0.0858				
1979	1	1	0	0	1539	0.0037	0.0097	0.0000	0.0000	0.0045	0.0116	0.0377
	0.1272	0.2419	0.3627	0.6064	0.9330	1.0785	1.2116	1.3609	1.1767	1.0738	0.9737	0.8697
	0.7638	1.0134	1.2884	2.1901	3.1243	4.4482	5.5505	6.5905	7.3083	7.4803	7.3508	7.1915
	6.8207	6.1776	5.2697	4.4570	3.4610	2.5085	1.9857	1.3847	1.0024	0.6851	0.4921	0.3971
	0.2037	0.1600	0.1547	0.1172	0.0869	0.0479	0.0772	0.1275				
1980	1	1	0	0	811	0.0091	0.0023	0.0015	0.0000	0.0073	0.0000	0.0000
	0.0087	0.0126	0.0458	0.0204	0.0433	0.1149	0.2228	0.5250	0.7315	1.2779	2.1458	3.0350
	3.7493	4.1531	4.0760	4.3104	4.0557	4.3473	4.6273	5.0774	5.6263	5.8858	6.0686	5.8665
	5.5856	5.4307	5.0389	4.3970	3.5729	2.4554	2.0179	1.4813	1.1084	0.7881	0.5016	0.3861
	0.4173	0.1653	0.1672	0.1005	0.0862	0.0783	0.0779	0.0960				
1981	1	1	0	0	1093	0.0800	0.1084	0.3599	0.7080	0.9938	1.3236	1.4714
	1.4205	1.1953	0.9210	0.5505	0.3604	0.3151	0.1801	0.1889	0.2756	0.5729	0.9527	1.7359
	2.9281	4.0255	5.0184	5.6197	6.0028	6.2402	6.2228	6.0960	5.8936	5.4876	5.3678	5.1780
	4.8316	4.1992	3.4228	2.5465	1.9163	1.4854	1.0655	0.5759	0.4974	0.3794	0.2661	0.1841
	0.1667	0.1191	0.0804	0.0909	0.0528	0.0518	0.0368	0.2368				
1982	1	1	0	0	1142	0.0012	0.0006	0.0006	0.0069	0.0278	0.0623	0.1581
	0.3195	0.4785	0.7517	1.1521	1.7236	2.2861	2.4465	2.4854	2.2689	2.0172	1.5572	1.1535
	1.1139	1.6668	2.6606	3.7590	4.8387	5.2255	5.3355	5.4254	5.3001	5.2641	5.1765	5.0040
	4.8301	4.5324	4.1043	3.5769	3.1039	2.2985	1.8991	1.4468	1.2094	0.8385	0.6099	0.4744
	0.3877	0.2877	0.1802	0.1433	0.1309	0.0730	0.0768	0.1282				
1983	1	1	0	0	1069	0.0000	0.0000	0.0000	0.0000	0.0000	0.0019	0.0039
	0.0049	0.0079	0.0489	0.1747	0.4093	0.9641	1.9860	3.0671	3.7988	4.5641	5.0988	5.4378
	5.5811	5.4899	5.2058	4.8753	4.4715	4.3545	4.5081	4.6308	4.5736	4.3279	4.1003	3.7933
	3.3540	3.0048	2.5516	2.1759	1.7089	1.3795	0.9958	0.7211	0.5140	0.4447	0.4355	0.3254
	0.2806	0.1772	0.1214	0.0937	0.0720	0.0499	0.0400	0.0738				
1984	1	1	0	0	2035	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0105	0.0637	0.2676	0.8974	2.4412	4.6053	7.0343
	8.2610	8.8066	8.8926	8.7328	8.0202	6.4816	5.1629	4.8620	4.4832	4.1105	3.7143	3.0779
	2.4524	1.9414	1.4921	1.0246	0.7090	0.4861	0.3571	0.2395	0.2084	0.1822	0.1480	0.1098
	0.1142	0.0654	0.0783	0.0392	0.0748	0.0613	0.0518	0.2390				
1985	1	1	0	0	2061	0.0087	0.0274	0.0648	0.1319	0.2167	0.3147	0.4723
	0.5712	0.7749	0.8416	0.8311	0.7368	0.6614	0.4257	0.2871	0.2003	0.2466	0.5571	1.2729
	2.9829	5.8356	7.8579	8.7403	9.0648	8.9656	8.5779	7.5892	6.4114	5.4273	4.5509	3.8589
	2.9729	2.3139	1.7167	1.2206	0.8974	0.6230	0.3798	0.2779	0.1994	0.1635	0.1281	0.0756
	0.1044	0.0668	0.0528	0.0551	0.0356	0.0388	0.0281	0.1439				
1986	1	1	0	0	3878	0.0000	0.0016	0.0013	0.0000	0.0013	0.0028	0.0096
	0.0200	0.0693	0.1515	0.3138	0.5911	1.1404	2.1111	3.2822	3.7332	3.8731	3.7860	3.3537
	2.7946	3.0905	5.3259	7.2056	8.0638	8.2040	8.0180	7.5393	6.3690	4.9986	3.8386	3.0525
	2.3423	1.8172	1.3727	1.0227	0.6270	0.4857	0.3479	0.2423	0.1877	0.1401	0.1158	0.0973
	0.0599	0.0422	0.0187	0.0227	0.0287	0.0125	0.0215	0.0526				
1987	1	1	0	0	3406	0.0007	0.0003	0.0003	0.0034	0.0017	0.0011	0.0010
	0.0046	0.0057	0.0063	0.0188	0.0204	0.0694	0.2387	0.6284	1.1515	2.2635	4.1013	5.6298
	6.4771	6.8780	6.9840	7.1824	7.5291	7.5888	7.4579	7.1477	6.4886	5.4910	4.4749	3.4480
	2.5218	1.8452	1.3414	0.9380	0.5999	0.3987	0.3065	0.1802	0.1242	0.0990	0.0605	0.0629
	0.0346	0.0404	0.0319	0.0267	0.0229	0.0186	0.0088	0.0434				
1988	1	1	0	0	3035	0.0007	0.0000	0.0000	0.0000	0.0017	0.0093	0.0120
	0.0258	0.0340	0.0449	0.0486	0.0299	0.0550	0.0644	0.1627	0.3887	0.8553	1.5375	3.2362
	5.6799	7.6535	8.5678	8.8030	8.8150	8.6617	8.3324	8.0693	7.2917	6.1416	4.5565	3.2785
	2.2118	1.6226	1.0448	0.8112	0.4643	0.3538	0.2647	0.2094	0.1601	0.0876	0.0695	0.0400
	0.0650	0.0289	0.0369	0.0335	0.0233	0.0179	0.0229	0.0740				
1989	1	1	0	0	2581	0.0005	0.0067	0.0011	0.0040	0.0045	0.0000	0.0043
	0.0110	0.0275	0.1121	0.3024	0.6741	1.0166	1.2433	1.2873	1.1719	1.1842	1.3513	1.8609
	3.2026	5.4862	7.6096	8.4166	8.5480	8.5158	8.3558	8.1199	7.4837	6.5009	5.1206	3.5657
	2.4235	1.8394	1.2021	0.9268	0.6719	0.4551	0.2600	0.2193	0.2046	0.1429	0.0997	0.0843
	0.0574	0.0486	0.0286	0.0164	0.0259	0.0302	0.0163	0.0577				
1990	1	1	0	0	2039	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0011	0.0165	0.0335	0.0560	0.1147	0.2150	0.3131	0.6847	1.0370	1.6040	2.5415	3.9025

	5.3464	6.1623	6.6671	7.1218	7.7462	7.9435	8.0196	7.9224	7.6186	6.9470	5.6783	3.7969
	2.7834	1.6893	1.1798	0.7962	0.5256	0.3690	0.2677	0.2133	0.1416	0.0824	0.0778	0.0709
	0.0621	0.0564	0.0224	0.0350	0.0320	0.0178	0.0174	0.0702				
1991	1	1	0	0	817	0.0253	0.0066	0.0046	0.0095	0.0000	0.0000	0.0037
	0.0188	0.0188	0.0064	0.0447	0.1253	0.2715	0.4231	0.8148	1.2033	2.0136	2.9728	3.5959
	4.2063	4.7795	5.9500	6.1653	6.8269	8.1632	8.4062	8.7522	7.8287	6.3656	4.8131	3.4933
	2.4196	1.6501	1.3979	1.2589	1.1846	1.1067	0.9981	0.8329	0.6915	0.3356	0.2210	0.1430
	0.1272	0.0789	0.0680	0.0615	0.0107	0.0326	0.0170	0.0554				
1992	1	1	0	0	836	0.0281	0.0667	0.0757	0.0833	0.0847	0.0681	0.0818
	0.0962	0.1170	0.1903	0.2537	0.4457	0.6030	0.7764	1.1068	1.3336	1.8384	2.0298	1.6095
	1.8875	3.7787	5.8426	7.3393	8.9692	10.0915	10.2542	9.9512	9.4832	7.3533	5.4802	3.2085
	1.8284	1.2047	0.7084	0.4253	0.3018	0.2260	0.1613	0.1262	0.0848	0.0840	0.0563	0.0546
	0.0267	0.0317	0.0166	0.0102	0.0082	0.0162	0.0065	0.0938				
1993	1	1	0	0	442	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0070	0.0000	0.0000	0.0082	0.1118	0.0949	0.4661	1.0299	1.9220	3.7253	4.5722	6.2424
	6.2361	5.8973	5.3501	5.8937	7.2187	8.3169	8.6226	8.8043	7.5067	7.1225	4.6537	2.7273
	1.3580	0.5706	0.4606	0.3049	0.2458	0.1720	0.1125	0.0270	0.0518	0.0266	0.0349	0.0235
	0.0061	0.0025	0.0025	0.0047	0.0000	0.0576	0.0000	0.0085				
1994	1	1	0	0	649	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0015	0.0141	0.0015	0.0170	0.0052	0.0191	0.0819	0.1821	0.6538	1.5734	3.1216
	4.4610	5.8132	6.9431	7.4792	8.1627	8.4792	9.3948	9.4855	8.9230	7.8291	5.9172	4.1409
	2.6141	1.4632	1.0154	0.6571	0.4624	0.2675	0.1930	0.1728	0.1298	0.1028	0.0608	0.0196
	0.0257	0.0226	0.0176	0.0132	0.0044	0.0019	0.0104	0.0457				
1995	1	1	0	0	470	0.1038	0.0228	0.0198	0.0284	0.0357	0.0357	0.0357
	0.0198	0.0000	0.0000	0.0091	0.0078	0.0571	0.0912	0.1238	0.1013	0.2443	0.2585	0.5044
	1.1955	2.3724	4.4641	6.6707	9.0914	10.4171	10.4798	10.8746	9.6864	8.4629	6.6830	5.2642
	3.6818	2.8972	1.8339	1.2249	0.8681	0.5701	0.5399	0.2679	0.2461	0.1648	0.1209	0.0787
	0.0556	0.0218	0.0338	0.0073	0.0208	0.0036	0.0000	0.0018				
1996	1	1	0	0	557	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0151
	0.0148	0.0575	0.0624	0.3453	0.9726	1.5831	3.0203	3.8219	4.7231	4.1074	3.4972	3.3323
	3.8879	4.0162	4.3223	4.5049	5.8851	7.4956	8.5752	8.2382	7.4850	6.1778	4.4124	3.4555
	2.1185	1.4007	0.7752	0.5304	0.3100	0.2074	0.2374	0.1246	0.0495	0.0525	0.0369	0.0385
	0.0192	0.0183	0.0234	0.0000	0.0000	0.0104	0.0000	0.0381				
1997	1	1	0	0	681	0.0000	0.0000	0.0000	0.0000	0.0000	0.0054	0.0000
	0.0000	0.0000	0.0000	0.0004	0.0129	0.0242	0.0621	0.1670	0.5697	1.1618	2.5034	4.2684
	6.5930	9.1337	10.3301	10.9611	10.6951	9.1385	8.2452	6.7816	5.6553	4.4197	3.4122	2.0201
	1.2148	0.7188	0.4538	0.3833	0.2249	0.2018	0.0783	0.1077	0.0375	0.0815	0.0931	0.1300
	0.0086	0.0097	0.0081	0.0552	0.0051	0.0000	0.0129	0.0138				
1998	1	1	0	0	803	0.0000	0.0019	0.0000	0.0356	0.0312	0.0000	0.0000
	0.0018	0.0050	0.0307	0.1578	0.5719	1.1926	1.8658	1.8962	2.1940	3.1873	4.9169	5.9828
	6.3878	6.7259	7.5506	8.9308	9.1918	8.9787	7.9720	6.5252	5.1066	3.8389	2.3801	1.5499
	0.8679	0.5270	0.3689	0.2026	0.1499	0.1612	0.1050	0.0570	0.0861	0.0879	0.0039	0.0120
	0.0034	0.0132	0.0171	0.0161	0.0014	0.0454	0.0000	0.0642				
1999	1	1	0	0	2268	0.0028	0.0000	0.0000	0.0030	0.0088	0.0298	0.0088
	0.0562	0.1532	0.3180	0.7684	1.1024	1.6890	2.4598	3.4549	4.0658	5.0615	5.8249	6.6752
	6.3233	6.6134	6.1512	6.1289	6.7057	6.9914	7.0649	6.3137	4.8892	3.6905	2.3132	1.5526
	1.0083	0.7842	0.4498	0.3077	0.1635	0.1629	0.1472	0.0544	0.1511	0.0529	0.0800	0.0497
	0.0106	0.0125	0.0187	0.0165	0.0089	0.0198	0.0152	0.0657				
2000	1	1	0	0	2199	0.0008	0.0000	0.0000	0.0000	0.0000	0.0049	0.0230
	0.0779	0.1520	0.3576	0.3585	0.3253	0.2198	0.2314	0.2139	0.3953	0.6127	1.1692	1.9467
	2.6461	4.1004	4.7630	5.8897	6.8340	8.3000	9.5471	9.8429	9.2381	8.5885	6.6670	5.2995
	3.7409	2.5171	1.7399	1.2479	0.7236	0.4943	0.5228	0.3619	0.2084	0.1557	0.1254	0.0844
	0.0832	0.0432	0.0291	0.0261	0.0251	0.0104	0.0289	0.0260				
2001	1	1	0	0	2239	0.0040	0.0047	0.0000	0.0142	0.0049	0.0144	0.0049
	0.0450	0.0368	0.1065	0.2524	0.5181	0.7379	1.0920	1.5401	2.4071	3.1572	3.3718	3.3389
	3.6980	4.1295	4.9045	5.9444	6.3796	6.9969	7.3855	8.0234	8.2212	7.5621	5.8676	4.3308
	3.3034	2.0719	1.5149	0.9362	0.6821	0.4124	0.2491	0.1603	0.1745	0.1023	0.0504	0.0731
	0.0517	0.0206	0.0268	0.0330	0.0073	0.0166	0.0030	0.0161				
2002	1	1	0	0	1821	0.0000	0.0000	0.0000	0.0000	0.0000	0.0153	0.0000
	0.0005	0.0005	0.0009	0.0349	0.0455	0.0237	0.0205	0.1192	0.3983	0.9800	2.6734	5.4078
	8.8163	10.7909	12.1021	11.2284	9.1867	6.7869	5.1606	4.4545	3.5139	3.1230	2.9931	2.6154
	2.2683	1.8634	1.5485	1.1389	0.7967	0.4894	0.3872	0.2213	0.1985	0.1627	0.1216	0.0636
	0.0584	0.0544	0.0301	0.0271	0.0061	0.0231	0.0117	0.0366				
2003	1	1	0	0	1915	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0300	0.0000	0.0000	0.0387	0.0022	0.0769	0.0808	0.1733	0.9888	2.3873	4.6812
	8.0242	11.1703	11.9985	12.9450	12.6406	10.5481	8.0278	5.3379	3.5339	2.3350	1.6809	1.1599

	0.7129	0.4354	0.2866	0.2158	0.1281	0.1050	0.0474	0.0597	0.0310	0.0171	0.0142	0.0162
	0.0138	0.0066	0.0076	0.0093	0.0099	0.0000	0.0080	0.0143				
2004	1	1	0	0	2797	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0007	0.0016	0.0038	0.0089	0.0000	0.0000	0.0081	0.0131	0.0296	0.1831	0.6135
	1.4590	3.7500	7.0232	11.1220	14.3372	15.4579	14.7871	10.8375	7.4020	4.8577	2.7464	1.7989
	1.2653	0.6564	0.3878	0.2692	0.2233	0.2484	0.0934	0.0338	0.0283	0.0757	0.0703	0.0158
	0.0102	0.0581	0.0045	0.0151	0.0173	0.0045	0.0044	0.0767				
2005	1	1	0	0	3064	0.0039	0.0031	0.0026	0.0020	0.0000	0.0023	0.0000
	0.0000	0.0000	0.0030	0.0024	0.0063	0.0239	0.0509	0.0915	0.1204	0.1841	0.4387	0.5751
	0.6107	1.1091	2.4939	6.2652	12.8750	18.8037	19.4426	15.5383	9.6723	5.1798	2.7770	1.4521
	0.8477	0.4493	0.3130	0.1687	0.1364	0.0896	0.0711	0.0473	0.0281	0.0267	0.0180	0.0129
	0.0096	0.0076	0.0067	0.0072	0.0038	0.0045	0.0044	0.0175				
2006	1	1	0	0	2824	0.0080	0.0112	0.0136	0.0303	0.0380	0.0436	0.0995
	0.0849	0.1161	0.1820	0.3199	0.3412	0.4424	0.6127	0.5952	0.4830	0.5777	0.8092	1.1048
	1.9977	3.4644	4.1244	5.3737	8.2206	12.9583	15.6928	15.2216	11.1138	7.0618	4.1189	1.9392
	1.1155	0.5196	0.2754	0.1379	0.1278	0.0776	0.1017	0.0682	0.0344	0.0414	0.0425	0.0251
	0.0278	0.0354	0.0148	0.0260	0.0123	0.0161	0.0074	0.0926				
2007	1	1	0	0	2936	0.7915	0.0932	0.0502	0.0665	0.0725	0.0426	0.0384
	0.0898	0.1579	0.3023	0.4876	0.9153	1.3500	1.6763	1.7752	1.7866	1.8838	1.6279	1.4620
	1.1528	1.2516	1.9565	3.2215	5.2290	7.9868	11.5435	14.1474	13.7874	10.0416	6.2371	3.9688
	1.8856	0.9790	0.6219	0.3572	0.2097	0.1553	0.1589	0.0589	0.0893	0.0639	0.0571	0.0220
	0.0483	0.0184	0.0114	0.0112	0.0051	0.0046	0.0018	0.0469				
2008	1	1	0	0	4273	0.0061	0.0074	0.0055	0.0279	0.0600	0.0918	0.1468
	0.1316	0.2161	0.2467	0.2693	0.5193	0.9721	1.6845	2.0252	2.2063	2.4328	3.5896	6.0167
	7.4710	7.3298	5.8014	4.3301	3.5973	3.9889	5.4842	7.2089	8.0745	7.4183	5.9649	4.2933
	2.9103	1.8244	1.1920	0.7306	0.5419	0.3023	0.2480	0.1491	0.1294	0.0601	0.0725	0.0564
	0.0390	0.0284	0.0159	0.0279	0.0190	0.0036	0.0088	0.0219				
2009	1	1	0	0	2688	0.1078	0.0614	0.0666	0.0424	0.0852	0.0777	0.1023
	0.2075	0.1821	0.1066	0.0910	0.0874	0.1972	0.3630	0.8506	1.8340	3.4691	5.4386	7.5262
	8.3266	8.7696	8.6063	8.1010	7.1596	5.4270	4.7241	4.7582	4.6424	4.6286	4.3470	3.1284
	2.0618	1.3585	0.9298	0.5488	0.3675	0.2917	0.2110	0.1938	0.1540	0.0732	0.0815	0.0397
	0.0218	0.0575	0.0226	0.0210	0.0192	0.0070	0.0131	0.0109				
# Canadian fishery												
1988	1	2	0	0	38	0.0000	0.0000	0.0000	0.0015	0.0042	0.0013	0.0000
	0.0012	0.0000	0.0026	0.0047	0.0016	0.0109	0.0287	0.0347	0.1011	0.1622	0.2725	0.4999
	0.8217	1.6591	3.0254	5.2973	7.5743	9.8487	11.8018	11.9507	10.6459	8.8695	6.9198	5.2416
	4.0676	3.0620	2.1469	1.6566	1.2806	0.8882	0.6213	0.4338	0.3289	0.2480	0.1422	0.0926
	0.0926	0.0635	0.0281	0.0175	0.0131	0.0143	0.0048	0.0143				
1989	1	2	0	0	43	0.0040	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0008	0.0000	0.0000	0.0000	0.0000	0.0000	0.0079	0.0039	0.0000	0.0116	0.0234	0.0729
	0.1029	0.3302	1.1841	3.6208	7.3076	11.0626	13.9101	14.3775	12.2475	10.0729	7.4976	5.3460
	3.8031	2.5146	1.9580	1.3638	0.8697	0.6090	0.4848	0.2969	0.2583	0.2076	0.1215	0.0985
	0.0644	0.0415	0.0313	0.0347	0.0133	0.0026	0.0093	0.0314				
1990	1	2	0	0	33	0.0025	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0146	0.0089	0.0665	0.0878	0.1169
	0.2445	0.6916	0.8924	1.9520	4.6396	8.2469	13.1450	15.1195	14.6946	12.1628	8.7682	6.0184
	3.8082	2.6119	1.7409	1.1643	0.8935	0.7293	0.4191	0.3702	0.2793	0.2472	0.1841	0.1927
	0.1571	0.0847	0.0648	0.0653	0.0228	0.0194	0.0370	0.0351				
1991	1	2	0	0	56	0.0020	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0031	0.0100	0.0000	0.0033	0.0073	0.0033	0.0288	0.0615	0.1335
	0.1961	0.2554	0.5079	0.7854	1.3650	3.2862	6.6629	11.0345	14.2636	15.4089	13.1927	9.9821
	7.0393	4.8797	3.3430	2.1798	1.4970	1.0171	0.7579	0.5609	0.3871	0.3152	0.2666	0.1598
	0.1119	0.0769	0.0668	0.0524	0.0185	0.0272	0.0168	0.0327				
1992	1	2	0	0	60	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0015	0.0000	0.0000	0.0000	0.0017	0.0017	0.0070	0.0113
	0.0170	0.1428	0.4641	1.4115	3.5680	7.2311	11.7795	16.0994	16.7776	14.5902	10.6207	6.6180
	3.9245	2.3324	1.3938	0.8834	0.5575	0.3640	0.2610	0.2263	0.1462	0.1277	0.1166	0.0871
	0.0495	0.0532	0.0353	0.0125	0.0261	0.0057	0.0117	0.0424				
1993	1	2	0	0	60	0.0102	0.0000	0.0000	0.0017	0.0000	0.0014	0.0000
	0.0014	0.0103	0.0061	0.0079	0.0053	0.0019	0.0014	0.0039	0.0054	0.0045	0.0070	0.0187
	0.0581	0.2378	0.6761	1.7934	4.2474	9.5096	15.5218	19.1337	17.8105	12.9661	7.8210	4.2887
	2.2775	1.3447	0.7572	0.4675	0.3220	0.2047	0.1464	0.1057	0.0596	0.0460	0.0213	0.0202
	0.0200	0.0028	0.0151	0.0076	0.0100	0.0072	0.0031	0.0103				
1994	1	2	0	0	76	0.0391	0.0037	0.0033	0.0034	0.0025	0.0051	0.0019
	0.0009	0.0027	0.0026	0.0015	0.0000	0.0017	0.0023	0.0013	0.0090	0.0121	0.0202	0.0211
	0.0403	0.1377	0.3263	0.7286	1.8425	4.1592	8.2000	13.3817	16.8869	16.0807	12.8616	9.0190

	5.6153	3.4957	2.2325	1.5106	0.9776	0.6701	0.4595	0.3314	0.2424	0.1778	0.1279	0.0899
	0.0687	0.0405	0.0392	0.0236	0.0318	0.0200	0.0084	0.0378				
1995	1	2	0	0	43	0.5433	0.5663	1.5444	2.8853	2.8406	3.0367	2.0194
	1.2639	0.6258	0.1966	0.0873	0.0440	0.0292	0.0483	0.0254	0.0278	0.0167	0.0000	0.0000
	0.0034	0.0068	0.0722	0.2495	0.9728	2.6665	5.3574	9.1578	12.8613	14.7039	12.3917	9.3775
	5.8628	3.5750	2.4331	1.2689	0.9287	0.6043	0.4867	0.3577	0.3214	0.1383	0.1170	0.0715
	0.0482	0.0518	0.0412	0.0355	0.0100	0.0000	0.0113	0.0151				
1996	1	2	0	0	54	0.0024	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0069	0.0168	0.0622	0.1235	0.2794	0.4614	0.8566	1.3516	1.9391	2.2300
	2.0055	1.5635	1.2560	1.4221	2.7105	5.4517	10.2072	14.0882	15.4694	13.5617	9.5714	6.3589
	3.5570	2.0126	1.1256	0.7121	0.4531	0.2665	0.2264	0.1552	0.0981	0.0831	0.0799	0.0618
	0.0397	0.0297	0.0245	0.0246	0.0090	0.0115	0.0090	0.0244				
1997	1	2	0	0	102	0.0000	0.0000	0.0045	0.0045	0.0175	0.0095	0.0180
	0.0283	0.0240	0.0361	0.0300	0.0346	0.0303	0.0320	0.0191	0.0136	0.0307	0.1000	0.2532
	0.9009	2.1714	3.9752	6.0868	7.3180	8.2774	8.8846	10.3676	10.7128	10.2442	8.6087	6.4056
	4.5583	3.0897	2.2322	1.5336	1.0943	0.7586	0.6056	0.3728	0.2314	0.2456	0.1737	0.1118
	0.0810	0.0760	0.0483	0.0550	0.0183	0.0299	0.0052	0.0394				
1998	1	2	0	0	94	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0291	0.0055	0.0152	0.0201	0.0309	0.0786	0.2148	0.4806	0.9896
	1.9114	3.1067	4.6458	7.7507	10.9445	13.0675	13.7215	12.3742	9.4706	6.3908	4.2349	2.5262
	1.4915	0.9287	0.5946	0.3971	0.2716	0.2143	0.1214	0.1003	0.0878	0.0475	0.0406	0.0232
	0.0258	0.0235	0.0122	0.0057	0.0036	0.0029	0.0049	0.0093				
1999	1	2	0	0	136	0.0000	0.0140	0.0037	0.0090	0.0010	0.0034	0.0066
	0.0057	0.0316	0.0521	0.1189	0.3614	0.7028	1.1060	1.7214	1.9452	2.0639	2.0924	2.2368
	2.8403	3.0093	3.6328	4.6785	6.2507	8.1427	10.3291	10.9685	10.3095	8.5619	6.2326	3.9248
	2.8442	1.7230	1.1824	0.7861	0.5753	0.4115	0.2814	0.1936	0.1657	0.0846	0.1275	0.0871
	0.0396	0.0642	0.0204	0.0157	0.0201	0.0028	0.0078	0.0104				
2000	1	2	0	0	16	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0002	0.0115	0.0269	0.0783	0.2229	0.5715	0.8796	1.3716	1.4679
	1.9613	2.4665	3.4212	4.4835	5.4263	6.1167	6.3849	7.2244	8.1919	8.6751	8.1729	7.9389
	6.0299	4.6940	3.5788	2.7613	1.9144	1.6095	1.1091	0.8607	0.6031	0.4619	0.4388	0.2513
	0.2007	0.1381	0.0794	0.0489	0.0472	0.0230	0.0196	0.0364				
2001	1	2	0	0	72	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0095	0.0067	0.0587	0.2057	0.2672	0.2541	0.2360	0.2768	0.1680	0.1071	0.0729	0.0268
	0.0359	0.0413	0.0228	0.1328	0.3029	0.7079	1.4757	3.0338	5.7325	8.9079	11.2086	12.8480
	11.8996	10.4744	8.4391	6.5580	4.7269	3.5529	2.5374	1.8422	1.1844	0.7793	0.5817	0.3953
	0.2782	0.2220	0.1321	0.1047	0.0273	0.0319	0.0287	0.0642				
2002	1	2	0	0	103	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0116	0.0168	0.0046	0.0046	0.0049	0.0295	0.0076
	0.0620	0.0081	0.0366	0.1599	0.2942	0.4882	1.1396	1.3920	2.5956	4.8810	7.4663	10.1087
	12.5335	12.7077	11.0521	8.9671	6.8943	5.5104	4.3519	2.7694	1.8741	1.5376	1.1212	0.6999
	0.4071	0.2684	0.1780	0.1428	0.0868	0.0675	0.0483	0.0700				
2003	1	2	0	0	118	0.0000	0.0078	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0091	0.0000	0.0376	0.0168	0.0530	0.0391	0.0327	0.0427	0.0346
	0.0000	0.2505	1.1718	2.9946	5.7363	9.9890	11.3838	12.8838	11.9749	10.6071	9.6759	6.2904
	4.3829	3.3957	2.1501	1.5351	1.2581	1.0889	0.6767	0.5597	0.3709	0.3422	0.3288	0.1696
	0.2269	0.0750	0.0465	0.0194	0.0403	0.0334	0.0069	0.0614				
2004	1	2	0	0	101	0.0021	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0022	0.0021	0.0056	0.0015	0.0062	0.0079	0.0102	0.0059	0.0287	0.0284	0.0883
	0.2258	0.6649	1.9245	4.8011	9.4218	13.3395	15.5264	14.0944	11.8361	9.0958	6.2083	4.1077
	2.6686	1.7630	1.1389	0.7698	0.6081	0.4042	0.3224	0.2523	0.1392	0.1278	0.0905	0.0712
	0.0548	0.0269	0.0236	0.0117	0.0218	0.0183	0.0096	0.0419				
2005	1	2	0	0	130	0.0000	0.0000	0.0000	0.0010	0.0000	0.0030	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0043	0.0021	0.0072	0.0201	0.0402
	0.0701	0.2991	0.5674	2.2474	5.5402	9.6405	13.5221	15.5204	14.7159	11.1222	8.5734	6.1017
	3.7296	2.3164	1.4919	1.1319	0.7689	0.6852	0.5564	0.3588	0.2161	0.1146	0.2099	0.0687
	0.0986	0.0455	0.0433	0.0322	0.0013	0.0181	0.0074	0.1072				
2006	1	2	0	0	136	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0430
	0.0006	0.0000	0.0204	0.0011	0.0000	0.0273	0.0364	0.0360	0.0025	0.0017	0.0435	0.0119
	0.1024	0.1601	0.5107	1.2618	2.7040	5.0533	8.4006	11.8521	14.1337	13.0027	11.9276	8.6126
	6.3217	4.1324	2.7241	2.1604	1.5860	1.0035	0.9456	0.6311	0.7092	0.4058	0.2925	0.2235
	0.1914	0.1281	0.1315	0.1141	0.0468	0.0870	0.0301	0.1892				
2007	1	2	0	0	167	0.0034	0.0002	0.0002	0.0002	0.0001	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0002	0.0005	0.0005	0.0017	0.0038	0.0017
	0.0034	0.0063	0.0072	0.0181	0.0308	0.0567	0.0763	0.1203	0.1430	0.1501	0.1002	0.0946
	0.0594	0.0386	0.0210	0.0170	0.0097	0.0101	0.0059	0.0041	0.0029	0.0024	0.0016	0.0022
	0.0017	0.0017	0.0005	0.0009	0.0002	0.0003	0.0001	0.0005				

2008	1	2	0	0	188	0.0000	0.0000	0.0000	0.0000	0.0002	0.0004	0.0015
	0.0034	0.0030	0.0016	0.0011	0.0022	0.0032	0.0059	0.0127	0.0108	0.0129	0.0081	0.0153
	0.0120	0.0212	0.0131	0.0172	0.0144	0.0217	0.0329	0.0602	0.0764	0.1226	0.1003	0.1239
	0.0854	0.0737	0.0451	0.0334	0.0168	0.0126	0.0075	0.0080	0.0042	0.0054	0.0017	0.0033
	0.0010	0.0022	0.0011	0.0000	0.0000	0.0004	0.0000	0.0000				
2009	1	2	0	0	342	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0002	0.0000	0.0009	0.0030	0.0074	0.0199	0.0412
	0.0516	0.0719	0.0630	0.0559	0.0495	0.0508	0.0515	0.0591	0.0637	0.0855	0.0740	0.0723
	0.0516	0.0457	0.0287	0.0217	0.0146	0.0093	0.0005	0.0060	0.0005	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000				
# Acoustic survey												
1977	1	3	0	0	85	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0762	0.1870	0.4156	0.4018	0.6304	0.6719	0.8313	1.2122	1.3716
	1.3716	1.5932	2.1543	2.7847	3.6021	4.1009	4.3918	5.1676	6.9825	8.2433	9.4417	8.9983
	7.4397	6.5738	5.2092	3.8930	2.7847	2.2582	1.7872	1.1153	0.8728	0.7551	0.5819	0.5611
	0.3671	0.3117	0.1940	0.2078	0.1316	0.0485	0.0554	0.0554				
1980	1	3	0	0	49	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0241	0.0000	0.0241	0.0723	0.3135	0.6872	1.7483	3.7618	5.6909
	6.1249	5.2689	3.8582	1.5192	0.8922	0.5426	0.7596	1.9050	3.2433	5.8235	8.3193	9.2838
	8.5483	8.1022	6.2937	4.7263	3.0625	2.0979	1.5915	1.0851	0.6872	0.6028	0.4943	0.2773
	0.1688	0.2411	0.1206	0.1326	0.1206	0.1085	0.0603	0.0603				
1983	1	3	0	0	35	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0232	0.0116	0.0348	0.4295	1.6369	4.1560	7.8941	10.5410	11.4465
	9.2408	7.7084	5.4678	3.6568	2.4611	2.1477	2.4611	3.3666	4.0051	4.2141	3.8542	3.5407
	2.8326	2.2638	1.8923	1.4511	0.8591	0.7198	0.4644	0.2786	0.3367	0.1741	0.1393	0.0929
	0.0580	0.0116	0.0116	0.0580	0.0116	0.0116	0.0232	0.0000				
1986	1	3	0	0	43	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001
	0.0003	0.0003	0.0020	0.0064	0.0223	0.0598	0.1116	0.1155	0.0614	0.0239	0.0072	0.0033
	0.0023	0.0039	0.0113	0.0382	0.0693	0.0909	0.0990	0.0670	0.0486	0.0372	0.0298	0.0229
	0.0166	0.0139	0.0103	0.0072	0.0049	0.0035	0.0022	0.0021	0.0012	0.0007	0.0006	0.0005
	0.0006	0.0004	0.0002	0.0002	0.0001	0.0003	0.0001	0.0002				
1989	1	3	0	0	22	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0534	0.0356	0.0000	0.0356	0.1956	0.5513	1.9029	2.2230	2.1697
	1.3694	1.5472	2.6143	7.9673	13.8182	16.6993	16.3258	11.4885	7.7361	4.6239	2.4898	1.6895
	0.9248	0.5513	0.3557	0.2668	0.1601	0.1067	0.0178	0.1423	0.0000	0.0178	0.0000	0.0000
	0.0178	0.0178	0.0356	0.0000	0.0000	0.0000	0.0000	0.0178				
1992	1	3	0	0	43	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.9966	1.0747	1.1451	2.0523	2.2678	1.3747	0.7046	0.4705	0.1384
	0.2064	0.5554	1.7227	3.9070	6.9265	10.1668	13.5941	14.4537	11.2977	7.4794	4.4176	2.5313
	1.2286	0.5984	0.4789	0.2226	0.1257	0.1510	0.0318	0.0608	0.0354	0.0260	0.0126	0.0029
	0.0043	0.0014	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000				
1995	1	3	0	0	69	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.2414	0.3534	1.4379	4.0874	8.1213	8.5327	6.1473	2.9749	1.2684
	0.5451	0.5222	1.2059	2.6843	4.8278	6.9954	8.0774	8.3294	7.4855	6.1477	3.8777	2.5148
	1.2530	0.8335	0.3644	0.2652	0.1357	0.0966	0.0656	0.0532	0.0414	0.0348	0.0181	0.0073
	0.0056	0.0032	0.0024	0.0091	0.0226	0.0176	0.0037	0.0037				
1998	1	3	0	0	84	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	1.9111	2.3583	2.7987	2.9771	2.6344	1.9192	1.7780	2.5431	3.2512
	3.6925	3.7927	4.3047	5.4560	7.6075	8.0688	8.4396	7.5478	6.2551	4.9928	3.5322	2.5057
	1.6519	1.0415	0.7464	0.4515	0.3132	0.2538	0.1641	0.1156	0.0562	0.0557	0.0423	0.0236
	0.0210	0.0125	0.0035	0.0053	0.0059	0.0084	0.0061	0.0135				
2001	1	3	0	0	49	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	1.3525	4.1216	8.3658	14.6019	16.9774	14.2018	8.5876	3.5231	1.6717
	1.4485	1.5298	1.9460	1.9285	1.9610	1.8787	2.2680	2.1509	2.2040	2.1926	1.9429	1.1800
	0.8779	0.6301	0.4768	0.3006	0.2136	0.1543	0.1206	0.0551	0.0789	0.0185	0.0621	0.0381
	0.0841	0.0565	0.0314	0.0243	0.0261	0.0014	0.0354	0.0687				
2003	1	3	0	0	71	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0944	0.1537	0.3314	0.4047	0.7614	0.6356	1.1926	1.0760	1.7630
	1.7640	4.4833	7.5862	14.3289	14.8713	13.9081	10.0821	7.4014	5.8903	3.9399	2.7178	1.9627
	1.3133	0.9244	0.6519	0.4871	0.3781	0.2422	0.1693	0.1103	0.1016	0.0309	0.0101	0.0184
	0.0231	0.0085	0.0160	0.0057	0.0028	0.0028	0.0046	0.0249				
2005	1	3	0	0	49	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.5764	0.6518	2.2930	3.3930	4.9816	3.7852	2.8587	2.0472	1.2751
	1.0973	1.1591	2.8742	4.7100	8.8084	14.7650	12.1110	12.1030	6.6716	5.1654	3.3105	1.6901
	1.0512	0.6182	0.3690	0.1856	0.1908	0.1801	0.0734	0.0314	0.0457	0.0478	0.0314	0.0335
	0.0175	0.0161	0.0124	0.0118	0.0879	0.0000	0.0000	0.0131				

2007	1	3	0	0	69	0.0000	0.0000	0.0000	0.0000	0.0053	0.0021	0.0031
	0.0074	0.0194	0.0291	0.0496	0.0587	0.0550	0.0488	0.0311	0.0250	0.0187	0.0101	0.0048
	0.0056	0.0068	0.0096	0.0172	0.0300	0.0390	0.0641	0.0831	0.0914	0.0843	0.0781	0.0423
	0.0289	0.0183	0.0127	0.0068	0.0039	0.0018	0.0019	0.0015	0.0007	0.0010	0.0007	0.0007
	0.0003	0.0003	0.0004	0.0002	0.0000	0.0000	0.0001	0.0003				
2009	1	3	0	0	50	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
	0.00000	0.00000	0.00000	0.00029	0.00053	0.00106	0.00158	0.00454	0.01849	0.03092	0.05423	0.08397
	0.13205	0.10945	0.11049	0.09887	0.07290	0.04825	0.04624	0.03160	0.03022	0.03156	0.02582	0.02638
	0.01333	0.00876	0.00484	0.00443	0.00318	0.00202	0.00117	0.00054	0.00039	0.00048	0.00012	0.00013
	0.00025	0.00005	0.00003	0.00037	0.00000	0.00022	0.00012	0.00014				
# Historical CA fisheries												
1963	1	5	0	0	13	0.0000	0.0000	0.0000	7.0000	5.0000	11.0000	11.0000
	10.0000	9.0000	5.0000	7.0000	10.0000	8.0000	6.0000	5.0000	2.0000	1.0000	1.0000	5.0000
	2.0000	1.0000	2.0000	3.0000	2.0000	0.0000	0.0000	0.0000	1.0000	0.0000	1.0000	2.0000
	0.0000	1.0000	0.0000	0.0000	2.0000	1.0000	0.0000	2.0000	1.0000	0.0000	2.0000	0.0000
	2.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000				
1964	1	5	0	0	5	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	1.0000	0.0000	0.0000	4.0000	2.0000
	2.0000	2.0000	3.0000	3.0000	4.0000	2.0000	1.0000	3.0000	1.0000	2.0000	3.0000	2.0000
	3.0000	3.0000	1.0000	3.0000	2.0000	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000
	1.0000	1.0000	0.0000	1.0000	1.0000	0.0000	0.0000	1.0000				
1966	1	5	0	0	1	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	2.0000	2.0000
	0.0000	1.0000	2.0000	0.0000	0.0000	1.0000	0.0000	0.0000				
1967	1	5	0	0	6	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000
	1.0000	2.0000	3.0000	6.0000	4.0000	2.0000	0.0000	1.0000	2.0000	1.0000	1.0000	0.0000
	1.0000	2.0000	1.0000	0.0000	0.0000	1.0000	1.0000	0.0000	0.0000	1.0000	0.0000	0.0000
	1.0000	1.0000	1.0000	0.0000	3.0000	0.0000	3.0000	2.0000	2.0000	2.0000	3.0000	3.0000
	2.0000	0.0000	0.0000	2.0000	0.0000	0.0000	1.0000	1.0000				
1968	1	5	0	0	18	3.0000	1.0000	0.0000	0.0000	1.0000	1.0000	6.0000
	10.0000	15.0000	11.0000	4.0000	5.0000	1.0000	2.0000	2.0000	1.0000	5.0000	1.0000	4.0000
	3.0000	2.0000	1.0000	1.0000	1.0000	3.0000	3.0000	1.0000	1.0000	1.0000	1.0000	2.0000
	0.0000	1.0000	6.0000	2.0000	4.0000	2.0000	5.0000	8.0000	6.0000	9.0000	8.0000	3.0000
	6.0000	6.0000	5.0000	3.0000	4.0000	2.0000	1.0000	6.0000				
1969	1	5	0	0	38	3.0000	0.0000	14.0000	33.0000	36.0000	37.0000	10.0000
	5.0000	3.0000	4.0000	2.0000	1.0000	3.0000	10.0000	5.0000	11.0000	5.0000	9.0000	14.0000
	11.0000	4.0000	9.0000	9.0000	1.0000	2.0000	5.0000	2.0000	1.0000	0.0000	1.0000	4.0000
	4.0000	1.0000	3.0000	4.0000	4.0000	6.0000	10.0000	4.0000	6.0000	12.0000	5.0000	10.0000
	11.0000	5.0000	10.0000	4.0000	4.0000	1.0000	6.0000	13.0000				
1970	1	5	0	0	39	4.0000	0.0000	9.0000	12.0000	21.0000	35.0000	24.0000
	19.0000	10.0000	13.0000	10.0000	11.0000	14.0000	10.0000	8.0000	10.0000	7.0000	13.0000	10.0000
	11.0000	7.0000	11.0000	10.0000	7.0000	8.0000	13.0000	6.0000	3.0000	3.0000	5.0000	4.0000
	1.0000	1.0000	3.0000	4.0000	3.0000	1.0000	1.0000	1.0000	4.0000	5.0000	2.0000	6.0000
	3.0000	4.0000	4.0000	1.0000	3.0000	1.0000	3.0000	10.0000				
1963	1	6	0	0	9	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	2.0000	1.0000	6.0000	6.0000	8.0000	7.0000	12.0000	9.0000	8.0000	9.0000
	6.0000	3.0000	3.0000	1.0000	3.0000	2.0000	2.0000	1.0000	1.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000				
1966	1	6	0	0	14	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000
	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	2.0000	0.0000	1.0000	1.0000
	2.0000	0.0000	5.0000	3.0000	3.0000	7.0000	6.0000	9.0000	9.0000	11.0000	12.0000	9.0000
	8.0000	7.0000	10.0000	8.0000	9.0000	2.000	2.0000	8.0000				
1967	1	6	0	0	2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	1.0000	0.0000	2.0000	0.0000	2.0000
	1.0000	1.0000	4.0000	1.0000	1.0000	0.0000	1.0000	2.0000				
1968	1	6	0	0	12	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	1.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000
	0.0000	3.0000	2.0000	2.0000	2.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	4.0000
	1.0000	3.0000	1.0000	4.0000	1.0000	2.0000	4.0000	10.0000	4.0000	5.0000	12.0000	4.0000
	11.0000	7.0000	3.0000	6.0000	6.0000	8.0000	1.0000	10.0000				

1969	1	6	0	0	14	2.0000	0.0000	0.0000	1.0000	7.0000	10.0000	10.0000
	6.0000	8.0000	4.0000	9.0000	4.0000	0.0000	5.0000	3.0000	1.0000	4.0000	4.0000	3.0000
	1.0000	1.0000	2.0000	1.0000	2.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	1.0000	0.0000	0.0000	3.0000	1.0000	1.0000	1.0000	2.0000	2.0000	3.0000	4.0000	3.0000
	1.0000	3.0000	5.0000	3.0000	5.0000	1.0000	1.0000	6.0000				
1970	1	6	0	0	12	0.0000	0.0000	0.0000	0.0000	2.0000	1.0000	3.0000
	6.0000	2.0000	1.0000	7.0000	12.0000	14.0000	12.0000	8.0000	5.0000	0.0000	3.0000	2.0000
	5.0000	2.0000	2.0000	2.0000	2.0000	0.0000	3.0000	2.0000	2.0000	1.0000	2.0000	0.0000
	2.0000	1.0000	1.0000	1.0000	0.0000	2.0000	0.0000	1.0000	1.0000	0.0000	1.0000	3.0000
	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000				
1963	1	7	0	0	24	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	3.0000	1.0000	2.0000	0.0000	1.0000	0.0000	2.0000	1.0000	3.0000	2.0000	6.0000
	6.0000	4.0000	8.0000	11.0000	9.0000	9.0000	13.0000	6.0000	8.0000	10.0000	15.0000	19.0000
	18.0000	12.0000	16.0000	5.0000	4.0000	7.0000	9.0000	8.0000	5.0000	2.0000	4.0000	1.0000
	4.0000	1.0000	1.0000	1.0000	0.0000	1.0000	0.0000	3.0000				
1966	1	7	0	0	22	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	2.0000	5.0000	0.0000	2.0000	1.0000
	3.0000	3.0000	2.0000	4.0000	4.0000	5.0000	3.0000	3.0000	4.0000	4.0000	4.0000	16.0000
	11.0000	9.0000	6.0000	16.0000	7.0000	16.0000	10.0000	15.0000	14.0000	13.0000	10.0000	7.0000
	4.0000	6.0000	3.0000	1.0000	1.0000	1.0000	0.0000	2.0000				
1967	1	7	0	0	26	2.0000	0.0000	0.0000	0.0000	0.0000	2.0000	2.0000
	5.0000	2.0000	2.0000	3.0000	2.0000	6.0000	6.0000	0.0000	18.0000	17.0000	22.0000	14.0000
	3.0000	10.0000	5.0000	3.0000	4.0000	1.0000	2.0000	2.0000	4.0000	5.0000	2.0000	1.0000
	9.0000	11.0000	6.0000	7.0000	7.0000	8.0000	8.0000	8.0000	14.0000	10.0000	7.0000	1.0000
	3.0000	3.0000	4.0000	2.0000	2.0000	1.0000	1.0000	3.0000				
1968	1	7	0	0	31	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	1.0000
	0.0000	0.0000	2.0000	0.0000	2.0000	1.0000	2.0000	0.0000	3.0000	2.0000	1.0000	2.0000
	0.0000	2.0000	1.0000	1.0000	6.0000	4.0000	2.0000	4.0000	4.0000	7.0000	7.0000	12.0000
	11.0000	15.0000	16.0000	11.0000	21.0000	27.0000	24.0000	19.0000	21.0000	19.0000	22.0000	6.0000
	4.0000	7.0000	5.0000	4.0000	2.0000	1.0000	1.0000	5.0000				
1969	1	7	0	0	12	1.0000	1.0000	1.0000	0.0000	0.0000	0.0000	2.0000
	1.0000	5.0000	3.0000	5.0000	6.0000	5.0000	4.0000	9.0000	2.0000	2.0000	0.0000	1.0000
	1.0000	3.0000	2.0000	1.0000	3.0000	0.0000	2.0000	1.0000	0.0000	2.0000	1.0000	2.0000
	0.0000	2.0000	4.0000	3.0000	2.0000	3.0000	4.0000	6.0000	4.0000	3.0000	3.0000	2.0000
	5.0000	6.0000	1.0000	1.0000	1.0000	5.0000	1.0000	0.0000				
1963	1	8	0	0	7	5.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	2.0000	0.0000	1.0000	1.0000	1.0000
	3.0000	1.0000	5.0000	5.0000	2.0000	2.0000	3.0000	3.0000	3.0000	2.0000	2.0000	2.0000
	1.0000	3.0000	1.0000	3.0000	2.0000	2.0000	2.0000	0.0000	0.0000	3.0000	1.0000	2.0000
	2.0000	1.0000	0.0000	1.0000	1.0000	0.0000	0.0000	0.0000				
1964	1	8	0	0	18	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	0.0000	3.0000	0.0000	1.0000	2.0000	0.0000	3.0000	1.0000	3.0000	8.0000	10.0000	5.0000
	9.0000	10.0000	6.0000	5.0000	8.0000	8.0000	10.0000	4.0000	6.0000	7.0000	6.0000	6.0000
	6.0000	14.0000	10.0000	6.0000	4.0000	7.0000	0.0000	5.0000	2.0000	3.0000	0.0000	0.0000
	1.0000	1.0000	0.0000	0.0000	1.0000	1.0000	1.0000	1.0000				
1966	1	8	0	0	23	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	3.0000	8.0000	7.0000	13.0000	9.0000	16.0000	12.0000	6.0000	8.0000	4.0000	3.0000	2.0000
	2.0000	1.0000	4.0000	4.0000	2.0000	2.0000	2.0000	3.0000	1.0000	5.0000	4.0000	4.0000
	2.0000	5.0000	8.0000	9.0000	6.0000	8.0000	4.0000	5.0000	8.0000	12.0000	4.0000	2.0000
	5.0000	7.0000	8.0000	2.0000	0.0000	1.0000	2.0000	2.0000				
1967	1	8	0	0	3	1.0000	0.0000	0.0000	0.0000	2.0000	2.0000	6.0000
	4.0000	3.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000
	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000
	1.0000	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	1.0000	1.0000	0.0000
	0.0000	0.0000	0.0000	1.0000	0.0000	1.0000	0.0000	2.0000				
1968	1	8	0	0	72	11.0000	9.0000	28.0000	55.0000	58.0000	63.0000	31.0000
	17.0000	10.0000	20.0000	12.0000	33.0000	44.0000	36.0000	20.0000	25.0000	27.0000	16.0000	16.0000
	11.0000	11.0000	14.0000	10.0000	11.0000	9.0000	10.0000	6.0000	6.0000	3.0000	6.0000	4.0000
	5.0000	5.0000	8.0000	0.0000	4.0000	3.0000	2.0000	8.0000	3.0000	8.0000	2.0000	9.0000
	7.0000	2.0000	4.0000	1.0000	5.0000	2.0000	1.0000	7.0000				
1969	1	8	0	0	29	0.0000	4.0000	13.0000	22.0000	37.0000	26.0000	17.0000
	10.0000	7.0000	6.0000	12.0000	4.0000	7.0000	7.0000	7.0000	8.0000	4.0000	6.0000	3.0000
	7.0000	6.0000	10.0000	9.0000	4.0000	6.0000	3.0000	9.0000	2.0000	2.0000	2.0000	1.0000
	3.0000	3.0000	4.0000	1.0000	1.0000	2.0000	2.0000	3.0000	2.0000	0.0000	1.0000	1.0000
	1.0000	3.0000	0.0000	2.0000	0.0000	1.0000	0.0000	0.0000				
1970	1	8	0	0	7	8.0000	1.0000	1.0000	0.0000	3.0000	4.0000	0.0000
	9.0000	4.0000	4.0000	3.0000	0.0000	3.0000	3.0000	0.0000	4.0000	4.0000	3.0000	3.0000

```
0.0000 1.0000 0.0000 0.0000 0.0000 0.0000 0.0000 2.0000 1.0000 0.0000 0.0000 1.0000
0.0000 0.0000 0.0000 1.0000 0.0000 1.0000 0.0000 0.0000 1.0000 0.0000 0.0000 1.0000
0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 1.0000

14 #_N_age_bins
# Age bins
2 3 4 5 6 7 8 9 10 11 12 13 14 15

37 #_N_ageerror_definitions
# Cohort and lab-specific tuned to 1.0 for normal, 0.55 for strong cohorts (77,80,84,99) and 0.80 for moderate cohorts (70,73,87,90).
0.5 1.5 2.5 3.5 4.5 5.5 6.5 7.5 8.5 9.5 10.5 11.5 12.5
13.5 14.5 15.5
0.40439 0.40439 0.412684 0.3387032 0.437168 0.454948 0.477873 0.507433 0.545548 0.594694 0.658063 0.739771 0.845126
0.980971 1.15613 1.38198
0.5 1.5 2.5 3.5 4.5 5.5 6.5 7.5 8.5 9.5 10.5 11.5 12.5
13.5 14.5 15.5
0.40439 0.323512 0.412684 0.423379 0.3497344 0.454948 0.477873 0.507433 0.545548 0.594694 0.658063 0.739771 0.845126
0.980971 1.15613 1.38198
0.5 1.5 2.5 3.5 4.5 5.5 6.5 7.5 8.5 9.5 10.5 11.5 12.5
13.5 14.5 15.5
0.40439 0.40439 0.3301472 0.423379 0.437168 0.3639584 0.477873 0.507433 0.545548 0.594694 0.658063 0.739771 0.845126
0.980971 1.15613 1.38198
0.5 1.5 2.5 3.5 4.5 5.5 6.5 7.5 8.5 9.5 10.5 11.5 12.5
13.5 14.5 15.5
0.40439 0.40439 0.412684 0.3387032 0.437168 0.454948 0.3822984 0.507433 0.545548 0.594694 0.658063 0.739771 0.845126
0.980971 1.15613 1.38198
0.5 1.5 2.5 3.5 4.5 5.5 6.5 7.5 8.5 9.5 10.5 11.5 12.5
13.5 14.5 15.5
0.40439 0.40439 0.412684 0.423379 0.3497344 0.454948 0.477873 0.4059464 0.545548 0.594694 0.658063 0.739771 0.845126
0.980971 1.15613 1.38198
0.5 1.5 2.5 3.5 4.5 5.5 6.5 7.5 8.5 9.5 10.5 11.5 12.5
13.5 14.5 15.5
0.40439 0.2224145 0.412684 0.423379 0.437168 0.3639584 0.477873 0.507433 0.4364384 0.594694 0.658063 0.739771 0.845126
0.980971 1.15613 1.38198
0.5 1.5 2.5 3.5 4.5 5.5 6.5 7.5 8.5 9.5 10.5 11.5 12.5
13.5 14.5 15.5
0.40439 0.40439 0.2269762 0.423379 0.437168 0.454948 0.3822984 0.507433 0.545548 0.4757552 0.658063 0.739771 0.845126
0.980971 1.15613 1.38198
0.5 1.5 2.5 3.5 4.5 5.5 6.5 7.5 8.5 9.5 10.5 11.5 12.5
13.5 14.5 15.5
0.40439 0.40439 0.412684 0.23285845 0.437168 0.454948 0.477873 0.4059464 0.545548 0.594694 0.5264504 0.739771
0.845126 0.980971 1.15613 1.38198
0.5 1.5 2.5 3.5 4.5 5.5 6.5 7.5 8.5 9.5 10.5 11.5 12.5
13.5 14.5 15.5
0.40439 0.2224145 0.412684 0.423379 0.2404424 0.454948 0.477873 0.507433 0.4364384 0.594694 0.658063 0.5918168 0.845126
0.980971 1.15613 1.38198
0.5 1.5 2.5 3.5 4.5 5.5 6.5 7.5 8.5 9.5 10.5 11.5 12.5
13.5 14.5 15.5
0.40439 0.40439 0.2269762 0.423379 0.437168 0.2502214 0.477873 0.507433 0.545548 0.4757552 0.658063 0.739771 0.6761008
0.980971 1.15613 1.38198
0.5 1.5 2.5 3.5 4.5 5.5 6.5 7.5 8.5 9.5 10.5 11.5 12.5
13.5 14.5 15.5
0.40439 0.40439 0.412684 0.23285845 0.437168 0.454948 0.26283015 0.507433 0.545548 0.594694 0.5264504
0.739771 0.845126 0.7847768 1.15613 1.38198
0.5 1.5 2.5 3.5 4.5 5.5 6.5 7.5 8.5 9.5 10.5 11.5 12.5
13.5 14.5 15.5
0.40439 0.40439 0.412684 0.423379 0.2404424 0.454948 0.477873 0.27908815 0.545548 0.594694 0.658063 0.5918168
0.845126 0.980971 0.924904 1.38198
0.5 1.5 2.5 3.5 4.5 5.5 6.5 7.5 8.5 9.5 10.5 11.5 12.5
13.5 14.5 15.5
0.40439 0.2224145 0.412684 0.423379 0.437168 0.2502214 0.477873 0.507433 0.3000514 0.594694 0.658063 0.739771 0.6761008
0.980971 1.15613 1.105584
0.5 1.5 2.5 3.5 4.5 5.5 6.5 7.5 8.5 9.5 10.5 11.5 12.5
13.5 14.5 15.5
0.40439 0.40439 0.2269762 0.423379 0.437168 0.454948 0.26283015 0.507433 0.545548 0.3270817 0.658063 0.739771
0.845126 0.7847768 1.15613 1.38198
```

0.5	1.5	2.5	3.5	4.5	5.5	6.5	7.5	8.5	9.5	10.5	11.5	12.5
	13.5	14.5	15.5									
0.40439	0.40439	0.412684	0.23285845		0.437168	0.454948	0.477873	0.27908815		0.545548	0.594694	
	0.36193465		0.739771	0.845126	0.980971	0.924904	1.38198					
0.5	1.5	2.5	3.5	4.5	5.5	6.5	7.5	8.5	9.5	10.5	11.5	12.5
	13.5	14.5	15.5									
0.40439	0.323512	0.412684	0.423379	0.2404424	0.454948	0.477873	0.507433	0.3000514	0.594694	0.658063	0.40687405	
	0.845126	0.980971	1.15613	1.105584								
0.5	1.5	2.5	3.5	4.5	5.5	6.5	7.5	8.5	9.5	10.5	11.5	12.5
	13.5	14.5	15.5									
0.40439	0.40439	0.3301472	0.423379	0.437168	0.2502214	0.477873	0.507433	0.545548	0.3270817	0.658063	0.739771	0.4648193
	0.980971	1.15613	1.38198									
0.5	1.5	2.5	3.5	4.5	5.5	6.5	7.5	8.5	9.5	10.5	11.5	12.5
	13.5	14.5	15.5									
0.40439	0.40439	0.412684	0.3387032	0.437168	0.454948	0.26283015		0.507433	0.545548	0.594694	0.36193465	
	0.739771	0.845126	0.53953405		1.15613	1.38198						
0.5	1.5	2.5	3.5	4.5	5.5	6.5	7.5	8.5	9.5	10.5	11.5	12.5
	13.5	14.5	15.5									
0.40439	0.323512	0.412684	0.423379	0.3497344	0.454948	0.477873	0.27908815		0.545548	0.594694	0.658063	
	0.40687405		0.845126	0.980971	0.6358715	1.38198						
0.5	1.5	2.5	3.5	4.5	5.5	6.5	7.5	8.5	9.5	10.5	11.5	12.5
	13.5	14.5	15.5									
0.40439	0.40439	0.3301472	0.423379	0.437168	0.3639584	0.477873	0.507433	0.3000514	0.594694	0.658063	0.739771	0.4648193
	0.980971	1.15613	0.760089									
0.5	1.5	2.5	3.5	4.5	5.5	6.5	7.5	8.5	9.5	10.5	11.5	12.5
	13.5	14.5	15.5									
0.40439	0.40439	0.412684	0.3387032	0.437168	0.454948	0.3822984	0.507433	0.545548	0.3270817	0.658063	0.739771	0.845126
	0.53953405		1.15613	1.38198								
0.5	1.5	2.5	3.5	4.5	5.5	6.5	7.5	8.5	9.5	10.5	11.5	12.5
	13.5	14.5	15.5									
0.40439	0.40439	0.412684	0.423379	0.3497344	0.454948	0.477873	0.4059464	0.545548	0.594694	0.36193465		0.739771
	0.845126	0.980971	0.6358715	1.38198								
0.5	1.5	2.5	3.5	4.5	5.5	6.5	7.5	8.5	9.5	10.5	11.5	12.5
	13.5	14.5	15.5									
0.40439	0.40439	0.412684	0.423379	0.437168	0.3639584	0.477873	0.507433	0.4364384	0.594694	0.658063	0.40687405	
	0.845126	0.980971	1.15613	0.760089								
0.5	1.5	2.5	3.5	4.5	5.5	6.5	7.5	8.5	9.5	10.5	11.5	12.5
	13.5	14.5	15.5									
0.40439	0.40439	0.412684	0.423379	0.437168	0.454948	0.3822984	0.507433	0.545548	0.4757552	0.658063	0.739771	0.4648193
	0.980971	1.15613	1.38198									
0.5	1.5	2.5	3.5	4.5	5.5	6.5	7.5	8.5	9.5	10.5	11.5	12.5
	13.5	14.5	15.5									
0.40439	0.40439	0.412684	0.423379	0.437168	0.454948	0.477873	0.4059464	0.545548	0.594694	0.5264504	0.739771	0.845126
	0.53953405		1.15613	1.38198								
0.5	1.5	2.5	3.5	4.5	5.5	6.5	7.5	8.5	9.5	10.5	11.5	12.5
	13.5	14.5	15.5									
0.40439	0.40439	0.412684	0.423379	0.437168	0.454948	0.477873	0.507433	0.4364384	0.594694	0.658063	0.5918168	0.845126
	0.980971	0.6358715	1.38198									
0.5	1.5	2.5	3.5	4.5	5.5	6.5	7.5	8.5	9.5	10.5	11.5	12.5
	13.5	14.5	15.5									
0.40439	0.40439	0.412684	0.423379	0.437168	0.454948	0.477873	0.507433	0.545548	0.4757552	0.658063	0.739771	0.6761008
	0.980971	1.15613	0.760089									
0.5	1.5	2.5	3.5	4.5	5.5	6.5	7.5	8.5	9.5	10.5	11.5	12.5
	13.5	14.5	15.5									
0.40439	0.2224145	0.412684	0.423379	0.437168	0.454948	0.477873	0.507433	0.545548	0.594694	0.5264504	0.739771	0.845126
	0.7847768	1.15613	1.38198									
0.5	1.5	2.5	3.5	4.5	5.5	6.5	7.5	8.5	9.5	10.5	11.5	12.5
	13.5	14.5	15.5									
0.329242	0.329242	0.19080435		0.368632	0.395312	0.42809	0.468362	0.517841	0.57863	0.653316	0.745076	0.6862504
	0.996322	1.1665	1.100456	1.305952								
0.5	1.5	2.5	3.5	4.5	5.5	6.5	7.5	8.5	9.5	10.5	11.5	12.5
	13.5	14.5	15.5									
0.329242	0.329242	0.346917	0.2027476	0.395312	0.42809	0.468362	0.517841	0.57863	0.653316	0.745076	0.857813	0.7970576
	1.1665	1.37557	1.63244									
0.5	1.5	2.5	3.5	4.5	5.5	6.5	7.5	8.5	9.5	10.5	11.5	12.5
	13.5	14.5	15.5									

```
0.329242 0.329242 0.346917 0.368632 0.2174216 0.42809 0.468362 0.517841 0.57863 0.653316 0.745076 0.857813 0.996322
         0.9332   1.37557  1.63244
0.5      1.5      2.5      3.5      4.5      5.5      6.5      7.5      8.5      9.5      10.5     11.5     12.5
         13.5     14.5     15.5
0.329242 0.329242 0.346917 0.368632 0.395312 0.2354495 0.468362 0.517841 0.57863 0.653316 0.745076 0.857813 0.996322
         1.1665   1.100456 1.305952
0.5      1.5      2.5      3.5      4.5      5.5      6.5      7.5      8.5      9.5      10.5     11.5     12.5
         13.5     14.5     15.5
0.329242 0.329242 0.346917 0.368632 0.395312 0.42809 0.2575991 0.517841 0.57863 0.653316 0.745076 0.857813 0.996322
         1.1665   1.37557  1.63244
0.5      1.5      2.5      3.5      4.5      5.5      6.5      7.5      8.5      9.5      10.5     11.5     12.5
         13.5     14.5     15.5
0.329242 0.2633936 0.346917 0.368632 0.395312 0.42809 0.468362 0.28481255 0.57863 0.653316 0.745076 0.857813
         0.996322 1.1665  1.37557  1.63244
0.5      1.5      2.5      3.5      4.5      5.5      6.5      7.5      8.5      9.5      10.5     11.5     12.5
         13.5     14.5     15.5
0.329242 0.329242 0.2775336 0.368632 0.395312 0.42809 0.468362 0.517841 0.3182465 0.653316 0.745076 0.857813 0.996322
         1.1665   1.37557  1.63244
0.5      1.5      2.5      3.5      4.5      5.5      6.5      7.5      8.5      9.5      10.5     11.5     12.5
         13.5     14.5     15.5
0.329242 0.329242 0.346917 0.2949056 0.395312 0.42809 0.468362 0.517841 0.57863 0.3593238 0.745076 0.857813 0.996322
         1.1665   1.37557  1.63244
0.5      1.5      2.5      3.5      4.5      5.5      6.5      7.5      8.5      9.5      10.5     11.5     12.5
         13.5     14.5     15.5
0.329242 0.329242 0.346917 0.368632 0.3162496 0.42809 0.468362 0.517841 0.57863 0.653316 0.4097918 0.857813 0.996322
         1.1665   1.37557  1.63244

2669     # Number of age comp observations using restricted length ranges
2        # Length bin refers to: 1=population length bin indices; 2=data length bin indices
0        #_combine males into females at or below this bin number

# Yr Seas Flt/Svy   Gender Part   Ageerr Lbin_lo Lbin_hi Nsamp datavector(female-male)
# US fishery
1973     1        1        0        0        1        1        51       60       0        0.26     0.045    0.101
         0.187    0.117    0.107    0.1      0.048    0.021    0.009    0.005    0        0
1974     1        1        0        0        2        1        51       60       0.0044   0.0033   0.5066   0.0692
         0.1198   0.1494   0.0868   0.0385   0.0121   0.0055   0.0033   0.0011   0        0
1975     1        1        0        0        3        4        4        1        1        0        0        0
         0        0        0        0        0        0        0        0        0        0
1975     1        1        0        0        3        5        5        1        1        0        0        0
         0        0        0        0        0        0        0        0        0        0
1975     1        1        0        0        3        6        6        1        1        0        0        0
         0        0        0        0        0        0        0        0        0        0
1975     1        1        0        0        3        7        7        2        1        0        0        0
         0        0        0        0        0        0        0        0        0        0
1975     1        1        0        0        3        8        8        2        1        0        0        0
         0        0        0        0        0        0        0        0        0        0
1975     1        1        0        0        3        9        9        1        1        0        0        0
         0        0        0        0        0        0        0        0        0        0
1975     1        1        0        0        3        10       10       3        1        0        0        0
         0        0        0        0        0        0        0        0        0        0
1975     1        1        0        0        3        11       11       5        1        0        0        0
         0        0        0        0        0        0        0        0        0        0
1975     1        1        0        0        3        12       12       3        1        0        0        0
         0        0        0        0        0        0        0        0        0        0
1975     1        1        0        0        3        13       13       5        1        0        0        0
         0        0        0        0        0        0        0        0        0        0
1975     1        1        0        0        3        14       14       2        0.9405   0.0595   0        0
         0        0        0        0        0        0        0        0        0        0
1975     1        1        0        0        3        15       15       4        0.9591   0.0409   0        0
         0        0        0        0        0        0        0        0        0        0
1975     1        1        0        0        3        16       16       4        0.9333   0.0667   0        0
         0        0        0        0        0        0        0        0        0        0
1975     1        1        0        0        3        17       17       5        0.7037   0.2963   0        0
         0        0        0        0        0        0        0        0        0        0
1975     1        1        0        0        3        18       18       5        0.683    0.317    0        0
         0        0        0        0        0        0        0        0        0        0
```

1975	1	1	0	0	3	19	19	3	0.2805	0.1569	0	0.5626
	0	0	0	0	0	0	0	0	0	0		
1975	1	1	0	0	3	20	20	2	0	0.372	0	0.5
	0	0.128	0	0	0	0	0	0	0	0		
1975	1	1	0	0	3	21	21	6	0	0	0.2381	0.7447
	0.0172	0	0	0	0	0	0	0	0	0		
1975	1	1	0	0	3	22	22	10	0	0	0	0.9467
	0.0533	0	0	0	0	0	0	0	0	0		
1975	1	1	0	0	3	23	23	9	0	0	0.1932	0.8068
	0	0	0	0	0	0	0	0	0	0		
1975	1	1	0	0	3	24	24	9	0	0	0.0928	0.8553
	0	0.0519	0	0	0	0	0	0	0	0		
1975	1	1	0	0	3	25	25	10	0	0	0.07	0.8487
	0.07	0	0.0112	0	0	0	0	0	0	0		
1975	1	1	0	0	3	26	26	8	0	0	0	0.7783
	0.1682	0.0268	0.0268	0	0	0	0	0	0	0		
1975	1	1	0	0	3	27	27	9	0	0	0.0701	0.7221
	0	0.0284	0.1094	0.0701	0	0	0	0	0	0		
1975	1	1	0	0	3	28	28	7	0	0	0	0.2813
	0.5318	0.0255	0.1614	0	0	0	0	0	0	0		
1975	1	1	0	0	3	29	29	10	0	0	0	0.3104
	0	0.4162	0.2145	0.0589	0	0	0	0	0	0		
1975	1	1	0	0	3	30	30	8	0	0	0	0.0482
	0.7822	0.1336	0	0	0.0361	0	0	0	0	0		
1975	1	1	0	0	3	31	31	4	0	0	0	0.0999
	0	0.7015	0.1987	0	0	0	0	0	0	0		
1975	1	1	0	0	3	32	32	5	0	0	0	0.2871
	0	0.0536	0.5823	0.077	0	0	0	0	0	0		
1975	1	1	0	0	3	33	33	6	0	0	0	0
	0	0.2769	0.4642	0.0426	0.1603	0.056	0	0	0	0		
1975	1	1	0	0	3	35	35	2	0	0	0	0
	0	0.7354	0.2646	0	0	0	0	0	0	0		
1975	1	1	0	0	3	36	36	4	0	0	0	0
	0	0.107	0.893	0	0	0	0	0	0	0		
1975	1	1	0	0	3	38	38	1	0	0	0	0
	0	1	0	0	0	0	0	0	0	0		
1975	1	1	0	0	3	39	39	1	0	0	0	0
	0	0	0	0	0	0	1	0	0	0		
1975	1	1	0	0	3	40	40	2	0	0	0	0
	0	0	0.2149	0	0	0.7851	0	0	0	0		
1975	1	1	0	0	3	41	41	1	0	0	0	0
	0	0	0	0	0	0	0	1	0	0		
1975	1	1	0	0	3	49	49	1	0	0	0	0
	0	0	0	0	0	1	0	0	0	0		
1975	1	1	0	0	3	50	50	1	0	0	0	0
	0	0	0	0	0	0	0	0	1	0		
1976	1	1	0	0	4	3	3	1	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
1976	1	1	0	0	4	4	4	1	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
1976	1	1	0	0	4	5	5	1	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
1976	1	1	0	0	4	6	6	3	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
1976	1	1	0	0	4	7	7	1	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
1976	1	1	0	0	4	8	8	4	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
1976	1	1	0	0	4	9	9	5	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
1976	1	1	0	0	4	10	10	4	0.978	0.022	0	0
	0	0	0	0	0	0	0	0	0	0		
1976	1	1	0	0	4	11	11	4	0.4381	0.5619	0	0
	0	0	0	0	0	0	0	0	0	0		
1976	1	1	0	0	4	12	12	6	0.9558	0.0442	0	0
	0	0	0	0	0	0	0	0	0	0		

1976	1	1	0	0	4	13	13	8	0.7676	0.1848	0.0476	0
	0	0	0	0	0	0	0	0	0	0		
1976	1	1	0	0	4	14	14	9	0.8393	0.1607	0	0
	0	0	0	0	0	0	0	0	0	0		
1976	1	1	0	0	4	15	15	10	0.4683	0.5317	0	0
	0	0	0	0	0	0	0	0	0	0		
1976	1	1	0	0	4	16	16	7	0.2113	0.7887	0	0
	0	0	0	0	0	0	0	0	0	0		
1976	1	1	0	0	4	17	17	13	0.2865	0.7135	0	0
	0	0	0	0	0	0	0	0	0	0		
1976	1	1	0	0	4	18	18	23	0.0739	0.6708	0.2445	0.0108
	0	0	0	0	0	0	0	0	0	0		
1976	1	1	0	0	4	19	19	26	0.0438	0.6345	0.3195	0
	0.0022	0	0	0	0	0	0	0	0	0		
1976	1	1	0	0	4	20	20	45	0.0606	0.7007	0.2234	0.011
	0.0017	0.0026	0	0	0	0	0	0	0	0		
1976	1	1	0	0	4	21	21	58	0.0574	0.7345	0.164	0.0225
	0.0202	0.0014	0	0	0	0	0	0	0	0		
1976	1	1	0	0	4	22	22	53	0.0024	0.6833	0.2001	0.0474
	0.0558	0.011	0	0	0	0	0	0	0	0		
1976	1	1	0	0	4	23	23	55	0.0032	0.7128	0.1398	0.0135
	0.1086	0.0221	0	0	0	0	0	0	0	0		
1976	1	1	0	0	4	24	24	56	0.0057	0.5527	0.221	0.0464
	0.1456	0.0213	0.0074	0	0	0	0	0	0	0		
1976	1	1	0	0	4	25	25	54	0	0.3929	0.1663	0.0789
	0.2949	0.067	0	0	0	0	0	0	0	0		
1976	1	1	0	0	4	26	26	47	0.0098	0.2632	0.122	0.056
	0.4639	0.0851	0	0	0	0	0	0	0	0		
1976	1	1	0	0	4	27	27	47	0	0.1093	0.2956	0.0532
	0.4177	0.1132	0.0111	0	0	0	0	0	0	0		
1976	1	1	0	0	4	28	28	39	0	0.0219	0.0193	0.0511
	0.7372	0.115	0.0415	0.0141	0	0	0	0	0	0		
1976	1	1	0	0	4	29	29	42	0	0.0203	0.0314	0.0486
	0.5862	0.2588	0.0348	0.008	0.0062	0	0.0029	0.0029	0	0		
1976	1	1	0	0	4	30	30	44	0	0	0.0107	0.0115
	0.638	0.2305	0.0698	0.0369	0.0026	0	0	0	0	0		
1976	1	1	0	0	4	31	31	57	0	0	0	0.0339
	0.5675	0.2176	0.0229	0.0597	0.0319	0.0148	0.0065	0	0.0452	0		
1976	1	1	0	0	4	32	32	62	0	0.0038	0	0.0206
	0.3736	0.2764	0.1116	0.1706	0.014	0.0001	0.0083	0.002	0.019	0		
1976	1	1	0	0	4	33	33	60	0	0	0.0077	0.0094
	0.2628	0.3862	0.1089	0.055	0.0827	0.0558	0.0024	0.0291	0	0		
1976	1	1	0	0	4	34	34	69	0	0	0	0.0339
	0.1473	0.1962	0.2986	0.1038	0.1643	0.0013	0.0547	0	0	0		
1976	1	1	0	0	4	35	35	64	0	0	0.0034	0
	0.1102	0.2184	0.2629	0.1766	0.0764	0.0424	0.0419	0.065	0.0029	0		
1976	1	1	0	0	4	36	36	58	0	0	0	0.0027
	0.13	0.3916	0.1777	0.1439	0.0839	0.0514	0.0152	0.0035	0	0		
1976	1	1	0	0	4	37	37	67	0	0	0	0.007
	0.1063	0.1894	0.1757	0.1725	0.1264	0.2008	0.0124	0.0048	0	0.0048		
1976	1	1	0	0	4	38	38	65	0	0	0	0
	0.0539	0.155	0.2507	0.1231	0.3253	0.0384	0.0305	0.0232	0	0		
1976	1	1	0	0	4	39	39	62	0	0	0	0
	0.0792	0.2445	0.2162	0.242	0.1218	0.0376	0.0079	0.0422	0.0085	0		
1976	1	1	0	0	4	40	40	57	0	0	0	0
	0.1455	0.1615	0.2425	0.1723	0.1519	0.056	0.0244	0.0273	0	0.0186		
1976	1	1	0	0	4	41	41	56	0	0	0	0.0037
	0.1479	0.1153	0.1514	0.3359	0.0721	0.0963	0.0707	0	0.0067	0		
1976	1	1	0	0	4	42	42	48	0	0	0	0
	0.0181	0.1664	0.2579	0.2624	0.1268	0.0807	0.0579	0.0027	0.0272	0		
1976	1	1	0	0	4	43	43	45	0	0	0	0
	0.0585	0.0121	0.3462	0.204	0.0525	0.1589	0.1108	0.0443	0.0126	0		
1976	1	1	0	0	4	44	44	30	0	0	0	0
	0.0468	0.0397	0.1537	0.2533	0.1572	0.0822	0.0756	0.1014	0.0901	0		
1976	1	1	0	0	4	45	45	36	0	0	0	0
	0	0.0591	0.2812	0.209	0.2408	0.1097	0.0811	0.0177	0.0014	0		

1976	1	1	0	0	4	46	46	33	0	0	0	0
	0	0.0379	0.0677	0.1629	0.2168	0.2329	0.1623	0.1106	0.0088	0		
1976	1	1	0	0	4	47	47	33	0	0	0	0
	0	0.0491	0.3136	0.0988	0.18	0.1342	0.1857	0.0385	0	0		
1976	1	1	0	0	4	48	48	33	0	0	0	0
	0	0.02	0.2074	0.0845	0.2476	0.2728	0.1106	0.0425	0.0085	0.006		
1976	1	1	0	0	4	49	49	28	0	0	0	0
	0	0.0137	0.1389	0.2733	0.2016	0.1612	0.0161	0.1125	0.0325	0.0503		
1976	1	1	0	0	4	50	50	25	0	0	0	0
	0	0	0.122	0.1008	0.153	0.1807	0.3805	0.0295	0.0336	0		
1976	1	1	0	0	4	51	51	71	0	0	0	0
	0.0061	0.001	0.0301	0.1087	0.2296	0.1739	0.2187	0.0755	0.1333	0.023		
1977	1	1	0	0	5	1	1	1	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
1977	1	1	0	0	5	2	2	1	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
1977	1	1	0	0	5	12	12	2	0.8299	0	0	0
	0	0	0.1701	0	0	0	0	0	0	0		
1977	1	1	0	0	5	14	14	4	0.4537	0.0691	0.4773	0
	0	0	0	0	0	0	0	0	0	0		
1977	1	1	0	0	5	15	15	5	0.5662	0.4338	0	0
	0	0	0	0	0	0	0	0	0	0		
1977	1	1	0	0	5	16	16	12	0.9224	0.0776	0	0
	0	0	0	0	0	0	0	0	0	0		
1977	1	1	0	0	5	17	17	28	0.8125	0.1193	0.066	0
	0	0	0.0023	0	0	0	0	0	0	0		
1977	1	1	0	0	5	18	18	56	0.7772	0.1286	0.0941	0
	0	0	0	0	0	0	0	0	0	0		
1977	1	1	0	0	5	19	19	71	0.8142	0.0567	0.1247	0
	0	0.0015	0.0029	0	0	0	0	0	0	0		
1977	1	1	0	0	5	20	20	99	0.7333	0.1031	0.1617	0.0011
	0.0007	0	0	0	0	0	0	0	0	0		
1977	1	1	0	0	5	21	21	114	0.1644	0.2215	0.5934	0.0173
	0	0.0016	0	0.0018	0	0	0	0	0	0		
1977	1	1	0	0	5	22	22	146	0.0923	0.159	0.6948	0.0264
	0.0077	0.0191	0.0007	0	0	0	0	0	0	0		
1977	1	1	0	0	5	23	23	141	0.0062	0.1476	0.7218	0.0577
	0.0316	0.035	0	0	0	0	0	0	0	0		
1977	1	1	0	0	5	24	24	160	0.0032	0.0716	0.7254	0.0942
	0.049	0.0501	0.0057	0	0	0.0008	0	0	0	0		
1977	1	1	0	0	5	25	25	160	0	0.0327	0.6877	0.1254
	0.0543	0.0915	0.0085	0	0	0	0	0	0	0		
1977	1	1	0	0	5	26	26	147	0	0.0484	0.5472	0.0594
	0.1153	0.2175	0.0086	0.0036	0	0	0	0	0	0		
1977	1	1	0	0	5	27	27	142	0	0.0025	0.4435	0.1097
	0.1106	0.2577	0.0615	0.0082	0.0064	0	0	0	0	0		
1977	1	1	0	0	5	28	28	132	0	0.006	0.314	0.0613
	0.1098	0.4411	0.0473	0.006	0.0032	0.0114	0	0	0	0		
1977	1	1	0	0	5	29	29	128	0	0.0023	0.142	0.0543
	0.1526	0.5996	0.0393	0.0043	0.0038	0.0017	0	0	0	0		
1977	1	1	0	0	5	30	30	136	0	0	0.0793	0.0593
	0.2159	0.4992	0.0777	0.0358	0.0273	0.0055	0	0	0	0		
1977	1	1	0	0	5	31	31	123	0	0	0.0414	0.0399
	0.1582	0.5998	0.0951	0.0486	0.0014	0.0081	0.0059	0.0016	0	0		
1977	1	1	0	0	5	32	32	135	0	0.0012	0.0281	0.0149
	0.1329	0.5877	0.1012	0.0655	0.0608	0.0035	0.0007	0.0033	0	0		
1977	1	1	0	0	5	33	33	140	0	0	0.0026	0.0275
	0.1081	0.4946	0.1841	0.1026	0.0622	0.0157	0.0011	0.0015	0	0		
1977	1	1	0	0	5	34	34	146	0	0	0.0099	0.0043
	0.07	0.478	0.2452	0.0972	0.0697	0.0189	0.0046	0.0021	0	0		
1977	1	1	0	0	5	35	35	147	0	0	0	0.0012
	0.0243	0.3832	0.1788	0.2209	0.1037	0.0553	0.0325	0	0	0		
1977	1	1	0	0	5	36	36	161	0.0019	0	0.0039	0.0022
	0.0421	0.2342	0.1925	0.2045	0.1375	0.1001	0.0465	0.0246	0.0101	0		
1977	1	1	0	0	5	37	37	139	0	0	0	0
	0.0303	0.2215	0.1949	0.2289	0.1368	0.1083	0.0669	0.0124	0	0		

1977	1	1	0	0	5	38	38	131	0	0	0	0
	0.0105	0.1675	0.21	0.1919	0.1204	0.2065	0.0814	0.0105	0	0.0014		
1977	1	1	0	0	5	39	39	94	0	0	0	0
	0.0127	0.0573	0.3377	0.1953	0.1128	0.1185	0.1161	0.0435	0.003	0.0031		
1977	1	1	0	0	5	40	40	95	0	0	0	0
	0.0027	0.1283	0.1146	0.2983	0.138	0.1317	0.1481	0.0287	0.0063	0.0033		
1977	1	1	0	0	5	41	41	73	0	0	0	0.0055
	0.0055	0.1773	0.0236	0.1405	0.1973	0.2013	0.1986	0.0418	0.0087	0		
1977	1	1	0	0	5	42	42	60	0	0	0	0
	0.0055	0.0499	0.0594	0.1587	0.2694	0.3643	0.0224	0.0492	0.0105	0.0106		
1977	1	1	0	0	5	43	43	52	0	0	0	0
	0	0.0242	0.0512	0.1418	0.2557	0.3208	0.0729	0.1249	0.0086	0		
1977	1	1	0	0	5	44	44	46	0	0	0	0
	0.0073	0.0537	0.0821	0.2441	0.2116	0.2037	0.1287	0.0615	0	0.0073		
1977	1	1	0	0	5	45	45	42	0	0	0	0
	0	0.0824	0.0222	0.0767	0.2262	0.3032	0.1929	0.0606	0.0359	0		
1977	1	1	0	0	5	46	46	23	0	0	0	0
	0	0.0105	0.1508	0.1211	0.0848	0.1563	0.3663	0.1102	0	0		
1977	1	1	0	0	5	47	47	17	0	0	0	0
	0	0	0.0114	0.237	0.0963	0.1037	0.3749	0.1767	0	0		
1977	1	1	0	0	5	48	48	15	0	0	0	0
	0	0	0.0365	0.2538	0.0771	0.1398	0.1929	0.2188	0.081	0		
1977	1	1	0	0	5	49	49	18	0	0	0.0025	0
	0	0	0	0.1157	0.2068	0.023	0	0.0788	0.1044	0.4688		
1977	1	1	0	0	5	50	50	17	0	0	0	0
	0	0.0159	0.0824	0.2843	0.1584	0.0198	0.3424	0.0968	0	0		
1977	1	1	0	0	5	51	51	62	0	0	0	0
	0	0	0	0.001	0.1218	0.1033	0.1904	0.3855	0.1219	0.0761		
1978	1	1	0	0	6	2	2	2	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
1978	1	1	0	0	6	3	3	2	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
1978	1	1	0	0	6	4	4	4	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
1978	1	1	0	0	6	5	5	4	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
1978	1	1	0	0	6	6	6	10	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
1978	1	1	0	0	6	7	7	10	0.9898	0.0103	0	0
	0	0	0	0	0	0	0	0	0	0		
1978	1	1	0	0	6	8	8	9	0.9835	0.0165	0	0
	0	0	0	0	0	0	0	0	0	0		
1978	1	1	0	0	6	9	9	14	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
1978	1	1	0	0	6	10	10	7	0.5882	0.4118	0	0
	0	0	0	0	0	0	0	0	0	0		
1978	1	1	0	0	6	11	11	4	0.8627	0.1373	0	0
	0	0	0	0	0	0	0	0	0	0		
1978	1	1	0	0	6	12	12	2	0.976	0.024	0	0
	0	0	0	0	0	0	0	0	0	0		
1978	1	1	0	0	6	17	17	3	0.7052	0.2948	0	0
	0	0	0	0	0	0	0	0	0	0		
1978	1	1	0	0	6	18	18	7	0.4619	0.5381	0	0
	0	0	0	0	0	0	0	0	0	0		
1978	1	1	0	0	6	19	19	17	0	0.7421	0.2307	0.0196
	0	0	0.0077	0	0	0	0	0	0	0		
1978	1	1	0	0	6	20	20	51	0	0.6089	0.2035	0.1859
	0.0016	0	0	0	0	0	0	0	0	0		
1978	1	1	0	0	6	21	21	88	0	0.5128	0.2425	0.2367
	0.008	0	0	0	0	0	0	0	0	0		
1978	1	1	0	0	6	22	22	129	0	0.4106	0.1932	0.341
	0.0551	0	0	0	0	0	0	0	0	0		
1978	1	1	0	0	6	23	23	176	0	0.3421	0.2019	0.4112
	0.0428	0.002	0	0	0	0	0	0	0	0		
1978	1	1	0	0	6	24	24	171	0	0.2003	0.2269	0.5104
	0.0451	0.006	0.0112	0	0	0	0	0	0	0		

1978	1	1	0	0	6	25	25	158	0	0.1438	0.1929	0.5646
	0.062	0.0236	0.0071	0	0	0.006	0	0	0	0		
1978	1	1	0	0	6	26	26	165	0	0.0429	0.1257	0.6614
	0.1228	0.0281	0.0192	0	0	0	0	0	0	0		
1978	1	1	0	0	6	27	27	148	0	0.0133	0.0857	0.623
	0.082	0.0933	0.0882	0.0042	0.0102	0	0	0	0	0		
1978	1	1	0	0	6	28	28	144	0	0.0064	0.0591	0.5178
	0.1041	0.122	0.1837	0.0068	0	0	0	0	0	0		
1978	1	1	0	0	6	29	29	154	0	0	0.0143	0.4216
	0.0813	0.2157	0.2633	0.0003	0.0017	0.0019	0	0	0	0		
1978	1	1	0	0	6	30	30	143	0	0	0.0074	0.3001
	0.0663	0.2068	0.3783	0.034	0.0071	0	0	0	0	0		
1978	1	1	0	0	6	31	31	147	0	0	0.0002	0.1778
	0.0518	0.2469	0.4317	0.0613	0.0302	0	0	0	0	0		
1978	1	1	0	0	6	32	32	156	0	0	0.0052	0.067
	0.0496	0.2608	0.5014	0.0854	0.0147	0.0104	0.0042	0.0013	0	0		
1978	1	1	0	0	6	33	33	184	0	0	0	0.0844
	0.0372	0.1948	0.4926	0.1311	0.0261	0.0275	0.0063	0	0	0		
1978	1	1	0	0	6	34	34	178	0	0	0	0.0211
	0.0124	0.1427	0.5319	0.127	0.0972	0.055	0.0105	0.0022	0	0		
1978	1	1	0	0	6	35	35	186	0	0	0	0.0065
	0.0124	0.1068	0.4222	0.1921	0.1965	0.0504	0.0122	0.0011	0	0		
1978	1	1	0	0	6	36	36	176	0	0	0	0
	0.0041	0.0583	0.4449	0.1516	0.1747	0.0774	0.0427	0.0461	0	0		
1978	1	1	0	0	6	37	37	156	0	0	0	0.001
	0.0074	0.0341	0.3783	0.2106	0.1838	0.1191	0.0224	0.0121	0.0312	0		
1978	1	1	0	0	6	38	38	115	0	0	0	0.0024
	0.008	0.0577	0.2728	0.228	0.1737	0.1715	0.0731	0.0016	0.0113	0		
1978	1	1	0	0	6	39	39	103	0	0	0	0
	0	0.0131	0.2922	0.253	0.1152	0.183	0.0585	0.0666	0.0024	0.0161		
1978	1	1	0	0	6	40	40	60	0	0	0	0
	0	0.1187	0.2963	0.2178	0.1354	0.0516	0.1689	0.0084	0.003	0		
1978	1	1	0	0	6	41	41	60	0	0	0	0
	0	0.0115	0.1997	0.1645	0.2698	0.2498	0.0265	0.0052	0.0677	0.0052		
1978	1	1	0	0	6	42	42	45	0	0	0	0
	0	0	0.3197	0.1521	0.14	0.1821	0.1273	0.0608	0.0179	0		
1978	1	1	0	0	6	43	43	41	0	0	0	0
	0	0	0.172	0.2205	0.1766	0.183	0.0247	0.1895	0.0336	0		
1978	1	1	0	0	6	44	44	27	0	0	0	0
	0	0	0.1623	0.2126	0.2836	0.1779	0.0319	0.0835	0.0482	0		
1978	1	1	0	0	6	45	45	26	0	0	0	0
	0	0	0.2144	0.0597	0.3865	0.1814	0.1132	0.0448	0	0		
1978	1	1	0	0	6	46	46	18	0	0	0	0
	0	0	0.3853	0.0306	0.0605	0.2906	0.1201	0.0175	0.007	0.0884		
1978	1	1	0	0	6	47	47	14	0	0	0	0
	0	0	0.2756	0.2195	0.0207	0.1161	0.1284	0.0956	0	0.1441		
1978	1	1	0	0	6	48	48	18	0	0	0	0
	0	0	0.1204	0.0599	0.1588	0.5282	0.1024	0	0.0302	0		
1978	1	1	0	0	6	49	49	13	0	0	0	0
	0	0	0.1328	0	0	0.7673	0.0098	0.0183	0.0313	0.0405		
1978	1	1	0	0	6	50	50	10	0	0	0	0
	0	0	0	0.0247	0.1125	0.0921	0.01	0.5684	0.1623	0.03		
1978	1	1	0	0	6	51	51	60	0	0	0	0
	0	0	0.011	0.0331	0.1176	0.3275	0.1213	0.1602	0.1593	0.0699		
1979	1	1	0	0	7	1	1	1	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
1979	1	1	0	0	7	6	6	1	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
1979	1	1	0	0	7	7	7	2	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
1979	1	1	0	0	7	8	8	2	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
1979	1	1	0	0	7	9	9	4	0.3745	0.6255	0	0
	0	0	0	0	0	0	0	0	0	0		
1979	1	1	0	0	7	10	10	10	0.5643	0.4357	0	0
	0	0	0	0	0	0	0	0	0	0		

1979	1	1	0	0	7	11	11	21	0.3772	0.6228	0	0
	0	0	0	0	0	0	0	0	0	0		
1979	1	1	0	0	7	12	12	27	0.5091	0.4805	0.0104	0
	0	0	0	0	0	0	0	0	0	0		
1979	1	1	0	0	7	13	13	30	0.4863	0.503	0.0107	0
	0	0	0	0	0	0	0	0	0	0		
1979	1	1	0	0	7	14	14	46	0.431	0.5633	0.0057	0
	0	0	0	0	0	0	0	0	0	0		
1979	1	1	0	0	7	15	15	33	0.5063	0.4176	0.0761	0
	0	0	0	0	0	0	0	0	0	0		
1979	1	1	0	0	7	16	16	24	0.2205	0.7455	0.034	0
	0	0	0	0	0	0	0	0	0	0		
1979	1	1	0	0	7	17	17	17	0.0173	0.6694	0.3133	0
	0	0	0	0	0	0	0	0	0	0		
1979	1	1	0	0	7	18	18	19	0.0986	0.7796	0.1218	0
	0	0	0	0	0	0	0	0	0	0		
1979	1	1	0	0	7	19	19	12	0.2266	0.4975	0.2605	0.0154
	0	0	0	0	0	0	0	0	0	0		
1979	1	1	0	0	7	20	20	11	0.0366	0.8589	0.1045	0
	0	0	0	0	0	0	0	0	0	0		
1979	1	1	0	0	7	21	21	17	0.045	0.5406	0.4105	0.0039
	0	0	0	0	0	0	0	0	0	0		
1979	1	1	0	0	7	22	22	25	0	0.1521	0.8417	0
	0.0061	0	0	0	0	0	0	0	0	0		
1979	1	1	0	0	7	23	23	36	0	0.0681	0.8183	0.0487
	0.065	0	0	0	0	0	0	0	0	0		
1979	1	1	0	0	7	24	24	44	0	0.0389	0.695	0.085
	0.1811	0	0	0	0	0	0	0	0	0		
1979	1	1	0	0	7	25	25	65	0	0.0553	0.3856	0.2848
	0.2408	0.0133	0.0183	0	0	0.0018	0	0	0	0		
1979	1	1	0	0	7	26	26	72	0	0	0.264	0.2038
	0.4724	0.02	0.0398	0	0	0	0	0	0	0		
1979	1	1	0	0	7	27	27	74	0	0	0.147	0.1139
	0.6377	0.0373	0.0534	0.0108	0	0	0	0	0	0		
1979	1	1	0	0	7	28	28	84	0	0	0.1915	0.1386
	0.5158	0.0251	0.0968	0.0321	0	0	0	0	0	0		
1979	1	1	0	0	7	29	29	83	0	0	0.0447	0.1057
	0.5245	0.1043	0.1597	0.0595	0.0016	0	0	0	0	0		
1979	1	1	0	0	7	30	30	76	0	0	0.0406	0.0734
	0.5083	0.0754	0.2347	0.0647	0.003	0	0	0	0	0		
1979	1	1	0	0	7	31	31	83	0	0	0.0181	0.0046
	0.3197	0.2092	0.2893	0.1345	0.0247	0	0	0	0	0		
1979	1	1	0	0	7	32	32	89	0	0	0.0173	0.0004
	0.2528	0.1714	0.3883	0.1548	0.0103	0.0049	0	0	0	0		
1979	1	1	0	0	7	33	33	85	0	0	0	0.0147
	0.1925	0.1214	0.3134	0.2427	0.0975	0.0037	0.0141	0	0	0		
1979	1	1	0	0	7	34	34	86	0	0	0	0.0185
	0.245	0.1422	0.2931	0.2313	0.0531	0.0152	0.0015	0	0	0		
1979	1	1	0	0	7	35	35	78	0	0	0	0.0005
	0.0558	0.1054	0.3829	0.329	0.0372	0.0741	0.0016	0.0136	0	0		
1979	1	1	0	0	7	36	36	70	0	0	0	0
	0.064	0.1172	0.2945	0.4124	0.0622	0.0435	0	0.0062	0	0		
1979	1	1	0	0	7	37	37	66	0	0	0	0
	0.0741	0.0832	0.2487	0.2875	0.1394	0.1146	0.0307	0.0004	0.0213	0		
1979	1	1	0	0	7	38	38	58	0	0	0	0
	0.0263	0.1152	0.1075	0.4844	0.1269	0.0937	0.0214	0.0017	0	0.023		
1979	1	1	0	0	7	39	39	41	0	0	0	0
	0.0293	0.0639	0.0949	0.4903	0.2103	0.0288	0.0208	0.0617	0	0		
1979	1	1	0	0	7	40	40	47	0	0	0	0.0339
	0.0374	0.021	0.2147	0.1839	0.1026	0.0663	0.2244	0.0463	0.0695	0		
1979	1	1	0	0	7	41	41	22	0	0	0	0
	0.013	0	0.1209	0.2671	0.1739	0.2761	0.1238	0.0251	0	0		
1979	1	1	0	0	7	42	42	26	0	0	0	0.0264
	0	0	0.0409	0.322	0.1474	0.3139	0.0885	0.0031	0	0.0579		
1979	1	1	0	0	7	43	43	16	0	0	0	0
	0	0	0.0773	0.1778	0.4542	0.1656	0.0036	0.1215	0	0		

1979	1	1	0	0	7	44	44	12	0	0	0	0
	0	0	0.1625	0.4001	0.1203	0.1988	0	0.1183	0	0		
1979	1	1	0	0	7	45	45	8	0	0	0.171	0
	0	0	0	0.1966	0.4113	0	0.0534	0	0.1655	0.0023		
1979	1	1	0	0	7	46	46	13	0	0	0.0537	0
	0	0	0.096	0.1347	0.2569	0.1848	0.1147	0.1045	0.0547	0		
1979	1	1	0	0	7	47	47	11	0	0	0	0.1364
	0	0	0	0.022	0.0241	0.5934	0.095	0.1291	0	0		
1979	1	1	0	0	7	48	48	6	0	0	0	0
	0	0	0	0.6702	0.1933	0	0	0	0	0.1364		
1979	1	1	0	0	7	49	49	8	0	0	0.0795	0
	0	0	0	0.0563	0.6569	0.1455	0	0	0.0438	0.0179		
1979	1	1	0	0	7	50	50	4	0	0	0	0
	0	0	0	0.5	0	0	0.378	0	0.122	0		
1979	1	1	0	0	7	51	51	16	0	0	0.0648	0
	0	0	0.0011	0	0.0812	0.2059	0.0406	0.1659	0.1556	0.285		
1980	1	1	0	0	8	1	1	1	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
1980	1	1	0	0	8	2	2	3	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
1980	1	1	0	0	8	3	3	2	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
1980	1	1	0	0	8	4	4	1	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
#1980	1	1	0	0	8	5	5	2	0.4863	0	0	0
	0	0	0	0	0	0.5137	0	0	0	0		
1980	1	1	0	0	8	6	6	1	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
#1980	1	1	0	0	8	8	8	1	0	0	0	0
	0	0	1	0	0	0	0	0	0	0		
#1980	1	1	0	0	8	9	9	1	0	0	0	1
	0	0	0	0	0	0	0	0	0	0		
#1980	1	1	0	0	8	10	10	1	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
#1980	1	1	0	0	8	11	11	1	0	0	0	0
	0	1	0	0	0	0	0	0	0	0		
1980	1	1	0	0	8	13	13	3	0	0.909	0	0
	0	0	0	0	0.091	0	0	0	0	0		
1980	1	1	0	0	8	14	14	4	0	0.8527	0	0.0317
	0.1155	0	0	0	0	0	0	0	0	0		
1980	1	1	0	0	8	15	15	9	0.0509	0.9463	0.0028	0
	0	0	0	0	0	0	0	0	0	0		
1980	1	1	0	0	8	16	16	19	0.4221	0.5758	0.0021	0
	0	0	0	0	0	0	0	0	0	0		
1980	1	1	0	0	8	17	17	38	0.0024	0.9192	0.0785	0
	0	0	0	0	0	0	0	0	0	0		
1980	1	1	0	0	8	18	18	66	0	0.9863	0.0137	0
	0	0	0	0	0	0	0	0	0	0		
1980	1	1	0	0	8	19	19	74	0.0744	0.8963	0.0293	0
	0	0	0	0	0	0	0	0	0	0		
1980	1	1	0	0	8	20	20	84	0	0.9476	0.0447	0
	0	0	0	0	0	0	0.0077	0	0	0		
1980	1	1	0	0	8	21	21	89	0	0.8153	0.1396	0.0048
	0.0112	0.0291	0	0	0	0	0	0	0	0		
1980	1	1	0	0	8	22	22	83	0	0.8883	0.0728	0.0219
	0.0023	0.0147	0	0	0	0	0	0	0	0		
1980	1	1	0	0	8	23	23	93	0.0041	0.5766	0.3752	0.0313
	0.0016	0.0113	0	0	0	0	0	0	0	0		
1980	1	1	0	0	8	24	24	88	0	0.5549	0.161	0.0815
	0.0887	0.0759	0.0278	0	0.0104	0	0	0	0	0		
1980	1	1	0	0	8	25	25	100	0	0.445	0.1296	0.1898
	0.081	0.0991	0.0492	0.0035	0.0028	0	0	0	0	0		
1980	1	1	0	0	8	26	26	111	0	0.2791	0.0529	0.3384
	0.1374	0.1232	0.0335	0.0315	0.002	0.0018	0.0001	0	0	0		
1980	1	1	0	0	8	27	27	114	0	0.1255	0.0881	0.3068
	0.2127	0.1799	0.0541	0.0328	0	0	0	0	0	0		

1980	1	1	0	0	8	28	28	96	0	0.0184	0.0441	0.2277
	0.2229	0.364	0.036	0.0626	0.0237	0.0006	0	0	0	0		
1980	1	1	0	0	8	29	29	90	0	0	0.0344	0.0961
	0.1843	0.3925	0.1249	0.1054	0.0499	0.0098	0	0	0.0026	0		
1980	1	1	0	0	8	30	30	85	0	0.0046	0.0131	0.1713
	0.203	0.2465	0.1085	0.1814	0.0589	0.0125	0	0	0.0002	0		
1980	1	1	0	0	8	31	31	90	0	0	0	0.0591
	0.1336	0.3987	0.1223	0.1727	0.0894	0.0107	0.0027	0.0068	0.0039	0		
1980	1	1	0	0	8	32	32	87	0	0.0133	0	0.0288
	0.1104	0.2836	0.1182	0.2909	0.1176	0.0062	0.0188	0.0087	0.0035	0		
1980	1	1	0	0	8	33	33	92	0	0.0127	0.0142	0.0171
	0.0484	0.2109	0.2137	0.2668	0.1247	0.0518	0.0148	0.0204	0	0.0045		
1980	1	1	0	0	8	34	34	94	0	0.0083	0	0.0004
	0.038	0.4772	0.1363	0.1155	0.1517	0.0357	0.0092	0.0148	0	0.013		
1980	1	1	0	0	8	35	35	105	0	0	0	0.027
	0.0172	0.2123	0.1987	0.2037	0.2257	0.0585	0.0317	0.0106	0.005	0.0096		
1980	1	1	0	0	8	36	36	102	0	0	0	0.0127
	0.023	0.2748	0.0917	0.2384	0.213	0.0812	0.0316	0.0291	0.0012	0.0034		
1980	1	1	0	0	8	37	37	102	0	0	0	0
	0.0125	0.0754	0.097	0.3467	0.2105	0.1317	0.0288	0.0374	0.0235	0.0364		
1980	1	1	0	0	8	38	38	102	0	0	0	0
	0.0072	0.3501	0.1639	0.197	0.169	0.0124	0.032	0.0449	0.0102	0.0133		
1980	1	1	0	0	8	39	39	88	0	0	0	0
	0	0.0548	0.1385	0.0795	0.3968	0.1686	0.0737	0.0414	0.0208	0.0259		
1980	1	1	0	0	8	40	40	52	0	0	0	0
	0	0.0934	0.0695	0.1233	0.5689	0.0505	0.0286	0.0184	0.0222	0.0251		
1980	1	1	0	0	8	41	41	60	0	0	0	0
	0.0016	0.0083	0.0146	0.0673	0.346	0.2652	0.1995	0.0817	0	0.0158		
1980	1	1	0	0	8	42	42	39	0	0	0	0
	0	0.0001	0.0214	0.0188	0.2278	0.0762	0.5725	0.0817	0	0.0016		
1980	1	1	0	0	8	43	43	27	0	0	0	0
	0	0.015	0.059	0.0281	0.28	0.0801	0.0275	0.1861	0.1359	0.1883		
1980	1	1	0	0	8	44	44	25	0	0	0	0
	0	0	0.2895	0.0645	0.1704	0.209	0.1221	0.0382	0.0964	0.01		
1980	1	1	0	0	8	45	45	26	0	0	0	0
	0	0.0233	0.027	0.1892	0.191	0.2051	0.1251	0.1058	0.1015	0.0321		
1980	1	1	0	0	8	46	46	19	0	0	0	0
	0	0	0	0.4077	0.1657	0.0306	0.1422	0.2538	0	0		
1980	1	1	0	0	8	47	47	12	0	0	0	0
	0	0	0	0.024	0.5807	0	0.1564	0.2389	0	0		
1980	1	1	0	0	8	48	48	11	0	0	0	0
	0	0	0	0.1616	0.5095	0.0689	0.2206	0	0.0391	0.0003		
1980	1	1	0	0	8	49	49	9	0	0	0	0
	0	0.0508	0	0.1813	0.1811	0	0.1249	0.0301	0.4319	0		
1980	1	1	0	0	8	50	50	7	0	0	0	0
	0	0	0	0.0107	0.236	0.3512	0	0	0	0.4021		
1980	1	1	0	0	8	51	51	14	0	0	0	0
	0	0	0	0.0046	0	0.2813	0.5651	0	0.0274	0.1216		
1981	1	1	0	0	9	1	1	5	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
1981	1	1	0	0	9	2	2	9	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
1981	1	1	0	0	9	3	3	13	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
1981	1	1	0	0	9	4	4	23	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
1981	1	1	0	0	9	5	5	25	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
1981	1	1	0	0	9	6	6	29	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
1981	1	1	0	0	9	7	7	40	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
1981	1	1	0	0	9	8	8	34	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
1981	1	1	0	0	9	9	9	22	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		

1981	1	1	0	0	9	10	10	21	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
1981	1	1	0	0	9	11	11	16	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
1981	1	1	0	0	9	12	12	12	0.9415	0.0585	0	0
	0	0	0	0	0	0	0	0	0	0		
1981	1	1	0	0	9	13	13	6	0.3822	0.6178	0	0
	0	0	0	0	0	0	0	0	0	0		
1981	1	1	0	0	9	14	14	9	0.3386	0.6614	0	0
	0	0	0	0	0	0	0	0	0	0		
1981	1	1	0	0	9	15	15	12	0.0173	0.9727	0.0099	0
	0	0	0	0	0	0	0	0	0	0		
1981	1	1	0	0	9	16	16	16	0.2759	0.4697	0.2544	0
	0	0	0	0	0	0	0	0	0	0		
1981	1	1	0	0	9	17	17	28	0.1289	0.5569	0.3109	0.0034
	0	0	0	0	0	0	0	0	0	0		
1981	1	1	0	0	9	18	18	49	0.1088	0.2494	0.6418	0
	0	0	0	0	0	0	0	0	0	0		
1981	1	1	0	0	9	19	19	59	0.0342	0.1586	0.8072	0
	0	0	0	0	0	0	0	0	0	0		
1981	1	1	0	0	9	20	20	78	0.0089	0.1551	0.836	0
	0	0	0	0	0	0	0	0	0	0		
1981	1	1	0	0	9	21	21	94	0.0012	0.0981	0.8935	0.0072
	0	0	0	0	0	0	0	0	0	0		
1981	1	1	0	0	9	22	22	84	0	0.0364	0.9595	0.0041
	0	0	0	0	0	0	0	0	0	0		
1981	1	1	0	0	9	23	23	85	0	0.0108	0.9813	0.0063
	0.0016	0	0	0	0	0	0	0	0	0		
1981	1	1	0	0	9	24	24	88	0	0.007	0.9504	0.0193
	0.0233	0	0	0	0	0	0	0	0	0		
1981	1	1	0	0	9	25	25	101	0	0.009	0.9141	0.03
	0.0147	0.0127	0.0016	0.018	0	0	0	0	0	0		
1981	1	1	0	0	9	26	26	101	0	0	0.8382	0.0467
	0.0968	0.0014	0.017	0	0	0	0	0	0	0		
1981	1	1	0	0	9	27	27	107	0	0	0.616	0.0813
	0.0794	0.0325	0.1563	0.0027	0.0261	0.0057	0	0	0	0		
1981	1	1	0	0	9	28	28	114	0	0	0.3926	0.0444
	0.1459	0.1156	0.2385	0.0314	0.025	0.0067	0	0	0	0		
1981	1	1	0	0	9	29	29	122	0	0	0.2205	0.0658
	0.1481	0.1324	0.2675	0.0601	0.061	0.0416	0	0.003	0	0		
1981	1	1	0	0	9	30	30	122	0	0	0.1012	0.0637
	0.0808	0.1269	0.3446	0.1267	0.1041	0.052	0	0	0	0		
1981	1	1	0	0	9	31	31	105	0	0	0.0614	0.0033
	0.0963	0.1522	0.2796	0.1362	0.1635	0.1074	0	0	0	0		
1981	1	1	0	0	9	32	32	113	0	0	0.0019	0.0014
	0.1049	0.1483	0.4456	0.1015	0.1319	0.05	0.0137	0.0008	0	0		
1981	1	1	0	0	9	33	33	107	0	0	0	0.0052
	0.045	0.1154	0.4279	0.2109	0.0797	0.1071	0.0085	0.0004	0	0		
1981	1	1	0	0	9	34	34	116	0	0	0	0.0054
	0.0628	0.0783	0.3522	0.177	0.0699	0.2376	0.0044	0.0071	0.0054	0		
1981	1	1	0	0	9	35	35	96	0	0	0	0
	0.0105	0.1142	0.444	0.0989	0.139	0.1678	0.017	0	0.0012	0.0073		
1981	1	1	0	0	9	36	36	80	0	0	0	0
	0.0314	0.1338	0.1225	0.1555	0.1706	0.367	0.0072	0.0019	0.0102	0		
1981	1	1	0	0	9	37	37	65	0	0	0	0
	0.0915	0.0113	0.21	0.1806	0.3102	0.1563	0.0223	0.0022	0	0.0156		
1981	1	1	0	0	9	38	38	56	0	0	0	0
	0.1212	0	0.0622	0.0187	0.0703	0.49	0.1831	0.0435	0.0109	0.0002		
1981	1	1	0	0	9	39	39	39	0	0	0	0
	0.1161	0	0.1017	0.3391	0.0416	0.2684	0.0295	0.0651	0.036	0.0026		
1981	1	1	0	0	9	40	40	34	0	0	0	0
	0.0108	0.0061	0.2057	0.0974	0.0904	0.5382	0.0179	0.0292	0	0.0043		
1981	1	1	0	0	9	41	41	36	0	0	0	0
	0.0254	0	0.0471	0.0606	0.0253	0.1345	0.5426	0.09	0.0256	0.0488		
1981	1	1	0	0	9	42	42	30	0	0	0	0
	0	0	0.1345	0.0561	0.0886	0.5157	0.0676	0.0242	0.1118	0.0015		

1981	1	1	0	0	9	43	43	20	0	0	0	0
	0	0	0.0138	0.038	0.1907	0.2114	0.1532	0.3637	0	0.0291		
1981	1	1	0	0	9	44	44	20	0	0	0	0
	0	0	0.0299	0.0015	0	0.9054	0.0077	0.0241	0.0251	0.0063		
1981	1	1	0	0	9	45	45	16	0	0	0	0
	0	0	0.2465	0.3707	0.0996	0.1901	0.0778	0.0096	0	0.0057		
1981	1	1	0	0	9	46	46	8	0	0	0	0
	0	0	0.6455	0	0.0066	0.0268	0.3176	0.0002	0.0032	0		
1981	1	1	0	0	9	47	47	10	0	0	0	0
	0	0	0.0145	0.0137	0.4114	0.4966	0.0579	0.0059	0	0		
1981	1	1	0	0	9	48	48	10	0	0	0	0
	0	0	0	0	0.702	0.2296	0.031	0.0373	0	0		
1981	1	1	0	0	9	49	49	5	0	0	0	0
	0	0	0	0.2939	0	0.5966	0	0	0	0.1095		
1981	1	1	0	0	9	50	50	7	0	0	0	0
	0	0	0	0.9724	0	0.0041	0	0.0126	0.011	0		
1981	1	1	0	0	9	51	51	15	0	0	0	0
	0	0	0	0	0	0.1205	0.5252	0.2063	0.0537	0.0944		
1982	1	1	0	0	10	5	5	2	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
1982	1	1	0	0	10	6	6	5	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
1982	1	1	0	0	10	7	7	11	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
1982	1	1	0	0	10	8	8	9	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
1982	1	1	0	0	10	9	9	12	0.9799	0.0201	0	0
	0	0	0	0	0	0	0	0	0	0		
1982	1	1	0	0	10	10	10	18	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
1982	1	1	0	0	10	11	11	37	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
1982	1	1	0	0	10	12	12	38	0.9899	0.0101	0	0
	0	0	0	0	0	0	0	0	0	0		
1982	1	1	0	0	10	13	13	52	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
1982	1	1	0	0	10	14	14	62	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
1982	1	1	0	0	10	15	15	66	0.9857	0.0061	0.0082	0
	0	0	0	0	0	0	0	0	0	0		
1982	1	1	0	0	10	16	16	62	0.984	0.0045	0.0115	0
	0	0	0	0	0	0	0	0	0	0		
1982	1	1	0	0	10	17	17	55	0.9431	0.0569	0	0
	0	0	0	0	0	0	0	0	0	0		
1982	1	1	0	0	10	18	18	59	0.7845	0.1801	0	0.0354
	0	0	0	0	0	0	0	0	0	0		
1982	1	1	0	0	10	19	19	48	0.6234	0.3176	0.0201	0.0389
	0	0	0	0	0	0	0	0	0	0		
1982	1	1	0	0	10	20	20	50	0.4699	0.3738	0.0594	0.0801
	0.0168	0	0	0	0	0	0	0	0	0		
1982	1	1	0	0	10	21	21	62	0.0997	0.2371	0.0624	0.5878
	0.013	0	0	0	0	0	0	0	0	0		
1982	1	1	0	0	10	22	22	66	0.0223	0.2028	0.1748	0.556
	0.0377	0	0	0	0	0	0	0	0	0.0063		
1982	1	1	0	0	10	23	23	86	0.0058	0.0958	0.0551	0.787
	0.0495	0	0	0.0068	0	0	0	0	0	0		
1982	1	1	0	0	10	24	24	94	0	0.0524	0.0335	0.8529
	0.0393	0.0055	0	0.0164	0	0	0	0	0	0		
1982	1	1	0	0	10	25	25	99	0	0.0074	0.022	0.9265
	0.0381	0.006	0	0	0	0	0	0	0	0		
1982	1	1	0	0	10	26	26	100	0	0.0065	0.0322	0.8947
	0.0385	0.0082	0.0064	0.007	0	0.0038	0	0	0	0.0028		
1982	1	1	0	0	10	27	27	99	0	0	0.0075	0.8201
	0.0696	0.0255	0.0148	0.0456	0.0063	0	0.0039	0	0	0.0067		
1982	1	1	0	0	10	28	28	103	0	0	0.0038	0.7791
	0.0792	0.0368	0.0351	0.066	0	0	0	0	0	0		

1982	1	1	0	0	10	29	29	111	0	0	0	0.47
	0.1656	0.0825	0.0628	0.1689	0.0241	0.0262	0	0	0	0		
1982	1	1	0	0	10	30	30	116	0	0	0.0136	0.4788
	0.1026	0.0994	0.0955	0.1758	0.004	0.015	0.0092	0	0	0.0061		
1982	1	1	0	0	10	31	31	101	0	0	0	0.3477
	0.0746	0.1381	0.0766	0.234	0.0557	0.0124	0.061	0	0	0		
1982	1	1	0	0	10	32	32	112	0	0	0	0.1659
	0.0353	0.1522	0.1189	0.2767	0.0757	0.0545	0.1166	0.0041	0	0		
1982	1	1	0	0	10	33	33	100	0	0	0	0.1155
	0.0385	0.1061	0.137	0.2923	0.0601	0.0482	0.1845	0.0178	0	0		
1982	1	1	0	0	10	34	34	106	0	0	0	0.0441
	0.0055	0.1382	0.1737	0.3282	0.1074	0.0691	0.1056	0.0061	0.0053	0.0169		
1982	1	1	0	0	10	35	35	104	0	0	0	0.037
	0.0201	0.1159	0.0573	0.3434	0.1022	0.0803	0.2382	0	0	0.0057		
1982	1	1	0	0	10	36	36	86	0	0	0	0.0077
	0.0067	0.0507	0.2346	0.291	0.052	0.1404	0.196	0.017	0	0.004		
1982	1	1	0	0	10	37	37	85	0	0	0	0.0068
	0.013	0.0558	0.0809	0.2471	0.037	0.0572	0.4831	0.0086	0.0052	0.0053		
1982	1	1	0	0	10	38	38	81	0	0	0	0.006
	0.0359	0.1306	0.0427	0.2809	0.048	0.2033	0.1857	0.0508	0.0162	0		
1982	1	1	0	0	10	39	39	48	0	0	0	0
	0	0.0419	0.0534	0.257	0.0828	0.2633	0.2055	0.0528	0	0.0433		
1982	1	1	0	0	10	40	40	53	0	0	0	0
	0	0.0815	0.0872	0.3616	0.1213	0.0985	0.2189	0.0031	0.0162	0.0117		
1982	1	1	0	0	10	41	41	37	0	0	0	0
	0	0.1	0.0025	0.4418	0.0764	0.0496	0.2586	0	0.046	0.0253		
1982	1	1	0	0	10	42	42	28	0	0	0	0
	0	0.0156	0.0714	0.2493	0	0.1469	0.4179	0	0	0.099		
1982	1	1	0	0	10	43	43	17	0	0	0	0
	0	0	0	0.1702	0.0135	0.0298	0.6885	0.0979	0	0		
1982	1	1	0	0	10	44	44	21	0	0	0	0
	0	0.0159	0.023	0.6101	0.0312	0.0541	0.0758	0.1576	0.0323	0		
1982	1	1	0	0	10	45	45	21	0	0	0	0
	0	0.0178	0.0712	0.0926	0	0.0433	0.5293	0.046	0.1617	0.0381		
1982	1	1	0	0	10	46	46	18	0	0	0	0
	0	0.0665	0	0.3261	0	0.0454	0.4891	0.0729	0	0		
1982	1	1	0	0	10	47	47	9	0	0	0	0
	0	0	0	0.0228	0.0796	0.5035	0.3019	0.0922	0	0		
1982	1	1	0	0	10	48	48	10	0	0	0	0
	0	0	0	0.0624	0	0.4373	0.5003	0	0	0		
1982	1	1	0	0	10	49	49	6	0	0	0	0
	0	0	0	0.0162	0	0	0.8747	0	0	0.1091		
1982	1	1	0	0	10	50	50	6	0	0	0	0
	0	0	0	0	0	0.2581	0.5073	0	0.1633	0.0713		
1982	1	1	0	0	10	51	51	14	0.0568	0	0	0
	0	0	0	0	0.0122	0.0981	0.3928	0.0604	0.1741	0.2056		
1983	1	1	0	0	11	7	7	1	0	1	0	0
	0	0	0	0	0	0	0	0	0	0		
1983	1	1	0	0	11	10	10	6	0	1	0	0
	0	0	0	0	0	0	0	0	0	0		
1983	1	1	0	0	11	11	11	10	0	1	0	0
	0	0	0	0	0	0	0	0	0	0		
1983	1	1	0	0	11	12	12	11	0	1	0	0
	0	0	0	0	0	0	0	0	0	0		
1983	1	1	0	0	11	13	13	23	0	0.9755	0.0245	0
	0	0	0	0	0	0	0	0	0	0		
1983	1	1	0	0	11	14	14	23	0	0.9599	0.0401	0
	0	0	0	0	0	0	0	0	0	0		
1983	1	1	0	0	11	15	15	35	0	0.9482	0.0406	0
	0.0112	0	0	0	0	0	0	0	0	0		
1983	1	1	0	0	11	16	16	39	0	0.9928	0.0072	0
	0	0	0	0	0	0	0	0	0	0		
1983	1	1	0	0	11	17	17	51	0	0.9579	0.0421	0
	0	0	0	0	0	0	0	0	0	0		
1983	1	1	0	0	11	18	18	55	0	0.9268	0.0732	0
	0	0	0	0	0	0	0	0	0	0		

1983	1	1	0	0	11	19	19	62	0	0.9072	0.0841	0.0087
	0	0	0	0	0	0	0	0	0	0		
1983	1	1	0	0	11	20	20	58	0	0.9052	0.082	0.0129
	0	0	0	0	0	0	0	0	0	0		
1983	1	1	0	0	11	21	21	62	0	0.8478	0.0971	0.029
	0.0261	0	0	0	0	0	0	0	0	0		
1983	1	1	0	0	11	22	22	69	0	0.764	0.12	0.0224
	0.0935	0	0	0	0	0	0	0	0	0		
1983	1	1	0	0	11	23	23	77	0	0.6015	0.1727	0.0122
	0.1938	0.016	0	0	0.0038	0	0	0	0	0		
1983	1	1	0	0	11	24	24	72	0	0.4101	0.1457	0.1051
	0.3239	0.0152	0	0	0	0	0	0	0	0		
1983	1	1	0	0	11	25	25	69	0	0.2321	0.0992	0.1061
	0.5097	0.0519	0	0.0004	0.0006	0	0	0	0	0		
1983	1	1	0	0	11	26	26	69	0	0.1105	0.0232	0.047
	0.7371	0.0326	0.043	0.0058	0.0003	0.0006	0	0	0	0		
1983	1	1	0	0	11	27	27	75	0	0.0154	0.0074	0.0333
	0.7902	0.047	0.0236	0.0322	0.042	0.0089	0	0	0	0		
1983	1	1	0	0	11	28	28	74	0	0.0255	0.0271	0.0414
	0.7211	0.097	0.023	0.0034	0.0418	0.0071	0.0073	0.0054	0	0		
1983	1	1	0	0	11	29	29	70	0	0.0278	0.0151	0.0359
	0.6431	0.1052	0.0377	0.0696	0.0379	0.012	0.0132	0.0026	0	0		
1983	1	1	0	0	11	30	30	69	0	0.0163	0	0.0186
	0.4169	0.0689	0.0581	0.1604	0.1637	0.0379	0.0284	0.0307	0	0		
1983	1	1	0	0	11	31	31	71	0	0	0	0.0118
	0.4593	0.0818	0.1149	0.1194	0.0982	0.0768	0.0351	0	0.0026	0		
1983	1	1	0	0	11	32	32	59	0	0	0	0.0038
	0.2531	0.1084	0.1153	0.1071	0.2304	0.0066	0.0082	0.1483	0.0047	0.0142		
1983	1	1	0	0	11	33	33	66	0	0	0	0.0068
	0.3616	0.1156	0.074	0.1563	0.1131	0.0559	0.0127	0.104	0	0		
1983	1	1	0	0	11	34	34	66	0	0	0	0.0087
	0.1687	0.2545	0.1399	0.1147	0.188	0.0744	0.0069	0.0441	0	0		
1983	1	1	0	0	11	35	35	61	0	0.0043	0	0.006
	0.058	0.0573	0.1012	0.1043	0.3515	0.0382	0.2221	0.0361	0.0208	0		
1983	1	1	0	0	11	36	36	57	0	0	0	0
	0.1278	0.0187	0.1506	0.0947	0.3021	0.0813	0.1135	0.0903	0	0.021		
1983	1	1	0	0	11	37	37	44	0	0	0	0
	0.0676	0.0133	0.1161	0.2286	0.3864	0.126	0.0547	0.0073	0	0		
1983	1	1	0	0	11	38	38	32	0	0	0	0
	0.053	0.0654	0.0446	0.1149	0.3563	0.1548	0.1043	0.0403	0.0438	0.0227		
1983	1	1	0	0	11	39	39	32	0	0	0	0
	0.0259	0.0354	0.1384	0.1751	0.2559	0.0719	0.0844	0.1292	0.0839	0		
1983	1	1	0	0	11	40	40	17	0	0	0	0
	0.0311	0	0.0868	0.2246	0.4008	0.0646	0.0309	0.0311	0.1302	0		
1983	1	1	0	0	11	41	41	22	0	0	0	0
	0.0181	0.0647	0.0877	0.2182	0.455	0.0473	0.0093	0.0988	0	0.0009		
1983	1	1	0	0	11	42	42	15	0	0	0	0
	0	0	0.073	0	0.1985	0.1158	0.0159	0.3428	0.2397	0.0143		
1983	1	1	0	0	11	43	43	9	0	0	0	0
	0.2783	0	0	0.04	0.2594	0.2181	0.1009	0.1034	0	0		
1983	1	1	0	0	11	44	44	12	0	0	0	0
	0	0	0	0	0.0769	0.0862	0.3018	0.4562	0.0789	0		
1983	1	1	0	0	11	45	45	6	0	0	0	0
	0	0	0.1094	0	0.3284	0.4994	0	0.0628	0	0		
1983	1	1	0	0	11	46	46	6	0	0	0	0
	0	0	0	0.0721	0.6149	0	0.3129	0	0	0		
1983	1	1	0	0	11	47	47	4	0	0	0	0
	0	0	0	0.0568	0	0.0662	0	0.7849	0	0.0922		
1983	1	1	0	0	11	48	48	4	0	0	0	0
	0	0	0	0	0.5491	0.2389	0.1051	0.1069	0	0		
1983	1	1	0	0	11	49	49	5	0	0	0	0
	0	0	0	0.1742	0.1527	0	0.3507	0.1929	0	0.1294		
1983	1	1	0	0	11	50	50	1	0	0	0	0
	0	0	0	0	1	0	0	0	0	0		
1983	1	1	0	0	11	51	51	12	0	0	0	0
	0	0	0	0.0197	0.0998	0.3181	0.0397	0.0858	0.3651	0.0718		

1984	1	1	0	0	12	8	8	1	0	0	1	0
	0	0	0	0	0	0	0	0	0	0		
1984	1	1	0	0	12	12	12	3	0	0	1	0
	0	0	0	0	0	0	0	0	0	0		
1984	1	1	0	0	12	13	13	1	0	0	1	0
	0	0	0	0	0	0	0	0	0	0		
1984	1	1	0	0	12	14	14	2	0	0	1	0
	0	0	0	0	0	0	0	0	0	0		
1984	1	1	0	0	12	15	15	6	0	0	1	0
	0	0	0	0	0	0	0	0	0	0		
1984	1	1	0	0	12	16	16	12	0	0	1	0
	0	0	0	0	0	0	0	0	0	0		
1984	1	1	0	0	12	17	17	25	0	0.033	0.967	0
	0	0	0	0	0	0	0	0	0	0		
1984	1	1	0	0	12	18	18	41	0	0.0196	0.9804	0
	0	0	0	0	0	0	0	0	0	0		
1984	1	1	0	0	12	19	19	72	0	0.0161	0.9739	0.009
	0.001	0	0	0	0	0	0	0	0	0		
1984	1	1	0	0	12	20	20	112	0	0.0215	0.9565	0.022
	0	0	0	0	0	0	0	0	0	0		
1984	1	1	0	0	12	21	21	121	0	0.0095	0.9473	0.0432
	0	0	0	0	0	0	0	0	0	0		
1984	1	1	0	0	12	22	22	135	0	0.0124	0.9366	0.0488
	0	0.0022	0	0	0	0	0	0	0	0		
1984	1	1	0	0	12	23	23	125	0	0	0.9463	0.0351
	0.0083	0.0102	0	0	0	0	0	0	0	0		
1984	1	1	0	0	12	24	24	112	0	0	0.8584	0.0882
	0.0217	0.0316	0	0	0	0	0	0	0	0		
1984	1	1	0	0	12	25	25	93	0	0	0.761	0.0755
	0.0802	0.0833	0	0	0	0	0	0	0	0		
1984	1	1	0	0	12	26	26	82	0	0	0.5885	0.0593
	0.0826	0.2473	0.0223	0	0	0	0	0	0	0		
1984	1	1	0	0	12	27	27	83	0	0	0.2856	0.1035
	0.1704	0.3995	0.0309	0	0.0102	0	0	0	0	0		
1984	1	1	0	0	12	28	28	74	0	0	0.1396	0.0978
	0.2141	0.4656	0.0289	0.0117	0	0.024	0	0	0.0183	0		
1984	1	1	0	0	12	29	29	67	0	0	0.0489	0.0248
	0.2297	0.5731	0.0728	0.014	0.0157	0.0211	0	0	0	0		
1984	1	1	0	0	12	30	30	66	0	0	0.0398	0.0014
	0.1021	0.7133	0.0641	0.0457	0.0114	0.0222	0	0	0	0		
1984	1	1	0	0	12	31	31	50	0	0	0.0219	0.0116
	0.137	0.4594	0.1591	0.0384	0.0623	0.0754	0	0.0348	0	0		
1984	1	1	0	0	12	32	32	49	0	0	0	0.0122
	0.0835	0.4197	0.0938	0.0734	0.0985	0.1193	0.0088	0.0194	0.0713	0		
1984	1	1	0	0	12	33	33	43	0	0	0	0.0051
	0.0421	0.4031	0.0911	0.0596	0.0495	0.1944	0	0.0989	0.0561	0		
1984	1	1	0	0	12	34	34	28	0	0	0	0
	0	0.2245	0.1708	0.1166	0.1265	0.1542	0	0	0.1134	0.094		
1984	1	1	0	0	12	35	35	20	0	0	0	0
	0	0.1729	0.0532	0.2592	0.0316	0.4179	0	0	0.0652	0		
1984	1	1	0	0	12	36	36	11	0	0	0	0
	0	0.0581	0.1757	0.2622	0.0108	0	0.2497	0.2436	0	0		
1984	1	1	0	0	12	37	37	5	0	0	0	0
	0	0	0.0865	0.0958	0.5069	0.0855	0.2253	0	0	0		
1984	1	1	0	0	12	38	38	5	0	0	0	0
	0	0.0729	0	0.0954	0.2953	0	0	0.5018	0.0346	0		
1984	1	1	0	0	12	39	39	4	0	0	0	0
	0	0.7069	0.1318	0	0.11	0	0.0512	0	0	0		
1984	1	1	0	0	12	40	40	7	0	0	0	0
	0	0	0.2563	0	0.0671	0.3585	0.124	0	0.1942	0		
1984	1	1	0	0	12	41	41	2	0	0	0	0
	0	0	0	0	0.1547	0.1547	0	0	0.6905	0		
1984	1	1	0	0	12	43	43	4	0	0	0	0
	0	0	0	0	0	0.9647	0	0.0353	0	0		
1984	1	1	0	0	12	44	44	4	0	0	0	0
	0	0	0	0	0	0.595	0.2895	0	0.1155	0		

1984	1	1	0	0	12	45	45	2	0	0	0	0
	0	0	0	0	0	0	0	0	0.4484	0.5516		
1984	1	1	0	0	12	46	46	1	0	0	0	0
	0	0	0	0	0	0	1	0	0	0		
1984	1	1	0	0	12	48	48	1	0	0	0	0
	0	0	0	0	0	1	0	0	0	0		
1984	1	1	0	0	12	49	49	2	0	0	0	0
	0	0	0	0	0	0.4713	0.5287	0	0	0		
1984	1	1	0	0	12	50	50	3	0	0	0	0
	0	0	0	0	0	0.7176	0	0	0.2824	0		
1984	1	1	0	0	12	51	51	9	0	0	0	0
	0	0	0.0739	0.1309	0	0.2935	0.0274	0.0346	0.3688	0.071		
1985	1	1	0	0	13	7	7	1	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
1985	1	1	0	0	13	9	9	1	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
1985	1	1	0	0	13	10	10	2	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
1985	1	1	0	0	13	11	11	1	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
1985	1	1	0	0	13	12	12	3	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
1985	1	1	0	0	13	13	13	3	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
1985	1	1	0	0	13	14	14	3	0.6433	0.3567	0	0
	0	0	0	0	0	0	0	0	0	0		
1985	1	1	0	0	13	15	15	2	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
1985	1	1	0	0	13	16	16	1	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
1985	1	1	0	0	13	17	17	1	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
1985	1	1	0	0	13	18	18	2	0	0	1	0
	0	0	0	0	0	0	0	0	0	0		
1985	1	1	0	0	13	19	19	7	0.0491	0.3364	0	0.6145
	0	0	0	0	0	0	0	0	0	0		
1985	1	1	0	0	13	20	20	16	0	0	0.2126	0.7874
	0	0	0	0	0	0	0	0	0	0		
1985	1	1	0	0	13	21	21	43	0.0063	0.0018	0.2711	0.6902
	0.0306	0	0	0	0	0	0	0	0	0		
1985	1	1	0	0	13	22	22	78	0	0	0.1444	0.7675
	0.0881	0	0	0	0	0	0	0	0	0		
1985	1	1	0	0	13	23	23	107	0	0	0.1295	0.8359
	0.0345	0	0	0	0	0	0	0	0	0		
1985	1	1	0	0	13	24	24	121	0	0	0.0855	0.886
	0.0257	0.0027	0	0	0	0	0	0	0	0		
1985	1	1	0	0	13	25	25	124	0	0	0.04	0.8974
	0.062	0.0007	0	0	0	0	0	0	0	0		
1985	1	1	0	0	13	26	26	115	0	0	0.0234	0.8869
	0.0646	0.0099	0.0152	0	0	0	0	0	0	0		
1985	1	1	0	0	13	27	27	101	0	0	0.0103	0.8008
	0.0993	0.0499	0.0397	0	0	0	0	0	0	0		
1985	1	1	0	0	13	28	28	79	0	0	0.0098	0.6165
	0.1039	0.1529	0.1169	0	0	0	0	0	0	0		
1985	1	1	0	0	13	29	29	63	0	0	0	0.415
	0.2415	0.1786	0.1615	0.0034	0	0	0	0	0	0		
1985	1	1	0	0	13	30	30	58	0	0	0	0.2954
	0.1652	0.1788	0.3415	0.0191	0	0	0	0	0	0		
1985	1	1	0	0	13	31	31	52	0	0	0	0.1511
	0.1357	0.1548	0.5076	0.047	0.0001	0	0.0036	0	0	0		
1985	1	1	0	0	13	32	32	25	0	0	0	0.0448
	0.2469	0.088	0.5438	0	0.0511	0	0.0255	0	0	0		
1985	1	1	0	0	13	33	33	24	0	0	0	0
	0	0.1586	0.6698	0.0131	0.0414	0.117	0	0	0	0		
1985	1	1	0	0	13	34	34	17	0	0	0	0
	0.1612	0.3	0.3874	0	0.0542	0.0973	0	0	0	0		

1985	1	1	0	0	13	35	35	15	0	0	0	0
	0	0.0902	0.5058	0.2053	0.1151	0	0.0836	0	0	0		
1985	1	1	0	0	13	36	36	11	0	0	0	0
	0	0	0.3983	0.3581	0.1833	0.0482	0.0122	0	0	0		
1985	1	1	0	0	13	37	37	3	0	0	0	0
	0	0	0.1405	0	0	0.6709	0.1885	0	0	0		
1985	1	1	0	0	13	38	38	4	0	0	0	0
	0	0	0.0668	0.9332	0	0	0	0	0	0		
1985	1	1	0	0	13	39	39	3	0	0	0	0
	0	0	0	0.1047	0	0.5112	0.3841	0	0	0		
1985	1	1	0	0	13	41	41	1	0	0	0	0
	0	0	0	0	0	1	0	0	0	0		
1985	1	1	0	0	13	42	42	1	0	0	0	0
	0	0	0	1	0	0	0	0	0	0		
1985	1	1	0	0	13	49	49	1	0	0	0	0
	0	0	0	0	0	0	0	1	0	0		
1986	1	1	0	0	14	5	5	1	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
1986	1	1	0	0	14	10	10	1	0	1	0	0
	0	0	0	0	0	0	0	0	0	0		
1986	1	1	0	0	14	11	11	5	0.7986	0.2014	0	0
	0	0	0	0	0	0	0	0	0	0		
1986	1	1	0	0	14	12	12	8	0.8369	0.0987	0	0
	0.0644	0	0	0	0	0	0	0	0	0		
1986	1	1	0	0	14	13	13	19	0.7475	0.2525	0	0
	0	0	0	0	0	0	0	0	0	0		
1986	1	1	0	0	14	14	14	22	0.8952	0.1048	0	0
	0	0	0	0	0	0	0	0	0	0		
1986	1	1	0	0	14	15	15	49	0.8924	0.1033	0	0
	0	0	0	0	0	0	0	0.0043	0	0		
1986	1	1	0	0	14	16	16	41	0.9315	0.0685	0	0
	0	0	0	0	0	0	0	0	0	0		
1986	1	1	0	0	14	17	17	42	0.8993	0.1007	0	0
	0	0	0	0	0	0	0	0	0	0		
1986	1	1	0	0	14	18	18	40	0.766	0.2022	0.0227	0
	0.0092	0	0	0	0	0	0	0	0	0		
1986	1	1	0	0	14	19	19	39	0.5346	0.3611	0.0434	0.0234
	0.0375	0	0	0	0	0	0	0	0	0		
1986	1	1	0	0	14	20	20	36	0.2168	0.2068	0.0794	0
	0.481	0.016	0	0	0	0	0	0	0	0		
1986	1	1	0	0	14	21	21	51	0.0967	0.1245	0	0.0415
	0.718	0.0192	0	0	0	0	0	0	0	0		
1986	1	1	0	0	14	22	22	85	0.0143	0.0569	0.0429	0.0963
	0.747	0.0408	0.002	0	0	0	0	0	0	0		
1986	1	1	0	0	14	23	23	114	0	0.0162	0.0138	0.0633
	0.8265	0.0746	0.0057	0	0	0	0	0	0	0		
1986	1	1	0	0	14	24	24	119	0	0	0.0132	0.0755
	0.8346	0.0737	0.003	0	0	0	0	0	0	0		
1986	1	1	0	0	14	25	25	110	0	0.0073	0	0.0385
	0.8688	0.0614	0.02	0.004	0	0	0	0	0	0		
1986	1	1	0	0	14	26	26	113	0	0	0.0064	0.0388
	0.7934	0.0999	0.0439	0.0176	0	0	0	0	0	0		
1986	1	1	0	0	14	27	27	105	0	0	0	0.0392
	0.7694	0.096	0.0467	0.0486	0	0	0	0	0	0		
1986	1	1	0	0	14	28	28	100	0	0	0	0.005
	0.6861	0.1173	0.0867	0.105	0	0	0	0	0	0		
1986	1	1	0	0	14	29	29	83	0	0	0.0087	0.0054
	0.5111	0.1732	0.1317	0.1536	0.007	0.0093	0	0	0	0		
1986	1	1	0	0	14	30	30	67	0	0	0	0
	0.4155	0.147	0.1706	0.2345	0.0185	0.0139	0	0	0	0		
1986	1	1	0	0	14	31	31	77	0	0	0	0
	0.2452	0.1266	0.1916	0.382	0.0345	0.013	0	0.0072	0	0		
1986	1	1	0	0	14	32	32	59	0	0	0	0
	0.2164	0.1501	0.0899	0.4173	0.0377	0.0364	0.0142	0.0246	0.0053	0.0083		
1986	1	1	0	0	14	33	33	51	0	0	0	0
	0.0868	0.064	0.1148	0.4276	0.1377	0.0808	0.0563	0.032	0	0		

1986	1	1	0	0	14	34	34	52	0	0	0	0
	0.1319	0.1375	0.1477	0.2997	0.0741	0.0378	0.0761	0.0952	0	0		
1986	1	1	0	0	14	35	35	44	0	0	0	0
	0.0563	0.032	0.0362	0.4116	0.1344	0.205	0.0359	0.0725	0	0.0161		
1986	1	1	0	0	14	36	36	27	0	0	0	0
	0.072	0.0969	0.1015	0.2885	0.1861	0.0792	0.0439	0.132	0	0		
1986	1	1	0	0	14	37	37	31	0	0	0	0
	0	0.0487	0.2645	0.0804	0.0804	0.2176	0.1997	0.0613	0.0474	0		
1986	1	1	0	0	14	38	38	24	0	0	0	0
	0.0332	0	0.1093	0.2359	0.1034	0.1553	0.0066	0.3261	0.0302	0		
1986	1	1	0	0	14	39	39	11	0	0	0	0
	0	0	0	0.1314	0.1022	0.5425	0.0448	0.1791	0	0		
1986	1	1	0	0	14	40	40	11	0	0	0	0
	0	0	0	0.1337	0.0675	0.2444	0	0.3673	0	0.1871		
1986	1	1	0	0	14	41	41	7	0	0	0	0
	0	0.1915	0	0	0.4505	0.3351	0	0	0.0228	0		
1986	1	1	0	0	14	42	42	8	0	0	0	0
	0	0	0	0.5975	0.0814	0	0	0.0984	0	0.2227		
1986	1	1	0	0	14	43	43	7	0	0	0	0
	0	0	0	0.1306	0.2845	0	0.2833	0.3017	0	0		
1986	1	1	0	0	14	44	44	3	0	0	0	0
	0	0	0	0	0.1447	0.3308	0	0.5245	0	0		
1986	1	1	0	0	14	45	45	6	0	0	0	0
	0	0	0.2829	0.1794	0.1415	0.2689	0	0.1273	0	0		
1986	1	1	0	0	14	46	46	5	0	0	0	0
	0	0	0	0	0	0.3841	0.0562	0.2535	0	0.3062		
1986	1	1	0	0	14	47	47	6	0	0	0	0
	0.0525	0	0	0	0.0525	0.1035	0.1563	0.5186	0	0.1167		
1986	1	1	0	0	14	48	48	4	0	0	0	0
	0	0	0	0	0.061	0.3475	0	0.1661	0.4254	0		
1986	1	1	0	0	14	49	49	3	0	0	0	0
	0	0	0.1424	0	0	0.1424	0	0.7153	0	0		
1986	1	1	0	0	14	50	50	4	0	0	0	0
	0	0	0	0	0	0	0	0.5429	0	0.4571		
1986	1	1	0	0	14	51	51	25	0	0	0	0
	0	0	0.0074	0.4041	0.0675	0.1412	0.1492	0.1325	0.0394	0.0587		
1987	1	1	0	0	15	14	14	3	0	1	0	0
	0	0	0	0	0	0	0	0	0	0		
1987	1	1	0	0	15	15	15	6	0	1	0	0
	0	0	0	0	0	0	0	0	0	0		
1987	1	1	0	0	15	16	16	16	0	1	0	0
	0	0	0	0	0	0	0	0	0	0		
1987	1	1	0	0	15	17	17	29	0	0.9813	0.0187	0
	0	0	0	0	0	0	0	0	0	0		
1987	1	1	0	0	15	18	18	60	0	0.9612	0.0388	0
	0	0	0	0	0	0	0	0	0	0		
1987	1	1	0	0	15	19	19	79	0	0.9003	0.0737	0.0118
	0	0.0142	0	0	0	0	0	0	0	0		
1987	1	1	0	0	15	20	20	88	0	0.9119	0.0476	0
	0.0174	0.0231	0	0	0	0	0	0	0	0		
1987	1	1	0	0	15	21	21	97	0	0.8257	0.0207	0.0094
	0	0.1443	0	0	0	0	0	0	0	0		
1987	1	1	0	0	15	22	22	104	0	0.7603	0.0385	0
	0.0043	0.1829	0.0021	0.0119	0	0	0	0	0	0		
1987	1	1	0	0	15	23	23	112	0	0.5048	0.015	0.0082
	0.0319	0.4166	0.0235	0	0	0	0	0	0	0		
1987	1	1	0	0	15	24	24	121	0	0.2743	0.0201	0.0123
	0.0077	0.6558	0.0241	0	0.0058	0	0	0	0	0		
1987	1	1	0	0	15	25	25	117	0	0.0716	0.0417	0.0041
	0.0044	0.8268	0.0351	0	0.0163	0	0	0	0	0		
1987	1	1	0	0	15	26	26	113	0	0.0132	0.0031	0.0032
	0.0151	0.8578	0.0414	0.0247	0.0416	0	0	0	0	0		
1987	1	1	0	0	15	27	27	106	0	0.0014	0.0057	0.0127
	0.0733	0.7813	0.0718	0.0129	0.0398	0	0	0	0.001	0		
1987	1	1	0	0	15	28	28	102	0	0	0	0.0051
	0.0016	0.7359	0.1202	0.0172	0.12	0	0	0	0	0		

1987	1	1	0	0	15	29	29	92	0	0	0	0
	0.0021	0.7355	0.0337	0.0359	0.1823	0.0048	0	0	0	0.0057		
1987	1	1	0	0	15	30	30	83	0	0.004	0	0
	0.0121	0.6676	0.0823	0.0114	0.2101	0	0	0	0.0124	0		
1987	1	1	0	0	15	31	31	59	0	0	0	0
	0.0118	0.565	0.0427	0.0264	0.3118	0.0093	0	0	0.0331	0		
1987	1	1	0	0	15	32	32	40	0	0	0	0
	0	0.3497	0.0775	0.0662	0.3661	0.0357	0.0162	0	0.0886	0		
1987	1	1	0	0	15	33	33	31	0	0	0	0
	0	0.3648	0.0261	0.0091	0.505	0.0403	0	0	0.0546	0		
1987	1	1	0	0	15	34	34	18	0	0	0	0
	0	0.0779	0.0385	0.0169	0.6232	0	0.0454	0	0.1982	0		
1987	1	1	0	0	15	35	35	14	0	0	0	0
	0	0.3415	0	0	0.4553	0	0	0	0.2033	0		
1987	1	1	0	0	15	36	36	8	0	0	0	0
	0.1596	0.0351	0	0	0.5772	0	0	0.0924	0.1357	0		
1987	1	1	0	0	15	37	37	5	0	0	0	0
	0	0	0.0913	0	0.3026	0.1435	0	0.1373	0.1662	0.1591		
1987	1	1	0	0	15	38	38	5	0	0	0	0
	0.1127	0	0.6198	0	0.1729	0	0	0	0.0947	0		
1987	1	1	0	0	15	39	39	3	0	0	0	0
	0	0	0	0.2073	0.2023	0	0	0	0.2952	0.2952		
1987	1	1	0	0	15	40	40	2	0	0	0	0
	0	0	0	0	0.7793	0.2207	0	0	0	0		
1987	1	1	0	0	15	41	41	5	0	0	0	0
	0	0	0.1403	0	0.6712	0	0	0	0.1885	0		
1987	1	1	0	0	15	42	42	3	0	0	0	0
	0	0	0	0	0.2722	0	0	0	0.221	0.5069		
1987	1	1	0	0	15	43	43	6	0	0	0	0
	0	0	0	0	0.433	0.3544	0	0.0357	0.0869	0.0899		
1987	1	1	0	0	15	44	44	1	0	0	0	0
	0	0	0	0	1	0	0	0	0	0		
1987	1	1	0	0	15	45	45	2	0	0	0	0
	0	0	0	0	0	0	0	0.243	0.757	0		
1987	1	1	0	0	15	46	46	3	0	0	0	0
	0	0.3506	0	0.3921	0	0	0	0	0.2574	0		
1987	1	1	0	0	15	47	47	1	0	0	0	0
	0	0	0	0	0	0	0	0	0	1		
1987	1	1	0	0	15	48	48	2	0	0	0	0
	0	0	0	0	0.4349	0	0	0	0.5651	0		
1987	1	1	0	0	15	49	49	3	0	0	0	0
	0	0	0.2406	0.4317	0	0	0	0	0	0.3278		
1987	1	1	0	0	15	50	50	1	0	0	0	0
	0	0	0	0	0	0	0	0	1	0		
1987	1	1	0	0	15	51	51	5	0	0	0	0
	0	0	0	0	0.1639	0	0	0.5995	0.2366	0		
1988	1	1	0	0	16	7	7	1	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
1988	1	1	0	0	16	10	10	1	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
1988	1	1	0	0	16	12	12	1	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
1988	1	1	0	0	16	13	13	2	0.493	0.507	0	0
	0	0	0	0	0	0	0	0	0	0		
1988	1	1	0	0	16	14	14	2	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
1988	1	1	0	0	16	15	15	3	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
1988	1	1	0	0	16	16	16	3	0.4793	0	0.5207	0
	0	0	0	0	0	0	0	0	0	0		
1988	1	1	0	0	16	17	17	3	0.3398	0.3192	0.341	0
	0	0	0	0	0	0	0	0	0	0		
1988	1	1	0	0	16	18	18	15	0.0679	0.0688	0.7531	0.1102
	0	0	0	0	0	0	0	0	0	0		
1988	1	1	0	0	16	19	19	56	0.0217	0.0239	0.9317	0
	0	0	0.0227	0	0	0	0	0	0	0		

1988	1	1	0	0	16	20	20	101	0.0042	0.0137	0.953	0.0232
	0	0	0.006	0	0	0	0	0	0	0		
1988	1	1	0	0	16	21	21	129	0	0.007	0.9307	0.0359
	0.0035	0.0044	0.0184	0	0	0	0	0	0	0		
1988	1	1	0	0	16	22	22	141	0	0.0038	0.9256	0.0419
	0.0064	0	0.0224	0	0	0	0	0	0	0		
1988	1	1	0	0	16	23	23	141	0	0.0017	0.9052	0.0287
	0.0019	0	0.057	0.0056	0	0	0	0	0	0		
1988	1	1	0	0	16	24	24	145	0	0	0.7042	0.0303
	0.004	0.0076	0.2446	0	0	0.0094	0	0	0	0		
1988	1	1	0	0	16	25	25	153	0	0	0.5065	0.0104
	0.0092	0.0084	0.4279	0.027	0	0.0106	0	0	0	0		
1988	1	1	0	0	16	26	26	152	0	0	0.1856	0.0125
	0.0041	0.0151	0.7179	0.0338	0.0035	0.0274	0	0	0	0		
1988	1	1	0	0	16	27	27	150	0	0	0.1435	0.0103
	0.0025	0.0274	0.7427	0.0301	0.0048	0.0387	0	0	0	0		
1988	1	1	0	0	16	28	28	137	0	0	0.0748	0.013
	0.0163	0.0132	0.7874	0.0347	0	0.0606	0	0	0	0		
1988	1	1	0	0	16	29	29	123	0	0	0.0476	0.0034
	0	0.0214	0.7797	0.0797	0.0117	0.0524	0	0.0041	0	0		
1988	1	1	0	0	16	30	30	81	0	0	0.0425	0
	0.0649	0.0038	0.556	0.0484	0.04	0.2235	0.0069	0	0	0.0142		
1988	1	1	0	0	16	31	31	68	0	0	0.0214	0
	0	0.0078	0.4008	0.0512	0.0244	0.477	0.0074	0	0	0.0101		
1988	1	1	0	0	16	32	32	45	0	0	0.0051	0
	0.0132	0.0234	0.455	0.0246	0	0.326	0	0	0	0.1527		
1988	1	1	0	0	16	33	33	34	0	0	0	0
	0	0	0.4361	0.0281	0.1075	0.3441	0	0	0	0.0842		
1988	1	1	0	0	16	34	34	22	0	0	0	0
	0	0	0.4126	0.0648	0	0.449	0.033	0	0	0.0405		
1988	1	1	0	0	16	35	35	15	0	0	0	0
	0	0	0.0713	0.1054	0	0.5877	0	0	0	0.2355		
1988	1	1	0	0	16	36	36	14	0	0	0	0
	0	0	0.0975	0.2658	0	0.3733	0	0	0	0.2635		
1988	1	1	0	0	16	37	37	8	0	0	0	0
	0	0	0.1291	0	0	0.1432	0	0	0	0.7277		
1988	1	1	0	0	16	38	38	13	0	0	0	0
	0	0	0.2178	0.097	0	0.5284	0	0	0	0.1568		
1988	1	1	0	0	16	39	39	11	0	0	0	0
	0	0	0.1278	0	0	0.3234	0	0.2868	0	0.262		
1988	1	1	0	0	16	40	40	4	0	0	0	0
	0	0	0	0	0	0.8301	0.1699	0	0	0		
1988	1	1	0	0	16	41	41	6	0	0	0	0
	0	0	0.3603	0	0	0.6397	0	0	0	0		
1988	1	1	0	0	16	42	42	5	0	0	0	0
	0	0	0.0971	0	0	0.7763	0	0	0	0.1266		
1988	1	1	0	0	16	43	43	1	0	0	0	0
	0	0	1	0	0	0	0	0	0	0		
1988	1	1	0	0	16	45	45	4	0	0	0	0
	0	0	0.3583	0	0	0.3987	0	0	0	0.243		
1988	1	1	0	0	16	46	46	3	0	0	0	0
	0	0	0.3319	0	0	0	0	0	0	0.6681		
1988	1	1	0	0	16	47	47	4	0	0	0	0
	0	0	0	0	0	1	0	0	0	0		
1988	1	1	0	0	16	49	49	2	0	0	0	0
	0	0	0	0	0	0.3221	0	0	0	0.6779		
1988	1	1	0	0	16	50	50	3	0	0	0	0
	0	0	0	0	0	0.1183	0	0	0	0.8817		
1988	1	1	0	0	16	51	51	12	0	0	0	0
	0	0.0169	0.0123	0.0167	0	0.0927	0	0	0	0.8614		
1989	1	1	0	0	17	10	10	2	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
1989	1	1	0	0	17	11	11	3	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
1989	1	1	0	0	17	12	12	9	0.9742	0.0258	0	0
	0	0	0	0	0	0	0	0	0	0		

1989	1	1	0	0	17	13	13	15	0.641	0.359	0	0
	0	0	0	0	0	0	0	0	0	0		
1989	1	1	0	0	17	14	14	15	0.8114	0.1886	0	0
	0	0	0	0	0	0	0	0	0	0		
1989	1	1	0	0	17	15	15	8	0.8279	0.1721	0	0
	0	0	0	0	0	0	0	0	0	0		
1989	1	1	0	0	17	16	16	10	0.3828	0.3312	0.286	0
	0	0	0	0	0	0	0	0	0	0		
1989	1	1	0	0	17	17	17	13	0.3559	0.6441	0	0
	0	0	0	0	0	0	0	0	0	0		
1989	1	1	0	0	17	18	18	9	0.1751	0.4883	0.2796	0.057
	0	0	0	0	0	0	0	0	0	0		
1989	1	1	0	0	17	19	19	17	0	0.2413	0.1695	0.5892
	0	0	0	0	0	0	0	0	0	0		
1989	1	1	0	0	17	20	20	40	0	0.2682	0.0786	0.6242
	0.0113	0.0176	0	0	0	0	0	0	0	0		
1989	1	1	0	0	17	21	21	79	0	0.0973	0.0606	0.7924
	0.0304	0	0	0.0193	0	0	0	0	0	0		
1989	1	1	0	0	17	22	22	120	0	0.0336	0.025	0.8962
	0.0269	0.004	0.0016	0.0105	0.0021	0	0	0	0	0		
1989	1	1	0	0	17	23	23	129	0	0.006	0.007	0.8945
	0.0383	0	0	0.0523	0	0.0019	0	0	0	0		
1989	1	1	0	0	17	24	24	125	0	0.0053	0.0107	0.8874
	0.0034	0	0	0.0932	0	0	0	0	0	0		
1989	1	1	0	0	17	25	25	127	0	0	0.0024	0.7444
	0.0065	0.0079	0	0.2234	0.0131	0	0.0023	0	0	0		
1989	1	1	0	0	17	26	26	125	0	0	0	0.5785
	0.0067	0.009	0.0185	0.3573	0.0265	0.0035	0	0	0	0		
1989	1	1	0	0	17	27	27	130	0	0	0	0.3755
	0.0157	0.0129	0.0116	0.542	0.0351	0.003	0.0043	0	0	0		
1989	1	1	0	0	17	28	28	133	0	0	0	0.2074
	0.0231	0.0028	0.0106	0.7298	0.0253	0	0.001	0	0	0		
1989	1	1	0	0	17	29	29	118	0	0	0.0038	0.1147
	0.0213	0.0035	0.0208	0.7404	0.0276	0.0172	0.0506	0	0	0		
1989	1	1	0	0	17	30	30	98	0	0	0	0.1194
	0	0.0117	0.0123	0.7787	0.0395	0	0.0358	0	0.0025	0		
1989	1	1	0	0	17	31	31	74	0	0	0	0.0511
	0.0248	0.0163	0.0248	0.6789	0.0419	0.0157	0.1465	0	0	0		
1989	1	1	0	0	17	32	32	49	0	0	0	0
	0	0.0095	0	0.6874	0.0537	0.0117	0.212	0	0	0.0257		
1989	1	1	0	0	17	33	33	40	0	0	0	0.0594
	0	0	0.0229	0.7036	0.0144	0	0.1998	0	0	0		
1989	1	1	0	0	17	34	34	35	0	0	0	0.0219
	0	0	0	0.5424	0.0668	0	0.2825	0.0161	0.0312	0.039		
1989	1	1	0	0	17	35	35	27	0	0	0	0.0178
	0.0307	0	0	0.4036	0.0202	0.0171	0.3939	0	0	0.1167		
1989	1	1	0	0	17	36	36	14	0	0	0	0
	0	0	0	0.3857	0.1103	0.1229	0.0763	0	0	0.3047		
1989	1	1	0	0	17	37	37	15	0	0	0	0
	0	0	0	0.1716	0.0484	0.033	0.7197	0	0	0.0273		
1989	1	1	0	0	17	38	38	8	0	0	0	0
	0	0	0	0.5079	0	0	0.4921	0	0	0		
1989	1	1	0	0	17	39	39	8	0	0	0	0
	0	0	0	0.1266	0	0	0.8412	0	0.0323	0		
1989	1	1	0	0	17	40	40	7	0	0	0	0
	0	0	0	0.575	0	0	0.3398	0	0.0851	0		
1989	1	1	0	0	17	41	41	3	0	0	0	0
	0	0	0	0	0.28	0	0.1715	0	0	0.5485		
1989	1	1	0	0	17	42	42	6	0	0	0	0
	0	0	0	0.2687	0	0	0.7313	0	0	0		
1989	1	1	0	0	17	44	44	3	0	0	0	0
	0	0	0	0	0	0	0.6146	0.3854	0	0		
1989	1	1	0	0	17	45	45	1	0	0	0	0
	0	0	0	1	0	0	0	0	0	0		
1989	1	1	0	0	17	46	46	1	0	0	0	0
	0	0	0	1	0	0	0	0	0	0		

1989	1	1	0	0	17	47	47	2	0	0	0	0
	0	0	0	0.8107	0	0	0.1893	0	0	0		
1989	1	1	0	0	17	49	49	4	0	0	0	0
	0	0	0	0.3549	0.1515	0	0.4937	0	0	0		
1989	1	1	0	0	17	51	51	4	0	0	0	0
	0	0	0	0	0.2364	0	0.7636	0	0	0		
1990	1	1	0	0	18	9	9	2	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
1990	1	1	0	0	18	10	10	6	0.7445	0.2555	0	0
	0	0	0	0	0	0	0	0	0	0		
1990	1	1	0	0	18	11	11	5	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
1990	1	1	0	0	18	12	12	15	0.3977	0.6023	0	0
	0	0	0	0	0	0	0	0	0	0		
1990	1	1	0	0	18	13	13	22	0.6987	0.3013	0	0
	0	0	0	0	0	0	0	0	0	0		
1990	1	1	0	0	18	14	14	24	0.5851	0.4121	0	0
	0.0029	0	0	0	0	0	0	0	0	0		
1990	1	1	0	0	18	15	15	45	0.4253	0.543	0.0043	0
	0.0275	0	0	0	0	0	0	0	0	0		
1990	1	1	0	0	18	16	16	51	0.2285	0.7564	0.0151	0
	0	0	0	0	0	0	0	0	0	0		
1990	1	1	0	0	18	17	17	76	0.2853	0.6603	0.0499	0
	0.0045	0	0	0	0	0	0	0	0	0		
1990	1	1	0	0	18	18	18	84	0.0664	0.876	0.0203	0
	0.0363	0	0	0	0.0009	0	0	0	0	0		
1990	1	1	0	0	18	19	19	94	0.0812	0.8065	0.0856	0
	0.0225	0	0	0	0.0042	0	0	0	0	0		
1990	1	1	0	0	18	20	20	98	0.0174	0.8915	0.0588	0.0018
	0.0286	0	0	0	0.0018	0	0	0	0	0		
1990	1	1	0	0	18	21	21	104	0.0074	0.8394	0.0534	0
	0.0938	0	0	0	0.0061	0	0	0	0	0		
1990	1	1	0	0	18	22	22	95	0	0.7097	0.084	0.0097
	0.1758	0	0	0.0049	0.016	0	0	0	0	0		
1990	1	1	0	0	18	23	23	96	0	0.4045	0.0507	0.0212
	0.4732	0.0053	0	0	0.0451	0	0	0	0	0		
1990	1	1	0	0	18	24	24	93	0	0.1055	0.04	0
	0.7633	0.0055	0	0	0.0819	0	0	0.0037	0	0		
1990	1	1	0	0	18	25	25	91	0	0.0266	0.0439	0
	0.6759	0	0.0111	0	0.2425	0	0	0	0	0		
1990	1	1	0	0	18	26	26	82	0	0.0121	0.0132	0.0116
	0.6018	0.0254	0.0065	0.0124	0.3083	0.0054	0	0.0033	0	0		
1990	1	1	0	0	18	27	27	88	0	0	0.005	0.0099
	0.5591	0.0062	0	0	0.4197	0	0	0	0	0		
1990	1	1	0	0	18	28	28	82	0	0	0	0.0204
	0.4363	0.0112	0	0.0061	0.5086	0	0	0.0174	0	0		
1990	1	1	0	0	18	29	29	84	0	0	0	0
	0.3034	0.0121	0.0135	0	0.6126	0	0	0.0585	0	0		
1990	1	1	0	0	18	30	30	73	0	0	0	0
	0.2749	0.0121	0	0.0163	0.5863	0.0111	0	0.0896	0	0.0097		
1990	1	1	0	0	18	31	31	72	0	0	0	0
	0.2638	0.0101	0	0	0.6243	0.0226	0	0.0793	0	0		
1990	1	1	0	0	18	32	32	74	0	0	0	0
	0.1179	0	0	0	0.7839	0	0	0.0906	0	0.0077		
1990	1	1	0	0	18	33	33	58	0	0	0	0
	0.0338	0	0	0	0.7978	0.0142	0	0.1542	0	0		
1990	1	1	0	0	18	34	34	43	0	0	0	0
	0.0073	0	0	0	0.6572	0	0	0.2934	0	0.0422		
1990	1	1	0	0	18	35	35	34	0	0	0	0
	0.0275	0	0	0	0.677	0	0	0.2699	0	0.0256		
1990	1	1	0	0	18	36	36	20	0	0	0	0
	0.0096	0	0	0	0.7408	0	0	0.2496	0	0		
1990	1	1	0	0	18	37	37	15	0	0	0	0
	0.0289	0	0	0	0.2609	0	0	0.581	0	0.1291		
1990	1	1	0	0	18	38	38	14	0	0	0	0
	0	0	0	0	0.618	0.0543	0	0.2958	0	0.0319		

1990	1	1	0	0	18	39	39	14	0	0	0	0
	0	0	0	0	0.6941	0.0483	0	0.0441	0	0.2136		
1990	1	1	0	0	18	40	40	11	0	0	0	0
	0	0	0	0	0.7701	0	0	0.2299	0	0		
1990	1	1	0	0	18	41	41	14	0	0	0	0
	0	0	0.0458	0	0.3996	0	0	0.4244	0	0.1302		
1990	1	1	0	0	18	42	42	15	0	0	0	0
	0	0	0	0	0.5968	0	0	0.3866	0	0.0166		
1990	1	1	0	0	18	43	43	9	0	0	0	0
	0	0	0	0	0.8455	0	0	0.0331	0	0.1214		
1990	1	1	0	0	18	44	44	9	0	0	0	0
	0	0	0	0	0.1571	0	0	0.7827	0	0.0602		
1990	1	1	0	0	18	45	45	8	0	0	0	0
	0	0	0	0	0.3222	0	0	0.6778	0	0		
1990	1	1	0	0	18	46	46	8	0	0	0	0
	0	0	0	0	0.3974	0	0	0.6026	0	0		
1990	1	1	0	0	18	47	47	8	0	0	0	0
	0	0	0	0	0.3214	0	0	0.3795	0	0.2991		
1990	1	1	0	0	18	48	48	6	0	0	0	0
	0	0	0	0	0.5001	0	0	0.5	0	0		
1990	1	1	0	0	18	49	49	6	0	0	0	0
	0	0	0	0	0.7289	0	0	0.2515	0	0.0196		
1990	1	1	0	0	18	50	50	7	0	0	0	0
	0	0	0	0	0.5397	0	0	0.4603	0	0		
1990	1	1	0	0	18	51	51	20	0	0	0	0
	0	0	0	0	0.352	0	0.0139	0.5689	0	0.0653		
1991	1	1	0	0	19	1	1	2	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
1991	1	1	0	0	19	2	2	2	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
1991	1	1	0	0	19	3	3	1	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
1991	1	1	0	0	19	4	4	1	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
1991	1	1	0	0	19	11	11	1	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
1991	1	1	0	0	19	12	12	2	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
1991	1	1	0	0	19	13	13	5	0.4588	0.5412	0	0
	0	0	0	0	0	0	0	0	0	0		
1991	1	1	0	0	19	14	14	13	0.2271	0.7729	0	0
	0	0	0	0	0	0	0	0	0	0		
1991	1	1	0	0	19	15	15	23	0.2385	0.6414	0.1201	0
	0	0	0	0	0	0	0	0	0	0		
1991	1	1	0	0	19	16	16	32	0.1485	0.7042	0.1339	0.0134
	0	0	0	0	0	0	0	0	0	0		
1991	1	1	0	0	19	17	17	33	0	0.7138	0.2801	0.0062
	0	0	0	0	0	0	0	0	0	0		
1991	1	1	0	0	19	18	18	39	0	0.7747	0.2253	0
	0	0	0	0	0	0	0	0	0	0		
1991	1	1	0	0	19	19	19	38	0	0.7006	0.2994	0
	0	0	0	0	0	0	0	0	0	0		
1991	1	1	0	0	19	20	20	47	0	0.5373	0.4347	0.026
	0	0	0.002	0	0	0	0	0	0	0		
1991	1	1	0	0	19	21	21	54	0.002	0.3492	0.5473	0.1015
	0	0	0	0	0	0	0	0	0	0		
1991	1	1	0	0	19	22	22	63	0	0.2337	0.6324	0.0313
	0	0.0943	0	0	0	0.0083	0	0	0	0		
1991	1	1	0	0	19	23	23	66	0	0.0701	0.6015	0.0715
	0.0702	0.1225	0	0	0	0.0642	0	0	0	0		
1991	1	1	0	0	19	24	24	66	0	0.0431	0.4777	0.0914
	0.0246	0.3299	0.0131	0	0	0.0202	0	0	0	0		
1991	1	1	0	0	19	25	25	62	0	0.0056	0.3264	0.0685
	0.0018	0.4967	0.0161	0.0023	0.0078	0.0655	0.0083	0	0.001	0		
1991	1	1	0	0	19	26	26	61	0	0.0018	0.1424	0.0368
	0	0.6786	0.001	0	0.002	0.1258	0.0116	0	0	0		

1991	1	1	0	0	19	27	27	61	0	0	0.0804	0.0649
	0.0038	0.619	0.0702	0.0101	0	0.1425	0.0092	0	0	0		
1991	1	1	0	0	19	28	28	55	0	0	0.0084	0.0234
	0.0685	0.5863	0.0198	0.0062	0.0084	0.2331	0.0064	0	0.0395	0		
1991	1	1	0	0	19	29	29	56	0	0	0.0039	0
	0	0.5328	0.02	0.002	0	0.4281	0	0	0.0132	0		
1991	1	1	0	0	19	30	30	49	0	0	0	0.0184
	0.0032	0.463	0.0173	0	0	0.4602	0.0049	0	0.033	0		
1991	1	1	0	0	19	31	31	40	0	0	0	0
	0	0.184	0.0518	0	0	0.6606	0.0249	0	0.0787	0		
1991	1	1	0	0	19	32	32	20	0	0	0	0
	0	0.4162	0	0	0	0.3907	0.0291	0	0.164	0		
1991	1	1	0	0	19	33	33	9	0	0	0	0
	0	0	0.0808	0	0	0.5974	0	0	0.3219	0		
1991	1	1	0	0	19	34	34	6	0	0	0	0
	0	0.1254	0	0	0	0.1853	0	0	0.6894	0		
1991	1	1	0	0	19	35	35	6	0	0	0	0
	0	0.4802	0	0	0	0.194	0.1194	0	0	0.2064		
1991	1	1	0	0	19	36	36	7	0	0	0	0
	0	0.2149	0.1044	0	0	0.1178	0	0	0.5629	0		
1991	1	1	0	0	19	37	37	2	0	0	0	0
	0	0	0	0	0	0.1803	0	0	0	0.8197		
1991	1	1	0	0	19	38	38	3	0	0	0	0
	0	0.4074	0	0	0	0.0403	0	0	0.145	0.4074		
1991	1	1	0	0	19	39	39	2	0	0	0	0
	0	0	0	0	0	0.222	0	0	0.778	0		
1991	1	1	0	0	19	40	40	3	0	0	0	0
	0	0	0	0	0	0.5654	0	0	0.4346	0		
1991	1	1	0	0	19	42	42	3	0	0	0	0
	0	0	0.0744	0	0	0.8062	0	0	0.1195	0		
1991	1	1	0	0	19	43	43	3	0	0	0	0
	0	0	0	0	0	0.7328	0	0	0.2672	0		
1991	1	1	0	0	19	44	44	3	0	0	0	0
	0	0.3544	0	0	0	0.3769	0	0	0.2687	0		
1991	1	1	0	0	19	46	46	2	0	0	0	0
	0	0	0.5682	0	0.1439	0.1439	0	0	0	0.1439		
1991	1	1	0	0	19	47	47	5	0	0	0	0
	0	0	0.4589	0	0	0.0556	0	0	0.4855	0		
1991	1	1	0	0	19	48	48	2	0	0	0	0
	0	0	0	0	0	0.2273	0	0	0.7727	0		
1991	1	1	0	0	19	49	49	2	0	0	0	0
	0	0	0	0	0.6351	0	0	0	0.3649	0		
1991	1	1	0	0	19	50	50	1	0	0	0	0
	0	0	0	0	0	0	0	0	1	0		
1991	1	1	0	0	19	51	51	9	0.1062	0	0	0
	0	0	0	0	0	0.3296	0	0	0.3821	0.182		
1992	1	1	0	0	20	8	8	1	0	1	0	0
	0	0	0	0	0	0	0	0	0	0		
1992	1	1	0	0	20	9	9	2	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
1992	1	1	0	0	20	10	10	5	0.8005	0.1995	0	0
	0	0	0	0	0	0	0	0	0	0		
1992	1	1	0	0	20	11	11	6	0.7807	0.2193	0	0
	0	0	0	0	0	0	0	0	0	0		
1992	1	1	0	0	20	12	12	8	0.8747	0.1253	0	0
	0	0	0	0	0	0	0	0	0	0		
1992	1	1	0	0	20	13	13	6	0.6588	0.3412	0	0
	0	0	0	0	0	0	0	0	0	0		
1992	1	1	0	0	20	14	14	6	0.6584	0.3416	0	0
	0	0	0	0	0	0	0	0	0	0		
1992	1	1	0	0	20	15	15	7	0.9204	0.0796	0	0
	0	0	0	0	0	0	0	0	0	0		
1992	1	1	0	0	20	16	16	7	0.7743	0.2257	0	0
	0	0	0	0	0	0	0	0	0	0		
1992	1	1	0	0	20	17	17	11	0.6443	0.3381	0.0177	0
	0	0	0	0	0	0	0	0	0	0		

1992	1	1	0	0	20	18	18	28	0.2198	0.4744	0.2227	0.0832
	0	0	0	0	0	0	0	0	0	0		
1992	1	1	0	0	20	19	19	26	0.1265	0.3456	0.4738	0.0541
	0	0	0	0	0	0	0	0	0	0		
1992	1	1	0	0	20	20	20	61	0.0019	0.1689	0.5579	0.2713
	0	0	0	0	0	0	0	0	0	0		
1992	1	1	0	0	20	21	21	75	0.0049	0.1298	0.4127	0.4204
	0.0293	0	0	0	0	0	0.0029	0	0	0		
1992	1	1	0	0	20	22	22	89	0	0.1443	0.4557	0.3399
	0.022	0	0.0381	0	0	0	0	0	0	0		
1992	1	1	0	0	20	23	23	105	0	0.0349	0.4786	0.3775
	0.0099	0	0.0668	0.0049	0	0	0.0275	0	0	0		
1992	1	1	0	0	20	24	24	108	0	0.0076	0.2871	0.4958
	0.0387	0.013	0.1411	0	0	0	0.0151	0	0.0017	0		
1992	1	1	0	0	20	25	25	108	0	0.0103	0.2371	0.3882
	0.0322	0.0162	0.271	0.0055	0.0039	0	0.0355	0	0	0		
1992	1	1	0	0	20	26	26	107	0	0.0032	0.0802	0.3392
	0.0221	0.0319	0.4342	0.0077	0.0034	0.0059	0.0722	0	0	0		
1992	1	1	0	0	20	27	27	107	0	0.0022	0.0181	0.2246
	0.039	0.0367	0.4697	0.024	0.0036	0.0141	0.1612	0	0	0.0068		
1992	1	1	0	0	20	28	28	111	0	0	0.021	0.1682
	0.0313	0.0075	0.5439	0.0126	0	0	0.2121	0	0	0.0034		
1992	1	1	0	0	20	29	29	103	0	0	0.0168	0.0881
	0.0321	0.0434	0.5233	0.0206	0.0058	0	0.27	0	0	0		
1992	1	1	0	0	20	30	30	93	0	0	0	0.1031
	0.0041	0.0103	0.5841	0.0212	0.0034	0	0.2542	0.0042	0	0.0154		
1992	1	1	0	0	20	31	31	78	0	0	0	0.0632
	0.0316	0.0177	0.4915	0.0231	0	0	0.3232	0.0136	0	0.0361		
1992	1	1	0	0	20	32	32	61	0	0	0.0079	0.0096
	0.0103	0	0.4328	0.0033	0	0	0.4861	0.0199	0	0.0301		
1992	1	1	0	0	20	33	33	41	0	0	0	0.0112
	0.0063	0	0.3404	0	0	0	0.3277	0.0602	0	0.2542		
1992	1	1	0	0	20	34	34	35	0	0	0	0
	0.0083	0	0.4815	0.0288	0	0.0045	0.4237	0.0309	0	0.0223		
1992	1	1	0	0	20	35	35	28	0	0	0	0
	0	0	0.308	0	0	0	0.475	0.0069	0.009	0.2011		
1992	1	1	0	0	20	36	36	20	0	0	0	0
	0	0	0.572	0	0.0203	0	0.3014	0	0	0.1063		
1992	1	1	0	0	20	37	37	16	0	0	0	0
	0	0	0.2744	0	0	0.0091	0.4954	0	0	0.2211		
1992	1	1	0	0	20	38	38	15	0	0	0	0
	0	0	0.2486	0	0	0.2769	0.4326	0	0	0.0419		
1992	1	1	0	0	20	39	39	9	0	0	0	0
	0	0	0.0906	0	0	0	0.7983	0	0	0.1111		
1992	1	1	0	0	20	40	40	9	0	0	0	0
	0	0	0.3644	0	0	0	0.4283	0.0668	0	0.1405		
1992	1	1	0	0	20	41	41	7	0	0	0	0
	0	0	0.1555	0	0	0	0.5592	0.1448	0	0.1405		
1992	1	1	0	0	20	42	42	5	0	0	0	0
	0	0	0	0	0	0	1	0	0	0		
1992	1	1	0	0	20	43	43	5	0	0	0	0
	0	0	0	0	0	0	0.6621	0	0	0.338		
1992	1	1	0	0	20	44	44	2	0	0	0	0
	0	0	0	0	0	0	0.8135	0	0	0.1865		
1992	1	1	0	0	20	45	45	3	0	0	0	0
	0	0	0.1273	0	0	0	0	0	0	0.8727		
1992	1	1	0	0	20	46	46	2	0	0	0	0
	0	0	0.4922	0	0	0	0.5078	0	0	0		
1992	1	1	0	0	20	47	47	2	0	0	0	0
	0	0	0	0	0	0	1	0	0	0		
1992	1	1	0	0	20	49	49	2	0	0	0	0
	0	0	0	0	0	0	0.8995	0	0	0.1005		
1992	1	1	0	0	20	51	51	7	0	0	0	0
	0	0	0	0.0224	0	0	0.1277	0.0642	0	0.7857		
1993	1	1	0	0	21	12	12	5	0.9268	0.0732	0	0
	0	0	0	0	0	0	0	0	0	0		

1993	1	1	0	0	21	13	13	1	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
1993	1	1	0	0	21	14	14	5	0	1	0	0
	0	0	0	0	0	0	0	0	0	0		
1993	1	1	0	0	21	15	15	6	0.1285	0.8715	0	0
	0	0	0	0	0	0	0	0	0	0		
1993	1	1	0	0	21	16	16	20	0.0187	0.9551	0.0262	0
	0	0	0	0	0	0	0	0	0	0		
1993	1	1	0	0	21	17	17	39	0.0233	0.9387	0.0042	0.0339
	0	0	0	0	0	0	0	0	0	0		
1993	1	1	0	0	21	18	18	50	0.0204	0.84	0.1331	0.0066
	0	0	0	0	0	0	0	0	0	0		
1993	1	1	0	0	21	19	19	59	0	0.8782	0.0301	0.0873
	0	0	0	0.0044	0	0	0	0	0	0		
1993	1	1	0	0	21	20	20	63	0	0.9206	0.0488	0.0258
	0	0	0	0	0	0	0	0.0048	0	0		
1993	1	1	0	0	21	21	21	59	0	0.7371	0.0944	0.1582
	0.0103	0	0	0	0	0	0	0	0	0		
1993	1	1	0	0	21	22	22	49	0	0.4832	0.1108	0.2635
	0.1426	0	0	0	0	0	0	0	0	0		
1993	1	1	0	0	21	23	23	67	0	0.1128	0.1183	0.4917
	0.2299	0	0	0.0374	0	0	0	0.01	0	0		
1993	1	1	0	0	21	24	24	77	0	0.0383	0.0619	0.3681
	0.3359	0.0667	0.0485	0.077	0	0	0	0.0036	0	0		
1993	1	1	0	0	21	25	25	86	0	0.0052	0.0084	0.2767
	0.4484	0.0259	0.0045	0.1732	0	0	0	0.0542	0	0.0036		
1993	1	1	0	0	21	26	26	87	0	0.0041	0.0126	0.2388
	0.279	0.0171	0.044	0.3175	0.0028	0	0.0009	0.0762	0	0.007		
1993	1	1	0	0	21	27	27	85	0	0	0	0.1193
	0.2858	0.0055	0.0104	0.4429	0.015	0.0056	0	0.0973	0	0.0182		
1993	1	1	0	0	21	28	28	79	0	0	0	0.0387
	0.2262	0.0068	0.0038	0.5628	0.0739	0	0	0.0879	0	0		
1993	1	1	0	0	21	29	29	78	0	0	0	0.0178
	0.1868	0.0226	0.0102	0.5324	0	0	0	0.2118	0	0.0184		
1993	1	1	0	0	21	30	30	59	0	0	0	0.013
	0.0265	0.0502	0	0.535	0.0115	0	0	0.3638	0	0		
1993	1	1	0	0	21	31	31	37	0	0	0	0.0162
	0.1039	0	0	0.4935	0	0	0	0.3603	0	0.0261		
1993	1	1	0	0	21	32	32	26	0	0	0	0
	0	0.0104	0	0.4913	0.0813	0	0	0.4043	0	0.0128		
1993	1	1	0	0	21	33	33	9	0	0	0	0
	0	0	0	0.3578	0	0	0	0.5449	0	0.0973		
1993	1	1	0	0	21	34	34	4	0	0	0	0
	0	0	0	0.1487	0	0	0.1008	0	0.0814	0.6692		
1993	1	1	0	0	21	35	35	7	0	0	0	0
	0	0	0	0.3014	0	0	0	0.6986	0	0		
1993	1	1	0	0	21	36	36	7	0	0	0	0
	0	0	0	0.6571	0	0.0769	0	0.1045	0	0.1616		
1993	1	1	0	0	21	37	37	1	0	0	0	0
	0	0	0	0	0	0	0	1	0	0		
1993	1	1	0	0	21	38	38	2	0	0	0	0
	0	0	0	0.7583	0	0	0	0.2417	0	0		
1993	1	1	0	0	21	40	40	1	0	0	0	0
	0	0	0	1	0	0	0	0	0	0		
1993	1	1	0	0	21	42	42	2	0	0	0	0
	0	0	0	0.3821	0	0	0.309	0.309	0	0		
1993	1	1	0	0	21	50	50	1	0	0	0	0
	0	0	0	0	0	1	0	0	0	0		
1993	1	1	0	0	21	51	51	1	0	0	0	0
	0	0	0	0	0	0	0	1	0	0		
1994	1	1	0	0	22	11	11	1	0	1	0	0
	0	0	0	0	0	0	0	0	0	0		
1994	1	1	0	0	22	14	14	1	0	1	0	0
	0	0	0	0	0	0	0	0	0	0		
1994	1	1	0	0	22	16	16	3	0	1	0	0
	0	0	0	0	0	0	0	0	0	0		

1994	1	1	0	0	22	17	17	9	0	0.6707	0.3293	0	
	0	0	0	0	0	0	0	0	0	0			
1994	1	1	0	0	22	18	18	20	0	0.4908	0.5092	0	
	0	0	0	0	0	0	0	0	0	0			
1994	1	1	0	0	22	19	19	50	0.0187	0.4867	0.4708	0.0238	
	0	0	0	0	0	0	0	0	0	0			
1994	1	1	0	0	22	20	20	78	0	0.1519	0.8022	0.0179	
	0.0244	0.0036	0	0	0	0	0	0	0	0			
1994	1	1	0	0	22	21	21	92	0	0.0747	0.8142	0.0248	
	0.0675	0.0188	0	0	0	0	0	0	0	0			
1994	1	1	0	0	22	22	22	101	0	0.0227	0.7964	0.0323	
	0.126	0.0226	0	0	0	0	0	0	0	0			
1994	1	1	0	0	22	23	23	110	0	0.0019	0.6752	0.0042	
	0.1751	0.1206	0	0	0.012	0	0	0	0.011	0			
1994	1	1	0	0	22	24	24	119	0	0.0071	0.347	0.0113	
	0.3325	0.222	0	0	0.06	0	0	0	0.0201	0			
1994	1	1	0	0	22	25	25	137	0	0	0.1731	0.0157	
	0.2967	0.3328	0	0	0.1697	0	0.0032	0	0.0048	0.004			
1994	1	1	0	0	22	26	26	137	0	0.003	0.046	0.0107	
	0.2309	0.3704	0.0019	0.0174	0.2894	0	0.0008	0	0.0282	0.0014			
1994	1	1	0	0	22	27	27	137	0	0	0.0127	0.006	
	0.2113	0.3476	0.0063	0.0086	0.3058	0.0041	0.0063	0	0.0897	0.0015			
1994	1	1	0	0	22	28	28	132	0	0	0.0316	0	
	0.1186	0.364	0.0069	0.0021	0.3847	0.0024	0	0	0.082	0.0078			
1994	1	1	0	0	22	29	29	129	0	0	0	0	
	0.0571	0.2445	0.024	0.0036	0.5425	0	0.0106	0	0.097	0.0208			
1994	1	1	0	0	22	30	30	119	0	0	0	0	
	0.0037	0.2268	0.0093	0	0.4508	0	0.0026	0	0.2772	0.0297			
1994	1	1	0	0	22	31	31	81	0	0	0.0095	0	
	0.0264	0.2434	0.042	0.0116	0.4346	0	0.0347	0.0066	0.1662	0.025			
1994	1	1	0	0	22	32	32	47	0	0	0	0	
	0.0114	0.1968	0	0	0.5614	0	0.0363	0	0.1905	0.0035			
1994	1	1	0	0	22	33	33	30	0	0	0	0	
	0.0689	0.0537	0	0	0.4776	0	0	0	0.3236	0.0762			
1994	1	1	0	0	22	34	34	16	0	0	0	0	
	0	0.0447	0	0	0.8001	0	0	0.0176	0.1376	0			
1994	1	1	0	0	22	35	35	14	0	0	0	0	
	0	0.0648	0.165	0	0.7079	0	0	0	0.0623	0			
1994	1	1	0	0	22	36	36	9	0	0	0	0	
	0	0	0	0	0.575	0	0.1251	0	0.295	0.0049			
1994	1	1	0	0	22	37	37	4	0	0	0	0	
	0	0.1206	0	0	0.8794	0	0	0	0	0			
1994	1	1	0	0	22	38	38	7	0	0	0	0	
	0	0.1525	0	0	0.7208	0	0	0	0.1267	0			
1994	1	1	0	0	22	39	39	6	0	0	0	0	
	0	0.2823	0	0	0.1497	0	0	0	0.4116	0.1564			
1994	1	1	0	0	22	40	40	2	0	0	0	0	
	0	0	0	0	0.8201	0	0	0	0.1799	0			
1994	1	1	0	0	22	41	41	3	0	0	0	0	
	0	0	0	0	0.4079	0	0	0	0.5921	0			
1994	1	1	0	0	22	42	42	1	0	0	0	0	
	0	0	0	0	0	0	0	0	1	0			
1994	1	1	0	0	22	43	43	1	0	0	0	0	
	0	0	0	0	1	0	0	0	0	0			
1994	1	1	0	0	22	44	44	1	0	0	0	0	
	0	0	0	0	0	0	0	0	0	1			
1994	1	1	0	0	22	45	45	1	0	0	0	0	
	0	0	0	0	1	0	0	0	0	0			
1994	1	1	0	0	22	46	46	2	0	0	0	0	
	0	0	0	0	0	0	0	0	1	0			
1994	1	1	0	0	22	48	48	1	0	0	0	0	
	0	0	0	0	1	0	0	0	0	0			
1994	1	1	0	0	22	49	49	1	0	0	0	0	
	0	0	0	0	0	0	0	0	1	0			
1994	1	1	0	0	22	50	50	1	0	0	0	0	
	0	0	0	0	0	0	0	0	1	0			

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1994	1	1	0	0	22	51	51	5	0	0	0	0
	0	0	0	0	0	0	0	0	0.815	0.185		
1995	1	1	0	0	23	1	1	1	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
1995	1	1	0	0	23	5	5	1	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
1995	1	1	0	0	23	6	6	1	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
1995	1	1	0	0	23	7	7	1	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
1995	1	1	0	0	23	13	13	1	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
1995	1	1	0	0	23	15	15	1	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
1995	1	1	0	0	23	17	17	2	0.6345	0.3655	0	0
	0	0	0	0	0	0	0	0	0	0		
1995	1	1	0	0	23	18	18	2	0.5539	0	0.4461	0
	0	0	0	0	0	0	0	0	0	0		
1995	1	1	0	0	23	19	19	4	0	0	0.0595	0.9405
	0	0	0	0	0	0	0	0	0	0		
1995	1	1	0	0	23	20	20	4	0	0	0.1828	0.8172
	0	0	0	0	0	0	0	0	0	0		
1995	1	1	0	0	23	21	21	13	0	0	0.3854	0.6146
	0	0	0	0	0	0	0	0	0	0		
1995	1	1	0	0	23	22	22	35	0	0	0.448	0.5201
	0	0.0178	0.0055	0	0	0.0085	0	0	0	0		
1995	1	1	0	0	23	23	23	58	0	0	0.1944	0.6973
	0.01	0.0765	0.0159	0	0	0.0059	0	0	0	0		
1995	1	1	0	0	23	24	24	68	0	0	0.1602	0.689
	0.0058	0.0593	0.0792	0	0	0.0065	0	0	0	0		
1995	1	1	0	0	23	25	25	71	0	0	0.075	0.6708
	0.0073	0.1097	0.1006	0.0037	0	0.0298	0	0	0	0.0032		
1995	1	1	0	0	23	26	26	71	0	0	0.0121	0.4467
	0.0141	0.1186	0.2266	0.0189	0	0.1357	0	0	0	0.0275		
1995	1	1	0	0	23	27	27	71	0	0	0.0106	0.3652
	0.0141	0.0836	0.3069	0.0084	0	0.1752	0	0.0029	0	0.033		
1995	1	1	0	0	23	28	28	74	0	0	0.0047	0.1262
	0.0071	0.0692	0.2962	0.0043	0.0133	0.3627	0.0143	0.008	0	0.094		
1995	1	1	0	0	23	29	29	71	0.0016	0	0.0029	0.0441
	0	0.1049	0.4051	0.0354	0.0032	0.3418	0.0062	0	0	0.0547		
1995	1	1	0	0	23	30	30	64	0	0	0	0.051
	0	0.0252	0.2997	0.0027	0	0.4975	0	0.0035	0.005	0.1154		
1995	1	1	0	0	23	31	31	53	0.002	0	0	0.0038
	0	0.0844	0.2133	0.0587	0	0.3949	0.0078	0	0	0.2352		
1995	1	1	0	0	23	32	32	39	0	0	0	0
	0.004	0.0537	0.337	0.02	0	0.403	0	0	0	0.1822		
1995	1	1	0	0	23	33	33	28	0	0	0	0.0574
	0	0.0267	0.3903	0	0	0.2322	0	0.0195	0	0.2741		
1995	1	1	0	0	23	34	34	16	0	0	0	0
	0	0.0689	0.3139	0	0	0.1572	0	0.0218	0	0.4383		
1995	1	1	0	0	23	35	35	14	0	0	0	0
	0	0	0.2373	0	0	0.336	0	0	0	0.4267		
1995	1	1	0	0	23	36	36	10	0	0	0	0
	0	0	0.3489	0	0	0.4531	0	0	0	0.198		
1995	1	1	0	0	23	37	37	6	0	0	0	0
	0	0	0.5181	0	0	0.4819	0	0	0	0		
1995	1	1	0	0	23	38	38	5	0	0	0	0
	0	0.0587	0	0	0	0.8813	0	0	0	0.06		
1995	1	1	0	0	23	39	39	7	0	0	0	0
	0	0	0	0	0	0.799	0	0.1537	0	0.0473		
1995	1	1	0	0	23	40	40	4	0	0	0	0
	0	0	0	0	0	0.6533	0	0	0	0.3467		
1995	1	1	0	0	23	41	41	1	0	0	0	0
	0	0	1	0	0	0	0	0	0	0		
1995	1	1	0	0	23	42	42	1	0	0	0	0
	0	0	0	0	0	0	0	0	0	1		

1995	1	1	0	0	23	43	43	3	0	0	0	0
	0	0	0	0	0	0.1247	0	0.807	0	0.0682		
1995	1	1	0	0	23	44	44	1	0	0	0	0
	0	0	0	0	0	1	0	0	0	0		
1995	1	1	0	0	23	51	51	1	0	0	0	0
	0	0	0	0	0	0	0	0	0	1		
1996	1	1	0	0	24	11	11	3	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
1996	1	1	0	0	24	12	12	9	0.5951	0.4049	0	0
	0	0	0	0	0	0	0	0	0	0		
1996	1	1	0	0	24	13	13	17	0.9462	0.0538	0	0
	0	0	0	0	0	0	0	0	0	0		
1996	1	1	0	0	24	14	14	29	0.929	0.071	0	0
	0	0	0	0	0	0	0	0	0	0		
1996	1	1	0	0	24	15	15	39	0.9436	0.0564	0	0
	0	0	0	0	0	0	0	0	0	0		
1996	1	1	0	0	24	16	16	47	0.9228	0.0772	0	0
	0	0	0	0	0	0	0	0	0	0		
1996	1	1	0	0	24	17	17	48	0.7796	0.2142	0.0063	0
	0	0	0	0	0	0	0	0	0	0		
1996	1	1	0	0	24	18	18	40	0.4531	0.5469	0	0
	0	0	0	0	0	0	0	0	0	0		
1996	1	1	0	0	24	19	19	43	0.4288	0.5264	0.008	0.0369
	0	0	0	0	0	0	0	0	0	0		
1996	1	1	0	0	24	20	20	51	0.1549	0.794	0.0394	0.0117
	0	0	0	0	0	0	0	0	0	0		
1996	1	1	0	0	24	21	21	55	0.0125	0.8681	0.0324	0.0509
	0.0361	0	0	0	0	0	0	0	0	0		
1996	1	1	0	0	24	22	22	53	0	0.7291	0.0239	0.1053
	0.1361	0	0	0	0	0	0.0056	0	0	0		
1996	1	1	0	0	24	23	23	54	0.0032	0.4555	0.058	0.1888
	0.2654	0.0154	0.004	0.0098	0	0	0	0	0	0		
1996	1	1	0	0	24	24	24	71	0	0.167	0.0336	0.2595
	0.4036	0	0.0513	0.0685	0	0	0.0164	0	0	0		
1996	1	1	0	0	24	25	25	88	0	0.0627	0.0188	0.1977
	0.4801	0.0088	0.0516	0.0959	0.0018	0	0.0559	0	0	0.0266		
1996	1	1	0	0	24	26	26	95	0	0	0.0083	0.1608
	0.5233	0.0032	0.0946	0.1328	0.0035	0	0.0671	0	0	0.0063		
1996	1	1	0	0	24	27	27	96	0	0	0	0.1549
	0.4371	0.0016	0.0878	0.1325	0	0	0.1436	0	0	0.0424		
1996	1	1	0	0	24	28	28	92	0	0	0	0.0725
	0.2685	0	0.0601	0.2269	0.0059	0	0.3298	0	0	0.0363		
1996	1	1	0	0	24	29	29	86	0	0	0	0.0836
	0.1754	0.0033	0.093	0.2345	0	0	0.346	0	0	0.0642		
1996	1	1	0	0	24	30	30	71	0	0	0	0
	0.1901	0	0.0472	0.3405	0.0047	0	0.3139	0	0	0.1037		
1996	1	1	0	0	24	31	31	58	0	0	0	0.0096
	0.0168	0	0.0284	0.2778	0	0.0184	0.5201	0	0	0.129		
1996	1	1	0	0	24	32	32	35	0	0	0	0
	0.0898	0.011	0.0052	0.1424	0	0	0.6311	0	0.01	0.1105		
1996	1	1	0	0	24	33	33	32	0	0	0	0.0235
	0.1055	0	0.0364	0.1447	0	0.0127	0.4546	0	0.0155	0.207		
1996	1	1	0	0	24	34	34	11	0	0	0	0
	0.0577	0	0	0.4503	0	0	0.472	0	0	0.0199		
1996	1	1	0	0	24	35	35	12	0	0	0	0
	0	0	0	0.2533	0.0312	0	0.7154	0	0	0		
1996	1	1	0	0	24	36	36	7	0	0	0	0
	0	0.0484	0.0216	0.2223	0	0	0.7077	0	0	0		
1996	1	1	0	0	24	37	37	4	0	0	0	0
	0	0	0	0.776	0	0	0.224	0	0	0		
1996	1	1	0	0	24	38	38	3	0	0	0	0
	0	0	0	0.2731	0	0	0.3658	0	0.3611	0		
1996	1	1	0	0	24	39	39	3	0	0	0	0
	0	0	0	0.1303	0	0	0.8697	0	0	0		
1996	1	1	0	0	24	40	40	3	0	0	0	0
	0	0	0	0	0	0.5254	0.4746	0	0	0		

1996	1	1	0	0	24	41	41	1	0	0	0	0
	0	0	0	0	0	0	1	0	0	0		
1996	1	1	0	0	24	42	42	2	0	0	0	0
	0	0	0	0	0	0	1	0	0	0		
1996	1	1	0	0	24	43	43	2	0	0	0	0
	0	0	0	0	0	0	0.7645	0	0.2355	0		
1996	1	1	0	0	24	44	44	1	0	0	0	0
	0	0	0	0	0	0	0	0	0	1		
1996	1	1	0	0	24	45	45	1	0	0	0	0
	0	0	0	0	0	0	0	0	0	1		
1996	1	1	0	0	24	46	46	1	0	0	0	0
	0	0	0	0	0	0	0	0	0	1		
1996	1	1	0	0	24	48	48	1	0	0	0	0
	0	0	0	0	0	0	1	0	0	0		
1996	1	1	0	0	24	51	51	3	0	0	0	0
	0	0	0	0	0	0	0.1809	0	0.1809	0.6382		
1997	1	1	0	0	25	15	15	1	0	1	0	0
	0	0	0	0	0	0	0	0	0	0		
1997	1	1	0	0	25	16	16	1	0	1	0	0
	0	0	0	0	0	0	0	0	0	0		
1997	1	1	0	0	25	17	17	7	0	0.8878	0.1122	0
	0	0	0	0	0	0	0	0	0	0		
1997	1	1	0	0	25	18	18	16	0.1757	0.7282	0.0961	0
	0	0	0	0	0	0	0	0	0	0		
1997	1	1	0	0	25	19	19	32	0	0.9284	0.0716	0
	0	0	0	0	0	0	0	0	0	0		
1997	1	1	0	0	25	20	20	47	0	0.8497	0.1503	0
	0	0	0	0	0	0	0	0	0	0		
1997	1	1	0	0	25	21	21	59	0	0.7021	0.2832	0
	0.0148	0	0	0	0	0	0	0	0	0		
1997	1	1	0	0	25	22	22	77	0	0.6375	0.3157	0.0031
	0.0314	0	0.0123	0	0	0	0	0	0	0		
1997	1	1	0	0	25	23	23	83	0	0.5552	0.4197	0
	0.0149	0.0102	0	0	0	0	0	0	0	0		
1997	1	1	0	0	25	24	24	84	0	0.3006	0.6069	0
	0.0385	0.0433	0	0.0052	0	0	0	0.0055	0	0		
1997	1	1	0	0	25	25	25	70	0	0.3101	0.4229	0.0254
	0.0844	0.1039	0.0203	0.0258	0.0037	0	0	0.0036	0	0		
1997	1	1	0	0	25	26	26	71	0	0.035	0.346	0
	0.1126	0.3927	0.0158	0.0117	0.0756	0	0	0.0105	0	0		
1997	1	1	0	0	25	27	27	57	0	0	0.0657	0
	0.0898	0.473	0.0114	0.0476	0.2516	0	0	0.0425	0.0037	0.0148		
1997	1	1	0	0	25	28	28	53	0	0	0.0133	0.0064
	0.0732	0.4159	0.0251	0.0571	0.1446	0.0198	0.0034	0.2095	0	0.0317		
1997	1	1	0	0	25	29	29	41	0	0	0	0.0049
	0.0529	0.2773	0.0101	0.1113	0.1799	0	0	0.2138	0	0.1498		
1997	1	1	0	0	25	30	30	28	0	0	0	0
	0.091	0.0894	0	0.2568	0.0905	0	0	0.3434	0.0127	0.1163		
1997	1	1	0	0	25	31	31	27	0	0	0	0
	0.0121	0.418	0.0203	0.026	0.1185	0	0.042	0.2742	0	0.0889		
1997	1	1	0	0	25	32	32	21	0	0	0	0
	0	0.0109	0.0545	0.1783	0.4441	0	0.0147	0.2328	0	0.0647		
1997	1	1	0	0	25	33	33	11	0	0	0	0
	0	0.0763	0.1328	0	0.2552	0	0	0.3639	0	0.1718		
1997	1	1	0	0	25	34	34	11	0	0	0	0
	0	0.1681	0	0	0.2564	0.1565	0	0.194	0	0.225		
1997	1	1	0	0	25	35	35	5	0	0	0	0
	0	0.0768	0	0	0	0.1854	0	0.7378	0	0		
1997	1	1	0	0	25	36	36	1	0	0	0	0
	0	1	0	0	0	0	0	0	0	0		
1997	1	1	0	0	25	37	37	3	0	0	0	0
	0	0	0	0	0	0	0	1	0	0		
1997	1	1	0	0	25	38	38	1	0	0	0	0
	0	0	0	0	0	0	0	0	0	1		
1997	1	1	0	0	25	39	39	1	0	0	0	0
	0	0	0	0	0	0	0	0	0	1		

1997	1	1	0	0	25	40	40	1	0	0	0	0
	0	0	0	0	0	0	0	1	0	0		
1997	1	1	0	0	25	41	41	1	0	0	0	0
	0	0	0	0	0	0	0	0	0	1		
1997	1	1	0	0	25	42	42	1	0	0	0	0
	0	0	0	0	1	0	0	0	0	0		
1997	1	1	0	0	25	44	44	1	0	0	0	0
	0	0	0	0	0	0	0	0	0	1		
1997	1	1	0	0	25	47	47	1	0	0	0	0
	0	0	0	0	0	0	0	0	0	1		
1997	1	1	0	0	25	51	51	2	0	0	0	0
	0	0	0	0	0	0	0	0.5619	0	0.4381		
1998	1	1	0	0	26	4	4	1	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
1998	1	1	0	0	26	5	5	1	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
1998	1	1	0	0	26	10	10	1	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
1998	1	1	0	0	26	11	11	3	0.8436	0.1564	0	0
	0	0	0	0	0	0	0	0	0	0		
1998	1	1	0	0	26	12	12	5	0.8406	0.1594	0	0
	0	0	0	0	0	0	0	0	0	0		
1998	1	1	0	0	26	13	13	11	0.9551	0.0449	0	0
	0	0	0	0	0	0	0	0	0	0		
1998	1	1	0	0	26	14	14	18	0.8499	0.1501	0	0
	0	0	0	0	0	0	0	0	0	0		
1998	1	1	0	0	26	15	15	11	0.8356	0.1471	0.0173	0
	0	0	0	0	0	0	0	0	0	0		
1998	1	1	0	0	26	16	16	15	0.5409	0.3968	0.0623	0
	0	0	0	0	0	0	0	0	0	0		
1998	1	1	0	0	26	17	17	28	0.176	0.6676	0.1376	0.0188
	0	0	0	0	0	0	0	0	0	0		
1998	1	1	0	0	26	18	18	43	0.067	0.804	0.0998	0.0292
	0	0	0	0	0	0	0	0	0	0		
1998	1	1	0	0	26	19	19	59	0.0003	0.8136	0.1323	0.0539
	0	0	0	0	0	0	0	0	0	0		
1998	1	1	0	0	26	20	20	62	0.0066	0.7215	0.2061	0.0469
	0.019	0	0	0	0	0	0	0	0	0		
1998	1	1	0	0	26	21	21	75	0	0.4705	0.3286	0.1907
	0	0	0.0102	0	0	0	0	0	0	0		
1998	1	1	0	0	26	22	22	87	0	0.1982	0.3269	0.4282
	0.0192	0.0133	0.0143	0	0	0	0	0	0	0		
1998	1	1	0	0	26	23	23	113	0	0.0398	0.2763	0.5346
	0.055	0.031	0.0572	0	0	0.0061	0	0	0	0		
1998	1	1	0	0	26	24	24	137	0	0.0165	0.194	0.5553
	0.0777	0.0557	0.0757	0.0065	0.0059	0.0128	0	0	0	0		
1998	1	1	0	0	26	25	25	142	0	0.0096	0.1635	0.4387
	0.0533	0.0516	0.1907	0.0179	0.011	0.0455	0.006	0	0.0098	0.0025		
1998	1	1	0	0	26	26	26	117	0	0.0001	0.0827	0.3781
	0.058	0.0919	0.2435	0.0252	0.0252	0.0668	0	0	0.0286	0		
1998	1	1	0	0	26	27	27	95	0	0.0019	0.0343	0.2349
	0.044	0.0862	0.3093	0.0329	0.013	0.1315	0.0124	0.0195	0.053	0.0272		
1998	1	1	0	0	26	28	28	63	0	0	0.0168	0.1554
	0.0236	0.0906	0.351	0.0275	0.0163	0.1796	0	0	0.1377	0.0015		
1998	1	1	0	0	26	29	29	50	0	0	0.0025	0.1039
	0.0354	0.0963	0.1955	0.0059	0.0315	0.1814	0.003	0.0008	0.2973	0.0465		
1998	1	1	0	0	26	30	30	27	0	0	0	0.0101
	0.011	0.1418	0.2622	0.0938	0.0837	0.2067	0.0082	0.0023	0.1027	0.0776		
1998	1	1	0	0	26	31	31	18	0	0	0	0
	0	0.0055	0.2643	0.0041	0	0.4444	0	0	0.2096	0.0722		
1998	1	1	0	0	26	32	32	8	0	0	0	0
	0	0	0.1199	0	0	0	0	0	0.8065	0.0737		
1998	1	1	0	0	26	33	33	4	0	0	0	0
	0	0	0.0374	0	0	0	0.3612	0	0.5663	0.0351		
1998	1	1	0	0	26	34	34	4	0	0	0	0
	0	0	0.1991	0.0162	0	0.2864	0	0	0.4983	0		

1998	1	1	0	0	26	35	35	3	0	0	0	0
	0	0	0.2512	0	0	0.1286	0	0	0.6202	0		
1998	1	1	0	0	26	36	36	5	0	0	0	0.0287
	0	0	0.0951	0	0	0	0	0	0.8762	0		
1998	1	1	0	0	26	37	37	1	0	0	0	0
	0	0	1	0	0	0	0	0	0	0		
1998	1	1	0	0	26	38	38	1	0	0	0	0
	0	0	0.3924	0	0	0	0	0	0.6076	0		
1998	1	1	0	0	26	39	39	1	0	0	0	0
	0	0	0	1	0	0	0	0	0	0		
1998	1	1	0	0	26	40	40	2	0	0	0	0
	0	0	0.023	0	0	0	0.977	0	0	0		
1998	1	1	0	0	26	41	41	1	0	0	0	0
	0	0	0	0	0	0.6076	0	0	0.3924	0		
1998	1	1	0	0	26	43	43	1	0	0	0	0
	0	0	0	0	0	0	0	0	1	0		
1998	1	1	0	0	26	46	46	1	0	0	0	0
	0	0	0	0	0	0	0	0	1	0		
1998	1	1	0	0	26	49	49	1	0	0	0	0
	0	0	0	0	0	0	0	0	0	1		
1998	1	1	0	0	26	51	51	1	0	0	0	0
	0	0	0	0	0.2708	0.2708	0	0	0.4583	0		
1999	1	1	0	0	27	6	6	1	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
1999	1	1	0	0	27	9	9	1	0.6667	0.3333	0	0
	0	0	0	0	0	0	0	0	0	0		
1999	1	1	0	0	27	10	10	3	0.1674	0.8326	0	0
	0	0	0	0	0	0	0	0	0	0		
1999	1	1	0	0	27	11	11	10	0.7872	0.1497	0.0631	0
	0	0	0	0	0	0	0	0	0	0		
1999	1	1	0	0	27	12	12	10	0.7382	0.2022	0.0595	0
	0	0	0	0	0	0	0	0	0	0		
1999	1	1	0	0	27	13	13	12	0.5272	0.4728	0	0
	0	0	0	0	0	0	0	0	0	0		
1999	1	1	0	0	27	14	14	25	0.6487	0.3513	0	0
	0	0	0	0	0	0	0	0	0	0		
1999	1	1	0	0	27	15	15	40	0.4336	0.4679	0.0826	0.016
	0	0	0	0	0	0	0	0	0	0		
1999	1	1	0	0	27	16	16	52	0.3422	0.581	0.0768	0
	0	0	0	0	0	0	0	0	0	0		
1999	1	1	0	0	27	17	17	55	0.1512	0.6652	0.1836	0
	0	0	0	0	0	0	0	0	0	0		
1999	1	1	0	0	27	18	18	59	0.0304	0.7128	0.2208	0.0361
	0	0	0	0	0	0	0	0	0	0		
1999	1	1	0	0	27	19	19	80	0.0144	0.6944	0.2345	0.0408
	0.0159	0	0	0	0	0	0	0	0	0		
1999	1	1	0	0	27	20	20	80	0	0.5813	0.3214	0.0627
	0.0141	0.0109	0.0096	0	0	0	0	0	0	0		
1999	1	1	0	0	27	21	21	73	0	0.2778	0.4704	0.1561
	0.0624	0.0169	0	0	0	0	0.0082	0.0082	0	0		
1999	1	1	0	0	27	22	22	78	0	0.1645	0.4986	0.2039
	0.0779	0.0188	0.0088	0.0175	0	0.0088	0.0012	0	0	0		
1999	1	1	0	0	27	23	23	66	0	0.0557	0.3676	0.3666
	0.1438	0.0379	0.0274	0.0011	0	0	0	0	0	0		
1999	1	1	0	0	27	24	24	94	0	0.013	0.3384	0.2889
	0.2139	0.0234	0.0573	0.0362	0	0	0.0096	0.0096	0.0096	0		
1999	1	1	0	0	27	25	25	90	0	0.0095	0.1571	0.369
	0.207	0.0298	0.0866	0.0791	0.0088	0.0078	0.0266	0.0109	0	0.0078		
1999	1	1	0	0	27	26	26	99	0	0	0.1099	0.3287
	0.2062	0.0576	0.1356	0.076	0	0.0005	0.0353	0	0.0208	0.0295		
1999	1	1	0	0	27	27	27	82	0	0	0.0232	0.4216
	0.2176	0.0876	0.0428	0.0826	0.0426	0.0183	0.0258	0	0.0172	0.0206		
1999	1	1	0	0	27	28	28	74	0	0	0.0208	0.2363
	0.2377	0.0419	0.1411	0.0983	0.0159	0.0234	0.079	0.0149	0.0298	0.0609		
1999	1	1	0	0	27	29	29	55	0	0	0	0.1019
	0.0962	0.0564	0.126	0.1987	0.021	0.0977	0.1507	0	0.0736	0.0779		

1999	1	1	0	0	27	30	30	36	0	0	0.0014	0.1442
	0.0444	0.0784	0.0492	0.2458	0.0517	0.0098	0.1957	0.001	0.0651	0.1133		
1999	1	1	0	0	27	31	31	20	0	0	0	0.0497
	0.0086	0.0146	0.0495	0.109	0.0446	0.1062	0.2138	0	0.0446	0.3594		
1999	1	1	0	0	27	32	32	16	0	0	0	0.0046
	0.1319	0.0615	0.0634	0.3199	0.0055	0.0526	0.1063	0.1038	0	0.1505		
1999	1	1	0	0	27	33	33	11	0	0	0	0.0768
	0	0.0768	0	0.0904	0	0.0914	0.2425	0.1839	0	0.2382		
1999	1	1	0	0	27	34	34	7	0	0	0	0
	0.0088	0	0.0144	0.122	0	0.3255	0.0151	0	0	0.5142		
1999	1	1	0	0	27	35	35	4	0	0	0	0
	0	0	0.1659	0.1659	0	0.2794	0.364	0	0	0.0249		
1999	1	1	0	0	27	36	36	1	0	0	0	0
	0	0	0	0.5	0	0	0	0	0	0.5		
1999	1	1	0	0	27	37	37	1	0	0	0	0
	0.2143	0	0	0.4286	0	0	0	0	0	0.3572		
1999	1	1	0	0	27	38	38	4	0	0	0	0
	0	0	0.209	0	0	0.2648	0.209	0	0.0493	0.2679		
1999	1	1	0	0	27	39	39	2	0	0	0	0
	0	0	0	0	0	0	0.4111	0	0	0.5889		
1999	1	1	0	0	27	40	40	1	0	0	0	0
	0	0	0.5	0	0	0.2087	0	0	0	0.2913		
1999	1	1	0	0	27	41	41	2	0	0	0	0
	0	0	0	0	0.0632	0	0	0	0	0.9368		
1999	1	1	0	0	27	42	42	3	0	0	0	0
	0.0973	0	0	0.0292	0	0	0.8735	0	0	0		
1999	1	1	0	0	27	43	43	2	0	0	0	0
	0	0	0	0.0609	0	0	0	0.9391	0	0		
1999	1	1	0	0	27	49	49	1	0	0	0	0
	0	0	0	0	0	0	1	0	0	0		
1999	1	1	0	0	27	50	50	1	0	0	0	0
	0	0	0	1	0	0	0	0	0	0		
1999	1	1	0	0	27	51	51	1	0	0	0	0
	0	0	0	0	0	0	0	0	0	1		
2000	1	1	0	0	28	9	9	3	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
2000	1	1	0	0	28	10	10	3	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
2000	1	1	0	0	28	11	11	4	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
2000	1	1	0	0	28	12	12	4	0.7372	0.2628	0	0
	0	0	0	0	0	0	0	0	0	0		
2000	1	1	0	0	28	13	13	3	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
2000	1	1	0	0	28	14	14	2	0.3805	0.6195	0	0
	0	0	0	0	0	0	0	0	0	0		
2000	1	1	0	0	28	15	15	3	0.8927	0.072	0.0353	0
	0	0	0	0	0	0	0	0	0	0		
2000	1	1	0	0	28	16	16	4	0.632	0.2875	0	0.0805
	0	0	0	0	0	0	0	0	0	0		
2000	1	1	0	0	28	17	17	7	0.6476	0.2101	0.1423	0
	0	0	0	0	0	0	0	0	0	0		
2000	1	1	0	0	28	18	18	19	0.2218	0.644	0.1342	0
	0	0	0	0	0	0	0	0	0	0		
2000	1	1	0	0	28	19	19	18	0.2636	0.4344	0.2139	0.0881
	0	0	0	0	0	0	0	0	0	0		
2000	1	1	0	0	28	20	20	28	0.3091	0.3001	0.2337	0.0986
	0.0055	0	0.0529	0	0	0	0	0	0	0		
2000	1	1	0	0	28	21	21	43	0.0626	0.449	0.2132	0.1566
	0.0297	0.0297	0.0593	0	0	0	0	0	0	0		
2000	1	1	0	0	28	22	22	53	0.0351	0.2583	0.3768	0.2096
	0.0452	0.025	0.025	0	0.025	0	0	0	0	0		
2000	1	1	0	0	28	23	23	66	0.0092	0.0782	0.3976	0.1475
	0.2501	0.0473	0.0241	0	0.023	0	0	0.023	0	0		
2000	1	1	0	0	28	24	24	99	0.0008	0.2061	0.329	0.1608
	0.1579	0.0438	0.0211	0.0466	0	0	0.0168	0	0.0168	0		

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2000	1	1	0	0	28	25	25	105	0.0004	0.0697	0.3671	0.2289
	0.1677	0.0966	0.0296	0.0309	0.0089	0.0001	0	0	0	0		
2000	1	1	0	0	28	26	26	116	0.0004	0.0309	0.2671	0.2791
	0.1928	0.0745	0.0837	0.0168	0.0067	0.0153	0.0225	0.001	0	0.009		
2000	1	1	0	0	28	27	27	137	0.0004	0.0184	0.1218	0.1877
	0.29	0.1558	0.1352	0.0419	0.0068	0.0036	0.0166	0.0056	0	0.0162		
2000	1	1	0	0	28	28	28	147	0	0.0096	0.0541	0.203
	0.2789	0.1346	0.129	0.0852	0.001	0.0215	0.0316	0.0003	0.0205	0.0307		
2000	1	1	0	0	28	29	29	128	0	0.0003	0.0525	0.16
	0.2223	0.1578	0.1305	0.0671	0.0347	0.0148	0.0595	0.0118	0.0171	0.0716		
2000	1	1	0	0	28	30	30	115	0	0	0.0389	0.104
	0.2565	0.1737	0.1304	0.0987	0.0454	0.0436	0.0317	0.0163	0.0192	0.0419		
2000	1	1	0	0	28	31	31	88	0	0	0	0.0585
	0.2353	0.2276	0.0997	0.1159	0.0659	0.0174	0.0278	0.0481	0	0.1038		
2000	1	1	0	0	28	32	32	66	0	0	0	0.0515
	0.3254	0.1629	0.0386	0.0935	0.0198	0.0478	0.0498	0.0448	0.067	0.0988		
2000	1	1	0	0	28	33	33	40	0	0	0.0005	0.0569
	0.249	0.191	0.1156	0.1229	0.0046	0.1039	0.0016	0.0053	0.0247	0.1239		
2000	1	1	0	0	28	34	34	23	0	0	0	0.0523
	0.2118	0.198	0.0613	0.1534	0.058	0.0749	0.0553	0	0.0603	0.0749		
2000	1	1	0	0	28	35	35	20	0	0	0	0
	0.1871	0.2081	0.1102	0.1821	0.0828	0.1502	0	0	0	0.0795		
2000	1	1	0	0	28	36	36	12	0	0	0	0
	0.3523	0.1752	0.2405	0.0631	0.0558	0.0568	0.0002	0.0558	0.0002	0		
2000	1	1	0	0	28	37	37	13	0	0	0	0
	0.1754	0.0125	0	0.2325	0	0.1143	0.0303	0.2883	0	0.1467		
2000	1	1	0	0	28	38	38	5	0	0	0	0
	0	0.1942	0.1389	0.3302	0.1106	0.0062	0	0.0838	0	0.136		
2000	1	1	0	0	28	39	39	4	0	0	0	0
	0.0074	0	0.0148	0	0	0.1072	0.2832	0.1072	0	0.4803		
2000	1	1	0	0	28	40	40	6	0	0	0	0
	0.0761	0	0	0.3226	0	0.0188	0	0	0.0129	0.5695		
2000	1	1	0	0	28	41	41	5	0	0	0	0
	0	0.1412	0	0.3319	0.0232	0.1753	0	0.3165	0	0.012		
2000	1	1	0	0	28	42	42	2	0	0	0	0
	0	0	0.6508	0	0	0	0	0	0.3492	0		
2000	1	1	0	0	28	43	43	5	0	0	0	0
	0	0	0.1079	0	0	0	0.0832	0	0.8089	0		
2000	1	1	0	0	28	44	44	2	0	0	0	0
	0	0	0	0	0	0.0244	0.2942	0	0	0.6814		
2000	1	1	0	0	28	46	46	2	0	0	0	0
	0	0	0	0	0	0	1	0	0	0		
2000	1	1	0	0	28	48	48	1	0	0	0	0
	0	0	0	0	0	1	0	0	0	0		
2000	1	1	0	0	28	50	50	1	0	0	0	0
	0	0	0	0	0	0	0	0	0	1		
2000	1	1	0	0	28	51	51	1	0	0	0	0
	0	0	0	0	0	0	0	1	0	0		
2001	1	1	0	0	29	8	8	2	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
2001	1	1	0	0	29	9	9	1	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
2001	1	1	0	0	29	10	10	1	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
2001	1	1	0	0	29	11	11	10	0.9598	0.0402	0	0
	0	0	0	0	0	0	0	0	0	0		
2001	1	1	0	0	29	12	12	9	0.9352	0.0648	0	0
	0	0	0	0	0	0	0	0	0	0		
2001	1	1	0	0	29	13	13	21	0.9294	0.0191	0	0
	0	0	0	0	0	0	0.0515	0	0	0		
2001	1	1	0	0	29	14	14	24	0.9578	0.0422	0	0
	0	0	0	0	0	0	0	0	0	0		
2001	1	1	0	0	29	15	15	31	0.9091	0.0786	0.0123	0
	0	0	0	0	0	0	0	0	0	0		
2001	1	1	0	0	29	16	16	36	0.851	0.1457	0.0033	0
	0	0	0	0	0	0	0	0	0	0		

2001	1	1	0	0	29	17	17	56	0.8824	0.089	0.0286	0
	0	0	0	0	0	0	0	0	0	0		
2001	1	1	0	0	29	18	18	62	0.7742	0.2023	0	0.0235
	0	0	0	0	0	0	0	0	0	0		
2001	1	1	0	0	29	19	19	68	0.7402	0.2353	0.0244	0
	0	0	0	0	0	0	0	0	0	0		
2001	1	1	0	0	29	20	20	65	0.4637	0.4296	0.0244	0.062
	0	0	0	0	0	0.0202	0	0	0	0		
2001	1	1	0	0	29	21	21	70	0.1311	0.5606	0.2333	0.061
	0.0027	0.0113	0	0	0	0	0	0	0	0		
2001	1	1	0	0	29	22	22	109	0.0273	0.6504	0.2465	0.0591
	0	0.0168	0	0	0	0	0	0	0	0		
2001	1	1	0	0	29	23	23	119	0.0126	0.6949	0.1765	0.0865
	0.0287	0	0	0	0	0	0	0.0008	0	0		
2001	1	1	0	0	29	24	24	123	0.0007	0.6177	0.1605	0.1806
	0.0193	0.0211	0	0	0	0	0	0	0	0		
2001	1	1	0	0	29	25	25	142	0	0.3584	0.1398	0.3094
	0.1121	0.035	0.0325	0.0128	0	0	0	0	0	0		
2001	1	1	0	0	29	26	26	151	0.0009	0.1764	0.1418	0.4861
	0.1155	0.0511	0.0194	0.0045	0	0	0	0	0.0042	0		
2001	1	1	0	0	29	27	27	173	0	0.1065	0.2057	0.3721
	0.1624	0.067	0.0246	0.0229	0.0235	0.0117	0.0035	0	0	0		
2001	1	1	0	0	29	28	28	178	0	0.0513	0.1824	0.3118
	0.1551	0.1458	0.0909	0.0066	0.0126	0.0094	0.0155	0	0.0065	0.012		
2001	1	1	0	0	29	29	29	194	0.0002	0.023	0.1515	0.3059
	0.1895	0.1541	0.1037	0.0184	0.0121	0.0063	0.0122	0.0061	0.0067	0.0104		
2001	1	1	0	0	29	30	30	144	0	0.0055	0.1369	0.2987
	0.0936	0.2398	0.0862	0.0178	0.0316	0.0207	0.0255	0.0089	0.0226	0.0121		
2001	1	1	0	0	29	31	31	106	0	0.0117	0.075	0.2027
	0.1416	0.3807	0.0839	0.021	0.0038	0.0457	0.0199	0.0125	0.0007	0.0009		
2001	1	1	0	0	29	32	32	76	0	0	0.1558	0.0842
	0.2191	0.1384	0.1086	0.0781	0.0958	0.0593	0.0128	0.0354	0.0015	0.0109		
2001	1	1	0	0	29	33	33	60	0	0	0.1357	0.1356
	0.0705	0.3023	0.1264	0.0215	0.0513	0.0225	0.0466	0.0433	0.0009	0.0434		
2001	1	1	0	0	29	34	34	42	0	0	0.0607	0.0745
	0.1338	0.3196	0.1991	0.0405	0.0437	0.0093	0.0376	0	0.0767	0.0047		
2001	1	1	0	0	29	35	35	37	0	0	0.0072	0.0487
	0.1599	0.2445	0.3257	0.0031	0.0059	0.0702	0.0617	0.0015	0.0009	0.0707		
2001	1	1	0	0	29	36	36	12	0	0	0	0
	0.1341	0.4997	0.1372	0	0.0039	0.0799	0.0905	0.0547	0	0		
#2001	1	1	0	0	29	37	37	9	0	0	0.088	0
	0.0418	0.1283	0.149	0.4305	0.1623	0	0	0	0	0		
#2001	1	1	0	0	29	38	38	12	0	0.1931	0	0
	0.0138	0.2183	0.0109	0.2212	0.1931	0.0059	0	0.0148	0.1222	0.0068		
2001	1	1	0	0	29	39	39	2	0	0	0	0
	0.27	0.019	0	0	0	0	0.27	0.441	0	0		
2001	1	1	0	0	29	40	40	3	0	0	0	0
	0	0	0.0293	0	0	0	0	0	0.481	0.4897		
2001	1	1	0	0	29	41	41	5	0	0	0	0.447
	0	0.0745	0.0169	0	0	0	0.0145	0.447	0	0		
2001	1	1	0	0	29	42	42	1	0	0	0	0
	0	1	0	0	0	0	0	0	0	0		
2001	1	1	0	0	29	43	43	1	0	0	0	0
	0	0	0	0	1	0	0	0	0	0		
2001	1	1	0	0	29	44	44	1	0	0	0	0
	0	0	0	0	0	0	0	0	0	1		
2001	1	1	0	0	29	45	45	1	0	0	0	0
	0	1	0	0	0	0	0	0	0	0		
2001	1	1	0	0	29	46	46	2	0	0	0	0
	0	0	0	0	0	0.9538	0	0	0	0.0462		
2001	1	1	0	0	29	47	47	1	0	0	0	0
	0	0	0	0	0	0	0	0	0	1		
2001	1	1	0	0	29	51	51	1	0	0	0	0
	0	0	0	0	0	0	1	0	0	0		
2002	1	1	0	0	30	12	12	1	0	1	0	0
	0	0	0	0	0	0	0	0	0	0		

2002	1	1	0	0	30	15	15	1	0	1	0	0
	0	0	0	0	0	0	0	0	0	0		
2002	1	1	0	0	30	16	16	3	0	1	0	0
	0	0	0	0	0	0	0	0	0	0		
2002	1	1	0	0	30	17	17	13	0	1	0	0
	0	0	0	0	0	0	0	0	0	0		
2002	1	1	0	0	30	18	18	27	0.0212	0.9575	0.0212	0
	0	0	0	0	0	0	0	0	0	0		
2002	1	1	0	0	30	19	19	64	0	0.9536	0.0262	0.0087
	0.0014	0.0014	0	0.0087	0	0	0	0	0	0		
2002	1	1	0	0	30	20	20	113	0	0.9516	0.0479	0
	0.0005	0	0	0	0	0	0	0	0	0		
2002	1	1	0	0	30	21	21	153	0	0.92	0.0687	0.0103
	0	0	0	0.0004	0	0	0.0006	0	0	0		
2002	1	1	0	0	30	22	22	176	0	0.8539	0.1351	0.0009
	0.007	0	0.0031	0	0	0	0	0	0	0		
2002	1	1	0	0	30	23	23	156	0	0.7696	0.1876	0.0383
	0	0	0	0.0046	0	0	0	0	0	0		
2002	1	1	0	0	30	24	24	131	0	0.6197	0.3125	0.0152
	0.0326	0.0138	0	0	0	0	0.0054	0	0.0008	0		
2002	1	1	0	0	30	25	25	105	0	0.3903	0.4597	0.0576
	0.0474	0.0248	0.0067	0.0135	0	0	0	0	0	0		
2002	1	1	0	0	30	26	26	78	0	0.2787	0.4258	0.0796
	0.1445	0.0606	0.0014	0.0094	0	0	0	0	0	0		
2002	1	1	0	0	30	27	27	66	0	0.0833	0.3968	0.1322
	0.2763	0.0375	0.0575	0.0141	0.0023	0	0	0	0	0		
2002	1	1	0	0	30	28	28	67	0	0.027	0.2691	0.3369
	0.2088	0.0691	0.0135	0.0394	0.0046	0	0.0036	0.0012	0.0216	0.0052		
2002	1	1	0	0	30	29	29	72	0	0.0372	0.2939	0.1665
	0.1178	0.246	0.0386	0.0602	0.0184	0.0013	0.0166	0	0.0012	0.0023		
2002	1	1	0	0	30	30	30	79	0	0.0289	0.2717	0.2158
	0.2912	0.0453	0.0649	0.0687	0.0071	0.0017	0.0016	0	0.0013	0.0019		
2002	1	1	0	0	30	31	31	82	0	0.0066	0.1999	0.1397
	0.3033	0.084	0.1279	0.066	0.0048	0.0283	0.0345	0.0023	0	0.0026		
2002	1	1	0	0	30	32	32	72	0	0	0.0821	0.2383
	0.1397	0.2734	0.1195	0.1268	0.0061	0.0058	0.0053	0	0	0.0031		
2002	1	1	0	0	30	33	33	58	0	0.0037	0.0629	0.1679
	0.0987	0.1781	0.129	0.096	0.1642	0	0.0862	0.0064	0	0.007		
2002	1	1	0	0	30	34	34	50	0	0	0.1472	0.0996
	0.0224	0.1104	0.3308	0.0903	0.0759	0.0739	0.0494	0	0	0		
2002	1	1	0	0	30	35	35	41	0	0.0026	0	0.1863
	0.0145	0.0756	0.4734	0.1079	0.0326	0.0724	0.0326	0	0	0.0023		
2002	1	1	0	0	30	36	36	28	0	0.0078	0	0.1485
	0.1362	0.2861	0.1138	0.2598	0.0084	0.0195	0	0.0098	0.0101	0		
2002	1	1	0	0	30	37	37	18	0	0	0	0
	0.3278	0.3563	0.0455	0.0221	0	0	0.0119	0	0.0536	0.1828		
2002	1	1	0	0	30	38	38	14	0	0	0	0.1886
	0	0.1937	0.3789	0.0081	0.0129	0.0141	0	0.0077	0	0.196		
2002	1	1	0	0	30	39	39	8	0	0	0	0
	0.0413	0.0488	0.0213	0.1095	0.0358	0	0.0462	0	0	0.6971		
2002	1	1	0	0	30	40	40	5	0	0	0	0
	0	0	0.9383	0.0617	0	0	0	0	0	0		
2002	1	1	0	0	30	41	41	5	0	0	0	0.021
	0	0	0.0362	0	0	0.0357	0	0	0	0.907		
2002	1	1	0	0	30	42	42	2	0	0	0	0
	0	0	0	1	0	0	0	0	0	0		
#2002	1	1	0	0	30	43	43	3	0	0.7126	0	0
	0	0	0.2532	0	0	0	0	0	0	0.0342		
2002	1	1	0	0	30	44	44	2	0	0	0	0
	0	0.9624	0.0376	0	0	0	0	0	0	0		
2002	1	1	0	0	30	45	45	3	0	0	0	0
	0	0	0.0264	0.943	0	0	0	0	0.0306	0		
2002	1	1	0	0	30	46	46	1	0	0	0	0
	0	0	0	1	0	0	0	0	0	0		
2002	1	1	0	0	30	47	47	1	0	0	0	0
	0	0	0	0	0	0	0	0	0	1		

2002	1	1	0	0	30	49	49	1	0	0	0	0
	0	0	0	0.5	0	0	0	0	0	0.5		
2002	1	1	0	0	30	51	51	1	0	0	0	0
	0	0	0	0	0	0	0	0	1	0		
2003	1	1	0	0	31	9	9	1	0	0	1	0
	0	0	0	0	0	0	0	0	0	0		
2003	1	1	0	0	31	12	12	2	0	0	1	0
	0	0	0	0	0	0	0	0	0	0		
2003	1	1	0	0	31	14	14	3	0.2523	0	0.7477	0
	0	0	0	0	0	0	0	0	0	0		
2003	1	1	0	0	31	15	15	2	0.3497	0	0.6503	0
	0	0	0	0	0	0	0	0	0	0		
2003	1	1	0	0	31	16	16	6	0	0	0.6704	0.1418
	0	0.1878	0	0	0	0	0	0	0	0		
2003	1	1	0	0	31	17	17	29	0	0.1229	0.8322	0.0198
	0.0251	0	0	0	0	0	0	0	0	0		
2003	1	1	0	0	31	18	18	42	0.012	0.1288	0.8306	0.0287
	0	0	0	0	0	0	0	0	0	0		
2003	1	1	0	0	31	19	19	60	0.0223	0.077	0.8543	0.0419
	0.0046	0	0	0	0	0	0	0	0	0		
2003	1	1	0	0	31	20	20	92	0	0.0233	0.8959	0.0327
	0.0232	0.0188	0.0028	0	0.0032	0	0	0	0	0		
2003	1	1	0	0	31	21	21	133	0	0.0407	0.8958	0.0522
	0.0052	0	0.0023	0.0026	0.0011	0	0	0	0	0		
2003	1	1	0	0	31	22	22	205	0	0.0285	0.8839	0.0693
	0.0055	0.0042	0.0086	0	0	0	0	0	0	0		
2003	1	1	0	0	31	23	23	264	0	0.0041	0.8944	0.0668
	0.0145	0.0069	0.0069	0.0041	0.0013	0.001	0	0	0	0		
2003	1	1	0	0	31	24	24	283	0	0.0016	0.8602	0.1027
	0.011	0.0134	0.0056	0.0034	0.0021	0	0	0	0	0		
2003	1	1	0	0	31	25	25	246	0	0.0028	0.7977	0.1425
	0.0179	0.0207	0.016	0.0012	0.0012	0	0	0	0	0		
2003	1	1	0	0	31	26	26	181	0	0.0013	0.7751	0.131
	0.019	0.0367	0.0094	0.0109	0	0.0059	0.0076	0.0031	0	0		
2003	1	1	0	0	31	27	27	121	0	0.0021	0.6549	0.1207
	0.0338	0.0939	0.0296	0.0423	0.0088	0.0051	0	0.0088	0	0		
2003	1	1	0	0	31	28	28	77	0	0	0.3367	0.1165
	0.0608	0.2035	0.1417	0.0483	0.0542	0.0157	0.0005	0.0102	0.0119	0		
2003	1	1	0	0	31	29	29	57	0	0	0.3516	0.1979
	0.0524	0.0917	0.0554	0.0979	0.0742	0.0303	0	0.0263	0	0.0222		
2003	1	1	0	0	31	30	30	39	0	0	0.1948	0.1642
	0.0155	0.0711	0.1806	0.2315	0.0947	0.0202	0.0102	0.0172	0	0		
2003	1	1	0	0	31	31	31	38	0	0	0.1585	0.1644
	0.1092	0.0922	0.0709	0.1619	0.0686	0.1001	0.0247	0.023	0	0.0265		
2003	1	1	0	0	31	32	32	20	0	0	0.0423	0.3264
	0.0644	0.0903	0.1195	0.1637	0	0.0912	0.0412	0.061	0	0		
2003	1	1	0	0	31	33	33	16	0	0	0.0644	0.3435
	0.0541	0.0601	0.1103	0.0578	0.2012	0	0.053	0	0	0.0555		
2003	1	1	0	0	31	34	34	5	0	0	0.3322	0
	0	0.252	0.2176	0	0	0.1983	0	0	0	0		
2003	1	1	0	0	31	35	35	7	0	0	0.134	0.5138
	0.1414	0.1018	0.1089	0	0	0	0	0	0	0		
2003	1	1	0	0	31	36	36	4	0	0	0.3824	0.1644
	0.243	0	0.2102	0	0	0	0	0	0	0		
2003	1	1	0	0	31	37	37	3	0	0	0.3228	0.4274
	0	0	0	0	0	0.2498	0	0	0	0		
2003	1	1	0	0	31	39	39	1	0	0	0	0
	0	0	0	0	0	0	0	0	0	1		
2003	1	1	0	0	31	40	40	1	0	0	0	0
	0	0	0	1	0	0	0	0	0	0		
2003	1	1	0	0	31	46	46	1	0	0	0	0
	0	0	0	0	0	0	0	0	1	0		
#2004	1	1	0	0	32	1	1	1	0	0	0	1
	0	0	0	0	0	0	0	0	0	0		
2004	1	1	0	0	32	12	12	1	0	1	0	0
	0	0	0	0	0	0	0	0	0	0		

2004	1	1	0	0	32	18	18	3	0	0.6326	0	0.3674
	0	0	0	0	0	0	0	0	0	0		
2004	1	1	0	0	32	19	19	11	0	0.7737	0	0.2263
	0	0	0	0	0	0	0	0	0	0		
2004	1	1	0	0	32	20	20	29	0	0.9268	0.0225	0.0507
	0	0	0	0	0	0	0	0	0	0		
2004	1	1	0	0	32	21	21	73	0	0.5005	0.177	0.3173
	0	0	0.0052	0	0	0	0	0	0	0		
2004	1	1	0	0	32	22	22	138	0	0.324	0.2537	0.4
	0.0223	0	0	0	0	0	0	0	0	0		
2004	1	1	0	0	32	23	23	197	0	0.1389	0.1658	0.6729
	0.0116	0	0.0078	0	0	0	0.0031	0	0	0		
2004	1	1	0	0	32	24	24	284	0	0.0301	0.1207	0.8076
	0.0349	0.0047	0.002	0	0	0	0	0	0	0		
2004	1	1	0	0	32	25	25	298	0	0.0253	0.0914	0.8411
	0.0262	0.0026	0.0093	0.0034	0.0008	0	0	0	0	0		
2004	1	1	0	0	32	26	26	294	0	0.0143	0.0583	0.8355
	0.0554	0.0085	0.0152	0.0108	0.0019	0	0	0	0	0		
2004	1	1	0	0	32	27	27	244	0	0.0013	0.0297	0.8023
	0.0764	0.0248	0.0204	0.037	0.0024	0.0058	0	0	0	0		
2004	1	1	0	0	32	28	28	152	0	0	0.0402	0.6945
	0.1002	0.0285	0.0756	0.0264	0.0033	0.0223	0.009	0	0	0		
2004	1	1	0	0	32	29	29	119	0	0.0057	0.0264	0.5327
	0.098	0.0396	0.1565	0.074	0.0174	0.0167	0	0.018	0	0.015		
2004	1	1	0	0	32	30	30	60	0	0	0.0065	0.4137
	0.1909	0.0281	0.1921	0.0959	0.0405	0.0249	0.0074	0	0	0		
2004	1	1	0	0	32	31	31	42	0	0	0.0126	0.31
	0.2561	0.0566	0.1632	0.0423	0.0471	0.0804	0	0.0317	0	0		
2004	1	1	0	0	32	32	32	25	0	0	0	0.2405
	0.2211	0.1585	0.086	0.1898	0.0344	0	0.0344	0.0355	0	0		
2004	1	1	0	0	32	33	33	19	0	0	0	0.1649
	0.1188	0.0973	0.1768	0.2085	0.1837	0	0.05	0	0	0		
2004	1	1	0	0	32	34	34	7	0	0	0	0
	0.1523	0	0.3585	0.1579	0.3312	0	0	0	0	0		
2004	1	1	0	0	32	35	35	7	0	0.0555	0	0
	0.3404	0	0.1029	0.1029	0.2042	0.1942	0	0	0	0		
2004	1	1	0	0	32	36	36	6	0	0	0	0.3098
	0	0.3037	0.2113	0	0	0	0	0	0.1752	0		
2004	1	1	0	0	32	37	37	5	0	0	0	0
	0.2089	0.4178	0.1247	0	0.02	0.1468	0	0	0	0.0818		
2004	1	1	0	0	32	38	38	2	0	0	0	0
	0.532	0	0	0	0	0	0.468	0	0	0		
2004	1	1	0	0	32	39	39	2	0	0	0	0
	0	0	0.4609	0	0	0	0	0	0	0.5391		
2004	1	1	0	0	32	40	40	1	0	0	0	0
	0	0	0	1	0	0	0	0	0	0		
2004	1	1	0	0	32	41	41	3	0	0	0	0
	0	0.3113	0	0.3345	0	0	0	0.3542	0	0		
2004	1	1	0	0	32	42	42	2	0	0	0	1
	0	0	0	0	0	0	0	0	0	0		
2004	1	1	0	0	32	43	43	1	0	0	0	0
	0	0	0	0	0	1	0	0	0	0		
2004	1	1	0	0	32	45	45	2	0	0	0	0.6249
	0	0	0	0.3751	0	0	0	0	0	0		
2004	1	1	0	0	32	48	48	1	0	0	0	0
	0	0	0	1	0	0	0	0	0	0		
2004	1	1	0	0	32	51	51	2	0	0	0	0
	0	0	0	0	0.3186	0.3628	0	0.3186	0	0		
2005	1	1	0	0	33	14	14	1	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
2005	1	1	0	0	33	15	15	2	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
2005	1	1	0	0	33	16	16	4	0.7596	0	0	0
	0.2404	0	0	0	0	0	0	0	0	0		
2005	1	1	0	0	33	18	18	4	0.5915	0	0	0
	0.2043	0	0	0	0	0.2043	0	0	0	0		

2005	1	1	0	0	33	19	19	4	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
2005	1	1	0	0	33	20	20	12	0.6044	0.1484	0.155	0
	0.0923	0	0	0	0	0	0	0	0	0		
2005	1	1	0	0	33	21	21	34	0.2282	0.155	0.2543	0
	0.3625	0	0	0	0	0	0	0	0	0		
2005	1	1	0	0	33	22	22	74	0	0.0415	0.4382	0.038
	0.4592	0.023	0	0	0	0	0	0	0	0		
2005	1	1	0	0	33	23	23	164	0	0.0109	0.1942	0.1051
	0.6086	0.0685	0.0126	0	0	0	0	0	0	0		
2005	1	1	0	0	33	24	24	295	0	0.0115	0.1855	0.0741
	0.6754	0.0458	0.0076	0	0	0	0	0	0	0		
2005	1	1	0	0	33	25	25	362	0	0.0016	0.1104	0.0772
	0.714	0.0724	0.0159	0.0038	0.0047	0	0	0	0	0		
2005	1	1	0	0	33	26	26	373	0	0	0.0629	0.0714
	0.7741	0.0621	0.0129	0.009	0.0027	0.0048	0	0	0	0		
2005	1	1	0	0	33	27	27	324	0	0	0.0271	0.0488
	0.7865	0.0548	0.042	0.0166	0.0149	0.0019	0.0074	0	0	0		
2005	1	1	0	0	33	28	28	246	0	0	0.0246	0.0597
	0.7312	0.0816	0.0164	0.0352	0.0332	0.0049	0.0085	0	0.0048	0		
2005	1	1	0	0	33	29	29	150	0	0	0	0.0544
	0.6082	0.1228	0.0249	0.0912	0.0477	0.0128	0.038	0	0	0		
2005	1	1	0	0	33	30	30	98	0	0	0	0
	0.5747	0.138	0.0975	0.1048	0.0311	0.0109	0.0242	0.0189	0	0		
2005	1	1	0	0	33	31	31	63	0	0	0	0
	0.5779	0.0912	0.0392	0.0857	0.0449	0.0507	0.0349	0.053	0	0.0224		
2005	1	1	0	0	33	32	32	42	0	0	0	0.0247
	0.5025	0.0552	0.0135	0.1295	0.1213	0.0641	0.0892	0	0	0		
2005	1	1	0	0	33	33	33	16	0	0	0	0
	0.7348	0.0889	0	0	0	0.1763	0	0	0	0		
2005	1	1	0	0	33	34	34	19	0	0	0.0427	0
	0.2822	0.1596	0.2031	0.1243	0	0.0816	0.1065	0	0	0		
2005	1	1	0	0	33	35	35	9	0	0	0	0.1827
	0.2983	0.1309	0.0977	0.1099	0	0	0	0	0	0.1804		
2005	1	1	0	0	33	36	36	5	0	0	0	0
	1	0	0	0	0	0	0	0	0	0		
2005	1	1	0	0	33	37	37	8	0	0	0	0
	0.8069	0	0	0	0	0	0	0.1931	0	0		
2005	1	1	0	0	33	38	38	8	0	0	0	0
	0.6253	0	0.3747	0	0	0	0	0	0	0		
2005	1	1	0	0	33	39	39	1	0	0	0	0
	0	0	1	0	0	0	0	0	0	0		
2005	1	1	0	0	33	40	40	4	0	0	0	0
	0	0.3876	0	0	0	0	0.6124	0	0	0		
2005	1	1	0	0	33	42	42	1	0	0	0	0
	0	0	0	1	0	0	0	0	0	0		
2005	1	1	0	0	33	47	47	3	0	0	0	0
	0	0	0	0	0	1	0	0	0	0		
2005	1	1	0	0	33	49	49	1	0	0	0	0
	0	0	1	0	0	0	0	0	0	0		
2006	1	1	0	0	34	6	6	1	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
2006	1	1	0	0	34	7	7	1	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
2006	1	1	0	0	34	8	8	1	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
2006	1	1	0	0	34	9	9	2	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
2006	1	1	0	0	34	10	10	4	0.6142	0.2926	0	0
	0	0.0932	0	0	0	0	0	0	0	0		
2006	1	1	0	0	34	11	11	6	0.871	0	0	0
	0.0171	0.1119	0	0	0	0	0	0	0	0		
2006	1	1	0	0	34	12	12	7	0.8446	0	0	0
	0	0.1554	0	0	0	0	0	0	0	0		
2006	1	1	0	0	34	13	13	11	0.7909	0	0	0.0334
	0.1224	0.0533	0	0	0	0	0	0	0	0		

2006	1	1	0	0	34	14	14	11	0.7731	0	0	0
	0.1335	0.0331	0.0603	0	0	0	0	0	0	0		
2006	1	1	0	0	34	15	15	10	0.8494	0	0	0
	0	0.1506	0	0	0	0	0	0	0	0		
2006	1	1	0	0	34	16	16	9	0.5093	0.3036	0	0.0623
	0	0.1248	0	0	0	0	0	0	0	0		
2006	1	1	0	0	34	17	17	7	0.6496	0.2299	0	0
	0	0.1205	0	0	0	0	0	0	0	0		
2006	1	1	0	0	34	18	18	14	0.2079	0.6933	0	0.0432
	0	0.0556	0	0	0	0	0	0	0	0		
2006	1	1	0	0	34	19	19	28	0.1025	0.8754	0	0
	0	0.022	0	0	0	0	0	0	0	0		
2006	1	1	0	0	34	20	20	51	0.0136	0.9143	0.0163	0.0347
	0	0.0132	0.0079	0	0	0	0	0	0	0		
2006	1	1	0	0	34	21	21	96	0.0192	0.8386	0.0498	0.0285
	0	0.0511	0.0106	0	0.0021	0	0	0	0	0		
2006	1	1	0	0	34	22	22	107	0.0092	0.6934	0.0448	0.0698
	0.0054	0.1667	0.0073	0.0009	0	0	0	0.0024	0	0		
2006	1	1	0	0	34	23	23	128	0.0125	0.428	0.0547	0.1532
	0.0071	0.311	0.0335	0	0	0	0	0	0	0		
2006	1	1	0	0	34	24	24	187	0.0021	0.1592	0.0566	0.163
	0.035	0.5616	0.012	0	0.0064	0.0018	0.0024	0	0	0		
2006	1	1	0	0	34	25	25	275	0.0045	0.0446	0.0306	0.1604
	0.0888	0.612	0.0465	0.0029	0.0048	0.0023	0.0026	0	0	0		
2006	1	1	0	0	34	26	26	298	0.0009	0.0289	0.0098	0.1042
	0.0656	0.7374	0.0393	0.0024	0.0064	0.0012	0.0022	0	0.0018	0		
2006	1	1	0	0	34	27	27	328	0.0048	0.0064	0.0066	0.0934
	0.0597	0.7712	0.0379	0.0028	0.0034	0.0019	0.0078	0.0041	0	0		
2006	1	1	0	0	34	28	28	248	0.0011	0.0031	0	0.0738
	0.0671	0.7762	0.0379	0.0123	0.0102	0.0099	0.0011	0.0062	0.001	0		
2006	1	1	0	0	34	29	29	187	0	0	0.002	0.0889
	0.0608	0.7157	0.0615	0.0333	0.0222	0.0128	0	0.0027	0	0		
2006	1	1	0	0	34	30	30	112	0	0.0043	0.0049	0.0682
	0.0419	0.6553	0.0555	0.0351	0.0666	0.0289	0.0091	0	0	0.0302		
2006	1	1	0	0	34	31	31	72	0	0	0.0141	0.0124
	0.1107	0.4962	0.0936	0.1005	0.0498	0.0307	0.0187	0.0585	0	0.0146		
2006	1	1	0	0	34	32	32	45	0	0	0	0.0096
	0.0172	0.5782	0.061	0.0449	0.2078	0.0142	0.0382	0	0.0289	0		
2006	1	1	0	0	34	33	33	18	0.0317	0.0228	0	0.0225
	0	0.5419	0	0.0955	0.0783	0.2072	0	0	0	0		
2006	1	1	0	0	34	34	34	8	0	0	0	0
	0	0.5547	0	0.0776	0	0.0963	0.2333	0.0381	0	0		
2006	1	1	0	0	34	35	35	2	0	0	0	0
	0	0.5319	0	0	0.4681	0	0	0	0	0		
2006	1	1	0	0	34	36	36	8	0	0	0.0209	0.109
	0	0.67	0	0.0772	0.1229	0	0	0	0	0		
2006	1	1	0	0	34	37	37	3	0	0	0	0
	0	0.7188	0.0462	0.2349	0	0	0	0	0	0		
2006	1	1	0	0	34	38	38	6	0	0	0	0
	0	0.5267	0.181	0	0.2922	0	0	0	0	0		
2006	1	1	0	0	34	39	39	4	0	0	0	0
	0	0.197	0.3508	0.2902	0.162	0	0	0	0	0		
#2006	1	1	0	0	34	40	40	1	0	1	0	0
	0	0	0	0	0	0	0	0	0	0		
#2006	1	1	0	0	34	41	41	2	0	0.7817	0	0
	0	0	0.2183	0	0	0	0	0	0	0		
2006	1	1	0	0	34	42	42	1	0	0	0	0
	0	0	1	0	0	0	0	0	0	0		
2006	1	1	0	0	34	43	43	1	0	0	0	0
	0	0	1	0	0	0	0	0	0	0		
2006	1	1	0	0	34	45	45	2	0	0	0	0
	0	1	0	0	0	0	0	0	0	0		
2006	1	1	0	0	34	46	46	1	0	0	0	0
	0	1	0	0	0	0	0	0	0	0		
2006	1	1	0	0	34	47	47	3	0	0	0	0
	0	0.7668	0.2332	0	0	0	0	0	0	0		

2006	1	1	0	0	34	49	49	2	0	0	0	0.3178
	0	0	0	0	0	0	0	0	0	0.6822		
2006	1	1	0	0	34	51	51	5	0	0	0	0.1182
	0	0.2948	0	0	0	0.2307	0.3563	0	0	0		
2007	1	1	0	0	35	1	1	4	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
2007	1	1	0	0	35	3	3	1	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
2007	1	1	0	0	35	4	4	1	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
2007	1	1	0	0	35	7	7	1	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
2007	1	1	0	0	35	8	8	3	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
2007	1	1	0	0	35	9	9	6	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
2007	1	1	0	0	35	10	10	8	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
2007	1	1	0	0	35	11	11	11	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
2007	1	1	0	0	35	12	12	17	0.9923	0.0077	0	0
	0	0	0	0	0	0	0	0	0	0		
2007	1	1	0	0	35	13	13	39	0.9844	0	0.0156	0
	0	0	0	0	0	0	0	0	0	0		
2007	1	1	0	0	35	14	14	41	0.9862	0	0.0038	0
	0	0	0.0101	0	0	0	0	0	0	0		
2007	1	1	0	0	35	15	15	41	0.9732	0.0014	0.0045	0
	0	0	0.0208	0	0	0	0	0	0	0		
2007	1	1	0	0	35	16	16	57	0.9344	0.0271	0.0275	0
	0.011	0	0	0	0	0	0	0	0	0		
2007	1	1	0	0	35	17	17	45	0.9249	0.029	0.005	0
	0.0033	0	0.0378	0	0	0	0	0	0	0		
2007	1	1	0	0	35	18	18	49	0.7971	0.1966	0	0
	0	0.0029	0.0034	0	0	0	0	0	0	0		
2007	1	1	0	0	35	19	19	60	0.5815	0.3678	0.0107	0
	0	0	0.0368	0.0032	0	0	0	0	0	0		
2007	1	1	0	0	35	20	20	42	0.3778	0.4168	0.186	0
	0	0	0.0194	0	0	0	0	0	0	0		
2007	1	1	0	0	35	21	21	46	0.0136	0.5893	0.3929	0.0042
	0	0	0	0	0	0	0	0	0	0		
2007	1	1	0	0	35	22	22	72	0.0297	0.2207	0.6874	0.0353
	0	0	0.0268	0	0	0	0	0	0	0		
2007	1	1	0	0	35	23	23	126	0	0.1017	0.7274	0.0234
	0.0782	0.0174	0.0518	0	0	0	0	0	0	0		
2007	1	1	0	0	35	24	24	155	0.0006	0.067	0.5713	0.0269
	0.0497	0.0252	0.2532	0.0061	0	0	0	0	0	0		
2007	1	1	0	0	35	25	25	235	0	0.0298	0.3914	0.0335
	0.0988	0.0246	0.3901	0.0222	0.0066	0.0007	0.0023	0	0	0		
2007	1	1	0	0	35	26	26	319	0.0004	0.0049	0.2068	0.0205
	0.098	0.0539	0.5364	0.0643	0.0045	0.0059	0.0006	0.0026	0.0012	0		
2007	1	1	0	0	35	27	27	332	0.0041	0.0005	0.112	0.0306
	0.1035	0.0822	0.601	0.0328	0.0128	0.0133	0.0071	0	0	0		
2007	1	1	0	0	35	28	28	315	0.0026	0.0049	0.0604	0.0149
	0.1122	0.0863	0.6003	0.0755	0.0222	0.0051	0.0137	0.001	0.0007	0		
2007	1	1	0	0	35	29	29	259	0.0042	0.0043	0.0532	0.0087
	0.1211	0.0643	0.6378	0.0331	0.0378	0.0293	0.0039	0	0	0.0025		
2007	1	1	0	0	35	30	30	173	0.0024	0.0061	0.0332	0
	0.089	0.0499	0.6318	0.0821	0.0278	0.0247	0.0376	0.0072	0	0.0082		
2007	1	1	0	0	35	31	31	124	0	0	0.0209	0
	0.0707	0.0449	0.594	0.0983	0.0188	0.0876	0.0565	0.0083	0	0		
2007	1	1	0	0	35	32	32	74	0	0	0.0045	0
	0.0643	0.0957	0.5661	0.1267	0.0758	0.0591	0	0	0.0077	0		
2007	1	1	0	0	35	33	33	53	0.0086	0	0	0.0349
	0.0572	0.0744	0.5612	0.0283	0.1532	0.0478	0.0285	0	0	0.0059		
2007	1	1	0	0	35	34	34	31	0	0	0	0
	0	0.0744	0.4638	0.1615	0.147	0.0312	0	0.055	0.0087	0.0584		

2007	1	1	0	0	35	35	35	19	0	0.0208	0.0174	0
	0	0.1247	0.5505	0.2052	0.0815	0	0	0	0	0		
2007	1	1	0	0	35	36	36	14	0	0	0	0
	0	0	0.5045	0.1678	0.0805	0.0432	0	0	0	0.2041		
2007	1	1	0	0	35	37	37	9	0.0358	0	0	0
	0	0	0.6	0.0468	0.2686	0	0	0	0	0.0488		
2007	1	1	0	0	35	38	38	16	0	0	0	0
	0	0.1129	0.3285	0.2399	0.1147	0.0736	0	0.0289	0	0.1015		
2007	1	1	0	0	35	39	39	4	0	0	0	0
	0	0	0.3342	0	0.6658	0	0	0	0	0		
2007	1	1	0	0	35	40	40	6	0	0	0	0
	0	0	0.1221	0.5907	0	0.2873	0	0	0	0		
2007	1	1	0	0	35	41	41	6	0	0	0	0
	0	0	0.3024	0.355	0.2298	0.1129	0	0	0	0		
2007	1	1	0	0	35	42	42	2	0	0	0	0
	0	0	0	0.4418	0	0	0.5582	0	0	0		
2007	1	1	0	0	35	43	43	1	0	0	0	0
	0	0	1	0	0	0	0	0	0	0		
2007	1	1	0	0	35	44	44	5	0	0	0	0
	0	0.0529	0	0.6491	0.1778	0.1203	0	0	0	0		
2007	1	1	0	0	35	45	45	1	0	0	0	0
	0	0	0	0	0	0	1	0	0	0		
2007	1	1	0	0	35	46	46	1	0	0	0	0
	0	0	0	1	0	0	0	0	0	0		
2007	1	1	0	0	35	47	47	1	0	0	0	0
	0	0	0	0	0	0	0	0	1	0		
2007	1	1	0	0	35	51	51	4	0	0	0	0
	0	0	0	0.3215	0.3215	0.1045	0.1821	0.0702	0	0		
2008	1	1	0	0	36	4	4	1	1.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
2008	1	1	0	0	36	5	5	3	1.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
2008	1	1	0	0	36	6	6	2	1.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
2008	1	1	0	0	36	7	7	6	1.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
2008	1	1	0	0	36	8	8	7	1.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
2008	1	1	0	0	36	9	9	6	1.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
2008	1	1	0	0	36	10	10	9	1.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
2008	1	1	0	0	36	11	11	8	1.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
2008	1	1	0	0	36	12	12	17	1.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
2008	1	1	0	0	36	13	13	24	0.9393	0.0607	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
2008	1	1	0	0	36	14	14	41	0.9725	0.0275	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
2008	1	1	0	0	36	15	15	56	0.9285	0.0715	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
2008	1	1	0	0	36	16	16	53	0.7149	0.2773	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0079	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
2008	1	1	0	0	36	17	17	65	0.5457	0.4543	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
2008	1	1	0	0	36	18	18	104	0.1561	0.8439	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
2008	1	1	0	0	36	19	19	155	0.0440	0.9349	0.0009	0.0074
	0.0000	0.0066	0.0000	0.0061	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
2008	1	1	0	0	36	20	20	172	0.0175	0.9725	0.0049	0.0052
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
2008	1	1	0	0	36	21	21	187	0.0001	0.9782	0.0140	0.0000
	0.0000	0.0000	0.0000	0.0078	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
2008	1	1	0	0	36	22	22	186	0.0007	0.9120	0.0379	0.0445
	0.0011	0.0000	0.0000	0.0039	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		

2008	1	1	0	0	36	23	23	144	0.0036	0.8307	0.0605	0.0737
	0.0022	0.0000	0.0000	0.0271	0.0021	0.0000	0.0000	0.0000	0.0000	0.0000		
2008	1	1	0	0	36	24	24	124	0.0000	0.5363	0.1230	0.2770
	0.0000	0.0201	0.0106	0.0330	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
2008	1	1	0	0	36	25	25	178	0.0000	0.2448	0.1319	0.4865
	0.0242	0.0298	0.0059	0.0643	0.0033	0.0094	0.0000	0.0000	0.0000	0.0000		
2008	1	1	0	0	36	26	26	199	0.0000	0.0631	0.0772	0.5049
	0.0183	0.0600	0.0409	0.2327	0.0030	0.0000	0.0000	0.0000	0.0000	0.0000		
2008	1	1	0	0	36	27	27	242	0.0000	0.0321	0.0365	0.3639
	0.0219	0.1158	0.0594	0.3306	0.0399	0.0000	0.0000	0.0000	0.0000	0.0000		
2008	1	1	0	0	36	28	28	287	0.0000	0.0089	0.0182	0.3015
	0.0093	0.0680	0.0865	0.4509	0.0346	0.0129	0.0073	0.0020	0.0000	0.0000		
2008	1	1	0	0	36	29	29	256	0.0000	0.0029	0.0192	0.2209
	0.0105	0.0763	0.0671	0.5475	0.0323	0.0019	0.0063	0.0030	0.0086	0.0037		
2008	1	1	0	0	36	30	30	238	0.0000	0.0035	0.0088	0.1401
	0.0373	0.0725	0.0545	0.6084	0.0296	0.0058	0.0259	0.0036	0.0096	0.0005		
2008	1	1	0	0	36	31	31	172	0.0000	0.0000	0.0122	0.1218
	0.0152	0.0491	0.0823	0.6246	0.0372	0.0222	0.0314	0.0042	0.0000	0.0000		
2008	1	1	0	0	36	32	32	127	0.0000	0.0000	0.0183	0.0870
	0.0313	0.0708	0.0858	0.6380	0.0267	0.0169	0.0119	0.0013	0.0000	0.0120		
2008	1	1	0	0	36	33	33	96	0.0000	0.0000	0.0055	0.0608
	0.0266	0.0656	0.1427	0.5859	0.0530	0.0062	0.0300	0.0146	0.0080	0.0009		
2008	1	1	0	0	36	34	34	75	0.0000	0.0000	0.0000	0.0929
	0.0137	0.0204	0.0864	0.6913	0.0171	0.0333	0.0334	0.0000	0.0115	0.0000		
2008	1	1	0	0	36	35	35	40	0.0000	0.0000	0.0000	0.0582
	0.0000	0.0459	0.0895	0.6313	0.1107	0.0438	0.0000	0.0023	0.0000	0.0183		
2008	1	1	0	0	36	36	36	32	0.0000	0.0000	0.0000	0.0736
	0.0000	0.0205	0.0784	0.7341	0.0797	0.0000	0.0000	0.0000	0.0136	0.0000		
2008	1	1	0	0	36	37	37	23	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0395	0.0778	0.8102	0.0000	0.0000	0.0000	0.0000	0.0051	0.0675		
2008	1	1	0	0	36	38	38	16	0.0000	0.0000	0.0000	0.0653
	0.0000	0.0000	0.0596	0.7649	0.0000	0.0632	0.0000	0.0000	0.0470	0.0000		
2008	1	1	0	0	36	39	39	10	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.1084	0.4531	0.1625	0.2522	0.0238	0.0000	0.0000	0.0000		
2008	1	1	0	0	36	40	40	8	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.8733	0.0000	0.1161	0.0106	0.0000	0.0000	0.0000		
2008	1	1	0	0	36	41	41	6	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.4803	0.3629	0.1567	0.0000	0.0000	0.0000	0.0000		
2008	1	1	0	0	36	42	42	4	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.8166	0.0000	0.0000	0.0000	0.1834	0.0000	0.0000		
2008	1	1	0	0	36	43	43	6	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.8545	0.1455	0.0000	0.0000	0.0000	0.0000	0.0000		
2008	1	1	0	0	36	44	44	3	0.0000	0.0000	0.0000	0.0000
	0.0000	0.2037	0.0000	0.3208	0.0000	0.4755	0.0000	0.0000	0.0000	0.0000		
2008	1	1	0	0	36	45	45	1	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000		
2008	1	1	0	0	36	46	46	1	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000		
2008	1	1	0	0	36	47	47	3	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0998	0.0000	0.0000	0.4831	0.4171	0.0000	0.0000		
2008	1	1	0	0	36	49	49	1	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
2009	1	1	0	0	37	3	3	1	1.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
2009	1	1	0	0	37	4	4	1	1.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
2009	1	1	0	0	37	5	5	2	1.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
2009	1	1	0	0	37	6	6	2	1.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
2009	1	1	0	0	37	8	8	2	1.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
2009	1	1	0	0	37	9	9	3	1.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
2009	1	1	0	0	37	11	11	1	1.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		

2009	1	1	0	0	37	13	13	2	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
2009	1	1	0	0	37	14	14	9	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
2009	1	1	0	0	37	15	15	16	0.3266	0.6734	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
2009	1	1	0	0	37	16	16	35	0.1292	0.8555	0.0154	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
2009	1	1	0	0	37	17	17	53	0.0106	0.9894	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
2009	1	1	0	0	37	18	18	84	0.0102	0.9535	0.0234	0.0000	0.0000	0.0000	0.0000	0.0000	0.0128	0.0000	0.0000	0.0000	0.0000	0.0000
2009	1	1	0	0	37	19	19	92	0.0000	0.9305	0.0695	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
2009	1	1	0	0	37	20	20	116	0.0000	0.7997	0.2003	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
2009	1	1	0	0	37	21	21	138	0.0000	0.4877	0.5072	0.0000	0.0000	0.0000	0.0051	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
2009	1	1	0	0	37	22	22	146	0.0000	0.2254	0.7583	0.0087	0.0076	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
2009	1	1	0	0	37	23	23	156	0.0000	0.0747	0.8945	0.0083	0.0166	0.0000	0.0000	0.0000	0.0057	0.0000	0.0000	0.0000	0.0000	0.0000
2009	1	1	0	0	37	24	24	136	0.0000	0.0329	0.8587	0.0371	0.0577	0.0000	0.0000	0.0000	0.0136	0.0000	0.0000	0.0000	0.0000	0.0000
2009	1	1	0	0	37	25	25	141	0.0000	0.0152	0.7664	0.0462	0.1122	0.0059	0.0022	0.0091	0.0429	0.0000	0.0000	0.0000	0.0000	0.0000
2009	1	1	0	0	37	26	26	112	0.0000	0.0000	0.4506	0.1495	0.2418	0.0339	0.0295	0.0004	0.0734	0.0209	0.0000	0.0000	0.0000	0.0000
2009	1	1	0	0	37	27	27	132	0.0000	0.0000	0.1835	0.0638	0.3203	0.0304	0.0391	0.0179	0.3115	0.0158	0.0000	0.0000	0.0175	0.0000
2009	1	1	0	0	37	28	28	136	0.0000	0.0000	0.1142	0.0678	0.2788	0.0265	0.0688	0.0263	0.3870	0.0305	0.0000	0.0000	0.0000	0.0000
2009	1	1	0	0	37	29	29	118	0.0000	0.0000	0.0679	0.0995	0.2762	0.0111	0.0595	0.0480	0.3799	0.0450	0.0007	0.0122	0.0000	0.0000
2009	1	1	0	0	37	30	30	107	0.0000	0.0000	0.0383	0.0453	0.2531	0.0267	0.0846	0.0206	0.4513	0.0464	0.0027	0.0311	0.0000	0.0000
2009	1	1	0	0	37	31	31	77	0.0000	0.0000	0.0269	0.0435	0.1820	0.0140	0.1110	0.0401	0.4883	0.0784	0.0020	0.0048	0.0091	0.0000
2009	1	1	0	0	37	32	32	53	0.0000	0.0000	0.0000	0.0000	0.1361	0.0263	0.0596	0.0918	0.6144	0.0017	0.0000	0.0000	0.0328	0.0373
2009	1	1	0	0	37	33	33	38	0.0000	0.0000	0.0000	0.0296	0.2547	0.0025	0.0421	0.1408	0.3851	0.0222	0.0481	0.0268	0.0342	0.0139
2009	1	1	0	0	37	34	34	30	0.0000	0.0000	0.0000	0.0000	0.1458	0.0464	0.0473	0.1208	0.5591	0.0000	0.0338	0.0002	0.0000	0.0465
2009	1	1	0	0	37	35	35	20	0.0000	0.0000	0.0000	0.0134	0.0952	0.0000	0.0000	0.0000	0.7150	0.0805	0.0000	0.0123	0.0562	0.0275
2009	1	1	0	0	37	36	36	11	0.0000	0.0000	0.0000	0.0000	0.0804	0.0000	0.1420	0.0000	0.4806	0.1239	0.0000	0.1731	0.0000	0.0000
2009	1	1	0	0	37	37	37	15	0.0000	0.0000	0.1326	0.0000	0.1992	0.0000	0.1879	0.0729	0.3646	0.0000	0.0000	0.0429	0.0000	0.0000
2009	1	1	0	0	37	38	38	7	0.0000	0.0000	0.0000	0.0000	0.3281	0.0000	0.0241	0.0000	0.4827	0.1202	0.0449	0.0000	0.0000	0.0000
2009	1	1	0	0	37	39	39	10	0.0000	0.0000	0.0000	0.0000	0.5046	0.0000	0.0000	0.0000	0.1634	0.1807	0.0618	0.0000	0.0000	0.0895
2009	1	1	0	0	37	40	40	7	0.0000	0.0000	0.0000	0.0000	0.1387	0.0000	0.0000	0.1710	0.4399	0.2504	0.0000	0.0000	0.0000	0.0000
2009	1	1	0	0	37	41	41	3	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.3067	0.6900	0.0000	0.0033
2009	1	1	0	0	37	42	42	5	0.0000	0.0000	0.0000	0.0000	0.0728	0.0000	0.2197	0.0000	0.3658	0.0000	0.0000	0.0000	0.0000	0.3417
2009	1	1	0	0	37	43	43	4	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.2203	0.5049	0.2129	0.0000	0.0618	0.0000	0.0000
2009	1	1	0	0	37	45	45	3	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
2009	1	1	0	0	37	46	46	1	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000

2009	1	1	0	0	37	47	47	1	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.8013	0.0000	0.1987	0.0000	0.0000	0.0000		
2009	1	1	0	0	37	50	50	1	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000		
2009	1	1	0	0	37	51	51	1	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000		
# Ghost US fishery												
1973	1	1	0	0	1	1	51	-1	0	0.26	0.045	0.101
	0.187	0.117	0.107	0.1	0.048	0.021	0.009	0.005	0	0		
1974	1	1	0	0	2	1	51	-1	0.0044	0.0033	0.5066	0.0692
	0.1198	0.1494	0.0868	0.0385	0.0121	0.0055	0.0033	0.0011	0	0		
1975	1	1	0	0	3	1	51	-1	0.314	0.0417	0.0396	0.3841
	0.0553	0.0678	0.0655	0.0082	0.0059	0.0078	0.005	0.0043	0.0009	0		
1976	1	1	0	0	4	1	51	-1	0.0387	0.1588	0.0531	0.0142
	0.1407	0.1109	0.117	0.1021	0.0973	0.0655	0.0564	0.0224	0.0192	0.0038		
1977	1	1	0	0	5	1	51	-1	0.0947	0.0408	0.215	0.0289
	0.0528	0.2044	0.077	0.079	0.0627	0.0575	0.0426	0.0295	0.0079	0.0071		
1978	1	1	0	0	6	1	51	-1	0.0242	0.1074	0.0705	0.2066
	0.0326	0.0662	0.2077	0.079	0.0704	0.0726	0.0241	0.0205	0.013	0.0053		
1979	1	1	0	0	7	1	51	-1	0.0544	0.0986	0.1084	0.0457
	0.1995	0.0682	0.157	0.1473	0.0522	0.0344	0.0145	0.0091	0.0056	0.0053		
1980	1	1	0	0	8	1	51	-1	0.0116	0.3165	0.0524	0.0599
	0.0528	0.1392	0.0663	0.0902	0.1022	0.0369	0.0368	0.0187	0.0078	0.0088		
1981	1	1	0	0	9	1	51	-1	0.1106	0.0761	0.3302	0.0128
	0.0406	0.0436	0.1364	0.0673	0.0563	0.0893	0.0225	0.0089	0.003	0.0025		
1982	1	1	0	0	10	1	51	-1	0.2586	0.0369	0.0148	0.2731
	0.0315	0.0455	0.0451	0.1268	0.0255	0.0377	0.0883	0.0076	0.0034	0.0052		
1983	1	1	0	0	11	1	51	-1	0	0.3883	0.0384	0.0183
	0.2179	0.0425	0.0422	0.0546	0.0999	0.0312	0.0256	0.0292	0.0092	0.0026		
1984	1	1	0	0	12	1	51	-1	0	0.0071	0.6914	0.0387
	0.0384	0.1183	0.0197	0.0133	0.0096	0.0311	0.0071	0.0057	0.0163	0.0033		
1985	1	1	0	0	13	1	51	-1	0.0082	0.0076	0.0606	0.707
	0.0751	0.0437	0.0784	0.0102	0.0036	0.0039	0.0016	0.0001	0	0		
1986	1	1	0	0	14	1	51	-1	0.1509	0.0416	0.009	0.0245
	0.4486	0.0656	0.0465	0.1029	0.0241	0.033	0.0143	0.0284	0.0036	0.0071		
1987	1	1	0	0	15	1	51	-1	0	0.3819	0.0209	0.0049
	0.0138	0.4487	0.0333	0.0105	0.0678	0.0028	0.0005	0.0023	0.01	0.0026		
1988	1	1	0	0	16	1	51	-1	0.0045	0.0032	0.4458	0.0169
	0.0068	0.0086	0.3554	0.0242	0.0058	0.0862	0.0011	0.0026	0	0.0388		
1989	1	1	0	0	17	1	51	-1	0.0389	0.0321	0.0129	0.4824
	0.0145	0.0053	0.007	0.339	0.0184	0.0035	0.0406	0.0005	0.0009	0.0039		
1990	1	1	0	0	18	1	51	-1	0.0687	0.3184	0.0232	0.0028
	0.1864	0.0033	0.0014	0.0014	0.2986	0.0029	0.0003	0.0828	0	0.0098		
1991	1	1	0	0	19	1	51	-1	0.0491	0.2494	0.2193	0.0295
	0.0092	0.227	0.0156	0.0018	0.0017	0.1379	0.0047	0	0.0462	0.0087		
1992	1	1	0	0	20	1	51	-1	0.0501	0.0607	0.1531	0.1865
	0.0181	0.0092	0.2877	0.0077	0.0018	0.0052	0.1797	0.0065	0.0003	0.0335		
1993	1	1	0	0	21	1	51	-1	0.0101	0.3064	0.0357	0.1392
	0.1565	0.0128	0.0095	0.2204	0.0103	0.0015	0.0006	0.0893	0.0002	0.0075		
1994	1	1	0	0	22	1	51	-1	0.0006	0.0464	0.2699	0.0112
	0.1285	0.212	0.0071	0.0039	0.2367	0.0007	0.0049	0.0004	0.0702	0.0074		
1995	1	1	0	0	23	1	51	-1	0.0126	0	0.0645	0.3242
	0.0027	0.061	0.2202	0.0092	0.0011	0.2185	0	0.005	0	0.0809		
1996	1	1	0	0	24	1	51	-1	0.1851	0.1622	0.0071	0.0895
	0.2083	0.0017	0.0401	0.1087	0.0012	0.0029	0.1595	0	0.0017	0.032		
1997	1	1	0	0	25	1	51	-1	0.0038	0.3634	0.2641	0.0032
	0.0438	0.1342	0.0101	0.0271	0.061	0.0036	0.0017	0.0599	0.0006	0.0236		
1998	1	1	0	0	26	1	51	-1	0.108	0.2512	0.1541	0.2576
	0.0299	0.0324	0.0883	0.0079	0.0067	0.0329	0.0026	0.0011	0.0232	0.0041		
1999	1	1	0	0	27	1	51	-1	0.0783	0.2754	0.2037	0.1655
	0.0902	0.0244	0.0371	0.0416	0.0064	0.0124	0.0267	0.0056	0.0081	0.0247		
2000	1	1	0	0	28	1	51	-1	0.0344	0.0718	0.1511	0.1551
	0.2037	0.1161	0.0855	0.0577	0.0188	0.0203	0.0238	0.0126	0.0113	0.0377		
2001	1	1	0	0	29	1	51	-1	0.1317	0.2028	0.1327	0.2138
	0.0969	0.1034	0.0499	0.0145	0.0141	0.0116	0.0107	0.0062	0.0049	0.0068		
2002	1	1	0	0	30	1	51	-1	0.0005	0.6017	0.1863	0.0547
	0.0551	0.0347	0.0287	0.0194	0.0054	0.0031	0.0048	0.0003	0.0009	0.0045		

2003	1	1	0	0	31	1	51	-1	0.0008	0.0123	0.7937	0.1021
	0.0165	0.0256	0.0157	0.0146	0.0072	0.0053	0.0017	0.0024	0.0008	0.0012		
2004	1	1	0	0	32	1	51	-1	0	0.0812	0.1116	0.682
	0.0522	0.0139	0.0226	0.0206	0.0035	0.007	0.0012	0.0027	0	0.0015		
2005	1	1	0	0	33	1	51	-1	0.0121	0.006	0.0897	0.0629
	0.6939	0.0668	0.0216	0.0195	0.0121	0.0056	0.0067	0.0018	0.0005	0.0008		
2006	1	1	0	0	34	1	51	-1	0.0214	0.1454	0.0194	0.0986
	0.0521	0.5872	0.037	0.0102	0.0128	0.0063	0.0043	0.0029	0.0007	0.0017		
2007	1	1	0	0	35	1	51	-1	0.179	0.0402	0.1714	0.0155
	0.0729	0.0449	0.3989	0.0402	0.0164	0.0124	0.0075	0.0014	0.0004	0.002		
2008	1	1	0	0	36	1	51	-1	0.0903	0.3751	0.0268	0.1491
	0.0100	0.0361	0.0347	0.2458	0.0163	0.0055	0.0059	0.0014	0.0020	0.0011		
2009	1	1	0	0	37	1	51	-1	0.0090	0.2716	0.3466	0.0327
	0.1102	0.0094	0.0249	0.0152	0.1532	0.0148	0.0024	0.0047	0.0031	0.0023		

Canadian Fishery

1977	1	2	0	0	5	1	51	60	0.0021	0.0021	0.0516	0.0186
	0.0619	0.3772	0.1093	0.1031	0.0866	0.0825	0.0722	0.033	0	0		
1978	1	2	0	0	6	1	51	60	0	0	0.0339	0.0593
	0.0475	0.1797	0.222	0.1898	0.1051	0.0814	0.0356	0.0305	0.0153	0		
1979	1	2	0	0	7	1	51	60	0	0	0.0188	0.0554
	0.1162	0.1019	0.1877	0.2699	0.0983	0.0706	0.0331	0.0223	0.0152	0.0107		
1980	1	2	0	0	8	1	51	60	0	0	0	0.0311
	0.0411	0.1629	0.0609	0.0782	0.4463	0.0841	0.0411	0.0411	0.0133	0		
1981	1	2	0	0	9	1	51	60	0	0	0.0488	0.0131
	0.0682	0.0667	0.207	0.0411	0.1141	0.2988	0.0721	0.029	0.0411	0		
1982	1	2	0	0	10	1	51	60	0	0	0.0221	0.4268
	0.0352	0.046	0.0451	0.141	0.032	0.0249	0.1931	0.0189	0.015	0		
1983	1	2	0	0	11	1	51	60	0.0009	0.218	0.016	0.028
	0.4999	0.0201	0.0291	0.026	0.0869	0.012	0.004	0.053	0.004	0.002		
1984	1	2	0	0	12	1	51	60	0	0.018	0.215	0.028
	0.15	0.338	0.0331	0.0381	0.025	0.0779	0.0151	0.013	0.0429	0.006		
1985	1	2	0	0	13	1	51	60	0.002	0.002	0.0808	0.2648
	0.0544	0.1072	0.3173	0.0162	0.0181	0.0181	0.0544	0.0122	0	0.0524		
1986	1	2	0	0	14	1	51	60	0.0021	0.0021	0.0043	0.0608
	0.5877	0.0369	0.0369	0.1757	0.0196	0.0087	0.0152	0.0217	0.0066	0.0217		
1987	1	2	0	0	15	1	51	60	0	0.0094	0.0063	0.0016
	0.0268	0.7415	0.03	0.03	0.1088	0.0063	0.0047	0.0126	0.0094	0.0126		
1988	1	2	0	0	16	16	16	1	0	0	1	0
	0	0	0	0	0	0	0	0	0	0		
1988	1	2	0	0	16	18	18	1	0	0	0	0
	0	1	0	0	0	0	0	0	0	0		
1988	1	2	0	0	16	19	19	1	0	0	1	0
	0	0	0	0	0	0	0	0	0	0		
1988	1	2	0	0	16	20	20	3	0	0	1	0
	0	0	0	0	0	0	0	0	0	0		
1988	1	2	0	0	16	21	21	4	0	0	1	0
	0	0	0	0	0	0	0	0	0	0		
1988	1	2	0	0	16	22	22	4	0	0.063	0.8963	0
	0	0	0.0407	0	0	0	0	0	0	0		
1988	1	2	0	0	16	23	23	4	0	0	0.6076	0
	0	0.0239	0.3685	0	0	0	0	0	0	0		
1988	1	2	0	0	16	24	24	5	0	0.0157	0.4178	0
	0.0356	0.0154	0.5028	0	0	0.0127	0	0	0	0		
1988	1	2	0	0	16	25	25	5	0	0	0.2662	0.0129
	0.0098	0.01	0.6847	0	0.0065	0.0098	0	0	0	0		
1988	1	2	0	0	16	26	26	5	0	0.0116	0.1763	0.0094
	0.0094	0.0042	0.7612	0.013	0	0.0148	0	0	0	0		
1988	1	2	0	0	16	27	27	5	0	0	0.0915	0
	0.016	0.0218	0.8548	0.016	0	0	0	0	0	0		
1988	1	2	0	0	16	28	28	5	0	0	0.057	0.004
	0.0172	0.0121	0.853	0.011	0.004	0.0367	0.005	0	0	0		
1988	1	2	0	0	16	29	29	5	0	0	0.0431	0.0072
	0.0119	0.0191	0.7988	0.027	0.0144	0.0786	0	0	0	0		
1988	1	2	0	0	16	30	30	5	0	0	0.0084	0.0084
	0	0.0279	0.7414	0.0239	0.0169	0.1732	0	0	0	0		
1988	1	2	0	0	16	31	31	5	0	0	0.0133	0
	0.0052	0.008	0.8117	0.0133	0.0157	0.1275	0	0	0.0052	0		

1988	1	2	0	0	16	32	32	5	0	0	0	0
	0	0.0227	0.6203	0.0125	0.0554	0.2558	0	0	0.0166	0.0166		
1988	1	2	0	0	16	33	33	5	0	0	0	0
	0	0.0384	0.6474	0.0158	0	0.2545	0	0.0296	0.0064	0.0079		
1988	1	2	0	0	16	34	34	5	0	0	0	0
	0	0	0.5295	0.0107	0.0428	0.298	0	0.0268	0	0.0921		
1988	1	2	0	0	16	35	35	5	0	0	0.0255	0
	0	0	0.5594	0.0602	0.051	0.2405	0.0264	0	0.0107	0.0264		
1988	1	2	0	0	16	36	36	4	0	0	0	0
	0	0	0.4977	0	0.0383	0.1996	0	0.041	0	0.2234		
1988	1	2	0	0	16	37	37	4	0	0	0.0396	0
	0	0	0.4063	0.0132	0.0791	0.3634	0.0409	0	0	0.0574		
1988	1	2	0	0	16	38	38	4	0	0	0	0
	0	0	0.2085	0.07	0.0748	0.357	0	0.1013	0	0.1884		
1988	1	2	0	0	16	39	39	4	0	0	0	0
	0	0	0.2196	0.047	0.0773	0.4365	0	0.0908	0.038	0.0908		
1988	1	2	0	0	16	40	40	3	0	0	0	0
	0	0	0.462	0	0	0.3806	0	0	0	0.1574		
1988	1	2	0	0	16	41	41	3	0	0	0	0
	0	0	0.5654	0	0	0.1592	0.0581	0	0	0.2173		
1988	1	2	0	0	16	42	42	2	0	0	0	0
	0	0	0	0	0	0.7157	0	0	0	0.2843		
1988	1	2	0	0	16	43	43	1	0	0	0	0
	0	0	0.5	0	0	0	0	0	0.5	0		
1988	1	2	0	0	16	44	44	1	0	0	0	0
	0	0	0.5	0	0	0.5	0	0	0	0		
1988	1	2	0	0	16	45	45	1	0	0	0	0
	0	0	0	0	0	0.5	0	0	0	0.5		
1988	1	2	0	0	16	46	46	1	0	0	0	0
	0	0	0	0	0	0	0	0	0	1		
1988	1	2	0	0	16	51	51	1	0	0	0	0
	0	0	0	0	0	1	0	0	0	0		
1989	1	2	0	0	17	21	21	2	0	0	0	1
	0	0	0	0	0	0	0	0	0	0		
1989	1	2	0	0	17	22	22	5	0	0.0582	0	0.8415
	0	0	0	0.1004	0	0	0	0	0	0		
1989	1	2	0	0	17	23	23	6	0	0	0	0.9226
	0	0	0	0.0774	0	0	0	0	0	0		
1989	1	2	0	0	17	24	24	6	0	0	0	0.7568
	0	0	0	0.2415	0	0	0.0018	0	0	0		
1989	1	2	0	0	17	25	25	6	0	0	0	0.6973
	0	0	0	0.3027	0	0	0	0	0	0		
1989	1	2	0	0	17	26	26	6	0	0	0.0112	0.5641
	0	0	0	0.4185	0	0.0062	0	0	0	0		
1989	1	2	0	0	17	27	27	6	0	0	0.001	0.4773
	0	0	0.008	0.4922	0	0.016	0.0056	0	0	0		
1989	1	2	0	0	17	28	28	6	0	0	0	0.3428
	0.0073	0.0104	0	0.6163	0	0	0.0231	0	0	0		
1989	1	2	0	0	17	29	29	6	0	0	0	0.2365
	0	0	0.0101	0.6574	0.0302	0.0142	0.0374	0.0142	0	0		
1989	1	2	0	0	17	30	30	6	0	0	0	0.2081
	0	0	0.0197	0.715	0.0278	0	0.0197	0.0098	0	0		
1989	1	2	0	0	17	31	31	6	0	0	0.0153	0.1517
	0	0	0	0.7488	0	0.0173	0.0669	0	0	0		
1989	1	2	0	0	17	32	32	6	0	0	0	0.0167
	0	0	0	0.8686	0	0	0.1147	0	0	0		
1989	1	2	0	0	17	33	33	6	0	0	0	0.1111
	0	0	0.0224	0.5314	0.0408	0.0571	0.2371	0	0	0		
1989	1	2	0	0	17	34	34	6	0	0	0	0.0403
	0	0	0	0.7302	0.0388	0.0973	0.0934	0	0	0		
1989	1	2	0	0	17	35	35	4	0	0	0	0
	0	0.0851	0	0.6749	0.0289	0.0705	0.1347	0	0	0.006		
1989	1	2	0	0	17	36	36	5	0	0.0306	0	0
	0	0	0	0.7102	0	0.0422	0.1797	0	0	0.0373		
1989	1	2	0	0	17	37	37	4	0	0	0	0
	0	0	0	0.5935	0	0.0395	0.2795	0	0	0.0876		

1989	1	2	0	0	17	38	38	4	0	0	0	0
	0	0	0	0.6563	0	0	0.301	0	0	0.0427		
1989	1	2	0	0	17	39	39	3	0	0	0	0.0684
	0	0	0	0.7104	0	0	0.1245	0	0.0967	0		
1989	1	2	0	0	17	40	40	2	0	0	0	0
	0	0	0	0.2674	0.0891	0	0.6434	0	0	0		
1989	1	2	0	0	17	41	41	2	0	0	0	0.0406
	0	0	0	0.4797	0	0.2398	0.2398	0	0	0		
1989	1	2	0	0	17	42	42	1	0	0	0	0
	0	0	0	0.3333	0	0.3333	0	0	0.3333	0		
1989	1	2	0	0	17	43	43	3	0	0	0	0
	0	0	0	0.4939	0	0	0.5061	0	0	0		
1989	1	2	0	0	17	44	44	3	0	0	0	0
	0	0	0	0.5173	0	0	0.2176	0	0	0.2651		
1989	1	2	0	0	17	45	45	2	0	0	0	0
	0	0	0	0.4142	0	0	0.2929	0	0	0.2929		
1989	1	2	0	0	17	46	46	1	0	0	0	0
	0	0	0	1	0	0	0	0	0	0		
1989	1	2	0	0	17	47	47	1	0	0	0	0
	0	0	0	0.5	0	0	0	0	0	0.5		
1989	1	2	0	0	17	48	48	2	0	0	0	0
	0	0	0	0.6455	0	0	0.3545	0	0	0		
1989	1	2	0	0	17	51	51	4	0	0	0	0
	0	0	0	0.7198	0	0	0.0479	0	0	0.2322		
1990	1	2	0	0	18	19	19	2	0	1	0	0
	0	0	0	0	0	0	0	0	0	0		
1990	1	2	0	0	18	20	20	3	0	0.3572	0.2447	0
	0.1534	0.2447	0	0	0	0	0	0	0	0		
1990	1	2	0	0	18	21	21	3	0	0.8579	0	0
	0.1421	0	0	0	0	0	0	0	0	0		
1990	1	2	0	0	18	22	22	4	0	0.6056	0.1558	0
	0.1862	0.0111	0	0	0.0412	0	0	0	0	0		
1990	1	2	0	0	18	23	23	5	0	0.3327	0.0323	0
	0.635	0	0	0	0	0	0	0	0	0		
1990	1	2	0	0	18	24	24	6	0	0.1181	0.0678	0
	0.7562	0.0091	0	0	0.0316	0	0	0.0172	0	0		
1990	1	2	0	0	18	25	25	4	0	0.0561	0.0519	0.0151
	0.7626	0	0.0142	0	0.1001	0	0	0	0	0		
1990	1	2	0	0	18	26	26	4	0	0.0118	0.0146	0
	0.7622	0	0	0	0.2011	0.0103	0	0	0	0		
1990	1	2	0	0	18	27	27	4	0	0	0.0237	0
	0.6975	0.0203	0	0	0.2466	0	0	0.012	0	0		
1990	1	2	0	0	18	28	28	4	0	0	0.0199	0
	0.5867	0	0	0	0.3935	0	0	0	0	0		
1990	1	2	0	0	18	29	29	4	0	0	0	0
	0.5109	0.0123	0.0123	0	0.4408	0.0188	0	0.0048	0	0		
1990	1	2	0	0	18	30	30	4	0	0	0	0
	0.3016	0.0117	0	0	0.675	0.0117	0	0	0	0		
1990	1	2	0	0	18	31	31	5	0	0	0	0
	0.1982	0	0	0	0.6373	0	0	0.1645	0	0		
1990	1	2	0	0	18	32	32	5	0	0	0	0
	0.1635	0	0	0	0.7753	0.0157	0	0.0454	0	0		
1990	1	2	0	0	18	33	33	6	0	0	0	0
	0.0743	0	0	0	0.8912	0	0	0.0345	0	0		
1990	1	2	0	0	18	34	34	4	0	0	0	0
	0.0801	0	0	0	0.6645	0	0	0.2553	0	0		
1990	1	2	0	0	18	35	35	5	0	0	0	0
	0.0495	0.0181	0	0	0.8964	0	0	0.0361	0	0		
1990	1	2	0	0	18	36	36	3	0	0	0	0
	0.3641	0	0	0	0.3778	0.1821	0	0.0507	0.0254	0		
1990	1	2	0	0	18	37	37	4	0	0	0	0
	0.204	0.102	0.0142	0	0.4661	0	0	0.1995	0	0.0142		
1990	1	2	0	0	18	38	38	4	0	0	0	0
	0	0	0	0	0.9823	0	0	0.0177	0	0		
1990	1	2	0	0	18	39	39	3	0	0	0	0
	0.0449	0	0	0	0.4575	0	0	0.4126	0	0.085		

1990	1	2	0	0	18	40	40	4	0	0	0	0
	0	0	0	0	0.9151	0	0	0.0556	0	0.0294		
1990	1	2	0	0	18	41	41	3	0	0	0	0
	0	0	0	0	0.8113	0	0	0.1887	0	0		
1990	1	2	0	0	18	42	42	2	0	0	0	0
	0.6715	0	0	0	0.3285	0	0	0	0	0		
1990	1	2	0	0	18	43	43	4	0	0	0	0
	0	0	0	0	0.5143	0	0	0.2468	0	0.2389		
1990	1	2	0	0	18	44	44	4	0	0	0	0
	0	0	0	0	0.9708	0	0	0.0292	0	0		
1990	1	2	0	0	18	45	45	2	0	0	0	0
	0	0	0	0	0.2684	0	0	0.7316	0	0		
1990	1	2	0	0	18	46	46	2	0	0	0	0
	0	0	0	0	0.2179	0	0	0.7821	0	0		
1990	1	2	0	0	18	47	47	1	0	0	0	0
	0	0	0	0	1	0	0	0	0	0		
1990	1	2	0	0	18	48	48	2	0	0	0	0
	0	0	0	0	1	0	0	0	0	0		
1990	1	2	0	0	18	50	50	1	0	0	0	0
	0	0	0	0	0.5	0	0	0.5	0	0		
1990	1	2	0	0	18	51	51	1	0	0	0	0
	0	0	0	0	1	0	0	0	0	0		
1991	1	2	0	0	19	20	20	1	0	1	0	0
	0	0	0	0	0	0	0	0	0	0		
1991	1	2	0	0	19	21	21	1	0	0	0	0
	0	1	0	0	0	0	0	0	0	0		
1991	1	2	0	0	19	22	22	1	0	0	1	0
	0	0	0	0	0	0	0	0	0	0		
1991	1	2	0	0	19	23	23	3	0	0	0.1924	0
	0	0.3336	0	0	0	0.4741	0	0	0	0		
1991	1	2	0	0	19	24	24	6	0	0	0.509	0
	0	0.1479	0	0	0	0.3431	0	0	0	0		
1991	1	2	0	0	19	25	25	14	0	0	0.1965	0.0662
	0	0.4044	0	0	0	0.294	0	0	0.0389	0		
1991	1	2	0	0	19	26	26	16	0	0	0.0568	0.0262
	0	0.639	0	0	0	0.278	0	0	0	0		
1991	1	2	0	0	19	27	27	16	0	0	0.0768	0.0101
	0	0.5971	0.0064	0	0	0.3096	0	0	0	0		
1991	1	2	0	0	19	28	28	16	0	0	0.0762	0.0101
	0.0057	0.5297	0.0033	0	0	0.3691	0.0033	0	0.0027	0		
1991	1	2	0	0	19	29	29	16	0	0	0.0242	0.0214
	0	0.5746	0	0	0	0.3798	0	0	0	0		
1991	1	2	0	0	19	30	30	16	0	0	0.0376	0.011
	0	0.5278	0.0105	0	0	0.4096	0	0	0.0035	0		
1991	1	2	0	0	19	31	31	16	0	0	0	0.0097
	0.0063	0.586	0	0	0	0.3796	0	0	0.0185	0		
1991	1	2	0	0	19	32	32	16	0	0	0.0147	0.0096
	0.0124	0.5178	0.0045	0	0	0.3892	0	0	0.0519	0		
1991	1	2	0	0	19	33	33	13	0	0	0	0.0522
	0	0.5666	0	0	0	0.3358	0	0	0.0278	0.0176		
1991	1	2	0	0	19	34	34	13	0	0	0.0123	0.048
	0	0.4702	0	0	0	0.4392	0.0303	0	0	0		
1991	1	2	0	0	19	35	35	8	0	0	0.0533	0.1965
	0	0.3819	0	0	0	0.2435	0	0	0.1248	0		
1991	1	2	0	0	19	36	36	4	0	0	0	0
	0	0.3992	0	0	0	0.6008	0	0	0	0		
1991	1	2	0	0	19	37	37	8	0	0	0	0
	0	0.0541	0	0	0	0.9459	0	0	0	0		
1991	1	2	0	0	19	38	38	3	0	0	0	0
	0	0.1559	0	0	0	0.6883	0	0	0.1559	0		
1991	1	2	0	0	19	39	39	5	0	0	0	0.1351
	0	0.3317	0	0	0	0.4364	0	0	0.0968	0		
1991	1	2	0	0	19	40	40	3	0	0	0	0
	0	0.4818	0	0	0	0.5182	0	0	0	0		
1991	1	2	0	0	19	41	41	2	0	0	0	0
	0	0.6147	0	0	0	0.3853	0	0	0	0		

1991	1	2	0	0	19	42	42	2	0	0	0	0
	0	0	0	0	0	1	0	0	0	0		
1991	1	2	0	0	19	43	43	2	0	0	0	0
	0	0.3472	0	0	0	0	0	0	0.6528	0		
1991	1	2	0	0	19	45	45	1	0	0	0	0
	0	0	0	0	1	0	0	0	0	0		
1991	1	2	0	0	19	47	47	1	0	0	0	0
	0	0	1	0	0	0	0	0	0	0		
1991	1	2	0	0	19	49	49	1	0	0	0	0
	0	0	0	0	0	0	0	0	1	0		
1991	1	2	0	0	19	50	50	1	0	0	0	0
	0	0	0	0	0	1	0	0	0	0		
1991	1	2	0	0	19	51	51	1	0	0	0	0
	0	0	0	0	0	1	0	0	0	0		
1992	1	2	0	0	20	18	18	1	0	0	0	1
	0	0	0	0	0	0	0	0	0	0		
1992	1	2	0	0	20	19	19	1	0	0	1	0
	0	0	0	0	0	0	0	0	0	0		
1992	1	2	0	0	20	20	20	2	0	0	0	0.8566
	0	0	0	0	0	0	0.1434	0	0	0		
1992	1	2	0	0	20	21	21	3	0	0	0.8034	0.1966
	0	0	0	0	0	0	0	0	0	0		
1992	1	2	0	0	20	22	22	9	0	0.0629	0.4474	0.3831
	0	0	0.1067	0	0	0	0	0	0	0		
1992	1	2	0	0	20	23	23	15	0	0.0707	0.4155	0.2003
	0.0291	0	0.2844	0	0	0	0	0	0	0		
1992	1	2	0	0	20	24	24	22	0	0.0457	0.3167	0.3246
	0.0375	0	0.2681	0	0	0	0.0075	0	0	0		
1992	1	2	0	0	20	25	25	27	0	0	0.1557	0.3182
	0.0334	0.011	0.4011	0	0	0	0.0806	0	0	0		
1992	1	2	0	0	20	26	26	29	0	0.0019	0.0722	0.2586
	0.0312	0	0.5154	0	0	0	0.1208	0	0	0		
1992	1	2	0	0	20	27	27	29	0	0.0033	0.0457	0.2214
	0.0545	0.0035	0.4628	0.0037	0	0.0035	0.2017	0	0	0		
1992	1	2	0	0	20	28	28	29	0	0	0.0257	0.1411
	0.0392	0.0026	0.5138	0.0023	0	0	0.2679	0	0	0.0074		
1992	1	2	0	0	20	29	29	29	0	0	0.0081	0.0788
	0.0295	0.0056	0.52	0.0081	0	0	0.3466	0	0	0.0033		
1992	1	2	0	0	20	30	30	29	0	0.0048	0	0.0651
	0.0118	0.0076	0.4998	0.0056	0	0	0.375	0.0126	0	0.0177		
1992	1	2	0	0	20	31	31	27	0	0	0	0.0178
	0.0063	0	0.6126	0	0	0.0052	0.3534	0	0	0.0046		
1992	1	2	0	0	20	32	32	28	0	0	0	0.046
	0.0102	0	0.5851	0	0	0	0.3213	0	0.0229	0.0145		
1992	1	2	0	0	20	33	33	16	0	0	0	0
	0	0	0.5088	0	0	0	0.4634	0	0	0.0278		
1992	1	2	0	0	20	34	34	15	0	0	0	0
	0.061	0	0.3594	0	0	0	0.3817	0	0	0.1978		
1992	1	2	0	0	20	35	35	12	0	0	0.0638	0
	0	0	0.5697	0	0	0	0.2556	0	0	0.1109		
1992	1	2	0	0	20	36	36	7	0	0	0	0
	0	0	0.287	0	0	0	0.5187	0	0	0.1943		
1992	1	2	0	0	20	37	37	4	0	0	0	0
	0	0	0.6682	0	0	0	0.1704	0	0	0.1614		
1992	1	2	0	0	20	38	38	4	0	0	0	0.3974
	0	0	0.2059	0	0	0	0.2173	0	0	0.1795		
1992	1	2	0	0	20	39	39	4	0	0	0	0.1344
	0.2934	0	0.1986	0	0	0	0.2392	0	0	0.1344		
1992	1	2	0	0	20	40	40	1	0	0	0	0
	0	0	0	0	0	0	1	0	0	0		
1992	1	2	0	0	20	41	41	3	0	0	0	0
	0	0	0.4912	0	0	0	0.5088	0	0	0		
1992	1	2	0	0	20	43	43	1	0	0	0	0
	0	0	0	0	0	0	1	0	0	0		
1992	1	2	0	0	20	44	44	2	0	0	0	0
	0	0	0	0	0	0	1	0	0	0		

1992	1	2	0	0	20	51	51	1	0	0	0	0
	0	0	1	0	0	0	0	0	0	0		
#1993	1	2	0	0	21	15	15	1	0	0	0	0
	0	0	0	1	0	0	0	0	0	0		
1993	1	2	0	0	21	17	17	1	0	0	0	0
	0	0	0	1	0	0	0	0	0	0		
1993	1	2	0	0	21	21	21	5	0	0.2669	0	0
	0.1832	0	0	0.1037	0	0	0	0.4461	0	0		
1993	1	2	0	0	21	22	22	10	0	0.3785	0	0.4759
	0.1456	0	0	0	0	0	0	0	0	0		
1993	1	2	0	0	21	23	23	14	0	0.049	0.2204	0.3917
	0.2392	0	0	0.0279	0	0	0	0.0717	0	0		
1993	1	2	0	0	21	24	24	17	0	0.0065	0.0704	0.3988
	0.3301	0.04	0	0.1362	0	0	0	0.0181	0	0		
1993	1	2	0	0	21	25	25	17	0	0.0134	0.0481	0.282
	0.2498	0.016	0	0.3397	0.0084	0	0	0.0426	0	0		
1993	1	2	0	0	21	26	26	18	0	0.0083	0.0234	0.1825
	0.2647	0.0078	0.0016	0.4499	0	0	0	0.0618	0	0		
1993	1	2	0	0	21	27	27	18	0	0	0.0213	0.1381
	0.1638	0.0225	0.0043	0.5129	0	0	0	0.1371	0	0		
1993	1	2	0	0	21	28	28	18	0	0	0.0017	0.097
	0.2	0.0189	0.01	0.4795	0	0	0	0.1929	0	0		
1993	1	2	0	0	21	29	29	18	0	0	0	0.0401
	0.1918	0.0227	0	0.5464	0.0145	0	0	0.1802	0	0.0042		
1993	1	2	0	0	21	30	30	18	0	0	0.0048	0.0329
	0.1918	0.0107	0	0.4723	0	0	0	0.2711	0.0162	0		
1993	1	2	0	0	21	31	31	17	0.0148	0	0.0201	0.0515
	0.0594	0.0127	0	0.6059	0	0	0	0.2356	0	0		
1993	1	2	0	0	21	32	32	13	0	0	0	0
	0.0676	0.032	0	0.5675	0	0	0	0.3329	0	0		
1993	1	2	0	0	21	33	33	12	0	0	0	0
	0.0449	0	0	0.4602	0	0	0	0.4949	0	0		
1993	1	2	0	0	21	34	34	4	0	0	0	0
	0.1043	0.2424	0	0.5207	0	0	0	0.1326	0	0		
1993	1	2	0	0	21	35	35	5	0	0	0	0
	0	0	0	0.9022	0	0	0	0.0978	0	0		
1993	1	2	0	0	21	36	36	1	0	0	0	0
	0	0	0	1	0	0	0	0	0	0		
1993	1	2	0	0	21	39	39	5	0	0	0	0
	0	0	0	0.8445	0	0	0	0.1555	0	0		
#1994	1	2	0	0	22	14	14	1	0	0	0	0
	0	0	0	0	0	0	0	0	0	1		
#1994	1	2	0	0	22	16	16	1	0	0	0	0
	0	0	0	0	0	0	0	0	1	0		
1994	1	2	0	0	22	17	17	1	0	0	0	1
	0	0	0	0	0	0	0	0	0	0		
1994	1	2	0	0	22	18	18	1	0	0	0	0
	1	0	0	0	0	0	0	0	0	0		
1994	1	2	0	0	22	22	22	6	0	0.1446	0.32	0.0594
	0.0263	0.1446	0	0	0.1239	0.1813	0	0	0	0		
1994	1	2	0	0	22	23	23	10	0	0.0607	0.4747	0.0819
	0.0922	0.1228	0	0	0.1328	0	0	0	0.035	0		
1994	1	2	0	0	22	24	24	20	0	0.113	0.1242	0.1669
	0.2058	0.203	0.1052	0	0.0619	0	0	0	0.0199	0		
1994	1	2	0	0	22	25	25	24	0	0.0085	0.0636	0.0395
	0.2079	0.2954	0.0196	0.0188	0.2712	0	0	0	0.0754	0		
1994	1	2	0	0	22	26	26	28	0	0.0126	0.0364	0.0564
	0.1828	0.2228	0.0322	0.0046	0.3896	0.0084	0	0	0.0528	0.0014		
1994	1	2	0	0	22	27	27	29	0	0	0.0307	0.0239
	0.1444	0.2145	0.0177	0.0025	0.4255	0.0056	0	0	0.1331	0.0021		
1994	1	2	0	0	22	28	28	30	0	0	0.0037	0.0106
	0.0986	0.1857	0.0315	0.0133	0.5073	0.0052	0	0	0.1398	0.0043		
1994	1	2	0	0	22	29	29	31	0	0.0017	0.004	0.0171
	0.1292	0.1952	0.0276	0.015	0.4508	0.0067	0.0027	0	0.1462	0.0039		
1994	1	2	0	0	22	30	30	30	0	0	0.0062	0.0091
	0.0717	0.1661	0.0249	0	0.4854	0.011	0.0106	0	0.2096	0.0055		

1994	1	2	0	0	22	31	31	28	0	0	0	0.0063
	0.0497	0.1058	0.0234	0.0043	0.5769	0.0014	0	0	0.2161	0.0161		
1994	1	2	0	0	22	32	32	28	0	0	0.0128	0.0049
	0.0932	0.1607	0.0227	0	0.4916	0	0.0126	0	0.2015	0		
1994	1	2	0	0	22	33	33	27	0	0	0	0
	0.0438	0.0697	0.0653	0	0.6349	0.0072	0	0	0.1722	0.0069		
1994	1	2	0	0	22	34	34	23	0	0	0	0.0215
	0.0287	0.1084	0.0217	0.0122	0.4374	0.0126	0	0	0.3577	0		
1994	1	2	0	0	22	35	35	18	0	0	0	0
	0	0.1464	0.0182	0	0.6881	0	0	0	0.1205	0.0267		
1994	1	2	0	0	22	36	36	21	0	0	0	0
	0.0157	0.057	0	0	0.7723	0	0	0	0.1315	0.0235		
1994	1	2	0	0	22	37	37	12	0	0	0	0
	0.2011	0.0684	0.0678	0	0.5074	0	0	0	0.062	0.0933		
1994	1	2	0	0	22	38	38	9	0	0	0	0
	0	0.1112	0	0	0.6705	0	0	0	0.2183	0		
1994	1	2	0	0	22	39	39	6	0	0	0	0
	0.2052	0	0	0	0.71	0	0	0	0.0848	0		
1994	1	2	0	0	22	40	40	8	0	0	0	0
	0	0	0	0	0.3183	0	0	0	0.6817	0		
1994	1	2	0	0	22	41	41	6	0	0	0	0
	0	0.1747	0	0	0.3552	0	0	0	0.2124	0.2577		
1994	1	2	0	0	22	42	42	5	0	0	0	0
	0.1924	0	0	0	0.3477	0	0	0	0.4599	0		
1994	1	2	0	0	22	43	43	3	0	0	0	0
	0	0	0	0	0.7261	0	0	0	0.2739	0		
1994	1	2	0	0	22	44	44	2	0	0	0	0
	0	0	0	0	0.4851	0	0	0	0.5149	0		
1994	1	2	0	0	22	45	45	3	0	0	0	0
	0	0	0	0	0.6264	0	0	0	0	0.3736		
1994	1	2	0	0	22	46	46	5	0	0	0	0
	0	0	0	0	0.7399	0	0	0	0.2602	0		
1994	1	2	0	0	22	47	47	1	0	0	0	0
	0	0	0	0	1	0	0	0	0	0		
1994	1	2	0	0	22	51	51	2	0	0	0	0
	0	0	0	0	0	0	0	0	0.2489	0.7511		
1995	1	2	0	0	23	4	4	1	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
1995	1	2	0	0	23	5	5	2	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
1995	1	2	0	0	23	6	6	2	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
1995	1	2	0	0	23	7	7	1	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
1995	1	2	0	0	23	8	8	1	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
1995	1	2	0	0	23	9	9	1	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
1995	1	2	0	0	23	14	14	1	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
1995	1	2	0	0	23	22	22	1	0	0	1	0
	0	0	0	0	0	0	0	0	0	0		
1995	1	2	0	0	23	23	23	6	0	0.1065	0.283	0.3988
	0.1744	0.0373	0	0	0	0	0	0	0	0		
1995	1	2	0	0	23	24	24	11	0	0	0.4603	0.2464
	0.1938	0.0114	0.0394	0	0	0.0487	0	0	0	0		
1995	1	2	0	0	23	25	25	18	0.0202	0.0175	0.3776	0.2152
	0.0365	0.1002	0.1023	0.0391	0	0.0916	0	0	0	0		
1995	1	2	0	0	23	26	26	21	0	0	0.2148	0.1523
	0.082	0.1676	0.1249	0.0541	0.019	0.132	0	0.0127	0	0.0406		
1995	1	2	0	0	23	27	27	21	0	0.0146	0.1317	0.1007
	0.0437	0.119	0.2029	0.0309	0	0.2953	0.0181	0	0	0.0431		
1995	1	2	0	0	23	28	28	21	0	0.0036	0.0753	0.0903
	0.0374	0.134	0.1723	0.0211	0	0.3675	0.0102	0	0	0.0883		
1995	1	2	0	0	23	29	29	21	0	0.0093	0.0337	0.0176
	0.0108	0.12	0.2076	0.0286	0.0117	0.4131	0.0152	0	0	0.1326		

1995	1	2	0	0	23	30	30	21	0	0.0063	0.0131	0.0145
	0.0448	0.1462	0.1765	0.0453	0	0.4209	0.0078	0	0	0.1247		
1995	1	2	0	0	23	31	31	21	0	0	0.0195	0.0171
	0.0056	0.1207	0.1918	0.0346	0.0198	0.4375	0.0031	0	0	0.1504		
1995	1	2	0	0	23	32	32	21	0	0	0.0122	0.0261
	0.0098	0.0707	0.185	0.0799	0.0115	0.3818	0	0	0	0.2231		
1995	1	2	0	0	23	33	33	17	0	0	0.0289	0
	0.048	0.0888	0.0905	0.0759	0.0194	0.4846	0.0056	0	0	0.1583		
1995	1	2	0	0	23	34	34	17	0	0	0	0.0281
	0.0458	0.0319	0.1026	0.0836	0.0266	0.5102	0.0066	0	0	0.1647		
1995	1	2	0	0	23	35	35	14	0	0	0	0
	0	0.0337	0.0961	0.0955	0	0.5536	0	0	0	0.2212		
1995	1	2	0	0	23	36	36	11	0	0	0	0
	0.0316	0.0316	0.1278	0.0896	0	0.518	0	0	0	0.2014		
1995	1	2	0	0	23	37	37	7	0	0	0	0
	0	0.112	0.057	0.0285	0	0.7172	0	0	0	0.0852		
1995	1	2	0	0	23	38	38	5	0	0	0	0
	0	0	0.1767	0.102	0	0.5726	0	0	0	0.1488		
1995	1	2	0	0	23	39	39	9	0	0	0	0
	0	0	0	0.0497	0	0.9238	0	0	0	0.0266		
1995	1	2	0	0	23	40	40	6	0	0	0	0
	0	0	0.2439	0	0.0714	0.3531	0	0	0	0.3317		
1995	1	2	0	0	23	41	41	4	0	0	0	0
	0	0	0	0	0	0.6004	0	0	0	0.3996		
1995	1	2	0	0	23	42	42	4	0	0	0	0
	0.4388	0	0.2477	0	0	0.081	0	0	0	0.2325		
1995	1	2	0	0	23	43	43	1	0	0	0	0
	0	0	1	0	0	0	0	0	0	0		
1995	1	2	0	0	23	44	44	2	0	0	0	0
	0	0	0	0	0	0.6925	0	0	0	0.3075		
1995	1	2	0	0	23	45	45	3	0	0	0	0
	0	0	0	0	0.1487	0.5283	0	0	0	0.323		
1995	1	2	0	0	23	46	46	1	0	0	0	0
	0	0	0	0	0	0	0	0	0	1		
1995	1	2	0	0	23	47	47	1	0	0	0	0
	0	0	0	0	0	1	0	0	0	0		
1995	1	2	0	0	23	48	48	1	0	0	0	0
	0	0	0	0	0	0	0	0	0	1		
1995	1	2	0	0	23	50	50	1	0	0	0	0
	0	0	0	0	0	1	0	0	0	0		
1995	1	2	0	0	23	51	51	1	0	0	0	0
	0	0	0	0	0	1	0	0	0	0		
1996	1	2	0	0	24	12	12	2	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
1996	1	2	0	0	24	13	13	2	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
1996	1	2	0	0	24	14	14	3	0.7801	0.1176	0	0
	0	0	0	0	0	0	0.1023	0	0	0		
1996	1	2	0	0	24	15	15	3	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
1996	1	2	0	0	24	16	16	4	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
1996	1	2	0	0	24	17	17	8	0.9488	0.0512	0	0
	0	0	0	0	0	0	0	0	0	0		
1996	1	2	0	0	24	18	18	9	0.8959	0.0671	0	0
	0.037	0	0	0	0	0	0	0	0	0		
1996	1	2	0	0	24	19	19	12	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
1996	1	2	0	0	24	20	20	7	0.8573	0.1174	0	0
	0	0	0	0.0254	0	0	0	0	0	0		
1996	1	2	0	0	24	21	21	8	0.7235	0.1658	0.0723	0
	0	0	0	0	0	0	0.0384	0	0	0		
1996	1	2	0	0	24	22	22	6	0.3887	0.32	0	0
	0.2912	0	0	0	0	0	0	0	0	0		
1996	1	2	0	0	24	23	23	14	0.0907	0.3327	0.0359	0.3086
	0.1473	0.0245	0.0245	0	0	0	0.0359	0	0	0		

1996	1	2	0	0	24	24	24	15	0.0392	0.1847	0.0618	0.1652
	0.3377	0.0267	0.1308	0.0169	0.0369	0	0	0	0	0		
1996	1	2	0	0	24	25	25	22	0	0.034	0.0482	0.2096
	0.2696	0.0397	0.1635	0.1614	0	0	0.0738	0	0	0		
1996	1	2	0	0	24	26	26	24	0	0.023	0.0269	0.2128
	0.2057	0.0379	0.1245	0.1283	0.018	0.0258	0.1576	0.0053	0	0.0343		
1996	1	2	0	0	24	27	27	24	0	0	0.0029	0.1606
	0.2049	0.0486	0.1451	0.158	0.0025	0.0048	0.224	0	0	0.0486		
1996	1	2	0	0	24	28	28	24	0	0.0034	0.0087	0.0851
	0.1236	0.0488	0.1278	0.1765	0.0125	0	0.3444	0	0	0.0692		
1996	1	2	0	0	24	29	29	24	0	0	0	0.0625
	0.0884	0.0177	0.1411	0.175	0.0219	0.0285	0.3787	0	0	0.0861		
1996	1	2	0	0	24	30	30	23	0.0041	0.01	0	0.0417
	0.0931	0.0387	0.1383	0.2076	0.0452	0.0113	0.3233	0	0	0.0867		
1996	1	2	0	0	24	31	31	23	0	0	0	0.0783
	0.0253	0.0432	0.093	0.1054	0.0656	0	0.4234	0	0	0.1657		
1996	1	2	0	0	24	32	32	22	0	0	0	0.0205
	0.0492	0.02	0.1245	0.1063	0.0587	0	0.4658	0	0	0.155		
1996	1	2	0	0	24	33	33	17	0	0	0	0.0326
	0.0491	0.0466	0.1239	0.1604	0.0176	0	0.4493	0	0	0.1205		
1996	1	2	0	0	24	34	34	11	0	0	0	0.0415
	0.0813	0	0	0.2205	0.0931	0	0.3872	0	0	0.1764		
1996	1	2	0	0	24	35	35	12	0	0	0	0
	0	0	0	0.1756	0.0486	0	0.4268	0	0	0.349		
1996	1	2	0	0	24	36	36	4	0	0	0	0
	0	0	0	0	0.2724	0.3387	0.389	0	0	0		
1996	1	2	0	0	24	37	37	7	0	0	0	0.163
	0	0.1771	0.1908	0.172	0	0	0.2971	0	0	0		
1996	1	2	0	0	24	38	38	7	0	0	0	0
	0	0	0	0.2281	0	0	0.6124	0	0	0.1595		
1996	1	2	0	0	24	39	39	6	0	0	0	0
	0	0	0.0612	0	0	0	0.5364	0	0	0.4024		
1996	1	2	0	0	24	40	40	1	0	0	0	0
	0	0	1	0	0	0	0	0	0	0		
1996	1	2	0	0	24	41	41	4	0	0	0	0
	0	0	0	0	0	0	0.3943	0	0	0.6057		
1996	1	2	0	0	24	42	42	4	0	0	0	0
	0	0	0	0	0	0	0.7404	0	0	0.2596		
1996	1	2	0	0	24	43	43	1	0	0	0	0
	0	0	0	0	0	0	1	0	0	0		
1996	1	2	0	0	24	46	46	2	0	0	0	0
	0	0	0	0	0	0	1	0	0	0		
1996	1	2	0	0	24	47	47	1	0	0	0	0
	0	0	0	0	0	0	0	0	0	1		
1996	1	2	0	0	24	49	49	1	0	0	0	0
	0	0	0	0	0	0	0	0	0	1		
1997	1	2	0	0	25	19	19	1	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
1997	1	2	0	0	25	20	20	7	0	0.8108	0	0.1892
	0	0	0	0	0	0	0	0	0	0		
1997	1	2	0	0	25	21	21	10	0	0.2011	0.775	0
	0.0238	0	0	0	0	0	0	0	0	0		
1997	1	2	0	0	25	22	22	17	0.0219	0.9294	0.0358	0.0047
	0	0.0054	0	0	0	0	0	0.0028	0	0		
1997	1	2	0	0	25	23	23	21	0.0034	0.2016	0.2805	0.335
	0.0032	0.0038	0.1705	0.0019	0	0	0	0	0	0		
1997	1	2	0	0	25	24	24	22	0.0026	0.4606	0.4345	0.0162
	0.0463	0.017	0.0072	0.0027	0.0122	0	0	0	0	0.0005		
1997	1	2	0	0	25	25	25	22	0.0061	0.1771	0.3724	0.011
	0.0726	0.2823	0.0049	0.0279	0.0241	0	0	0.0214	0	0		
1997	1	2	0	0	25	26	26	23	0	0.1097	0.1388	0.0091
	0.1102	0.1434	0.0205	0.0357	0.3632	0.0074	0	0.0516	0	0.0105		
1997	1	2	0	0	25	27	27	23	0	0.0152	0.2461	0.0072
	0.2723	0.0659	0.1072	0.0458	0.1539	0.0107	0.0048	0.0615	0.0034	0.0061		
1997	1	2	0	0	25	28	28	23	0	0.0114	0.0158	0.0721
	0.187	0.2453	0.075	0.096	0.1036	0.0089	0	0.11	0.0684	0.0066		

1997	1	2	0	0	25	29	29	23	0	0	0.0134	0.0079
	0.158	0.0589	0.1172	0.1515	0.1635	0.0178	0.0026	0.1813	0.1183	0.0095		
1997	1	2	0	0	25	30	30	22	0	0.0015	0.0052	0.0094
	0.3102	0.3247	0.0041	0.0255	0.0776	0.1429	0.0062	0.0696	0.003	0.0201		
1997	1	2	0	0	25	31	31	22	0	0	0	0.0037
	0.1864	0.1711	0.0086	0.017	0.1951	0.3268	0	0.0692	0.0111	0.0111		
1997	1	2	0	0	25	32	32	18	0	0	0	0
	0.1552	0.0496	0.0621	0.1722	0.1571	0	0	0.2149	0.0282	0.1607		
1997	1	2	0	0	25	33	33	18	0	0	0	0.0075
	0.0226	0.3958	0.0011	0.4241	0.0401	0.0169	0.0163	0.047	0.0099	0.0188		
1997	1	2	0	0	25	34	34	14	0	0	0	0.0335
	0.0949	0.0322	0	0.1832	0.2078	0.0322	0	0.3055	0.0574	0.0533		
1997	1	2	0	0	25	35	35	9	0	0	0	0
	0.0844	0	0	0.3349	0.0097	0	0	0.4746	0.0963	0		
1997	1	2	0	0	25	36	36	5	0	0	0	0
	0.0415	0	0	0	0	0	0	0.746	0	0.2125		
1997	1	2	0	0	25	37	37	2	0	0	0	0
	0	0	0	0	0.0839	0	0	0.9161	0	0		
1997	1	2	0	0	25	38	38	3	0	0	0	0
	0.9754	0	0	0	0	0	0	0.0029	0.0189	0.0029		
1997	1	2	0	0	25	40	40	1	0	0	0	0
	0	0	0	0	1	0	0	0	0	0		
1997	1	2	0	0	25	41	41	1	0	0	0	0
	0	0	0	0	0	0	0	0	0	1		
1997	1	2	0	0	25	45	45	1	0	0	0	0
	0	0	0	0	0	0	0	1	0	0		
1997	1	2	0	0	25	49	49	1	0	0	0	0
	0	0	0	0	0	0	0	1	0	0		
1998	1	2	0	0	26	1	1	1	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
1998	1	2	0	0	26	9	9	1	0	1	0	0
	0	0	0	0	0	0	0	0	0	0		
1998	1	2	0	0	26	15	15	1	0	0	1	0
	0	0	0	0	0	0	0	0	0	0		
#1998	1	2	0	0	26	17	17	4	0.0345	0	0.0189	0.3449
	0	0	0.2568	0	0.3449	0	0	0	0	0		
1998	1	2	0	0	26	18	18	8	0	0.5986	0.3749	0.0265
	0	0	0	0	0	0	0	0	0	0		
1998	1	2	0	0	26	19	19	10	0.1256	0.578	0.1778	0.1186
	0	0	0	0	0	0	0	0	0	0		
1998	1	2	0	0	26	20	20	17	0	0.8538	0.1205	0.0172
	0	0	0	0.0085	0	0	0	0	0	0		
1998	1	2	0	0	26	21	21	18	0	0.5139	0.381	0.0895
	0.0156	0	0	0	0	0	0	0	0	0		
1998	1	2	0	0	26	22	22	19	0	0.4461	0.2215	0.2761
	0.0064	0.0136	0.0331	0	0	0	0	0	0.0032	0		
1998	1	2	0	0	26	23	23	25	0	0.1167	0.3418	0.4663
	0.0253	0.0175	0.0243	0	0.0066	0.0014	0	0	0	0		
1998	1	2	0	0	26	24	24	24	0	0.0309	0.3833	0.3358
	0.0247	0.1375	0.05	0.0104	0.0261	0.0011	0	0	0	0		
1998	1	2	0	0	26	25	25	25	0	0	0.285	0.4765
	0.0312	0.0925	0.0626	0.0118	0.0175	0.0219	0	0	0.0008	0		
1998	1	2	0	0	26	26	26	25	0	0.0359	0.2319	0.3365
	0.0273	0.1013	0.151	0.0007	0.0293	0.0716	0.0126	0	0	0.0019		
1998	1	2	0	0	26	27	27	25	0	0.0022	0.2871	0.1884
	0.0021	0.0789	0.1817	0.0518	0.0777	0.0814	0.0199	0.0013	0.0222	0.0053		
1998	1	2	0	0	26	28	28	25	0	0.0141	0.172	0.1622
	0.0238	0.1393	0.1426	0.037	0.0989	0.1111	0.0223	0	0.0522	0.0246		
1998	1	2	0	0	26	29	29	23	0	0.0349	0.0549	0.0657
	0.0073	0.2123	0.1676	0.0018	0.0649	0.1436	0.021	0	0.212	0.0139		
1998	1	2	0	0	26	30	30	21	0	0	0.0199	0.0534
	0.0212	0.2403	0.1171	0.0033	0.0718	0.0995	0	0.007	0.2573	0.109		
1998	1	2	0	0	26	31	31	22	0	0	0.0494	0.1161
	0	0.0863	0.2201	0	0.2375	0.0238	0	0	0.2408	0.0259		
1998	1	2	0	0	26	32	32	17	0	0	0.0717	0.0464
	0.0388	0.2628	0.1504	0.0259	0.0168	0.075	0	0.0039	0.3023	0.0061		

1998	1	2	0	0	26	33	33	8	0	0	0	0
	0	0.0261	0.0261	0	0	0.2889	0	0.0742	0.5671	0.0175		
1998	1	2	0	0	26	34	34	8	0	0	0	0.2937
	0	0.1852	0.0291	0	0.0762	0.0818	0	0	0.334	0		
1998	1	2	0	0	26	35	35	6	0	0	0	0
	0	0	0.0338	0	0.4542	0.4	0	0	0	0.112		
1998	1	2	0	0	26	36	36	2	0	0	0	0
	0	0.2931	0	0	0	0.2931	0.4138	0	0	0		
1998	1	2	0	0	26	37	37	2	0	0	0	0
	0	0.4795	0.4795	0.0409	0	0	0	0	0	0		
1998	1	2	0	0	26	38	38	3	0	0	0	0.1498
	0	0	0	0	0.1924	0.6578	0	0	0	0		
1998	1	2	0	0	26	39	39	2	0	0	0	0.7682
	0	0	0	0	0	0	0	0	0.2318	0		
1998	1	2	0	0	26	40	40	1	0	0	0	0
	0	0	0	0	0	0	1	0	0	0		
1998	1	2	0	0	26	44	44	1	0	0	0	0
	0	0	0	0	0	0	0	0	1	0		
1999	1	2	0	0	27	2	2	1	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
1999	1	2	0	0	27	3	3	1	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
1999	1	2	0	0	27	4	4	2	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
1999	1	2	0	0	27	7	7	2	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
1999	1	2	0	0	27	10	10	1	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
1999	1	2	0	0	27	11	11	1	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
1999	1	2	0	0	27	12	12	3	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
1999	1	2	0	0	27	13	13	5	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
1999	1	2	0	0	27	14	14	10	0.9464	0.0111	0.0425	0
	0	0	0	0	0	0	0	0	0	0		
1999	1	2	0	0	27	15	15	7	0.9785	0	0	0.0215
	0	0	0	0	0	0	0	0	0	0		
1999	1	2	0	0	27	16	16	10	0.9707	0.0045	0.0248	0
	0	0	0	0	0	0	0	0	0	0		
1999	1	2	0	0	27	17	17	16	0.8775	0.0674	0.0551	0
	0	0	0	0	0	0	0	0	0	0		
1999	1	2	0	0	27	18	18	17	0.7131	0.177	0.0444	0.0655
	0	0	0	0	0	0	0	0	0	0		
1999	1	2	0	0	27	19	19	19	0.4669	0.2718	0.226	0.0354
	0	0	0	0	0	0	0	0	0	0		
1999	1	2	0	0	27	20	20	26	0.228	0.3938	0.2863	0.0515
	0.0404	0	0	0	0	0	0	0	0	0		
1999	1	2	0	0	27	21	21	27	0.0037	0.3535	0.4644	0.1469
	0.0314	0	0	0	0	0	0	0	0	0		
1999	1	2	0	0	27	22	22	30	0	0.1846	0.4158	0.2226
	0.1713	0	0	0.0057	0	0	0	0	0	0		
1999	1	2	0	0	27	23	23	35	0.0174	0.1038	0.408	0.2263
	0.2274	0	0	0.0172	0	0	0	0	0	0		
1999	1	2	0	0	27	24	24	36	0	0.0244	0.34	0.2597
	0.3139	0.0437	0.0016	0.0167	0	0	0	0	0	0		
1999	1	2	0	0	27	25	25	35	0.0016	0.0288	0.2074	0.3925
	0.2757	0.0355	0.0298	0.0162	0	0	0	0	0	0.0124		
1999	1	2	0	0	27	26	26	37	0	0.0145	0.1105	0.4163
	0.3236	0.0378	0.0188	0.0183	0.011	0.022	0.0115	0	0.0074	0.0082		
1999	1	2	0	0	27	27	27	38	0.0063	0.0125	0.0228	0.3987
	0.2864	0.0314	0.0776	0.0889	0.0135	0.0211	0.0175	0	0.004	0.0193		
1999	1	2	0	0	27	28	28	38	0	0.0006	0.0318	0.3619
	0.2354	0.0306	0.1185	0.0935	0.0201	0.0348	0.0261	0.0181	0	0.0286		
1999	1	2	0	0	27	29	29	34	0	0	0.0184	0.2493
	0.2137	0.0408	0.1151	0.0814	0.0561	0.0781	0.067	0.0174	0.0087	0.0541		

1999	1	2	0	0	27	30	30	35	0	0	0.0195	0.3751
	0.1606	0.0085	0.076	0.1532	0.0376	0.0452	0.0681	0.01	0	0.0463		
1999	1	2	0	0	27	31	31	31	0	0	0.0588	0.3042
	0.1252	0	0.0588	0.1102	0.0334	0.0241	0.0901	0.0419	0	0.1532		
1999	1	2	0	0	27	32	32	27	0	0.0257	0.0294	0.1211
	0.0824	0.0704	0.2222	0.1073	0.0798	0.027	0.0299	0.0227	0.0386	0.1435		
1999	1	2	0	0	27	33	33	22	0	0	0	0.1122
	0.1733	0	0.2969	0.0951	0.044	0.1001	0	0.0662	0	0.1124		
1999	1	2	0	0	27	34	34	14	0	0	0	0.0679
	0	0.0069	0.036	0.1597	0.0434	0.0769	0.0883	0.0524	0.0671	0.4013		
1999	1	2	0	0	27	35	35	11	0.015	0	0	0.0647
	0.1004	0	0.1596	0.15	0	0	0.3853	0.1041	0	0.0209		
1999	1	2	0	0	27	36	36	9	0	0	0	0.226
	0.2449	0	0	0	0	0.2069	0.1502	0	0.0313	0.1407		
1999	1	2	0	0	27	37	37	6	0	0	0	0.0239
	0	0.1958	0.137	0	0.21	0.0239	0.0239	0.1916	0	0.1939		
1999	1	2	0	0	27	38	38	2	0	0	0	0
	0	0	0	0	0	1	0	0	0	0		
1999	1	2	0	0	27	39	39	4	0	0	0	0.0527
	0	0	0	0.2476	0	0.3665	0.3332	0	0	0		
1999	1	2	0	0	27	40	40	4	0	0	0	0
	0	0	0.2948	0	0	0.2809	0.0687	0	0.3556	0		
1999	1	2	0	0	27	41	41	1	0	0	0	0
	0	0	0	1	0	0	0	0	0	0		
1999	1	2	0	0	27	42	42	1	0	0	0	0
	0	0	0	0	0	0	1	0	0	0		
1999	1	2	0	0	27	43	43	1	0	0	0	0
	0	0	0	0	0	0	1	0	0	0		
1999	1	2	0	0	27	45	45	1	0	0	0	0
	0	0	0	0	0	0	0	0	0	1		
1999	1	2	0	0	27	47	47	2	0	0	0	0
	0	0	0.5163	0	0	0	0.4837	0	0	0		
2000	1	2	0	0	28	12	12	1	0	1	0	0
	0	0	0	0	0	0	0	0	0	0		
2000	1	2	0	0	28	15	15	1	0	1	0	0
	0	0	0	0	0	0	0	0	0	0		
2000	1	2	0	0	28	16	16	3	0	1	0	0
	0	0	0	0	0	0	0	0	0	0		
2000	1	2	0	0	28	17	17	4	0	0.8414	0.1586	0
	0	0	0	0	0	0	0	0	0	0		
2000	1	2	0	0	28	18	18	5	0	1	0	0
	0	0	0	0	0	0	0	0	0	0		
2000	1	2	0	0	28	19	19	6	0	1	0	0
	0	0	0	0	0	0	0	0	0	0		
2000	1	2	0	0	28	20	20	5	0	0.907	0.0605	0
	0.0324	0	0	0	0	0	0	0	0	0		
2000	1	2	0	0	28	21	21	9	0.0285	0.9595	0	0
	0.012	0	0	0	0	0	0	0	0	0		
2000	1	2	0	0	28	22	22	13	0	0.8801	0.0958	0.0242
	0	0	0	0	0	0	0	0	0	0		
2000	1	2	0	0	28	23	23	14	0.0117	0.8847	0.0438	0.0239
	0.014	0	0	0.0218	0	0	0	0	0	0		
2000	1	2	0	0	28	24	24	14	0	0.8452	0.1116	0.0338
	0	0	0	0	0.0094	0	0	0	0	0		
2000	1	2	0	0	28	25	25	17	0.007	0.7126	0.1507	0.0359
	0.0625	0.0282	0	0	0.0031	0	0	0	0	0		
2000	1	2	0	0	28	26	26	16	0	0.459	0.1797	0.0828
	0.193	0.0692	0	0.0077	0.0086	0	0	0	0	0		
2000	1	2	0	0	28	27	27	18	0.0081	0.3412	0.1217	0.1624
	0.156	0.133	0.0201	0.0297	0.0133	0.0069	0	0	0	0.0077		
2000	1	2	0	0	28	28	28	19	0	0.1405	0.0814	0.102
	0.3552	0.197	0.0213	0.0301	0.0191	0.0366	0.0066	0.0103	0	0		
2000	1	2	0	0	28	29	29	19	0	0.0796	0.053	0.1444
	0.3267	0.2519	0.045	0.0298	0.0089	0.0074	0.0337	0.006	0	0.0136		
2000	1	2	0	0	28	30	30	19	0	0.018	0.0134	0.106
	0.3534	0.2389	0.0281	0.0795	0.0731	0.0068	0.031	0.0055	0.0085	0.0378		

2000	1	2	0	0	28	31	31	20	0	0.0091	0.0104	0.0371
	0.3035	0.2991	0.035	0.0699	0.0262	0.0134	0.0341	0.1282	0.016	0.018		
2000	1	2	0	0	28	32	32	18	0	0.0096	0.0215	0.0799
	0.3314	0.152	0.0212	0.1212	0.0646	0.043	0.007	0.0464	0.0399	0.0623		
2000	1	2	0	0	28	33	33	16	0	0	0	0.0822
	0.3165	0.1881	0.0116	0.127	0.1003	0.0706	0.0476	0.015	0	0.0412		
2000	1	2	0	0	28	34	34	17	0	0	0.0121	0.02
	0.3169	0.1977	0.0212	0.2137	0.0347	0.013	0.0414	0.1056	0.0136	0.0102		
2000	1	2	0	0	28	35	35	15	0	0	0	0.0048
	0.338	0.1936	0.0127	0.1296	0.0095	0.0048	0.026	0.0066	0.034	0.2404		
2000	1	2	0	0	28	36	36	9	0	0.0059	0	0
	0.6663	0.0822	0	0	0.0691	0	0.0943	0.0647	0.0059	0.0116		
2000	1	2	0	0	28	37	37	10	0	0	0	0.1152
	0.1592	0	0.0163	0.2656	0.0212	0.0172	0.1335	0.1266	0.0085	0.1367		
2000	1	2	0	0	28	38	38	6	0	0.0303	0	0
	0.1299	0.0526	0	0.0569	0	0.5781	0.0526	0	0	0.0995		
2000	1	2	0	0	28	39	39	6	0	0	0.2004	0
	0.0485	0	0.2004	0.0516	0.0197	0	0.2455	0.2004	0	0.0334		
2000	1	2	0	0	28	40	40	8	0	0	0	0
	0.5526	0	0.0491	0.0431	0	0	0.3285	0.0267	0	0		
2000	1	2	0	0	28	41	41	4	0	0	0	0
	0	0	0.1648	0	0.5544	0	0.1473	0	0	0.1334		
2000	1	2	0	0	28	42	42	4	0	0	0	0
	0.0681	0.0681	0	0.4687	0	0	0.2053	0	0	0.1898		
2000	1	2	0	0	28	44	44	2	0	0	0	0
	0.0316	0	0	0	0	0.9684	0	0	0	0		
2000	1	2	0	0	28	45	45	1	0	0	0	0
	0	0	0	0	0	0	1	0	0	0		
2000	1	2	0	0	28	47	47	1	0	0	0	0
	0	0	0	0	0	0	0	0	0	1		
2000	1	2	0	0	28	48	48	1	0	0	0	0
	0	0	0	0	0	0	0	1	0	0		
2000	1	2	0	0	28	51	51	1	0	0	0	0
	0	0	0	0	0	0	0	0	0	1		
2001	1	2	0	0	29	12	12	1	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
2001	1	2	0	0	29	22	22	1	0	0	0	1
	0	0	0	0	0	0	0	0	0	0		
2001	1	2	0	0	29	23	23	3	0	0	0.2522	0
	0.7478	0	0	0	0	0	0	0	0	0		
2001	1	2	0	0	29	24	24	4	0	0.351	0.649	0
	0	0	0	0	0	0	0	0	0	0		
2001	1	2	0	0	29	25	25	6	0	0.1256	0.3869	0.293
	0.0818	0	0.0818	0	0.0309	0	0	0	0	0		
2001	1	2	0	0	29	26	26	11	0	0.1061	0.4791	0.0189
	0.1866	0.1727	0.0368	0	0	0	0	0	0	0		
2001	1	2	0	0	29	27	27	15	0	0	0.499	0.0653
	0.2659	0.0759	0.0544	0.0248	0	0	0.0146	0	0	0		
2001	1	2	0	0	29	28	28	18	0	0.0826	0.4287	0.1058
	0.0978	0.1043	0.0791	0.0129	0	0.0424	0.015	0.024	0.0074	0		
2001	1	2	0	0	29	29	29	20	0	0.0494	0.3783	0.1216
	0.1908	0.1078	0.0621	0.0235	0.0122	0.0233	0	0.0142	0.0071	0.0098		
2001	1	2	0	0	29	30	30	20	0	0.0162	0.2301	0.1
	0.1479	0.2316	0.1758	0.0194	0.0201	0.0211	0.0045	0.008	0.0201	0.0053		
2001	1	2	0	0	29	31	31	20	0	0.0162	0.2234	0.0569
	0.1229	0.3025	0.0535	0.0358	0.0313	0.0498	0.013	0.043	0.0284	0.0231		
2001	1	2	0	0	29	32	32	20	0	0.0074	0.2169	0.107
	0.089	0.2881	0.1235	0.0206	0.0526	0.0335	0.0022	0.0162	0.0258	0.0173		
2001	1	2	0	0	29	33	33	20	0	0.0176	0.1685	0.0482
	0.0773	0.3021	0.1377	0.0408	0.0334	0.0597	0.0205	0.0248	0.0238	0.0457		
2001	1	2	0	0	29	34	34	19	0	0	0.0661	0.0105
	0.0522	0.3786	0.2435	0.01	0.0493	0.074	0.047	0.0126	0.0377	0.0187		
2001	1	2	0	0	29	35	35	18	0	0.0149	0.0122	0.0094
	0.0633	0.379	0.2474	0.0437	0.068	0.0474	0	0.0466	0.0302	0.0379		
2001	1	2	0	0	29	36	36	19	0	0	0	0.0195
	0.0926	0.2545	0.1888	0.0642	0.0095	0.1033	0.0362	0.1267	0.0095	0.0953		

2001	1	2	0	0	29	37	37	17	0	0	0.0133	0.0328
	0.1014	0.3356	0.1206	0.0413	0.0673	0.1096	0	0.0154	0.0872	0.0755		
2001	1	2	0	0	29	38	38	17	0	0	0	0
	0.1143	0.2767	0.1861	0.0359	0.1095	0.0993	0.0256	0.0467	0.0339	0.072		
2001	1	2	0	0	29	39	39	17	0	0	0	0
	0.0545	0.3484	0.2062	0.1137	0.0702	0.0926	0.0507	0.0316	0.032	0		
2001	1	2	0	0	29	40	40	12	0	0	0	0
	0	0.3602	0.053	0	0.1103	0.1366	0.0999	0.0334	0.0772	0.1292		
2001	1	2	0	0	29	41	41	9	0	0	0.0686	0
	0.0716	0.4975	0	0.0686	0.2221	0.0716	0	0	0	0		
2001	1	2	0	0	29	42	42	7	0	0	0	0
	0.0693	0.2129	0.0537	0.1276	0.1804	0.1431	0.2129	0	0	0		
2001	1	2	0	0	29	43	43	4	0	0	0	0
	0	0.526	0	0	0.2361	0.1393	0.0987	0	0	0		
2001	1	2	0	0	29	44	44	2	0	0	0	0
	0	0.3367	0.3367	0	0	0	0	0	0	0.3267		
2001	1	2	0	0	29	45	45	2	0	0	0	0
	0	0	0.2827	0	0	0	0	0	0	0.7173		
2001	1	2	0	0	29	46	46	3	0	0	0	0
	0	0.4858	0.2796	0	0	0	0	0	0	0.2346		
2001	1	2	0	0	29	47	47	1	0	0	0	0
	0	0	0	0	0	0	0	1	0	0		
2001	1	2	0	0	29	48	48	2	0	0	0	0
	0	0	0	0.4892	0	0.5108	0	0	0	0		
2002	1	2	0	0	30	18	18	1	0	1	0	0
	0	0	0	0	0	0	0	0	0	0		
2002	1	2	0	0	30	24	24	8	0	0.4236	0.4519	0.1244
	0	0	0	0	0	0	0	0	0	0		
2002	1	2	0	0	30	25	25	3	0	0.171	0.829	0
	0	0	0	0	0	0	0	0	0	0		
2002	1	2	0	0	30	26	26	5	0	0.3356	0.1722	0.3875
	0	0.1047	0	0	0	0	0	0	0	0		
2002	1	2	0	0	30	27	27	11	0	0.1017	0.4274	0.0414
	0.3158	0.1137	0	0	0	0	0	0	0	0		
2002	1	2	0	0	30	28	28	15	0	0	0.2106	0.2685
	0.2485	0.0726	0.0837	0.0617	0.0206	0.0338	0	0	0	0		
2002	1	2	0	0	30	29	29	22	0	0.0107	0.2295	0.2895
	0.0831	0.0595	0.1515	0.0784	0.0102	0.0329	0.027	0	0.0278	0		
2002	1	2	0	0	30	30	30	24	0	0.0108	0.1042	0.3278
	0.1159	0.0861	0.1629	0.1356	0.0122	0	0	0	0.0288	0.0156		
2002	1	2	0	0	30	31	31	25	0	0	0.103	0.3927
	0.1028	0.0962	0.1307	0.0816	0.0292	0.0268	0.0277	0	0.0094	0		
2002	1	2	0	0	30	32	32	26	0	0	0.0896	0.311
	0.1478	0.0908	0.165	0.1105	0.017	0.0112	0.042	0	0	0.0151		
2002	1	2	0	0	30	33	33	26	0	0.0114	0.0595	0.4025
	0.0673	0.0631	0.2048	0.0819	0.0064	0.0155	0.0277	0	0.0306	0.0294		
2002	1	2	0	0	30	34	34	26	0	0	0.0482	0.3387
	0.0633	0.091	0.1846	0.1382	0.0399	0.0232	0.0415	0.0058	0	0.0256		
2002	1	2	0	0	30	35	35	26	0	0.0077	0.0894	0.3053
	0.0644	0.0863	0.1933	0.1325	0.0282	0.0153	0.021	0.0117	0.0082	0.0369		
2002	1	2	0	0	30	36	36	26	0	0	0.05	0.2033
	0.0759	0.1598	0.3031	0.1071	0.0113	0.0507	0.0072	0	0.0114	0.02		
2002	1	2	0	0	30	37	37	25	0	0	0.0339	0.1815
	0.0881	0.0913	0.3736	0.0985	0.0087	0.0194	0.0241	0.0139	0.0203	0.0467		
2002	1	2	0	0	30	38	38	25	0	0	0.0512	0.1371
	0.063	0.116	0.3027	0.1265	0.0399	0.0091	0.0713	0	0.029	0.0543		
2002	1	2	0	0	30	39	39	21	0	0	0	0.0997
	0.0216	0.0953	0.3534	0.1685	0.0246	0.0325	0.0858	0.0222	0	0.0965		
2002	1	2	0	0	30	40	40	13	0	0	0.037	0
	0.0313	0.1683	0.4097	0.2748	0.0335	0.0453	0	0	0	0		
2002	1	2	0	0	30	41	41	18	0	0	0.0408	0.036
	0.0872	0.1019	0.2444	0.0507	0.041	0.0844	0.1017	0.0837	0	0.1281		
2002	1	2	0	0	30	42	42	12	0	0	0.0553	0
	0	0.254	0.1736	0.1153	0.0791	0.0504	0.0894	0	0.0486	0.1344		
2002	1	2	0	0	30	43	43	12	0	0	0	0
	0	0.1192	0.6183	0.136	0	0.0628	0	0.0636	0	0		

2002	1	2	0	0	30	44	44	7	0	0	0	0
	0	0	0.4432	0.2129	0	0.1051	0	0	0	0.2388		
2002	1	2	0	0	30	45	45	2	0	0	0	0
	0	0	0	0.5032	0	0	0.4968	0	0	0		
2002	1	2	0	0	30	46	46	1	0	0	0	0
	0	0	1	0	0	0	0	0	0	0		
2002	1	2	0	0	30	47	47	2	0	0	0	0
	0	0	0.3475	0.3049	0.3475	0	0	0	0	0		
2002	1	2	0	0	30	48	48	1	0	0	0	0
	0	0	0	0	0	0	0	0	1	0		
2002	1	2	0	0	30	49	49	1	0	0	0	0
	0	0	0	0	0	0	0	0	1	0		
2003	1	2	0	0	31	13	13	2	0	0	0	1
	0	0	0	0	0	0	0	0	0	0		
2003	1	2	0	0	31	14	14	2	0	0	0	1
	0	0	0	0	0	0	0	0	0	0		
2003	1	2	0	0	31	17	17	1	0	0	0	1
	0	0	0	0	0	0	0	0	0	0		
2003	1	2	0	0	31	21	21	1	0	0	1	0
	0	0	0	0	0	0	0	0	0	0		
2003	1	2	0	0	31	22	22	3	0	0	0.752	0
	0	0	0	0.248	0	0	0	0	0	0		
2003	1	2	0	0	31	23	23	11	0	0	0.6801	0.1192
	0.0651	0.1015	0.0341	0	0	0	0	0	0	0		
2003	1	2	0	0	31	24	24	14	0	0	0.6859	0.2079
	0.0276	0.0395	0.0199	0.0191	0	0	0	0	0	0		
2003	1	2	0	0	31	25	25	14	0	0.0227	0.5618	0.2715
	0.0468	0.0584	0.0108	0.0091	0.0188	0	0	0	0	0		
2003	1	2	0	0	31	26	26	15	0	0.0183	0.5825	0.1592
	0.0548	0.0717	0.0316	0.0321	0.0283	0.0106	0	0.0108	0	0		
2003	1	2	0	0	31	27	27	15	0	0	0.3791	0.2562
	0.0417	0.112	0.0791	0.0472	0.0567	0.0071	0.0137	0.0073	0	0		
2003	1	2	0	0	31	28	28	15	0	0	0.4119	0.2477
	0.0311	0.1056	0.0556	0.0631	0.0467	0.0156	0	0.014	0	0.0087		
2003	1	2	0	0	31	29	29	15	0	0	0.2732	0.2013
	0.0813	0.1769	0.0849	0.1071	0.0553	0.02	0	0	0	0		
2003	1	2	0	0	31	30	30	15	0	0	0.2971	0.1168
	0.0582	0.2095	0.0773	0.1212	0.0388	0.0202	0.0147	0.0341	0	0.012		
2003	1	2	0	0	31	31	31	15	0	0	0.1271	0.2302
	0.1134	0.156	0.0723	0.1131	0.1345	0.0206	0	0.0177	0	0.0151		
2003	1	2	0	0	31	32	32	13	0	0	0.1499	0.1028
	0.1961	0.1156	0.1554	0.1255	0.0556	0.0619	0	0.0373	0	0		
2003	1	2	0	0	31	33	33	13	0	0	0.0516	0.2507
	0.1773	0.195	0.1347	0.0451	0.091	0.0231	0	0	0.0315	0		
2003	1	2	0	0	31	34	34	11	0	0	0.1028	0.1197
	0.1613	0.254	0.0667	0.113	0.0844	0	0.0373	0.0304	0.0304	0		
2003	1	2	0	0	31	35	35	11	0	0	0	0.1463
	0.0539	0.1878	0.1029	0.2507	0.072	0.1567	0	0.0299	0	0		
2003	1	2	0	0	31	36	36	9	0	0	0.0743	0.1868
	0.3167	0.2594	0	0.0619	0	0.0504	0	0	0	0.0504		
2003	1	2	0	0	31	37	37	7	0	0	0.0817	0.0844
	0.07	0.07	0	0.4607	0.07	0.1633	0	0	0	0		
2003	1	2	0	0	31	38	38	6	0	0	0	0.1396
	0	0.0984	0.1017	0.4465	0.075	0.1388	0	0	0	0		
2003	1	2	0	0	31	39	39	8	0	0	0	0.0889
	0.2559	0.1212	0	0.1836	0	0	0.1072	0.1148	0	0.1284		
2003	1	2	0	0	31	40	40	5	0	0	0	0
	0	0.3535	0	0.4653	0	0	0	0	0	0.1812		
2003	1	2	0	0	31	41	41	5	0	0	0	0
	0.3046	0	0.2984	0.1238	0.1238	0	0.1493	0	0	0		
2003	1	2	0	0	31	42	42	3	0	0	0	0
	0.3126	0.2999	0	0.3875	0	0	0	0	0	0		
2003	1	2	0	0	31	43	43	1	0	0	0	0
	0	0	0	0	1	0	0	0	0	0		
2003	1	2	0	0	31	44	44	1	0	0	0	0
	0	0	0.5	0	0	0	0	0	0	0.5		

2003	1	2	0	0	31	45	45	1	0	0	0	0
	1	0	0	0	0	0	0	0	0	0		
2003	1	2	0	0	31	46	46	1	0	0	0	0
	0	0	1	0	0	0	0	0	0	0		
2003	1	2	0	0	31	49	49	1	0	0	0	0
	0	0	0	1	0	0	0	0	0	0		
#2004	1	2	0	0	32	10	10	1	0	0	0	1
	0	0	0	0	0	0	0	0	0	0		
#2004	1	2	0	0	32	11	11	1	0	0	0	0
	0	0	1	0	0	0	0	0	0	0		
2004	1	2	0	0	32	13	13	1	0	0	0	0
	1	0	0	0	0	0	0	0	0	0		
2004	1	2	0	0	32	14	14	1	0	0	0	0
	1	0	0	0	0	0	0	0	0	0		
2004	1	2	0	0	32	15	15	2	0.5851	0	0	0
	0.4149	0	0	0	0	0	0	0	0	0		
2004	1	2	0	0	32	16	16	1	0	0	0	1
	0	0	0	0	0	0	0	0	0	0		
2004	1	2	0	0	32	17	17	1	0	0	0	0.2
	0.8	0	0	0	0	0	0	0	0	0		
2004	1	2	0	0	32	18	18	2	0	0	0	0
	0.7035	0	0	0.2965	0	0	0	0	0	0		
2004	1	2	0	0	32	19	19	2	0	0	0.6976	0.1512
	0.1512	0	0	0	0	0	0	0	0	0		
2004	1	2	0	0	32	20	20	3	0	0.1859	0.1231	0.1231
	0	0.5679	0	0	0	0	0	0	0	0		
2004	1	2	0	0	32	21	21	11	0	0.5958	0	0.2823
	0.1219	0	0	0	0	0	0	0	0	0		
2004	1	2	0	0	32	22	22	20	0	0.1574	0.054	0.6835
	0.0602	0.045	0	0	0	0	0	0	0	0		
2004	1	2	0	0	32	23	23	26	0	0.1215	0.042	0.7519
	0.0708	0.0052	0.0086	0	0	0	0	0	0	0		
2004	1	2	0	0	32	24	24	31	0	0.034	0.0314	0.8306
	0.0749	0.0193	0.0051	0.0048	0	0	0	0	0	0		
2004	1	2	0	0	32	25	25	32	0	0.0048	0.0335	0.7386
	0.1683	0.0137	0.0105	0.0163	0.0078	0.0064	0	0	0	0		
2004	1	2	0	0	32	26	26	32	0	0.0015	0.016	0.7745
	0.1189	0.0157	0.0232	0.0296	0.014	0.0066	0	0	0	0		
2004	1	2	0	0	32	27	27	32	0	0	0.0105	0.7153
	0.1436	0.0379	0.0463	0.0229	0.0097	0.0083	0.0055	0	0	0		
2004	1	2	0	0	32	28	28	32	0	0	0.0036	0.6695
	0.1164	0.0168	0.0932	0.0328	0.0363	0.0245	0.005	0.0018	0	0		
2004	1	2	0	0	32	29	29	31	0	0.0061	0.0167	0.5282
	0.1843	0.0513	0.0903	0.0398	0.0538	0.0193	0.0064	0.0014	0.0024	0		
2004	1	2	0	0	32	30	30	31	0	0	0.0082	0.4812
	0.1592	0.0712	0.0713	0.0837	0.0604	0.0407	0.0094	0	0.0147	0		
2004	1	2	0	0	32	31	31	31	0	0	0.0133	0.2895
	0.127	0.0531	0.2178	0.1077	0.0919	0.0339	0.0172	0.0257	0	0.0229		
2004	1	2	0	0	32	32	32	27	0	0	0.0136	0.3805
	0.1248	0.0288	0.1834	0.0867	0.0527	0.0704	0.0381	0.0032	0	0.018		
2004	1	2	0	0	32	33	33	18	0	0	0.0504	0.3032
	0.0746	0.1446	0.1328	0.1013	0.0439	0.1245	0	0	0.0247	0		
2004	1	2	0	0	32	34	34	17	0	0	0.0474	0.2726
	0.0649	0.1653	0.1763	0.1458	0.0495	0	0	0.0782	0	0		
2004	1	2	0	0	32	35	35	13	0	0	0	0.1624
	0.2113	0.3775	0.064	0.0229	0	0.0354	0	0	0.0594	0.0671		
2004	1	2	0	0	32	36	36	11	0	0	0	0.1877
	0.1735	0.1673	0.2057	0.0985	0.0148	0	0.062	0	0.0284	0.062		
2004	1	2	0	0	32	37	37	5	0	0	0	0.3349
	0.2535	0	0	0	0.0699	0.0699	0	0	0.2718	0		
2004	1	2	0	0	32	38	38	7	0	0	0	0.2722
	0.3457	0.1025	0.0595	0.1606	0.0595	0	0	0	0	0		
2004	1	2	0	0	32	39	39	3	0	0	0	0
	0.2135	0.2327	0	0.5538	0	0	0	0	0	0		
2004	1	2	0	0	32	40	40	1	0	0	0	0
	0.5	0	0	0	0.5	0	0	0	0	0		

2004	1	2	0	0	32	41	41	5	0	0	0	0.1647
	0	0.3677	0.1519	0	0.1638	0	0	0	0.1519	0		
2004	1	2	0	0	32	42	42	2	0	0	0	0
	0	0.2744	0.7256	0	0	0	0	0	0	0		
2004	1	2	0	0	32	43	43	1	0	0	0	0
	0	0	0	0	0	1	0	0	0	0		
2004	1	2	0	0	32	44	44	2	0	0	0	0
	0	0	0	0	1	0	0	0	0	0		
#2004	1	2	0	0	32	46	46	1	0	0	0	1
	0	0	0	0	0	0	0	0	0	0		
2004	1	2	0	0	32	47	47	1	0	0	0	0
	0	1	0	0	0	0	0	0	0	0		
2004	1	2	0	0	32	49	49	1	0	0	0	0
	1	0	0	0	0	0	0	0	0	0		
2004	1	2	0	0	32	50	50	1	0	0	0	0
	0	0	0	0	0	1	0	0	0	0		
2005	1	2	0	0	33	19	19	2	0	0	0.4816	0
	0.5184	0	0	0	0	0	0	0	0	0		
2005	1	2	0	0	33	21	21	1	0	0	0.3333	0
	0.6667	0	0	0	0	0	0	0	0	0		
2005	1	2	0	0	33	22	22	3	0	0	0	0.5498
	0.234	0	0.2162	0	0	0	0	0	0	0		
2005	1	2	0	0	33	23	23	12	0	0	0.0213	0.0969
	0.8138	0.0107	0.0574	0	0	0	0	0	0	0		
2005	1	2	0	0	33	24	24	17	0	0	0.0573	0.0073
	0.7845	0.1009	0	0	0.0501	0	0	0	0	0		
2005	1	2	0	0	33	25	25	19	0	0	0.0129	0.0043
	0.7532	0.2026	0.027	0	0	0	0	0	0	0		
2005	1	2	0	0	33	26	26	20	0	0	0.0294	0.0525
	0.6111	0.19	0.022	0.076	0.019	0	0	0	0	0		
2005	1	2	0	0	33	27	27	20	0	0	0.0273	0.0054
	0.782	0.1359	0.0006	0.0423	0.0065	0	0	0	0	0		
2005	1	2	0	0	33	28	28	20	0	0	0.0189	0.0074
	0.5929	0.1458	0.0592	0.0456	0.127	0.0004	0.0027	0	0	0		
2005	1	2	0	0	33	29	29	19	0	0	0	0.0789
	0.5674	0.0808	0.0172	0.1509	0.0505	0.0231	0.026	0	0	0.0053		
2005	1	2	0	0	33	30	30	17	0	0	0	0.056
	0.5103	0.1642	0.0562	0.0668	0	0.0716	0.0281	0.0244	0	0.0224		
2005	1	2	0	0	33	31	31	12	0	0	0	0.0358
	0.5092	0.1476	0	0.0168	0.1217	0.0474	0.0781	0	0	0.0434		
2005	1	2	0	0	33	32	32	12	0	0	0	0
	0.3592	0.2362	0.0137	0.0561	0.2593	0.0732	0.0023	0	0	0		
2005	1	2	0	0	33	33	33	2	0	0	0	0
	0.718	0	0.282	0	0	0	0	0	0	0		
2005	1	2	0	0	33	34	34	5	0	0	0	0
	0.2434	0.3445	0	0.4121	0	0	0	0	0	0		
2005	1	2	0	0	33	35	35	7	0	0	0	0
	0.5132	0.0118	0	0.0216	0	0.2492	0.0118	0.1924	0	0		
2005	1	2	0	0	33	36	36	6	0	0	0	0
	0.1941	0.2166	0	0	0.1989	0.2317	0.1588	0	0	0		
2005	1	2	0	0	33	37	37	4	0	0	0	0
	0.6923	0	0.2864	0	0	0.0213	0	0	0	0		
2005	1	2	0	0	33	38	38	2	0	0	0	0
	0.4052	0.2974	0	0	0.2974	0	0	0	0	0		
2005	1	2	0	0	33	39	39	2	0	0	0	0
	0	0.8969	0	0	0.1031	0	0	0	0	0		
2005	1	2	0	0	33	40	40	1	0	0	0	0
	0	0	0	1	0	0	0	0	0	0		
2005	1	2	0	0	33	42	42	1	0	0	0	0
	0	0	0	1	0	0	0	0	0	0		
2005	1	2	0	0	33	45	45	1	0	0	0	0
	0	1	0	0	0	0	0	0	0	0		
2005	1	2	0	0	33	46	46	1	0	0	0	0
	0	1	0	0	0	0	0	0	0	0		
2006	1	2	0	0	34	20	20	1	0	0.3176	0	0
	0	0.6824	0	0	0	0	0	0	0	0		

2006	1	2	0	0	34	21	21	2	0	0	0	0
	0	1	0	0	0	0	0	0	0	0		
2006	1	2	0	0	34	22	22	5	0	0.1542	0.4545	0
	0	0.3913	0	0	0	0	0	0	0	0		
2006	1	2	0	0	34	23	23	13	0	0.1314	0	0.3893
	0	0.4793	0	0	0	0	0	0	0	0		
2006	1	2	0	0	34	24	24	16	0	0.0202	0	0.2148
	0.1668	0.364	0.2342	0	0	0	0	0	0	0		
2006	1	2	0	0	34	25	25	41	0.0176	0.0202	0.0218	0.0596
	0.0195	0.7992	0.0621	0	0	0	0	0	0	0		
2006	1	2	0	0	34	26	26	51	0	0.0113	0	0.0389
	0.0398	0.6975	0.1486	0.0051	0.02	0.0136	0.0251	0	0	0		
2006	1	2	0	0	34	27	27	73	0	0	0	0.1351
	0.0136	0.7032	0.0788	0.0514	0.0075	0.0066	0.0038	0	0	0		
2006	1	2	0	0	34	28	28	82	0	0	0.0094	0.0257
	0.0334	0.759	0.077	0.0369	0.0326	0.0193	0	0.003	0	0.0037		
2006	1	2	0	0	34	29	29	81	0	0	0	0.0633
	0.0503	0.6531	0.0845	0.0334	0.0506	0.0442	0.0131	0	0	0.0077		
2006	1	2	0	0	34	30	30	71	0	0	0	0.0381
	0.0432	0.7271	0.0646	0.0404	0.0136	0.0253	0.0135	0.0175	0.0167	0		
2006	1	2	0	0	34	31	31	70	0	0	0.0249	0.0238
	0.0178	0.6851	0.0817	0.0121	0.1092	0.004	0.0209	0	0.016	0.0046		
2006	1	2	0	0	34	32	32	59	0	0	0	0.0082
	0.0483	0.5428	0.0938	0.085	0.0416	0.0842	0.0617	0.0291	0.0053	0		
2006	1	2	0	0	34	33	33	45	0	0	0	0
	0.0419	0.6242	0.1012	0.0401	0.0677	0.0186	0.053	0	0	0.0532		
2006	1	2	0	0	34	34	34	24	0	0	0	0
	0	0.5707	0.0703	0.0678	0.023	0.0533	0.1225	0.0923	0	0		
2006	1	2	0	0	34	35	35	26	0	0	0	0.0307
	0	0.5945	0.2057	0.0278	0	0.1413	0	0	0	0		
2006	1	2	0	0	34	36	36	10	0	0	0	0
	0	0.4352	0.2936	0.0767	0	0.1944	0	0	0	0		
2006	1	2	0	0	34	37	37	12	0	0	0	0
	0	0.4892	0	0.0436	0.046	0.0921	0.2354	0.0938	0	0		
2006	1	2	0	0	34	38	38	6	0	0	0	0
	0	0.5044	0	0.254	0.1372	0.1044	0	0	0	0		
2006	1	2	0	0	34	39	39	6	0	0	0	0
	0	0.0678	0	0.404	0	0.5282	0	0	0	0		
2006	1	2	0	0	34	40	40	7	0	0	0	0
	0	0.1434	0	0.0526	0.2714	0	0.4197	0.1129	0	0		
2006	1	2	0	0	34	41	41	7	0	0	0	0
	0	0.6224	0	0	0.1142	0	0.2635	0	0	0		
2006	1	2	0	0	34	42	42	6	0	0	0	0
	0	0.0794	0.4332	0.2901	0.0754	0	0	0	0	0.1219		
2006	1	2	0	0	34	44	44	1	0	0	0	0
	0	1	0	0	0	0	0	0	0	0		
2006	1	2	0	0	34	45	45	2	0	0	0	0
	0	0	0	0	0.4207	0	0	0	0.5793	0		
2006	1	2	0	0	34	46	46	2	0	0	0	0
	0	0	0	0	0	0	0	1	0	0		
2006	1	2	0	0	34	47	47	1	0	0	0	0
	0	0	0	0	0	0	0	1	0	0		
2006	1	2	0	0	34	51	51	1	0	0	0	0
	0	0	0	1	0	0	0	0	0	0		
2007	1	2	0	0	35	1	1	2	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
2007	1	2	0	0	35	15	15	1	0	0	1	0
	0	0	0	0	0	0	0	0	0	0		
2007	1	2	0	0	35	16	16	2	0.8893	0	0.1107	0
	0	0	0	0	0	0	0	0	0	0		
2007	1	2	0	0	35	19	19	1	0	0	1	0
	0	0	0	0	0	0	0	0	0	0		
2007	1	2	0	0	35	20	20	1	0	0	0	0
	0	0	1	0	0	0	0	0	0	0		
2007	1	2	0	0	35	21	21	4	0	0.2041	0.7959	0
	0	0	0	0	0	0	0	0	0	0		

2007	1	2	0	0	35	22	22	7	0	0	0.2574	0
	0	0.1044	0.6381	0	0	0	0	0	0	0		
2007	1	2	0	0	35	23	23	13	0	0	0.5275	0
	0	0	0.4348	0.0376	0	0	0	0	0	0		
2007	1	2	0	0	35	24	24	15	0	0	0.3889	0.0484
	0.1108	0.0336	0.326	0.0557	0.0367	0	0	0	0	0		
2007	1	2	0	0	35	25	25	19	0	0	0.2279	0.036
	0.114	0	0.4652	0.1152	0.0198	0.0218	0	0	0	0		
2007	1	2	0	0	35	26	26	24	0	0	0.1179	0.0172
	0.1106	0.0208	0.6283	0.0892	0.016	0	0	0	0	0		
2007	1	2	0	0	35	27	27	26	0	0	0.0674	0
	0.0573	0.0861	0.6751	0.0987	0	0	0	0.0154	0	0		
2007	1	2	0	0	35	28	28	29	0	0	0.0323	0.0131
	0.0343	0.0285	0.624	0.1946	0.0137	0.0318	0.0276	0	0	0		
2007	1	2	0	0	35	29	29	30	0	0	0.0007	0.0293
	0.0843	0.0338	0.6401	0.115	0.0174	0.0329	0.0305	0.0024	0.0136	0		
2007	1	2	0	0	35	30	30	33	0	0	0	0.0026
	0.0276	0.0167	0.7084	0.121	0.0234	0.0148	0.0267	0.0384	0.0205	0		
2007	1	2	0	0	35	31	31	31	0	0	0.0015	0.0432
	0.0283	0.0115	0.5761	0.0849	0.0232	0.1112	0.0446	0.0094	0.0662	0		
2007	1	2	0	0	35	32	32	23	0	0	0	0.0003
	0.1689	0.0326	0.4976	0.0629	0	0.0456	0.0789	0.04	0.0732	0		
2007	1	2	0	0	35	33	33	23	0	0	0	0
	0.0883	0.0797	0.4269	0.1145	0.1233	0.1667	0.0008	0	0	0		
2007	1	2	0	0	35	34	34	17	0	0	0	0.0081
	0.0623	0	0.4576	0.1547	0.0004	0.1711	0.1459	0	0	0		
2007	1	2	0	0	35	35	35	21	0	0	0	0
	0.0629	0.014	0.4663	0.2737	0.0113	0.0638	0	0.0574	0.0506	0		
2007	1	2	0	0	35	36	36	10	0	0	0	0
	0	0	0.1413	0.1067	0.1549	0.0113	0.2437	0.1865	0.1557	0		
2007	1	2	0	0	35	37	37	12	0	0	0	0
	0	0.1696	0.6031	0.1897	0.0365	0.0011	0	0	0	0		
2007	1	2	0	0	35	38	38	9	0	0	0	0.0078
	0	0.0435	0.4561	0.0715	0.3395	0.0023	0	0.0715	0.0078	0		
2007	1	2	0	0	35	39	39	12	0	0	0	0
	0	0.0024	0.386	0.186	0.0735	0.194	0.1581	0	0	0		
2007	1	2	0	0	35	40	40	8	0	0	0	0
	0.0529	0	0.492	0.0312	0.4212	0.0028	0	0	0	0		
2007	1	2	0	0	35	41	41	6	0	0	0	0
	0	0	0.1384	0.0094	0	0	0.4509	0.2629	0.1384	0		
2007	1	2	0	0	35	42	42	2	0	0	0	0
	0	0	0.1098	0.1098	0.7804	0	0	0	0	0		
2007	1	2	0	0	35	43	43	4	0	0	0	0
	0	0	0.2583	0.5772	0.1631	0.0014	0	0	0	0		
2007	1	2	0	0	35	44	44	2	0	0	0	0
	0	0	1	0	0	0	0	0	0	0		
2007	1	2	0	0	35	45	45	3	0	0	0	0
	0	0	0.433	0.567	0	0	0	0	0	0		
2007	1	2	0	0	35	46	46	2	0	0	0	0
	0	0	0.0508	0.9492	0	0	0	0	0	0		
2007	1	2	0	0	35	47	47	2	0	0	0	0
	0	0	0	0	1	0	0	0	0	0		
2007	1	2	0	0	35	49	49	3	0	0	0	0
	0	0	0.0167	0.9333	0	0	0	0.05	0	0		
2007	1	2	0	0	35	50	50	1	0	0	0	0
	0	0	0	0	1	0	0	0	0	0		
2007	1	2	0	0	35	51	51	2	0	0	0	0
	0	0	0	0	0	0.0169	0.9831	0	0	0		
2008	1	2	0	0	36	4	4	1	1.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
2008	1	2	0	0	36	5	5	1	1.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
2008	1	2	0	0	36	6	6	1	1.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
2008	1	2	0	0	36	7	7	1	1.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		

2008	1	2	0	0	36	8	8	2	1.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
2008	1	2	0	0	36	9	9	2	1.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
2008	1	2	0	0	36	10	10	2	1.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
2008	1	2	0	0	36	11	11	1	1.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
2008	1	2	0	0	36	12	12	4	1.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
2008	1	2	0	0	36	13	13	6	0.8931	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.1069	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
2008	1	2	0	0	36	14	14	7	0.9677	0.0323	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
2008	1	2	0	0	36	15	15	7	1.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
2008	1	2	0	0	36	16	16	8	0.9017	0.0983	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
2008	1	2	0	0	36	17	17	7	0.7143	0.2857	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
2008	1	2	0	0	36	18	18	7	0.3519	0.6481	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
2008	1	2	0	0	36	19	19	8	0.2394	0.7606	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
2008	1	2	0	0	36	20	20	12	0.0830	0.8471	0.0698	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
2008	1	2	0	0	36	21	21	7	0.0352	0.9293	0.0000	0.0355
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
2008	1	2	0	0	36	22	22	12	0.0301	0.5732	0.0172	0.0372
	0.0000	0.0000	0.0000	0.2301	0.1121	0.0000	0.0000	0.0000	0.0000	0.0000		
2008	1	2	0	0	36	23	23	11	0.0000	0.7105	0.0975	0.0365
	0.0000	0.0680	0.0000	0.0876	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
2008	1	2	0	0	36	24	24	20	0.0000	0.2117	0.0407	0.2492
	0.0154	0.0734	0.0132	0.2951	0.0747	0.0000	0.0266	0.0000	0.0000	0.0000		
2008	1	2	0	0	36	25	25	27	0.0000	0.0211	0.0185	0.2026
	0.0000	0.0901	0.0987	0.3977	0.1272	0.0000	0.0000	0.0440	0.0000	0.0000		
2008	1	2	0	0	36	26	26	36	0.0000	0.0011	0.0441	0.2212
	0.0074	0.0061	0.0649	0.5547	0.0459	0.0001	0.0175	0.0000	0.0000	0.0371		
2008	1	2	0	0	36	27	27	41	0.0000	0.0236	0.0022	0.1057
	0.0157	0.0189	0.0793	0.5572	0.1175	0.0093	0.0000	0.0122	0.0123	0.0462		
2008	1	2	0	0	36	28	28	42	0.0000	0.0000	0.0037	0.1384
	0.0000	0.0625	0.0301	0.6551	0.0770	0.0128	0.0031	0.0000	0.0087	0.0085		
2008	1	2	0	0	36	29	29	40	0.0000	0.0014	0.0092	0.1455
	0.0000	0.0287	0.0288	0.5657	0.1130	0.0462	0.0118	0.0496	0.0000	0.0000		
2008	1	2	0	0	36	30	30	45	0.0000	0.0007	0.0019	0.0735
	0.0359	0.0374	0.0197	0.6579	0.0748	0.0225	0.0427	0.0168	0.0074	0.0089		
2008	1	2	0	0	36	31	31	40	0.0000	0.0000	0.0140	0.0665
	0.0000	0.0355	0.0144	0.6187	0.1062	0.0573	0.0479	0.0165	0.0000	0.0231		
2008	1	2	0	0	36	32	32	42	0.0000	0.0109	0.0069	0.0069
	0.0123	0.0327	0.0327	0.6637	0.1101	0.0221	0.0184	0.0260	0.0073	0.0498		
2008	1	2	0	0	36	33	33	34	0.0000	0.0000	0.0000	0.0005
	0.0000	0.0350	0.0028	0.6804	0.1380	0.0377	0.0330	0.0324	0.0403	0.0000		
2008	1	2	0	0	36	34	34	29	0.0000	0.0000	0.0008	0.0495
	0.0075	0.0519	0.0497	0.4746	0.0698	0.1864	0.0389	0.0564	0.0146	0.0000		
2008	1	2	0	0	36	35	35	21	0.0000	0.0000	0.0111	0.0410
	0.0000	0.0559	0.0446	0.4459	0.0866	0.0169	0.0930	0.0545	0.0960	0.0545		
2008	1	2	0	0	36	36	36	22	0.0000	0.0000	0.0000	0.0113
	0.0000	0.0000	0.0001	0.6357	0.1916	0.0240	0.0000	0.0708	0.0000	0.0665		
2008	1	2	0	0	36	37	37	13	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0172	0.0000	0.8737	0.0004	0.0612	0.0000	0.0474	0.0000	0.0000		
2008	1	2	0	0	36	38	38	17	0.0000	0.0000	0.0000	0.0426
	0.0000	0.1265	0.0000	0.5277	0.0335	0.1403	0.0165	0.0740	0.0000	0.0388		
2008	1	2	0	0	36	39	39	7	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.8762	0.0000	0.0307	0.0000	0.0005	0.0927	0.0000		
2008	1	2	0	0	36	40	40	8	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.8999	0.0672	0.0329	0.0000	0.0000	0.0000	0.0000		

2008	1	2	0	0	36	41	41	3	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.2354	0.7646	0.0000	0.0000	0.0000	0.0000	0.0000		
2008	1	2	0	0	36	42	42	7	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0822	0.5378	0.2317	0.1469	0.0014	0.0000	0.0000		
2008	1	2	0	0	36	43	43	3	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.9938	0.0000	0.0062	0.0000	0.0000	0.0000	0.0000		
2008	1	2	0	0	36	44	44	1	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
2008	1	2	0	0	36	45	45	2	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000		
2008	1	2	0	0	36	48	48	1	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000		
2009	1	2	0	0	37	13	13	1	0.0000	1.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
2009	1	2	0	0	37	15	15	3	0.8084	0.1916	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
2009	1	2	0	0	37	16	16	2	0.0000	1.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
2009	1	2	0	0	37	17	17	4	0.0000	1.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
2009	1	2	0	0	37	18	18	6	0.0000	0.2804	0.7196	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
2009	1	2	0	0	37	19	19	6	0.0000	0.4542	0.5458	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
2009	1	2	0	0	37	20	20	5	0.0000	0.1915	0.8085	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
2009	1	2	0	0	37	21	21	10	0.0000	0.2124	0.6794	0.1074
	0.0007	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
2009	1	2	0	0	37	22	22	8	0.0442	0.1074	0.7137	0.0000
	0.0000	0.1347	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
2009	1	2	0	0	37	23	23	13	0.0000	0.0524	0.7206	0.0205
	0.1198	0.0000	0.0000	0.0000	0.0868	0.0000	0.0000	0.0000	0.0000	0.0000		
2009	1	2	0	0	37	24	24	17	0.0000	0.0158	0.6412	0.0578
	0.1821	0.0008	0.0000	0.0000	0.1023	0.0000	0.0000	0.0000	0.0000	0.0000		
2009	1	2	0	0	37	25	25	19	0.0000	0.0034	0.4794	0.0829
	0.1117	0.0800	0.0000	0.0000	0.1622	0.0804	0.0000	0.0000	0.0000	0.0000		
2009	1	2	0	0	37	26	26	21	0.0000	0.0054	0.4580	0.0296
	0.1271	0.0002	0.0001	0.0288	0.3500	0.0000	0.0007	0.0000	0.0000	0.0000		
2009	1	2	0	0	37	27	27	24	0.0000	0.0039	0.2390	0.0472
	0.2612	0.0799	0.0009	0.0616	0.2721	0.0230	0.0112	0.0000	0.0000	0.0000		
2009	1	2	0	0	37	28	28	22	0.0000	0.0000	0.1993	0.0909
	0.1837	0.0582	0.0768	0.0015	0.2896	0.0923	0.0002	0.0062	0.0012	0.0000		
2009	1	2	0	0	37	29	29	25	0.0000	0.0000	0.0555	0.1607
	0.3330	0.0457	0.0164	0.0380	0.2772	0.0668	0.0014	0.0005	0.0008	0.0040		
2009	1	2	0	0	37	30	30	21	0.0000	0.0061	0.0050	0.0155
	0.4487	0.0016	0.0370	0.0446	0.4105	0.0049	0.0225	0.0007	0.0000	0.0030		
2009	1	2	0	0	37	31	31	24	0.0000	0.0242	0.0036	0.1180
	0.3978	0.0302	0.0073	0.0968	0.2740	0.0235	0.0184	0.0027	0.0035	0.0000		
2009	1	2	0	0	37	32	32	21	0.0000	0.0000	0.0055	0.0690
	0.2000	0.0082	0.0028	0.0114	0.5435	0.1552	0.0011	0.0016	0.0017	0.0000		
2009	1	2	0	0	37	33	33	22	0.0000	0.0000	0.0010	0.1172
	0.1231	0.0000	0.1789	0.0643	0.2908	0.2153	0.0026	0.0019	0.0047	0.0003		
2009	1	2	0	0	37	34	34	21	0.0000	0.0000	0.0000	0.0300
	0.2276	0.0000	0.0180	0.0301	0.5227	0.1150	0.0545	0.0015	0.0000	0.0006		
2009	1	2	0	0	37	35	35	16	0.0000	0.0000	0.0000	0.0000
	0.0253	0.0000	0.0058	0.0045	0.5199	0.3261	0.0403	0.0547	0.0000	0.0235		
2009	1	2	0	0	37	36	36	12	0.0000	0.0000	0.0000	0.0000
	0.0123	0.0000	0.0341	0.0000	0.2096	0.7050	0.0000	0.0341	0.0000	0.0048		
2009	1	2	0	0	37	37	37	11	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0177	0.0000	0.0863	0.1428	0.3759	0.0028	0.0070	0.3044	0.0633		
2009	1	2	0	0	37	38	38	5	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.4345	0.0000	0.5655	0.0000	0.0000	0.0000		
2009	1	2	0	0	37	39	39	4	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.9736	0.0000	0.0264	0.0000	0.0000	0.0000		
2009	1	2	0	0	37	40	40	5	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.9698	0.0000	0.0083	0.0000	0.0071	0.0148	0.0000		

2009	1	2	0	0	37	41	41	2	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.1587	0.6826	0.0000	0.0000	0.0000	0.0000	0.1587		
2009	1	2	0	0	37	43	43	2	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000		
2009	1	2	0	0	37	45	45	1	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000		

Ghost marginals for Canadian fishery

1977	1	2	0	0	5	1	51	-1	0.0021	0.0021	0.0516	0.0186
	0.0619	0.3773	0.1093	0.1031	0.0866	0.0825	0.0722	0.033	0	0		
1978	1	2	0	0	6	1	51	-1	0	0	0.0339	0.0593
	0.0475	0.1797	0.222	0.1898	0.1051	0.0814	0.0356	0.0305	0.0153	0		
1979	1	2	0	0	7	1	51	-1	0	0	0.0188	0.0554
	0.1162	0.1019	0.1877	0.2699	0.0983	0.0706	0.0331	0.0223	0.0152	0.0107		
1980	1	2	0	0	8	1	51	-1	0	0	0	0.0311
	0.0411	0.1629	0.0609	0.0782	0.4464	0.0841	0.0411	0.0411	0.0133	0		
1981	1	2	0	0	9	1	51	-1	0	0	0.0488	0.0131
	0.0682	0.0667	0.207	0.0411	0.1141	0.2988	0.0721	0.029	0.0411	0		
1982	1	2	0	0	10	1	51	-1	0	0	0.0221	0.4268
	0.0352	0.046	0.0451	0.141	0.032	0.0249	0.1931	0.0189	0.015	0		
1983	1	2	0	0	11	1	51	-1	0.0009	0.218	0.016	0.028
	0.4999	0.0201	0.0291	0.026	0.0869	0.012	0.004	0.053	0.004	0.002		
1984	1	2	0	0	12	1	51	-1	0	0.018	0.215	0.028
	0.15	0.338	0.0331	0.0381	0.025	0.0779	0.0151	0.013	0.0429	0.006		
1985	1	2	0	0	13	1	51	-1	0.002	0.002	0.0808	0.2648
	0.0544	0.1072	0.3173	0.0162	0.0181	0.0181	0.0544	0.0122	0	0.0524		
1986	1	2	0	0	14	1	51	-1	0.0021	0.0021	0.0043	0.0608
	0.5878	0.0369	0.0369	0.1757	0.0196	0.0087	0.0152	0.0217	0.0066	0.0217		
1987	1	2	0	0	15	1	51	-1	0	0.0094	0.0063	0.0016
	0.0268	0.7414	0.03	0.03	0.1088	0.0063	0.0047	0.0126	0.0094	0.0126		
1988	1	2	0	0	16	1	51	-1	0	0.0023	0.106	0.0033
	0.0075	0.0148	0.6643	0.0161	0.0173	0.13	0.0035	0.007	0.0036	0.0247		
1989	1	2	0	0	17	1	51	-1	0	0.0013	0.0023	0.3852
	0.0008	0.0029	0.0042	0.5181	0.0083	0.014	0.0533	0.0018	0.0018	0.0061		
1990	1	2	0	0	18	1	51	-1	0	0.1036	0.0262	0.001
	0.4077	0.0145	0.0023	0	0.3852	0.0064	0	0.0473	0.0005	0.0054		
1991	1	2	0	0	19	1	51	-1	0	0.0013	0.0485	0.0212
	0.0026	0.5343	0.0036	0	0.0005	0.3715	0.0018	0	0.014	0.0007		
1992	1	2	0	0	20	1	51	-1	0	0.0052	0.064	0.157
	0.0305	0.0036	0.4791	0.0027	0	0.0009	0.2443	0.0014	0.0008	0.0105		
1993	1	2	0	0	21	1	51	-1	0.0006	0.0092	0.0234	0.1475
	0.2018	0.0179	0.0028	0.4509	0.0026	0	0	0.1417	0.0012	0.0005		
1994	1	2	0	0	22	1	51	-1	0	0.0045	0.0196	0.0199
	0.1063	0.1723	0.0269	0.0068	0.4704	0.0062	0.0023	0	0.1563	0.0085		
1995	1	2	0	0	23	1	51	-1	0.0215	0.0058	0.076	0.059
	0.0347	0.113	0.1659	0.0388	0.0079	0.3592	0.0082	0.0009	0	0.1093		
1996	1	2	0	0	24	1	51	-1	0.0869	0.0229	0.0099	0.0998
	0.1252	0.0334	0.1152	0.1381	0.0209	0.0091	0.2667	0.0005	0	0.0716		
1997	1	2	0	0	25	1	51	-1	0.0021	0.1134	0.1276	0.0455
	0.1611	0.1472	0.0575	0.0668	0.1049	0.0462	0.002	0.0739	0.0296	0.0223		
1998	1	2	0	0	26	1	51	-1	0.0021	0.1	0.2356	0.254
	0.0183	0.1014	0.1035	0.0143	0.0455	0.0553	0.0088	0.0011	0.0501	0.0099		
1999	1	2	0	0	27	1	51	-1	0.0903	0.0481	0.1228	0.2775
	0.2013	0.0249	0.0605	0.0569	0.0181	0.0257	0.0266	0.0096	0.0045	0.0335		
2000	1	2	0	0	28	1	51	-1	0.0017	0.2365	0.052	0.0591
	0.2582	0.1253	0.0204	0.0677	0.0319	0.0241	0.0427	0.0365	0.007	0.0369		
2001	1	2	0	0	29	1	51	-1	0.0003	0.0219	0.1964	0.0652
	0.1113	0.2588	0.1308	0.0307	0.0385	0.0507	0.0158	0.0274	0.024	0.0281		
2002	1	2	0	0	30	1	51	-1	0	0.01	0.0861	0.2747
	0.0865	0.0936	0.2133	0.1107	0.022	0.0229	0.0313	0.0054	0.0149	0.0286		
2003	1	2	0	0	31	1	51	-1	0	0.0043	0.3594	0.2008
	0.0747	0.1233	0.0639	0.0796	0.0473	0.0201	0.0061	0.0121	0.0019	0.0064		
2004	1	2	0	0	32	1	51	-1	0.001	0.0158	0.0212	0.5955
	0.1444	0.041	0.0679	0.0432	0.0296	0.0223	0.0068	0.0034	0.0047	0.0034		
2005	1	2	0	0	33	1	51	-1	0	0.0017	0.0207	0.0347
	0.6585	0.1288	0.0224	0.0512	0.0397	0.0229	0.0116	0.0046	0	0.0032		
2006	1	2	0	0	34	1	51	-1	0.0008	0.0066	0.0067	0.0502
	0.0335	0.6619	0.0892	0.04	0.0395	0.0299	0.0234	0.0098	0.0039	0.0046		

2007	1	2	0	0	35	1	51	-1	0.0016	0.0013	0.067	0.016
	0.0645	0.0332	0.5785	0.1178	0.0247	0.0377	0.0274	0.0131	0.0174	0		
2008	1	2	0	0	36	1	51	-1	0.0734	0.0814	0.0110	0.0848
	0.0076	0.0333	0.0287	0.5046	0.0850	0.0289	0.0189	0.0189	0.0078	0.0156		
###												
# Need to update to final 2009 Canadian												
2009	1	2	0	0	37	1	51	-1	0.0034	0.0481	0.1932	0.0701
	0.2071	0.0246	0.0283	0.0373	0.2813	0.0827	0.0107	0.0034	0.0055	0.0044		
# Acoustic survey												
1977	1	3	0	0	5	7	7	1	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
1977	1	3	0	0	5	9	9	1	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
1977	1	3	0	0	5	10	10	1	0.6667	0.3333	0	0
	0	0	0	0	0	0	0	0	0	0		
1977	1	3	0	0	5	11	11	1	0.5714	0.4286	0	0
	0	0	0	0	0	0	0	0	0	0		
1977	1	3	0	0	5	12	12	2	0.9286	0.0714	0	0
	0	0	0	0	0	0	0	0	0	0		
1977	1	3	0	0	5	13	13	3	0.8571	0.1429	0	0
	0	0	0	0	0	0	0	0	0	0		
1977	1	3	0	0	5	14	14	4	0.8293	0.1707	0	0
	0	0	0	0	0	0	0	0	0	0		
1977	1	3	0	0	5	15	15	3	0.8	0.2	0	0
	0	0	0	0	0	0	0	0	0	0		
1977	1	3	0	0	5	16	16	9	0.6724	0.2414	0.0862	0
	0	0	0	0	0	0	0	0	0	0		
1977	1	3	0	0	5	17	17	14	0.6825	0.2063	0.0952	0
	0	0.0159	0	0	0	0	0	0	0	0		
1977	1	3	0	0	5	18	18	16	0.6061	0.303	0.0909	0
	0	0	0	0	0	0	0	0	0	0		
1977	1	3	0	0	5	19	19	14	0.5352	0.2958	0.169	0
	0	0	0	0	0	0	0	0	0	0		
1977	1	3	0	0	5	20	20	17	0.5	0.2639	0.2222	0.0139
	0	0	0	0	0	0	0	0	0	0		
1977	1	3	0	0	5	21	21	20	0.2568	0.3108	0.4189	0.0135
	0	0	0	0	0	0	0	0	0	0		
1977	1	3	0	0	5	22	22	22	0.1	0.2231	0.6154	0.0462
	0.0077	0	0.0077	0	0	0	0	0	0	0		
1977	1	3	0	0	5	23	23	24	0.027	0.1689	0.7297	0.0473
	0.0203	0.0068	0	0	0	0	0	0	0	0		
1977	1	3	0	0	5	24	24	29	0	0.161	0.7561	0.0341
	0.0098	0.039	0	0	0	0	0	0	0	0		
1977	1	3	0	0	5	25	25	34	0	0.0625	0.825	0.05
	0.0125	0.0458	0.0042	0	0	0	0	0	0	0		
1977	1	3	0	0	5	26	26	40	0	0.0319	0.7211	0.0558
	0.0438	0.1394	0.004	0	0	0.004	0	0	0	0		
1977	1	3	0	0	5	27	27	41	0.0032	0.0354	0.5498	0.045
	0.0611	0.2958	0.0032	0	0.0032	0.0032	0	0	0	0		
1977	1	3	0	0	5	28	28	45	0	0.0023	0.3151	0.0708
	0.0913	0.4772	0.032	0.0114	0	0	0	0	0	0		
1977	1	3	0	0	5	29	29	48	0	0	0.1947	0.0302
	0.0851	0.6314	0.0416	0.0113	0.0019	0.0038	0	0	0	0		
1977	1	3	0	0	5	30	30	48	0	0.0017	0.1224	0.0448
	0.0914	0.6552	0.0552	0.0121	0.0086	0.0017	0.0069	0	0	0		
1977	1	3	0	0	5	31	31	45	0	0	0.0692	0.0242
	0.0725	0.6892	0.0918	0.0258	0.0209	0.0032	0.0032	0	0	0		
1977	1	3	0	0	5	32	32	47	0	0	0.0292	0.0117
	0.0585	0.6433	0.1248	0.0663	0.0409	0.0136	0.0097	0	0.0019	0		
1977	1	3	0	0	5	33	33	46	0	0	0.0139	0.0046
	0.0464	0.5592	0.1601	0.1044	0.0696	0.0302	0.007	0.0046	0	0		
1977	1	3	0	0	5	34	34	44	0	0	0.0259	0.0162
	0.0356	0.466	0.165	0.11	0.0777	0.0777	0.0227	0	0.0032	0		
1977	1	3	0	0	5	35	35	40	0	0	0.0042	0.0084
	0.0084	0.479	0.1555	0.1345	0.1134	0.0378	0.0378	0.0168	0.0042	0		
1977	1	3	0	0	5	36	36	38	0	0	0	0
	0.0291	0.3372	0.1686	0.186	0.1395	0.0756	0.0233	0.0407	0	0		

1977	1	3	0	0	5	37	37	31	0	0	0	0
	0.0216	0.3309	0.1439	0.223	0.1007	0.1079	0.0576	0.0144	0	0		
1977	1	3	0	0	5	38	38	33	0	0	0	0.007
	0	0.2183	0.1972	0.1761	0.169	0.0986	0.0915	0.0352	0.007	0		
1977	1	3	0	0	5	39	39	27	0	0	0	0
	0.0263	0.2237	0.1447	0.1711	0.2237	0.0789	0.0789	0.0263	0.0263	0		
1977	1	3	0	0	5	40	40	19	0	0	0.0182	0
	0	0.1455	0.0909	0.1636	0.2364	0.1636	0.0909	0.0364	0.0364	0.0182		
1977	1	3	0	0	5	41	41	18	0	0	0	0
	0.02	0.2	0.14	0.16	0.22	0.14	0.04	0.06	0.02	0		
1977	1	3	0	0	5	42	42	16	0	0	0	0
	0	0.1026	0.1282	0.2051	0.0513	0.2308	0.1538	0.1282	0	0		
1977	1	3	0	0	5	43	43	11	0	0	0	0
	0.0278	0.0556	0.1389	0.1111	0.1944	0.1944	0.1944	0.0278	0.0278	0.0278		
1977	1	3	0	0	5	44	44	11	0	0	0	0
	0	0.1379	0.1724	0.3103	0.2069	0.1034	0.069	0	0	0		
1977	1	3	0	0	5	45	45	10	0	0	0	0
	0	0	0.0476	0.3333	0.2381	0.1429	0.0952	0.0476	0	0.0952		
1977	1	3	0	0	5	46	46	8	0	0	0	0
	0	0.2778	0.1111	0.1111	0.1667	0.1667	0.0556	0.0556	0.0556	0		
1977	1	3	0	0	5	47	47	8	0	0	0	0
	0	0.1	0	0	0.1	0.6	0.1	0	0	0.1		
1977	1	3	0	0	5	48	48	8	0	0	0	0
	0	0	0.1111	0.3333	0.2222	0.1111	0.1111	0.1111	0	0		
1977	1	3	0	0	5	49	49	7	0	0	0	0
	0	0.125	0.125	0.125	0	0	0.25	0.25	0	0.125		
1977	1	3	0	0	5	50	50	4	0	0	0	0
	0	0	0	0.5	0.1667	0.3333	0	0	0	0		
1977	1	3	0	0	5	51	51	7	0	0	0.0909	0
	0	0.1818	0	0.0909	0	0.0909	0.0909	0	0.0909	0.3636		
1980	1	3	0	0	8	10	10	1	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
1980	1	3	0	0	8	15	15	4	0	1	0	0
	0	0	0	0	0	0	0	0	0	0		
1980	1	3	0	0	8	16	16	7	0	1	0	0
	0	0	0	0	0	0	0	0	0	0		
1980	1	3	0	0	8	17	17	9	0.0208	0.9375	0.0417	0
	0	0	0	0	0	0	0	0	0	0		
1980	1	3	0	0	8	18	18	10	0.0154	0.9538	0.0308	0
	0	0	0	0	0	0	0	0	0	0		
1980	1	3	0	0	8	19	19	12	0.0112	0.9438	0.0449	0
	0	0	0	0	0	0	0	0	0	0		
1980	1	3	0	0	8	20	20	10	0	0.933	0.067	0
	0	0	0	0	0	0	0	0	0	0		
1980	1	3	0	0	8	21	21	12	0	0.9263	0.0684	0.0053
	0	0	0	0	0	0	0	0	0	0		
1980	1	3	0	0	8	22	22	11	0	0.8611	0.1319	0.0069
	0	0	0	0	0	0	0	0	0	0		
1980	1	3	0	0	8	23	23	10	0	0.7037	0.2963	0
	0	0	0	0	0	0	0	0	0	0		
1980	1	3	0	0	8	24	24	12	0	0.5588	0.3235	0
	0.0294	0.0882	0	0	0	0	0	0	0	0		
1980	1	3	0	0	8	25	25	13	0	0.2222	0.2222	0.2778
	0.1111	0.1667	0	0	0	0	0	0	0	0		
1980	1	3	0	0	8	26	26	16	0	0.087	0.087	0.3043
	0.2174	0.1304	0.1304	0	0.0435	0	0	0	0	0		
1980	1	3	0	0	8	27	27	18	0	0.0182	0.0545	0.3455
	0.1636	0.2727	0.0182	0.1091	0.0182	0	0	0	0	0		
1980	1	3	0	0	8	28	28	19	0	0	0	0.2533
	0.16	0.3867	0.12	0.0533	0.0267	0	0	0	0	0		
1980	1	3	0	0	8	29	29	21	0	0	0	0.1801
	0.1491	0.3665	0.0932	0.1801	0.0311	0	0	0	0	0		
1980	1	3	0	0	8	30	30	24	0	0	0.0044	0.136
	0.1316	0.4211	0.1272	0.1404	0.0263	0.0088	0	0.0044	0	0		
1980	1	3	0	0	8	31	31	22	0	0	0	0.0625
	0.0586	0.4297	0.1133	0.2539	0.0625	0.0156	0	0.0039	0	0		

1980	1	3	0	0	8	32	32	22	0	0	0	0.0404
	0.0448	0.3812	0.0807	0.3229	0.0762	0.0448	0.0045	0.0045	0	0		
1980	1	3	0	0	8	33	33	21	0	0	0	0.0264
	0.0529	0.3744	0.0529	0.304	0.1322	0.0396	0.0132	0	0	0.0044		
1980	1	3	0	0	8	34	34	19	0	0	0	0.0226
	0.0056	0.3051	0.1412	0.3164	0.0904	0.0791	0.0113	0.0169	0.0056	0.0056		
1980	1	3	0	0	8	35	35	18	0	0	0	0.0075
	0.0373	0.2761	0.0672	0.2985	0.194	0.0821	0.0224	0.0075	0	0.0075		
1980	1	3	0	0	8	36	36	17	0	0	0	0.0099
	0.0198	0.2376	0.099	0.3069	0.1683	0.0891	0.0396	0.0297	0	0		
1980	1	3	0	0	8	37	37	19	0	0.0137	0	0.0137
	0.0274	0.1507	0.0274	0.3151	0.2329	0.0822	0.0548	0.0411	0.0411	0		
1980	1	3	0	0	8	38	38	16	0	0	0	0
	0	0.2	0.08	0.3	0.16	0.22	0.02	0.02	0	0		
1980	1	3	0	0	8	39	39	11	0	0	0	0
	0	0.0938	0.0625	0.2188	0.3438	0.25	0.0313	0	0	0		
1980	1	3	0	0	8	40	40	14	0	0	0	0
	0.0455	0.0909	0.0455	0.2273	0.2273	0.2273	0.0455	0.0455	0	0.0455		
1980	1	3	0	0	8	41	41	7	0	0	0	0.0588
	0	0.0588	0.0588	0.2941	0.1176	0.2941	0.1176	0	0	0		
1980	1	3	0	0	8	42	42	4	0	0	0	0
	0	0	0	0.1818	0.1818	0.3636	0.0909	0.0909	0.0909	0		
1980	1	3	0	0	8	43	43	3	0	0	0	0
	0	0	0	0	0.5	0.25	0	0.25	0	0		
1980	1	3	0	0	8	44	44	2	0	0	0	0
	0	0	0	0	0	0.4	0.4	0.2	0	0		
1980	1	3	0	0	8	45	45	2	0	0	0	0
	0	0	0	0	0.2857	0.5714	0.1429	0	0	0		
1980	1	3	0	0	8	46	46	3	0	0	0	0
	0	0	0	0	0.3333	0.3333	0	0	0	0.3333		
1980	1	3	0	0	8	47	47	2	0	0	0	0
	0	0	0	0	1	0	0	0	0	0		
1980	1	3	0	0	8	48	48	2	0	0	0	0
	0	0	0	0	0	0.5	0	0.5	0	0		
1980	1	3	0	0	8	49	49	4	0	0	0	0
	0	0	0	0.1429	0.2857	0	0.2857	0.2857	0	0		
1980	1	3	0	0	8	50	50	3	0	0	0	0
	0	0	0	0.3333	0.3333	0	0	0.3333	0	0		
1980	1	3	0	0	8	51	51	3	0	0	0	0
	0	0	0	0	0	0.25	0	0.25	0.25	0.25		
1983	1	3	0	0	11	14	14	2	0	1	0	0
	0	0	0	0	0	0	0	0	0	0		
1983	1	3	0	0	11	15	15	4	0.0588	0.9412	0	0
	0	0	0	0	0	0	0	0	0	0		
1983	1	3	0	0	11	16	16	3	0.0313	0.9688	0	0
	0	0	0	0	0	0	0	0	0	0		
1983	1	3	0	0	11	17	17	5	0.0164	0.9836	0	0
	0	0	0	0	0	0	0	0	0	0		
1983	1	3	0	0	11	18	18	7	0	0.9733	0.0133	0
	0.0133	0	0	0	0	0	0	0	0	0		
1983	1	3	0	0	11	19	19	8	0	1	0	0
	0	0	0	0	0	0	0	0	0	0		
1983	1	3	0	0	11	20	20	9	0	0.9811	0.0189	0
	0	0	0	0	0	0	0	0	0	0		
1983	1	3	0	0	11	21	21	13	0	0.963	0.0123	0.0247
	0	0	0	0	0	0	0	0	0	0		
1983	1	3	0	0	11	22	22	11	0	1	0	0
	0	0	0	0	0	0	0	0	0	0		
1983	1	3	0	0	11	23	23	11	0	0.9032	0.0645	0.0323
	0	0	0	0	0	0	0	0	0	0		
1983	1	3	0	0	11	24	24	9	0	0.8077	0.0962	0.0385
	0.0577	0	0	0	0	0	0	0	0	0		
1983	1	3	0	0	11	25	25	13	0	0.4906	0.0566	0.0566
	0.3585	0.0377	0	0	0	0	0	0	0	0		
1983	1	3	0	0	11	26	26	12	0	0.2759	0.069	0.0517
	0.5517	0.0345	0.0172	0	0	0	0	0	0	0		

1983	1	3	0	0	11	27	27	13	0	0.0725	0.0435	0.0435
	0.7971	0.0145	0.0145	0	0.0145	0	0	0	0	0		
1983	1	3	0	0	11	28	28	12	0	0.0319	0.0213	0.0319
	0.7872	0.0638	0.0319	0.0106	0.0213	0	0	0	0	0		
1983	1	3	0	0	11	29	29	13	0	0	0.0106	0.0426
	0.8191	0.0638	0.0319	0.0213	0	0	0.0106	0	0	0		
1983	1	3	0	0	11	30	30	12	0	0	0.0122	0.0244
	0.7439	0.0854	0.061	0.0244	0.0488	0	0	0	0	0		
1983	1	3	0	0	11	31	31	12	0	0	0	0.0141
	0.6056	0.0282	0.0704	0.0845	0.1127	0.0423	0.0423	0	0	0		
1983	1	3	0	0	11	32	32	11	0	0	0	0
	0.5818	0.0909	0.1091	0.0727	0.0727	0.0364	0.0182	0.0182	0	0		
1983	1	3	0	0	11	33	33	10	0	0	0	0
	0.3922	0.0784	0.0784	0.1176	0.2157	0.0392	0.0784	0	0	0		
1983	1	3	0	0	11	34	34	9	0	0	0	0
	0.2273	0.0227	0.1136	0.1364	0.2273	0.0909	0.0455	0.1136	0.0227	0		
1983	1	3	0	0	11	35	35	8	0	0	0	0
	0.1333	0.0333	0.2333	0.2	0.2667	0.1	0.0333	0	0	0		
1983	1	3	0	0	11	36	36	6	0	0	0	0
	0.0588	0.0588	0.1176	0.1176	0.2353	0.1176	0.1176	0.1765	0	0		
1983	1	3	0	0	11	37	37	5	0	0	0	0
	0.0909	0	0.1818	0.1818	0.0909	0.0909	0.0909	0.2727	0	0		
1983	1	3	0	0	11	38	38	7	0	0	0	0
	0.0909	0	0	0.1818	0.3636	0.1818	0.0909	0	0.0909	0		
1983	1	3	0	0	11	39	39	2	0	0	0	0
	0	0	0.2	0.2	0.4	0.2	0	0	0	0		
1983	1	3	0	0	11	40	40	3	0	0	0	0
	0	0	0	0	0.6667	0	0	0.1667	0.1667	0		
1983	1	3	0	0	11	41	41	1	0	0	0	0
	0	0	0	0	0	1	0	0	0	0		
1983	1	3	0	0	11	42	42	2	0	0	0	0
	0	0	0	0	1	0	0	0	0	0		
1983	1	3	0	0	11	43	43	2	0	0	0	0
	0	0	0	0	0.5	0	0.5	0	0	0		
1983	1	3	0	0	11	44	44	1	0	0	0	0
	0	0	0	0	0.5	0	0	0.5	0	0		
1983	1	3	0	0	11	46	46	1	0	0	0	0
	0	0	0	0	0	1	0	0	0	0		
1983	1	3	0	0	11	47	47	1	0	0	0	0
	0	0	0	0	0	0	1	0	0	0		
1983	1	3	0	0	11	50	50	1	0	0	0	0
	0	0	0	0	1	0	0	0	0	0		
1986	1	3	0	0	14	10	10	2	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
1986	1	3	0	0	14	11	11	3	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
1986	1	3	0	0	14	12	12	6	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
1986	1	3	0	0	14	13	13	8	0.9639	0.0361	0	0
	0	0	0	0	0	0	0	0	0	0		
1986	1	3	0	0	14	14	14	8	0.9762	0.0238	0	0
	0	0	0	0	0	0	0	0	0	0		
1986	1	3	0	0	14	15	15	9	0.9816	0.0184	0	0
	0	0	0	0	0	0	0	0	0	0		
1986	1	3	0	0	14	16	16	9	0.9765	0.0235	0	0
	0	0	0	0	0	0	0	0	0	0		
1986	1	3	0	0	14	17	17	11	0.8913	0.087	0.0217	0
	0	0	0	0	0	0	0	0	0	0		
1986	1	3	0	0	14	18	18	8	0.7647	0.1765	0.0588	0
	0	0	0	0	0	0	0	0	0	0		
1986	1	3	0	0	14	19	19	10	0.7778	0.2222	0	0
	0	0	0	0	0	0	0	0	0	0		
1986	1	3	0	0	14	20	20	5	0.2	0.2	0.2	0
	0.4	0	0	0	0	0	0	0	0	0		
1986	1	3	0	0	14	21	21	6	0	0	0.1429	0
	0.8571	0	0	0	0	0	0	0	0	0		

1986	1	3	0	0	14	22	22	12	0	0	0	0.2
	0.8	0	0	0	0	0	0	0	0	0		
1986	1	3	0	0	14	23	23	21	0	0	0.0208	0.0729
	0.8438	0.0417	0.0208	0	0	0	0	0	0	0		
1986	1	3	0	0	14	24	24	21	0	0	0.0136	0.0544
	0.8844	0.034	0.0136	0	0	0	0	0	0	0		
1986	1	3	0	0	14	25	25	20	0	0	0.0095	0.0571
	0.8667	0.0619	0.0048	0	0	0	0	0	0	0		
1986	1	3	0	0	14	26	26	21	0	0	0.0047	0.0234
	0.9019	0.0467	0.0187	0.0047	0	0	0	0	0	0		
1986	1	3	0	0	14	27	27	21	0	0	0.006	0.0476
	0.7976	0.1012	0.0417	0.006	0	0	0	0	0	0		
1986	1	3	0	0	14	28	28	17	0	0	0	0.0244
	0.6748	0.1301	0.0488	0.122	0	0	0	0	0	0		
1986	1	3	0	0	14	29	29	18	0	0	0	0.0215
	0.6129	0.129	0.1398	0.0968	0	0	0	0	0	0		
1986	1	3	0	0	14	30	30	16	0	0	0	0.0411
	0.4658	0.1781	0.0959	0.2055	0	0.0137	0	0	0	0		
1986	1	3	0	0	14	31	31	16	0	0	0	0
	0.4211	0.1228	0.1579	0.2807	0.0175	0	0	0	0	0		
1986	1	3	0	0	14	32	32	16	0	0	0	0
	0.18	0.18	0.18	0.42	0.02	0.02	0	0	0	0		
1986	1	3	0	0	14	33	33	11	0	0	0	0
	0.122	0.0976	0.122	0.561	0.0488	0.0244	0	0.0244	0	0		
1986	1	3	0	0	14	34	34	13	0	0	0	0
	0.2571	0.0286	0.1429	0.3429	0.0857	0.0857	0.0286	0.0286	0	0		
1986	1	3	0	0	14	35	35	8	0	0	0	0
	0.1304	0	0.0435	0.4348	0.1304	0.1304	0	0.1304	0	0		
1986	1	3	0	0	14	36	36	9	0	0	0	0
	0.15	0	0.05	0.4	0.1	0.2	0	0.1	0	0		
1986	1	3	0	0	14	37	37	4	0	0	0	0
	0	0.0769	0.1538	0.3846	0.0769	0.1538	0	0.1538	0	0		
1986	1	3	0	0	14	38	38	4	0	0	0	0
	0	0.0769	0.0769	0.3077	0.1538	0.0769	0.0769	0.1538	0.0769	0		
1986	1	3	0	0	14	39	39	3	0	0	0	0
	0	0.0833	0.0833	0.3333	0.1667	0.0833	0	0.25	0	0		
1986	1	3	0	0	14	40	40	3	0	0	0	0
	0	0	0	0.5556	0.2222	0.1111	0	0.1111	0	0		
1986	1	3	0	0	14	41	41	4	0	0	0	0
	0	0	0	0.3333	0	0	0.1667	0.3333	0.1667	0		
1986	1	3	0	0	14	42	42	3	0	0	0	0
	0	0	0	0	0.5	0	0	0.25	0.25	0		
1986	1	3	0	0	14	43	43	2	0	0	0	0
	0	0	0	0	0	0	0	0.75	0	0.25		
1986	1	3	0	0	14	45	45	3	0	0	0	0
	0	0	0	0.3333	0	0	0.6667	0	0	0		
1986	1	3	0	0	14	46	46	1	0	0	0	0
	0	0	0	0	0	0	1	0	0	0		
1986	1	3	0	0	14	48	48	1	0	0	0	0
	0	0	0	1	0	0	0	0	0	0		
1986	1	3	0	0	14	49	49	1	0	0	0	0
	0	0	0	0	0	0	1	0	0	0		
1986	1	3	0	0	14	50	50	1	0	0	0	0
	0	0	0	0	0	0	0	0	1	0		
1986	1	3	0	0	14	51	51	1	0	0	0	0
	0	0	0	0	0	0	0	0	0.5	0.5		
1989	1	3	0	0	17	8	8	1	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
1989	1	3	0	0	17	14	14	1	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
1989	1	3	0	0	17	15	15	3	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
1989	1	3	0	0	17	16	16	4	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
1989	1	3	0	0	17	17	17	6	0.7778	0.2222	0	0
	0	0	0	0	0	0	0	0	0	0		

1989	1	3	0	0	17	18	18	8	0.8857	0.0857	0.0286	0
	0	0	0	0	0	0	0	0	0	0		
1989	1	3	0	0	17	19	19	7	0.8205	0.1538	0.0256	0
	0	0	0	0	0	0	0	0	0	0		
1989	1	3	0	0	17	20	20	9	0.7105	0.2368	0.0263	0.0263
	0	0	0	0	0	0	0	0	0	0		
1989	1	3	0	0	17	21	21	10	0.0833	0.375	0.0833	0.4167
	0.0417	0	0	0	0	0	0	0	0	0		
1989	1	3	0	0	17	22	22	15	0	0.0769	0	0.7436
	0.0513	0.0256	0	0.1026	0	0	0	0	0	0		
1989	1	3	0	0	17	23	23	20	0	0.0167	0.0167	0.9
	0.0083	0	0	0.05	0	0	0.0083	0	0	0		
1989	1	3	0	0	17	24	24	20	0	0.0085	0.0169	0.8686
	0.0169	0.0042	0.0042	0.072	0.0042	0	0.0042	0	0	0		
1989	1	3	0	0	17	25	25	20	0	0	0.0036	0.7607
	0.0036	0.0107	0.0036	0.2	0.0107	0	0.0071	0	0	0		
1989	1	3	0	0	17	26	26	20	0	0	0	0.6541
	0.0171	0	0.0171	0.2842	0.0171	0.0034	0.0068	0	0	0		
1989	1	3	0	0	17	27	27	20	0	0	0	0.4868
	0.0106	0.0106	0.0159	0.4339	0.0265	0	0.0159	0	0	0		
1989	1	3	0	0	17	28	28	18	0	0	0.0082	0.3279
	0.0082	0.0082	0.0246	0.5984	0.0082	0	0.0164	0	0	0		
1989	1	3	0	0	17	29	29	16	0	0	0	0.1957
	0.0217	0.0109	0.0326	0.6413	0.0217	0.0217	0.0543	0	0	0		
1989	1	3	0	0	17	30	30	16	0	0	0	0.1818
	0	0	0	0.7045	0.0455	0	0.0682	0	0	0		
1989	1	3	0	0	17	31	31	10	0	0	0	0.0833
	0	0.0417	0	0.75	0	0	0.125	0	0	0		
1989	1	3	0	0	17	32	32	8	0	0	0	0.2
	0	0	0	0.6	0.0667	0	0.1333	0	0	0		
1989	1	3	0	0	17	33	33	9	0	0	0	0
	0	0	0	0.8	0	0	0	0	0	0.2		
1989	1	3	0	0	17	34	34	6	0	0	0	0
	0	0.125	0	0.5	0	0	0.375	0	0	0		
1989	1	3	0	0	17	35	35	5	0	0	0	0
	0	0	0	0.5714	0	0	0.4286	0	0	0		
1989	1	3	0	0	17	36	36	2	0	0	0	0
	0	0	0	0.5	0	0	0.5	0	0	0		
1989	1	3	0	0	17	37	37	2	0	0	0	0
	0	0	0	0.3333	0	0	0.6667	0	0	0		
1989	1	3	0	0	17	39	39	3	0	0	0	0
	0	0	0	0.6667	0	0	0	0	0	0.3333		
1989	1	3	0	0	17	40	40	2	0	0	0	0
	0	0	0	0.5	0	0	0	0	0	0.5		
1989	1	3	0	0	17	41	41	2	0	0	0	0
	0	0	0	0.5	0	0	0.5	0	0	0		
1989	1	3	0	0	17	44	44	1	0	0	0	0
	0	0	0	1	0	0	0	0	0	0		
1989	1	3	0	0	17	45	45	1	0	0	0	0
	0	0	0	1	0	0	0	0	0	0		
1989	1	3	0	0	17	46	46	1	0	0	0	0
	0	0	0	1	0	0	0	0	0	0		
1989	1	3	0	0	17	50	50	1	0	0	0	0
	0	0	0	0	0	0	0	0	0	1		
1989	1	3	0	0	17	51	51	2	0	0	0	0
	0	0	0	0	0	0	0.6667	0	0	0.3333		
1992	1	3	0	0	20	5	5	2	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
1992	1	3	0	0	20	6	6	2	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
1992	1	3	0	0	20	7	7	2	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
1992	1	3	0	0	20	8	8	4	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
1992	1	3	0	0	20	9	9	2	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		

1992	1	3	0	0	20	10	10	5	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
1992	1	3	0	0	20	11	11	7	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
1992	1	3	0	0	20	12	12	7	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
1992	1	3	0	0	20	13	13	8	0.9615	0.0385	0	0
	0	0	0	0	0	0	0	0	0	0		
1992	1	3	0	0	20	14	14	8	0.9661	0.0339	0	0
	0	0	0	0	0	0	0	0	0	0		
1992	1	3	0	0	20	15	15	8	0.8627	0.1373	0	0
	0	0	0	0	0	0	0	0	0	0		
1992	1	3	0	0	20	16	16	7	0.898	0.102	0	0
	0	0	0	0	0	0	0	0	0	0		
1992	1	3	0	0	20	17	17	6	0.875	0.125	0	0
	0	0	0	0	0	0	0	0	0	0		
1992	1	3	0	0	20	18	18	6	0.5	0.1667	0.3333	0
	0	0	0	0	0	0	0	0	0	0		
1992	1	3	0	0	20	19	19	5	0.125	0.5	0.25	0.125
	0	0	0	0	0	0	0	0	0	0		
1992	1	3	0	0	20	20	20	8	0.1	0.2	0.5	0.2
	0	0	0	0	0	0	0	0	0	0		
1992	1	3	0	0	20	21	21	7	0	0.1111	0.3889	0.4444
	0.0556	0	0	0	0	0	0	0	0	0		
1992	1	3	0	0	20	22	22	10	0	0.0385	0.3846	0.5385
	0.0385	0	0	0	0	0	0	0	0	0		
1992	1	3	0	0	20	23	23	24	0	0.0526	0.4737	0.3684
	0.0175	0	0.0877	0	0	0	0	0	0	0		
1992	1	3	0	0	20	24	24	28	0	0.0263	0.2632	0.4825
	0.0526	0.0088	0.1316	0.0088	0	0	0.0263	0	0	0		
1992	1	3	0	0	20	25	25	36	0	0.0207	0.1295	0.3731
	0.0311	0.0104	0.3679	0.0155	0	0	0.0466	0.0052	0	0		
1992	1	3	0	0	20	26	26	38	0	0	0.0952	0.2381
	0.022	0.0073	0.4689	0.0073	0.011	0.0037	0.1465	0	0	0		
1992	1	3	0	0	20	27	27	39	0	0	0.0386	0.1544
	0.0421	0.007	0.5684	0.014	0.007	0.007	0.1404	0.014	0	0.007		
1992	1	3	0	0	20	28	28	37	0	0	0.0127	0.135
	0.0211	0.0042	0.6076	0.0211	0.0127	0	0.1646	0.0042	0	0.0169		
1992	1	3	0	0	20	29	29	34	0	0	0.006	0.0904
	0.012	0.0301	0.506	0.0301	0.006	0	0.3012	0.012	0	0.006		
1992	1	3	0	0	20	30	30	30	0	0	0.0095	0.0667
	0	0.0095	0.5048	0.0095	0.0286	0.0095	0.3333	0.019	0	0.0095		
1992	1	3	0	0	20	31	31	22	0	0	0	0.0147
	0.0147	0	0.4706	0.0147	0.0147	0.0147	0.4265	0.0147	0	0.0147		
1992	1	3	0	0	20	32	32	18	0	0	0	0
	0.0233	0.0465	0.3488	0.0233	0	0.0233	0.3953	0.0465	0	0.093		
1992	1	3	0	0	20	33	33	14	0	0	0	0
	0	0.0667	0.5	0.0333	0	0	0.3	0.0333	0	0.0667		
1992	1	3	0	0	20	34	34	6	0	0	0	0
	0	0	0.3529	0.0588	0	0.0588	0.4118	0	0	0.1176		
1992	1	3	0	0	20	35	35	3	0	0	0	0
	0	0	0.25	0.0833	0	0	0.5833	0.0833	0	0		
1992	1	3	0	0	20	36	36	4	0	0	0	0
	0	0	0.7778	0	0	0	0.2222	0	0	0		
1992	1	3	0	0	20	37	37	5	0	0	0	0
	0	0	0.3333	0	0	0.1111	0.5556	0	0	0		
1992	1	3	0	0	20	38	38	4	0	0	0	0
	0	0	0.1667	0.1667	0	0	0.3333	0	0	0.3333		
1992	1	3	0	0	20	39	39	3	0	0	0	0
	0	0	0.4	0	0	0	0.6	0	0	0		
1992	1	3	0	0	20	40	40	1	0	0	0	0
	0	0	0.25	0	0	0	0.75	0	0	0		
1992	1	3	0	0	20	41	41	1	0	0	0	0
	0	0	0	0	0	0	1	0	0	0		
1992	1	3	0	0	20	42	42	1	0	0	0	0
	0	0	0	0	0	0	1	0	0	0		

1992	1	3	0	0	20	43	43	2	0	0	0	0
	0	0	0	0	0	0	0.5	0	0	0.5		
1992	1	3	0	0	20	44	44	3	0	0	0	0
	0	0	0	0	0	0	0.75	0	0	0.25		
1995	1	3	0	0	23	9	9	2	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
1995	1	3	0	0	23	10	10	1	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
1995	1	3	0	0	23	11	11	2	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
1995	1	3	0	0	23	12	12	4	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
1995	1	3	0	0	23	13	13	9	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
1995	1	3	0	0	23	14	14	13	0.9792	0.0208	0	0
	0	0	0	0	0	0	0	0	0	0		
1995	1	3	0	0	23	15	15	15	0.954	0.0345	0.0115	0
	0	0	0	0	0	0	0	0	0	0		
1995	1	3	0	0	23	16	16	21	0.8934	0.1066	0	0
	0	0	0	0	0	0	0	0	0	0		
1995	1	3	0	0	23	17	17	20	0.8571	0.131	0	0.0119
	0	0	0	0	0	0	0	0	0	0		
1995	1	3	0	0	23	18	18	17	0.7358	0.2453	0.0189	0
	0	0	0	0	0	0	0	0	0	0		
1995	1	3	0	0	23	19	19	14	0.5185	0.3333	0.037	0.1111
	0	0	0	0	0	0	0	0	0	0		
1995	1	3	0	0	23	20	20	6	0.1111	0.2222	0.1111	0.5556
	0	0	0	0	0	0	0	0	0	0		
1995	1	3	0	0	23	21	21	11	0	0.2857	0.0714	0.5714
	0	0	0.0714	0	0	0	0	0	0	0		
1995	1	3	0	0	23	22	22	15	0	0.0345	0.069	0.8276
	0	0.0345	0.0345	0	0	0	0	0	0	0		
1995	1	3	0	0	23	23	23	26	0	0.0192	0.0577	0.6538
	0.0385	0.0769	0.1346	0	0	0.0192	0	0	0	0		
1995	1	3	0	0	23	24	24	40	0	0.0101	0.0505	0.6768
	0.0202	0.101	0.0808	0	0	0.0505	0	0	0	0.0101		
1995	1	3	0	0	23	25	25	45	0	0	0.027	0.5608
	0.0405	0.0541	0.1689	0.0068	0	0.1216	0	0	0	0.0203		
1995	1	3	0	0	23	26	26	49	0	0	0.0152	0.4112
	0	0.1015	0.2589	0.0152	0	0.1472	0	0.0152	0	0.0355		
1995	1	3	0	0	23	27	27	53	0	0	0	0.2837
	0.0093	0.0465	0.2698	0	0	0.3023	0	0.0093	0	0.0791		
1995	1	3	0	0	23	28	28	50	0	0	0.0047	0.1721
	0.0186	0.0419	0.2651	0.0093	0	0.3581	0.0047	0.014	0	0.1116		
1995	1	3	0	0	23	29	29	47	0	0	0	0.0795
	0.017	0.0398	0.3466	0.0057	0	0.3693	0	0.0114	0	0.1307		
1995	1	3	0	0	23	30	30	38	0	0	0	0.0526
	0.015	0.0526	0.3459	0	0	0.3985	0	0.0301	0	0.1053		
1995	1	3	0	0	23	31	31	27	0	0	0	0.0319
	0.0213	0.0426	0.2766	0	0	0.5106	0	0.0213	0	0.0957		
1995	1	3	0	0	23	32	32	17	0	0	0	0.0192
	0.0192	0.0769	0.25	0	0	0.4423	0	0.0385	0	0.1538		
1995	1	3	0	0	23	33	33	14	0	0	0	0.0333
	0	0	0.3	0	0	0.4667	0	0	0	0.2		
1995	1	3	0	0	23	34	34	10	0	0	0	0
	0	0.0588	0.2941	0	0	0.4706	0	0	0	0.1765		
1995	1	3	0	0	23	35	35	7	0	0	0	0
	0.0833	0	0.3333	0	0	0.4167	0	0	0	0.1667		
1995	1	3	0	0	23	36	36	5	0	0	0	0
	0	0.1	0.1	0	0	0.7	0	0	0	0.1		
1995	1	3	0	0	23	37	37	6	0	0	0	0
	0	0	0.1667	0	0	0.8333	0	0	0	0		
1995	1	3	0	0	23	38	38	3	0	0	0	0
	0	0.25	0	0	0	0.5	0	0	0	0.25		
1995	1	3	0	0	23	39	39	5	0	0	0	0
	0	0	0	0	0	0.7143	0	0.1429	0	0.1429		

1995	1	3	0	0	23	40	40	2	0	0	0	0
	0	0	0	0	0	0	0	0	0	1		
1995	1	3	0	0	23	41	41	2	0	0	0	0
	0	0	0.25	0	0	0.25	0	0.25	0	0.25		
1995	1	3	0	0	23	42	42	1	0	0	0	0
	0	0	0	0	0	0	0	1	0	0		
1995	1	3	0	0	23	43	43	4	0	0	0	0
	0	0	0	0	0	0.25	0	0	0	0.75		
1995	1	3	0	0	23	44	44	2	0	0	0	0
	0	0	0.2	0	0	0.4	0	0	0	0.4		
1995	1	3	0	0	23	45	45	1	0	0	0	0
	0	0	0	0	0	1	0	0	0	0		
1995	1	3	0	0	23	46	46	2	0	0	0	0
	0	0	0	0	0	1	0	0	0	0		
1995	1	3	0	0	23	47	47	2	0	0	0	0
	0	0	0	0	0	0.5	0	0.5	0	0		
1995	1	3	0	0	23	48	48	2	0	0	0	0
	0	0	0	0	0	0.3333	0	0.3333	0	0.3333		
1995	1	3	0	0	23	50	50	1	0	0	0	0
	0	0	0	0	0	0	0	0	0	1		
1995	1	3	0	0	23	51	51	3	0	0	0	0
	0	0	0	0	0	0.75	0	0.25	0	0		
1998	1	3	0	0	26	5	5	1	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
1998	1	3	0	0	26	6	6	3	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
1998	1	3	0	0	26	7	7	2	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
1998	1	3	0	0	26	8	8	4	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
1998	1	3	0	0	26	9	9	10	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
1998	1	3	0	0	26	10	10	13	0.9524	0.0476	0	0
	0	0	0	0	0	0	0	0	0	0		
1998	1	3	0	0	26	11	11	16	0.9516	0.0484	0	0
	0	0	0	0	0	0	0	0	0	0		
1998	1	3	0	0	26	12	12	20	0.8621	0.1264	0.0115	0
	0	0	0	0	0	0	0	0	0	0		
1998	1	3	0	0	26	13	13	23	0.8947	0.1053	0	0
	0	0	0	0	0	0	0	0	0	0		
1998	1	3	0	0	26	14	14	23	0.8406	0.1594	0	0
	0	0	0	0	0	0	0	0	0	0		
1998	1	3	0	0	26	15	15	31	0.7368	0.2632	0	0
	0	0	0	0	0	0	0	0	0	0		
1998	1	3	0	0	26	16	16	31	0.5238	0.4286	0.0317	0.0159
	0	0	0	0	0	0	0	0	0	0		
1998	1	3	0	0	26	17	17	30	0.2273	0.7273	0.0303	0.0152
	0	0	0	0	0	0	0	0	0	0		
1998	1	3	0	0	26	18	18	36	0.1111	0.7889	0.0667	0.0333
	0	0	0	0	0	0	0	0	0	0		
1998	1	3	0	0	26	19	19	39	0.0194	0.9223	0.0583	0
	0	0	0	0	0	0	0	0	0	0		
1998	1	3	0	0	26	20	20	50	0.0083	0.8083	0.1667	0.0167
	0	0	0	0	0	0	0	0	0	0		
1998	1	3	0	0	26	21	21	44	0	0.7895	0.1368	0.0526
	0	0.0211	0	0	0	0	0	0	0	0		
1998	1	3	0	0	26	22	22	55	0	0.3923	0.3154	0.2692
	0.0077	0.0077	0.0077	0	0	0	0	0	0	0		
1998	1	3	0	0	26	23	23	62	0	0.2013	0.327	0.3774
	0.0063	0.0503	0.0189	0.0063	0	0.0126	0	0	0	0		
1998	1	3	0	0	26	24	24	66	0	0.0417	0.3981	0.3889
	0.037	0.0509	0.0648	0.0139	0	0.0046	0	0	0	0		
1998	1	3	0	0	26	25	25	64	0	0.0326	0.2233	0.4977
	0.0279	0.0465	0.1163	0.014	0.0093	0.0233	0	0	0.0093	0		
1998	1	3	0	0	26	26	26	57	0	0.0118	0.2071	0.3728
	0.0237	0.0651	0.2012	0.0237	0.0059	0.0592	0	0	0.0296	0		

1998	1	3	0	0	26	27	27	49	0	0	0.1406	0.3047
	0.0313	0.1172	0.1719	0.0156	0.0234	0.1094	0	0.0078	0.0703	0.0078		
1998	1	3	0	0	26	28	28	51	0	0	0.1271	0.1102
	0.0254	0.1271	0.1864	0.0508	0.0339	0.1949	0	0.0169	0.0763	0.0508		
1998	1	3	0	0	26	29	29	46	0	0.0108	0.1075	0.086
	0.0538	0.0645	0.2796	0.043	0.0323	0.129	0.0108	0.0108	0.1183	0.0538		
1998	1	3	0	0	26	30	30	31	0	0	0.0769	0.0577
	0	0.0385	0.2885	0.0577	0.0192	0.2692	0	0	0.1731	0.0192		
1998	1	3	0	0	26	31	31	22	0	0	0.0294	0.0882
	0	0.0294	0.2353	0	0	0.2353	0.0294	0	0.2647	0.0882		
1998	1	3	0	0	26	32	32	9	0	0	0	0
	0	0.1	0.2	0	0	0	0	0.1	0.5	0.1		
1998	1	3	0	0	26	33	33	5	0	0	0	0
	0	0	0.3333	0	0	0.3333	0	0	0.1667	0.1667		
1998	1	3	0	0	26	34	34	6	0	0	0	0
	0	0	0.1429	0.1429	0	0.2857	0	0	0.2857	0.1429		
1998	1	3	0	0	26	35	35	4	0	0	0	0
	0	0	0	0.25	0.25	0.25	0	0	0	0.25		
1998	1	3	0	0	26	36	36	2	0	0	0	0
	0	0	0	0	0	0	0	0	0.5	0.5		
1998	1	3	0	0	26	37	37	2	0	0	0	0
	0	0	0	0	0	0	0	0.5	0.5	0		
1998	1	3	0	0	26	38	38	3	0	0	0	0
	0	0	0	0	0	0.3333	0	0	0	0.6667		
1998	1	3	0	0	26	39	39	5	0	0	0	0.2
	0	0	0	0	0.2	0.4	0	0	0.2	0		
1998	1	3	0	0	26	41	41	1	0	0	0	0
	0	0	0	0	0	1	0	0	0	0		
1998	1	3	0	0	26	42	42	2	0	0	0	0
	0	0	0	0	0	0.5	0	0	0.5	0		
1998	1	3	0	0	26	50	50	1	0	0	0	0
	0	0	0	0	0	1	0	0	0	0		
2001	1	3	0	0	29	8	8	2	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
2001	1	3	0	0	29	11	11	3	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
2001	1	3	0	0	29	12	12	8	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
2001	1	3	0	0	29	13	13	14	0.9811	0.0189	0	0
	0	0	0	0	0	0	0	0	0	0		
2001	1	3	0	0	29	14	14	17	0.9615	0.0288	0.0096	0
	0	0	0	0	0	0	0	0	0	0		
2001	1	3	0	0	29	15	15	20	0.9394	0.0424	0.0182	0
	0	0	0	0	0	0	0	0	0	0		
2001	1	3	0	0	29	16	16	20	0.9416	0.039	0.013	0.0065
	0	0	0	0	0	0	0	0	0	0		
2001	1	3	0	0	29	17	17	20	0.8675	0.0964	0.0361	0
	0	0	0	0	0	0	0	0	0	0		
2001	1	3	0	0	29	18	18	17	0.9048	0.0952	0	0
	0	0	0	0	0	0	0	0	0	0		
2001	1	3	0	0	29	19	19	13	0.697	0.2727	0.0303	0
	0	0	0	0	0	0	0	0	0	0		
2001	1	3	0	0	29	20	20	10	0.2941	0.4118	0.2353	0.0588
	0	0	0	0	0	0	0	0	0	0		
2001	1	3	0	0	29	21	21	17	0.0303	0.7576	0.1515	0.0303
	0	0.0303	0	0	0	0	0	0	0	0		
2001	1	3	0	0	29	22	22	14	0	0.871	0.0323	0.0968
	0	0	0	0	0	0	0	0	0	0		
2001	1	3	0	0	29	23	23	18	0.0204	0.7347	0.1429	0.0816
	0.0204	0	0	0	0	0	0	0	0	0		
2001	1	3	0	0	29	24	24	22	0	0.5	0.1591	0.2955
	0.0227	0.0227	0	0	0	0	0	0	0	0		
2001	1	3	0	0	29	25	25	17	0	0.3333	0.1818	0.3333
	0.1212	0.0303	0	0	0	0	0	0	0	0		
2001	1	3	0	0	29	26	26	29	0	0.1111	0.2222	0.375
	0.125	0.0972	0.0694	0	0	0	0	0	0	0		

2001	1	3	0	0	29	27	27	29	0	0.0215	0.2796	0.3333
	0.1398	0.0645	0.0968	0.0323	0.0108	0.0215	0	0	0	0		
2001	1	3	0	0	29	28	28	30	0	0.0253	0.2595	0.2911
	0.1519	0.0886	0.0886	0.019	0.0316	0.019	0.0127	0.0063	0	0.0063		
2001	1	3	0	0	29	29	29	30	0	0.006	0.3155	0.2381
	0.1845	0.1429	0.0595	0.0298	0.0179	0.006	0	0	0	0		
2001	1	3	0	0	29	30	30	28	0	0.01	0.2139	0.2338
	0.1891	0.1144	0.1095	0.0299	0.0299	0.0199	0.01	0.0299	0.005	0.005		
2001	1	3	0	0	29	31	31	27	0	0.012	0.1856	0.1796
	0.1617	0.1916	0.1198	0.0299	0.0479	0.0299	0.018	0.018	0	0.006		
2001	1	3	0	0	29	32	32	25	0	0	0.1045	0.1119
	0.1194	0.3284	0.1418	0.0522	0.0448	0.0299	0.0224	0.0149	0.0075	0.0224		
2001	1	3	0	0	29	33	33	26	0	0	0.1008	0.0756
	0.1513	0.2437	0.1597	0.0504	0.0504	0.0252	0.0504	0.0336	0.0168	0.042		
2001	1	3	0	0	29	34	34	24	0	0	0.0562	0.1348
	0.1461	0.2921	0.1124	0.0674	0.0449	0.0562	0.0337	0.0112	0	0.0449		
2001	1	3	0	0	29	35	35	25	0	0	0.0154	0.0154
	0.0923	0.3077	0.1385	0.1231	0.0923	0.0462	0.0615	0	0.0154	0.0923		
2001	1	3	0	0	29	36	36	18	0	0	0.0244	0
	0.0732	0.3171	0.1951	0.0488	0.0488	0.122	0	0.0732	0.0244	0.0732		
2001	1	3	0	0	29	37	37	13	0	0	0	0
	0.125	0.375	0.2083	0.0417	0.0417	0.0417	0	0.0417	0	0.125		
2001	1	3	0	0	29	38	38	10	0	0	0	0
	0.15	0.35	0.1	0.1	0.05	0.1	0.1	0	0	0.05		
2001	1	3	0	0	29	39	39	10	0	0.05	0	0
	0.05	0.4	0.1	0	0.15	0.05	0.1	0	0	0.1		
2001	1	3	0	0	29	40	40	7	0	0	0	0
	0.125	0.5	0.125	0.125	0	0.125	0	0	0	0		
2001	1	3	0	0	29	41	41	8	0	0	0	0
	0.0714	0.1429	0.0714	0	0.2143	0.1429	0	0.2143	0.0714	0.0714		
2001	1	3	0	0	29	42	42	5	0	0	0	0
	0	0.1429	0	0.2857	0.1429	0	0.1429	0.1429	0	0.1429		
2001	1	3	0	0	29	43	43	3	0	0	0	0
	0	0	0	0.3333	0.3333	0	0	0.3333	0	0		
2001	1	3	0	0	29	44	44	2	0	0	0	0
	0	0.5	0	0	0.5	0	0	0	0	0		
2001	1	3	0	0	29	45	45	4	0	0	0	0
	0	0.25	0.25	0	0.25	0	0	0	0	0.25		
2001	1	3	0	0	29	46	46	3	0	0	0	0
	0	0	0.25	0.25	0	0.25	0	0.25	0	0		
2001	1	3	0	0	29	47	47	2	0	0	0	0
	0	0	0	0	0.5	0	0.5	0	0	0		
2001	1	3	0	0	29	48	48	1	0	0	0	0
	0	0.5	0	0	0	0	0.5	0	0	0		
2001	1	3	0	0	29	49	49	2	0	0	0	0
	0	0.1667	0.1667	0	0	0	0.5	0.1667	0	0		
2001	1	3	0	0	29	50	50	4	0	0	0	0
	0	0.25	0.5	0	0	0.25	0	0	0	0		
2001	1	3	0	0	29	51	51	4	0	0	0	0
	0	0.2222	0	0	0.3333	0.1111	0	0.1111	0.1111	0.1111		
2003	1	3	0	0	31	6	6	1	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
2003	1	3	0	0	31	9	9	1	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
2003	1	3	0	0	31	11	11	2	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
2003	1	3	0	0	31	12	12	2	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
2003	1	3	0	0	31	13	13	4	0.8824	0	0.0588	0.0588
	0	0	0	0	0	0	0	0	0	0		
2003	1	3	0	0	31	14	14	4	0.8148	0.0741	0	0.1111
	0	0	0	0	0	0	0	0	0	0		
2003	1	3	0	0	31	15	15	8	0.68	0.16	0.04	0.12
	0	0	0	0	0	0	0	0	0	0		
2003	1	3	0	0	31	16	16	8	0.6087	0	0.087	0.3043
	0	0	0	0	0	0	0	0	0	0		

2003	1	3	0	0	31	17	17	8	0.5122	0	0.0732	0.3415
	0.0732	0	0	0	0	0	0	0	0	0		
2003	1	3	0	0	31	18	18	9	0.1304	0.2174	0.2174	0.3913
	0.0435	0	0	0	0	0	0	0	0	0		
2003	1	3	0	0	31	19	19	14	0.1875	0.1875	0.4688	0.1563
	0	0	0	0	0	0	0	0	0	0		
2003	1	3	0	0	31	20	20	14	0.0833	0.1667	0.5833	0.1389
	0	0.0278	0	0	0	0	0	0	0	0		
2003	1	3	0	0	31	21	21	29	0	0.0462	0.8308	0.1231
	0	0	0	0	0	0	0	0	0	0		
2003	1	3	0	0	31	22	22	43	0	0.0866	0.8504	0.0551
	0.0079	0	0	0	0	0	0	0	0	0		
2003	1	3	0	0	31	23	23	56	0	0.0145	0.8836	0.0727
	0.0145	0.0036	0.0073	0.0036	0	0	0	0	0	0		
2003	1	3	0	0	31	24	24	55	0	0.0144	0.9078	0.0634
	0.0058	0.0086	0	0	0	0	0	0	0	0		
2003	1	3	0	0	31	25	25	59	0	0.0093	0.8037	0.1184
	0.0125	0.0343	0.0156	0.0031	0.0031	0	0	0	0	0		
2003	1	3	0	0	31	26	26	61	0	0.0099	0.6414	0.1382
	0.0362	0.0822	0.0461	0.0197	0.0066	0.0132	0.0033	0.0033	0	0		
2003	1	3	0	0	31	27	27	53	0	0	0.5112	0.1418
	0.0299	0.1642	0.0634	0.0373	0.0485	0	0	0.0037	0	0		
2003	1	3	0	0	31	28	28	55	0	0	0.3223	0.1488
	0.0413	0.1612	0.1446	0.0496	0.0702	0.0207	0.0124	0.0083	0	0.0207		
2003	1	3	0	0	31	29	29	43	0	0	0.2159	0.1023
	0.0795	0.1875	0.125	0.0739	0.1023	0.0284	0.0114	0.0455	0.0114	0.017		
2003	1	3	0	0	31	30	30	41	0	0	0.2215	0.1007
	0.0201	0.2013	0.1678	0.0336	0.1007	0.0403	0.0201	0.0201	0.047	0.0268		
2003	1	3	0	0	31	31	31	32	0	0	0.134	0.134
	0.0825	0.1753	0.134	0.1134	0.134	0.0309	0.0309	0	0.0103	0.0206		
2003	1	3	0	0	31	32	32	28	0	0	0.1149	0.046
	0.1034	0.2184	0.1609	0.1149	0.1034	0.046	0.0575	0	0.023	0.0115		
2003	1	3	0	0	31	33	33	24	0	0	0.08	0.1
	0.1	0.14	0.14	0.16	0.1	0.04	0.02	0	0.08	0.04		
2003	1	3	0	0	31	34	34	19	0	0	0.0526	0.0702
	0.193	0.1053	0.1053	0.2105	0.0877	0.0526	0.0526	0.0526	0.0175	0		
2003	1	3	0	0	31	35	35	12	0	0	0.0588	0.1176
	0.2059	0.1765	0.1765	0.1176	0.0588	0.0294	0	0.0294	0	0.0294		
2003	1	3	0	0	31	36	36	12	0	0	0	0.125
	0.2813	0.1563	0.125	0.2188	0.0313	0	0	0.0313	0	0.0313		
2003	1	3	0	0	31	37	37	7	0	0	0	0.0556
	0.3333	0.0556	0	0.3333	0.0556	0.0556	0	0.0556	0	0.0556		
2003	1	3	0	0	31	38	38	6	0	0	0	0.2
	0.2667	0	0.1333	0.0667	0.1333	0.0667	0	0.0667	0	0.0667		
2003	1	3	0	0	31	39	39	5	0	0	0	0.0714
	0.2143	0.1429	0.2143	0.2143	0	0.0714	0	0.0714	0	0		
2003	1	3	0	0	31	40	40	3	0	0	0	0
	0	0	0.25	0.25	0.25	0	0.25	0	0	0		
2003	1	3	0	0	31	41	41	6	0	0	0	0.3
	0.1	0	0.2	0.2	0.1	0	0	0	0	0.1		
2003	1	3	0	0	31	42	42	2	0	0	0	0
	0.1429	0.1429	0.2857	0.2857	0	0	0	0	0	0.1429		
2003	1	3	0	0	31	43	43	5	0	0	0	0
	0.625	0	0	0	0.25	0	0	0	0	0.125		
2003	1	3	0	0	31	45	45	2	0	0	0	0
	0	1	0	0	0	0	0	0	0	0		
2003	1	3	0	0	31	46	46	2	0	0	0	0.3333
	0	0	0.3333	0	0.3333	0	0	0	0	0		
2003	1	3	0	0	31	47	47	2	0	0	0	0
	0	0	1	0	0	0	0	0	0	0		
2003	1	3	0	0	31	48	48	2	0	0	0	0
	0.3333	0	0	0	0	0	0.6667	0	0	0		
2003	1	3	0	0	31	50	50	2	0	0	0	0
	0	0.5	0	0	0	0.5	0	0	0	0		
2003	1	3	0	0	31	51	51	6	0	0	0	0
	0	0	0.1429	0.2857	0	0.2857	0.1429	0	0	0.1429		

2005	1	3	0	0	33	9	9	1	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
2005	1	3	0	0	33	10	10	1	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
2005	1	3	0	0	33	11	11	4	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
2005	1	3	0	0	33	12	12	6	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
2005	1	3	0	0	33	13	13	7	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
2005	1	3	0	0	33	14	14	10	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
2005	1	3	0	0	33	15	15	8	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
2005	1	3	0	0	33	16	16	10	1	0	0	0
	0	0	0	0	0	0	0	0	0	0		
2005	1	3	0	0	33	17	17	9	0.9189	0.0811	0	0
	0	0	0	0	0	0	0	0	0	0		
2005	1	3	0	0	33	18	18	10	0.8696	0.087	0.0435	0
	0	0	0	0	0	0	0	0	0	0		
2005	1	3	0	0	33	19	19	8	0.5	0.2857	0.2143	0
	0	0	0	0	0	0	0	0	0	0		
2005	1	3	0	0	33	20	20	10	0.3333	0.4	0.2667	0
	0	0	0	0	0	0	0	0	0	0		
2005	1	3	0	0	33	21	21	6	0.25	0.375	0.125	0.25
	0	0	0	0	0	0	0	0	0	0		
2005	1	3	0	0	33	22	22	22	0	0.0909	0.3636	0.1212
	0.4242	0	0	0	0	0	0	0	0	0		
2005	1	3	0	0	33	23	23	28	0	0.0519	0.2597	0.1558
	0.4805	0.039	0.013	0	0	0	0	0	0	0		
2005	1	3	0	0	33	24	24	36	0	0.0112	0.1229	0.0726
	0.7318	0.0503	0.0112	0	0	0	0	0	0	0		
2005	1	3	0	0	33	25	25	41	0	0	0.123	0.0714
	0.7381	0.0516	0.0079	0.004	0	0.004	0	0	0	0		
2005	1	3	0	0	33	26	26	42	0	0	0.0515	0.0588
	0.7537	0.0809	0.0147	0.0184	0.011	0.011	0	0	0	0		
2005	1	3	0	0	33	27	27	41	0	0	0.0327	0.0531
	0.6939	0.0857	0.049	0.0449	0.0122	0.0163	0	0.0041	0	0.0082		
2005	1	3	0	0	33	28	28	39	0	0	0.016	0.0745
	0.6543	0.1064	0.0372	0.0638	0.0213	0.0213	0.0053	0	0	0		
2005	1	3	0	0	33	29	29	32	0	0	0.0083	0.0167
	0.6667	0.1	0.0333	0.0667	0.05	0.025	0.025	0.0083	0	0		
2005	1	3	0	0	33	30	30	27	0	0	0	0.0448
	0.5522	0.0597	0.0149	0.1493	0.0896	0.0597	0	0.0149	0	0.0149		
2005	1	3	0	0	33	31	31	23	0	0	0.0213	0.0426
	0.4468	0.0638	0.0426	0.1064	0.0851	0.0213	0.0851	0.0426	0.0213	0.0213		
2005	1	3	0	0	33	32	32	12	0	0	0	0
	0.3333	0.0952	0.0952	0.0952	0.1905	0.0952	0.0476	0.0476	0	0		
2005	1	3	0	0	33	33	33	12	0	0	0	0
	0.2	0.2667	0.1333	0.1333	0	0.2	0.0667	0	0	0		
2005	1	3	0	0	33	34	34	9	0	0	0	0.0833
	0.25	0.25	0.0833	0.1667	0.0833	0	0.0833	0	0	0		
2005	1	3	0	0	33	35	35	5	0	0	0	0
	0.25	0.25	0	0	0.375	0.125	0	0	0	0		
2005	1	3	0	0	33	36	36	3	0	0	0	0
	1	0	0	0	0	0	0	0	0	0		
2005	1	3	0	0	33	37	37	5	0	0	0	0
	0.2	0.4	0	0.2	0.2	0	0	0	0	0		
2005	1	3	0	0	33	38	38	2	0	0	0	0
	0	0	0	0.5	0	0	0.5	0	0	0		
2005	1	3	0	0	33	39	39	1	0	0	0	0
	0	1	0	0	0	0	0	0	0	0		
2005	1	3	0	0	33	40	40	1	0	0	0	0
	0	0	1	0	0	0	0	0	0	0		
2005	1	3	0	0	33	45	45	1	0	0	0	0
	0	0	0	0	0	0	1	0	0	0		

2005	1	3	0	0	33	46	46	1	0	0	0	0
	0	0	0	0	0	1	0	0	0	0	
2005	1	3	0	0	33	49	49	1	0	0	0	0
	0	0	0	1	0	0	0	0	0	0	
2005	1	3	0	0	33	50	50	1	0	0	0	0
	0	0	0	1	0	0	0	0	0	0	
2005	1	3	0	0	33	51	51	6	0	0	0	0
	0.1429	0	0	0	0.4286	0.1429	0.1429	0	0.1429	0	
2007	1	3	0	0	35	5	5	3	1	0	0	0
	0	0	0	0	0	0	0	0	0	0	
2007	1	3	0	0	35	6	6	2	1	0	0	0
	0	0	0	0	0	0	0	0	0	0	
2007	1	3	0	0	35	7	7	4	1	0	0	0
	0	0	0	0	0	0	0	0	0	0	
2007	1	3	0	0	35	8	8	7	1	0	0	0
	0	0	0	0	0	0	0	0	0	0	
2007	1	3	0	0	35	9	9	8	1	0	0	0
	0	0	0	0	0	0	0	0	0	0	
2007	1	3	0	0	35	10	10	15	1	0	0	0
	0	0	0	0	0	0	0	0	0	0	
2007	1	3	0	0	35	11	11	17	1	0	0	0
	0	0	0	0	0	0	0	0	0	0	
2007	1	3	0	0	35	12	12	18	1	0	0	0
	0	0	0	0	0	0	0	0	0	0	
2007	1	3	0	0	35	13	13	17	0.9929	0.0071	0	0
	0	0	0	0	0	0	0	0	0	0	
2007	1	3	0	0	35	14	14	20	0.9688	0.0208	0.0104	0
	0	0	0	0	0	0	0	0	0	0	
2007	1	3	0	0	35	15	15	20	0.9762	0.0119	0.0119	0
	0	0	0	0	0	0	0	0	0	0	
2007	1	3	0	0	35	16	16	16	0.9302	0.0233	0.0465	0
	0	0	0	0	0	0	0	0	0	0	
2007	1	3	0	0	35	17	17	15	0.7561	0.0976	0.1463	0
	0	0	0	0	0	0	0	0	0	0	
2007	1	3	0	0	35	18	18	13	0.7692	0.0385	0.1538	0.0385
	0	0	0	0	0	0	0	0	0	0	
2007	1	3	0	0	35	19	19	11	0.2353	0.2353	0.5294	0
	0	0	0	0	0	0	0	0	0	0	
2007	1	3	0	0	35	20	20	10	0.1429	0.4286	0.3571	0
	0.0714	0	0	0	0	0	0	0	0	0	
2007	1	3	0	0	35	21	21	16	0	0.3684	0.6316	0
	0	0	0	0	0	0	0	0	0	0	
2007	1	3	0	0	35	22	22	14	0	0.4	0.55	0.05
	0	0	0	0	0	0	0	0	0	0	
2007	1	3	0	0	35	23	23	27	0	0.2593	0.5926	0.0556
	0.0185	0.037	0.037	0	0	0	0	0	0	0	
2007	1	3	0	0	35	24	24	36	0	0.0822	0.6438	0.0137
	0.0411	0	0.2192	0	0	0	0	0	0	0	
2007	1	3	0	0	35	25	25	38	0	0.0413	0.4132	0.0331
	0.0661	0.0331	0.3636	0.0496	0	0	0	0	0	0	
2007	1	3	0	0	35	26	26	43	0	0.0089	0.2133	0.0444
	0.1244	0.0533	0.5067	0.0311	0.0089	0.0044	0	0.0044	0	0	
2007	1	3	0	0	35	27	27	44	0	0.0037	0.1157	0.0373
	0.1269	0.0522	0.6045	0.0373	0.0075	0.0112	0.0037	0	0	0	
2007	1	3	0	0	35	28	28	54	0	0	0.0787	0.0131
	0.0787	0.0623	0.6328	0.0754	0.0131	0.0295	0.0066	0.0066	0.0033	0	
2007	1	3	0	0	35	29	29	49	0	0	0.0319	0.0064
	0.0703	0.0479	0.6613	0.0863	0.0383	0.0192	0.0192	0.0096	0.0096	0	
2007	1	3	0	0	35	30	30	46	0	0	0.028	0.008
	0.056	0.052	0.648	0.052	0.044	0.056	0.028	0.016	0.012	0	
2007	1	3	0	0	35	31	31	37	0	0	0.007	0
	0.0282	0.0845	0.6408	0.0775	0.0563	0.0493	0.0282	0.007	0	0.0211	
2007	1	3	0	0	35	32	32	30	0	0	0	0
	0.0769	0.0481	0.5673	0.0962	0.0481	0.0673	0.0288	0.0385	0.0192	0.0096	
2007	1	3	0	0	35	33	33	22	0	0	0	0
	0.0833	0.0333	0.5167	0.05	0.1167	0.1	0.0333	0.0333	0.0333	0	

2007	1	3	0	0	35	34	34	22	0	0	0	0
	0	0.0204	0.6327	0.1224	0.0204	0.0204	0.0816	0.0408	0.0204	0.0408		
2007	1	3	0	0	35	35	35	12	0	0	0	0
	0	0.08	0.48	0.16	0.04	0.08	0	0.12	0.04	0		
2007	1	3	0	0	35	36	36	12	0	0	0	0
	0	0	0.5333	0.0667	0.0667	0.0667	0.0667	0.2	0	0		
2007	1	3	0	0	35	37	37	6	0	0	0	0
	0	0	0.6667	0	0.1667	0	0	0.1667	0	0		
2007	1	3	0	0	35	38	38	6	0	0	0	0
	0	0	0.4286	0	0.2857	0.1429	0	0.1429	0	0		
2007	1	3	0	0	35	39	39	7	0	0	0	0
	0	0	0.5556	0.2222	0.1111	0	0.1111	0	0	0		
2007	1	3	0	0	35	40	40	5	0	0	0	0
	0.1667	0	0.3333	0.1667	0.3333	0	0	0	0	0		
2007	1	3	0	0	35	41	41	6	0	0	0	0
	0	0.1667	0.3333	0.3333	0.1667	0	0	0	0	0		
2007	1	3	0	0	35	42	42	3	0	0	0	0
	0	0	0.5	0	0	0	0	0.5	0	0		
2007	1	3	0	0	35	45	45	4	0	0	0	0
	0	0	0	0	0.6667	0	0.3333	0	0	0		
2007	1	3	0	0	35	47	47	2	0	0	0	0
	0	0	0	1	0	0	0	0	0	0		
2007	1	3	0	0	35	51	51	2	0	0	0	0
	0	0	0	0	0	0	1	0	0	0		
2009	1	3	0	0	37	11	11	2	0.5000	0.5000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
2009	1	3	0	0	37	12	12	1	0.0000	1.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
2009	1	3	0	0	37	13	13	2	0.3333	0.6667	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
2009	1	3	0	0	37	14	14	4	0.2500	0.7500	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
2009	1	3	0	0	37	15	15	13	0.0952	0.9048	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
2009	1	3	0	0	37	16	16	16	0.0000	0.9487	0.0513	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
2009	1	3	0	0	37	17	17	32	0.0364	0.8636	0.1000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
2009	1	3	0	0	37	18	18	43	0.0188	0.8500	0.1250	0.0000
	0.0063	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
2009	1	3	0	0	37	19	19	42	0.0000	0.7771	0.2171	0.0000
	0.0057	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
2009	1	3	0	0	37	20	20	46	0.0000	0.5859	0.4023	0.0000
	0.0117	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
2009	1	3	0	0	37	21	21	45	0.0000	0.3496	0.6391	0.0000
	0.0113	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
2009	1	3	0	0	37	22	22	46	0.0000	0.1728	0.8106	0.0000
	0.0166	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
2009	1	3	0	0	37	23	23	42	0.0000	0.0874	0.8579	0.0164
	0.0273	0.0109	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
2009	1	3	0	0	37	24	24	43	0.0000	0.0368	0.8405	0.0184
	0.0859	0.0123	0.0000	0.0000	0.0061	0.0000	0.0000	0.0000	0.0000	0.0000		
2009	1	3	0	0	37	25	25	41	0.0000	0.0000	0.7373	0.0932
	0.1186	0.0000	0.0000	0.0085	0.0339	0.0085	0.0000	0.0000	0.0000	0.0000		
2009	1	3	0	0	37	26	26	40	0.0000	0.0213	0.4681	0.0426
	0.2660	0.0319	0.0213	0.0106	0.1277	0.0106	0.0000	0.0000	0.0000	0.0000		
2009	1	3	0	0	37	27	27	33	0.0000	0.0000	0.2558	0.0930
	0.2907	0.0581	0.0349	0.0349	0.1628	0.0349	0.0349	0.0000	0.0000	0.0000		
2009	1	3	0	0	37	28	28	31	0.0000	0.0000	0.0778	0.0778
	0.3000	0.0111	0.0889	0.0333	0.2778	0.0889	0.0333	0.0000	0.0111	0.0000		
2009	1	3	0	0	37	29	29	26	0.0000	0.0286	0.0429	0.0286
	0.2429	0.0000	0.0714	0.0857	0.3429	0.1429	0.0000	0.0000	0.0143	0.0000		
2009	1	3	0	0	37	30	30	27	0.0000	0.0000	0.0189	0.0660
	0.2453	0.0189	0.0189	0.0943	0.4151	0.0943	0.0094	0.0094	0.0094	0.0000		
2009	1	3	0	0	37	31	31	28	0.0000	0.0000	0.0194	0.0291
	0.1650	0.0388	0.0583	0.0971	0.4369	0.0777	0.0194	0.0485	0.0097	0.0000		

2009	1	3	0	0	37	32	32	21	0.0000	0.0000	0.0462	0.0462
	0.1231	0.0308	0.0462	0.0154	0.4923	0.0923	0.0615	0.0154	0.0308	0.0000		
2009	1	3	0	0	37	33	33	16	0.0000	0.0000	0.0172	0.0172
	0.0172	0.0000	0.0517	0.0345	0.6379	0.1379	0.0172	0.0172	0.0172	0.0345		
2009	1	3	0	0	37	34	34	12	0.0000	0.0000	0.0000	0.0000
	0.1034	0.0690	0.1034	0.1724	0.3793	0.1379	0.0000	0.0345	0.0000	0.0000		
2009	1	3	0	0	37	35	35	9	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.1613	0.7742	0.0323	0.0323	0.0000	0.0000	0.0000		
2009	1	3	0	0	37	36	36	9	0.0000	0.0000	0.0000	0.0400
	0.0400	0.0400	0.0800	0.1200	0.4400	0.0800	0.0000	0.0400	0.0800	0.0400		
2009	1	3	0	0	37	37	37	8	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0909	0.1818	0.3636	0.0000	0.2727	0.0000	0.0909	0.0000		
2009	1	3	0	0	37	38	38	7	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.4444	0.1111	0.0000	0.1111	0.1111	0.2222		
2009	1	3	0	0	37	39	39	7	0.0000	0.0000	0.0000	0.0000
	0.1250	0.0000	0.0000	0.1250	0.2500	0.1250	0.2500	0.0000	0.1250	0.0000		
2009	1	3	0	0	37	40	40	5	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.6667	0.0000	0.3333	0.0000	0.0000	0.0000		
2009	1	3	0	0	37	41	41	4	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.2000	0.0000	0.4000	0.4000	0.0000	0.0000	0.0000		
2009	1	3	0	0	37	42	42	2	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.3333	0.0000	0.6667	0.0000	0.0000	0.0000		
2009	1	3	0	0	37	43	43	1	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000		
2009	1	3	0	0	37	44	44	1	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000		
2009	1	3	0	0	37	45	45	1	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.5000	0.0000	0.5000	0.0000	0.0000	0.0000	0.0000		
2009	1	3	0	0	37	46	46	1	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000		
2009	1	3	0	0	37	48	48	1	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
2009	1	3	0	0	37	49	49	1	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000		
2009	1	3	0	0	37	51	51	1	0.0000	0.0000	0.0000	0.0000
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000		
# Ghost acoustic survey revised for 2010												
1977	1	3	0	0	5	1	51	-1	151.94	144.57	902.04	82.60
	115.79	1001.86	138.13	102.08	58.53	54.82	28.54	10.61	2.79	3.46		
1980	1	3	0	0	8	1	51	-1	16.18	1971.21	190.90	115.65
	94.42	417.83	154.83	333.21	133.62	78.76	13.26	22.81	4.75	3.49		
1983	1	3	0	0	11	1	51	-1	1.10	3254.35	107.83	32.62
	428.59	68.59	47.27	33.71	92.68	21.86	25.80	26.90	4.32	0.00		
1986	1	3	0	0	14	1	51	-1	4555.66	119.65	21.04	148.80
	2004.57	215.71	171.63	225.45	27.33	28.72	2.08	10.85	3.49	0.00		
1989	1	3	0	0	17	1	51	-1	411.82	141.76	31.19	1276.32
	28.43	10.08	18.30	435.18	22.95	1.75	43.08	0.00	0.00	1.76		
1992	1	3	0	0	20	1	51	-1	318.37	42.50	246.38	630.74
	77.96	31.61	1541.82	46.68	28.08	14.14	533.23	27.13	0.00	28.42		
1995	1	3	0	0	23	1	51	-1	880.52	117.80	32.62	575.90
	26.58	88.78	403.38	5.90	0.00	429.34	0.96	17.42	0.00	130.39		
1998	1	3	0	0	26	1	51	-1	414.33	460.41	386.81	481.76
	34.52	135.59	215.61	26.41	39.14	120.27	7.68	4.92	104.47	29.19		
2001	1	3	0	0	29	1	51	-1	1471.36	185.56	109.35	117.25
	54.26	54.03	29.41	17.11	12.03	5.07	4.48	8.73	0.83	3.10		
2003	1	3	0	0	31	1	51	-1	99.78	84.88	2146.50	366.87
	92.55	201.22	133.09	73.54	74.67	24.06	14.18	14.63	10.33	14.12		
2005	1	3	0	0	33	1	51	-1	601.86	61.02	180.86	129.98
	1210.46	132.12	45.07	61.09	34.83	28.17	11.90	6.11	0.81	4.35		
2007	1	3	0	0	35	1	51	-1	849.10	48.34	202.04	22.86
	81.75	51.65	575.01	59.95	26.72	26.16	14.25	12.07	5.51	7.79		
2009	1	3	0	0	37	1	51	-1	0.001881487		0.229516308	
	0.423131165		0.024860506		0.091878204		0.00785628		0.018073704		0.024434	
	0.128612757		0.029027282		0.009417396		0.005566288		0.005401788		0.000342836	

0 # No Mean size-at-age data
0 # Total number of environmental variables

0 # Total number of environmental observations
0 # No Weight frequency data
0 # No tagging data
0 # No morph composition data

999 # End data file

Agenda Item E.3.a
Attachment 3
March 2010

Pacific Whiting
The Joint U.S.-Canada STAR Panel Report

Pacific Fishery Management Council
Hotel Deca
Seattle, Washington
February 8-10, 2010

Review Panel Members:

Vidar Wespestad (Chair), SSC representative
Geoff Tingley, Center for Independent Experts
Patrick Cordue, Center for Independent Experts
Tom Carruthers, University of British Columbia

Stock Assessment Team (STAT) Members Present:

Ian Stewart, Northwest Fisheries Science Center
Owen Hamel, Northwest Fisheries Science Center
Steve Martell, University of British Columbia

Advisors:

Jason Cope, GMT representative
Tom Libby, GAP representative
Robyn Forrest, Department of Fisheries and Oceans, British Columbia
Chris Grandin, Department of Fisheries and Oceans, British Columbia
Greg Workman, Department of Fisheries and Oceans, British Columbia
John DeVore, PFMC representative

Overview

During 8-10 February 2010, a joint Canada-U.S. Pacific hake / whiting Stock Assessment Review (STAR) Panel met in Seattle, Washington, to review two draft stock assessment documents that had been prepared by Stewart & Hamel (2010) and Martell (2010). The Panel operated under the U.S. Pacific Fishery Management Council's Terms of Reference for the Groundfish Stock Assessment and Review Process for 2009-2010 (PFMC 2008). As in previous years, the Panel attempted to adhere to the spirit of the Canada-U.S. Treaty on Pacific hake / whiting, with the Panel including a member from Canada. The revised stock assessments and the STAR Panel Report will be forwarded to the Pacific Fishery Management Council (PFMC) and its advisory groups, and to the Canadian Department of Fisheries and Oceans (DFO) managers and the Groundfish Sub-committee of PSARC (Pacific Scientific Advice Review Committee).

The Panel convened at 9AM Monday, February 8, 2010 with a welcome from the Chairman and a round of introductions. Mr. John DeVore of the Pacific Fisheries Management Council opened the meeting with an overview of the STAR process and reviewed the terms of reference. The agenda was reviewed and finalized for the duration of the STAR panel.

After the opening proceedings the STAR panel received an overview of the 2009 hake/whiting fisheries in Canadian waters from Chris Grandin, DFO and from Ian Stewart, NMFS Northwest Fisheries Science Center (NWFSC) on the 2009 fishery in U.S. waters. The presence of Humboldt squid was noted in the 2009 fishery, primarily in northern Washington and southern BC. Squid were not a problem in the fishery off Oregon as reported by fishermen present at the STAR panel.

Following the presentation of fisheries data, Dr. Dezhang Chu of the NWFSC Acoustic staff provided the STAR with an overview of the methodology of acoustic stock estimation techniques and the manner of constructing stock estimates from acoustic signals. This was followed by a presentation of the 2009 survey results by Dr. Rebecca Thomas, also a member of the NWFSC acoustics group. The survey results were the whiting/hake stock in 2009 was estimated to be 1.462 million metric tons (mmt), up from 0.879 mmt in 2007. Dr. Thomas noted that the majority of the stock was located in US waters in 2009 and fish were nearly continuously distributed from California to mid Vancouver Island. The presence of Humboldt squid was noted in the acoustic survey, and their relative abundance/biomass was much higher than that from the 2007 survey.

The presence of squid in 2009 was problematic. Echograms suggested that squid caused the distribution of hake to be altered on survey transects where they were present. In these situations, it appeared that hake were schooled near the bottom with a mixed hake/squid layer above it. Sampling by trawl and camera indicated variability in the distribution of squid and hake in the distributional strata of transects where squid were present making it difficult to determine the actual species mix. On 44 transects of the total of 77 transects where hake were present, there is higher confidence of hake identification, although there may have been some squid on these transects. The estimated biomass from these transects was 0.87 mmt. A large part of the STAR panel discussion focused on the acoustic survey in regards to squid in the 2009 survey and the adequacy and accuracy of acoustic survey trawl sampling of observed echo sign (marks) for length frequency and species composition of the sign/marks.

The panel also received a presentation by Dr. Chu on the ongoing analysis of the time series of the acoustic survey. Currently the data reside in various locations and data forms that preclude direct analysis of all of the data collected since the late 1970s. Dr. Chu's group has an on-going project to prepare a standardized database of the entire data set. The STAR panel agrees with Dr. Chu that this is an important task and supports his efforts to improve the acoustic data base for the U.S.-Canadian hake stock.

The remainder of the first day of the meeting was taken up by an overview of the data sources used for the 2010 whiting/hake assessment by Drs. Ian Stewart and Owen Hamel of the U.S. STAT Team. On the second day, the STAR resumed with presentations of the results of the two stock assessment models under review. Ian Stewart of the U.S. STAT presented the Stock

Synthesis model description and results, which was followed by a presentation of the TINSS model description and results by Dr. Steve Martell of the Canadian STAT.

The STAR Panel focused their attention on the modeling approaches and the treatment of data and explored model sensitivity. Secondly, the STAR Panel explored the influence of the 2009 acoustic survey data and age compositions on model results. This was to examine the potential bias of the presence of large numbers of Humboldt squid on results, and in general the question of adequacy of sampling of echo-sign for length-age composition.

The STAR Panel progressed in three stages through the base models and the underlying data. This process began by examining the underlying structure of the base models and then moved toward an examination of the fishery and survey data used in the base model. From there the STAR Panel formulated different configurations of the two base models until arriving at models with defensible input data and minimal complexity.

The preliminary base models provided by the STAT teams were not considered acceptable by the STAR Panel primarily because of data issues. The STAR Panel's preliminary preferred runs specified a number of changes to the input data:

- Remove all acoustic age and length frequency data
- Remove 1986 and 2009 acoustic biomass estimates
- Split acoustic time series into two parts (separate qs): 1977-1992, 1995-2007
- SS3: Remove length frequencies and conditional age-at-length; replace with age frequencies

The acoustic composition data were omitted because it was considered extremely unlikely that the opportunistic sampling of hake layers with mid-water trawl gear could provide a consistent time series (i.e., with a constant selectivity across years). The 2009 biomass estimate was clearly compromised by the significant presence of squid and was not comparable to earlier survey estimates. Also, a smaller survey area was covered in the 1977-1992 surveys and although "expansion factors" had been applied to the survey estimates it was prudent to split the time series into two components. The 1986 survey estimate was potentially biased as the pre- and post-survey calibrations were substantially different. Finally, efforts to fit the length frequencies and conditional age-at-length data in the SS3 model had been less than successful with very poor residual patterns for the length data. There was also the technical issue that fish were growing during the fishing season and this would potentially compromise the use of the conditional age-at-length data.

The STAR Panel considered that the SS3 and TINSS models were equally acceptable to provide a base model run. However, the full MCMC run was only available for the TINSS model. It is primarily for this reason that the Panel adopted the TINSS model, with the Panel's preferred data specification, as the base model.

The final preferred base model was the TINSS model:

- acoustic biomass indices split into two time series: 1977-1992; 1995-2007 (the 1986 and 2009 indices are omitted, as are all composition data); standard deviation in log space assumed constant within each time series: 0.5 and 0.25 respectively
- commercial age frequencies (single fishery; US and Canadian data combined)

The point estimate of 2010 depletion is 37% with a projected OY of 339,000 mt (based on the 40-10 rule using estimated F_{MSY} rather than the proxy of $F_{40\%}$). These are "risk neutral" estimates being the medians of the marginal posterior distributions. A decision table, with alternative catch streams and three states of nature, can be constructed from the base MCMC run using the central 50% of the posterior distribution, and the two tails each containing 25% probability.

Summary of data and assessment models

The STAR Panel was provided with five basic components to enable and support the review. These were:

(i) background documentation;
(ii) overviews of the US and Canadian fisheries;
(iii) information and data relating to the 2009 acoustic survey;
(iv) full details of the base Stock Synthesis 3 (SS3) stock assessment model (Stewart and Hamel, 2010); and
(v) full details of the base TINSS stock assessment model (Martell, 2010).

In addition to the written papers, presentations on the acoustic survey, SS3 model and outputs, and the TINSS model and outputs were made to the Panel.

The quantity and coverage of the background material was adequate and provided in a timely manner in advance of the meeting together with the draft SS3 and TINSS stock assessments.

The only subject not covered by the material made available in advance of the meeting was information about the 2009 acoustic survey. Typically this would not necessarily be required; however, due to the presence of large numbers of squid and the impact of this on the hake biomass estimate, the STAR Panel would have benefited from an earlier awareness of the survey and these associated issues.

The quality of the written material was high and largely comprehensive and all participants fully supported the Panel members in their understanding of the techniques, results and caveats, freely answering calls for clarification and for additional supporting detail. Those responsible for producing and presenting the material are to be congratulated.

Issues of note from the fisheries include the failure to catch the OY in some years due to reaching bycatch limits, the inefficiencies exhibited by new entrants to the fishery, and some market difficulties leading to a temporary reduction in effort. The presence and extent of the Humboldt squid, *Dosidicus gigas*, radiation and their influence on the fishery in 2009 was also noted.

Within the assessment were descriptions of some alternative survey-based approaches to develop hake biomass indices none of which had proved satisfactory.

Suggestions for future reviews of Pacific hake / whiting assessments.

When it is fully implemented, the Pacific Hake / Whiting Agreement between the U.S. and Canada will establish a process for developing and reviewing stock assessments and providing management advice for this important transboundary stock. Given the definite possibility that the assessment review next year (2010) may again operate under the STAR Terms of Reference, the PFMC's Scientific and Statistical Committee (SSC) should consider altering the STAR Terms of Reference to better accommodate alternative stock assessments developed by Canadian scientists.

The process for future assessments of Pacific hake should ensure that the STAT has adequate time to conduct the assessment. Late arrival of data and a compressed schedule to resolve the assessment can result in a rushed assessment that can lead to incorrect results. A different assessment and review process is needed given the expectation that this situation will re-occur with late-season fishing in both countries. For example, a partial release of catch quota could be made to accommodate the early season, with a later release based on a new assessment that is completed in March or April.

Simulation evaluation

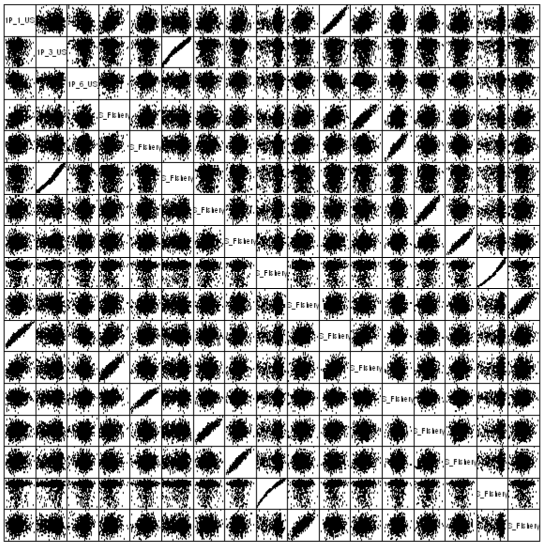
A simple but useful exercise when proposing a relatively complex assessment model is to simulate data from the same model using known parameter values. The model can then be refitted to these data to evaluate whether such parameters can be reliably estimated ('search for parsimony': TOR Appendix B, Section D 4 a). It is unlikely that there is sufficient information to separately estimate the parameters of the SS3 base case model reliably, particularly if subject to realistic levels of observation error (to an extent this is supported by the literature; e.g. Thompson 1994). An advantage of the TINSS model was the ability to demonstrate that parameters could be accurately estimated from simulated data.

Requests by the STAR Panel and Responses by the STAT

The first set of requests was to the US STAT team and applied to their preliminary base model.

1. A plot of MCMC posterior parameter correlation among: descending limb selectivity parameters, natural mortality rate, senescence, time varying growth parameters, B_0.

> Rationale: To better understand parameter confounding and the surface of the joint posterior.



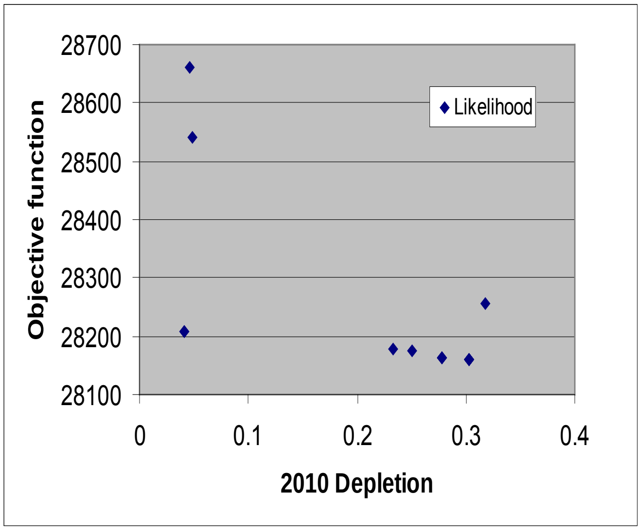


Figure 1. **Figure 2.**

Since they are related issues, a discussion of this STAT response is included below in the response to request 2.

2. Jittered runs (multiple random starting values) of the MLE run returning the normalized depletion estimates of a number of runs (10+). For each run could the STAT team also report the value of the objective function and the number of runs that did not satisfy convergence criteria.

> Rational: This was requested to understand whether SS3 can reliably arrive at similar model predictions from different initial values
>
> Response: The STAT team produced the plots displayed above.
>
> Discussion: In general the SS3 assessment model appears overly complex leading to undesirable model properties. The SS assessment seeks to simultaneously estimate time varying growth, senescence, descending limb parameters of several dome shaped selectivities, initial biomass and recruitment anomalies that are all to some extent theoretically confounded (e.g. Thompson, 1994). This is illustrated by Figure 1 above that describes strong parameter cross correlation and redundancy in model complexity.

The poorly defined objective surface is reflected by the inability of AUTODIFF to converge reliably. In 29 different jittered runs the base case SS3 model did not converge in 10 and found subjectively 'unrealistic' values in all but 5 of the remaining model runs. Of the five model runs that were deemed credible, the range of estimated depletions ranged from around 2.3 to 3.2 (Figure 2). This large range is concerning since it implies that the estimation method cannot consistently find a global minimum (this is relevant to the TOR Appendix B Section D 4 f). It follows that many MLE runs must be undertaken before one can have confidence over whether a true global minimum as been found. This raises the issue of whether individual sensitivity runs are representative of genuine sensitivities or simply the product of poor convergence from a particular set of starting values.

These concerns was less relevant to the TINSS model since most sensitivity analyses were conducted on the MCMC run (we had assurance from the Canadian STAT team that the TINSS MLE model converged on the same parameter values and management recommendations irrespective of starting values).

Historically the AIC model selection criterion has been used to select the SS3 base case model structure. Given the parameter redundancy highlighted above, the current base case may not be a suitable starting point for the search for a parsimonious model.

3. Model runs with the removal of the 2009 acoustic survey data for comparison with base case and other runs. Biomass out, composition data in; or all data out.

> Rational: To further examine the sensitivity of estimated depletion to the weight on the 2009 survey data (removal being equivalent to an infinite CV).
>
> Response: Estimated 2010 depletion was reduced from 31% (base model, CV=0.5) to 25% with the exclusion of the 2009 biomass index. Including or excluding the 2009 composition data made very little difference. There was an existing run with a CV of 0.25 on the 2009 index which had depletion estimated at 43%.
>
> Discussion: This emphasized the importance of the weight given to the 2009 biomass index – a point that had already been noted by both STAT teams.

4. Provide details of the scaling procedures used to produce commercial length frequencies and conditional age at length.

> Rational: Clarification was required due to some slight ambiguities in the documentation.
>
> Response: The relevant equations were presented. Samples were scaled-up by number within each haul/landing, and then scaled by catch weight within fleet (shore-based or at-sea).
>
> Discussion: The scaling at each stage should be by number. Also, spatial and temporal strata, and perhaps finer scale fleet strata, should be used. (See Research Recommendations.)

5. Provide expansion factors applied to the acoustic estimates in each year.

> Rational: To confirm the years in which indices had been adjusted and by how much.
>
> Response: Extracts of documents were presented detailing the history of adjustments which had been made to the indices from 1977 to 1992 inclusive. There had been an initial adjustment for a change in assumed target strength (from –35 dB per kg to the

Traynor (1996) relationship), combined with an adjustment for area differences (Dorn et al. 1996). The area expansion factors ranged from 1.47 to 1.78. Adjustments were later revised using a more complex method (Helser et al. 2004).

Discussion: Substantial expansion factors were applied to the 1977 to 1992 indices. This suggests that the acoustic time series does not have a consistent proportionality constant (q) across all years, and indicates that it should be modeled as two time series with separate qs.

6. Propose the number of qs to use and the years to which each q applies.

Rational: The simple split indicated by which surveys had been expanded may not be the only basis by which to assign surveys to alternate qs.

Response: The STAT team declined to offer a suggestion.

Discussion: This was an optimistic request – it would require a very detailed analysis of spatial distributions and other factors to arrive at an alternative method of splitting the time series.

7. Likelihood profile across R_0 for all likelihood components including penalties.

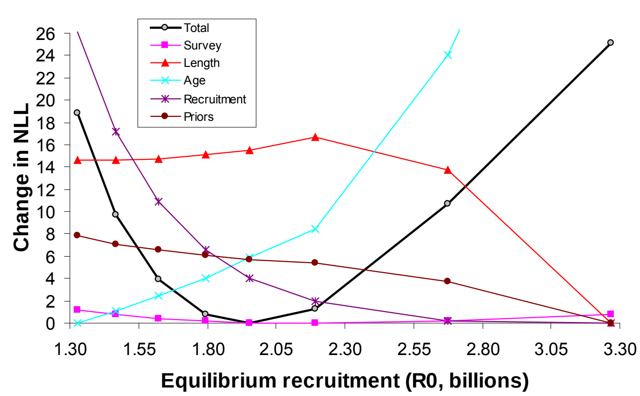
Rational: The examination of likelihood profiles across R_0 for individual components reveals which data are consistent with low or high biomass and shows the contribution that each data type makes to the total likelihood.

Response: The main contributions to the total likelihood came from the age data and the *penalties* on recruitment deviations. R_0 was determined by a trade-off between these two components, with the age data preferring low biomass which was associated with high penalties on the recruitment deviations.

Discussion: It is a common feature of these types of models that the survey biomass index makes little relative contribution to the total likelihood which is dominated by age/length data. It is not so common to see a relatively arbitrary penalty function playing such a central role in determining the estimate of R_0. This needs further investigation (see Research Recommendations).

8. Likelihood profile across q (0.6-1.3) for all likelihood components including penalties.

Rational: As for the previous



request, but looking at another parameter of interest.

Response/Discussion: The survey biomass indices were central to the estimate of q as would be expected given that R_0 was largely determined by the other data (and penalties).

Given the sensitivity of assessment results to the weight placed on the 2009 acoustic biomass index a request was made to the acoustic team to provide a further summary of data with regard to the squid problem:

Acoustics request: 2009 acoustic survey, how extensive were the squid: spatial distribution; number of transects with identified squid or mixed echo sign; biomass estimates split by mark type (hake, mixed hake & squid)

Rational: A decision needed to be taken on whether the 2009 acoustic index was comparable to other points in the recent time series.

Response: Preliminary information on the spatial distribution of assigned squid backscatter was presented and compared with the assigned hake backscatter. There was clearly a large spatial overlap in the distributions. The "rule of tentacle" which had been used to assign backscatter to hake, when there was a potential mixing of squid and hake, was used on 33 out of 77 transects in US waters. These transects contributed 41% of the total estimated hake biomass. The biomass associated with "definite" hake marks was 870,000 t (compared to the total estimate of 1,470,000 t)

Discussion: There is clear potential for large bias in the 2009 index because of mis-classification of acoustic layers and marks. Also, the relative target strengths of squid and hake are very uncertain, as are their relative selectivities to the trawl gear, which makes the partitioning of backscatter between the two species on the basis of trawl catches very problematic.

The second set of requests were for both STAT teams with regard to their preliminary base models

1. Runs with 1986 acoustic survey in or out; runs with alternative calibration used.

Rational: In 1986, the pre-survey and post-survey calibrations differed by 1.7 dB (a factor of about 1.5). As it has an indeterminate bias, the index should be excluded from assessment runs, but the Panel wanted to know if its inclusion made any difference to the results.

Response/discussion: There was little difference to the results in either model.

2. Runs with no acoustic data (compositional data and biomass removed for all years).

Rational: To determine if the results were sensitive to the inclusion of the acoustic survey data.

Response/discussion: The exclusion of the data made little difference to the SS3 model results (as could be expected by the results of the likelihood profile on R_0 – see above). However, in the TINSS model the exclusion of the data resulted in lower estimated spawning biomass and a dramatic reduction in the depletion estimate (about 25% compared to 61% in the base model).

3. Runs with fishery selectivities moved further to the left (informed prior on age at 50% selectivity: weight at 3 years)

Rational: In the SS3 model, estimated selectivities seem somewhat unlikely with full selection not occurring until 8-10 years of age. It was wondered if similar fits to the data could be achieved with full selection at younger ages. In the TINSS model full selection was already further to the left at about 6 years.

Response/discussion: The informed priors were over-ridden by the data and results were little changed. This issue could do with further investigation.

For US STAT team:

4. Summary of commercial catch by season within year (by sector if possible).

Rational: There was concern that the growth of fish during the fishing season could compromise the use of the conditional age-at-length data (in the SS3 model).

Response/discussion: Data provided by the US STAT team and from other sources suggested that this was an area of concern, particularly, but not exclusively, in the last three years. It is primarily an issue for the US data as younger fish, which grow faster, are caught in this fishery.

For Canadian STAT team:

5. Implied prior on derived variables e.g., depletion

Rational: To understand the prior inference regarding management reference points.

Response/discussion: Removing the likelihood function reveals that prior assumptions lead to less pessimistic depletion estimates and that the model is not updated strongly by inclusion of the data.

6. MCMC integration results for the three parameter Thompson selectivity curve (posterior density plots for M and the gamma parameter).

> Rational: The dome shaped Thompson selectivity curve seeks to estimate a third parameter that controls the slope of the descending limb. This request served to investigate whether dome shaped selectivity and lower natural mortality rate could provide a better explanation of the data.
>
> Response/discussion: Parameters estimates were in keeping with asymptotic selectivity and high natural mortality rate. Dome shaped selectivity was not supported by the TINSS model fitted to the aggregated Canadian and US commercial data.

The third set of requests were for both STAT teams:

1. Model run for:

STAR Panel's preliminary preferred run:

- Remove all acoustic age and length frequency data
- Remove 1986 and 2009 acoustic biomass estimates
- Split acoustic time series into two parts (separate qs): 1977-1992, 1995-2007
- SS3: Remove length frequencies and conditional age-at-length; replace with age frequencies
- SS3: Use MPD growth estimates from preliminary base model
- Acoustic selectivity: e.g., 50% 2+ biomass; and try alternative assumptions: 20% at age 2, 80% 3+;

Time permitting: explore sensitivities (e.g., acoustic age and length frequencies included; SS3: low M, high M; TINSS: alternative priors on C*, F*, high and low central tendency, high and low variability).

TINSS: MCMC run for preliminary preferred model with diagnostics (time permitting).

Rational: The STAR Panel wished to see results for runs from each model which used only fully defensible data. Sensitivities were requested to explore dimensions of uncertainty appropriate to each model. MCMC results were not requested for the SS3 model as they would not have been available in time (this model can takes days to produce MCMC results).

> Response/discussion:
>
> In the TINSS model, in comparison with the original base, biomass estimates were reduced and the 2010 depletion estimate was much lower (34%, compared to 61%). There was strong sensitivity to assumed priors with regard to OY, especially in terms of the assumed variance of the MSY prior; lower variance removing the long tail resulting in a much lower point estimate (being the median of the posterior).

The US STAT team presented results for the requested run but also offered an alternative run on which they based their sensitivity runs. Their variation was to estimate a single *M* over all ages rather than fix *M* at 0.23 and estimate a senescence value (for 14-15+). For both runs, in comparison to their base model, much higher biomass was estimated (about a factor of 2.5) but with similar, although higher, 2010 depletion: 40% compared to the base model estimate of 31%.

2. Runs with the "minimum" 2009 hake estimate (0.87mmt): preliminary preferred model; STAT team preliminary base models.

Rational: To determine the effect of including a "confident", yet probably biased low, estimate of hake biomass for the 2009 survey.

Response/discussion: The inclusion of the estimate had little effect in any of the runs. However, the direction of the changes were interesting for the SS3 models, with the inclusion of the estimate in the STAR Panel preferred model giving a lower estimate of 2010 female spawning biomass, and its inclusion in the STAT teams preliminary base model giving a small increase.

The fourth set of requests called for a slight change to the STAR Panel's preferred models and requested model specific sensitivity runs:

STAR Panel preferred base models: as in request 3 with higher CVs on earlier acoustic times series (e.g., .5 for 1977-1992; 0.25 for 1995-2007). SS3: M=.23, Canadian fishery selectivity asymptotic.

Sensitivity runs to preferred base models:

SS3: Two bracketing runs: estimate M with asymptotic Canadian fishery selectivity; estimate M with free selectivities; alternative runs as necessary to fully bracket uncertainty (e.g., in depletion and OY)

TINSS: Two bracketing runs using alternative priors for F* and/or C* changing the median values and/or variances.

SS3: a plot of the STAT team preliminary base model posterior and prior density with regards to the slope of the fishery selectivity descending limb parameter (s) including the MLE estimate (in the inverse logit space 0-1).

SS3: likelihood profile for individual components across R0 for the STAR Panel preferred model

Rational: As pointed out by the US STAT team, the earlier acoustic time series was clearly more uncertain than the recent series (so higher CVs for the earlier series) The dimension of uncertainty for SS3 was chosen to be *M* and the trade-off between *M* and domed or asymptotic fishery selectivities. The US fishery doesn't have access to all of the older fish, so the US fishery selectivity was allowed to remain domed in all runs. The other SS3 requests concern technical issues which lead to research recommendations. The dimension of uncertainty for the TINSS model were the two crucial assumed priors.

Response/discussion:

In the SS3 model the change to asymptotic selectivity in the Canadian fishery resulted in a large decline in estimated biomass, back to a level similar to that of the STAT team's preliminary base model. Also, estimated 2010 depletion was somewhat lower at 32% (compared to 40% in the STAR Panel's preliminary preferred model) which was almost the same as the STAT team's preliminary base model estimate of 31%. The range of estimated 2010 depletion for sensitivity runs was 15-42%.

The slight modifications to the TINSS model made little difference to the results. The sensitivity runs also showed the same effects: changing the priors had little effect on estimated biomass or 2010 depletion (range 33-38%), but dramatically affected estimated OY (range 250,000-400,000 t).

The final request to the STAT teams was for a summary table of estimates across a number of runs:

1. Summary table for three runs: STAR Panel preferred runs, SS3 and TINSS; SS3 preliminary base model.

Include estimates for: 2010 depletion, OY, acoustic *q*s, steepness (*h*), *M*.

SS3: MPD estimates
TINSS: Median of posterior; MPD (mode of posterior)

Response: The table is given below.

	TINSS	TINSS	SS3	SS3 (update)
Metric	MPD	Median	MPD	MPD
2010 Depletion	29%	37%	32%	31%
2010 OY mt	220,000	339,000	235,000	225,000
*q*s	0.454/0.467	0.39	0.59/0.68	0.94
h	0.538	0.519	0.86	0.88
M	0.273	0.286	0.23	0.23/0.62

Discussion: A great deal of care is needed in interpreting this table. The OYs for the TINSS run are based on F_{MSY}, but the SS3 runs use $F_{40\%}$. If OY was estimated based on $F_{40\%}$ in the TINSS run, the estimates would be much higher; $F_{40\%}$ is a very aggressive policy in the TINSS parameter space and is not a good proxy for F_{MSY}. Also, the acoustic *q*s are not comparable between the SS3 update run (being the STAT team's preliminary base model) and the other runs.

The update-run has a domed selectivity for the acoustic survey whereas the other runs assume 50% selection at age 2 and 100% selection at ages 3 and older. A single q is given for the TINSS median; there are actually two qs but they are not very different. The second M for the update run is for senescence.

Description of base model and alternative models used to bracket uncertainty

The STAR Panel considered that the SS3 and TINSS models were equally acceptable to provide a base model run. However, the full MCMC run was only available for the TINSS model. It is primarily for this reason that the Panel adopted the TINSS model, with the Panel's preferred data specification, as the base model.

TINSS model:

- acoustic biomass indices split into two time series: 1977-1992; 1995-2007 (the 1986 and 2009 indices are omitted, as are all composition data); sd in log space assumed constant within each time series: 0.5 and 0.25 respectively
- commercial age frequencies (single fishery; US and Canadian data combined)

Alternative models used to bracket uncertainty.

The full MCMC run for the base model is used to describe and bracket uncertainty. This is achieved by basing the decision table on the central 50% of the posterior distribution and the left and right hand tails (each holding 25% of the posterior distribution).

This single model does not encompass the full range of uncertainty, but it does, by itself, describe such an uncertain assessment of the status of the stock that the addition of further uncertainty would not be useful to managers.

Comments on the assessments

Comments on the data

There may be useful information within the commercial catch and effort data that are currently unused in these assessments.

The acoustic survey is currently generating the only usable biomass index to support the assessment.

Preliminary base runs

Neither of the preliminary base runs presented by STAT teams were considered acceptable by the STAR Panel. There were a number of serious problems with the input data in both models.

The most serious data problems were with the treatment and use of the acoustic survey data. It became clear during the meeting that the 2009 survey results were badly compromised by the unusual occurrence of large quantities of squid in the survey area. The biomass index for 2009 was clearly not comparable with other points in the time series (and had to be omitted in later runs). Also, use of the survey compositional data assumes that the samples from trawl catches provide representative length/age samples of the hake that are vulnerable to the acoustic beam.

There is a selectivity pattern associated with the trawl gear . There is a different selectivity pattern associated with the acoustic beam (that is not comparable to the catch data as used in the base models). However, within the assessment models the trawl selectivity pattern must necessarily be age-based and assumed constant across the time series. Minor deviations from year to year are not an issue, but potential changes in selectivity from year to year may be large and currently cannot be quantified. At issue are: that the trawling is targeted on marks at the discretion of the voyage leader; the stated aim of the trawling is to obtain a "sample" of fish (and to avoid large catches and specific by-catch species); different fishing strategies will have been used by the various personnel doing the fishing over the years (on the two vessels) – e.g., a dip into a layer, or targeting the headline below the layer; and the length compositions are post-stratified and assigned to transects (for scaling up) on an ad hoc basis.

It was noted that acoustic surveys conducted elsewhere in the world also collect length and age data. However, these data do not appear to then be used in assessment models but are used only with the specific survey data.

There is undoubtedly some length structure within the hake layers and marks; the length composition in a trawl catch will not only depend on what fish are in the mark but also on how the mark is fished. The absence of any statistical design aimed at providing consistent representative sampling for length or age structure makes it very difficult to justify the use of the survey composition data in stock assessment model runs.

It was also clear, from the scale of the expansion factors that had been applied to the early indices in the acoustic time series, that they could not be considered comparable to the later indices. As a matter of good practice, they needed to be split into a separate time series (even though, within the early series not all surveys are necessarily comparable). Finally, with regard to the acoustic data, the biomass estimate of the 1986 survey was suspect because of a large difference between the pre- and post-survey calibration results.

The commercial catch composition data were not without problems either. In both models there are concerns that catch compositions have not been stratified and scaled in the most appropriate manner (see Research Recommendations). However, the main issue is that of the growth of young fish during the fishing season. In the SS3 preliminary base model, a single mid-year prediction of proportions at age for a given length are made to fit the conditional age-at-length data. However, in the fishery, which may extend for 7-8 months, including summer when perhaps most growth occurs, the proportions of age-at-length can be dramatically different at the start of fishing season compared to the end of the fishing season (for some of the younger age classes that are vulnerable to the US fishery). In the TINSS model, the age frequencies were derived from the age samples independently of the length frequencies (so do not suffer from this problem).

Technical merits:

The Panel chose the TINSS model as the base, but both models are equally acceptable and so are considered here.

Data used in both models:

- The most defensible data set that was available in the timeframe of the review

TINSS:

- A reasonably well tested model as it has been used for a number of years and has been peer reviewed on each occasion.
- Has the advantage of relative simplicity in terms of population dynamics.
- Explicitly accounts for observation and process error
- Integrates major aspects of uncertainty through Bayesian estimation.

SS3:

- Developed using a well tested and documented package
- Has separate US and Canadian fisheries and associated selectivities
- Attempts to account for changes in fishery selectivity over time in both fisheries

Technical deficiencies:

As in the above section, both models are considered:

TINSS:

- Some of the technical aspects of the model are not well understood by many stock assessment scientists (because it is a relatively unusual model in the stock assessment context); hence the level of peer review it has received may not be as in-depth as it could be.
- Similarly, the suite of suitable model diagnostics is not as well-developed as for a "standard" observation error model (such as SS3).
- The age frequencies may not be properly weighted because of stratification issues and the aggregation into a single fishery.
- There is no mechanism to compensate for possible changes in fishery selectivity.
- The model does not have informed priors for the acoustic *q*s which limits our ability to judge the plausibility of the estimated size of the stock

SS3:

- The model may be over-parameterized due to the extensive blocking structure which attempts to compensate for possible changes in fishery selectivities.
- Some of the supposedly un-informative priors on selectivity parameters may actually be highly informative
- The age frequencies may not be properly weighted because of stratification issues.
- The model reviewed by the Panel does not integrate uncertainty through Bayesian estimation (the Bayesian run is not available to the Panel before the finalization of this report due to time constraints).
- The model does not have informed priors for the acoustic *q*s which limits our ability to judge the plausibility of the estimated size of the stock

Explanation of areas of disagreement regarding STAR Panel recommendations

Among STAR Panel members (including GAP and GMT representatives)

None

Between the STAR Panel and STAT Team

There were no significant disagreements between the STAR Panel and STAT Team.

Unresolved problems and major uncertainties

- It is not clear how best to assess this stock, either in terms of the appropriate level of model complexity, or in terms of the level of data aggregation (but, this is a generic problem for many stock assessments).
- The available input data are inadequate to provide a precise assessment of stock status. In particular, the scale of the stock, in absolute terms, is very poorly determined.
- The stratification and scaling of the age samples may be inappropriate.
- The split of the acoustic surveys into two time series may need revision in terms of which years belong in which series (or if more than two series are needed).

Management, data, or fishery issues raised by the GMT or GAP representatives during the STAR Panel.

The GMT representative noted that there were differences in how management advice is formulated using the two different models. The GMT may have to rely on the assessment author to provided needed GMT input in the absence of people familiar with the TINSS model. The issue of management advice linked to specific models may be something the SSC may wish to take up.

Recommendations for future research and data collection.

- A detailed analysis of catch, effort, length, and age data by sex, going as far back as possible, and split by fleet, and vessel type, is needed to help understand the commercial data which go into the stock assessment models. In particular, this would enable, (i) defensible length and age frequencies to be constructed by fleet (not just shore-based and at-sea within country), which in turn may enable the modeling of the fisheries data with constant selectivities over time within fleet (or, at least, lead to a reduction in the need for time-varying selectivities); and (ii) abundance indices (i.e. one or more fleet-based CPUE indices) to be explored to provide an alternative (or an addition) to the acoustic survey biomass (should the squid remain in the region and continue to make survey-based hake biomass unreliable; also, having alternative or additional indices would strengthen the ability of the modelers to adequately assess the hake stock) . This should also include additional spatial data describing the tribal and shore-based fisheries.
- Analysis from all data sources (commercial and acoustic survey) aimed at understanding the spatial, vertical, and temporal patterns of hake distribution (by length, age, and sex).
- Fund research into the appropriateness of attempting to produce biomass estimates at length, age, and sex, from acoustic surveys of semi-demersal species such as hake and pollock, including in the presence of possible confounding species such as Humboldt squid and lingcod. Once the work has been done (by statistician(s) with practical fisheries experience, in conjunction with acousticians) convene a workshop to discuss and review the findings. Ideally this should also address the issue of adequately sampling to ground-truth the acoustic estimates, including, for example, duration of trawl sampling, using a commercial trawler to sample, using another (additional) gear type to sample.
- Place a very high priority on obtaining a defensible length to target strength relationship for hake.
- Place a high priority on obtaining a defensible length to target strength relationship for Humboldt squid and assessing available techniques to acoustically distinguish between hake and squid biomass in the field.
- Construct informed priors for the acoustic qs associated with the existing time series (this will ensure that future model runs stay in sensible space, or alternatively, that the estimates will be a revealing diagnostic).
- Provide an option in SS3 to disable or severely limit the penalty on recruitment deviations while maintaining internal consistency in the definition of B_0.

Acknowledgements

The STAR wishes to extend its thanks to Dr. Jim Hastie and Ms. Stacey Miller of the NWFSC for logistical and Staff support and Mr. John DeVore of the Pacific Fishery Management Council for guidance on terms of reference and recording of the Panel. The STAR panel also thanks Dr. Dezhang Chu and his staff for their contributions and also Mr. Chris Grandin and Mr. Greg Workman of the Department of Fisheries and Oceans, British Columbia for presentation of Canadian fishery and research data.

The Panel would like to extend a note of commendation to the STAT members: Ian Stewart, and Owen Hamel of Northwest Fisheries Science Center and Steve Martell, University of British Columbia. They performed exceptionally and their modeling skills and data knowledge made it possible to explore the models and data sets almost to their entirety. The Panel notes that any inability of the STAT to perform related to inherent limitations in the models, computing power, or a lack of access to data.

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GROUNDFISH ADVISORY SUBPANEL REPORT ON PACIFIC WHITING HARVEST SPECIFICATIONS FOR 2010

The Groundfish Advisory Subpanel (GAP) received a presentation from Mr. John Devore about the current whiting stock assessments, the Stock Assessment Review (STAR) Panel, and preliminary Scientific and Statistical Committee (SSC) discussions. We also heard from Mr. Tom Libby, the GAP advisor on the STAR Panel. The STAR Panel recommended using the TINSS model as the final preferred base model.

The GAP supports the STAR Panel's final preferred base model. This model estimates 2010 depletion at 37 percent. Based on this model, the GAP recommends a 2010 coastwide optimum yield (OY) of 339,000 mt. This harvest level is based on the three-year constant catch stream presented on Table E of Agenda Item E.3.a, Attachment 1 (Assessment and Management advice for Pacific hake in U.S. and Canadian waters in 2010, Martell 2010). This level of harvest is projected to result in a 2011 depletion of 31 percent, maintaining the stock well above the overfished threshold.

The 339,000 mt coastwide OY is a somewhat more conservative value than the 2010 F_{MSY} catch projected by the base model (341,900 mt). As described in Martell 2010, the F_{MSY} policy seeks to maximize long-term sustainable yield and, thus, F_{MSY} harvest estimates are lower than $F_{40\%}$ harvest estimates. Moreover, F_{MSY} is more conservative than the default Pacific Fishery Management Council and U.S./Canada Hake Agreement $F_{40\%}$ harvest policies.

The GAP understands that work is underway to comprehensively review and update data used in the whiting assessment, including re-analysis of the acoustic survey data. The GAP supports this work and expects it to provide a clearer signal about the strength of 2005 and 2006 year classes.

Relative to this question of year class strength, current information appears to confirm past fishery and acoustic survey data. Specifically, "[t]he most recent length and age compositional data from the 2008-2009 U.S. fishery and the 2009 acoustic survey also indicate the presence of a relatively strong 2005 year class. Apparent also in 2009 is the emergence of another pronounced cohort at age 3 (the 2006 year class) and the continued presence of a small number of fish from the 1999 year-class, now age 10" (page 27, Agenda Item E.3.a, Attachment 2).

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Agenda Item E.3.b
Supplemental GMT Report
March 2010

GROUNDFISH MANAGEMENT TEAM REPORT ON PACIFIC WHITING HARVEST SPECIFICATIONS FOR 2010

The Groundfish Management Team (GMT) reviewed documents under this agenda item and provides the following comments for Council consideration.

Adoption of 2010 Assessment and 2010 Optimum Yield (OY)
At the time of writing, the GMT understand that the Scientific and Statistical Committee (SSC) will present two models to use in setting the 2010 Pacific whiting harvest specifications: (1) the Stock Assessment Review (STAR) panel recommended TINSS model; and, (2) the Northwest Fisheries Science Center (NWFSC) stock assessment team preferred update of the 2009 stock synthesis model (NWFSC Model).

Without a recommendation from the SSC, the Council is faced with two alternative states of nature (i.e., two very different life histories and scales of biomass) with considerable differences in the estimates of stock abundance and productivity between them. When the Council is faced with such uncertainty in the scientific advice, the GMT recommends that the Council consider the risks posed by the competing models. Yearly stock assessments allow for frequent revisions to stock status in this highly dynamic species, thus hopefully decreasing long-term risk to the stock. However, as with last year, there is some risk that the stock could be declared overfished in the next assessment.

Under the TINSS model, the $F_{40\%}$ proxy harvest rate would result in a 40-10 adjusted optimum yield (OY) of over 600,000 mt. The TINSS model projects that this level of harvest would drive the stock below the overfished threshold in 2011. Catches of 550,000 mt are expected to drop the stock to the overfished threshold. This stock depletion occurs because the $F_{40\%}$ proxy is a higher mortality rate than the F_{MSY} ($F_{53\%}$) value.

The author of the TINSS model strongly recommended against using proxy harvest rate, much preferring the F_{MSY} harvest rate estimated by the model. This harvest rate, with the 40-10 adjustment, would result in a 2010 OY of 341,900 mt.

Under the NWFSC model, any catch above 186,000 is projected to drop the stock below the $B_{25\%}$ threshold in the next year. This catch level is 55 percent of the 2010 F_{MSY} yield from the TINSS model, and less than 30 percent of the yield under the $F_{40\%}$ proxy harvest rate.

Whiting Set-Asides

Prior to calculating the whiting sector allocations, tribal set-asides and whiting removals in other fisheries and research must be accounted. Information presented in the NWFSC Total Mortality reports from 2005 through 2008 are presented in Table 1 below. The Northwest Region anticipates approximately 15 mt will be needed for research in 2010. Because of the variability in catches of whiting in the limited entry non-whiting trawl fishery and because of the time lag in receiving the final impacts from these fisheries, the GMT recommends that 3,000 mt, which is the average level of removals from 2007 and 2008, be deducted in 2010 prior to determining the non-tribal sector allocations.

Table 1. Catches of whiting in non-whiting fisheries from 2005 through 2008.

	2005	**2006**	**2007**	**2008**
Pink Shrimp + Bottom Trawl	826	942	3,963	1,934
Pink Shrimp Only	-	-	2,808	684
LE Non-whiting Bottom Trawl Only	-	-	1,155	1,251
Research	42	16	49	12
TOTAL	**868**	**958**	**4,012**	**1,946**

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SCIENTIFIC AND STATISTICAL COMMITTEE REPORT ON PACIFIC WHITING ASSESSMENT AND HARVEST SPECIFICATION FOR 2010

The Scientific and Statistical Committee (SSC) was briefed by Dr. Steve Martell (University of British Columbia) on the model (TINSS) selected by Pacific Whiting STAR Panel as the base model, and Dr. Ian Stewart (NWFSC) on the Stock Synthesis model which updated the 2009 stock assessment. The TINSS model was thus formulated using the recommendations by the Stock Assessment Review (STAR) Panel and the Stock Synthesis (SS) model was based on that presented to the STAR Panel and not the version which was considered acceptable by the STAR Panel. Dr. Vidar Wespestad presented the report of the STAR Panel.

During its deliberations, the 2010 whiting STAR Panel identified major issues with both assessments: (a) whether the age and length data from the acoustic survey are representative, (b) whether the commercial length and conditional catch-at-age data are inconsistent with the assumptions of the models, and (c) whether the 1986 acoustic survey estimate is biased because the pre- and post survey calibrations are substantially different. These issues had also been expressed by past STAR Panels and have also been reflected in past research recommendations. The 2010 whiting STAR Panel also expressed concerns with the 2009 acoustic biomass estimate because of the presence of large numbers of Humboldt squid, which has a similar acoustic signal as whiting.

The response of the STAR Panel to these concerns was to identify a simpler model which did not use data it considered questionable. This led to two new model formulations. The Panel considered both of these as equally acceptable, but adopted the TINSS model as its base model because it had MCMC results immediately available to quantify uncertainty. Catch levels were calculated for both the $F_{40\%}$ and F_{MSY} harvest strategies.

The SSC discussed three key questions arising from the deliberations of the STAR Panel: (a) whether all of the data considered to be questionable should have been omitted from the models, (b) whether the assessment should be based on TINSS or Stock Synthesis, and (c) whether the management advice should be based on the $F_{40\%}$ or F_{MSY} harvest strategies. In relation to this last question, the SSC agreed that management advice should be based on the $F_{40\%}$ harvest strategy (with a 40-10 adjustment as needed) as applied to Markov–Chain Monte Carlo (MCMC) output as was the case last year, in particular because the SSC criteria for using the F_{MSY} estimate had not been met for whiting. The recommended ABC would be the median of the posterior distribution for the catch under the 40-10 control rule, subject to the constraint that the projected spawning stock biomass in 2011 is larger than the overfished threshold of $0.25B_0$.

The SSC discussed the other two questions in considerable detail, and two alternative views emerged.

- Management advice should be based on the STAR Panel recommended TINSS model because there are no demonstrable errors of judgement or failure to follow the terms of reference.
- Management advice should be based on the initial version of the Stock Synthesis model which was presented to the STAR Panel (i.e., which includes all of the data which the STAR Panel recommended be omitted). Reasons for adopting this model

include that (a) the removal of large amounts of data used in many previous assessments should have only been done following more thorough review, (b) the model outputs, in particular the recommendations for catch levels, are sensitive to the assumptions regarding prior distributions, and (c) aspects of the TINSS model (such as its assumptions that the stock was unfished in 1966, that selectivity was constant over time, and that the US and Canada catch-at-age data can be pooled by weighting the catch-at-age data by nation by catch weights) have not been fully evaluated.

The SSC, STAT and STAR Panel found themselves in a very difficult situation this year. This is due to several long-standing issues which need to be addressed as soon as possible.

- The timing of the assessment process for whiting is problematic. Specifically, the assessment authors only received the final version of the data three days before the deadline for submitting documents to the Panel. This does not provide enough time for the two groups of assessment authors to collaborate to the extent desirable, limits exploration of the data for the most recent year, and reduces the time available for error checking. The time between the end of the STAR Panel and the briefing book deadline for the March Council meeting is very short which meant that the assessment authors did not see the draft of the STAR Panel report in sufficient time to respond whether they agreed with its final conclusions or not.
- Many of the concerns which led the STAR Panel to reject data had been identified as research recommendations by previous STAR Panels and the SSC, but had not been addressed.

The SSC agreed the ideal way forward given the issues raised during the STAR Panel and during the SSC discussion would be to hold a mop-up panel as soon as technically feasible. The SSC realizes that there may be logistical reasons why that may be very difficult, but considers a mop-up panel the only way to rectify the problems and allow the SSC to provide a unified scientific recommendation regarding the best available science for Pacific whiting. The SSC strongly encourages the Council to consider the possibility of a mop-up panel for Pacific whiting this year.

Absent a mop-up panel, management decisions will have to be based on model formulations about which the SSC has major concerns, irrespective of which model is adopted. Although it discussed the issue extensively, the SSC was unable to reach consensus regarding which model formulation reflected the best available science for Pacific whiting this year and is consequently forced to put both models forward as best available science without assigning weights to either. The resulting OY values from the two models are 186,000t (Stock Synthesis) and 550,000t (TINSS). These values are less than the corresponding values reported in the assessment documents (224,975t and 617,700t respectively) because those values would lead to predictions of stock depletion to below $0.25B_0$ in 2011. If the SS model is the correct, and a catch exceeding 186,000t is taken, the stock is predicted to drop below the overfished threshold. In contrast, if the TINSS model is correct, taking a catch of 186,000t will lead to forgone yield.

The SSC was informed that the NWFSC acoustics group is engaged in an acoustic data reconstruction project. The SSC strongly encourages this work and asks that they and DFO scientists undertake experimental work to answer key questions such as hake target strength and evaluation of the representativeness of survey biological sampling.

The SSC noted that the high abundance of Humboldt squid in 2009 may well have impacted the size of the whiting resource due to predation. The size of this effect cannot be quantified at present, but may be substantial. The Chilean whiting stock has been greatly reduced because of squid predation. The SSC recommends that an acoustic survey take place in 2010 to explore this issue as well as how to estimate whiting abundance given the presence of squid.

Finally, the SSC emphasizes the assessment of whiting is uncertain at present. The results of the two models are highly uncertain as formulated, there is uncertainty regarding which model is better, there is uncertainty regarding which data sources are best included in assessments of whiting, and there is uncertainty due to the presence of a new but voracious predator species. Some of this uncertainty could be resolved through a mop-up panel but some is inherent to Pacific whiting, although the long-term solution necessarily involves collection of appropriate additional data.

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Agenda Item E.3.b
Supplemental SSC Report 2
March 2010

Pacific Whiting ABCs and OYs from the TINSS and SS Models

TINSS – catch forecasts under F40% harvest rate using median of MCMC posterior

	ABC	OY (w/ 40:10)	prevent B < B25%
2010	641,100	617,700	550,000
2011	377,500	281,900	-
2012	300,500	193,100	-

SS – approximate catch forecasts under F40% harvest rate using median of MCMC posterior

	ABC	OY (w/ 40:10)	prevent B < B25%
2010	270,000[1]	240,000[1]	186,000

Quinault Indian Nation
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March 5, 2010

Mr. Dave Ortmann
Chair
Pacific Fisheries Management Council
7700 NE Ambassador Place, Suite 101
Portland, OR 97220-1384

Re: Quinault Whiting Fishery

Dear Chairman Ortmann,

The Quinault Indian Nation will not participate in the whiting fishery in 2010 but we continue our discussions with NOAA and other co-managers regarding the development of the treaty fishery for this species. To facilitate planning and orderly conduct of the whiting fishery, we will provide notice well in advance of our expected entry.

This past season, proposals to reallocate whiting catch allowances from treaty to non-treaty fisheries were brought to the Council for consideration. Such requests for reallocation should not be considered absent prior agreement of the affected tribes.

Quinault continues to assert that any treaty fishery allocation of whiting is accessible by all tribes absent agreement between them. NOAA Fisheries does not have authority to allocate fish to individual tribes as "set-asides" or "sub-quotas". It is up to tribes to determine how treaty fish will be allocated in the whiting fishery.

Sincerely,

Ed Johnstone, Fisheries Policy Spokesperson
Quinault Indian Nation

c.c. Frank Lockhart; Eileen Cooney – NOAA Fisheries

Agenda Item E.4
Situation Summary
March 2010

FISHERY MANAGEMENT PLAN AMENDMENT 23:
ANNUAL CATCH LIMITS AND ACCOUNTABILITY MEASURES

Fishery Management Plan Amendment 23 concerns incorporating a new framework for deciding groundfish harvest specifications consistent with new National Standard 1 (NS1) guidelines. Agenda Item E.4.a, Attachment 1 provides a brief overview of the new fishery management concepts and harvest specifications contemplated under Amendment 23. The Council is tasked at this meeting with adopting a preliminary preferred alternative Fishery Management Plan (FMP) framework for Amendment 23 and providing guidance to the Scientific and Statistical Committee (SSC) and the Groundfish Management Team (GMT) on 2011-2012 biennial harvest specifications analyses to make the Council's April decision on this subject easier.

Amendment 23 FMP Framework Considerations

The Council's guidance on Amendment 23 at the November 2009 meeting was to provide a simple FMP framework that was not overly prescriptive. Council staff, in consultation with staff from the National Marine Fisheries Service (NMFS) Northwest Region office and National Oceanic and Atmospheric Administration (NOAA) General Counsel, revised the proposed FMP language under Amendment 23 in accordance with this guidance (Agenda Item E.4.a, Attachment 2). The Council and its advisors should review this FMP language and decide whether it meets the purpose and need of Amendment 23 to incorporate new NS1 guidelines while maintaining the Council's preference to keep the framework relatively simple. It is anticipated that most of the specific decisions under the contemplated Amendment 23 framework (e.g., the size of scientific uncertainty and/or management uncertainty buffers for specifying acceptable biological catch [ABC] and annual catch limits [ACLs] will be made in the Council process for deciding biennial harvest specifications.

Three other specific Amendment 23 framework issues have been identified for Council consideration: 1) translating the current 40-10 rule under the new framework, 2) consideration for adding an annual catch target (ACT) specification, and categorizing some species as Ecosystem Component species (see text in the next section). The 40-10 control rule is the current default precautionary adjustment of the optimum yield (OY) from the ABC when a stock's biomass is below the target (i.e., $<B_{MSY}$). It can be considered a default rebuilding strategy designed to rebuild the stock to target levels and is typically used when a stock's biomass is below B_{MSY} but above the overfished threshold (i.e., the precautionary zone). Two options for translating the current 40-10 control rule under the Amendment 23 framework are presented in Agenda Item E.4.a, Attachment 3. The decision on which option to include under Amendment 23 is a Council policy decision. The SSC and other advisors will offer their considerations and recommendations for this decision in supplemental reports at this meeting.

The ACT is an optional accountability measure (AM) intended for the management of fisheries without effective inseason monitoring and harvest controls. Agenda Item E.4.a, Attachment 4 evaluates the current groundfish management system and AMs in consideration for adding an

ACT as an additional AM. Other considerations for managing some stocks with an ACT are also provided in Attachment 4.

2011-2012 Biennial Specifications Considerations

The new ABC in the NS1 guidelines and contemplated under Amendment 23 considers scientific uncertainty for specifying a buffer below the overfishing limit (OFL). The SSC has provided a conceptual framework for factoring scientific uncertainty in the new ABC rule for stocks with a history of multiple, relatively data-rich assessments (i.e., category 1 stocks). They recommended quantifying assessment variability as a basis for evaluating the size of a scientific uncertainty buffer and the risk of overfishing the stock due to this scientific uncertainty. Those stocks with data-poor assessments (i.e., category 2 stocks) would have a larger scientific uncertainty buffer than category 1 stocks, and those stocks without an assessment and sparse data to inform harvest specifications (i.e., category 3 stocks) would have a scientific uncertainty buffer that is larger still. The SSC will provide the documentation and results of the analysis for category 1 stocks and their recommendations for scientific uncertainty buffers for category 2 and 3 stocks in their supplemental report at this meeting.

There is also the consideration for classifying some FMP species as Ecosystem Component (EC) species where, according to the new NS1 guidelines, there is no requirement to specify reference points (i.e., OFLs, ABCs, and ACLs). To aid the Council and its advisors, column 5 in Agenda Item E.4.a, Attachment 5 provides a preliminary categorization of FMP species as category 1, 2, 3, or EC species that was done by Council staff. Additionally, the species vulnerability scores produced by the GMT using the Productivity and Susceptibility Assessment (Agenda Item E.2.b, GMT Report) may be useful in deciding species categorizations. Council advisors will critically review this categorization and may recommend changes to the initial categorization of FMP species.

Ultimately, as described above, species categorizations will be used to decide scientific uncertainty buffers for FMP stocks. The SSC will decide the detailed approach for quantifying scientific uncertainty and will define the relationship between the variance in stock biomass estimates (the SSC-preferred metric for defining scientific uncertainty) and the probability of overfishing the stock based on this scientific uncertainty (denoted P*). The SSC is recommending the choice of P* is a policy decision that the Council should make. A P* of 50 percent represents a point estimate with a 50 percent probability of being too high and a 50 percent probability of being too low, and infers there is no scientific uncertainty buffer. That is, a P* of 50 percent equates to the ABC being set equal to the OFL. The Council is asked to provide general guidance at this meeting on the P* decision, such as defining a maximum P* for category 1 stocks (a P*-biomass variance metric cannot be calculated for category 2 and 3 stocks; scientific uncertainty buffers larger than that for category 1 stocks defines the ABC) that will be specifically made at the April meeting. Any further instructions to Council staff on the analyses and data the Council would like to review in April for making decisions on 2011-2012 harvest specifications would also be timely.

The specific Council tasks under this agenda item are to adopt draft FMP language describing the Amendment 23 framework for public review and to provide guidance on scientific uncertainty buffers and other data and analyses the Council would like to review before making a decision on biennial harvest specifications. The Council is scheduled to decide their preferred 2011-12 harvest specifications at the April meeting and a final preferred alternative for the Amendment 23 framework at the June meeting.

Council Action:

1. **Adopt preliminary preferred FMP amendatory language for Amendment 23 for public review.**
2. **Provide guidance on data and analyses needed to decide biennial harvest specifications at the April meeting.**

Reference Materials:

1. Agenda Item E.4.a, Attachment 1: A Brief Overview of Harvest Specifications Under the Current FMP Framework Compared With Those Contemplated Under Amendment 23.
2. Agenda Item E.4.a, Attachment 2: Draft Groundfish Fishery Management Plan Amendatory Language Proposed Under Amendment 23.
3. Agenda Item E.4.a, Attachment 3: Options For Defining The 40-10 Control Rule Under The Amendment 23 Framework.
4. Agenda Item E.4.a, Attachment 4: Evaluation of the Effectiveness of the Current Groundfish Management System To Prevent Overfishing in Consideration of the Annual Catch Target Specification Under Amendment 23.
5. Agenda Item E.4.a, Attachment 5: Table 2-1. Specified 2009 and 2010 ABCs (mt) and Projected 2011 and 2012 OFLs (mt) for Assessed stocks and Initial FMP Species Categorizations.

Agenda Order:

a. Agenda Item Overview — John DeVore
b. Reports and Comments of Management Entities and Advisory Bodies
c. Public Comment
d. **Council Action**: Adopt Alternatives for Public Review

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Agenda Item E.4.a
Attachment 1
March 2010

A BRIEF OVERVIEW OF HARVEST SPECIFICATIONS UNDER THE CURRENT FMP FRAMEWORK COMPARED WITH THOSE CONTEMPLATED UNDER AMENDMENT 23

The Magnuson-Stevens Fishery Conservation and Management Reauthorization Act of 2006 (MSRA) established several new fishery management provisions pertaining to National Standard 1 (NS1) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA), which states, “Conservation and management measures shall prevent overfishing while achieving, on a continuing basis, the optimum yield (OY) from each fishery for the United States fishing industry.” On January 16, 2009, the National Marine Fisheries Service (NMFS) published a final rule in the Federal Register to implement the new MSRA requirements and amend the guidelines for NS1 (74 FR 3178, see Agenda Item D.3.a, Attachment 1, April 2009). The Council decided in April 2009 to proceed with Amendment 23 to incorporate these new NS1 guidelines in the Fishery Management Plan (FMP).

The MSRA and amended NMFS guidelines introduce new fishery management concepts including overfishing limits (OFLs), an acceptable biological catch (ABC) to incorporate a scientific uncertainty buffer in specifications, annual catch limits (ACLs), annual catch targets (ACTs), and accountability measures (AMs) that are designed to better account for scientific and management uncertainty and to prevent overfishing. These important aspects of the MSRA are required to be implemented by 2011 for most species and by 2010 for those species designated as being subject to overfishing. There are no groundfish species currently subject to overfishing, so 2011 is the implementation goal.

The new terms and concepts recommended in the NS1 guidelines used the west coast groundfish FMP as a template. For instance, our current ABC control rule defines the overfishing limit and the new OFL is defined exactly the same way. Likewise, our current OY has been used in groundfish management as an annual total catch limit since 1999 and is therefore directly analogous to the new ACL. The figure below compares the terms in our current harvest specification framework with those proposed in the Amendment 23 harvest specification framework.

Current Harvest Specification Framework		**Am. 23 Harvest Specification Framework**	
ABC	Overfishing Limit	OFL	Overfishing Limit
	Buffer accommodates scientific uncertainty, management uncertainty, socioeconomic concerns, rebuilding concerns, etc.		Buffer accommodates scientific uncertainty
		ABC	Buffer accommodates management uncertainty, socioeconomic concerns, rebuilding concerns, etc.
OY		ACL	
	Buffer accommodates ad hoc sector allocations and other management objectives		Buffer could accommodate inseason catch monitoring uncertainty, ad hoc sector allocations and other management objectives
HG		ACT	

Agenda Item E.4.a
Attachment 2
March 2010

PACIFIC COAST GROUNDFISH FISHERY MANAGEMENT PLAN

FOR THE CALIFORNIA, OREGON, AND WASHINGTON GROUNDFISH FISHERY

AS AMENDED THROUGH AMENDMENT ~~19~~23

~~INCLUDING AMENDMENTS 15 AND 21~~

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FEBRUARY 2009

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Printed on: 2/22/2010 5:16:00 PM

This document is published by the Pacific Fishery Management Council; current National Oceanic and Atmospheric Administration Award Number NA05NMF441008.

Changes to the FMP since the Version Published in July 1993

The table below shows how the FMP chapters have been reorganized in comparison to the last generally available version produced in July 1993.

Current Chapters	Previous Chapters (July 1993 Version)	Summary of Amendment Changes
Chapter 1 Introduction	Chapter 1 Introduction	Updated by Amendment 18
Chapter 2 Goals and Objectives	Chapter 2 Goals and Objectives	Amendments and additions, no substantial change in organization. (Amendments 12, 13, 16-1, 17, and 18.)
Chapter 3 Areas and Stocks Involved	Chapter 3 Areas and Stocks Involved	Amendments and additions, no substantial change in organization. (Amendment 16-1.)
Chapter 4 Optimum Yield	Chapter 4 Optimum Yield	Substantially changed and expanded by Amendment 16-1, which moved and revised material on determining ~~ABC~~OFL, OY, precautionary thresholds, and rebuilding overfished species that was in Chapter 5 into this chapter. Amendments 16-2 and 16-3 add rebuilding plan summaries to section 4.5.4. Amendment 16-4 revises rebuilding plans in section 4.5.4. Substantially changed and expanded by Amendment 23, which provided material on specifying redefined ABCs, ACLs, and ACTs.
Chapter 5 Specification and Apportionment of Harvest Levels	Chapter 5 Specification and Apportionment of Harvest Levels	Substantially changed by Amendment 16-1, which moved material to Chapter 4, as noted above. Discussion of DAH, DAP, JVP, and TALFF deleted. (Also Amendments 12, 13, 17, and 18.) Substantially changed by Amendment 23, which incorporated new National Standard 1 guidelines and mandates of the 2006 reauthorization of the Magnuson-Stevens Act.
Chapter 6 Management Measures	Chapter 6 Management Measures	Substantially reorganized and changed by Amendment 18 and 19. (Also Amendments 10, 11, 13, 16-1, 17.)
	Chapter 7 Experimental Fisheries	Renumbered Chapter 8
	Chapter 8 Scientific Research	Renumbered Chapter 9
Chapter 7 Essential Fish Habitat		New Chapter created by Amendment 19 from substantially revised material previously in Chapter 6

Current Chapters	Previous Chapters (July 1993 Version)	Summary of Amendment Changes
Chapter 8 Experimental Fisheries		Renumbered and revised by Amendment 18
Chapter 9 Scientific Research		Renumbered, no other changes
	Chapter 9 Restrictions on Other Fisheries	Deleted with material incorporated into Chapter 6
Chapter 10 Procedures for Reviewing State Regulations	Chapter 10 Procedures for Reviewing State Regulations	Background section revised by Amendment 18
	Chapter 11 Appendices	Published under separate cover
	Chapter 12 Management Measures that Continue in Effect with Implementation of Amendment 4	Deleted with material incorporated into Chapter 6
	Chapter 13 References	Moved to an unnumbered section at the end of the document.
Chapter 11 Groundfish Limited Entry	Chapter 14 Groundfish Limited Entry	Renumbered; Amendment 15 modification to section 11.2.12, current section 11.5 inserted as new
References		Previously Chapter 13
Guide to Appendices		Previously Chapter 11 contained descriptive information brought forward from the original FMP. This material moved to Appendix A. Three new appendices (B-D) were added by Amendment 19

A note on other annotations: Amended parts of the FMP subsequent to Amendment 4, which substantially revised the original FMP, are denoted at the end of chapters or sections by amendment number.

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LIST OF ACRONYMS AND ABBREVIATIONS

ABC	~~allowable~~ acceptable biological catch
ACL	annual catch limit
ACT	annual catch target
AM(s)	accountability measure(s)
BCCA	Bottom Contact Closed Area
BTCA	Bottom Trawl Closed Area
CCA	Cowcod Conservation Area
CDFG	California Department of Fish and Game
CRCZ	Columbia River Conservation Zone
CRFS	California Recreational Fisheries Survey
DAH	domestic annual harvest
DAP	domestic annual processing
EEZ	exclusive economic zone
EFH	essential fish habitat
EFP	experimental fishing permit
ESA	Endangered Species Act
FMP	fishery management plan
FMU	fishery management unit
GAP	Groundfish Advisory Subpanel
GCA	Groundfish Conservation Area
GIS	geographic information system
GMT	Groundfish Management Team
~~HAPC~~	~~Habitat area of particular concern~~
HAPC	Habitat Area of Particular Concern
HG	harvest guideline
HSP	habitat suitability probability
HUD	Habitat Use Database
IFQ	individual fishing quota
IFQ	individual fishing quota
INPFC	International North Pacific Fisheries Commission
JV	joint-venture
JVP	joint-venture processing
KRCZ	Klamath River Conservation Zone
LE	limited entry
Magnuson-Stevens Act	Magnuson-Stevens Fishery Conservation and Management Act
MARPOL	International Convention for the Prevention of Pollution from Ships
MBTA	Migratory Bird Treaty Act
MHHW	mean higher high water level
MLR	minimum landing requirement
MMPA	Marine Mammal Protection Act
MPA	marine protected area
MRFSS	Marine Recreational Fisheries Statistic~~s~~al Survey
MSST	minimum stock size threshold
MSY	maximum sustainable yield
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
ODFW	Oregon Department of Fish and Wildlife

OFL	overfishing limit
ORBS	Ocean Recreational Boat Survey (Oregon Department of Fish and Wildlife)
OSP	Washington Department of Fish and Wildlife Ocean Sampling Program
OY	optimum yield
POP	Pacific ocean perch
PRA	Paperwork Reduction Act
PSMFC	Pacific States Marine Fisheries Commission
RCA	Rockfish Conservation Area
RecFIN	Recreational Fisheries Information Network
SAFE	Stock Assessment and Fishery Evaluation
SDC	Status Determination Criteria
SEBS	Shore and Estuary Boat Survey (Oregon Department of Fish and Wildlife)
Secretary	U.S. Secretary of Commerce
SFA	Sustainable Fisheries Act
SPR	spawning biomass per recruit
SSC	Scientific and Statistical Committee
SSC	Scientific and Statistical Committee
STT	Salmon Technical Team
USFWS	U.S. Fish and Wildlife Service
VMS	vessel monitoring system
YRCA	Yelloweye Rockfish Conservation Area

1 INTRODUCTION

1.1. History of the FMP

The Pacific Coast Groundfish Fishery Management Plan (FMP) was approved by the U.S. Secretary of Commerce (Secretary) on January 4, 1982, and implemented on October 5, 1982. Prior to implementation of the FMP, management of domestic groundfish fisheries was under the jurisdiction of the states of Washington, Oregon, and California. State regulations have been in effect on the domestic fishery for more than 100 years, with each state acting independently in both management and enforcement. Furthermore, many fisheries overlapped state boundaries and participants often operated in more than one state. Management and a lack of uniformity of regulations had become a difficult problem, which stimulated the formation of the Pacific States Marine Fisheries Commission (PSMFC) in 1947. PSMFC had no regulatory power but acted as a coordinating entity with authority to submit specific recommendations to states for their adoption. The 1977 Fishery Conservation and Management Act (later amended and renamed the Magnuson-Stevens Fishery Conservation and Management Act or Magnuson-Stevens Act) established eight regional fishery management Councils, including the Pacific Council. Between 1977 and the implementation of the groundfish FMP in 1982, state agencies worked with the Council to address conservation issues. Specifically, in 1981, managers proposed a rebuilding program for Pacific ocean perch. To implement this program, the states of Oregon and Washington established landing limits for Pacific ocean perch in the Vancouver and Columbia management areas.

Management of foreign fishing operations began in February 1967 when the U.S. and U.S.S.R. signed the first bilateral fishery agreement affecting trawl fisheries off Washington, Oregon, and California. The U.S. later signed bilateral agreements with Japan and Poland for fishing off the U.S. West Coast. Each of these agreements was renegotiated to reduce the impact of foreign fishing on important West Coast stocks, primarily rockfish, Pacific whiting, and sablefish. When the U.S. extended its jurisdiction to 200 miles (upon signing the Fishery Conservation and Management Act of 1976), the National Marine Fisheries Service (NMFS) developed and the Secretary implemented the preliminary management plan for the foreign trawl fishery off the Pacific Coast. From 1977 to 1982, the foreign fishery was managed under that plan. Many of these regulations were incorporated into the FMP, which provided for continued management of the foreign fishery.

Joint-venture fishing, where domestic vessels caught the fish to be processed aboard foreign vessels, began in 1979 and by 1989 had entirely supplanted directed foreign fishing. These joint ventures primarily targeted Pacific whiting. Joint-venture fisheries were then rapidly replaced by wholly domestic processing; by 1991 foreign participation had ended and U.S.-flagged motherships, catcher-processors, and shore-based vessels had taken over the Pacific whiting fishery. Since then U.S. fishing vessels and seafood processors have fully utilized Pacific Coast fishery resources. Although the Council may entertain applications for foreign or joint venture fishing or processing at any time, provisions for these activities have been removed from the FMP. Re-establishing such opportunities would require another FMP amendment.

Since it was first implemented in 1982, the Council has amended the groundfish FMP 20 times in response to changes in the fishery, reauthorizations of the Magnuson-Stevens Act, and litigation that invalidated provisions incorporated by earlier amendments. During the first 10 years of plan implementation, up to 1992, the Secretary approved six amendments. Amendment 4, approved in 1990, was the most significant early amendment; in addition to a comprehensive update and reorganization of the FMP, it established additional framework procedures for establishing and modifying management measures. Another important change was implemented in 1992 with Amendment 6, which established a license limitation (limited entry) program intended to address overcapitalization by restricting further participation in groundfish trawl, longline, and trap fisheries.

The next decade, through 2002, saw the approval of another seven amendments. Amendment 9 modified the limited entry program by establishing a sablefish endorsement for longline and pot permits. Amendments 11, 12, and 13 were responses to changes in the Magnuson-Stevens Act due to the 1996 Sustainable Fisheries Act. These changes required FMPs to identify essential fish habitat (EFH), more actively reduce bycatch and bycatch mortality, and strengthen conservation measures to both prevent fish stocks from becoming overfished and promote rebuilding of any stocks that had become overfished. Amendment 14, implemented in 2001, built on Amendment 9 to further refine the limited entry permit system for the economically important fixed gear sablefish fishery. It allowed a vessel owner to "stack" up to three limited entry permits on one vessel along with associated sablefish catch limits. This in effect established a limited tradable quota system for participants in the primary sablefish fishery.

Most of the amendments adopted since 2001 deal with legal challenges to the three Sustainable Fisheries Act of 1996 (SFA)-related amendments mentioned above, which were remanded in part by the Federal Court. These have required new amendments dealing with overfishing, bycatch monitoring and mitigation, and EFH. In relation to the first of these three issues, the Magnuson-Stevens Act now requires FMPs to identify thresholds for both the fishing mortality rate constituting overfishing and the stock size below which a stock is considered overfished. Once the Secretary determines a stock is overfished, the Council must develop and implement a plan to rebuild it to a healthy level. Since these thresholds were established for Pacific Coast groundfish, nine stocks have been declared overfished. The Court found that the rebuilding plan framework adopted by Amendment 12 did not comply with the Magnuson-Stevens Act. In response, Amendments 16-1, 16-2, and 16-3 established the current regime for managing these overfished species. Amendment 16-1, approved in 2003, incorporated guidelines for developing and adopting rebuilding plans and substantially revised Chapters 4 and 5. Amendments 16-2 and 16-3, approved in 2004, incorporated key elements of rebuilding plans into Section 4.5.4. In 2005, a Court of Appeals ruling refined court interpretation of the Magnuson-Stevens Act rebuilding period requirements. Amendment 16-4, partially approved in 2006, revised the FMP to specify that rebuilding periods will be as short as possible, taking into account the status and biology of the stocks, the needs of fishing communities, and interactions of overfished stocks with the marine ecosystem. As a result of this ruling, Amendment 16-4 also revised the rebuilding periods for darkblotched rockfish, Pacific ocean perch, canary rockfish, bocaccio, cowcod, widow rockfish, and yelloweye rockfish.

Amendment 17 modified the periodic process the Council uses to establish and modify harvest specifications and management measures for the groundfish fishery. Although not an SFA-related issue, this change did solve a procedural problem raised in litigation. The Council now establishes specifications and management measures every two years, allowing more time for them to be developed during the Council's public meetings.

Amendment 18, approved in 2006, addresses a remand of elements in Amendment 11 related to bycatch monitoring and mitigation. It incorporates a description of the Council's bycatch-related policies and programs into Chapter 6. It also effected a substantial reorganization and update of the FMP, so that it better reflects the Council's and the NMFS's evolving framework approach to management. Under this framework, the Council may recommend a range of broadly defined management measures for NMFS to implement. In addition to the range of measures, this FMP specifies the procedures the Council and NMFS must follow to establish and modify these measures. When first implemented, the FMP specified a relatively narrow range of measures, which were difficult to modify in response to changes in the fishery. The current framework allows the Council to effectively respond when faced with the dynamic challenges posed by the current groundfish fishery.

Amendment 19, also approved in 2006, revises the definition of groundfish EFH, identified habitat areas of particular concern, and describes management measures intended to mitigate the adverse effects of fishing on EFH. This amendment supplants the definition of EFH added to the FMP by Amendment 11.

Amendment 15 was initiated in 1999 in response to provisions in the American Fisheries Act (AFA) intended to shield West Coast fisheries from certain effects of that legislation. Because of competing workload and no threatened imminent harm, the Council tabled action on Amendment 15 in 2001. Work on the amendment was re-initiated in 2007 in response to changes in the Pacific whiting fishery. Its purpose is to address conservation and socioeconomic issues in the shoreside, catcher/processor, and mothership sectors of the Pacific whiting fishery by requiring vessels to qualify for an additional license to participate in a given sector, based on their historical participation. It is an interim measure, which will sunset when the trawl rationalization program (Amendment 20) is implemented.

Amendment 23 was initiated in 2009 to incorporate new National Standard 1 guidelines to prevent overfishing. These new National Standard 1 guidelines were developed in response to the Magnuson-Stevens Act re-authorization of 2006 which mandated an end to overfishing.

1.2. How This Document is Organized

The groundfish FMP is organized into 11 chapters

- Chapter 1 (this chapter) describes the development of the FMP and how it is organized.
- Chapter 2 describes the goals and objectives of the plan and defines key terms and concepts.
- Chapter 3 specifies the geographic area covered by this plan and lists the species managed by it, referred to as the fishery management unit (FMU).
- Chapter 4 describes how the Council determines harvest levels. These harvest limits are related to the maximum sustainable yield (MSY) and ~~allowable biological catch~~overfishing limit (~~ABC~~OFL) for FMU species. Precautionary reductions from these thresholds may be applied, depending on the management status of a given stock. If, according to these thresholds, a stock is determined to be overfished, the Council must recommend measures to end overfishing and develop a rebuilding plan, as specified in this chapter. Based on the thresholds, criteria, and procedures described in this chapter, the Council specifies an ~~optimum yield (OY)~~annual catch limit (ACL), or harvest limit, for managed stocks or stock complexes.
- Chapter 5 describes how the Council periodically specifies harvest levels and the management measures needed to prevent catches from exceeding those levels. Currently, the Council develops these specifications over the course of three meetings preceding the start of a two-year management period. (Separate OYs are specified for each of the two years in this period.) This chapter also describes how the stock assessment/fishery evaluation (SAFE) document, which provides information important to management, is developed.
- Chapter 6 describes the management measures used by the Council to meet the objectives of the Magnuson-Stevens Act and this FMP. As noted above, this FMP is a framework plan; therefore, the range of management measures is described in general terms while the processes necessary to establish or modify different types of management measures are detailed. Included in the description of management measures is the Council's program for monitoring total catch (which includes bycatch) and minimizing bycatch.

- Chapter 7 identifies EFH for groundfish FMU species and the types of measures that may be used to mitigate adverse impacts to EFH from fishing.

- Chapter 8 describes procedures followed by the Council to evaluate and recommend issuing exempted fishing permits (EFPs). Permitted vessels are authorized, for limited experimental purposes, to harvest groundfish by means or in amounts that would otherwise be prohibited by this FMP and its implementing regulations. These permits allow experimentation in support of FMP goals and objectives. EFPs have been used, for example, to test gear types that result in less bycatch.

- Chapter 9 provides criteria for determining what activities involving groundfish would qualify as scientific research and could therefore qualify for special treatment under the management program.

- Chapter 10 describes the procedures used to review state regulations in order to ensure that they are consistent with this FMP and its implementing regulations.

- Chapter 11 describes the groundfish limited entry program.

- Appendix A contains descriptions of the biological, economic, social, and regulatory characteristics of the groundfish fishery.

- Appendix B contains detailed information on groundfish EFH.

- Appendix C describes the effects of fishing on groundfish EFH.

- Appendix D describes the effects of activities other than fishing on groundfish EFH.

The appendices contain supporting information for the management program. Because these appendices do not describe the management framework or Council groundfish management policies and procedures, and only supplement the required and discretionary provisions of the FMP described in §303 of the Magnuson-Stevens Act, they may be periodically updated without being subjected to the Secretarial review and approval process described in §304(a) of the Magnuson-Stevens Act. These appendices are published under separate cover.

[Amended: 11, 18, 19, 16-4]

2 GOALS AND OBJECTIVES

2.1. Goals and Objectives for Managing the Pacific Coast Groundfish Fishery

The Council is committed to developing long-range plans for managing the Washington, Oregon, and California groundfish fisheries that will promote a stable planning environment for the seafood industry, including marine recreation interests, and will maintain the health of the resource and environment. In developing allocation and harvesting systems, the Council will give consideration to maximizing economic benefits to the United States, consistent with resource stewardship responsibilities for the continuing welfare of the living marine resources. Thus, management must be flexible enough to meet changing social and economic needs of the fishery as well as to address fluctuations in the marine resources supporting the fishery. The following goals have been established in order of priority for managing the West Coast groundfish fisheries, to be considered in conjunction with the national standards of the Magnuson-Stevens Act.

Management Goals

Goal 1 - Conservation. Prevent overfishing and rebuild overfished stocks by managing for appropriate harvest levels and prevent, to the extent practicable, any net loss of the habitat of living marine resources.

Goal 2 - Economics. Maximize the value of the groundfish resource as a whole.

Goal 3 - Utilization. Within the constraints of overfished species rebuilding requirements, achieve the maximum biological yield of the overall groundfish fishery, promote year-round availability of quality seafood to the consumer, and promote recreational fishing opportunities.

Objectives. To accomplish these management goals, a number of objectives will be considered and followed as closely as practicable:

Conservation

Objective 1. Maintain an information flow on the status of the fishery and the fishery resource which allows for informed management decisions as the fishery occurs.

Objective 2. Adopt harvest specifications and management measures consistent with resource stewardship responsibilities for each groundfish species or species group. Achieve a level of harvest capacity in the fishery that is appropriate for a sustainable harvest and low discard rates, and which results in a fishery that is diverse, stable, and profitable. This reduced capacity should lead to more effective management for many other fishery problems.

Objective 3. For species or species groups that are overfished, develop a plan to rebuild the stock as soon as possible, taking into account the status and biology of the stock, the needs of fishing communities, recommendations by international organizations in which the United States participates, and the interaction of the overfished stock within the marine ecosystem..

Objective 4. Where conservation problems have been identified for non-groundfish species and the best scientific information shows that the groundfish fishery has a direct impact on the ability of that species to maintain its long-term reproductive health, the Council may consider establishing management measures to control the impacts of groundfish fishing on those species. Management measures may be imposed on the groundfish fishery to reduce fishing mortality of a non-groundfish species for documented conservation reasons. The action will be designed to minimize disruption of the groundfish fishery, in so far as consistent with the goal to minimize the bycatch of non-groundfish species, and will not preclude achievement of a quota, harvest guideline, or allocation of groundfish, if any, unless such action is required by other applicable law.

Objective 5. Describe and identify essential fish habitat (EFH), adverse impacts on EFH, and other actions to conserve and enhance EFH, and adopt management measures that minimize, to the extent practicable, adverse impacts from fishing on EFH.

Economics

Objective 6. Within the constraints of the conservation goals and objectives of the FMP, attempt to achieve the greatest possible net economic benefit to the nation from the managed fisheries.

Objective 7. Identify those sectors of the groundfish fishery for which it is beneficial to promote year-round marketing opportunities and establish management policies that extend those sectors fishing and marketing opportunities as long as practicable during the fishing year.

Objective 8. Gear restrictions to minimize the necessity for other management measures will be used whenever practicable. Encourage development of practicable gear restrictions intended to reduce regulatory and/or economic discards through gear research regulated by EFP.

Utilization

Objective 9. Develop management measures and policies that foster and encourage full utilization (harvesting and processing), in accordance with conservation goals, of the Pacific Coast groundfish resources by domestic fisheries.

Objective 10. Recognizing the multispecies nature of the fishery and establish a concept of managing by species and gear or by groups of interrelated species.

Objective 11. Develop management programs that reduce regulations-induced discard and/or which reduce economic incentives to discard fish. Develop management measures that minimize bycatch to the extent practicable and, to the extent that bycatch cannot be avoided, minimize the mortality of such bycatch. Promote and support monitoring programs to improve estimates of total fishing-related mortality and bycatch, as well as those to improve other information necessary to determine the extent to which it is practicable to reduce bycatch and bycatch mortality.

Social Factors.

Objective 12. When conservation actions are necessary to protect a stock or stock assemblage, attempt to develop management measures that will affect users equitably.

Objective 13. Minimize gear conflicts among resource users.

Objective 14. When considering alternative management measures to resolve an issue, choose the measure that best accomplishes the change with the least disruption of current domestic fishing practices, marketing procedures, and the environment.

Objective 15. Avoid unnecessary adverse impacts on small entities.

Objective 16. Consider the importance of groundfish resources to fishing communities, provide for the sustained participation of fishing communities, and minimize adverse economic impacts on fishing communities to the extent practicable.

Objective 17. Promote the safety of human life at sea.

[Amended; 7, 11, 13, 16-1, 18, 16-4]

2.2. Operational Definition of Terms

Acceptable Biological Catch (ABC) is a ~~biologically based estimate of the amount of fish that may be harvested from the fishery each year without jeopardizing the resource. It is a seasonally determined catch that may differ from MSY for biological reasons. It may be lower or higher than MSY in some years for species with fluctuating recruitment. The ABC may be modified to incorporate biological safety factors and risk assessment due to uncertainty. Lacking other biological justification, the ABC is defined as the MSY exploitation rate multiplied by the exploitable biomass for the relevant time period.~~harvest specification that ~~is set below the overfishing limit to incorporate a scientific uncertainty buffer~~accounts for the scientific uncertainty in the estimate of OFL, and any other scientific uncertainty.~~ against exceeding the overfishing limit~~.

Accountability Measures (AMs) are management controls, such as inseason adjustments to fisheries or annual catch targets, to prevent annual catch limits, including sector-specific annual catch limits, from being exceeded, and to correct or mitigate overages of the annual catch limit if they occur. Accountability measures should address and minimize both the frequency and magnitude of overages and correct the problems that caused the overage in as short a time as possible.

Annual Catch Limit (ACL) is a harvest specification set equal to or below the acceptable biological catch threshold in consideration of conservation objectives, socioeconomic concerns, management uncertainty and other factors. All sources of fishing-related mortality including landings, discard mortality, research catches, and catches in exempted fishing permit activities are counted against the annual catch limit. Sector-specific annual catch limits can be specified, especially in cases where a sector has a formal, long-term allocation of the harvestable surplus of a stock or stock complex. The ACL serves as the basis for invoking AMs.

Annual Catch Target (ACT) is a ~~harvest specification~~management target set below the annual catch limit and ~~is~~ may be used as an accountability measure in cases where there is ~~great~~ uncertainty in inseason catch monitoring to ensure against exceeding an annual catch limit. Since the annual catch target is a target and not a limit it can be used in lieu of harvest guidelines or strategically to accomplish other management objectives. Sector-specific annual catch targets can also be specified to accomplish management objectives.

Biennial fishing period is defined as a 24-month period beginning January 1 and ending December 31.

Bottom (or flatfish bottom) trawl is a trawl in which the otter boards or the footrope of the net are in contact with the seabed. It includes roller (or bobbin) trawls, Danish and Scottish seine gear, and pair trawls fished on the bottom.

Bottom-contact gear by design, or as modified, and through normal use makes contact with the sea floor

Bycatch means fish which are harvested in a fishery, but which are not sold or kept for personal use and includes economic discards and regulatory discards. Such term does not include fish released alive under a recreational catch and release fishery management program.

Chafing gear is webbing or other material attached to the codend of a trawl net to protect the codend from wear.

Charter fishing means fishing from a vessel carrying a passenger for hire (as defined in section 2101(21a) of title 46, United States Code) who is engaged in recreational fishing.

Closure, when referring to closure of a fishery, means that taking and retaining, possessing or landing the particular species or species complex is prohibited.

Council means the Pacific Fishery Management Council, including its Groundfish Management Team (GMT), Scientific and Statistical Committee (SSC), Groundfish Advisory Subpanel (GAP), and any other committee established by the Council.

Commercial fishing is (1) fishing by a person who possesses a commercial fishing license or is required by law to possess such license issued by one of the states or the federal government as a prerequisite to taking, landing, and/or sale; or (2) fishing which results in or can be reasonably expected to result in sale, barter, trade, or other disposition of fish for other than personal consumption.

Density dependence is the degree to which recruitment declines as spawning biomass declines. Typically we assume that a Beverton-Holt form is appropriate and that the level of density-dependence is such that the recruitment only declines by ten percent when the spawning biomass declines by 50%.

Double-walled codend is a codend constructed of two walls of webbing.

Economic discards means fish which are the target of a fishery, but which are not retained because they are of an undesirable size, sex, quality, or for other economic reasons.

Essential fish habitat means those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity.

Exploitable biomass is the biomass that is available to a unit of fishing effort. Defined as the sum of the population biomass at age (calculated as the mean within the fishing year) multiplied by the age-specific availability to the fishery. Exploitable biomass is equivalent to the catch biomass divided by the instantaneous fishing mortality rate.

F is the instantaneous rate of fishing mortality. F typically varies with age, so the F values are presented for the age with maximum F. Fish of other ages have less availability to the fishery, so a unit of effort applies a lower relative level of fishing mortality to these fish.

F_{MSY} is the fishing mortality rate that maximizes catch biomass in the long term.

$F_{0.1}$ is the fishing mortality rate at which a change in fishing mortality rate will produce a change in yield per recruit that is ten percent of the slope of the yield curve at nil levels of fishing mortality.

F_{OF} is the rate of fishing mortality defined as overfishing.

$F_{x\%}$ is the rate of fishing mortality that will reduce female spawning biomass per recruit to x percent of its unfished level. $F_{100\%}$ is zero, and $F_{35\%}$ is a reasonable proxy for F_{MSY}.

Fishing means (1) the catching, taking, or harvesting of fish; (2) the attempted catching, taking, or harvesting of fish; (3) any other activity which can reasonably be expected to result in the catching, taking, or harvesting of fish; or (4) any operations at sea in support of, or in preparation for, any activity described above. This term does not include any activity by a vessel conducting authorized scientific research.

Fishing year is defined as January 1 through December 31.

Fishing community means a community which is substantially dependent on or substantially engaged in the harvest or processing of fishery resources to meet social and economy needs and includes fishing vessel owners, operators, crew, and recreational fishers and United States fish processors that are based in such community.

Fixed gear (anchored non-trawl gear) includes longline, trap or pot, set net, and stationary hook-and-line gear (including commercial vertical hook-and-line) gears.

Gillnet is a single-walled, rectangular net which is set upright in the water.

Harvest guideline (HG) is an specified numerical harvest objective which is not a quota. Attainment of a HG does not require closure of a fishery.

Hook-and-line means one or more hooks attached to one or more lines. Commercial hook-and-line fisheries may be mobile (troll) or stationary (anchored).

Incidental catch or incidental species means groundfish species caught when fishing for the primary purpose of catching a different species.

Individual fishing quota (IFQ) means a federal permit under a limited access system to harvest a quantity of fish expressed by a unit or units representing a percentage of the total allowable catch of a fishery that may be received or held for exclusive use by a person.

Longline is a stationary, buoyed, and anchored groundline with hooks attached, so as to fish along the seabed.

Maximum sustainable yield is an estimate of the largest average annual catch or yield that can be taken over a significant period of time from each stock under prevailing ecological and environmental conditions. It may be presented as a range of values. One MSY may be specified for a group of species in a mixed-species fishery. Since MSY is a long-term average, it need not be specified annually, but may be reassessed periodically based on the best scientific information available.

Midwater (pelagic or off-bottom) trawl is a trawl in which the otter boards may occasionally contact the seabed, but the footrope of the net remains above the seabed. It includes pair trawls if fished in midwater. A midwater trawl has no rollers or bobbins on the net.

MSY stock size means the largest long-term average size of the stock or stock complex, measured in terms of spawning biomass or other appropriate units that would be achieved under an MSY control rule in which the fishing mortality rate is constant. The proxy typically used in this fishery management plan is 40% of the estimated unfished biomass, although other values based on the best scientific information are also authorized.

Nontrawl gear means all legal commercial gear other than trawl gear.

Optimum yield means the amount of fish which will provide the greatest overall benefit to the U.S., particularly with respect to food production and recreational opportunities, and taking into account the protection of marine ecosystems, is prescribed as such on the basis of the maximum sustainable yield from the fishery as reduced by any relevant economic, social, or ecological factor; and in the case of an overfished fishery, provides for rebuilding to a level consistent with producing the maximum sustainable yield in such fishery.

Overfished describes any stock or stock complex whose size is sufficiently small that a change in management practices is required to achieve an appropriate level and rate of rebuilding. The term generally describes any stock or stock complex determined to be below its overfished/rebuilding threshold. The default proxy is generally 25% of its estimated unfished biomass; however, other scientifically valid values are also authorized.

Overfishing means fishing at a rate or level that jeopardizes the capacity of a stock or stock complex to produce MSY on a continuing basis. More specifically, overfishing is defined as exceeding a maximum allowable fishing mortality rate. For any groundfish stock or stock complex, the maximum allowable mortality rate will be set at a level not to exceed the corresponding MSY rate (F_{MSY}) or its proxy (e.g., $F_{35\%}$).

Overfishing limit (OFL) is an estimate of the catch level above which overfishing is occurring. ~~biologically based estimate of the amount of fish that may be harvested from the fishery each year without jeopardizing the resource.~~ It is a seasonally determined catch that may differ from MSY for biological reasons. It may be lower or higher than MSY in some years for species with fluctuating recruitment. The OFL may be modified to incorporate biological safety factors and risk assessment due to uncertainty[sdl1]. Lacking other biological justification, the OFL is defined as the MSY exploitation rate multiplied by the exploitable biomass for the relevant time period[sdl2].

Processing or to process means the preparation or packaging of groundfish to render it suitable for human consumption, retail sale, industrial uses, or long-term storage, including, but not limited to, cooking, canning, smoking, salting, drying, filleting, freezing, or rendering into meal or oil, but does not mean heading and gutting unless additional preparation is done.

Processor means a person, vessel, or facility that (1) engages in processing, or (2) receives live groundfish directly from a fishing vessel for sale without further processing.

Prohibited species are those species and species groups which must be returned to the sea as soon as is practicable with a minimum of injury when caught and brought aboard except when their retention is authorized by other applicable law. Exception may be made in the implementing regulations for tagged fish, which must be returned to the tagging agency, or for examination by an authorized observer.

Quota means a specified numerical harvest objective, the attainment (or expected attainment) of which causes closure of the fishery for that species or species group. Groundfish species or species groups under this FMP for which quotas have been achieved shall be treated in the same manner as prohibited species.

Recreational fishing means fishing for sport or pleasure, but not for sale.

Regulatory discards are fish harvested in a fishery which fishermen are required by regulation to discard whenever caught or are required by regulation to retain, but not sell.

Roller (or bobbin) trawl is a bottom trawl that has footropes equipped with rollers or bobbins made of wood, steel, rubber, plastic, or other hard material which keep the footrope above the seabed, thereby protecting the net.

Set net is a stationary, buoyed, and anchored gillnet or trammel net.

Spawning biomass is the biomass of mature female fish at the beginning of the year. If the production of eggs is not proportional to body weight, then this definition should be modified to be proportional to expected egg production.

Spawning biomass per recruit is the expected egg production of a female fish over its lifetime. Alternatively, this is the mature female biomass of an equilibrium stock divided by the mean level of recruitment that produced this stock.

Spear is a sharp, pointed, or barbed instrument on a shaft. Spears may be propelled by hand or by mechanical means.

Stock Assessment and Fishery Evaluation (SAFE) document is a document prepared by the Council that provides a summary of the most recent biological condition of species in the fishery management unit, and the social and economic condition of the recreational and commercial fishing industries, and the fish processing industry. It summarizes, on a periodic basis, the best available information concerning the past, present, and possible future condition of the stocks and fisheries managed by the FMP.

Target fishing means fishing for the primary purpose of catching a particular species or species group (the target species).

~~A total catch limit is a portion of the OY for a groundfish FMU species, stock, or stock complex assigned to a defined fishery sector or to an individual vessel. Total catch is defined as landed catch plus bycatch (discard) mortality. The Council may specify total catch limits that are transferable or nontransferable among sectors or tradable or non-tradable between vessels.~~

Trammel net is a gillnet made with two or more walls joined to a common float line.

Trap (or pot) is a portable, enclosed device with one or more gates or entrances and one or more lines attached to surface floats.

Vertical hook-and-line gear (commercial) is hook-and-line gear that involves a single line anchored at the bottom and buoyed at the surface so as to fish vertically.

[Amended: 5, 11, 13, 17, 18, 19]

3 AREAS AND STOCKS INVOLVED

3.1. Area to Which this Fishery Management Plan Applies

The management regime of this FMP applies to:

1. The U.S. EEZ of the northeast Pacific ocean that lies between the U.S.-Canada border (as specified in *Federal Register*, Volume 42, Number 44, March 7, 1977, page 12938) and the U.S.-Mexico border (Figure).

2. All foreign and domestic commercial and recreational vessels which are used to fish for groundfish in the management area.

3. All groundfish stocks which comprise this fishery management unit (see Section 3.1).

Management Areas. Upon consideration of stock distribution and domestic and foreign historical catch statistics, the following statistical areas (Figure 3-1) have been determined by the Pacific Fishery Management Council (Council) to be the most convenient administrative and biological management areas. These areas are based on International North Pacific Fisheries Commission (INPFC) statistical areas, but in some cases have been modified slightly. The areas are, from south to north:

Conception - Southern boundary of EEZ to 36°00' N latitude
Monterey - 36°00' N latitude to 40°30' N latitude
Eureka - 40°30' N latitude to 43°00' N latitude
Columbia - 43°00' N latitude to 47°30' N latitude
Vancouver - 47°30' N latitude to northern boundary of the EEZ

These areas may be modified or deleted and additional statistical reporting and management areas may be added, modified, or deleted if necessary to refine information or management of a species or species group. Changes will be implemented in accordance with the procedures in Chapters 5 and 6.

3.2. Species Managed by this Fishery Management Plan

Table 3-1 is the listing of species managed under this FMP.

Table 3-1. Common and scientific names of species included in this FMP.

Common Name	Scientific Name
SHARKS	
Big skate	*Raja binoculata*
California skate	*R. inornata*
Leopard shark	*Triakis semifasciata*
Longnose skate	*R. rhina*
Soupfin shark	*Galeorhinus zyopterus*
Spiny dogfish	*Squalus acanthias*
RATFISH	
Ratfish	*Hydrolagus colliei*
MORIDS	
Finescale codling	*Antimora microlepis*
GRENADIERS	
Pacific rattail	*Coryphaenoides acrolepis*
ROUNDFISH	
Cabezon	*Scorpaenichthys marmoratus*
Kelp greenling	*Hexagrammos decagrammus*
Lingcod	*Ophiodon elongatus*
Pacific cod	*Gadus macrocephalus*
Pacific whiting (hake)	*Merluccius productus*
Sablefish	*Anoplopoma fimbria*
ROCKFISH[a/]	
Aurora rockfish	*Sebastes aurora*
Bank rockfish	*S. rufus*
Black rockfish	*S. melanops*
Black and yellow rockfish	*S. chrysomelas*
Blackgill rockfish	*S. melanostomus*
Blue rockfish	*S. mystinus*
Bocaccio	*S. paucispinis*
Bronzespotted rockfish	*S. gilli*
Brown rockfish	*S. auriculatus*
Calico rockfish	*S. dallii*
California scorpionfish	*Scorpaena gutatta*
Canary rockfish	*Sebastes pinniger*
Chameleon rockfish	*S. phillipsi*
Chilipepper	*S. goodei*
China rockfish	*S. nebulosus*
Copper rockfish	*S. caurinus*
Cowcod	*S. levis*
Darkblotched rockfish	*S. crameri*
Dusky rockfish	*S. ciliatus*
Dwarf-red rockfish	*S. rufinanus*
Flag rockfish	*S. rubrivinctus*
Freckled rockfish	*S lentiginosus*
Gopher rockfish	*S. carnatus*
Grass rockfish	*S. rastrelliger*
Greenblotched rockfish	*S. rosenblatti*
Greenspotted rockfish	*S. chlorostictus*
Greenstriped rockfish	*S. elongatus*
Halfbanded rockfish	*S. semicinctus*
Harlequin rockfish	*S. variegatus*
Honeycomb rockfish	*S. umbrosus*
Kelp rockfish	*S. atrovirens*
Longspine thornyhead	*Sebastolobus altivelis*
Mexican rockfish	*Sebastes macdonaldi*
Olive rockfish	*S. serranoides*
Pink rockfish	*S. eos*
Pinkrose rockfish	*S. simulator*
Pygmy rockfish	*S. wilsoni*

Common Name	Scientific Name
Pacific ocean perch	*S. alutus*
Quillback rockfish	*S. maliger*
Redbanded rockfish	*S. babcocki*
Redstripe rockfish	*S. proriger*
Rosethorn rockfish	*S. helvomaculatus*
Rosy rockfish	*S. rosaceus*
Rougheye rockfish	*S. aleutianus*
Sharpchin rockfish	*S. zacentrus*
Shortbelly rockfish	*S. jordani*
Shortraker rockfish	*S. borealis*
Shortspine thornyhead	*Sebastolobus alascanus*
Silvergray rockfish	*Sebastes brevispinis*
Speckled rockfish	*S. ovalis*
Splitnose rockfish	*S. diploproa*
Squarespot rockfish	*S. hopkinsi*
Starry rockfish	*S. constellatus*
Stripetail rockfish	*S. saxicola*
Swordspine rockfish	*S. ensifer*
Tiger rockfish	*S. nigrocinctus*
Treefish	*S. serriceps*
Vermilion rockfish	*S. miniatus*
Widow rockfish	*S. entomelas*
Yelloweye rockfish	*S. ruberimus*
Yellowmouth rockfish	*S. reedi*
Yellowtail rockfish	*S. flavidus*
FLATFISH	
Arrowtooth flounder (turbot)	*Atheresthes stomias*
Butter sole	*Isopsetta isolepis*
Curlfin sole	*Pleuronichthys decurrens*
Dover sole	*Microstomus pacificus*
English sole	*Parophrys vetulus*
Flathead sole	*Hippoglossoides elassodon*
Pacific sanddab	*Citharichthys sordidus*
Petrale sole	*Eopsetta jordani*
Rex sole	*Glyptocephalus zachirus*
Rock sole	*Lepidopsetta bilineata*
Sand sole	*Psettichthys melanostictus*
Starry flounder	*Platichthys stellatus*

[a/] The category "rockfish" includes all genera and species of the family Scorpaenidae, even if not listed, that occur in the Washington, Oregon, and California area. The Scorpaenidae genera are *Sebastes, Scorpaena, Sebastolobus, and Scorpaenodes*.

[Amended: 11, 16-1]

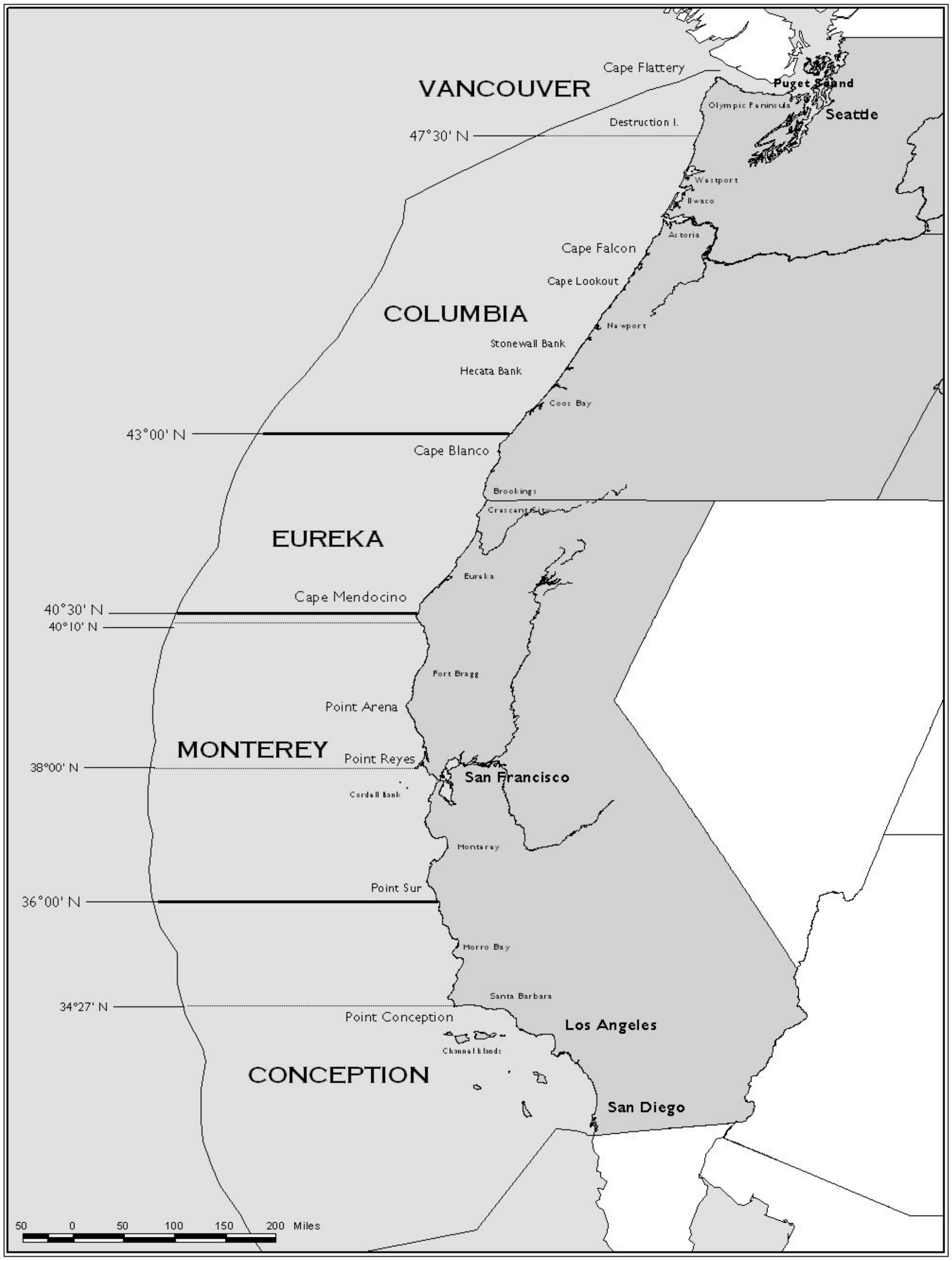


Figure 3-1. International North Pacific Fisheries Commission (INPFC) statistical areas in the U.S. exclusive economic zone seaward of Washington, Oregon, and California.

4 PREVENTING OVERFISHING AND ACHIEVING OPTIMUM YIELD

4.1. National Standard 1 Guidelines

National Standard 1 requires that "Conservation and management measures shall prevent overfishing while achieving, on a continuing basis, the OY from each fishery for the U.S. fishing industry" (@ 50 CFR 600.310(a)).

The determination of OY and ACL is a decisional mechanism for resolving the Magnuson-Stevens Act's multiple purposes and policies, implementing an FMP's objectives and balancing the various interests that comprise the national welfare. OY is based on MSY, or on MSY as it may be reduced ... [in consideration of social, economic or ecological factors].... The most important limitation on the specification of OY and ACL is that the choice of OY and ACL and the conservation and management measures proposed to achieve it must prevent overfishing @ (50 CFR Section 600.310(b)).

This chapter addresses the essential considerations suggested for National Standard 1, as identified in the NMFS guidelines on the standard (600.310):

- Estimating MSY, estimated the MSY biomass and setting the MSY control rule (50 CFR 600.310(c); Section 4.2 of this Chapter).
- Specifying stock status determination criteria (maximum fishing mortality threshold and minimum stock size threshold, or reasonable proxies thereof) (50 CFR 600.310(d); Section 4.4 of this Chapter).
- Actions for ending overfishing and rebuilding overfished stocks (including the development and adoption of rebuilding plans) (50 CFR 600.310(e); Section 4.5 of this Chapter).
- Setting OY and apportionment of harvest levels (50 CFR 600.310(f); Section 4.6 of this Chapter).

In establishing OYs and ACLs for West Coast groundfish, this FMP uses the interim step of calculating ~~ABC~~OFLs and ABCs for major stocks or management units (groups of species). ~~ABC~~OFL is the MSY harvest level associated with the current stock abundance. Over the long term, if ~~ABC~~OFLs are fully harvested, the average of the ~~ABC~~OFLs would be MSY. ABC is a threshold below the OFL, which ~~incorporates a scientific uncertainty buffer~~accounts for scientific uncertainty. ACL is a ~~in~~ harvest specification~~s~~ set at or below ABC and is intended~~ designed~~ to prevent overfishing.

OYs and ACLs are ~~is~~ set and apportioned under the procedures outlined in Chapter 5.

[Added: 16-1, Amended 16-4 and 23]

4.2. Species Categories

B_{MSY}, ~~ABC~~OFL and the overfished/rebuilding stock size threshold cannot be precisely defined for all species, because of the absence of available information for many species managed under the FMP. For the purpose of setting MSY, ~~ABC~~OFL, the maximum fishing mortality threshold (MFMT), the minimum stock size threshold (MSST), ABC, OY, ACL and rebuilding standards, three categories of species are identified. The first are the ~~relatively few~~those species for which a relatively data-rich quantitative stock assessment can be conducted on the basis of catch-at-age, catch-at-length or other data. ~~ABC~~OFLs and overfished/rebuilding thresholds can generally be calculated for these species. ABCs can also be calculated for these species based on the uncertainty of the biomass estimated within an assessment or the variance in biomass estimates between assessments for all species in this category. The second category includes a large number of species for which some biological indicators are available, ~~but~~ including a relatively data-poor quantitative assessment or a nonquantitative ~~analysis cannot be conducted~~assessment.

It is difficult to estimate overfished and overfishing thresholds for the second category of species a priori, but indicators of long-term, potential overfishing can be identified. ABCOFLs and ABCs for species in this category are typically set at a constant level and some monitoring is necessary to determine if this level of catch is causing a slow decline in stock abundance. The third category includes minor species which are caught, but for which there is, at best, only information on landed biomass. For species in this category, it is impossible to quantitatively determine MSY, ABCOFL, or an overfished threshold. Typically, average historic catches are used to determine the OFL for category 3 species.

A fourth category of species is identified as ecosystem component (EC) species. These species are not "in the fishery" and therefore not actively managed. EC species are not targeted in any fishery and are not generally retained for sale or personal use. EC species are not determined to be subject to overfishing, approaching an overfished condition, or overfished, nor are they likely to become subject to overfishing or overfished in the absence of conservation and management measures. Harvest specifications are not decided for EC species, although the bycatch of EC species is monitored to ensure they continue to be classified correctly. While EC species are not considered to be "in the fishery," the Council should consider measures for the fishery to minimize bycatch and bycatch mortality of EC species consistent with National Standard 9, and to protect their associated role in the ecosystem. EC species do not require specification of reference points but should be monitored to the extent that any new pertinent scientific information becomes available (e.g., catch trends, vulnerability, etc.) to determine changes in their status or their vulnerability to the fishery. If necessary, they should be reclassified as "in the fishery."

[Amended: 16-1 and 23]

4.3. Determination of MSY, or MSY Proxy, and B_{MSY}

Harvest policies are to be specified according to standard reference points such as MSY (MSY, interpreted as a maximum average achievable catch under prevailing ecological and environmental conditions over a prolonged period). The long-term average biomass associated with fishing at F_{MSY} is B_{MSY}. In this FMP, MSY generally refers to a constant F control rule that is assumed to produce the maximum average yield over time while protecting the spawning potential of the stock. Thus the constant F control rule is generally the proxy for the MSY control rule. Fishing rates above F_{MSY} eventually result in biomass smaller than B_{MSY} and produce less harvestable fish on a sustainable basis. The biomass level that produces MSY (i.e., B_{MSY}) is generally unknown and assumed to be variable over time due to long-term fluctuations in ocean conditions, so that no single value is appropriate. During periods of unfavorable environmental conditions it is important to account for reduced sustainable yield levels.

The problem with an F_{MSY} control rule is that it is tightly linked to an assumed level of density-dependence in recruitment, and there is insufficient information to determine the level of density-dependence in recruitment for many West Coast groundfish stocks. Therefore, the use of approximations or proxies is necessary. Absent a more accurate determination of F_{MSY}, the Council will apply default MSY proxies. The current (20012009) proxies are: $F_{40\%30\%}$ for flatfish and whiting, $F_{50\%}$ for rockfish (including thornyheads) and $F_{45\%}$ for all species such as sablefish and lingcod. However, values ($F_{40\%30\%}$, $F_{45\%}$, and $F_{50\%}$) are provided here as examples only and are expected to be modified from time to time as scientific knowledge improves. If available information is sufficient, values of F_{MSY}, B_{MSY}, and more appropriate harvest control rules may be developed for any species or species group.

At this time, it is generally believed that, for many species, $F_{45\%}$ strikes a balance between obtaining a large fraction of the MSY if recruitment is highly insensitive to reductions in spawning biomass and preventing a rapid depletion in stock abundance if recruitment is found to be extremely sensitive to reductions in spawning biomass. The long-term expected yield under an $F_{45\%}$ policy depends upon the (unknown) level of density-dependence in recruitment. The recommended level of harvest will reduce the average lifetime egg production by each female entering the stock to 45% of the lifetime egg production for females that are unfished.

Because the level of recruitment is expected to decline somewhat as a stock is fished at $F_{45\%}$, the expected B_{MSY} proxy is less than 45% of the unfished biomass. A biomass level of 40% is a reasonable proxy for B_{MSY}. The short-term yield under an $F_{45\%}$ policy will vary as the abundance of the exploitable stock varies. This is true for any fishing policy that is based on a constant exploitation rate. The abundance of the stock will vary, because of the effects of fishing, and because of natural variation in recruitment. When stock abundance is high (i.e., near its average unfished level), short-term annual yields can be approximately two to three times greater than the expected long-term average annual yield. For many of the long-lived groundfish species common on the West Coast, this "fishing down" transition can take decades. Many of the declines in ~~ABC~~OFL that occurred during the 1980s were the result of this transition from a lightly exploited, high abundance stock level to a fully exploited, moderately abundant stock level. Further declines below the overfished levels in the 1990s were due in large part to harvest rate policies that were later discovered to not be sustainable. More recent stock assessments indicate that West Coast groundfish stocks likely have lower levels of productivity than other similar species worldwide. Based on this retrospective information, harvest rate policies in the 1990s were too high to maintain stocks at B_{MSY}. The Council revised its harvest rate policies for lower levels of production, described below.

Scientific information as of 1997 (Clark 1993; Ianelli and Heifetz 1995; Mace 1994) indicated that $F_{35\%}$ may not be the best approximation of F_{MSY}, given more realistic information about recruitment than was initially used by Clark in 1991. In his 1993 publication Clark extended his 1991 results by improving the realism of his simulations and analysis. In particular he (1) modeled stochasticity into the recruitment process, (2) introduced serial correlation into recruitment time series, and (3) performed separate analyses for the Ricker and Beverton-Holt spawner-recruit functions. For rockfish, these changes improved the realism of his spawning biomass per recruit (SPR) harvest policy calculations, because these species are known to have stochastic recruitment and they appear to display serial correlation in recruitments (especially on interdecadal time scales), and because the Beverton-Holt spawner-recruit curve may be biologically the most plausible recruitment model. The effect of each of these changes, in isolation and in aggregate, was to decrease F_{MSY}. Consequently, the estimated SPR reduction needed to provide an optimal F_{MSY} proxy (defined as that level of fishing which produces the largest assured proportion of MSY), must necessarily be increased. Clark concluded that $F_{40\%}$ is the optimal rate for fish stocks exhibiting recruitment variability similar to Alaska groundfish stocks. Likewise, Mace (Mace 1994) recommended the use of $F_{40\%}$ as the target mortality rate when the stock-recruitment relationship is unknown. Lastly, Ianelli and Heifitz (Ianelli and Heifetz 1995) determined that $F_{44\%}$ was a good F_{MSY} proxy for Gulf of Alaska Pacific ocean perch, although he subsequently indicated that a recent recruitment to that stock was larger than expected and that $F_{44\%}$ may be too conservative in that case.

Based on this information and advice by its Groundfish Management Team, in 1997 the Council concluded that $F_{40\%}$ should be used as the proxy for F_{MSY} for rockfish in the absence of specific knowledge of recruitment or life history characteristics which would allow a more accurate determination of F_{MSY}. This proxy was later revised based on further Scientific and Statistical Committee (SSC) investigation into the appropriate F_{MSY} proxies in 2000.

In the spring of 2000, the Council's SSC sponsored a workshop to review the Council's groundfish exploitation rate policy. The workshop explored the historic use of different fishing mortality (F) rates and found that the Council's past practices have generally changed in response to new information from the scientific community. Starting in the early 1990s, the Council used a standard harvest rate of F35%. The SSC's workshop participants reported that new scientific studies in 1998 and 1999 had shown that the $F_{35\%}$ and $F_{40\%}$ rates used by the Council had been too aggressive for Pacific Coast groundfish stocks, such that some groundfish stocks could not maintain a viable population over time. A 1999 study, The Meta-Analysis of the Maximum Reproductive Rate for Fish Populations to Estimate Harvest Policy; a Review (Myers, *et al.* 2000) showed that Pacific Coast groundfish stocks, particularly rockfish, have very low productivity compared to other, similar species worldwide. One prominent theory about the reason for this low productivity is the large-scale North Pacific climate shifts that are thought to cycle Pacific Coast waters through warm and cool phases of 20-30 years duration. Pacific Coast waters shifted to a warm phase around 1977-1978, with ocean conditions less favorable for Pacific Coast groundfish and other fish stocks. Lower harvest rates are necessary to guard against steep declines in abundance during these periods of low productivity (low recruitment). After an intensive review of historic harvest rates, and current scientific literature on harvest rates and stock productivity, the SSC workshop concluded that $F_{40\%}$ is too aggressive for many Pacific Coast groundfish stocks, particularly for rockfish. For 2001 and beyond, the Council adopted the SSC's new recommendations for harvest policies of: $F_{40\%}$ for flatfish and whiting, $F_{50\%}$ for rockfish (including thornyheads) and $F_{45\%}$ for other groundfish such as sablefish and lingcod.

In the past, F_{MSY} fishing rates were treated by the Council (as intended) as targets. Under the Magnuson-Stevens Act as amended in 1996, these fishing rates are more appropriately considered to be thresholds that should not be exceeded (see Section 4.4).

The Council will consider any new scientific information relating to calculation of MSY or MSY proxies and may adopt new values based on improved understanding of the population dynamics and harvest of any species or group of species.

While B_{MSY} may be set based on the averaged unfished abundance ($B_{unfished}$) there are many possible approximations and estimates of mean $B_{unfished}$. If the necessary data exist, the following standard methodology is the preferred approach:

$$\text{mean } B_{unfished} = \text{mean } R * SPR(F=0)$$

Where mean R is the average estimated recruitment expected under unfished conditions, and SPR(F=0) is the spawning potential per recruit at zero fishing mortality rate. SPR(F=0) is normally available as part of the calculation leading to determination of $F_{45\%}$ and is equivalent to $F_{100\%}$.

[Amended: 5, 11, 16-1, 23]

4.4. Determination of ~~ABC~~OFL and ABC[JDD3][s4]

In establishing OYs and ACLs for West Coast groundfish, this FMP utilizes the interim step of calculating ~~ABC~~OFLs and ABCs for major stocks or management units (groups of species). ~~ABC~~OFL is the MSY harvest level associated with the current stock abundance. Over the long term, if ~~ABC~~OFLs are fully harvested, the average of the ~~ABC~~OFLs would be MSY. ABC is a harvest specification set below the OFL and is a threshold that incorporates a scientific uncertainty buffer against overfishing (i.e., exceeding the OFL). The SSC recommends the OFL and a range of ABCs for each stock and stock complex. The ABC is associated with a probability of overfishing (P*), which is analytically developed by the SSC. The Council decides an ABC from the SSC-recommended range based on an overfishing risk assessment informed by the estimated probability of overfishing.

4.4.1. Stocks with OFL and ABC Set by Relatively Data-Rich Quantitative Assessments, Category 1

The stocks with relatively data-rich quantitative assessments are those that have recently been assessed by a catch-at-age or catch-at-length analysis and judged to be informative for deciding stock-specific harvest specifications by the SSC. Annual evaluation of the appropriate MSY proxy (e.g., $F_{45\%}$) for species in this category will require some specific information in the SAFE document. Estimated age- or length-specific maturity, growth, and availability to the fishery (with evaluation of changes over time in these characteristics) are sufficient to determine the relationship between fishing mortality and yield-per-recruit and spawning biomass-per-recruit. The estimated time series of recruitment, spawning biomass, and fishing mortality are also required to determine whether recent trends indicate a point of concern. In general, ~~ABC~~OFL will be calculated by applying $F_{45\%}$ (or $F_{40\%}$, $F_{50\%}$, or other established MSY proxy) to the best estimate of current biomass. This current biomass estimate may be for a single year or the average of the present and several future years. Thus, ~~ABC~~OFL may be intended to remain constant over a period of three or more years.

The ABC, which incorporates a scientific uncertainty buffer against overfishing, can be calculated for category 1 species. The SSC quantifies the variability in biomass estimates for category 1 species from stock assessments as a basis for evaluating the size of a scientific uncertainty buffer (i.e., the difference between the OFL and the ABC) and the risk of overfishing the stock. Approaches to quantifying the variability in biomass estimates include using the standard error about the estimated biomass of a stock in the most recently approved assessment and estimating the between-assessment variance in biomass estimates for a stock with multiple assessments or for all category 1 stocks with multiple assessments in a meta-analysis. A proxy variance (σ) can be calculated using this latter approach for all or some category 1 species. None of these approaches are mutually exclusive and the SSC may recommend stock-specific approaches to quantifying scientific uncertainty for category 1 species. Once scientific uncertainty is quantified, it is mapped to an estimated probability of overfishing (P*) by the SSC. [s5]The Council chooses the ABC from the SSC-recommended range based on the estimated P*, which is a risk assessment policy decision.

4.4.2. Stocks with ~~ABC~~OFL and ABC Set by Relatively Data-Poor Quantitative or Nonquantitative Assessment, Category 2

These stocks with ~~ABC~~OFL set by relatively data-poor quantitative or nonquantitative assessments typically do not have a recent, quantitative assessment, but there may be a previous assessment or some indicators of the status of the stock. Category 2 stocks may also have a recent assessment that was judged to be relatively data-poor by the SSC. Detailed biological information is not routinely available for these stocks, and ~~ABC~~OFL levels have typically been established on the basis of average historical landings, trends in a fishery independent survey or some other index of current biomass. Typically, the spawning biomass, level of recruitment, or the current fishing mortality rate for Category 2 stocks are unknown. The Council places high priority on improving the information for managing these stocks so that they may be moved to Category 1 status.

Since there is greater scientific uncertainty for category 2 stocks relative to category 1 stocks, the scientific uncertainty buffer is ~~generally~~ greater than that recommended for category 1 stocks. The SSC recommends the ABC for category 2 stocks.[s6]

4.4.3. Stocks With~~out~~ ~~ABC~~OFL Values Set by Nonquantitative Assessment, Category 3

Of the ~~80~~90-plus groundfish species managed under the FMP, ~~ABC~~OFL values have been established for only about ~~25~~32. The remaining species are incidentally landed and usually are not listed separately on fish landing receipts. Information from fishery independent surveys are often lacking for these stocks, because of their low abundance or they are not vulnerable to survey sampling gear. Until sufficient quantities of at-sea observer program data are available or surveys of other fish habitats are conducted, it is unlikely that there will be sufficient data to upgrade the assessment capabilities or to evaluate the overfishing potential of these stocks. Interim ~~ABC~~OFL values ~~may be~~are established for these stocks based on average historic catch or qualitative information, including advice from the Council's advisory entities.

Since there is greater scientific uncertainty for category 3 stocks relative to category 1 or 2 stocks, the scientific uncertainty buffer is greater than that recommended for category 1 and 2 stocks. The SSC recommends the ABC for category 3 stocks.

4.4.4. Ecosystem Component Stocks Without OFL Values[s7]

Ecosystem Component species do not require specification of reference points (i.e., OFLs, ABCs, and ACLs) but are monitored to the extent that any new pertinent scientific information becomes available (e.g., catch trends, vulnerability, etc.) to determine changes in their status or their vulnerability to the fishery. For this classification, such species should:

1) be a non-target species or stock;
2) not be determined to be subject to overfishing, approaching overfished, or overfished;
3) not be likely to become subject to overfishing or overfished, according to the best available information, in the absence of conservation and management measures; and
4) not generally be retained for sale or personal use.

Categorizing [s8]FMP species as ~~Ecosystem Component~~Category 1, 2 or 3 species ~~is~~may be done biennially in the specifications decision process~~,~~; however, recategorizing species as in the fishery or as Ecosystem Component species requires an FMP amendment.. A productivity and suscepetibility assessment (PSA) is done for FMP species in the biennial specifications process to guide a decision on whether stocks are actively managed with harvest specifications (i.e., category 1, 2, or 3 stocks) or are monitored as Ecosystem Component species. ~~Recategorizing species as in the fishery or as Ecosystem Component species requires an FMP amendment.~~

[Amended: 11, 12, 16-1, 23]

4.5. Precautionary Thresholds and Overfishing Status Determination Criteria

The National Standard Guidelines define two thresholds that are necessary to maintain a stock at levels capable of producing MSY: the maximum fishing mortality threshold (MFMT) and a minimum stock size threshold (MSST). These two limits are intended for use as benchmarks to decide if a stock or stock complex is being overfished or is in an overfished state. The MFMT and MSST are intrinsically linked through the MSY control rule, which specifies how fishing mortality or catches could vary as a function of stock biomass in order to achieve yields close to MSY.

4.5.1. Determination of Precautionary Thresholds

The precautionary threshold is the biomass level at which point the harvest rate will be reduced to help the stock return to the MSY level (see Section 4.6.1 - Default Precautionary and Interim Rebuilding ~~OY~~ACL Calculation). The precautionary biomass threshold is in addition to the overfishing and overfished/rebuilding thresholds required under the Magnuson-Stevens Act (MFMT and MSST). The precautionary biomass threshold is higher than the overfished biomass (MSST). Because B_{MSY} is a long term average, biomass will by definition be below B_{MSY} in some years and above B_{MSY} in other years. Thus, even in the absence of overfishing, biomass may decline to levels below B_{MSY} due to natural fluctuation. By decreasing harvest rates when biomass is below B_{MSY} but maintaining MSY control rule (or proxy control rule) harvest rates for biomass levels above MSY, the precautionary threshold and accompanying response effectively constitute a control rule that manages for harvests lower than MSY and an average biomass above MSY.

The precautionary threshold is established only for category 1 species. The precautionary threshold will be the B_{MSY} level, if known. The default precautionary threshold will be 40% of the estimated unfished biomass level. The Council may recommend different precautionary thresholds for any species or species group based on the best scientific information about that species or group. It is expected the threshold will be between 25% and 50% of the estimated unfished biomass level.

4.5.2. Determination of Overfishing Threshold

In this FMP, for Category 1 species, the term "overfishing" is used to denote situations where catch exceeds or is expected to exceed the established ~~ABC~~OFL or MSY proxy ($F_{x\%}$). This can also be expressed as where catch exceeds or is expected to exceed the MFMT. The term "overfished" describes a stock whose abundance is below its overfished/rebuilding threshold, or MSST. Overfished/rebuilding thresholds, in general, are linked to the same productivity assumptions that determine the ~~ABC~~OFL levels. The default value of this threshold is 25% of the estimated unfished biomass level or 50% of B_{MSY}, if known. The MFMT is simply the value(s) of fishing mortality in the MSY control rule. Technically, exceeding F_{MSY} constitutes overfishing.

For Category 2 species, the following may be evaluated as potential indicators of overfishing:

- catch per effort from logbooks
- catch area from logbooks
- index of stock abundance from surveys
- stock distribution from surveys
- mean size of landed fish

If declining trends persist for more than three years, then a focused evaluation of the status of the stock, its ~~ABC~~OFL, and overfishing threshold will be quantified. If data are available, such an evaluation should be conducted at approximately five year intervals even when negative trends are not apparent. In fact, many stocks are in need of re-evaluation to establish a baseline for monitoring of future trends. Whenever an evaluation indicates the stock may be declining and approaching an overfished state, the Council should:

1. Improve data collection for this species so it can be moved to Category 1.

2. Determine the rebuilding rate that would allow the stock to return to MSY in no longer than ten years.

Information from fishery independent surveys is often lacking for Category 3 species because of their low abundance or because they are not vulnerable to survey sampling gear. Until sufficient data become available from the at-sea observer program, the risk of overfishing these species cannot be fully evaluated.

4.5.3. Determination of Overfished/Rebuilding Thresholds

The MSST (overfished/rebuilding threshold) is the default value of 25% of the estimated unfished biomass level or 50% of B_{MSY}, if known. The overfished/rebuilding threshold (also referred to as $B_{rebuild}$), is generally in the range of 25% to 40% of $B_{unfished}$, and may also be written as

$B_{rebuild}$ = x% * mean R * SPR(F=0)

The default overfished/rebuilding threshold for category 1 groundfish is $0.25B_{unfished}$. The Council may establish different thresholds for any species based on information provided in stock assessments, the SAFE document, or other scientific or groundfish management-related report. For example, if B_{MSY} is known, the overfished threshold may be set equal to 50% of that amount. The Council may also specify a lower level of abundance where catch or fishing effort is reduced to zero. This minimum abundance threshold (B_{MIN}) would correspond to an abundance that severely jeopardizes the stock's ability to recover to B_{MSY} in a reasonable length of time.

[Amended: 11, 12, 16-1]

4.6. Ending Overfishing and Rebuilding

4.6.1. Default Precautionary and Interim Rebuilding ~~OY~~ ACL Calculation

The precautionary threshold, defined in Section 4.5.1~~4.4.1~~, is used to trigger a precautionary management approach. If biomass declines to a level that requires rebuilding (below the MSST), the precautionary management approach also provides an interim rebuilding harvest control policy to guide the setting ~~OY~~ACL until the Council sets a new rebuilding policy specific to the conditions of the stock and fishery. The default ~~OY~~ACL/rebuilding policy can be described as an "ICES-type catch-based approach" that consists of a modification of the catch policy, where catch (C) declines from $C(F_{MSY})$ at the precautionary threshold in a straight line to F=0 at the minimum abundance threshold of ten percent of the estimated mean unfished biomass (sometimes called pristine or virgin biomass or reproductive potential). This approach could also be described as an ~~OY~~ACL based on a variable F_{SPR} that is progressively more conservative at low biomass levels. The abbreviated name for this is the "40-10" default adjustment. In most cases, there is inadequate information to estimate F_{MSY}; in such cases, the best proxy for F_{MSY} will be used. The default proxy values will be $F_{40\%}$ for flatfish and whiting, $F_{50\%}$ for rockfish in the Sebastes complex and $F_{45\%}$ for other species such as sablefish and lingcod. The Council anticipates scientific information about the population dynamics of the various stocks will improve over time and that this information will result in improved estimates of appropriate harvest rates and MSY proxies. Thus, these initial default proxy values will be replaced from time to time. Such changes will not require amendment to the FMP, but the scientific basis for new values must be documented.

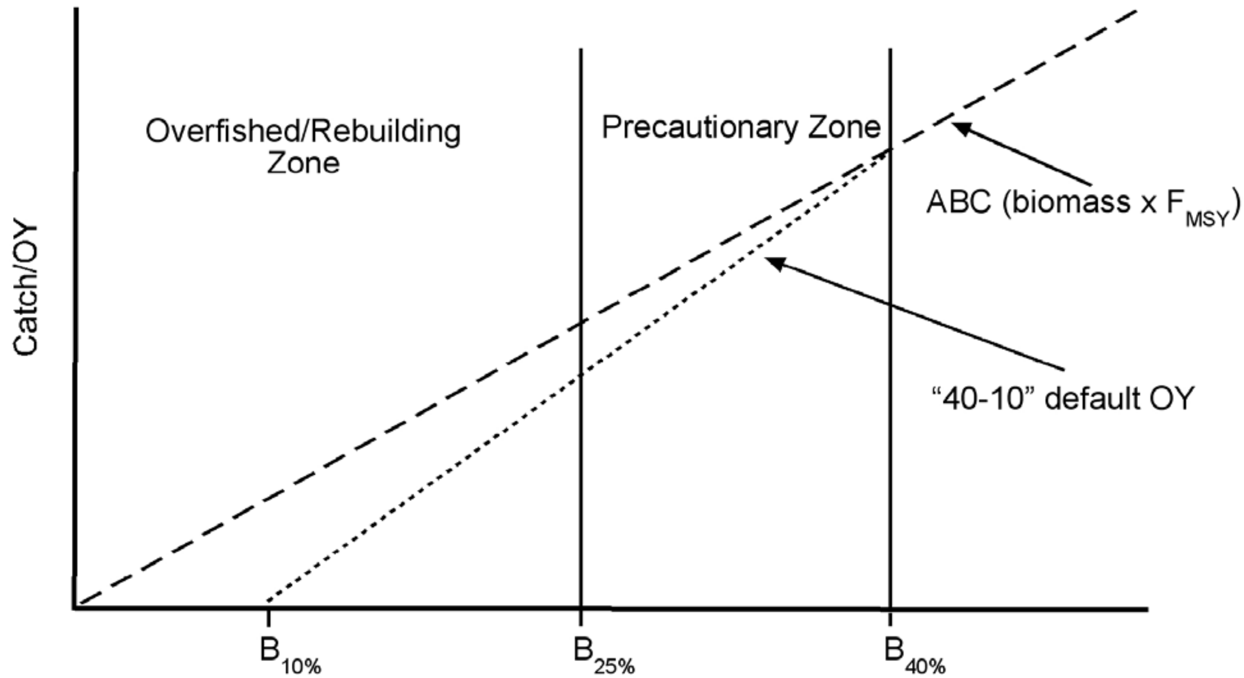


Figure **4-1**. Illustration of the default ACL rule compared to OFL. **[NOTE: need to import a revised figure here]**

The greater amount of catch reduction applied below the precautionary threshold will foster quicker return to the MSY level. If a stock falls below its overfished/rebuilding threshold, this line would be used as the interim rebuilding plan during the year until the Council develops a formal rebuilding plan. The point at which the line intersects the horizontal axis does not necessarily imply zero catch would be allowed, but rather is for determining the slope of the line.

In order to apply this default approach, a minimal amount of information is necessary; only stocks in Category 1 can be managed in this way. For stocks with inadequate information to apply this approach, the Council will consider other methods of ensuring that overfishing will be avoided. The Council will consider the approaches discussed in the National Standard Guidelines in developing such recommendations for stocks in Categories 2 and 3.

4.6.2. Procedures for Calculating Rebuilding Parameters

The Magnuson-Stevens Act and National Standard Guidelines provide a descriptive framework for developing strategies to rebuild overfished stocks. This framework identifies three parameters: a minimum time in which an overfished stock can rebuild to its target biomass (denoted T_{MIN}), a maximum permissible time period for rebuilding the stock to its target biomass (T_{MAX}), and a target year, falling within the time period between T_{MIN} and T_{MAX} and representing the year by which the stock can be rebuilt, as soon possible, taking into account the status and biology of the stock, the needs of fishing communities, and the interaction of the stock of fish within the marine ecosystem (T_{TARGET}).

T_{MIN}, the lower limit of the specified time period for rebuilding, will be determined by the status and biology of the stock or stock complex and its interactions with other components of the marine ecosystem or environmental conditions and is defined as the amount of time that would be required for rebuilding if fishing mortality were eliminated entirely.

If T_{MIN} is less than ten years, then the specified time period for rebuilding may be adjusted upward so that the rebuilding period is as short as possible, taking into account the status and biology of the stock, the needs of fishing communities, and the interaction of the stock of fish within the marine ecosystem,, except that no such upward adjustment may result in the specified time period exceeding ten years (which would then constitute T_{MAX}), unless management measures under an international agreement in which the United States participates dictate otherwise.

If T_{MIN} is ten years or greater, then the specified time period for rebuilding may be adjusted upward so that the rebuilding period is as short as possible, taking into account the status and biology of the stock, the needs of fishing communities, and the interaction of the stock of fish within the marine ecosystem, except that no such upward adjustment can exceed the rebuilding period calculated in the absence of fishing mortality, plus one mean generation time or equivalent period based on the species' life history characteristics. For example, if a stock could be rebuilt within 12 years in the absence of any fishing mortality, and has a mean generation time of eight years, the maximum allowable time to rebuild would be 20 years, which is T_{MAX}.

The Council may consider a number of factors in determining the time period for rebuilding, including:

1. The status and biology of the stock or stock complex.

2. Interactions between the stock or stock complex and other components of the marine ecosystem or environmental conditions.

3. The needs of fishing communities.

4. Recommendations by international organizations in which the United States participates.

5. Management measures under an international agreement in which the United States participates.

4.6.2.1. Calculating Rebuilding Probabilities

Stock assessment results form the basis of a rebuilding analysis, which in turn is used to develop rebuilding policies and choose the rebuilding parameters identified in each rebuilding plan. The elements of rebuilding analyses are described in the SSC Terms of Reference for Rebuilding Analyses (SSC 2001). This guidance has been incorporated into a computer program (Punt 2002). In the analysis the probability that the overfished stock will reach its target biomass is determined with respect to T_{MIN}, T_{MAX}, and T_{TARGET}. The methods for calculating the values of these parameters are described below. This is a simplified explanation of the current methodology; for example, equations and technical specifications are omitted. The SSC may revise their terms of reference in the future and the computer program undergoes continued refinement and elaboration.

The rebuilding analysis program uses “Monte Carlo simulation” to derive a probability estimate for a given rebuilding strategy. This method projects population growth many times in separate simulations. It accounts for possible variability by randomly choosing the value of a key variable, in this case total recruitment or recruits per spawner from a range of values. These values can be specified empirically, by listing some set of historical values, or by a relationship based on a model. The SSC recommends that the rebuilding analyses use historical values. Because of this variability in a key input value, each simulation will show a different pattern of population growth. As a result, a modeled population may reach the target biomass that defines a rebuilt stock (B_{MSY}) in a different year in each of the simulations.

This technique is first used to calculate T_{MIN} in probabilistic terms, which is defined as the time needed to reach the target biomass in the absence of fishing with a 50% probability. In other words, in half the simulations the target biomass was reached in some year up to and including the computed T_{MIN}. Given T_{MIN}, T_{MAX} is computed as 10 years or by adding the value of one mean generation time to T_{MIN}, if T_{MIN} is greater than or equal to 10 years.

A target year, T_{TARGET}, is set as a year at T_{MIN} or greater, which does not exceed T_{MAX} ,and which is as short as possible, taking into account the status and biology of the stock, the needs of fishing communities, and the interaction of the stock of fish within the marine ecosystem. Prior to Amendment 16-4, the Council set T_{TARGET} in part by considering the probability of rebuilding the stock by T_{MAX}. The Council may continue to review the probability of rebuilding the stock by T_{MAX} given differing F rates, a reference parameter known as "P_{MAX}." The Magnuson-Stevens Act, however, simply requires that rebuilding periods be as short as possible, taking into account:

- the status and biology of any overfished stocks of fish;
- the needs of fishing communities;
- recommendations by international organizations in which the United States participates;
- the interaction of the overfished stock of fish within the marine ecosystem (§304(e)(4)(A)(i)).

It is important to recognize that some of the terms introduced and described above represent policy decisions at the national level and the Council **does not have a choice** in setting their values. The dates for T_{MIN} and T_{MAX} are determined based on guidelines established at the national level. Mean generation time is a biological characteristic that cannot be chosen by policymakers. Thus, the Council cannot choose these values and then use them as a basis for management. Defined in national guidelines, T_{MIN} is a consequence of the productivity of the fish stock and is calculated by fishery biologists based on information they get from a particular stock. Similarly, T_{MAX}, which is calculated from T_{MIN}, does not represent a Council choice.

Policy flexibility comes into play in determining T_{TARGET}, or the time by which the stock is projected to rebuild. As explained earlier, the time to rebuild must be as short as possible, taking into account the status and biology of the stock, the needs of fishing communities, and the interaction of the stock of fish within the marine ecosystem. When developing a management strategy the Council **can** choose a fishing mortality rate and corresponding annual level of fishing. However, when rebuilding overfished species, the choice of F is based on the value of T_{TARGET}, keeping in mind that these values cannot be chosen independently of one another. In other words, the Council may choose one value and derive the other from it, but they cannot choose these values independently of the each other.

4.6.3. Stock Rebuilding Plans

As required by the Magnuson-Stevens Act, within one year of being notified by the Secretary that a stock is overfished or approaching a condition of being overfished, the Council will prepare a recommendation to end the overfished condition and rebuild the stock(s) or to prevent the overfished condition from occurring. For a stock that is overfished, the rebuilding plan will specify a time period for ending the overfished condition and rebuilding the stock. Overfishing restrictions and recovery benefits should be fairly and equitably allocated among sectors of the fishery.

Certain elements of a rebuilding plan developed by the Council, as specified in Section 4.5.3.2 (Contents of Rebuilding Plans), will be submitted to the Secretary as an FMP amendment and implementing regulations. Changes to key rebuilding plan elements will be accomplished through full (notice and comment) rulemaking. Once approved by the Secretary, a rebuilding plan will remain in effect for the specified duration of the rebuilding program, or until modified. The Council will make all approved rebuilding plans available in the annual SAFE document or by other means. The Council may recommend that the Secretary implement interim measures to reduce overfishing until the Council's program has been developed and implemented.

The Council intends its stock rebuilding plans to provide targets, checkpoints, and guidance for rebuilding overfished stocks to healthy and productive levels. They should provide a clear vision of the intended results and the means to achieve those results. They will provide the strategies and objectives that regulations are intended to achieve, and proposed regulations and results will be measured against the rebuilding plans. It is likely that rebuilding plans will be revised over time to respond to new information, changing conditions, and success or lack of success in achieving the rebuilding schedule and other goals. If, in response to these revisions, the Council recommends changes to the management target for a particular stock, such changes will be published through full (notice and comment) rulemaking as described in Section 6.2 of this FMP. As with all Council activities, public participation is critical to the development, implementation and success of management programs.

4.6.3.1. Goals and Objectives of Rebuilding Plans

The overall goals of rebuilding programs are to (1) achieve the population size and structure that will support the maximum sustainable yield within a specified time period that is as short as possible, taking into account the status and biology of the stock, the needs of fishing communities, and the interaction of the stock of fish within the marine ecosystem; (2) minimize, to the extent practicable, the adverse social and economic impacts associated with rebuilding, including adverse impacts on fishing communities; (3) fairly and equitably distribute both the conservation burdens (overfishing restrictions) and recovery benefits among commercial, recreational, and charter fishing sectors; (4) protect the quantity and quality of habitat necessary to support the stock at healthy levels in the future; and (5) promote widespread public awareness, understanding and support for the rebuilding program. More specific goals and objectives may be developed in the rebuilding plan for each overfished species.

To achieve the rebuilding goals, the Council will strive to (1) explain the status of the overfished stock, pointing out where lack of information and uncertainty may require that conservative assumptions be made in order to maintain a risk-averse management approach; (2) identify present and historical harvesters of the stock; (3) where adequate harvest sharing plans are not already in place, develop harvest sharing plans for the rebuilding period and for when rebuilding is completed; (4) set harvest levels that will achieve the specified rebuilding schedule; (5) implement any necessary measures to allocate the resource in accordance with harvest sharing plans; (6) promote innovative methods to reduce bycatch and bycatch mortality of the overfished stock; (7) monitor fishing mortality and use available stock assessment information to evaluate the condition of the stock; (8) identify any critical or important habitat areas and implement measures to ensure their protection; and (9) promote public education regarding these goals, objectives, and the measures intended to achieve them.

4.6.3.2. Contents of Rebuilding Plans

Generally, rebuilding plans will contain:

1. A description of the biology and status of the overfished stock and fisheries affected by stock rebuilding measures.

2. A description of how rebuilding parameters for the overfished stock were determined (including any calculations that demonstrate the scientific validity of parameters).

3. Estimates of rebuilding parameters (Bunfished, B_{MSY}, T_{MIN}, T_{MAX}, and the probability of reaching target biomass by this date, and T_{TARGET}) at the time of rebuilding plan adoption.

4. A description of the fishing communities' needs that were considered at the time of adoption of the plan.

5. The process, and any applicable standards, that will be used during periodic review to evaluate progress in rebuilding the stock to the target biomass (see Section 4.5.3.5).

6. Any management measures the Council may wish to specifically describe in the FMP, which facilitate stock rebuilding in the specified period. (These measures would be in addition to any existing measures typically implemented through annual or biennial management. See Section 4.5.3.4 for more information.)

7. Any goals and objectives in addition to or different from those listed in the preceding section.

8. Potential or likely allocations among sectors.

9. For fisheries managed under international agreement, a discussion of how the rebuilding plan will reflect traditional participation in the fishery, relative to other nations, by fishermen of the United States.

10. Any other information that may be useful to achieve the rebuilding plan's goals and objectives.

The following questions also serve as a guide in developing rebuilding plans:

1. What is the apparent cause of the current condition (historical fishing patterns, a declining abundance or recruitment trend, a change in assessment methodology, or other factors)?

2. Is there a downward trend in recruitment that may indicate insufficient compensation in the spawner-recruitment relationship?

3. Based on a comparison of historical harvest levels (including discards) relative to recommended ~~ABC~~~~OFL~~ [s9]ACL~~level~~s, has there been chronic over-harvest?

4. Is human-induced environmental degradation implicated in the current stock condition? Have natural environmental changes been observed that may be affecting growth, reproduction, and/or survival?

5. Would reduction in fishing mortality be likely to improve the condition of the stock?

6. What types of fishing communities rely on catch of this particular stock, or on catch of stocks that co-occur with this stock?

7. Is the particular species caught incidentally with other species? Is it a major or minor component in a mixed-stock complex?

8. What types of management measures are anticipated and/or appropriate to achieve the biological, social, economic, and community goals and objectives of the rebuilding plan?

Rebuilding plan documents are distinct from the analytical documents required by the National Environmental Policy Act and other legal mandates, although they will reflect the contents of those analyses in a much briefer form. Rebuilding plan elements incorporated into the FMP (in Section 4.5.4) summarize the contents enumerated in this section. Rebuilding plans as a whole will be published in the next annual SAFE document after their approval.

Any new rebuilding program will commence as soon as the first measures to rebuild the stock or stock complex are implemented.

Fishing communities need a sustainable fishery that: is safe, well-managed, and profitable; provides jobs and incomes; contributes to the local social fabric, culture, and image of the community; and helps market the community and its services and products.

4.6.3.3. Process for Development and Approval of Rebuilding Plans

Upon receiving notification that a stock is overfished, the Council will identify one or more individuals to draft the rebuilding plan. A draft of the plan will be reviewed and preliminary action taken (tentative adoption or identification of preferred alternatives), followed by final adoption at a subsequent meeting. The tentative plan or alternatives will be made available to the public and considered by the Council at a minimum of two meetings, unless stock conditions suggest more immediate action is warranted. Upon completing its final recommendations, the Council will submit the proposed rebuilding plan or revision to an existing plan to NMFS for concurrence. A rebuilding plan will be developed following the standard procedures for considering and implementing an FMP amendment under the Magnuson-Stevens Act and other applicable law.

The following elements in each rebuilding plan will be incorporated into the FMP in Section 4.5.4:

1. A brief description of the status of the stock and fisheries affected by stock rebuilding measures at the time the rebuilding plan was prepared.

2. The methods used to calculate stock rebuilding parameters, if substantially different from those described in Section 4.5.2.

3. An estimate at the time the rebuilding plan was prepared of:
   - unfished biomass ($B_{unfished}$ or B_0) and target biomass (B_{MSY});
   - the year the stock would be rebuilt in the absence of fishing (T_{MIN});
   - T_{MIN} plus one mean generation time (T_{MAX}); and
   - the year in which the stock would be rebuilt based on the application of stock rebuilding measures that achieve rebuilding as soon as possible, taking into account the status and biology of the stock, the needs of fishing communities, and the interaction of the overfished stock within the marine ecosystem (T_{TARGET}).

4. A description of the harvest control rule (e.g., constant catch or harvest rate) and the specification of this parameter. The types of management measures that will be used to constrain harvests to the level implied by the control rule will also be described (see also Section 4.5.3.4). These two elements, the harvest control rule and a description of management measures, represents the rebuilding strategy intended to rebuild the stock by the target year.

It is likely that over time the parameters listed above will change. It must be emphasized that the values enumerated in the FMP represent estimates at the time the rebuilding plan is prepared. Therefore, the FMP need not be amended if new estimates of these values are calculated. The values for these parameters found in the FMP are for reference, so that managers and the public may track changes in the strategy used to rebuild an overfished stock. However, any new estimates of the parameters listed above will be published in the SAFE documents as they become available.

4.6.3.4. Updating Key Rebuilding Parameters

In addition to an initial specification in the FMP, the target year (T_{TARGET}) and the harvest control rule (type and numerical value) will also be specified in regulations. If new information indicates a need to change the value of either of these two parameters, such a change will be accomplished through full (notice and comment) rulemaking as described in Section 6.2 of this FMP. The target year is the year by which the stock would be rebuilt to its target biomass. Therefore, if a subsequent analysis identifies an earlier target year for the current fishing mortality rate (based on the harvest control rule), there is no obligation to change in regulations either the target year (to the computed earlier year) or the harvest control rule (to delay rebuilding to the original target year). Stock assessments for overfished species are typically conducted every two years. Stock assessments and rebuilding analyses use mathematical models to predict a stock's current abundance, as well as project future abundance and recruitment. In any mathematical model that uses a variety of data sources, as the stock assessments do, model results tend to vary from one assessment to the next within some range of values. This expected variation means that, when the Council and SSC review a new overfished species stock assessment and rebuilding model, they must also consider whether the result of that model or models show a rebuilding trajectory that varies from the previously-predicted trajectory to a significant degree. If the variation between the stock assessments and rebuilding analyses for a particular species do not show significant differences in the rebuilding trajectory for that species, they are mathematically considered to be essentially the same. In that circumstance, the Council will likely not need to revise the T_{TARGET} or harvest control rule for that species. Since the target year is the key rebuilding parameter, it should only be changed after careful deliberation. For example, the Council might recommend that the target year be changed if, based on new information about the status and/or biology of the stock, they determine that the existing target year is later than the recomputed maximum rebuilding time (T_{MAX}) or if a recomputed harvest control rule would result in such a low optimum yield as to cause substantial socioeconomic impacts. These examples are not definitive: the Council may elect to change the target year because of other circumstances. However, any change to the target year or harvest control rule must be supported by commensurate analysis that demonstrates that the new target year is a target to rebuild the stock as soon as possible, taking into account the status and biology of the stock, the needs of fishing communities, and the interaction of the stock within the marine ecosystem.

4.6.3.5. Implementation of Actions Required Under the Rebuilding Plan

NMFS will implement or adjust, with the adoption of the rebuilding plan, any management measures not already in effect that are necessary to implement the rebuilding plan. Many necessary measures may already be in place through the standard management process. Because of the complex nature of the fishery and the interaction of various stocks, regulations will need to be adjusted over the periods of the rebuilding plans. Management measures will be adjusted, or new measures will be developed and implemented in the future, in order to best implement each rebuilding plan throughout the life of that plan.

Once a rebuilding plan is adopted, certain measures required in the rebuilding plan may need to be implemented through authorities and processes already described in the FMP. Management actions to achieve OY harvest, and objectives related to rebuilding requirements of the Magnuson-Stevens Act and goals and objectives of the FMP (each of which may require a slightly different process) include: automatic actions, notices, abbreviated rulemaking actions, and full rulemaking actions. (These actions are detailed in Section 4.6, Chapter 5, and Section 6.2.) Allocation proposals require consideration as specified in the allocation framework (see Section 6.2.3.1). Any proposed regulations to implement the rebuilding plan will be developed in accordance with the framework procedures of this FMP.

Any rebuilding management measures that are not already authorized under the framework of the existing FMP, or specified in the FMP consequent of rebuilding plan adoption, will be implemented by further FMP amendments. These plan amendments may establish the needed measures or expand the framework to allow the implementation of the needed measures under framework procedures.

The Council may designate a state or states to take the lead in working with its citizens to develop management proposals to achieve stock rebuilding.

4.6.3.6. Periodic Review of Rebuilding Plans

Rebuilding plans will be reviewed periodically, but at least every two years, although the Council may propose revisions to an adopted rebuilding plan at any time. These reviews will take into account the goals and objectives listed in Section 4.5.3.1, recognizing that progress towards the first goal, to achieve the population size and structure that will support MSY within the specified time period, will only be evaluated on receipt of new information from the most recent stock assessment.

The Council, in consultation with the SSC and GMT, will determine on a case-by-case basis whether there has been a significant change in a parameter such that the chosen management target must be revised. If, based on this review, the Council decides that the harvest control rule or target year must be changed, the procedures outlined in Section 4.5.3.3 will be followed. Regardless of the Council's schedule for reviewing overfished species rebuilding plans, the Secretary of Commerce, through NMFS, is required to review the progress of overfished species rebuilding plans toward rebuilding goals every two years, per Magnuson-Stevens Act at 16 U.S.C. '304(e)(7).

4.6.3.7. Precedence of a Recovery Plan or "No Jeopardy" Standard Issued Pursuant to the Endangered Species Act

Like rebuilding plans pursuant to National Standard 1 in the Magnuson-Stevens Act, a recovery plan pursuant to the Endangered Species Act outlines measures for the conservation and survival of the designated species. Under Section 7 of the Endangered Species Act an agency must consult NMFS when any activity permitted, funded, or conducted by that agency may affect a listed marine species or its designated critical habitat. (In the case of fishery management actions, NMFS is both the action and consulting agency.) As part of these consultations, a biological opinion is produced describing standards that must be met when permitting or implementing the action to ensure that the action is not likely to jeopardize the continued existence of the listed species; these are referred to as Ano jeopardy@ standards.

Measures under a recovery plan or "no jeopardy" standards in a biological opinion will supersede rebuilding plan measures and targets if they will result in the stock rebuilding to its target biomass by an earlier date than the target year identified in the current rebuilding plan. (If expressed probabilistically, any ESA standard expressed as a combination of date and probability that constitutes a higher standard will take precedence over the equivalent target and probability in the rebuilding plan. For example, an ESA standard requiring recovery by the rebuilding plan target year, but with a higher probability, would take precedence over the rebuilding plan.) If a stock is de-listed before reaching its target biomass, the rebuilding plan will come back into effect until such time as the stock is fully rebuilt.

4.6.4. Summary of Rebuilding Plan Contents

As noted in Section 4.5.3.3, this section summarizes the contents of rebuilding plans, including the values for rebuilding parameters, at the time of their adoption. The specified numerical values for these parameters are likely to change over time. This section will not be amended to incorporate any revised values. As described in Section 4.5.3.4, if the numerical specification of the harvest control rule or target year for a given overfished species is changed the new value will be published in federal groundfish regulations. In addition, subsequent SAFE documents may include updated values for the parameters listed in Section 4.5.3.3 and Table 4-1.

In 2005, the Council decided to pursue Amendment 16-4 to re-evaluate and revise, if necessary, adopted rebuilding plans for seven depleted (overfished) groundfish species, so that the rebuilding periods are as short as possible, taking into account the status and biology of the depleted species, the socioeconomic needs of West Coast fishing communities, and the interaction of the depleted stocks within the marine ecosystem. The revised rebuilding plans under Amendment 16-4 are based on 2005 stock assessments and, in the case of yelloweye rockfish, a new assessment done in 2006. The revised rebuilding plan parameters are presented in Table 4-2. Table 4-2 presents a new rebuilding parameter, $T_{F=0}$, which is the median time to rebuild the stock if all fishing-related mortality were eliminated with the implementation of a revised rebuilding plan (which for Amendment 16-4 is 2007) and is considered the shortest possible time to rebuild the stocks under consideration in Amendment 16-4. This parameter is distinguished from T_{MIN}, which is the shortest time to rebuild based on the assumption of no fishing-related mortality from the onset of the initial rebuilding plan, which is usually the year after the stock was declared overfished.

In 1999, NMFS notified the Council that the coastwide lingcod stock was considered overfished. Amendment 16-2 to the FMP included a rebuilding plan for lingcod that set a T_{TARGET} rebuilding date of 2009. However, the lingcod stock rebuilt faster than the Council had initially anticipated. The 2005 lingcod stock assessment showed that the coastwide stock had rebuilt to a level exceeding statutory requirements, B_{MSY} or $B_{40\%}$. Amendment 16-4, therefore, removed the lingcod rebuilding plan from the FMP.

4.6.4.1. Bocaccio Rockfish

Status of the Bocaccio Stock and Fisheries Affected by Stock Rebuilding Measures at the Time of Rebuilding Plan Adoption (April 2004)

Assessment scientists and managers have treated West Coast bocaccio as independent stocks north and south of Cape Mendocino. The southern stock, which has been declared overfished, occurs south of Cape Mendocino and the northern stock north of 48° N latitude in northern Washington (off Cape Flattery). The overfished southern bocaccio rockfish stock occurs in Central and Southern California waters, on the continental shelf and in nearshore areas, often in rocky habitat. They are caught in both commercial and recreational fisheries in approximately equal amounts. Commercial catches mainly occur in limited entry trawl fisheries.

Bocaccio have long been an important component of California rockfish fisheries. Catches increased to high levels in the 1970s and early 1980s as relatively strong year-classes recruited to the stock. The Council began to recommend increasingly restrictive regulations after an assessment of the southern stock in 1990 (Bence and Hightower 1990) indicated that fishing rates were too high. The southern stock has been assessed six times (Bence and Hightower 1990; Bence and Rogers 1992; MacCall, *et al.* 1999; MacCall 2002; MacCall 2003b; Ralston, *et al.* 1996) and has suffered poor recruitment during the warm water conditions that have prevailed off Southern California since the late 1980s. The 1996 assessment (Ralston, *et al.* 1996) indicated the stock was in severe decline. NMFS formally declared the stock overfished in March 1999 after the groundfish FMP was amended to incorporate the tenets of the Sustainable Fisheries Act. MacCall et al. (MacCall, *et al.* 1999) confirmed the overfished status of bocaccio and estimated spawning output of the southern stock to be 2.1% of its unfished biomass and 5.1% of the maximum sustainable yield (MSY) level. The northern stock of bocaccio has not been assessed.

While previous assessments only used data from Central and Northern California, an assessment in 2002 (MacCall and He 2002) also included data for southern California. While relative abundance increased slightly from the last assessment (4.8% of unfished biomass), potential productivity appears lower than previously thought, making for a more pessimistic outlook. The Council assumed a medium recruitment scenario for the 1999 year class, which was not assessed (MacCall, *et al.* 1999). The 2002 assessment revealed the 1999 year class experienced relatively lower recruitment. Therefore, although the 1999 year class contributed a substantial quantity of fish to the population, it did not contribute as much to rebuilding as was previously thought.

The 2003 bocaccio assessment differs greatly from the 2002 assessment. It is driven by the strength of the incoming 1999 year class that had not recruited into the indices used for the 2002 assessment and by a revised lower estimate of natural mortality (MacCall 2003b). In addition to the 2001 Triennial Survey data, the 2003 assessment used larval abundance data from recent CalCOFI surveys as well as length and catch per unit effort (CPUE) data from recreational fisheries. In calculating the recreational CPUE information, a new method was used that identifies relevant fishing trips by species composition and adjusts the catch history for regulatory changes that affect the level of discard and avoidance. The results of these calculations suggest that recreational CPUE has increased dramatically in recent years and is at a record high level in Central California north of Pt. Conception. The STAR Panel recommended the use of two assessment models as a means of bracketing uncertainty from the very different signals between the Triennial Survey and the recreational CPUE data. Following the Stock Assessment Review (STAR) Panel meeting, MacCall presented a third Ahybrid@ model that incorporated the data from all of the indices. The Scientific and Statistical Committee (SSC) recommended, and the Council approved, the use of this third modeling approach. This resulted in modest improvement in estimated stock size, but significantly affected the estimated productivity of the stock. These results had substantial effects on the rebuilding outlook for bocaccio which, under the 2002 assessment, was not expected to rebuild within T_{MAX} even with no fishing related mortality. Total mortality in 2003 fisheries was restricted to less than 20 mt as a means of conserving the stock while minimizing adverse socioeconomic impacts to communities. The current rebuilding analysis (MacCall 2003a), using the "hybrid" model, suggests the stock could rebuild to B_{MSY} within 25 years while sustaining an optimum yield (OY) of approximately 300 mt in 2004.

The Council adopted a rebuilding plan for bocaccio rockfish at its April 2004 meeting, as described by the parameter values listed in Table 4-1. These values are based on a rebuilding analysis conducted by MacCall (2003b).

Amendment 16-4, adopted by the Council at its June 2006 meeting, revised the rebuilding parameters for bocaccio, as listed in Table 4-2. These values are based on a rebuilding analysis conducted by MacCall (2006) which had determined that the bocaccio stock was at 10.7% of its unfished level in 2005.

Fisheries in central and southern California are affected by the bocaccio rebuilding plan because the overfished population occurs in these waters. Recreational and limited entry trawl fisheries in this region have accounted for the bulk of landings in recent years.

Methods Used to Calculate Stock Rebuilding Parameters

The methods used in the rebuilding analysis (MacCall 2003a) upon which the original rebuilding plan was based, and those used for the rebuilding plan revision under Amendment 16-4 (MacCall 2006) do not differ substantially from the approach described in Section 4.5.2.

Rebuilding Parameter Values at the Time of Rebuilding Plan Adoption

Table 4-1 lists the numerical values for B_0, B_{MSY}, T_{MIN}, T_{MAX}, P_{MAX}, T_{TARGET} and F. The values of B_0, B_{MSY}, T_{MIN}, and T_{MAX} are derived from the rebuilding analysis used in formulating the rebuilding plan (MacCall 2003a). Using the STATc base model from the most recent stock assessment (MacCall 2003b), the Council chose a value of 70% for P_{MAX}, based on a harvest control rule of F = 0.0498. This results in a target year of 2023.

Rebuilding Parameter Values from Amendment 16-4 Rebuilding Plan Update

Table 4-2 lists the numerical values for B_0, B_{MSY}, T_{MIN}, T_{MAX}, $T_{F=0}$, P_{MAX}, T_{TARGET} and an SPR harvest rate. The values of B_0, B_{MSY}, T_{MIN}, $T_{F=0}$, and T_{MAX} are derived from the rebuilding analysis used in formulating the rebuilding plan (MacCall 2006). The Council chose a target rebuilding year of 2026.

Bocaccio Fishing Communities

Amendment 16-4 revised the Council's approach to rebuilding plans, requiring an analysis of the needs of fishing communities in relation to overfished species rebuilding times, in addition to the traditional analysis of rebuilding times in relation to the status and biology of the stock. For Amendment 16-4 and the 2007-2008 fisheries, fishing community needs are described and analyzed in an EIS (PFMC 2006). Chapter 7 of that EIS discusses the communities that make up the socio-economic environment of the Pacific Coast groundfish fisheries. In general, bocaccio is a continental shelf species that is most frequently taken south of 40°10' N. latitude. in all of the groundfish fisheries, commercial and recreational. All groundfish fishing communities off the southern U.S. West Coast are affected by bocaccio rebuilding measures.

Bocaccio Rockfish Rebuilding Strategy

As shown in Table 4-1, at the inception of the rebuilding plan the harvest control rule for bocaccio rockfish was a fishing mortality rate of 0.0498. Based on the 2003 rebuilding analysis, this harvest rate is likely to rebuild the stock by the target year of 2023. This value is likely to change over time as stock size and structure changes. Any updated value will be published in federal groundfish regulations. The fishing mortality rate is applied to the exploitable biomass estimate to determine the OY for a given fishing period.

Management measures are implemented through the biennial harvest specification and management process described in Chapter 5. The types of management measures that may be implemented through this process are described in Chapter 6. In 2004, at the time of rebuilding plan adoption, measures intended to limit bycatch of overfished species included prohibiting retention of certain overfished species during some parts of the year, reducing landing limits (cumulative trip limits) on co-occurring species, establishing extensive time/area closures, and restricting the use of trawl nets equipped with large footropes. (By using large footropes with heavy roller gear, bottom trawlers can access rocky habitat on the continental shelf. This is the preferred habitat for some overfished species.)

Beginning in 2002, time/area closures known as GCAs came into use as a way of decreasing bycatch of overfished species. GCAs enclose depth ranges where bycatch of overfished species is most likely to occur, based on information retrieved from logbooks and the at-sea observer program. The boundaries vary by season and fishery sector, and may be modified in response to new information about the geographic and seasonal distribution of bycatch.

As noted, a large proportion of bocaccio catch occurs in recreational fisheries in Central and Southern California. Recreational depth closures, restricting fishing to shallow waters, bag limits, and seasonal closures have been used to reduce recreational bocaccio catches.

The Council's rebuilding measures for 2007-2008, adopted at the same time as the Council's adoption of Amendment 16-4, continue the Council's strategy of constraining bocaccio total mortality by restricting fishing on co-occurring healthy stocks, particularly chilipepper rockfish, and preventing fishing in areas where bocaccio may be taken incidentally.

4.6.4.2. Canary Rockfish

Status of the Canary Rockfish Stock and Fisheries Affected by Stock Rebuilding Measures at the Time of the Council's Rebuilding Plan Adoption (June 2003)

Canary rockfish exploitation began in the early 1940s when World War II increased demand for protein (Alverson, *et al.* 1964; Browning 1980). Through this decade the trawl fishery expanded in Oregon and Washington, accounting for most of the canary rockfish catch; in California longlines were mainly used to target rockfish during this period. Other gear historically used to catch canary rockfish include hook-and-line (primarily vertical longline), shrimp trawls, and pots and traps. From 1966 until 1976 foreign trawlers were responsible for most of the harvest. After passage of the Magnuson Act in 1977 domestic vessels became the dominant harvesters of this species. In recent years canary rockfish have become an important recreational target north of Cape Mendocino.

Overfishing, or exceeding the MFMT, was detected by a 1994 stock assessments and subsequent update (Sampson 1996; Sampson and Stewart 1994). In both cases the harvest rate exceeded the F20% threshold. In 1999 two age-based stock assessments showed that the stock was overfished in a northern area comprising the Columbia and U.S. Vancouver management zones (Crone, *et al.* 1999) and in a southern area comprising Conception, Monterey, and Eureka management zones (Williams, *et al.* 1999). Based on these assessments, the stock was declared overfished in January 2000.

The first rebuilding analysis (Methot 2000a) used results from the northern area assessment to project rates of potential stock recovery. The stock was found to have extremely low productivity, defined as production of recruits in excess of the level necessary to maintain the stock at its current low level. According to the anlaysis, rates of recovery are highly dependent on the level of recent recruitment, which could not be estimated with high certainty.

A subsequent assessment (Methot and Piner 2002c) treated the stock as a single coastwide unit (covering the area from the Monterey zone through the U.S. Vancouver zone). This differed from past assessments, where northern and southern areas were treated separately. The lack of older, mature females in surveys and other assessment indices was another consideration in this assessment. Older females may simply have a higher natural mortality rate, or survey and fishing gear may be less effective at catching them. If these fish are in fact un-sampled, productivity estimates should be higher because older, larger fish are more fecund. Methot and Piner (Methot and Piner 2002c) combined these two hypotheses in a single age-structured version of the SSC-endorsed stock synthesis assessment model (Methot 2000b). They estimated the 2002 abundance of canary rockfish coastwide was about 8% of B_0.

The Canary rockfish rebuilding plan was adopted by the Council at its June 2003 meeting and is based on a 2002 rebuilding analysis (Methot and Piner 2002a). The 2002 rebuilding analysis updated the first rebuilding analysis for canary rockfish, completed in 2000, using information from the aforementioned stock assessment. The Council's rebuilding strategy, when combined with the results of this rebuilding analysis, required a substantial reduction in the OY for 2003. As a result, fisheries must be managed for canary rockfish bycatch, often limiting the amount of target species that may be harvested.

Amendment 16-4, adopted by the Council at its June 2006 meeting, revised the rebuilding parameters for canary rockfish, as listed in Table 4-2. These values are based on a rebuilding analysis conducted by Methot (2006) which had determined that the canary rockfish stock was at 9.4% of its unfished level in 2005.

Canary rockfish are encountered in a relatively wide variety of both commercial and recreational fisheries. However, limited entry trawlers targeting flatfish and arrowtooth flounder account for a large proportion of the landed catch, mainly north of Cape Mendocino. Much smaller amounts are caught in the whiting and DTS limited entry trawl fisheries, and by fixed gear vessels targeting groundfish on the continental shelf. Charter vessels account for most of recreationally-caught canary rockfish, mainly off of Northern California and Oregon.

Methods Used to Calculate Stock Rebuilding Parameters

The methods used in the rebuilding analysis (Methot and Piner 2002a) upon which the original rebuilding plan was based, and those used for the rebuilding plan revision under Amendment 16-4 (Methot and Stewart 2006) do not differ substantially from the approach described in Section 4.5.2.

Rebuilding Parameter Values at the Time of Rebuilding Plan Adoption

Table 4-1 lists the numerical values for B_0, B_{MSY}, T_{MIN}, T_{MAX}, P_{MAX}, T_{TARGET} and F. The values of B_0, B_{MSY}, T_{MIN}, and T_{MAX} are derived from the rebuilding analysis used in formulating the rebuilding plan (Methot and Piner 2002a). The Council chose a value of 60% for P_{MAX}, based on a harvest control rule of $F = 0.022$. This results in a target year of 2074.

Rebuilding Parameter Values from Amendment 16-4 Rebuilding Plan Update

Table 4-2 lists the numerical values for B_0, B_{MSY}, T_{MIN}, T_{MAX}, $T_{F=0}$, P_{MAX}, T_{TARGET} and an SPR harvest rate. The values of B_0, B_{MSY}, T_{MIN}, $T_{F=0}$, and T_{MAX} are derived from the rebuilding analysis used in formulating the rebuilding plan (Methot and Stewart 2006). The Council chose a target rebuilding year of 2063.

Canary Rockfish Fishing Communities

Amendment 16-4 revised the Council's approach to rebuilding plans, requiring an analysis of the needs of fishing communities in relation to overfished species rebuilding times, in addition to the traditional analysis of rebuilding times in relation to the status and biology of the stock. For Amendment 16-4 and the 2007-2008 fisheries, fishing community needs are described and analyzed in an EIS (PFMC 2006). Chapter 7 of that EIS discusses the communities that make up the socio-economic environment of the Pacific Coast groundfish fisheries. In general, canary rockfish is a continental shelf species that is taken coastwide in all of the groundfish fisheries, commercial and recreational, as well as in many commercial and recreational fisheries targeting species other than groundfish. All groundfish fishing communities and many non-groundfish fishing communities off the U.S. West Coast are affected by canary rockfish rebuilding measures.

Canary Rockfish Rebuilding Strategy

As shown in Table 4-1, at the inception of the rebuilding plan the harvest control rule for canary rockfish was a fishing mortality rate of 0.022. Based on the 2002 canary rockfish rebuilding analysis (Methot and Piner 2002a), this harvest rate is likely to rebuild the stock by the target year of 2074. This value is likely to change over time as stock size and structure changes. Any updated value will be published in federal groundfish regulations. The fishing mortality rate is applied to the exploitable biomass estimate to determine the OY for a given fishing period.

Management measures are implemented through the biennial harvest specification and management process described in Chapter 5. The types of management measures that may be implemented through this process are described in Chapter 6. In 2003, at the time of rebuilding plan adoption, measures intended to limit bycatch of overfished species included prohibiting retention of certain overfished species during some parts of the year, reducing landing limits (cumulative trip limits) on co-occurring species, establishing extensive time/area closures, and restricting the use of trawl nets equipped with large footropes. (By using large footropes with heavy roller gear, bottom trawlers can access rocky habitat on the continental shelf. This is the preferred habitat for some overfished species.)

Beginning in 2002 time/area closures, referred to as Groundfish Conservation Areas (GCAs), came into use as a way of decreasing bycatch of overfished species. GCAs enclose depth ranges where bycatch of overfished species is most likely to occur, based on information retrieved from log books and the at-sea observer program. The boundaries vary by season and fishery sector, and may be modified in response to new information about the geographic and seasonal distribution of bycatch.

Canary rockfish prefer rocky areas on the continental shelf so management measures in use at the time of rebuilding plan adoption were intended to discourage fishing in these areas. Under the regulations in place during 2003, bottom trawling is prohibited in the GCA, which encompasses depth ranges where canary rockfish are most frequently caught. In addition, the aforementioned restrictions on the use of trawl nets equipped with large footropes discourage fishing in the rocky habitat preferred by this species. In areas shoreward of the GCA large footrope gear is prohibited, preventing trawlers from assessing rocky habitat in these shallower depths. In areas deeper than the GCA, either small or large footrope gear may be used, although large footrope gear is the preferred type in these depths. In addition, cumulative trip limits are structured to encourage vessels to fish exclusively in deep water where canary rockfish (as well as some other overfished species) are not encountered. Vessels are allowed to use all gear configurations during any given cumulative limit period (currently two months). However, vessels which use the small footrope configuration are restricted to lower cumulative trip limits than vessels using large footrope configurations. Since the large footrope configuration may only be used offshore of the GCA, these measures encourage fishing exclusively in deeper water to take advantage of the higher limits afforded this gear type.

Recreational fisheries are managed mainly through bag limits, size limits, and fishing seasons established for each West Coast state. Bag and size limits have been established for canary rockfish. In addition, managers have the option of closing areas to recreational fishing if needed to prevent the canary rockfish OY from being exceeded.

The Council's rebuilding measures for 2007-2008, adopted at the same time as the Council's adoption of Amendment 16-4, continue the Council's strategy of constraining canary rockfish total mortality by restricting fishing on co-occurring healthy stocks and preventing fishing in areas where canary rockfish may be taken incidentally. Additionally, the Council has adopted a requirement that trawl vessels operating north of 40°10' N. latitude use selective flatfish trawl gear when operating in nearshore waters, a gear that minimizes rockfish bycatch during flatfish trawl fishing. The Council has also adopted canary rockfish bycatch limits for the Pacific whiting fishery, which has some canary rockfish incidental catch.

4.6.4.3. Cowcod

Status of the Cowcod and Fisheries Affected by Stock Rebuilding Measures at the Time of Rebuilding Plan Adoption (April 2004)

Relatively little is known about cowcod, a species of large rockfish that ranges from Ranger Bank and Guadalupe Island in central Baja California to Usal, Mendocino County, California (Miller and Lea 1972), and may infrequently occur as far north as Newport, Oregon. Cowcod have been assessed only once (Butler, *et al.* 1999). Adult cowcod are primarily found over high relief rocky areas (Allen 1982). They are generally solitary, but occasionally aggregate (Love, *et al.* 1990).

While cowcod are not a major component of the groundfish fishery, they are highly desired by both recreational and commercial fishers because of their bright color and large size. In recent years small amounts have been caught by limited entry trawl vessels and recreational anglers in Southern California. The cowcod stock south of Cape Mendocino has experienced a long-term decline. The cowcod stock in the Conception area was assessed in 1998 (Butler, *et al.* 1999). Abundance indices decreased approximately tenfold between the 1960s and the 1990s, based on commercial passenger fishing vessel (CPFV) logs (Butler, *et al.* 1999). Recreational and commercial catch also declined substantially from peaks in the 1970s and 1980s, respectively.

B_0 was estimated to be 3,370 mt, and 1998 spawning biomass was estimated at 7% of B_0, well below the 25% overfishing threshold. As a result, NMFS declared cowcod in the Conception and Monterey management areas overfished in January 2000. Large areas off Southern California (the Cowcod Conservation Areas [CCAs]) have been closed to fishing for cowcod. The stock's low productivity and declined spawning biomass also necessitates an extended rebuilding period, estimated at 62 years with no fishing-related mortality (T_{MIN}), to achieve a 1,350 mt BMSY for the Conception management area.

There is relatively little information about the cowcod stock, and there are major uncertainties in the one assessment that has been conducted. The assessment authors needed to make estimates of early landings based on more recent data and reported total landings of rockfish. Age and size composition of catches are poorly sampled, population structure is unknown, and the assessment was restricted to Southern California waters.

A cowcod rebuilding review was completed in 2003, which validated the assumption that non-retention regulations and area closures have been effective in constraining cowcod fishing mortality (Butler, *et al.* 2003). These results, although encouraging, are based on cowcod fishery-related removals from CPFV observations and angler reported discards. Non-retention regulations and limited observation data have increased the need for fishery independent population indices.

The Council adopted a rebuilding plan for cowcod at its April 2004 meeting, as described by the parameter values listed in Table 4-1. These values are based on a rebuilding analysis conducted by Butler and Barnes (Butler and Barnes 2000).

Amendment 16-4, adopted by the Council at its June 2006 meeting, revised the rebuilding parameters for cowcod, as listed in Table 4-2. These values are based on a rebuilding analysis conducted by Piner (2006) which had determined that the cowcod stock was between 14% and 21% of its unfished level in 2005.

Methods Used to Calculate Stock Rebuilding Parameters

The Cowcod rebuilding analysis (Butler and Barnes 2000) was completed before the SSC default rebuilding analysis methodology (Punt 2002), described in Section 4.5.2 , had been developed. Instead, it uses a surplus production model using a log-normal distribution fitted to recruitment during 1951-1998. At the time of rebuilding plan adoption (2004) a new cowcod stock assessment and rebuilding analysis had not been completed. In April 2004 the SSC recommended that future cowcod stock assessments use a model whose output can be used in the default rebuilding analysis methodology.

The methods in the rebuilding analysis (Piner 2006) used to develop the revised cowcod rebuilding plan under Amendment 16-4 do not differ substantially from the approach described in Section 4.5.2.

Rebuilding Parameter Values at the Time of Rebuilding Plan Adoption

Table 4-1 lists the numerical values for B_0, B_{MSY}, T_{MIN}, T_{MAX}, P_{MAX}, T_{TARGET} and F. The values of B_0, B_{MSY}, T_{MIN}, and T_{MAX} are derived from the rebuilding analysis (Butler and Barnes 2000) used in formulating the rebuilding plan. The Council chose a value of 60% for P_{MAX}, based on a harvest control rule of F = 0.009. This results in a target year of 2090.

Rebuilding Parameter Values from Amendment 16-4 Rebuilding Plan Update

Table 4-2 lists the numerical values for B_0, B_{MSY}, T_{MIN}, T_{MAX}, $T_{F=0}$, P_{MAX}, T_{TARGET} and an SPR harvest rate. The values of B_0, B_{MSY}, T_{MIN}, $T_{F=0}$, and T_{MAX} are derived from the rebuilding analysis used in formulating the rebuilding plan (Piner 2006). The Council chose a target rebuilding year of 2039.

Cowcod Fishing Communities

Amendment 16-4 revised the Council's approach to rebuilding plans, requiring an analysis of the needs of fishing communities in relation to overfished species rebuilding times, in addition to the traditional analysis of rebuilding times in relation to the status and biology of the stock. For Amendment 16-4 and the 2007-2008 fisheries, fishing community needs are described and analyzed in an EIS (PFMC 2006). Chapter 7 of that EIS discusses the communities that make up the socio-economic environment of the Pacific Coast groundfish fisheries. In general, cowcod is a sedentary and site-loyal continental shelf species that is most frequently taken off southern California in commercial non-trawl and recreational fisheries. All groundfish fishing communities off the southern U.S. West Coast are affected by cowcod rebuilding measures.

Cowcod Rebuilding Strategy

As shown in Table 4-1, at the inception of the rebuilding plan the harvest control rule for cowcod was a fishing mortality rate of 0.009. Based on the 2000 cowcod rebuilding analysis (Butler and Barnes 2000), this harvest rate is likely to rebuild the stock by the target year of 2090. This value is likely to change over time as stock size and structure changes. Any updated value will be published in federal groundfish regulations. The fishing mortality rate is applied to the exploitable biomass estimate to determine the OY for a given fishing period.

Management measures are implemented through the biennial harvest specification and management process described in Chapter 5. The types of management measures that may be implemented through this process are described in Chapter 6. In 2004, at the time of rebuilding plan adoption, measures intended to limit bycatch of overfished species included prohibiting retention of certain overfished species during some parts of the year, reducing landing limits (cumulative trip limits) on co-occurring species, establishing extensive time/area closures, and restricting the use of trawl nets equipped with large footropes. (By using large footropes with heavy roller gear, bottom trawlers can access rocky habitat on the continental shelf. This is the preferred habitat for some overfished species.)

Beginning in 2002, time/area closures known as GCAs came into use as a way of decreasing bycatch of overfished species. GCAs enclose depth ranges where bycatch of overfished species is most likely to occur, based on information retrieved from logbooks and the at-sea observer program. The boundaries vary by season and fishery sector, and may be modified in response to new information about the geographic and seasonal distribution of bycatch.

Because cowcod is a fairly sedentary species, establishment of a marine protected area, considered one of the GCAs, is the key strategy for limiting cowcod fishing mortality. The CCAs in the Southern California Bight encompasses two areas of greatest cowcod density, as estimated in 2000, based on historical cowcod catch and catch rates in commercial and recreational fisheries. To aid in enforcement, the CCAs are bounded by straight lines enclosing simple polygons. Butler, et al. (Butler, *et al.* 2003) concluded that the CCAs have been effective in reducing bycatch to levels projected to allow stock rebuilding. Estimated fishery removals have been at levels sufficient to rebuild the stock, since the CCAs were implemented, except in 2001 when 5.6 mt was caught in the Conception management area. Most of this catch occurred in the spot prawn trawl fishery, which subsequently has been phased out.

Given the particular life history characteristics of cowcod, the Council will continue to use species-specific area closures to protect cowcod. As new information becomes available on cowcod behavior and fisheries interactions with cowcod, the boundaries or related regulations concerning the current CCAs may change, and additional CCAs may be established by regulation.

The Council's rebuilding measures for 2007-2008, adopted at the same time as the Council's adoption of Amendment 16-4, continue the Council's strategy of constraining cowcod total mortality by restricting or eliminating fishing in areas where cowcod commonly occur and may be taken incidentally.

4.6.4.4. Darkblotched Rockfish

Status of the Darkblotched Stock and Fisheries Affected by Stock Rebuilding Measures at the Time of the Council's Rebuilding Plan Adoption (June 2003)

Historically, darkblotched rockfish were managed as part of a coastwide Sebastes complex, which was later segregated into north and south management units divided at 40º30' N latitude. As a result, fishery-dependent data from this period are generally unavailable. The first darkblotched rockfish stock assessment estimated the proxy MSY harvest rate and overfishing rate for the stock (Lenarz 1993).

Rogers et al. (Rogers, *et al.* 2000) assessed darkblotched stock status in 2000 and determined the stock was at 14% to 31% of its unfished level. This range in biomass estimates encompasses the MSST threshold of 25%; uncertainty in past catches by foreign vessels, which targeted Pacific ocean perch and also caught darkblotched rockfish, was the most important contributor to this wide range for the biomass estimate. A larger unfished biomass (B_0) is computed using larger historic catch estimates. Since the MSST is expressed as a percent of unfished biomass, a larger B_0 increases the absolute value of this threshold, making an overfished determination more likely. Without definitive information on foreign catches, managers assumed darkblotched comprised 10% of this catch, leading to the conclusion that the spawning stock biomass was 22% of its unfished level. Because this is below the MSST, the stock was declared overfished in 2000.

The Council adopted a rebuilding plan for darkblotched rockfish at its June 2003 meeting, as described by the parameter values listed in Table 4-1. These values are based on a rebuilding analysis conducted by Methot and Rogers (Methot and Rogers 2001).

Darkblotched rockfish occur on the outer continental shelf and continental slope, mainly north of Point Reyes. Because of this distribution they are caught exclusively by commercial vessels. Most landings have been made by bottom trawl vessels targeting flatfish on the continental shelf, rockfish on the continental slope, and the Dover sole-thornyhead-sablefish complex, also on the slope.

Methods Used to Calculate Stock Rebuilding Parameters

The methods used in the rebuilding analysis (2001) upon which the original rebuilding plan was based, and those used for the rebuilding plan revision under Amendment 16-4 (2006), do not differ substantially from the approach described in Section 4.5.2.

Rebuilding Parameter Values at the Time of Rebuilding Plan Adoption

Table 4-1 lists the numerical values for B_0, B_{MSY}, T_{MIN}, T_{MAX}, P_{MAX}, T_{TARGET} and F. The values of B_0, B_{MSY}, T_{MIN}, and T_{MAX} are derived from the rebuilding analysis used in formulating the rebuilding plan (Methot and Rogers 2001). The Council chose a value of 80% for P_{MAX}, based on a harvest control rule of F = 0.027. This results in a target year of 2030.

Rebuilding Parameter Values from Amendment 16-4 Rebuilding Plan Update

Table 4-2 lists the numerical values for B_0, B_{MSY}, T_{MIN}, T_{MAX}, $T_{F=0}$, P_{MAX}, T_{TARGET} and an SPR harvest rate. The values of B_0, B_{MSY}, T_{MIN}, $T_{F=0}$, and T_{MAX} are derived from the rebuilding analysis used in formulating the rebuilding plan (Rogers 2006). The Council chose a target rebuilding year of 2011.

Darkblotched Rockfish Fishing Communities

Amendment 16-4 revised the Council's approach to rebuilding plans, requiring an analysis of the needs of fishing communities in relation to overfished species rebuilding times, in addition to the traditional analysis of rebuilding times in relation to the status and biology of the stock. For Amendment 16-4 and the 2007-2008 fisheries, fishing community needs are described and analyzed in an EIS (PFMC 2006). Chapter 7 of that EIS discusses the communities that make up the socio-economic environment of the Pacific Coast groundfish fisheries. In general, darkblotched rockfish is a continental slope species that is most frequently taken in the commercial trawl fisheries north of 38° N. latitude. Fishing communities that participate in the slope trawl fisheries of the northern U.S. West Coast are most strongly affected by darkblotched rebuilding measures.

Darkblotched Rockfish Rebuilding Strategy

As shown in Table 4-1, at the inception of the rebuilding plan the harvest control rule for darkblotched rockfish was a fishing mortality rate of 0.027. Based on the 2001 rebuilding analysis, this harvest rate is likely to rebuild the stock by the target year of 2030. This value is likely to change over time as stock size and structure changes. Any updated value will be published in federal groundfish regulations. The fishing mortality rate is applied to the exploitable biomass estimate to determine the OY for a given fishing period.

Management measures are implemented through the biennial harvest specification and management process described in Chapter 5. The types of management measures that may be implemented through this process are described in Chapter 6. In 2003, at the time of rebuilding plan adoption, measures intended to limit bycatch of overfished species included prohibiting retention of certain overfished species during some parts of the year, reducing landing limits (cumulative trip limits) on co-occurring species, establishing extensive time/area closures, and restricting the use of trawl nets equipped with large footropes. (By using large footropes with heavy roller gear, bottom trawlers can access rocky habitat on the continental shelf. This is the preferred habitat for some overfished species.)

Beginning in 2002 time/area closures, referred to as Groundfish Conservation Areas (GCAs), came into use as a way of decreasing bycatch of overfished species. GCAs enclose depth ranges where bycatch of overfished species is most likely to occur, based on information retrieved from log books and the at-sea observer program. The boundaries vary by season and fishery sector, and may be modified in response to new information about the geographic and seasonal distribution of bycatch.

To limit darkblotched rockfish bycatch, an outer boundary of the GCA was set to move fishing activity into deeper water, away from the depth range of higher abundance for this species. In 2003 this outer boundary was modified during the winter months to allow targeting of petrale sole and other flatfish in shallower depths while still minimizing bycatch. The cumulative trip limits for minor slope rockfish north of Cape Mendocino, the species complex that darkblotched rockfish are managed under, and for splitnose rockfish, a co-occurring target species, were also lowered. Trip limits for other target species also may be adjusted to reduce darkblotched rockfish bycatch.

The Council's rebuilding measures for 2007-2008, adopted at the same time as the Council's adoption of Amendment 16-4, continue the Council's strategy of constraining darkblotched rockfish total mortality by restricting fishing on co-occurring healthy stocks and preventing fishing in areas where darkblotched rockfish may be taken incidentally. Additionally, the Council has adopted darkblotched rockfish bycatch limits for the Pacific whiting fishery, which has some darkblotched rockfish incidental catch.

4.6.4.5. Pacific Ocean Perch

Status of the Pacific Ocean Perch Stock and Fisheries Affected by Stock Rebuilding Measures at the Time of the Council's Rebuilding Plan Adoption (June 2003)

Pacific Ocean Perch (POP) were targeted by Soviet and Japanese factory trawlers between 1965 and 1975. Their large catches during this period substantially contributed to a decline in the West Coast stock. In 1981, just before this FMP was implemented, the Council declared the POP stock depleted and recommended conservative harvest policies. Although management measures discouraged targeting POP while allowing continued fishing on other species, the stock did not recover and the Council recommended still more restrictive measures. A 1998 stock assessment (Ianelli and Zimmerman 1998) estimated POP biomass was 13% of the unfished level, leading NMFS to declare the stock overfished in 1999.

The Council adopted a rebuilding plan for POP at its June 2003 meeting, as described by the parameter values listed in Table 4-1. These values are based on a 2000 stock assessment (Ianelli, *et al.* 2000) and subsequent rebuilding analysis (Punt and Ianelli 2001). A retrospective analysis of foreign fleet catches, underway at the time of rebuilding plan adoption, may change the rebuilding period estimates on which the rebuilding plan is based.

Amendment 16-4, adopted by the Council at its June 2006 meeting, revised the rebuilding parameters for POP, as listed in Table 4-2. These values are based on a rebuilding analysis conducted by Hamel (2006), which had determined that the POP stock was at 23.4% of its unfished level in 2005.

POP tend to occur at similar depths as darkblotched rockfish, although they have a more northerly geographic distribution. As a result, POP are caught in similar fisheries as darkblotched rockfish, but only north of Cape Mendocino. At the time the rebuilding plan was adopted, limited entry trawl vessels targeting flatfish, including petrale sole and arrowtooth flounder, accounted for more than 90% of all POP landings. POP are not an important component of the recreational fishery.

Methods Used to Calculate Stock Rebuilding Parameters

The methods in the rebuilding analysis (Punt and Ianelli 2001) upon which the original rebuilding plan was based, and those used for the rebuilding plan revision under Amendment 16-4 (Hamel 2006), do not differ substantially from the approach described in Section 4.5.2.

Rebuilding Parameter Values at the Time of Rebuilding Plan Adoption

Table 4-1 lists the numerical values for B_0, B_{MSY}, T_{MIN}, T_{MAX}, P_{MAX}, T_{TARGET} and F. The values of B_0, B_{MSY}, T_{MIN}, and T_{MAX} are derived from the rebuilding analysis used in formulating the rebuilding plan (Punt and Ianelli 2001). The Council chose a value of 70% for P_{MAX}, based on a harvest control rule of F = 0.0082. This results in a target year of 2027.

Rebuilding Parameter Values from Amendment 16-4 Rebuilding Plan Update

Table 4-2 lists the numerical values for B_0, B_{MSY}, T_{MIN}, T_{MAX}, $T_{F=0}$, P_{MAX}, T_{TARGET} and an SPR harvest rate. The values of B_0, B_{MSY}, T_{MIN}, $T_{F=0}$, and T_{MAX} are derived from the rebuilding analysis used in formulating the rebuilding plan (Hamel 2006). The Council chose a target rebuilding year of 2017.

Pacific Ocean Perch Fishing Communities

Amendment 16-4 revised the Council's approach to rebuilding plans, requiring an analysis of the needs of fishing communities in relation to overfished species rebuilding times, in addition to the traditional analysis of rebuilding times in relation to the status and biology of the stock. For Amendment 16-4 and the 2007-2008 fisheries, fishing community needs are described and analyzed in an EIS (PFMC 2006). Chapter 7 of that EIS discusses the communities that make up the socio-economic environment of the Pacific Coast groundfish fisheries. In general, POP is a continental slope species that is most frequently taken in the commercial trawl fisheries north of 40° 10' N. latitude. Fishing communities that participate in the slope trawl fisheries of the northern U.S. West Coast are most strongly affected by POP rebuilding measures.

Pacific Ocean Perch Rebuilding Strategy

As shown in Table 4-1, at the inception of the rebuilding plan the harvest control rule for POP was a fishing mortality rate of 0.0082. Based on the 2001 POP rebuilding analysis (Punt and Ianelli 2001), this harvest rate is likely to rebuild the stock by the target year of 2027. This value is likely to change over time as stock size and structure changes. Any updated value will be published in federal groundfish regulations. The fishing mortality rate is applied to the exploitable biomass estimate to determine the OY for a given fishing period.

Management measures are implemented through the biennial harvest specification and management process described in Chapter 5. The types of management measures that may be implemented through this process are described in Chapter 6. In 2003, at the time of rebuilding plan adoption, measures intended to limit bycatch of overfished species included prohibiting retention of certain overfished species during some parts of the year, reducing landing limits (cumulative trip limits) on co-occurring species, establishing extensive time/area closures, and restricting the use of trawl nets equipped with large footropes. (By using large footropes with heavy roller gear, bottom trawlers can access rocky habitat on the continental shelf. This is the preferred habitat for some overfished species.)

Beginning in 2002 time/area closures, referred to as Groundfish Conservation Areas (GCAs), came into use as a way of decreasing bycatch of overfished species. GCAs enclose depth ranges where bycatch of overfished species is most likely to occur, based on information retrieved from log books and the at-sea observer program. The boundaries vary by season and fishery sector, and may be modified in response to new information about the geographic and seasonal distribution of bycatch.

Because POP tend to co-occur with darkblotched rockfish, management measures applicable to that species also serve to constrain catches of POP. These measures include configuring the outer boundary of the GCA so that vessels fish in deeper water, where POP are less abundant. A cumulative trip limit, which represents the maximum amount of an identified species or species group that may be landed within the cumulative limit period (in 2003, two months) is also established for this species. Trip limits for overfished species are intended to discourage targeting on them while permitting any incidental catch to be landed. (Bycatch discarded at sea is more difficult to monitor.) As with darkblotched rockfish, trip limits for target species also may be adjusted in order to minimize bycatch of overfished species.

The Council's rebuilding measures for 2007-2008, adopted at the same time as the Council's adoption of Amendment 16-4, continue the Council's strategy of constraining POP total mortality by restricting fishing on co-occurring healthy stocks and preventing fishing in areas where POP may be taken incidentally.

4.6.4.6. Widow Rockfish

Status of the Widow Rockfish Stock and Fisheries Affected by Stock Rebuilding Measures at the Time of Rebuilding Plan Adoption (April 2004)

Widow rockfish are an important commercial species from British Columbia to central California, particularly since 1979, when an Oregon trawl fisherman demonstrated the ability to make large catches at night using midwater trawl gear. Since that time, many more participants entered the fishery and landings of widow rockfish increased rapidly (Love, *et al.* 2002). Because widow rockfish are commonly distributed in the mesopelagic (midwater) zone they are most commonly caught in with midwater trawl gear, which sweeps this zone (in contrast to bottom trawl gear used to target most groundfish species). Historically, widow rockfish were a major target species. Landings peaked at 12,473 mt in 1989 and as recently as 2000 stood at 3,866 mt (PFMC 2002). Target fisheries were eliminated after widow rockfish were declared overfished in 2001. Currently, the Pacific whiting fishery accounts for about three-quarters of widow rockfish catches; a small directed fishery for yellowtail rockfish, prosecuted by Washington treaty Indian Tribes, and the limited entry fixed gear sector account for almost all of the remaining incidental catches. Most catches occur in the U.S.-Vancouver, Columbia, and Eureka management areas.

Williams, et al. (Williams, *et al.* 2000) assessed the widow rockfish in 2000. The spawning output level (8,223 mt), based on that assessment and a revised rebuilding analysis (Punt and MacCall 2002) adopted by the Council in June 2001, was at 23.6% of the unfished level (33,490 mt) in 1999. This result was computed using the average recruitment from 1968 to 1979 multiplied by the spawning output-per-recruit at F = 0. The analysis concluded the rebuilding period in the absence of fishing is 22 years, and with a mean generation time of 16 years, the maximum allowable time to rebuild (T_{MAX}) is 38 years. Widow rockfish were declared overfished in 2001 based on these analyses.

The most recent assessment (He, *et al.* 2003b) concluded that the widow rockfish stock size is 22.4% of the unfished biomass, but indicates stock productivity is considerably lower than previously thought. Data sparseness was a significant problem in this widow rockfish assessment (Conser, *et al.* 2003; He, *et al.* 2003b). Limited logbook data prior to 1990 is available from bottom trawl fisheries, a questionable data source for a midwater species. The NMFS laboratory at Santa Cruz conducts a midwater trawl survey from which a juvenile index is derived. This index has been highly variable in its ability to predict recruitment, in part, due to the survey's limited geographical area relative to the overall distribution of widow rockfish. The widow rockfish rebuilding analysis considered a wide range of model formulations that investigated different hypothesis on natural mortality, stock-recruitment variability, and the use of a power coefficient to reduce variability of the Santa Cruz midwater juvenile survey. The SSC recommended model formulations that pre-specify the recruitment for 2003-2005, do not use a stock-recruitment relationship (recruits per spawner ratios were used instead to project future recruitment), and vary the power coefficient between two and four in the Santa Cruz midwater juvenile survey. The SSC did not recommend a power coefficient higher than four because the relationship between the Santa Cruz midwater survey recruitment index and other recruitment indices changed dramatically with higher powers. The previous rebuilding analysis (Punt and MacCall 2002) had used a power coefficient of 10 that dampened the estimate of recruitment variability and suggested much higher stock productivity.

Many of the rebuilding parameters for widow rockfish did not change dramatically with the new rebuilding analysis. The rebuilding period in the absence of fishing increased to 25 years and, with a mean generation time of 16 years; the maximum allowable time to rebuild (T_{MAX}) is 41 years. However, the harvest rate associated with different rebuilding strategies dropped significantly in response to the new understanding of decreased stock productivity. Thus, the interim rebuilding OY for 2003 using the 2000 rebuilding analysis was 832 mt, while in 2004, using the 2003 rebuilding analysis (He, *et al.* 2003a), the OY was 284 mt (using the base model, Model 8, which uses a power coefficient of three).

The Council adopted a rebuilding plan for widow rockfish at its April 2004 meeting, as described by the parameter values listed in Table 4-1. These values are based on a rebuilding analysis conducted by He, et al. (He, *et al.* 2003a).

Amendment 16-4, adopted by the Council at its June 2006 meeting, revised the rebuilding parameters for widow rockfish, as listed in Table 4-2. These values are based on a rebuilding analysis conducted by He, et al. (2006) which had determined that the widow rockfish was at 31.1% of its unfished level in 2004.

Methods Used to Calculate Stock Rebuilding Parameters

The methods used in the rebuilding analysis (He, *et al.* 2003a) upon which the original rebuilding plan was based, and those used for the rebuilding plan revision under Amendment 16-4 (He, *et al.* 2006), do not differ substantially from the approach described in Section 4.5.2.

Rebuilding Parameter Values at the Time of Rebuilding Plan Adoption

Table 4-1 lists the numerical values for B_0, B_{MSY}, T_{MIN}, T_{MAX}, P_{MAX}, T_{TARGET}, and F. The values of B_0, B_{MSY}, T_{MIN}, and T_{MAX} are derived from the rebuilding analysis used in formulating the rebuilding plan (He, *et al.* 2003a). Using Model 8, the base model from the 2003 stock assessment (He, *et al.* 2003b), the Council chose a value of 60% for P_{MAX}, based on a harvest control rule of F = 0.0093. This results in a target year of 2038.

Rebuilding Parameter Values from Amendment 16-4 Rebuilding Plan Update

Table 4-2 lists the numerical values for B_0, B_{MSY}, T_{MIN}, T_{MAX}, $T_{F=0}$, P_{MAX}, T_{TARGET} and an SPR harvest rate. The values of B_0, B_{MSY}, T_{MIN}, $T_{F=0}$, and T_{MAX} are derived from the rebuilding analysis used in formulating the rebuilding plan (He, *et al.* 2006). The Council chose a target rebuilding year of 2015.

Widow Rockfish Fishing Communities

Amendment 16-4 revised the Council's approach to rebuilding plans, requiring an analysis of the needs of fishing communities in relation to overfished species rebuilding times, in addition to the traditional analysis of rebuilding times in relation to the status and biology of the stock. For Amendment 16-4 and the 2007-2008 fisheries, fishing community needs are described and analyzed in an EIS (PFMC 2006). Chapter 7 of that EIS discusses the communities that make up the socio-economic environment of the Pacific Coast groundfish fisheries. In general, widow rockfish is a continental shelf species that is most frequently taken as incidental catch in the mid-water trawl Pacific whiting fisheries north of 40°10' N. latitude, but which is also taken incidentally in all groundfish fishing sectors in this area. Measures to rebuild widow rockfish by eliminating its directed harvest and to preventing its incidental catch affect all groundfish fishing communities off the central and northern U.S. West Coast.

Widow Rockfish Rebuilding Strategy

As shown in Table 4-1, at the inception of the rebuilding plan the harvest control rule for canary rockfish was a fishing mortality rate of 0.0093. Based on the 2003 widow rockfish rebuilding analysis (He, et al. 2003a), this harvest rate is likely to rebuild the stock by the target year of 2038. This value is likely to change over time as stock size and structure changes. Any updated value will be published in federal groundfish regulations. The fishing mortality rate is applied to the exploitable biomass estimate to determine the OY for a given fishing period.

Management measures are implemented through the biennial harvest specification and management process described in Chapter 5. The types of management measures that may be implemented through this process are described in Chapter 6. In 2004, at the time of rebuilding plan adoption, measures intended to limit bycatch of overfished species included prohibiting retention of certain overfished species during some parts of the year, reducing landing limits (cumulative trip limits) on co-occurring species, establishing extensive time/area closures, and restricting the use of trawl nets equipped with large footropes. Because widow rockfish are mainly caught in the water column, bottom trawl gear restrictions have little effect on widow rockfish catch rates.

Beginning in 2002, time/area closures known as GCAs came into use as a way of decreasing bycatch of overfished species. GCAs enclose depth ranges where bycatch of overfished species is most likely to occur, based on information retrieved from logbooks and the at-sea observer program. The boundaries vary by season and fishery sector, and may be modified in response to new information about the geographic and seasonal distribution of bycatch.

Because widow rockfish occur in midwater and aggregate at night, elimination of target fishery opportunities is a relatively easy way of reducing widow rockfish bycatch. The Council has taken a policy approach of establishing management measures to reduce incidental catch in the Pacific whiting fishery sufficient to constrain total mortality below harvest levels (OYs) needed to rebuild the stock. At the time of rebuilding plan adoption, catch in other fisheries is sufficiently small so that rebuilding targets can be met without applying any special measures, beyond those needed to discourage targeting, to reduce widow rockfish fishing mortality in these fishery sectors.

Widow rockfish catches in recreational fisheries are relatively modest. Catches in this sector are managed mainly through bag limits, size limits, and fishing seasons established for each West Coast state. No recreational bag and size limits have been established for widow rockfish. However, general bag limits for rockfish may have some constraining effect on widow recreational catches.

The Council's rebuilding measures for 2007-2008, adopted at the same time as the Council's adoption of Amendment 16-4, continue the Council's strategy of constraining widow rockfish total mortality by eliminating the directed mid-water yellowtail and widow rockfish fishery, restricting fishing on co-occurring healthy stocks and preventing fishing in areas where widow rockfish may be taken incidentally. Additionally, the Council has adopted a requirement that trawl vessels operating north of 40°10' N. latitude use selective flatfish trawl gear when operating in nearshore waters, a gear that minimizes rockfish bycatch during flatfish trawl fishing. The Council has also adopted widow rockfish bycatch limits for the Pacific whiting fishery, which tends to take widow rockfish incidentally.

4.6.4.7. Yelloweye Rockfish

Status of the Yelloweye Rockfish Stock and Fisheries Affected by Stock Rebuilding Measures at the Time of Rebuilding Plan Adoption (April 2004)

Yelloweye rockfish are common from Central California northward to the Gulf of Alaska. They are bottom-dwelling, generally solitary, rocky reef fish, found either on or just over reefs (Eschmeyer, *et al.* 1983; Love 1991; Miller and Lea 1972; O'Connell and Funk 1986). Boulder areas in deep water (>180 m) are the most densely populated habitat type, and juveniles prefer shallow-zone broken-rock habitat (O'Connell and Carlile 1993). They also reportedly occur around steep cliffs and offshore pinnacles (Rosenthal, *et al.* 1982). The presence of refuge spaces is an important factor affecting their occurrence (O'Connell and Carlile 1993). Yelloweye rockfish are potentially caught in a range of both commercial and recreational fisheries. Because of their preference for rocky habitat, they are more vulnerable to hook and line gear.

The first ever yelloweye rockfish stock assessment was conducted in 2001 (Wallace 2002). This assessment incorporated two area assessments: one from Northern California using CPUE indices constructed from Marine Recreational Fisheries Statistical Survey (MRFSS) sample data and California Department of Fish and Game (CDFG) data collected on board commercial passenger fishing vessels, and the other from Oregon using Oregon Department of Fish and Wildlife (ODFW) sampling data. The assessment concluded current yelloweye rockfish stock biomass is about 7% of unexploited biomass in Northern California and 13% of unexploited biomass in Oregon. The assessment revealed a thirty-year declining biomass trend in both areas with the last above average recruitment occurring in the late 1980s. The assessment's conclusion that yelloweye rockfish biomass was well below the 25% of unexploited biomass threshold for overfished stocks led to this stock being separated from the rockfish complexes in which it was previously listed. Until 2002, when yelloweye rockfish were declared overfished, they were listed in the Aremaining rockfish@ complex on the shelf in the Vancouver, Columbia, and Eureka management areas and the Aother rockfish@ complex on the shelf in the Monterey and Conception areas. As with the other overfished stocks, yelloweye rockfish harvest is now tracked separately.

In June 2002 the SSC recommended that managers should conduct a new assessment incorporating Washington catch and age data. This recommendation was based on evidence that the biomass distribution of yelloweye rockfish on the West Coast was centered in waters off Washington and that useable data from Washington were available. Based on that testimony, the Council recommended completing a new assessment in the summer of 2002, before a final decision was made on 2003 management measures. Methot et al. (Methot and Piner 2002b) did the assessment, which was reviewed by a STAR Panel in August 2002. The assessment result was much more optimistic than the one prepared by Wallace (Wallace 2002), largely due to the incorporation of Washington fishery data. While the overfished status of the stock was confirmed (24% of unfished biomass), Methot et al. (Methot and Piner 2002b) provided evidence of higher stock productivity than originally assumed. The assessment also treated the stock as a coastwide assemblage. This assessment was reviewed and approved by the SSC and the Council at the September 2002 Council meeting. Methot and Piner (2002) prepared a rebuilding analysis based on this assessment.

The Council adopted a rebuilding plan for yelloweye rockfish at its April 2004 meeting, as described by the parameter values listed in Table 4-1. These values are based on a rebuilding analysis conducted by Methot and Piner (Methot and Piner 2002a).

Amendment 16-4, adopted by the Council at its June 2006 meeting, revised the rebuilding parameters for yelloweye rockfish, as listed in Table 4-2. These values are based on a rebuilding analysis conducted by Tsou and Wallace (2006) which had determined that the yelloweye rockfish stock was at 17.7% of its unfished level in 2006.

Because yelloweye rockfish prefer rocky reef habitat on the continental shelf, they are most vulnerable to recreational and commercial fixed gear fisheries. In the past, the groundfish trawl sector has accounted for a large proportion of the catch: from 1990 to 1997 trawlers took an average of 46% of the catch coastwide (although most catches occur in Washington and Oregon waters). (This discussion is based on data in the table on page 3 of Methot, *et al.* 2003) Trip limit reductions after 1997 and the imposition of restrictions on large footrope trawl gear in 2000 have substantially diminished the amount of yelloweye rockfish caught by the trawl sector. (Large footrope gear had made it possible for trawlers to access the rocky habitat where yelloweye live.) Trawl vessels accounted for only 14% of the catch on average from 1998 to 2001. Commercial fixed gear catches have also taken a significant share of the catch, 38% in the years 1990-1997. However, the implementation of the non-trawl RCA, which encloses much yelloweye habitat, has resulted in their share falling also. Open access directed groundfish fisheries and the Pacific halibut longline fleet also catch small amounts of yelloweye rockfish. Recreational catches have become more significant with the reduction in commercial catches. Comparing the 1990-1997 and 1998-2001 periods, their share of the total coastwide catch almost doubled to 30%, although actual average catches declined slightly. Most recreational catches occur in Washington State waters.

Methods Used to Calculate Stock Rebuilding Parameters

The methods used in the rebuilding analysis (Methot and Piner 2002a) upon which the original rebuilding plan was based, and those used for the rebuilding plan revision under Amendment 16-4 (Tsou and Wallace 2006), do not differ substantially from the approach described in Section 4.5.2.

Rebuilding Parameter Values at the Time of Rebuilding Plan Adoption

Table 4-1 lists the numerical values for B_0, B_{MSY}, T_{MIN}, T_{MAX}, P_{MAX}, T_{TARGET}, and F. The values of B_0, B_{MSY}, T_{MIN}, and T_{MAX} are derived from the rebuilding analysis used in formulating the rebuilding plan (Methot and Piner 2002a). The Council chose a value of 80% for P_{MAX}, based on a harvest control rule of F = 0.0153. This results in a target year of 2058.

Rebuilding Parameter Values from Amendment 16-4 Rebuilding Plan Update

Table 4-2 lists the numerical values for B_0, B_{MSY}, T_{MIN}, T_{MAX}, $T_{F=0}$, P_{MAX}, T_{TARGET} and an SPR harvest rate. The values of B_0, B_{MSY}, T_{MIN}, $T_{F=0}$, and T_{MAX} are derived from the rebuilding analysis used in formulating the rebuilding plan (Tsou and Wallace 2006). The Council chose a target rebuilding year of 2084.

Yelloweye Rockfish Fishing Communities

Amendment 16-4 revised the Council's approach to rebuilding plans, requiring an analysis of the needs of fishing communities in relation to overfished species rebuilding times, in addition to the traditional analysis of rebuilding times in relation to the status and biology of the stock. For Amendment 16-4 and the 2007-2008 fisheries, fishing community needs are described and analyzed in an EIS (PFMC 2006). Chapter 7 of that EIS discusses the communities that make up the socio-economic environment of the Pacific Coast groundfish fisheries. In general, yelloweye rockfish is a site-loyal continental shelf species that is most frequently taken in recreational and commercial hook-and-line fisheries north of 40°10' N. lat. Measures to rebuild yelloweye rockfish by eliminating its directed harvest and preventing its incidental catch affect all hook-and-line groundfish fishing off the northern U.S. West Coast.

Yelloweye Rockfish Rebuilding Strategy

As shown in Table 4-1, at the inception of the rebuilding plan the harvest control rule for canary rockfish was a fishing mortality rate of 0.0153. Based on the 2002 rebuilding analysis (Methot and Piner 2002), this harvest rate is likely to rebuild the stock by the target year of 2058. This value is likely to change over time as stock size and structure changes. Any updated value will be published in federal groundfish regulations. The fishing mortality rate is applied to the exploitable biomass estimate to determine the OY for a given fishing period.

Management measures are implemented through the biennial harvest specification and management process described in Chapter 5. The types of management measures that may be implemented through this process are described in Chapter 6. In 2004, at the time of rebuilding plan adoption, measures intended to limit bycatch of overfished species included prohibiting retention of certain overfished species during some parts of the year, reducing landing limits (cumulative trip limits) on co-occurring species, establishing extensive time/area closures, and restricting the use of trawl nets equipped with large footropes. (By using large footropes with heavy roller gear, bottom trawlers can access rocky habitat on the continental shelf. This is the preferred habitat for some overfished species.)

Beginning in 2002, time/area closures known as GCAs came into use as a way of decreasing bycatch of overfished species. GCAs enclose depth ranges where bycatch of overfished species is most likely to occur, based on information retrieved from logbooks and the at-sea observer program. The boundaries vary by season and fishery sector, and may be modified in response to new information about the geographic and seasonal distribution of bycatch.

In addition to the more general measures described above, which are intended to reduce bycatch of all overfished species, the Yelloweye Rockfish Conservation Area (YRCA), a C-shaped closed area off the Washington coast, near Cape Flattery, prevents recreational groundfish and halibut anglers from targeting this species in an area where they are concentrated. Recreational bag and size limits are also used to manage total yelloweye rockfish fishing mortality.

Given the particular life history characteristics of yelloweye rockfish, the Council will continue to use a species-specific area closure or closures to protect yelloweye rockfish. As new information becomes available on yelloweye rockfish behavior and fisheries interactions with yelloweye rockfish, the boundaries or related regulations concerning the current YRCA may change, and additional YRCAs may be established by regulation.

The Council's rebuilding measures for 2007-2008, adopted at the same time as the Council's adoption of Amendment 16-4, continue the Council's strategy of constraining yelloweye rockfish total mortality by restricting fishing on co-occurring healthy stocks and preventing fishing in areas where yelloweye rockfish may be taken incidentally. Additionally, the Council has adopted yelloweye rockfish rebuilding measures in the Pacific halibut fisheries and new YRCAs for the commercial groundfish and salmon fisheries operating off the northern U.S. West Coast.

The Council recognized the need to restrict the fisheries based on the new yelloweye rockfish assessment, but also took into account the potentially widespread negative effects of an immediate reduction in OY and recommended an OY ramp-down strategy over a 5-year period (see the footnote to Table 4-2). The ramp-down strategy provides time to collect much-needed additional data that could better inform new management measures for greater yelloweye rockfish protection, and reduces the immediate adverse impacts to fishing communities while altering the rebuilding period by less than one year.

Table 4-1. Specified rebuilding plan parameters at the time of plan adoption.

Species	Year Stock Declared Overfished	Year Rebuilding Plan Adopted	B_0	B_{MSY}	T_{MIN}	T_{MAX}	P_{MAX}	T_{TARGET}	Harvest Control Rule
Darkblotched Rockfish	2000	2003	29,044 mt	11,618 mt	2014	2047	80%	2030	F = 0.027
Pacific Ocean Perch	1999	2003	60,212 units of spawning output	24,084 units of spawning output	2012	2042	70%	2027	F = 0.0082
Canary Rockfish	2000	2003	31,550 mt	12,620 mt	2057	2076	60%	2074	F = 0.022
Lingcod	1999	2003	28,882 mt N; 20,971 mt S	9,153 mt N; 8,389 mt S	2007	2009	60%	2009	F = 0.0531 N; F = 0.061 S
Bocaccio*	1999	2004	13,387 B eggs in 2003	5,355 B eggs	2018	2032	70%	2023	F = 0.0498
Cowcod	2000	2004	3,367 mt	1,350 mt	2062	2099	60%	2090	F = 0.009
Widow Rockfish**	2001	2004	43,580 M eggs	17,432 M eggs	2026	2042	60%	2038	F= 0.0093
Yelloweye Rockfish	2002	2004	3,875 mt	1,550 mt	2027	2071	80%	2058	F= 0.0153

***Based on the STATc base model in MacCall (MacCall 2003b).**

****Based on the Model 8 base model in He, *et al.* (He, *et al.* 2003b).**

Table 4-2. Specified rebuilding plan parameters revised under Amendment 16-4.

Species	B_0	B_{MSY}	T_{MIN} *	T_{MAX}	$T_{F=0}$ *	P_{MAX}	T_{TARGET}	Harvest Control Rule (SPR Harvest Rate)
Darkblotched Rockfish	26,650 M eggs	10,660 M eggs	2009	2033	2010	100%	2011	F60.7%
Pacific Ocean Perch	37,838 units of spawning output	15,135 units of spawning output	2015	2043	2015	92.9%	2017	F86.4%
Canary Rockfish	34,155 mt	13,662 mt	2048	2071	2053	55.4%	2063	F88.7%
Bocaccio	13,402 B eggs in 2005	5,361 B eggs	2018	2032	2021	77.7%	2026	F77.7%
Cowcod	3,045 mt	1,218 mt	2035	2074	2035	90.6%	2039	F90.0%
Widow Rockfish	49,678 M eggs	19,871 M eggs	2013	2033	2013	95.2%	2015	F95.0%
Yelloweye Rockfish	3,322 mt	1,328 mt	2046	2096	2048	80%	2084	F71.9% **

* T_{MIN} is the shortest time to rebuild from the onset of the rebuilding plan or from the first year of a rebuilding plan, which is usually the year after the stock was declared overfished. The shortest possible time to rebuild the stocks with rebuilding plans under consideration in Amendment 16-4 is $T_{F=0}$, which is the median time to rebuild the stock if all fishing-related mortality were eliminated beginning in 2007.

** The yelloweye rebuilding plan specifies a harvest rate ramp-down strategy before resuming a constant harvest rate in 2011. F71.9% is the constant harvest rate beginning in 2011.

[Amended: 11, 12, 16-1, 16-2, 16-3, 16-4]

4.7. Determination [s10]of OY, ACL, and ACT

Optimum yield (OY) is defined in the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) as the amount of fish which will provide the greatest overall benefit to the Nation. The Magnuson-Stevens Act also specifies that OY is based on maximum sustainable yield (MSY), and may be equal to or less than MSY. The fishery management plan (FMP) authorizes establishment of a numerical or non-numerical OY for any groundfish species or species group and lays out the procedures the Council will follow in determining appropriate numerical OY values. An OY may be specified for the fishery management area as a whole or for specific subareas. Numerical one-year OYs will be specified biennially, based on acceptable biological catchoverfishing limits (ABCOFLs) for major species or species groups, which are in turn based on quantitative or qualitative stock assessments. Control rules for determining the numerical values of OYs ensure they will not exceed the ABCOFLs except under tightly limited conditions.

The OY is a target level of annual harvest and can be exceeded annually as long as it is not exceeded on average over the long term. The OY differs from an annual catch limit (ACL) in that the ACL is a total catch limit which cannot be exceeded annually. All sources of fishing-related mortality, including landings, discard mortality, research catches, and catches under exempted fishing permit activities, count against the ACL. The ACL and the OY are directly analogous in how these specifications have been used in West Coast groundfish management since 1999 when the Council began specifying total catch OYs. OYs and ACLs may not exceed the ABC and may be set equal to the ABC if the Council and NMFS judge there are no reasons to buffer the ABC to account for management uncertainty, socioeconomic concerns, or rebuilding concerns, ***[NOTE: a national working group will be convened by NMFS to develop guidelines for the specification and use of OYs in light of the introduction of the ACL in new NS1 guidelines. Until that guidance is provided, it may be prudent to set OYs equal to ACLs. Regardless, the FMP under Amendment 23 will generally use the term ACL instead of OY to describe annual catch limits.]*** If ACLs are exceeded more often than 1 in 4 years, then accountability measures (AMs), such as catch monitoring and inseason adjustments to fisheries, need to improve. Otherwise, an annual catch target (ACT), which is a level of harvest below the ACL, may need to be specified. The ACT, which is yet another AM, may be especially important for a stock subject to highly uncertain inseason catch monitoring. Unlike an ACL, the ACT can be exceeded annually. However, it is expected that inseason adjustments to fisheries will occur upon projected attainment of an ACT. OYs, ACLs, and ACTs, if needed, are annual specifications that are specified every other year in the biennial specifications process described in section 5.1.

ACLs and ACTs [s11]can also be specified for sectors of a fishery. In such cases, the sector-specific ACLs and/or ACTs would sum to the ACL or ACT specified for the stock. Sector-specific ACLs may be decided for sectors with a formal, long-term allocation of the harvestable surplus of a stock (see section **Error! Reference source not found.**6.3). A sector-specific ACT may serve as a harvest guideline for a sector or used strategically in a rebuilding plan to attempt to reduce mortality of an overfished stock more than the rebuilding plan limits prescribe.

Most of the 8090-plus species managed by the FMP have never been assessed in either a quantitative or qualitative manner. In some cases even basic catch statistics are unavailable, because many species (rockfish, for example) are not sorted unless specifically required by regulation. Species of this type have generally not been subject to numerical harvest limits, but rather harvest is limited by gear restrictions and market demand. Other management measures which determine the total amount of harvest each year include trip landing and frequency limits. Those species without a specified OYACL and not included in a multi-species OYACL will be included in a non-numerical OY, which is defined as all the fish that can be taken under the regulations, specifications, and management measures authorized by the FMP and promulgated by the U.S. Secretary of Commerce. This non-numerical OY is not a predetermined numerical value, but rather the harvest that results from regulations, specifications, and management measures as they are changed in response to changes in the resource and the fishery. In many cases, the absence of a numerical specification reflects the absence of basic management information, such as abundance estimates and catch statistics. The non-numerical OY concept allows for a variable amount of groundfish to be harvested annually, limited by such constraints as gear restrictions, management measures for other species, and/or absence of consumer acceptance or demand.

The close spatial relationship of many groundfish species throughout the management area results in commercial and recreational catches often consisting of mixtures of several species. This is especially the case in the trawl fishery where fishermen may target on one species, but unavoidably harvest several other species. In such cases, the optimum harvest strategy often is to target on a group (complex or assemblage) of groundfish species.

The Council will avoid allowing overfishing individual stocks and control harvest mortality to allow overfished stocks to rebuild to the MSY level. In the event the Council determines that greater long-term benefits will be gained from the groundfish fishery by overfishing individual stocks or by preventing a stock from recovering to its MSY level, it will justify the action in writing in accordance with the procedures and standards identified in this section and the National Standard Guidelines (50 CFR 600.310(d)). Conversely, the Council may determine that greater benefits will accrue from protecting an individual stock by constraining the multiple species complex or specific components of that complex.

Prior to implementation of the FMP in 1982, the states of Washington, Oregon, and California managed the groundfish fishery without the use of quotas. State regulations since the mid-1940s took the form of area closures (such as San Francisco Bay), legal gear definitions, minimum codend mesh regulations, size limits, bag limits, and other non-quota management measures. Implementation of the FMP built upon those historical management practices by increasing the level of catch monitoring, improving the assessment of stock conditions, and establishing other mechanisms for responding to management needs. It provides for continuation of the historical fishery on traditionally harvested groundfish species while allowing for the development of new fisheries for underutilized species. The FMP, as amended, provides for the establishment of resource conservation measures such as harvest guidelines or quotas through the annual specification procedure and annual and inseason management measures through the Apoints of concern@ and socioeconomic framework mechanisms.

Reduction in catches or fishing rates for either precautionary or rebuilding purposes is an important component of converting values of ~~ABC~~OFL to values of ~~OY~~ACL. This relationship is specified by the ABC control rule, which accounts for scientific uncertainty in the determination of the OFL, and the harvest control rule. All ~~OYs~~ ACLs will remain in effect until revised, and, whether revised or not, will be announced at the beginning of the fishing period along with other specifications (see Chapter 5).

Groundfish stock assessments generally provide the following information to aid in determination of ~~ABC~~OFL and ~~OY~~ACL.

1. Current biomass (and reproductive potential) estimate.

2. F_{MSY} or proxy, translated into exploitation rate.

3. Estimate of MSY biomass (B_{MSY}), or proxy, unfished biomass (based on average recruitment), precautionary threshold, and/or overfished/rebuilding threshold.

4. Precision estimate (e.g., confidence interval) for current biomass estimate.

4.7.1. Determination of Numerical ~~OYs~~ ACLs [s12]If Stock Assessment Information Is Available from a Relatively Data-Rich Assessment (Category 1)

The Council will follow these steps in determining numerical ~~OYs~~ACLs. The recommended numerical ~~OY~~ ACL values will include any necessary adjustments to harvest mortality needed to rebuild any stock determined to be below its overfished/rebuilding threshold and may include adjustments to address uncertainty in the status of the stock.

1. ~~ABC~~OFL: Multiply the current fishable biomass estimate times the F_{MSY} exploitation rate or its proxy to get ~~ABC~~OFL.

2. ABC: Determine an appropriate scientific uncertainty buffer to set the ABC below the OFL.

~~2~~3. Precautionary adjustment: If the abundance is above the specified precautionary threshold, ~~OY~~ACL may be equal to or less than ABC. If current biomass estimate is less than the precautionary threshold (Section 4.5.1~~4.4.1~~), the harvest rate will be reduced according to the harvest control rule specified in Section 4.6.1~~4.5.1~~ in order to accelerate a return of abundance to optimal levels. If the abundance falls below the overfished/rebuilding threshold (Section 4.5.3~~4.4.2~~), the harvest control rule will generally specify a greater reduction in exploitation as an interim management response toward rebuilding the stock while a formal rebuilding plan is being developed. The rebuilding plan will include a specific harvest control rule designed to rebuild the stock, and that control rule will be used in this stage of the determination of ~~OY~~ACL.

~~3. Uncertainty adjustments: In cases where there is a high degree of uncertainty about the biomass estimate and other parameters, OYACL may be further reduced accordingly.~~

4. Other adjustments to ~~OY~~ACL: Adjustments to ~~OY~~ACL for other social, economic, or ecological considerations may be made. ~~OY~~ACL will be reduced for anticipated bycatch mortality (i.e. mortality of discarded fish). Amounts of fish harvested as compensation [s13]for private vessels participating in NMFS resource survey activities will also be deducted from ~~ABC~~OFL prior to setting ~~OY~~ACL.

5. ~~OY~~ACL recommendations will be consistent with established rebuilding plans and achievement of their goals and objectives.
   - (a) In cases where overfishing is occurring, Council action will be sufficient to end overfishing.
   - (b) In cases where a stock or stock complex is overfished, Council action will specify ~~OY~~ACL in a manner that complies with rebuilding plans developed in accordance with Section 4.6.2~~4.5.2~~.
   - (c) For fisheries managed under an international agreement, Council action must reflect traditional participation in the fishery, relative to other nations, by fishermen of the United States.
   - (d) For any stock that has been declared overfished, the open access/limited entry allocation shares may be temporarily revised for the duration of the rebuilding period by amendment to the regulations in accordance with the normal allocation process described in this FMP. However, the Council may at any time recommend the shares specified in chapter 12 of this FMP be reinstated without requiring further analysis. Once reinstated, any change may be made only through the allocation process.
   - (e) For any stock that has been declared overfished, any vessel with a limited entry permit may be prohibited from operating in the open access fishery when the limited entry fishery has been closed.

6. Adjustments[s14] to ~~OY~~ACL could include increasing ~~OY~~ACL above the default value up to the ~~overfishing level~~ABC as long as the management still allows achievement of established rebuilding goals and objectives. In limited circumstances, these adjustments could include increasing ~~OY~~ACL above the overfishing level as long as the harvest meets the standards of the mixed stock exception in the National Standard Guidelines:
   (a) The Council demonstrates by analysis that such action will result in long-term net benefits to the Nation.
   (b) The Council demonstrates by analysis that mitigating measures have been considered and that a similar level of long-term net benefits cannot be achieved by modifying fleet behavior, gear selection/ configuration, or other technical characteristic in a manner such that no overfishing would occur.
   (c) The resulting rate or level of fishing mortality will not cause any species or evolutionarily significant unit thereof to require protection under the Endangered Species Act.[s15]

Exceptions to requirements to prevent overfishing. Exceptions to the requirement to prevent overfishing could apply under certain limited circumstances. Harvesting one stock at its optimum level may result in overfishing of another stock when the two stocks tend to be caught together (This can occur when the two stocks are part of the same fishery or if one is bycatch in the other's fishery). Before the Council and NMFS may decide to allow this type of overfishing, an analysis must be performed and the analysis must contain a justification in terms of overall benefits, including a comparison of benefits under alternative management measures, and an analysis of the risk of any stock or stock complex falling below its MSST. The Council may decide to allow this type of overfishing if the fishery is not overfished and the analysis demonstrates that all of the following conditions are satisfied

1) Such action will result in long-term net benefits to the Nation.

2) Mitigating measures have been considered and it has been demonstrated that a similar level of long-term net benefits cannot be achieved by modifying fleet behavior, gear selection/configuration, or other technical characteristic in a manner such that no overfishing would occur; and

3) The resulting rate of fishing mortality will not cause any stock or stock complex to fall below its MSST more than 50 percent of the time in the long term, although it is recognized that persistent overfishing is expected to cause the affected stock to fall below its B_{MSY} more than 50 percent of the time in the long term.

7. For species complexes (such as Sebastes complex), the ~~OY~~ACL will generally be set equal to the sum of the individual component ~~ABC~~OFLs, HGs, and/or ~~OY~~ACLs, as appropriate.

4.7.2. *Determination of a Numerical ~~OY~~ACL If ~~ABC~~OFL Is Based on a Relatively Data-Poor Quantitative or Non-quantitative Assessment (Category 2)*

1. ~~ABC~~OFL may be based on average of past landings, a previous relatively data-poor assessment, a non-quantitative assessment, or other qualitative information.

2. Precautionary adjustments, if any, would be based on relevant information. In general, the Council will follow a risk-averse approach and may recommend an ~~OY~~ACL below ~~ABC~~OFL if there is a perception the stock is below its MSY biomass level. If a declining trend persists for more than three years, then a focused evaluation of the status of the stock, its ~~ABC~~OFL, and the overfishing parameters will be quantified. If data are available, such an evaluation should be conducted at approximately five-year intervals even when negative trends are not apparent. In

fact, many stocks are in need of re-evaluation to establish a baseline for monitoring of future trends. Whenever an evaluation indicates the stock may be declining and approaching an overfished state, then the Council should:

(a) Recommend improved data collection for this species.

(b) Determine the rebuilding rate that would increase the multispecies value of the fishery.

3. Uncertainty adjustment: In cases where there is a high degree of uncertainty about the condition of the stock or stocks, OYACL may be reduced accordingly.

4. Amounts of fish harvested as compensation for industry research activities will also be deducted.

5. These adjustments could include increasing OYACL above the default value as indicated for Category 1 stocks, items 5 and 6 above.

4.7.3. Non-numericalNumerical OY ACL for Stocks with No ABC OFL Values Set by Nonquantitative Assessment (Category 3)

Fish of these species are incidentally landed and usually are not listed separately in fish landing receipts. Information from fishery-independent surveys are often lacking for these stocks, because of their low abundance or they are not vulnerable to survey sampling gear. Until sufficient quantities of at-sea observer program data are available or surveys of other fish habitats are conducted and/or requirements that landings of all species be recorded separately, it is unlikely that there will be sufficient data to upgrade the assessment capabilities or to evaluate the overfishing potential of these stocks.

These species typically may be included in a non-numerical OY that is defined as all the fish that can be taken under the regulations, specifications, and management measures authorized by the FMP and promulgated by the Secretary. Such an OY may not be a predetermined numerical value, but rather that harvest that results from regulations, specifications, and management measures as they are changed in response to changes in the resource and the fishery. Nothing in this FMP prevents inclusion of these species in a numerical OY if the Council believes that is more appropriatehave OFL values based on average historical landings, often from a species composition estimate of landings from port sampling, and a precautionary reduction of the ABC and ACL of half the OFL amount[JDD16]. Another approach typically used for deciding the OFL value for a category 3 species is based on a fishing mortality rate (F) associated with the species estimated or assumed natural mortality rate (M); such as F = .75M.

Most category 3 species are managed in a stock complex, where harvest specifications are set for the complex in its entirety, "Stock complex" means a group of stocks that are sufficiently similar in geographic distribution, life history, and vulnerabilities to the fishery such that the impact of management actions on the stocks is similar. At the time a stock complex is established, the FMP should provide a full and explicit description of the proportional composition of each stock in the stock complex, to the extent possible. Stocks may be grouped into complexes for various reasons, including where stocks in a multispecies fishery cannot be targeted independent of one another and MSY cannot be defined on a stock-by-stock basis (see paragraph (e)(1)(iii) of this section); where there is insufficient data to measure their status relative to SDC; or when it is not feasible for fishermen to distinguish individual stocks among their catch. The vulnerability of stocks to the fishery should be evaluated when determining if a particular stock complex should be established or reorganized, or if a particular stock should be included in a complex. Stock complexes may be comprised of: one or more indicator stocks, each of which has SDC and ACLs, and several other stocks; several stocks without an indicator stock, with SDC and an ACL for the complex as a whole; or one of more indicator stocks, each of which has SDC and management objectives, with an ACL for the complex as a whole.

An indicator stock is a stock with measurable SDC that can be used to help manage and evaluate more poorly known stocks that are in a stock complex. If an indicator stock is used to evaluate the status of a complex, it should be representative of the typical status of each stock within the complex, due to similarity in vulnerability. If the stocks within a stock complex have a wide range of vulnerability, they should be reorganized into different stock complexes that have similar vulnerabilities; otherwise the indicator stock should be chosen to represent the more vulnerable stocks within the complex. In instances where an indicator stock is less vulnerable than other members of the complex, management measures need to be more conservative so that the more vulnerable members of the complex are not at risk from the fishery. More than one indicator stock can be selected to provide more information about the status of the complex. When indicator stock(s) are used, periodic re-evaluation of available quantitative or qualitative information (e.g., catch trends, changes in vulnerability, fish health indices, etc.) is needed to determine whether a stock is subject to overfishing, or is approaching (or in) an overfished condition.

[Amended: 11, 16-1, 17, 23]

5 PERIODIC SPECIFICATION AND APPORTIONMENT OF HARVEST LEVELS[s17]

The ability to establish and adjust harvest levels is the first major tool at the Council's disposal to exercise its resource stewardship responsibilities. Each biennial fishing period, the Council will assess the biological, social, and economic condition of the Pacific Coast groundfish fishery and update maximum sustainable yield (MSY) estimates or proxies for specific stocks (management units) where new information on the population dynamics is available. The Council will make this information available to the public in the form of the *Stock Assessment and Fishery Evaluation (SAFE)* document described in Section 5.1. Based upon the best scientific information available, the Council will evaluate the current level of fishing relative to the MSY level for stocks where sufficient data are available. Estimates of the ~~acceptable biological catch~~ ~~(~~~~ABC~~OFL~~)~~ for major stocks will be developed, as well as an ABC that accounts for the scientific uncertainty of the stock's estimated biomass. ~~and t~~The Council will identify those species or species groups which it proposes to be managed by the establishment of numerical harvest levels (optimum yields [OYs], ACLs, ACTS, harvest guidelines [HGs], or quotas). For those stocks judged to be below their overfished/rebuilding threshold, the Council will develop a stock rebuilding management strategy.

The process for specification of numerical harvest levels includes the estimation of ~~ABC~~OFL, an ABC specification set below the OFL to account for scientific uncertainty, the establishment of OYs and ACLs for various stocks (may be set equal to the ABC), and the calculation of specified allocations between harvest sectors. The specification of numerical harvest levels described in this chapter is the process of designating and adjusting overall numerical limits for a stock either throughout the entire fishery management area or throughout specified subareas. The process normally occurs biennially between November and June, but can occur under specified circumstances, at other times of the fishing year. The Council will identify those OYs which should be designated for allocation between limited entry and open access sectors of the commercial industry. Other numerical limits which allocate the resource or which apply to one segment of the fishery and not another would be imposed through one of the management measures processes at either 6.2 C or D in Chapter 6.

The National Marine Fisheries Service (NMFS) Regional Administrator will review the Council's recommendations, supporting rationale, public comments, and other relevant information; and, if it is approved, will undertake the appropriate method of implementation. Rejection of a recommendation will be explained in writing.

The procedures specified in this chapter do not affect the authority of the U.S. Secretary of Commerce (Secretary) to take emergency regulatory action as provided for in Section 305(c) of the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) if an emergency exists involving any groundfish resource or to take such other regulatory action as may be necessary to discharge the Secretary's responsibilities under Section 305(d) of the Magnuson-Stevens Act.

This chapter describes the steps in this process.

[Amended: 5, 12, 16-1, 17, 18]

5.1. General Overview of the Harvest Specifications and Management Process

The specifications and management process, in general terms, occurs as follows:

1. The Council will determine the MSY or MSY proxy and ~~ABC~~OFL for each major stock. Typically, the MSY proxy will be in terms of a fishing mortality rate ($F_{x\%}$,) and ~~ABC~~OFL will be

the $F_{x\%}$ applied to the current biomass estimate. The MSY is the maximum long-term average yield expected from annual application of the MSY (or proxy) harvest policy under prevailing ecological and environmental conditions.

2. Every species will either have its own designated OY or be included in a multispecies OY. Species which are included in a multispecies OY may also have individual OYs, have individual HGs, or be included in a HG for a subgroup of the multispecies OY. Stocks without quantitative or qualitative assessment information may be included in a numerical or non-numerical OY.

3. To determine the OY for each stock, the Council will determine the best estimate of current abundance and its relation to its precautionary and overfished thresholds. If the abundance is above the precautionary threshold, OY will be equal to or less than ~~ABC~~OFL. If abundance falls below the precautionary threshold, OY will be reduced according to the harvest control rule for that stock. If abundance falls below the overfished/rebuilding threshold, OY will be set according to the interim rebuilding rule until the Council develops a formal rebuilding plan for that species.

4. For any stock or stock complex where the Secretary identifies that overfishing is occurring, the Council will take remedial action to end overfishing and prevent the stock or stock complex from falling below the minimum stock size threshold. For any stock the Secretary has declared overfished or approaching the overfished condition, or for any stock the Council determines is in need of rebuilding, the Council will implement such periodic management measures as are necessary to rebuild the stock by controlling harvest mortality, habitat impacts, or other effects of fishing activities that are subject to regulation under this biennial process. These management measures will be consistent with any approved rebuilding plan.

5. The Council may reserve and deduct a portion of the ~~ABC~~OFL of any stock to provide for compensation for vessels conducting scientific research authorized by NMFS. Prior to the research activities, the Council will authorize amounts to be made available to a research reserve. However, the deduction from the ~~ABC~~OFL [s18]will be made in the year after the compensation fishing; the amounts deducted from the ~~ABC~~OFL will reflect the actual catch during compensation fishing activities.

6. The Council will identify stocks which are likely to be fully harvested (i.e., the ~~ABC~~OFL, OY, or HG achieved) in the absence of specific management measures and for which allocation between limited entry and open access sectors of the fishery is appropriate.

7. The groundfish resource is fully utilized by U.S. fishing vessels and seafood processors. The Council may entertain applications for foreign or joint venture fishing or processing at any time, but fishing opportunities may be established only through amendment to this FMP. This section supersedes other provisions of this FMP relating to foreign and joint venture fishing.

[Amended: 5, 12, 16-1, 17]

5.2. 5.2 SAFE Document

For the purpose of providing the best available scientific information to the Council for evaluating the status of the fisheries relative to the MSY and overfishing definition, developing ~~ABC~~OFLs, determining the need for individual species or species group management, setting and adjusting numerical harvest levels, assessing social and economic conditions in the fishery, and updating the appendices of this fishery management plan (FMP); a SAFE document is prepared annually. Not all species and species groups can be reevaluated every year due to limited state and federal resources. However, the SAFE document [s19] or the biennial specifications and management measures NEPA document will in general contain the following information:

1. A report on the current status of Washington, Oregon, and California groundfish resources by major species or species group.

2. Specify and update estimates of harvest control rule parameters for those species or species groups for which information is available. (The Council anticipates scientific information about the population dynamics of the various stocks will improve over time and that this information will result in improved estimates of appropriate harvest rates and MSY proxies. Thus, initial default proxy values will be replaced from time to time. Such changes will not require amendment to the FMP, but the scientific basis for new values must be documented.)

3. Estimates of MSY and ~~ABC~~OFL for major species or species groups.

4. Catch statistics (landings and value) for commercial, recreational, and charter sectors.

5. Recommendations of species or species groups for individual management by OYs.

6. A brief history of the harvesting sector of the fishery, including recreational sectors.

7. A brief history of regional groundfish management.

8. A summary of the most recent economic information available, including number of vessels and economic characteristics by gear type.

9. Other relevant biological, social, economic, ecological, and essential fish habitat information which may be useful to the Council.

10. A description of the maximum fishing mortality threshold (MFMT) and the minimum stock size threshold (MSST) for each stock or stock complex, along with other information the Council may use to determine whether overfishing is occurring or a stock or stock complex is overfished. (The default overfished/rebuilding threshold for category 1 groundfish is $0.25B_{unfished}$. The Council may establish different thresholds for any species based on information provided in stock assessments, the SAFE document, or other scientific or groundfish management-related report.)

11 A description of any rebuilding plans currently in effect, a summary of the information relevant to the rebuilding plans, and any management measures proposed or currently in effect to achieve the rebuilding plan goals and objectives.

12. A list of annual specifications and management measures that have been designated as routine under processes described in the FMP at Section 6.2.

Under a biennial specifications and management measures process, elements 2, 5, 6, 7, and 11 would not need to be included in a SAFE document in years when the Council is not setting specifications and management measures for an upcoming biennial fishing period. The stock assessment section of the SAFE document is normally completed when the most current stock assessment and fisheries performance information is available and prior to the meeting at which the Council approves its final management recommendations for the upcoming biennial fishing period. The Council will announce the availability of the stock assessment section of the SAFE document to the public by such means as mailing lists or newsletters, and will provide copies upon request. The fishery evaluation section of the SAFE may be prepared after the Council has made its final recommendations for the upcoming biennial fishing period and will include the final recommendations, an estimate of the previous year's catch, and including summaries of rebuilding plans. Availability will be similarly announced and copies made available upon request.

[Amended: 5, 12, 13, 16-1, 17]

5.3. Authorization and Accounting for Fish Taken as Compensation for Authorized Scientific Research Activities.

At a Council meeting, NMFS will advise the Council of upcoming resource surveys that would be conducted using private vessels with groundfish as whole or partial compensation. For each proposal, NMFS will identify the maximum number of vessels expected or needed to conduct the survey, an estimate of the species and amounts of compensation fish likely to be needed to compensate vessels for conducting the survey, when the fish would be taken, and when the fish would be deducted from the ~~ABC~~OFL in determining the OY/harvest guideline. NMFS will initiate a competitive solicitation to select vessels to conduct resource surveys. NMFS will consult with the Council regarding the amounts and types of groundfish species to be used to support the surveys. If the Council approves NMFS' proposal, NMFS may proceed with awarding the contracts, taking into account any modifications requested by the Council. If the Council does not approve the proposal to use fish as compensation to pay for resource surveys, NMFS will not use fish as compensation.

Because the species and amounts of fish used as compensation will not be determined until the contract is awarded, it may not be possible to deduct the amount of compensation fish from the ~~ABC~~OFL or harvest guideline in the year that the fish are caught. Therefore, the compensation fish will be deducted from the ~~ABC~~OFL the year or biennial fishing period after the fish are harvested. During the specification and management measures process, NMFS will announce the total amount of fish caught during the year or biennial fishing period as compensation for conducting a resource survey, which then will be deducted from the following year's ~~ABC~~OFLs in setting the OYs.

[Amended: 11, 17]

5.4. Biennial Implementation Procedures for Specifications and Management Measures

Biennially, the Council will develop recommendations for the specification of ~~ABC~~OFLs, ABCs, OYs, and any ACTs, HGs or quotas [s20]over the span of three Council meetings. In addition during this process, the Council may recommend establishment of HGs and quotas for species or species groups within an OY. Depending on stock assessment availability and fishery management interactions with Canada, the Council may also develop recommendations for the specification of the Pacific whiting ~~ABC~~OFL/OY and quotas in a separate, annual process.

The Council will develop preliminary recommendations at the first of three meetings (usually in November) based upon the best stock assessment information available to the Council at the time and consideration of public comment. After the first meeting, the Council will provide a summary of its preliminary recommendations and their basis to the public through its mailing list as well as providing copies of the information at the Council office and to the public upon request. The Council will notify the public of its intent to develop final recommendations at its third meeting (usually in June) and solicit public comment both before and at its second meeting.

At its second and/or third meeting, the Council will again consider the best available stock assessment information which should be contained in the recently completed SAFE report and consider public testimony before adopting final recommendations to the Secretary. Following the third meeting, the Council will submit its recommendations along with the rationale and supporting information to the Secretary for review and implementation.

Upon receipt of the Council's recommendations supporting rationale and information, the Secretary will review the submission, and, if it is sufficient for public review, publish a proposed rule in the *Federal Register*, making the Council's recommendations available for public comment and agency review. Following the public comment period on the proposed rule, the Secretary will review the proposed rule, taking into account any comments or additional information received, and will publish a final rule in the Federal Register, possibly modified from the proposed rule in accordance with the Secretary's consideration of the proposed rule. All ~~ABC~~OFLs, OYs, and any HGs or quotas will remain in effect until revised, and, whether revised or not, will be announced at the beginning of the biennial fishing period along with other specifications.

In the event that the Secretary disapproves one or more of the Council's recommendations, he may implement those portions approved and notify the Council in writing of the disapproved portions along with the reasons for disapproval. The Council may either provide additional rationale or information to support its original recommendation, if required, or may submit alternative recommendations with supporting rationale. In the absence of an approved recommendation at the beginning of the biennial fishing period, the current specifications in effect at the end of the previous biennial fishing period will remain in effect until modified, superseded, or rescinded.

[Amended: 5, 11, 17]

5.5. Inseason Procedures for Establishing or Adjusting Specifications

5.5.1. Inseason Adjustments to ~~ABC~~OFLs and ABCs

Under the biennial specifications and management measures process, stock assessments for most species will become available every other year, prior to the November Council meeting that begins the three-meeting process for setting specifications and management measures. The November Council meeting that begins that three-meeting process will be the November of the first fishing year in a biennial fishing period. If the Council determines that any of the ~~ABC~~OFLs, ABCs, ACLs, or OYs set in the prior management process are not adequately conservative to meet rebuilding plan goals for an overfished species, harvest specifications for that overfished species and/or for co-occurring species may be revised for the second fishing year of the then current biennial management period.

Beyond this process, ~~ABC~~OFLs, ABCs, ACLs, OYs, ACTs, HGs, and quotas may only be modified in cases where a harvest specification announced at the beginning of the fishing period is found to have resulted from incorrect data or from computational errors. If the Council finds that such an error has occurred, it may recommend the Secretary publish a notice in the *Federal Register* revising the incorrect harvest specification at the earliest possible date.

5.5.2. Inseason Establishment and Adjustment of ACLs, OYs, ACTs, HGs, and Quotas

ACLs, OYs and HGs may be established and adjusted inseason (1) for resource conservation through the "points of concern" framework described in Chapter 6; (2) in response to a technical correction to ~~ABC~~OFL described above; or, (3) under the socioeconomic framework described in Chapter 6.

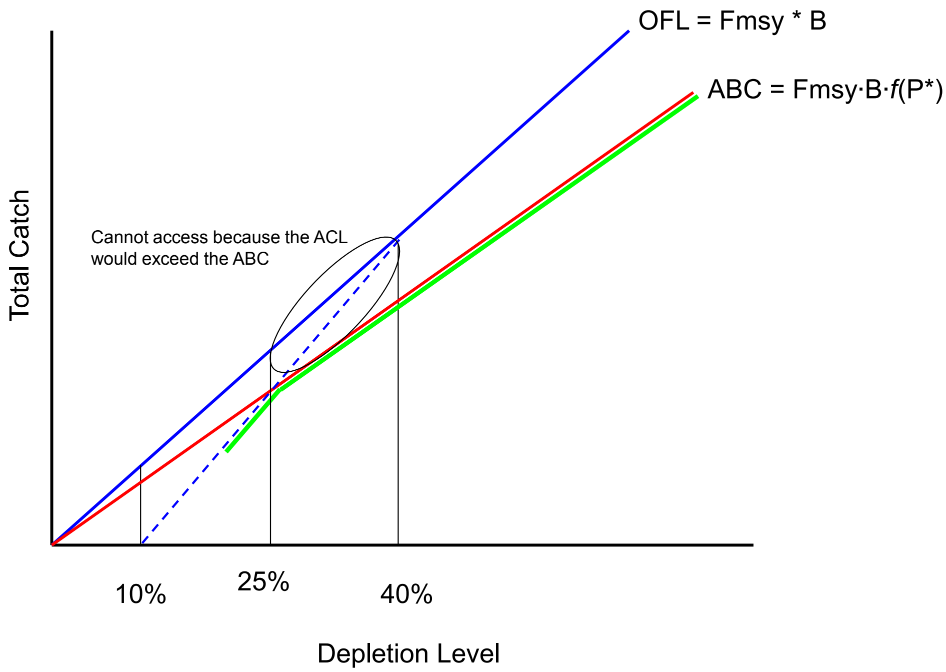
Quotas may be established and adjusted inseason only for resource conservation or in response to a technical correction to ~~ABC~~OFL. These constraints on establishing and adjusting ACLs, OYs, ACTs, HGs, and quotas do not apply to the process for establishing and adjusting sector-specific catch limits, which is provided in section 6.5.3.2.

[Amended: 11, 17, 18]

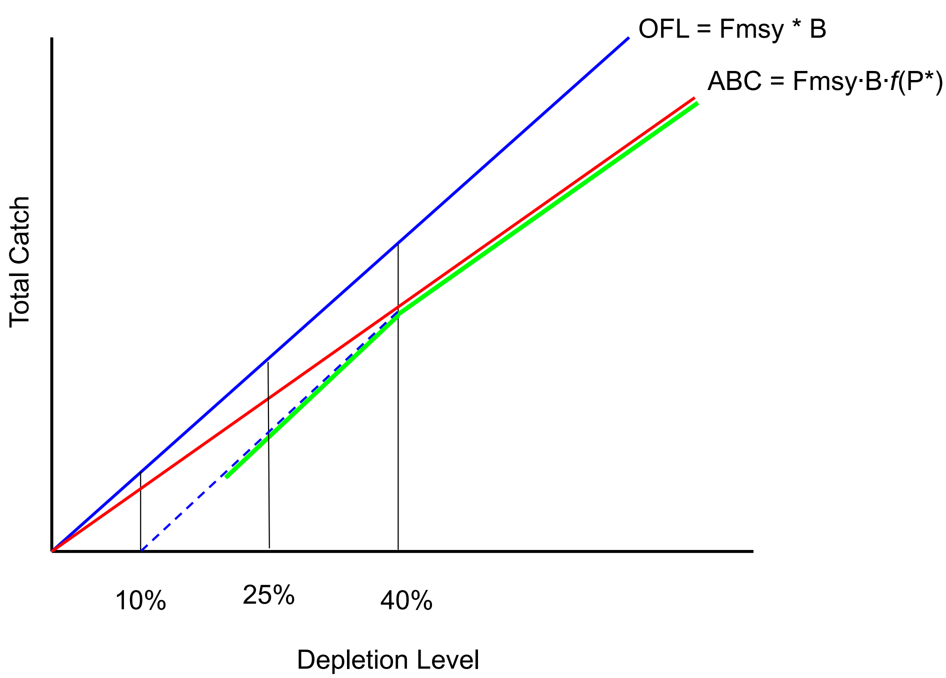
Agenda Item E.4.a
Attachment 3
March 2010

OPTIONS FOR DEFINING THE 40-10 CONTROL RULE UNDER THE AMENDMENT 23 FRAMEWORK

<u>Option 1: Application of the 40/10 control rule to OFL</u>



<u>Option 2: more precautionary approach to application of the 40/10 control rule</u>



EVALUATION OF THE EFFECTIVENESS OF THE CURRENT GROUNDFISH MANAGEMENT SYSTEM TO PREVENT OVERFISHING IN CONSIDERATION OF THE ANNUAL CATCH TARGET SPECIFICATION UNDER AMENDMENT 23

The Magnuson Stevens Act (MSA) reauthorization of 2006 mandated an end to overfishing. The National Standard 1 (NS1) guidelines were amended earlier this year to recommend procedures and considerations for achieving that objective. The new NS1 guidelines define an Overfishing Limit (OFL) as "the annual amount of catch that corresponds to the estimate of MFMT (maximum fishing mortality threshold or the level of fishing mortality estimated to produce maximum sustainable yield (F_{MSY}), on an annual basis, above which overfishing is occurring) applied to a stock or stock complex's abundance", which is analogous to the acceptable biological catch (ABC) in the current Groundfish Fishery Management Plan (FMP).

Amendment 23 to the FMP contemplates incorporation of the terms and concepts recommended in the new NS1 guidelines designed to prevent overfishing. Precautionary thresholds below the OFL are recommended to consider scientific uncertainty (the new ABC specification), and other considerations, such as socioeconomic impacts and conservation objectives, to set a lower annual catch limit (ACL), which is analogous to the current optimum yield (OY) specification, which has been used as an annual total catch limit in west coast groundfish management since 1999.

The new NS1 guidelines also recommend effective accountability measures (AMs) to keep from exceeding specified ACLs. The guidelines recommend consideration for a further yield buffer, termed the annual catch target (ACT), which can be set below the ACL if there is great uncertainty in the ability of the management system to effectively keep total fishing mortality below the prescribed ACL. The NS1 guidelines recommend an ACT does not need to be specified in the FMP if there are effective AMs, such as an inseason monitoring program, that can be demonstrated to keep harvest below the ACL. The performance standard recommended in the new NS1 guidelines for AMs is ACLs cannot be exceeded more often than once in four years.

The performance of the current management system was evaluated to determine if there are stocks and/or instances where an ACT may need to be specified. The current management system has evolved since 2002 with the advent of the West Coast Groundfish Observer Program (WCGOP) and better tracking of discard mortality. The Groundfish Management Team (GMT) has been using a report provided by the Pacific Fisheries Information Network (PacFIN) called the Quota Species Monitoring (QSM) report to track commercial landings of stocks and stock complexes managed under OYs or harvest guidelines. The GMT and the states track discard mortality of these species which are also posted on the QSM report based on impact projection models developed by the GMT and the NMFS Northwest Fisheries Science Center that associates species' discards with landings of target species using bycatch rates obtained from the WCGOP. The QSM is updated every two weeks and a program within PacFIN tracks total catches (landings plus discard mortalities) for monitored species relative to past years' catches. A companion program that tracks recreational catches is maintained on the Recreational Fisheries Information Network (RecFIN) and is used by the GMT and the states to track that catch component, ensuring that all catches are counted against annual harvest specifications to better ensure these catch limits are not exceeded.

Total catch estimates of stocks and stock complexes with specified OYs were compared with the specified OY during 1999-2007 to evaluate the effectiveness of the current management system to stay within specified OYs. This period was used since total catch OYs, where all sources of fishing related mortality are counted against the OY, were specified beginning in 1999[1]. The analysis extends through 2007 since this is the most recent year with an available total mortality report from the NMFS Northwest Fisheries Science Center. Table 1 depicts those instances when the annual total catch of a species has exceeded the specified OY.

Table 1. Instances when groundfish OYs have been exceeded in the recent management period, 1999-2007.

Species	Year OY was exceeded	Specified total catch OY (mt)	Estimated total catch (mt)	Percent of OY overage
Bocaccio	2000	100	112.0	12.0%
	2001	100	109.0	9.0%
Cabezon (CA)	2004	69	101.8	47.5%
	2005	69	85.4	23.8%
Canary	2001	93	133.0	43.0%
	2002	93	98.1	5.5%
	2003	44	59.9	36.1%
	2004	47	50.3	6.3%
	2005	47	60.4	29.1%
	2006	47	62.0	31.9%
	2007	44	44.7	1.6%
Darkblotched	2001	130	274.0	110.8%
	2002	168	179.0	6.5%
	2004	240	252.0	5.0%
Dover sole	2005	7,476	7,507.0	0.4%
	2006	7,564	7,730.0	2.2%
Petrale sole	2005	2,762	2,960.0	7.2%
POP	2001	303	307.0	1.3%
	2007	150	156.0	4.0%
Shortspine	1999	805	1,001.0	24.3%
	2000	970	1,037.0	6.9%
	2002	955	960.0	0.5%
	2003	955	1,014.0	6.2%

Prior to implementing rockfish conservation areas (RCAs) in 2003, which closed the core areas to groundfish fishing where overfished species occur, it was more difficult to manage fishery impacts to the low OYs prescribed in rebuilding plans. This led to higher magnitude OY overages prior to RCA management. Also, the precision of impact projection models has improved since 2003 as more WCGOP data became available to inform these models with more representative bycatch rates. These two factors and an adaptive management process where the GMT and Council have learned which management measures (e.g., RCA configurations and

[1] Prior to 1999, landed catch OYs were specified where only landings and not discard mortalities were counted against the OY.

cumulative landing limits) work best under rebuilding regimes has led to improved management performance in recent years. However, there has been a persistent problem in managing the low canary rockfish OYs. Also, there have been instances where OYs for other species were exceeded in more recent years that require further explanation.

The canary rockfish management challenge has been extreme. This species is caught in all groundfish fisheries by a variety of gears and has therefore been one of the most constraining stocks limiting fishing opportunities since it was declared overfished in 2000. It is also apparent that the patterns of canary rockfish distribution, both seasonally and from year to year, are relatively unpredictable. The impact projection model used for the limited entry trawl fishery does a relatively good job of predicting impacts for the overfished species; however, there has always been a problem projecting canary rockfish impacts with relative precision. The lack of real-time reporting of canary discards in the trawl fishery has led to a reliance on the impact projection model. The imprecision of that model has led to a persistent problem of exceeding the specified canary rockfish OY despite increasingly stringent management measures imposed on the trawl fleet (e.g., shelf area closures north of Cape Alava and between Humbug Mt. and Cape Arago). Further, recreational catch projections are also relatively uncertain and canary rockfish are readily caught as bycatch in coastwide recreational fisheries as well. Therefore, current catch monitoring systems and impact projection models have failed to adequately perform in managing fishery impacts within canary rockfish OYs.

Other species' OY overages are a little more easily explained and the result of either human error (e.g., petrale sole in 2005), poor catch monitoring systems that have since been improved (e.g., bocaccio in 2000 and 2001), or a relatively rare and unexpected bycatch event (e.g., POP in 2007).

For example, the petrale sole OY was exceeded in 2005 due to human error. The petrale catch had been higher than normal during the first half of the year; however, managers were not paying adequate attention to this fact and did not react in time. It was realized over the summer that the petrale catch was projected to exceed the OY by a significant amount. In September, the Council reacted by closing the fishery and was able to mitigate this management miscue by minimizing the OY overage.

The bocaccio OY overages in 2000 and 2001 were due to recreational catches exceeding projections due largely to a very imprecise recreational census program called the Marine Recreational Fisheries Statistical Survey (MRFSS). The MRFSS program was designed to gauge gross catch and effort trends in marine recreational fisheries nationwide and it did not have the precision necessary for inseason management. However, MRFSS catch estimates were the best available data, so the Council and NMFS used them for management decision-making. The imprecision of MRFSS for monitoring recreational catch stems from the fact that effort is tracked through a telephone survey of coastal residents nationwide leading to highly uncertain and variable effort estimates that were used in California for estimating recreational catch. This lack of precision and the difficulty managing recreational fishery impacts using MRFSS led to the implementation of the California Recreational Fisheries Survey (CRFS) in 2004, which bolsters catch sampling and surveys effort using the California angler license frame. Since the implementation of CRFS, estimated catches of recreationally important species in California such as bocaccio have been more certain and recreational impact projections more precise.

The POP OY overage in 2007 was the result of one high landing in the shoreside whiting fishery at the end of the year. There was a hiatus in the whiting fishery that year when the widow total catch limit was attained prior to attaining whiting quotas. The fishery was shut down in July and re-opened in October when available widow yield was added to the total catch limit by the Council and NMFS. However, there was concern that the canary total catch limit would be exceeded that fall without a mitigating management restriction on the fishery. Therefore, the Council and NMFS re-opened the fishery with a 150 fm depth restriction, which forced the fleets to fish in deeper waters than they normally fished to avoid canary. The shoreside whiting vessel that had the high POP catch was consequently operating in waters unfamiliar to the skipper at a time when the shoreside whiting fishery would not normally be open. This bycatch event that led to the POP OY overage was therefore not anticipated and occurred too late in the season to react to with an inseason adjustment to the fishery.

The other instances of species OY overages depicted in Table 1 (i.e., those for darkblotched, Dover sole, and shortspine thornyheads) were due to trawl catches that exceeded projections (these are all trawl-dominant species). Some of these overages occurred late in the season from effort that was higher than projected and other overages were due to imprecise trawl bycatch projections from modeling non-representative bycatch rates, especially early in the period depicted in Table 1. Management decisions subsequent to these OY overage instances adapted from these miscues with better understanding of expected catch and effort late in the season under a range of management measures.

The performance standard of not exceeding total catch limits more often than once in four years on average has clearly not been met for all groundfish species. For this reason, the Council may want to add the ACT as another accountability measure to ensure ACLs are not exceeded in the future. While there may be no compelling reason to specify an ACT for most groundfish stocks, it is clear that it may be an important AM for a stock like canary rockfish under our current management system.

There are anticipated improvements to the management system that may make it less necessary to add the ACT to the FMP. The trawl fishery under the preferred alternative for Amendment 20 rationalization will have 100% observer coverage and real-time reporting of all catch, including discard mortality. This is a significant improvement in trawl catch monitoring and will eliminate management reliance on the trawl bycatch model and is a very precise AM for this fishery, which has historically had the highest groundfish bycatch. Trawl allocations of all the species listed in Table 1 will not likely be exceeded and, for the trawl-dominant species in Table 1 (i.e., all species other than bocaccio, cabezon, and canary), total catch limits will not likely be exceeded under the trawl rationalization program. However, the ACT may still be a useful AM for species like bocaccio, cabezon, and canary that are caught significantly in recreational fisheries. Catch estimation and projection in recreational fisheries is relatively uncertain and an ACT may be a reasonable measure for managing recreational impacts given this management uncertainty.

There are also other potential uses for the ACT. Since the ACT is a target and not a total catch limit, the ACT can be exceeded without penalty. Therefore, the ACT could be specified in a rebuilding strategy where the ACL defines the limit of acceptable fishing related mortality under a rebuilding plan and the ACT can be set lower in an attempt to get the fishery to perform better at avoiding the overfished species. For instance, the Council and NMFS have decided rebuilding strategies for bocaccio in the past where OYs were specified according to the adopted rebuilding plan, but the Council and NMFS stated a management intent to do better than that and set a target impact less than the OY. Likewise, the 2009-2010 rebuilding strategy for canary rockfish was to maintain the target harvest rate prescribed in the Amendment 16-4 rebuilding plan (the SPR harvest rate in the rebuilding plan projected a 155 mt OY in 2009 and 2010), but to set OYs under a lower harvest rate (i.e., 105 mt in 2009 and 2010). In both the bocaccio and canary cases, the ACL could be specified according to the rebuilding plan harvest rates and a lower ACT could be specified to attempt a more aggressive rebuilding strategy than prescribed in the adopted rebuilding plan. Given the management uncertainty associated with trying to balance conservation and socioeconomic objectives in a rebuilding plan (i.e., trying to rebuild overfished species in as short a time as possible while considering socioeconomic impacts on fishing communities), the strategic use of the ACT may be helpful.

The ACT may also be a helpful AM for species with relatively high rates of discard. Discard estimates tend to be highly variable from year to year and there is about a year and a half lag before discard mortality is reported in the total mortality reports provided by the NMFS Northwest Fisheries Science Center. Therefore, the uncertainty associated with high rates of discard mortality could be addressed by specifying an ACT. While this uncertainty is expected to be addressed for the trawl sectors under trawl rationalization, there are still some species such as arrowtooth flounder, spiny dogfish, and skates that are discarded at a relatively high rate in some limited entry and open access fixed gear fisheries. Such species may be good candidates for an ACT specification.

Finally, the ACT could be used as a harvest guideline in groundfish management since both specifications are annual catch targets and not limits. The new NS1 guidelines suggest ACTs could also be specified as sector-specific targets, which is analogous to the current use of harvest guidelines in groundfish management. The GMT discussed this aspect of managing with ACTs at their October meeting, including the potential of supplanting the current use of a harvest guideline in the FMP with the ACT. In concept, this was considered a reasonable Amendment 23 consideration. However, one practical impediment to this action is the California statute that says in effect that CDFG can close or modify fishing seasons and/or pursue other management actions to prevent exceeding a federally-specified OY or harvest guideline[2]. Unless the statute is amended to allow such an automatic agency action (i.e., without a decision from the California Fish and Wildlife Commission, which is a more protracted process), redefining the harvest guideline as the ACT in the FMP may be untenable. However, such a change in the California statute may be needed anyway to allow automatic agency action to prevent exceeding a federally-specified ACL.

[2] The Washington and Oregon Departments of Fish and Wildlife already have relatively broad authority from their respective commissions to automatically close or modify their fisheries.

Table 2-1. Specified 2009 and 2010 ABCs (mt) and projected 2011 and 2012 OFLs (mt) for assessed stocks and initial FMP species categorizations. (Overfished stocks in CAPS; Stocks with new assessments in bold; Species contributions to a stock complex specification in *italics*).

Stock	2009 ABC	2010 ABC	2011 OFL	2012 OFL	Presumptive Species Category a/	Comments
Lingcod - coastwide	5,278	4,829	4,961	4,848	1	Council may choose coastwide specifications or area-specific specifications (e.g., OR-WA and CA) for 2011-12.
Lingcod N. of 42° N latitude (OR & WA)			2,438	2,251		
Lingcod S. of 42° N latitude (CA)			2,523	2,597		
Pacific Cod	3,200	3,200			3	Not clear why there are stock-specific harvest specifications for this stock.
Pacific Whiting (U.S.)	253,852 (US. + Canada)	To be determined in 2010	To be determined in 2011	To be determined in 2012	1	Not to be managed under Am. 23 framework under the Council's preliminary preferred alt. **No P* or scientific uncertainty buffer decision required. b/**
Sablefish - coastwide	9,914	9,217	8,808	8,623	1	
PACIFIC OCEAN PERCH	1,160	1,173	1,026	1,007	1	
Shortbelly	6,950	6,950			EC	**No P* or scientific uncertainty buffer decision required. b/**
WIDOW	7,728	6,937	5,097	4,923	1	
CANARY	937	940	614	622	1	
Chilipepper c/	3,037	2,576	2,229	2,013	1	
BOCACCIO S. of 40°10' N latitude	793	793	737	732	1	
Splitnose d/	615	615	2,381	2,507	2	
Yellowtail N. of 40°10' N latitude	4,562	4,562	4,566	4,573	1	
Shortspine Thornyhead - coastwide	2,437	2,411	2,384	2,358	1	
Longspine Thornyhead - coastwide	3,766	3,671	3,577	3,483	1	
COWCOD (Con + Mon)	13	14	25	25	2	The SSC may recommend a different approach for specifying the Monterey area OFL contribution for this stock. Therefore, the 2011 and 2012 OFLs are subject to change.
DARKBLOTCHED	437	440	508	497	1	
YELLOWEYE	31	32	48	48	2	
Black Rockfish (WA)	490	464	445	435	1	

Table 2-1 (continued). Specified 2009 and 2010 ABCs (mt) and projected 2011 and 2012 OFLs (mt) for assessed stocks and initial FMP species categorizations. (Overfished stocks in CAPS; Stocks with new assessments in bold; Species contributions to a stock complex specification in *italics*).

Stock	2009 ABC	2010 ABC	2011 OFL	2012 OFL	Presumptive Species Category a/	Comments
Black Rockfish (OR-CA)	1,469	1,317	1,217	1,169	1	
Minor Rockfish North	3,678	3,678			3	
Minor Nearshore Rockfish North						
Black and yellow					3	
Blue					2	
Brown					3	
Calico					EC	**No P* or scientific uncertainty buffer decision required. b/**
China					3	
Copper					3	
Gopher					1	
Grass					3	
Kelp					3	
Olive					3	
Quillback					3	
Treefish					3	
Minor Shelf Rockfish North						
Bronzespotted					3	
Bocaccio	*318*	*318*			3	
Chameleon					3	
Chilipepper					3	
Cowcod					3	
Dusky					Not in Fishery	Remove from FMP
Dwarf-red					Not in Fishery	Remove from FMP
Flag					EC	**No P* or scientific uncertainty buffer decision required. b/**
Freckled					EC	**No P* or scientific uncertainty buffer decision required. b/**
Greenblotched					3	

Table 2-1 (continued). Specified 2009 and 2010 ABCs (mt) and projected 2011 and 2012 OFLs (mt) for assessed stocks and initial FMP species categorizations. (Overfished stocks in CAPS; Stocks with new assessments in bold; Species contributions to a stock complex specification in *italics*).						
Stock	**2009 ABC**	**2010 ABC**	**2011 OFL**	**2012 OFL**	**Presumptive Species Category a/**	**Comments**
Greenspotted					3	
Greenstriped					2	
Halfbanded					EC	**No P* or scientific uncertainty buffer decision required. b/**
Harlequin					3	
Honeycomb					3	
Mexican					3	
Pink					3	
Pinkrose					3	
Puget Sound					EC	**No P* or scientific uncertainty buffer decision required. b/**
Pygmy					EC	**No P* or scientific uncertainty buffer decision required. b/**
Redstripe	*576*	*576*			3	
Rosethorn					3	
Rosy					3	
Silvergray	*38*	*38*			3	2? Common in trawl survey
Speckled					3	
Squarespot					3	
Starry					3	
Stripetail					3	
Swordspine					3	
Tiger					3	
Vermilion					2	3? 2005 asssessment used to determnine stock status but too uncertain to set harvest specifications
Minor Slope Rockfish North						
Aurora					3	
Bank					2	
Blackgill					1	
Redbanded					3	
Rougheye					3	
Sharpchin	*307*	*307*			3	

Table 2-1 (continued). Specified 2009 and 2010 ABCs (mt) and projected 2011 and 2012 OFLs (mt) for assessed stocks and initial FMP species categorizations. (Overfished stocks in CAPS; Stocks with new assessments in bold; Species contributions to a stock complex specification in *italics*).						
Stock	**2009 ABC**	**2010 ABC**	**2011 OFL**	**2012 OFL**	**Presumptive Species Category a/**	**Comments**
Shortraker					3	
Splitnose	*242*	*242*			2	
Yellowmouth	*99*	*99*			3	
Minor Rockfish South	3,384	3,382				
Minor Nearshore Rockfish South						
Shallow Nearshore Species						
Black and yellow					3	
China					3	
Gopher					1	Not clear why this stock is managed within the complex
Grass					3	
Kelp					3	
Deeper Nearshore Species						
Blue	*213*	*211*			2	
Brown					3	
Calico					EC	**No P* or scientific uncertainty buffer decision required. b/**
Copper					3	
Olive					3	
Quillback					3	
Treefish					3	
Minor Shelf Rockfish South						
Bronzespotted					3	
Chameleon					3	
Dusky					Not in Fishery	Remove from FMP
Dwarf-red					Not in Fishery	Remove from FMP
Flag					EC	**No P* or scientific uncertainty buffer decision required. b/**
Freckled					3	
Greenblotched					3	

Table 2-1 (continued). Specified 2009 and 2010 ABCs (mt) and projected 2011 and 2012 OFLs (mt) for assessed stocks and initial FMP species categorizations. (Overfished stocks in CAPS; Stocks with new assessments in bold; Species contributions to a stock complex specification in *italics*).

Stock	2009 ABC	2010 ABC	2011 OFL	2012 OFL	Presumptive Species Category a/	Comments
Greenstriped					2	
Halfbanded					EC	**No P* or scientific uncertainty buffer decision required. b/**
Harlequin					3	
Honeycomb					3	
Mexican					3	
Pink					3	
Pinkrose					3	
Pygmy					EC	**No P* or scientific uncertainty buffer decision required. b/**
Redstripe					3	
Rosethorn					3	
Rosy					3	
Silvergray					3	2? Common in trawl survey
Speckled					3	
Squarespot					3	
Starry					3	
Stripetail					3	
Swordspine					3	
Tiger					3	
Vermilion					2	3? 2005 asssessment used to determnine stock status but too uncertain to set harvest specifications
Yellowtail	*116*	*116*			3	
Minor Slope Rockfish South						
Aurora					3	
Bank	*350*	*350*			2	
Blackgill					1	Not clear why this stock is managed within the complex
Pacific ocean perch					3	
Redbanded					3	
Rougheye					3	

Table 2-1 (continued). Specified 2009 and 2010 ABCs (mt) and projected 2011 and 2012 OFLs (mt) for assessed stocks and initial FMP species categorizations. (Overfished stocks in CAPS; Stocks with new assessments in bold; Species contributions to a stock complex specification in *italics*).

Stock	2009 ABC	2010 ABC	2011 OFL	2012 OFL	Presumptive Species Category a/	Comments
Sharpchin	*45*	*45*			3	
Shortraker					3	
Yellowmouth					3	
California scorpionfish	175	155	141	132	1	
Cabezon (CA)	106	111	187	176	1	
Cabezon (OR)	Managed under the Other Fish complex		52	50	1	
Dover Sole	29,453	28,582	44,400	44,826	1	
English Sole	14,326	9,745	20,675	10,620	1	
PETRALE SOLE (1,200 mt 2010 OY)	2,811	2,751	1,021	1,279	1	
PETRALE SOLE (1,200 mt 2010 OY; no wint	2,811	2,751	1,170	1,369	1	
Arrowtooth Flounder	11,267	10,112	18,211	14,460	2	
Starry Flounder	1,509	1,578	1,802	1,813	2	
Longnose skate	3,428	3,269	3,128	3,006	2	
Other Flatfish	6,731	6,731			3	
Butter sole	*5*				3	
Curlfin sole	*8*				3	
Flathead sole	*123*				3	
Pacific sanddab	*3,172*	*3,172*			2	
Rex sole	*2,902*	*2,902*			2	
Rock sole	*46*				3	
Sand sole	*376*				3	

Table 2-1 (continued). Specified 2009 and 2010 ABCs (mt) and projected 2011 and 2012 OFLs (mt) for assessed stocks and initial FMP species categorizations. (Overfished stocks in CAPS; Stocks with new assessments in bold; Species contributions to a stock complex specification in *italics*).

Stock	2009 ABC	2010 ABC	2011 OFL	2012 OFL	Presumptive Species Category a/	Comments
Other Fish	11,200	11,200			3	
Big skate	*No Species-Specific Basis or Contribution to the Stock Complex Harvest Specifications*				*3*	
California skate					*3*	
Leopard shark					*3*	
Soupfin shark					*3*	
Spiny dogfish					*3*	
Finescale codling					*3*	
Pacific rattail					*3*	
Ratfish					*3*	
Cabezon (OR in 2009-10)					*1*	*Presumably will be removed from complex in 2011-12*
Cabezon (WA)					*3*	
Kelp greenling					*3*	*2 in OR? 2005 assessment used to determine stock status (OR subpopulation) but too uncertain to set harvest specifications*

a/ Presumptive Species Category is the initial categorization made by Council staff for consideration by the SSC, GMT, and the Council. Category 1 = relatively data-rich assessed species; category 2 = relatively data-poor assessed or unassessed species; category 3 = relatively data-sparse unassesssed species; and EC = ecosystem species that should be monitored but not actively managed in the fishery.

b/ P* is the probability of overfishing a stock due to scientific uncertainty in the assessment. This concept is part of the Amendment 23 framework and a key aspect of deciding the new ABC control rule for category 1 stocks.

c/ Chilipepper rockfish are projected from the 2007 assessment based on the population occurring in waters off CA and OR. They were specified for south of $40^{0}10'$ N latitude in 2009-10, but should have been applied for the waters off CA and OR.

d/ Splitnose rockfish specifications in 2009-10 were for south of $40^{0}10'$ N latitude. The 2011-12 specifications are projected from the 2009 assessment and apply coastwide.

Agenda Item E.4.b
Supplemental GAP Report
March 2010

GROUNDFISH ADVISORY SUBPANEL (GAP) REPORT ON FISHERY MANAGEMENT PLAN AMENDMENT 23: ANNUAL CATCH LIMITS AND ACCOUNTABILITY MEASURES

The Groundfish Advisory Subpanel (GAP) met with Mr. John DeVore regarding the proposed groundfish fishery management plan (FMP) Amendment 23 framework and offers the following comments.

The GAP agrees with the preliminary Council guidance to adopt a relatively simple Amendment 23 framework that is not overly prescriptive. The GAP does not believe a complicated framework is necessary, especially since the FMP served as the template for new National Standard 1 guidelines. However, the GAP is concerned that the new Amendment 23 framework may be adding unnecessary buffers (e.g., scientific uncertainty buffers defining the ABC) to our current management framework which has performed well to prevent overfishing.

The GAP reviewed the two options for defining the 40-10 harvest control rule under the Amendment 23 framework presented in Agenda Item E.4.a, Attachment 3. The GAP recommends option 1 for the 40-10 rule, which is a direct translation of the current rule under Amendment 23. Option 2 was considered overly precautionary by the GAP since it begins the 40-10 adjustment after the scientific uncertainty buffer specifying the ABC is applied. The GAP believes this is another example of an unnecessary buffer under the proposed framework.

The GAP also agrees with the concept of removing dusky and dwarf-red rockfish from the FMP. These species do not occur on the U.S. west coast according to the literature. The categorization of those species in Agenda Item E.3.a, Attachment 5 as Ecosystem Component (EC) species is also recommended by the GAP. These species are not encountered in west coast fisheries and appear to be good candidates for an EC designation.

PFMC
03/08/10

GROUNDFISH MANAGEMENT TEAM (GMT) REPORT ON FISHERY MANAGEMENT PLAN AMENDMENT 23 – ANNUAL CATCH LIMITS AND ACCOUNTABILITY MEASURES

The Groundfish Management Team (GMT) discussed Amendment 23 and has the following comments for Council consideration.

In or Out of the Fishery and Ecosystem Component Species

Evaluation of Species Currently Managed in the FMP

As discussed in previous statements, the NS1 guidelines suggest that the Council set annual catch limits (ACLs) for target stocks, any non-target stocks that are overfished, or those non-target stocks potentially vulnerable to overfishing. A report detailing our initial analysis of vulnerability of each stock in the Fishery Management Plan (FMP) is reported in this agenda item (Agenda Item E.2.b, GMT Report).

Based on that analysis we do not recommend removing any species from the FMP other than dusky and dwarf-red rockfish at this time. These two species are included in the FMP based on very few occurrences. Dusky rockfish are distributed to the north of the U.S. west coast Exclusive Economic Zone (EEZ). We have record of only a few fish being landed into Washington. There is only one occurrence of dwarf-red rockfish in the Channel Islands when two individuals were observed following a Navy underwater demolition. Setting an ACL for these species would serve no purpose.

Ecosystem Component Species

On the question of designating ecosystem component (EC) species in the FMP, the GMT is generally in favor of their inclusion but is not prepared to do so at this time. Until a better understanding of how designation of EC species might benefit management and a more thorough consideration of species both in and out of the FMP as potential EC species is done, the GMT recommends deferring any EC species designation to the next management cycle.

Stock Complexes

As detailed in our vulnerability analysis (Agenda Item E.2.b., GMT Report), we also evaluated our current stock complexes under the revised NS1 guidelines by looking at latitudinal and depth distributions, vulnerability scores, and fishery interactions of each species currently managed within a complex. This analysis shows that improvements can be made in the composition of the stock complexes. Such changes include rearranging current complexes and possibly adding other species into the FMP and consideration for constructing the complexes around indicator species. The analyses needed to create annual catch limits (ACLs) for any new or reconfigured complexes are not likely feasible within the remaining timeframe.

The Other Fish complex is of most concern to the GMT given the lack of a quantitative basis for its current harvest specifications and the relatively high vulnerability of its component elasmobranch species. Preliminary discussions have identified various alternatives for decomposing this complex into a few new stock complexes.

Consideration of Non-FMP species

In November, the Council gave lower priority to the GMT's suggestion to the evaluation of species not in the FMP. Using publically available WCGOP reports on the non-whiting trawl fishery in 2007 and 2008, and a simple method for expanding total catch, the GMT was able to roughly compare the relative magnitude of total catch of FMP species versus species not in the FMP.[1] As shown in Table 1, some species not in the FMP are caught in greater amounts than FMP species.

Table 1. GMT Estimated Total Catch of Select FMP and Non-FMP species in the Non-Whiting Trawl Fisheries, 2007 and 2008.[1]

Other Flatfish	2007	2008
butter sole	0.7	0.3
curlfin sole/turbot	8.8	1.8
flathead sole	4.0	1.2
Pacific sanddab	395.9	235.1
rex sole	647.3	459.2
rock sole	8.3	0.1
sand sole	21.7	11.9
Non-FMP Flatfish	**2007**	**2008**
Deepsea sole	43.1	76.5
Slender sole	45.1	21.6

Select Other Fish	2007	2008
big skate	123.2	51.6
California skate	7.2	5.9
finescale codling/Pacific flatnose	14.7	4.7
Pacific rattail/grenadier	183.7	81.3
ratfish	183.7	169.9
Non-FMP Skates	**2007**	**2008**
Aleutian skate	5.9	14.0
Black skate	61.0	128.3
Other & Unidentified skate	422.2	308.2
Non-FMP Sharks	**2007**	**2008**
Brown cat shark	33.0	50.2
Shark (unidentified)	16.9	28.7
Non-FMP Grenadiers	**2007**	**2008**
Giant grenadier	265.4	144.8
Other & Unidentified grenadier	3.3	15.6

It is clear that the vulnerability scores of these species would be indistinguishable from those of the current FMP species.

[1] Estimates were produced using catch and coverage information published in two West Coast Groundfish Observer Program reports: Data Report and Summary Analyses of the U.S. West Coast Limited Entry Groundfish Bottom Trawl Fishery, Oct 2009; Data Report and Summary Analyses of the West Coast Limited Entry Groundfish Bottom Trawl Fishery, Oct 2008.

The discard portion of total catch was produced by multiplying the ratio of observed species specific discards to observed aggregate landings to total aggregate landings. The landed catch portion of t he estimate was produced by dividing species specific observed landings by the fraction of total observed aggregate landings. The calculations were performed separately for the areas north and south of 40°10' N. This is not the same methodology used to produce annual total mortality estimates.

Recommendations and Next Steps
In sum, with our 2011-12 biennial management workload, we do not believe we can complete the necessary analyses and discussion to fully implement the changes suggested by the NS1 guidelines on the timeline for implementing Amendment 23. We would recommend revisiting the "in the fishery" classification following this biennial cycle (e.g., implementation in the 2013-2014 cycle).

Categorization of Species (1, 2, or 3)

The categorization of species in the FMP is not a decision made through Amendment 23, rather it is the application of the acceptable biological catch (ABC) control rules to the categories that the GMT discussed and would be decided in the biennial specifications process. The categorization of each species in the FMP will determine the size of the scientific uncertainty buffers that define the ABCs. Once the Council accepts the Scientific and Statistical Committee's (SSC) ABC control rule recommendations, the control rules can then be applied according to the categorization of each stock. These categorizations will need to be decided at the April Council meeting so that ABCs can be decided at this meeting.

Because the categorization of a species determines which ABC control rule will apply, the GMT believes this is most appropriately an SSC determination. However, given that this is the first specifications cycle in which these new control rules are being applied, the GMT will work with the SSC and Council staff to comment on the presumptive species categories as listed in Agenda item E.4.a, Attachment 5. The GMT will attempt to complete this task prior to the April Council briefing book deadline.

Additionally, if the Council has any guidance on the definitions of category 1, 2, or 3 stocks as currently defined in the FMP, that guidance would best be given at this meeting because the category designation determines which ABC control will be applied to a stock.

Determining ABC values (incorporating scientific uncertainty buffers)

Category 1 species
The GMT discussed the use of the overfishing probability (P*) as a tool for the Council in setting the scientific uncertainty buffer from overfishing limit (OFL) to ABC. Because the ABC control rule for category one species has not been finalized by the Council, the GMT does not have specific recommendations but offers some initial thoughts for Council consideration.
Because choosing the P* value determines the ABC, the SSC has deferred this as a policy decision for the Council. The GMT feels it would be helpful for the Council to establish criteria for choosing a P*. These criteria would provide the Council with a basis and transparent rationale for setting P* values into the future. The GMT began discussing possible criteria the Council could consider when choosing a P* value but was unable to finalize any specific recommendations. The GMT plans to bring more specific recommendations for Council consideration at the April meeting. However, the GMT would like to offer the following initial thoughts on setting P* values. If the Council were to establish a P* value very close to 0.5, which is the maximum P* value recommended by the SSC, for example 0.499, this would equate to no buffer to account for scientific uncertainty for that particular species (Table 2). This would set the OFL equal to the ABC. The GMT would also like to point out that the criteria for

choosing a P* may be something the Council wishes to list in the FMP. Establishing criteria may aid the Council in differentiating P* values between category one species. Not all category one species assessments have the same level of certainty; therefore, using criteria to address those differences would help to acknowledge and account for that uncertainty. In their report on this issue (Agenda Item E.4.b, Supplemental SSC Report 2) the SSC recognizes that the current analysis on P* is only a first step because it does not cover all scientific uncertainty. This only reinforces the need for criteria in determining P* values to help the Council consider additional sources of scientific uncertainty. The Council would be aided in this decision by guidance from .a collaboration between the GMT and SSC on which stock may need a lower P* to address higher uncertainty.

Table 2. P* and CV values with their resulting percent reductions from the OFL.

% Reduction from OFL

P*	CV 0.36	0.4	0.45	0.5	0.55	0.6
0.5	0%	0%	0%	0%	0%	0%
0.4999	0%	0%	0%	0%	0%	0%
0.45	4%	5%	5%	6%	7%	7%
0.4	9%	10%	11%	12%	13%	14%
0.35	13%	14%	16%	18%	19%	21%
0.3	17%	19%	21%	23%	25%	27%
0.25	22%	24%	26%	29%	31%	33%
0.2	26%	29%	32%	34%	37%	40%
0.15	31%	34%	37%	40%	43%	46%
0.1	37%	40%	44%	47%	51%	54%
0.05	45%	48%	52%	56%	60%	63%
0	100%	100%	100%	100%	100%	100%

Probability of exceeding OFL by 50%

P*	CV 0.36	0.4	0.45	0.5	0.55	0.6
0.5	0.13	0.16	0.18	0.21	0.23	0.25
0.4999	0.13	0.16	0.18	0.21	0.23	0.25
0.45	0.11	0.13	0.15	0.17	0.19	0.21
0.4	0.08	0.10	0.12	0.14	0.16	0.18
0.35	0.07	0.08	0.10	0.12	0.13	0.14
0.3	0.05	0.06	0.08	0.09	0.10	0.12
0.25	0.04	0.05	0.06	0.07	0.08	0.09
0.2	0.02	0.03	0.04	0.05	0.06	0.06
0.15	0.02	0.02	0.03	0.03	0.04	0.04
0.1	0.01	0.01	0.01	0.02	0.02	0.03
0.05	0.00	0.00	0.01	0.01	0.01	0.01
0	0.00	0.00	0.00	0.00	0.00	0.00

Probability of exceeding OFL by 100%

P*	CV 0.36	0.4	0.45	0.5	0.55	0.6
0.5	0.03	0.04	0.06	0.08	0.10	0.12
0.4999	0.03	0.04	0.06	0.08	0.10	0.12
0.45	0.02	0.03	0.05	0.07	0.08	0.10
0.4	0.01	0.02	0.04	0.05	0.07	0.08
0.35	0.01	0.02	0.03	0.04	0.05	0.06
0.3	0.01	0.01	0.02	0.03	0.04	0.05
0.25	0.00	0.01	0.01	0.02	0.03	0.03
0.2	0.00	0.01	0.01	0.01	0.02	0.02
0.15	0.00	0.00	0.00	0.01	0.01	0.01
0.1	0.00	0.00	0.00	0.00	0.01	0.01
0.05	0.00	0.00	0.00	0.00	0.00	0.00
0	0.00	0.00	0.00	0.00	0.00	0.00

The buffer between OFL and ABC is intended to represent scientific uncertainty. The SSC has provided a minimum estimate of scientific uncertainty. The Council's choice of P* will determine the buffer between OFL and ABC as a function of scientific uncertainty. In choosing P*, the GMT recommends that the Council consider several factors including, but not limited to economic concerns, stock status (e.g., stocks in the precautionary zone), and stock productivity driven by life history characteristics.

Category 2 and 3 Species

Buffers for category 3 species will be greater than for category 2 species which will be greater than buffers for category 1 species. Once the new ABC control rules are established for category 2 and 3 stocks the assignment of a species to either of these categories will essentially determine their ABC values. Because the ABC control rules for category 2 and 3 have not been finalized by the Council the GMT does not have recommendations on this issue. However, the GMT would like to, along with the SSC, recommend that the DB-SRA method be used for determining the OFL for data-poor stocks when the appropriate catch history is available. Council staff has made a preliminary suggestion that scientific uncertainty buffers could set for category 2 and 3 stocks between 25 and 50 percent reduction from the OFL. However, the SSC has not taken action taken action on this suggestion.

The 40-10 Control Rule

Integrating the scientific uncertainty buffer with the existing 40-10 harvest control rule

Above the target reference biomass ($B_{40\%}$), the ABC is the product of F_{MSY} (or its proxy), the exploitable biomass, and an uncertainty buffer derived from P* and scientific uncertainty in the biomass. The 40-10 rule was implemented to help rebuild the stock to the target level when the current biomass is below the target biomass, but above the minimum stock size threshold (MSST or $B_{25\%}$; below this level, the species is declared overfished and a rebuilding plan is initiated) (Figure 1). The addition of the scientific uncertainty buffer above the target biomass has made it necessary to redefine the interaction of the 40-10 harvest control rule with the newly calculated ABC. It is prudent to point out that the 40-10 harvest control rule is a self-imposed policy under the FMP, and is not recommended under NS1 guidelines as is the scientific uncertainty buffer.

The SSC has identified the following two options for reconciling the scientific uncertainty buffer and the 40-10 control rule:

Option 1: The 40-10 control rule and scientific uncertainty buffer should be applied to the OFL independently and the lower of the two resulting ACLs should be used for management (Figure **2**). This option provides more flexibility in setting the ACL because mandatory additional reductions are not required once stocks enters the precautionary zone, as shown in the example in Figure **2** where the ABC accounts for scientific uncertainty and is lower than the 40-10 throughout most of the precautionary zone. On the other hand, this option increases the likelihood of stocks becoming overfished relative to option 2 (Figure **3**) because, even though scientific uncertainty is accounted for in the ABC (Figure 2), the P* chosen to account for this scientific uncertainty may not be low enough to keep the stock out of the precautionary zone and potentially from being overfished.

Option 2: The 40-10 control rule would be applied in addition to the buffer for scientific uncertainty (Figure **3**). Option 2 always results in lower ACL values than under Option 1 for species in the precautionary zone. The SSC has provided some example ABCs and ACLs that would result from each option for the Council to use in weighing the magnitude of difference in the ABC that would result from each of the two options (Table 3).

The philosophy behind Option 1 is that the 40-10 control rule and scientific uncertainty buffer are precautionary adjustments which are both attempting to achieve the same thing, namely adjusting for uncertainty in stock status, and therefore the lower of the two should be used for management. The philosophy behind Option 2 is that the ACL rule adjusts for uncertainty in the absolute scale of biomass, whereas the 40-10 rule facilitates "rebuilding" towards the biomass target and the two should be applied separately to achieve both goals.

Under Option 1, there are instances when the uncertainty buffer is large enough to render the 40-10 adjustment unnecessary (i.e. the calculated scientific uncertainty buffer will always be lower than 40-10). Table 2 provides an analysis showing the maximum P* values under various F_{MSY} proxies, scientific uncertainty, and resultant buffers. The analysis demonstrates that the scientific uncertainty buffer is constant (0.80) across the different F_{MSY} proxies and scientific uncertainty measures. Different P* values relate to the constant buffer value because scientific uncertainty changes. As an example, for the minimum scientific uncertainty measure ($\sigma = 0.36$) prescribed by the SSC, a P* $\leq$ 0.27 will cause the 40-10 adjustment to be irrelevant.

However, the ABC buffer may accomplish the goal of the 40-10 adjustment by setting an ACL level at or below the 40-10 adjustment.

The decision on which option to apply hinges on whether one considers the scientific uncertainty buffer and 40-10 rule to be achieving the same (Option 1) or different (Option 2) purposes.

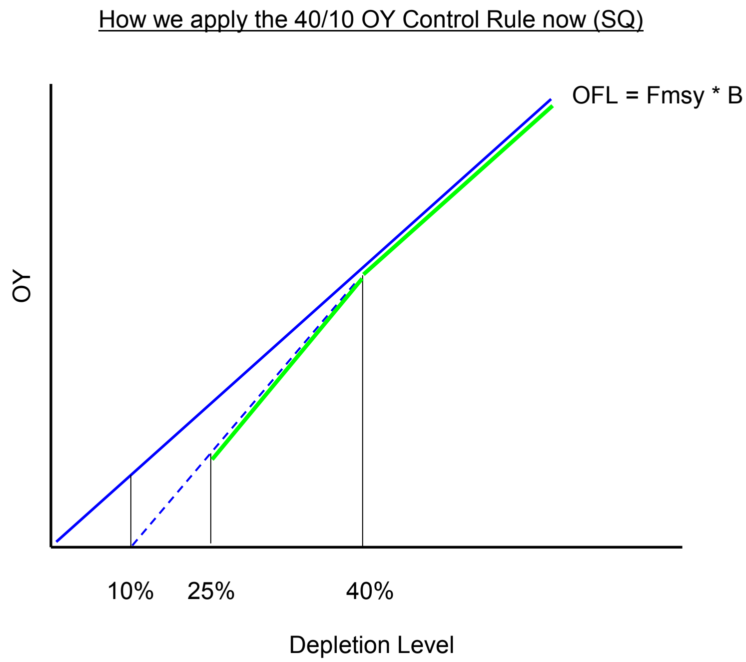


Figure 1. 40-10 harvest control rule as currently applied to stocks in the precautionary zone. The green line represents the ABC resulting from the application of the rule.

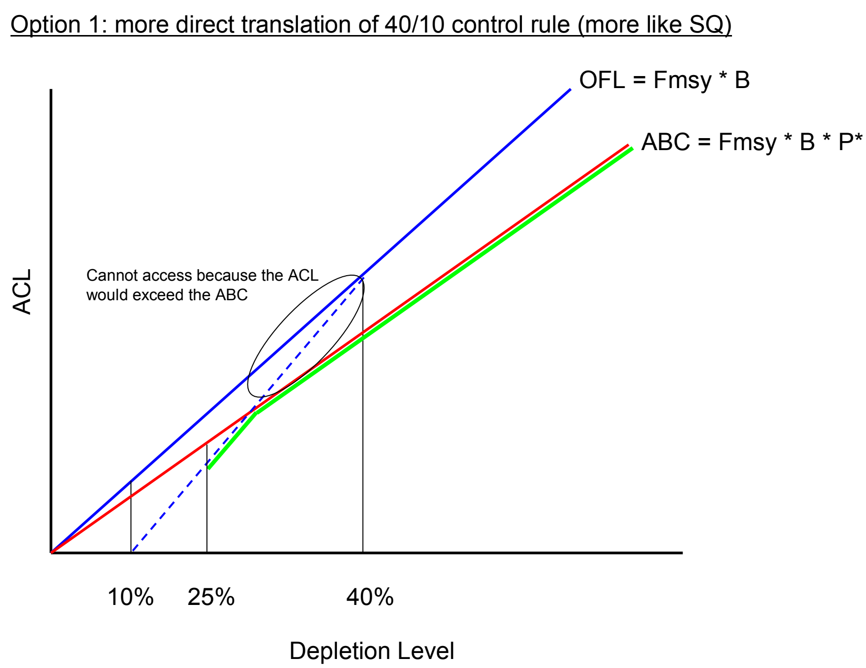


Figure 2. Option 1. Selection of the lower ABC produced from either the 40-10 rule (blue line) or from the application of scientific uncertainty buffer P* (green line).

Option 2: more precautionary approach to application of the 40/10 control rule

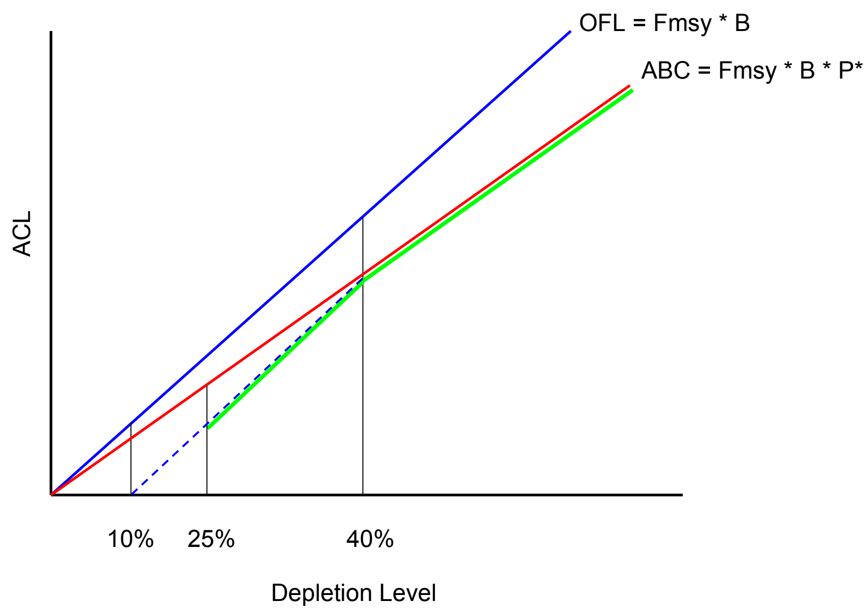


Figure 3. Option 2. ABC resulting from the combined application of the 40-10 rule and the scientific uncertainty buffer P*, represented by the green line. The 40-10 rule would be applied to the ABC, as it is now, and that value would be the maximum acceptable ACL. This would result in two reductions beginning at 40% depletion, one for scientific uncertainty to provide ABC, as buffered from the OFL, and a second (the 40-10 adjustment) to provide the ACL based on the 40-10 rule.

Table 3. Hypothetical ABC and ACL levels under options 1 and 2 over a range of depletion levels and buffer factors is given in the table below.

Example - OFL at target (B40) is 1000 mt

		Depletion Level				
Percent reduction from the OFL	Option	25%	30%	35%	40%	
0%	ABC	625	750	875	1000	(Current ABC)
0%	ACL Option 1	500	667	833	1000	
0%	ACL Option 2	500	667	833	1000	(Current 40-10 rule)
5%	ABC	594	713	831	950	
5%	ACL Option 1	500	667	831	950	
5%	ACL Option 2	475	633	792	950	
15%	ABC	531	638	744	850	
15%	ACL Option 1	500	638	744	850	
15%	ACL Option 2	425	567	708	850	
25%	ABC	469	563	656	750	

25%	ACL Option 1	469	563	656	750	
25%	ACL Option 2	375	500	625	750	

Table 4. Maximum P* values and the associated percent reduction under different measures of scientific uncertainty (CV) for two different F_{MSY} proxies that will cause the 40-10 adjustment to become irrelevant under control rule option 1.

Adjustment component	F_{MSY} proxy = 0.4 or 0.5			
P*	0.27	0.29	0.33	0.36
CV	0.36	0.40	0.50	0.60
% Reduction from OFL	0.20	0.20	0.20	0.20

Adoption of Harvest Control Rules for Flatfish

A revised corollary to the 40-10 harvest control rule, 25-5 control rule, has been developed for flatfish and reviewed by the SCC groundfish subcommittee. This minimum stock threshold is a slight reduction from the 25-6.25 control rule originally approved by the Council. This difference from the original 40-10 control rule reflects the higher productivity of flatfish stocks relative to other groundfish species, allowing a lower relative threshold as evidenced by the Council's decision on setting MSST at 50% of the B_{MSY} target. The overfished threshold biomass would still be 12.5% of unfished biomass for flatfish species.

Between 12.5% and 25% of unfished biomass, the interaction between the scientific uncertainty buffer and the 25-5 harvest control rule should be addressed in a way that is analogous to the decision regarding the 40-10 control rule for other ground fish species. The changes to the harvest control rule should be established in the FMP language.

Other Management Tools

Annual Catch Targets (ACTs)

It has been demonstrated that the current management system in the Pacific Ocean off Washington, Oregon, and California has resulted in catches exceeding optimum yield (OY) for eight species since 2000 (Agenda Item E.4.a, Attachment 4). Although management in this region has improved since the early 2000s, annual harvest in excess of OYs continues to occur. Reasons for these overages include delayed catch reporting, imprecise catch projections, interannual variability of catches, and other reasons that are related to management uncertainty. Hence, after the implementation of Amendment 23, the GMT acknowledges that certain groundfish fisheries off Washington, Oregon, and California will benefit from the implementation of accountability measures (AMs) such as annual catch targets (ACTs) to keep from exceeding ACLs (see Agenda Item G.5.b, Supplemental GMT Report, November 2009). ACTs will be beneficial as targets set below ACLs to ensure that ACLS are not exceeded due to management uncertainty, or as harvest guidelines (Agenda Item E.4.a, Attachment 4).

Therefore, the GMT recommends that (a) Amendment 23 continue to include ACTs in the management of west coast groundfish fisheries and (b) make the term “harvest guideline” equivalent to the term “annual catch targets.”

PFMC
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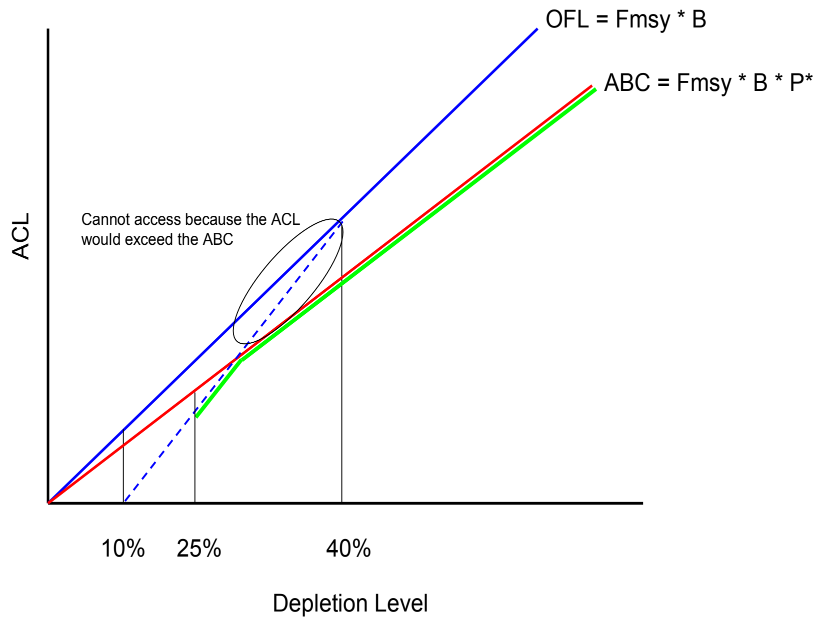
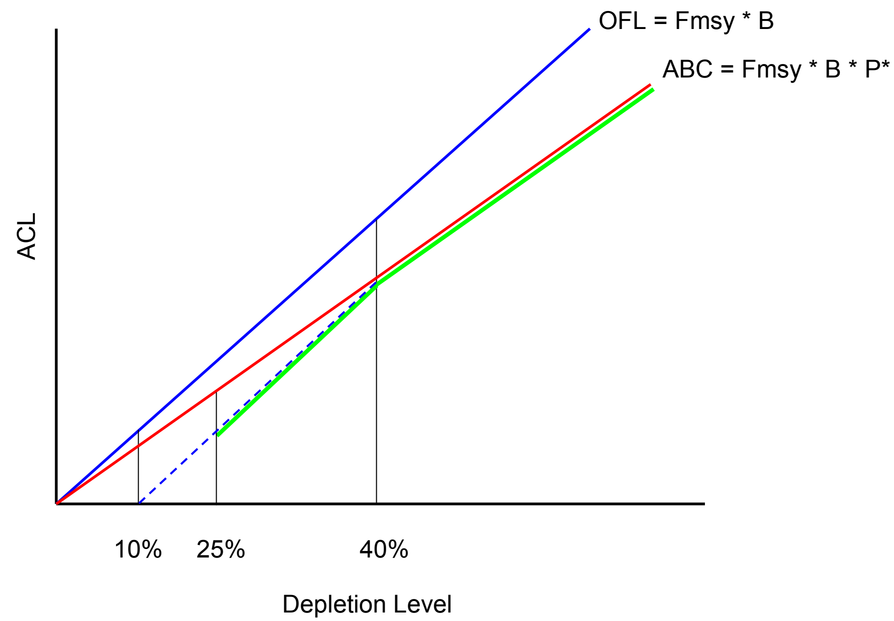
Option 1: more direct translation of 40/10 control rule (more like SQ)



Option 2: more precautionary approach to application of the 40/10 control rule



An Approach to Quantifying Scientific Uncertainty in West Coast Stock Assessments

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March 1, 2010

Summary

Quantifying scientific uncertainty in estimating an appropriate catch level for a fish stock is challenging. Multiple sources of error can easily be identified, including measurement error that is conditioned on the adopted model, model specification error, forecast error, and uncertainty about overall stock productivity. In addition, there are without doubt other unknown factors that will negatively influence the precision of scientific advice on catch levels. Notwithstanding these difficulties, the Magnuson-Stevens Act (MSA) as amended in 2007 requires the Scientific and Statistical Committees (SSCs) of the Regional Fishery Management Councils to provide an acceptable biological catch (ABC) recommendation. According to the revised National Standard 1 Guidelines, ABCs must account for scientific uncertainty in estimates of overfishing limits (OFLs). Moreover, the ABC is the catch level that annual catch limits (ACLs) may not exceed.

While many sources of uncertainty exist, the focus here is on quantification of statistical measurement error and model specification error, particularly the latter. While not all inclusive, the study of these two factors is feasible using the information that is currently available. They are also likely to include the dominant sources of scientific uncertainty in the development of scientific advice with respect to catch levels at the Pacific Fishery Management Council for groundfish and coastal pelagic species.

Although full Bayesian integration through MCMC calculations is a preferred method of estimating measurement error "within" a stock assessment, an insufficient number of studies have successfully achieved that type of analysis. Consequently, we report the first order approximate estimates of the standard error on terminal biomass from stock assessments that are calculated by inverting of the model's Hessian matrix (i.e., the asymptotic standard error). To summarize variation "among" stock assessments, as a proxy for model specification error, we characterize retrospective variation among multiple assessments of the same stock.

Results show that for 17 groundfish and coastal pelagic species the mean of the coefficient of variation on terminal biomass is 18%. This represents the average amount of statistical measurement error within assessments conducted for the PFMC. In contrast, the average coefficient of variation ascribable to model specification error (i.e., among assessment variation) is 37%, which is the greater of the two sources of uncertainty. Given these results, if only this source of variation is considered, and the probability of overfishing is fixed at 0.40, an appropriate buffer on the overfishing catch level is to reduce the harvest by ~9%.

Introduction

The Pacific Fishery Management Council currently manages a wide variety of west coast fish stocks under four different Fishery Management Plans (FMPs), including groundfish, coastal pelagic species (CPS), salmon, and highly migratory species (HMS). In the case of groundfish, the PFMC adopts optimum yields (OYs) for the fishery on a biennial basis following application of a harvest control rule to the results of stock assessments. Functionally, this procedure involves four separate calculations: (1) estimation of exploitable biomass for the current year, (2) projecting the population forward for several years into the near future, (3) applying a harvest rate to the projected population that would be expected to produce Maximum Sustainable Yield (MSY) in the long term, and (4) adjusting the projected catch downwards to account for a variety of factors of particular concern to management if the stock is assessed to be below a specified target level. Application of the MSY harvest rate ($\boldsymbol{F_{MSY}}$ or its proxy) to the projected stock biomass results in an estimated Allowable Biological Catch (ABC)[1], which has been considered an upper bound on annual catches, i.e., catches in excess of the ABC represent "overfishing." Adjustment of the ABC catch downwards to account for the concerns of management then results in an OY. An example of such an adjustment is the 40:10 groundfish harvest control rule that reduces OY relative to the ABC once the biomass of a stock drops below 40% of its unfished level. Hence, under the Council's traditional approach to setting groundfish catch levels, the ABC is the absolute upper limit on annual catch, whereas the OY incurs some reduction in catch to account for a variety of conservation concerns to management. A comparable procedure is in place for CPS, except that the OY is termed a harvest guideline (HG).

The Magnuson-Stevens Fishery Conservation and Management Act (MSA) as amended in 2007 requires the establishment of Annual Catch Limits (ACLs)[2] to prevent overfishing and measures to ensure accountability. An annual catch limit represents a numerically specified upper limit on total fishing mortality that should not be exceeded, and defines the level of annual catch that serves as the basis for invoking accountability measures[3]. In addition, the MSA stipulates that the Scientific and Statistical Committees (SSCs) of each of the eight regional Fishery Management Councils are now required to recommend an acceptable biological catch (ABC) to their respective Councils, and which the NS1 Guidelines further explain is a reference point that accounts for scientific uncertainty in the estimate of the overfishing limit. This new requirement effectively adds a new step in setting catch levels. In particular, the application of $\boldsymbol{F_{MSY}}$ (or its proxy) to projected biomass values from a stock assessment now results in an Overfishing Limit (OFL), which is functionally identical to the old definition of the ABC in the Groundfish and CPS fishery management plans. As before, annual catches in excess of the OFL constitute overfishing. However, the NS1 Guidelines now define

[1] The symbol ABC will be used for two quantities in this document "Allowable Biological Catch" and "Acceptable Biological Catch"

[2] MSA § 303(a)(15): Fishery management plans shall "establish a mechanism for specifying annual catch limits in the plan (including a multiyear plan), implementing regulations, or annual specifications, at a level such that overfishing does not occur in the fishery, including measures to ensure accountability."

[3] See NS1 Guidelines § 600.310(f)

ABC as an annual catch amount that is reduced from the OFL in order to account for scientific uncertainty in the development of management advice by SSCs to their Councils[2]. The expectation under the Guidelines is that scientific advice that is relatively uncertain will result in ABCs that are relatively lower, all other things being equal, i.e., a precautionary reduction in catch will occur due purely to scientific uncertainty. The MSA also states that the ACL may not exceed the SSC's fishing level recommendation[4], which the NS1 Guidelines equate to the newly required ABC. Moreover, if management is unable to insure that annual catches do not exceed the ACL, possibly due to inadequate in-season monitoring of catches, the NS1 Guidelines recommend the development of an Annual Catch Target (ACT) that is specified at a level sufficiently below the ACL to insure that the ACL is not exceeded more than once in four years due to management uncertainty. The relationships of these various terms are depicted graphically in Figure 1 below.

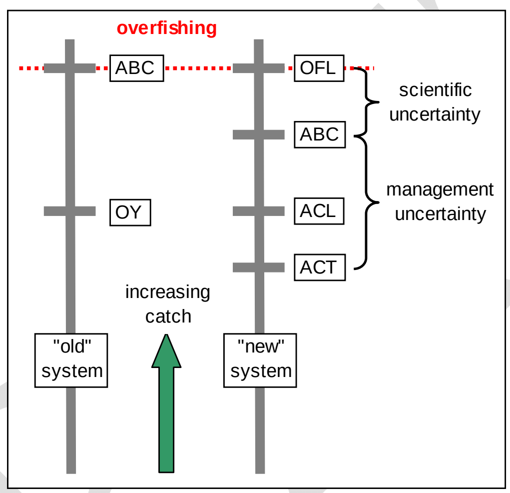

Figure 1. Relationships among the various definitions of terms under the MSA and NS1 Guidelines, and the Council's old system.

Given the new requirement that each SSC is now responsible for characterizing scientific uncertainty in a manner that allows their Council to establish a risk policy that provides a precautionary "buffer" between the OFL and the ABC, this document summarizes the Pacific Fishery Management Council SSC's preliminary approach to addressing this problem for groundfish and CPS stocks.

Sources of Uncertainty

As described previously, estimation of the OFL (formerly ABC) involves three basic steps: (1) estimation of current exploitable biomass ($\boldsymbol{B_t}$), (2) projecting the current exploitable biomass into the future for several years ($\boldsymbol{B_{t+1}}$, $\boldsymbol{B_{t+2}}$, etc.), and (3) applying an estimate of $\boldsymbol{F_{MSY}}$ to predictions of future biomass. While there are clear uncertainties associated with each step, the PFMC SSC elected to focus its attention first and foremost

[4] MSA§ 302(h)(6)

on variation in the estimation of current biomass in the terminal year of groundfish and CPS stock assessments. Our reason for doing so is aptly illustrated in Figure 2, which shows the results of 15 different Pacific whiting stock assessments that have been conducted for the PFMC over the last 18 years. It is instructive to consider this species because it is one of the most data-rich stocks managed by the Council, it is of great economic importance, and it has been assessed on an annual basis for many years. However, in spite of considerable resources having been devoted to evaluating the status of this stock, from an assessment retrospective perspective, estimates of biomass have been highly variable. Note, for example, that estimated spawning biomass in 1985 has ranged from 1.2-5.9×10^6 mt; approximately a 5-fold range in abundance.

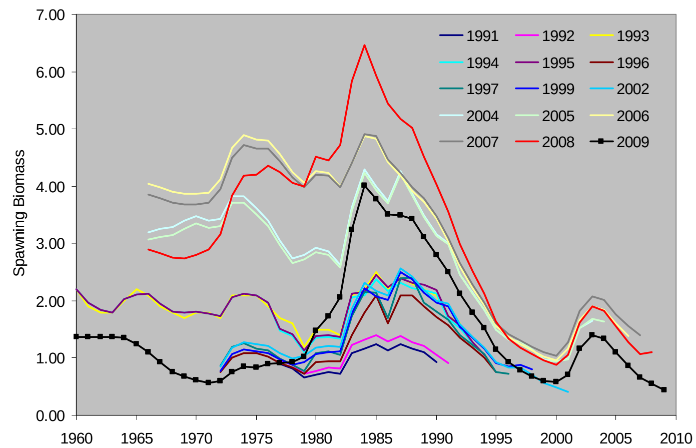

Figure 2. Results of 15 separate stock assessments of Pacific whiting conducted for the PFMC since 1991. The legend refers to the year the stock assessment was conducted.

There are many reasons for these variations in stock size estimation, including differences in: (1) the modeling software that was used, (2) the composition of the analytical team doing the assessment, (3) the composition of the review panel, (4) changes in the availability of data, (5) altered priors for the parameters, and (6) changes in overall model structure. Importantly, these issues contribute to variation in all groundfish and CPS stock assessments, which collectively demonstrate considerable "among" assessment variance. Hence, it is currently the view of the SSC that quantifying and accounting for this source of uncertainty is the first and most important to consider when establishing a buffer between the OFL and the ABC. However, as this process develops into the next biennial management cycle the SSC intends to consider other types of errors, including forecast uncertainty (Shertzer *et al*. 2008) and uncertainty in the optimal harvest rate (e.g., Dorn 2002; Punt *et al*. 2008). Hence, quantification of variation as revealed in this exercise should be considered a lower bound on total uncertainty at this time. However, even if forecast and harvest rate uncertainty were incorporated explicitly in this analysis, numerous other unaccounted for factors exist that may never be fully evaluated, including for example the effects of climate and/or ecosystem interactions on the estimation of an OFL.

Quantifying Biomass Uncertainty

For our analysis we initially consider two types of uncertainty in biomass estimation. The first we term "within" assessment variability and is represented by the coefficient of variation (CV) for the terminal year biomass taken from the most recent stock assessment that has been conducted, whether it was a full or update assessment. In a very limited number of studies (e.g., Pacific Ocean perch) full Bayesian integration of uncertainty via Monte Carlo Markov Chain (MCMC) analysis has been achieved. Such cases are unusual, however. Consequently, we report the asymptotic standard error estimate on terminal biomass developed by inverting of the model's Hessian matrix as a first order approximation of variation. This error estimate can be considered a measure of statistical uncertainty "within" a stock assessment model that is "conditioned" on all the structural assumptions embedded within the model. We convert the asymptotic standard error to a CV by simple division using the terminal biomass statistic as the denominator.

However, as previously noted, "among" assessment variation is attributable to a wide variety of factors, many of which represent a significant form of model or structural uncertainty. Assertion of asymptotic or dome-shaped selectivity patterns is one example, as is incorporation of age-dependent natural mortality. Such structural issues will often change from one assessment to the next. Likewise, biologically important fixed parameters often change from one assessment to the next (e.g., natural mortality or spawner-recruit productivity) and whole new data time series can be incorporated into the assessment model (e.g., the NWFSC combined trawl survey). Beyond such changes in model specification, among assessment variation includes other sources of variability due to, for example, differences in the reviewers who evaluated and approved an assessment.

To quantify among assessment variability we assembled time series of biomass from historical assessments of a stock. We excluded update assessments unless they were the most recent assessment conducted (in which case we excluded the original full assessment upon which the update was based) because of strong constraints imposed by the TOR for groundfish stock assessments on how much update assessments could change from the last full assessment. In situations where a change in biomass metric across assessments occurred (e.g., mid-year biomass in one assessment and beginning year biomass in another) we used ratio estimation (Cochran 1977) over a common time frame to standardize to a common metric across all assessments that were conducted on a stock. Lastly, we limited the number of data points under consideration to no more than the last 20 years from each assessment in order to focus our attention on variation associated with the estimation of terminal year biomass. We also trimmed the time series to include only the most recent 20, 15, 10, and 5 years to evaluate the stability of the estimates to time interval selection criteria.

Variation in biomass estimates among a set of stock assessments can be quantified in a number of ways. We evaluated three fundamentally different approaches to calculating variation around a point of central tendency, that is the population mean: (1) consider all biomass estimates in a year as equally plausible representations of reality, (2) consider the mean of biomass estimates in a year as the best estimate of central tendency, and (3) consider the most recent stock assessment as the best estimate of the population mean.

In the first approach, biomass variation between two stock assessments was quantified by forming all possible ratios of estimated abundances in common years. Specifically, if there existed an estimate of biomass (***B***) in common year ***t*** from assessments ***i*** and ***j***, we calculated: $R_{i|j,t} = B_{i,t} / B_{j,t}$, i.e., the proportional deviation of assessment ***i*** using assessment ***j*** as a standard. Based on a symmetry argument we also calculated $R_{j|i,t}$ and all the ratios were $\log_e$-transformed. Note that because $ln(R_{i|j,t}) = -ln(R_{j|i,t})$ the distributions were perfectly symmetrical. For each stock under consideration the standard deviation (σ^*) of the data was calculated. This statistic is positively biased, however, because it is based on the ratio of two random variables ($B_{i,t}$ and $B_{j,t}$). The appropriate bias correction term ($\sqrt{2}$) can be derived[5] and applied so that the corrected estimate of variation is:

$$\sigma = \frac{\sigma^*}{\sqrt{2}}$$

Thus, in method one, we used the bias-adjusted estimate of the standard deviation of the $ln(R_{i|j,t})$ as a quantitative measure of among assessment variation.

In method two, the data were log-transformed and the mean and standard deviation calculated (σ). Variation in this approach was measured as squared deviations from the annual mean in log-space. Specifically, we calculate the mean log-biomass in year ***t*** as:

$$\overline{\ln[B_t]} = \frac{\sum_i \ln[B_{i,t}]}{n_t}$$

where, as before, $B_{i,t}$ is the estimated biomass from the i^{th} assessment in year ***t*** and n_t is the number of available assessments in year ***t*** ($n_t \geq 2$). The standard deviation (σ) is then calculated as:

$$\sigma = \sqrt{\frac{\sum_t \sum_i (\ln[B_{i,t}] - \overline{\ln[B_t]})^2}{\sum_t n_t - 1}}$$

Method three is exactly the same as method two except that the mean ($\overline{\ln[B_t]}$) is replaced with the biomass estimate from the most recent stock assessment, and the most recent year is excluded from the summations and the calculation of the n_t. This approach assumes that the most current information represents the best estimate of the population mean.

[5] Mohr, M. S. 2009. Groundfish ABC accounting for scientific uncertainty derivation of biomass scalar. Unpublished document submitted to PFMC SSC, 4 p.

It is understood that these statistics are not valid measures of "among" assessment variance, at least in the traditional ANOVA context, because one would expect some variation in biomass estimates due to incorporation of new data, even if the structural characteristics of the model remained completely unchanged. In this regard the measured variance might be thought of as "total" variance. However, the data used from one assessment to the next are not independent of one another. The same age compositions and trend indices, for example, are used over and over again. Hence, to estimate the degree to which the "total" variance statistic was contaminated by serially correlated "within" variance, retrospective analyses of the most recent stock assessments were conducted and the variances calculated as described above. This effectively removed any model specification differences in the calculation of σ, which we term σ_{retro}. True "among" model variance could then be calculated as $\sigma^2_{among} = \sigma^2_{total} - \sigma^2_{retro}$. Given a valid estimate of σ^2_{among}, total variance could be calculated by summation with σ^2_{within} based on Hessian approximations.

In order to combine "within" and "among" sources of variation we note that for lognormally distributed random variables, the CV on the arithmetic scale is equal to:

$$CV = \sqrt{\exp(\sigma^2) - 1}$$

where σ^2 is the variance on the logarithmic scale (Johnson and Kotz 1970). When necessary we used this relationship to convert a within assessment CV to a variance term on the logarithmic scale, added the square of the among assessment log-scale standard deviation, and back-transformed the total variance to a coefficient of variation on the arithmetic scale.

Methodological Comparisons

When the data were restricted to include only the most recent 20 years (1990-2009), methods one, two, and three yielded mean estimates of σ equal to 0.382, 0.335, and 0.307, respectively. The SSC's groundfish and CPS subcommittees elected to express uncertainty using method two (squared deviations from the mean in log-space) upon consideration of these results and discussion of the relative merits of the different approaches. Similarly, a sensitivity of the results to the choice of the number of years included in the calculation, i.e., the most recent 5, 10, 15, or 20 years, showed the estimates were robust to this choice, except that σ was not estimable for some species as the time series of data was truncated to ≤ 10 years. The subcommittees recommended a standard window of time extending from 1990-2009 as the basis for quantifying variation among stock assessments based on that finding.

The evaluation of σ_{retro}, as a basis for estimating σ_{among}, showed that σ_{retro} was sometimes greater than σ_{total}. Considering that a "within" model retrospective analysis will lead, on occasion, to deletion of an entire data component, this result is perhaps not surprising, particularly if structural changes to the model were made to partially offset the effect of a new data source. Calculation of σ_{retro} as an approach to estimating a corrected σ_{among} assessments was abandoned because of this type of erratic behavior. Rather, it was concluded that whichever variance statistic was greater, i.e., σ^2_{total} or σ^2_{within} (based on the Hessian approximation), would be used as the basis for calculating the adjustment to the OFL to account for scientific uncertainty.

Following a similar line of inquiry, subcommittee members considered estimation of variation in biomass estimates from stock assessments using the information contained in the decision tables contained in stock assessments. The Terms of Reference for Groundfish Stock Assessments requires development of decision tables for use in characterizing stock assessment uncertainty. The guidance states:

> "*Once a base model has been bracketed on either side by alternative model scenarios, which capture the overall degree of uncertainty within the assessment, a 2-way decision table analysis (states-of-nature versus management action) is the preferred way to present the repercussions of uncertainty to management. An attempt should be made to develop alternative model scenarios such that the base model is considered twice as likely as the alternative models, i.e., the ratio of probabilities should be 25:50:25 for the low stock size alternative, the base model, and the high stock size alternative.*"

It is therefore possible, in theory, to express biomass uncertainty in a quantitative manner by appropriately weighting the results for different states of nature represented in the decision table. A preliminary analysis of this approach used alternative forecasts for the biomass in 2011 from decision tables to calculate log-scale $\sigma_{decision}$. $\sigma_{decision}$ would be used to calculate the ABC buffer if it were larger than both σ_{total} and or σ_{within}

The table below shows estimates of log-normal $\sigma_{decision}$ calculated by assuming: (1) the base model is the true mean and (2) weights of 25%, 50% and 25% on either the Low, Base and High alternatives (approach A), or the Low and Base alternatives, and a high alternative constructed to be equidistant in log space from the Base alternative as the Low alternative is (this is equivalent to giving the Low and Base alternative each a weight of 0.5) (approach B). The latter approach is preferred because it represents uncertainty around the base model in the lower direction, which is the direction of uncertainty we are concerned about when defining buffers to avoid exceeding OFLs.

Table 1: Uncertainty estimation based on decision table log-scale standard deviations.

Species	Abundance Measure	Approach A (Low, Base, High)	Preferred Approach B (Low, Base)
Canary rockfish	Sp. biomass	0.546	0.678
Darkblotched rockfish	Sp. output	0.671	0.792
Lingcod N. of 42º	Sp. biomass	0.052	0.062
Lingcod S. of 42º	Sp. biomass	0.442	0.551
Pacific ocean perch	Sp. biomass	0.129	0.125
Petrale sole	Sp. biomass	0.301	0.351
Splitnose rockfish	Sp. output	0.082	0.115
Widow rockfish	Sp. output	0.234	0.290
Yelloweye rockfish	Sp. output	0.371	0.332

Stock-Specific Accounts

In the accounts that follow information for 15 groundfish and 2 CPS stocks is summarized. Specifically, we include the following well-studied, relatively data-rich species: bocaccio, canary rockfish, chilipepper, darkblotched rockfish, Pacific Ocean perch (POP), shortspine thornyhead, widow rockfish, yelloweye rockfish, yellowtail rockfish, cabezon, lingcod, Pacific whiting, sablefish, Dover sole, petrale sole, Pacific mackerel, and Pacific sardine. All have been assessed using some version of the Stock Synthesis modeling program in a fully dynamic context, except for POP which uses a stand-alone forward-projection age-structured model programmed in ADMB.

The summary for each stock includes a brief description of the species, references to what assessments were included in the analysis, and whether any ratio estimation was required to standardize biomass metrics. In addition, graphs are provided depicting: (1) time series of population biomass trajectories from 1970-2009, summarized from previously completed full stock assessments [Figure 3a,b] and (2) frequency distributions of log-deviations from the mean [Figure 4a,b]. The latter form the basis of stock-specific estimates of σ_{total}.

Bocaccio (*Sebastes paucispinis*):

Bocaccio is an overfished rockfish that is currently under rebuilding (Figs. 3a & 4a). It is principally distributed in the State of California. We identified five stock assessments that could be incorporated into the meta-analysis (Ralston *et al*. 1996; MacCall *et al*. 1999; MacCall 2002; MacCall 2003; Field *et al*. In press). While earlier assessments of this species have been conducted, they did not identify a base model and instead presented a range of alternatives predicated on a predefined array of possibilities. Results from Field *et al*. (In press) were presented as mid-year total biomass, where as the four earlier studies referenced biomass at the beginning of the year. However, results from MacCall (2003) included time series in both biomass metrics and ratio estimation over the period 1951-2002 from that assessment was used to standardize to biomass at the beginning of the year ($\sum$ begin-year biomass $\div$ $\sum$ mid-year biomass = 1.044). For bocaccio the standard deviation (σ) calculated using method two (squared deviations from the mean in log-space) is 0.367 (n = 61).

Canary rockfish (*Sebastes pinniger*)

Canary rockfish is also an overfished stock under a highly restrictive rebuilding plan (Figs. 3a & 4a). It is distributed along the entire U.S. west coast and is largely responsible for the implementation of the Rockfish Conservation Area (RCA) spatial trawl area closures. For the meta-analysis we report the results of eight stock assessments (Sampson and Stewart 1994; Sampson 1996; Williams *et al*. 1999; Crone *et al*. 1999; Methot and Piner 2002; Methot and Stewart 2005; Stewart 2008; Stewart 2009). All report their results in terms of spawning biomass [mt]. However, we made the following adjustments to the abundance time series from these assessments: (1) we averaged the "base-1" and "base-2" models from Sampson and Stewart (1994), Sampson

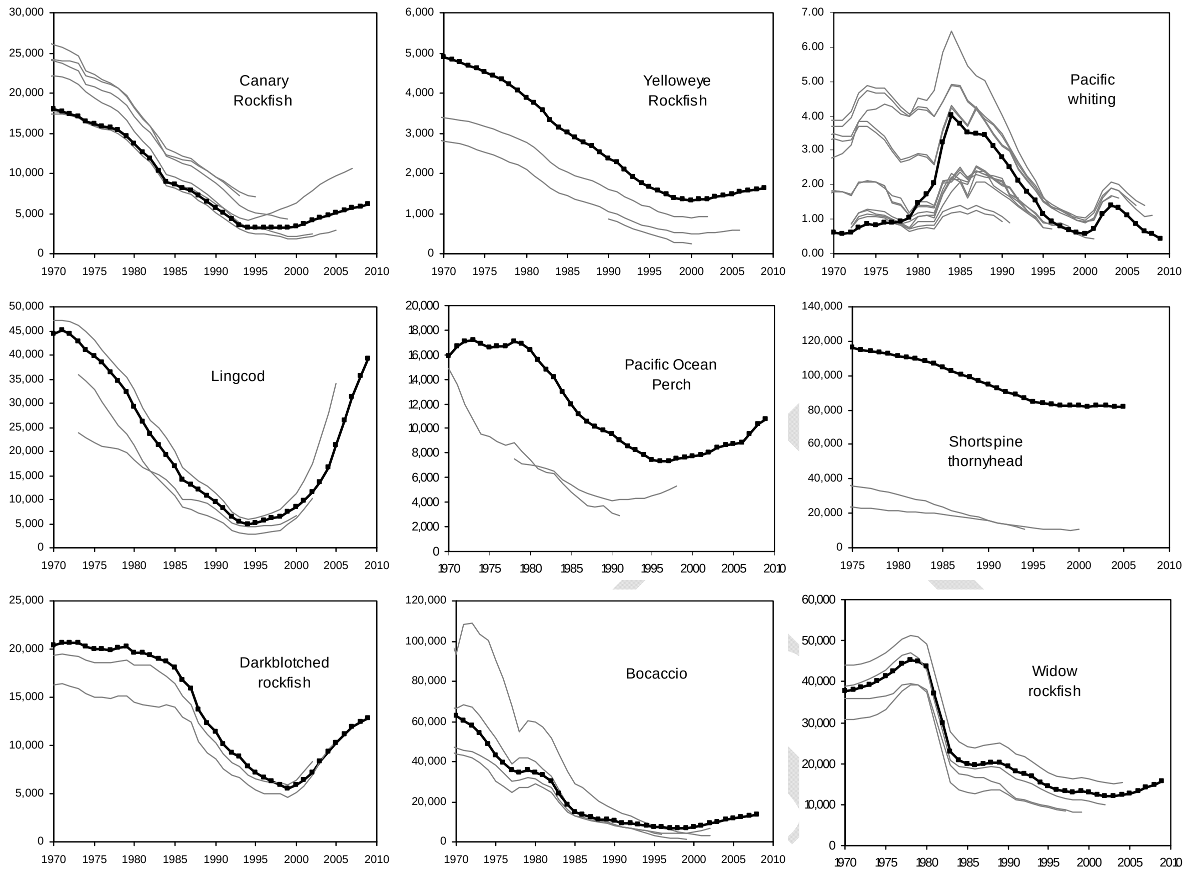

Figure 3a. Time series of biomass estimates for selected groundfish and CPS stocks that have been assessed for the PFMC. The bold line in each graph represents the most recent analysis, whereas the lighter gray lines are time series of abundance from older stock assessments. Uncertainty is measured based on the variability of estimates within years. Units of biomass are provided in the individual species-specific accounts.

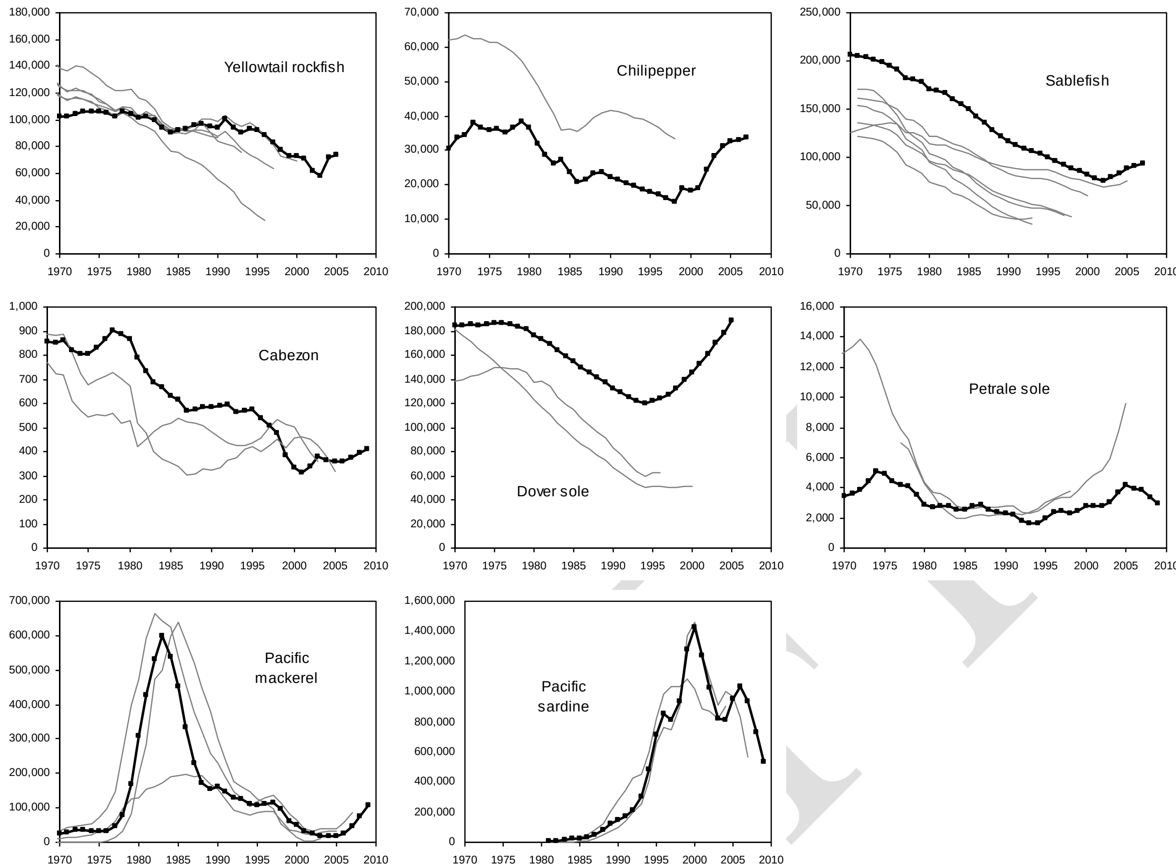

Figure 3b. Time series of biomass estimates for selected groundfish and CPS stocks that have been assessed for the PFMC. The bold line in each graph represents the most recent analysis, whereas the lighter gray lines are time series of abundance from older stock assessments. Uncertainty is measured based on the variability of estimates within years. Units of biomass are provided in the individual species-specific accounts.

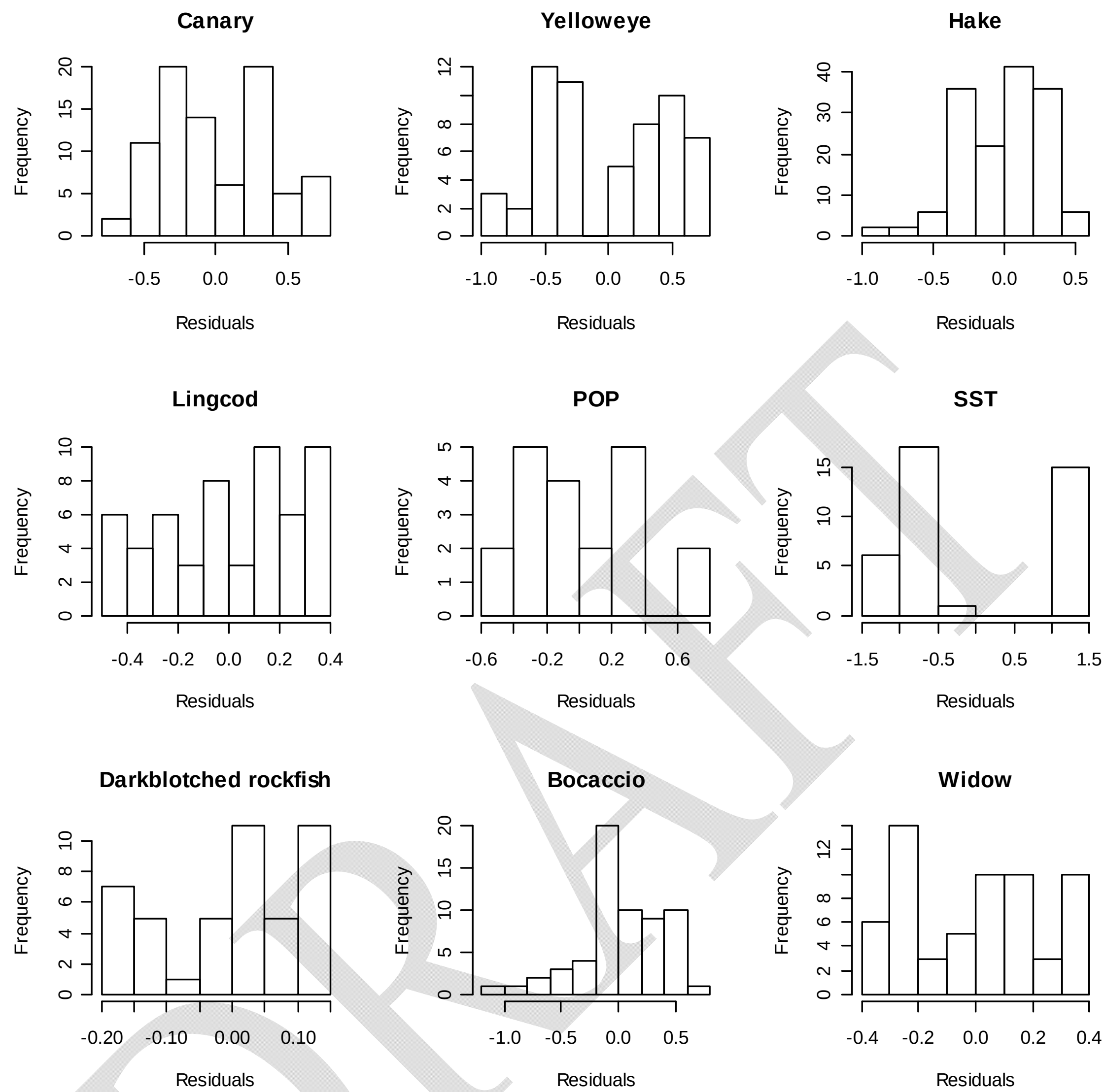

Figure 4a. Frequency distributions of log-scale biomass deviations from the mean for selected groundfish and CPS stocks that have been assessed for the PFMC.

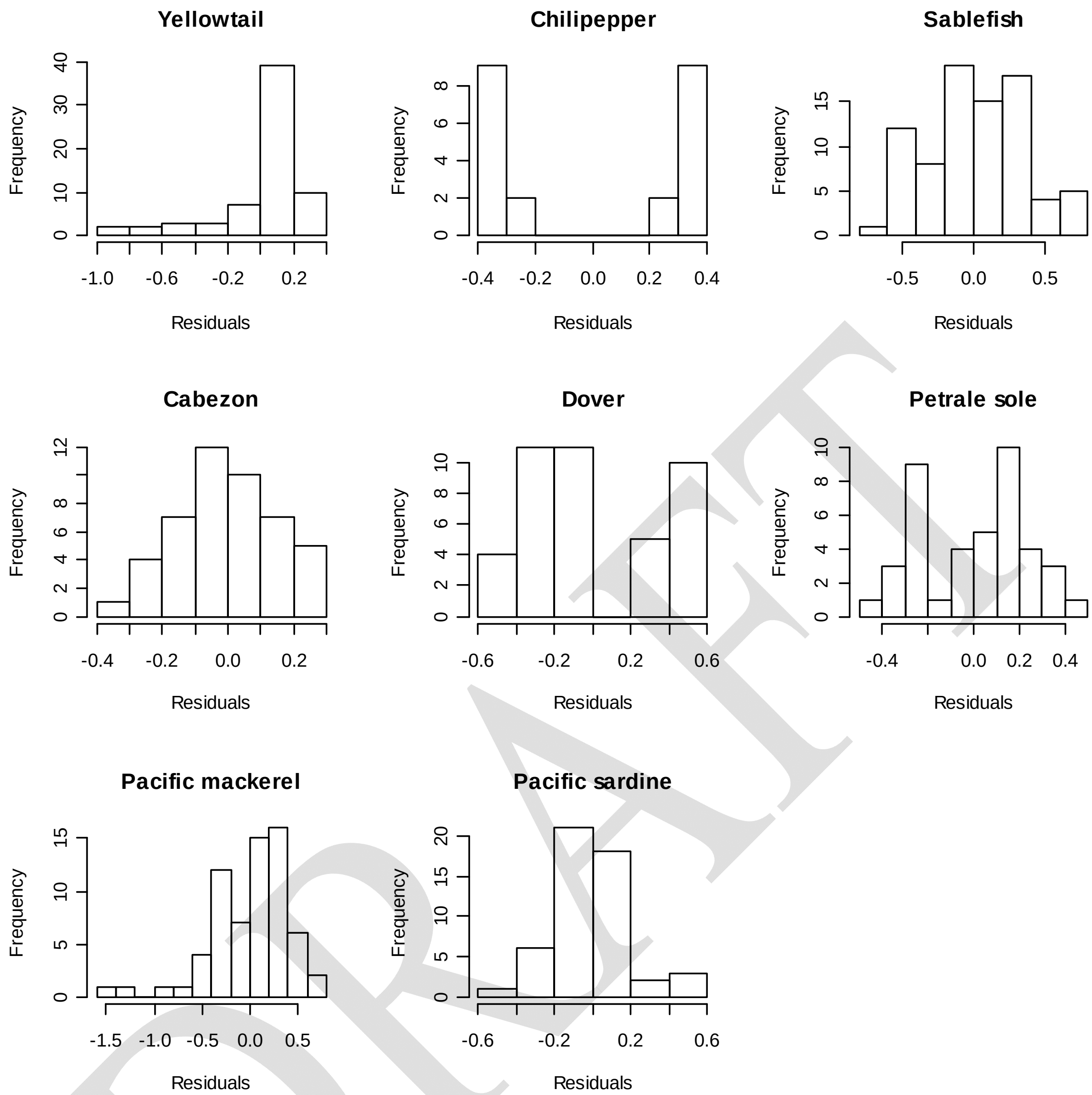

Figure 4b. Frequency distributions of log-scale biomass deviations from the mean for selected groundfish and CPS stocks that have been assessed for the PFMC.

(1996) and Crone *et al*. (1999), (2) we added the southern results of Williams *et al*. (1999) to the northern results of Crone *et al*. (1999) to obtain a coastwide estimate, (3) we used a ratio estimate developed from the period 1967-93 based on the coastwide biomass from the combined 1999 assessments relative to the north (×1.16) to expand the northern results of Sampson and Stewart (1994) and Sampson (1996) to coastwide values, and (4) we averaged the "diff" and "no-diff" models from Methot and Stewart (2005). Following these adjustments we calculate that for canary rockfish σ = 0.375 based on 85 deviations.

Chilipepper (*Sebastes goodei*)

Only two stock assessments of chilipepper were included into this study (Ralston *et al*. 1998; Field 2008). This species is currently underutilized because landings have been constrained by restrictions that have been placed on the bocaccio fishery, a species with which it regularly co-occurs. Chilipepper is predominately found only in California. No adjustments to the abundance time series were required because estimates of total age 1+ biomass were available from both assessments (Figs. 3b & 4b). We calculate that σ = 0.354 based on the variation of 22 deviations from the mean.

Darkblotched rockfish (*Sebastes crameri*)

This species is primarily distributed off the State of Oregon and is one of several overfished rockfish stocks that are currently under rebuilding (Figs. 3a & 4a). A review of past assessments indicates that full stock assessments were conducted in 2003 and 2005 and an update assessment was completed in 2009 (Rogers 2003; Rogers 2005; Wallace and Hamel In press). All three assessment report time series of total age-1+ biomass and summarize the stock over the same geographical area. Consequently, no standardization of biomass metrics was required. Analysis of the 45 data points yields a standard deviation of 0.103.

Pacific Ocean perch (*Sebastes alutus*)

Like the preceding species, Pacific Ocean perch (a.k.a. POP) is a northerly distributed overfished rockfish stock (Figs. 3a & 4a). Large removals occurred due to distant water foreign fishing fleets in the 1960s and POP was one of the first stocks of conservation concern to the PFMC. Based on an examination of material in previous PFMC Stock Assessment and Fishery Evaluation (SAFE) documents it was determined that only the assessments conducted in 1992, 1998, and 2009 (an update) could be included in this analysis (Ianelli *et al*. 1992; Ianelli and Zimmerman 1998; Hamel 2009). All of these studies provided time series of stock size in terms of total biomass. A summarization of the data yielded 20 deviations and resulted in σ = 0.352.

Shortspine thornyhead (*Sebastolobus alascanus*)

Shortspine thornyhead is a member of the "DTS" complex (Dover sole, thornyhead, and sablefish) and is harvested primarily in the continental slope trawl fishery (Figs. 3a & 4a). Like rockfishes, it is a member of the scorpionfish family, although it has quite different life history characteristics (e.g., oviparity). For this study three stock assessments were identified for detailed analysis (Ianelli *et al*. 1994; Piner and Methot 2001; Hamel 2005); no standardization of time series was required. Results show that the standard deviation of the 39 anomalies was 0.923. The estimate of among assessment variances was highest for this stock because of the markedly different biomass time series due to a change from an assumption of asymptotic to dome-shaped selectivity in the 2005 assessment. (Fig. 3a).

<u>Widow rockfish (*Sebastes entomelas*)</u>

This species is another overfished rockfish that is under rebuilding (Figs. 3a & 4a). Five assessments met the necessary criteria for inclusion in the meta-analysis: Ralston *et al*. (1997), Williams *et al*. (2000), He *et al*. (2003), He *et al*. (2006), and He *et al*. (In press). All studies reported total spawning output, although the data presented in Ralston *et al*. (1997) scaled differently relative to the other assessments. Hence, a ratio estimate was developed to convert spawning output from that study to be equivalent to the others. To accomplish the standardization the ratio of the sums of spawning output (SO) over the period 1970-97 was utilized, i.e., (∑ SO 2000 model) / (∑ SO 1997 model) = 0.083. Following standardization the 61 data points resulted in σ = 0.241.

<u>Yelloweye rockfish (*Sebastes ruberrimus*)</u>

This is yet another overfished rockfish stock that is found along the entire US west coast, typically in rockfish shelf habitats. Six assessments have been completed since 2001 (Figs. 3a & 4a), although two were updates and could not be utilized. The remaining four assessment were used here, i.e., Wallace 2001; Methot *et al*. 2002; Wallace *et al*. 2006; Stewart *et al*. In press. Results obtained from the most recent asessments (Stewart *et al*. In press) presented stock size in terms of larval production, whereas the three earlier assessments presented spawning biomass. The former statistic was therefore converted to units of spawning biomass using ratio estimation over the period 1924-2006. Specifically, results in Wallace *et al*. (2006) showed that (∑ spawning biomass) / (∑ total biomass) = 0.429, which when multiplied by the total biomass estimates provided in Stewart *et al*. (In press) to calculate estimates of spawning biomass. The standard deviation of the 58 values resulted in σ = 0.492 after standardization of the time series.

<u>Yellowtail rockfish (*Sebastes flavidus*)</u>

This more northerly species, like chilipepper, has been underutilized in recent years due to constraints placed on it by concerns over other overfished rockfish, including canary and widow rockfish (Figs. 3b & 4b). Six assessments were identified that could inform the estimation of scientific uncertainty in stock size estimation (Tagart 1991; Tagart 1993; Tagart and Wallace 1996; Tagart *et al*. 1997; Tagart *et al*. 2000; Wallace and Lai 2005). All stocks reported the abundance of yellowtail rockfish in terms of total age-4+ biomass, which was summed over three sub-regions. However, the first four assessments each presented two alternative models, which were averaged for this analysis. This produced 66 deviations, resulting in a standard deviation of 0.269.

Cabezon (*Scorpaenichthys marmoratus*)

Cabezon is a member of the sculpin family (Cottidae) that inhabits shallow, high relief reef systems in California and Oregon (Figs. 3b & 4b). Three stock assessments have been completed for this stock and were evaluated as part of the meta-analysis (Cope *et al*. 2004; Cope and Punt 2006; Cope and Key In press). The first assessment of cabezon did not report spawning output in the same units as the last two studies. A ratio estimate of the 1970-2003 summed spawning outputs from the 2006 and 2004 assessments was therefore used to standardize the 2004 data (2006 units = $1.06 \times 10^{-3} \cdot$ 2004 units). After standardizing the data, 46 anomalies were calculated, yielding $\boldsymbol{\sigma} = 0.154$.

Lingcod (*Ophiodon elongatus*)

Lingcod is a large hexagrammid west coast species of considerable importance to both commercial and recreational fisheries. While once overfished, it recovered rapidly and is currently forms the basis for a productive fishery. Four stock assessments (Figs. 3a & 4a) were include din the meta-analysis: Jagielo *et al*. (2000), Jagielo *et al*. (2003), Jagielo and Wallace (2005), and Hamel *et al*. (In press). All assessments reported biomass time series in equivalent units and no standardization was required. Analysis of the 56 values led to a standard deviation of 0.263.

Pacific whiting (*Merluccius productus*)

Pacific whiting, also known as Pacific hake, has been assessed more times than any other groundfish stock. It is a gadoid species that undertakes annual migrations along the entire U.S. west coast to summer feeding grounds off Oregon, Washington, and British Columbia. Time series of spawning biomass from 15 different stock assessments (Figs. 3a & 4a) were summarized for the meta-analysis (Dorn and Methot 1991, 1992; Dorn *et al*. 1993; Dorn 1994, 1995, 1996; Dorn and Saunders 1997; Dorn *et al*. 1999; Helser *et al*. 2002, 2004, 2005, 2006; Helser and Martell 2007; Helser *et al*. 2008; Hamel and Stewart In press). The four assessments conducted from 2004-2007 each presented two separate models that differed due to assumptions about the acoustic survey $\boldsymbol{q}$; these were averaged within each assessment to produce a single assessment-specific time series for this analysis. Analysis of the 151 log-differences yielded $\boldsymbol{\sigma} = 0.286$.

Sablefish (*Anoplopoma fimbria*)

Sablefish is a very important commercial species that is harvested in fixed gear and trawl fisheries operating on the continental shelf and slope. It is found along the entire U.S. west coast. Seven stock assessments (Figs. 3b & 4b) were incorporated into the meta-analysis (Methot 1992; Methot *et al*. 1994; Crone *et al*. 1997; Methot *et al*. 1998; Schirripa and Methot 2001; Schirripa and Colbert 2005; Schirripa 2007). All analyses reported stock size in terms of spawning biomass. However, the 1997 and 1998 assessments presented two and three, respectively, different model scenarios that were blended (averaged) into a single representation for each assessment. From these data a total of 82 deviations were calculated, which yielded an estimated standard deviation of 0.340.

Dover sole (*Microstomus pacificus*)

This flatfish species is a member of the continental slope DTS complex that is harvested by trawl fisheries along the whole west coast. Although the stock has been assessed for many years, only three assessments (Figs 3b & 4b) were utilized in the meta-analysis because of changing geographic stock definitions. For this study we summarized spawning biomass estimates from Brodziak *et al*. (1997), Sampson and Wood (2001), and Sampson (2005). Even then a ratio estimate (1967-96) was required to expand the 1997 assessment results (Monterey to US Vancouver INPFC areas) to a coastwide estimate (×1.42). Following standardization a total of 41 log-deviations were calculated, with $\sigma = 0.360$.

Petrale sole (*Eopsetta jordani*)

This is a high-value flatfish species that is taken in trawl fisheries along the entire west coast. It has been fished intensively for decades. We analyzed results from three petrale sole stock assessments (Figs. 3b & 4b), including Sampson and Lee (1999), Lai *et al*. (2005), and Haltuch and Hicks (In press). Results in all documents are presented as time series of spawning biomass and consequently no standardization to a common abundance metric was required. From the three reports 41 anomalies were calculated, resulting in a standard deviation of 0.227.

Pacific mackerel (*Scomber japonicus*)

Pacific mackerel is a CPS species that is fished primarily off the State of California and Mexico in "wetfish" purse seine fisheries. Two update stock assessments were excluded from the meta-analysis, but four other full assessments were included (Hill and Crone 2004, 2005; Dorval *et al*. 2007; Crone *et al*. 2009) (Figs. 3b & 4b). All assessments report population abundance in terms of spawning biomass [mt] and no ratio-based standardization was needed. From those four citations 66 deviations were calculated, resulting in $\sigma = 0.415$.

Pacific sardine (*Sardinops sagax*)

The last species considered in this analysis is Pacific sardine, which is a very important CPS species that is harvested from Mexico to Canada in purse seine fisheries. We considered three full sardine stock assessments (Figs 3b & 4b) in the analysis, including Conser *et al*. (2004), Hill *et al*. (2007), and Hill *et al*. (2009). All three assessment documents reported population abundance in terms of spawning biomass over a common geographical area and no standardization of metrics was required. A total of 51 log-anomalies were obtained, with a standard deviation of 0.206.

Synopsis: Seventeen species were considered in this analysis and individual stock-specific results for all are summarized in Table 2. Also included are the "within" assessment estimates of statistical uncertainty as measured by the asymptotic standard deviation derived by inverting the Hessian matrix. In order to directly compare the two measures of uncertainty, the log-scale variation among assessments was expressed as a CV on the arithmetic scale (Johnson and Kotz 1970). When plotted against one another (Fig. 5) it is evident that the total variation among stock assessments is typically greater than that within assessments. The most obvious exception to that generalization is Pacific sardine. In contrast, the total assessment CV for shortspine thornyhead (SST) is far in excess of that measured for any other stock. We note that there is not a significant correlation between the two measures of variation ($r = -0.36$, $P = 0.23$). Finally, the mean and standard deviation of the 17 total CVs is 0.359 and 0.231, whereas for within assessment CVs these statistics are 0.181 and 0.090, respectively.

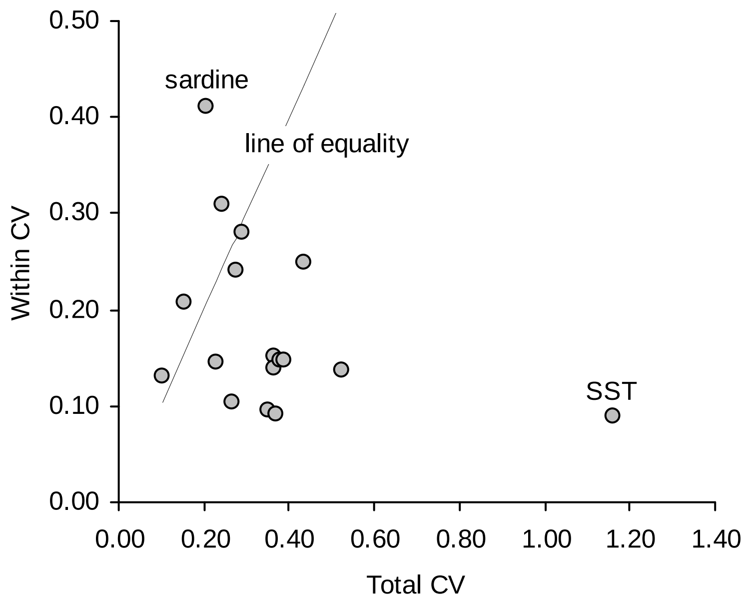

Figure 5. Relationship between the "total" coefficient of variation (CV), calculated from biomass variation over multiple full stock assessments, and an estimate of the CV based on statistical uncertainty measured "within" the most recent analysis. CVs are presented in arithmetic-scale.

Table 2. Summary of stock-specific analyses of variation in abundance estimates from assessments of groundfish and CPS species.

Group	Common Name	Scientific Name	Number of Assessments	Total Variation: Squared Deviations	Total Variation: log-scale Standard Deviation	Within Variation: Terminal Stock Size	Within Variation: Hessian Asymptotic SD	CV
Rockfish	Bocaccio	*Sebastes paucispinis*	5	61	0.367	13,251	1,962	0.148
Rockfish	Canary rockfish	*Sebastes pinniger*	7	85	0.375	6,170	911	0.148
Rockfish	Chilipepper	*Sebastes goodei*	2	22	0.354	33,619	4,713	0.140
Rockfish	Darkblotched rockfish	*Sebastes crameri*	3	45	0.103	12,847	1,670	0.130
Rockfish	Pacific Ocean Perch	*Sebastes alutus*	3	20	0.352	10,794	1,644	0.152
Rockfish	Shortspine thornyhead	*Sebastolobus alascanus*	3	39	0.923	82,151	7,394	0.090
Rockfish	Widow rockfish	*Sebastes entomelas*	5	61	0.241	15,625	4,821	0.309
Rockfish	Yelloweye rockfish	*Sebastes ruberrimus*	4	58	0.492	1,645	225	0.136
Rockfish	Yellowtail rockfish	*Sebastes flavidus*	6	66	0.269	72,152	17,396	0.241
Roundfish	Cabezon	*Scorpaenichthys marmoratus*	3	46	0.154	410	85	0.207
Roundfish	Lingcod	*Ophiodon elongatus*	4	56	0.263	39,140	4,018	0.103
Roundfish	Pacific whiting	*Merluccius productus*	15	151	0.286	434,714	122,033	0.281
Roundfish	Sablefish	*Anoplopoma fimbria*	7	82	0.340	98,831	9,435	0.095
Flatfish	Dover sole	*Microstomus pacificus*	3	41	0.360	188,987	17,313	0.092
Flatfish	Petrale sole	*Eopsetta jordani*	3	41	0.227	2,938	425	0.145
CPS	Pacific sardine	*Sardinops sagax*	3	51	0.206	529,540	217,620	0.411
CPS	Pacific mackerel	*Scomber japonicus*	4	65	0.415	108,385	27,096	0.250

Pooled Results

The PFMC's groundfish FMP includes approximately 80 species and ACLs will need to be established for all species that are "in the fishery". Of the stocks listed in the FMP, only about 25-30% have been assessed using population dynamics models, e.g., Stock Synthesis (Methot 2000). Importantly, a number of species have only been assessed once, so that total assessment biomass variation cannot always be estimated using meta-analysis, even when an assessment has been conducted. There is, consequently, some merit in pooling results from the well-studied species described here in order to develop proxy relationships for all groundfish and CPS stocks, even those that have been assessed multiple times.

Three natural groupings exist for the groundfish species we have summarized, which are classified in the FMP as rockfish, roundfish, and flatfish. In Table 2 each of the 15 groundfish stocks we considered is assigned to one of these three species groupings. In a similar manner, the two CPS species were grouped together. We considered two approaches for pooling the results for the 17 stocks: (a) taking the square root of the average of the variances, and (b) pooling all of the residuals and finding the standard deviation of the pooled set. The first approach gives each stock equal weight and hence does not overemphasize stocks for which there are many assessments, while the second treats each year data point as independent of all others. Neither approach is ideal given that lack of independence among the data. However, the outcomes of applying the two methods are very similar σ = 0.379 and 0.358 for the two approaches respectively.

Figure 5 shows the distributions of residuals for the four groups. The distribution for rockfish is closest to normal, while those for roundfish and flatfish exhibit less kurtosis than the distribution for rockfish; the distribution for CPS species exhibits a tail to the left. The pooled estimates of σ are, however, similar (Table 3).

Table 3. Comparison of different methods of pooling stock-specific variance estimates. Approach ***a*** weights each species equally, whereas approach ***b*** weights each data point equally. Reported values are estimates of σ.

Group	Approach ***a***	Approach ***b***
Rockfish (n=8)	0.442	0.418
Roundfish (n=4)	0.269	0.281
Flatfish (n=2)	0.301	0.299
CPS (n=2)	0.328	0.339

While the point estimates of σ differ among groups to some degree, the sample sizes are also very small. To explore whether the data provide support for treating each group separately, the estimates of σ^2 were fitted using a linear mixed model with group as a random effect. This analysis provided no evidence in support of stratifying by group, i.e., the point estimate of the between-group variance in σ^2 was essentially zero ($< 10^{-5}$).

Given the lack of support for between-group variability in σ, the need to treat each species as a replicate is not great and approach ***b*** (pooling all of the residuals and finding the standard deviation of the pooled set) seems most justified. This leads to an estimate of 0.36 for σ (to two significant places). Assuming the residuals are independent, an approximate 95% confidence interval for σ is [0.342, 0.374].

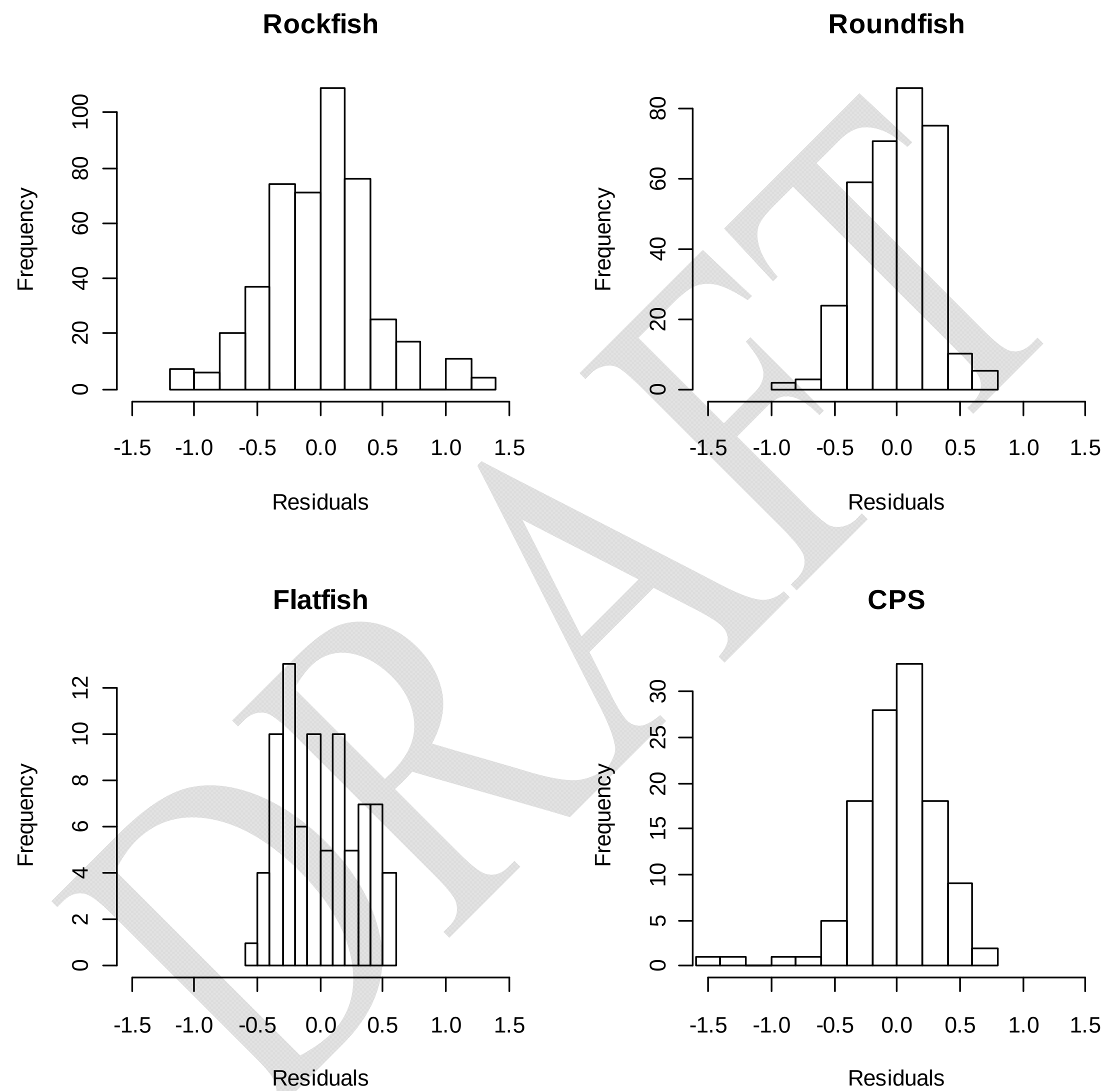

Figure 5. Composite distributions of log-deviations from the mean for rockfish (n=8), roundfish (n=4), flatfish (n=2), and CPS (n=2).

Discussion

We evaluated three methods of quantifying the scientific uncertainty in groundfish and coastal pelagic species stock assessments that have been conducted over the last 20 years for the Pacific Fishery Management Council. We concluded that measurement of log-scale variability as deviations from the mean of biomass estimates in common years from past assessments is an appropriate analytical approach to measuring variation in biomass. Moreover, a comparison of stock- and group-specific estimates of σ indicated that a single value of σ_{total} = 0.36 is a reasonable proxy for all groundfish and CPS stocks. That value translates into a CV on the arithmetic scale of 37%. Of the 17 stocks listed in Table 2, only Pacific sardine yielded a Hessian-based "within" CV that is greater (41%). On first principles variance within cannot be greater than total variance. Therefore, for sardine a stock-specific relationship with σ = 0.39 may better represent biomass uncertainty.

A preliminary evaluation of uncertainty based on an analysis of states of nature contained in groundfish decision tables was also conducted, although a complete analysis could not be accomplished in time for this assessment cycle. Still, in three of the nine cases examined, the estimate of $\sigma_{decision}$ exceeded σ_{total} = 0.36, whether calculated using approach A (low, base, and high) or approach B (low and base only). For a fourth species (yelloweye rockfish), only the non-preferred approach A produced a greater estimate of variation. In all but two cases (one being Pacific ocean perch, for which the decision table is based upon a Bayesian posterior), approach A yields a smaller variance estimate than approach B, reflecting the tendency for decision tables to express greater uncertainty in the direction of lower biomass. We view these preliminary findings as promising and recommend that a thorough analysis of statistically weighted states of nature produced for stock assessments be considered as an alternative approach to characterization of scientific uncertainty. Therefore, future decision tables should: (1) clearly define the exact probabilities of all specified states of nature and (2) should include a measure of summary or exploitable biomass in the calculations.

To illustrate how an estimate of σ can be used to quantify scientific uncertainty, and thus form the basis of an ABC control rule, we back-transform to the arithmetic scale a lognormal distribution with σ = 0.36 (Fig. 6). Note that half of the probability density is below a value of 1.00, which represents the mode of the distribution. One can then select a cumulative probability less than 0.50 that maps onto a multiplier that can be interpreted as a reduction from the point estimate of the mean of the distribution (Fig. 7). For example, 40% of the probability density is found at values ≤ 0.913. If one assumes that the mode of the lognormal distribution (1.00) is indicative of the best point estimate of catch (= OFL), 91% of that amount would associated with a 0.40 probability of exceeding the OFL. Of course an actual policy decision will need to be made as to an appropriate level of P* (the probability of overfishing), whether it be 0.40 or some other value. Likewise, this example does not include scientific uncertainty attributable to sources other than current year biomass. The groundfish and CPS subcommittees recommend that a concerted effort be made to better characterize forecast and harvest rate uncertainty so that those components of variance can be accounted for in the next management cycle.

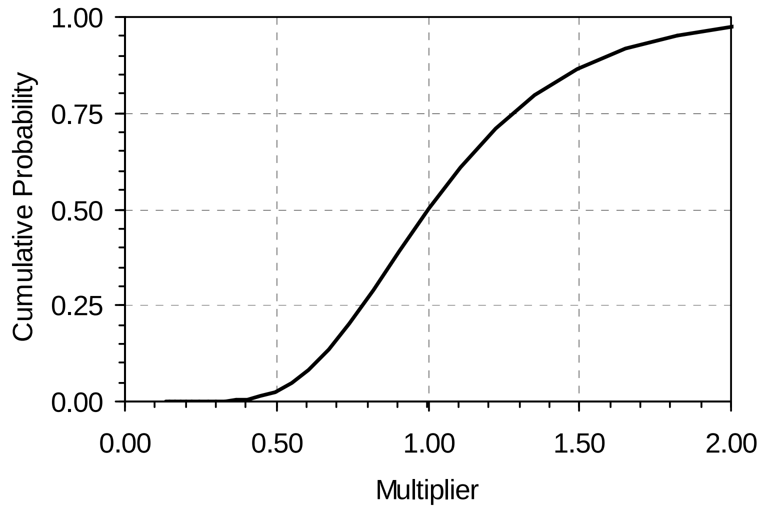

Figure 6. Lognormal probability distribution with $\sigma = 0.36$ exponentiated to the arithmetic scale.

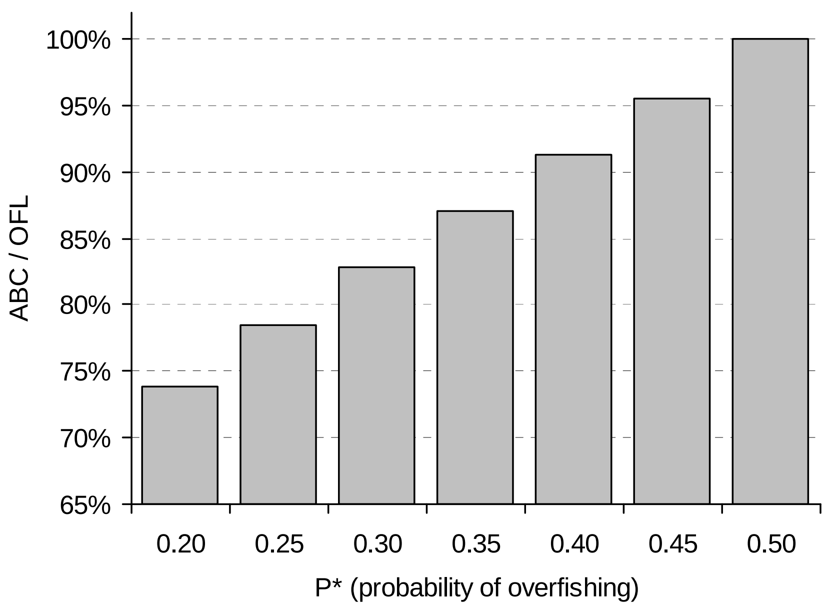

Figure 7. Relationship between the probability of overfishing (P*) and an appropriate buffer between the ABC and the OFL, based on $\sigma_{total} = 0.36$.

Acknowledgments

This study was developed by the Groundfish and Coastal Pelagic Species subcommittees of the Pacific Fishery Management Council's Scientific and Statistical Committee. Stephen Ralston conducted the analyses and prepared the document, which was then reviewed by subcommittee members, including Tom Barnes, Loo Botsford, Ray Conser, Martin Dorn, Owen Hamel, Selina Heppell, Tom Jagielo, Andre Punt, Theresa Tsou, and Vidar Wespestad. In addition, a number of people mined the primary PFMC stock assessment literature and provided the SSC with the various time series of abundance for use in the meta-analysis. In particular, we would like to offer our sincerest gratitude and thanks to Jason Cope (cabezon), Paul Crone (Pacific mackerel), John DeVore (sablefish and Dover sole), John Field (bocaccio), Melissa Haltuch (petrale sole), Owen Hamel (darkblotched rockfish, lingcod, POP, and shortspine thornyhead), Xi He (widow rockfish), Kevin Hill (Pacific sardine), Ian Stewart (canary rockfish, Pacific whiting, and yelloweye rockfish), and John Wallace (yellowtail rockfish).

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Agenda Item E.4.b
Supplemental SSC Report 2
March 2010

SCIENTIFIC AND STATISTICAL COMMITTEE REPORT ON FISHERY MANAGEMENT PLAN 23 – ANNUAL CATCH LIMITS AND ACCOUNTABILITY MEASURES

Dr. Steve Ralston briefed the Scientific and Statistical Committee (SSC) on the proceedings of the SSC Groundfish and Coastal Pelagic Species (CPS) subcommittee meeting (held with the Groundfish and Coastal Pelagic Species Management Teams in January, 2009) that met for the purpose of discussing implementation of several new requirements of the Magnuson-Stevens Reauthorization Act. (See subcommittee report, attached).

The initial discussion focused on consideration of the various methodological changes that have been made since the SSC last reviewed the analysis described in the document "An approach to quantifying scientific uncertainty in west coast stock assessments "(Agenda Item E.4.b, Supplemental SSC Report 1). It was agreed that: (1) the variance statistic from the meta-analysis (sigma=0.36 from the analysis of 17 data rich stocks) is best characterized as a "total variance" statistic and (2) in cases where within-model variance is greater, that value should be used in lieu of the meta-analysis statistic. For example, the within-model variance for sardine (0.39) is higher than the sigma value of 0.36 derived from the meta-analysis. The report was ultimately approved and the methodology was endorsed by the SSC.

The SSC recognized that this analysis is only a first step, in part because it just considers uncertainty in biomass. Going forward, it will be important to consider other sources of uncertainty, such as F_{msy}. Because of that it was also recognized that the present analysis underestimates total variance. While biomass is most likely the dominant source of uncertainty, it is anticipated that other factors will need to be considered.

The SSC recommends that a table should be provided to the council to show how the information shown in Figure 7 could be used to establish a scientific uncertainty buffer for category 1 (data rich) species. The suggested process is: (1) the SSC determines a value of sigma (e.g. using the methodology described in Agenda Item E.4.b, Supplemental SSC Report 1) and (2) the GMT uses the recommended formulation to translate sigma to a range of p* values (the probability of overfishing). Each p* is then mapped to its corresponding buffer fraction. The Council then determines the preferred level of risk aversion by selecting an appropriate p* value.

The SSC discussed two options for application the 40:10 control rule with respect to application of buffers for scientific uncertainty. The SSC agreed that choosing between these options is a policy decision for the council to make based on its preferred level of risk aversion.

The SSC also heard a presentation by Dr. E.J. Dick describing methods for determining scientific uncertainty buffers for data poor situations (i.e., category 2 and 3 species). The SSC agreed that the method of depletion-based stock reduction analysis is a useful tool for developing overfishing level (OFL) recommendations for data-poor species in cases where the requisite catch history data are available. It was noted that this method is an improvement over current practice, and is likely to yield numbers more reliable than those in place now. The SSC recommends that this approach should be used on a stock specific basis to establish OFLs for the current specification process. In cases where stocks are in multiple complexes (e.g. north/south), the analysis should parse catches by region, where possible. It was also noted that, in principle, the method allows values of p* to be selected and buffers established to account for scientific uncertainty for these species, as well. Alternatively, it was suggested that buffers could simply be set in the range of a 25-50 percent reduction in OFL.

The SSC also discussed the need to assign categories to the species in the specification tables, but did not have sufficient time to accomplish this task at the present meeting.

PFMC
03/07/10

Attachment

SSC Groundfish & CPS Subcommittee Meeting Report
(Hotel Deca, Seattle, WA – January 26-28, 2010)

The Groundfish and Coastal Pelagic Species (CPS) subcommittees of the Scientific and Statistical Committee (SSC) met with the Groundfish Management Team (GMT) and the CPS Management Team (CPSMT) at the Hotel Deca in Seattle from January 26-28, 2010. The purpose of the meeting was to discuss implementation of several new requirements of the 2006 Magnuson-Stevens Reauthorization Act (MSRA). Members of the SSC in attendance included: Steve Ralston (chair), Bob Conrad, Ray Conser, Martin Dorn, Vladlena Gertseva, Owen Hamel, Tom Jagielo, Meisha Key (Barnes alternate), André Punt, Theresa Tsou, and Vidar Wespestad.

The agenda for the meeting is attached as Appendix A and included a number of specific issues that were discussed, including characterization of scientific uncertainty, harvest control rules, productivity-susceptibility analysis, definition of stock complexes, and the development of data-poor methods. The meeting began with Council staff (John DeVore and Mike Burner) outlining the process and timelines for implementation of Amendments 23 and 13 to the groundfish and CPS Fishery Management Plans, respectively. There is particular urgency for completion of Amendment 23 as groundfish management measures need to be developed between now and June so that regulations can be in place by January 1, 2011, as required by law. This summary report of the meeting is organized according to the sequence of agenda items, with individual headings for each topic.

Review of Existing Harvest Control Rules for CPS

The group discussed to what extent existing CPS harvest control rules already reflect adjustments for scientific uncertainty. The discussion initially focused on the *FRACTION* term of the Pacific sardine harvest control rule (HCR). The *FRACTION* term of the HCR has previously been referred to as F_{MSY}. This is a misnomer in the case of sardine because in certain instances the value used for *FRACTION* can be either lower or higher than the F_{MSY} value. For example, the original analysis that was used to motivate the temperature based HCR (Jacobson and MacCall 1995) specified F_{MSY} values of 0.04 for a cool water regime, 0.16 for a moderate temperature regime, and 0.26 for a warm regime. However, when the Council adopted the CPS FMP (1999), it constrained the *FRACTION* used for management such that $0.05 \leq FRACTION \leq 0.15$. The upper limit of the FMP-constrained range ($FRACTION = 0.15$) was less than the best estimate of F_{MSY} during warm temperature regimes – in essence providing a buffer for OFL. During cool regimes, however, the lower limit of FMP-constrained range was greater than the best estimate of F_{MSY} – in essence allowing OFL to be exceeded. The conceptual work of Jacobson and MacCall was updated for use in the CPS FMP (Figure Sardine-1).

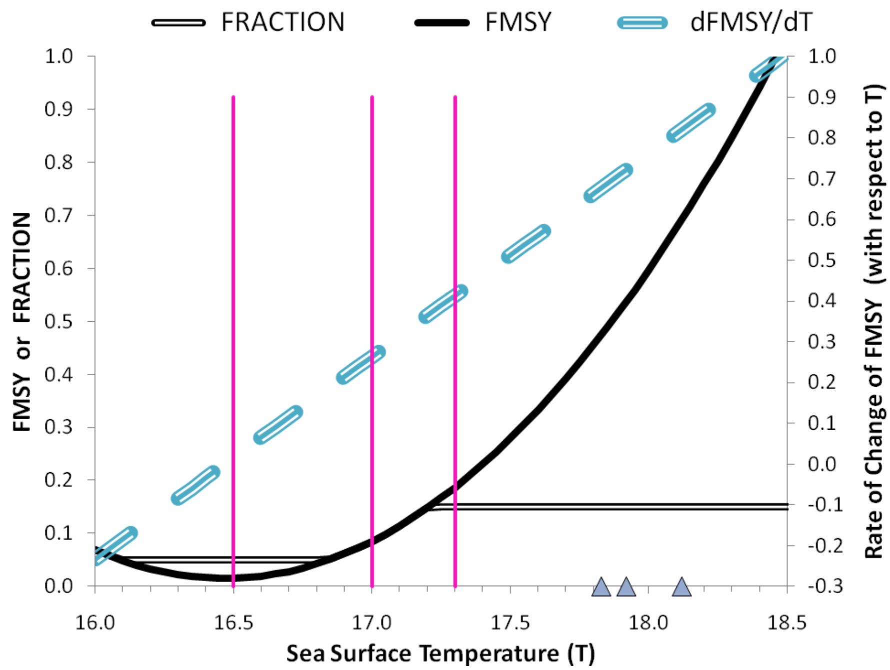


Figure Sardine-1. Pacific sardine F_{MSY} as a function of sea surface temperature (T) as used in the CPS FMP (1999). Note that while the function is conceptual based on Jacobson and MacCall (1995), it was updated for the FMP and differs somewhat from that given in Jacobson and MacCall (1995). *FRACTION* is the PFMC-imposed constraint on F that requires $0.05 \leq F \leq 0.15$. dF_{MSY}/dT is the derivative of F_{MSY} with respect to T. Vertical lines are the 25th, 50th, and 75th percentiles of SST from Jacobson and MacCall (1995). Triangles on the T axis show the SST for the last three years (from left to right: 2008, 2009, and 2007, respectively).

To evaluate the degree of buffer provided by the current HCR over the full span of temperature regimes, the SSC recommends conducting an analysis where OFL is computed using regime-specific best estimates of F_{MSY}. A comparison of those results with prospective ACLs, as they might be computed using the current HCR, would be useful in gauging the extent to which the HCR is more or less conservative than an OFL.

However, the SSC's primary responsibility is in evaluating the OFL and ABC rather than the ACL. The temperature-dependent F_{MSY} for sardine (Figure Sardine-1) is unique among F_{MSY} definitions for Council-managed species. Sardine assessment uncertainty (a combination of within and among assessment variance) is the largest of all the Council-managed species that have been examined to date – implying the need for a significant buffer between OFL and ABC. After the SSC's work on "Quantifying Scientific Uncertainty in PFMC Stock Assessments" has been completed, it will be important to compare OFL, ABC (buffered for scientific uncertainty), and ABC (subject to the PFMC *FRACTION* constraint) over a range of P* values (say 0.2 – 0.5) for cool, intermediate, and warm temperature regimes. The likely outcome is that, should the Council continue to implement its *FRACTION* constraint on F, that process may provide adequate OFL buffers for some range of warmer SSTs. However, in cooler temperature regimes, additional buffering will likely be needed.

Finally, some consideration should be given to limiting the range of SST over which the F_{MSY} function can be considered reliable. Recent SSTs are well above the bulk of the data used for deriving the F_{MSY} function (Figure Sardine-1). While this may not be a major issue for a linear function, the nonlinear sardine F_{MSY} function at current SSTs exhibits appreciable differences in F_{MSY} for rather small changes in SST. While it may not be practical to revise and/or replace this F_{MSY} function on the Council's schedule for NS1-related FMP amendment, it may be possible to suggest some reasonable sideboards to limit its use, e.g., to restrict its use to SSTs that fall below the 75th percentile of SST from the Jacobson and MacCall (1995) work.

Update on Characterization of Variation in Stock Size Based on Variation Within and Among Stock Assessments

Dr. Steve Ralston presented a brief overview of "Quantifying Scientific uncertainty in PFMC Stock Assessments".

Two main assertions were made in pursuing quantification of scientific uncertainty in stock assessments: (1) data-poor assessments cannot be more certain than data-rich assessments and (2) variation among stock assessments captures a wide variety of sources of uncertainty. Some of those sources of uncertainty include: the modeling software, the types of data incorporated into the model, model specification issues, parameter priors, STAT team composition, and STAR panel composition.

The general method undertaken in the analysis was to compare previous full assessments (or the most recent update thereof), and consider the logarithms of the ratios of the biomass estimates for each pair of assessments and their reciprocals using the last 20 years from an assessment. This provides a distribution of stock size differences in log-space and, if this variation is averaged over species, provides a general view of total biomass variation that emerges among repeat assessments of stocks, while embracing a wide range of factors that affect variability in results. While the original standard deviation (σ) reported from this method was 0.48, a revision that incorporated a correction factor[1] for using paired points ($\sqrt{2}$), revised that value down to 0.34.

The analysis also considered the CV "within" assessments as an additional source of uncertainty that could be combined with the uncertainty calculated "among" assessments in some way. It was agreed that, due to some parameters being pre-specified in some assessments, which would reduce "within" variance estimates, the median value of the distribution for the CV "within" (0.15) should be used in lieu of the reported CV, if the reported value was less than the median.

Dr. André Punt presented work that considered the above method for estimating "among" assessment variance, along with three other methods. All four approaches gave generally similar results, even though there were differences in methodology. The attending SSC members agreed that the standard method of calculating "among" assessment variance

[1] Mohr, M.S. Groundfish ABC accounting for scientific uncertainty – derivation of biomass scalar. Unpublished document dated 17 November 2009, 4 p.

should be one that starts with the most recent stock assessment, goes back a fixed number of years (20), and compares all of the assessment biomass estimates in a year to the mean estimate of biomass for that year (based on averaging over the available data). It was recommended that the rest of the analysis be carried out in a manner analogous to that described above.

The notion that, in the adopted approach, "among" assessment variance is contaminated by "within" assessment variance was raised and was discussed at some length. It was argued that variation estimated by comparing past stock assessments in the manner described was better characterized as a "total" variance statistic. Several potential methods to estimate the extent of potential double counting were proposed and, based on that discussion, a recommendation was made that an analysis using assessment retrospectives should be pursued to further evaluate the issue. Dr. Owen Hamel, Dr. Punt, and Dr. Ralston agreed to follow-up on this topic.

A discussion of productivity/susceptibility analysis (PSA) metrics then transpired and it was concluded that such metrics would likely not add useful insights to the quantification of scientific uncertainty for data-rich stocks that have been evaluated with a full assessment.

Lastly, there was discussion about the merits of estimating the probability of exceeding the true OFL by 50% (1.5×) or 100% (2×). Example analysis of these probabilities is shown in the tables below. Given that most standard errors this year are likely to be less than 0.4, limiting a P* to a maximum of 0.4 would avoid either of the below limits in most cases.

To limit to 10% the chance of exceeding the true OFL by 50%

σ (log space)	P*	Buffer Factor
0.10	0.50	1.00
0.20	0.50	1.00
0.30	0.50	1.00
0.40	0.39	0.90
0.50	0.32	0.79
0.60	0.27	0.70

To limit to 5% the chance of exceeding the true OFL by 100%

σ (log space)	P*	Buffer Factor
0.10	0.50	1.00
0.20	0.50	1.00
0.30	0.50	1.00
0.40	0.50	1.00
0.50	0.40	0.88
0.60	0.31	0.75

Reference Points and Control Rules for Monitored CPS

The monitored CPS species include jack mackerel, northern anchovy (central and northern sub-populations), market squid, and krill. Krill are a non-targeted (and currently prohibited) species that could reasonably be classified as an ecosystem component (EC) species. The lifecycle of market squid is shorter than one year and so status determination criteria are required but not an ACL. The fishery is managed by maintaining egg escapement > 30% calculated on a per-recruit basis.

Jack mackerel and Northern anchovy are targeted species that require an OFL. In the current FMP, OFL is the product of biomass, F_{MSY}, and a distribution fraction (portion vulnerable in the US) for these species. ABC is then established at 25% of OFL. The values used for biomass and F_{MSY} are quite dated and should be re-evaluated. The applicability of the 75% buffer should also be reviewed.

The specific values for jack mackerel are: OFL = 195,000mt × 0.65 = 124,800mt; ABC = OFL × 0.25 = 31,000mt. The group discussed the idea of setting an annual catch target (ACT) at 4,000mt (the highest recent catch). For northern anchovy (northern subpopulation), the biomass from a recent acoustic survey is 159,800mt, but F_{MSY} is unknown. For the central subpopulation, OFL = 123,000mt × 0.82. The group discussed the idea of setting an ACT at 19,000mt (highest recent catch).

Productivity and Susceptibility Analysis for Groundfish

Dr. Jason Cope reported on the progress made by the PFMC GMT and the NMFS Vulnerability Evaluation Work Group (VEWG) for determining the vulnerability of a stock. The vulnerability of a stock to becoming overfished is defined in the National Standard 1 (NS1) guidelines as a function of its productivity and susceptibility to the fishery. The guidelines note that the "vulnerability" of fish stocks should be considered when: (1) differentiating between stocks "in the fishery" and ecosystem component stocks, (2) assembling and managing stock complexes, and (3) creating management control rules.

The productivity and susceptibility of a stock was determined by providing a score ranging from 1 to 3 for a set of attributes related to each component. Currently there are 10 attributes for productivity that reflect stock life history and 12 attributes that reflect susceptibility to the impacts of fishing and management. The table below lists all attributes evaluated in the productivity-susceptibility analysis (PSA):

productivity attributes	**susceptibility attributes**
population intrinsic growth rate (*r*)	management strategy
maximum age	areal overlap
maximum size	geographic concentration
von Bertalanffy growth rate (*k*)	vertical overlap
natural mortality	fishing rate relative to M
measured fecundity	biomass of spawners (SSB) or other proxies
breeding strategy	seasonal migrations
recruitment pattern	schooling/aggregation and other behaviors
age at maturity	gear selectivity
mean trophic level	survival after capture and release
	desirability/value of the fishery
	Fishery impact to habitat

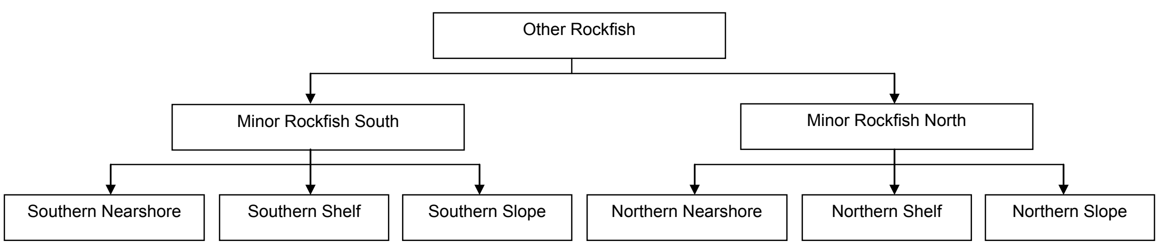
PSA scores have been calculated for all groundfish stocks and were graphically displayed on an x-y scatter plot. Stocks with a low productivity score and a high susceptibility score were considered to be more vulnerable, while stocks with a high productivity score and low susceptibility score were considered to be less vulnerable. Vulnerability is calculated as the Euclidean distance from the origin {3,1}. Each attribute score is also evaluated for the quality of the data used to determine the score. Data quality scores range from 1 to 5, where low numbers indicate better quality.

A four step approach was presented to define the relationship between fisheries and appropriate stock complexes: (1) calculate PSA scores for each species in the FMP, (2) identify the overlap in distributions of each species based on latitude and depth range, (3) assign each species to the various fisheries, and (4) overlay the groupings onto the PSA plot. The GMT is finalizing PSA vulnerability scores for west coast groundfish and completed a cluster analysis based on latitude and depth to identify spatial overlaps. Preliminary results indicate that there is a need to adjust the assignment of FMP stocks to complexes.

Description of Existing Methods for Determining ABCs for Stock Complexes

John Devore provided an overview of current groundfish stock complexes and existing harvest specifications (ABCs and OYs) for these complexes. There are currently six rockfish complexes and two non-rockfish complexes.

The “Other” rockfish complexes are classified as shown below:



These rockfish assemblages contain a large number of species. Some species with coastwide distributions may be managed in a complex in one region and stock-specifically in the other region. An example is bocaccio, which is managed in the “Minor Rockfish North – Northern Shelf” complex north of lat. 40°10’N and as a specific data-rich stock to the south of that management line. For some stocks considerable information is available; for many others we know very little.

For species with some fishery-independent survey information available, Rogers *et. al.* (1996) calculated species-specific harvest specifications (ABCs) using an approach where F_{MSY} was set equal to the natural mortality rate (M) applied to swept-area biomass. In 2000, these ABCs were reduced to account for scientific uncertainty by applying a 25% buffer (i.e., OY = 0.75 × ABC). For species with little information other than landings statistics, average historical catch was used to set ABCs, and OYs were calculated as either 25% or 50% of ABC (depending on the species).

Over time, several species were removed from the other rockfish complexes (for example, darkbloched and widow rockfish) and are currently managed as separate stocks. The harvest specifications for complexes are recalculated every time a species is removed. The "Other flatfish" complex includes species that have not been assessed (e.g., rex sole). Two species having somewhat more information have their ABCs set based on both average historical catch and survey abundance data (area-swept approach). Existing OYs for these two species were calculated as 25% of ABCs. The other species in the complex have their ABCs calculated based on average historical catch only, with OY set as 50% of ABC. Starry flounder was initially in the other flatfish complex, but was recently assessed (with species-specific ABCs and OYs calculated), and removed from the complex. The specifications for the complex were recalculated reliably, since the catches of starry flounder were monitored and well-documented.

The "Other Fish" complex is the most problematic. Harvest specifications were established to not to constrain the fishery, and species compositions were not monitored. Existing ABCs are based on average historical catch, and OY is calculated as 50% of ABC. Only one species in the Other Fish complex (longnose skate) has been assessed. There is no reliable way to estimate the historical contribution of longnose skate to the aggregate total for the complex because species compositions have not been monitored. There is, therefore, no way to remove it from the complex. Most species in the Other Fish complex are caught in small numbers, with some exceptions (e.g., spiny dogfish). Due to its life history characteristics this species is a cause for concern. There is consideration to remove all the elasmobranches from the "other fish" complex and to place them in their own assemblage. This would provide an opportunity for better monitoring and protection of those species, which is desirable given their life history characteristics.

It was noted that a major problem is that current harvest specifications for stock complexes have been used for decades without updating or reconsideration of ABCs. In addition, it is not clear exactly what methods and data were applied to calculate the original ABCs and OYs for each component stock in each complex. The GMT is now engaged in the process of trying to reconstruct the statistics that provide the basis for our existing harvest specifications.

In the short term, documentation of methods used to derive the existing ABCs and OYs for each component stock in each complex will be attempted by John DeVore, which should be available for review at the April Council meeting. In the long term, the goal is to determine whether stock complexes should be re-defined (based on the approaches such as PSA) and to explore new, more sensible approaches to set harvest specifications for complexes (see below).

<u>Depletion-Corrected Average Catch (DCAC) Analysis for Groundfish</u>

Dr. E.J. Dick presented results of recent work with Dr. Alec MacCall on estimating yield for data-poor stocks. His presentation compared yield distributions derived from two data-poor methods, Depletion-Corrected Average Catch (DCAC) and Depletion-Based Stock Reduction Analysis (DB-SRA), with point estimates of yield from 28 data-rich groundfish stock assessments. Both data-poor methods require time series of historical catch and four prior distributions (M, F_{MSY}/M, B_{MSY}/B_0, and relative stock status). DB-SRA also requires an estimate of age at 50% maturity. DCAC distributions are yields that were likely to be sustainable over the time period of historical catch, and these were compared to SPR proxy MSY values from the data-rich assessments. Median DCAC values for most stocks were typically below MSY (as expected), but sometimes exceeded the proxy values. The subcommittee discussed the distribution of DCAC across stocks, relative to MSY proxy values from the assessments, and the potential use of this ratio as an empirical bias-correction factor for applications to unassessed species. DB-SRA extends DCAC by using draws from the prior distributions to fully specify a delay-difference production model. This extension generates distributions of MSY, B_{MSY}, B_0, and OFL that are conditioned on the time series of catch. Dr. Dick presented two sets of results comparing yield distributions: (1) when expected relative abundance (depletion) was assumed known (set equal to that estimated in the stock assessments for the species being compared) and (2) when expected relative abundance was unknown, but was assumed to be at 40% of the unfished biomass level. The second comparison was intended to evaluate the effect of uncertainty in stock status on yield estimates. Distributions of OFL generated using DB-SRA were generally consistent with assessment results, with evidence of a slight negative bias. The subcommittee discussed how integrated (across species) DB-SRA distributions of OFL and MSY, relative to their respective assessment results, could be used to correct for potential bias.

The SSC's groundfish subcommittee inquired about the relative influence of each prior distribution on the results. The subcommittee agreed that a better understanding of which distributions have the greatest effect on model outputs would be beneficial. Factors that may determine the direction of bias relative to SPR proxy reference points should also be investigated. It was suggested that relative yield distributions be plotted against spawner-recruit steepness to evaluate its effect on yield estimates. Rejection rates, i.e., the fraction of implausible (negative) biomass trajectories, differed among species and further explanation of these differences was also considered important by the subcommittee. Interpretation of P^* for stock complexes was also discussed. In this context, P^* might be considered as the fraction of stocks within a stock complex that would likely experience overfishing.

The groundfish subcommittee endorsed application of DCAC and DB-SRA, if possible, to unassessed stocks in the groundfish FMP. Dr. Dick agreed to compile the time series of historical catch and life history information needed as inputs to the models, and will present his results to the SSC at the March 2010 meeting in Sacramento, CA.

<u>Overfishing Limits (OFLs) for Groundfish Including Revisions due to New Harvest Proxy for Flatfish Species</u>

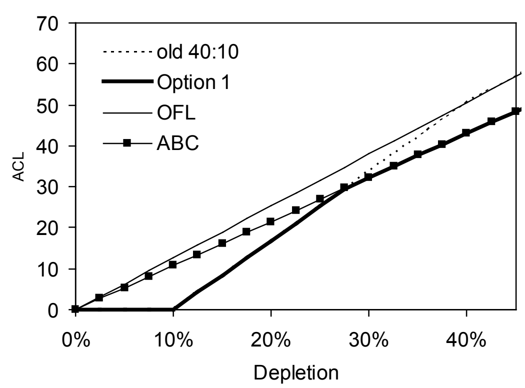
John Devore presented the list of OFLs for groundfish species, these OFLs will be discussed in detail during the March SSC meeting.

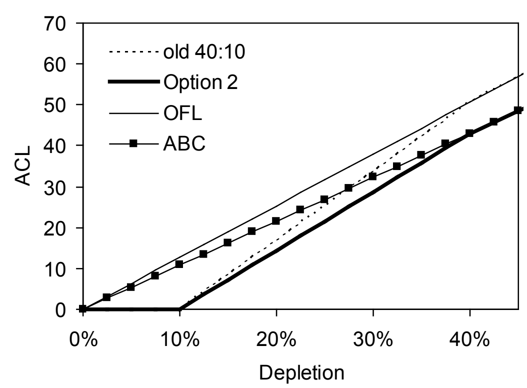
Application of the Groundfish 40-10 Rule

The SSC regards the "40-10" and analogous rules as aids in setting the ACL when stocks fall below their biomass target (B_{MSY} or its proxy). The SSC, moreover, considers the decision on how to apply the "40-10" rule in conjunction with the new ABC definition as a policy decision that should be made by the Council. The two options to consider, along with their underlying supporting philosophies/arguments, are outlined and diagrammed below. In addition, an analogous rule for flatfish is described and arguments for and against implementing such an analogous rule are presented.

Option 1: The 40-10 rule and the ABC rule would be applied separately to the OFL and the lower of the two would be the maximum acceptable ACL. The philosophy behind this approach is that the 40-10 rule and the new ABC rule (applying an offset from the OFL) are precautionary adjustments which are both attempting to achieve the same thing, namely adjusting for uncertainty in stock status and F_{MSY}, and therefore the minimum of the two should be taken.

Option 2: The 40-10 rule would be applied directly to the newly defined ABC and that value would be the maximum acceptable ACL. This would result in two reductions for stocks depleted below the target level of $0.4B_0$, one for scientific uncertainty to provide an ABC, as buffered from the OFL, and a second (the 40-10 adjustment) to provide the ACL based on the 40-10 rule. The philosophy behind this approach is that the ABC rule adjusts for uncertainty in the absolute scale of biomass or the correct F_{MSY}, whereas the 40-10 rule facilitates "rebuilding" towards the biomass target.





The SSC suggests an analogous rule to 40-10 for flatfish be the "25-5" rule, which would essentially ramp down catches linearly from 25% of B_0 to zero catch at 5% of B_0. This rule results in a 20% reduction in fishing mortality at the overfished threshold (12.5% of B_0), which is the same reduction seen in the 40-10 rule at 25% of B_0 (the overfished threshold) for rockfish. The use of such a rule in determining ACLs would achieve the same benefits as the 40-10 rule for rockfish. Given the higher productivity, in general, for flatfish compared to rockfish, the 25-5 rule should be sufficient, even given the lower absolute proportion of virgin biomass. The treatment of the 25-5 rule in conjunction with

ABCs should be equivalent to the treatment of the 40-10 rule, i.e. the choice of options 1 and 2 above should apply to flatfish as well.

An example of the ABC and ACL levels under options 1 and 2 over a range of depletion levels and scientific uncertainty buffers is given in the table below.

Example - OFL at target (B40) is 1000 mt						
			Depletion Level			
Buffer Factor		25%	30%	35%	40%	
1	ABC	625	750	875	1000	(Current ABC)
1	ACL Option 1	500	667	833	1000	
1	ACL Option 2	500	667	833	1000	(Current 40-10 rule)
0.95	ABC	594	713	831	950	
0.95	ACL Option 1	500	667	831	950	
0.95	ACL Option 2	475	633	792	950	
0.9	ABC	563	675	788	900	
0.9	ACL Option 1	500	667	788	900	
0.9	ACL Option 2	450	600	750	900	
0.85	ABC	531	638	744	850	
0.85	ACL Option 1	500	638	744	850	
0.85	ACL Option 2	425	567	708	850	
0.8	ABC	500	600	700	800	
0.8	ACL Option 1	500	600	700	800	
0.8	ACL Option 2	400	533	667	800	
0.75	ABC	469	563	656	750	
0.75	ACL Option 1	469	563	656	750	
0.75	ACL Option 2	375	500	625	750	

OFLs, ABCs, and Annual Catch Limits (ACLs) for Groundfish Stock Complexes & ABC Control Rules for Category 1, 2, and 3 Groundfish Stocks

Species in the Groundfish FMP are placed into one of three categories. Stocks in category 1 are those with quantitative assessments that allow harvest control rules and status determination criteria to be applied. Stocks in category 2 are generally those with some quantitative basis for estimating stock abundance (i.e., a time series of survey biomass estimates), while category 3 stocks are those where only estimates of landed catch are available. These categories are somewhat fuzzy in their definition, which has hampered consistent application of the framework in the past.

The Groundfish Management Team (GMT) has applied a policy of setting the OY to 75% of the ABC for category 2 stocks, and setting the OY to 50% of the ABC for category 3 stocks. Bringing management practices for category 2 and 3 stock into compliance with the new National Standard 1 guidelines will require some changes in nomenclature, but the buffers already in place were implemented to account for scientific uncertainty, and presumably reflect Council's risk preferences for data-poor species. The larger buffer for category 3 stocks reflects the greater scientific uncertainty associated with these stocks. Under such an approach, the current ABC would be designated as the new OFL, and old OY would be designated as the new ABC.

The SSC's role in making ABC recommendations for category 2 and 3 stocks would be to review the assignment of stocks to category, and to review the methods used to determine the OFLs and ABCs. The SSC, as a review body, will not be responsible for producing estimates of OFL and ABC, but will provide recommendations on the methods that are applied, and review the estimates to determine whether they represent the best scientific information.

Many of the ABCs and OYs for category 2 and 3 stocks have been established for a long time, and have been carried over from one assessment cycle to the next without further review. The basis for some of the ABCs and OYs is not readily available, and those based on Rogers *et al*. (1996) do not make use of the groundfish assessment surveys that have occurred in recent years. Given the compressed schedule for Amendment 23 and the groundfish biennial specifications process, it is unlikely that all OFL and ABC estimates for category 2 and 3 stocks can be updated and reviewed by the SSC for the 2011-12 management cycle. However, as a first step, the SSC requests that that the GMT or Council staff prepare a list of each species in the FMP with the following information:

1. Species category
2. Basis for category assignment
3. OFL
4. Basis for OFL.
5. Species complex (if any).
6. Whether the species is a candidate for the ecosystem component category.

Species complexes are used extensively for Category 2 and 3 stocks. Determining the OFL and ABCs for species complexes is a simple matter of summing the OFLs and ABCs for the species in the complex. An initial review of the current grouping of stocks into complexes showed no serious deficiencies, but suggested that further refinements may be possible. Ongoing work with PSA may provide a more objective approach to grouping species with similar life history, vulnerability to the fishery, and geographic distribution (see discussion above).

Depletion-corrected average catch (DCAC) and depletion-based stock reduction analysis (DB-SRA) offer advantages over the methods that have been used in the past to estimate ABC and OFL for category 2 and 3 stocks. The SSC encourages application of these methods to as many stocks as is feasible, but would need to review the results before recommending changes from the existing methods.

For rebuilding stocks, no additional analysis is required, as the OFL is already calculated for the rebuilding analysis. A rebuilding OY is functionally equivalent to an ACL, which must be less than or equal to the ABC.

Rogers, J.B., Wilkins, M.E., Kamikawa, D., Wallace, F., Builder, T., Zimmerman, M., Kander, M., and Culver, B. 1996. Appendix E: status of the remaining rockfish in the Sebastes complex in 1996 and recommendations for management in 1997. In Appendix Volume II to the Status of the Pacific Coast groundfish fishery through 1996 and recommended acceptable biological catches for 1997. Pac. Fish. Manag. Council, Portland, OR 97201.

Appendix A:

PROPOSED AGENDA

Management Teams and Scientific and Statistical Subcommittees for Coastal Pelagic Species and Groundfish

Pacific Fishery Management Council
Hotel Deca
4507 Brooklyn Avenue Northeast
Seattle, Washington 98105
(800) 899-0251

January 26-28, 2010

Management Team and Scientific and Statistical Committee (SSC) Subcommittee meetings for Groundfish (GF) and Coastal Pelagic Species (CPS) are open to the public and public comments will be taken at the discretion of the meeting Chair. Agenda times are approximate and are subject to change.

TUESDAY, JANUARY 26, 2010

8:30 a.m.	Welcome and Introductions
8:35 a.m.	Approval of the Agenda
8:45 a.m.	Rapporteur assignments
9:00 a.m.	Process and timelines for Groundfish FMP Amendment 23 (Devore)
9:30 a.m.	Process and timelines for CPS FMP Amendment 13 (Burner)
10:00 a.m.	Coffee Break
10:15 a.m.	Review of existing harvest control rules for CPS (Hill/Burner)
12:00 noon	Lunch
1:15 p.m.	Update on characterization of variation in stock size based on variation within and among stock assessments (Punt/Ralston)
2:15 p.m.	Expressing uncertainty – Acceptable Biological Catch (ABC) Control Rules for CPS (Hill/Burner)
3:15 p.m.	Coffee Break
3:30 p.m.	Reference points and control rules for monitored CPS (CPSMT/Burner)
5:00 p.m.	Adjourn for the day

WEDNESDAY, JANUARY 27, 2010

8:30 a.m.	Productivity and Susceptibility Analysis for groundfish (Cope)
10:00 a.m.	Coffee Break
10:15 a.m.	Description of existing methods for determining ABCs for stock complexes (Devore)
10:30 a.m.	Depletion-Corrected Average Catch (DCAC) analysis for groundfish (Dick)
12:00 noon	Lunch
1:00 p.m.	Overfishing Limits (OFLs) for groundfish including revisions due to new harvest proxy for flatfish species
3:00 p.m.	Coffee Break
3:15 p.m.	Application of the groundfish 40-10 rule (DeVore)
4:14 p.m.	ABCs and Annual Catch Limits (ACLs) for groundfish stock complexes
5:00 p.m.	Adjourn

THURSDAY, JANUARY 28, 2010

8:30 a.m.	ABC control rules for category 1, 2, and 3 groundfish stocks
10:00 a.m.	Coffee Break
10:15 a.m.	ABC recommendations for all groundfish stocks (continued)
12:00 noon	Lunch
1:00 p.m.	ACL and Annual Catch Target Strategies for groundfish stocks/complexes
2:00 p.m.	Preparation of report for SSC consideration
3:00 p.m.	Coffee Break
3:15 p.m.	Preparation of report for SSC consideration (continued)
5:00 p.m.	Adjourn

PFMC
01/25/2010

CONSIDERATION OF INSEASON ADJUSTMENTS (INCLUDING PACIFIC WHITING MANAGEMENT MEASURES AND BYCATCH LIMITS)

Management measures for the 2010 groundfish season were set by the Council with the understanding these measures would likely need to be adjusted throughout the biennial period to attain, but not exceed, the optimum yields (OYs). This agenda item will consider inseason adjustments to ongoing 2010 fisheries.

Potential inseason adjustments under this agenda item include changes to Pacific whiting bycatch limits, adjustments to Rockfish Conservation Area boundaries, adjustments to commercial and recreational catch limits, and catch estimate revisions based on the latest information from the West Coast Groundfish Observer Program.

The Groundfish Management Team and the Groundfish Advisory Subpanel will meet prior to this agenda item to discuss and recommend inseason adjustments to 2010 groundfish fisheries. After hearing this advisory body advice and public comments, the Council will consider preliminary or final inseason adjustments. Agenda Item E.8, Final Consideration of Inseason Adjustments, is scheduled for Thursday, March 11, should further analysis or clarification be needed.

Council Action:

Consider information on the status of 2010 fisheries and adopt preliminary or final inseason adjustments as necessary.

Reference Materials:

None.

Agenda Order:

a. Agenda Item Overview — Kelly Ames
b. Reports and Comments of Management Entities and Advisory Bodies
c. Public Comment
d. **Council Action:** Adopt Preliminary or Final Recommendations for Adjustments to 2010 Groundfish Fisheries

PFMC
02/17/10

GROUNDFISH ADVISORY SUBPANEL REPORT ON INSEASON ADJUSTMENTS (INLUDING PACIFIC WHITING MANAGMEMENT MEASURES AND BYCATCH LIMITS

The Groundfish Advisory Subpanel (GAP) and the Groundfish Management Team (GMT) met to discuss inseason adjustments and concerns. The GMT highlighted that, because of adjustments to projections in the scorecard, the yelloweye difference amount is lower than previous projections. Current projections indicate 99.4 percent of the yelloweye optimum yield (OY) will be attained, which would provide a 0.1 mt margin.

Based on the GMT's revised projections and because it is very early in the season, the GAP recommends the Council not make any changes in the scorecard at this time. The predictions on yelloweye impacts are based on full attainment of yelloweye amounts in directed fisheries and the EFPs. Past performance demonstrates that most likely neither will be attained, thus leaving some yelloweye margin.

With the above comments in mind, the GAP provides the following recommendations. Implementation of these recommendations will not increase yelloweye impacts beyond current projections.

WHITING SECTOR SPECIFIC BYCATCH LIMITS

The GAP discussed this issue with whiting industry representatives. Bycatch management was much smoother in 2009, in large part, because of the sector-specific limits. The 2009 amounts were sufficient to cover potential bycatch, provided sufficient incentives to not race to fish, and did not diminish opportunities in non-whiting fisheries. Therefore, the GAP recommends 2009 amounts for canary and darkblotched be used again in 2010. For widow, the GAP requests consideration of amounts higher than 2009 if the scorecard can accommodate these increases. As widow is close to rebuilt, it is possible that encounter rates could increase and constrain the whiting fishery.

SOUTH OF 36° N Fixed Gear Sablefish

Limited entry -- Remove the daily limit in the daily-trip-limit (DTL) fishery. Removal of the daily limit should reduce regulatory discards. The cumulative weekly limit would be 1,500 lb.

Open access -- Retain the daily and weekly limits, but increase the current cumulative limit of 8,000 lb per 2/months to 9,000 lb per 2/months. Currently, many fishermen are landing the 1,500 lb per week limit and the small increase from 8,000 lb to 9,000 lb would allow for six full trips per period. This would also reduce discards.

NORTH OF 36° Fixed Gear Sablefish

Open access -- Current seasonal landings are less than projected and the fish have gone un-harvested in recent years. Trip limit increases have occurred too late in the year for the northern fleet to properly attain the limits due to bad weather incurred late in the season. This fishery fishes too deep to impact yelloweye. The new limits would be as follows:

300 lb daily, one landing per week up to 1,000 lb and a bi-monthly limit of 3,000 lb.

PFMC
03/10/09

GROUNDFISH MANAGEMENT TEAM REPORT ON CONSIDERATION OF INSEASON ADJUSTMENTS (INCLUDING PACIFIC WHITING MANAGEMENT MEASURES AND BYCATCH LIMITS)

The Groundfish Management Team (GMT) considered the requests from industry representatives, the most recent information from the West Coast Groundfish Observer Program (WCGOP) and the status of ongoing fisheries.

The GMT received guidance from National Marine Fisheries Service Northwest Region (NMFS NWR) regarding timing of implementation of inseason recommendations from this meeting. Given the priority of implementation of the trawl rationalization program, among other things, NMFS does not anticipate implementing any routine inseason adjustments to fishery management measure before May 1, 2010, at the earliest.

Scorecard Updates

RESEARCH
During the 2009-2010 biennial specifications process, the Council approved a 2.8 mt yelloweye set-aside per year for research catch in the scorecard. Given all other yelloweye impacts, there was 0.5 mt residual in the scorecard projections. During 2009, the GMT received regular updates on research activities and yelloweye rockfish impacts were adjusted to 0.7 mt at the November meeting.

The GMT has received updates on proposed research activities for 2010 from NMFS NWR, Washington Department of Fish and Wildlife (WDFW), Oregon Department of Fish and Wildlife (ODFW), and the International Pacific Halibut Commission (IPHC) relative to changes in projected research catches (Table 1).

Table 1. Yelloweye rockfish research catches and projections, 2009-2010.

	2009-2010 Biennial SPEX	2009 Estimated Impacts	2010 Projected Impacts
IPHC Survey	0.7	0.3	1.1
WDFW Enhanced Rockfish	1.0	0.2	1.0
ODFW Enhanced Rockfish	0.9	0.0	1.0
Other (including NMFS trawl survey)	0.2	0.2	0.2
Total	**2.8**	**0.7**	**3.3**

The GMT also received an update that the IPHC survey will be increasing the number of skates fished in their annual Pacific halibut stock assessment survey, from 5 to 8 skates per survey station. Based on the highest catch of yelloweye per skate between 2002 and 2009, the yelloweye rockfish impacts projected using 8 skates of gear are 1.1 mt. Based on the average catch of yelloweye per skate during the same time period, the projected IPHC impacts are 0.8 mt (Table 2). The GMT currently has 1.1 mt for the IPHC survey in the scorecard, based on the maximum catch per skate value in the data as a risk averse estimate. We have used a similar approach in the past for estimating research catch because most research is not constrained by overfished species impacts. The ODFW and WDFW enhanced surveys, in contrast, have agreed to keep impacts at or below their projections. The Council may wish to choose a less risk averse estimate based on the information shown in Table 2.

Table 2. Yelloweye rockfish catch statistics from IPHC standard grid stations, 2002-2009, with projected impacts given 8 skates in 2010 and 3-year average weight (2007-2009).

Statistic	Predicted Number YE	Predicted (mt)
Median	218	0.8
75th percentile	228	0.8
90th percentile	258	0.9
Max	316	1.1
Average	157	0.7

The GMT notes that with the slightly higher projected research impacts currently in the scorecard, all yelloweye rockfish is prescribed in 2010. If the Council desires a larger yelloweye residual in the scorecard, the GMT requests guidance on what magnitude of yelloweye residual they would prefer and which fisheries should be constrained given available options (Table 3). The GMT notes that there are more options that may increase the residual in the scorecard if action is considered early in the year (i.e., under Agenda Item E.8 Inseason Part II at this meeting), and that the options for reducing yelloweye impacts later in the year may need to be more severe to get the same catch reductions.

Table 3. Fisheries and potential management actions to reduce yelloweye impacts available at this meeting. If actions are necessary later in the year, they will likely have to be more severe.

Fishery	Potential Management Actions
Non-whiting trawl	Adjust shoreward RCA, reduce trip limits
Non-nearshore fixed gear (sablefish)	Adjust non-trawl RCA north Point Chehalis (100 to 125/150 fm) or 43º N. lat. to Cascade Head (125-150 fm), reduce trip limits
Nearshore fixed gear	Reduce trip limits north 40º10 N. lat., south 40º10 N. lat. adjust non-trawl RCA or reduce trip limits
Recreational	Depth restrictions, reduce bag limit, reduce season length
EFP	Reduce YE cap, zero YE cap, postpone EFPs

NON-WHITING EFPs
The Council recommended five non-whiting exempted fishing permits (EFPs) for 2010 at their November 2009 meeting. The overfished species bycatch caps for the non-whiting EFPs were corrected in the attached 2010 scorecard.

TREATY TRIBAL WHITING BYCATCH
The GMT updated the 2010 scorecard for the tribal whiting based on the adoption of set-asides under Agenda Item E.3 Pacific Whiting Harvest Specifications. Using the methodology described in the 2009-2010 harvest specifications and management measures Environmental Impact Statement, the GMT projects impacts of 4.30 mt for canary, 0.05 mt for darkblotched, 7.21 mt for POP, and 4.99 mt for widow (Table 4).

Table 4. Estimated bycatch in the tribal whiting fisheries for 2010.

Sector	Southern Bocaccio	Canary	Darkblotched	POP	Widow	Yelloweye
Makah	0.00	1.78	0.02	2.99	2.06	0.00
Quileute	0.00	2.52	0.03	4.22	2.92	0.00
Total Tribal	0.00	4.30	0.05	7.21	4.99	0.00

RECREATIONAL

2009 Fisheries
The GMT received reports from Washington, Oregon, and California regarding catch estimates for the 2009 recreational fisheries. None of the catch estimates for Washington and Oregon indicate that harvest guidelines for overfished or target species were exceeded in 2009. The yelloweye rockfish impacts in the California recreational fishery is estimated to have exceeded the 2.8 mt harvest guideline by 1.1 mt in 2009 for a total estimated catch of 3.9 mt. There was an unanticipated increase in yelloweye rockfish catch at the end of the 2009 season. The current yelloweye rockfish catch tracking methods track catch with a one week lag, allowing timely

action inseason if needed. When the harvest guideline was projected to be exceeded, the season had already closed in the North-Central North of Point Arena Management Area and the season in the Northern Management Area was already scheduled to close within two weeks.

California Department of Fish and Game staff informed the GMT that examination of the 2009 California Recreational yelloweye rockfish catch data indicated that implementation of additional management measures other than season length reductions would not significantly reduce yelloweye rockfish catch in 2010. The majority of yelloweye rockfish were encountered North of Point Arena, where the current depth and season structures already represent severe constraints. A 20 fm depth restriction will again be in place North of Point Arena as in 2009 as well as 2008, when the catch of yelloweye rockfish was 1.8 mt (1 mt below the 2010 HG of 2.8 mt). It is uncertain how much catch will accrue in 2010 given factors such as weather and alternative fishing opportunities. Therefore, CDFG is not recommending any pre-season adjustments at this time. Inseason action will be taken if necessary.

COMMERCIAL

2008 Total Mortality Report
The GMT received an updated set of total catch data from the West Coast Groundfish Observer Program (WCGOP) based on results published in the Total Mortality Report for 2008 (October 2009). Models were updated where appropriate and discussed in more detail below.

Limited Entry Non-Whiting Trawl
The GMT was unable to update the trawl bycatch model with the newest data from the WCGOP because of recent staffing changes. The team did compare the results of the 2008 Total Mortality Report with the 2008 PacFIN Best Estimate Reports (i.e., QSM) to determine whether differences in the trawl model projections versus the estimated total catch were apparent. Because significant differences between the 2008 QSM and Total Mortality Report were not detected, and since all management measures recommended by the GMT for the 2010 season (see Agenda Item G.10.b, Supplemental GMT Report, November 2009) were only recently implemented (February 26, 2010), with the exception of the recommended petrale sole management measures, no adjustments to trawl fishery management measures are recommended at this time. More discussion regarding petrale sole follows.

Petrale Sole
Management measures recommended for petrale sole at the November 2009 Council meeting were adopted on January 1, 2010. These measures included a reduction in trip limits to 9,500 lbs/ 2 months and a modified RCA boundary to include access to petrale sole areas (i.e., petrale cut outs). Feedback from industry in early 2010 indicated high discarding events were occurring. The GMT contemplated whether the reports of discard were higher than the assumptions in the November model and if additional management measures were necessary. The GMT understands that these occurrences of discarding took place over a short period of time by a small portion of the fleet. The GMT also understands that following these initial reports of excessive discarding of petrale sole during the first period, fishermen voluntarily refrained from fishing within the petrale cut outs and limited towing duration to prevent excessive petrale catches. Petrale cut outs are closed beginning Period 2 through Period 5, hence, there is no longer any concern of

fishermen trawling within these areas of high petrale sole concentration until Period 6. Furthermore, we understand that petrale sole are undertaking their seasonal shallow-water migration, and are now largely inaccessible since they are within the trawl RCA. This information, along with the fact that very little catch data is available to track 2010 petrale sole landings (i.e., we are too early in the season), has led the **GMT to recommend no additional management measures for petrale sole at this time**. The GMT will continue to closely monitor landings, and may recommend additional management measures for this fishery at future Council meetings.

Limited entry Non-Tribal Whiting Trawl Fishery

Shorebased whiting trip limits

In 2007, cumulative monthly limits were specified in the shoreside whiting Exempted Fishing Permit (EFP) for lingcod, minor slope rockfish (including darkblotched), minor shelf, shortbelly, widow, and yellowtail rockfish, Pacific Ocean perch, Pacific cod, and sablefish. The 2009 EFP structure did not provide landing allowances for species other than whiting. Since those allowances were not made in the EFP, Federal regulations applied and only allowed fishermen to get paid for monthly landing allowances for yellowtail and widow rockfish (species for which there is a midwater gear trip limit specified in regulation). In November 2009, the Council tasked the GMT and Region with analyzing mid-water trawl trip limits for the shoreside whiting EFP for 2010.

The GMT analyzed the 2007 trip limit structure specified in the EFP and compared it to landings in 2008 and 2009, years when overages were forfeited to the state, to determine whether these limits could be appropriate for the 2010 EFP. Overall, the limits specified in the 2007 EFP appear to be appropriate, although many boats would be expected to exceed the sablefish and slope rockfish limits. The GMT does not recommend increasing these limits to accommodate the higher landings because the whiting season is very short (~4-6 weeks) and there is limited opportunity to decrease limits inseason should it become necessary. These recommended limits are not expected to change the species composition of the landings or the magnitude of landings; they are only to allow the fishermen to get paid for their incidental catch, instead of forfeiting those landings to the state.

The GMT recommends the following limits be specified in the 2010 EFP:

- Lingcod: 600 lb per calendar month
- Minor slope rockfish, including darkblotched rockfish: 1,000 lb per calendar month
- Pacific ocean perch: 600 lb per calendar month
- Pacific cod: 600 lb per calendar month
- Sablefish: 1,000 lb per calendar month

These limits would be in addition to the current midwater trawl limits specified in federal regulations (i.e., trip limit table 3) for widow rockfish and yellowtail rockfish.

Bycatch limits

Beginning in 2009, whiting bycatch limits for canary, darkblotched, and widow were set for the entire non-tribal fishery and then distributed to each sector (shorebased, mothership, and catcher processor) pro-rata to their whiting allocations. Whiting allocations, bycatch limits and total catch are presented in Table 5.

Table 5. Pacific whiting fishery summary by sector (2006 - 2009). SS = Shoreside, CP = Catcher Processor, MS = Mothership.

		2006		2007		2008		2009	
Species	Sector	Alloc/Cap	Catch	Alloc/Cap	Catch	Alloc/Cap	Catch	Alloc/Cap*	Catch
Pacific whiting	SS	97,469	97,297	87,398	73,280	58,669	50,423	40,738	40,771
	CP	78,903	78,864	70,751	73,263	115,789	108,121	35,376	34,620
	MS	55,696	55,355	49,942	47,809	58,087	57,432	24,034	24,091
	TOTAL	232,068	231,516	208,091	194,352	232,545	215,976	100,148	99,482
Canary	SS		1.64		2.01		1.66		2.31
	CP		0.10		0.35		2.43		0.23
	MS		0.85		1.62		0.74		0.60
	TOTAL	4.0 - 4.7	2.59	4.7	3.98	4.7 - 6.7	4.83	18.0	3.14
Darkblotched	SS		2.28		0.95		0.94		0.87
	CP		6.73		5.28		2.40		0.11
	MS		4.24		6.73		3.93		0.20
	TOTAL	25.0	13.25	25.0	12.96	40.0	7.27	25.0	1.18
POP	SS		0.14		23.14		0.07		4.70
	CP		0.75		2.92		12.83		0.06
	MS		1.88		0.73		2.93		1.40
	TOTAL		2.77		26.79		15.83		6.16
Widow	SS		49.38		88.97		99.09		108.64
	CP		67.00		72.77		52.37		0.96
	MS		71.80		72.99		60.75		24.94
	TOTAL	200 - 220	188.18	220 - 275	234.73	275 - 287	212.21	250.0	134.54
Yelloweye	SS		0.06		0.04		0.00		0.00
	CP		0.01		0.01		0.01		0.00
	MS		0.02		0.00		0.00		0.00
	TOTAL		0.09		0.05		0.01		0.00

* In 2009, bycatch caps were divided among the three whiting sectors pro-rata. The totals of those sector-specific limits are given here.

The GMT explored bycatch limits for the non-tribal whiting fishery for the 2010 season. Currently bycatch limits are specified in regulation for canary, darkblotched, and widow rockfish. Industry requested that the bycatch limits from 2009 be used for 2010 with the exception that the widow limit be increased to accommodate frequent interactions. The GMT notes that very little of the bycatch limit for either canary or darkblotched was used while a greater proportion of the widow limit was utilized by the fleet (Figures 1, 2, and 3).

Canary

Based on the latest understanding of canary biomass from the most recent assessment as well as the relatively high cap in 2009 (18.5 mt) compared to past amounts, the GMT suggests that the Council may want to consider a lower canary bycatch limit. A comparison of the most recent comparable biomass estimates from the 2007 and 2009 stock assessments suggests that a bycatch limit of 10.3 mt (55.8% of the 2009 bycatch limit) would be consistent with our current understanding of canary biomass. At the same time the GMT recognizes that the bycatch rate of canary in the whiting fishery is increasing in recent years. **The GMT recommends that the Council consider a lower canary limit, while balancing the increasing trend in the bycatch**

rate. We further note that if the Council does not want to reduce the canary limit for the non-tribal whiting fleet, reductions will have to be realized in other fisheries. For example, there is a considerable difference in the harvest guidelines of canary rockfish in the scorecard for the recreational fisheries compared to the projected impacts from those fisheries.

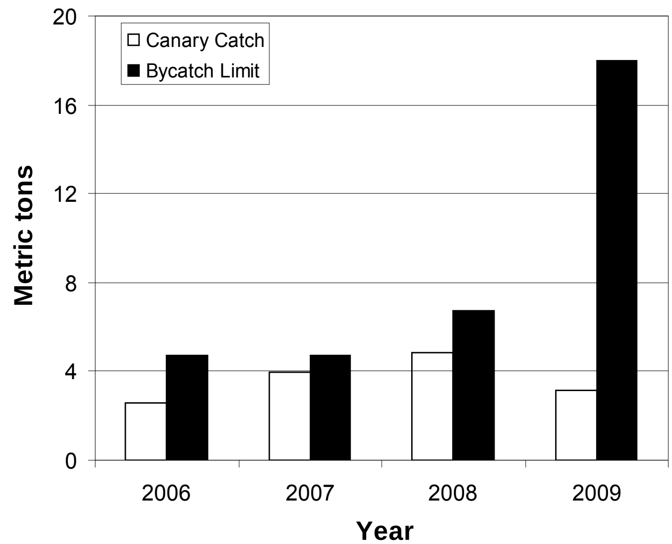


Figure 1. Canary bycatch limit and catch by year for all non-tribal sectors.

Darkblotched

For darkblotched rockfish the GMT discussed the rationale for setting the current bycatch limit (25 mt) as reflected in the 2009-2010 specifications and management measures EIS. Bycatch of shelf rockfish like canary is inversely proportional to bycatch of darkblotched. As such even though the darkblotched limit has not been fully attained in any year from 2006-2009, enough should be available to the fleet to prevent shutting down the fishery during the season. Given the recommendation to reduce the amount of canary available to the fleet, the **GMT recommends a status quo darkblotched limit**.

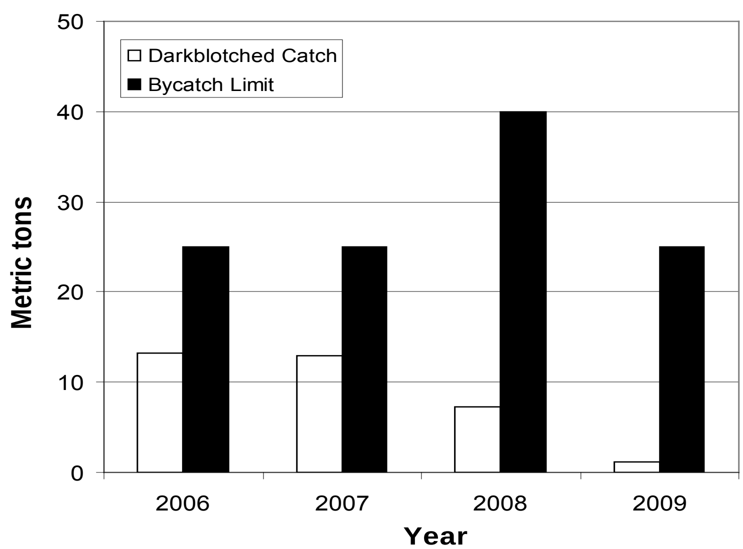


Figure 2. Darkblotched bycatch limit and catch by year for all non-tribal sectors.

Widow

The GMT examined widow bycatch rates in recent years and notes that they are increasing (Figure 4). Likewise, the relatively level of attainment for the widow bycatch limit in recent years is high compared to bycatch limits for other species (Figure 3). A linear interpolation of bycatch rates for 2006-2009 results in an estimate of 279 mt for 2010. **The GMT recommends that the Council consider an increase in the limit to 279 mt**.

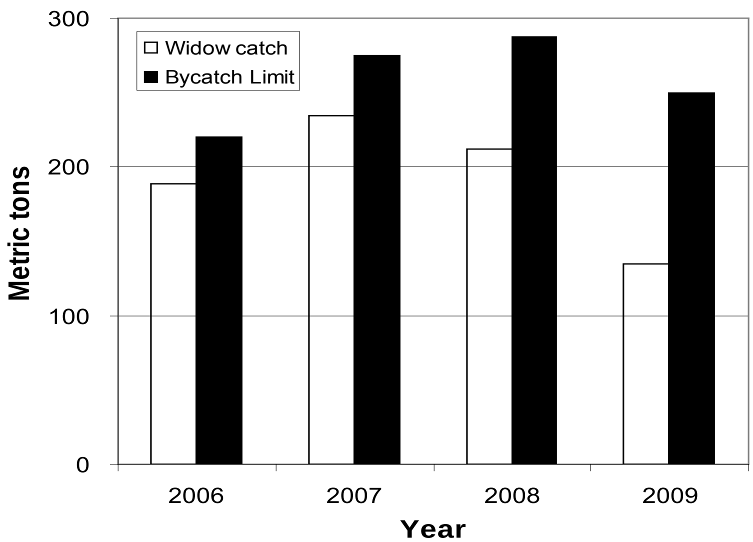


Figure 3. Widow bycatch limit and catch for the fleet by year.

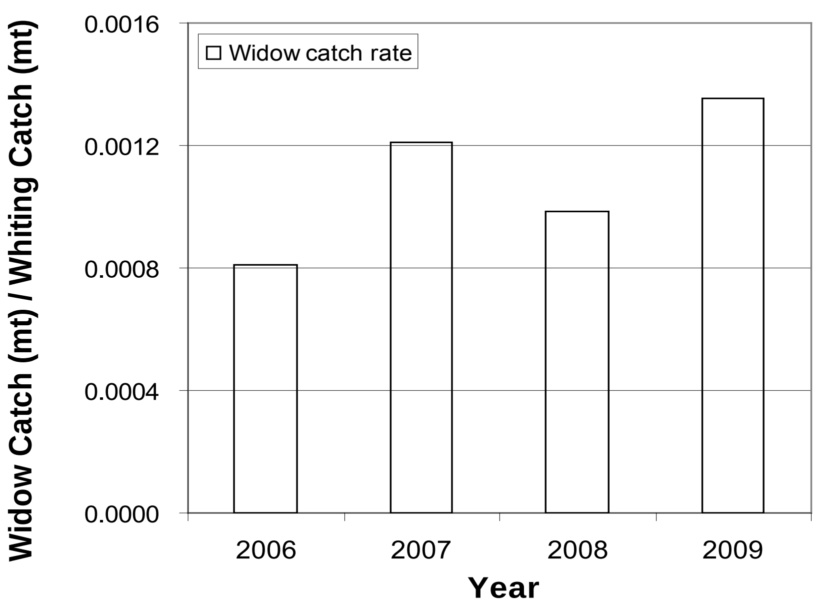


Figure 4. Total non-tribal fleet widow bycatch rates by year.

Limited Entry Fixed Gear
The GMT received an updated set of bycatch data from the West Coast Groundfish Observer Program. Based on this data, the projected catch of overfished species in the limited entry sablefish fishery was revised. These updates are shown in the scorecard.

Incidental Halibut in the Limited Entry Sablefish Primary Fishery
The final area 2A Pacific halibut Total Allowable Catch for 2010 is below 900,000 lbs, and according to the Council's Catch Sharing Plan on halibut, no halibut quota will be assigned to the sablefish primary fishery. Therefore in 2010 no retention of halibut will be allowed in the sablefish primary season north of Pt. Chehalis, WA. The GMT realizes that NMFS will be adjusting the groundfish regulations to reflect this change for May 1.

Limited Entry Fixed Gear Sablefish Daily Trip Limit (DTL) Fishery South of 36° N. lat.
The GMT received a request to remove the daily trip limit from the limited entry fixed gear sablefish DTL fishery south of 36° N lat. Currently the trip limit is **"***400 lb/ day, or 1 landing per week of up to 1,500 lb".* At the September 2009 meeting (Agenda Item E.4.b, Revised Supplemental GMT Report) the Council recommended removing the daily limit through the end of the year because the data available at that time indicated Conception Area sablefish landings were tracking well within the OY and since the limited entry fishery is more stable, a daily limit was unnecessary to control effort shifts. Also in its November 2009 inseason statement (Agenda Item G.4.B, Supp. GMT Report) the GMT stated it was "supportive of removing the daily limit for the LE sector beginning period 2" of 2010.

The GMT recommends removing the daily limit from the LEFG sablefish fishery south of 36° N lat. The resulting trip limit would be a cumulative weekly limit of 1,500 lb. The Team will continue to monitor this fishery and can take corrective measures in the future if they perceive a risk of exceeding the Conception Area OY.

Open Access Sablefish Daily Trip Limit (DTL) Fishery North of 36° N. lat.
The GMT received a request to examine an increase in the trip limits for sablefish in the DTL north of 36° N lat from *"300 lb/day, or 1 landing per week up to 800 lb, not to exceed 2,400 lb/2 months"* to "*300 lb/day, or 1 landing per week up to 1,000 lb, not to exceed 3,000 lb/2 months*". Model results indicate that the fishery is currently projected to attain the OY. **The GMT does not recommend increasing trip limits at this time**. The GMT will continue to monitor this fishery and could make adjustments later in the year.

Open Access Sablefish south of 36° N lat.
The GMT received a request to examine an increase in the bi-monthly trip limit for sablefish in the DTL south of 36° N lat from *"400 lb/day, or 1 landing per week up to 1,500 lb, not to exceed 8,000 lb/2 months"* to "*400 lb/day, or 1 landing per week up to 1,500 lb, not to exceed 9,000 lb/2 months*". At this time the GMT does not know the effect of the trip limit modifications taken at the September 2009 meeting where the weekly limit was increased and the bi-monthly limit was eliminated. **The GMT does not recommend increasing the weekly or bi-monthly limit at this time.** The GMT will continue to monitor this fishery and may make recommendations for adjustments later in the year.

Nearshore Fishery

The GMT received an updated set of bycatch data from the west Coast Groundfish Observer Program. Based on this data, the projected impacts to overfished species in the nearshore fishery was revised. These updates are shown in the scorecard.

The GMT received a request in November 2009 to remove the 20 fm depth restriction between 40°10' N lat and 43° N lat for the nearshore fishery that was put in place in 2009 to reduce yelloweye impacts. If this fishery is moved back to 30 fm, overfished species impacts would increase from 1.3 mt to 2.0 mt for yelloweye and 3.6 mt to 4.1 mt for canary rockfish. Due to the limited amount of yelloweye rockfish available in the scorecard, **the GMT does not recommend modifying the 20 fm restriction at this time**.

GMT Recommendations:

1. Adopt trip limits for the shorebased whiting fishery in the 2010 EFP.
   - Lingcod: 600 lb per calendar month
   - Minor slope rockfish, including darkblotched rockfish: 1,000 lb per calendar month
   - Pacific ocean perch: 600 lb per calendar month
   - Pacific cod: 600 lb per calendar month
   - Sablefish: 1,000 lb per calendar month

2. Lower the canary bycatch limit for the non-tribal whiting fishery considering stock status and the increasing bycatch rate.

3. Increase the widow bycatch limit for the non-tribal whiting fishery based on the increasing bycatch rate.

4. Remove the daily limit for the limited entry fixed-gear sablefish fishery south of 36° N latitude.

Projected mortality impacts (mt) of overfished groundfish species for 2010 updated with most recent EFP caps and 2008 WCGOP data for the nearshore and non-nearshore fixed gear fisheries and estimates of tribal whiting impacts.							
Fishery	**Bocaccio b/**	**Canary**	**Cowcod**	**Dkbl**	**POP**	**Widow**	**Yelloweye**
Limited Entry Trawl - Non-whiting	16.1	21.3	1.5	230.6	100.8	21.6	0.6
Limited Entry Trawl - Whiting							
At-sea whiting motherships a/		4.3		6.0	0.5	60.0	0.0
At-sea whiting cat-proc a/		6.1		8.5	0.5	85.0	0.0
Shoreside whiting a/		7.6		10.5	**4.7**	105.0	0.0
Tribal whiting		**4.3**		0.0	**7.2**	**5.0**	0.0
Tribal							
Midwater Trawl		3.6		0.0	0.0	40.0	0.0
Bottom Trawl		0.8		0.0	3.7	0.0	0.0
Troll		0.5		0.0	0.0		0.0
Fixed gear		0.3		0.0	0.0	0.0	2.3
Fixed Gear Sablefish	**0.0**	**2.5**	0.0	**4.5**	**0.4**	**0.0**	**0.9**
Fixed Gear Nearshore	0.3	3.6	0.0	0.0	0.0	0.3	**1.3**
Fixed Gear Other	5.0	0.0	0.0	9.0	0.0	0.7	0.0
Open Access: Incidental Groundfish	2.0	0.9	0.0	0.0	0.0	4.0	0.3
Recreational Groundfish e/							
WA		20.9					5.1
OR						1.0	
CA	67.3	22.9	0.3			6.2	2.8
EFPs	**11.0**	**1.3**	**0.2**	**1.5**	**0.1**	**11.0**	**0.4**
Research: Includes NMFS trawl shelf-slope surveys, the IPHC halibut survey, and expected impacts from SRPs and LOAs.							
	2.0	4.5	0.2	2.0	2.0	5.7	**3.3**
TOTAL	103.7	105.4	2.2	272.6	119.9	345.5	17.0
2010 OY f/	288	105	4.0	291	200	509	17
Difference	184.3	-0.4	1.8	18.4	80.1	163.5	0.0
Percent of OY	36.0%	100.4%	55.0%	93.7%	60.0%	67.9%	100.0%
Key		= either not applicable; trace amount (<0.01 mt); or not reported in available					

a/ Non-tribal whiting values for canary, darkblotched, and widow reflect bycatch limits for the non-tribal whiting sectors. All other species' impacts are projected from the GMT's whiting impact projection model. The Council may elect to change these bycatch limits when setting final whiting management measures in March 2010 or under any inseason action at any of their future meetings.

b/ South of 40°10' N. lat.

e/ Values in scorecard represent projected impacts for all species except canary and yelloweye rockfish, which are the prescribed harvest guidelines.

f/ 2009 and 2010 OYs are the same except for darkblotched (291 mt in 2010), POP (200 mt in 2010), and widow (509 mt in 2010).

PFMC
03/10/10

WASHINGTON DEPARTMENT OF FISH AND WILDLIFE INFORMATIONAL REPORT ON GROUNDFISH INSEASON ADJUSTMENTS

At their meeting on February 5-6, 2010, the Washington Fish and Wildlife Commission adopted sportfishing rule proposals for the next three-year cycle (2010-2012). The rules adopted will be effective May 1, 2010.

Among the rules adopted were proposals affecting recreational bottomfish fishing in a portion of the Washington Department of Fish and Wildlife's (WDFW) Marine Catch Area 4, which extends from Cape Alava north and into the Strait of Juan de Fuca to the Sekiu River. The primary intent of these changes is to protect some of the Puget Sound rockfish stocks which are of concern, such as canary, yelloweye, and bocaccio, as well as other nearshore stocks, such as copper, china, and quillback rockfish, whose status is unknown, while still allowing anglers to catch healthier stocks, such as black rockfish and lingcod.

Within Area 4B, which extends from the entrance to the Strait (Bonilla-Tatoosh line) to the Sekiu River, the bottomfish bag limit will be reduced from 10 fish to 6 fish, and only black and blue rockfish can be retained. While the status of blue rockfish is also unknown, their similarity in appearance to black rockfish makes compliance with a prohibition on blue rockfish difficult to achieve.

Additional measures to protect Puget Sound rockfish include the adoption of a 20-fm depth restriction for Area 4B as well as all of the inner Puget Sound areas. Anglers would not be able to fish for or retain bottomfish seaward of a line approximating the 20-fm depth contour, except on days that the halibut fishery is open. In outer Area 4 (Cape Alava to Bonilla-Tatoosh), WDFW already has a 20-fm depth restriction in place from May 21 through September 30, except on halibut fishing days.

We do not anticipate that any action is needed on the part of the Council or the National Marine Fisheries Service as the action taken is within state waters in the Strait of Juan de Fuca and Puget Sound.

-------- Original Message --------
Date: Sun, 21 Feb 2010 10:09:04 -0800 (PST)
From:brett cunningham <morrobayfish@att.net>
To:pfmc.comments@noaa.gov
CC:wdiller@sbcglobal.net <wdiller@sbcglobal.net>

I WOULD LIKE PFMC TO ONCE AGAIN CONCIDER REMOVING THE DAILY TRIP LIMIT FOR FIXED GEAR LIMITED ENTRY SABLE FISH IN THE CONCEPTION AREA. THIS FORM OF MANAGEMENT IS NOT EFFECTIVE. IT REQUIRES FISHERMEN TO DISCARD FISH, THERE FOR IT IS A WASTE OF THE SABLE FISH RESOURCE, FUEL AND TIME. KILLING FISH FOR NO REASON IS NOT MANAGEMENT. PLEASE RIGHT THIS WRONG. FISHERMEN NEED TO BE ABLE TO KEEP THE FISH THEY CATCH WITHOUT BEING PUNISHED FOR NOT CATCHING ENOUGH OF A SINGLE SPIECIES ON A GIVEN TRIP. IF ANY ONE ON THE COUNCIL IS INTERESTED FURTHER UNDER STANDING HOW THIS SIMPLE CHANGE EFFECTS FISHERMEN ON THE GROUNDS PLEASE FEEL FREE TO EMAIL ME AT; MORROBAYFISH@ATT.NET -SINCERLY BRETT CUNNINGHAM

Subject: To GMT re: daily limits
Date: Sun, 21 Feb 2010 08:40:07 -0800
From: William Diller <wdiller@sbcglobal.net>
To:pfmc.comments@noaa.gov

Dear Council Members and Groundfish Management Team

I'm writing to you today to ask you to consider changing one aspect of the current management scheme for Limited Entry Fixed Gear/Longline. We are asking that you consider removing the daily trip limit for sablefish in the Conception area. We are not asking to catch more fish, just to be able to use what we already catch and to reduce discards. An example of what is happening under the current system would be as follows: I make a trip targeting slope rockfish and along with the rockfish, I catch 700 pounds of sablefish. I'm allowed 1500 pounds of sablefish per week currently. I cannot bring in more than 400 pounds on any one day so I am compelled to dump the 700 pounds in anticipation that I will be able to make a sablefish targeted trip later that week and get my full allotment. If I could land that 700 pounds and make a trip later with less gear and catch the remaining 800 pounds for the week, the resource would be better utilized. Once again, we are not asking to catch more, actually what we are suggesting would remove the option of 7 trips at 400 pounds per week with a possible take of 2800 pounds. On another point, the idea of moving the Conception Area to 34-27 , thus moving Morro Bay and Port San Luis into the North would decimate what is left of the groundfish industry in those two ports. Thank You, William G. Diller

REGULATORY DEEMING FOR FISHERY MANAGEMENT PLANS AMENDMENT 20–TRAWL RATIONALIZATION AND AMENDMENT 21—INTERSECTOR ALLOCATION, AND PLANNING FOR COMMUNITY FISHERY ASSOCIATIONS (CFA)

At its June 2009 meeting, the Council finalized its trailing actions on the trawl rationalization program, and a minor revision regarding canary rockfish was broached at the September 2009 Council meeting and decided at the November 2009 Council meeting. The draft environmental impact statement (EIS) for Amendment 20 was submitted to National Marine Fisheries Service (NMFS) on schedule, November 20, 2009, and the public comment period on the draft EIS was completed on January 19, 2010. Public comment received on the Amendment 20 draft EIS can be found at http://www.pcouncil.org/groundfish/fishery-management-plan/fmp-amendment-20/trawl-rationalization-schedule-and-quota-share-allocation-tables/#comments. The draft EIS for Amendment 21 was submitted to NMFS on January 14, 2010, and the public comment period will close on March 15, 2010. The Council's final recommendations are scheduled for formal transmission to the U.S. Secretary of Commerce (Secretary) on April 30, 2010. A complete overview of all the steps of the approval and implementation process is provided in Agenda Item E.6.a, Attachment 1 and the Council final action on Amendment 20 is provided as Agenda Item E.6.a, Attachment 2.

At this meeting, the Council is scheduled to determine whether the draft of the main rule implementing Amendment 20 (trawl rationalization) and Amendment 21 (intersector allocation) is consistent with the Council action, and necessary or appropriate to implement the Council recommendation (collectively termed regulatory deeming). Additionally, under this agenda item the Council is scheduled to formally adopt the fishery management plan (FMP) language for Amendment 21 (Agenda Item E.6.a, Attachment 2) and specify a schedule for the consideration of a trailing amendment on community fishing associations (CFAs).

NMFS has been drafting regulations that will implement the trawl rationalization program, if it is approved by the Secretary. It is expected that the trawl rationalization program will be implemented through three or more regulatory actions:

Rule – Short Name	Description	Status
1. Data collection	Rule on submission of ownership information and notice that fishery data corrections must be submitted by May 2010.	Final Rule Published January 29
2. Grand Framework Rule	Main rule implementing the trawl rationalization action, covers both Amendments 20 and 21.	Scheduled to be submitted • to the Council for deeming at its March 2010 meeting. • to NMFS headquarters for review on March 31, 2010. • to the Secretary for approval on April 30, 2010.
3. Follow-up Rule	Miscellaneous regulations, other than those dealing with initial allocation of quota shares and time sensitive provisions that need to be in place for implementation of the program on January 1, 2011.	To be submitted to the Council for deeming June 2010.

The National Marine Fisheries Service (NMFS) Northwest Region has provided five reports for this briefing package. The first report provides a summary of NMFS interpretations of the Council action where there appeared to be some latitude for interpretation (Agenda Item E.6.b, NMFS Report 1). The second report provides a summary of areas where NMFS was uncertain as to how to interpret Council intent (Agenda Item E.6.b, NMFS Report 2). The third report provides an outline of the organization of the regulations (Agenda Item E.6.b, NMFS Report 3). The fourth report contains a draft of the proposed regulations (Agenda Item E.6.b, NMFS Report 4). And, the fifth report covers mandatory economic data collection program design (Agenda Item E.6.b, NMFS Report 5). Under the regulation deeming process (Council Operating Procedure 1) adopted by the Council in 2009, the Executive Director is charged with reviewing the draft regulations to ensure that they are consistent with Council action, unless otherwise directed by the Council. However, because of the complexity of regulations on this issue, the Council itself is reviewing and making the regulatory deeming decision on the draft regulations for trawl rationalization. An advance meeting of knowledgeable individuals from the Council family met February 4-5, 2010 in Seattle to preview regulatory deeming issues, and it is expected that the Groundfish Management Team, Groundfish Advisory Subpanel and Enforcement Consultants will submit statements for Council consideration.

As mentioned above, under this agenda item the Council will address two other tasks related to trawl rationalization. The first is the adoption of the FMP amendment language to implement Amendment 21 (intersector allocation). In the process of developing this language and the regulations, it was determined that there is an inconsistency between the language of the written motion and one of the tables referenced in the written motion. This inconsistency is discussed in Agenda Item E.6.a, Attachment 2. The Council should resolve this inconsistency when it adopts the FMP amendment language.

The second issue is the schedule for consideration of an amendment pertaining to Community Fishing Associations. At the November 2009 Council meeting, Council members (1) identified a desire to explicitly review the regulatory language on the quota share control rule with respect to the impact of that language on groups of QS holders working together (whether in risk control pools or community based associations), and (2) specify a calendar for the consideration of a trailing amendment on community fishing associations (CFAs). The first of these two items should be addressed when the Council determines whether to deem the draft regulations consistent with its action. The second may be addressed under this agenda item or when the Council takes up future meeting planning at the end of the meeting.

Council Task:

1. **Determine whether draft regulations are consistent with final Council action on Amendments 20 and 21, with particular attention to language on control limits; in the event draft regulations do not fully comport with final council action, determine schedule to complete this task.**
2. **Adopt FMP amendment language for Amendment 21.**
3. **Decide on schedule for consideration of CFAs, for confirmation under agenda item D.6 "Future Council Meeting Agenda and Workload Planning" on Thursday, March 11, 2010.**

Reference Materials:

1. Trawl Rationalization Approval and Implementation Process (Agenda Item E.6.a, Attachment 1).
2. Council Preferred Groundfish Trawl Rationalization Alternative (Agenda Item E.6.a, Attachment 2).
3. Staff Draft Groundfish Fishery Management Plan Amendatory Language For Amendment 21 (Agenda Item E.6.a, Attachment 3).
4. NMFS Interpretations of Council Intent (Agenda Item E.6.b, NMFS Report 1).
5. Clarifications Requested of Council (Agenda Item E.6.b, NMFS Report 2).
6. Draft Regulatory Outline (Agenda Item E.6.b, NMFS Report 3).
7. Draft Proposed Regulations for Amendments 20 and 21 (Agenda Item E.6.b, NMFS Report 4).
8. Mandatory Economic Data Collection Program Design For Groundfish Trawl Rationalization (Agenda Item E.6.b, NMFS Report 5).
9. Public Comment (Agenda Item E.6.c, Public Comment).

Agenda Order:

a. Agenda Item Overview — Jim Seger/Kit Dahl/ John DeVore
b. Reports and Comments of Management Entities and Advisory Bodies
c. Public Comment
d. **Council Action:** Deem Amendment Implementing Regulations, Adopt Plan Amendment Language for Amendment 21, and Consider Planning to Address CFA Alternatives

PFMC
02/23/10

Agenda Item E.6.a
Attachment 1
March 2010

TRAWL RATIONALIZATION APPROVAL AND IMPLEMENTATION PROCESS

The approval and implementation process will include five parts:

1. **EIS.** Submission of a draft and final environmental impact statement (EIS) (National Environmental Protection Act process public comment period on the draft EIS).
2. **Rules.** Submission of at least three proposed and final rules (one on data collection, the other on the main body of the trawl rationalization policy, and the third and any subsequent on other miscellaneous implementation measures).
3. **Recommendations (Rec).** Formal submission of the Council policy recommendations (Amendment 20) under the Magnuson-Stevens Act (MSA). (MSA process public comment period on Council recommendations).
4. **Decisions (Dec).** NMFS decision on whether or not to approve Council recommendations.
5. **Implementation (Impl.)** Implementation, if approved by NMFS.

Note that the intersector allocation amendment (Amendment 21) will be on a similar schedule and the rule making for Amendment 21 will be combined with that for trawl rationalization (Amendment 20). The following table provides the anticipated schedule and tracks progress for Amendment 20.

Approval Process	Schedule	Status
EIS. Finalization of Draft EIS and Related Elements of the Decision Package	Summer/Fall 2009	Complete
Rules. Drafting of Proposed Regulations	Summer/Fall/Winter 2009-2010	In Progress - NMFS/NOAA General Counsel
Rule (1) First Proposed Rule Submitted **Topic**: Collection of Ownership Data	September 16, 2009	Public Comment Period Ended
Rule (2) Council Review of Regulations Proposed for Second Rule **Topic**: Main Body of the Trawl Rationalization Policy.	Fall 2009 through Spring 2010	Scheduled for March 2010 Council Meeting
EIS. Submission of Draft EIS to EPA	Winter 2009	Complete
EIS. 45-Day Public Comment Period on Draft EIS	Winter 2009-2010	Completed January 19, 2010.
Rule (1). Finalization of Rule on Collection of Ownership Data	Winter 2010	Complete: Published January 29, 2010
Rec and Rule (2). Formal submission of Council MSA Recommendations and Proposed Regulations to NMFS	Spring 2010	

Rec and Rule (2). 45-60 Day MSA Process Public Comment on Trawl Rationalization Fishery Management Plan Amendment and Proposed Implementing Regulations (Rule 2)	Spring 2010	
Rule (3). Council Review of Regulations Proposed for Third Rule. **Topic:** Tracking, Monitoring, Fees, Etc.	Spring 2010	
Dec. NMFS Decision to Approve or Disapprove Council Recommendations	Summer 2010	
Rule (3). Submission of Third Proposed Rule for Public Comment	Summer 2010	
Impl. QS Application Process	Fall 2010	
Rule (3). Finalization of Rule on Tracking, Monitoring, Fees, Etc.	Fall/Winter 2010	
Impl. IFQ Required for Groundfish Trawl Vessels Making Shoreside Landings, Co-op Structures in Place for At-Sea Whiting Fishery	January 1, 2011	

PFMC
02/23/10

Agenda Item E.6.a
Attachment 2
March 2010

COUNCIL-PREFERRED GROUNDFISH TRAWL RATIONALIZATION ALTERNATIVE

Revised and printed on February 23, 2010

D.1 Overview of Recommendations by Sector

The Pacific Fishery Management Council's (Council) sector specific recommendations for rationalizing the trawl fishery are provided here and will be finalized and forwarded to the National Marine Fisheries (NMFS) for approval later in 2009. The recommendations were adopted at the Council's November 2008 meeting. In general, the Council recommends the following:

Shoreside Trawl Sector (nonwhiting groundfish species and whiting):

Manage with individual fishing quotas (IFQs).

Provide 90 percent of the initial allocation of nonwhiting IFQ to holders of vessel permits; and

set aside 10 percent of the initial allocation for an adaptive management program that may benefit processors and communities, among others.

Provide 80 percent of the initial allocation of whiting IFQ to holders of vessel permits; and

provide 20 percent of the initial allocation of whiting to processors.

Mothership Trawl Sector (whiting and groundfish bycatch species):

Manage with a harvester co-op system and limited entry for mothership processors.

Require that vessels declare preseason the mothership processor for which they will fish in a coming year.

Catcher Processor (CP) Sector (whiting and groundfish bycatch species):

Create a permit endorsement to prevent expansion of the number of participants.

Allocate whiting and bycatch to the existing voluntary co-op.[1]

Provide an IFQ program if the voluntary co-op fails (initially allocate IFQ equally among all permit holders).

[1] When the Council took final action, NMFS indicated its preliminary intent to license the voluntary co-op. However, this was not part of the Council's final action.

The amount of allocation available for these sectors will be determined through the intersector allocation process. IFQ for the shoreside fishery may not be delivered to at-sea processors, nor may quota allocated to the mothership or catcher-processor sectors be delivered shoreside.

The following sections provide a general summary of the program for each sector, followed by a complete description that also identifies trailing actions the Council has been working on in 2009. These actions will be completed prior the time it submits the package to NMFS for approval.[2] *The trailing actions pertain to eligibility to own IFQ, accumulation limits, and adaptive management. Implementation is not expected earlier than 2011.*

D.2 Shoreside Trawl Sector: IFQ Program (Appendix A of the Environmental Impact Statement [EIS])

This section details the IFQ program that the Council is recommending for the shoreside sector of the groundfish fishery. The first part of the section describes major components of the program. Table 1, which starts on page 6, presents complete details on elements of the recommended IFQ program.

D.2.1 Overview of the IFQ Program Elements

Under this program, most status quo management tools would remain in place. The main exceptions are cumulative landing limits for nonwhiting groundfish species and a closure period to control whiting harvest at the start of the year.[3] Other measures, such as Rockfish Conservation Area (RCA) boundaries, may be adjusted as experience is gained with the IFQ program.

An IFQ will grant an entity the privilege to catch a specified portion of the trawl sector's allocation. Within the IFQ program, vessels will be allowed to use a variety of directed groundfish commercial gear (including nontrawl gear) to take the shoreside trawl sector allocation, which will thus allow for "gear switching." IFQs will be created for most species of groundfish under the Groundfish Fishery Management Plan (FMP) (although some will still be managed collectively at the stock complex level, e.g. remaining minor slope rockfish). Some groundfish species rarely caught by trawl gear and dogfish will be excluded from the IFQ program. To ensure that optimum yields (OY) for species not covered by IFQ are not exceeded, catch of those species will be monitored and deductions made from the OY in anticipation of the expected level of shoreside trawl sector catch. For trips targeted on whiting, IFQ will be required only for whiting and the main bycatch species.

Halibut individual bycatch quota (IBQ) will be required to cover the incidental catch[4] of Pacific halibut in the groundfish trawl shoreside fishery. Under an IBQ program, retention would not be allowed.

The following sections describe the major provisions of the IFQ program.

D.2.1.1 Initial Allocation

The program will initially allocate IFQ as quota share (QS) to fishery participants based mainly on their historic involvement in the fishery. Following the initial allocation, transfers (described below) will

[2] During its March and April 2009 meetings the Council also clarified a number of its recommendations. These clarifications are reflected in the version of the trawl rationalization recommendation provided here.

[3] This closure period is necessary because of Endangered Species Act concerns related to salmon.

[4] At its June meeting, the Council will consider a recommendation by the Groundfish Allocation Committee to interpret previous Council action under Amendment 21 as creating an IBQ program to cover incidental mortality rather than catch.

allow for others to also participate in the fishery as quota holders. The initial allocation can be viewed in two segments:

First, in developing its recommendation the Council considered the groups that should be included in the initial allocation, and the proportional split among the groups. The Council recommended that harvesters (those holding limited entry permits for trawl vessels) be given an initial allocation of 90 percent of the nonwhiting QS and 80 percent of the whiting QS. Ten percent of the QS for nonwhiting species would be made available for an adaptive management program and processors would receive 20 percent of the whiting QS.

Second, the Council considered specific allocation formulas that will determine the amount of QS each eligible entity will receive. These calculations are based primarily on the delivery history associated with a vessel permit or processing company over a set number of years. For the allocation to permits, the QS associated with the history of permits retired in the buyback program will be distributed equally among the remaining qualified permits (about 44 percent of the QS will be allocated in this fashion). A special calculation is provided for incidentally caught overfished species. For these species the allocation will be based on the QS recipient's need to cover incidental catch under current fishing practices (as measured by bycatch rates, individual permit logbooks for recent years, and the amount of target species QS that an entity receives). None of the QS for overfished species will be allocated equally among harvesters, with the exception of canary rockfish. A similar approach would be used for the allocation of halibut IBQ.

D.2.1.2 Stock Management Units for IFQs

QS will be issued for the species groups and areas for which there are OYs (management units). However, QS will not be required for some rarely-caught species. Catch of these species would be monitored to ensure they don't exceed any established allocations. There may be further area subdivisions for species for which there is an area specific precautionary harvest policy. There are also provisions that provide for both species group and area subdivision of QS after initial allocation.

D.2.1.3 Annual Issuance, Holding Requirements and Transfer Rules

In designing the management regime for the IFQ program, the Council is balancing the benefits of flexibility and individual accountability with program costs and the constraints of the very low allowable catch levels of overfished species. Prior to the start of each fishing year, NMFS will issue quota pounds (QP) to entities based on the amount of QS they hold and the shoreside trawl sector allocation. The QP would have to be transferred to a vessel account in order to be used. When a vessel goes fishing under the IFQ program, all catch must be recorded (including discards) and must be matched by an equal amount of QP from the vessel's QP account. If there is not enough QP to cover the catch from a trip, there is a 30-day grace period during which adequate QP must be transferred into the vessel's account. A vessel's fishing will be limited, and its permit cannot be sold, until the overage is covered. A carryover provision will allow for an overage in one year to be covered by up to 10 percent of the following year's QP; likewise, the provision also will allow QP that were not used in one year to be carried over into the following year, up to 10 percent.

Bycatch reduction and greater efficiency are expected to occur in the groundfish fishery under the IFQ program because of the transferability of QS and QP. Through the transfer of QS/QP (bought and sold or "leased" through private contract), it is anticipated that those best able to avoid catching overfished species, and those who are most efficient, will increase the amount of QS/QP registered to them, while those who consistently have high bycatch rates or operate less efficiently might choose to sell their QS and leave the fishery. Generally, anyone eligible to own a U.S.-documented fishing vessel could also acquire QS and QP, and the QS and QP could be acquired in very small increments.[5] These provisions will allow for new entrants into the fishery; for example, a crew member could slowly purchase amounts of quota. They also allow for ownership of QS by entities that do not otherwise participate in the fishery. *In early 2009, during its trailing actions the Council considered but rejected substantially modifying provisions pertaining to who is eligible to own the QS.*

While transferability is an important component, in order to protect against unintended consequences some provisions limit transferability. For example, there will be accumulation limits on the amount of QS or QP that can be controlled by an entity, and accumulation limits on the amount of QP registered to a vessel. The intent of these limits is to prevent excessive control of quota by a participant. *The exact percentages which will be used in these limits will be determined through a trailing action.*

An adaptive management provision will allow the Council to use 10 percent of the trawl allocation to provide incentives, support, or other compensation to offset adverse impacts of the program. This program may benefit communities and processors, among others. *Details will be the subject of a trailing action.*

D.2.1.4 Tracking and Monitoring

A tracking and monitoring program is necessary to assure that all catch (including discards) is documented and matched against QP. At-sea observers would be required on all vessels and shoreside monitoring during all off-loading (100 percent coverage). Cameras may be used to augment the observers and assure compliance. Compared to status quo monitoring, this will be a significant increase for a large portion of the trawl fleet, particularly nonwhiting shoreside vessels. More accurate estimates of total mortality will benefit stock conservation goals. Discarding will be allowed, though all fish discarded will also have to be covered by QP. There would be 100 percent shoreside monitoring; and there may be limited landing hours to control costs. Additionally, a program for the mandatory submission of economic data is included to facilitate monitoring program performance.

D.2.1.5 Costs and Fee Structure

Program costs are of concern and ongoing Federal administrative costs are estimated in the EIS at $2.4 to $2.9 million per year for the entire trawl rationalization program, including the co-ops for the at-sea segment of the fishery (see Section 3). Program benefits are expected to significantly exceed costs. The costs listed here do not include initial implementation costs or the costs that industry will bear for observers. Fee structures will be proposed to recover program costs from industry, up to the limit of three percent of exvessel value.

D.2.1.6 Program Monitoring, Review and Future Auction

The Council will conduct a formal review of program performance no later than five years after implementation and every four years thereafter. The result of the evaluation could include dissolution of the program, revocation of all or part of quota shares, or other fundamental changes to the program. At the time of its first review, the Council will consider also the use of an auction or other nonhistory based method when distributing quota share that may become available after the initial allocation.

[5] To be eligible to own QS the person need not actually own a U.S. documented fishing vessel.

D.3 Detailed Specification of IFQ Program Elements and Options

Table 1 provides a complete description of the IFQ program.

Table 1. Full description of the IFQ Program for shoreside trawl deliveries.

	Element	SubElement	
A. ***Trawl Sector Management***			
A-1.1	Scope for IFQ Management, Including Gear Switching		For trips delivered shoreside, QP will be required to cover catch of all groundfish (including all discards) by limited entry (LE) trawl vessels with certain gear and species exceptions. Gear Exception: Vessels with an LE trawl permit using the following gears would not be required to cover their groundfish catch with QP: exempted trawl, [a] gear types defined in the coastal pelagic species FMP, gear types defined in the highly migratory species FMP, salmon troll, crab pot, and LE fixed gear when the vessel also has a LE permit endorsed for fixed-gear (longline or fishpot) AND has declared that they are fishing in the LE fixed-gear fishery. Species Exception: The following would be an exception from the QP requirement longspine thornyheads south of 34º27' N latitude, minor nearshore rockfish (north and south), black rockfish (WOC), California scorpionfish, cabezon, kelp greenling, shortbelly rockfish, and the "Other Fish" category of groundfish. *This definition of the scope allows an LE trawl vessel to switch between trawl and nontrawl groundfish gears, including fixed-gear, for the purpose of catching their QP ("gear switching"). It also allows a nontrawl vessel to acquire a trawl permit, and thereby use trawl QP to catch the LE trawl allocation using nontrawl gear.*[b]

Table 1. Full description of the IFQ program (continued).

	Element	SubElement	
A-1.2	IFQ Management Units, Including Latitudinal Area Management		QS will carry designations for the species/species group, area, and trawl sector to which it applies (see A-1.3 for the list of trawl sectors). The QP will have the same species/species group, area, and sector designations as the QS on the basis of which the QP was issued. QP will not be used in a trawl sector other than that for which it was issued,[c] and will not be used in a nontrawl sector (i.e. by vessels without trawl permits).[d] QP will not be used in a catch area or for a species/species group other than that for which it is designated. For those species within the scope of the program, the QS/QP species groupings and area subdivisions will be those for which OYs are specified in the acceptable biological catch (ABC)/OY table that is generated through the groundfish biennial specifications process and those for which there is an area-specific precautionary harvest policy[e] QS for remaining minor rockfish will be aggregated for the shelf and slope depth strata (nearshore are excluded from the scope, see Section A-1.1). Changing the management units. After initial QS allocation the Council may alter the management units by changing the management areas or subdividing species groups. Section A-2.1.6 provides methods for reallocating QS when such changes are made after initial implementation of the program.[f] *Hereafter, all references to species include species and species group, unless otherwise indicated.*
A-1.3	General Management and Trawl Sectors		Unless otherwise specified, status quo regulations, other than trip limits for species within the scope of the IFQ program, will remain in place. If individual vessel overages (catch not covered by QP) make it necessary, area restrictions, season closures, or other measures will be used to prevent the trawl sector (in aggregate or the individual trawl sectors listed here) from going over allocations.[g] The IFQ fishery may also be restricted or closed as a result of overages in other sectors. There will be three trawl sectors: shoreside, mothership, and catcher-processors. However, as per Section A-1.1, IFQ will be required only for the shoreside trawl sector. The mothership and catcher-processor sectors will be managed using co-ops, as specified in the co-op section of the trawl rationalization program. If the industry organized voluntary co-op program for the catcher-processor sector collapses, IFQ will be required for the catcher-processor sector, as specified in the co-op program described for that sector. *Allocation among trawl sectors has been determined in FMP Amendment 21. Those allocations not covered by Amendment 21 will be addressed in the biannual specifications process.* *Trawl vessels fishing IFQ with nontrawl gear will be required to comply with the RCA lines applicable for that gear. Such restrictions, as necessary, will be determined in a separate process.*
A-1.4	Management of NonWhiting Trips		Nonwhiting trips are those with less than 50 percent whiting. No changes to management measures, other than those identified in Section A-1.3, have been identified at this time.
A-1.5	Management of Whiting Trips[h]		Whiting seasons will not be changed under the IFQ program, and so the current spring openings will be maintained to control impacts on ESA-listed salmon.[i] When the primary whiting season is closed for shoreside deliveries, cumulative whiting catch limits will apply and shoreside QP will be required to cover whiting incidental catch.

Table 1. Full description of the IFQ program (continued).

	Element	SubElement	
A-1.6	Groundfish Permit Length Endorsements		Length endorsement restrictions on LE permits endorsed for groundfish gear will be retained; however, the provision that requires that the size endorsements on trawl permits transferred to smaller vessels be reduced to the size of that smaller vessel will be eliminated (i.e., length endorsements will not change when a trawl-endorsed permit is transferred to a smaller vessel).
A-2. ***IFQ System Details***			
A-2.1	**Initial Allocation and Direct Reallocation**		
A-2.1.1	Eligible Groups	a Groups and Initial Split of QS	***Eligible Groups*** The initial allocation of QS will be made either only to permit owners and processors, as follows. Whiting QS: 80 percent to permits, 20 percent to processors and zero percent for adaptive management. Nonwhiting QS: 90 percent to permits, zero percent to processors, and 10 percent for adaptive management. *After initial allocation, trading will likely result in changes in the distribution of shares among permit owners and processors. Additionally, entities that are neither permit owners nor processors may acquire QS (see below: "IFQ/Permit Holding Requirements and IFQ Acquisition").*
		b Permits	Landing history will accrue to the permit under which the landing was made. The owner of a groundfish LE permit at the time of initial allocation will receive the QS issued based on the permit. (Also, see Section A-2.1.4 on permit combinations and other exceptional situations.)
		c Processors and Processing Definition	A special definition of "processor" and "processing" will be used for initial QS allocation. A main intent of the definition is to specify that only the first processor of the fish be credited for the history of that delivery when the initial allocation formula is applied (see footnote for definition).[j]
		d Attributing and Accruing Processing History	For an allocation for **shoreside processors (applies only to whiting):** attribute history to the receiver reported on the landing receipt (i.e. the entity responsible for filling out the state fishticket), except history may be reassigned to an entity not on the landings receipt, if parties agree or through an agency appeals process. *The intent of this option is to provide an opportunity for catch history to be assigned to the entity that actually processed the fish.* For shoreside processors, allocations go to the processing business and successor-in-interest will be recognized. NMFS will develop criteria for use in determining the successor in interest with respect to the entities listed on the landings receipts or otherwise eligible for an initial QS allocation based on being the first processor of the fish.[k]
A-2.1.2	Recent Participation	a Permits (including CP permits)	Recent participation is not required in order for a permit to qualify for an initial allocation of QS.
		b Processors (motherships)	Not applicable because a co-op program was provided for this sector rather than IFQs. *(This header is being left in the document so that paragraph numbering will correspond to numbering in the analysis.)*

Table 1. Full description of the IFQ program (continued).

	Element	SubElement	
		c Processors (shoreside)	Recent participation is required to qualify for an initial allocation of whiting QS: 1 mt or more of deliveries from whiting trips in each of any two years from 1998-2004.
A-2.1.3	Allocation Formula	a Permits with catcher vessel history	QS will be issued for all fish management units within the scope of the program (see Section A-1.2) based on equal division and permit history, as follows:[l] **Equal Division:** There will be an equal division of the buy-back permits' pool of QS among all qualifying permits *(except the incidentally caught overfished species other than canary)*. Qualifying permits include all catcher vessel permits, including those that have been used only in the mothership sector. (The QS pool associated with the buyback permits will be the buyback permit history as a percent of the total fleet history for the allocation period. The calculation will be based on total absolute pounds with no other adjustments and no dropped years.) **Permit History:** The remaining QS *(the QS left after setting aside amounts for equal allocation)* will be allocated based on each permit's history (see following formulas). **For the portion of the allocation based on each permit's history.** For **nonwhiting** trips, permit history used for QS allocation will be calculated: **For nonoverfished species**: using an allocation period of 1994-2003. Within that period use relative history and drop the three worst years.[m] **For overfished species taken incidentally:[n]** using target species QS as a proxy based on the following approach: Apply fleet average bycatch rates to each permit's depth and latitude distributions and target species QS allocations. Fleet average bycatch rates for latitudinal areas[o] divided shoreward and seaward of the RCA will be developed from West Coast Observer Program data for 2003-06. For the purposes of the allocation, a permit's QS for each target species will be distributed shoreward and seaward of the RCA and latitudinally based on the permit's logbook information for 2003-06. If a permit does not have any logbooks for 2003-06, fleetwide averages will be used.[p] For **whiting** trips, permit history used for QS allocation will be calculated as follows: **For whiting**, use an allocation period of 1994-2003. Within that period, use relative history and drop the two worst years. [q] **For bycatch species** (if IFQ is used for bycatch species): use the whiting history as a proxy (i.e., allocation will be pro rata based on the whiting allocation). **Area Assignments:** Landings history will be assigned to catch areas based on port of landing.[r] **Relative history (percent).** For each sector, the permit history for each year is measured as a percent of the sector's total for the year. **Initial allocations will be constrained by accumulation limits.** See Section A-2.2.3.e for a discussion of the limits and divestiture requirements.

Table 1. Full description of the IFQ program (continued).

	Element	SubElement	
.		b Permits with catcher-processor history	Not applicable because a co-op program was provided for this sector rather than IFQs. *(This header is being left in the document so that paragraph numbering will correspond to numbering in the analysis).*
		c Processors (motherships)	Not applicable because a co-op program was provided for this sector rather than IFQs *(This header is being left in the document so that paragraph numbering will correspond to numbering in the analysis).*
		d Processors (shoreside)	For whiting: • Allocate whiting QS based on the entity's history for the allocation period of 1994-2004 (drop two worst years) and use relative history. **Initial allocations will be constrained by accumulation limits.** See Section A-2.2.3.e for a discussion of the limits and divestiture requirements.
A-2.1.4	History for Combined Permits and Other Exceptional Situations		Permit history for combined permits will include the history for all the permits that have been combined. For history occurring when two or more trawl permits were stacked, split the history evenly between the stacked permits. History for illegal landings will not count toward an allocation of QS. Landings made under nonwhiting Experimental Fishing Permits (EFPs) that are in excess of the cumulative limits in place for the nonEFP fishery will not count toward an allocation of QS. Compensation fish will not count toward an allocation of QS.
A-2.1.5	Initial Issuance Appeals		There will be no Council appeals process on the initial issuance of IFQ. NMFS will develop a proposal for an internal appeals process and bring it to the Council for consideration. Any revisions to an entity's fishtickets must be approved by the state in order to be accepted. Any proposed revisions to fishtickets should undergo review by state enforcement personnel prior to finalization of the revisions.

Table 1. Full description of the IFQ program (continued).

	Element	SubElement	
A-2.1.6	Direct Reallocation and Future Allocations After Initial Issuance		**Reallocation With Change in Overfished Status**: When an overfished species is rebuilt or a species becomes overfished there may be a change in the QS allocation within a sector (allocation between sectors is addressed in the intersector allocation process). When a stock becomes rebuilt, the reallocation will be to facilitate the re-establishment of historic target fishing opportunities. When a stock becomes overfished, QS may be reallocated to maintain target fisheries to the degree possible. That change may be based on a person's holding of QS for target species associated with the rebuilt species or other approaches deemed appropriate by the Council. **Reallocation With Changes in Area Management** (Changes in management lines are expected to be rare; however, when they occur the following provides for the reallocation of QS in a manner that will give individual QS holders with the same amounts of total QP before and after the line changes.) **Area Subdivision**: If at any time after the initial allocation an IFQ management unit is geographically subdivided, those holding QS for the unit being subdivided will receive an amount of QS for each newly created area that is equivalent to the amount they held for the area before it was subdivided. **Area Recombination**: When two areas are combined, the QS held by individuals in each area will be adjusted proportionally such that (1) the total QS for the area sums to 100 percent, and (2) a person holding QS in the newly created area will receive the same amount of total QP as they would if the areas had not been combined. **Area Line Movement**: When a management boundary line is moved, the QS held by individuals in each area will be adjusted proportionally such that they each maintain their same share of the trawl allocation on a coastwide basis (a fishing area may expand or decrease, but the individual's QP for both areas combined wouldn't change because of the change in areas). In order to achieve this end, the holders of QS in the area being reduced will receive QS for the area being expanded, such that the total QP they would be issued will not be reduced as a result of the area reduction.[s] Those holding QS in the area being expanded will have their QS reduced such that the total QP they receive in the year of the line movement will not increase as a result of the expansion (nor will it be reduced). **Reallocation With Subdivision of a Species Group**: If at any time after the initial allocation an IFQ management unit for a species group is subdivided, those holding QS for the unit being subdivided will receive an amount of QS for each newly created IFQ management units that is equivalent to the amount they held for the species group before it was subdivided. For example, if a person holds one percent of a species group before the subdivision, that person will hold one percent of the QS for each of the groups resulting from the subdivision. **Future Allocation of Groundfish Outside the Scope of the IFQ Program:** For the "Other Fish," category of groundfish, if at some time in the future the Council adds it to the IFQ system, the initial allocation would be determined using the same history criteria as was used for other IFQ species (i.e. 1994-2003 history), unless otherwise specified by a future Council action.

Table 1. Full description of the IFQ program (continued).

	Element	SubElement	
A-2.2	**Permit/IFQ Holding Requirements and Acquisition** **(after initial allocation)**		
A-2.2.1	Permit/IFQ Holding Requirement		1. Only vessels with LE trawl permits are allowed to fish in the trawl IFQ fishery. 2. For a vessel to use QP, the QP must be in the vessel's QP account. 3. All catch a vessel takes on a trip must be covered with QP within 30 days of the landing for that trip unless the overage is within the limits of the carryover provision (Section A-2.2.2.b), in which case the vessel has 30 days or a reasonable time (to be determined) after the QP for the following year are issued, whichever is greater.[t] 4. For any vessel with an overage (catch not covered by QP), fishing that is within the scope of the IFQ program (Section A-1.1) will be prohibited until the overage is covered, regardless of the amount of the overage. Vessels which have not adequately covered their overage within the time limits specified in paragraph 3, must still cover the overage before resuming fishing, using QP from the following year(s), if necessary. If a vessel covers its overage, but coverage occurs outside the specified time limit (paragraph 3), the vessel may still be cited for a program violation. 5. For vessels with an overage, the LE permit may not be sold or transferred until the deficit is cleared.
A-2.2.2	IFQ Annual Issuance	a Annual Quota Pound Issuance	QP will be issued annually to QS holders based on the amount of QS held.[u] *As specified above, QS holders will have to transfer their QP to a vessel account in order for those QP to be used.*

Table 1. Full description of the IFQ program (continued).

	Element	SubElement	
		b Carryover (Surplus or Deficit)	To the extent allowed by the conservation requirements of the Magnuson-Stevens Fishery Conservation and Management Act (MSA), a carryover allowance will allow surplus QP in a vessel's QP account to be carried over from one year to the next or allow a deficit in a vessel's QP account for one year to be carried over and covered with QP from a subsequent year. Surplus QP may not be carried over for more than one year. A vessel with a QP **surplus** at the end of the current year will be able to use that QP in the immediately following year, up to the limit of the carryover allowance (see below). However, if there is a decline in the OY, the amount of QP carried over as a surplus will be reduced in proportion to the reduction in the OY. A vessel with a QP **deficit** in the current year will be able to cover that deficit with QP from the following year without incurring a violation if (1) the amount of QP it needs from the following year is within the carryover allowance (see below), and (2) the QP are acquired within the time limits specified in A-2.2.1.[v] **Carryover Allowance**: Limit of up to 10 percent carryover for each species. This applies to both nonoverfished species and overfished species. The percentage is calculated based on the total pounds (used and unused) in a vessel's QP account for the current year. The percentage used for the carryover provision may be changed during the biennial specifications process.
		c QS Use-or-Lose Provisions (Deleted)	*This section has been deleted but the numbering is being maintained as a placeholder so as not to change section numbering and corresponding references in the analysis.*[w]
		d Entry Level Opportunities	Under the MSA, the Council is required to consider entry level fishermen, small vessel owners, and crew members, and in particular the possible allocation of a portion of the annual harvest to individuals falling in those categories. No special provisions have been identified for analysis. New entry is addressed indirectly by allowing crew, captains and others to acquire QS in small increments.
A-2.2.3	IFQ Transfer Rules	a Eligible to Own or Hold	No person can acquire quota shares or quota pounds other than 1) a United States citizen, 2) a permanent resident alien, or 3) a corporation, partnership, or other entity established under the laws of the United States or any State, that is eligible to own and control a U.S. fishing vessel with a fishery endorsement pursuant to 46 USC 12113 (general fishery endorsement requirements and 75 percent citizenship requirement for entities). However, there is an exception for any entity that owns a mothership that participated in the west coast groundfish fishery during the allocation period and is eligible to own or control that U.S. fishing vessel with a fishery endorsement pursuant to sections 203(g) and 213(g) of the AFA.

Table 1. Full description of the IFQ program (continued).

	Element	SubElement	
		b Transfers and Leasing	QS/QP will be transferable and transfers must be registered with NMFS. NMFS will not differentiate between a transfer for a lease and a permanent transfer.[x] Each year, all QP must be transferred to a vessel account. A penalty for not meeting this transfer requirement has not been recommended; however, this requirement is intended to encourage its availability for use by the fleet. QP can only be transferred into vessel accounts. Once in a vessel account QP can be transferred from one vessel account to another.
		c Temporary Transfer Prohibition	NMFS may establish temporary prohibitions on the transfer of QS, as necessary to facilitate program administration. QS will not be transferred in the first two years of the program (QP will be transferable).
		d Divisibility	QS will be highly divisible and the QP will be transferred in whole pound units (i.e. fractions of a pound may not be transferred).

Table 1. Full description of the IFQ program (continued).

	Element	SubElement	
		e Accumulation Limits (Vessel and Control)	Limits[y] may vary by species/species group, areas, and sector. The values for the limits are provided in Table 2. The vessel unused QP limits may be revisited in the first biennial specifications process after implementation of the program. **Vessel Use Limit (Vessel Limit)**: A limit on the total QP that may be registered for a single vessel during the year. This element will mean that a vessel could not have more used and unused quota pounds registered for the vessel than a predetermined percentage of the QP pool. **Vessel Unused QP Limit**: A limit on the amount of unused QP that may be registered to the vessel at any time. This limit applies only for overfished species and Pacific halibut. **QS Control Limit:** A person, individually or collectively, may not control QS in excess of the specified limit (because there is no the grandfather clause). QS controlled by a person shall include those registered to that person, plus those controlled by other entities in which the person has a direct or indirect ownership interest, as well as shares that the person controls through other means.[z] The calculation of QS controlled by a person will follow the "individual and collective" rule. Individual and Collective Rule: The QS that counts toward a person's accumulation limit will include 1) the QS or QP owned by them, and 2) a portion of the QS owned by any entity in which that person has an interest. The person's share of interest in that entity will determine the portion of that entity's QS that counts toward the person's limit.[aa] **Grandfather Clause and Divestiture:** There will not be a grandfather clause for the QS control limits, however, an adjustment period is provided through the following divestiture rules. QS will be issued for amounts in excess of aggregate and species control limits only for holders of permits transferred by November 8, 2008, if such transfers have been registered with NMFS by November 30, 2008. The holder of any permit transferred after that time will be eligible to receive an initial allocation for that permit of only those QS that are within the aggregate and individual species control limits. Anyone who qualifies for an initial allocation of QS in excess of the control limits will be allowed to receive that allocation but required to divest themselves of that excess QS sometime during years three and four of the IFQ program (the two years after the QS transfer moratorium specified in Section A-2.2.3.c). Holders of QS in excess of the limits may receive and use the QP associated with that excess, up to the time their divestiture is completed. However, QP for year five of the program will not be issued for QS held in excess of the limits. At the end of year four, any QS still held in excess of the species or aggregate limits in place at the time of the initial QS allocation will be revoked and redistributed to the remainder of the QS holders in proportion to their QS holdings. No compensation will be due for any revoked shares. Divestiture transfers will be allowed in accordance with the provisions established here and the transfer rules and processes implemented by NMFS. Permit transfers will not be limited or required by the divestiture provision. **Calculation of Aggregate Nonwhiting QS Holdings:** To determining how much aggregate nonwhiting QS an entity holds, an entity's QS for each species will be converted to pounds. This conversion will always be conducted using the trawl allocations applied to the 2010 OYs, until such time as the Council recommends otherwise. Specifically, each entity's QS for each species will be multiplied by the shoreside trawl allocation for that species. The entity's pounds for all nonwhiting species will then be summed and divided by the shoreside trawl allocation of all nonwhiting species to get the entity's share of the aggregate nonwhiting trawl quota. *Note: QS that is not allocated because of the accumulation limits and absence of the grandfather clause will be distributed to other eligible recipients in a manner that maintains the distribution among groups specified in A-2.1.1 and based on the allocation formulas specified in A-2.1.3.*

Table 1. Full description of the IFQ program (continued).

	Element	SubElement	
A-2.3	**Program Administration**		
A-2.3.1	Tracking, Monitoring and Enforcement		It is the Council intent to provide NMFS flexibility sufficient to design and implement a tracking and monitoring program that will achieve the goals and objectives of the trawl rationalization program. **Discarding by Shoreside Sector** Nonwhiting – Discarding of IFQ species allowed, discarding of IBQ species required, discarding of nongroundfish species allowed. Whiting Maximized retention vessels: Discarding of fish covered by IFQ or IBQ, and nongroundfish species prohibited. Vessels sorting at-sea: Same as for nonwhiting. **At-Sea Catch Monitoring for Shoreside Sector** Nonwhiting – The sorting of catch, the weighing and discarding of any IBQ and IFQ species, and the retention of IFQ species must be monitored by the observer. Whiting For maximized retention vessels: video monitoring as proposed under Amendment 10. Observers would be required in addition to or as a replacement for video monitoring. For vessels that sort at-sea: The sorting, weighing and discarding of any IFQ or IBQ species must be monitored by an observer with supplemental video monitoring. Shoreside Landings Monitoring The sorting, weighing and reporting of any IFQ species must be monitored by a shoreside landings monitor (IBQ will have been discarded at sea). (Description continued on next page.)

Table 1. Full description of the IFQ program (continued).

	Element	SubElement	
			(...continued from previous page) **Catch Tracking Mechanisms for Shoreside Sector** **Electronic vessel logbook report** VMS-based electronic logbook required to be transmitted from vessel. At-sea entry by vessel personnel required including catch weight by species and if retained or discarded. **Vessel landing declaration report** Mandatory declaration reports. **Electronic ITQ landing report** Mandatory reports completed by processors and similar to electronic fishticket report. **Processor production report** Mandatory reports (possible inclusion of proprietary data included to be recommended as option is fleshed out). **Cost Control Mechanisms for Shoreside Sector** **Shoreside landing hour restrictions** Landing hours may be restricted. **Shoreside site Licenses** Mandatory license for shoreside deliveries. License can be issued to any site that meets the monitoring requirements. **Vessel Certification** Mandatory certification. Certificate can be issued to any vessel that meets the monitoring requirements. **Program Performance Measures for Shoreside Sector** Integrate into the tracking and monitoring program the collection of data on cost, earnings and profitability; economic efficiency and stability; capacity measures; net benefits to society; distribution of net benefits; product quality; functioning of quota market; incentives to reduce bycatch; market power; spillover effects into other fisheries; contribution to regional economies (income and employment); distributional effects/community impacts; employment in seafood catching and processing; safety; bycatch and discards; administrative, enforcement, and management costs. (See A-2.3.2)
A-2.3.2	Socio-Economic Data Collection		The data collection program will be expanded and submission of economic data by harvesters and processors will be mandatory. Random and targeted audits may be used to validate mandatory data submissions. See footnote for a full description[bb] Information on QS transaction prices, will be included in a central QS ownership registry. *NOTE: Data collection started before the first year of implementation would be beneficial, in order to have a baseline for comparison.*
A-2.3.3	Program Costs	a Cost Recovery	Fees up to three percent of exvessel value, consistent with 303A(e) of the MSA may be assessed. Cost recovery shall be for costs of management, data collection, analysis, and enforcement activities.
		b Fee Structure	To be determined. The TIQC recommended a fee structure that reflects usage. A fee structure that allows for equitable sharing of observer costs for smaller vessels may be developed.

Table 1. Full description of the IFQ program (continued).

	Element	SubElement	
A-2.3.4	Program Duration and Modification		The Council shall begin a review of the IFQ program no later than 5 years after implementation of the program. The review will evaluate the progress the IFQ program has made in achieving the goal and objectives of Amendment 20. The result of this evaluation could include dissolution of the program, revocation of all or part of quota shares, or other fundamental changes to the program. Holders of quota shares should remain cognizant of this fact when making decisions regarding their quota shares, including buying selling, and leasing of these shares. The Council shall consider the use of an auction or other nonhistory based methods when distributing quota share that may become available after initial allocation. This may include quota created when a stock transitions from overfished to nonoverfished status, quota not used by the adaptive management program, quota forfeited to “use it or lose it” provisions, and any quota that becomes available as a result of the initial or subsequent reviews of the program. The specific form of the auction or other method of distribution shall be designed to achieve the goals of Amendment 20, specifically including minimizing the adverse effects from an IFQ program on fishing communities to the extent practical. After the initial review, there will be a review process every four years. A community advisory committee will take part in the review of IFQ program performance.

Table 1. Full description of the IFQ program (continued).

	Element	SubElement	
A-3	***Adaptive Management** (also see Section A-9)*		Ten percent of the nonwhiting QS will be reserved to facilitate adaptive management in the shoreside nonwhiting sector. Therefore, each year 10 percent of the shoreside trawl sector nonwhiting quota pounds will be available for use in adaptive management (adaptive management QP). The set aside will be used to address the following objectives. o Community stability o Processor stability o Conservation o Unintended/Unforeseen consequences of IFQ management. o Facilitating new entrants. **Years One and Two.** During the first two years in which the IFQ program is in place, the method to be used in distributing QP in years three through five will be determined, including. o The decision making and organization structure to be used in distributing the QP set aside[cc] o The formula for determining community and processor eligibility, as well as methods for allocation, consistent with additional goals. o The division of QP among the states. o Whether to allow the multi-year commitment of QP to a particular project. **Years Three through Five.** QP will be distributed through the organizational structure, decision process, formulas and criteria developed in years one and two and implemented through subsequent Council recommendation and NMFS rule making processes. Consideration will be given to the multiyear commitment of QP to particular projects (three year commitments). **Review and Duration.** The set aside of QP for the identified objectives will be reviewed as part of the year five comprehensive review and a range of sunset dates will be considered, including 10, 15, 20 year and no sunset date options.
A-4	***Pacific Halibut IBQ—nonretention***		IBQ for Pacific halibut bycatch in the trawl fishery will be established. The IBQ will be required to cover legal and sublegal sized Pacific halibut bycatch mortality in the area north of 40°10 N latitude. It is the intent of the Council that halibut IBQ mortality be estimated on an individual vessel basis. Such IBQ will be issued on the basis of a bycatch rate applied to the target species QS an entity receives in a manner similar to that described in Section A-2.1.3.a, for overfished species caught incidentally. Area-specific bycatch rates may be used for allocation but halibut IBQ will not be geographically subdivided.

Table 1. Full description of the IFQ program (continued).

[a] California halibut gear of 7.5" or greater used in state waters would be exempted.

[b] Mandatory gear conversion (the permanent switching from trawl to some other gear) was considered but not included at this time.

[c] Since the shoreside trawl sector covers all shoreside deliveries, this implies that IFQ issued for the shoreside trawl sector may not be used for at-sea deliveries (i.e. may not be used to cover deliveries made to motherships or catch by catcher-processors).

[d] Not withstanding this provision, a vessel with a LE trawl permit may catch the trawl QP with a nontrawl gear, as per Section A-1.1.

[e] At present there are no groundfish species for which the harvest in the trawl fishery is managed differently by geographic area. An example of an area specific precautionary policy from outside trawl fishery management is the geographic differential recommended by the Scientific and Statistical Committee for lingcod. Lingcod is monitored and managed differently in different geographic areas though there is a single coastwide ABC and OY for lingcod. Since there are no geographic subdivisions in the trawl management measures for lingcod, it is assumed that lingcod trawl IFQ will not be geographically subdivided.

[f] Such changes in latitudinal area management may occur as a result of changes in the management areas for species/species complexes in the ABC/OY table or as a result of separate Council action to change the trawl QS by area. In either case, specific Council action will be required to change the management areas and such action will be accompanied by appropriate supporting analysis and public comment opportunity.

[g] The Council authority to establish or modify RCAs will not be changed by this program.

[h] A whiting QP rollover provision was considered but rejected from further analysis. This provision would have allowed unused QP to be reclassified so that they could be used in any whiting sector.

[i] The current process for changing the whiting fishery opening dates involves a regulatory amendment developed under the FMP through a framework process. Implementation of an IFQ program should not change this process.

[j] "**Processors**" are defined as follows:

An at-sea processor is a vessel that operates as a mothership in the at-sea whiting fishery or a permitted vessel operating as a catcher-processor in the at-sea whiting fishery.

A shoreside processor is an operation, working on US soil, that takes delivery of trawl-caught groundfish that has not been "processed at-sea" and that has not been "processed shoreside"; and that thereafter engages that particular fish in "shoreside processing." Entities that received fish that have not undergone "at-sea processing" or "shoreside processing" (as defined in this paragraph) and sell that fish directly to consumers shall not be considered a "processor" for purposes of QS allocations.

"Shoreside Processing" is defined as either of the following:

1. Any activity that takes place shoreside; and that involves: cutting groundfish into smaller portions; OR freezing, cooking, smoking, drying groundfish; OR packaging that groundfish for resale into 100 pound units or smaller for sale or distribution into a wholesale or retail market.

   OR

2. The purchase and redistribution into a wholesale or retail market of live groundfish from a harvesting vessel.

Table 1. Full description of the IFQ program (continued).

[k] Transfer of physical assets alone should not be considered a basis for successor in interest. Business relationships such as transfer of the company name and customer base might be reasonable evidence of successor in interest.

[l] Due to the divestiture provision of Section A-2.3.2.e, it is relatively unlikely that accumulation limits will constrain the amount of QS an entity receives in the initial allocation. However, if an entity qualifies for QS in excess of accumulation limits and is does not qualify to receive that QS under the divestiture provision, the initial allocation will be constrained by first applying the aggregate limits and then, if necessary, the individual species limits. In using this approach, the entity's QS allocation should not be scaled back more than necessary to stay within limits and any QS not allocated will be reallocated to other QS recipients.

[m] State landings receipts (fishtickets) will be used to assess landings history for shoreside deliveries. In some cases, fishticket records do does not identify species to the same level of detail used for the IFQ management units (e.g. reports "unspecified rockfish"). Under such circumstances standard species composition routines usually used at the port level have been applied to vessel level data to estimate the species composition of such landings. In some instances, even after applying species composition information there may be some fishticket records with a species groundfish categorization that does not match with one of the IFQ management units. Under such circumstances, when the initial allocations are made, other information on the landings records and in logbooks might be used to assign the landing to its most probable species category.

[n] The intent is to provide an allocation method for QS for overfished species which addresses the vessel's need to have the QS to cover incidental catch in fisheries that target healthy stocks. The method would attempt to allocate the species to those who will be receiving QS for related target species. By allocating overfished species QS to those most in need of it, such an allocation would be expected to reduce transition costs. Currently, the list of overfished species that fall into this category is as follows: canary rockfish, darkblotched rockfish, Pacific Ocean perch, widow rockfish, and yelloweye rockfish. This list may change by the time the program is ready to be implemented. If a major target species became overfished, it would not be intended that such a species would be allocated via an alternative method (for example species such as Dover sole, sablefish, or Pacific whiting).

[o] The four areas are as follows: (1) north of 47°40 N latitude; (2) between 47°40 N latitude and 43°55 N latitude; (3) between 43°55 N latitude and 40°10 N latitude; and (4) south of 40°10 N latitude.

[p] In order to determine an amount of aggregate target species to which bycatch rates will be applied, each vessel's QS will be multiplied by the trawl allocation at the time of implementation.

[q] State landings receipts (fishtickets) will be used to assess landings history for shoreside deliveries.

[r] Catch area data on fishtickets are not considered appropriate for this purpose. The catch area field is often filled out by fish receivers that do not know the area in which the vessel fished. Additionally catch area is often left unspecified. Therefore, it will be assumed that all catch comes from ocean areas near the port of landing.

[s] Unless there is a change in the total OY or other factors affecting trawl allocation for the areas involved, in which case their change in QP would be proportional to the change in the trawl allocation.

[t] QP from a subsequent year may not be accessed until such QP have been issued by NMFS.

[u] Including QS that an entity received in excess of accumulation limits in place at the time of initial allocation (see Section A-2.2.3.e).

Table 1. Full description of the IFQ program (continued).

[v] Carryover of deficits provides some flexibility to use pounds from a year to cover a deficit from a previous year. Without a carryover provision, a vessel would still need to use pounds in a subsequent year to cover an overage but would incur a violation.

[w] The following is the text deleted from this section: "No QS use-or-lose provision has been specified.. The need for this provision will be evaluated as part of program review process, and the provision could be added later, if necessary. *Section A-2.2.3.b contains a provision mandating the transfer of QP to vessels each year. This is intended to encourage QP use."*

[x] QS may be transferred on a temporary basis through private contract (leased) but NMFS will not track lease transfers differently than any other transfer.

[y] The "vessel" accumulation limit was originally termed a "permit" limit. The term "permit" was changed to "vessel" to be consistent with Section A-2.1.3, which indicates that QP go into vessel accounts, not permit accounts. The term "own or control" was shortened to "control" for simplicity. "Control" includes ownership and therefore is inclusive of "ownership."

[z] It is the Council intent that control limits should not constrain the formation of risk pools to help the fishermen deal with overfished species constraints, so long as the pools do not undermine the effectiveness of the accumulation limits. A risk pool is one in which two or more people enter into an agreement whereby if one person does not have the QP the others would agree to provide the QP, if they have them. Whether these kinds of agreements are informal or formal, as other considerations and conditions are added to the agreements they may begin to constitute control. It is the Council intent to allow for these pooling agreements, so long as they do not become control.

[aa] For example, if a person has a 50 percent ownership interest in that entity, then 50 percent of the QS owned by that entity will count against the individual's accumulation limit unless it is otherwise determined that have effective control of a greater or lesser amount.

[bb]**Expanded data collection** would include:

mandatory submission of economic data for LE trawl industry (harvesters and processors),

voluntary submission of economic data for other sectors of the fishing industry,

transaction value information in a centralized registry of ownership, and

formal monitoring of government costs.

Mandatory Provisions: The Pacific Fishery Management Council and NMFS shall have the authority to implement a data collection program for cost, revenue, ownership, and employment data, compliance with which will be mandatory for members of the west coast groundfish industry harvesting or processing fish under the Council's authority. Data collected under this authority will be treated as confidential in accordance with Section 402 of the MSA.

A mandatory data collection program shall be developed and implemented as part of the groundfish trawl rationalization program and continued through the life of the program. Cost, revenue, ownership, employment and other information will be collected on a periodic basis (based on scientific requirements) to provide the information necessary to study the impacts of the program, including achievement of goals and objectives associated with the rationalization program. These data may also be used to analyze the economic and social impacts of future FMP amendments on industry, regions, and localities. The program will include targeted and random audits as necessary to verify and validate

Table 1. Full description of the IFQ program (continued).

data submissions. Additional funding (as compared to status quo) will be needed to support the collection of these data. The data collected would include data needed to meet MSA requirements (including antirust).

The development of the program shall include: a comprehensive discussion of the enforcement of such a program, including discussion of the type of enforcement actions that will be taken if inaccuracies are found in mandatory data submissions. The intent of this action will be to ensure that accurate data are collected without being overly burdensome on industry in the event of unintended errors.

Voluntary Provisions: A voluntary data collection program will be used to collect information needed to assess spillover impacts on nontrawl fisheries.

Central Registry: Information on transaction prices will be included in a central registry of QS owners. Such information will also be included for LE permit owners/lessees.

Government Costs: Data will be collected and maintained on the monitoring, administration, and enforcement costs related to governance of the trawl rationalization program.

[cc] The following are three options for the sequences of agency involvement in decision making for the distribution of adaptive management QP after year 2..

1. NMFS
2. State → Council →NMFS
3. Council →NMFS

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Table 2. Control and vessel limit options: Council preferred alternative.

Species Category	Vessel Limit (Applies to all QP in a Vessel Account, Used and Unused)	Vessel Unused QP Limit	QS Control Lim
Nonwhiting Groundfish Species	3.2%		2.7%
Lingcod - coastwide	3.8%		2.5%
Pacific Cod	20.0%		12.0%
Pacific whiting (shoreside)	15.0%		10.0%
Pacific whiting (mothership)	30.0%		20.0%
Sablefish			
N. of 36° (Monterey north)	4.5%		3.0%
S. of 36° (Conception area)	15.0%		10.0%
PACIFIC OCEAN PERCH	6.0%	4.0%	4.0%
WIDOW ROCKFISH *	8.5%	5.1%	5.1%
CANARY ROCKFISH	10.0%	4.4%	4.4%
Chilipepper Rockfish	15.0%		10.0%
BOCACCIO	15.4%	13.2%	13.2%
Splitnose Rockfish	15.0%		10.0%
Yellowtail Rockfish	7.5%		5.0%
Shortspine Thornyhead			
N. of 34°27'	9.0%		6.0%
S. of 34°27'	9.0%		6.0%
Longspine Thornyhead			
N. of 34°27'	9.0%		6.0%
COWCOD	17.7%	17.7%	17.7%
DARKBLOTCHED	6.8%	4.5%	4.5%
YELLOWEYE	11.4%	5.7%	5.7%
Minor Rockfish North			
Shelf Species	7.5%		5.0%
Slope Species	7.5%		5.0%
Minor Rockfish South			
Shelf Species	13.5%		9.0%
Slope Species	9.0%		6.0%
Dover sole	3.9%		2.6%
English Sole	7.5%		5.0%
Petrale Sole	4.5%		3.0%
Arrowtooth Flounder	20.0%		10.0%
Starry Flounder	20.0%		10.0%
Other Flatfish	15.0%		10.0%
Other Fish	7.5%		5.0%
Pacific Halibut	14.4%	5.4%	5.4%

* If widow rockfish is rebuilt before initial allocation of QS, the vessel limit will be set at
limit will be 1.5 times the control limit.

D.4 Whiting At-sea Trawl Sector: Cooperative Program (Appendix B of the EIS)

The at-sea whiting sector co-op program is described generally below. Table 3 provides an outline of the sections of the program. A full description of the co-op programs follows Table 3, beginning with a section on management of the whiting fishery and followed by sections on the mothership and catcher-processor sectors of the whiting fishery (the "at-sea" sectors).

The Council considered but did not adopt a co-op program for the shoreside whiting fishery. Instead, the shoreside whiting sector was merged with the nonwhiting sector, both to be managed with IFQs. However, section place holders for the shoreside whiting co-op program are maintained in this document to maintain a numbering system that will correspond to the numbering of the alternatives and sections of the analysis as they are laid out in the EIS.

D.5 Overview of Co-op Program Elements

D.5.1 At-sea Whiting Sector Management under Co-ops

While co-ops will be used to control the harvest within the at-sea whiting sectors, a number of management measures will still be required to control competition between the whiting sectors. This section covers those measures along with other measures which will apply to all sectors managed under co-ops, such as observer requirements and mandatory submission of economic data. The description of the co-op management program for each at-sea whiting sector starts in Section D.5.2.

The existing allocation of whiting between the shoreside, mothership, and catcher-processor (CP) sectors will not change under the rationalization program (42, 24, and 34 percent, respectively).

Provisions also address bycatch in the at-sea whiting fishery (particularly that of certain overfished species). The Council is recommending incidental groundfish species caps for each of the whiting sectors, for the co-op and nonco-op fisheries within the mothership sector, and for the co-ops within the mothership sector. Within sectors, bycatch allocations would be pro rata, based on the amount of whiting allocated to that sector.

Area closures may be used to control the pace of the fishery. For the mothership sector, the fishery will be divided into a co-op fishery and a nonco-op fishery (for those who do not desire to take part in a co-op). Participants in the nonco-op fishery will not have a claim to a particular amount of the fish allocated to that fishery; therefore the vessels will likely race to harvest the available allocation.

NMFS will close the whiting fishery, a particular sector, the co-op or nonco-op fishery within a sector, or individual co-ops, as appropriate, when it is projected that a whiting catch or bycatch limit will be reached. With respect to co-ops, inseason monitoring and closure will be needed only at the highest level of aggregation of the co-ops. For example, if individual co-ops join together to form an inter-co-op that covers the entirety of one of the whiting sectors, then NMFS will track and close at the sector level. Nevertheless, vessel level monitoring will still be required to ensure that catch is accurately recorded.

Given the high level of monitoring already in place in the whiting fishery, only moderate changes in monitoring are needed to implement this program for the at-sea whiting fishery. For the at-sea segment of the fishery, 100 percent coverage aboard mothership and catcher processors will continue. A program for the mandatory submission of economic data is also included, to facilitate monitoring program performance.

D.5.2 Co-ops for Catcher Vessels Delivering to Motherships

Under this program, those who hold whiting-endorsed permits for catcher vessels in the mothership sector will choose each year whether to be part of a co-op or to register to fish in the nonco-op portion of the fishery. The holders of catcher vessel permits with mothership whiting endorsements will form the co-ops. Based on its catch history, each permit that qualifies for a mothership whiting endorsement will be capped at a portion of the history (endorsement share) of the mothership sector allocation of whiting and bycatch species. Each year, NMFS will distribute a catch allocation to each catcher vessel co-op based on the sum of the endorsement shares for the permits registered to that co-op. NMFS will also distribute a catch allocation each year to the nonco-op portion of the fishery, based on the collective endorsement shares of the permits opting to participate in the nonco-op fishery.

The co-op organization will coordinate harvest by its members. Although co-op agreements will include a mandatory clause that the catch allocation made to a member must equal the amount that the member brings into the co-op, co-op members may transfer catch allocations among themselves. Similarly, if multiple co-ops join together in an inter-co-op, one co-op will be allowed to transfer catch allocation to another co-op within that inter-co-op. NMFS will not necessarily need to track transfers among co-op members or within an inter-co-op.

The class of motherships will be closed by creating a LE permit for mothership vessels. There will be restrictions limiting a vessels ability to both catch and operate as a mothership in the whiting fishery in the same year. This will limit the ability of processing vessels to move between the catcher processor and mothership sectors.

Prior to the start of each season, each catcher vessel permit desiring to participate in the co-op fishery will obligate itself to deliver its catch to a particular mothership. The obligation to a particular co-op or mothership will not carry-over from one year to the next, it may be changed at the catcher vessel permit owners discretion based on its preseason declaration. While catch may be transferred among participants in a co-op or inter-co-op, such transfers would not change the mothership to which the catch is obligated, unless a mutual agreement is reached.

As in the IFQ program, accumulation limits will be imposed to prevent excessive concentration of catch allocations. They will cap the proportion of whiting that an individual or entity can process, cap the proportion of whiting an individual or entity could accumulate via ownership of catcher vessel permit(s), and cap the amount that can be landed by any one catcher vessel.

D.5.3 Co-ops for Catcher-Processors

Under the catcher-processor (CP) co-op program, as under status quo, a voluntary CP co-op may continue to be formed by CP permit holders. This system will continue as long the existing co-op system continues to operate successfully or until the FMP is otherwise amended. If the voluntary co-op system fails, it will be replaced with an IFQ system. Currently the co-op operates under a private contract that includes division of the harvest among participants according to an agreed schedule. In the event the co-op system fails, IFQ will be allocated equally to each CP permit (equally divided among all CP endorsed permits).

Under the catcher-processor (CP) co-op program, the main Council recommendations are the creation of a CP endorsement to close the CP fishery to new entrants and the assignment of an allocation to the voluntary CP co-op. The endorsement will be granted to LE permits registered to CP vessels if the vessels meet specified qualification criteria. Only vessels with a CP LE permit will be allowed to harvest fish from the CP sector's allocation. LE permits with CP endorsements will continue to be transferable. NMFS will not establish an allocation of catch or catch history among CP permits unless the co-op fails. NMFS will specify in regulation the assignment of the CP sector allocation to the CP sector co-op. If necessary, a closure will be used to keep the CP sector from exceeding its allocation of whiting and bycatch species.

D.6 Detailed Specification of Co-op Program Elements

Table 3 Overview of the co-op program.

B.1	***Whiting Sector Management Under Co-ops***
B-1.1	Whiting Management
B-1.2	Annual Whiting Rollovers
B-1.3	Bycatch Species Management
B-1.4	At-sea Observers/Monitoring
B-1.5	Mandatory Data Collection
B-1.6	Adaptive Management—Not included in recommendation. *(This section header is being maintained as a place holder so that numbering will correspond to that of the alternatives and analysis in the EIS).*
B-1.7	Length Endorsement
B-2	***Whiting Mothership Sector Co-op Program***
B-2.1	Participation in the Mothership Sector
B-2.2	Permits/Endorsement Qualification and Characteristics
B-2.3	Co-op Formation and Operation Rules
B-2.4	Obligations to Processors
B-2.5	NMFS Role
B-3	***Whiting Shoreside Sector Co-op Program***
	Not included in recommendation. *(This section header is being maintained as a place holder)*.
B-4	***Catcher-Processors Co-op Program***
B-4.1	Participation in the Catcher-Processor Sector and Endorsement Qualification
B-4.2	Co-op Formation and Operation Rules
B-4.3	NMFS Role

B-1 Whiting Sector Management Under Co-ops

B-1.1 Whiting Management

Under the co-op program, catcher vessel permits for the mothership sector will be endorsed for deliveries to motherships and amounts of history assigned to each catcher vessel permit based on past harvest in the fishery. Catcher-processor permits will be endorsed for participation in the catcher-processor sector.

The whiting catch history calculation for each mothership-endorsed catcher vessel permit [CV(MS)] will be assigned to a pool for the co-op in which the permit will participate or a pool for the mothership nonco-op fishery. NMFS will make an allocation assignment to the catcher-processor sector co-op based on the allocation to the CP sector. Co-ops are responsible for monitoring and enforcing the catch limits of co-op members.

NMFS will monitor the catch in the mothership nonco-op fishery, the mothership co-op fishery, the CP fishery, and the overall whiting catch of all at-sea sectors. NMFS will close each segment of the fishery based on projected attainment of whiting catch. Additionally, all at-sea sectors will be subject to closure based on attainment of the overall trawl whiting allocation.

B-1.2 Annual Whiting Rollovers

There will not be a rollover of unused whiting from one sector to another.

B-1.3 Bycatch Species Management

For the foreseeable future, the whiting fishery will be managed under bycatch limits (hard caps) for widow, canary, darkblotched rockfish, and Pacific Ocean perch. The catch of all groundfish will be accounted for and tracked against the OY.

The ESA-listed salmon bycatch management measures—that is, the 11,000 Chinook threshold, 0.05 rate threshold, and triggered 100 fathom closure—will also continue to be in place.

The goal of bycatch management is to control the rate and amounts of rockfish and salmon bycatch to ensure each sector is provided an opportunity to harvest its whiting allocation.

There will be a set aside of Pacific halibut for the at-sea whiting fishery, as specified in the intersector allocation process (Amendment 21).

B-1.3.1 Bycatch Allocation Subdivision

Subdivide bycatch species managed with hard caps (widow, canary, darkblotched rockfish, and Pacific Ocean perch) among each of the whiting sectors; within the sectors subdivide between the co-op fishery and nonco-op fishery (subdivision for the nonco-op fishery does not apply to the catcher-processor co-op program); and subdivide among co-ops.

Only those species with hard caps will be subdivided for bycatch management and bycatch will be allocated to each permit and co-op pro rata in proportion to its whiting allocation. The mothership sector's bycatch allocation will be divided between its co-op and nonco-op fishery, based on the allocations made to the permits participating in each portion of the fishery.

B-1.3.2 Bycatch Management

All sectors and co-ops will close based on projected attainment of the at-sea whiting fishery bycatch cap for any one species. The mothership co-op fishery, nonco-op fishery, and catcher-processor fishery will each be closed based on projected attainment of their individual allocation. Additionally, each co-op will cease fishing when its bycatch allocation is reached.

The Council may also use area closures (seasonal or year-round) to manage overfished stocks in the co-op and nonco-op fisheries. The area closures may be the same or different for different species. Area closures may be year-round, seasonal, or triggered automatically by the attainment of certain levels of catch.

Unused bycatch may be rolled over from one sector to another if the sector's full allocation of whiting has been harvested or participants in the sector do not intend to harvest the remaining sector allocation.

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B-1.4 At-sea Observers/ Monitoring

At-sea Whiting Fishery: 100 percent observer coverage aboard mothership and catcher-processors will continue. Observers would be required in addition to or as a replacement for video monitoring.[6]

For some coverage, cameras may be used in place of observers (feasibility to be determined). It is the Council intent to provide NMFS flexibility sufficient to design and implementation a tracking and monitoring program that will achieve the goals and objectives of the trawl rationalization program.

[6] February 2010: The second sentence of this paragraph was adopted as part of the Council's November 2008 motion but it was located under the section on the IFQ program rather than the section on the motherhship co-op program.

B-1.5 Mandatory Data Collection

The following are the central elements of the data collection program that will be implemented as part of the co-op program.

- Mandatory submission of economic data for LE trawl industry (harvesters and processors).
- Voluntary submission of economic data for other sectors of the fishing industry.
- Include transaction value information in a centralized registry of ownership.
- Formal monitoring of government costs.

Mandatory Provisions. The Council and NMFS shall have the authority to implement a data collection program for cost, revenue, ownership, and employment data, compliance with which will be mandatory for members of the west coast groundfish industry harvesting or processing fish under the Council's authority. Data collected under this authority will be treated as confidential in accordance with Section 402 of the MSA.

A mandatory data collection program shall be developed and implemented as part of the groundfish trawl rationalization program and continued through the life of the program. Cost, revenue, ownership, employment and other information will be collected on a periodic basis (based on scientific requirements) to provide the information necessary to study the impacts of the program, including achievement of goals and objectives associated with the rationalization program. These data may also be used to analyze the economic and social impacts of future FMP amendments on industry, regions, and localities. The program will include targeted and random audits as necessary to verify and validate data submissions. *Data collected under this authority will be treated as confidential in accordance with Section 402 of the MSA.* Additional funding (as compared to status quo) will be needed to support the collection of these data. The data collected would include data needed to meet MSA requirements (including antirust).

The development of the program shall include a comprehensive discussion of the enforcement of such a program, including discussion of the type of enforcement actions that will be taken if inaccuracies are found in mandatory data submissions. The intent of this action will be to ensure that accurate data are collected without being overly burdensome to industry in the event of unintended errors. Annual reports will be provided to the Council.

Voluntary Provisions: A voluntary data collection program will be used to collect information needed to assess spillover impacts on nontrawl fisheries.

Central Registry: Information on transaction prices will be included in a central registry of whiting endorsed permit and mothership permit owners. Such information will also be included for sales and lessees.

Government Costs: Data will be collected and maintained on the monitoring, administration, and enforcement costs related to governance of the rationalization program.

B-1.6 Adaptive Management

There will not be an adaptive management set aside for the at-sea whiting fisheries. *(This section is being maintained as a place holder so that numbering will correspond to that in the alternatives and analysis of the EIS.)*

B-1.7 Length Endorsement

Length endorsement restrictions on LE permits endorsed for groundfish gear will be retained, however, the provision that requires that the size endorsements on trawl permits transferred to smaller vessels be reduced to the size of that smaller vessel will be eliminated (i.e. length endorsements will not change when a trawl endorsed permit is transferred to a smaller vessel).

B-2 Whiting Mothership Sector Co-Op Program

Overview. Qualified permits will be endorsed for mothership (MS) co-op participation. Each year the holders of those permits will choose whether their vessels will fish in the co-op fishery, in which individual co-ops will direct harvest, or fish in a nonco-op fishery that will be managed by NMFS as an Olympic style fishery. The co-op will be obligated to deliver its fish to specific mothership processors based on the obligations of each permit in the co-op determined based on preseason declarations. LE permits will be issued for motherships and required for a mothership to receive whiting from catcher vessels.

B-2.1 Participation in the Mothership Sector

a. Catcher Vessels

Vessels with CV(MS)-endorsed permits may participate in either the co-op or nonco-op portion of the mothership fishery. They will choose annually which fishery they will participate in for the coming year. Additionally, any groundfish LE trawl permitted vessels may participate in the co-op portion of the fishery if they join a co-op (as described in Section B-2.3.3).[7] No other catcher vessels may participate in the mothership fishery.

A vessel may not engage in the processing of whiting during any year in which a catcher vessel (mothership) (CV[MS]) endorsed permit is registered for use with the vessel.

b. Processors

Only motherships with a mothership LE permit may receive deliveries from catcher vessels participating in the co-op or nonco-op portions of the mothership sector whiting fishery. (Note: motherships may acquire such permits by transfer; see Section B-2.2.2.)

c. Vessels Excluded[8]

Motherships also operating as a catcher-processor may not operate as a mothership: during a year in which it also participates as a catcher-processor.

[7] When such permits participate in a co-op the co-op will not be allocated any additional fish based on participation by such a vessel.

[8] A vessel that has been under foreign registry after the date of the AFA and that has participated in fisheries in the territorial waters or exclusive economic zones of other countries will not be eligible to participate as a mothership in the mothership sector of the Pacific whiting fishery, as per the AFA's modification of Section 12102(c)(6) of the USC. Section 12102(c)(6) of the USC has since been renumbered.

B-2.2 Permits/Endorsement Qualification and Characteristics

B-2.2.1 Catcher Vessel Mothership (CV[MS] Whiting Endorsement)

a. Endorsement Qualification and History Assignment

Permits with a qualifying history will be designated as CV(MS) permits through the addition of an endorsement to their LE groundfish permit. At the time of endorsement qualification, each permit will also be assigned a catch history that will determine the share of the mothership whiting allocation associated with that permit.

Qualifying for a CV(MS) Whiting Endorsement. A LE permit will qualify for a CV(MS) whiting endorsement if it has a total of more than 500 mt of whiting deliveries to motherships from 1994 through 2003.

Catch History Assignment (Identification of Endorsement Related Catch History). The initial catch history calculation for CV(MS) whiting endorsements will be based on whiting history of the permit for 1994 through 2003, dropping two[9] years. A permit's history for each year will be measured as a share of the fleet history for that year (i.e. "relative pounds" will be used). This catch history will be used by NMFS to assign both whiting and bycatch species allocations to the co-ops and nonco-op fishery pools, as per section B.1.3.2.

For the purpose of the endorsement and initial calculation, catch history associated with the permit includes that of permits that were combined to generate the current permit.

b. Whiting Permit and Endorsement Transferability and Endorsement Severability

The CV(MS) whiting endorsement (together with the associated catch history) *may not be* severed from the groundfish LE trawl permit. Catch history associated with the whiting endorsement may not be subdivided. CV(MS) permits may be transferred two times during the fishing year, provided that the second transfer is back to the original catcher vessel (i.e. only one transfer per year to a different catcher vessel).

c. Accumulation Limit

CV(MS) Permit Ownership: No individual or entity may own CV(MS) permits for which the allocation total is greater than 20 percent.
Catcher Vessel Usage Limit: No vessel may catch more than 30 percent of the mothership sector's whiting allocation.

[9] February 2010: The word "worst" was removed in line with the Council's April 2009 action specifying that the permit owner would be allowed to select the years dropped from the calculation.

d. Combination

CV(MS) Permit Combination to Achieve a Larger Size Endorsement. When a CV(MS)-endorsed permit is combined with another permit (including unendorsed permits), the resulting permit will be CV(MS) endorsed.[10]

B-2.2.2 Mothership Processor Permit

a. Qualifying Entities

The owners of qualifying motherships will be issued MS permits. In the case of bareboat charters, the charterer of the bareboat will be issued the permit.

b. Qualification Requirements

A qualifying mothership is one which processed at least 1,000 mt of whiting in each of any two years from 1997 through 2003.

c. Transferability

1. MS permits will be transferable
2. MS permits may be transferred to a vessel of any size (there will be no size endorsements associated with the permit). MS permits **may not** be transferred to a vessel engaged in the *harvest* of whiting in the year of the transfer.
3. Limit on the Frequency of Transfers: MS permits may be transferred two times during the fishing year provided that the second transfer is back to the original mothership (i.e. only one transfer per year to a different mothership).

d. Usage Limit

No individual or entity owning a MS permit(s) may process more than 45 percent of the total MS sector whiting allocation.

B-2.3 Co-op Formation and Operation Rules.

B-2.3.1 Who and Number of Co-ops

Co-ops are not required but may be voluntarily formed among CV(MS) permit owners. The number of co-ops will be indirectly limited by the limit on the minimum number of vessels able to form a co-op (see Section 2.3.3-b).

[10] Specifically, a CV(MS)-endorsed permit that is combined with a LE trawl permit that is not CV(MS) endorsed or one that is CV(Shoreside) [CV(SS)] endorsed will be reissued with the CV(MS) endorsement. If the other permit is CV(SS) endorsed, the CV(SS) endorsement will also be maintained on the resulting permit. However, CV(MS) and CV(SS) catch histories will be maintained separately on the resulting permit and be specific to participation in the sectors for which the catch histories were originally determined. If a CV(MS) permit is combined with a CP permit, the CV(MS) endorsement and history will not be reissued on the combined permit. The size endorsement resulting from permit combinations will be determined based on the existing permit combination formula.

B-2.3.2 When

Each year at a date certain prior to the start of the fishery, MS and CV(MS) permit holders planning to participate in the mothership sector must register with NMFS. At that time CV(MS) permit holders must identify which co-op they will participate in or if they plan to participate in the nonco-op fishery.

B-2.3.3 Co-op Agreement Standards

a. Submissions to NMFS and the Council

Co-op agreement. Co-op agreements will be submitted to NMFS for approval. Signed copies of the cooperative contracts must be filed with the Council and NMFS and available for public review before the co-op is authorized to engage in fishing activities.[11] Any material changes or amendments to the contract must be filed annually with the Council and NMFS by a date certain.

Letter to Department of Justice. Co-ops must also file with the Council and NMFS a copy of a letter from the co-op requesting a business review letter on the fishery cooperative from the Department of Justice and any response to such request.

b. Number of Participants in Each Co-op (Including Inter-co-ops)

CV permits may join together in separate harvester co-ops. A minimum of 20 percent of the CV(MS) permit holders are required to form a co-op.[12] Co-ops may form co-ops with other co-ops. Within one of the whiting sectors, these co-ops may be formed to manage directed catch and/or bycatch. Whiting and bycatch allocations may be transferred among co-ops through inter-co-op agreements.

c. Catch History Distributions Among Permits

Co-op agreements must stipulate that catch allocations to members of the co-op be based on their catch history calculation by NMFS used for distribution to the co-op.

d. Participation by NonCV (MS) Endorsed Permits

Through temporary arrangements a co-op allocation may be harvested by any catcher vessel holding a valid LE trawl permit which has joined the co-op (including one that does not have a CV(MS) endorsement).[13]

e. Other Required Co-op Agreement Provisions

[11] During council discussion this was flagged by NOAA GC as a potential legal problem.

[12] The minimum threshold number of participants required to form a co-op balances the potential advantages for multiple co-ops while limiting implementation and management costs and administrative requirements for managing this sector.

[13] As a member of the co-op, such a vessel would be subject to Section B-2.4 and the indicated processor obligations.

The Council's intent is to have mothership sector participants work with NMFS to develop and describe a process and co-op agreement requirements to include in implementing regulations for this action.

A co-op agreement must include:

1. A list of all vessels, and which must match the amount distributed to individual permit holders by NMFS.
2. Signature of all permit holders participating in the co-op.
3. A plan to adequately monitor catch and bycatch.
4. Adequate enforcement and penalty provisions to ensure that catch and bycatch overages do not occur.
5. Measures designed to reduce bycatch of overfished species.
6. An obligation to manage inseason transfers of catch history.
7. A requirement that agreement by at least a majority of the members is required to dissolve a co-op (**During council discussion this was flagged by NOAA GC as a potential legal problem**).
8. An obligation to produce an annual report to the Council and NMFS by a date certain documenting the co-op's catch and bycatch data and inseason transfers (the report is to be available for review by the public).
9. Identification of a co-op manager who will:
    a. serve as the contact person with NMFS, the Council and other co-ops,
    b. be responsible for the annual distribution of catch and bycatch,
    c. oversee transfers,
    d. prepare annual reports, and
    e. be authorized to receive or respond to any legal process against the co-op.
10. Provisions that prohibit co-op membership by permit holders that have incurred legal sanctions that prevent them from fishing groundfish in the Council region.
11. A provision that requires new owners to comply with membership restrictions in the co-op agreements.

f. Additional Provisions for Inter-co-op Agreements

1. In the case of two or more cooperatives entering into an inter-cooperative agreement, the inter-co-op agreement must incorporate and honor the provisions of the individual co-op agreements unless all such agreements (or modifications thereof) are resubmitted for approval.
2. The requirements of Sections 2.3.3.a-2.3.3.e apply to the inter-co-op agreement, except that for the purpose of Section 2.3.3.e., subparagraph 7, the members of the interco-ops are the co-ops and not the participants in each co-op.

B-2.3.4 Annual Allocation Transferability

a. The annual allocations received by a co-op based on catch history of the whiting endorsements held by its members may be transferred among co-op members and from one co-op to another so long as obligations to processors are met (as per Section B-2.4). Additionally, in order to transfer annual allocation from one co-op to another there must be a NMFS approved inter-co-op agreement.
b. Allocations may not be transferred from the mothership sector to another sector.

B-2.4 Obligations to Processors (Processor Ties)

Each year, a permit will obligate to a processor all of its catch for a coming year.

B-2.4.1 Formation and Modification of Processor Tie Obligations

There will not be processor tie that caries from one year to the next. CV(MS) permits will be obligated to a single MS permit for an entire year but may change to a different MS permit through a preseason declaration of intent.

By September 1 of the year prior to implementation and every year thereafter, each CV(MS) permit is required to contact NMFS and indicate whether CV(MS) permit will be participating in the co-op or nonco-op fishery in the following year. If participating in the co-op fishery, then CV(MS) permit must also provide the name of the MS permit that CV(MS) permit will be linked to in the following year (i.e., annual catcher vessel, mothership linkage that may be changed each year without requirement to go into the "nonco-op" fishery). Once established, the catcher vessel, mothership linkage shall remain in place until changed by CV(MS) permit. By July 1 of the year prior to implementation and every year thereafter, if CV permit would be participating in the co-op fishery in the following year, then CV permit must notify the MS permit that the CV permit QP will be linked to in the following year.[14]

Mothership Permit Transfer. If a mothership transfers its MS permit to a different mothership or different owner, the CV(MS) permit obligation for that year remains in place and transfers with the MS permit to the replacement mothership unless the obligation is changed by mutual agreement. The obligation does not extend beyond the fishing year.

B-2.4.2 Flexibility in Meeting Obligations to Processors

a. Temporary Transfer of the Annual Allocation Within the Co-op or from One Co-op to Another

When CV(MS) permit owners transfer co-op allocations from one co-op member to another within the co-op or from one co-op to another within an inter-co-op such allocations must be delivered to the mothership to which the allocation is obligated through the preseason declaration, unless released by mutual agreement.

b. Mutual Agreement Exception

By mutual agreement of the CV(MS) permit owner and mothership to which the permit is obligated, a permit may deliver to a licensed mothership other than that to which it is obligated.

B-2.4.3 Mothership Processor Withdrawal

If a mothership withdraws subsequent to quota assignment, then the CV(MS) permit that it is obligated to it is free to participate in the co-op or nonco-op fishery. The MS permit shall notify

[14] February 2010: The last sentence of this paragraph was part of the November 2008 Council motion and was inadvertently omitted from previous drafts of the Council's final preferred alternative.

NMFS and linked CV(MS) permits of its withdrawal, and CV(MS) permits shall notify NMFS of their intent to participate in the co-op or nonco-op fishery thereafter. If continuing in co-op fishery, then CV(MS) permit shall provide NMFS with the name of the new MS permit to which it will be obligated for that season.

B-2.5 NMFS Role

B-2.5.1 Permit and Endorsement Issuance

NMFS will issue all necessary permits and endorsements under the rules specified under this program. Appeals processes will be provided as appropriate and necessary.

B-2.5.2 Fishery Registration and Co-op Approval

NMFS will announce a deadline before which all co-op agreements must be received for the coming year. NMFS will review and approve or reject co-op agreements based on standards provided here and other standards that it deems necessary to achieve the policy intent of the Council's actions.

B-2.5.3 Annual Allocation to Co-ops and the Nonco-op Fishery

a. Co-op Allocation

Each year NMFS will determine the percent of the mothership sector's harvest allocation to be given to each co-op based on the catch history calculation of CV(MS) permits registered to participate in the co-op that year. NMFS does not allocate to the individual permit holder; rather, NMFS allocates an aggregate amount of harvest tonnage annually to the co-op based on the catch histories associated with the members of the co-ops.

b. Nonco-op Allocation

Each year NMFS will determine the distribution to be given to the nonco-op fishery based on the catch history calculation of permit holders registered to participate in that fishery.

B-2.5.4 Fishery Management and Co-op Monitoring

1. NMFS will track all permit transfers and the invocation of mutual agreement exceptions. Permit transfers will not be valid until registered and acknowledged by NMFS.

2. NMFS will monitor catch and close segments of the fishery as necessary to ensure catch limits are not exceeded for:
   a. the whiting mothership co-op fishery
   b. the whiting mothership nonco-op fishery
   c. the mothership whiting sector as a whole
3. NMFS will not necessarily monitor, but will investigate and enforce as it deems necessary, the permit and co-op obligations to motherships.

4. NMFS will not necessarily monitor or enforce (except as it deems necessary):
   a. an individual permit's progress towards its catch allocations (permit level catch control will be at the co-op level and enforced through execution of the private contract)
   b. a co-op's progress toward its catch allocation[15]
   c. actual performance of the co-op agreement (the parties to the contract will resolve through private contract and remedies any deviation from provisions such as that requiring that a vessel have the opportunity to harvest the catch allocated to the co-op based on that vessel's permit, Section B-2.3.3.c)
5. NMFS will monitor other program provisions as needed. In some situations, there may need to be a declaration procedure to determine where a permit is delivering its obligated catch, for example, if a mothership withdraws without transferring its permit or reaching a mutual agreement for the transfer of obligated deliveries to a different mothership.

B-3 Whiting Shoreside Sector Co-Op Program (placeholder, not recommended)

The shoreside whiting sector will be managed with an IFQ program. This section header is being maintained so that section numbering here will correspond to section numbering in the alternatives and analysis in the EIS.

[15] This assumes that there is an inter-co-op agreement in place that covers the entire co-op fishery. If such an agreement is not in place covering both catch and bycatch, NMFS may need to monitor catch by each individual co-op (but not by the individual vessels in the co-op).

B-4 Catcher-Processors Co-op Program

Catch by the catcher-processor sector will be controlled primarily by closing the fishery when a constraining allocation is reached.[16] As under status quo, vessels may form co-ops to achieve benefits that result from a slower-paced, more controlled harvest. The main recommendations are the creation of a limited number of catcher-processor endorsements and the specification in regulation of the amounts that will be available for harvest by the voluntary co-op. A new entrant will have to acquire a permit with a catcher-processor endorsement in order to enter the fishery. If the co-op system fails it will be replaced by an IFQ program and the initial issuance of IFQ will be allocated equally among the permits (equally divided among all CP endorsed permits).

B-4.1 Participation in the Catcher-Processor Sector , Endorsement Qualification and Permit Transferability.

Catcher-processor (CP) Endorsement. The class of CP endorsed permits (CP permits) will be limited by an endorsement placed on a LE permit. LE permits registered to qualified catcher-processor vessels will be endorsed as CP permits. A qualified permit is one that harvested and processed in the catcher-processor sector of the Pacific whiting fishery at any time from 1997 through 2003. Only vessels catcher-processor vessels with a CP endorsed LE permit will be allowed to process whiting at-sea as part of the CP sector. LE permits with CP endorsements will continue to be transferable.

Participation as Mothership. A catcher-processor cannot operate as a mothership during the same year it participates in the CP fishery.

CP Permit Combination to Achieve a Larger Size Endorsement. A CP permit that is combined with a LE trawl permit that is not CP endorsed will result in a single CP permit with a larger size endorsement. (A CV(MS) endorsement on one of the permits being combined will not be reissued on the resulting permit.) The resulting size endorsement will be determined based on the existing permit combination formula.

CP Permit Transfers to Smaller Vessels. Length endorsement restrictions on LE permits endorsed for groundfish gear will be retained, however, the provision that requires that the size endorsements on trawl permits transferred to smaller vessels be reduced to the size of that smaller vessel will be eliminated (i.e. length endorsements will not change when a trawl endorsed permit is transferred to a smaller vessel).

Number of Transfers Per Year. CP permits may be transferred two times during the fishing year, provided that the second transfer was back to the original CP (I.e., only one transfer per year to a different CP).

[16] All references to catcher-processors in this section references to vessels operating in the catcher-processor sector. Vessels under 75’ which catch and process at-sea as part of the shoreside sector are not covered here.

B-4.2 Co-op Formation and Operation Rules

No annual registrations or declarations are required. As under status quo, co-op(s) will be formed among holders of permits for catcher-processors. Participation in the co-op will be at the discretion of those permit holders. If eligible participants choose to form a co-op, the catcher-processor sector will be managed as a private voluntary cooperative and governed by a private contract that specifies, among other things, allocation of whiting among CP permits, catch/bycatch management, and enforcement and compliance provisions. Under the co-op program, if more than one co-op is formed, a race for fish could ensue absent an inter co-op agreement. NMFS will not establish an allocation of catch or catch history among permits unless the co-op fails to form. If the co-op system fails it will be replaced by an IFQ program and the initial issuance of IFQ will be divided equally among all CP endorsed permits.

Annual Reporting Requirements. The CP cooperative will submit an annual report to the Council at their November meeting. The report will contain information about the current year's CP fishery, including the CP sector's annual allocation of Pacific whiting; the CP cooperative's actual retained and discarded catch of Pacific whiting, salmon, rockfish, groundfish, and other species on a vessel-by-vessel basis; a description of the method used by the CP cooperative to monitor performance of cooperative vessels that participated in the CP sector of the fishery; and a description of any actions taken by the CP cooperative in response to any vessels that exceed their allowed catch and bycatch. The report will also identify plans for the next year's CP fishery, including the companies participating in the cooperative, the harvest agreement, and catch monitoring and reporting requirements.

B-4.3 NMFS Role

B-4.3.1 Permit and Endorsement Issuance

NMFS will issue all necessary endorsements under the rules specified under this program. Appeals processes will be provided as appropriate and necessary.

B-4.3.2 Annual Allocation

Harvest amounts for the co-op will be specified in regulation. If the co-op breaks up, IFQ will issue and divided equally among the 10 permits.

The catcher-processor sector allocation may be divided among eligible catcher-processor vessels (i.e., those catcher-processor vessels for which a CP permit is held) according to an agreed catcher-processor cooperative harvest schedule as specified by private contract.

B-4.3.3 Fishery and Co-op Monitoring

1. NMFS will track all permit transfers. Permit transfers will not be valid until registered and acknowledged by NMFS.
2. NMFS will monitor catch and close the catcher-processor sector fishery as necessary to ensure catch limits are not exceeded.

STAFF DRAFT GROUNDFISH FISHERY MANAGEMENT PLAN AMENDATORY LANGUAGE FOR AMENDMENT 21

This document provides a draft of staff proposed changes to the groundfish fishery management plan (FMP) language that would implement the final preferred alternative adopted by the Council at its April 2009 meeting (motion provided as an appendix to this document). Prior to adopting the amendment language to implement the FPA, there is one issue requiring clarification (see Agenda Item E.6.b, NMFS Report 2).

Amendatory Language

The Council has not yet formally adopted this language. This is the staff interpretation of how the Pacific Coast Groundfish Fishery Management Plan (FMP) language would be modified based on the Council motion for Amendment 21.

Under Amendment 21, the Pacific Fishery Management Council (Council) decided that all formal, long term allocations need to be in the Pacific Coast Groundfish FMP, which would require an FMP amendment to change in the future (see section 2.4 in this DEIS). Section 6.3 of the FMP describes the allocation framework, which was followed in deciding the formal allocations under Amendment 21. Two FMP stocks, Pacific whiting and sablefish north of 36° N latitude have been formally allocated prior to Amendment 21. While these allocations have been implemented in federal regulations, they are not included in the FMP. Because of the Council's Amendment 21 decision to specify formal allocations in the FMP, two sections in Chapter 11 are recommended to be added to the FMP that describe the pre-existing allocations as follows. Actual section numbers are not provided in this recommendation since it is anticipated that Chapter 11 will also be amended by implementation of Amendment 20.

11.[insert section number] Sector Allocations of Sablefish North of 36° N Latitude

Fixed allocations of sablefish are based on the OY specified for the area north of 36° N latitude (to the U.S.-Canada border). Sablefish allocations north of 36° N latitude are determined by first deducting the tribal share from the OY specified for north of 36° N latitude, then deducting the estimated total mortality of sablefish in research and non-groundfish fisheries (these deductions are decided in the biennial process for specifying harvest specifications and management measures based on the best available information at the time of the decision), then dividing the remaining yield (non-tribal share) between open access and limited entry fisheries, with the limited entry share divided between the trawl and fixed gear (longline and fishpot) sectors. The proportions of each of these divisions are indicated in Figure 11-1. The limited entry fixed gear share is then generally divided 85% to the primary fishery for limited entry fixed gear vessels with sablefish endorsements and 15% for the daily-trip-limit fishery, for such vessels with and without sablefish endorsements.

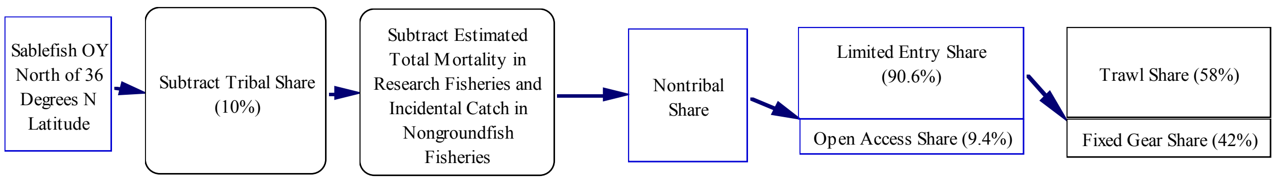


Figure 11-1. Fixed intersector allocations of sablefish north of 36° N latitude.

11.[insert section number] Sector allocations of Pacific Whiting

Projected total mortalities of Pacific whiting in recreational, research, and non-whiting fisheries are first set aside (these deductions are decided in the annual process for specifying Pacific whiting harvest specifications and management measures based on the best available information at the time of the decision), then a yield amount is set-aside to accommodate tribal whiting fisheries. In some years the whiting set-aside may be increased to accommodate other programs, such as EFPs. The nontribal commercial share of whiting is allocated to LE whiting trawl sectors as follows: 42% for the shoreside whiting sector, 24% for the at-sea mothership whiting sector, and 34% for the at-sea catcher-processor whiting sector. No more than five percent of the shoreside whiting sector's allocation may be taken and retained south of 42° N latitude prior to the start of the shore-based whiting season north of 42° N latitude (in waters off Oregon and Washington).

Pursuant to the Council's preferred alternative under Amendment 21, the following amendatory language is recommended for FMP chapter 11:

11.[insert section number] Limited Entry Trawl Allocations for Amendment 21 Species

Formal allocations of species covered under Amendment 21 support Amendment 20 trawl rationalization measures. Annual OYs are established for these species the same as for other groundfish species. The OYs are then reduced by deducting the estimated total mortality of these species in research, tribal, and non-groundfish fisheries, and the bycatch limits specified in adopted exempted fishing permits. The remainder of the OYs are then allocated according to the percentages in Table 11-1. The trawl percentage is for the non-treaty trawl fishery managed under Amendment 21. The non-treaty, non-trawl percentage is for the limited entry fixed gear fishery, the open access fishery, and the recreational fishery.

Trawl/Nontrawl Allocations

Table 11-1. Allocation percentages for limited entry trawl and non-trawl sectors specified for FMP groundfish stocks and stock complexes under Amendment 21 (most percentages based on 2003-2005).

Stock or Complex	All Non-Treaty LE Trawl Sectors	All Non-Treaty Non-Trawl Sectors
Lingcod	45.0%	55.0%
Pacific Cod	95.0%	5.0%
Sablefish S. of 36° N latitude	42.0%	58.0%
PACIFIC OCEAN PERCH	**95.0%**	**5.0%**
WIDOW	**91.0%**	**9.0%**
Chilipepper S. of 40°10' N latitude	75.0%	25.0%
Splitnose S. of 40°10' N latitude	95.0%	5.0%
Yellowtail N. of 40°10' N latitude	88.0%	12.0%
Shortspine N. of 34°27' N latitude	95.0%	5.0%
Shortspine S. of 34°27' N latitude	50 mt	Remaining Yield
Longspine N. of 34°27' N latitude	95.0%	5.0%
DARKBLOTCHED	**95.0%**	**5.0%**
Minor Slope RF North of 40°10' N latitude	81.0%	19.0%
Minor Slope RF South of 40°10' N latitude	63.0%	37.0%
Dover Sole	95.0%	5.0%
English Sole	95.0%	5.0%
Petrale Sole	95.0%	5.0%
Arrowtooth Flounder	95.0%	5.0%
Starry Flounder	50.0%	50.0%
Other Flatfish	90.0%	10.0%

Shoreside Trawl Allocations for Initial Issuance

Under Amendment 20 trawl rationalization, the two existing LE trawl sectors delivering groundfish to shoreside processing plants (i.e., shoreside whiting and shoreside non-whiting) are managed as one sector under a system of individual fishing quotas (IFQs). However, before quota shares can be allocated to eligible LE trawl permit holders, an initial one-time allocation was made to the two shoreside sectors. All species subject to formal allocation, including sablefish north of 36° N latitude and excluding the three trawl-dominant overfished species (i.e., darkblotched rockfish, Pacific ocean perch, and widow rockfish) and yellowtail rockfish are allocated to the shoreside whiting and shoreside non-whiting sectors based on 1995-2005 sector catch percentages (Table 11-2). An initial allocation of 300 mt of yellowtail rockfish was made to the shoreside whiting sector prior to allocation of Amendment 20 quota shares. The estimated fishing mortality of Amendment 21 species in the at-sea whiting fishery (i.e., total catch by catcher-processors and vessels delivering whiting to motherships) other than the three trawl-dominant overfished species is set-aside from the LE trawl allocations specified in Table 11-1 prior to making the initial shoreside trawl sector allocations. While set-aside amounts for the at-sea whiting fishery (Mothership and Catcher/Processor sectors) were preliminarily decided under Amendment 21, the actual set-aside amounts will be based on the best available information on bycatch by these sectors in the biennial harvest specifications and management measures decision process.

Table 11-2. Shoreside trawl sector catch percentages during 1995-2005 used to apportion the initial allocation of Amendment 21 species to LE trawl sectors delivering groundfish to shoreside processing plants (i.e., shoreside whiting and shoreside non-whiting).

Stock or Complex	1995-2005 Sector Catch Percentage	
	Non-whiting	**Whiting**
Lingcod	99.70%	0.30%
Pacific Cod	99.90%	0.10%
Pacific Whiting	0.10%	99.90%
Sablefish N. of 36° N latitude	98.20%	1.80%
Sablefish S. of 36° N latitude	100.00%	0.00%
Chilipepper S. of 40°10' N latitude	100.00%	0.00%
Splitnose S. of 40°10' N latitude	100.00%	0.00%
Shortspine N. of 34°27' N latitude	99.90%	0.10%
Shortspine S. of 34°27' N latitude	100.00%	0.00%
Longspine N. of 34°27' N latitude	100.00%	0.00%
Minor Slope RF North of 40°10' N latitude	98.60%	1.40%
Dover Sole	100.00%	0.00%
English Sole	99.90%	0.10%
Petrale Sole	100.00%	0.00%
Arrowtooth Flounder	100.00%	0.00%
Starry Flounder	100.00%	0.00%
Other Flatfish	99.90%	0.10%

Allocation of Trawl Dominant Overfished Species

Under Amendment 20, the at-sea whiting sectors (i.e., catcher-processors and motherships) are managed in a system of sector-specific harvest cooperatives. Each at-sea whiting sector will manage their bycatch of canary rockfish, darkblotched rockfish, Pacific ocean perch, and widow rockfish using sector-specific total catch limits. An initial allocation of these four species needs to be made to the four existing LE trawl sectors before initial allocation of quota shares under Amendment 20. Initial sector allocation of canary rockfish would be decided in the biennial harvest specification and management measures process immediately preceding implementation of Amendments 20 and 21. The initial sector allocation of the trawl-dominant overfished species under Amendment 21 is as follows:

Darkblotched Rockfish

Allocate 9% or 25 mt, whichever is greater, of the total LE trawl allocation of darkblotched rockfish to the whiting fisheries (at-sea and shoreside combined). The distribution of the whiting trawl allocation of darkblotched to individual whiting sectors will be done pro rata relative to the sectors' whiting allocation.

Pacific Ocean Perch

Allocate 17% or 30 mt, whichever is greater, of the total LE trawl allocation of Pacific ocean perch to the whiting fisheries (at-sea and shoreside combined). The distribution of the whiting trawl allocation of POP to individual whiting sectors will be done pro rata relative to the sectors' whiting allocation.

Widow Rockfish

Initially allocate 52% of the total LE trawl allocation of widow rockfish to the whiting sectors if the stock is under rebuilding or 10% of the total LE trawl allocation or 500 mt of the trawl allocation to the whiting sectors, whichever is greater, if the stock is rebuilt. If the stock is overfished when the initial allocation is implemented, the latter allocation scheme automatically kicks in when it is declared rebuilt. The distribution of the whiting trawl allocation of widow to individual whiting sectors will be done pro rata relative to the sectors' whiting allocation.

<u>Allocation of Pacific Halibut</u>

Pacific halibut is a prohibited species in the west coast LE trawl fishery. Under Amendment 20, Pacific halibut bycatch in the shoreside trawl fishery north of 40°10’ N latitude is managed using a system of individual bycatch quotas (IBQs). Under Amendment 21, an allocation of Pacific halibut was decided as follows:

The trawl mortality limit for legal and sublegal Pacific halibut be set at 15% of the Area 2A (i.e., waters off California, Oregon, and Washington) constant exploitation yield for legal size halibut, not to exceed 130,000 pounds for the first four years of trawl rationalization and not to exceed 100,000 pounds starting in the fifth year. This total bycatch limit may be adjusted downward or upward through the biennial specifications and management measures process. Part of the overall total catch limit is a set-aside of 10 mt of Pacific halibut to accommodate bycatch in the at-sea whiting fishery and bottom trawl bycatch south of 40°10' N latitude. The set-aside amount of Pacific halibut to accommodate the incidental catch in the trawl fishery south of 40°10’ N latitude and in the at-sea whiting fishery may be adjusted in the biennial specifications and management measures process in future years as better information becomes available.

Under Amendment 21, it was decided that any formal allocations be specified in the FMP. Future consideration for a re-allocation of FMP species subject to a formal allocation will require an FMP amendment. The provision to temporarily suspend the limited entry, open access allocation if a species is declared overfished (see section 4.6.1(5) of the FMP) is maintained under Amendment 21.

All intersector allocations will be formally reviewed along with the formal review of the trawl rationalization program five years after implementation of Amendments 20 and 21.

[Amendment 21]

Appendix: Council Motions on Amendment 21 from April 2009 and Amendment from June 2009

The WDFW documents referenced in these motions are provided at the end of this appendix.

APRIL 2009 MOTIONS

Motion 14: Adopt the Motion 1 allocations in the WDFW motion document (Agenda Item F.3.d, Supplemental WDFW Motions in Writing), including status quo allocations for Pacific whiting and sablefish. The specific motion language is as follows: "Intersector Allocation between trawl and non-trawl: Adopt the GAC Alternative, which includes:

Status quo allocation for Pacific whiting.

- Allocations for all other species, except those for which IFQ would not be assigned through the trawl rationalization program as well as those species for which allocations would be decided through the biennial specifications process (actual species included listed in Table 2-10 on p. 23 of Preliminary Draft EIS). Note: longspine thornyhead south of 34°27′ N. latitude would not be included.
- Using 2003-2005 sector total catch percentages as the basis for allocations.
- All trawl allocations greater than or equal to 95% would be set at 95% (actual percentages, by species, are in Table 2-9, on p. 21 of Preliminary Draft EIS)."

Moved by: Phil Anderson Seconded by: Dale Myer

Amndmnt #1 Amend the main motion (Amendment 1 to Motion 14) to include a 75% trawl and 25% non-trawl allocation of chilipepper rockfish south of 40°10' N. latitude, a 50% trawl and 50% non-trawl allocation of starry flounder, and a 90% trawl and 10% non-trawl allocation of Other Flatfish.

Moved by: Marija Vojkovich Seconded by: Kathy Fosmark
Amendment 1 passed; Mr. Moore voted no, Mr. Lockhart abstained.

Amndmnt #2 Amend the main motion (Amendment 2 to Motion 14) to allocate 50 mt of shortspine south of 34°27' N latitude to the trawl fleet as recommended by the GAP.

Moved by: Marija Vojkovich Seconded by: Rod Moore
Amendment 2 passed; Mr. Lockhart abstained.

Main Motion 14 as amended by Amendment #1 passed; Mr. Lockhart abstained.

Motion 15: Adopt Motion 2 in Agenda Item F.3.d, Supplemental WDFW Motions in Writing, which is the Alternative 4 for Pacific halibut trawl total catch limits with one modification which provides that in the fifth year of trawl rationalization the limit decreases to 15% of the Area 2A CEY, not to exceed 100K lbs. The specific motion language, with the modification, is as follows:

Pacific halibut trawl bycatch limits: Alternative 4, with one change (underlined):

- An initial limit for total Pacific halibut bycatch mortality (legal-sized and sublegal fish) in the trawl fishery of 15%, not to exceed 130,000 lbs. per year for the first <u>four years</u>.

- Beginning with the <u>fifth year</u> of implementation, the maximum amount set aside for the trawl rationalization program would be reduced to a total mortality amount of 100,000 lbs. per year.
- The total halibut bycatch mortality amount may be adjusted downward through the biennial specifications process for future years.
- The at-sea trawl sector and shoreside trawl sector south of 40°10' N. latitude would have a bycatch set aside of 5 mt each (total bycatch set aside of 10 mt), which would come out of the 15% trawl sector allocation.

Moved by: Phil Anderson Seconded by: Mark Cedergreen
Motion 15 passed unanimously.

Motion 16: Adopt Motion 3 in Agenda Item F.3.d, Supplemental WDFW Motions in Writing. The specific motion language is as follows:

"1. At-sea sector set asides: Adopt the GAC recommendation to set the at-sea sector set asides large enough to not constrain their fisheries given the interannual variation in sector catches by establishing a 5 mt minimum set-aside for any incidentally caught species in the at-sea fisheries with all set asides rounded up to the nearest 5 mt (actual amounts specified in Table 4-23, p. 102 of Preliminary Draft EIS).

2. Within trawl bycatch allocations between whiting and non-whiting sectors would be set using 1995-2005 catch shares, except as follows:
   - Darkblotched rockfish – Allocate 9% or 25 mt, whichever is greater, of the total trawl allocation of darkblotched rockfish to the whiting fisheries (at-sea and shoreside combined). This amount accommodates the catches in both the 1995-2005 and 2003-2005 periods.
   - Pacific Ocean perch (POP) – Allocate 17% or 30 mt, whichever is greater, of the total trawl allocation of Pacific ocean perch to the whiting fisheries (at-sea and shoreside combined). This amount accommodates the catches in both the 1995-2005 and 2003-2005 periods.
   - Widow rockfish – If widow rockfish is still under a rebuilding plan for the initial year of implementation of trawl rationalization, then 250 mt would be assigned for the initial allocation for the whiting fisheries (at-sea and shoreside), which is consistent with the amount set for 2009. If widow rockfish has been rebuilt by the initial year of implementation, then 10% or 500 mt, whichever is greater, would be assigned for the initial allocation for the whiting fisheries. This would accommodate the amount caught during the 1995-2005 period.
   - Yellowtail rockfish – Allocate 300 mt of yellowtail rockfish to shoreside whiting and 300 mt to at-sea whiting fisheries. This would split the difference between the average catches in the shoreside sector during the 1995-2005 time period and the average catches that occurred under a healthy widow rockfish period (1995-2000). The 300 mt set aside for the at-sea sector is consistent with the GAP recommendation.

3. Bycatch sharing among whiting sectors: Consistent with 2009 allocations and the trawl rationalization program, distribute darkblotched and widow rockfishes and Pacific ocean perch pro rata among whiting sectors."

Moved by: Phil Anderson Seconded by: Mark Cedergreen

Amndmnt #1 Amend the main motion (Amendment 1 to Motion 16) to allocate 275 mt of widow rockfish to whiting sectors rather than 250 mt if the stock is still under rebuilding.

Moved by: Rod Moore Seconded by: Frank Warrens
Amendment #1 failed; Mr. Warrens, Mr. Williams, Mr. Moore, and Mr. Sones voted in favor of the amendment; Mr. Lockhart abstained; Mr. Myer recused.

Amndmnt #2 Amend the main motion (Amendment 2 to Motion 16) to allocate 50 mt of shortspine south of 34°27' N latitude to the trawl fleet as recommended by the GAP.

Moved by: Rod Moore Seconded by: Frank Warrens
Amendment #2 passed; Mr. Myer recused and Mr. Lockhart abstained.

Main Motion 16 as amended by Amendment #2 passed; Mr. Myer recused, Mr. Lockhart abstained.

Motion 17: Adopt Motion 4 in Agenda Item F.3.d, Supplemental WDFW Motions in Writing. The specific motion language is as follows:

"Framework for future allocations: Specify sector allocations to be decided through the biennial specifications and management process for only those species listed in Table 4-23 on p. 102, specifically:

Canary rockfish	black rockfish (WOC)	CA scorpionfish
Bocaccio rockfish	blue rockfish (CA)	cabezon (CA)
Cowcod rockfish	minor nearshore rockfish (N & S)	longnose skate
Yelloweye rockfish	minor shelf rockfish (N & S)	other fish

All other allocations would require a regulatory amendment process to revise. Maintain the FMP provision to suspend formal allocations if a stock is declared as overfished."

Moved by: Phil Anderson Seconded by: Mark Cedergreen

Amndmnt #1 Amend the main motion (Amendment 1 to Motion 17) to include these species considerations as allocations <u>or set-asides</u> in the biennial management process.

Moved by: Marija Vojkovich Seconded by: Dan Wolford
Amendment #1 to Motion 17 passed unanimously.

Amndmnt #2 Amend the main motion (Amendment 2 to Motion 17) for a 5-year review of Amendment 21 allocations coincident with the Amendment 20 review. The motion language is as follows:

"… amend the main motion to incorporate a review of the intersector allocation, to coincide with the 5-year review of the TIQ program. The review will specifically consider adjusting the allocation to gear that has been determined to have fewer adverse environmental impacts. In support of this review, NMFS will develop an analysis consistent with the NMFS report under this agenda item (Agenda Item F.3.b, NMFS supplemental report) to inform this Council review. The analysis will be considered in the context of: creating positive benefits for EFH; helping to reduce bycatch of non-target and overfished species; and minimizing of impacts on protected resources. The analysis will also consider the overall economic impact on coastal communities of shifting allocation among gear types."

Moved by: Frank Lockhart   Seconded by: Mark Cedergreen

Amndmnt #3 Amend Amendment #2 to Motion 17 by striking the second sentence of Amendment #2.

Moved by: Phil Anderson   Seconded by: Dale Myer
Amendment #3 to Amendment #2 to Motion 17 withdrawn, not voted on.

Amndmnt #4 Amend Amendment #2 to Motion 17 by striking the second sentence of Amendment #2.

Moved by: Dave Hanson   Seconded by: Dave Ortmann
Amendment #4 to Amendment #2 passed; Mr. Lockhart voted no.

Amendment #2 to Motion 17 as amended by Amendment #4 passed unanimously.

Motion 17 as amended passed unanimously.

Motion 18: Initially allocate 52% of the trawl allocation of widow rockfish to the whiting sectors if the stock is under rebuilding or 10% of the trawl allocation or 500 mt of the trawl allocation to the whiting sectors, whichever is greater, if the stock is rebuilt. If the stock is overfished when the initial allocation is implemented, the latter allocation scheme automatically kicks in when it is declared rebuilt. As decided under Motion 16, the distribution of the whiting trawl allocation of widow to individual whiting sectors will be done pro rata relative to the sectors' whiting allocation.

Moved by: Rod Moore   Seconded by: Michele Culver
Motion 18 passed unanimously; Mr. Lockhart abstained, Mr. Myer recused.

JUNE 2009 MOTION

Motion 27: Using Agenda Item E.10.d, Supplemental WDFW Motion in Writing, adopt the following – "**Trawl Sector Limits for Pacific Halibut and Managing Halibut IBQ in the Trawl Rationalization Program:** The trawl mortality limit for legal and sublegal halibut is set at 15% of the Area 2A Total Constant Exploitation Yield not to exceed 130,000 lbs for the first 4 years of trawl rationalization program, and not to exceed 100,000 lbs beginning in the 5th year of the program. This total bycatch limit may be adjusted through the biennial management process. Halibut IBQ will be based on halibut bycatch mortality, not on total halibut catch."

Moved by: Phil Anderson Seconded by: Dale Myer

Amdt #1: Add "The intent of the Council that halibut bycatch mortality would be measured on an individual vessel basis".

Moved by: Rod Moore Seconded by: Frank Warrens

Amdt #2: Amend the amendment to replace the word "measure" with the word "estimated".

Moved by: Frank Lockhart Seconded by: Kathy Fosmark
Amendment #2 passed unanimously.
Amendment #1 as amended, passed unanimously.

Amdt #3: Revise the following sentence that reads "The trawl mortality limit for legal and sublegal halibut is set at 15% of the Area 2A Total Constant Exploitation Yield not to exceed 130,000 lbs for the first 4 years. . . ." change it to read "The trawl mortality limit for legal and sublegal halibut is set at 15% of the Area 2A Total Constant Exploitation Yield not to exceed 130,000 lbs **each year for** the first 4 years. . . .".

Moved by: David Hanson Seconded by: Rod Moore
Amendment #3 to Motion 27 passed unanimously.
Motion 27 passed unanimously as amended.

WASHINGTON DEPARTMENT OF FISH AND WILDLIFE MOTIONS ON GROUNDFISH FMP AMENDMENT 21: INTERSECTOR ALLOCATION

Working from Agenda Item F.3.a, Attachment 1, Preliminary Draft Environmental Impact Statement (EIS) and Agenda Item F.3.b, GAC Report, I would move the following motions:

Motion # 1: Intersector Allocation between trawl and non-trawl: Adopt the GAC Alternative, which includes:

- Status quo allocation for Pacific whiting
- Allocations for all other species, except those for which IFQ would not be assigned through the trawl rationalization program as well as those species for which allocations would be decided through the biennial specifications process (actual species included listed in Table 2-10 on p. 23 of Preliminary Draft EIS). Note: longspine thornyhead south of 34°27' would not be included.
- Using 2003-2005 sector total catch percentages as the basis for allocations
- All trawl allocations greater than or equal to 95% would be set at 95% (actual percentages, by species, are in Table 2-9, on p. 21 of Preliminary Draft EIS)

Motion # 2: Pacific halibut trawl bycatch limits: Alternative 4, with one change (underlined):

- An initial limit for total Pacific halibut bycatch mortality (legal-sized and sublegal fish) in the trawl fishery of 15%, not to exceed 130,000 lbs. per year for the first four years.
- Beginning with the fifth year of implementation, the maximum amount set aside for the trawl rationalization program would be reduced to a total mortality amount of 100,000 lbs. per year.
- The total halibut bycatch mortality amount may be adjusted downward through the biennial specifications process for future years.
- The at-sea trawl sector and shoreside trawl sector south of 40°10' N. latitude would have a bycatch set aside of 5 mt each (total bycatch set aside of 10 mt), which would come out of the 15% trawl sector allocation.

Motion # 3:

1. At-sea sector set asides: Adopt the GAC recommendation to set the at-sea sector set asides large enough to not constrain their fisheries given the interannual variation in sector catches by establishing a 5 mt minimum set-aside for any incidentally caught species in the at-sea fisheries with all set asides rounded up to the nearest 5 mt (actual amounts specified in Table 4-23, p. 102 of Preliminary Draft EIS).

2. Within trawl bycatch allocations between whiting and non-whiting sectors would be set using 1995-2005 catch shares, except as follows:

Darkblotched rockfish – Allocate 9% or 25 mt, whichever is greater, of the total trawl allocation of darkblotched rockfish to the whiting fisheries (at-sea and shoreside combined). This amount accommodates the catches in both the 1995-2005 and 2003-2005 periods.

Pacific ocean perch (POP) – Allocate 17% or 30 mt, whichever is greater, of the total trawl allocation of Pacific ocean perch to the whiting fisheries (at-sea and shoreside combined). This amount accommodates the catches in both the 1995-2005 and 2003-2005 periods.

Widow rockfish – If widow rockfish is still under a rebuilding plan for the initial year of implementation of trawl rationalization, then 250 mt would be assigned for the initial allocation for the whiting fisheries (at-sea and shoreside), which is consistent with the amount set for 2009. If widow rockfish has been rebuilt by the initial year of implementation, then 10% or 500 mt, whichever is greater, would be assigned for the initial allocation for the whiting fisheries. This would accommodate the amount caught during the 1995-2005 period.

Yellowtail rockfish – Allocate 300 mt of yellowtail rockfish to shoreside whiting and 300 mt to at-sea whiting fisheries. This would split the difference between the average catches in the shoreside sector during the 1995-2005 time period and the average catches that occurred under a healthy widow rockfish period (1995-2000). The 300 mt set aside for the at-sea sector is consistent with the GAP recommendation.

See attached tables that describe the rebuilding ABCs and OYs for darkblotched rockfish, POP, and widow rockfish, and the results of the percentages specified above.

3. Bycatch sharing among whiting sectors: Consistent with 2009 allocations and the trawl rationalization program, distribute darkblotched and widow rockfishes and Pacific Ocean perch pro rata among whiting sectors.

Motion # 4: Framework for future allocations: Specify sector allocations to be decided through the biennial specifications and management process for only those species listed in Table 4-23 on p. 102, specifically:

Canary rockfish	black rockfish (WOC)	CA scorpionfish
Bocaccio rockfish	blue rockfish (CA)	cabezon (CA)
Cowcod rockfish	minor nearshore rockfish (N & S)	longnose skate
Yelloweye rockfish	minor shelf rockfish (N & S)	other fish

All other allocations would require a regulatory amendment process to revise.

Maintain FMP provision to suspend formal allocations if a stock is declared as overfished.

Table 1. Example results of proposed whiting sector allocations for darkblotched rockfish and POP using values specified in 2007 rebuilding plans

Year	Darkblotched Rockfish				Pacific Ocean Perch			
	ABC	Rebuilding OY	Twl Alloc at 95%	Whiting Allocation	ABC	Rebuilding OY	Twl Alloc at 95%	Whiting Allocation
2009	437	285	271	**25**	1,160	189	180	31
2010	440	291	276	25	1,173	200	190	32
2011	453	305	290	26	1,275	207	197	33
2012	461	310	295	27	1,333	215	204	35
2013	468	315	299	27	1,381	222	211	36
2014	475	320	304	27	1,415	229	218	37
2015	483	325	309	28	1,435	232	220	37
2016	490	331	314	28	1,465	237	225	38
2017	500	338	321	29	1,491	241	229	39
2018	509	344	327	29	1,508	246	234	40

Table 2. Example results of proposed whiting sector allocation for widow rockfish using values specified in 2007 rebuilding plan

Year	Widow Rockfish					
	ABC	Rebuilding OY	Rebuilding Allocation		Rebuilt Allocation	
			Twl at 91%	Whiting	Twl at 91%	Whiting
2009	7,728	522	475	**250**	7,032	703
2010	6,937	509	463	**250**	6,313	631
2011	6,191	487	443	**250**	5,634	563
2012	5,592	465	423	**250**	5,089	509
2013	5,174	448	408	**250**	4,708	**500**
2014	4,928	438	399	**250**	4,484	**500**
2015	4,801	435	396	**250**	4,369	**500**
2016	4,745	436	397	**250**	4,318	**500**
2017	4,676	440	400	**250**	4,255	**500**
2018	4,588	444	404	**250**	4,175	**500**

Note: Bolded numbers indicate where minimum amounts were greater than allocation percentage

1) Eligibility to Own

No person can acquire quota shares or quota pounds other than 1) a United States citizen, 2) a permanent resident alien, or 3) a corporation, partnership, or other entity established under the laws of the United States or any State, that is eligible to own and control a US fishing vessel with a fishery endorsement pursuant to 46 USC 12113 (general fishery endorsement requirements and 75% citizenship requirement for entities).

Any ~~person or~~ entity that owns a mothership that participated in the west coast groundfish fishery during the allocation period and is eligible to own or control that US fishing vessel with a fishery endorsement pursuant to Sections 203(g) and 213(g) of the American Fisheries Act (AFA).

2) Carry-Over Provision

Each individual trawl vessel account will be able to carry-over up to 10 percent of the total quota pounds (QP) held in its account during that year. In addition, if the OY goes down substantially carry-over of QP would be reduced by the same percentage as the OY decrease.

3) Dogfish/Other Fish in the IFQ Program

Option 2: Dogfish included as Part of the Other Fish complex. Other Fish complex would not be included in the IFQ program. If at a future time Other Fish were added to the IFQ program, QS would be determined using the same catch history criteria as the other IFQ species, unless otherwise specified by a future Council action.

4) Determining Catch History in the Mothership Whiting Cooperatives

Determine catch history in the mothership whiting co-op alternative using relative pounds.

5) Trawl Sector Limits for Pacific Halibut and Managing Halibut IBQ in the Trawl Rationalization Program

The trawl mortality limit for legal and sublegal halibut is set at 15% of the Area 2A Total Constant Exploitation Yield not to exceed 130,000 lbs for the first 4 years of trawl rationalization program, and not to exceed 100,000 lbs beginning in the 5th year of the program. This total bycatch limit may be adjusted through the biennial management process.

Halibut IBQ will be based on halibut bycatch mortality, not on total halibut catch.

ALTERNATIVE IMPLEMENTATION SCHEDULES

The Council staff has developed the comparative detailed calendars and information on the implications of the two alternative implementation schedules described in Agenda Item E.6.b, Supplemental NMFS Report 6. Specific steps and deadlines for the approval and implementation process are based on

- internal NMFS/Council-staff planning documents,
- our understanding of NMFS scheduling Options as 1 presented in NMFS Report 6,
- our understanding of plans for developing the tracking and monitoring program and related cost estimates, arising out of presentations made in November 2009.

The comparative detailed calendars are provided in Table 1:

- Acronyms are provided in the right hand comments column.
- Rows pertaining to the “clean-up” rule are shaded.
- Cells for which the target date vary between the original November 2009 Schedule and NMFS Option 1 have a double line boarder.

NMFS Option 2 is discussed below but a detailed calendar not presented in Table 1. The NMFS Option 1 does not identify specifically what portions of the regulations are in each rule making. The following is our understanding of the general content of each of the rule makings.

Schedule	Content
November 2009 Plan	
Grand Framework Rule	Initial Allocation, Program Components, Some Tracking and Monitoring
Follow-up Rule	Economic Data Collection, Remaining Tracking & Monitoring and Miscellaneous Other
Option 1	
Grand Framework Rule	Initial Allocation, Program Components
"Clean Up" Rule	Economic Data Collection, Tracking &Monitoring, and Other
Option 2	
Grand Framework Rule 1	Initial Allocation
Grand Framework Rule 2	Program Components, Economic Data Collection, Tracking & Monitoring and Other
"Clean Up" Rule	Other

Table 1. Detailed Schedule for the Groundfish Trawl Rationalization Implementation Process After Final Council Action at the November, 2009 Council Meeting

Event	Plan Subsequent to the November 2009 Council Meeting	E.6.a, NMFS Option 1	Comments
A-20 DEIS transmitted from Council office	November 17, 2009	November 17, 2009	A-20: Groundfish FMP Amendment 20
45-day public comment period opens on DEIS	December 5, 2010	December 5, 2010	DEIS: Draft EIS
45-day public comment period ends on DEIS	January 18, 2010	January 18, 2010	
Transmittal of full draft GFR regualtions to Council office	January 22, 2010	March 24, 2010	GFR: Grand Framework Rule
Ad-hoc Deeming Committee review of GFR regualations	February 4-5, 2010	April 1-2, 2010	
Transmittle of revised GFR regulations to Council office	February 17, 2010	April 8, 2010	
Completion of plans for T&M (including plans for 100% observer coverage, costs, electronics fish tickets, etc.)	Dec 2009 - Feb 2010	April 8, 2010	T&M: Tracking and Monitoring
Council deeming of full GFR regulations	March 10, 2010	Mar 10, 2010 **(Rnd 3)** April 14, 2010 **(Rnd 4)**	
Report to the Council on tracking and monitoring cost resolution	March or April CM	Uncertain	CM: Council Meeting
Council deeming of "clean-up" rule	April 14, 2010	see May and June	
GFR PRA package submitted by NWR to HQ for early review	March 16, 2010	April 30, 2010	PRA: Paperwork Reduction Act
NOA/PR/PRA package submitted to HQ for pre-review (GFR)	March 31, 2010	April 30, 2010	NOA: Notice of Availability; PR Proposed Rule
Pre-submission review copy of A-20 FEIS from Council to HQ (PPI)	April 16, 2010	April 16, 2010	PPI: Program Planning and Integration (?)
Formal MSA transmittal of A-20 and A-21 to NMFS	April 30, 2010	April 30, 2010	MSA: Magnuson Stevens Act
NOA publishes for GFR regulations	May 5, 2010	May 5, 2010	NOA: Notice of Availability
NWR provides complete RIR/IRFA to HQ	May 20, 2010	May 20, 2010	In Option 1: RIR/IRFA uses preliminary cost estimates range from Nov, 2009 RIR: Regulatory Impact Review; IRFA: Initial Regulatory Flexibility Analysis
GFR PR publishes; Submit PRA to OMB (60-day review period)	May 20, 2010	May 20, 2010	
FEIS sent from Council office.	June 1, 2010	June 1, 2010	FEIS: Final EIS
Confirmation of FY 2010 funding for 2011 100% Observer necessities (industry transition funding,new NWFSC support staff, observer equipment and training, etc.) observer training,	June 1, 2010	June 1, 2010	
Transmittal of full draft clean-up regualtions to Council office	N/A	May 12, 2010	
Ad-hoc Deeming Committee review of draft clean-up regualations	N/A	May 19, 2010	
Transmittal of revised draft clean-up regualtions to Council office	N/A	May 26, 2010	
Council Deeming of "clean up" regulations and review of T&M plans	Jun 2010	June 2010	"June and/or Sept" in NMFS Report

FEIS submitted to EPA	June 18, 2010	June 18, 2010	EPA: Environmental Protection Agency
NOA pub., 30-day cooling off period begins; Prep. & review ROD	June 25, 2010	June 25, 2010	ROD: Record of Decision
PRA package submitted to HQ for early review	June 29, 2010	June 29, 2010	
60-day NOA & 45-day PR public comment period ends	July 5, 2010	July 5, 2010	
Ad-hoc Deeming Committee review of cleanup regualations (if needed)	N/A	Early July	
Infrastructure Setup o testing of electronic fish tickets, at-sea discard, landing and QP tracking protocols. o hiring of new NMFS support staff o training of observers			
Comment response, revisions completed	July 14, 2010	July 14, 2010	
PR/PRA package submitted to HQ for review	July 14, 2010	July 14, 2010	
30-day cooling off period ends, Send ROD to HQ	July 26, 2010	July 26, 2010	
FR submitted to HQ	July 29, 2010	July 29, 2010	
ROD signed	July 30, 2010	July 30, 2010	
FR DM signed at HQ; MSA day 95; Approval letter to PFMC	August 3, 2010	August 3, 2010	
FR publishes	August 10, 2010	August 10, 2010	
PR publishes	August 13, 2010	August 13, 2010	
RIR/IRFA provides RIR/IRFA with final tracking & monitoring cost est.	August 13, 2010	August 13, 2010	
Infrastructure Setup o initial issuance of QS, whiting endorsements, MS permits, CP endorsemetns. o appeals process period o appeals resolution process o issuance of QP to QS holders o transfer of QP to vessel accounts	Aug-Dec 2010 **	Late Sept - Dec 2010	
Council clarfications/public comment	None	Sep 2010	
30-day cooling off period ends; FMP effective	September 9, 2010	September 9, 2010	
45-day PR public comment period ends	September 27, 2010	September 27, 2010	
Comment response, revisions completed	October 27, 2010	October 27, 2010	
FR submitted to HQ	November 11, 2010	November 11, 2010	
FR DM signed at HQ	November 16, 2010	November 16, 2010	
FR publishes	November 23, 2010	November 23, 2010	
30-day cooling off period ends	December 23, 2010	December 23, 2010	
Implementation	January 1, 2011	January 1, 2011	

** NMFS estimates that initial issuance & appeals may take longer. (footnote from June-Nov 2009 planning document)

Implications, Observations and Comments

The attached figure illustrates scheduling implications with respect to the timing of the groundfish biennial specifications processes, quota share trading and moratorium, divestiture periods, the Adaptive Management Program, the accumulation limit review process, the Community Fishing Association amendment development process and other processes, with and without a one year delay in implementation of the trawl rationalization program.

Observations

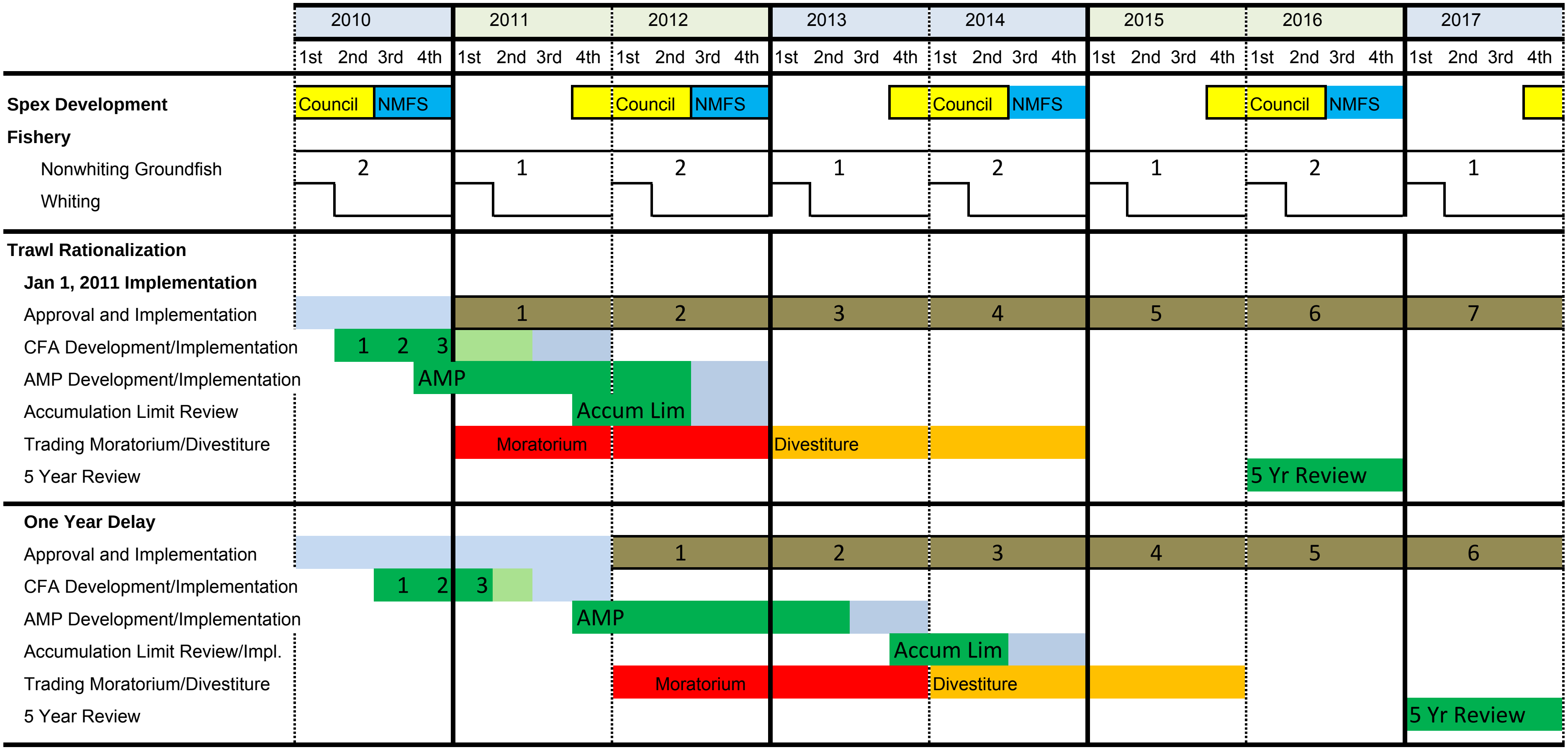
Proceeding with Option 1:

1. Legal review will have to be shortened.
2. It appears that final cost estimates for the industry, NMFS will not be available for the regulatory impact review/initial regulatory flexibility analysis document to be submitted with the regulations and Amendments 20 and 21 for public review in May. We are uncertain as to the status of the cost estimates for the states.
3. The NMFS Option 1 schedule indicates a possibility that regulations for the cleanup rule will not be available in June ("Deeming at June and or September 2010 Council meeting"). The proposed rule needs to be published before the September Council meeting.
4. The quota share issuance and appeals process period has now been shortened to late September–December.
5. It is unclear that there is enough certainty about accomplishing Option 1 that the biennial specification process should not also analyze a one year delay in implementation. A determination on how to proceed on this matter needs to be made under Agenda Item E.7.

Proceeding with Option 2.

1. Splitting the grand framework rule into two parts increases work load, possibly requiring the production of two National Environmental Protection Act (NEPA) documents instead of the one that has already been produced.
2. Provides additional time for legal and administrative review of draft regulations.
3. Cost estimates for Regulatory Impact Review (RIR)/Initial Regulatory Flexibility Analysis (IRFA) will still not be available for the first grand framework.

PFMC
3/08/10



Jan 1, 2011 Implementation

CFA development on tight schedule, if goal is to have it done toward start of program.

AMP development occurs mainly in off year of biennial spex.

First accumulation limit review starts at end of 1st year of program.

Trading moratorium ends and there will be about a year before start of development of next biennial specifications.

5 year review corresponds with year of biennial spex process.

One Year Delay

CFA development has more time, if goal is to have it done toward start of program.

AMP development occurs during development of biennial spex.

First accumulation limit review occurs at the end of year 2 of the program.

Trading moratorium ends during development of next biennial specifications.

5 year review corresponds with off year of biennial spex process.

COUNCIL STAFF REVIEW OF DRAFT NMFS REGULATIONS

The following showed up as potential issues to address in the draft regulations provided in Agenda Item E.6.b, NMFS Report 4.

Initial Allocation Formula: Substantial Concerns

There are a number of substantive issues in Section 660.140(d)8(ii) on the (QS) allocation criteria:

1. There is no specification for the allocation of QS for whiting taken as bycatch in the nonwhiting fishery.
2. There is no specification for the allocation of QS for nonwhiting taken as bycatch in the whiting fishery.
3. The allocation of canary QS is misspecified (the approach of allocating a minimum of 50 pounds from AMP is used instead of providing an equal allocation from the QS pool created based on the buyback permits).
4. The allocation formula for overfished species does not indicate that the formula only applies to those taken as incidental catch (e.g. not to Petrale sole).
5. Rules are not provided for the combination of the QS allocated for nonwhiting trips with the QS allocated for whiting trips to achieve a single shoreside sector.
6. Amounts of QS to be allocated for different groups or on the basis of different parts of the allocation formula are not indicated
   a. The AMP set aside is not accounted for. There is a section for AMP that is reserved. The allocation of QS for AMP needs to be specified to apply the initial allocation formula for QS.
   b. There is no indication of the amount of the total QS that is to be allocated to permit holders on the basis of permit history. For nonwhiting QS, the amount allocated based on permit history would be that QS left over after first removing the 10% for AMP and then the amount that is used for the equal allocation pool (for non-overfished species and canary rockfish).
   c. The amount of whiting QS to be allocated to processors and permit holders is not indicated.

Initial Allocation Formula: Easily Addressed Corrections to the Initial Allocation Regulations

Some additional specifics which may need to be addressed.

1. 660.140(d)(8)(ii)(A)(3) should explicitly state that each permit's lowest landings by "weight" should be determined after that weight has been divided by the fleet's landings history for each year, i.e. relative history as explained in paragraph (A)(2).
2. 660.140(d)(8)(ii)(A)(4) and 660.150(g)(6)(ii)(A) replace the word "both" with "all" and add to the end of the sentence: "for the period of time for which the permits were registered for the same vessel."
3. 660.140(d)(8)(ii)(A)(6) consider eliminating this paragraph. The landing history is not shared equally among all permits. An amount of QS is set aside into a pool and that QS is divided equally among all of the limited entry permits. It is not the QS permits among which the QS is allocated but rather among the limited entry permit holders (unless entities holding multiple permits will receive one QS permit for each limited entry permit they own). This issue is addressed in 660.140(d)(8)(ii)(D).
4. 660.140(d)(8)(ii)(B)(1) Drop 2 worst years instead of 3 worst years. Include the date for fixing the data set, as provided in Section 660.140(d)(8)(ii)(A)(1). Make changes similar to those listed for items 1, 2, and 3 above.
5. 660.140(d)(8)(ii)(B)(2) Change "2003" to "2004." Make changes similar to those listed for item 1 above.

6. 660.140(d)(8)(ii) (D). Indicate that the equal division is to be used for non-overfished species and canary rockfish. Indicate that the equal division will be among all qualifying limited entry permits. If the term “QS permits” is to be used, indicate that the QS permits to which an equal allocation is provided does not include the QS permits given to those processors receiving QS permits for their whiting allocations and that an applicant will receive one QS permit for each limited entry permit that it owns.

Other Substantial Concerns

1. Co-op Permits for Catcher-Processors. The co-op permit sections are not yet provided, however, there is a reserved section for a catcher-processor co-op permit. The Council voted against requiring a co-op permit when it was told that if such a permit were required it would make the catcher-processor sector a LAPP and possibly subject to a fee of up to 3%. Also, in section 660.160(a) the catcher-processor co-op program is classified as a limited access program.

Other Minor Concerns and Comments

1. Additional attention needs to be given to the specification of set asides, when they come off the top and when they come off sector allocations.
2. 660.11. Catch Monitor. The definition for those monitoring shoreside deliveries reference the monitoring and verification of catch sorting. Should this language reference “landings” instead of “catch”?
3. 660.11. Nontrawl Fishery and Groundfish Trawl. The term “exempted gear” and “exempted trawl gear” are used but not defined in the regulations. Define or replace with “nongroundfish trawl gear.”
4. 660.11. “Trawl fishery” does not seem to be defined (or at least the definition is difficult to locate). It might make the regulations easier to follow if there were also a definition of trawl fishery. “What is particularly difficult to parse is the status of catch by trawl vessels using nontrawl gear, exempted gear in particular.
5. 660.25(b)(2). The meaning of the following sentence needs to be clarified possibly by removing the last clause. “A MS permit is a type of limited entry permit and may not be transferred separately from the limited entry permit. “
6. 660.111. IFQ is defined similarly to the term QS but it is used only as a descriptor: IFQ programs, IFQ species, IFQ fisheries, IFQ first receivers, IFQ landing, IFQ endorsed, IFQ sector, IFQ vessels etc., with the exception of the definition of the midwater whiting fishery and quota shares (see below). In Council documents we also use the term IFQ when we mean both QS and QP. Consider whether the term “IFQ” might be given a more general definition so that it would cover both QS and QP or might otherwise be used in a fashion that does not duplicate QS.
7. 660.111. Midwater whiting fishery. The term “shore-based IFQ endorsed limited entry permit” is used. This type of permit does seem to be defined elsewhere and is not anticipated as part of Amendment 20.
8. 660.111. Processor Obligation is phrased to indicate that it is a particular permit that must make the obligated deliveries. Rephrase the wording from “an annual requirement for a MS/CV endorsed limited entry permit to deliver its catch to a particular mothership processor permit.” to deliver something like “an annual requirement for a MS/CV endorsed limited entry permit for the delivery of catch associated with that permit to a particular mothership processor permit.”
9. 660.111. Quota Shares is defined as something used to determine a person’s IFQ. This should probably read “QP” instead of “IFQs.”
10. 660.111. Vessel Limits is defined in such a way that the limit might apply to pounds that were transferred onto and off of a vessel without being used. The term should also indicate that the limit is an annual limit.

11. 660.140 (a) and 660.150(a)(5), 660.160(a)(5). Should those sections indicate that the fishery could be restricted because of major overages in non-trawl sectors?
12. Consider modifying the language in paragraph 660.140(d)(4)(iii), 660.150(f)(3)(iii) and 660.150(g)(3)(i)(B) to more directly indicate that QS held by entities in the fashions listed in this paragraph would be considered to be controlled by them and count against the accumulation limits.
13. In the first sentence of paragraph 660.140(d)(4)(iv), add some qualifying language to indicate that it applies to those who exceed the accumulation limits as a result of the initial allocation.
14. 660.140(d)(8)(i)(A), (i)(B), (iii)(A) and (iii)(B). Consider eliminating "For harvesters" and "For shoreside first receivers/processors" from the starts of the paragraphs and making appropriate related adjustments. Businesses that own processing plants may also own harvester permits but not own any harvesting vessels. Consider changing references from "shoreside processors" to "shoreside first/receivers." Information on whether a shoreside first receiver is also a processor will only become available as a result of information submitted by applicants later in the application process.
15. 660.150(f)(1). The MS permit would not be a co-op participant.
16. 660.150(g)(6)(ii) Adjust this section so that the qualifying history evaluated is the permit's history rather than the history of the vessel registered to the permit.
17. 660.150(g)(6)(iii)(A) Modify to indicate that the vessel history counted toward the permit history is only that which occurred during the time the vessel was registered to the permit.
18. 660.150(g)(6)(iii)(C) Add "unless otherwise requested by the applicant during the initial issuance and appeals process."
19. 660.160(d)(1). Consider dropping the last sentence. It appears to require that in order for an owner of a catcher-processor endorsed permit to participate in the fishery, they must join a co-op. A catcher-processor endorsed permit owner would have the option of not participating in the co-op, causing the dissolution of the co-op fishery and the transition to an IFQ fishery, in which it could participate.

PFMC
03/10/10

Agenda Item E.6.a
Supplemental Attachment 6
March 2010

E.6 List of Reports

REGULATORY DEEMING FOR FISHERY MANAGEMENT PLANS AMENDMENT 20–TRAWL RATIONALIZATION AND AMENDMENT 21—INTERSECTOR ALLOCATION, AND PLANNING FOR COMMUNITY FISHERY ASSOCIATIONS (CFA)

Reference Materials:

1. Agenda Item E.6.a, Attachment 1: Trawl Rationalization Approval and Implementation Process.
2. Agenda Item E.6.a, Attachment 2: Council Preferred Groundfish Trawl Rationalization Alternative.
3. Agenda Item E.6.a, Attachment 3: Staff Draft Groundfish Fishery Management Plan Amendatory Language For Amendment 21.
4. Agenda Item E.6.a, Supplemental Attachment 4: Alternative Implementation Schedules.
5. Agenda Item E.6.a, Supplemental Attachment 5: Council Staff Review of Draft NMFS Regulations.
6. Agenda Item E.6.a, Supplemental Attachment 6: List of Reports.
7. Agenda Item E.6.b, NMFS Report 1: NMFS Interpretations of Council Intent.
8. Agenda Item E.6.a, Supplemental REVISED NMFS Report 1.
9. Agenda Item E.6.b, NMFS Report 2: Clarifications Requested of Council.
10. Agenda Item E.6.a, Supplemental REVISED NMFS Report 2.
11. Agenda Item E.6.b, NMFS Report 3: Draft Regulatory Outline.
12. Agenda Item E.6.b, NMFS Report 4: Draft Proposed Regulations for Amendments 20 and 21.
13. Agenda Item E.6.a, Supplemental REVISED NMFS Report 4.
14. Agenda Item E.6.b, NMFS Report 5: Mandatory Economic Data Collection Program Design For Groundfish Trawl Rationalization.
15. Agenda Item E.6.b, Supplemental NMFS Report 6: Groundfish TIQ Schedule for Council Consideration.
16. Agenda Item E.6.b, Supplemental SSC Report.
17. *Agenda Item E.6.b, Supplemental GAP Report. (forthcoming)*
18. *Agenda Item E.6.b, Supplemental GMT Report. (possible)*
19. Agenda Item E.6.b, Supplemental EC Report.
20. Agenda Item E.6.c, Public Comment.
21. Agenda Item E.6.c, Supplemental Public Comment 2.
22. Agenda Item E.6.c, Supplemental Public Comment 3.
23. Agenda Item E.6.c, Supplemental Public Comment 4.
24. Agenda Item E.6.c, Supplemental Public Comment 5.

Agenda Order:

a. Agenda Item Overview — Jim Seger/Kit Dahl/ John DeVore
b. Reports and Comments of Management Entities and Advisory Bodies
c. Public Comment
d. **Council Action:** Deem Amendment Implementing Regulations, Adopt Plan Amendment Language for Amendment 21, and Consider Planning to Address CFA Alternatives

Table 1. Detailed Schedule for the Groundfish Trawl Rationalization Implementation Process After Final Council Action at the November, 2009 Council Meeting. Shaded cells and italic indicate deadlines for follow-up rule. List of acronyms and abbreviations may be found at the bottom of the table.

Event	Plan Subsequent to the November 2009 Council Meeting	E.6.a, NMFS Option 1	Comments
A-20 DEIS transmitted from Council office	November 17, 2009	November 17, 2009	A-20: Groundfish FMP Amendment 20
45-day public comment period opens on DEIS	December 5, 2010	December 5, 2010	
45-day public comment period ends on DEIS	January 18, 2010	January 18, 2010	
Transmittal of full draft GFR regualtions to Council office	January 22, 2010	March 24, 2010	
Ad-hoc Deeming Committee review of GFR regualations	February 4-5, 2010	April 1-2, 2010	FR meeting notice needed 23 days before
Transmittal of revised GFR regulations to Council office	February 17, 2010	April 8, 2010	
Completion of plans for T&M (including plans for 100% observer coverage, infrastructure costs, such as electronics fish tickets, etc.)	Dec 2009 - Feb 2010	April 8, 2010	
Council deeming of full GFR regulations	March 10, 2010	Mar & April CMs	
Report to the Council on tracking and monitoring cost resolution	March or April CM	April CM	
Council deeming of follow-up rule	April 14, 2010	see May and June	
GFR PRA package submitted by NWR to HQ for early review	March 16, 2010	April 30, 2010	
NOA/PR/PRA package submitted to HQ for pre-review (GFR)	March 31, 2010	April 30, 2010	
Pre-submission review copy of A-20 FEIS from Council to HQ (PPI)	April 16, 2010	April 16, 2010	
Formal MSA transmittal of A-20 and A-21 to NMFS	April 30, 2010	April 30, 2010	
NOA publishes for Amendment 20 (MSA process)	May 5, 2010	May 5, 2010	
NWR provides complete RIR/IRFA to HQ			In NMFS Option 1: RIR/IRFA uses preliminary cost estimates range from Nov, 2009. Council staff notes the range needs to be resolved by the April 2010 CM.
GFR PR publishes; Submit PRA to OMB (60-day review period)	May 20, 2010	May 20, 2010	
FEIS sent from Council office.	June 1, 2010	June 1, 2010	
Confirmation of availability of FY 2010 funding for infrastructure necessities for 1/1/11 start: Industry transition funding for 100% observers,new NWFSC support staff, observer equipment and training, electronic fish tickets, etc.	June 1, 2010	June 1, 2010	
Transmittal of full draft follow-up regualtions to Council office	N/A	May 12, 2010	
Ad-hoc Deeming Committee review of draft follow-up regualations	N/A	May 19, 2010	
Transmittal of revised draft follow-up regualtions to Council office	N/A	May 26, 2010	
Council Deeming of follow-up regulations and review of T&M plans	Jun 2010	June 2010	"June and/or Sept" in NMFS Report
FEIS submitted to EPA	June 18, 2010	June 18, 2010	

Event	Plan Subsequent to the November 2009 Council Meeting	E.6.a, NMFS Option 1	Comments
FEIS NOA pub., 30-day cooling off period begins; Prep. & review ROD	June 25, 2010	June 25, 2010	
PRA package submitted to HQ for early review	June 29, 2010	June 29, 2010	
60-day NOA & 45-day PR public comment period ends	July 5, 2010	July 5, 2010	
Ad-hoc Deeming Committee review of follow-up regualations (if needed)	N/A	Early July	
Infrastructure Setup o testing of electronic fish tickets, at-sea discard, landing and QP tracking protocols. o hiring of new NMFS support staff			
Comment response, revisions completed for MSA and PR	July 14, 2010	July 14, 2010	
PR/PRA package submitted to HQ for review	July 14, 2010	July 14, 2010	
30-day cooling off period ends, Send ROD to HQ	July 26, 2010	July 26, 2010	
FR submitted to HQ	July 29, 2010	July 29, 2010	
ROD signed	July 30, 2010	July 30, 2010	
FR DM signed at HQ; MSA day 95; Approval letter to PFMC	August 3, 2010	August 3, 2010	
FR publishes	August 10, 2010	August 10, 2010	
PR publishes & RIR/IRFA provides final tracking & monitoring cost estimates	August 13, 2010	August 13, 2010	
Infrastructure Setup o initial issuance of QS, whiting endorsements, MS permits, CP endorsemetns. o appeals process period; appeals resolution process o training of observers o issuance of QP to QS holders; transfer of QP to vessel accounts	Aug-Dec 2010	Late Sept - Dec 2010	
Council clarfications/public comment	None	Sep 2010	
30-day cooling off period ends; FMP effective	September 9, 2010	September 9, 2010	
45-day PR public comment period ends	September 27, 2010	September 27, 2010	
Comment response, revisions completed	October 27, 2010	October 27, 2010	
FR submitted to HQ	November 11, 2010	November 11, 2010	
FR DM signed at HQ	November 16, 2010	November 16, 2010	
FR publishes	November 23, 2010	November 23, 2010	
30-day cooling off period ends	December 23, 2010	December 23, 2010	
Implementation	January 1, 2011	January 1, 2011	

Acronyms and Abbreviations

T&M: Tracking and Monitoring
CM: Council Meeting
DEIS: Draft EIS
EPA: Environmental Protection Agency
FEIS: Final EIS
FR: Federal Register
GFR: Grand Framework Rule
IRFA: Initial Regulatory Flexibility Analysis
MSA: Magnuson Stevens Act
NOA: Notice of Availability; PR Proposed Rule
PPI: Program Planning and Integration
PRA: Paperwork Reduction Act
RIR: Regulatory Impact Review;
ROD: Record of Decision
T&M: Tracking and Monitoring

NMFS Interpretations of Council Intent

Disclaimer: Additional interpretations of the Council intent on the trawl rationalization program will arise as the program is reviewed by NMFS. Amendments 20 & 21 to the Groundfish FMP, have not yet been formally submitted to NMFS, or approved or implemented by NMFS. NMFS and the Council staff are currently clarifying issues raised by these amendments.

ALL TRAWL FISHERIES

Ownership Interest

1) All individuals with greater than or equal to 2% ownership interest in a permit or vessel must report their ownership interest to the individual level.

Background:
After reviewing public comment on the proposed rule to collect ownership interest for the trawl rationalization program (74 FR 47545, 9/16/09), NMFS decided to revaluate the proposal to collect ownership information from ALL individuals with an ownership interest in the permit or vessel. Public comment noted that some permits are owned by large corporations (CDQ groups, publicly-held corporations, NGOs, etc) and NMFS proposed information collection would potentially require 1,000s of individuals and their % ownership to be reported to NMFS. Suggestions ranged from exempting large companies from reporting, to requiring them to sign an affidavit with heavy penalties for noncompliance, to setting a minimum threshold. NMFS is required to monitor ownership interest in order to avoid excessive control, in this case, through accumulation limits.

Rationale:
NMFS decided exempting large corporations would not be allowed . Requiring an affidavit would reduce NMFS' burden of monitoring accumulation limits. However, this option would not be as effective at achieving the goal of ensuring that the ownership of quota share is not inappropriately concentrated. By requiring the reporting of ownership information, NMFS can better ensure that accumulation limits are not exceeded before fishing under the program occurs, rather than after a violation has been identified and corrected. Therefore, NMFS decided to set a minimum threshold. NMFS decided that the variable threshold among sectors would add unnecessary complexity to the program. The 10% minimum threshold might be too high for some sectors. NMFS decided the

GAP recommended 2% (a threshold that is slightly below the lowest accumulation limit of 2.5 percent) was reasonable because it would ensure that data collection requirements are most useful for enforcement purposes without creating an undue administrative burden. It would also accomplish the purpose of reducing burdensome reporting for companies with large numbers of individuals with very small amounts of ownership interest.

Submission of an ownership interest form will be required with the initial applications, with permit renewal, transfers, and in subsequent years for a CV/MS endorsed permit, a MS permit, and a QS permit. Any new permit owner must also submit an ownership interest form at the time of transfer of the permit to another permit owner.

See Nov 2009 PFMC meeting, Agenda Item G.8.b, NMFS Report and Supplemental GAP Report, and the response to comments in the final rule for the ownership information collection for additional information.

<u>Allocations</u>

2) The amendment 21 allocation structure is in addition to existing groundfish allocation structures.

Background:
The Council motion on Am 21 from the April 2009 meeting states, "[Am 21] Allocations for all other species, except those for which IFQ would not be assigned through the trawl rationalization program as well as those species for which allocations would be decided through the biennial specifications process (actual species included listed in Table 2-10 on p. 23 of Preliminary Draft EIS). Note: longspine thornyhead south of 34°27' N. latitude would not be included." In other words, Am 21 allocations do not apply to non-IFQ species and species with allocations decided through the biennial specifications process.

Rationale:
NMFS interpretation of the Council's intent is that the Am 21(trawl/nontrawl) allocation structure is in addition to the existing groundfish allocation structure which is based on Am 6 (limited entry (LE)/open access (OA)) (See Table 1). A process for allocating between the limited entry and open access fisheries was developed with the limited entry program under Am 6 (see section 11.2.2 of the FMP). The Am 21 allocation structure (trawl/nontrawl) applies to Am 21 species (which differs from IFQ species which also includes whiting, sablefish N of 36, canary, bocaccio, cowcod, yelloweye rockfish, and minor shelf rockfish N & S). Note that while Am 21 does formally allocate some overfished species in the FMP (darkblotched, POP, and widow), it does not remove the FMP provision at 4.6.1(5) where formal limited entry, open access allocations may be suspended for overfished species for the duration of rebuilding. For trawl rationalization, canary, bocaccio, cowcod, yelloweye, minor shelf rockfish N & S would be allocated through the biennial specifications process. The Am 6 allocation structure (LE/OA) applies to remaining groundfish species.

Table 1. Groundfish allocation process and guidance.

		Optimum Yield				
			Fishery Guideline			
			Commercial Guideline			
Step in Process	Policy Guidance	Initial Set-asides	LE Trawl	LE Fixed Gear	Directed Open Acess	Recre-ational
1. Initial Set-Asides - Reduce OY by tribal amounts, estiamted research catch, pojected bycatch in non-gr, EFP bycatch limits.	Determine During Biennial Specifications Process	Tribal, Resarch, Incidental, EFPs				
2. Determine Limited Entry (LE) Trawl Allocation	A-21 (Fishery Guideline * Trawl %)		Trawl Amt			
3. Determine Recreational (Rec) Allocation	Determine During Biennial Specifications Process					Rec Amt
4. Determine Open Access (OA) Allocation	A-6 (Commercial Guideline x open access %)				Directed OA Amt	
5. Determine LE Fixed Gear	Remainder from Steps 1-4, Determined During Biennial Specifications Process			Fixed Gear Amt		
6. Subdivide trawl (Shoreside whiting (Wht)/Nonwhiting (NWht) split needed only for QS allocation in first year of program. Shoreside (SS), Motherhship (MS), and catch-processor (CP) splits needed on an ongoing basis.	Split trawl based on A-21 and at-sea set asides (set asides modifiable during biennial specifications process).		SS Nwht / SS Wht / MS / CP			

Currently, the allocations between limited entry and open access are calculated from the commercial harvest guideline after certain amounts of fish are "taken off the top" or reduced from the OY. That process has been modified over time, and is currently as follows:

> The OY is reduced by tribal amounts, estimated research catch (estimated research catch comes off the ABC for non-overfished species & off the OY for overfished species), projected bycatch in non-groundfish fisheries, EFP set-asides, and estimated recreational set-asides (defined in existing regulation at 660.302 under the definition for "commercial harvest guideline"). The result is the commercial harvest guideline. The commercial harvest guideline is then allocated between the limited entry fishery (both trawl and fixed gear) and the directed open access fishery.

After implementation of Am 21, if approved, the allocations for species will be a mix of trawl/nontrawl allocations for Am 21 species and LE/OA allocations for the remaining groundfish species. That process is interpreted as follows:

For Am 21 species:

> The OY is reduced by tribal amounts, estimated research catch (estimated research catch comes off the ABC for non-overfished species & off the OY for overfished species), projected bycatch in non-groundfish fisheries, and EFP set-asides (note: recreational estimates are not deducted here). The result is the fishery harvest guideline. The fishery harvest guideline is then allocated between the trawl and nontrawl fisheries. Here the nontrawl fisheries are defined as limited entry fixed gear, directed open access, and the recreational fishery. For the nontrawl fisheries, the estimated recreational set-asides would be deducted.

The directed OA amount would be calculated according to the Am 6 LE/OA split where the LE amount is the amount for all of limited entry (i.e., limited entry trawl plus limited entry fixed gear). The resulting directed OA amount would be deducted and the remaining nontrawl allocation (after the deduction for the recreational set-asides and directed OA) would be available to the limited entry fixed gear fishery.

For remaining groundfish species:

The OY is reduced by tribal amounts, estimated research catch (estimated research catch comes off the ABC for non-overfished species & off the OY for overfished species), projected bycatch in non-groundfish fisheries, EFP set-asides, and estimated recreational set-asides. The result is the commercial harvest guideline. The commercial harvest guideline is then allocated between the limited entry fishery (both trawl and fixed gear) and the directed open access fishery.

The differences between these 2 allocation structures are where the recreational catch estimates are deducted and whether the limited entry fixed gear fleet shares a pot of fish with the limited entry trawlers or with the directed open access and recreational fleet.

To accommodate this blending of allocation structures, NMFS has developed a definition for a "fishery harvest guideline" and has revised the "commercial harvest guideline" definition in the draft regulations.

Annual Renewal

3) After initial issuance, all permits, licenses, agreements, and accounts will be subject to annual renewal or registration.

Background:
NMFS discussed whether some permits, licenses, agreements, or accounts could be effective for more than one year (i.e., not subject to annual renewal) and only subject to renewal/reissuance after a change (new owners, transfer, etc.).

Rationale:
NMFS decided that all permits, licenses, agreements, and accounts once issued should be subject to annual renewal. One reason for this decision is to emphasize that these permits, licenses, and accounts are a privilege that provide access to the fishery and not a permanent right or ownership. Another reason for this decision is that business arrangements change over time and while it is a requirement to notify NMFS within 15 days of any change, this does not always occur. Annual registration or renewal requires the permits, licenses, agreements, and accounts to be reviewed and updated each year. Examples of changes include change of address, change of members with ownership interest in a business entity or their percent ownership, change of authorized

representative or designated coop managers that serve as the responsible party and NMFS contact, etc.

Permit Transfers

4) Limits on the frequency of change in vessel registrations for MS permit, MS/CV endorsed permits, and C/P endorsed permits and effective date of a change in vessel registration.

Background:

Council motion as captured in Appendix D (p. D-35) states, "Limit on the Frequency of Transfers: MS permits may be transferred two times during the fishing year provided that the second transfer is back to the original mothership (i.e. only one transfer per year to a different mothership)." The same provisions apply to MS/CV endorsed permits and C/P endorsed permits (p. D-34 and D-41). NMFS has interpreted this as follows:

> A MS permit may be registered to another vessel two times during the fishing season as long as the second transfer is back to the original vessel. NMFS considers the original vessel to mean either the vessel registered to the permit as of January 1 or if no vessel is registered to the permit as of January 1, the original mothership is the first vessel to which it is registered after January 1. In this latter case, the first transfer could be to another vessel, but any second transfer would have to be back to the original vessel.

The Council motion as documented in Appendix D of the Am 20 DEIS does not address the effective date of a change in vessel registration for C/P, CV/MS or MS permits. NMFS intends to make changes in vessel registrations for these permits effective upon NMFS approval and issuance of the transferred permit. This is different than the frequency and effective date of transfers for the other limited entry permits, including trawl endorsed limited entry permits in the shorebased IFQ fishery. [NOTE: If a MS/CV permitted vessel also fishes in the IFQ fishery, what is the effective date and does the 1 transfer or 2 transfer rule apply to that permit? See NMFS clarifications document for more details.]

Rationale:

NMFS has interpreted how the frequency of transfers applies to permits in an "unidentified" status (i.e., not registered to a vessel at the start of the year) in accordance with existing regulations on the frequency of limited entry permit transfers. Unlike the existing limited entry permit transfer rules, these permit transfers would be effective immediately upon NMFS issuance of the transferred permit because the at-sea coop fisheries are not subject to 2-month cumulative trip limits.

5) Frequency of permit transfers for limited entry trawl endorsed permits and effective date.

Background:
Limited entry trawl-endorsed permits without MS/CV or C/P endorsements would remain as stated in existing regulations. In other words, one transfer per year would be allowed and approved transfers would be effective at the start of the next cumulative trip limit period.

Rationale:
Transfers would continue to be effective at the start of the next cumulative trip limit period as long as there are trip limits in place. The reason for this requirement is to prevent any double dipping on the 2-month cumulative trip limit (a per vessel limit) by a permit being registered to 2 vessels within the same period.

6) QS permits, First Receiver Site Licenses, and Coop permits are non-transferable. If the permit or licenses are sold, the old one is “closed” and, as appropriate NMFS will issue a new permit or license.

Background:
QS permits, First Receiver Site Licenses, and Coop permits are not permits directly associated with a vessel and, are not limited entry permits. Therefore, these permits and licenses do not convey a transferrable privilege and as such are non-transferrable. These types of permits and licenses are issued when a complete application and its associated requirements are submitted to NMFS.

Rationale:
QS permits, First Receiver Site Licenses, and Coop permits require certain standards to be met to acquire these permits. Since these are not limited entry permits associated with a vessel, any eligible entity could apply. These permits and licenses all require annual reissuance. In the case of the first receiver site license and the coop permit, NMFS does not presume that the holder will participate in their respective fishery in a subsequent year. Also, an applicant for the first receiver site license must submit a new catch monitor plan each year; while a coop must submit a coop agreement each year. In the case of a QS permit, in the third year of the program QS amounts (not permits) will become transferrable to other persons. At that time, any new person must register with NMFS and meet the eligibility requirements in order for NMFS to establish a QS account and to receive QS. The registration process to receive QS is separate from the actual transfer process of QS.

VMS declarations

7) New VMS declarations

Background:
VMS declarations are used to determine the fisheries in which vessels are participating in and which management measures apply. New VMS declarations will be needed for the trawl rationalization program.

Rationale:
NMFS will revise the VMS declarations to accommodate the trawl rationalization program. Multiple declarations will be needed for the IFQ fishery given how existing management measures, such as EFH, RCAs, conservation areas, gear requirements (one trawl gear onboard), apply in the IFQ fishery. New VMS declarations are as follows:

- Limited entry midwater trawl, non whiting IFQ
- Limited entry midwater trawl, Pacific whiting IFQ.
- Limited entry midwater trawl, Pacific whiting C/P sector.
- Limited entry midwater trawl, Pacific whiting MS sector.
- Limited entry IFQ bottom trawl, not including demersal trawl
- Limited entry IFQ demersal trawl.

These VMS declarations may be further revised as gear switching and other trawl rationalization program provisions are developed.

Definitions

8) Defining a whiting trip for the shoreside IFQ fishery.

Background:
Whiting trips, for the purpose of IFQ QS allocation, means those shorebased whiting fishing trips where greater than or equal to 50 percent of the total catch (landings and discards) is Pacific whiting. This definition does not work with the existing management measures for seasons and area closures in the shorebased whiting fishery.

Rationale:
The definition of whiting trips for IFQ QS allocations works for allocations and will be used for initial issuance of whiting QS, but does not work for ongoing management of the fishery, including seasons and area restrictions. The definition for whiting trips for IFQ QS allocations is based on information known after a trip. For management of the fishery, the whiting trip needs to be defined based on information known before or during the trip. Therefore, NMFS has developed a definition based on gear, similar to the definition currently used in regulation. The new definition for a shorebased whiting trip, for the purposes of ongoing management of the fishery, will be "a trip in which a vessel registered to a limited entry permit uses legal midwater groundfish trawl gear with a valid declaration for limited entry midwater trawl, Pacific whiting IFQ, as specified at 660.13 (d)(5) during the dates that the midwater whiting season is open."

Endorsements
9) Use of endorsed permits among trawl sectors (IFQ, MS, C/P)

Background:
As stated in Appendix D section B-4.1 (p. D-41) vessels that operate as C/Ps may also operate as MS, but not in the same year. Section B-2.1 (p. D-33) states that permits with a MS/CV endorsement may participate in either the coop or non-coop portion of the Mothership fishery. This section also states that any groundfish LE trawl permitted vessel may participate in the coop portion of the MS fishery if they join a coop. Finally, section B-2.1 also specifies that a MS operating as a C/P may not operate as a MS during the same year that they participated as a C/P.

Rationale:
NMFS interprets the use of endorsed permits among the trawl sectors as follows:

- C/P endorsed permit can be used by a catcher/processor in the C/P sector
- a MS permit can be used by a mothership in the mothership sector
- A vessel may be registered to both a C/P endorsed permit and a MS permit, but cannot fish in both sectors in the same year
- MS/CV endorsed permit can be used by a catcher vessel in the MS sector and IFQ sector if QP are available for use by the vessel.
- A trawl endorsed permit with no at-sea endorsements can be used by a vessel in the IFQ sector if QP are available for use by the vessel.and in the MS sector if it participates in a MS coop.

Observers
10) Current vessel observer data collection duties would incorporate, not be replaced by, IFQ species data collection needs.

Background:
With an increase of observer coverage, there has been some uncertainty about what observers on vessels would sample as part of the trawl rationalization program and whether their duties may focus entirely on collecting IFQ information.

Rationale:
With the implementation of trawl rationalization, updated sampling methodology will incorporate the need to collect more data on IFQ species; however, NMFS will maintain observer data collection necessary for the management of the groundfish fishery. These data collections are necessary in order to fulfill the Agency's overall conservation and management obligations under the MSA. An example of current data collection to be maintained under IFQ is species age structure data such as length, weight and sex. This information is key to many groundfish stock assessments.

11) No observer coverage waivers will be granted.

Background:
Currently, the bottom trawl fleet coverage is less than 100%. The IFQ program will require 100% observer coverage: all boats will be required to take an observer on all trips. NMFS will not issue observer coverage waivers to any vessels who wish to participate in the MS, C/P or IFQ sectors.

Rationale:
The IFQ program relies on 100% observer coverage to account for of all IFQ species. Granting coverage waivers would jeopardize the IFQ program's ability to accurately track and record catch of all IFQ species. Vessels must maintain safe conditions in order to have coverage or they cannot fish. If a vessel is determined to be unsafe, if appropriate, the quota pounds registered to it could be transferred to another vessel, consistent with the regulations.

IFQ PROGRAM

Trip Limits

12) Some status quo management measures will remain in place, including trip limits.

Background:
Am 20 DEIS, Appendix D, p. D-7 (A-1.3) states that unless otherwise specified, status quo regulations, including trip limits for non-IFQ species, would remain in place. It also states (p. D-3), "To ensure that optimum yields (OY) for species not covered by IFQ are not exceeded, catch of those species will be monitored and deductions made from the OY in anticipation of the expected level of shoreside trawl sector catch."

Rationale:
NMFS interprets this to mean trip limits will remain in place for some non-IFQ species such as spiny dogfish and other fish, while set asides are used for other non-IFQ species, such as nearshore species. These decisions can be made during the spex process to reflect the needs at the time. Routine management measures for the IFQ fishery will need to be defined at the start of the program to provide the rationale for an action and create a tool for management, should it be necessary.

Vessel Account

13) Holder of the vessel account and responsible party

Background:
The Am 20 DEIS, Appendix D, discusses the vessel account but does not define who will be the recognized "person" who may apply for the account or will be authorized to manage the account. It possibly could be interpreted to be the vessel owner, the vessel operator, or the vessel lessee or associated permit holder. Whoever is designated as the holder of the vessel account is responsible for managing the account and complies with the QP limits in the account or covering any overages. For any fishing violations associated with the vessel registered to the vessel account, the vessel owner(s) account manager(s) and/or vessel operator(s) will have joint and severable liability.

Rationale:
NMFS decided that the vessel owner is the holder of the vessel account and is responsible for managing the account. This is consistent with the current limited entry system where the vessel owner must be the holder of the limited entry permit that is registered to that owner's vessel. When setting up or renewing a vessel account, the vessel owner may designate other persons that can access the vessel account (i.e., vessel operator, manager, etc.).

14) 30 days to cover all catch from an IFQ trip

Background:
The Council motion as captured in Appendix D of the Am 20 DEIS (A-2.2.1, p. D-12) states, "All catch a vessel takes on a trip must be covered with QP within 30 days of the landing for that trip unless the overage is within the limits of the carryover provision (Section A-2.2.2.b), in which case the vessel has 30 days or a reasonable time (to be determined) after the QP for the following year are issued, whichever is greater. [t]"

Rationale:
NMFS plans to implement the Council motion as follows: All catch a vessel takes on a trip must be covered with QP within 30 days of the landing for that trip unless the overage is within the limits of the carryover provision (Section A-2.2.2.b), in which case the vessel has 30 days ~~or a reasonable time (to be determined)~~ after the QP for the following year are issued~~, whichever is greater~~." NMFS is removing the struckout language because a specific deadline is needed to be enforceable. NMFS has determined that 30-days is a reasonable amount of time to cover an overage. Because there is flexibility in the Council's recommendation, the regulations could be amended in the future through a rulemaking to provide for a different timeframe.

(Note: issue 4 within the clarifications document addresses when the 30 day clock starts)

First Receiver Site License

15) An accepted catch monitoring plan will be required before issuance of a first receiver site license

Background:
The Council motion recommended the use of "shoreside site licenses" (Am 20 DEIS, Appendix D, A-2.3.1, p. D-17). NMFS concurs with the requirement for these licenses, but calls them "first receiver site licenses" to make the term consistent with existing shoreside whiting first receiver regulations at 50 CFR 660.373(j). First receiver site licenses and requirements are modeled after Pacific whiting first receiver EFP requirements used in 2008 and 2009 for the Pacific whiting shoreside fishery. To acquire the first receiver site license, NMFS will require additional information/equipment, including a catch monitoring plan, certified scale(s), necessary state first receiver fish buyers license, internet access, computer/software for electronic fish tickets, etc. For the requirement to have a certified scale(s), NMFS is working with the states to determine the best process. NMFS acknowledges that there is a state certification process and does not intend to duplicate effort. NMFS may conduct or require periodic scale testing to ensure compliance. Catch monitoring plans are prepared by the first receivers and are narrative responses to questions specified in regulation. NMFS may conduct a site inspection before accepting the plans and at any time during the year if there is a shift in first receiver operations (i.e., from receiving non-whiting groundfish to receiving whiting). Catch monitors may be shared by facilities or businesses using the same facilities, consistent with the regulations including those pertaining to coverage and daily working hours.

Rationale:
First receiver site licenses are needed to register those first receivers who are authorized to receive offloads of QS species at specific sites, for NMFS to assess catch monitor training and equipment needs, to ensure adequate monitoring and accounting of landed catch, to ensure accurate weighing and documenting of IFQ landings, and to ensure timely transmission of landed catch data. First receiver site licenses would only be issued to a person that submits a completed application to NMFS, including an accepted catch monitoring plan, and who has a corresponding physical location (not a PO Box). The catch monitor plan must be accepted by NMFS before NMFS will issue the license. A first receiver must have different site licenses for different physical locations where IFQ groundfish are received. NMFS will use the information in the application and catch monitoring plan to aid catch monitors in their duties and to assess if the catch can be adequately monitored. The catch monitoring plan is submitted annually and must be resubmitted if there is a substantial change in how fish are received, sorted, or weighed.

First receiver site licenses also provide NMFS with a mechanism to take enforcement or administrative action if any of the conditions of the license are not met. The site license also provides a mechanism for NMFS, assess potential catch monitoring needs for a particular site, and the potential overall program need. NMFS may require the first receiver to attend a mandatory meeting and have a site inspection in order to receive a first receiver site license.

IFQ Species Area Management

16) As IFQ species will be managed in four distinct geographic areas with different management measures, a vessel will be prohibited from fishing in different areas during the same trip.

Background:
Many groundfish species are tracked as either a single species with different QS by area; or as a single species in one area and as part of a minor shelf or slope group north or south of 40°10' N. lat. For example, yellowtail rockfish is an individual species management unit north of 40°10', but a member of the minor shelf rockfish species complex south of 40°10'. QS for sablefish is issued with area distinctions either north or south of 36° N. lat. QS for shortspine thornyhead is issued with area distinctions either north or south of 34°27' N. lat.

Rationale:
The IFQ management areas will be as follows:

- US/Canada border to ≥ 40°10'
- 40°10' to ≥ 36°
- 36° to ≥ 34°27'
- 34°27' to the US/Mexico border

As landings are a mix of all hauls taken during a single trip, to simplify sorting requirements, at-sea observation and enforcement of IFQ limits, a vessel must fish entirely in one management area during any trip. This is the most straightforward and efficient method to track and verify total catch of a vessel's IFQ limits for individual species and rockfish complexes.

IBQ Data Collection

17) Pacific halibut discard and mortality data collection frequency will likely increase, but the nature of the information collected will remain constant under trawl rationalization in order to provide individual vessel mortalities.

Background:
In formulating IBQ, the Appendix D states "The IBQ will be required to cover legal and sublegal sized Pacific halibut bycatch mortality in the area north of 40°10 N latitude. It is the intent of the Council that halibut IBQ mortality be estimated on an individual vessel basis." (Appendix D, A.4, p. D-19).

Rationale:
Appendix A states "Pacific halibut IBQ would function in a manner similar to IFQ for other species, except that retention and landing of halibut would be prohibited and only

pounds of dead halibut would be counted against the IBQ. Discard at sea of Pacific halibut would be required, and before discard occurs observers would estimate the halibut bycatch mortality on that vessel ~~(fleet wide average mortality rates would be used)~~ to provide greater individual accountability and incentives for harvesters to control halibut mortality." (Appendix A, A-4, p. A-440). NMFS is not including this phrase as it is opposite to Council intent of the IBQ. If large numbers of Pacific halibut occur in a haul the observer would likely sub-sample.

The current data collection methodology makes no distinction between legal and sublegal halibut, but, as length is collected, allows for analysts to divide out halibut bycatch as needed. In addition, weight of discarded halibut is determined by a length to weight conversion developed by the International Pacific Halibut Commission. As collecting halibut weight at-sea is problematic, use of the published length to weight conversion table is the accepted method to determine Pacific halibut weights.

<u>Processing at-sea by IFQ whiting vessels</u>.

18) The exemption for processing at-sea by shoreside whiting vessels will remain in place and the value for the weight conversion will be based on a published value.

Background:
Under the definition of processing in the groundfish regulations at 50 CFR 660.302, heading and gutting is allowed while a vessel is at sea provided no additional preparation is done. At the start of 2009 a provision was added for Pacific whiting shoreside vessels 75 feet in length or less, to exclude from the processing definition whiting that are headed and gutted with the tails removed and frozen at sea. The provision allows these vessels to continue to be part of the shore-based whiting fishery and the Pacific whiting taken by these vessels continues to be attributed to the shore-based allocation (50 CFR 660.373(a)(3)). To date only a single vessel has headed and gutted Pacific whiting at sea. The vessel used a smaller net and shorter tows to maintain product quality. Allowing the Pacific whiting to be tailed and frozen at-sea increases the value of the catch. This provision will continue. Therefore, NMFS should have a weight conversion in regulation.

Rationale:
NMFS will use a weight conversion for whiting based on published values in Crapo et al. (2004) (Sea Grant document). Without conversions for other species, species other than whiting may not be processed at-sea.

AT-SEA COOP PROGRAMS (MS & C/P)

Equipment Requirements

19) All catch in the at-sea whiting fleet will be required to be weighed by a NMFS certified flow scale that meets the testing requirements.

Background:

The motherships and catcher/processors operating in the at-sea whiting fleet generally use flow scales to weigh catch, but are not required to do so. Flow scales were incorporated into their fishing operations due to their requirement to operate in restricted access fisheries in the North Pacific. Although flow scales are commonly used in the whiting fishery rather than changing factory layouts or operations, it is unknown if they follow similar performance testing requirements as when they participate in the North Pacific fisheries

Rationale:

As the flow scales are already in operation and they are a proven method to attain accurate estimates of total catch in this high volume fishery, NMFS will now require their use in the at-sea whiting fishery. Flow scale certification and regulations in place for the North Pacific fisheries will be adopted and updated where appropriate for use in the whiting fishery. The Northwest Region is working with the Alaska Region to determine how best to incorporate the North Pacific requirements.

Non-whiting species reapportionment

20) Non-whiting groundfish species with formal allocations may be reapportioned within the MS Coop Program or between the MS and C/P Coop Programs.

Background:

Non-whiting groundfish species with allocations (i.e., darkblotched, POP, widow, and canary) may be reapportioned to permitted coops and the non-coop fishery when a MS permitted coop or the non-coop fishery reaches its whiting allocation. Similarly when a sector (i.e., MS or C/P) reaches its whiting allocation, the non-whiting species catch allocations can be reapportioned to the other sector. Whiting allocations cannot be reapportioned.

Rationale:

Reapportionment could occur when a sector reaches its whiting allocation or participants in the sector do not intend to harvest the remaining sector allocation. When considering redistribution of non-whiting catch allocation, the Regional Administrator will take into consideration the best available data on total projected fishing impacts in all fisheries.

With coops, we assume a very small amount of whiting will be left on the table at the end of a season meaning that the allocation is never actually reached. We will use a cease fishing notice provided by the participants to determine when coops and vessels are done for the year and reapportionment of non-whiting species with allocations can occur. The designated coop manager, or in the case of inter-coop, all of the designated coop managers, must notify NMFS in writing that their harvesting has concluded for the year. The regulations will specify that at any time after 80 percent of the MS sector whiting allocation has been harvested, the Regional Administrator may contact designated coop managers to determine whether they intend to continue fishing.

Coop Permit and Agreement

21) A coop permit approved by NMFS will be required of any coop participating in the MS or C/P Coop Program.

Background:
The Council motion as stated in Appendix D regarding the MS and C/P coop programs does not mention the requirement for a coop permit. In addition, Appendix D (p. D-42) of the Am 20 DEIS states that the C/P coop will not be required to have an annual registration or make annual declarations. However, NMFS has determined that there is a management need to require a permit at the coop level for both the MS and the C/P Coop Programs.

Rationale:
While both the MS and C/P sectors will be adequately managed by the coops, NMFS has determined that there is a need to require a permit at the coop level for any coop participating in the MS and the C/P Coop Program. The coop agreement establishes the terms and conditions for the coop. The coop permit formally registers the coop and its associated members to harvest and process whiting in the sector. The coop agreement, plus the specification of the coop managers, provides a mechanism for NMFS to track and to communicate with the coop. In NMFS's view, this is an appropriate element of the trawl rationalization program. In addition, the permit provides important accountability measures at the coop level instead of at the individual level, this is also an important element of the trawl rationalization program. The coop permit also provides NMFS a mechanism to take enforcement or administrative action at the coop level if any of the conditions of the permit and its associated coop agreement are not met. The coop permit may be revised by NMFS to reflect changes in the membership or participating vessels and other material changes to the coop.

22) Additional information in MS coop agreement.

Background:
Appendix D of the Am 20 DEIS (p. D-37) lists the contents of MS coop agreements. Item #1 states that a coop agreement must include "a list of all vessels, which must match the amount distributed to individual permit holders by NMFS." NMFS interprets this to

mean that the coop agreement should list the coop's permit numbers and also the vessels and vessel owners. Some vessels owners may not own the permit to which they are registered. In addition to the information recommended in Appendix D, the following information is also being required in a MS coop agreement (*See Attachment A for regulatory text of full list of MS coop agreement contents*):

- The mothership sector catch history assignment associated with each MS/CV endorsed limited entry permit.
- A catch history assignment clause indicating that each member MS/CV endorsed permit's catch history assignment must equal the catch history assignment that the member permit brings to the coop.
- A listing of all MS permits by permit number and the vessel registered to each permit that the MS coop members intend to deliver to.
- A description of how the coop would be dissolved.
[*This replaces the Council recommendation for an agreement by at least a majority of the members is required to dissolve a coop. During Council discussion this was flagged by NOAA GC as having potential legal issues.*]

Rationale:
NMFS has determined that a list of MS permits and a list of all vessels participating in the coop is necessary for establishing legal liability and catch tracking and monitoring. NMFS has determined that a list of permits participating in the coop is necessary as permits can be transferred and it is the permit that brings the catch history. The MS/CV endorsed permit owners are the coop members. The additional information includes a clause pertaining to the "Golden Rule" requirement recommended by the Council. These pieces of the program have been consolidated for efficiency.

23) A coop agreement will also be required of the C/P Coop.

Background:
The Council motion as stated in Appendix D (p. D-36 & D-37) requires submission of a coop agreement to NMFS and the Council for any MS coop. Appendix D does not have a similar coop agreement requirement for the C/P Coop Program. The coop agreement for the MS program is necessary to ensure that the coop will meet a set of terms and conditions (e.g., will adequately monitor catch and discards, designate a coop manager, list of participating permits/vessels, signatures of participants, obligation to produce an annual report, etc.).

Rationale:
For the same reasons that a coop agreement is required in the MS Coop Program, NMFS has determined that the C/P Coop Program should have a similar requirement for a coop agreement that is submitted to NMFS as part of the application process for a coop permit.

In addition, the coop agreement would allow NMFS to track if a member has left the coop and determine if the coop has been dissolved. This is an appropriate element of the trawl rationalization program. Because these events identify a coop failure, requirements for the C/P Coop Program to become an IFQ fishery would be triggered and NMFS requires certainty of this situation to take appropriate management action. The C/P coop agreement would be similar to that for the MS Coop Program, but with fewer provisions (i.e., the C/P coop agreement does not need to address catch history assignments). The draft regulatory text of the C/P coop agreement contents is in Attachment B.

24) Coop failure or dissolution

Background:
The Council's recommendation did not address specifically what constitutes a coop failure. Unlike the C/P fishery, NMFS could make a determination to revoke a particular MS coop permit or not reissue permits to MS coops that have been determined to have failed.

Rationale:
NMFS has interpreted a MS coop failure as any or all of the following :

1. If the coop members voluntarily dissolve the coop, or
2. If the coop membership falls below 20 percent of the CV/MS endorsed limited entry permits, or
3. If the coop agreement is no longer valid, or
4. If the coop fails to meet the MS coop responsibilities specified in regulation.
5. If the coop fails to submit an annual report.

MOTHERSHIP COOP PROGRAM

Maximized retention by mothership catcher vessels

25) The MS/CV fleet will only be allowed to discard minor operational amounts of catch at sea after the observer has accounted for the catch (i.e., a maximized retention fishery).

Background:

Current groundfish regulations at § 660.306 (i)(2) prohibit interfering with or biasing the sampling employed by an observer by mechanically or physically sorting or discarding catch before sampling. This language was intended to include the dumping of catch at sea by mothership catcher vessels. In addition, a prohibition was added in 2009 that prohibits the sorting or discarding of any portion of the catch taken by a catcher vessel in the mothership sector prior to the catch being received on a mothership, and prior to the observer being provided access to the unsorted catch, with the exception of minor amounts of catch that are lost when the codend is separated from the net and prepared for transfer. In addition the current definition of "landing" in regulation is that once the offloading of any species begins, all fish aboard the vessel are counted as part of the landing and must be reported as such. Transfer of fish at sea is prohibited unless a vessel is participating in the mothership or catcher-processor sectors. Maintaining the current regulations will require catcher vessels in the mothership sector to transfer catch to a vessel registered to a MS processor permit with all catch from a haul being transferred to the same mothership prior to the gear being set for a subsequent haul. Catcher vessels delivering to motherships will be required to carry observers under the coop system. Accommodation must be made to reduce the likelihood of hauls that are too large to purse off all catch in the codend. Catcher vessels with hauls that are too large to purse off in the cod end, must make accommodations for retaining and transferring the catch to the mothership or for the catcher vessel observer to obtain an accurate weight by species before fishing may be resumed. Catch in the mothership sector may not be offloaded to a tender vessel.

Rationale:

NMFS believes that maximized retention requirements must be maintained to derive accurate weights of the catch. Under this definition of "landing," whiting catch cannot go from a MS/CV to a tender vessel. To avoid discarding any portion of the catch, the catcher vessel operator is responsible for taking the necessary steps to prevent dumping or bleeding of catch directly from the codend Transfer of product to cargo vessels by mothership and catcher processor vessels continues to be allowed.

MS/CV endorsed limited entry permit catch history assignments

26) Years dropped in MS/CV catch history assignments

Background:

Appendix D (p.D-34) states that, "The initial catch history calculation for CV(MS) whiting endorsements will be based on whiting history of the permit for 1994 through 2003, dropping two worst years." The Council motion in November 2008 does not include the word "worst".

Rationale:

Initially NMFS will drop the two years with the lowest relative pounds of whiting. NMFS will then allow industry to choose which two years will be dropped from the calculation. If a participant would prefer to drop years other than the "worst" years (lowest relative pounds) This will reduce the burden on the agency during the initial issuance phase.

Non-coop Fishery

27) Allocation of whiting to the non-coop fishery

Background:

In Appendix D (B-2.5.3, p. D-39), the non-coop allocation is determined as follows: "Each year NMFS will determine the distribution to be given to the non-coop fishery based on the catch history calculation of permit holders registered to participate in that fishery."

Rationale:

Interpreted literally, this would mean that the non-coop fishery is the sum of all permits that declare in to the non-coop fishery preseason through the permit renewal process. Potentially, there may be cases where permits were not renewed on time and are permanently expired. This means that any remaining catch history assignments from permits not renewed or those that did not declare a coop or non-coop fishery would not contribute to the fishery for that year.

NMFS has interpreted this provision in Appendix D as follows: "The non-coop whiting fishery is authorized to harvest a quantity of whiting that is remaining in the mothership sector annual allocation after the deduction of all coop allocations." Thus, any remaining amounts of whiting from permits with catch history assignments that did not renew or that did not declare in to the coop fishery, would go toward the non-coop fishery allocation. In the second year, the catch history assignment from a permit that did not renew and were permanently expired would be redistributed proportionately to all valid MS/CV endorsed permits.

NMFS will require all MS coops to register with NMFS by a deadline date prior to the beginning of the at-sea whiting fishery. The catch history assignment associated with any MS/CV endorsed permit that is not registered for use by a coop would default to the non-coop fishery. NMFS will aggregate the amount of whiting catch history assignment for each of the permits assigned to the non-coop fishery and will allocate the aggregated sum to the non-coop fishery.

Only MS/CV vessels not registered to a coop may fish in the non-coop fishery. As part of the permit renewal process, NMFS will request that MS/CV endorsed permit owners indicate if they will participate in the coop or non-coop fishery.

Inseason management

28) Inseason management of species with at-sea sector set asides or without MS allocations

Background:
The Council action as captured in the Am 21 DEIS (p. 48) states that species with at-sea sector set asides would not be managed inseason; similarly any species without MS allocations would not be managed inseason.

Rationale:
NMFS agrees with this provision and interprets it to mean that these species would be managed on a annual basis according to the sector allocation, the species specific ACLs, and any other accountability measures.

29) MS Coop Program fishery closures.

Background:
In appendix D (B-1.1, p.D-29), states "NMFS will monitor the catch in the mothership non-coop fishery, the mothership co-op fishery, the CP fishery, and the overall whiting catch of all at-sea sectors. NMFS will close each segment of the fishery based on projected attainment of whiting catch. Additionally, all at-sea sectors will be subject to closure based on attainment of the overall trawl whiting allocation."

Rationale:
NMFS also interprets this to mean that NMFS will close the entire MS fishery (coop and non-coop fishery) if they are projected to attain an allocation. NMFS will not close individual coops in the MS fishery. The individual coops are responsible for closing their coop as stated in their coop agreement.

Mutual Agreement Exception

30) Catch history assignment for a MS/CV endorsed permit exiting a MS coop

Background:
The Council motion as captured in Appendix D of the AM 20 DEIS, (B-2.4.2(b.), p.D-38) states, "By mutual agreement of the CV(MS) permit owner and mothership to which the permit is obligated, a permit may deliver to a licensed mothership other than that to which it is obligated."

Rationale:
NMFS interpretation of the mutual agreement exception is that it means a written, private agreement that allows the owner of a MS/CV endorsed limited entry permit to withdraw the catcher vessel's obligation to a permitted mothership processor. Catch shares that are obligated to a particular mothership can be moved between vessels in the same MS permitted coop or between MS permitted coops that have an accepted inter-coop agreement. Catch shares cannot move between the coop and non-coop fisheries. A mutual agreement exception must be submitted to NMFS as notification that a particular MS/CV endorsed permit and the vessel registered to it will deliver to a different permitted mothership processor for the fishing season.

Definition of "material change"

31) New definition for the term "material change" as it applies to the MS fishery.

Background:
The Council motion states in Appendix D, page D-36 that "Any material changes or amendments to the contract must be filed annually with the Council and NMFS by a date certain." This language does not specifically define a material change.

Rationale:
NMFS has developed a preliminary definition for the term "material change". A material change means: "After the mothership coop permit is issued, NMFS must be notified in writing if a mothership coop makes changes to any of the following components of the coop agreement:

1. the designated coop manager;
2. the description of the coop's plan to adequately monitor and account for the catch of Pacific whiting and non whiting allocations, and to monitor and account for catch of prohibited species;
3. MS/CV endorsed member permit transfers ownership through mutual agreement in or out of the coop;
4. the description of the enforcement and penalty provisions;

5. the description of measures to reduce catch of overfished species;
6. the description of how the obligation to manage inseason transfers of catch history assignment will be conducted;
7. the description of how the coop is being dissolved;
8. the addition or withdrawal of any catcher vessel (MS/CV endorsed or limited entry trawl endorsed without an MS/CV endorsement) to the coop;

In addition, it is not clear why such changes would be submitted annually, unless no changes to the coop agreement and/or participants are anticipated to occur during the fishing season. If any substantive change to the coop agreement occurs during the fishing season, the coop manager must immediately provide to NMFS an amended cooperative agreement.

CATCHER/PROCESSOR COOP PROGRAM

Coop Formation

32) C/P Coop Program only allows for the formation of a single voluntary coop

Background:
In a couple of places, the council motion as captured in Appendix D (p. D-41, p.D-27) states that C/P endorsed vessels may form coops (plural). Other places in Appendix D (p. D-2, D-27, D-28, D-41) refer to a single voluntary coop. The Council motion in November 2008 refers to a single coop.

Rationale:
Because most places in Appendix D reference a single coop for the C/P coop program and because NMFS believes the Council intent is to keep the C/P coop structure similar to its current operations , NMFS has interpreted the C/P coop program to only include the formation of a single voluntary coop. Further, multiple competing coops could result in a race for fish, which is contrary to the goals of the trawl rationalization program.

Attachment A

Mothership Coop Agreements.

(A) Coop agreement. NMFS will review coop agreements for completeness and to determine if the coop permit contains sufficient information for the required items and to determine if the coop has adequate mechanisms to effectively manage the coop to track, monitor, and report on the catch activities of the coop members. A coop agreement must include all of the information listed at paragraph (e)(2)(iii)(A)(1) to be considered a complete coop agreement.

(1) Coop agreement contents. Each agreement must include the following information:

(i) A listing of all coop member vessels, including any member vessels registered to a MS/CV endorsed limited entry permit or a trawl-endorsed limited entry permit without a MS/CV endorsement.

(ii) A listing of all MS/CV endorsed limited entry member permits by permit number.

(iii) The mothership sector catch history assignment associated with each member MS/CV endorsed limited entry permit.

(iv) A listing of all MS permits by permit number and the vessel registered to each permit that the MS coop members intend to deliver to.

(vi) A catch history assignment clause indicating that each member MS/CV endorsed permit's catch history assignment must equal the catch history assignment that the member permit brings to the coop.

(vii) A description of the coop plan to adequately monitor and account for the catch of Pacific whiting and non-whiting groundfish allocations, and to monitor and account for the catch of prohibited species.

(viii) A new member permit owner clause that requires new owners of member permit's to comply with membership restrictions in the coop agreements

(ix) A description of the coop plan to enforcement and penalty provisions adequate to ensure that of Pacific whiting and non-whiting groundfish allocations overages do not occur.

(x) A description of measures to reduce catch of overfished species.

(xi) A description of how the obligation to manage inseason transfers of catch history assignments will be conducted.

(xii) A description of how the obligation to produce an annual report to the Council and NMFS by a date certain documenting the coop's catch and bycatch data and inseason transfers will be met.

(xiii) Identification of the designated coop manager.

(xiv) A signed clause by the designated coop manager acknowledging the responsibilities of a designated coop manager defined in 660.XXX.

(xv) A signed clause by all permit holders participating in the coop acknowledging the responsibilities of a coop member.

(xvi) A description for how the coop will be dissolved, including a requirement that at least a majority of the members are required to make a decision to dissolve a coop

(xvii) Provisions that prohibit coop membership by permit holders that have incurred legal sanctions that prevent them from fishing groundfish in the Council region.

Attachment B

Catcher/Processor Coop Agreements

(A) Coop agreement. NMFS will review coop agreements for completeness and to determine if the coop permit contains sufficient information for the required items and to determine if the coop has adequate mechanisms to effectively manage the coop to track, monitor, and report on the catch activities of the coop members. A coop agreement must include all of the information listed at paragraph (d)(2)(iii)(A)(1) to be considered a complete coop agreement.

(1) Coop agreements contents. Each agreement must include the following information:

(i) A listing of all C/P endorsed limited entry member permits by permit number. The coop agreement is not required to list the vessels registered to each permit.

(ii) A description of the coop plan to adequately monitor and account for the catch of Pacific whiting and non-whiting groundfish allocations, and to monitor and account for the catch of prohibited species.

(iii) A new member permit owner clause that requires new owners of member permit's to comply with membership restrictions in the coop agreements

(iv) A description of the coop plan for enforcement and penalty provisions adequate to ensure that of Pacific whiting and non-whiting groundfish allocations, Pacific halibut set-asides overages do not occur.

(v) A description of measures to reduce catch of overfished species.

(vi) A description of how the obligation to produce an annual report to the Council and NMFS by the November Council meeting documenting the coop's catch and bycatch data and inseason transfers will be met.

(vii) Identification of the designated coop manager.

(vii) A signed clause by the designated coop manager acknowledging the responsibilities of a designated coop manager defined in 660.XXXX.

(viii) A signed clause by all permit holders participating in the coop acknowledging the responsibilities of a coop member.

(ix) A description for how the coop will be dissolved.

(x) Provisions that prohibit coop membership by permit holders that have incurred legal sanctions that prevent them from fishing groundfish in the Council region.

Clarifications Requested of Council

Disclaimer: Additional issues for clarification on the trawl rationalization program will arise as the program is reviewed by NMFS. Amendments 20 & 21 to the Groundfish FMP, have not yet been formally submitted to NMFS or approved or implemented by NMFS. NMFS and the Council staff are currently clarifying issues raised by these amendments.

ALL TRAWL FISHERIES.

Permit initial issuance & appeal

Issue 1: Transfer of limited entry permits during application process for QS permit, MS/CV endorsed permit, or C/P endorsed permit.

Option A:
QS, MS/CV, or C/P permit history and the limited entry permit are non-severable during application period and until final decision on application is made. Transfers of limited entry permits and their permit history can happen, but QS, MS/CV, or C/P permit would be issued to the new limited entry permit owner of record after the application process is complete.

Option B:
This option only applies to QS permit. The applicant would stay the same throughout application process regardless of whether the limited entry permit had transferred and the QS permit, if approved, would be issued to the original applicant. NMFS would maintain the list of limited entry trawl permit owners as of a specific date (e.g., date the prequalified application was mailed). Transfers of limited entry permit could occur, but QS would go to owner of record of the limited entry permit as of the specific. Therefore, the QS permit owner may not be the same person as the limited entry permit owner of record when NMFS makes its final decision and issues the QS permit with initial issuance of QS.

Option C: (NMFS-preferred)
No limited entry permit with a trawl endorsement associated with an application for a QS permit, or MS/CV or C/P endorsement could be transferred to a different permit owner during the application process.

Discussion: The Council motion does not discuss how permit transfers would be handled during the application process for the initial issuance of a QS permit, a MS/CV endorsed limited entry trawl permit, or a C/P endorsed limited entry trawl permit. Since the discussion of this issue at the GAP/GMT meeting on February 2-5, 2010, NMFS has reconsidered its preferred option. NMFS now prefers Option C which would not allow a change in permit ownership after an application is made for a QS permit or MS/CV or C/P endorsement. In NMFS's view, an applicant for the QS permit or MS/CV or CP endorsement is eligible to make the application only because the person owns the permit at the time of application and is making the application in good faith with the full expectation, that if approved, the requested privilege will be assigned to them. To allow a change in permit owner during application or appeals period, could introduce complexities where the new permit owner attempts to make assertions regarding the application or seek to appeal an IAD issued to original applicant.

Option A would require NMFS to make an initial determination to the original application, pending the conclusion of any appeal. NMFS would have the added step of having to reassign the QS or catch history assignment to the new permit owner. Further, in the case of making an allocation of QS or whiting catch history assignment, the new permit owner may have been approved for amounts of QS or whiting catch history assignment under a separate application that results in the new permit owner exceeding accumulation limits. While Option C may restrict some business flexibility on the part of the permit owner, the permit owner may make a change in vessel registration during the application and appeals process. In short, NMFS believes Option C provides the least confusing and least administratively burdensome approach to manage this issue. Option A maintains the permit history and the limited entry permit as non-severable during the application process. However, under the IFQ fishery which prohibits transfers of QS during the first 2 years of the program, this would essentially allow some trading of QS, although the exact amount may not be known, before the QS permit and its associated QS amount is issued. Option B is similar to Option A, but does not allow this "trading" of potential QS privilege during the application process. Option C may restrict some business decisions by limited entry permit owners during the application process.

Issue 2: <u>Status of QS and MS/CV endorsed permits pending appeal</u> . If all of the appeals associated with initial issuance of QS amounts on the QS permit and catch history assignments on the MS/CV endorsed permits are not completed by the time the trawl rationalization program is scheduled to be implemented, how will those permits still under the appeals process be handled?

Option A (*NMFS-preferred*):
While under appeal, the QS amount assigned for an IFQ management unit species will remain as previously assigned to the associated QS permit before the appeals process. The QS permit may participate in the Pacific Coast groundfish fishery with the QS amounts assigned to the QS permit before the appeal. Once a final decision on the appeal has been made and if a revised QS amount for a specific IFQ species will be assigned to the QS permit, the QS amount associated with the QS permit will be effective

at the start of the next calendar year. This same process would be followed for a whiting catch history assignment associated with MS/CV endorsed permit under appeal.

Option B:
NMFS would not issue QS to any qualified applicants until all the appeals are done. The fishery would continue under trip limits until all appeals are completed. NMFS would initially issue a QS contribution factor and would show applicants the pounds that went into the calculation of their QS but not issue QS until the start of the next year after all appeals are completed. For the Mothership fishery, NMFS would not issue MS/CV endorsed permits and their catch history assignments until all appeals are done. The fishery would continue under status quo management until all appeals are completed, and would start under the trawl rationalization MS coop program in the year following the completion of appeals.

Discussion: Under Option B, NMFS would not issue any QS until all appeals are completed. In the interim, the fishery would continue under trip limits. During the application process, permits that qualify would be issued a contribution factor which shows the pounds for each IFQ species that they will contribute to the IFQ fishery (i.e., their numerator in the IFQ equation where the denominator is all qualified QS permits). QS percentages would not be issued until all appeals had been completed and the denominator for each IFQ species was known. This method results in less changes among all QS permit owners' QS amounts during the first year of the program. Similarly, the MS/CV endorsed permits and their associated catch history assignments would not be issued until all appeals were completed. This is what was done for the scallop IFQ fishery in the NE. This method would provide an incentive to the fleet to finish all appeals in a timely manner.

Option A allows QS permit owners to fish all of the QS they were initially issued, including any QS amounts under appeal after December 31, 2010. QS amounts under appeal would be issued as the QS amount that appeared on the QS permit before the appeal. Once the appeal is completed and if it results in a change to the QS amount, the amended QS would appear on the QS permit in the next calendar year. NMFS would also adjust QS for all existing QS permit owners at the start of the next year based on appeals completed after December 31, 2010. Option A could also mean that in year two of the program those who had been issued QS might have their QS amended because of the outcome of appeals. This same process would be followed for a whiting catch history assignment associated with MS/CV endorsed permit under appeal.

IFQ FISHERY

<u>Vessel Account</u>

Issue 3: <u>30-day clock</u>. When does the 30-day clock start for vessel overages?

Option A:
Start the clock upon completion of the landing that caused the overage even if all data/documentation (observer reported discards and fish ticket reported landings) are not available in the vessel account. Assumes that at the time of landing, the vessel operator knows there was an overage that occurred on that trip.

Option B (*NMFS-preferred*):
If an overage shows on the fish ticket at the time of landing or in the vessel account at any time after the landing, the clock would start when any data/documentation from the trip which caused the overage is available or the vessel account shows there is an overage.

Discussion: Am 20 DEIS, Appendix D (A-2.2.1, p. D-12), states the 30-day clock starts from the landing for the trip that caused the overage. NMFS is concerned about the availability of data confirming the overage. When the Council made its motion on this issue, they assumed electronic reporting would be in place and data would be available rapidly, which may not be the case. If the language from the Council motion is followed strictly, it could start the 30-day clock before the responsible party may know there is an overage. NMFS prefers Option B because it would ensure all parties have an opportunity to be aware of the overage when the 30-day clock starts. For example: When the fish ticket deduction creates an overage (deficit) in the vessel account, the 30-day clock would start. If subsequent observer data creates the deficit, the 30-day clock would start when the observer data is entered into the vessel account. Whenever a data submission creates a negative balance for any species, the 30-day clock would start. In situations where the original fish ticket data created the deficit and the 30-day clock is initiated, and subsequent observer data and/or QA/QC data would be additive to the original deficit balance, it would not "restart" the 30-day clock.

Issue 4: <u>10% carryover</u>. The 10% carryover provision can be calculated from the vessel account different ways.

Option A (*NMFS-preferred for deficit or surplus*): The 10% carryover is 10% of the QPs in a vessel's account based on the balance 45 days after QPs have been initially issued for that year by NMFS based on the IFQ fishery allocation.

Option B: The 10% carryover is 10% of the total cumulative QP (used and unused) that have been in the vessel's account over the calendar year minus any QP that were transferred to another vessel's account.

Option C: The 10% carryover is 10% of the QPs in a vessel's account (used and unused) as of the balance at the end of the calendar year.

Discussion: Am 20 DEIS, Appendix D (A-2.2.2 b, p. D-13), states there is a limit of up to 10% carryover for each species. The 10% is calculated on the total pounds (used and unused) in a vessel QP account for the current year. There is some room for interpretation of the Council's motion as to when the 10% is calculated.

NMFS prefers Option A for both deficit and surplus carryover of up to 10% because it allows for the flexibility the industry seeks in managing the QPs in its vessel accounts, provides certainty of information for vessel account managers, simplifies tracking and monitoring, and furthers the Council intent to have all QPs assigned to a vessel account early in the year. QP deficits in a vessel account must be covered within 30 days to avoid investigation/prosecution for quota busting. The industry recognized early on that with the 10% carryover provision, an overage (account deficit) occurring after Dec. 2nd of a given year could potentially be "covered" by the annual issuance of QPs in the next year, i.e. January 1. This understanding lead to creation of a option where, if a vessel incurs a QP deficit of up to 10% of any species in its vessel account, that vessel may opt out of the fishery for the remainder of the year and avoid investigation/prosecution for incurring a QP deficit in its vessel account. Given that the deficit and desire to opt out could occur at any time of the year, it is important to identify what the 10% value is, early in the year. By identifying the 10% carryover value early in the year, account managers will know what the 10% carryover provision is for QP accounting for any given species in that year, and can plan accordingly. The industry will have an incentive to load QP in to their vessel accounts by mid-February thus furthering Council intent, and tracking and monitoring will be greatly simplified with a fixed number identified early on.

The account surplus carryover will be carried over to the vessel account from which it was derived for the following year and will be held (controlled) by the vessel account owner. For end of the year deficits, the account deficit must be covered by the vessel account owner within 30 days after QPs have been initially issued for that year by NMFS based upon the IFQ fishery allocation.

Issue 5: All QP in a QS account must go in to a Vessel Account each year.

Option A:
All QP in a QS account must go in to a Vessel Account by December 31 each year.

Option B (*NMFS-preferred*):
All QP in a QS account must go in to a Vessel Account by a specified date each year, for example, September 1.

Discussion: NMFS understands that this provision is intended to ensure that no QS owner can sit on the QP in their QS account; therefore, not providing harvest opportunity for vessels participating in the IFQ fishery. If the Council motion as described in Appendix D (A-2.2.3 b, p. D-14), which states, “each year, all QP must be transferred to a vessel account,” is interpreted to mean that QP must go in to a vessel account by the end of the calendar year, then it does not meet the Council’s intent of making QP available to the IFQ fishery. There could be a scenario where a QS owner would move QP in to a vessel account on December 31, causing most of those QP to be unavailable for use during the year (aside from any QP allowed from the carryover provision). Thus, NMFS prefers Option B, which would give QS owners time during the year to distribute QP to vessel accounts, but would also allow vessel’s time to use any QP arriving in to their vessel accounts later in the year.

MOTHERSHIP & CATCHER-PROCESSOR COOP

At-sea Whiting Trawl Sector Set-Asides (Am 21)

Issue 6: There is an inconsistency in the Council’s motion from April 2009 on at-sea whiting trawl sector set-asides. The motion states, "At-sea sector set asides: Adopt the GAC recommendation to set the at-sea sector set-asides large enough to not constrain their fisheries given the inter-annual variation in sector catches by establishing a 5 mt minimum set-aside for any incidentally caught species in the at-sea fisheries with all set asides rounded up to the nearest 5 mt (actual amounts specified in Table 4-23, p. 102 of Preliminary Draft EIS)."

Option A:
This could be interpreted to be at least 5 mt minimum set-aside for any species

Option B:
This could be interpreted to be actual amounts in the table from the preliminary DEIS which showed some species set-asides of less than 5 mt (e.g., 0 mt and 1 mt).

Discussion: For the Amendment 21 DEIS, NMFS has interpreted the GAC-recommended alternative to be a 5 mt minimum set aside for any species, except yelloweye rockfish which would remain at 0 mt, and the Council-preferred alternative to be the values that were originally reflected in the preliminary DEIS as shown in Table 2-13 of the DEIS (see below). The Council-preferred alternative would set-aside 1 mt of the following species: Pacific cod, longspine thornyheads north of 34 27’ N. lat., English sole, Petrale sole, starry flounder, and longnose skate. Yelloweye rockfish would remain at 0 mt.

NMFS intends to put the set asides in regulation with the ABC/OY tables.

Table 2-13. Alternatives for yield set-asides to accommodate the bycatch in future at-sea whiting fisheries under trawl rationalization.

Allocation Process	Stock or Stock Complex	Alternative 1: No Action	Alternative 2: GAC-recommended	Alternative 3: Council-preferred at-sea Set-aside (mt) [a/]
Sector Allocations Decided Through the Intersector Allocation Process	Lingcod	No set asides for the at-sea whiting fishery. Historically have been set-asides for yellowtail and widow rockfish to accommodate catches in the at-sea whiting fishery. Once those fisheries were completed, the set-asides rolled back in to the limited entry trawl amounts available to the entire fishery.	6	6
	Pacific Cod		5	1
	Pacific Whiting (U.S.)		NA	NA
	Sablefish N. of 36º		50	50
	Sablefish S. of 36º		NA	NA
	PACIFIC OCEAN PERCH		Formal Allocation	Formal Allocation
	WIDOW ROCKFISH		Formal Allocation	Formal Allocation
	Chilipepper S. of 40°10'		NA	NA
	Splitnose S. of 40°10'		NA	NA
	Yellowtail N. of 40°10'		500	300
	Shortspine Thornyhead N. of 34º27'		20	20
	Shortspine Thornyhead S. of 34º27'		NA	NA
	Longspine Thornyhead N. of 34º27'		5	1
	Longspine Thornyhead S. of 34º27'		NA	NA
	DARKBLOTCHED		Formal Allocation	Formal Allocation
	Minor Slope RF N.		55	55
	Minor Slope RF S.		NA	NA
	Dover Sole		5	5
	English Sole		5	1
	Petrale Sole - coastwide		5	1
	Arrowtooth Flounder		10	10
	Starry Flounder		5	1
	Other Flatfish		20	20
	Pacific Halibut		10	5
Sector Allocations Decided Through the Biennial Specifications and Management Measures Process	CANARY ROCKFISH		Formal Allocation	Formal Allocation
	BOCACCIO		NA	NA
	COWCOD		NA	NA
	YELLOWEYE		0	0
	Black Rockfish		NA	NA
	Blue Rockfish (CA)		NA	NA
	Minor Nearshore RF N.		NA	NA
	Minor Nearshore RF S.		NA	NA
	Minor Shelf RF N.		35	35
	Minor Shelf RF S.		NA	NA
	California scorpionfish		NA	NA
	Cabezon (off CA only)		NA	NA
	Other Fish		520	520
	Longnose Skate		5	1

<u>Deadline for coop fishery declarations & permits</u>

Issue 7: What is an appropriate deadline for a coop permit (MS or C/P) and for a MS/CV endorsed permit to declare in to a MS coop or the non-coop fishery?

Option A:
September 1-December 31 of the year before the whiting season the MS/CV endorsed permit must declare through the permit renewal process that they are going to participate in the coop or non-coop fishery. Between September 1and December 31 of the year before the whiting season the coop must also apply for a coop permit, which would include the coop agreement.

Option B (*NMFS-preferred*):
September 1-December 31 of the year before the whiting season the MS/CV endorsed permit must declare through the permit renewal process that they are going to participate in the coop or non-coop fishery. Between February 1and March 31 before the whiting season the coop must also apply for a coop permit, which would include the coop agreement.

Discussion: The Council motion as captured in Appendix D of the Am 20 DEIS (B-2.4.1, p. D-38), states "By September 1 of the year prior to implementation and every year thereafter, each CV(MS) permit is required to contact NMFS and indicate whether CV(MS) permit will be participating in the co-op or non-coop fishery in the following year. If participating in the co-op fishery, then CV(MS) permit must also provide the name of the MS permit that CV(MS) permit will be linked to in the following year." The Council's motion (B-2.3.3, p. D-36) also states that the coop agreement must be submitted to NMFS for approval before the coop is authorized to engage in fishing activities. However, it does not set a firm date. As discussed in the NMFS Interpretations document, NMFS determined the need for a coop permit for both the MS and C/P fisheries.

Both Option A and B conform with the Council motion for when a MS/CV endorsed permit should declare their intent to participate in the MS coop (but not which coop) or non-coop fishery. Because the MS/CV endorsed permit is an endorsement on the limited entry permit, it makes sense to have that declaration of intent be part of the limited entry permit renewal process which happens from September 1 through December 31 each year.

Option A also requires the coop (MS or C/P) to register for a coop permit between September 1 and December 31 each year. However, a list of coop member permits and vessels is a required as part of the coop agreement that must be included with the permit application that is sent to NMFS. The September 1, timing may be difficult if all MS/CV endorsed or C/P endorsed limited entry permits have not yet been renewed.

Option B allows time for the MS/CV endorsed or C/P endorsed limited entry permits to be renewed between September 1 and December 31. The coop (MS or C/P would register for a coop permit between February 1 and March 31, which would include a list of coop member permits and vessels that are less likely to change. The coop permit application deadline is before the whiting OY for the year is announced and before the season starts. NMFS prefers Option B. Applications for the inter-coop agreements in the MS fishery would be accepted by NMFS any time during the year.

MOTHERSHIP COOP PROGRAM

Permit transfers

Issue 8: Should a MS/CV-endorsed permit allow two changes in vessel registration in a year, if participating in both the shorebased IFQ fishery and the MS fishery?

Option A:
NMFS could make the two changes in vessel registration rule apply to any trawl endorsed permit. This would potentially increase the number of vessel registrations but would provide a uniformed requirement across the broader trawl fleet.

Option B (*NMFS-preferred*):
NMFS could require that any second change in vessel registration on a MS/CV permit would require that the permit owner declare that the vessel being assigned to the permit will operate in the MS whiting fishery. The declaration would happen through the VMS declaration requirements and regulations would state that after the second transfer, the vessel must fish exclusively in the MS fishery.

Discussion: The Council motion includes a provision (Appendix D, Page D-34) that allows a MS/CV endorsed permit to have two changes in vessel registration in a year, with the second change in vessel registration to the original vessel assigned to the permit. Vessels registered to a MS/CV endorsed permit can deliver whiting to the MS sector and potentially could deliver IFQ groundfish to shorebased processors. If the MS/CV endorsed permit is used exclusively for fishing in the shorebased sector, it would seem that the one transfer rule would apply and that such changes in vessel registration would be effective at the start of the next cumulative trip limit period. The question is which transfer rules would apply to a particular transfer of a MS/CV endorsed permit and when those transfers could be effective.

CATCHER/PROCESSOR COOP PROGRAM

Coop Failure → IFQ Fishery

Issue 9: The Council motion as captured in Appendix D of the Am 20 DEIS (p. D-41 & D-42) states that "If the co-op system fails it will be replaced by an IFQ program." What determines a coop failure and when would C/P fishery move to IFQ?

Option A:
The C/P coop will be determined to fail if the coop agreement fails to include all C/P endorsed limited entry permits during the coop permitting process or if a permit withdraws from the coop at any time during the year; if the designated coop manager contacts NMFS regarding a failure; or if the coop fails to meet its defined responsibilities. If failed, the C/P fishery would cease fishing until NMFS could implement the C/P IFQ fishery.

Option B (*NMFS-preferred*):
The C/P coop will be determined to fail if the coop agreement fails to include all C/P endorsed limited entry permits during the coop permitting process or if a permit withdraws from the coop at any time during the year; if the designated coop manager contacts NMFS regarding a failure; or if the coop fails to meet its defined responsibilities. If failed, the remaining C/P coop members continue to fish on the C/P sector allocations and would move to an IFQ fishery in the following year once NMFS implements the appropriate regulations.

Discussion: Unless all IFQ provisions are initially implemented with this rulemaking, to transform the C/P fishery from a coop to an IFQ program would require time for NMFS to prepare a rulemaking. Under Option B, the fishery could continue to operate as a coop to prevent substantial impacts. Under such circumstances, steps could be immediately taken to implement an IFQ program with the intent of having it in place for the following year.

NMFS has interpreted a C/P coop failure as follows:

1. If any of the C/P endorsed permits are not identified as coop members on the coop agreement submitted to NMFS during the coop permit application process.
2. If any vessel registered to a C/P endorsed permit withdraws from the C/P coop agreement.
3. If the C/P coop fails to submit an annual report If the C/P coop fails to manage harvest such that allocations are repeatedly exceeded

If a coop (MS or C/P) dissolves, the designated coop manager must notify NMFS in writing of the dissolution of the coop. NMFS expects coops to self-report, but NMFS maintains authority to determine if a coop fails or is dissolved. The Regional Administrator may make an independent determination of a permitted coop failure based on factual information collected by or provided to NMFS.

Agenda Item E.6.b
NMFS Report 3
March 2010

Draft Regulatory Outline

Disclaimer: The trawl rationalization program is under review by NMFS. Amendments 20 & 21 to the Groundfish FMP, have not yet been formally submitted to NMFS, or approved or implemented by NMFS. NMFS and the Council staff are currently clarifying issues raised by these amendments.
This is a working draft and has not been through full NMFS review.
This outline will continue to change before a proposed rule is published, including numbering, organization, section headings and contents.

Subpart C – West Coast Groundfish Fisheries – General (660.10-660.99)

660.10 Purpose and Scope
660.11 General Definitions
660.12 General Groundfish Prohibitions
660.13 Recordkeeping and reporting
660.14 Vessel Monitoring System (VMS) requirements.
660.15 Equipment requirements.
660.16 Groundfish observer program.
660.17 Catch monitors and catch monitor service providers.
660.18 Certification and decertification procedures for observers, catch monitors, catch monitor providers and observer providers.
660.20 Vessel and Gear Identification.
660.24 Limited entry and open access fisheries.
660.25 Permits
- (a) General.
- (b) limited entry permit
  - (1) eligibility and registration.
  - (2) Mothership (MS) permit.
  - (3) Endorsements.
    - (i) "A" endorsements
    - (ii) gear endorsements
    - (iii) vessel size endorsements
    - (iv) sablefish endorsement and tier assignment
    - (v) MS/CV endorsement

(vi) C/P endorsement

(vii) endorsement and exemption restrictions

(4) Limited entry permit actions- renewal, combination, stacking, change of permit ownership or permit holdership, and transfer.

(5) small fleet.

(c) QS permit

(d) First Receiver Site License

(e) Coop permit

(1) MS coop permit

(2) C/P coop permit

(f) Permit fees

(g) permit appeals process

(1) General.

(2) Who may appeal.

(3) Submission of appeals.

(4) Timing of appeals.

(5) Address of record.

(6) Decisions on appeals.

(7) Status of permits pending appeal

(h) Permit sanctions

660.26 Pacific whiting vessel licenses.

660.30 Compensation with fish for collecting resource information – EFPs

660.40 Overfished species rebuilding plans

660.50 Pacific Coast Treaty Indian fisheries

660.51 Washington coastal tribal fisheries management measures.

660.55 Allocations

(a) General.

(b) Trawl / Nontrawl Allocations.

(c) Limited Entry / Open Access Allocations.

(d) Catch accounting between the limited entry and open access fisheries.

(e) Treaty Indian fisheries.

(f) Recreational fisheries.

(g) Sablefish allocations (north of of 36° N. lat.)

(h) Pacific whiting allocation.

(i) At-sea Whiting Trawl Fishery Set-Asides.

(j) Black rockfish harvest guideline

(k) Pacific halibut Bycatch Allocation.

660.60 Specifications and management measures.

660.65 Groundfish harvest specifications.

660.70-99 Closed Area - GCA's and EFH

* ABC/OY Tables –Tables (1a), OY tables (1b), Allocation tables (1c), Tables 2a, 2b, and 2c

* Vessel Capacity Rating Table - Table 2 to Part 660

Subpart D – West Coast Groundfish – Trawl Fisheries (660.100-660.199)

660.100 Purpose and Scope
660.111 Trawl Fishery Definitions
660.112 Limited entry trawl fishery prohibitions
660.113 Recordkeeping and reporting
660.116 Trawl Fishery Observer requirements.
660.120 Crossover provisions – Areas, Gears, Trawl Fisheries.
660.130 Limited entry trawl fishery management measures.
660.131 Pacific Whiting Fishery Management Measures.
660.140 Shorebased IFQ Program

- (a) General.
- (b) Participation requirements.
  - (1) QS Permit Owners
  - (2) IFQ Vessels
- (c) IFQ Species and Allocations.
  - (1) IFQ Species.
  - (2) IFQ Program Allocations.
- (d) QS permits and QS accounts.
  - (1) General.
  - (2) Eligibility and registration.
  - (3) Renewal, change of permit ownership, and transfer.
  - (4) Accumulation limits.
    - (i) QS control limits
    - (ii) Individual and collective rule.
    - (iii) Control
    - (iv) Divestiture.
  - (5) Appeals.
  - (6) Fees.
  - (7) [Reserved]
  - (8) Application Requirements and Initial Issuance for QS Permit and QS.
    - (i) Eligible Applicant.
    - (ii) Qualifying Criteria for QS.
      - (A) Non-whiting, non-overfished species QS.
      - (B) Whiting QS.
      - (C) Overfished Species QS.
      - (D) Equal Division of Buyback Permit History.
    - (iii) Prequalified Application.
    - (iv) Applicants Not Prequalified.
    - (v) Corrections to the Application
    - (vi) Submission of the Application and Application Deadline.
    - (vii) Permit transfer during application period.
    - (viii) Initial Administrative Determination (IAD).
    - (ix) Appeals.
- (e) Vessel accounts.
- (f) First Receiver Site License.

(g) Retention requirements (whiting and non-whiting vessels).
(h) Observer Requirements.
(i) [Reserved]
(j) Shoreside Catch Monitor requirements for IFQ first receivers.
(k) Catch weighing requirements.
(l) Gear Switching.
(m) Adaptive Management Program.

660.150 Mothership (MS) Coop Program

(a) General.
(b) Participation requirements
    (1) Mothership vessels
    (2) Mothership Catcher Vessels
    (3) MS Coop Formation and Failure.
(c) MS Coop Program Species and Allocations
    (1) MS Coop Program Species.
    (2) Annual Mothership Sector sub-allocations.
        (i) Mothership catcher vessel whiting catch history assignments.
        (ii) Annual Coop Allocations
        (iii) Annual Non-Coop Allocation.
    (3) Reaching an allocation or sub-allocation.
    (4) Non-whiting groundfish species reapportionment.
    (5) Announcements.
    (6) Redistribution of Annual Allocation.
    (7) Processor obligation
    (8) Allocation accumulation limits
(d) MS Coop Permit and Agreement.
(e) Inter-coop Agreement.
(f) Mothership (MS) Permit.
    (1) General.
        (i) Eligibility to Own or Hold a MS Permit.
        (ii) Vessel Size Endorsement.
        (iii) Restriction on C/P Vessel Operating as MS.
    (2) Renewal, Change of permit ownership, or vessel registration.
    (3) Accumulation Limit.
        (i) MS Permit Usage Limit.
        (ii) Individual and collective rule.
        (iii) Control
    (4) Appeals.
    (5) Fees.
    (6) Application Requirements and Initial Issuance for MS Permit.
        (i) Eligible Applicant.
        (ii) Qualifying Criteria for MS Permit.
        (iii) Prequalified Application.
        (iv) Applicants Not Prequalified.
        (v) Corrections to the Application.
        (vi) Submission of the Application and Application Deadline.

(vii) Initial Administrative Determination.
(viii) Appeals.
(g) Mothership catcher vessel (MS/CV) endorsed permit.
(1) General.
(i) Catch History Assignment.
(ii) MS/CV Endorsement Not Severable from Permit.
(iii) Vessel Size Endorsement.
(iv) Renewal.
(v) Restrictions on Processing by MS/CV endorsed Permit.
(2) Change of Permit owner, vessel registration, vessel owner, or combination.
(3) Accumulation Limits.
(i) MS/CV Permit Ownership Limit.
(A) Individual and collective rule.
(B) Control
(C) Divestiture.
(ii) Catcher Vessel Usage Limit.
(4) Appeals.
(5) Fees.
(6) Application Requirements and Initial Issuance for MS/CV Endorsement.
(i) Eligible Applicant.
(ii) Qualifying Criteria for MS/CV Endorsement.
(iii) Qualifying Criteria for Catch History Assignment.
(iv) Prequalified Application.
(v) Applicants Not Prequalified.
(vi) Corrections to the Application.
(vii) Submission of the Application and Application Deadline.
(viii) Initial Administrative Determination.
(ix) Appeals.
(h) Retention requirements.
(i) Observer Requirements.
(j) [Reserved.]
(k) Catch weighing requirements.
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Agenda Item E.6.b
NMFS Report 4
March 2010

Draft Proposed Regulations for Amendments 20 and 21

Disclaimer: These draft regulations will be reorganized and/or revised as it goes through the agency review process. Additional issues may arise as the program is reviewed by NMFS. Amendments 20 & 21 to the Groundfish FMP, have not yet been formally submitted to NMFS or approved or implemented by NMFS. NMFS and the Council staff are currently clarifying issues raised by these amendments.

Note: These draft regulations show new text specific to the trawl rationalization program (*in green, italicized, arial font*) and do not show all of the existing groundfish regulatory text that will get moved in to the new groundfish regulatory structure that will be in the proposed rule. Cross references to other sections within the regulations are highlighted in yellow and have not yet been updated.

For the reasons set out in the preamble, 50 CFR Part 660 is proposed to be amended as follows:
PART 660–-FISHERIES OFF WEST COAST STATES

1. The authority citation for part 660 continues to read as follows:

Authority: 16 U.S.C. 1801 et seq.

2. A new Subpart C is added to read as follows:

Subpart C – West Coast Groundfish Fisheries – General

§ 660.10 Purpose and Scope.

(a) *Subparts C through G* implement the Pacific Coast Groundfish Fishery Management Plan (PCGFMP) developed by the Pacific Fishery Management Council. *Subparts C through G* govern fishing vessels of the U.S. in the EEZ off the coasts of Washington, Oregon, and California. All weights are in round weight or round-weight equivalents, unless specified otherwise.

(b) Any person fishing subject to *Subparts C through G* is bound by the international boundaries described in this section, notwithstanding any dispute or negotiation between the U.S. and any neighboring country regarding their respective jurisdictions, until such time as new boundaries are established or recognized by the U.S.

§ 660.11 *General* Definitions.

Active sampling unit means a portion of the groundfish fleet in which an observer coverage plan is being applied.

Address of Record means the business address of a person, partnership, or corporation used by NMFS to provide notice of actions.

Allocation. (See §600.10).

Base permit, with respect to a limited entry permit stacking program, means a limited entry permit described at §660.25 (b)(1), Subpart C registered for use with a vessel that meets the permit length endorsement requirements appropriate to that vessel, as described at §660.25 (b)(2), Subpart C.

Biennial fishing period means a 24–month period beginning at 0001 local time on January 1 and ending at 2400 local time on December 31 of the subsequent year.

B_{MSY} means the biomass level that produces maximum sustainable yield (MSY), as stated in the PCGFMP at Section 4.2.

Calendar year. (see "fishing year")

Catch, take, harvest. (See §600.10).

Catch monitor means an individual that is certified by NMFS, is deployed to a first receiver, and whose primary duties include: monitoring and verification of the catch sorting relative to federal requirements defined in § 660.60 Subpart C; documentation of the weighing of catch relative to the requirements of section §660.13, Subpart C; and verification of first receivers reporting relative to the requirements defined in section§ 660.113, Subpart D.

Change in partnership or corporation means the addition of a new shareholder or partner to the corporate or partnership membership. This definition of a "change" will apply to any person added to the corporate or partnership membership since November 1, 2000, including any family member of an existing shareholder or partner. A change in membership is not considered to have occurred if a member dies or becomes legally incapacitated and a trustee is appointed to act on his behalf, nor if the ownership of shares among existing members changes, nor if a member leaves the corporation or partnership and is not replaced. Changes in the ownership of publicly held stock will not be deemed changes in ownership of the corporation.

Closure or closed means, when referring to closure of a fishery or a closed fishery, that taking and retaining, possessing, or landing the particular species or species group covered by the fishing closure is prohibited. Unless otherwise announced in the Federal Register or authorized in this subpart, offloading must begin before the closure time.

Commercial fishing means:

(1) Fishing by a person who possesses a commercial fishing license or is required by law to possess such license issued by one of the states or the Federal Government as a prerequisite to taking, landing and/or sale; or

(2) Fishing that results in or can be reasonably expected to result in sale, barter, trade or other disposition of fish for other than personal consumption.

Commercial harvest guideline or commercial quota *means the fishery harvest guideline minus the estimated recreational catch.* Limited entry and open access allocations are derived from the commercial harvest guideline or quota.

Conservation area(s) means either a Groundfish Conservation Area (GCA), an Essential Fish Habitat Conservation Area (EFHCA), or both.

(1) Groundfish Conservation Area or GCA means a geographic area defined by coordinates expressed in degrees latitude and longitude, wherein fishing by a particular gear type or types may be prohibited. GCAs are created and enforced for the purpose of contributing to the rebuilding of overfished West Coast groundfish species. Regulations at §§660.70 through 660.XXX, Subpart C define coordinates for these polygonal GCAs: Yelloweye Rockfish Conservation Areas, Cowcod Conservation Areas, waters encircling the Farallon Islands, and waters encircling the Cordell Banks. GCAs also include Rockfish Conservation Areas or RCAs, which are areas closed to fishing by particular gear types, bounded by lines approximating particular depth contours. RCA boundaries may and do change seasonally according to the different conservation needs of the different overfished species. Regulations at §§660.70 through 660.XX, Subpart C define RCA boundary lines with latitude/longitude coordinates; regulations at Tables 3-5 of Part 660 set RCA seasonal boundaries. Fishing prohibitions associated with GCAs are in addition to those associated with EFH Conservation Areas.

(2) Essential Fish Habitat Conservation Area or EFHCA means a geographic area defined by coordinates expressed in degrees latitude and longitude, wherein fishing by a particular gear type or types may be prohibited. EFHCAs are created and enforced for the purpose of contributing to the protection of West Coast groundfish essential fish habitat. Regulations at §§660.70, Subpart C through 660.XXX, Subpart C define EFHCA boundary lines with latitude/longitude coordinates. Fishing prohibitions associated with EFHCAs, which are found at §660.12, Subpart C, are in addition to those associated with GCAs.

Continuous transiting or transit through means that a fishing vessel crosses a groundfish conservation area or EFH conservation area on a constant heading, along a continuous straight line course, while making way by means of a source of power at all times, other than drifting by means of the prevailing water current or weather conditions.

Corporation is a legal, business entity, including incorporated (INC) and limited liability corporations (LLC).

Council means the Pacific Fishery Management Council, including its Groundfish Management Team (GMT), Scientific and Statistical Committee (SSC), Groundfish Advisory Subpanel (GAP), and any other committee established by the Council.

Date of landing means the date on which the transfer of fish or offloading of fish from any vessel to a processor or first receiver begins.

Direct financial interest means any source of income to or capital investment or other interest held by an individual, partnership, or corporation or an individual's spouse, immediate family member or parent that could be influenced by performance or non-performance of observer *or catch monitor* duties.

Electronic fish ticket means a software program or data files meeting data export specifications approved by NMFS that is used to send landing data to the Pacific States Marine Fisheries Commission. Electronic fish tickets are used to collect information similar to the information required in state fish receiving tickets or landing receipts, but do not replace or change any state requirements.

Electronic Monitoring System (EMS) means a data collection tool that uses a software operating system connected to an assortment of electronic components, including video recorders, to create a collection of data on vessel activities.

Endorsement means an additional specification affixed to the limited entry permit that further restricts fishery participation or further specifies a harvest privilege, and is non-severable from a limited entry permit.

Entity (See "Person")

Essential Fish Habitat or EFH. (See §600.10).

First Receiver means a person who receives, purchases, or takes custody, control, or possession of catch onshore directly from a vessel.

Fish. (See §600.10).

Fishery (See §600.10).

Fishery harvest guideline means the harvest guideline or quota after subtracting from the OY any allocation for the Pacific Coast treaty Indian tribes, projected research catch, deductions for fishing mortality in non-groundfish fisheries, as necessary, and set-asides for EFPs.

Fishery management area means the EEZ off the coasts of Washington, Oregon, and California between 3 and 200 nm offshore, and bounded on the north by the Provisional International Boundary between the U.S. and Canada, and bounded on the south by the International Boundary between the U.S. and Mexico. The inner boundary of the fishery management area is a line coterminous with the seaward boundaries of the States of Washington, Oregon, and California (the "3–mile limit"). The outer boundary of the fishery management area is a line drawn in such a manner that each point on it is 200 nm from the baseline from which the territorial sea is measured, or is a provisional or permanent international boundary between the U.S. and Canada or Mexico. All groundfish possessed between 0–200 nm offshore or landed in Washington, Oregon, or California are presumed to have been taken and retained from the EEZ, unless otherwise demonstrated by the person in possession of those fish.

Fishing. (See §600.10).

Fishing gear includes the following types of gear and equipment:

(1) Bottom contact gear. Fishing gear designed or modified to make contact with the bottom. This includes, but is not limited to, beam trawl, bottom trawl, dredge, fixed gear, set net, demersal seine, dinglebar gear, and other gear (including experimental gear) designed or modified to make contact with the bottom. Gear used to harvest bottom dwelling organisms (e.g. by hand, rakes, and knives) are also considered bottom contact gear for purposes of this subpart.

(2) Demersal seine. A net designed to encircle fish on the seabed. The Demersal seine is characterized by having its net bounded by lead-weighted ropes that are not encircled with

bobbins or rollers. Demersal seine gear is fished without the use of steel cables or otter boards (trawl doors). Scottish and Danish Seines are demersal seines. Purse seines, as defined at §600.10, are not demersal seines. Demersal seine gear is included in the definition of bottom trawl gear in (11)(i) of this subsection.

(3) Dredge gear. Dredge gear, with respect to the U.S. West Coast EEZ, refers to a gear consisting of a metal frame attached to a holding bag constructed of metal rings or mesh. As the metal frame is dragged upon or above the seabed, fish are pushed up and over the frame, then into the mouth of the holding bag.

(4) Entangling nets include the following types of net gear:

(i) Gillnet. (See §600.10).

(ii) Set net. A stationary, buoyed, and anchored gillnet or trammel net.

(iii) Trammel net. A gillnet made with two or more walls joined to a common float line.

(5) Fixed gear (anchored nontrawl gear) includes the following gear types: longline, trap or pot, set net, and stationary hook-and-line (including commercial vertical hook-and-line) gears.

(6) Hook-and-line. One or more hooks attached to one or more lines. It may be stationary (commercial vertical hook-and-line) or mobile (troll).

(i) Bottom longline. A stationary, buoyed, and anchored groundline with hooks attached, so as to fish along the seabed. It does not include pelagic hook-and-line or troll gear.

(ii) Commercial vertical hook-and-line. Commercial fishing with hook-and-line gear that involves a single line anchored at the bottom and buoyed at the surface so as to fish vertically.

(iii) Dinglebar gear. One or more lines retrieved and set with a troll gurdy or hand troll gurdy, with a terminally attached weight from which one or more leaders with one or more lures or baited hooks are pulled through the water while a vessel is making way.

(iv) Troll gear. A lure or jig towed behind a vessel via a fishing line. Troll gear is used in commercial and recreational fisheries.

(7) Mesh size. The opening between opposing knots. Minimum mesh size means the smallest distance allowed between the inside of one knot to the inside of the opposing knot, regardless of twine size.

(8) Nontrawl gear. All legal commercial groundfish gear other than trawl gear.

(9) Spear. A sharp, pointed, or barbed instrument on a shaft.

(10) Trap or pot. These terms are used as interchangeable synonyms. See §600.10 definition of "trap".

(11) Trawl gear means a cone or funnel-shaped net that is towed through the water, and can include a pair trawl that is towed simultaneously by two boats. Groundfish trawl is trawl gear that is used under the authority of a valid limited entry permit issued under this subpart endorsed for trawl gear. It does not include any type of trawl gear listed as non-groundfish trawl gear. Non-groundfish trawl gear is any trawl gear other than the Pacific Coast groundfish trawl gear that is authorized for use with a valid groundfish limited entry permit. Non-groundfish trawl gear includes pink shrimp, ridgeback prawn, California halibut south of Pt. Arena, and sea cucumbers south of Pt. Arena.

(i) Bottom trawl. A trawl in which the otter boards or the footrope of the net are in contact with the seabed. It includes demersal seine gear, and pair trawls fished on the bottom. Any trawl not meeting the requirements for a midwater trawl in §660.XXX of Subpart D is a bottom trawl.

(A) Beam trawl gear. A type of trawl gear in which a beam is used to hold the trawl open during fishing. Otter boards or doors are not used.

(B) Large footrope trawl gear. Large footrope gear is bottom trawl gear with a footrope diameter larger than 8 inches (20 cm,) and no larger than 19 inches (48 cm) including any rollers, bobbins, or other material encircling or tied along the length of the footrope.

(C) Small footrope trawl gear. Small footrope trawl gear is bottom trawl gear with a footrope diameter of 8 inches (20 cm) or smaller, including any rollers, bobbins, or other material encircling or tied along the length of the footrope. Selective flatfish trawl gear that meets the gear component requirements in §660.XXX of Subpart D is a type of small footrope trawl gear.

(ii) Midwater (pelagic or off-bottom) trawl. A trawl in which the otter boards and footrope of the net remain above the seabed. It includes pair trawls if fished in midwater. A midwater trawl has no rollers or bobbins on any part of the net or its component wires, ropes, and chains. For additional midwater trawl gear requirements and restrictions, see §660.XXX of Subpart D.

(iii) Trawl gear components.

(A) Breastline. A rope or cable that connects the end of the headrope and the end of the trawl fishing line along the edge of the trawl web closest to the towing point.

(B) Chafing gear. Webbing or other material attached to the codend of a trawl net to protect the codend from wear.

(C) Codend. (See §600.10).

(D) Double-bar mesh. Webbing comprised of two lengths of twine tied into a single knot.

(E) Double-walled codend. A codend constructed of two walls of webbing.

(F) Footrope. A chain, rope, or wire attached to the bottom front end of the trawl webbing forming the leading edge of the bottom panel of the trawl net, and attached to the fishing line.

(G) Headrope. A chain, rope, or wire attached to the trawl webbing forming the leading edge of the top panel of the trawl net.

(H) Rollers or bobbins are devices made of wood, steel, rubber, plastic, or other hard material that encircle the trawl footrope. These devices are commonly used to either bounce or pivot over seabed obstructions, in order to prevent the trawl footrope and net from snagging on the seabed.

(I) Single-walled codend. A codend constructed of a single wall of webbing knitted with single or double-bar mesh.

(J) Trawl fishing line. A length of chain, rope, or wire rope in the bottom front end of a trawl net to which the webbing or lead ropes are attached.

(K) Trawl riblines. Heavy rope or line that runs down the sides, top, or underside of a trawl net from the mouth of the net to the terminal end of the codend to strengthen the net during fishing.

Fishing trip is a period of time between landings when fishing is conducted.

Fishing vessel. (See §600.10).

Fishing *year or Calendar year* is the year beginning at 0001 local time on January 1 and ending at 2400 local time on December 31 of the same year. There are two fishing years in each biennial fishing period.

Grandfathered or first generation, when referring to a limited entry sablefish-endorsed permit owner, means those permit owners who owned a sablefish-endorsed limited entry permit prior to November 1, 2000, and are, therefore, exempt from certain requirements of the sablefish permit stacking program within the parameters of the regulations at §§660.334 through 660.341 and §660.372.

Groundfish means species managed by the PCGFMP, specifically:

(1) Sharks: leopard shark, Triakis semifasciata; soupfin shark, Galeorhinus zyopterus; spiny dogfish, Squalus acanthias.

(2) Skates: big skate, Raja binoculata; California skate, R. inornata; longnose skate, R. rhina.

(3) Ratfish: ratfish, Hydrolagus colliei.

(4) Morids: finescale codling, Antimora microlepis.

(5) Grenadiers: Pacific rattail, Coryphaenoides acrolepis.

(6) Roundfish: cabezon, Scorpaenichthys marmoratus; kelp greenling, Hexagrammos decagrammus; lingcod, Ophiodon elongatus; Pacific cod, Gadus macrocephalus; Pacific whiting, Merluccius productus; sablefish, Anoplopoma fimbria.

(7) Rockfish: In addition to the species below, longspine thornyhead, S. altivelis, and shortspine thornyhead, S. alascanus, "rockfish" managed under the PCGFMP include all genera and species of the family Scorpaenidae that occur off Washington, Oregon, and California, even if not listed below. The Scorpaenidae genera are Sebastes, Scorpaena, Scorpaenodes, and Sebastolobus. Where species below are listed both in a major category (nearshore, shelf, slope) and as an area-specific listing (north or south of 40°10' N. lat.) those species are considered "minor" in the geographic area listed.

(i) Nearshore rockfish includes black rockfish, Sebastes melanops and the following minor nearshore rockfish species:

(A) North of 40°10' N. lat.: black and yellow rockfish, S. chrysomelas; blue rockfish, S. mystinus; brown rockfish, S. auriculatus; calico rockfish, S. dalli; China rockfish, S. nebulosus; copper rockfish, S. caurinus; gopher rockfish, S. carnatus; grass rockfish, S. rastrelliger; kelp rockfish, S. atrovirens; olive rockfish, S. serranoides; quillback rockfish, S. maliger; treefish, S. serriceps.

(B) South of 40°10' N. lat., nearshore rockfish are divided into three management categories:

(1) Shallow nearshore rockfish consists of black and yellow rockfish, S. chrysomelas; China rockfish, S. nebulosus; gopher rockfish, S. carnatus; grass rockfish, S. rastrelliger; kelp rockfish, S. atrovirens.

(2) Deeper nearshore rockfish consists of black rockfish, S. melanops; blue rockfish, S. mystinus; brown rockfish, S. auriculatus; calico rockfish, S. dalli; copper rockfish, S. caurinus; olive rockfish, S. serranoides; quillback rockfish, S. maliger; treefish, S. serriceps.

(3) California scorpionfish, Scorpaena guttata.

(ii) Shelf rockfish includes bocaccio, Sebastes paucispinis; canary rockfish, S. pinniger; chilipepper, S. goodei; cowcod, S. levis; shortbelly rockfish, S. jordani; widow rockfish, S. entomelas; yelloweye rockfish, S. ruberrimus; yellowtail rockfish, S. flavidus and the following minor shelf rockfish species:

(A) North of 40°10' N. lat.: bronzespotted rockfish, S. gilli; bocaccio, S. paucispinis; chameleon rockfish, S. phillipsi; chilipepper, S. goodei; cowcod, S. levis; dusky rockfish, S. ciliatus; dwarf-red, S. rufianus; flag rockfish, S. rubrivinctus; freckled, S. lentiginosus; greenblotched rockfish, S. rosenblatti; greenspotted rockfish, S. chlorostictus; greenstriped rockfish, S. elongatus; halfbanded rockfish, S. semicinctus; harlequin rockfish, S. variegatus; honeycomb rockfish, S. umbrosus; Mexican rockfish, S. macdonaldi; pink rockfish, S. eos; pinkrose rockfish, S. simulator; pygmy rockfish, S. wilsoni; redstripe rockfish, S. proriger; rosethorn rockfish, S. helvomaculatus; rosy rockfish, S. rosaceus; silvergray rockfish, S. brevispinis; speckled rockfish, S. ovalis; squarespot rockfish, S. hopkinsi; starry rockfish, S. constellatus; stripetail rockfish, S. saxicola; swordspine rockfish, S. ensifer; tiger rockfish, S. nigrocinctus; vermilion rockfish, S. miniatus.

(B) South of 40°10' N. lat.: bronzespotted rockfish, S. gilli; chameleon rockfish, S. phillipsi; dusky rockfish, S. ciliatus; dwarf-red rockfish, S. rufianus; flag rockfish, S. rubrivinctus; freckled, S. lentiginosus; greenblotched rockfish, S. rosenblatti; greenspotted rockfish, S. chlorostictus; greenstriped rockfish, S. elongatus; halfbanded rockfish, S. semicinctus; harlequin rockfish, S. variegatus; honeycomb rockfish, S. umbrosus; Mexican rockfish, S. macdonaldi; pink rockfish, S. eos; pinkrose rockfish, S. simulator; pygmy rockfish, S. wilsoni; redstripe rockfish, S. proriger; rosethorn rockfish, S. helvomaculatus; rosy rockfish, S. rosaceus; silvergray rockfish, S. brevispinis; speckled rockfish, S. ovalis; squarespot rockfish, S. hopkinsi; starry rockfish, S. constellatus; stripetail rockfish, S. saxicola; swordspine rockfish, S. ensifer; tiger rockfish, S. nigrocinctus; vermilion rockfish, S. miniatus; yellowtail rockfish, S. flavidus.

(iii) Slope rockfish includes darkblotched rockfish, S. crameri; Pacific ocean perch, S. alutus; splitnose rockfish, S. diploproa; and the following minor slope rockfish species:

(A) North of 40°10' N. lat.: aurora rockfish, Sebastes aurora; bank rockfish, S. rufus; blackgill rockfish, S. melanostomus; redbanded rockfish, S. babcocki; rougheye rockfish, S. aleutianus; sharpchin rockfish, S. zacentrus; shortraker rockfish, S. borealis; splitnose rockfish, S. diploproa; yellowmouth rockfish, S. reedi.

(B) South of 40°10' N. lat.: aurora rockfish, Sebastes aurora; bank rockfish, S. rufus; blackgill rockfish, S. melanostomus; Pacific ocean perch, S. alutus; redbanded rockfish, S. babcocki; rougheye rockfish, S. aleutianus; sharpchin rockfish, S. zacentrus; shortraker rockfish, S. borealis; yellowmouth rockfish, S. reedi.

(8) Flatfish: arrowtooth flounder (arrowtooth turbot), Atheresthes stomias; butter sole, Isopsetta isolepis; curlfin sole, Pleuronichthys decurrens; Dover sole, Microstomus pacificus; English sole, Parophrys vetulus; flathead sole, Hippoglossoides elassodon; Pacific sanddab, Citharichthys sordidus; petrale sole, Eopsetta jordani; rex sole, Glyptocephalus zachirus; rock sole, Lepidopsetta bilineata; sand sole, Psettichthys melanostictus; starry flounder, Platichthys stellatus. Where regulations of this subpart refer to landings limits for "other flatfish," those limits apply to all flatfish cumulatively taken except for those flatfish species specifically listed in Tables 1–2 of this subpart. (i.e., "other flatfish" includes butter sole, curlfin sole, flathead sole, Pacific sanddab, rex sole, rock sole, and sand sole.)

(9) "Other fish": Where regulations of this subpart refer to landings limits for "other fish," those limits apply to all groundfish listed here in paragraphs (1)–(8) of this definition except for the following: those groundfish species specifically listed in Tables 1–2 of this subpart with an ABC for that area (generally north and/or south of 40°10' N. lat.); and Pacific cod and spiny dogfish coastwide. (i.e., "other fish" may include all sharks (except spiny dogfish), skates, ratfish, morids, grenadiers, and kelp greenling listed in this section, as well as cabezon in the north.)

Groundfish trawl means trawl gear that is used under the authority of a valid limited entry permit issued under Subparts C and D endorsed for trawl gear. It does not include any type of trawl gear listed as "exempted gear."

Harvest guideline means a specified numerical harvest objective that is not a quota. Attainment of a harvest guideline does not require closure of a fishery.

IAD means Initial *Administrative Determination*.

Incidental catch or incidental species means groundfish species caught while fishing for the primary purpose of catching a different species.

Land or landing means to begin transfer of fish, offloading fish, or to offload fish from any vessel. Once transfer of fish begins, all fish aboard the vessel are counted as part of the landing.

Legal fish means fish legally taken and retained, possessed, or landed in accordance with the provisions of 50 CFR part 660, Subparts C through G, the Magnuson-Stevens Act, any document issued under part 660, and any other regulation promulgated or permit issued under the Magnuson-Stevens Act.

Length overall (LOA) (with respect to a vessel) means the length overall set forth in the Certificate of Documentation (CG–1270) issued by the USCG for a documented vessel, or in a registration certificate issued by a state or the USCG for an undocumented vessel; for vessels that do not have the LOA stated in an official document, the LOA is the LOA as determined by the USCG or by a marine surveyor in accordance with the USCG method for measuring LOA.

License owner means a person who owns (legally controls) a first receiver site license issued under Subparts C through D and is the person of record with the SFD, Permits Office.

Limited entry fishery means the fishery composed of vessels registered for use with limited entry permits.

Limited entry gear means longline, trap (or pot), or groundfish trawl gear used under the authority of a valid limited entry permit affixed with an endorsement for that gear.

Limited entry permit means:

(1) The Federal permit required to participate in the limited entry *"A" endorsed* fishery, and includes any gear, size, or species endorsements affixed to the permit, or

(2) The Federal permit required to participate as a mothership processor.

Maximum Sustainable Yield or MSY. (See §600.310).

Mobile transceiver unit means a vessel monitoring system or VMS device, as set forth at §660.14, Subpart C installed on board a vessel that is used for vessel monitoring and transmitting the vessel's position as required by Subpart C.

Nontrawl fishery means

(1) For the purpose of allocations at §660.55, Subpart C, nontrawl fishery means the limited entry fixed gear fishery, the open access fishery, and the recreational fishery.

(2) For the purposes of all other management measures in Subparts C through G, nontrawl fishery means any legal groundfish gear other than trawl gear (groundfish trawl gear and exempted trawl gear).

North-South management area means the management areas defined in paragraph (1) of this definition, or defined and bounded by one or more or the commonly used geographic coordinates set out in paragraph (2) of this definition for the purposes of implementing different management measures in separate geographic areas of the U.S. West Coast.

(1) Management areas —

(i) Vancouver.

(A) The northeastern boundary is that part of a line connecting the light on Tatoosh Island, WA, with the light on Bonilla Point on Vancouver Island, British Columbia (at 48°35.73' N. lat., 124°43.00' W. long.) south of the International Boundary between the U.S. and Canada (at 48°29.62' N. lat., 124°43.55' W. long.), and north of the point where that line intersects with the boundary of the U.S. territorial sea.

(B) The northern and northwestern boundary is a line connecting the following coordinates in the order listed, which is the provisional international boundary of the EEZ as shown on NOAA/NOS Charts 18480 and 18007:

Point	N. Lat.	W. Long.
1	48°29.62'	124°43.55'
2	48°30.18'	124°47.22'

3	48°30.37'	124°50.35'
4	48°30.23'	124°54.87'
5	48°29.95'	124°59.23'
6	48°29.73'	125°00.10'
7	48°28.15'	125°05.78'
8	48°27.17'	125°08.42'
9	48°26.78'	125°09.20'
10	48°20.27'	125°22.80'
11	48°18.37'	125°29.97'
12	48°11.08'	125°53.80'
13	47°49.25'	126°40.95'
14	47°36.78'	127°11.97'
15	47°22.00'	127°41.38'
16	46°42.08'	128°51.93'
17	46°31.78'	129°07.65'

(C) The southern limit is 47°30' N. lat.

(ii) Columbia.

(A) The northern limit is 47°30' N. lat.

(B) The southern limit is 43°00' N. lat.

(iii) Eureka.

(A) The northern limit is 43°00' N. lat.

(B) The southern limit is 40°30' N. lat.

(iv) Monterey.

(A) The northern limit is 40°30' N. lat.

(B) The southern limit is 36°00' N. lat.

(v) Conception.

(A) The northern limit is 36°00' N. lat.

(B) The southern limit is the U.S.-Mexico International Boundary, which is a line connecting the following coordinates in the order listed:

Point	N. Lat.	W. Long.
1	32°35.37'	117°27.82'
2	32°37.62'	117°49.52'
3	31°07.97'	118°36.30'

4	30°32.52'	121°51.97'

(2) Commonly used geographic coordinates.
(i) Cape Alava, WA—48°10.00' N. lat.
(ii) Queets River, WA—47°31.70' N. lat.
(iii) Pt. Chehalis, WA—46°53.30' N. lat.
(iv) Leadbetter Point, WA—46°38.17' N. lat.
(v) Washington/Oregon border—46°16.00' N. lat.
(vi) Cape Falcon, OR—45°46.00' N. lat.
(vii) Cape Lookout, OR—45°20.25' N. lat.
(viii) Cascade Head, OR—45°03.83' N. lat.
(ix) Heceta Head, OR—44°08.30' N. lat.
(x) Cape Arago, OR—43°20.83' N. lat.
(xi) Cape Blanco, OR—42°50.00' N. lat.
(xii) Humbug Mountain—42°40.50' N. lat.
(xiii) Marck Arch, OR—42°13.67' N. lat.
(xiv) Oregon/California border—42°00.00' N. lat.
(xv) Cape Mendocino, CA—40°30.00' N. lat.
(xvi) North/South management line—40°10.00' N. lat.
(xvii) Point Arena, CA—38°57.50' N. lat.
(xviii) Point San Pedro, CA—37°35.67' N. lat.
(xix) Pigeon Point, CA—37°11.00' N. lat.
(xx) Ano Nuevo, CA—37°07.00' N. lat.
(xxi) Point Lopez, CA—36°00.00' N. lat.
(xxii) Point Conception, CA—34°27.00' N. lat. [Note: Regulations that apply to waters north of 34°27.00' N. lat. are applicable only west of 120°28.00' W. long.; regulations that apply to waters south of 34°27.00' N. lat. also apply to all waters both east of 120°28.00' W. long. and north of 34°27.00' N. lat.]

Observer. (See §600.10 - U.S. Observer or Observer)

Observer Program or Observer Program Office means the West Coast Groundfish Observer Program (WCGOP) Office of the Northwest Fishery Science Center, National Marine Fisheries Service, Seattle, Washington.

Office of Law Enforcement (OLE) refers to the National Marine Fisheries Service, Office of Law Enforcement, Northwest Division.

Open access fishery means the fishery composed of commercial vessels using open access gear fished pursuant to the harvest guidelines, quotas, and other management measures governing the harvest of open access allocations (detailed in §660.55 and Tables 1–2 of Subpart C) or governing the fishing activities of open access vessels (detailed in Subpart.F) Any commercial vessel that is not registered to a limited entry permit and which takes and retains, possesses or lands groundfish is a participant in the open access groundfish fishery.

Open access gear means all types of fishing gear except:

(1) Longline or trap (or pot) gear fished by a vessel that has a limited entry permit affixed with a gear endorsement for that gear.

(2) Groundfish trawl.

Optimum yield (OY) means the amount of fish that will provide the greatest overall benefit to the Nation, particularly with respect to food production and recreational opportunities, and, taking into account the protection of marine ecosystems, is prescribed as such on the basis of the MSY from the fishery, as reduced by any relevant economic, social, or ecological factor; and, in the case of an overfished fishery, provides for rebuilding to a level consistent with producing the MSY in such fishery. OY may be expressed numerically (as a harvest guideline, quota, or other specification) or non-numerically.

Operate means any use of a vessel, including, but not limited to, fishing, transiting, or drifting by means of the prevailing water current or weather conditions.

Operator. (See §600.10).

Overage means the amount of fish harvested by a vessel in excess of the applicable trip limit.

Owner of a vessel or vessel owner, as used in Subparts C through G, means a person identified as the current owner in the Certificate of Documentation (CG–1270) issued by the USCG for a documented vessel, or in a registration certificate issued by a state or the USCG for an undocumented vessel.

Ownership *interest means participation in ownership of a corporation, partnership, or other entity:*

(1) For sablefish-endorsed permits, ownership interest means participation in ownership of a corporation, partnership, or other entity that owns a sablefish endorsed permit. Participation in ownership does not mean owning stock in a publicly owned corporation.

(2) For the limited entry trawl fishery in Subpart D, ownership interest means ownership interest means participation in ownership of a corporation, partnership, or other entity that owns a QS permit, mothership permit, and a MS/CV endorsed limited entry permit.

Pacific Coast Groundfish Fishery Management Plan (PCGFMP) means the Fishery Management Plan for the Washington, Oregon, and California Groundfish Fishery developed by the Pacific Fishery Management Council and approved by the Secretary on January 4, 1982, and as it may be subsequently amended.

Partnership is two or more individuals, partnerships, or corporations, or combinations thereof, who have ownership interest in a permit, including married couples and legally recognized trusts and partnerships, such as limited partnerships (LP), general partnerships (GP), and limited liability partnerships (LLP).

Permit holder means a vessel owner as identified on the USCG form 1270 or state motor vehicle licensing document *and as registered on a limited entry permit issued under Subparts C through E.*

Permit owner means a person who owns *(legally controls) a permit issued under Subparts C through E, including the person of record with the SFD, Permits Office and any associated persons with an ownership interest in the permit. For first receiver site licenses, see definition "license owner."*

Person, as it applies to limited entry and open access fisheries conducted under § 660 Subparts C through G, means any individual, corporation, partnership, association or other entity (whether or not organized or existing under the laws of any state), and any Federal, state, or local government, or any entity of any such government that is eligible to own a documented vessel under the terms of 46 U.S.C. 12102(a).

Processing or to process means the preparation or packaging of groundfish to render it suitable for human consumption, retail sale, industrial uses or long-term storage, including, but not limited to, cooking, canning, smoking, salting, drying, filleting, freezing, or rendering into meal or oil, but does not mean heading and gutting unless additional preparation is done. (Also see an exception to certain requirements at §660.XXX, Subpart D pertaining to Pacific whiting shoreside vessels 75-ft (23-m) or less LOA that, in addition to heading and gutting, remove the tails and freeze catch at sea.)

(1) At-sea processing means processing that takes place on a vessel or other platform that floats and is capable of being moved from one location to another, whether shore-based or on the water.

(2) Shore-based processing or processing means processing that takes place at a facility that is permanently fixed to land. *(Also see the definition for shoreside processing at §660.XXX, Subpart D which defines shoreside processing for the purposes of qualifying for a QS permit.)*

Processor means person, vessel, or facility that engages in processing; or receives live groundfish directly from a fishing vessel for retail sale without further processing. *(Also see the definition for processors at §660.XXX, Subpart D which defines processor for the purposes of qualifying for a QS permit.)*

Prohibited species means those species and species groups whose retention is prohibited unless authorized by provisions of this section or other applicable law. The following are prohibited species: Any species of salmonid, Pacific halibut, Dungeness crab caught seaward of Washington or Oregon, and groundfish species or species groups under the PCGFMP for which quotas have been achieved and/or the fishery closed.

Quota means a specified numerical harvest objective, the attainment (or expected attainment) of which causes closure of the fishery for that species or species group.

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Recreational fishing means fishing with authorized recreational fishing gear for personal use only, and not for sale or barter.

Regional Administrator means the Administrator, Northwest Region, NMFS.

Reserve means a portion of the harvest guideline or quota set aside at the beginning of the fishing year or biennial fishing period to allow for uncertainties in preseason estimates.

Round weight. (See §600.10). Round weight does not include ice, water, or slime.

Scientific research activity. (See §600.10).

Secretary. (See §600.10).

Sectors means a group in the fishery and is defined in groundfish regulations as follows:

(1) For the purpose of allocations at §660.55, Subpart C, the fishery may be divided in to the trawl (limited entry trawl) and nontrawl (limited entry fixed gear, open access, recreational) fishery or sectors.

(2) The fisheries or sectors under the PCGFMP are divided in to the limited entry fishery, the open access fishery, and the recreational fishery.

(3) The limited entry fishery or sector is further divided in to the limited entry trawl fishery and limited entry fixed gear fishery.

(4) For the limited entry trawl fisheries in Subpart D, the trawl sectors are the shorebased IFQ fishery, the Mothership Coop fishery, and the C/P Coop fishery.

Sell or sale. (See §600.10).

Specification is a numerical or descriptive designation of a management objective, including but not limited to: ABC; optimum yield; harvest guideline; quota; limited entry or open access allocation; a setaside or allocation for a recreational or treaty Indian fishery; an apportionment of the above to an area, gear, season, fishery, or other subdivision.

Spouse means a person who is legally married to another person as recognized by state law (i.e., one's wife or husband).

Stacking is the practice of registering more than one limited entry permit for use with a single vessel (See §660.335(c)).

Sustainable Fisheries Division (SFD) means the Chief, Sustainable Fisheries Division, Northwest Regional Office, NMFS, or a designee.

Target fishing means fishing for the primary purpose of catching a particular species or species group (the target species).

Tax-exempt organization means an organization that received a determination letter from the Internal Revenue Service recognizing tax exemption under 26 CFR part 1(§§1.501 to 1.640).

Totally lost means the vessel being replaced no longer exists in specie, or is absolutely and irretrievably sunk or otherwise beyond the possible control of the owner, or the costs of repair (including recovery) would exceed the value of the vessel after repairs.

Trip. (See §600.10).

Trip limits. Trip limits are used in the commercial fishery to specify the maximum amount of a fish species or species group that may legally be taken and retained, possessed, or landed, per vessel, per fishing trip, or cumulatively per unit of time, or the number of landings that may be made from a vessel in a given period of time, as follows:

(1) A per trip limit is the total allowable amount of a groundfish species or species group, by weight, or by percentage of weight of legal fish on board, that may be taken and retained, possessed, or landed per vessel from a single fishing trip.

(2) A daily trip limit is the maximum amount of a groundfish species or species group that may be taken and retained, possessed, or landed per vessel in 24 consecutive hours, starting at 0001 hours local time (l.t.) Only one landing of groundfish may be made in that 24-hour period. Daily trip limits may not be accumulated during multiple day trips.

(3) A weekly trip limit is the maximum amount of a groundfish species or species group that may be taken and retained, possessed, or landed per vessel in 7 consecutive days, starting at 0001 hours l.t. on Sunday and ending at 2400 hours l.t. on Saturday. Weekly trip limits may not be accumulated during multiple week trips. If a calendar week falls within two different months or two different cumulative limit periods, a vessel is not entitled to two separate weekly limits during that week.

(4) A cumulative trip limit is the maximum amount of a groundfish species or species group that may be taken and retained, possessed, or landed per vessel in a specified period of time without a limit on the number of landings or trips, unless otherwise specified. The cumulative trip limit periods for limited entry and open access fisheries, which start at 0001 hours l.t. and end at 2400 hours l.t., are as follows, unless otherwise specified:

(i) The 2-month or “major” cumulative limit periods are: January 1–February 28/29, March 1–April 30, May 1–June 30, July 1–August 31, September 1–October 31, and, November 1–December 31.

(ii) One month means the first day through the last day of the calendar month.

(iii) One week means 7 consecutive days, Sunday through Saturday.

Vessel manager means a person or group of persons whom the vessel owner has given authority to oversee all or a portion of groundfish fishing activities aboard the vessel.

Vessel monitoring system or VMS means a vessel monitoring system or mobile transceiver unit as set forth in §660.14 and approved by NMFS for use on vessels that take (directly or incidentally) species managed under the PCGFMP, as required by this subpart.

Vessel of the United States or U.S. vessel. (See §600.10).

§ 660.12 General Groundfish Prohibitions.

§ 660.13 Recordkeeping and reporting.

§ 660.14 Vessel Monitoring System (VMS) requirements.

§ 660.15 Equipment requirements.

§ 660.16 Groundfish observer program.

§ 660.17 Catch monitors and catch monitor service providers. [Reserved]

§ 660.18 Certification and decertification procedures for observers, catch monitors, catch monitor providers and observer providers.

§ 660.20 Vessel and Gear Identification.

§ 660.24 Limited entry and open access fisheries.

§ 660.25 Permits.

(a) General. Each if the permits or licenses in this section, have different conditions or privileges as part of the permit or license. The permits or licenses in this section confer a conditional privilege of participating in the Pacific coast groundfish fishery, in accordance with Federal regulations in 50 CFR part 660.

(b) Limited entry permit.

(1) Eligibility and registration.

(i) General. In order for a vessel to participate in the limited entry fishery, the vessel owner must hold a limited entry permit and, through SFD, must register that vessel for use with a limited entry permit. When participating in the limited entry fishery, a vessel is authorized to fish with the gear type endorsed on the limited entry permit registered for use with that vessel, except that the MS permit does not have a gear endorsement. There are three types of gear endorsements: trawl, longline, and pot (or trap). All limited entry permits, except the MS permit, have size endorsements and a vessel registered for use with a limited entry permit must comply with the vessel size requirements of this subpart. A sablefish endorsement is also required for a vessel to participate in the primary season for the limited entry fixed gear sablefish fishery, north of 36° N. lat. Certain limited entry permits will also have endorsements to participate in a specific fishery, such as the MS/CV endorsement and the C/P endorsement. After May 11, 2009, a catcher vessel participating in either the whiting shore-based or mothership sector must, in addition to being registered for use with a limited entry permit, be registered for use with a sector-appropriate Pacific whiting vessel license under §660.336. After May 11, 2009, a vessel participating in the whiting catcher/processor sector must, in addition to being registered for use with a limited entry permit, be registered for use with a sector-appropriate Pacific whiting vessel license under §660.336. After April 9, 2009, although a mothership vessel participating in the whiting mothership sector is not required to be registered for use with a limited entry permit, such vessel must be registered for use with a sector-appropriate Pacific whiting vessel license under §660.336.

(ii) Eligibility. Only a person eligible to own a documented vessel under the terms of 46 U.S.C. 12113 (a) may be issued or may hold a limited entry permit.

(iii) Registration. Limited entry permits will normally be registered for use with a particular vessel at the time the permit is issued, renewed, transferred, or replaced. If the permit will be used with a vessel other than the one registered on the permit, the permit owner must register that permit for use with the new vessel through the SFD. The reissued permit must be placed on board the new vessel in order for the vessel to participate in the limited entry fishery.

(A) Registration of a permit to be used with a new vessel will take effect no earlier than the first day of the next major limited entry cumulative limit period following the date SFD receives the transfer form and the original permit.

(B) The major limited entry cumulative limit periods will be announced in the Federal Register with the harvest specifications and management measures, and with routine management measures when the cumulative limit periods are changed.

(iv) Limited entry permits indivisible. Limited entry permits may not be divided for use by more than one vessel.

(v) Initial *Administrative Determination*. SFD will make an IAD regarding permit endorsements, renewal, replacement, and change in vessel registration. SFD will notify the permit holder in writing with an explanation of any determination to deny a permit endorsement, renewal, replacement, or change in vessel registration. The SFD will decline to act on an application for permit endorsement, renewal, transfer, replacement, or registration of a limited entry permit if the permit is subject to sanction provisions of the Magnuson-Stevens Act at 16 U.S.C. 1858 (a) and implementing regulations at 15 CFR part 904, subpart D, apply.

(2) Mothership (MS) permit. The MS permit conveys a conditional privilege to the owner of a vessel registered to it, or as appropriate, the charter of a bareboat, to participate in the MS fishery and to receive and process deliveries of groundfish. A MS permit is a type of limited entry permit and may not be transferred separately from the limited entry permit. A MS permit does not have any endorsements affixed to the permit, as listed in paragraph (b)(3). The provisions for the MS permit, including eligibility, renewal, change of permit ownership, vessel registration, fees, and appeals are described at §660.150, subpart D, paragraph ().

(3) Endorsements.

(i) "A" endorsement. A limited entry permit with an "A" endorsement entitles the holder to participate in the limited entry fishery for all groundfish species with the type(s) of limited entry gear specified in the endorsement, except for sablefish harvested north of 36° N. lat. during times and with gears for which a sablefish endorsement is required. See §660.334 (d) for provisions on sablefish endorsement requirements. An "A" endorsement is transferable with the limited entry permit to another person, or to a different vessel under the same ownership under §660.335. An "A" endorsement expires on failure to renew the limited entry permit to which it is affixed. *A MS permit does not have a gear endorsement and is not considered a limited entry "A" endorsed permit.*

(ii) Gear endorsement. There are three types of gear endorsements: trawl, longline and pot (trap). When limited entry *"A" endorsed* permits were first issued, some vessel owners qualified for more than one type of gear endorsement based on the landings history of their vessels. Each limited entry *"A" endorsed* permit has one or more gear endorsement(s). Gear endorsement(s) assigned to the permit at the time of issuance will be permanent and shall not be modified. While participating in the limited entry fishery, the vessel registered to the limited entry *"A" endorsed* permit is authorized to fish the gear(s) endorsed on the permit. While participating in the limited entry, primary fixed gear fishery for sablefish described at §660.372, a vessel registered to more than one limited entry permit is authorized to fish with any gear, except trawl gear, endorsed on at least one of the permits registered for use with that vessel. During the limited entry fishery, permit holders may also fish with open access gear; except that vessels fishing against primary sablefish season cumulative limits described at §660.372(b)(3) may not fish with open access gear against those limits.

(iii) Vessel size endorsements.

(A) General. Each limited entry *"A" endorsed* permit will be endorsed with the LOA for the size of the vessel that initially qualified for the permit, except:

(1) If the permit is registered for use with a trawl vessel that is more than 5 ft (1.52 m) shorter than the size for which the permit is endorsed, it will be endorsed for the size of the smaller vessel. This requirement does not apply to a permit with a sablefish endorsement that is endorsed for both trawl and either longline or pot gear and which is registered for use with a longline or pot gear vessel for purposes of participating in the limited entry primary fixed gear sablefish fishery described at §660.372.

(2) When permits are combined into one permit to be registered for use with a vessel requiring a larger size endorsement, the new permit will be endorsed for the size that results from the combination of the permits as described in paragraph XXX of this section.

(B) Limitations of size endorsements —

(1) A limited entry permit endorsed only for gear other than trawl gear may be registered for use with a vessel up to 5 ft (1.52 m) longer than, the same length as, or any length shorter than, the size endorsed on the existing permit without requiring a combination of permits under §660.335 (b) or a change in the size endorsement.

(2) A limited entry permit endorsed for trawl gear may be registered for use with a vessel between 5 ft (1.52 m) shorter and 5 ft (1.52 m) longer than the size endorsed on the existing permit without requiring a combination of permits under §660.335 (b) or a change in the size endorsement under paragraph XXX of this section.

(3) The vessel harvest capacity rating for each of the permits being combined is that indicated in Table 2 of this part for the LOA (in feet)

endorsed on the respective limited entry permit. Harvest capacity ratings for fractions of a foot in vessel length will be determined by multiplying the fraction of a foot in vessel length by the difference in the two ratings assigned to the nearest integers of vessel length. The length rating for the combined permit is that indicated for the sum of the vessel harvest capacity ratings for each permit being combined. If that sum falls between the sums for two adjacent lengths on Table 2 of this part, the length rating shall be the higher length.

(C) Size endorsement requirements for sablefish-endorsed permits. Notwithstanding paragraphs (A) and (B) of this section, when multiple permits are "stacked" on a vessel, as described in §660.335(c), at least one of the permits must meet the size requirements of those sections. The permit that meets the size requirements of those sections is considered the vessel's "base" permit, as defined in §660.302. If more than one permit registered for use with the vessel has an appropriate length endorsement for that vessel, NMFS SFD will designate a base permit by selecting the permit that has been registered to the vessel for the longest time. If the permit owner objects to NMFS's selection of the base permit, the permit owner may send a letter to NMFS SFD requesting the change and the reasons for the request. If the permit requested to be changed to the base permit is appropriate for the length of the vessel as provided for in paragraph (c)(2)(i) of this section, NMFS SFD will reissue the permit with the new base permit. Any additional permits that are stacked for use with a vessel participating in the limited entry primary fixed gear sablefish fishery may be registered for use with a vessel even if the vessel is more than 5 ft (1.5 m) longer or shorter than the size endorsed on the permit.

(iv) Sablefish endorsement and tier assignment.

(A) General. Participation in the limited entry fixed gear sablefish fishery during the primary season described in §660.372 north of 36° N. lat., requires that an owner of a vessel hold (by ownership or lease) a limited entry permit, registered for use with that vessel, with a longline or trap (or pot) endorsement and a sablefish endorsement. Up to three permits with sablefish endorsements may be registered for use with a single vessel. Limited entry permits with sablefish endorsements are assigned to one of three different cumulative trip limit tiers, based on the qualifying catch history of the permit.

(1) A sablefish endorsement with a tier assignment will be affixed to the permit and will remain valid when the permit is transferred.

(2) A sablefish endorsement and its associated tier assignment are not separable from the limited entry permit, and therefore may not be transferred separately from the limited entry permit.

(B) Issuance process for sablefish endorsements and tier assignments. No new applications for sablefish endorsements will be accepted after November 30, 1998. All tier assignments and subsequent appeals processes were completed by September 1998.

(C) Ownership requirements and limitations.

(1) No partnership or corporation may own a limited entry permit with a sablefish endorsement unless that partnership or corporation owned a limited entry permit with a sablefish endorsement on November 1, 2000. Otherwise, only individual human persons may own limited entry permits with sablefish endorsements.

(2) No individual person, partnership, or corporation in combination may have ownership interest in or hold more than 3 permits with sablefish endorsements either simultaneously or cumulatively over the primary season, except for an individual person, or partnerships or corporations that had ownership interest in more than 3 permits with sablefish endorsements as of November 1, 2000. The exemption from the maximum ownership level of 3 permits only applies to ownership of the particular permits that were owned on November 1, 2000. An individual person, or partnerships or corporations that had ownership interest in 3 or more permits with sablefish endorsements as of November 1, 2000, may not acquire additional permits beyond those particular permits owned on November 1, 2000. If, at some future time, an individual person, partnership, or corporation that owned more than 3 permits as of November 1, 2000, sells or otherwise permanently transfers (not holding through a lease arrangement) some of its originally owned permits, such that they then own fewer than 3 permits, they may then acquire additional permits, but may not have ownership interest in or hold more than 3 permits.

(3) A partnership or corporation will lose the exemptions provided in paragraphs (d)(4)(i) and (ii) of this section on the effective date of any change in the corporation or partnership from that which existed on November 1, 2000. A "change" in the partnership or corporation is defined at §660.302. A change in the partnership or corporation must be reported to SFD within 15 calendar days of the addition of a new shareholder or partner.

(4) Any partnership or corporation with any ownership interest in or that holds a limited entry permit with a sablefish endorsement shall document the extent of that ownership interest or the individuals that hold the permit with the SFD via the Identification of Ownership Interest Form sent to the permit owner through the annual permit renewal process defined at §660.335(a) and whenever a change in permit owner, permit holder, and/or vessel registration occurs as defined at §660.335(d) and (e). SFD will not renew a sablefish-endorsed limited entry permit through the annual renewal process described at §660.335(a) or approve a change in permit owner, permit holder, and/or vessel registration unless the Identification of Ownership Interest Form has been completed. Further, if SFD discovers through review of the Identification of Ownership Interest Form that an individual person, partnership, or corporation owns or holds more than 3 permits and is not authorized to do so under paragraph (d)(4)(ii) of this section,

the individual person, partnership or corporation will be notified and the permits owned or held by that individual person, partnership, or corporation will be void and reissued with the vessel status as "unidentified" until the permit owner owns and/or holds a quantity of permits appropriate to the restrictions and requirements described in paragraph (d)(4)(ii) of this section. If SFD discovers through review of the Identification of Ownership Interest Form that a partnership or corporation has had a change in membership since November 1, 2000, as described in paragraph (d)(4)(iii) of this section, the partnership or corporation will be notified, SFD will void any existing permits, and reissue any permits owned and/or held by that partnership or corporation in "unidentified" status with respect to vessel registration until the partnership or corporation is able to transfer those permits to persons authorized under this section to own sablefish-endorsed limited entry permits.

(5) A person, partnership, or corporation that is exempt from the owner-on-board requirement may sell all of their permits, buy another sablefish-endorsed permit within up to a year from the date the last permit was approved for transfer, and retain their exemption from the owner-on-board requirements. An individual person, partnership or corporation could only obtain a permit if it has not added or changed individuals since November 1, 2000, excluding individuals that have left the partnership or corporation or that have died.

(D) Sablefish at-sea processing prohibition and exemption. Beginning January 1, 2007, vessels are prohibited from processing sablefish at sea that were caught in the primary sablefish fishery without sablefish at-sea processing exemptions at §660.306(e)(3). The sablefish at-sea processing exemption has been issued to a particular vessel and that permit and vessel owner who requested the exemption. The exemption is not part of the limited entry permit. The exemption is not transferable to any other vessel, vessel owner, or permit owner for any reason. The sablefish at-sea processing exemption will expire upon transfer of the vessel to a new owner or if the vessel is totally lost, as defined at §660.302.

(v) MS/CV endorsement. A limited entry permit with a MS/CV endorsement is a conditional privilege that allows a vessel registered to it to participate in either the coop or noncoop fishery in the Mothership Program described at XXXXXX. The provisions for the MS/CV endorsed limited entry permit, including eligibility, renewal, change of permit ownership, vessel registration, combinations, accumulation limits, fees, and appeals are described at §660.150, subpart D, paragraph ().

(vi) C/P endorsement. A limited entry permit with a C/P endorsement is a conditional privilege that allows a vessel registered to it to participate in the C/P Program described at XXXXXX. The provisions for the C/P endorsed limited entry permit, including eligibility, renewal, change of permit ownership, vessel registration, combinations, fees, and appeals are described at §660.160, subpart D, paragraph ().

(vii) Endorsement and exemption restrictions. "A" endorsements, gear endorsements, sablefish endorsements and sablefish tier assignments*, MS/CV endorsements, and C/P endorsements* may not be transferred separately from the limited entry permit. Sablefish at-sea processing exemptions are associated with the vessel and not with the limited entry permit and may not be transferred at all.

(4) Limited entry permit actions- renewal, combination, stacking, change of permit ownership or permit holdership, and transfer.

(i) Renewal of limited entry permits and gear endorsements —

(A) Limited entry permits expire at the end of each calendar year, and must be renewed between October 1 and November 30 of each year in order to remain in force the following year.

(B) Notification to renew limited entry permits will be issued by SFD prior to September 15 each year to the most recent address of the permit owner. The permit owner shall provide SFD with notice of any address change within 15 days of the change.

(C) Limited entry permit renewal requests received in SFD between November 30 and December 31 will be effective on the date that the renewal is approved. A limited entry permit that is allowed to expire will not be renewed unless the permit owner requests reissuance by March 31 of the following year and the SFD determines that failure to renew was proximately caused by illness, injury, or death of the permit owner.

(D) Limited entry permits with sablefish endorsements, as described at §660.334(d), will not be renewed until SFD has received complete documentation of permit ownership as required under §660.334(d)(4)(iv).

(ii) Combining limited entry permits. Two or more limited entry permits with "A" gear endorsements for the same type of limited entry gear may be combined and reissued as a single permit with a larger size endorsement as described in paragraph §660.334 (c)(2)(iii). With respect to permits endorsed for nontrawl limited entry gear, a sablefish endorsement will be issued for the new permit only if all of the permits being combined have sablefish endorsements. If two or more permits with sablefish endorsements are combined, the new permit will receive the same tier assignment as the tier with the largest cumulative landings limit of the permits being combined.

(iii) Stacking limited entry permits. "Stacking" limited entry permits, as defined at §660.302, refers to the practice of registering more than one permit for use with a single vessel. Only limited entry permits with sablefish endorsements may be stacked. Up to 3 limited entry permits with sablefish endorsements may be registered for use with a single vessel during the primary sablefish season described at §660.372. Privileges, responsibilities, and restrictions associated with stacking permits to participate in the primary sablefish fishery are described at §660.372 and at §660.334(d).

(iv) Changes in permit ownership and permit holder —

(A) General. The permit owner may convey the limited entry permit to a different person. The new permit owner will not be authorized to use the permit until the change in permit ownership has been registered with and approved by the SFD. The SFD will not approve a change in permit ownership for limited entry permits with sablefish endorsements that does not meet the ownership requirements for those permits described at §660.334 (d)(4). Change in permit owner and/or permit holder applications must be submitted to SFD with the appropriate documentation described at §660.335(g).

(B) Effective date. The change in ownership of the permit or change in the permit holder will be effective on the day the change is approved by SFD, unless there is a concurrent change in the vessel registered to the permit. Requirements for changing the vessel registered to the permit are described at paragraph (e) of this section.

(C) Sablefish-endorsed permits. If a permit owner submits an application to transfer a sablefish-endorsed limited entry permit to a new permit owner or holder (transferee) during the primary sablefish season described at §660.372(b) (generally April 1 through October 31), the initial permit owner (transferor) must certify on the application form the cumulative quantity, in round weight, of primary season sablefish landed against that permit as of the application signature date for the then current primary season. The transferee must sign the application form acknowledging the amount of landings to date given by the transferor. This certified amount should match the total amount of primary season sablefish landings reported on state fish tickets. As required at §660.303(c), any person landing sablefish must retain on board the vessel from which sablefish is landed, and provide to an authorized officer upon request, copies of any and all reports of sablefish landings from the primary season containing all data, and in the exact manner, required by the applicable state law throughout the primary sablefish season during which a landing occurred and for 15 days thereafter.

(v) <u>Changes in vessel registration-transfer of limited entry permits and gear endorsements</u> —

(A) General. A permit may not be used with any vessel other than the vessel registered to that permit. For purposes of this section, a permit transfer occurs when, through SFD, a permit owner registers a limited entry permit for use with a new vessel. Permit transfer applications must be submitted to SFD with the appropriate documentation described at §660.335(g). Upon receipt of a complete application, and following review and approval of the application, the SFD will reissue the permit registered to the new vessel. Applications to transfer limited entry permits with sablefish endorsements, as described at §660.334(d), will not be approved until SFD has received complete documentation of permit ownership as required under §660.334(d)(4)(iv).

(B) Application. A complete application must be submitted to SFD in order for SFD to review and approve a change in vessel registration. At a minimum, a permit owner seeking to transfer a limited entry permit shall submit to SFD a signed application form and his/her current limited entry permit before the first day of the cumulative limit period in which they wish to participate. If a permit owner provides a signed application and current limited entry permit after the first day of a cumulative limit period, the permit will not be effective until the succeeding cumulative limit period. SFD will not approve a change in vessel registration (transfer) until it receives a complete application, the existing permit, a current copy of the USCG 1270, and other required documentation.

(C) Effective date. Changes in vessel registration on permits will take effect no sooner than the first day of the next major limited entry cumulative limit period following the date that SFD receives the signed permit transfer form and the original limited entry permit. No transfer is effective until the limited entry permit has been reissued as registered with the new vessel.

(D) Sablefish-endorsed permits. If a permit owner submits an application to register a sablefish-endorsed limited entry permit to a new vessel during the primary sablefish season described at §660.372(b) (generally April 1 through October 31), the initial permit owner (transferor) must certify on the application form the cumulative quantity, in round weight, of primary season sablefish landed against that permit as of the application signature date for the then current primary season. The new permit owner or holder (transferee) associated with the new vessel must sign the application form acknowledging the amount of landings to date given by the transferor. This certified amount should match the total amount of primary season sablefish landings reported on state fish tickets. As required at §660.303(c)), any person landing sablefish must retain on board the vessel from which sablefish is landed, and provide to an authorized officer upon request, copies of any and all reports of sablefish landings from the primary season containing all data, and in the exact manner, required by the applicable state law throughout the primary sablefish season during which a landing occurred and for 15 days thereafter.

(vi) Restriction on frequency of transfers. Limited entry permits may not be registered for use with a different vessel (transfer) more than once per calendar year, except in cases of death of a permit holder or if the permitted vessel is totally lost as defined in §660.302. The exception for death of a permit holder applies for a permit held by a partnership or a corporation if the person or persons holding at least 50 percent of the ownership interest in the entity dies.

(A) A permit owner may designate the vessel registration for a permit as "unidentified," meaning that no vessel has been identified as registered for use with that permit. No vessel is authorize to use a permit with the vessel registration designated as "unidentified." A vessel owner who removes a permit from his vessel and registers that permit as "unidentified" is not exempt from VMS requirements at §660.312 unless specifically authorized by that section.

(B) When a permit owner requests that the permit's vessel registration be designated as "unidentified," the transaction is not considered a "transfer" for purposes of this section. Any subsequent request by a permit owner to change from the "unidentified" status of the permit in order to register the permit with a specific vessel will be considered a change in vessel registration (transfer) and subject to the restriction on frequency and timing of changes in vessel registration (transfer).

(vii) Application and supplemental documentation. Permit holders may request a transfer (change in vessel registration) and/or change in permit ownership or permit holder by submitting a complete application form. In addition, a permit owner applying for renewal, replacement, transfer, or change of ownership or change of permit holder of a limited entry permit has the burden to submit evidence to prove that qualification requirements are met. The owner of a permit endorsed for longline or trap (or pot) gear applying for a tier assignment under §660.334 (d) has the burden to submit evidence to prove that certain qualification requirements are met. The following evidentiary standards apply:

(A) For a request to change a vessel registration and/or change in permit ownership or permit holder, the permit owner must provide SFD with a current copy of the USCG Form 1270 for vessels of 5 net tons or greater, or a current copy of a state registration form for vessels under 5 net tons.

(B) For a request to change a vessel registration and/or change in permit ownership or permit holder for sablefish-endorsed permits with a tier assignment for which a corporation or partnership is listed as permit owner and/or holder, an Identification of Ownership Interest Form must be completed and included with the application form.

(C) For a request to change the vessel registration to a permit, the permit holder must submit to SFD a current marine survey conducted by a certified marine surveyor in accordance with USCG regulations to authenticate the length overall of the vessel being newly registered with the permit. Marine surveys older than 3 years at the time of the request for change in vessel registration will not be considered "current" marine surveys for purposes of this requirement.

(D) For a request to change a permit's ownership where the current permit owner is a corporation, partnership or other business entity, the applicant must provide to SFD a corporate resolution that authorizes the conveyance of the permit to a new owner and which authorizes the individual applicant to request the conveyance on behalf of the corporation, partnership, other business entity.

(E) For a request to change a permit's ownership that is necessitated by the death of the permit owner(s), the individual(s) requesting conveyance of the permit to a new owner must provide SFD with a death certificate of the permit owner(s) and appropriate legal documentation that either: specifically transfers the permit to a designated individual(s); or, provides legal authority to the transferor to convey the permit ownership.

(F) For a request to change a permit's ownership that is necessitated by divorce, the individual requesting the change in permit ownership must submit an executed divorce decree that awards the permit to a designated individual(s).

(G) Such other relevant, credible documentation as the applicant may submit, or the SFD or Regional Administrator may request or acquire, may also be considered.

(viii) Application forms available. Application forms for the change in vessel registration (transfer) and change of permit ownership or permit holder of limited entry permits are available from the SFD (see part 600 for address of the Regional Administrator). Contents of the application, and required supporting documentation, are specified in the application form.

(ix) Records maintenance. The SFD will maintain records of all limited entry permits that have been issued, renewed, transferred, registered, or replaced.

(5) Small fleet.

(i) Small limited entry fisheries fleets that are controlled by a local government, are in existence as of July 11, 1991, and have negligible impacts on the groundfish resource, may be certified as consistent with the goals and objectives of the limited entry program and incorporated into the limited entry fishery. Permits issued under this subsection will be issued in accordance with the standards and procedures set out in the PCGFMP and will carry the rights explained therein.

(ii) A permit issued under this section may be registered only to another vessel that will continue to operate in the same certified small fleet, provided that the total number of vessels in the fleet does not increase. A vessel may not use a small fleet limited entry permit for participation in the limited entry fishery outside of authorized activities of the small fleet for which that permit and vessel have been designated.

(c) QS permit. A quota share (QS) permit is a conditional privilege that allows a person to control quota share for designated species and species groups in the shoreside IFQ Program described at XXXXXX. A QS permit is not a limited entry permit. The provisions for the QS permit, including eligibility, renewal, change of permit ownership, accumulation limits, fees, and appeals are described at §660.140, subpart D, paragraph ().

(d) First Receiver Site License. The first receiver site license is a conditional privilege that allows a first receiver to receive, purchase, or take custody, control or possession of IFQ species/species groups onshore directly from a vessel fishing in the IFQ fishery. The first receiver site license is issued for a person and a unique physical site consistent with the terms

and conditions required to account and weigh the landed species. A first receiver site license is not a limited entry permit. The provisions for the First Receiver Site License, including eligibility, registration, change of ownership, fees, and appeals are described at §660.140, subpart D, paragraph ().

(e) Coop permit [Reserved]

(1) MS coop permit [Reserved]

(2) C/P coop permit [Reserved]

(f) Permit fees. The Regional Administrator is authorized to charge fees to cover administrative expenses related to issuance of permits including initial issuance, renewal, transfer, vessel registration, replacement, and appeals. The appropriate fee must accompany each application.

(g) permit appeals *process.*

*(1) General. For permit actions, including issuance, renewal, change in vessel registration, change in permit owner or permit holder, and endorsement upgrade, the Assistant Regional Administrator for Sustainable Fisheries will make an initial administrative determination (IAD) on the action. In cases where the applicant disagrees with the IAD, the applicant may appeal that decision. Final d*ecisions on appeals of *IADs* regarding issuance, renewal, change in vessel registration, change in permit owner or permit holder, and endorsement upgrade, will be made in writing by the Regional Administrator *acting on behalf of the Secretary of Commerce* and will state the reasons therefore. *This section describes the procedures for appealing the IAD on permit actions made in this title under subpart C through G of part 660. Additional information regarding appeals of an IAD related to the trawl rationalization program is contained in the specific program sections under Subpart D of part 660.*

(2) Who may appeal. Any person who receives an IAD that denies any part of their application may file a written appeal. For purposes of this section, such person will be referred to as the "applicant."

(3) Submission of appeals.

(i) The appeal must be in writing, must allege *credible* facts or circumstances to show why the criteria in this subpart have been met, *and must include any relevant information or documentation to support the appeal.*

(ii) Appeals must be mailed or faxed to: National Marine Fisheries Service, Northwest Region, Sustainable Fisheries Division, ATTN: Appeals, 7600 Sand Point Way NE, Seattle, WA, 98115; Fax: 206-526-6426; or delivered to National Marine Fisheries Service at the same address.

(4) Timing of appeals.

(i) If an applicant appeals an IAD, the appeal must be postmarked, faxed, or hand delivered to NMFS no later than 30 calendar days after the date on the IAD. If the applicant does not appeal the IAD within 30 calendar days, the IAD becomes the final decision of the Regional Administrator acting on behalf of the Secretary of Commerce.

(ii) The time period to submit an appeal begins with the date on the IAD. If the last day of the time period is a Saturday, Sunday, or Federal holiday, the time period will extend to the close of business on the next business day.

(5) Address of record. For purposes of the appeals process, NMFS will establish as the address of record, the address used by the applicant in initial correspondence to NMFS. Notifications of all actions affecting the applicant after establishing an address of record will be mailed to that address, unless the applicant provides NMFS, in writing, with any changes to that address. NMFS bears no responsibility if a notification is sent to the address of record and is not received because the applicant's actual address has changed without notification to NMFS.

(6) Decisions on appeals.

(i) For the appeal of an IAD related to the application and initial issuance process for the trawl rationalization program listed in subpart D of part 660, the RA shall appoint an appeals officer. After determining there is sufficient information and that all procedural requirements have been met, the appeals officer will review the record and issue a recommendation on the appeal to the RA, which shall be advisory only. The recommendation must be based solely on the record. Upon receiving the findings and recommendation, the RA shall issue a final decision on the appeal in accordance with paragraph (g)(6)(ii).

(ii) Final decision on appeal. The RA will issue a written decision on the appeal which is the final *decision* of the *Secretary* of Commerce.

(7) Status of permits pending appeal

(i) For all permits actions, except those actions related to the application and initial issuance process for the trawl rationalization program listed in subpart D of part 660, the permit registration remains as it was prior to the request until the final decision has been made.

(ii) For permit actions related to the application and initial issuance process for the trawl rationalization program listed in subpart D of part 660, the status of permits pending appeal is as follows:

(A) For permit and endorsement qualifications and eligibility appeals (i.e., QS permit, Mothership permit, MS/CV endorsement, C/P endorsement) and not QS amounts or whiting catch history assignment amounts, any permit or endorsement under appeal after December 31, 2010, may not participate in the Pacific Coast groundfish fishery until a final decision on the appeal has been made. If the permit or endorsement will be issued, the permit or endorsement will be effective upon approval, except for QS permits, which will be effective at the start of the next fishing year.

(B) For a QS amount for specific IFQ management unit species under appeal after December 31, 2010, the QS amount for the IFQ species under appeal will remain as that previously assigned to the associated QS permit before the appeals process. The QS permit may participate in the Pacific Coast groundfish fishery with the QS amounts

assigned to the QS permit before the appeal. Once a final decision on the appeal has been made and if a revised QS amount for a specific IFQ species will be assigned to the QS permit, the QS amount associated with the QS permit will be effective at the start of the next calendar year.

(C) For a whiting catch history assignment associated with a MS/CV endorsement under appeal after December 31, 2010, the catch history assignment will remain as that previously assigned to the associated MS/CV endorsed limited entry permit before the appeals process. The MS/CV endorsed limited entry permit may participate in the Pacific Coast groundfish fishery with the catch history assigned to the MS/CV endorsed permit before the appeal. Once a final decision on the appeal has been made and if a revised catch history assignment will be issued, the whiting catch history assignment associated with the MS/CV endorsement will be effective at the start of the next calendar year.

(h) Permit sanctions.

(1) *All* permits *and licenses* issued or applied for under *Subparts C through G* are subject to sanctions pursuant to the Magnuson Act at 16 U.S.C. 1858(g) and 15 CFR part 904, subpart D.

(2) All shorebased IFQ fishery permits (QS permit, first receiver site license), QS accounts, vessel accounts, and Coop fishery permits (MS permit, MS/CV endorsed permit, C/P endorsed permit, coop permit) issued under Subpart D:

(i) are considered permits for the purposes of 16 U.S.C. 1857, 1858, and 1859;

(ii) may be revoked, limited, or modified at any time in accordance with the Magnuson Act, including revocation if the system is found to have jeopardized the sustainability of the stocks or the safety of fishermen;

(iii) shall not confer any right of compensation to the holder of such permits, licenses, and accounts if it is revoked, limited, or modified;

(iv) shall not create, or be construed to create, any right, title, or interest in or to any fish before the fish is harvested by the holder; and

(v) shall be considered a grant of permission to the holder of the permit, license, or account to engage in activities permitted by such permit, license, or account.

§ 660.26 Pacific whiting vessel licenses.

§ 660.30 Compensation with fish for collecting resource information – EFPs.

§ 660.40 Overfished species rebuilding plans.

§ 660.50 Pacific Coast Treaty Indian fisheries.

§ 660.5 Washington coastal tribal fisheries management measures.

§ 660.55 Allocations.

(a) General. *An allocation is the apportionment of a harvest privilege for a specific purpose, to a particular person or group of persons. The opportunity to harvest Pacific Coast groundfish is allocated among participants in the fishery when the OYs for a given year are established in the biennial harvest specifications. For certain species, primarily trawl-dominant species, separate allocations for the trawl fishery and nontrawl fishery (which for this purpose includes limited entry fixed gear, open access, and recreational fisheries) will be established biennially or annually using the procedures described in Section 11 of the PCGFMP. Section 11 of the PCGFMP provides the allocation structure and percentages for species allocated between the trawl and nontrawl fisheries.* For *most* species and/or areas, separate allocations for the limited entry and open access fisheries will be established biennially or annually using the procedures described in this subpart or the PCGFMP. *Allocation of Sablefish north of 36° N. lat. is described in paragraph XXXX and in the PCGFMP. Allocation of Pacific whiting is described in paragraph XXXX and in the PCGFMP. Allocation of black rockfish is described in paragraph XXXX. Allocation of Pacific halibut bycatch is described in paragraph XXXX. Allocations not described in the PCGFMP are specified in regulation through the biennial harvest specifications and are described in Tables 1 a through c and Tables 2 a through c.*

(b) Trawl / Nontrawl Allocations. Amendment 21 to the PCGFMP established allocations between the trawl and nontrawl (limited entry fixed gear, open access, and recreational) fisheries. Amendment 21 species are listed in Table 11-1 in the PGCFMP. Under this allocation structure, the OY is reduced by estimates for Pacific Coast treaty Indian tribal catch; projected research catch, estimates of fishing mortality in non-groundfish fisheries, as necessary, and set-asides for EFPs. The remaining OY after these deductions is the fishery harvest guideline or quota, which is divided into trawl and nontrawl (limited entry fixed gear, open access, and recreational) fisheries.

(i) Trawl Allocation. The allocation for the limited entry trawl fishery is derived by applying the trawl allocation percentage or amount by species specified in the PCGFMP to the fishery harvest guideline.

(ii) Nontrawl Allocation. The allocation for the nontrawl fishery is the fishery harvest guideline minus the allocation to the trawl fishery. These amounts will equal the nontrawl allocation percentage or amount by species specified in the PCGFMP. The nontrawl allocation will be further divided between the limited entry fixed gear, open access, and recreational fisheries.

(c) Limited Entry / Open Access Allocations. Amendment 6 to the PCGFMP established a limited entry system and allocations between the limited entry and open access fisheries. If a species is declared overfished, the open access/limited entry allocation may be suspended for the duration of the rebuilding plan.

(i) Limited entry allocation. The allocation for the limited entry fishery is the commercial harvest guideline minus any allocation to the open access fishery.

(ii) Open access allocation. The allocation for the open access fishery is derived by applying the open access allocation percentage to the annual commercial harvest guideline or quota. For management areas or stocks for which quotas or harvest guidelines for a stock are not fully utilized, no separate allocation will be established for the open access fishery until it is projected that the allowable catch for a species will be reached.

(A) Open access allocation percentage. For each species with a harvest guideline or quota, the initial open access allocation percentage is calculated by:

(1) Computing the total catch for that species during the window period *for the limited entry program* by any vessel that *did* not initially receive a limited entry permit.

(2) Dividing that amount by the total catch during the window period by all gear.

(3) The guidelines in this paragraph apply to recalculation of the open access allocation percentage. Any recalculated allocation percentage will be used in calculating the following biennial fishing period's open access allocation.

(B) [Reserved.]

(d) Catch accounting between the limited entry and open access fisheries. Any groundfish caught by a vessel with a limited entry permit will be counted against the limited entry allocation while the limited entry fishery for that vessel's limited entry gear is open. When the fishery for a vessel's limited entry gear has closed, groundfish caught by that vessel with open access gear will be counted against the open access allocation. All groundfish caught by vessels without limited entry permits will be counted against the open access allocation.

(e) Treaty Indian fisheries. Certain amounts of groundfish *will* be set aside biennially or annually for tribal fisheries prior to dividing the balance of the allowable catch between the *non-tribal* fisheries. Tribal fisheries conducted under a set-aside are not subject to the regulations governing limited entry and open access fisheries.

(f) Recreational fisheries. Recreational fishing for groundfish is outside the scope of, and not affected by, the regulations governing limited entry and open access fisheries. Certain amounts of groundfish *will be set aside for* the recreational fishery *during the biennial specifications process.* These amounts will be estimated prior to dividing the commercial harvest guideline between the limited entry and open access fisheries.

(g) Sablefish allocations *(north of of 36° N. lat.)*

(1) Tribal-nontribal allocation. The sablefish allocation to Pacific coast treaty Indian tribes identified at §660.324(b) is 10 percent of the sablefish total catch OY for the area north of 36° N. lat. This allocation represents the total amount available to the treaty Indian fisheries before deductions for discard mortality. The annual tribal sablefish allocations are provided in §660.385(a).

(2) Between the limited entry and open access fisheries. Sablefish is allocated between the limited entry and open access fisheries according to the procedure described in *paragraph (c) and in Section 11 of the PCGFMP.*

(3) Between the limited entry trawl and limited entry fixed gear fisheries. The limited entry sablefish allocation is further allocated 58 percent to the trawl fishery and 42 percent to the limited entry fixed gear (longline and pot/trap) fishery.

(4) Between the limited entry fixed gear primary season and daily trip limit fisheries. Within the limited entry nontrawl sector allocation, 85 percent is reserved for the primary season described in §660.372(b), leaving 15 percent for the limited entry daily trip limit fishery described in §660.372(c).

(5) Ratios between tiers for sablefish-endorsed limited entry permits. The Regional Administrator will biennially or annually calculate the size of the cumulative trip limit for each of the three tiers associated with the sablefish endorsement such that the ratio of limits between the tiers is approximately 1:1.75:3.85 for Tier 3:Tier 2:Tier 1, respectively. The size of the cumulative trip limits will vary depending on the amount of sablefish available for the primary fishery and on estimated discard mortality rates within the fishery. The size of the cumulative trip limits for the three tiers in the primary fishery will be announced in §660.372.

(h) Pacific whiting Allocation. The allocation structure and percentages for Pacific whiting are described in the PCGFMP.

(1) Annual treaty tribal whiting allocations are provided in §660.385(e).

(2) The non-tribal commercial harvest guideline allocations for specific whiting sectors (shoreside, mothership, C/P) in a given calendar year are found in tables 1a and 2a of this subpart.

(i) At-sea Whiting Trawl Fishery Set-Asides. Set-asides are not formal allocations; they are projections of incidental catch by a fishery. For the at-sea whiting fishery (MS and C/P), set-asides will be deducted from the limited entry trawl fishery allocation. Set-aside amounts are specified in regulation at XXXX and may be adjusted through the biennial harvest specifications and management measures process.

(j) Black rockfish harvest guideline. The commercial tribal harvest guideline for black rockfish off Washington State is specified at § 660.XXX, Subpart C.

(k) Pacific halibut Bycatch Allocation. The Pacific halibut fishery off Washington, Oregon and California (Area 2A in the halibut regulations) is managed under regulations at XXXXXX. The PCGFMP sets a trawl mortality bycatch limit for legal and sublegal halibut at 15% of the Area 2A constant exploitation yield (CEY) for legal size halibut, not to exceed 130,000 pounds for the first four years of trawl rationalization and not to exceed 100,000 pounds starting in the fifth year. This total bycatch limit may be adjusted downward or upward through the biennial specifications and management measures process. Part of the overall total catch limit is a set-aside of 10 mt of Pacific halibut, 5 mt to accommodate bycatch in the at-sea whiting fishery and 5 mt to accommodate shoreside trawl bycatch south of 40°10' N lat.

§ 660.60 Specifications and management measures.

§ 660.65 Groundfish harvest specifications.

§ 660.70-99 Closed Area - GCA's and EFH

* ABC/OY Tables –Tables (1a), OY tables (1b), Allocation tables (1c), Tables 2a, 2b, and 2c
* Vessel Capacity Rating Table - Table 2 to Part 660

3. A new Subpart D is added to read as follows:
Subpart D – West Coast Groundfish – Trawl Fisheries

§ 660.100 Purpose and Scope.

In addition to the purpose and scope listed at § 660.10, subpart C, this subpart covers the Pacific Coast Groundfish limited entry trawl fishery. Under the trawl rationalization program, the limited entry trawl fishery consists of the shorebased IFQ Program, the Mothership Coop Program, and the C/P Coop Program.

§ 660.111 Trawl Fishery Definitions.

These definitions are specific to the limited entry trawl fisheries. General groundfish definitions are defined at § 660.11, Subpart C.

Catch history assignment means a percentage of the mothership sector allocation of Pacific whiting based on a vessel's catch history and which is specified on the MS/CV endorsed limited entry permit.

Catcher/processor coop means a harvester group that includes all eligible catcher/processor at-sea whiting endorsed permit owners who voluntarily form a coop and who manage the catcher/processor-specified allocations through private agreements and contracts.

Coop agreement means a private agreement between a group of MS/CV endorsed limited entry permit owners or C/P whiting endorsed permit owners that contains all information specified at §§ 660.XXX and 660.XXX, Subpart D.

Coop Member means all permit owners of MS/CV endorsed permits for the Mothership Program or C/P endorsed permits for the C/P Program that are legally obligated to the coop.

Coop permit means the Federal permit required to participate as a Pacific whiting coop in the catcher/processor or mothership sectors.

Designated coop manager means an individual appointed by a permitted coop who is identified in the coop agreement and is responsible for actions described at 660.XMPX and 660.XCPX.

Individual Fishing Quota (IFQ) means a quantity of fish, expressed as a percentage of the total allowable catch of a fishery that may be received or held for exclusive use by a person. IFQ is a harvest privilege that may be revoked at any time. IFQ species for the shorebased IFQ fishery are listed at 660.XXX.

<u>IFQ first receivers</u> mean persons who receive, purchase, or take custody, control, or possession of catch onshore directly from a vessel that harvested the catch while fishing under the Shorebased IFQ Program described at § 660.140.

<u>IFQ landing</u> means an offload of fish harvested under the Shorebased IFQ Program described at § 660.140, Subpart D.

<u>IFQ Program</u> means the Shorebased IFQ Program described at § 660.140, Subpart D.

<u>Inter-coop</u> means two or more permitted coops that have submitted an accepted inter-coop agreement to NMFS that specifies a coordinated strategy for harvesting pooled allocations of Pacific whiting and non-whiting groundfish.

<u>Inter-coop agreement</u> means a written agreement between two or more permitted mothership coops and which contains private contractual arrangements for sharing catch with one another.

<u>Material change</u> means, for the purposes of a coop agreement, a change to any of the components of the coop agreement which was submitted to NMFS during the application process for the coop permit and is further defined at § 660.XXX, Subpart D.

<u>Mothership coop</u> means a group of MS/CV endorsed limited entry permit owners that are authorized by means of a coop permit to jointly harvest and process from a single coop allocation.

<u>Mutual agreement exception</u> means, for the purpose of § 660.XXX, Subpart D, an agreement that allows the owner of a MS/CV endorsed limited entry permit to withdraw the catcher vessel's obligation to a permitted mothership processor and to deliver to a different permitted mothership processor.

<u>Pacific halibut set aside</u> means an amount of Pacific halibut annually allocated to a permitted coop or the non-coop fishery and which is based on the allocation of Pacific whiting.

<u>Pacific whiting shoreside or shore-based fishery</u> means Pacific whiting shoreside vessels and Pacific whiting shoreside first receivers.

<u>Pacific whiting shoreside first receivers</u> means persons who receive, purchase, or take custody, control, or possession of Pacific whiting onshore directly from a Pacific whiting shoreside vessel.

<u>Pacific whiting shoreside vessel</u> means any vessel that fishes using midwater trawl gear to take, retain, possess and land 4,000 lb (1,814 kg) or more of Pacific whiting per fishing trip from the Pacific whiting shore-based sector allocation for delivery to a Pacific whiting shoreside first receiver during the primary season.

<u>Processor obligation</u> means an annual requirement for a MS/CV endorsed limited entry permit limited entry permit to deliver its catch to a particular mothership processor permit.

<u>Midwater whiting fishery</u> means a trip in which a vessel registered to a shore-based IFQ endorsed limited entry permit uses legal midwater groundfish trawl gear with a valid declaration for Limited entry midwater trawl, Pacific whiting IFQ, as specified at §660.13 (d)(5) during the dates what the midwater whiting season is open.

<u>Quota pounds</u> means the round weight of fish that must be used to cover total catch (landings and discards) in the shorebased IFQ Program. QP are issued annually to QS permit owners based on the amount of QS they own and the amount of fish allocated to the IFQ

fishery. QP have the same species/species group, area, and sector designations as the QS from which it was issued.

Quota share (QS) means a permit, the face amount of which is used as the basis for the annual calculation and allocation of a person's IFQ. QS is expressed as a percentage and is designated for the species/species group, area, and trawl sector to which it applies. Species for which QS will be issued for the Shorebased IFQ Program are listed at 660.XXX, Subpart D.

Vessel limits means the amount of quota pounds a vessel can hold, acquire, or use.

Vessel account means an account held by the vessel owner where QP are registered for use by a vessel in the Shorebased IFQ Program.

§ 660.112 Limited entry trawl fishery prohibitions.

§ 660.113 Recordkeeping and reporting.

§ 660.116 Trawl Fishery Observer requirements.

§ 660.120 Crossover provisions – Areas, Gears, Trawl Fisheries. [Reserved]

§ 660.130 Limited entry trawl fishery management measures.

§ 660.131 Pacific Whiting Fishery Management Measures.

§ 660.140 Shorebased IFQ Program.

(a) General. The IFQ Program applies to qualified participants in the Pacific Coast Groundfish fishery and includes a system of transferable QS for most groundfish species or species groups and trip limits or set-asides for the remaining groundfish species or species groups. The IFQ Program is subject to area restrictions (GCAs, RCAs, and EFHCAs) listed at 660.XXX. The shorebased IFQ fishery may be restricted or closed as a result of projected overages within the shorebased IFQ Program, the Mothership Coop Program, or the C/P Coop Program. As determined necessary by the Regional Administrator, area restrictions, season closures, or other measures will be used to prevent the trawl sector in aggregate or the individual trawl sectors (shorebased IFQ, Mothership Coop, or C/P Coop) from exceeding an OY, or formal allocation specified in the PCGFMP or regulation at § 660.XXX subpart XX.

(b) Participation requirements. [Reserved]

(1) QS Permit Owners [Reserved]

(2)   IFQ Vessels [Reserved]

(c) IFQ Species and Allocations.

(1) IFQ Species. IFQ species are those groundfish species for which QS will be issued. QS will carry designations for the species/species groups, area, and trawl sector to which it applies. QS and QP species groupings and area subdivisions will be those for which OYs are specified in the ABC/OY tables (XXXXXXX) and those for which there is an area-specific precautionary harvest policy. QS for remaining minor rockfish will be

aggregated for the shelf and slope depth strata (nearshore species are excluded as described at § 660.XXX). The following are the IFQ species:

IFQ Species	
ROUNDFISH	ROCKFISH
Lingcod	Pacific ocean perch
Pacific cod	Widow rockfish
Pacific whiting	Canary rockfish
Sablefish north of 36° N. lat.	Chilipepper rockfish
Sablefish south of 36° N. lat.	Bocaccio
FLATFISH	Splitnose rockfish
Dover sole	Yellowtail rockfish
English sole	Shortspine thornyhead north of 34° 27' N. lat.
Petrale sole	Shortspine thornyhead south of 34° 27' N. lat.
Arrowtooth flounder	Longspine thornyhead north of 34° 27' N. lat.
Starry flounder	Cowcod
Other Flatfish stock complex	Darkblotched
	Yelloweye
	Minor Rockfish North slope species complex
	Minor Rockfish North shelf species complex
	Minor Rockfish South slope species complex
	Minor Rockfish South shelf species complex

(2) IFQ Program Allocations. [Reserved]

(d) QS permits and QS accounts.

(1) General. In order to obtain and control QS, a person must apply for a QS permit. NMFS will determine if the applicant is eligible to acquire QS and complies with the accumulation limits found at §660.XXX(x), Subpart D. For those persons that are found to be eligible for a QS permit, NMFS will establish a QS account. QP will be issued annually at the start of the year to a QS account based on the percent of QS registered to the account. QS owners must transfer their QP from their QS account to a vessel account in order for those QP to be fished.

(2) Eligibility and registration. [Reserved]

(3) Renewal, change of permit ownership, and transfer. [Reserved]

(4) Accumulation limits.

(i) QS control limits are an accumulation limit and are the amount of QS that a person, individually or collectively, may control. These amounts are as follows:

Species Category	*QS Control Limit*
Nonwhiting Groundfish Species	*2.7%*
Lingcod - coastwide	*2.5%*
Pacific Cod	*12.0%*
Pacific whiting (shoreside)	*10.0%*
Sablefish	
N. of 36° (Monterey north)	*3.0%*
S. of 36° (Conception area)	*10.0%*
PACIFIC OCEAN PERCH	*4.0%*
*WIDOW ROCKFISH **	*5.1%*
CANARY ROCKFISH	*4.4%*
Chilipepper Rockfish	*10.0%*
BOCACCIO	*13.2%*
Splitnose Rockfish	*10.0%*
Yellowtail Rockfish	*5.0%*
Shortspine Thornyhead	
N. of 34°27'	*6.0%*
S. of 34°27'	*6.0%*
Longspine Thornyhead	
N. of 34°27'	*6.0%*
COWCOD	*17.7%*
DARKBLOTCHED	*4.5%*
YELLOWEYE	*5.7%*
Minor Rockfish North	
Shelf Species	*5.0%*
Slope Species	*5.0%*
Minor Rockfish South	
Shelf Species	*9.0%*
Slope Species	*6.0%*
Dover sole	*2.6%*
English Sole	*5.0%*
Petrale Sole	*3.0%*
Arrowtooth Flounder	*10.0%*
Starry Flounder	*10.0%*
Other Flatfish	*10.0%*
Other Fish	*5.0%*
Pacific Halibut	*5.4%*

(ii) Individual and collective rule. The QS that counts toward a person's accumulation limit will include:

(A) the QS owned by them, and

(B) a portion of the QS owned by an entity in which that person has an interest, where the person's share of interest in that entity will determine the portion of that entity's QS that counts toward the person's limit.

(iii) Control means, but is not limited to the following:

(A) the person has the right to direct, or does direct, the business of the entity to which the QS are registered;

(B) the person has the right to direct, or does direct, the delivery of groundfish harvested under a permit registered to a different person;

(C) the person has the right in the ordinary course of business to limit the actions of or replace, or does limit or replace, the chief executive officer, a majority of the board of directors, any general partner, or any person serving in a management capacity of the entity to which the QS is registered;

(D) the person has the right to direct, or does direct, the transfer of QS;

(E) the person, through loan covenants, has the right to restrict, or does restrict, the day to day business activities and management policies of the entity to which the QS is registered;

(F) the person has the right to control, or does control, the management of, or to be a controlling factor in, the entity to which the QS is registered;

(G) the person has the right to cause, or does cause, the sale of QS;

(H) the person absorbs all of the costs and normal business risks associated with ownership and operation of the entity to which the QS is registered; and

(I) the person has the ability through any means whatsoever to control the entity to which QS is registered.

(iv) <u>Divestiture</u>. An adjustment period will be provided for QS permit owners that are found to exceed the accumulation limits. QS will be issued for amounts in excess of accumulation limits only for holders of limited entry permits transferred by November 8, 2008, if such transfers have been registered with NMFS by November 30, 2008. The holder of any permit transferred after that time will be eligible to receive an initial allocation for that permit of only those QS that are within the accumulation limits. Anyone who qualifies for an initial allocation of QS in excess of the accumulation limits will be allowed to receive that allocation but must divest themselves of the excess QS during years three and four of the IFQ program. Holders of QS in excess of the control limits may receive and use the QP associated with that excess, up to the time their divestiture is completed. At the end of year 4 of the IFQ program, any QS held by a person in excess of the accumulation limits in place at the time of the initial issuance of QS will be revoked and redistributed to the remainder of the of the QS holders in proportion to the QS holdings. At the start of the 5th year of the IFQ Program, QP will not be issued for QS held in excess of the accumulation limits. No compensation will be due for any revoked shares.

(5) <u>Appeals</u>. [Reserved]

(6) Fees. The Regional Administrator is authorized to charge fees for administrative costs associated with the issuance of a QS permit consistent with the provisions given at §660.25(f), Subpart C.

(7) [Reserved]

(8) Application Requirements and Initial Issuance for QS Permit and QS.

(i) Eligible Applicant.

(A) For harvesters, only an owner of a valid trawl limited entry permit is eligible to apply to NMFS for an initial issuance of a QS permit and its associated QS amount. NMFS will not accept an application from a person that does not meet the eligibility requirements. NMFS will not recognize any other person as permit owner other than the person listed as permit owner in NMFS permit database at the time of receipt of the application.

(B) For shoreside processing entities, only those shoreside whiting first receivers recorded in the database that was extracted from PacFIN by NMFS on [INSERT DATE PROPOSED RULE PUBLISHED IN Federal Register], as having received landings of 1 mt or more of whiting from whiting trips in each of any 2 years from 1998 through 2004 are eligible to apply for an initial issuance of whiting QS. For the purposes of initial issuance of whiting QS, the following further define eligible shoreside processor applicants:

(1) a whiting trip is a fishing trip where greater than or equal to 50 percent by weight of the landing of groundfish is whiting as recorded in the database that was extracted from PacFIN by NMFS on [INSERT DATE PROPOSED RULE PUBLISHED IN Federal Register].

(2) a shoreside processor is an operation, working on US soil, that takes delivery of trawl caught groundfish that has not been processed; and that thereafter engages that fish in shoreside processing. Entities that received fish that have not undergone at-sea processing or shoreside processing and sell that fish directly to consumers shall not be considered a processor for purposes of QS allocations. Shoreside processing is defined as either of the following:

(i) Any activity that takes place shoreside; and that involves: cutting groundfish into smaller portions; or freezing, cooking, smoking, drying groundfish; or packaging that groundfish for resale into 100 pound units or smaller for sale or distribution into a wholesale or retail market.

(ii) The purchase and redistribution into a wholesale or retail market of live groundfish from a harvesting vessel.

(ii) Qualifying Criteria for QS.

(A) Non-whiting, non-overfished species QS. QS for non-whiting, non-overfished species will be calculated based on a limited entry trawl-endorsed permit's relative landings history from 1994 through 2003, dropping the 3 worst years of landings. The calculation will be based on the following:

(1) State landing receipts (fish tickets) as recorded in the database that was extracted from PacFIN by NMFS on [INSERT DATE PROPOSED RULE PUBLISHED IN Federal Register], for non-whiting landings (that is, for trips on which whiting is less than 50% of the total landings) will be used by NMFS to calculate landings for each limited entry trawl-endorsed permit's shoreside deliveries.

(2) Relative landings history will be calculated for each qualifying year by dividing the total catch of each non-whiting, non-overfished IFQ species for the vessel(s) registered to the permit by the sum of the total catch of that IFQ groundfish species from all vessel(s) meeting the qualifying criteria for a QS permit.

(3) The 3 worst years of landings means the 3 years with the lowest landings by weight for a specific non-whiting, non-overfished IFQ species.

(4) The current limited entry permit's landings history includes the landings history of any permits that have been previously combined with that permit. If two or more limited entry trawl permits have been simultaneously registered to the same vessel, NMFS will split the landing history evenly between both permits.

(5) History of illegal landings will not count toward the allocation of QS. Any landings made under an EFP in excess of the cumulative limits in place for the non-EFP fishery will not count towards the allocation of QS.

(6) Landings history from Federal limited entry groundfish permits that were retired through the Federal buyback program will be divided equally among qualifying QS permits, as described at paragraph (D).

(B) Whiting QS.

(1) For harvesters, whiting QS will be calculated based on a limited entry trawl-endorsed permit's relative landings history from 1994 through 2003, dropping the 3 worst years of landings. State landing receipts (fish tickets) as extracted by NMFS from PacFIN for whiting landings will be used to calculate landings for each limited entry trawl-endorsed permit's shoreside deliveries. The current limited entry permit's landings history includes the landings history of any permits that have been previously combined with that permit. If two or more limited entry trawl permits have been simultaneously registered to the same vessel, NMFS will split the landing history evenly between both permits. History of illegal landings will not count toward the allocation of QS. Any landings made under an EFP in excess of the cumulative limits in place for the non-EFP fishery will not count towards the allocation of QS. Landings history from the Federal limited entry trawl permits that were retired through the Federal buyback program will be divided equally among qualifying QS permits, as described at paragraph (D).

(2) For shoreside processors, whiting QS will be calculated based on a processor's relative landings history from 1994 through 2003, dropping the 2 worst years of landings. State landing receipts (fish tickets) as extracted by NMFS from PacFIN for whiting trips will be used to make the calculation. For purposes of making an initial issuance of whiting QS to a shoreside processor, NMFS will attribute landing history to the first receiver/processor reported on the landing receipt (the entity responsible for filling out the state fish ticket) as recorded in the database that was extracted from PacFIN by NMFS on [INSERT DATE PROPOSED RULE PUBLISHED IN Federal Register], except history may be reassigned to a shoreside processor/first receiver not on the landings receipt if both parties agree or if, through the initial issuance and appeals process, NMFS determines that the first receiver that filed the fish ticket is not, in fact, the entity that first processed the fish.

(C) Overfished Species QS. QS for overfished species will be calculated for each permit using a formula of target species QS (i.e., non-overfished species QS), logbook data, and WCGOP data. NMFS will apply the fleetwide average bycatch rates from the WCGOP to each permit's depth and latitude distributions from state logbooks and to each permit's target species QS allocations. Fleetwide average bycatch rates for latitudinal areas are divided shoreward and seaward of the RCA and are based on WCGOP data from 2003 through 2006. If there are no state logbooks associated with a specific permit for a given year, then fleetwide averages will be used.

(1) Minimum QP Allocation for Canary Rockfish. For recipients of non-whiting QS that are issued less than 50 lb (QP) of canary rockfish, those recipients will receive additional canary rockfish QP in their QS account to bring their QP issued up to 50 lb. These additional canary rockfish QP will come from the 10 percent non-whiting QS that is reserved for the Adaptive Management Program. QS permit owners may not continue to receive this minimum canary rockfish QP after the first two years of the trawl rationalization program.

(2) [Reserved]

(D) Equal Division of Buyback Permit History. NMFS will make an equal division of the pool of non-overfished species QS from the Federal limited entry trawl permits that were retired through the Federal buyback program (i.e., buyback permit) (70 FR 45695, August 8, 2005) among all qualifying QS Permits for all QS species/species groups or areas. The QS pool associated with the buyback permits will be the buyback permit history as a percent of the total fleet history for the allocation period. The calculation will be based on total absolute pounds with no other adjustments and no dropped years.

(iii) Prequalified Application. A "prequalified application" is a partially pre-filled application where NMFS has preliminarily determined the landings history that may qualify the applicant for an initial issuance of QS.

(A) For harvesters, NMFS will mail a prequalified application to all current trawl limited entry permit owners, as listed in NMFS permit database, who are found to qualify for QS. NMFS will mail the application by certified mail to the current address of record in the NMFS permit database. The application will contain the basis of NMFS's calculation of their QS for each species/species group or area based on the database that was extracted from PacFIN by NMFS on [INSERT DATE PROPOSED RULE PUBLISHED IN Federal Register].

(B) For shoreside first receivers/processors, NMFS will mail a prequalified application to all shoreside processors who are found to qualify from PacFIN data for an initial issuance of whiting QS. NMFS will mail the application by certified mail to qualified shoreside processors to the current address of record given by the state in which entity is registered. For all qualified shoreside processors who meet the eligibility requirement at paragraph XXX, the application will provide the basis of NMFS's calculation of the initial issuance of whiting QS based on the database that was extracted from PacFIN by NMFS on [INSERT DATE PROPOSED RULE PUBLISHED IN Federal Register].

(iv) Applicants Not Prequalified. If a current permit owner of a trawl-endorsed limited entry permit or a whiting shoreside processor does not receive a prequalified application, and such persons believe they qualify for an initial issuance of QS, the person must contact NMFS in writing prior to the application deadline. The person must provide valid PacFIN data that substantiates that the person may be qualified for an initial issuance of QS. If NMFS finds that the person may qualify for QS, NMFS will allow the person to make an application. If the permit owner or shoreside processor fails to contact NMFS by the application deadline date, they forgo the opportunity to receive consideration for an initial issuance of QS.

(v) Corrections to the Application. If the applicant disagrees with the basis of NMFS' determination in the prequalified application, the applicant must provide in writing which parts of NMFS' determination are not accurate, and must include additional information to substantiate the correction. The corrections must be provided with the completed application form by the application deadline date. Corrections may only be submitted for the following:

(A) errors in NMFS' extraction, aggregation, or expansion of data, including:

(1) errors in NMFS extraction of landings data from PacFIN;

(2) errors in NMFS extraction of state logbook data from PacFIN;

(3) errors in the permit owner, permit combinations, or vessel registration as listed in NMFS permit database.

(B) Reassignment of whiting landings history for shoreside first receivers. For shoreside first receivers of whiting, the landing history may be reassigned to another person. In order for landing history to be reassigned to another person an authorized representative for the shoreside first receiver given on the state landing ticket must submit by the application deadline date for initial issuance of QS a letter which requests that the whiting landings history during the qualifying

years be conveyed to another person. The letter must be signed by an authorized representative of the shoreside first receiver named on the state landing tickets and signed by an authorized representative of the person the whiting landing history will be reassigned to. The letter must give the legal name of the person, business address and the name and phone number of the person receiving the whiting landing history. If a valid contract agreement exists that reassigns the landing history, that document must be provided to NMFS.

(vi) Submission of the Application and Application Deadline.

(A) Submission of the Application. Submission of the complete, certified application includes, but is not limited to, the following:

(1) The applicant is required to sign and notarize the application.

(2) The applicant must certify that they qualify to own QS and indicate whether they agree or disagree with NMFS' determination of initial issuance of QS provided in the application.

(3) The applicant is required to provide a complete Trawl Identification of Ownership Interest Form.

(4) Business entities are required to submit a corporate resolution or any other credible documentation as proof that the representative of the entity is authorized to act on behalf of the entity; and

(5) NMFS may request additional information of the applicant as necessary to make an IAD.

(B) Application Deadline. A complete, certified application must be postmarked no later than [insert date 60 calendar days after publication of the final rule in the FEDERAL REGISTER]. NMFS will not accept or review any applications received after the application deadline. There are no hardship provisions for this deadline.

(vii) Permit transfer during application period. At any time during the application process for initial issuance of QS and until a final decision is made by the Regional Administrator on behalf of the Secretary of Commerce, a permit owner cannot transfer ownership of the permit until the final decision for that application has been made.

(viii) Initial Administrative Determination (IAD). NMFS will issue an IAD for all complete, certified applications received by the application deadline date. If NMFS approves an application for initial issuance of QS, the applicant will receive a QS Permit specifying the amounts of QS the applicant has qualified for and will be registered to a QS Account. If NMFS disapproves an applicant's request to correct the application, the IAD will provide the reasons NMFS did not accept the corrections. As part of the IAD, NMFS will indicate if the QS Permit owner has QS in amounts that exceed the accumulation limits and are subject to divestiture provisions given at XXXXXX. If the applicant does not appeal the IAD within 30 calendar days of the date on the IAD, the IAD becomes the final decision of the Regional Administrator acting on behalf of the Secretary of Commerce.

(ix) Appeals. For QS permits issued under this section, the appeals process and timelines are specified at § 660.25(g), Subpart C. For the initial issuance of QS and the

QS permits, the basis for appeal are described in paragraph (d)(8)(v). Items not subject to appeal include, but are not limited to, the following:

(A) the accuracy of permit landings data or shoreside first receiver landings data from PacFIN;

(B) the formula used to calculate initial issuance of QS;

(C) the allocation of IFQ species to the shoreside trawl fishery.

(e) Vessel accounts. [Reserved]

(f) First Receiver Site License. [Reserved]

(g) Retention requirements (whiting and non-whiting vessels). [Reserved]

(h) Observer Requirements. [Reserved]

(i) [Reserved]

(j) Shoreside Catch Monitor requirements for IFQ first receivers. [Reserved]

(k) Catch weighing requirements. [Reserved]

(l) Gear Switching. [Reserved]

(m) Adaptive Management Program. [Reserved]

§ 660.150 Mothership (MS) Coop Program.

(a) General. The MS Coop Program is a limited access program that applies to eligible harvesters and processors in the mothership sector of the Pacific whiting at-sea trawl fishery. Eligible harvesters and processors, including MS permitted coop and non-coop fishery participants, must meet the requirements set forth in this section of the Pacific Coast groundfish regulations. In addition to the requirements of this section, the MS coop program is subject to the following groundfish regulations:

(1) Pacific whiting seasons §660.131, Subpart D

(2) Area restrictions specified for midwater trawl gear used to harvest Pacific whiting fishery specified at §660.131, Subpart D for GCAs, RCAs, Salmon Conservation Zones, BRAs, and EFHCAs.

(3) Regulations set out in the following sections of Subpart C: §660.11 Definitions, §660.XX Prohibitions, § 660.13 Recordkeeping and reporting, §660.14 VMS requirements, §660.15 Equipment requirements, §660.16 Groundfish Observer Program, §660.20 Vessel and gear identification, and §660.XXXAdd others plus the Pacific whiting measures at currently at 660.323XXX.

(4) Regulations set out in the following sections of Subpart D: §660.111 Trawl fishery definitions, §660.112 Trawl fishery prohibitions, §660.113 Trawl fishery recordkeeping and reporting, §660.116 Trawl fishery observer requirements, and §660.130 Limited entry trawl fishery management measures.

(5) The MS Coop program fishery may be restricted or closed as a result of projected overages within the MS Coop Program, the C/P Coop Program, or the shorebased IFQ Program. As determined necessary by the Regional Administrator, area restrictions, season closures, or other measures will be used to prevent the trawl sectors in aggregate or the individual sector (shorebased IFQ, MS Coop, or C/P Coop)) from exceeding an OY, or formal allocation specified in the PCGFMP or regulation at § 660.XXX subpart XX.

(b) Participation requirements. [Reserved]

(1) Mothership vessels. [Reserved]

(2) Mothership Catcher Vessels. [Reserved]

(3) MS Coop Formation and Failure. [Reserved]

(c) MS Coop Program Species and Allocations.

(1) MS Coop Program Species. MS Coop Program Species are as follows:

(i) Species with formal allocations to the MS Program: Pacific whiting, canary rockfish, darkblotched rockfish, Pacific Ocean perch, widow rockfish;

(ii) Species with set-asides for the MS and C/P Programs combined, as described in Table XXset-aside tableXX , Subpart C.

(2) Annual Mothership Sector sub-allocations. [Reserved]

(i) Mothership catcher vessel catch history assignments. [Reserved]

(ii) Annual Coop Allocations. [Reserved]

(iii) Annual Non-Coop Allocation. [Reserved]

(3) Reaching an allocation or sub-allocation. [Reserved]

(4) Non-whiting groundfish species reapportionment. [Reserved]

(5) Announcements. [Reserved]

(6) Redistribution of Annual Allocation. [Reserved]

(7) Processor obligation. [Reserved]

(8) Allocation accumulation limits [Reserved]

(d) MS Coop Permit and Agreement. [Reserved]

(e) Inter-coop Agreement. [Reserved]

(f) Mothership (MS) Permit.

(1) General. After January 1, 2011, only vessels registered to a MS permit can receive an at-sea whiting delivery in the mothership whiting sector. A vessel registered to MS permit may participate in a Mothership coop (subject to coop permit requirements and provisions of a private cooperative agreement) and/or may participate in the non-coop fishery at the same time or during the same year.

(i) Eligibility to Own or Hold a MS Permit. The only person that can acquire a MS permit is 1) a United States citizen; 2) a permanent resident alien; or 3) a corporation, partnership or other entity established under the laws of the United States or any State.

(ii) Vessel Size Endorsement. A MS permit does not have a vessel size endorsement assigned to it. The endorsement provisions at 660.334(c) do not apply to a MS permit.

(iii) Restriction on C/P Vessel Operating as MS. Restrictions on a vessel registered to C/P endorsed permit operating as a mothership are specified at § 660.XXC/P sxnX, Subpart D.

(2) Renewal, Change of permit ownership, or vessel registration. [Reserved]

(3) Accumulation Limit.

(i) MS Permit Usage Limit. No individual or entity who owns MS permit(s) may register the MS permit(s) to vessels that cumulatively process more than 45 percent of the annual mothership sector whiting allocation. For purposes of

determining accumulation limits, any person or entity subject to this limit must submit a complete trawl ownership interest form as part of annual renewal for the MS permit as provided for at 660.XXXXX. Also, an ownership interest form will be required when a new permit owner obtains a MS permit as part of a transfer request. Accumulation limits will be determined by calculating the percentage of ownership interest a person has in any MP permit. Ownership interest will subject to the individual and collective rule.

(ii) Individual and collective rule. The ownership that counts toward a person's accumulation limit will include:

(A) the MS permit owned by them, and

(B) a portion of the MS permit owned by an entity in which that person has an interest, where the person's share of interest in that entity will determine the portion of that entity's ownership that counts toward the person's limit.

(iii) Control means, but is not limited to the following:

(A) the person has the right to direct, or does direct, the business of the entity to which the permit is registered;

(B) the person has the right to direct, or does direct, the delivery of groundfish harvested under a permit registered to a different person;

(C) the person has the right in the ordinary course of business to limit the actions of or replace, or does limit or replace, the chief executive officer, a majority of the board of directors, any general partner, or any person serving in a management capacity of the entity to which the permit is registered;

(D) the person has the right to direct, or does direct, the transfer of the permit;

(E) the person, through loan covenants, has the right to restrict, or does restrict, the day to day business activities and management policies of the entity to which the permit is registered;

(F) the person has the right to control, or does control, the management of, or to be a controlling factor in, the entity to which the permit is registered;

(G) the person has the right to cause, or does cause, the sale of the permit;

(H) the person absorbs all of the costs and normal business risks associated with ownership and operation of the entity to which the permit is registered; and

(I) the person has the ability through any means whatsoever to control the entity to which permit is registered.

(4) Appeals. [Reserved]

(5) Fees. The Regional Administrator is authorized to charge fees for administrative costs associated with the issuance of a MS permit consistent with the provisions given at §660.25(f), Subpart C.

(6) Application Requirements and Initial Issuance for MS Permit.

(i) Eligible Applicant. An owner of a vessel that processed whiting in the mothership sector in the qualifying years may apply for a MS permit, except that in the case of bareboat charterers, the charterer of the bareboat may apply.

(ii) Qualifying Criteria for MS Permit. In order to qualify for a MS permit, a mothership vessel must have processed at least 1,000 mt of whiting in each of two years during the qualifying years of 1997 through 2003.

(iii) Prequalified Application. A "prequalified application" is a partially pre-filled application where NMFS has preliminarily determined the processing history that may qualify the applicant for MS permit. NMFS will mail a prequalified application to the owner of the vessel or charterer of the bareboat who are found to qualify for the MS permit. NMFS will mail the application by certified mail to the current address of record in the NMFS permit database or in the NORPAC database. The application will contain the basis of NMFS's determination that the mothership vessel meets the qualifying criteria for the MS permit based on Pacific Whiting observer data recorded in the database that was extracted from NORPAC by NMFS on [INSERT DATE PROPOSED RULE PUBLISHED IN Federal Register].

(iv) Applicants Not Prequalified. Owners of vessels that do not receive an prequalified application from NMFS, and believe they are qualified for a MS permit, must contact NMFS in writing by the application deadline date requesting clarification of their eligibility status and providing credible documentation to substantiate their claim. Credible documentation may include official NMFS observer records that demonstrate the vessel met the qualifying criteria given in paragraph (b) above. If NMFS finds that the person may qualify for a MS permit, NMFS will allow that person to make an application. If the person fails to contact NMFS in writing by the application deadline date, the person forgoes the opportunity to receive consideration for initial issuance of a MS permit.

(v) Corrections to the Application. If the applicant disagrees with the basis of NMFS' determination in the prequalified application, the applicant must provide in writing which parts of NMFS' determination are not accurate, and must include additional information to substantiate the correction. The corrections must be provided with the completed application form by the application deadline date. Corrections may only be submitted for errors in NMFS' extraction, aggregation, or expansion of the database that was extracted from NORPAC by NMFS on [INSERT DATE PROPOSED RULE PUBLISHED IN Federal Register] or errors in NMFS permit database.

(vi) Submission of the Application and Application Deadline.

(A) Submission of the Application. Submission of the complete, certified application includes, but is not limited to, the following:

(1) The applicant is required to sign and notarize the application.

(2) The applicant must certify that they qualify to own a MS permit and indicate whether they agree or disagree with NMFS' determination on initial issuance of the MS permit provided in the application.

(3) The applicant is required to provide a complete Trawl Identification of Ownership Interest Form.

(4) Business entities are required to submit a corporate resolution or any other credible documentation as proof that the representative of the entity is authorized to act on behalf of the entity;

(5) A bareboat charterer must provide credible evidence that demonstrates it was chartering the mothership vessel under a private contract during the qualifying years; and

(6) NMFS may request additional information of the applicant as necessary to make an IAD.

(B) Application Deadline. A complete, certified application must be postmarked no later than [insert date 60 calendar days after publication of the final rule in the FEDERAL REGISTER] [XX or February 1, 2011 XX]. NMFS will not accept or review any applications received after the application deadline. There are no hardship provisions for this deadline.

(vii) Initial Administrative Determination. NMFS will issue an IAD for all complete, certified applications received by the application deadline date. If NMFS approves an application, the applicant will receive a MS Permit. If NMFS disapproves an applicant's request to correct the application, the IAD will provide the reasons NMFS did not accept the corrections. If the applicant does not appeal the IAD within 30 calendar days of the date on the IAD, the IAD becomes the final decision of the Regional Administrator acting on behalf of the Secretary of Commerce.

(viii) Appeals. For a MS permit issued under this section, the appeals process and timelines are specified at § 660.25(g), Subpart C. For the initial issuance of a MS permit, the basis for appeal is described in paragraph (f)(5)(v). Items not subject to appeal include, but are not limited to, the following:

(A) the formula used to calculate initial issuance of a MS permit;

(B) the allocation of MS Coop species to the MS Coop fishery.

(g) Mothership catcher vessel (MS/CV) endorsed permit.

(1) General. NMFS will issue a MS/CV endorsement and catch history assignment on qualified limited entry "A" endorsed trawl permits. Within the MS whiting fishery, vessels registered to a MS/CV endorsed permit may participate in a MS coop or in the non-coop fishery.

(i) Catch History Assignment. A catch history assignment is permanently assigned to MS/CV endorsed permit. The catch history assignment is based the catch history in the MS whiting sector during qualifying years as described below. The catch history assignment is expressed as percentage of whiting of the total

MS whiting sector allocation. The catch history allocation accrues to the coop that the MS/CV permit is tied to through private agreement, or will be directed to the non-coop fishery if the MS/CV endorsed permit is not participating in the coop fishery.

(ii) MS/CV Endorsement Not Severable from Permit. A MS/CV endorsement is permanently affixed to the original qualifying limited entry permit, and cannot be transferred separately from the original qualifying limited entry permit.

(iii) Vessel Size Endorsement. All vessels registered to a MS/CV limited entry permit are be subject to vessel size endorsement regulations given at 50 CFR 660.334 (c)(1)(i) and (c)(2)(ii)

(iv) Renewal. In addition to the requirements at XXXX [LE permit requirements] the owner of a MS/CV endorsed permit must identify their intent to participate in the non coop or coop fishery for the following year.

(v) Restrictions on Processing by MS/CV endorsed Permit. A vessel registered to MS/CV endorsed permit in a given year shall not engage in processing of whiting during that year.

(2) Change of Permit owner, vessel registration, vessel owner, or combination. [Reserved]

(3) Accumulation Limits.

(i) MS/CV Permit Ownership Limit. No individual or entity shall own MS/CV permits for which the collective whiting allocation total is greater than 20 percent. For purposes of determining accumulation limits, NMFS requires that permit owners submit a complete trawl ownership interest form for the permit owner as part of annual renewal of a MS/CV endorsed permit. Also, an ownership interest form will be required when a new permit owner obtains a MS/CV permit as part of a transfer request. Accumulation limits will be determined by calculating the percentage of ownership interest a person has in any MS/CV permit and the amount of the whiting catch history assignment given on the permit. Ownership interest will subject to the individual and collective rule.

(A) Individual and collective rule. The whiting catch history assignment that counts toward a person's accumulation limit will include:

(1) the catch history assignment owned by them, and

(2) a portion of the catch history assignment owned by an entity in which that person has an interest, where the person's share of interest in that entity will determine the portion of that entity's catch history assignment that counts toward the person's limit.

(B) Control means, but is not limited to the following:

(1) the person has the right to direct, or does direct, the business of the entity to which the permit and catch history assignment are registered;

(2) the person has the right to direct, or does direct, the delivery of groundfish harvested under a permit registered to a different person;

(<u>3</u>) the person has the right in the ordinary course of business to limit the actions of or replace, or does limit or replace, the chief executive officer, a majority of the board of directors, any general partner, or any person serving in a management capacity of the entity to which the permit and catch history assignment are registered;

(<u>4</u>) the person has the right to direct, or does direct, the transfer of the permit;

(<u>5</u>) the person, through loan covenants, has the right to restrict, or does restrict, the day to day business activities and management policies of the entity to which the permit and catch history assignment are registered;

(<u>6</u>) the person has the right to control, or does control, the management of, or to be a controlling factor in, the entity to which the permit and catch history assignment are registered;

(<u>7</u>) the person has the right to cause, or does cause, the sale of the permit and associated catch history assignment;

(<u>8</u>) the person absorbs all of the costs and normal business risks associated with ownership and operation of the entity to which the permit and associated catch history assignment are registered; and

(<u>9</u>) the person has the ability through any means whatsoever to control the entity to which permit and associated catch history assignment are registered.

(C) <u>Divestiture</u>. If an individual or entity is found to exceed the ownership limit, NMFS will notify the applicant so that the applicant may comply with the MS/CV permit ownership limit requirement prior to issuance of the MS/CV endorsement.

(ii) <u>Catcher Vessel Usage Limit</u>. A vessel registered to MS/CV endorsed permit or a trawl limited entry permit shall not catch more than 30 percent of the mothership sector's whiting allocation.

(4) <u>Appeals</u>. [Reserved]

(5) <u>Fees</u>. The Regional Administrator is authorized to charge a fee for administrative costs associated with the issuance of a MS/CV endorsed permit as provided for at § 660.25(f), Subpart C.

(6) <u>Application Requirements and Initial Issuance for MS/CV Endorsement</u>.

(i) <u>Eligible Applicant</u>. Only a current owner of a trawl limited entry permit with a history of whiting deliveries in the MS whiting sector can apply for a MS/CV endorsement. Any past catch history associated with current trawl permit accrues to the current permit owner. NMFS will not accept an application from a person that does not meet the eligibility requirements. NMFS will not recognize any other person as permit owner other than the person listed as permit owner in NMFS permit database at the time of receipt of the application.

(ii) <u>Qualifying Criteria for MS/CV Endorsement</u>. In order to qualify for a MS/CV endorsement, vessels registered to a valid trawl endorsed limited entry

permit must have caught and delivered at least 500 mt of whiting to motherships between 1994 through 2003. The calculation will be based on the following:

(A) The catch history will include any deliveries of whiting by vessels registered to limited entry trawl endorsed permits that were subsequently combined to generate the current permit. If two or more limited entry trawl permits have been simultaneously registered to the same vessel, NMFS will split the landing history evenly between both permits.

(B) History of illegal landings will not count.

(C) Landings history from Federal limited entry groundfish permits that were retired through the Federal buyback program will not count.

(iii) Qualifying Criteria for Catch History Assignment. A catch history assignment will be specified as a percent on the MS/CV endorsed permit. The whiting catch history assignment calculation for the MS/CV endorsed permit will be based on the whiting catch history of vessels registered to the permit in each year from 1994 through 2003, dropping two years. The calculation will be based on the following:

(A) Pacific whiting observer data as recorded in the database that was extracted from NORPAC by NMFS on [INSERT DATE PROPOSED RULE PUBLISHED IN Federal Register].

(B) Relative pounds will be calculated for each qualifying year by dividing the total catch of Pacific whiting for the vessel(s) registered to the permit by the sum of the total catch from all Pacific whiting vessel(s) meeting the qualifying criteria for a MS/CV endorsed limited entry permit.

(C) The eight years with the highest relative pounds of Pacific whiting will be selected and added together to generate the permit's official catch history. The catch history amount associated with a permit will include the catch history of all permits that were combined into the current permit to create a larger vessel size endorsement.

(D) The catch history will include any deliveries of whiting by vessels registered to limited entry trawl endorsed permits that were subsequently combined to generate the current permit. If two or more limited entry trawl permits have been simultaneously registered to the same vessel, NMFS will split the landing history evenly between both permits.

(E) History of illegal landings will not count.

(F) Landings history from Federal limited entry groundfish permits that were retired through the Federal buyback program will not count.

(iv) Prequalified Application. A "prequalified application" is a partially pre-filled application where NMFS has preliminarily determined the landings history that may qualify the applicant for MS/CV endorsement and associated catch history assignment. NMFS will mail a prequalified application to the owner of the vessel who is found to qualify for the MS/CV endorsement and associated catch

history assignment. NMFS will mail the application by certified mail to the current address of record in the NMFS permit database. The application will contain the basis of NMFS's determination that the vessel meets the qualifying criteria for the MS/CV endorsement and associated catch history assignment based on Pacific Whiting observer data recorded in the database that was extracted from NORPAC by NMFS on [INSERT DATE PROPOSED RULE PUBLISHED IN Federal Register].

(v) Applicants Not Prequalified. If a current owner of a limited entry trawl endorsed permit does not receive a prequalified application, and the permit owner believes the permit's catch history qualifies for a MS/CV endorsement and catch history assignment, the permit owner must contact NMFS in writing by the application deadline date requesting clarification of their eligibility status and catch history assignment and provide credible documentation to substantiate their claim. Credible documentation may include official NMFS observer records that demonstrate the vessel met the qualifying criteria given in paragraphs (ii) and (iii) above. If NMFS finds that the permit owner may qualify for a MS/CV endorsement and catch history assignment, NMFS will allow the permit owner to make an application. If the permit owner fails to contact NMFS in writing by the application deadline date, the person forgoes the opportunity to receive consideration for a MS/CV endorsement and catch history assignment.

(vi) Corrections to the Application. If the applicant disagrees with the basis of NMFS' determination in the prequalified application, the applicant must provide in writing which parts of NMFS' determination are not accurate, and must include additional information to substantiate the correction. The corrections must be provided with the completed application form by the application deadline date. Corrections may only be submitted for errors in NMFS' extraction, aggregation, or expansion of the database that was extracted from NORPAC by NMFS on [INSERT DATE PROPOSED RULE PUBLISHED IN Federal Register] or errors in NMFS permit database.

(vii) Submission of the Application and Application Deadline.

(A) Submission of the Application. Submission of the complete, certified application includes, but is not limited to, the following:

(1) The applicant is required to sign and notarize the application.

(2) The applicant must certify that they qualify to own a MS/CV endorsed permit and indicate whether they agree or disagree with NMFS' determination on initial issuance of the MS/CV endorsed permit and catch history assignment provided in the application.

(3) The applicant is required to provide a complete Trawl Identification of Ownership Interest Form.

(4) Business entities are required to submit a corporate resolution or any other credible documentation as proof that the

representative of the entity is authorized to act on behalf of the entity;

(5) NMFS may request additional information of the applicant as necessary to make an IAD.

(B) Application Deadline. A complete, certified application must be postmarked no later than [insert date 60 calendar days after publication of the final rule in the FEDERAL REGISTER]. NMFS will not accept or review any applications received after the application deadline. There are no hardship provisions for this deadline.

(viii) Initial Administrative Determination. NMFS will issue an IAD for all complete, certified applications received by the application deadline date. If NMFS approves the application, the applicant will receive a MS/CV endorsed limited entry permit and associated whiting catch history assignment. If NMFS disapproves an applicant's request to correct the application, the IAD will provide the reasons NMFS did not accept the corrections. If known at the time of the IAD, NMFS will indicate if the MS/CV endorsed permit owner has ownership interest in catch history assignments that exceed the accumulation limits and are subject to divestiture provisions given at XXXXXX. If the applicant does not appeal the IAD within 30 calendar days of the date on the IAD, the IAD becomes the final decision of the Regional Administrator acting on behalf of the Secretary of Commerce.

(ix) Appeals. For a MS/CV endorsed permit and associated catch history assignment issued under this section, the appeals process and timelines are specified at § 660.25(g), Subpart C. For the initial issuance of a MS/CV endorsed permit and associated catch history assignment, the basis for appeal is described in paragraph (g)(6)(vi). Items not subject to appeal include, but are not limited to, the following:

(A) the formulas used to calculate initial issuance of a MS/CV endorsement and associated catch history assignment;

(B) the allocation of MS Coop species to the MS Coop fishery.

(h) Retention requirements. [Reserved]

(i) Observer Requirements. [Reserved]

(j) [Reserved.]

(k) Catch weighing requirements. [Reserved]

§ 660.160 Catcher-Processor (C/P) Coop Program

(a) General. The C/P Coop Program is a limited access program that applies to vessels in the C/P sector of the Pacific whiting at-sea trawl fishery and is a single voluntary coop. Eligible harvesters and processors must meet the requirements set forth in this section of the Pacific Coast groundfish regulations. In addition to the requirements of this section, the C/P coop program is subject to the following groundfish regulations:

(1) Pacific whiting seasons §660.131, Subpart D.

(2) Area restrictions specified for midwater trawl gear used to harvest Pacific whiting fishery specified at §660.131, Subpart D for GCAs, RCAs, Salmon Conservation Zones, BRAs, and EFHCAs.

(3) Regulations set out in the following sections of Subpart C: §660.11 Definitions, §660.XX Prohibitions, § 660.13 Recordkeeping and reporting, §660.14 VMS requirements, §660.15 Equipment requirements, §660.16 Groundfish Observer Program, §660.20 Vessel and gear identification, and §660.XXXAdd others plus the Pacific whiting measures at currently at 660.323XXX.

(4) Regulations set out in the following sections of Subpart D: §660.111 Trawl fishery definitions, §660.112 Trawl fishery prohibitions, §660.113 Trawl fishery recordkeeping and reporting, §660.116 Trawl fishery observer requirements, and §660.130 Limited entry trawl fishery management measures.

(5) The C/P Coop program may be restricted or closed as a result of projected overages within the MS Coop Program, the C/P Coop Program, or the shorebased IFQ Program. As determined necessary by the Regional Administrator, area restrictions, season closures, or other measures will be used to prevent the trawl sectors in aggregate or the individual sector (shore-based IFQ, MS Coop, or C/P Coop) from exceeding an OY, or formal allocation specified in the PCGFMP or regulation at § 660.XXX subpart XX.

(b) C/P Coop Program Species and Allocations

(1) C/P Coop Program Species. C/P Coop Program Species are as follows:

(i) Species with formal allocations to the C/P Coop Program: Pacific whiting, canary rockfish, darkblotched rockfish, Pacific Ocean perch, widow rockfish;

(ii) Species with set-asides for the MS and C/P Programs combined, as described in Table XXset-aside tableXX , Subpart C.

(2) [Reserved]

(c) C/P Coop Permit and Agreement. [Reserved]

(d) C/P endorsed permit.

(1) General. Participation of a vessel in the non-tribal primary whiting fishery in the C/P sector during the season described at 50 CFR 660.XXX requires that an owner of that vessel register the vessel to a valid limited entry permit with a C/P endorsement. All permit owners and owners of the vessels registered to these C/P endorsed permits will be members of the C/P coop and that coop must be registered to C/P coop permit and operate under a coop agreement as described at: XXXXX

(i) C/P Endorsement Not Separable from Permit. A C/P endorsement is not separable from the limited entry permit, and therefore, the endorsement may not be transferred separately from the limited entry permit.

(ii) Vessel Size Endorsement. A C/P endorsed limited entry permit registered to a vessel that is more than 5' smaller the permit size endorsement will not result in a permanent reduction in the size endorsement of the permit. The provision given at 50 CFR 660.334 (c)(1)(i) does not apply to a C/P endorsed permit.

(iii) Restriction on C/P Vessel operating as CV. A vessel registered to C/P endorsed permit cannot operate as a catcher vessel delivering unprocessed whiting to another processor in the same calendar year.

(iv) Restriction on C/P Vessel Operating as MS. A vessel registered to C/P endorsed permit cannot operate as a mothership during the same year it participates in the CP fishery. At the time of permit renewal, the owner of the vessel registered to the C/P endorsed permit may declare whether it will operate solely as a MS in the year the permit is renewed for.

(2) Eligibility and Renewal for C/P endorsed permit. [Reserved.]

(3) Change in permit ownership, vessel registration, vessel owner, transfer or combination. [Reserved]

(4) Appeals. [Reserved]

(5) Fees. The Regional Administrator is authorized to charge fees for the administrative costs associated with review and issuance of a C/P endorsement consistent with the provisions at § 660.25(f), Subpart C.

(6) [Reserved]

(7) Application Requirements and Initial Issuance for C/P endorsement.

(i) Eligible Applicant. Only current permit owners of trawl endorsed limited entry permits that have been registered to catcher-processors that participated in the catcher-processor fishery are eligible to apply for a C/P endorsement. Any past catch history associated with current trawl permit accrues to the current permit owner. NMFS will not accept an application from a person that does not meet the eligibility requirements. NMFS will not recognize any other person as permit owner other than the person listed as permit owner in NMFS permit database at the time of receipt of the application.

(ii) Qualifying Criteria for C/P Endorsement. In order to qualify for a C/P endorsement, a vessel registered to a valid trawl endorsed limited entry permit must have caught and processed any amount of whiting during a primary catcher-processor season between 1997 through 2003. The calculation will be based on the following:

(A) Pacific Whiting Observer data recorded in the database that was extracted from NORPAC by NMFS on [INSERT DATE PROPOSED RULE PUBLISHED IN Federal Register] and NMFS permit data on limited entry trawl endorsed permits will be used to determine whether a permit meets the qualifying criteria for a C/P endorsement.

(B) Only whiting regulated by this subpart that was taken with midwater (or pelagic) trawl gear will be considered for the C/P endorsement.

(C) Permit catch and processing history includes only the catch/processing history of whiting for a vessel when it was registered to that particular permit during the qualifying years.

(D) History of illegal landings will not count.

(E) Landings history from Federal limited entry groundfish permits that were retired through the Federal buyback program will not count.

(iii) Prequalified Application. A "prequalified application" is a partially pre-filled application where NMFS has preliminarily determined the landings history that may qualify the applicant for C/P endorsement. NMFS will mail a prequalified application to the owner of the vessel who is found to qualify for the C/P endorsement. NMFS will mail the application by certified mail to the current address of record in the NMFS permit database. The application will contain the basis of NMFS's determination that the vessel meets the qualifying criteria for the C/P endorsement based on Pacific Whiting observer data recorded in the database that was extracted from NORPAC by NMFS on [INSERT DATE PROPOSED RULE PUBLISHED IN Federal Register].

(iv) Applicants Not Prequalified. If a current owner of a limited entry trawl endorsed permit does not receive a prequalified application, and the permit owner believes the permit's catch history qualifies for a C/P endorsement, the permit owner must contact NMFS in writing by the application deadline date requesting clarification of their eligibility status and provide credible documentation to substantiate their claim. Credible documentation may include official NMFS observer records that demonstrate the vessel met the qualifying criteria given in paragraph (ii) above. If NMFS finds that the permit owner may qualify for a C/P endorsement, NMFS will allow the permit owner to make an application. If the permit owner fails to contact NMFS in writing by the application deadline date, the person forgoes the opportunity to receive consideration for a C/P endorsement.

(v) Corrections to the Application. If the applicant disagrees with the basis of NMFS' determination in the prequalified application, the applicant must provide in writing which parts of NMFS' determination are not accurate, and must include additional information to substantiate the correction. The corrections must be provided with the completed application form by the application deadline date. Corrections may only be submitted for errors in NMFS' extraction, aggregation, or expansion of the database that was extracted from NORPAC by NMFS on [INSERT DATE PROPOSED RULE PUBLISHED IN Federal Register] or errors in NMFS permit database.

(vi) Submission of the Application and Application Deadline.

(A) Submission of the Application. Submission of the complete, certified application includes, but is not limited to, the following:

(1) The applicant is required to sign and notarize the application.

(2) The applicant must certify that they qualify to own a C/P endorsed permit and indicate whether they agree or disagree with NMFS' determination on initial issuance of the C/P endorsed permit provided in the application.

(3) Business entities are required to submit a corporate resolution or any other credible documentation as proof that the representative of the entity is authorized to act on behalf of the entity;

(4) NMFS may request additional information of the applicant as necessary to make an IAD.

(B) Application Deadline. A complete, certified application must be postmarked no later than [insert date 60 calendar days after publication of the final rule in the FEDERAL REGISTER]. NMFS will not accept or review any applications received after the application deadline. There are no hardship provisions for this deadline.

(vii) Initial Administrative Determination. NMFS will issue an IAD for all complete, certified applications received by the application deadline date. If NMFS approves the application, the applicant will receive a C/P endorsed limited entry permit. If NMFS disapproves an applicant's request to correct the application, the IAD will provide the reasons NMFS did not accept the corrections. If the applicant does not appeal the IAD within 30 calendar days of the date on the IAD, the IAD becomes the final decision of the Regional Administrator acting on behalf of the Secretary of Commerce.

(viii) Appeal. For a C/P endorsed permit issued under this section, the appeals process and timelines are specified at § 660.25(g), Subpart C. For the initial issuance of a C/P endorsed permit, the basis for appeal is described in paragraph (d)(7)(v). Items not subject to appeal include, but are not limited to, the following:

(A) the formula used to calculate initial issuance of a C/P endorsement;

(B) the allocation of C/P Coop species to the C/P Coop Program.

(e) Retention requirements. [Reserved]

(f) Observers Requirements. [Reserved]

(g) [Reserved]

(h) Catch weighting requirements. [Reserved]

(i) C/P Coop failure. [Reserved]

* Figure 1

* Trip Limit Tables - Table 3 North and South

**Mandatory Economic Data Collection Program Design
For Groundfish Trawl Rationalization
Northwest Fisheries Science Center - Economics Group
February 17, 2010**

The purpose of this paper is to describe the types of economic data and models that are needed to monitor the economic effects of the groundfish trawl rationalization program. The need to develop a mandatory program is based both on the Council's action, and on language in the Magnuson-Stevens Fishery Conservation and Management Act. After reviewing the pertinent language in these documents, this paper describes the types of analysis that will be used to monitor the program, the models that will be used to perform that analysis, and the data needed to support the models.

I. Motivation for Development of a Mandatory Economic Data Collection Program

The Council's preferred alternative includes a mandatory economic data collection provision. This provision (see Attachment 1) enumerates several types of data for mandatory collection that are necessary to study the impacts of rationalization.

> *Cost, revenue, ownership, employment and other information will be collected on a periodic basis (based on scientific requirements) to provide the information necessary to study the impacts of the program, including achievement of goals and objectives associated with the rationalization program.*

The provision also states the following.

> *These data may also be used to analyze the economic and social impacts of future FMP amendments on industry, regions, and localities.*

The Magnuson-Stevens Fishery Conservation and Management Act (MSA) also contains a monitoring requirement to determine whether a LAPP is meeting its goals. Sec. 303A.(c)(1)(G) states that any LAPP shall:

> *include provisions for the regular monitoring and review by the Council and the Secretary of the operations of the program, including determining progress in meeting the goals of the program and this Act, and any necessary modification of the program to meet those goals, with a formal review 5 years after the implementation of the program and thereafter to coincide with scheduled Council review of the relevant fishery management plan (but no less frequent than once every 7 years).*

The Council has enumerated several goals for the groundfish trawl rationalization program that involve economic components. The goals include:

- Provide for a viable, profitable, and efficient groundfish fishery.
- Increase operational flexibility.
- Minimize adverse effects from an IFQ program on fishing communities and other fisheries to the extent practical.
- Promote measurable economic and employment benefits through the seafood catching, processing, distribution elements, and support sectors of the industry.
- Provide quality product for the consumer.
- Increase safety in the fishery

The Council has also identified several constraints and guiding principals:

- Minimizing negative impacts resulting from localized concentrations of fishing effort.
- Avoiding provisions where the primary intent is a change in marketing power balance between harvesting and processing sectors.
- Avoiding excessive quota concentration.
- Providing efficient and effective monitoring and enforcement.
- Designing a responsive review evaluation and modification mechanism.
- Taking into account the management and administrative costs of implementing and overseeing the IFQ or co-op program and complementary catch monitoring programs and the limited state and federal resources available.

The Magnuson-Stevens Fishery Conservation and Management Act (as amended through January 2007) also places importance on social and economic outcomes resulting from rationalization programs. Sec. 303A.(c)(1)(C) states that any limited access privilege program (LAPP) to harvest fish submitted by a Council or approved by the Secretary under this section shall promote social and economic benefits.

The next section describes the types of analysis and models that are needed to monitor the rationalization program. The description of the economic data that is needed is focused on addressing these goals and constraints.

II. Economic Analyses and Models for Monitoring Rationalization

Monitoring the economic effects of a rationalization program requires a variety of economic data. In general, the data requirements depend on the types of effects that need to be monitored and the economic models used to estimate them. The primary effects of a rationalization program can be captured in two broad areas of economic analysis: 1) economic performance measures; and, 2) regional economic impact analysis.

II.A. Economic Performance Measures

A primary motivation for the rationalization program is to increase the economic performance of the fishing industry, and provide increased net economic benefits to the nation. Economic performance measures include:

- Costs, earnings, and profitability
- Economic efficiency
- Capacity measures
- Economic stability
- Net benefits to society
- Distribution of economic net benefits
- Product quality
- Functioning of the quota market
- Incentives to reduce bycatch
- Market power
- Spillover effects in other fisheries

Estimation of economic performance measures requires information on the costs and earnings of harvesters and processors. Some of the above performance measures are derived through a tabulation of the data, while others require more sophisticated models such as cost function estimation, capacity models, and economic behavioral models.

II.B. Regional Economic Impact Analysis

One common concern associated with rationalization programs is their potential effect on regional economies. Some of these effects may be positive (e.g., increased harvest of under utilized target species), or mixed (e.g., fleet consolidation or shifting of the geographic location of fishing effort). A rationalization program will likely affect different regional economies in different ways.

Regional economic modeling involves quantifying these changes by tracking the expenditures of all businesses, households, and institutions within a given geographic region. The formal study of these economic relationships is done through input-output analysis, which analyzes the direct, indirect and induced effects, and the resulting economic multipliers associated with each business sector in the regional economy. An input-output model estimates:

- Economic contribution of the fishery to regional economies
- Distributional effects between fishing sectors
- Distributional effects across regional economies
- Community fishery dependence

Input-out models require data on the cost and earnings of harvesters and processors. They also require information about the location of the expenditures so they can be properly assigned to particular regional economies.

III. Survey Populations

All members of the West Coast groundfish industry harvesting or processing fish under the rationalization program will be required to supply economic data. Survey participants include:

- Catcher vessels
- Shoreside Processors
- Motherships
- Catcher/Processors

The most appropriate scale for the data collection is at the individual vessel or plant level. Information about ownership of multiple vessels or plants by a single individual or business entity may also be needed to account for fixed costs that are not allocated to individual operating units (vessels or plants). In addition, some data for co-ops may be needed if the co-ops are primarily responsible for tracking or maintaining economic data.

IV. Survey Design, Frequency and Methods

Most of the economic data will be collected through annual surveys of costs, earnings and employment. The Northwest Fishery Science Center (NWC) will work closely with industry members to ensure the survey forms are clear and concise, and to minimize the time required to complete them. Given the small number of participants in the rationalized fishery, and the expected consolidation, all members will be required to complete the annual surveys. In order to accurately measure the effect of rationalization, fishery level data will be needed, where that is feasible. The NWC will work with industry to determine the feasible level of data collection.

In addition to the annual surveys, it may be necessary to collect some trip level or fishery level data that will need to be recorded more frequently. These data may include crew size, fuel purchases, ice, and other inputs that may vary by trip or are not maintained by the vessels or plants for the annual data collections. These data collections may be a census or a sampling, depending on the data element and its variability. The NWC will work with fishery managers and industry to determine feasible methods that meet scientific standards.

Annual data collection will be needed in order to monitor and evaluate the economic effects of the trawl rationalization program. Since many factors affect the fishery each year (environmental, regulatory, economic, and others), a consistent survey providing a time series data base is necessary to determine the effects of the rationalization program. In order to have a baseline of conditions in the fishery prior to rationalization, it is critical that data collection includes years of operation before the implementation of rationalization. This is necessary to perform a valid before-and-after analysis.

V. Enforcement of Mandatory Data Collection

Accurate and complete data are important for monitoring the economic effects of rationalization. Mechanisms are needed to ensure compliance with the data collection program.

VI. Data Confidentiality

Protecting the confidentiality of data collected through the mandatory groundfish trawl survey is a critical survey design element. The Council's action states that data collected under this authority is to be treated as confidential in accordance with Section 402 of the MSA. Data collected from harvesters and processors provides not only information required for economic analysis of the LAPP, but also has the potential to be used by participants in the fishery to obtain a competitive advantage if the confidential nature of the data is not protected. Maintaining data confidentiality requires not only restricting access to the raw unaggregated data collected from harvesters and processors, but also presenting aggregate summary data in public reports in a way that does not reveal information about individual participants in the fishery. Section VIA section discusses restrictions on access to the raw unaggregated data, and section VIB discusses the aggregation protocol that will be used to protect confidentiality in the preparation of public reports.

VI.A. Restricting Data Access

Existing statues, regulations, and administrative orders limit access to the raw, unaggregated data collected by the groundfish trawl survey. The Code of Federal Regulations (50 CFR 600.506) restricts access to confidential data to:

(1) federal and Council employees responsible for the collection and maintenance of the data, FMP development, monitoring or enforcement, or performing research that requires access, or on a demonstrable need-to-know basis
(2) NOAA/NMFS contractors or grantees that require access to perform functions authorized by a Federal contract or grant
(3) state government personnel who demonstrate a need for confidential data for use in fishery conservation and management (provided the state has entered into an agreement to protect confidential data to a standard comparable to that required by the MSA).

NAO 216-100 establishes more specific responsibilities for granting access to confidential data to NMFS employees, Councils and staff, state employees, and contractors. Section 5.01 of the NOA confers responsibility for maintaining confidentiality of data collected within a given region to the NMFS Regional Director. 6.03b of the NAO specifies that "NMFS employees requesting confidential data must have certification as being authorized users for the particular type of data requested." Further, "authorized user" status may be granted under the NAO to state employees given approval of the NMFS office that maintains the source data, and to contractors if approved by the region. With the exception of Council members (for whom authorization authority is vested in the Assistant Administrator), the individual given authority to grant access to specific confidential data sources appears to be the Regional Director, although the language of the NAO is inconsistent on this point.

The confidential proprietary data collected by the mandatory groundfish trawl survey is exempt from disclosure of raw, unaggregated data through the Freedom of Information Act (FOIA) as it meets the definition of trade secrets as defined in the Freedom of Information Act (5 U.S.C. 552) and Trade Secrets Act (18 U.S.C. 1905).

VI.B. Data Aggregation Protocol for Public Reports

While the statutes, regulations, and administrative orders discussed above tightly restrict access to the raw, unaggregated data collected through the mandatory trawl groundfish economic survey, there is a need to summarize and present information based on survey data in both the Council process and other public forums. While release of information from individual respondents is clearly prohibited, federal law does permit the releases of information derived from the confidential raw unaggregated data so long as it is structured to prevent identification of the individual survey respondents or the information they submit.

In order to protect the confidentiality of individual responses, any numerical value reported in public documents will be based on responses from at least three economic entities. Since multiple vessels or processing plants may be owned and operated by a single economic entity, it is important to require data from three economic entities rather than three harvesters or processors. Otherwise, it would be possible to publish data based on responses from three vessels or processing plants under the same ownership.

While aggregation and the "rule of 3" provide one method of protecting the confidentiality of survey respondents, other methods may also be used to protect confidentiality. The Office of Management and Budget Committee on Statistical Methodology has prepared the Report on Statistical Disclosure Limitation Methodology, which will be reviewed and possibly used as a source of methods that may be applied to groundfish trawl data in order to develop confidentiality protocol.

VII. Data to Be Collected

This section discusses the data that is needed to meet MSA mandates for monitoring the economic impact of implementing a rationalization regime for the West Coast limited entry groundfish trawl fishery. A separate list of data requirements is presented for each of the four groups in the survey population identified in Section III – catcher vessels, shoreside processors, motherships, and catcher processors.

As mentioned in Section IV, most of the data will be collected through annual surveys. However some data may need to be collected on a more frequent basis to obtain trip level or fishery level data. In order to isolate the effects of the rationalization program on the groundfish fishery, it is necessary to collect data on variable costs at the fishery level. For example, catcher vessel expenses likely vary by target species and gear. To capture this difference, some data will need to be collected at the trip or fishery level when operating in the groundfish fishery, as well as an annual total for such expenditures. Other expenses that are not affected by the number or type of trips taken (such as moorage or accounting services) will be collected at only an annual level.

The models used to estimate regional economic impacts require data on the location of expenditures by harvesting vessels and processing plants. As a result, all participants in the survey will be asked to provide information on the location of many of their expenditures by geographic categories. The five geographic categories used for each expenditure type are:

- Home port
- Home state (for expenses occurring in the state where the home port is located, but not in the home port)
- West Coast (for expenses occurring in Washington, Oregon, or California but not in the home state)
- Alaska
- Other areas.

Survey participants will be asked to indicate the percentage of an expenditure type occurring in each of these five geographic categories. As an example, a vessel owner may indicate that 60% of fuel is purchased in the home port, 20% is purchased in the home state, and 20% is purchased on the West Coast.

VII.A. Catcher Vessels

Variable costs to be collected for both (1) total vessel operations over the entire year and (2) while targeting groundfish:

- Crew
- Captain
- Fuel
- Ice
- Provisions
- Bait (for non- trawl fisheries)
- Observer fees
- Other variable costs

Fixed costs to be collected on an annual basis for total vessel operations:

- Vessel and on-board equipment repairs, maintenance, improvements and purchases
- Moorage
- Dockside utilities
- Insurance
- Interest payments on vessel and on-board equipment
- General and administrative
- Commission and association dues
- Other fixed expenses

Annual revenue to be collected for total vessel operations:

- Pounds and revenue from other non-West-Coast landings and at-sea deliveries by major species groups
- Disaster relief payments
- Other revenue sources

Quota and permit revenue and expenses from sales and leases

Vessel characteristics include:

- Home port, horsepower, fuel capacity
- Speed when steaming full, steaming empty, and trawling
- Fuel consumption when steaming full, steaming empty, and trawling
- Crew compensation method (share system calculation details) when participating in the West Coast groundfish fishery
- Vessel ownership information
- Vessel, gear and on-board equipment market value
- Crew size

VII.B. Shoreside Processor Plants

Variable costs to be collected on an annual basis for groundfish and other fish processing:

- Purchase pounds and expenditure by species group
- Labor costs
- Packaging materials
- Non-fish ingredients
- Compliance monitoring costs
- Other variable costs

Fixed costs to be collected on an annual basis for total plant operations:

- Processing equipment repair, maintenance, and improvements
- Other plant related equipment repair, maintenance, and improvements
- Processing equipment purchases
- Other plant related equipment purchases
- Interest payments on plant and equipment
- Insurance
- Utilities
- General and administrative
- Property taxes for plant
- Commission and association dues
- Other fixed expenses

Annual revenues data to be reported:

- Total revenue by species and product category for West Coast trawl groundfish
- Total revenue from other fish inputs (to allocate expenses)
- Other sources of revenue associated with the plant (to allocate expenses)

Quota and permit revenue and expenses from sales and leases

Plant characteristics to be reported:

- Plant ID number
- Average number of processing and plant positions
- Plant ownership information
- Processing capacity
- Plant and equipment market value

VII.C. Mothership Vessels

Variable costs to be collected for both (1) total vessel operations over the entire year and (2) while processing groundfish:

- Crew and processing labor
- Captain
- Fuel
- Provisions
- Non-fish ingredients
- Packing materials
- Observer fees
- Other variable costs

Fixed costs to be collected on an annual basis for total vessel operations:

- Vessel and on-board equipment repairs, maintenance, improvements and purchases
- Processing equipment repair, maintenance, improvements purchases
- Moorage
- Interest on vessel and on-board equipment
- Insurance
- Dockside utilities
- General and administrative
- Commission and association dues
- Other fixed expenses

Annual revenue to be collected for total vessel operations:

- Total revenue by species and product category for West Coast trawl groundfish
- Total revenue from other fish inputs (to allocate expenses)
- Other sources of revenue associated with the vessel (to allocate expenses)

Quota and permit revenue and expenses from sales and leases

Vessel characteristics include:

- Home port, horsepower, fuel capacity
- Fuel consumption when steaming full and steaming empty
- Crew compensation method (share system calculation details) when participating in the West Coast groundfish fishery
- Vessel ownership information
- Vessel and on-board equipment market value
- Crew size

VII.D. Catcher/Processor Vessels

Variable costs to be collected for both (1) total vessel operations over the entire year and (2) while targeting groundfish:

- Crew and processing labor
- Captain
- Fuel
- Provisions
- Non-fish ingredients
- Packing materials
- Observer fees
- Other variable costs

Fixed costs to be collected on an annual basis for total vessel operations:

- Vessel and on-board equipment repairs, maintenance, improvements and purchases
- Processing equipment repair, maintenance, improvements and purchases
- Moorage
- Interest on vessel and on-board equipment
- Insurance
- Dockside utilities
- Utilities
- Insurance
- General and administrative
- Commission and association dues
- Other fixed expenses

Revenue revenues include:

- Total revenue by species and product category for West Coast trawl groundfish
- Total revenue from other fish inputs (to allocate expenses)
- Other sources of revenue associated with the vessel (to allocate expenses)

Quota and permit revenue and expenses from sales and leases

Vessel characteristics include:

- Home port, horsepower, fuel capacity
- Speed when steaming full, steaming empty, and trawling
- Fuel consumption when steaming full, steaming empty, and trawling
- Crew compensation method (share system calculation details) when participating in the West Coast groundfish fishery
- Vessel ownership information
- Vessel and on-board equipment market value
- Crew size

VIII. Data Collection Burden

The NWC currently surveys the limited entry groundfish catcher vessel fleet on a periodic basis. Data from 2003 and 2004 were collected in 2005-6, and data from 2007 and 2008 were collected in 2009. These surveys (see Attachment 2) are voluntary and have an average response rate of 68%. About 93% of the responses have data sufficient for analysis. These data have been used in two management relevant project. The first is a paper by Carl Lian (NWC) et. al. that estimated the likely reduction in the fleet size due to rationalization, and the corresponding change in fishery value. This paper was explicitly used in the EIS for trawl rationalization, and is now forthcoming in Marine Resource Economics. The second use of the data has been the NWC's development of a new regional economic model. The model went through both a CIE and SSC review during the fall of 2009. The regional model will be used as part of this year's specification process.

The average time it takes to complete the NWC's voluntary questionnaire, with two years of operating data, is less than 60 minutes (using in-person interviews). For catcher vessels, the mandatory annual data collection envisioned in this document would be very similar to the existing NWC surveys. The main difference in terms of burden hours is that annual expenses would be collected based on the fishery in which they occur, to the extent that this is feasible. The rational for this change is to better track the effects of rationalization. The current voluntary questionnaire is four pages long, and it is expected that the mandatory annual survey will add one or two additional pages, depending on formatting. In addition, more periodic reporting may be necessary to capture some trip level expenses, or expenses that occur fairly regularly. These include ice, fuel, bait (for non-trawl fisheries), etc. One option for recording such expenses is to make them a mandatory part of logbooks.

Shoreside and at-sea processors are currently asked to complete the Northwest Region's Fishery Products Report. This report (see Attachment 3) collects information on the quantity and value of products sold by species and product type, and employment data. The average response rate is over 90% for the two page survey, and the estimated burden time is 30 minutes. Some of the information is not complete for all plants. It is expected that a more comprehensive survey as discussed in this document would add approximately four additional pages to this survey. The burden hours would therefore increase.

IX. Central Registry of Quota Share Owners and Government Costs

The Council's preferred alternative includes a provision for a central registry of quota share owners and LE permit owners/lessees. It also includes data on the monitoring, administration, and enforcement costs related to governance of the trawl rationalization program. The NWC and NWR will need to work together to develop these systems.

Attachment 1 - Council Action on Mandatory Economic Data Collection

Taken from footnote bb in Appendix D to The Rationalization of the Pacific Coast Groundfish Limited Entry Trawl Fishery Draft Environmental Impact Statement (November 2009).

Expanded data collection would include:

> Mandatory submission of economic data for LE trawl industry (harvesters and processors),
>
> Voluntary submission of economic data for other sectors of the fishing industry, transaction value information in a centralized registry of ownership, and
>
> Formal monitoring of government costs.

Mandatory Provisions: The Pacific Fishery Management Council and NMFS shall have the authority to implement a data collection program for cost, revenue, ownership, and employment data, compliance with which will be mandatory for members of the west coast groundfish industry harvesting or processing fish under the Council's authority. Data collected under this authority will be treated as confidential in accordance with Section 402 of the MSA.
A mandatory data collection program shall be developed and implemented as part of the groundfish trawl rationalization program and continued through the life of the program. Cost, revenue, ownership, employment and other information will be collected on a periodic basis (based on scientific requirements) to provide the information necessary to study the impacts of the program, including achievement of goals and objectives associated with the rationalization program. These data may also be used to analyze the economic and social impacts of future FMP amendments on industry, regions, and localities. The program will include targeted and random audits as necessary to verify and validate data submissions. Additional funding (as compared to status quo) will be needed to support the collection of these data. The data collected would include data needed to meet MSA requirements (including antirust).
The development of the program shall include: a comprehensive discussion of the enforcement of such a program, including discussion of the type of enforcement actions that will be taken if inaccuracies are found in mandatory data submissions. The intent of this action will be to ensure that accurate data are collected without being overly burdensome on industry in the event of unintended errors.

Voluntary Provisions: A voluntary data collection program will be used to collect information needed to assess spillover impacts on nontrawl fisheries.

Central Registry: Information on transaction prices will be included in a central registry of QS owners. Such information will also be included for LE permit owners/lessees.

Government Costs: Data will be collected and maintained on the monitoring, administration, and enforcement costs related to governance of the trawl rationalization program.

Attachment 2 - Mandatory Economic Data Collection Program Design

WEST COAST LIMITED ENTRY VESSEL COST EARNINGS SURVEY

Conducted by:
NOAA Fisheries – Northwest Fisheries Science Center
Pacific States Marine Fisheries Commission

CONTACT INFORMATION FOR SURVEY RESPONDENT

1. Name: ________________________________ 2. Email: _________________________________

3. Date (Month/Day/Year): _________________ 4. Telephone: (____)________________________

5. Mailing Address (Street, City, State, and Zip Code):

____

VESSEL OWNERSHIP AND CHARACTERISTICS

6. Please verify the following information on record about your vessel's characteristics. If the information on record is correct, please place a check mark in the Corrections column. If the information on record is incorrect or there is no information on record, please provide the correct information in the Corrections column.

Item	Information on Record	Corrections
a. Owner's Name	*Charles Smith*	
b. Owner's Address	*333 1st Street, Waldport, OR 97005*	
c. Vessel Name		
d. USCG Vessel ID (USCG or State)	*33221843*	
e. Home Port	*Newport, OR*	
f. Length (feet)	*75*	
g. Fuel Capacity	*300*	
h. Engine Make and Model	*No Information on Record*	
i. Engine Horsepower	*380*	

7. What is the approximate market value of your vessel (not including associated permits)? $_______________

8. Please provide your vessel's fuel consumption, speed, and crew size (not including captain) when engaged in each of the following activities. If this vessel does not engage in an activity, please write "NA" in the appropriate columns.

Activity	Fuel Consumption (Gallons Per Hour)	Speed (Knots Per Hour)	Crew Size (Not Including Captain)
a. Trawling (while towing)			
b. Longlining			
c. Shrimping (while towing)			
d. Crabbing			
e. Trolling			
f. Steaming (fully loaded)			Not Applicable
g. Steaming (empty)			Not Applicable

ANNUAL COSTS AND EARNINGS

Questions 9 through 11 collect information about this vessel's costs and earnings **while operating in all fisheries** (groundfish, crab, shrimp, salmon, etc.). This survey's primary objective is to collect data on costs and earnings for 2008. However, we recognize that conditions in the fishery change from year to year and that two years of data can provide a more complete picture than a one-year snapshot. If possible, we would appreciate receiving your cost and earnings data for both 2007 and 2008.

9. In what month does your vessel's fiscal year begin? ___________

10. For each of the earnings (income) sources listed below, please indicate the income earned during your fiscal year 2007 and fiscal year 2008. If no income was earned from a particular source during a particular year, please write NA in the appropriate box.

Earnings (Income) Source	2007 ($)	2008 ($)
a. Landings in Alaska		
b. Landings outside the West Coast (Washington, Oregon, and California) and Alaska. Please do not include at sea deliveries, which are covered in part c of this question.		
c. West Coast at-sea deliveries		
e. Sale and leasing of permits associated with this vessel		
f. Salmon disaster relief payments		
g. Other (please specify)________________		

11. For each cost category below, please provide total annual expenditures during your fiscal year 2007 and fiscal year 2008. If you do not have separate data on expenditures for captain (part a) and crew (part b), please write combined expenditures in part *a* and write "NA" in part b. If no expenditures were incurred in a particular category during a particular year, please write NA in the appropriate box. For location of expenditures please indicate the location of expenditures as a percentage in the location categories: HP=home port, HS= home state but not home port city, WC=West Coast (WA, OR, or CA) state but not home state, AK= Alaska, US=United States outside of West Coast and Alaska. For Crew expenditures please indicate the percent of crew that reside in each location category.

Cost (Expenditure) Category	**2007 ($)**	**2008($)**	**Location of Expenditures (Percent of Total)**				
			HP	HS	WC	AK	US
a. Captain (include share payments, bonuses, other forms of compensation, and payroll taxes)							
b. Crew (include share payments, bonuses other forms of compensation, and payroll taxes)							
c. Fuel and Lube							
d. Food and crew provisions							
e. Ice							
f. Bait							
g. Repair, maintenance, and improvements for vessel, gear, and equipment							
h. Insurance							
i. Interest and Financial Services							
j. Enforcement and monitoring (include cost of observers and electronics such as cameras)							
k. Commission dues							
l. Moorage							
m. Purchase of permits for this vessel			**Not Applicable**				
n. Leasing of permits for this vessel			**Not Applicable**				
o. All other expenses for this vessel			**Not Applicable**				

CREW COMPENSATION AND FUEL USE WHILE TARGETING GROUNDFISH

Questions 12 through 17 collect information about labor and fuel costs when this vessel is participating in the West Coast (Washington, Oregon, and California) **groundfish fishery**.

12. Does this vessel use a crew share system to pay its crew when operating in West Coast **groundfish fisheries**?
    a. Yes (proceed to question 13).
    b. No (proceed to question 17)..

13. Which of the following expenses were deducted from total revenue before calculating the crew share when this vessel operated in West Coast **groundfish fisheries**?

a.	Fuel and lube.	Yes	No
b.	Food and other crew provisions.	Yes	No
c.	Landing taxes.	Yes	No
d.	Unloading expenses	Yes	No
e.	Trucking expenses	Yes	No
f.	Other. Please specify _____________.	Yes	No

14. On what percentage of fishing trips does the vessel owner serve as captain? ________%

15. On trips when the vessel owner serves as captain, please indicate the share of net revenue (revenue minus the deductions listed in question 13) going to the vessel, captain, and crew. If the vessel owner does not serve as captain on any trips, please write "NA".
Vessel share_______% Captain share ________% Crew share________% NA

16. On trips when the vessel owner does not serve as captain, please indicate the share of net revenue (revenue minus the deductions listed in question 13) going to the vessel, captain, and crew. If the vessel owner always serves as captain, please write "NA".
Vessel share_______% Captain share ________% Crew share________% NA

17. In order to understand how regulatory changes affect your vessel's per trip operating costs, we need to collect data on your fuel costs as well as your labor costs. For trips where this vessel targets flatfish, roundfish, and rockfish, please indicate the amount of fuel used on a daily basis. If this vessel did not make any trips targeting a particular type of fish, please write NA in the appropriate space.

	Typical Daily Fuel Use
Trips targeting Rockfish	
Trips targeting Roundfish	
Trips targeting Flatfish	

Survey Conclusion and Paperwork Reduction Act Statement
Thank you for participating in this survey. The information you have provided will improve studies of the economic performance and economic impact of the West Coast limited entry fishery. Public reporting burden for this information collection, including time for gathering data needed, and completing the survey with an interviewer is estimated to average **one hour** per respondent. We appreciate the confidential nature of the data being collected by this survey. When publishing survey results, we will combine your responses with information provided by other participants, and report it in summary form so that responses for any individual vessel cannot be identified. If a Freedom of Information Act (FOIA) request is received for the data collected by this survey, we will seek to protect the confidentiality of the survey responses under Exemption 4 of the FOIA. Any questions about this survey may be directed to either Carl Lian of NOAA Fisheries (206-302-2414) or Dave Colpo of the Pacific States Marine Fisheries Commission (503-595-3100). This survey is conducted under OMB No. 0648-0369, which expires on April 30, 2010.

Your coopertion is needed to make the results of the survey comprehensive. Individual reports are confidential and only summary totals are published. This report is authorized by law, 16 U.S.C. 1854(e).

Form Approved by OMB No. 0648-
Expires 4-30-20

Page: 1 of

YEAR	2009
REGION	6
STATE	41
PLANT NO	[redacted]
COUNTY	[redacted]

NOAA FORM 88-13
(REV 10/95)

U.S. DEPARTMENT OF COMMERCE
NOAA-NMFS

FISHERY PRODUCTS REPORT
U. S. PROCESSORS, ANNUAL

ARE YOU A:
PROCESSOR
WHOLESALER (Does Not Process)
COLD STORAGE
OTHER

COMPANY PHONE [redacted]

COMPANY FAX [redacted]

MAIL ADDRESS

[redacted]

PLANT ADDRESS

[redacted]

EMPLOYMENT DATA
TO BE COMPLETED BY ALL FIRMS OR PLANTS

NOTE: LIST BY MONTH THE NUMBER OF PERSONS WORKING AT THIS ESTABLISHMENT DURING THE PAYROLL PERIOD THAT INCLUDED THE 12TH OF THE MONTH.

JAN	FEB	MAR
APR	MAY	JUN
JUL	AUG	SEP
OCT	NOV	DEC

REPORT PREPARED BY (Print or type Name and Title)	TITLE

FRESH SEAFOOD	FOR NMFS USE	UNIT	QUANTITY	VALUE FOB PLANT	CHECK
COD FILLET	0820101160	LB			/////
FLOUNDERS ARROWTOOTH FILLET	1250101160	LB			/////
FLOUNDERS DOVER SOLE FILLET	1265101160	LB			/////
FLOUNDERS ENGLISH SOLE FILLET	1270101160	LB			/////
FLOUNDERS PETRALE SOLE FILLET	1275101160	LB			/////
FLOUNDERS REX SOLE DRESSED	1280101223	LB			/////
FLOUNDERS SAND SOLE FILLET	1285101160	LB			/////
FLOUNDERS STARRY FILLET	1289101160	LB			/////
HAKE PACIFIC DRESSED	1542101223	LB			/////
HALIBUT DRESSED	1590101223	LB			/////
LINGCOD FILLET	2090101160	LB			/////
LINGCOD DRESSED	2090101223	LB			/////
OCEAN PERCH PACIFIC FILLET	2410101160	LB			/////
TROUT RAINBOW DRESSED	2850101223	LB			/////
ROCKFISHES FILLET	2960101160	LB			/////
ROCKFISHES DRESSED	2960101223	LB			/////
SABLEFISH DRESSED	3020101223	LB			/////
SALMON CHINOOK ROE	3080101040	LB			/////
SALMON CHINOOK FILLET	3080101160	LB			/////
SALMON CHINOOK DRESSED	3080101223	LB			/////
SALMON COHO ROE	3084101040	LB			/////
SALMON COHO DRESSED	3084101223	LB			/////
SKATES WINGS	3650101085	LB			/////
STURGEON DRESSED	4211101223	LB			/////

ENFORCEMENT CONSULTANTS REPORT ON REGULATORY DEEMING FOR FISHERY MANAGEMENT PLAN AMENDMENT 20 – TRAWL RATIONALIZATION AND AMENDMENT 20 – INTERSECTOR ACCOCATION

The Enforcement Consultants (EC) has reviewed Agenda Items E.6.b, NMFS Reports 1, 2, 3, and 4 and has the following comments.

Report 3, Draft Regulatory Outline

The EC believes this organization of Federal groundfish regulations is a vast improvement over the existing regulation format. We have reviewed its content and are satisfied that it will meet the regulatory requirement. We will continue to monitor and participate in the development of the regulations that flow from this regulation outline.

Report 4, Draft Proposed Regulations for Am 20 & 21

In reviewing the draft proposed regulations, the EC focused on the definitions section. We believe the definitions to be adequate at this time, but note that these definitions will continue to evolve as the regulations package develops and matures. We also note that as of this time, GCEL has not completed its review of these draft definitions.

Report 1, NMFS Interpretation of Council Intent

We found the following listed elements to be consistent with Council intent and enforceable, and therefore recommend the Council deem them acceptable: Issue 7, vessel monitoring systems (VMS) declarations; Issue 8, Definitions; Issue 11, No observer coverage waivers will be granted; Issue 14, 30 day to cover all catch from an individual fishing quota (IFQ) trip; Issue 15, First Receiver Site License; Issue 16, IFQ Species Area Management; Issue 18, Processing at-sea by IFQ whiting vessels; Issue 19, Equipment requirements; and Issue 25, Maximized retention by mothership catcher vessels.

Report 2, Clarification Requested of Council

Regarding the Clarification Issues document, we have the following comment:

Issue 3: 30-day clock. When does the 30-day clock start for vessel overages?

We understand that even with electronic reporting, some catch data may not be immediately available. Consequently, enacting regulations reflecting option A could raise significant legal implications that could affect prosecution of violations. We strongly encourage the Council to adopt option B, "the clock would start when any data/documentation from the trip which caused the overage (account deficit) is available or the vessel account shows there is an overage (account deficit)."

Issue 4: 10 percent carryover.

One of the provisions of the carryover rule is to allow a vessel to "opt out" of the fishery during the year, in lieu of covering a landing deficit that is within the 10 percent carryover, within 30 days. Exercising this option, the vessel can avoid prosecution and can cover their deficit (up to 10 percent) with the quota pound (QP) allocation received in the following year. Implementation of this provision requires knowing what the 10 percent carryover is at the time the vessel chooses to opt out of the fishery. Neither option B or C provides this implementing information during the year.

We therefore endorse National Marine Fisheries Service preferred option A and agree with the discussion points presented under this issue. In addition to enabling implementation and enforceability of this issue, option A creates an incentive to load QP into vessel accounts early in the year, thus supporting Council intent discussed under Issue 5: "All QP in a QS account must go in to a Vessel Account each year."

PFMC
3/10/10

GROUNDFISH ADVISORY SUBPANEL REPORT ON REGULATORY DEEMING FOR FISHERY MANAGEMENT PLAN AMENDMENT 20—TRAWL RATIONALIZATION AND AMENDMENT 21—INTERSECTOR ALLOCATION, AND PLANNING FOR COMMUNITY FISHING ASSOCIATIONS (CFA)

Mr. Jim Seger, Ms. Jamie Goen, and Mr. Todd Lee provided the Groundfish Advisory Subpanel (GAP) with several reports and briefings regarding items related to regulatory deeming for Fishery Management Plan (FMP) Amendments 20 and 21. The GAP offers the following comments and recommendations.

Mandatory Data Collection

Overall, the GAP recognizes that economic data collection can provide important information to the Council, and is a required component of the five year review of the trawl rationalization program. However, the GAP is concerned that as presently drafted, the mandatory economic information to be collected is unduly onerous, going far beyond what is needed to determine the socioeconomic effects of the trawl program. The GAP is concerned that overly complex forms and data requests may hurt the accuracy of the information and the response rate, and recommends a simplified approach.

In addition, the GAP is concerned that data collection be limited to a reasonable period (i.e. not every year) after the five year review. The GAP would prefer every three or five years after that initial requirement.

The GAP notes that two important components of the fishery fall outside of the data collection system as currently proposed. Specifically, effects on groundfish communities and the recreational sector should be studied.

Regarding the validity of the information to be collected, the GAP points out that many operators do some jobs themselves which has the effect of changing the apparent profit levels of those operations in comparison to operators who contract that work out. The GAP recommends adjusting the survey to account for that potential discrepancy.

The GAP notes that determining why fishermen leave the fishery may be difficult to ascertain, and an assumption that they always do so for economic reasons is inaccurate. Interviews may be necessary to determine whether the departure was due to economic considerations, retirement, or some other factor.

Finally, the GAP notes that data collected for purposes of determining the effects of the trawl rationalization program will only be useful if an adequate baseline is established. To that end, robust information for the fishery and groundfish communities pre-implementation needs to be collected and analyzed.

To reiterate, the GAP recognizes the importance of data collection, but is concerned that the right information may not be collected, the level of detail for operators and processors is burdensome and unnecessary, and the baseline to compare effects of the program may not be established appropriately. Simplicity and the ability to have confidence in the data should be emphasized.

Trawl Rationalization Implementation Schedule

The GAP believes that the trawl rationalization program should be implemented January 1, 2011. The GAP notes that the program has already been delayed several times and does not wish to see any further delay. The GAP does not want a sub-par program implemented, however, at present we are not convinced that a 2012 implementation date is required for a successful trawl rationalization program. The GAP notes that the Federal appropriation for catch share programs nationwide provides millions of dollars for the trawl rationalization program, and is concerned that a delay in implementation could jeopardize that funding. There is also concern that a longer timeline to implementation creates a greater likelihood that the program will unravel.

The GAP recognizes that we are currently behind schedule in relation to a 2011 implementation date, and that NMFS has not had the resources necessary to develop the regulations in a timely manner. The GAP is disturbed that the lack of appropriate resources came to light so late in the day. In meeting the 2011 implementation schedule, the GAP recommends that National Marine Fisheries Service (NMFS) focus on the most important components of the program, and specifically recommends that NMFS and Council staff set aside the time necessary to ensure that regulations match Council intent. The GAP also notes that the program cannot and will not be perfect when it is implemented. Fine tuning of the program will be a continuous process. The GAP believes that additional resources for implementation are available from National Oceanic and Atmospheric Administration to get this program implemented. Those resources should be secured and mobilized as soon as possible.

Clarifications Requested of Council – (The GAP worked from Agenda Item E.6.b, Supplemental Revised NMFS Report 2, which has different numbering than the clarifications document sent out in the briefing book.)

Issue 1) The GAP recommends option c. This option is easiest administratively, but does not unduly hamper business flexibility.

Issue 2) The GAP recommends option a. This is the least confusing option and provides the opportunity to fish pending appeal.

Issue 3) The GAP recommends option b. Fishermen may not know of a potential overage until they are presented with final quota information. Therefore it would be punitive to start the 30 day clock at the time of landing.

Issue 4) The GAP recommends option a. This option provides an easy calculation to determine the value of the 10 percent carryover. The other options are much more complex. The GAP raised concerns about lessors of quota after the 45 day rule not being credited with carryover pounds, but ultimately decided that a clear rule would allow that to be taken into account during the quota transaction.

Issue 5) The GAP recommends option b. The GAP feels strongly that quota pounds need to go into vessel accounts before the end of the year. The GAP also notes that there may be value in having different rules for target and overfished species (e.g. July 1 for target species and September 1 for overfished species) which serves the dual function of ensuring pounds are in vessel accounts while providing additional flexibility in arranging quota portfolios for overfished species.

Issue 6) The GAP recommends option b. Option b reflects the actual intent of the Council and will provide adequate opportunity to the at-sea sector without taking away shoreside opportunity unnecessarily.

Issue 7) The GAP feels that there are two separate questions wrapped up in this issue. First, by what date must an intent declaration to fish in the co-op or open portion of the fishery be made, and second, whether a co-op permit is required for catcher-processors (CP).

Regarding the first question, the GAP believes neither option presented accurately reflects Council intent, which is clearly specified in the Council's motion (i.e. "by September 1").

On the second question, the GAP believes that the Council did not intend to require a permit for CP co-ops. That belief is supported by two separate Council actions and the language of the Draft Environmental Impact Statement (DEIS).

Issue 8) The GAP recommends option b. The intent was to keep multiple permit transactions within the mothership sector. Option a would go beyond Council intent.

Issue 9) The GAP recommends option b. It will take time administratively to implement an Individual Fishing Quota for a failed co-op. Allowing the remaining co-op members to fish on the C/P sector allocation through the end of the year after a co-op failure will prevent substantial negative impacts.

NMFS Interpretations of Council Intent

Issue 19) As described above in clarification issue 7, NMFS contradicted Council intent by requiring a co-op permit for C/P co-ops. Despite acknowledging the DEIS statement (p. D-42) that a co-op permit would not be required, NMFS determined that there was a "management need." The GAP believes that requiring a co-op permit drags the agency into co-op management unnecessarily, but most importantly the GAP believes Council intent was clear and consistent, and NMFS' interpretation is contrary to Council intent.

Process for Development of Community Fishing Associations

The GAP feels that Community Fishing Association (CFA) development is not an urgent priority. The GAP notes that CFAs are forming now and are not precluded under current rules.

Given other Council and trawl rationalization priorities, the GAP feels hurrying to develop CFAs could have detrimental impacts on other aspects of the program. There was some discussion about whether cooperative pooling arrangements (e.g. insurance pools) could potentially violate control caps, and if so, whether CFA development might need to occur earlier. The GAP believes this is unlikely to be a major issue and feels that fishermen and pools should work through the established constraints in the program.

The GAP also feels that a CFA committee should not be established. Adding extra bureaucracy and process will not necessarily yield a better result. The GAP feels that the normal Council process, involving Council staff, advisory panels, and the Council, is the right avenue for eventual CFA development.

Finally, the GAP notes that a large part of the interest in CFAs seems to be coming from the non-trawl fleet. While not directly related to the process question at hand, the GAP wishes to reiterate that a trawl permit will be required to land trawl quota.

Deeming – Amendment 21

The GAP feels that the Amendment 21 materials accurately reflect Council discussions and intent.

While not before the Council at this time, the GAP wishes to highlight that the intersector allocation process is not complete. Firm allocations between the other groundfish sectors, especially for certain species in certain areas (e.g. sablefish south of 36°), will need to be established. The GAP recommends that the Council undertake an additional intersector allocation process for making those determinations at the appropriate time.

PFMC
3/09/10

Agenda Item E.6.b
Supplemental GMT Report
March 2010

GROUNDFISH MANAGEMENT TEAM REPORT ON REGULATORY DEEMING FOR FISHERY MANAGEMENT PLAN AMENDMENT 20-TRAWL RATIONALIZATION AND AMENDMENT 21-INTERSECTOR ALLOCATION, AND PLANNING FOR COMMUNITY FISHERY ASSOCIATIONS

The Groundfish Management Team (GMT) would like to thank Ms. Jamie Goen and Dr. Todd Lee for their presentations on Agenda Item E.6. Our schedule did not allow for detailed discussion of the issues before the Council. However, with respect to Dr. Lee's presentation on Agenda Item E.6, NMFS Report 5, the team would like to again underscore the importance and express our support for the mandatory economic data collection program. With Amendment 20, the Council is hoping to improve economic conditions in the groundfish trawl fisheries and to minimize and possibly address any adverse impacts on fishing communities. Better economic monitoring will deepen the Council's understanding of how well its economic objectives are being met, as well as the where and why of any adverse impacts that may occur. Among other things, this deeper understanding will help inform the Council's design and implementation of the adaptive management program, consideration of community fishing associations, and any other potential modifications the Council may wish to make in the future to improve social or economic conditions in the fishery.

PFMC
3/10/10

Science, Service, Stewardship

Agenda Item E.6.b
Supplemental NMFS PowerPoint
March 2010

Trawl Rationalization

Regulatory Deeming

March 2010

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1. TRat rulemakings & schedule
2. Overview of new regulatory structure
3. Discuss BB documents
   - *NMFS interpretations of Council intent (NMFS Report 1) – only allocations*
   - *NMFS clarifications requested of Council (NMFS Report 2)*
   - *Draft regulatory outline (NMFS Report 3)*
   - *Draft proposed regulations for Am 20 & 21 (NMFS Report 4)*
   - *Mandatory economic data collection program design (NMFS Report 5)*

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TRat progress

NEPA Documents:

1. Am 20 FEIS being drafted
   - *Am 20 DEIS was open for public comment from 12/4 to 1/19*
   - *>1,850 comments received*
   - *Late Feb-March –*
     review of FEIS and response to comments
   - *FEIS should publish in June*

2. Am 21 DEIS open for public comment through 3/15

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TRat rulemaking contents

3 or more rulemakings-

1. Data Collection Rule (final rule published 1/29)

- *Potential participants in TRat program should complete an ownership interest form before May 1, 2010.*
- *Announces databases NMFS intends to use for initial issuance*
    1. *PacFIN (fish tickets & logbooks)*
    2. *NORPAC*
    3. *Limited Entry Permits*
- *Announces what data potential participants should check now and the contacts for checking that data (LET permit, shoreside processor/first receiver, MS/CV data requests)*
    1. *PacFIN*
       (fish ticket landings data for QS issuance, logbook data for depth and lat by target species, fish ticket data for first receiver to determine processor whiting QS)
    2. *NORPAC*
       (whiting data for catcher vessels in MS fishery, Motherships, C/P)
    3. *Limited Entry Permits*
       (permit owner of record, permit combinations)
    4. *This data must be reviewed & , if necessary, corrected before the Grand Framework proposed rule publishes (~May 2010). NMFS will not allow this data to be appealed during initial issuance. Only errors in NMFS extraction, aggregation, or expansion of the data may be appealed.*

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TRat rulemaking contents (con't)

3 or more rulemakings-

1. Data Collection Rule

2. Grand Framework Rule & FMP Review
   - *Will announce NMFS approval or disapproval of FMP AM 20 & 21 and EIS review*
   - *If approved, will announce draft regulations for program and will restructure existing groundfish regulations*
   - *Schedule*
     - *March & April – PFMC meetings – regulatory deeming*
     - *May – proposed rule publishes*
     - *August – final rule publishes*
     - *Sep-Dec – initial issuance & appeals*
     - *1/1/2011 – TRat program implemented*

3. Follow-up Rule (Fall 2010)
   - *Will include any remaining regulations, including but not limited to cost recovery*

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new regulatory structure

Subpart C – West Coast Groundfish Fisheries – General (660.10-660.99)

660.10 Purpose and Scope
660.11 Definitions
660.12 Prohibitions
660.13 Recordkeeping and reporting
660.14 VMS Program requirements
660.15 Equipment requirements
660.16 Groundfish observer program
660.17 Catch monitors & service providers
660.18 Certification and decertification
660.20 Vessel and Gear Identification
660.24 LE and OA fisheries
660.25 Permits
660.30 Comp. w/fish for collecting resource info. – EFPs
660.40 Overfished species rebuilding plans
660.50 Pacific Coast Treaty Indian fisheries
660.51 Washington coastal tribal fisheries
660.55 Allocations
660.60 Specs & management measures.
660.65 Groundfish harvest specifications.
660.70-99 Closed Area - GCA's and EFH

* ABC/OY Tables –
Tables (1a), OY tables (1b), Allocation tables (1c), Tables 2a, 2b, and 2c
* Vessel Capacity Rating Table - Table 2 to Part 660

Subpart D – West Coast Groundfish – Trawl Fisheries (660.100-660.199)

660.100 Purpose and Scope
660.111 Definitions
660.112 Prohibitions
660.113 Recordkeeping and reporting
660.120 Crossover provisions – Areas, Gears (?), Trawl Fisheries.
660.130 LE trawl fishery mgmt measures.
660.140 IFQ Program – Shore-based Trawl Fishery
660.150 Mothership (MS) Coop Program – Whiting At-sea Trawl Fishery
660.160 Catcher-Processor (C/P) Coop Program - Whiting At-sea Trawl
* Figure 1
* Trip Limit Tables - Table 3 North and South

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new regulatory structure (con't)

Subpart E – West Coast Groundfish – Fixed Gear Fisheries (660.200-660.299)

660.210 Purpose and Scope
660.211 Definitions
660.212 Prohibitions
660.213 Recordkeeping and reporting
660.216 Groundfish observer program.
660.219 Fixed gear identification and marking
660.220 Crossover provisions
660.230 LE fixed gear fishery mgmt. measures.
660.231 LEFG sablefish fishery management.
660.232 Sablefish LEFG daily trip limit fishery
* Trip Limit Tables - Table 4 North and South

Subpart F – West Coast Groundfish – Open Access Fisheries (660.300-.349)

660.310 Purpose and Scope
660.311 Definitions
660.312 Prohibitions
660.313 Recordkeeping and reporting
660.316 Groundfish observer program.
660.319 OA gear identification and marking
660.320 Crossover provisions
660.330 OA fishery mgmt measures.
660.331 Black rockfish fishery management
660.332 Sablefish OA daily trip limit fishery
660.333 OA non-groundfish trawl fishery mgmt measures
* Trip Limit Tables - Table 5 North and South

Subpart G – West Coast Groundfish – Recreational Fisheries (660.350-.399)

660.350 Purpose and Scope
660.351 Definitions
660.352 Prohibitions
660.353 Recordkeeping and reporting
660.360 Recreational fishery mgmt measures.

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IFQ Program
types of permits/accounts

1. QS permit /QS account
   - *initial issuance & appeals process for QS permit/QS amounts*
   - *QS account established when QS permit issued*
   - *permit/account non-transferable*
   - *annual renewal*
   - *ownership interest form required with application & renewal*
2. Vessel QP account
   - *vessel owner responsible for setting up vessel QP account*
   - *can designate others to access account*
   - *account non-transferable*
3. First Receiver Site License
   - *can apply any time of year, effective until end of year*
   - *issued to a person and a corresponding physical location*
   - *license non-transferable*
   - *annual renewal*
   - *catch monitor plan submitted as part of application & renewal*

MS Coop Program types of permits/accounts

1. Mothership permit (new)

- *initial issuance & appeals process*
- *transferable*
- *annual renewal*
- *ownership interest form required with application & renewal*
- *no size endorsement*

2. MS/CV endorsement (new & tied to LET permit)

- *initial issuance & appeals process*
- *catch history assigned to permit*
- *transferable, but non-severable from LET permit*
- *annual renewal with LET permit*
- *ownership interest form required with application & renewal*
- *maintain length endorsements, except transfers to smaller vessels do not have to be reduced*

3. Coop permit and agreement (new)

- *non-transferable*
- *annual renewal*
- *coop agreement submitted as part of application & renewal*

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C/P Coop Program types of permits/accounts

1. C/P endorsement (new & tied to LET permit)

- *initial issuance & appeals process*
- *transferable, but non-severable from LET permit*
- *annual renewal with LET permit*
- *maintain length endorsements, except transfers to smaller vessels do not have to be reduced*
- *C/P permit that is combined with a LET permit that is not C/P endorsed results in a single C/P permit with a larger size endorsement. (A CV/MS endorsement on one of the permits being combined will not be reissued on the resulting permit.)*

2. Coop permit and agreement (new)

- *non-transferable*
- *annual renewal*
- *coop agreement submitted as part of application & renewal*

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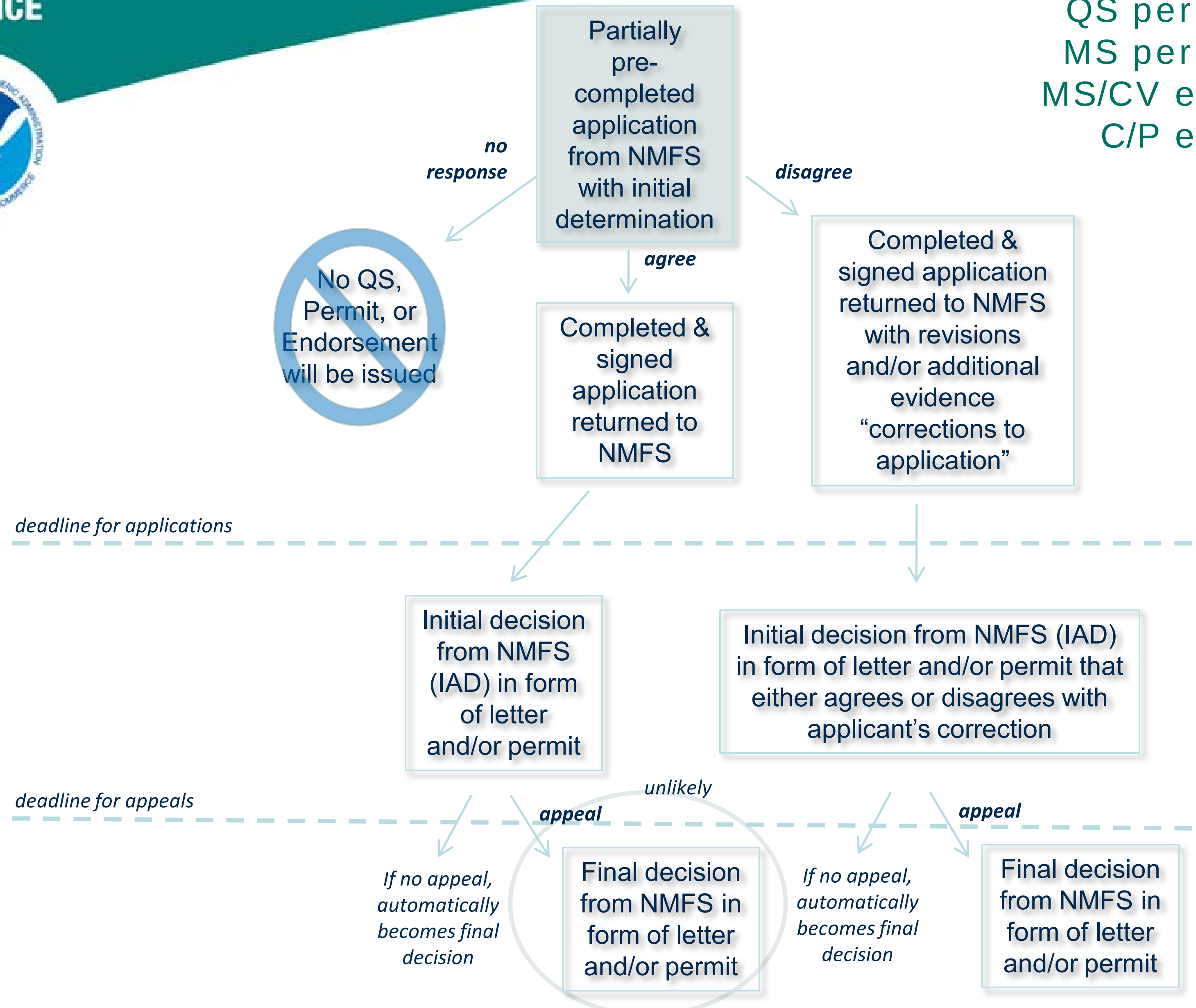
application/appeals
QS permit
MS permit
MS/CV end.
C/P end.



Science, Service, Stewardship

NMFS Interpretations of Council Intent

only 2) allocations (Am 21)

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Am 21 (trawl/non-trawl split)

Table 1. Groundfish allocation process and guidance.

		Optimum Yield				
			Fishery Guideline			
			Commercial Guideline			
Step in Process	Policy Guidance	Initial Set-asides	LE Trawl	LE Fixed Gear	Directed Open Acess	Recre-ational
1. Initial Set-Asides - Reduce OY by tribal amounts, estiamted research catch, pojected bycatch in non-gr, EFP bycatch limits.	Determine During Biennial Specifications Process	Tribal, Resarch, Incidental, EFPs				
2. Determine Limited Entry (LE) Trawl Allocation	A-21 (Fishery Guideline * Trawl %)		Trawl Amt			
3. Determine Recreational (Rec) Allocation	Determine During Biennial Specifications Process					Rec Amt
4. Determine Open Access (OA) Allocation	A-6 (Commercial Guideline x open access %)				Directed OA Amt	
5. Determine LE Fixed Gear	Remainder from Steps 1-4, Determined During Biennial Specifications Process			Fixed Gear Amt		
6. Subdivide trawl (Shoreside whiting (Wht)/Nonwhiting (NWht) split needed only for QS allocation in first year of program. Shoreside (SS), Motherhship (MS), and catch-processor (CP) splits needed on an ongoing basis.	Split trawl based on A-21 and at-sea set asides (set asides modifiable during biennial specifications process).		SS Nwht / SS Wht / MS / CP			

Science, Service, Stewardship

NMFS Clarifications Requested of Council

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NMFS clarifications

Issue 1:

Transfer of limited entry permits during application process for QS, MS/CV end., or C/P end.

- *A: Allow transfers; resulting permit/end. issued to new owner at time application complete*
- *B: Allow transfers; resulting QS permit issued to original applicant (even if doesn't own LE permit) – QS permits ONLY*
- *C (NMFS-preferred): Don't allow transfers*

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NMFS clarifications

Issue 2:

Status of permits pending appeal

How handle QS permits or MS/CV catch history assignments still under appeal at time of implementation?

- *A(NMFS-preferred): Allow use of QS permit/account or MS/CV catch history assignment based on amounts assigned before appeal. If appeal successful, revised QS or catch history assignment issued to all permits at time of renewal in the following year.*
- *B: Don't issue QS or catch history assignments until all appeals done, fishery continues under trip limits or existing whiting primary season until year following completion of appeals*

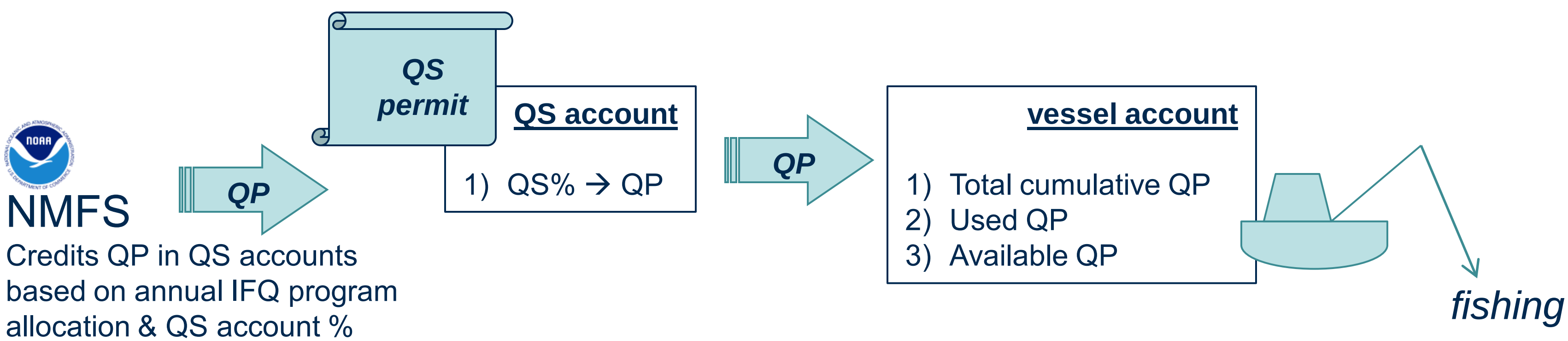
IFQ Program

Vessel Account

Issue 3:

When does the 30-day clock start for vessel overages?

- *A: start clock on landing that caused overage even if all data not available. Assumes vessel operator knows regardless of what vessel account says.*
- *B (NMFS-preferred): clock starts at the time data shows overage (fish tix at time of landing or vessel acct after landing)*



NMFS clarifications

Vessel Account

Issue 4:

The 10% carryover provision can be calculated from the vessel account different ways.

- *A (NMFS-preferred): carryover based on vessel account balance 45 days after start of the year QP issued to QS accounts.*
- *B: carryover based on total cumulative QP (used and unused) in vessel account over calendar year, minus QP that were transferred out.*
- *C: carryover based on vessel account balance at end of calendar year.*

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NMFS clarifications

Vessel Account

Issue 5:

All QP in a QS account must go in to a Vessel Account each year.

- *A: by December 31*
- *B (NMFS-preferred): close to end of year, but allowing enough time for fishing (by September 1?)*

NMFS clarifications

MS & C/P Coop Program

Issue 6:

Inconsistency in the Council's motion on at-sea whiting trawl sector set-asides (Am 21).

- *A: a 5 mt minimum set-aside for any species*
- *B: actual amounts in the preliminary DEIS table which showed some species set-asides of less than 5 mt (e.g., 0 mt and 1 mt).*
- *NMFS intends to put the set asides in regulation with the ABC/OY tables.*

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NMFS clarifications

Issue 7:

What is an appropriate deadline for a coop permit (MS or C/P) and for a MS/CV endorsed permit to declare in to a MS coop or the non-coop fishery?

- *September 1-December 31 of the year before the whiting season the MS/CV endorsed permit must declare through the permit renewal process that they are going to participate in the coop or non-coop fishery.*
- *A: Between September 1 - December 31 of the year before the whiting season the coop must apply for a coop permit*
- *B (NMFS-preferred): Between February 1 - March 31 before the whiting season the coop must apply for a coop permit*

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NMFS clarifications

MS Coop Program

Issue 8:

Should a MS/CV endorsed permit allow two changes in vessel registration in a year, if participating in both the shorebased IFQ fishery and the MS fishery?

- *A: Make 2x per year transfer rule apply to any trawl endorsed permit.*
- *B (NMFS-preferred): require that the MS/CV permit owner declare only in to MS fishery for 2nd change in vessel registration.*

C/P Coop Program

Issue 9:

What determines a coop failure and when would C/P fishery move to IFQ?

- C/P Coop Failure:
    1. If any C/P endorsed permits are not identified as coop members on the C/P coop agreement submitted to NMFS during the coop permit application process.
    2. If any vessel registered to a C/P endorsed permit withdraws from the C/P coop agreement.
    3. If the C/P coop fails to submit an annual report.
    4. If the C/P coop fails to manage harvest such that allocations are repeatedly exceeded.

NMFS clarifications

C/P Coop Program

Issue 9: (con't)

What determines a coop failure and when would C/P fishery move to IFQ?

- *A: If failed, the C/P fishery would cease fishing until C/P IFQ fishery implemented.*
- *B (NMFS-preferred): If failed, the remaining C/P coop members continue to fish on the C/P sector allocations and would move to an IFQ fishery in the following year once NMFS implements the appropriate regulations.*

Questions?

Agenda Item E.6.b
Supplemental NMFS PowerPoint 2
March 2010

Economic Data Collection for Monitoring the Effects of Trawl Rationalization

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March 2010

Objectives

- Follow guidance in Council's economic data collection provision
  - Study impacts of program
  - Determine whether goals and objectives are achieved
  - Data may be used to analyze future FMP amendments
- MSA reporting requirements to determine if program is attaining its goals
- Work closely with the Council, advisory panels, industry, participants and others to
  - Develop a valid and useful data collection program
  - Minimize burden

Current Groundfish Economic Data Collections

- Voluntary limited entry and open access surveys of harvesting vessels
  - Cost, earnings and employment data
  - 4 pages in length, 1 hour to respond
  - LE trawl fleet has 65% response rate
  - Data used for NWC's IO-PAC model, and NWC's (Lian et al.) analysis of rationalization
- Voluntary Processor Fishery Products Report
  - Products produced and employment data
  - 30 minutes to complete
  - 80-100% response rate
  - Used by NMFS headquarters for national reporting

Data Needed to Monitor Rationalization

- More data than currently collected
  - Catcher vessels: Some additional information
  - Shoreside processors, catcher/processors, and motherships: new surveys
  - Data at the fishery level where possible
- Need data for several years prior to rationalization
- Data for spillover effects collected through voluntary surveys of other fisheries

Types of Economic Analysis

- Economic performance measures
  - Cost, earnings and profitability
  - Economic efficiency
  - Net benefits to society

- Regional economic impact analysis
  - Contributions to regional economies: employment, income and output
  - Distributional effects

Proposed Program Design Process

- Feedback from March Council meeting
- Meetings with industry and associations
  - Feasibility and validity of collecting data elements
  - Survey logistics and administration
- Sound scientific practices
- Development of draft questionnaires and survey administration logistics
- Present June Council meeting

Other issues

- Burden of data collection on participants
  - Very important to minimize
  - Provide estimate in June
- Data confidentiality
- Mandatory regulations
- Central registry of quota share transaction prices
- Non-economic, social science data

Economic Performance Measures

- Cost, earnings and profitability
  (e.g., How do baseline economic measures change, do they vary by type of participant)
- Economic efficiency and stability
  (e.g., Cost per unit, product utilization, fleet consolidation)
- Capacity measures
  (e.g., # vessels/plants, changes in capacity, capacity utilization)
- Net benefits to society
  (e.g., Value created, changes in bycatch, environmental benefits)
- Distribution of net benefits
  (e.g., Crew, captains, vessels, processors, consumers)
- Product quality
  (e.g., Are there changes in the type or quality of fish products produced?)
- Functioning of quota market
  (e.g., Descriptive analysis, efficiency of market)
- Incentives to reduce bycatch
  (e.g., Changes in bycatch, effect of quota price, changes in target catch)
- Market power
  (e.g., Market power indexes, descriptive analysis)
- Spillover effects into other fisheries
  (e.g., Economic effects on other fleets, gear changes, market effects)

Regional Economic Impact Analysis

- Use the NWC IO-PAC model
  - Community effects
  - State level effects
  - West Coast effects
- Contribution to regional economies
  - Employment
  - Income
  - Output
- Distributional effects
  - Changes between regional economies
  - Changes across sectors or participants

Groundfish TIQ: Schedule Options for Council Consideration

March 2010 Council Meeting

Disclaimer : Amendments 20 & 21 to the Groundfish FMP have not yet been formally submitted to NMFS, or approved or implemented by NMFS.

Option: Program Implementation January *2011*

Data Collection Rule: nearly complete
Public notice will be mailed in mid-Feb.
Ownership interest forms mailed to potential participants in mid-Feb.
Industry makes data requests until late May

'Grand Rule'
Deeming: round 1 at March Council meeting; round 2 of deeming at April Council mtg
NEPA: Combined Am 20 & 21 FEIS publishes late June; ROD signed late July
Proposed Rule: May 20, 2010
Final Rule: August 10, 2010
Initial issuance/appeals process: late September 2010 – December 2010

Industry & Community Outreach Meetings
We will not be able to schedule any coastal meetings, but could have industry meetings in Seattle

Clean-up Rule
Deeming: June and/or September 2010 Council meeting
Drafting: April – July 2010
Proposed Rule: August 2010
Final Rule: November 2010

Option: Program Implementation January *2012*

Data Collection Rule: nearly complete
Public notice will be mailed in mid-Feb. 2010
Ownership interest forms mailed to potential participants in mid-Feb. 2010
Industry makes data requests until May 2010

'Grand Rule' Part 1 – FMP Review and Initial Issuance (same timeline as existing schedule)
Deeming: round 1 at March Council meeting; additional deeming may be required at April Council meeting
Proposed Rule: May 2010
NEPA: Combined Am 20 & 21 FEIS publishes late June; ROD signed late July
Final Rule: August 2010
Initial issuance/appeals process: Sep 2010 – July 2011

‘Grand Rule’ Part 2 – Program components, tracking/monitoring, economic data collection
Deeming: June and September 2010
Drafting: May-Sept. 2010
NEPA: May require additional NEPA coverage; supplemental EA/EIS (spring/summer 2010)
Proposed Rule: Fall/early winter 2010
Final Rule: Spring 2011
Implementation: January 2012

Industry & Community Outreach Meetings:
June – July 2010 in coastal communities of California, Oregon, & Washington
Additional outreach meetings possible in Winter 2010/2011

Clean-up Rule
Deeming: April 2011
Drafting: Jan – Apr 2011
Proposed Rule: Spring/Summer 2011
Final Rule: Fall 2011
Implementation: January 2012

NMFS Interpretations of Council Intent

Disclaimer: Additional interpretations of the Council intent on the trawl rationalization program will arise as the program is reviewed by NMFS. Amendments 20 & 21 to the Groundfish FMP, have not yet been formally submitted to NMFS, or approved or implemented by NMFS. NMFS and the Council staff are currently clarifying issues raised by these amendments.

ALL TRAWL FISHERIES

Ownership Interest

1) All individuals with greater than or equal to 2% ownership interest in a permit or vessel must report their ownership interest to the individual level.

Background:
After reviewing public comment on the proposed rule to collect ownership interest for the trawl rationalization program (74 FR 47545, 9/16/09), NMFS decided to revaluate the proposal to collect ownership information from ALL individuals with an ownership interest in the permit or vessel. Public comment noted that some permits are owned by large corporations (CDQ groups, publicly-held corporations, NGOs, etc) and NMFS proposed information collection would potentially require 1,000s of individuals and their % ownership to be reported to NMFS. Suggestions ranged from exempting large companies from reporting, to requiring them to sign an affidavit with heavy penalties for noncompliance, to setting a minimum threshold. NMFS is required to monitor ownership interest in order to avoid excessive control, in this case, through accumulation limits.

Rationale:
NMFS decided exempting large corporations would not be allowed . Requiring an affidavit would reduce NMFS' burden of monitoring accumulation limits. However, this option would not be as effective at achieving the goal of ensuring that the ownership of quota share is not inappropriately concentrated. By requiring the reporting of ownership information, NMFS can better ensure that accumulation limits are not exceeded before fishing under the program occurs, rather than after a violation has been identified and corrected. Therefore, NMFS decided to set a minimum threshold. NMFS decided that the variable threshold among sectors would add unnecessary complexity to the program. The 10% minimum threshold might be too high for some sectors. NMFS decided the

GAP recommended 2% (a threshold that is slightly below the lowest accumulation limit of 2.5 percent) was reasonable because it would ensure that data collection requirements are most useful for enforcement purposes without creating an undue administrative burden. It would also accomplish the purpose of reducing burdensome reporting for companies with large numbers of individuals with very small amounts of ownership interest.

Submission of an ownership interest form will be required with the initial applications, with permit renewal, transfers, and in subsequent years for a CV/MS endorsed permit, a MS permit, and a QS permit. Any new permit owner must also submit an ownership interest form at the time of transfer of the permit to another permit owner.

See Nov 2009 PFMC meeting, Agenda Item G.8.b, NMFS Report and Supplemental GAP Report, and the response to comments in the final rule for the ownership information collection for additional information.

Allocations

2) The amendment 21 allocation structure is in addition to existing groundfish allocation structures.

Background:

The Council motion on Am 21 from the April 2009 meeting states, "[Am 21] Allocations for all other species, except those for which IFQ would not be assigned through the trawl rationalization program as well as those species for which allocations would be decided through the biennial specifications process (actual species included listed in Table 2-10 on p. 23 of Preliminary Draft EIS). Note: longspine thornyhead south of 34°27' N. latitude would not be included." In other words, Am 21 allocations do not apply to non-IFQ species and species with allocations decided through the biennial specifications process.

Rationale:

NMFS interpretation of the Council's intent is that the Am 21(trawl/nontrawl) allocation structure is in addition to the existing groundfish allocation structure which is based on Am 6 (limited entry (LE)/open access (OA)) (See Table 1). A process for allocating between the limited entry and open access fisheries was developed with the limited entry program under Am 6 (see section 11.2.2 of the FMP). The Am 21 allocation structure (trawl/nontrawl) applies to Am 21 species (which differs from IFQ species which also includes whiting, sablefish N of 36, canary, bocaccio, cowcod, yelloweye rockfish, and minor shelf rockfish N & S). Note that while Am 21 does formally allocate some overfished species in the FMP (darkblotched, POP, and widow), it does not remove the FMP provision at 4.6.1(5) where formal limited entry, open access allocations may be suspended for overfished species for the duration of rebuilding. For trawl rationalization, canary, bocaccio, cowcod, yelloweye, minor shelf rockfish N & S would be allocated through the biennial specifications process. The Am 6 allocation structure (LE/OA) applies to remaining groundfish species.

Table 1. Groundfish allocation process and guidance.

		Optimum Yield				
			Fishery Guideline			
			Commercial Guideline			
Step in Process	Policy Guidance	Initial Set-asides	LE Trawl	LE Fixed Gear	Directed Open Acess	Recre-ational
1. Initial Set-Asides - Reduce OY by tribal amounts, estiamted research catch, pojected bycatch in non-gr, EFP bycatch limits.	Determine During Biennial Specifications Process	Tribal, Resarch, Incidental, EFPs				
2. Determine Limited Entry (LE) Trawl Allocation	A-21 (Fishery Guideline * Trawl %)		Trawl Amt			
3. Determine Recreational (Rec) Allocation	Determine During Biennial Specifications Process					Rec Amt
4. Determine Open Access (OA) Allocation	A-6 (Commercial Guideline x open access %)				Directed OA Amt	
5. Determine LE Fixed Gear	Remainder from Steps 1-4, Determined During Biennial Specifications Process			Fixed Gear Amt		
6. Subdivide trawl (Shoreside whiting (Wht)/Nonwhiting (NWht) split needed only for QS allocation in first year of program. Shoreside (SS), Motherhship (MS), and catch-processor (CP) splits needed on an ongoing basis.	Split trawl based on A-21 and at-sea set asides (set asides modifiable during biennial specifications process).		SS Nwht / SS Wht / MS / CP			

Currently, the allocations between limited entry and open access are calculated from the commercial harvest guideline after certain amounts of fish are "taken off the top" or reduced from the OY. That process has been modified over time, and is currently as follows:

> The OY is reduced by tribal amounts, estimated research catch (estimated research catch comes off the ABC for non-overfished species & off the OY for overfished species), projected bycatch in non-groundfish fisheries, EFP set-asides, and estimated recreational set-asides (defined in existing regulation at 660.302 under the definition for "commercial harvest guideline"). The result is the commercial harvest guideline. The commercial harvest guideline is then allocated between the limited entry fishery (both trawl and fixed gear) and the directed open access fishery.

After implementation of Am 21, if approved, the allocations for species will be a mix of trawl/nontrawl allocations for Am 21 species and LE/OA allocations for the remaining groundfish species. That process is interpreted as follows:

For Am 21 species:

> The OY is reduced by tribal amounts, estimated research catch (estimated research catch comes off the ABC for non-overfished species & off the OY for overfished species), projected bycatch in non-groundfish fisheries, and EFP set-asides (note: recreational estimates are not deducted here). The result is the fishery harvest guideline. The fishery harvest guideline is then allocated between the trawl and nontrawl fisheries. Here the nontrawl fisheries are defined as limited entry fixed gear, directed open access, and the recreational fishery. For the nontrawl fisheries, the estimated recreational set-asides would be deducted.

The directed OA amount would be calculated according to the Am 6 LE/OA split where the LE amount is the amount for all of limited entry (i.e., limited entry trawl plus limited entry fixed gear). The resulting directed OA amount would be deducted and the remaining nontrawl allocation (after the deduction for the recreational set-asides and directed OA) would be available to the limited entry fixed gear fishery.

For remaining groundfish species:

The OY is reduced by tribal amounts, estimated research catch (estimated research catch comes off the ABC for non-overfished species & off the OY for overfished species), projected bycatch in non-groundfish fisheries, EFP set-asides, and estimated recreational set-asides. The result is the commercial harvest guideline. The commercial harvest guideline is then allocated between the limited entry fishery (both trawl and fixed gear) and the directed open access fishery.

The differences between these 2 allocation structures are where the recreational catch estimates are deducted and whether the limited entry fixed gear fleet shares a pot of fish with the limited entry trawlers or with the directed open access and recreational fleet.

To accommodate this blending of allocation structures, NMFS has developed a definition for a "fishery harvest guideline" and has revised the "commercial harvest guideline" definition in the draft regulations.

Annual Renewal

3) After initial issuance, all permits, licenses, agreements, and accounts will be subject to annual renewal or registration.

Background:

NMFS discussed whether some permits, licenses, agreements, or accounts could be effective for more than one year (i.e., not subject to annual renewal) and only subject to renewal/reissuance after a change (new owners, transfer, etc.).

Rationale:

NMFS decided that all permits, licenses, agreements, and accounts once issued should be subject to annual renewal. One reason for this decision is to emphasize that these permits, licenses, and accounts are a privilege that provide access to the fishery and not a permanent right or ownership. Another reason for this decision is that business arrangements change over time and while it is a requirement to notify NMFS within 15 days of any change, this does not always occur. Annual registration or renewal requires the permits, licenses, agreements, and accounts to be reviewed and updated each year. Examples of changes include change of address, change of members with ownership interest in a business entity or their percent ownership, change of authorized representative or designated coop managers that serve as the responsible party and NMFS contact, etc.

Permit Transfers

4) Limits on the frequency of change in vessel registrations for MS permit, MS/CV endorsed permits, and C/P endorsed permits and effective date of a change in vessel registration.

Background:

Council motion as captured in Appendix D (p. D-35) states, "Limit on the Frequency of Transfers: MS permits may be transferred two times during the fishing year provided that the second transfer is back to the original mothership (i.e. only one transfer per year to a different mothership)." The same provisions apply to MS/CV endorsed permits and C/P endorsed permits (p. D-34 and D-41). NMFS has interpreted this as follows:

> A MS permit may be registered to another vessel two times during the fishing season as long as the second transfer is back to the original vessel. NMFS considers the original vessel to mean either the vessel registered to the permit as of January 1 or if no vessel is registered to the permit as of January 1, the original mothership is the first vessel to which it is registered after January 1. In this latter case, the first transfer could be to another vessel, but any second transfer would have to be back to the original vessel.

The Council motion as documented in Appendix D of the Am 20 DEIS does not address the effective date of a change in vessel registration for C/P, CV/MS or MS permits. NMFS intends to make changes in vessel registrations for these permits effective upon NMFS approval and issuance of the transferred permit. This is different than the frequency and effective date of transfers for the other limited entry permits, including trawl endorsed limited entry permits in the shorebased IFQ fishery. [NOTE: If a MS/CV permitted vessel also fishes in the IFQ fishery, what is the effective date and does the 1 transfer or 2 transfer rule apply to that permit? See NMFS clarifications document for more details.]

Rationale:

NMFS has interpreted how the frequency of transfers applies to permits in an "unidentified" status (i.e., not registered to a vessel at the start of the year) in accordance with existing regulations on the frequency of limited entry permit transfers. Unlike the existing limited entry permit transfer rules, these permit transfers would be effective immediately upon NMFS issuance of the transferred permit because the at-sea coop fisheries are not subject to 2-month cumulative trip limits.

5) Frequency of permit transfers for limited entry trawl endorsed permits and effective date.

Background:
Limited entry trawl-endorsed permits without MS/CV or C/P endorsements would remain as stated in existing regulations. In other words, one transfer per year would be allowed and approved transfers would be effective at the start of the next cumulative trip limit period.

Rationale:
Transfers would continue to be effective at the start of the next cumulative trip limit period as long as there are trip limits in place. The reason for this requirement is to prevent any double dipping on the 2-month cumulative trip limit (a per vessel limit) by a permit being registered to 2 vessels within the same period.

6) QS permits, First Receiver Site Licenses, and Coop permits are non-transferable. If the permit or licenses are sold, the old one is "closed" and, as appropriate NMFS will issue a new permit or license.

Background:
QS permits, First Receiver Site Licenses, and Coop permits are not permits directly associated with a vessel and, are not limited entry permits. Therefore, these permits and licenses do not convey a transferrable privilege and as such are non-transferrable. These types of permits and licenses are issued when a complete application and its associated requirements are submitted to NMFS.

Rationale:
QS permits, First Receiver Site Licenses, and Coop permits require certain standards to be met to acquire these permits. Since these are not limited entry permits associated with a vessel, any eligible entity could apply. These permits and licenses all require annual reissuance. In the case of the first receiver site license and the coop permit, NMFS does not presume that the holder will participate in their respective fishery in a subsequent year. Also, an applicant for the first receiver site license must submit a new catch monitor plan each year; while a coop must submit a coop agreement each year. In the case of a QS permit, in the third year of the program QS amounts (not permits) will become transferrable to other persons. At that time, any new person must register with NMFS and meet the eligibility requirements in order for NMFS to establish a QS account and to receive QS. The registration process to receive QS is separate from the actual transfer process of QS.

VMS declarations

7) New VMS declarations

Background:
VMS declarations are used to determine the fisheries in which vessels are participating in and which management measures apply. New VMS declarations will be needed for the trawl rationalization program.

Rationale:
NMFS will revise the VMS declarations to accommodate the trawl rationalization program. Multiple declarations will be needed for the IFQ fishery given how existing management measures, such as EFH, RCAs, conservation areas, gear requirements (one trawl gear onboard), apply in the IFQ fishery. New VMS declarations are as follows:

- Limited entry midwater trawl, non whiting IFQ
- Limited entry midwater trawl, Pacific whiting IFQ.
- Limited entry midwater trawl, Pacific whiting C/P sector.
- Limited entry midwater trawl, Pacific whiting MS sector.
- Limited entry IFQ bottom trawl, not including demersal trawl
- Limited entry IFQ demersal trawl.

These VMS declarations may be further revised as gear switching and other trawl rationalization program provisions are developed.

Definitions

8) Defining a whiting trip for the shoreside IFQ fishery.

Background:
Whiting trips, for the purpose of IFQ QS allocation, means those shorebased whiting fishing trips where greater than or equal to 50 percent of the total catch (landings and discards) is Pacific whiting. This definition does not work with the existing management measures for seasons and area closures in the shorebased whiting fishery.

Rationale:
The definition of whiting trips for IFQ QS allocations works for allocations and will be used for initial issuance of whiting QS, but does not work for ongoing management of the fishery, including seasons and area restrictions. The definition for whiting trips for IFQ QS allocations is based on information known after a trip. For management of the fishery, the whiting trip needs to be defined based on information known before or during the trip. Therefore, NMFS has developed a definition based on gear, similar to the definition currently used in regulation. The new definition for a shorebased whiting trip, for the purposes of ongoing management of the fishery, will be "a trip in which a vessel registered to a limited entry permit uses legal midwater groundfish trawl gear with a valid declaration for limited entry midwater trawl, Pacific whiting IFQ, as specified at 660.13 (d)(5) during the dates that the midwater whiting season is open."

Endorsements

9) Use of endorsed permits among trawl sectors (IFQ, MS, C/P)

Background:
As stated in Appendix D section B-4.1 (p. D-41) vessels that operate as C/Ps may also operate as MS, but not in the same year. Section B-2.1 (p. D-33) states that permits with a MS/CV endorsement may participate in either the coop or non-coop portion of the Mothership fishery. This section also states that any groundfish LE trawl permitted vessel may participate in the coop portion of the MS fishery if they join a coop. Finally, section B-2.1 also specifies that a MS operating as a C/P may not operate as a MS during the same year that they participated as a C/P.

Rationale:
NMFS interprets the use of endorsed permits among the trawl sectors as follows:

- C/P endorsed permit can be used by a catcher/processor in the C/P sector
- a MS permit can be used by a mothership in the mothership sector
- A vessel may be registered to both a C/P endorsed permit and a MS permit, but cannot fish in both sectors in the same year
- MS/CV endorsed permit can be used by a catcher vessel in the MS sector and IFQ sector if QP are available for use by the vessel.
- A trawl endorsed permit with no at-sea endorsements can be used by a vessel in the IFQ sector if QP are available for use by the vessel.and in the MS sector if it participates in a MS coop.

Observers

10) Current vessel observer data collection duties would incorporate, not be replaced by, IFQ species data collection needs.

Background:
With an increase of observer coverage, there has been some uncertainty about what observers on vessels would sample as part of the trawl rationalization program and whether their duties may focus entirely on collecting IFQ information.

Rationale:
With the implementation of trawl rationalization, updated sampling methodology will incorporate the need to collect more data on IFQ species; however, NMFS will maintain observer data collection necessary for the management of the groundfish fishery. These data collections are necessary in order to fulfill the Agency's overall conservation and management obligations under the MSA. An example of current data collection to be maintained under IFQ is species age structure data such as length, weight and sex. This information is key to many groundfish stock assessments.

11) No observer coverage waivers will be granted.

Background:
Currently, the bottom trawl fleet coverage is less than 100%. The IFQ program will require 100% observer coverage: all boats will be required to take an observer on all trips. NMFS will not issue observer coverage waivers to any vessels who wish to participate in the MS, C/P or IFQ sectors.

Rationale:
The IFQ program relies on 100% observer coverage to account for of all IFQ species. Granting coverage waivers would jeopardize the IFQ program's ability to accurately track and record catch of all IFQ species. Vessels must maintain safe conditions in order to have coverage or they cannot fish. If a vessel is determined to be unsafe, if appropriate, the quota pounds registered to it could be transferred to another vessel, consistent with the regulations.

IFQ PROGRAM

Trip Limits

12) Some status quo management measures will remain in place, including trip limits.

Background:
Am 20 DEIS, Appendix D, p. D-7 (A-1.3) states that unless otherwise specified, status quo regulations, including trip limits for non-IFQ species, would remain in place. It also states (p. D-3), "To ensure that optimum yields (OY) for species not covered by IFQ are not exceeded, catch of those species will be monitored and deductions made from the OY in anticipation of the expected level of shoreside trawl sector catch."

Rationale:
NMFS interprets this to mean trip limits will remain in place for some non-IFQ species such as spiny dogfish and other fish, while set asides are used for other non-IFQ species, such as nearshore species. These decisions can be made during the spex process to reflect the needs at the time. Routine management measures for the IFQ fishery will need to be defined at the start of the program to provide the rationale for an action and create a tool for management, should it be necessary.

Vessel Account

13) Holder of the vessel account and responsible party

Background:
The Am 20 DEIS, Appendix D, discusses the vessel account but does not define who will be the recognized “person” who may apply for the account or will be authorized to manage the account. It possibly could be interpreted to be the vessel owner, the vessel operator, or the vessel lessee or associated permit holder. Whoever is designated as the holder of the vessel account is responsible for managing the account and complies with the QP limits in the account or covering any overages. For any fishing violations associated with the vessel registered to the vessel account, the vessel owner(s) account manager(s) and/or vessel operator(s) will have joint and severable liability.

Rationale:
NMFS decided that the vessel owner is the holder of the vessel account and is responsible for managing the account. This is consistent with the current limited entry system where the vessel owner must be the holder of the limited entry permit that is registered to that owner’s vessel. When setting up or renewing a vessel account, the vessel owner may designate other persons that can access the vessel account (i.e., vessel operator, manager, etc.).

14) 30 days to cover all catch from an IFQ trip

Background:
The Council motion as captured in Appendix D of the Am 20 DEIS (A-2.2.1, p. D-12) states, “All catch a vessel takes on a trip must be covered with QP within 30 days of the landing for that trip unless the overage is within the limits of the carryover provision (Section A-2.2.2.b), in which case the vessel has 30 days or a reasonable time (to be determined) after the QP for the following year are issued, whichever is greater. [t]”

Rationale:
NMFS plans to implement the Council motion as follows: All catch a vessel takes on a trip must be covered with QP within 30 days of the landing for that trip unless the overage is within the limits of the carryover provision (Section A-2.2.2.b), in which case the vessel has 30 days ~~or a reasonable time (to be determined)~~ after the QP for the following year are issued~~, whichever is greater~~.” NMFS is removing the struckout language because a specific deadline is needed to be enforceable. NMFS has determined that 30-days is a reasonable amount of time to cover an overage. Because there is flexibility in the Council’s recommendation, the regulations could be amended in the future through a rulemaking to provide for a different timeframe.

(Note: issue 4 within the clarifications document addresses when the 30 day clock starts)

First Receiver Site License

15) An accepted catch monitoring plan will be required before issuance of a first receiver site license

Background:

The Council motion recommended the use of "shoreside site licenses" (Am 20 DEIS, Appendix D, A-2.3.1, p. D-17). NMFS concurs with the requirement for these licenses, but calls them "first receiver site licenses" to make the term consistent with existing shoreside whiting first receiver regulations at 50 CFR 660.373(j). First receiver site licenses and requirements are modeled after Pacific whiting first receiver EFP requirements used in 2008 and 2009 for the Pacific whiting shoreside fishery. To acquire the first receiver site license, NMFS will require additional information/equipment, including a catch monitoring plan, certified scale(s), necessary state first receiver fish buyers license, internet access, computer/software for electronic fish tickets, etc. For the requirement to have a certified scale(s), NMFS is working with the states to determine the best process. NMFS acknowledges that there is a state certification process and does not intend to duplicate effort. NMFS may conduct or require periodic scale testing to ensure compliance. Catch monitoring plans are prepared by the first receivers and are narrative responses to questions specified in regulation. NMFS may conduct a site inspection before accepting the plans and at any time during the year if there is a shift in first receiver operations (i.e., from receiving non-whiting groundfish to receiving whiting). Catch monitors may be shared by facilities or businesses using the same facilities, consistent with the regulations including those pertaining to coverage and daily working hours.

Rationale:

First receiver site licenses are needed to register those first receivers who are authorized to receive offloads of QS species at specific sites, for NMFS to assess catch monitor training and equipment needs, to ensure adequate monitoring and accounting of landed catch, to ensure accurate weighing and documenting of IFQ landings, and to ensure timely transmission of landed catch data. First receiver site licenses would only be issued to a person that submits a completed application to NMFS, including an accepted catch monitoring plan, and who has a corresponding physical location (not a PO Box). The catch monitor plan must be accepted by NMFS before NMFS will issue the license. A first receiver must have different site licenses for different physical locations where IFQ groundfish are received. NMFS will use the information in the application and catch monitoring plan to aid catch monitors in their duties and to assess if the catch can be adequately monitored. The catch monitoring plan is submitted annually and must be resubmitted if there is a substantial change in how fish are received, sorted, or weighed.

First receiver site licenses also provide NMFS with a mechanism to take enforcement or administrative action if any of the conditions of the license are not met. The site license also provides a mechanism for NMFS, assess potential catch monitoring needs for a particular site, and the potential overall program need. NMFS may require the first receiver to attend a mandatory meeting and have a site inspection in order to receive a first receiver site license.

IFQ Species Area Management

16) As IFQ species will be managed in four distinct geographic areas with different management measures, a vessel will be prohibited from fishing in different areas during the same trip.

Background:
Many groundfish species are tracked as either a single species with different QS by area; or as a single species in one area and as part of a minor shelf or slope group north or south of 40°10' N. lat. For example, yellowtail rockfish is an individual species management unit north of 40°10', but a member of the minor shelf rockfish species complex south of 40°10'. QS for sablefish is issued with area distinctions either north or south of 36° N. lat. QS for shortspine thornyhead is issued with area distinctions either north or south of 34°27' N. lat.

Rationale:
The IFQ management areas will be as follows:

- US/Canada border to ≥ 40°10'
- 40°10' to ≥ 36°
- 36° to ≥ 34°27'
- 34°27' to the US/Mexico border

As landings are a mix of all hauls taken during a single trip, to simplify sorting requirements, at-sea observation and enforcement of IFQ limits, a vessel must fish entirely in one management area during any trip. This is the most straightforward and efficient method to track and verify total catch of a vessel's IFQ limits for individual species and rockfish complexes.

IBQ Data Collection

17) Pacific halibut discard and mortality data collection frequency will likely increase, but the nature of the information collected will remain constant under trawl rationalization in order to provide individual vessel mortalities.

Background:
In formulating IBQ, the Appendix D states "The IBQ will be required to cover legal and sublegal sized Pacific halibut bycatch mortality in the area north of 40°10 N latitude. It is the intent of the Council that halibut IBQ mortality be estimated on an individual vessel basis." (Appendix D, A.4, p. D-19).

Rationale:
Appendix A states "Pacific halibut IBQ would function in a manner similar to IFQ for other species, except that retention and landing of halibut would be prohibited and only

pounds of dead halibut would be counted against the IBQ. Discard at sea of Pacific halibut would be required, and before discard occurs observers would estimate the halibut bycatch mortality on that vessel ~~(fleet wide average mortality rates would be used)~~ to provide greater individual accountability and incentives for harvesters to control halibut mortality." (Appendix A, A-4, p. A-440). NMFS is not including this phrase as it is opposite to Council intent of the IBQ. If large numbers of Pacific halibut occur in a haul the observer would likely sub-sample.

The current data collection methodology makes no distinction between legal and sublegal halibut, but, as length is collected, allows for analysts to divide out halibut bycatch as needed. In addition, weight of discarded halibut is determined by a length to weight conversion developed by the International Pacific Halibut Commission. As collecting halibut weight at-sea is problematic, use of the published length to weight conversion table is the accepted method to determine Pacific halibut weights.

Processing at-sea by IFQ whiting vessels.

18) The exemption for processing at-sea by shoreside whiting vessels will remain in place and the value for the weight conversion will be based on a published value.

Background:

Under the definition of processing in the groundfish regulations at 50 CFR 660.302, heading and gutting is allowed while a vessel is at sea provided no additional preparation is done. At the start of 2009 a provision was added for Pacific whiting shoreside vessels 75 feet in length or less, to exclude from the processing definition whiting that are headed and gutted with the tails removed and frozen at sea. The provision allows these vessels to continue to be part of the shore-based whiting fishery and the Pacific whiting taken by these vessels continues to be attributed to the shore-based allocation (50 CFR 660.373(a)(3)). To date only a single vessel has headed and gutted Pacific whiting at sea. The vessel used a smaller net and shorter tows to maintain product quality. Allowing the Pacific whiting to be tailed and frozen at-sea increases the value of the catch. This provision will continue. Therefore, NMFS should have a weight conversion in regulation.

Rationale:

NMFS will use a weight conversion for whiting based on published values in Crapo et al. (2004) (Sea Grant document). Without conversions for other species, species other than whiting may not be processed at-sea.

AT-SEA COOP PROGRAMS (MS & C/P)

Equipment Requirements

19) All catch in the at-sea whiting fleet will be required to be weighed by a NMFS certified flow scale that meets the testing requirements.

Background:
The motherships and catcher/processors operating in the at-sea whiting fleet generally use flow scales to weigh catch, but are not required to do so. Flow scales were incorporated into their fishing operations due to their requirement to operate in restricted access fisheries in the North Pacific. Although flow scales are commonly used in the whiting fishery rather than changing factory layouts or operations, it is unknown if they follow similar performance testing requirements as when they participate in the North Pacific fisheries

Rationale:
As the flow scales are already in operation and they are a proven method to attain accurate estimates of total catch in this high volume fishery, NMFS will now require their use in the at-sea whiting fishery. Flow scale certification and regulations in place for the North Pacific fisheries will be adopted and updated where appropriate for use in the whiting fishery. The Northwest Region is working with the Alaska Region to determine how best to incorporate the North Pacific requirements.

Non-whiting species reapportionment

20) Non-whiting groundfish species with formal allocations may be reapportioned within the MS Coop Program or between the MS and C/P Coop Programs.

Background:
Non-whiting groundfish species with allocations (i.e., darkblotched, POP, widow, and canary) may be reapportioned to permitted coops and the non-coop fishery when a MS permitted coop or the non-coop fishery reaches its whiting allocation. Similarly when a sector (i.e., MS or C/P) reaches its whiting allocation, the non-whiting species catch allocations can be reapportioned to the other sector. Whiting allocations cannot be reapportioned.

Rationale:
Reapportionment could occur when a sector reaches its whiting allocation or participants in the sector do not intend to harvest the remaining sector allocation. When considering redistribution of non-whiting catch allocation, the Regional Administrator will take into consideration the best available data on total projected fishing impacts in all fisheries.

With coops, we assume a very small amount of whiting will be left on the table at the end of a season meaning that the allocation is never actually reached. We will use a cease fishing notice provided by the participants to determine when coops and vessels are done for the year and reapportionment of non-whiting species with allocations can occur. The designated coop manager, or in the case of inter-coop, all of the designated coop managers, must notify NMFS in writing that their harvesting has concluded for the year. The regulations will specify that at any time after 80 percent of the MS sector whiting allocation has been harvested, the Regional Administrator may contact designated coop managers to determine whether they intend to continue fishing.

<u>Coop Permit and Agreement</u>

21) A coop permit approved by NMFS will be required of any coop participating in the MS or C/P Coop Program.

Background:
The Council motion as stated in Appendix D regarding the MS and C/P coop programs does not mention the requirement for a coop permit. In addition, Appendix D (p. D-42) of the Am 20 DEIS states that the C/P coop will not be required to have an annual registration or make annual declarations. However, NMFS has determined that there is a management need to require a permit at the coop level for both the MS and the C/P Coop Programs.

Rationale:
While both the MS and C/P sectors will be adequately managed by the coops, NMFS has determined that there is a need to require a permit at the coop level for any coop participating in the MS and the C/P Coop Program. The coop agreement establishes the terms and conditions for the coop. The coop permit formally registers the coop and its associated members to harvest and process whiting in the sector. The coop agreement, plus the specification of the coop managers, provides a mechanism for NMFS to track and to communicate with the coop. In NMFS's view, this is an appropriate element of the trawl rationalization program. In addition, the permit provides important accountability measures at the coop level instead of at the individual level, this is also an important element of the trawl rationalization program. The coop permit also provides NMFS a mechanism to take enforcement or administrative action at the coop level if any of the conditions of the permit and its associated coop agreement are not met. The coop permit may be revised by NMFS to reflect changes in the membership or participating vessels and other material changes to the coop.

22) Additional information in MS coop agreement.

Background:
Appendix D of the Am 20 DEIS (p. D-37) lists the contents of MS coop agreements. Item #1 states that a coop agreement must include "a list of all vessels, which must match the amount distributed to individual permit holders by NMFS." NMFS interprets this to

mean that the coop agreement should list the coop's permit numbers and also the vessels and vessel owners. Some vessels owners may not own the permit to which they are registered. In addition to the information recommended in Appendix D, the following information is also being required in a MS coop agreement (*See Attachment A for regulatory text of full list of MS coop agreement contents*):

- The mothership sector catch history assignment associated with each MS/CV endorsed limited entry permit.
- A catch history assignment clause indicating that each member MS/CV endorsed permit's catch history assignment must equal the catch history assignment that the member permit brings to the coop.
- A listing of all MS permits by permit number and the vessel registered to each permit that the MS coop members intend to deliver to.
- A description of how the coop would be dissolved.
[*This replaces the Council recommendation for an agreement by at least a majority of the members is required to dissolve a coop. During Council discussion this was flagged by NOAA GC as having potential legal issues.*]

Rationale:
NMFS has determined that a list of MS permits and a list of all vessels participating in the coop is necessary for establishing legal liability and catch tracking and monitoring. NMFS has determined that a list of permits participating in the coop is necessary as permits can be transferred and it is the permit that brings the catch history. The MS/CV endorsed permit owners are the coop members. The additional information includes a clause pertaining to the "Golden Rule" requirement recommended by the Council. These pieces of the program have been consolidated for efficiency.

23) A coop agreement will also be required of the C/P Coop.

Background:
The Council motion as stated in Appendix D (p. D-36 & D-37) requires submission of a coop agreement to NMFS and the Council for any MS coop. Appendix D does not have a similar coop agreement requirement for the C/P Coop Program. The coop agreement for the MS program is necessary to ensure that the coop will meet a set of terms and conditions (e.g., will adequately monitor catch and discards, designate a coop manager, list of participating permits/vessels, signatures of participants, obligation to produce an annual report, etc.).

Rationale:
For the same reasons that a coop agreement is required in the MS Coop Program, NMFS has determined that the C/P Coop Program should have a similar requirement for a coop agreement that is submitted to NMFS as part of the application process for a coop permit.

In addition, the coop agreement would allow NMFS to track if a member has left the coop and determine if the coop has been dissolved. This is an appropriate element of the trawl rationalization program. Because these events identify a coop failure, requirements for the C/P Coop Program to become an IFQ fishery would be triggered and NMFS requires certainty of this situation to take appropriate management action. The C/P coop agreement would be similar to that for the MS Coop Program, but with fewer provisions (i.e., the C/P coop agreement does not need to address catch history assignments). The draft regulatory text of the C/P coop agreement contents is in Attachment B.

24) Coop failure or dissolution

Background:
The Council's recommendation did not address specifically what constitutes a coop failure. Unlike the C/P fishery, NMFS could make a determination to revoke a particular MS coop permit or not reissue permits to MS coops that have been determined to have failed.

Rationale:
NMFS has interpreted a MS coop failure as any or all of the following :

1. If the coop members voluntarily dissolve the coop, or
2. If the coop membership falls below 20 percent of the CV/MS endorsed limited entry permits, or
3. If the coop agreement is no longer valid, or
4. If the coop fails to meet the MS coop responsibilities specified in regulation.
5. If the coop fails to submit an annual report.

MOTHERSHIP COOP PROGRAM

Maximized retention by mothership catcher vessels

25) The MS/CV fleet will only be allowed to discard minor operational amounts of catch at sea after the observer has accounted for the catch (i.e., a maximized retention fishery).

Background:

Current groundfish regulations at § 660.306 (i)(2) prohibit interfering with or biasing the sampling employed by an observer by mechanically or physically sorting or discarding catch before sampling. This language was intended to include the dumping of catch at sea by mothership catcher vessels. In addition, a prohibition was added in 2009 that prohibits the sorting or discarding of any portion of the catch taken by a catcher vessel in the mothership sector prior to the catch being received on a mothership, and prior to the observer being provided access to the unsorted catch, with the exception of minor amounts of catch that are lost when the codend is separated from the net and prepared for transfer. In addition the current definition of "landing" in regulation is that once the offloading of any species begins, all fish aboard the vessel are counted as part of the landing and must be reported as such. Transfer of fish at sea is prohibited unless a vessel is participating in the mothership or catcher-processor sectors. Maintaining the current regulations will require catcher vessels in the mothership sector to transfer catch to a vessel registered to a MS processor permit with all catch from a haul being transferred to the same mothership prior to the gear being set for a subsequent haul. Catcher vessels delivering to motherships will be required to carry observers under the coop system. Accommodation must be made to reduce the likelihood of hauls that are too large to purse off all catch in the codend. Catcher vessels with hauls that are too large to purse off in the cod end, must make accommodations for retaining and transferring the catch to the mothership or for the catcher vessel observer to obtain an accurate weight by species before fishing may be resumed. Catch in the mothership sector may not be offloaded to a tender vessel.

Rationale:

NMFS believes that maximized retention requirements must be maintained to derive accurate weights of the catch. Under this definition of "landing," whiting catch cannot go from a MS/CV to a tender vessel. To avoid discarding any portion of the catch, the catcher vessel operator is responsible for taking the necessary steps to prevent dumping or bleeding of catch directly from the codend Transfer of product to cargo vessels by mothership and catcher processor vessels continues to be allowed.

MS/CV endorsed limited entry permit catch history assignments

26) Years dropped in MS/CV catch history assignments

Background:
Appendix D (p.D-34) states that, "The initial catch history calculation for CV(MS) whiting endorsements will be based on whiting history of the permit for 1994 through 2003, dropping two worst years." The Council motion in November 2008 does not include the word "worst".

Rationale:
Initially NMFS will drop the two years with the lowest relative pounds of whiting. NMFS will then allow industry to choose which two years will be dropped from the calculation. If a participant would prefer to drop years other than the "worst" years (lowest relative pounds) This will reduce the burden on the agency during the initial issuance phase.

Non-coop Fishery

27) Allocation of whiting to the non-coop fishery

Background:
In Appendix D (B-2.5.3, p. D-39), the non-coop allocation is determined as follows: "Each year NMFS will determine the distribution to be given to the non-coop fishery based on the catch history calculation of permit holders registered to participate in that fishery."

Rationale:
Interpreted literally, this would mean that the non-coop fishery is the sum of all permits that declare in to the non-coop fishery preseason through the permit renewal process. Potentially, there may be cases where permits were not renewed on time and are permanently expired. This means that any remaining catch history assignments from permits not renewed or those that did not declare a coop or non-coop fishery would not contribute to the fishery for that year.

NMFS has interpreted this provision in Appendix D as follows: "The non-coop whiting fishery is authorized to harvest a quantity of whiting that is remaining in the mothership sector annual allocation after the deduction of all coop allocations." Thus, any remaining amounts of whiting from permits with catch history assignments that did not renew or that did not declare in to the coop fishery, would go toward the non-coop fishery allocation. In the second year, the catch history assignment from a permit that did not renew and were permanently expired would be redistributed proportionately to all valid MS/CV endorsed permits.

NMFS will require all MS coops to register with NMFS by a deadline date prior to the beginning of the at-sea whiting fishery. The catch history assignment associated with any MS/CV endorsed permit that is not registered for use by a coop would default to the non-coop fishery. NMFS will aggregate the amount of whiting catch history assignment for each of the permits assigned to the non-coop fishery and will allocate the aggregated sum to the non-coop fishery.

Only MS/CV vessels not registered to a coop may fish in the non-coop fishery. As part of the permit renewal process, NMFS will request that MS/CV endorsed permit owners indicate if they will participate in the coop or non-coop fishery.

Inseason management

28) Inseason management of species with at-sea sector set asides or without MS allocations

Background:
The Council action as captured in the Am 21 DEIS (p. 48) states that species with at-sea sector set asides would not be managed inseason; similarly any species without MS allocations would not be managed inseason.

Rationale:
NMFS agrees with this provision and interprets it to mean that these species would be managed on a annual basis according to the sector allocation, the species specific ACLs, and any other accountability measures.

29) MS Coop Program fishery closures.

Background:
In appendix D (B-1.1, p.D-29), states "NMFS will monitor the catch in the mothership non-coop fishery, the mothership co-op fishery, the CP fishery, and the overall whiting catch of all at-sea sectors. NMFS will close each segment of the fishery based on projected attainment of whiting catch. Additionally, all at-sea sectors will be subject to closure based on attainment of the overall trawl whiting allocation."

Rationale:
NMFS also interprets this to mean that NMFS will close the entire MS fishery (coop and non-coop fishery) if they are projected to attain an allocation. NMFS will not close individual coops in the MS fishery. The individual coops are responsible for closing their coop as stated in their coop agreement.

Mutual Agreement Exception

30) Catch history assignment for a MS/CV endorsed permit exiting a MS coop

Background:
The Council motion as captured in Appendix D of the AM 20 DEIS, (B-2.4.2(b.), p.D-38) states, "By mutual agreement of the CV(MS) permit owner and mothership to which the permit is obligated, a permit may deliver to a licensed mothership other than that to which it is obligated."

Rationale:
NMFS interpretation of the mutual agreement exception is that it means a written, private agreement that allows the owner of a MS/CV endorsed limited entry permit to withdraw the catcher vessel's obligation to a permitted mothership processor. Catch shares that are obligated to a particular mothership can be moved between vessels in the same MS permitted coop or between MS permitted coops that have an accepted inter-coop agreement. Catch shares cannot move between the coop and non-coop fisheries. A mutual agreement exception must be submitted to NMFS as notification that a particular MS/CV endorsed permit and the vessel registered to it will deliver to a different permitted mothership processor for the fishing season.

Definition of "material change"

31) New definition for the term "material change" as it applies to the MS fishery.

Background:
The Council motion states in Appendix D, page D-36 that "Any material changes or amendments to the contract must be filed annually with the Council and NMFS by a date certain." This language does not specifically define a material change.

Rationale:
NMFS has developed a preliminary definition for the term "material change". A material change means: "After the mothership coop permit is issued, NMFS must be notified in writing if a mothership coop makes changes to any of the following components of the coop agreement:

1. the designated coop manager;
2. the description of the coop's plan to adequately monitor and account for the catch of Pacific whiting and non whiting allocations, and to monitor and account for catch of prohibited species;
3. MS/CV endorsed member permit transfers ownership through mutual agreement in or out of the coop;
4. the description of the enforcement and penalty provisions;

5. the description of measures to reduce catch of overfished species;
6. the description of how the obligation to manage inseason transfers of catch history assignment will be conducted;
7. the description of how the coop is being dissolved;
8. the addition or withdrawal of any catcher vessel (MS/CV endorsed or limited entry trawl endorsed without an MS/CV endorsement) to the coop;

In addition, it is not clear why such changes would be submitted annually, unless no changes to the coop agreement and/or participants are anticipated to occur during the fishing season. If any substantive change to the coop agreement occurs during the fishing season, the coop manager must immediately provide to NMFS an amended cooperative agreement.

CATCHER/PROCESSOR COOP PROGRAM

Coop Formation

32) C/P Coop Program only allows for the formation of a single voluntary coop

Background:
In a couple of places, the council motion as captured in Appendix D (p. D-41, p.D-27) states that C/P endorsed vessels may form coops (plural). Other places in Appendix D (p. D-2, D-27, D-28, D-41) refer to a single voluntary coop. The Council motion in November 2008 refers to a single coop.

Rationale:
Because most places in Appendix D reference a single coop for the C/P coop program and because NMFS believes the Council intent is to keep the C/P coop structure similar to its current operations , NMFS has interpreted the C/P coop program to only include the formation of a single voluntary coop. Further, multiple competing coops could result in a race for fish, which is contrary to the goals of the trawl rationalization program.

Attachment A

Mothership Coop Agreements.

(A) Coop agreement. NMFS will review coop agreements for completeness and to determine if the coop permit contains sufficient information for the required items and to determine if the coop has adequate mechanisms to effectively manage the coop to track, monitor, and report on the catch activities of the coop members. A coop agreement must include all of the information listed at paragraph (e)(2)(iii)(A)(1) to be considered a complete coop agreement.

(1) Coop agreement contents. Each agreement must include the following information:

(i) A listing of all coop member vessels, including any member vessels registered to a MS/CV endorsed limited entry permit or a trawl-endorsed limited entry permit without a MS/CV endorsement.

(ii) A listing of all MS/CV endorsed limited entry member permits by permit number.

(iii) The mothership sector catch history assignment associated with each member MS/CV endorsed limited entry permit.

(iv) A listing of all MS permits by permit number and the vessel registered to each permit that the MS coop members intend to deliver to.

(vi) A catch history assignment clause indicating that each member MS/CV endorsed permit's catch history assignment must equal the catch history assignment that the member permit brings to the coop.

(vii) A description of the coop plan to adequately monitor and account for the catch of Pacific whiting and non-whiting groundfish allocations, and to monitor and account for the catch of prohibited species.

(viii) A new member permit owner clause that requires new owners of member permit's to comply with membership restrictions in the coop agreements

(ix) A description of the coop plan to enforcement and penalty provisions adequate to ensure that of Pacific whiting and non-whiting groundfish allocations overages do not occur.

(x) A description of measures to reduce catch of overfished species.

(xi) A description of how the obligation to manage inseason transfers of catch history assignments will be conducted.

(xii) A description of how the obligation to produce an annual report to the Council and NMFS by a date certain documenting the coop's catch and bycatch data and inseason transfers will be met.

(xiii) Identification of the designated coop manager.

(xiv) A signed clause by the designated coop manager acknowledging the responsibilities of a designated coop manager defined in 660.XXX.

(xv) A signed clause by all permit holders participating in the coop acknowledging the responsibilities of a coop member.

(xvi) A description for how the coop will be dissolved, including a requirement that at least a majority of the members are required to make a decision to dissolve a coop

(xvii) Provisions that prohibit coop membership by permit holders that have incurred legal sanctions that prevent them from fishing groundfish in the Council region.

Attachment B

Catcher/Processor Coop Agreements

(A) Coop agreement. NMFS will review coop agreements for completeness and to determine if the coop permit contains sufficient information for the required items and to determine if the coop has adequate mechanisms to effectively manage the coop to track, monitor, and report on the catch activities of the coop members. A coop agreement must include all of the information listed at paragraph (d)(2)(iii)(A)(1) to be considered a complete coop agreement.

(1) Coop agreements contents. Each agreement must include the following information:

(i) A listing of all C/P endorsed limited entry member permits by permit number. The coop agreement is not required to list the vessels registered to each permit.

(ii) A description of the coop plan to adequately monitor and account for the catch of Pacific whiting and non-whiting groundfish allocations, and to monitor and account for the catch of prohibited species.

(iii) A new member permit owner clause that requires new owners of member permit's to comply with membership restrictions in the coop agreements

(iv) A description of the coop plan for enforcement and penalty provisions adequate to ensure that of Pacific whiting and non-whiting groundfish allocations, Pacific halibut set-asides overages do not occur.

(v) A description of measures to reduce catch of overfished species.

(vi) A description of how the obligation to produce an annual report to the Council and NMFS by the November Council meeting documenting the coop's catch and bycatch data and inseason transfers will be met.

(vii) Identification of the designated coop manager.

(vii) A signed clause by the designated coop manager acknowledging the responsibilities of a designated coop manager defined in 660.XXXX.

(viii) A signed clause by all permit holders participating in the coop acknowledging the responsibilities of a coop member.

(ix) A description for how the coop will be dissolved.

(x) Provisions that prohibit coop membership by permit holders that have incurred legal sanctions that prevent them from fishing groundfish in the Council region.

Agenda Item E.6.b
Supplemental REVISED NMFS Report 2
March 2010

Clarifications Requested of Council

Disclaimer: Additional issues for clarification on the trawl rationalization program will arise as the program is reviewed by NMFS. Amendments 20 & 21 to the Groundfish FMP, have not yet been formally submitted to NMFS or approved or implemented by NMFS. NMFS and the Council staff are currently clarifying issues raised by these amendments.

ALL TRAWL FISHERIES.

<u>Permit initial issuance & appeal</u>

Issue 1: Transfer of limited entry permits during application process for QS permit, MS/CV endorsed permit, or C/P endorsed permit.

Option A:
QS, MS/CV, or C/P permit history and the limited entry permit are non-severable during application period and until final decision on application is made. Transfers of limited entry permits and their permit history can happen, but QS, MS/CV, or C/P permit would be issued to the new limited entry permit owner of record after the application process is complete.

Option B:
This option only applies to QS permit. The applicant would stay the same throughout application process regardless of whether the limited entry permit had transferred and the QS permit, if approved, would be issued to the original applicant. NMFS would maintain the list of limited entry trawl permit owners as of a specific date (e.g., date the prequalified application was mailed). Transfers of limited entry permit could occur, but QS would go to owner of record of the limited entry permit as of the specific. Therefore, the QS permit owner may not be the same person as the limited entry permit owner of record when NMFS makes its final decision and issues the QS permit with initial issuance of QS.

Option C: (NMFS-preferred)
No limited entry permit with a trawl endorsement associated with an application for a QS permit, or MS/CV or C/P endorsement could be transferred to a different permit owner during the application process.

Discussion: The Council motion does not discuss how permit transfers would be handled during the application process for the initial issuance of a QS permit, a MS/CV endorsed limited entry trawl permit, or a C/P endorsed limited entry trawl permit. Since the discussion of this issue at the GAP/GMT meeting on February 2-5, 2010, NMFS has reconsidered its preferred option. NMFS now prefers Option C which would not allow a change in permit ownership after an application is made for a QS permit or MS/CV or C/P endorsement. In NMFS's view, an applicant for the QS permit or MS/CV or CP endorsement is eligible to make the application only because the person owns the permit at the time of application and is making the application in good faith with the full expectation, that if approved, the requested privilege will be assigned to them. To allow a change in permit owner during application or appeals period, could introduce complexities where the new permit owner attempts to make assertions regarding the application or seek to appeal an IAD issued to original applicant.

Option A would require NMFS to make an initial determination to the original application, pending the conclusion of any appeal. NMFS would have the added step of having to reassign the QS or catch history assignment to the new permit owner. Further, in the case of making an allocation of QS or whiting catch history assignment, the new permit owner may have been approved for amounts of QS or whiting catch history assignment under a separate application that results in the new permit owner exceeding accumulation limits. While Option C may restrict some business flexibility on the part of the permit owner, the permit owner may make a change in vessel registration during the application and appeals process. In short, NMFS believes Option C provides the least confusing and least administratively burdensome approach to manage this issue. Option A maintains the permit history and the limited entry permit as non-severable during the application process. However, under the IFQ fishery which prohibits transfers of QS during the first 2 years of the program, this would essentially allow some trading of QS, although the exact amount may not be known, before the QS permit and its associated QS amount is issued. Option B is similar to Option A, but does not allow this "trading" of potential QS privilege during the application process. Option C may restrict some business decisions by limited entry permit owners during the application process.

Issue 2: <u>Status of QS and MS/CV endorsed permits pending appeal</u> . If all of the appeals associated with initial issuance of QS amounts on the QS permit and catch history assignments on the MS/CV endorsed permits are not completed by the time the trawl rationalization program is scheduled to be implemented, how will those permits still under the appeals process be handled?

Option A (*NMFS-preferred*):
While under appeal, the QS amount assigned for an IFQ management unit species will remain as previously assigned to the associated QS permit before the appeals process. The QS permit may participate in the Pacific Coast groundfish fishery with the QS amounts assigned to the QS permit before the appeal. Once a final decision on the appeal has been made and if a revised QS amount for a specific IFQ species will be assigned to the QS permit, the QS amount associated with the QS permit will be effective

at the start of the next calendar year. This same process would be followed for a whiting catch history assignment associated with MS/CV endorsed permit under appeal.

Option B:
NMFS would not issue QS to any qualified applicants until all the appeals are done. The fishery would continue under trip limits until all appeals are completed. NMFS would initially issue a QS contribution factor and would show applicants the pounds that went into the calculation of their QS but not issue QS until the start of the next year after all appeals are completed. For the Mothership fishery, NMFS would not issue MS/CV endorsed permits and their catch history assignments until all appeals are done. The fishery would continue under status quo management until all appeals are completed, and would start under the trawl rationalization MS coop program in the year following the completion of appeals.

Discussion: Under Option B, NMFS would not issue any QS until all appeals are completed. In the interim, the fishery would continue under trip limits. During the application process, permits that qualify would be issued a contribution factor which shows the pounds for each IFQ species that they will contribute to the IFQ fishery (i.e., their numerator in the IFQ equation where the denominator is all qualified QS permits). QS percentages would not be issued until all appeals had been completed and the denominator for each IFQ species was known. This method results in less changes among all QS permit owners' QS amounts during the first year of the program. Similarly, the MS/CV endorsed permits and their associated catch history assignments would not be issued until all appeals were completed. This is what was done for the scallop IFQ fishery in the NE. This method would provide an incentive to the fleet to finish all appeals in a timely manner.

Option A allows QS permit owners to fish all of the QS they were initially issued, including any QS amounts under appeal after December 31, 2010. QS amounts under appeal would be issued as the QS amount that appeared on the QS permit before the appeal. Once the appeal is completed and if it results in a change to the QS amount, the amended QS would appear on the QS permit in the next calendar year. NMFS would also adjust QS for all existing QS permit owners at the start of the next year based on appeals completed after December 31, 2010. Option A could also mean that in year two of the program those who had been issued QS might have their QS amended because of the outcome of appeals. This same process would be followed for a whiting catch history assignment associated with MS/CV endorsed permit under appeal.

IFQ FISHERY

Vessel Account

Issue 3: <u>30-day clock</u>. When does the 30-day clock start for vessel overages?

Option A:
Start the clock upon completion of the landing that caused the overage even if all data/documentation (observer reported discards and fish ticket reported landings) are not available in the vessel account. Assumes that at the time of landing, the vessel operator knows there was an overage that occurred on that trip.

Option B (*NMFS-preferred*):
If an overage shows on the fish ticket at the time of landing or in the vessel account at any time after the landing, the clock would start when any data/documentation from the trip which caused the overage is available or the vessel account shows there is an overage.

Discussion: Am 20 DEIS, Appendix D (A-2.2.1, p. D-12), states the 30-day clock starts from the landing for the trip that caused the overage. NMFS is concerned about the availability of data confirming the overage. When the Council made its motion on this issue, they assumed electronic reporting would be in place and data would be available rapidly, which may not be the case. If the language from the Council motion is followed strictly, it could start the 30-day clock before the responsible party may know there is an overage. NMFS prefers Option B because it would ensure all parties have an opportunity to be aware of the overage when the 30-day clock starts. For example: When the fish ticket deduction creates an overage (deficit) in the vessel account, the 30-day clock would start. If subsequent observer data creates the deficit, the 30-day clock would start when the observer data is entered into the vessel account. Whenever a data submission creates a negative balance for any species, the 30-day clock would start. In situations where the original fish ticket data created the deficit and the 30-day clock is initiated, and subsequent observer data and/or QA/QC data would be additive to the original deficit balance, it would not "restart" the 30-day clock.

Issue 4: <u>10% carryover</u>. The 10% carryover provision can be calculated from the vessel account different ways.

Option A (*NMFS-preferred for deficit or surplus*): The 10% carryover is 10% of the QPs in a vessel's account based on the balance 45 days after QPs have been initially issued for that year by NMFS based on the IFQ fishery allocation.

Option B: The 10% carryover is 10% of the total cumulative QP (used and unused) that have been in the vessel's account over the calendar year minus any QP that were transferred to another vessel's account.

Option C: The 10% carryover is 10% of the QPs in a vessel's account (used and unused) as of the balance at the end of the calendar year.

Discussion: Am 20 DEIS, Appendix D (A-2.2.2 b, p. D-13), states there is a limit of up to 10% carryover for each species. The 10% is calculated on the total pounds (used and unused) in a vessel QP account for the current year. There is some room for interpretation of the Council's motion as to when the 10% is calculated.

NMFS prefers Option A for both deficit and surplus carryover of up to 10% because it allows for the flexibility the industry seeks in managing the QPs in its vessel accounts, provides certainty of information for vessel account managers, simplifies tracking and monitoring, and furthers the Council intent to have all QPs assigned to a vessel account early in the year. QP deficits in a vessel account must be covered within 30 days to avoid investigation/prosecution for quota busting. The industry recognized early on that with the 10% carryover provision, an overage (account deficit) occurring after Dec. 2nd of a given year could potentially be "covered" by the annual issuance of QPs in the next year, i.e. January 1. This understanding lead to creation of a option where, if a vessel incurs a QP deficit of up to 10% of any species in its vessel account, that vessel may opt out of the fishery for the remainder of the year and avoid investigation/prosecution for incurring a QP deficit in its vessel account. Given that the deficit and desire to opt out could occur at any time of the year, it is important to identify what the 10% value is, early in the year. By identifying the 10% carryover value early in the year, account managers will know what the 10% carryover provision is for QP accounting for any given species in that year, and can plan accordingly. The industry will have an incentive to load QP in to their vessel accounts by mid-February thus furthering Council intent, and tracking and monitoring will be greatly simplified with a fixed number identified early on.

The account surplus carryover will be carried over to the vessel account from which it was derived for the following year and will be held (controlled) by the vessel account owner. For end of the year deficits, the account deficit must be covered by the vessel account owner within 30 days after QPs have been initially issued for that year by NMFS based upon the IFQ fishery allocation.

Issue 5: All QP in a QS account must go in to a Vessel Account each year.

Option A:
All QP in a QS account must go in to a Vessel Account by December 31 each year.

Option B (*NMFS-preferred*):
All QP in a QS account must go in to a Vessel Account by a specified date each year, for example, September 1.

Discussion: NMFS understands that this provision is intended to ensure that no QS owner can sit on the QP in their QS account; therefore, not providing harvest opportunity for vessels participating in the IFQ fishery. If the Council motion as described in Appendix D (A-2.2.3 b, p. D-14), which states, "each year, all QP must be transferred to a vessel account," is interpreted to mean that QP must go in to a vessel account by the end of the calendar year, then it does not meet the Council's intent of making QP available to the IFQ fishery. There could be a scenario where a QS owner would move QP in to a vessel account on December 31, causing most of those QP to be unavailable for use during the year (aside from any QP allowed from the carryover provision). Thus, NMFS prefers Option B, which would give QS owners time during the year to distribute QP to vessel accounts, but would also allow vessel's time to use any QP arriving in to their vessel accounts later in the year.

MOTHERSHIP & CATCHER-PROCESSOR COOP

At-sea Whiting Trawl Sector Set-Asides (Am 21)

Issue 6: There is an inconsistency in the Council's motion from April 2009 on at-sea whiting trawl sector set-asides. The motion states, "At-sea sector set asides: Adopt the GAC recommendation to set the at-sea sector set-asides large enough to not constrain their fisheries given the inter-annual variation in sector catches by establishing a 5 mt minimum set-aside for any incidentally caught species in the at-sea fisheries with all set asides rounded up to the nearest 5 mt (actual amounts specified in Table 4-23, p. 102 of Preliminary Draft EIS)."

Option A:
This could be interpreted to be at least 5 mt minimum set-aside for any species

Option B:
This could be interpreted to be actual amounts in the table from the preliminary DEIS which showed some species set-asides of less than 5 mt (e.g., 0 mt and 1 mt).

Discussion: For the Amendment 21 DEIS, NMFS has interpreted the GAC-recommended alternative to be a 5 mt minimum set aside for any species, except yelloweye rockfish which would remain at 0 mt, and the Council-preferred alternative to be the values that were originally reflected in the preliminary DEIS as shown in Table 2-13 of the DEIS (see below). The Council-preferred alternative would set-aside 1 mt of the following species: Pacific cod, longspine thornyheads north of 34 27' N. lat., English sole, Petrale sole, starry flounder, and longnose skate. Yelloweye rockfish would remain at 0 mt.

NMFS intends to put the set asides in regulation with the ABC/OY tables.

Table 2-13. Alternatives for yield set-asides to accommodate the bycatch in future at-sea whiting fisheries under trawl rationalization.

Allocation Process	Stock or Stock Complex	Alternative 1: No Action	Alternative 2: GAC-recommended	Alternative 3: Council-preferred at-sea Set-aside (mt) [a/]
Sector Allocations Decided Through the Intersector Allocation Process	Lingcod	No set asides for the at-sea whiting fishery. Historically have been set-asides for yellowtail and widow rockfish to accommodate catches in the at-sea whiting fishery. Once those fisheries were completed, the set-asides rolled back in to the limited entry trawl amounts available to the entire fishery.	6	6
	Pacific Cod		5	1
	Pacific Whiting (U.S.)		NA	NA
	Sablefish N. of 36º		50	50
	Sablefish S. of 36º		NA	NA
	PACIFIC OCEAN PERCH		Formal Allocation	Formal Allocation
	WIDOW ROCKFISH		Formal Allocation	Formal Allocation
	Chilipepper S. of 40°10'		NA	NA
	Splitnose S. of 40°10'		NA	NA
	Yellowtail N. of 40°10'		500	300
	Shortspine Thornyhead N. of 34º27'		20	20
	Shortspine Thornyhead S. of 34º27'		NA	NA
	Longspine Thornyhead N. of 34º27'		5	1
	Longspine Thornyhead S. of 34º27'		NA	NA
	DARKBLOTCHED		Formal Allocation	Formal Allocation
	Minor Slope RF N.		55	55
	Minor Slope RF S.		NA	NA
	Dover Sole		5	5
	English Sole		5	1
	Petrale Sole - coastwide		5	1
	Arrowtooth Flounder		10	10
	Starry Flounder		5	1
	Other Flatfish		20	20
	Pacific Halibut		10	5
Sector Allocations Decided Through the Biennial Specifications and Management Measures Process	CANARY ROCKFISH		Formal Allocation	Formal Allocation
	BOCACCIO		NA	NA
	COWCOD		NA	NA
	YELLOWEYE		0	0
	Black Rockfish		NA	NA
	Blue Rockfish (CA)		NA	NA
	Minor Nearshore RF N.		NA	NA
	Minor Nearshore RF S.		NA	NA
	Minor Shelf RF N.		35	35
	Minor Shelf RF S.		NA	NA
	California scorpionfish		NA	NA
	Cabezon (off CA only)		NA	NA
	Other Fish		520	520
	Longnose Skate		5	1

<u>Deadline for coop fishery declarations & permits</u>

Issue 7: What is an appropriate deadline for a coop permit (MS or C/P) and for a MS/CV endorsed permit to declare in to a MS coop or the non-coop fishery?

Option A:
September 1-December 31 of the year before the whiting season the MS/CV endorsed permit must declare through the permit renewal process that they are going to participate in the coop or non-coop fishery. Between September 1and December 31 of the year before the whiting season the coop must also apply for a coop permit, which would include the coop agreement.

Option B (*NMFS-preferred*):
September 1-December 31 of the year before the whiting season the MS/CV endorsed permit must declare through the permit renewal process that they are going to participate in the coop or non-coop fishery. Between February 1and March 31 before the whiting season the coop must also apply for a coop permit, which would include the coop agreement.

Discussion: The Council motion as captured in Appendix D of the Am 20 DEIS (B-2.4.1, p. D-38), states "By September 1 of the year prior to implementation and every year thereafter, each CV(MS) permit is required to contact NMFS and indicate whether CV(MS) permit will be participating in the co-op or non-coop fishery in the following year. If participating in the co-op fishery, then CV(MS) permit must also provide the name of the MS permit that CV(MS) permit will be linked to in the following year." The Council's motion (B-2.3.3, p. D-36) also states that the coop agreement must be submitted to NMFS for approval before the coop is authorized to engage in fishing activities. However, it does not set a firm date. As discussed in the NMFS Interpretations document, NMFS determined the need for a coop permit for both the MS and C/P fisheries.

Both Option A and B conform with the Council motion for when a MS/CV endorsed permit should declare their intent to participate in the MS coop (but not which coop) or non-coop fishery. Because the MS/CV endorsed permit is an endorsement on the limited entry permit, it makes sense to have that declaration of intent be part of the limited entry permit renewal process which happens from September 1 through December 31 each year.

Option A also requires the coop (MS or C/P) to register for a coop permit between September 1 and December 31 each year. However, a list of coop member permits and vessels is a required as part of the coop agreement that must be included with the permit application that is sent to NMFS. The September 1, timing may be difficult if all MS/CV endorsed or C/P endorsed limited entry permits have not yet been renewed.

Option B allows time for the MS/CV endorsed or C/P endorsed limited entry permits to be renewed between September 1 and December 31. The coop (MS or C/P would register for a coop permit between February 1 and March 31, which would include a list of coop member permits and vessels that are less likely to change. The coop permit application deadline is before the whiting OY for the year is announced and before the season starts. NMFS prefers Option B. Applications for the inter-coop agreements in the MS fishery would be accepted by NMFS any time during the year.

MOTHERSHIP COOP PROGRAM

Permit transfers

Issue 8: Should a MS/CV-endorsed permit allow two changes in vessel registration in a year, if participating in both the shorebased IFQ fishery and the MS fishery?

Option A:
NMFS could make the two changes in vessel registration rule apply to any trawl endorsed permit. This would potentially increase the number of vessel registrations but would provide a uniformed requirement across the broader trawl fleet.

Option B (*NMFS-preferred*):
NMFS could require that any second change in vessel registration on a MS/CV permit would require that the permit owner declare that the vessel being assigned to the permit will operate in the MS whiting fishery. The declaration would happen through the VMS declaration requirements and regulations would state that after the second transfer, the vessel must fish exclusively in the MS fishery.

Discussion: The Council motion includes a provision (Appendix D, Page D-34) that allows a MS/CV endorsed permit to have two changes in vessel registration in a year, with the second change in vessel registration to the original vessel assigned to the permit. Vessels registered to a MS/CV endorsed permit can deliver whiting to the MS sector and potentially could deliver IFQ groundfish to shorebased processors. If the MS/CV endorsed permit is used exclusively for fishing in the shorebased sector, it would seem that the one transfer rule would apply and that such changes in vessel registration would be effective at the start of the next cumulative trip limit period. The question is which transfer rules would apply to a particular transfer of a MS/CV endorsed permit and when those transfers could be effective.

CATCHER/PROCESSOR COOP PROGRAM

<u>Coop Failure → IFQ Fishery</u>

Issue 9: The Council motion as captured in Appendix D of the Am 20 DEIS (p. D-41 & D-42) states that "If the co-op system fails it will be replaced by an IFQ program." What determines a coop failure and when would C/P fishery move to IFQ?

Option A:
The C/P coop will be determined to fail if the coop agreement fails to include all C/P endorsed limited entry permits during the coop permitting process or if a permit withdraws from the coop at any time during the year; if the designated coop manager contacts NMFS regarding a failure; or if the coop fails to meet its defined responsibilities. If failed, the C/P fishery would cease fishing until NMFS could implement the C/P IFQ fishery.

Option B (*NMFS-preferred*):
The C/P coop will be determined to fail if the coop agreement fails to include all C/P endorsed limited entry permits during the coop permitting process or if a permit withdraws from the coop at any time during the year; if the designated coop manager contacts NMFS regarding a failure; or if the coop fails to meet its defined responsibilities. If failed, the remaining C/P coop members continue to fish on the C/P sector allocations and would move to an IFQ fishery in the following year once NMFS implements the appropriate regulations.

Discussion: Unless all IFQ provisions are initially implemented with this rulemaking, to transform the C/P fishery from a coop to an IFQ program would require time for NMFS to prepare a rulemaking. Under Option B, the fishery could continue to operate as a coop to prevent substantial impacts. Under such circumstances, steps could be immediately taken to implement an IFQ program with the intent of having it in place for the following year.

NMFS has interpreted a C/P coop failure as follows:

1. If any of the C/P endorsed permits are not identified as coop members on the coop agreement submitted to NMFS during the coop permit application process.
2. If any vessel registered to a C/P endorsed permit withdraws from the C/P coop agreement.
3. If the C/P coop fails to submit an annual report If the C/P coop fails to manage harvest such that allocations are repeatedly exceeded

If a coop (MS or C/P) dissolves, the designated coop manager must notify NMFS in writing of the dissolution of the coop. NMFS expects coops to self-report, but NMFS maintains authority to determine if a coop fails or is dissolved. The Regional Administrator may make an independent determination of a permitted coop failure based on factual information collected by or provided to NMFS.

*Contents in this revised document are ***unchanged*** from the previous version.
Page numbers and fonts have been modified to match the version distributed electronically.

Draft Proposed Regulations for Amendments 20 and 21

Disclaimer: These draft regulations will be reorganized and/or revised as it goes through the agency review process. Additional issues may arise as the program is reviewed by NMFS. Amendments 20 & 21 to the Groundfish FMP, have not yet been formally submitted to NMFS or approved or implemented by NMFS. NMFS and the Council staff are currently clarifying issues raised by these amendments.

Note: These draft regulations show new text specific to the trawl rationalization program (*in green, italicized, arial font*) and do not show all of the existing groundfish regulatory text that will get moved in to the new groundfish regulatory structure that will be in the proposed rule. Cross references to other sections within the regulations are highlighted in yellow and have not yet been updated.

For the reasons set out in the preamble, 50 CFR Part 660 is proposed to be amended as follows:
PART 660–-FISHERIES OFF WEST COAST STATES

1. The authority citation for part 660 continues to read as follows:

Authority: 16 U.S.C. 1801 et seq.

2. A new Subpart C is added to read as follows:

Subpart C – West Coast Groundfish Fisheries – General

§ 660.10 Purpose and Scope.

(a) *Subparts C through G* implement the Pacific Coast Groundfish Fishery Management Plan (PCGFMP) developed by the Pacific Fishery Management Council. *Subparts C through G* govern fishing vessels of the U.S. in the EEZ off the coasts of Washington, Oregon, and California. All weights are in round weight or round-weight equivalents, unless specified otherwise.

(b) Any person fishing subject to *Subparts C through G* is bound by the international boundaries described in this section, notwithstanding any dispute or negotiation between the U.S. and any neighboring country regarding their respective jurisdictions, until such time as new boundaries are established or recognized by the U.S.

§ 660.11 *General* Definitions.

Active sampling unit means a portion of the groundfish fleet in which an observer coverage plan is being applied.

Address of Record means the business address of a person, partnership, or corporation used by NMFS to provide notice of actions.

Allocation. (See §600.10).

Base permit, with respect to a limited entry permit stacking program, means a limited entry permit described at §660.25 (b)(1), Subpart C registered for use with a vessel that meets the permit length endorsement requirements appropriate to that vessel, as described at §660.25 (b)(2), Subpart C.

Biennial fishing period means a 24–month period beginning at 0001 local time on January 1 and ending at 2400 local time on December 31 of the subsequent year.

B_{MSY} means the biomass level that produces maximum sustainable yield (MSY), as stated in the PCGFMP at Section 4.2.

Calendar year. (see "fishing year")

Catch, take, harvest. (See §600.10).

Catch monitor means an individual that is certified by NMFS, is deployed to a first receiver, and whose primary duties include: monitoring and verification of the catch sorting relative to federal requirements defined in § 660.60 Subpart C; documentation of the weighing of catch relative to the requirements of section §660.13, Subpart C; and verification of first receivers reporting relative to the requirements defined in section§ 660.113, Subpart D.

Change in partnership or corporation means the addition of a new shareholder or partner to the corporate or partnership membership. This definition of a "change" will apply to any person added to the corporate or partnership membership since November 1, 2000, including any family member of an existing shareholder or partner. A change in membership is not considered to have occurred if a member dies or becomes legally incapacitated and a trustee is appointed to act on his behalf, nor if the ownership of shares among existing members changes, nor if a member leaves the corporation or partnership and is not replaced. Changes in the ownership of publicly held stock will not be deemed changes in ownership of the corporation.

Closure or closed means, when referring to closure of a fishery or a closed fishery, that taking and retaining, possessing, or landing the particular species or species group covered by the fishing closure is prohibited. Unless otherwise announced in the Federal Register or authorized in this subpart, offloading must begin before the closure time.

Commercial fishing means:

(1) Fishing by a person who possesses a commercial fishing license or is required by law to possess such license issued by one of the states or the Federal Government as a prerequisite to taking, landing and/or sale; or

(2) Fishing that results in or can be reasonably expected to result in sale, barter, trade or other disposition of fish for other than personal consumption.

Commercial harvest guideline or commercial quota *means the fishery harvest guideline minus the estimated recreational catch.* Limited entry and open access allocations are derived from the commercial harvest guideline or quota.

Conservation area(s) means either a Groundfish Conservation Area (GCA), an Essential Fish Habitat Conservation Area (EFHCA), or both.

(1) Groundfish Conservation Area or GCA means a geographic area defined by coordinates expressed in degrees latitude and longitude, wherein fishing by a particular gear type or types may be prohibited. GCAs are created and enforced for the purpose of contributing to the rebuilding of overfished West Coast groundfish species. Regulations at §§660.70 through 660.XXX, Subpart C define coordinates for these polygonal GCAs: Yelloweye Rockfish Conservation Areas, Cowcod Conservation Areas, waters encircling the Farallon Islands, and waters encircling the Cordell Banks. GCAs also include Rockfish Conservation Areas or RCAs, which are areas closed to fishing by particular gear types, bounded by lines approximating particular depth contours. RCA boundaries may and do change seasonally according to the different conservation needs of the different overfished species. Regulations at §§660.70 through 660.XX, Subpart C define RCA boundary lines with latitude/longitude coordinates; regulations at Tables 3-5 of Part 660 set RCA seasonal boundaries. Fishing prohibitions associated with GCAs are in addition to those associated with EFH Conservation Areas.

(2) Essential Fish Habitat Conservation Area or EFHCA means a geographic area defined by coordinates expressed in degrees latitude and longitude, wherein fishing by a particular gear type or types may be prohibited. EFHCAs are created and enforced for the purpose of contributing to the protection of West Coast groundfish essential fish habitat. Regulations at §§660.70, Subpart C through 660.XXX, Subpart C define EFHCA boundary lines with latitude/longitude coordinates. Fishing prohibitions associated with EFHCAs, which are found at §660.12, Subpart C, are in addition to those associated with GCAs.

Continuous transiting or transit through means that a fishing vessel crosses a groundfish conservation area or EFH conservation area on a constant heading, along a continuous straight line course, while making way by means of a source of power at all times, other than drifting by means of the prevailing water current or weather conditions.

Corporation is a legal, business entity, including incorporated (INC) and limited liability corporations (LLC).

Council means the Pacific Fishery Management Council, including its Groundfish Management Team (GMT), Scientific and Statistical Committee (SSC), Groundfish Advisory Subpanel (GAP), and any other committee established by the Council.

Date of landing means the date on which the transfer of fish or offloading of fish from any vessel to a processor or first receiver begins.

Direct financial interest means any source of income to or capital investment or other interest held by an individual, partnership, or corporation or an individual's spouse, immediate family member or parent that could be influenced by performance or non-performance of observer *or catch monitor* duties.

Electronic fish ticket means a software program or data files meeting data export specifications approved by NMFS that is used to send landing data to the Pacific States Marine Fisheries Commission. Electronic fish tickets are used to collect information similar to the information required in state fish receiving tickets or landing receipts, but do not replace or change any state requirements.

Electronic Monitoring System (EMS) means a data collection tool that uses a software operating system connected to an assortment of electronic components, including video recorders, to create a collection of data on vessel activities.

Endorsement means an additional specification affixed to the limited entry permit that further restricts fishery participation or further specifies a harvest privilege, and is non-severable from a limited entry permit.

Entity (See "Person")

Essential Fish Habitat or EFH. (See §600.10).

First Receiver means a person who receives, purchases, or takes custody, control, or possession of catch onshore directly from a vessel.

Fish. (See §600.10).

Fishery (See §600.10).

Fishery harvest guideline means the harvest guideline or quota after subtracting from the OY any allocation for the Pacific Coast treaty Indian tribes, projected research catch, deductions for fishing mortality in non-groundfish fisheries, as necessary, and set-asides for EFPs.

Fishery management area means the EEZ off the coasts of Washington, Oregon, and California between 3 and 200 nm offshore, and bounded on the north by the Provisional International Boundary between the U.S. and Canada, and bounded on the south by the International Boundary between the U.S. and Mexico. The inner boundary of the fishery management area is a line coterminous with the seaward boundaries of the States of Washington, Oregon, and California (the "3–mile limit"). The outer boundary of the fishery management area is a line drawn in such a manner that each point on it is 200 nm from the baseline from which the territorial sea is measured, or is a provisional or permanent international boundary between the U.S. and Canada or Mexico. All groundfish possessed between 0–200 nm offshore or landed in Washington, Oregon, or California are presumed to have been taken and retained from the EEZ, unless otherwise demonstrated by the person in possession of those fish.

Fishing. (See §600.10).

Fishing gear includes the following types of gear and equipment:

(1) Bottom contact gear. Fishing gear designed or modified to make contact with the bottom. This includes, but is not limited to, beam trawl, bottom trawl, dredge, fixed gear, set net, demersal seine, dinglebar gear, and other gear (including experimental gear) designed or modified to make contact with the bottom. Gear used to harvest bottom dwelling organisms (e.g. by hand, rakes, and knives) are also considered bottom contact gear for purposes of this subpart.

(2) Demersal seine. A net designed to encircle fish on the seabed. The Demersal seine is characterized by having its net bounded by lead-weighted ropes that are not encircled with

bobbins or rollers. Demersal seine gear is fished without the use of steel cables or otter boards (trawl doors). Scottish and Danish Seines are demersal seines. Purse seines, as defined at §600.10, are not demersal seines. Demersal seine gear is included in the definition of bottom trawl gear in (11)(i) of this subsection.

(3) Dredge gear. Dredge gear, with respect to the U.S. West Coast EEZ, refers to a gear consisting of a metal frame attached to a holding bag constructed of metal rings or mesh. As the metal frame is dragged upon or above the seabed, fish are pushed up and over the frame, then into the mouth of the holding bag.

(4) Entangling nets include the following types of net gear:

(i) Gillnet. (See §600.10).

(ii) Set net. A stationary, buoyed, and anchored gillnet or trammel net.

(iii) Trammel net. A gillnet made with two or more walls joined to a common float line.

(5) Fixed gear (anchored nontrawl gear) includes the following gear types: longline, trap or pot, set net, and stationary hook-and-line (including commercial vertical hook-and-line) gears.

(6) Hook-and-line. One or more hooks attached to one or more lines. It may be stationary (commercial vertical hook-and-line) or mobile (troll).

(i) Bottom longline. A stationary, buoyed, and anchored groundline with hooks attached, so as to fish along the seabed. It does not include pelagic hook-and-line or troll gear.

(ii) Commercial vertical hook-and-line. Commercial fishing with hook-and-line gear that involves a single line anchored at the bottom and buoyed at the surface so as to fish vertically.

(iii) Dinglebar gear. One or more lines retrieved and set with a troll gurdy or hand troll gurdy, with a terminally attached weight from which one or more leaders with one or more lures or baited hooks are pulled through the water while a vessel is making way.

(iv) Troll gear. A lure or jig towed behind a vessel via a fishing line. Troll gear is used in commercial and recreational fisheries.

(7) Mesh size. The opening between opposing knots. Minimum mesh size means the smallest distance allowed between the inside of one knot to the inside of the opposing knot, regardless of twine size.

(8) Nontrawl gear. All legal commercial groundfish gear other than trawl gear.

(9) Spear. A sharp, pointed, or barbed instrument on a shaft.

(10) Trap or pot. These terms are used as interchangeable synonyms. See §600.10 definition of "trap".

(11) Trawl gear means a cone or funnel-shaped net that is towed through the water, and can include a pair trawl that is towed simultaneously by two boats. Groundfish trawl is trawl gear that is used under the authority of a valid limited entry permit issued under this subpart endorsed for trawl gear. It does not include any type of trawl gear listed as non-groundfish trawl gear. Non-groundfish trawl gear is any trawl gear other than the Pacific Coast groundfish trawl gear that is authorized for use with a valid groundfish limited entry permit. Non-groundfish trawl gear includes pink shrimp, ridgeback prawn, California halibut south of Pt. Arena, and sea cucumbers south of Pt. Arena.

(i) Bottom trawl. A trawl in which the otter boards or the footrope of the net are in contact with the seabed. It includes demersal seine gear, and pair trawls fished on the bottom. Any trawl not meeting the requirements for a midwater trawl in §660.XXX of Subpart D is a bottom trawl.

(A) Beam trawl gear. A type of trawl gear in which a beam is used to hold the trawl open during fishing. Otter boards or doors are not used.

(B) Large footrope trawl gear. Large footrope gear is bottom trawl gear with a footrope diameter larger than 8 inches (20 cm,) and no larger than 19 inches (48 cm) including any rollers, bobbins, or other material encircling or tied along the length of the footrope.

(C) Small footrope trawl gear. Small footrope trawl gear is bottom trawl gear with a footrope diameter of 8 inches (20 cm) or smaller, including any rollers, bobbins, or other material encircling or tied along the length of the footrope. Selective flatfish trawl gear that meets the gear component requirements in §660.XXX of Subpart D is a type of small footrope trawl gear.

(ii) Midwater (pelagic or off-bottom) trawl. A trawl in which the otter boards and footrope of the net remain above the seabed. It includes pair trawls if fished in midwater. A midwater trawl has no rollers or bobbins on any part of the net or its component wires, ropes, and chains. For additional midwater trawl gear requirements and restrictions, see §660.XXX of Subpart D.

(iii) Trawl gear components.

(A) Breastline. A rope or cable that connects the end of the headrope and the end of the trawl fishing line along the edge of the trawl web closest to the towing point.

(B) Chafing gear. Webbing or other material attached to the codend of a trawl net to protect the codend from wear.

(C) Codend. (See §600.10).

(D) Double-bar mesh. Webbing comprised of two lengths of twine tied into a single knot.

(E) Double-walled codend. A codend constructed of two walls of webbing.

(F) Footrope. A chain, rope, or wire attached to the bottom front end of the trawl webbing forming the leading edge of the bottom panel of the trawl net, and attached to the fishing line.

(G) Headrope. A chain, rope, or wire attached to the trawl webbing forming the leading edge of the top panel of the trawl net.

(H) Rollers or bobbins are devices made of wood, steel, rubber, plastic, or other hard material that encircle the trawl footrope. These devices are commonly used to either bounce or pivot over seabed obstructions, in order to prevent the trawl footrope and net from snagging on the seabed.

(I) Single-walled codend. A codend constructed of a single wall of webbing knitted with single or double-bar mesh.

(J) Trawl fishing line. A length of chain, rope, or wire rope in the bottom front end of a trawl net to which the webbing or lead ropes are attached.

(K) Trawl riblines. Heavy rope or line that runs down the sides, top, or underside of a trawl net from the mouth of the net to the terminal end of the codend to strengthen the net during fishing.

Fishing trip is a period of time between landings when fishing is conducted.

Fishing vessel. (See §600.10).

Fishing *year or Calendar year* is the year beginning at 0001 local time on January 1 and ending at 2400 local time on December 31 of the same year. There are two fishing years in each biennial fishing period.

Grandfathered or first generation, when referring to a limited entry sablefish-endorsed permit owner, means those permit owners who owned a sablefish-endorsed limited entry permit prior to November 1, 2000, and are, therefore, exempt from certain requirements of the sablefish permit stacking program within the parameters of the regulations at §§660.334 through 660.341 and §660.372.

Groundfish means species managed by the PCGFMP, specifically:

(1) Sharks: leopard shark, Triakis semifasciata; soupfin shark, Galeorhinus zyopterus; spiny dogfish, Squalus acanthias.

(2) Skates: big skate, Raja binoculata; California skate, R. inornata; longnose skate, R. rhina.

(3) Ratfish: ratfish, Hydrolagus colliei.

(4) Morids: finescale codling, Antimora microlepis.

(5) Grenadiers: Pacific rattail, Coryphaenoides acrolepis.

(6) Roundfish: cabezon, Scorpaenichthys marmoratus; kelp greenling, Hexagrammos decagrammus; lingcod, Ophiodon elongatus; Pacific cod, Gadus macrocephalus; Pacific whiting, Merluccius productus; sablefish, Anoplopoma fimbria.

(7) Rockfish: In addition to the species below, longspine thornyhead, S. altivelis, and shortspine thornyhead, S. alascanus, "rockfish" managed under the PCGFMP include all genera and species of the family Scorpaenidae that occur off Washington, Oregon, and California, even if not listed below. The Scorpaenidae genera are Sebastes, Scorpaena, Scorpaenodes, and Sebastolobus. Where species below are listed both in a major category (nearshore, shelf, slope) and as an area-specific listing (north or south of 40°10' N. lat.) those species are considered "minor" in the geographic area listed.

(i) Nearshore rockfish includes black rockfish, Sebastes melanops and the following minor nearshore rockfish species:

(A) North of 40°10' N. lat.: black and yellow rockfish, S. chrysomelas; blue rockfish, S. mystinus; brown rockfish, S. auriculatus; calico rockfish, S. dalli; China rockfish, S. nebulosus; copper rockfish, S. caurinus; gopher rockfish, S. carnatus; grass rockfish, S. rastrelliger; kelp rockfish, S. atrovirens; olive rockfish, S. serranoides; quillback rockfish, S. maliger; treefish, S. serriceps.

(B) South of 40°10' N. lat., nearshore rockfish are divided into three management categories:

(1) Shallow nearshore rockfish consists of black and yellow rockfish, S. chrysomelas; China rockfish, S. nebulosus; gopher rockfish, S. carnatus; grass rockfish, S. rastrelliger; kelp rockfish, S. atrovirens.

(2) Deeper nearshore rockfish consists of black rockfish, S. melanops; blue rockfish, S. mystinus; brown rockfish, S. auriculatus; calico rockfish, S. dalli; copper rockfish, S. caurinus; olive rockfish, S. serranoides; quillback rockfish, S. maliger; treefish, S. serriceps.

(3) California scorpionfish, Scorpaena guttata.

(ii) Shelf rockfish includes bocaccio, Sebastes paucispinis; canary rockfish, S. pinniger; chilipepper, S. goodei; cowcod, S. levis; shortbelly rockfish, S. jordani; widow rockfish, S. entomelas; yelloweye rockfish, S. ruberrimus; yellowtail rockfish, S. flavidus and the following minor shelf rockfish species:

(A) North of 40°10' N. lat.: bronzespotted rockfish, S. gilli; bocaccio, S. paucispinis; chameleon rockfish, S. phillipsi; chilipepper, S. goodei; cowcod, S. levis; dusky rockfish, S. ciliatus; dwarf-red, S. rufianus; flag rockfish, S. rubrivinctus; freckled, S. lentiginosus; greenblotched rockfish, S. rosenblatti; greenspotted rockfish, S. chlorostictus; greenstriped rockfish, S. elongatus; halfbanded rockfish, S. semicinctus; harlequin rockfish, S. variegatus; honeycomb rockfish, S. umbrosus; Mexican rockfish, S. macdonaldi; pink rockfish, S. eos; pinkrose rockfish, S. simulator; pygmy rockfish, S. wilsoni; redstripe rockfish, S. proriger; rosethorn rockfish, S. helvomaculatus; rosy rockfish, S. rosaceus; silvergray rockfish, S. brevispinis; speckled rockfish, S. ovalis; squarespot rockfish, S. hopkinsi; starry rockfish, S. constellatus; stripetail rockfish, S. saxicola; swordspine rockfish, S. ensifer; tiger rockfish, S. nigrocinctus; vermilion rockfish, S. miniatus.

(B) South of 40°10' N. lat.: bronzespotted rockfish, S. gilli; chameleon rockfish, S. phillipsi; dusky rockfish, S. ciliatus; dwarf-red rockfish, S. rufianus; flag rockfish, S. rubrivinctus; freckled, S. lentiginosus; greenblotched rockfish, S. rosenblatti; greenspotted rockfish, S. chlorostictus; greenstriped rockfish, S. elongatus; halfbanded rockfish, S. semicinctus; harlequin rockfish, S. variegatus; honeycomb rockfish, S. umbrosus; Mexican rockfish, S. macdonaldi; pink rockfish, S. eos; pinkrose rockfish, S. simulator; pygmy rockfish, S. wilsoni; redstripe rockfish, S. proriger; rosethorn rockfish, S. helvomaculatus; rosy rockfish, S. rosaceus; silvergray rockfish, S. brevispinis; speckled rockfish, S. ovalis; squarespot rockfish, S. hopkinsi; starry rockfish, S. constellatus; stripetail rockfish, S. saxicola; swordspine rockfish, S. ensifer; tiger rockfish, S. nigrocinctus; vermilion rockfish, S. miniatus; yellowtail rockfish, S. flavidus.

(iii) Slope rockfish includes darkblotched rockfish, S. crameri; Pacific ocean perch, S. alutus; splitnose rockfish, S. diploproa; and the following minor slope rockfish species:

(A) North of 40°10' N. lat.: aurora rockfish, Sebastes aurora; bank rockfish, S. rufus; blackgill rockfish, S. melanostomus; redbanded rockfish, S. babcocki; rougheye rockfish, S. aleutianus; sharpchin rockfish, S. zacentrus; shortraker rockfish, S. borealis; splitnose rockfish, S. diploproa; yellowmouth rockfish, S. reedi.

(B) South of 40°10' N. lat.: aurora rockfish, Sebastes aurora; bank rockfish, S. rufus; blackgill rockfish, S. melanostomus; Pacific ocean perch, S. alutus; redbanded rockfish, S. babcocki; rougheye rockfish, S. aleutianus; sharpchin rockfish, S. zacentrus; shortraker rockfish, S. borealis; yellowmouth rockfish, S. reedi.

(8) Flatfish: arrowtooth flounder (arrowtooth turbot), Atheresthes stomias; butter sole, Isopsetta isolepis; curlfin sole, Pleuronichthys decurrens; Dover sole, Microstomus pacificus; English sole, Parophrys vetulus; flathead sole, Hippoglossoides elassodon; Pacific sanddab, Citharichthys sordidus; petrale sole, Eopsetta jordani; rex sole, Glyptocephalus zachirus; rock sole, Lepidopsetta bilineata; sand sole, Psettichthys melanostictus; starry flounder, Platichthys stellatus. Where regulations of this subpart refer to landings limits for “other flatfish,” those limits apply to all flatfish cumulatively taken except for those flatfish species specifically listed in Tables 1–2 of this subpart. (i.e., “other flatfish” includes butter sole, curlfin sole, flathead sole, Pacific sanddab, rex sole, rock sole, and sand sole.)

(9) “Other fish”: Where regulations of this subpart refer to landings limits for “other fish,” those limits apply to all groundfish listed here in paragraphs (1)–(8) of this definition except for the following: those groundfish species specifically listed in Tables 1–2 of this subpart with an ABC for that area (generally north and/or south of 40°10' N. lat.); and Pacific cod and spiny dogfish coastwide. (i.e., “other fish” may include all sharks (except spiny dogfish), skates, ratfish, morids, grenadiers, and kelp greenling listed in this section, as well as cabezon in the north.)

Groundfish trawl means trawl gear that is used under the authority of a valid limited entry permit issued under Subparts C and D endorsed for trawl gear. It does not include any type of trawl gear listed as “exempted gear.”

Harvest guideline means a specified numerical harvest objective that is not a quota. Attainment of a harvest guideline does not require closure of a fishery.

IAD means Initial *Administrative Determination*.

Incidental catch or incidental species means groundfish species caught while fishing for the primary purpose of catching a different species.

Land or landing means to begin transfer of fish, offloading fish, or to offload fish from any vessel. Once transfer of fish begins, all fish aboard the vessel are counted as part of the landing.

Legal fish means fish legally taken and retained, possessed, or landed in accordance with the provisions of 50 CFR part 660, Subparts C through G, the Magnuson-Stevens Act, any document issued under part 660, and any other regulation promulgated or permit issued under the Magnuson-Stevens Act.

Length overall (LOA) (with respect to a vessel) means the length overall set forth in the Certificate of Documentation (CG–1270) issued by the USCG for a documented vessel, or in a registration certificate issued by a state or the USCG for an undocumented vessel; for vessels that do not have the LOA stated in an official document, the LOA is the LOA as determined by the USCG or by a marine surveyor in accordance with the USCG method for measuring LOA.

License owner means a person who owns (legally controls) a first receiver site license issued under Subparts C through D and is the person of record with the SFD, Permits Office.

Limited entry fishery means the fishery composed of vessels registered for use with limited entry permits.

Limited entry gear means longline, trap (or pot), or groundfish trawl gear used under the authority of a valid limited entry permit affixed with an endorsement for that gear.

Limited entry permit means:

(1) The Federal permit required to participate in the limited entry *"A" endorsed* fishery, and includes any gear, size, or species endorsements affixed to the permit, or

(2) The Federal permit required to participate as a mothership processor.

Maximum Sustainable Yield or MSY. (See §600.310).

Mobile transceiver unit means a vessel monitoring system or VMS device, as set forth at §660.14, Subpart C installed on board a vessel that is used for vessel monitoring and transmitting the vessel's position as required by Subpart C.

Nontrawl fishery means

(1) For the purpose of allocations at §660.55, Subpart C, nontrawl fishery means the limited entry fixed gear fishery, the open access fishery, and the recreational fishery.

(2) For the purposes of all other management measures in Subparts C through G, nontrawl fishery means any legal groundfish gear other than trawl gear (groundfish trawl gear and exempted trawl gear).

North-South management area means the management areas defined in paragraph (1) of this definition, or defined and bounded by one or more or the commonly used geographic coordinates set out in paragraph (2) of this definition for the purposes of implementing different management measures in separate geographic areas of the U.S. West Coast.

(1) Management areas —

(i) Vancouver.

(A) The northeastern boundary is that part of a line connecting the light on Tatoosh Island, WA, with the light on Bonilla Point on Vancouver Island, British Columbia (at 48°35.73' N. lat., 124°43.00' W. long.) south of the International Boundary between the U.S. and Canada (at 48°29.62' N. lat., 124°43.55' W. long.), and north of the point where that line intersects with the boundary of the U.S. territorial sea.

(B) The northern and northwestern boundary is a line connecting the following coordinates in the order listed, which is the provisional international boundary of the EEZ as shown on NOAA/NOS Charts 18480 and 18007:

Point	N. Lat.	W. Long.
1	48°29.62'	124°43.55'
2	48°30.18'	124°47.22'

3	48°30.37'	124°50.35'
4	48°30.23'	124°54.87'
5	48°29.95'	124°59.23'
6	48°29.73'	125°00.10'
7	48°28.15'	125°05.78'
8	48°27.17'	125°08.42'
9	48°26.78'	125°09.20'
10	48°20.27'	125°22.80'
11	48°18.37'	125°29.97'
12	48°11.08'	125°53.80'
13	47°49.25'	126°40.95'
14	47°36.78'	127°11.97'
15	47°22.00'	127°41.38'
16	46°42.08'	128°51.93'
17	46°31.78'	129°07.65'

(C) The southern limit is 47°30' N. lat.

(ii) Columbia.

(A) The northern limit is 47°30' N. lat.

(B) The southern limit is 43°00' N. lat.

(iii) Eureka.

(A) The northern limit is 43°00' N. lat.

(B) The southern limit is 40°30' N. lat.

(iv) Monterey.

(A) The northern limit is 40°30' N. lat.

(B) The southern limit is 36°00' N. lat.

(v) Conception.

(A) The northern limit is 36°00' N. lat.

(B) The southern limit is the U.S.-Mexico International Boundary, which is a line connecting the following coordinates in the order listed:

Point	N. Lat.	W. Long.
1	32°35.37'	117°27.82'
2	32°37.62'	117°49.52'
3	31°07.97'	118°36.30'

4	30°32.52'	121°51.97'

(2) Commonly used geographic coordinates.
(i) Cape Alava, WA—48°10.00' N. lat.
(ii) Queets River, WA—47°31.70' N. lat.
(iii) Pt. Chehalis, WA—46°53.30' N. lat.
(iv) Leadbetter Point, WA—46°38.17' N. lat.
(v) Washington/Oregon border—46°16.00' N. lat.
(vi) Cape Falcon, OR—45°46.00' N. lat.
(vii) Cape Lookout, OR—45°20.25' N. lat.
(viii) Cascade Head, OR—45°03.83' N. lat.
(ix) Heceta Head, OR—44°08.30' N. lat.
(x) Cape Arago, OR—43°20.83' N. lat.
(xi) Cape Blanco, OR—42°50.00' N. lat.
(xii) Humbug Mountain—42°40.50' N. lat.
(xiii) Marck Arch, OR—42°13.67' N. lat.
(xiv) Oregon/California border—42°00.00' N. lat.
(xv) Cape Mendocino, CA—40°30.00' N. lat.
(xvi) North/South management line—40°10.00' N. lat.
(xvii) Point Arena, CA—38°57.50' N. lat.
(xviii) Point San Pedro, CA—37°35.67' N. lat.
(xix) Pigeon Point, CA—37°11.00' N. lat.
(xx) Ano Nuevo, CA—37°07.00' N. lat.
(xxi) Point Lopez, CA—36°00.00' N. lat.
(xxii) Point Conception, CA—34°27.00' N. lat. [Note: Regulations that apply to waters north of 34°27.00' N. lat. are applicable only west of 120°28.00' W. long.; regulations that apply to waters south of 34°27.00' N. lat. also apply to all waters both east of 120°28.00' W. long. and north of 34°27.00' N. lat.]

Observer. (See §600.10 - U.S. Observer or Observer)

Observer Program or Observer Program Office means the West Coast Groundfish Observer Program (WCGOP) Office of the Northwest Fishery Science Center, National Marine Fisheries Service, Seattle, Washington.

Office of Law Enforcement (OLE) refers to the National Marine Fisheries Service, Office of Law Enforcement, Northwest Division.

Open access fishery means the fishery composed of commercial vessels using open access gear fished pursuant to the harvest guidelines, quotas, and other management measures governing the harvest of open access allocations (detailed in §660.55 and Tables 1–2 of Subpart C) or governing the fishing activities of open access vessels (detailed in Subpart.F) Any commercial vessel that is not registered to a limited entry permit and which takes and retains, possesses or lands groundfish is a participant in the open access groundfish fishery.

Open access gear means all types of fishing gear except:

(1) Longline or trap (or pot) gear fished by a vessel that has a limited entry permit affixed with a gear endorsement for that gear.

(2) Groundfish trawl.

Optimum yield (OY) means the amount of fish that will provide the greatest overall benefit to the Nation, particularly with respect to food production and recreational opportunities, and, taking into account the protection of marine ecosystems, is prescribed as such on the basis of the MSY from the fishery, as reduced by any relevant economic, social, or ecological factor; and, in the case of an overfished fishery, provides for rebuilding to a level consistent with producing the MSY in such fishery. OY may be expressed numerically (as a harvest guideline, quota, or other specification) or non-numerically.

Operate means any use of a vessel, including, but not limited to, fishing, transiting, or drifting by means of the prevailing water current or weather conditions.

Operator. (See §600.10).

Overage means the amount of fish harvested by a vessel in excess of the applicable trip limit.

Owner of a vessel or vessel owner, as used in Subparts C through G, means a person identified as the current owner in the Certificate of Documentation (CG–1270) issued by the USCG for a documented vessel, or in a registration certificate issued by a state or the USCG for an undocumented vessel.

Ownership *interest means participation in ownership of a corporation, partnership, or other entity:*

(1) For sablefish-endorsed permits, ownership interest means participation in ownership of a corporation, partnership, or other entity that owns a sablefish endorsed permit. Participation in ownership does not mean owning stock in a publicly owned corporation.

(2) For the limited entry trawl fishery in Subpart D, ownership interest means ownership interest means participation in ownership of a corporation, partnership, or other entity that owns a QS permit, mothership permit, and a MS/CV endorsed limited entry permit.

Pacific Coast Groundfish Fishery Management Plan (PCGFMP) means the Fishery Management Plan for the Washington, Oregon, and California Groundfish Fishery developed by the Pacific Fishery Management Council and approved by the Secretary on January 4, 1982, and as it may be subsequently amended.

Partnership is two or more individuals, partnerships, or corporations, or combinations thereof, who have ownership interest in a permit, including married couples and legally recognized trusts and partnerships, such as limited partnerships (LP), general partnerships (GP), and limited liability partnerships (LLP).

Permit holder means a vessel owner as identified on the USCG form 1270 or state motor vehicle licensing document *and as registered on a limited entry permit issued under Subparts C through E.*

Permit owner means a person who owns *(legally controls) a permit issued under Subparts C through E, including the person of record with the SFD, Permits Office and any associated persons with an ownership interest in the permit. For first receiver site licenses, see definition "license owner."*

Person, as it applies to limited entry and open access fisheries conducted under § 660 Subparts C through G, means any individual, corporation, partnership, association or other entity (whether or not organized or existing under the laws of any state), and any Federal, state, or local government, or any entity of any such government that is eligible to own a documented vessel under the terms of 46 U.S.C. 12102(a).

Processing or to process means the preparation or packaging of groundfish to render it suitable for human consumption, retail sale, industrial uses or long-term storage, including, but not limited to, cooking, canning, smoking, salting, drying, filleting, freezing, or rendering into meal or oil, but does not mean heading and gutting unless additional preparation is done. (Also see an exception to certain requirements at §660.XXX, Subpart D pertaining to Pacific whiting shoreside vessels 75-ft (23-m) or less LOA that, in addition to heading and gutting, remove the tails and freeze catch at sea.)

(1) At-sea processing means processing that takes place on a vessel or other platform that floats and is capable of being moved from one location to another, whether shore-based or on the water.

(2) Shore-based processing or processing means processing that takes place at a facility that is permanently fixed to land. *(Also see the definition for shoreside processing at §660.XXX, Subpart D which defines shoreside processing for the purposes of qualifying for a QS permit.)*

Processor means person, vessel, or facility that engages in processing; or receives live groundfish directly from a fishing vessel for retail sale without further processing. *(Also see the definition for processors at §660.XXX, Subpart D which defines processor for the purposes of qualifying for a QS permit.)*

Prohibited species means those species and species groups whose retention is prohibited unless authorized by provisions of this section or other applicable law. The following are prohibited species: Any species of salmonid, Pacific halibut, Dungeness crab caught seaward of Washington or Oregon, and groundfish species or species groups under the PCGFMP for which quotas have been achieved and/or the fishery closed.

Quota means a specified numerical harvest objective, the attainment (or expected attainment) of which causes closure of the fishery for that species or species group.

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Recreational fishing means fishing with authorized recreational fishing gear for personal use only, and not for sale or barter.

Regional Administrator means the Administrator, Northwest Region, NMFS.

Reserve means a portion of the harvest guideline or quota set aside at the beginning of the fishing year or biennial fishing period to allow for uncertainties in preseason estimates.

Round weight. (See §600.10). Round weight does not include ice, water, or slime.

Scientific research activity. (See §600.10).

Secretary. (See §600.10).

Sectors means a group in the fishery and is defined in groundfish regulations as follows:

(1) For the purpose of allocations at §660.55, Subpart C, the fishery may be divided in to the trawl (limited entry trawl) and nontrawl (limited entry fixed gear, open access, recreational) fishery or sectors.

(2) The fisheries or sectors under the PCGFMP are divided in to the limited entry fishery, the open access fishery, and the recreational fishery.

(3) The limited entry fishery or sector is further divided in to the limited entry trawl fishery and limited entry fixed gear fishery.

(4) For the limited entry trawl fisheries in Subpart D, the trawl sectors are the shorebased IFQ fishery, the Mothership Coop fishery, and the C/P Coop fishery.

Sell or sale. (See §600.10).

Specification is a numerical or descriptive designation of a management objective, including but not limited to: ABC; optimum yield; harvest guideline; quota; limited entry or open access allocation; a setaside or allocation for a recreational or treaty Indian fishery; an apportionment of the above to an area, gear, season, fishery, or other subdivision.

Spouse means a person who is legally married to another person as recognized by state law (i.e., one's wife or husband).

Stacking is the practice of registering more than one limited entry permit for use with a single vessel (See §660.335(c)).

Sustainable Fisheries Division (SFD) means the Chief, Sustainable Fisheries Division, Northwest Regional Office, NMFS, or a designee.

Target fishing means fishing for the primary purpose of catching a particular species or species group (the target species).

Tax-exempt organization means an organization that received a determination letter from the Internal Revenue Service recognizing tax exemption under 26 CFR part 1(§§1.501 to 1.640).

Totally lost means the vessel being replaced no longer exists in specie, or is absolutely and irretrievably sunk or otherwise beyond the possible control of the owner, or the costs of repair (including recovery) would exceed the value of the vessel after repairs.

Trip. (See §600.10).

Trip limits. Trip limits are used in the commercial fishery to specify the maximum amount of a fish species or species group that may legally be taken and retained, possessed, or landed, per vessel, per fishing trip, or cumulatively per unit of time, or the number of landings that may be made from a vessel in a given period of time, as follows:

(1) A per trip limit is the total allowable amount of a groundfish species or species group, by weight, or by percentage of weight of legal fish on board, that may be taken and retained, possessed, or landed per vessel from a single fishing trip.

(2) A daily trip limit is the maximum amount of a groundfish species or species group that may be taken and retained, possessed, or landed per vessel in 24 consecutive hours, starting at 0001 hours local time (l.t.) Only one landing of groundfish may be made in that 24-hour period. Daily trip limits may not be accumulated during multiple day trips.

(3) A weekly trip limit is the maximum amount of a groundfish species or species group that may be taken and retained, possessed, or landed per vessel in 7 consecutive days, starting at 0001 hours l.t. on Sunday and ending at 2400 hours l.t. on Saturday. Weekly trip limits may not be accumulated during multiple week trips. If a calendar week falls within two different months or two different cumulative limit periods, a vessel is not entitled to two separate weekly limits during that week.

(4) A cumulative trip limit is the maximum amount of a groundfish species or species group that may be taken and retained, possessed, or landed per vessel in a specified period of time without a limit on the number of landings or trips, unless otherwise specified. The cumulative trip limit periods for limited entry and open access fisheries, which start at 0001 hours l.t. and end at 2400 hours l.t., are as follows, unless otherwise specified:

(i) The 2-month or "major" cumulative limit periods are: January 1–February 28/29, March 1–April 30, May 1–June 30, July 1–August 31, September 1–October 31, and, November 1–December 31.

(ii) One month means the first day through the last day of the calendar month.

(iii) One week means 7 consecutive days, Sunday through Saturday.

Vessel manager means a person or group of persons whom the vessel owner has given authority to oversee all or a portion of groundfish fishing activities aboard the vessel.

Vessel monitoring system or VMS means a vessel monitoring system or mobile transceiver unit as set forth in §660.14 and approved by NMFS for use on vessels that take (directly or incidentally) species managed under the PCGFMP, as required by this subpart.

Vessel of the United States or U.S. vessel. (See §600.10).

§ 660.12 General Groundfish Prohibitions.

§ 660.13 Recordkeeping and reporting.

§ 660.14 Vessel Monitoring System (VMS) requirements.

§ 660.15 Equipment requirements.

§ 660.16 Groundfish observer program.

§ 660.17 Catch monitors and catch monitor service providers. [Reserved]

§ 660.18 Certification and decertification procedures for observers, catch monitors, catch monitor providers and observer providers.

§ 660.20 Vessel and Gear Identification.

§ 660.24 Limited entry and open access fisheries.

§ 660.25 Permits.

(a) General. Each if the permits or licenses in this section, have different conditions or privileges as part of the permit or license. The permits or licenses in this section confer a conditional privilege of participating in the Pacific coast groundfish fishery, in accordance with Federal regulations in 50 CFR part 660.

(b) Limited entry permit.

(1) Eligibility and registration.

(i) General. In order for a vessel to participate in the limited entry fishery, the vessel owner must hold a limited entry permit and, through SFD, must register that vessel for use with a limited entry permit. When participating in the limited entry fishery, a vessel is authorized to fish with the gear type endorsed on the limited entry permit registered for use with that vessel, except that the MS permit does not have a gear endorsement. There are three types of gear endorsements: trawl, longline, and pot (or trap). All limited entry permits, except the MS permit, have size endorsements and a vessel registered for use with a limited entry permit must comply with the vessel size requirements of this subpart. A sablefish endorsement is also required for a vessel to participate in the primary season for the limited entry fixed gear sablefish fishery, north of 36° N. lat. Certain limited entry permits will also have endorsements to participate in a specific fishery, such as the MS/CV endorsement and the C/P endorsement. After May 11, 2009, a catcher vessel participating in either the whiting shore-based or mothership sector must, in addition to being registered for use with a limited entry permit, be registered for use with a sector-appropriate Pacific whiting vessel license under §660.336. After May 11, 2009, a vessel participating in the whiting catcher/processor sector must, in addition to being registered for use with a limited entry permit, be registered for use with a sector-appropriate Pacific whiting vessel license under §660.336. After April 9, 2009, although a mothership vessel participating in the whiting mothership sector is not required to be registered for use with a limited entry permit, such vessel must be registered for use with a sector-appropriate Pacific whiting vessel license under §660.336.

(ii) Eligibility. Only a person eligible to own a documented vessel under the terms of 46 U.S.C. 12113 (a) may be issued or may hold a limited entry permit.

(iii) Registration. Limited entry permits will normally be registered for use with a particular vessel at the time the permit is issued, renewed, transferred, or replaced. If the permit will be used with a vessel other than the one registered on the permit, the permit owner must register that permit for use with the new vessel through the SFD. The reissued permit must be placed on board the new vessel in order for the vessel to participate in the limited entry fishery.

(A) Registration of a permit to be used with a new vessel will take effect no earlier than the first day of the next major limited entry cumulative limit period following the date SFD receives the transfer form and the original permit.

(B) The major limited entry cumulative limit periods will be announced in the Federal Register with the harvest specifications and management measures, and with routine management measures when the cumulative limit periods are changed.

(iv) Limited entry permits indivisible. Limited entry permits may not be divided for use by more than one vessel.

(v) Initial *Administrative Determination*. SFD will make an IAD regarding permit endorsements, renewal, replacement, and change in vessel registration. SFD will notify the permit holder in writing with an explanation of any determination to deny a permit endorsement, renewal, replacement, or change in vessel registration. The SFD will decline to act on an application for permit endorsement, renewal, transfer, replacement, or registration of a limited entry permit if the permit is subject to sanction provisions of the Magnuson-Stevens Act at 16 U.S.C. 1858 (a) and implementing regulations at 15 CFR part 904, subpart D, apply.

(2) Mothership (MS) permit. The MS permit conveys a conditional privilege to the owner of a vessel registered to it, or as appropriate, the charter of a bareboat, to participate in the MS fishery and to receive and process deliveries of groundfish. A MS permit is a type of limited entry permit and may not be transferred separately from the limited entry permit. A MS permit does not have any endorsements affixed to the permit, as listed in paragraph (b)(3). The provisions for the MS permit, including eligibility, renewal, change of permit ownership, vessel registration, fees, and appeals are described at §660.150, subpart D, paragraph ().

(3) Endorsements.

(i) "A" endorsement. A limited entry permit with an "A" endorsement entitles the holder to participate in the limited entry fishery for all groundfish species with the type(s) of limited entry gear specified in the endorsement, except for sablefish harvested north of 36° N. lat. during times and with gears for which a sablefish endorsement is required. See §660.334 (d) for provisions on sablefish endorsement requirements. An "A" endorsement is transferable with the limited entry permit to another person, or to a different vessel under the same ownership under §660.335. An "A" endorsement expires on failure to renew the limited entry permit to which it is affixed. *A MS permit does not have a gear endorsement and is not considered a limited entry "A" endorsed permit.*

(ii) Gear endorsement. There are three types of gear endorsements: trawl, longline and pot (trap). When limited entry *"A" endorsed* permits were first issued, some vessel owners qualified for more than one type of gear endorsement based on the landings history of their vessels. Each limited entry *"A" endorsed* permit has one or more gear endorsement(s). Gear endorsement(s) assigned to the permit at the time of issuance will be permanent and shall not be modified. While participating in the limited entry fishery, the vessel registered to the limited entry *"A" endorsed* permit is authorized to fish the gear(s) endorsed on the permit. While participating in the limited entry, primary fixed gear fishery for sablefish described at §660.372, a vessel registered to more than one limited entry permit is authorized to fish with any gear, except trawl gear, endorsed on at least one of the permits registered for use with that vessel. During the limited entry fishery, permit holders may also fish with open access gear; except that vessels fishing against primary sablefish season cumulative limits described at §660.372(b)(3) may not fish with open access gear against those limits.

(iii) Vessel size endorsements.

(A) General. Each limited entry *"A" endorsed* permit will be endorsed with the LOA for the size of the vessel that initially qualified for the permit, except:

(1) If the permit is registered for use with a trawl vessel that is more than 5 ft (1.52 m) shorter than the size for which the permit is endorsed, it will be endorsed for the size of the smaller vessel. This requirement does not apply to a permit with a sablefish endorsement that is endorsed for both trawl and either longline or pot gear and which is registered for use with a longline or pot gear vessel for purposes of participating in the limited entry primary fixed gear sablefish fishery described at §660.372.

(2) When permits are combined into one permit to be registered for use with a vessel requiring a larger size endorsement, the new permit will be endorsed for the size that results from the combination of the permits as described in paragraph XXX of this section.

(B) Limitations of size endorsements —

(1) A limited entry permit endorsed only for gear other than trawl gear may be registered for use with a vessel up to 5 ft (1.52 m) longer than, the same length as, or any length shorter than, the size endorsed on the existing permit without requiring a combination of permits under §660.335 (b) or a change in the size endorsement.

(2) A limited entry permit endorsed for trawl gear may be registered for use with a vessel between 5 ft (1.52 m) shorter and 5 ft (1.52 m) longer than the size endorsed on the existing permit without requiring a combination of permits under §660.335 (b) or a change in the size endorsement under paragraph XXX of this section.

(3) The vessel harvest capacity rating for each of the permits being combined is that indicated in Table 2 of this part for the LOA (in feet)

endorsed on the respective limited entry permit. Harvest capacity ratings for fractions of a foot in vessel length will be determined by multiplying the fraction of a foot in vessel length by the difference in the two ratings assigned to the nearest integers of vessel length. The length rating for the combined permit is that indicated for the sum of the vessel harvest capacity ratings for each permit being combined. If that sum falls between the sums for two adjacent lengths on Table 2 of this part, the length rating shall be the higher length.

(C) Size endorsement requirements for sablefish-endorsed permits. Notwithstanding paragraphs (A) and (B) of this section, when multiple permits are "stacked" on a vessel, as described in §660.335(c), at least one of the permits must meet the size requirements of those sections. The permit that meets the size requirements of those sections is considered the vessel's "base" permit, as defined in §660.302. If more than one permit registered for use with the vessel has an appropriate length endorsement for that vessel, NMFS SFD will designate a base permit by selecting the permit that has been registered to the vessel for the longest time. If the permit owner objects to NMFS's selection of the base permit, the permit owner may send a letter to NMFS SFD requesting the change and the reasons for the request. If the permit requested to be changed to the base permit is appropriate for the length of the vessel as provided for in paragraph (c)(2)(i) of this section, NMFS SFD will reissue the permit with the new base permit. Any additional permits that are stacked for use with a vessel participating in the limited entry primary fixed gear sablefish fishery may be registered for use with a vessel even if the vessel is more than 5 ft (1.5 m) longer or shorter than the size endorsed on the permit.

(iv) Sablefish endorsement and tier assignment.

(A) General. Participation in the limited entry fixed gear sablefish fishery during the primary season described in §660.372 north of 36° N. lat., requires that an owner of a vessel hold (by ownership or lease) a limited entry permit, registered for use with that vessel, with a longline or trap (or pot) endorsement and a sablefish endorsement. Up to three permits with sablefish endorsements may be registered for use with a single vessel. Limited entry permits with sablefish endorsements are assigned to one of three different cumulative trip limit tiers, based on the qualifying catch history of the permit.

(1) A sablefish endorsement with a tier assignment will be affixed to the permit and will remain valid when the permit is transferred.

(2) A sablefish endorsement and its associated tier assignment are not separable from the limited entry permit, and therefore may not be transferred separately from the limited entry permit.

(B) Issuance process for sablefish endorsements and tier assignments. No new applications for sablefish endorsements will be accepted after November 30, 1998. All tier assignments and subsequent appeals processes were completed by September 1998.

(C) Ownership requirements and limitations.

(1) No partnership or corporation may own a limited entry permit with a sablefish endorsement unless that partnership or corporation owned a limited entry permit with a sablefish endorsement on November 1, 2000. Otherwise, only individual human persons may own limited entry permits with sablefish endorsements.

(2) No individual person, partnership, or corporation in combination may have ownership interest in or hold more than 3 permits with sablefish endorsements either simultaneously or cumulatively over the primary season, except for an individual person, or partnerships or corporations that had ownership interest in more than 3 permits with sablefish endorsements as of November 1, 2000. The exemption from the maximum ownership level of 3 permits only applies to ownership of the particular permits that were owned on November 1, 2000. An individual person, or partnerships or corporations that had ownership interest in 3 or more permits with sablefish endorsements as of November 1, 2000, may not acquire additional permits beyond those particular permits owned on November 1, 2000. If, at some future time, an individual person, partnership, or corporation that owned more than 3 permits as of November 1, 2000, sells or otherwise permanently transfers (not holding through a lease arrangement) some of its originally owned permits, such that they then own fewer than 3 permits, they may then acquire additional permits, but may not have ownership interest in or hold more than 3 permits.

(3) A partnership or corporation will lose the exemptions provided in paragraphs (d)(4)(i) and (ii) of this section on the effective date of any change in the corporation or partnership from that which existed on November 1, 2000. A "change" in the partnership or corporation is defined at §660.302. A change in the partnership or corporation must be reported to SFD within 15 calendar days of the addition of a new shareholder or partner.

(4) Any partnership or corporation with any ownership interest in or that holds a limited entry permit with a sablefish endorsement shall document the extent of that ownership interest or the individuals that hold the permit with the SFD via the Identification of Ownership Interest Form sent to the permit owner through the annual permit renewal process defined at §660.335(a) and whenever a change in permit owner, permit holder, and/or vessel registration occurs as defined at §660.335(d) and (e). SFD will not renew a sablefish-endorsed limited entry permit through the annual renewal process described at §660.335(a) or approve a change in permit owner, permit holder, and/or vessel registration unless the Identification of Ownership Interest Form has been completed. Further, if SFD discovers through review of the Identification of Ownership Interest Form that an individual person, partnership, or corporation owns or holds more than 3 permits and is not authorized to do so under paragraph (d)(4)(ii) of this section,

the individual person, partnership or corporation will be notified and the permits owned or held by that individual person, partnership, or corporation will be void and reissued with the vessel status as "unidentified" until the permit owner owns and/or holds a quantity of permits appropriate to the restrictions and requirements described in paragraph (d)(4)(ii) of this section. If SFD discovers through review of the Identification of Ownership Interest Form that a partnership or corporation has had a change in membership since November 1, 2000, as described in paragraph (d)(4)(iii) of this section, the partnership or corporation will be notified, SFD will void any existing permits, and reissue any permits owned and/or held by that partnership or corporation in "unidentified" status with respect to vessel registration until the partnership or corporation is able to transfer those permits to persons authorized under this section to own sablefish-endorsed limited entry permits.

(5) A person, partnership, or corporation that is exempt from the owner-on-board requirement may sell all of their permits, buy another sablefish-endorsed permit within up to a year from the date the last permit was approved for transfer, and retain their exemption from the owner-on-board requirements. An individual person, partnership or corporation could only obtain a permit if it has not added or changed individuals since November 1, 2000, excluding individuals that have left the partnership or corporation or that have died.

(D) Sablefish at-sea processing prohibition and exemption. Beginning January 1, 2007, vessels are prohibited from processing sablefish at sea that were caught in the primary sablefish fishery without sablefish at-sea processing exemptions at §660.306(e)(3). The sablefish at-sea processing exemption has been issued to a particular vessel and that permit and vessel owner who requested the exemption. The exemption is not part of the limited entry permit. The exemption is not transferable to any other vessel, vessel owner, or permit owner for any reason. The sablefish at-sea processing exemption will expire upon transfer of the vessel to a new owner or if the vessel is totally lost, as defined at §660.302.

(v) MS/CV endorsement. A limited entry permit with a MS/CV endorsement is a conditional privilege that allows a vessel registered to it to participate in either the coop or noncoop fishery in the Mothership Program described at XXXXXX. The provisions for the MS/CV endorsed limited entry permit, including eligibility, renewal, change of permit ownership, vessel registration, combinations, accumulation limits, fees, and appeals are described at §660.150, subpart D, paragraph ().

(vi) C/P endorsement. A limited entry permit with a C/P endorsement is a conditional privilege that allows a vessel registered to it to participate in the C/P Program described at XXXXXX. The provisions for the C/P endorsed limited entry permit, including eligibility, renewal, change of permit ownership, vessel registration, combinations, fees, and appeals are described at §660.160, subpart D, paragraph ().

(vii) Endorsement and exemption restrictions. "A" endorsements, gear endorsements, sablefish endorsements and sablefish tier assignments, *MS/CV endorsements, and C/P endorsements* may not be transferred separately from the limited entry permit. Sablefish at-sea processing exemptions are associated with the vessel and not with the limited entry permit and may not be transferred at all.

(4) Limited entry permit actions- renewal, combination, stacking, change of permit ownership or permit holdership, and transfer.

(i) Renewal of limited entry permits and gear endorsements —

(A) Limited entry permits expire at the end of each calendar year, and must be renewed between October 1 and November 30 of each year in order to remain in force the following year.

(B) Notification to renew limited entry permits will be issued by SFD prior to September 15 each year to the most recent address of the permit owner. The permit owner shall provide SFD with notice of any address change within 15 days of the change.

(C) Limited entry permit renewal requests received in SFD between November 30 and December 31 will be effective on the date that the renewal is approved. A limited entry permit that is allowed to expire will not be renewed unless the permit owner requests reissuance by March 31 of the following year and the SFD determines that failure to renew was proximately caused by illness, injury, or death of the permit owner.

(D) Limited entry permits with sablefish endorsements, as described at §660.334(d), will not be renewed until SFD has received complete documentation of permit ownership as required under §660.334(d)(4)(iv).

(ii) Combining limited entry permits. Two or more limited entry permits with "A" gear endorsements for the same type of limited entry gear may be combined and reissued as a single permit with a larger size endorsement as described in paragraph §660.334 (c)(2)(iii). With respect to permits endorsed for nontrawl limited entry gear, a sablefish endorsement will be issued for the new permit only if all of the permits being combined have sablefish endorsements. If two or more permits with sablefish endorsements are combined, the new permit will receive the same tier assignment as the tier with the largest cumulative landings limit of the permits being combined.

(iii) Stacking limited entry permits. "Stacking" limited entry permits, as defined at §660.302, refers to the practice of registering more than one permit for use with a single vessel. Only limited entry permits with sablefish endorsements may be stacked. Up to 3 limited entry permits with sablefish endorsements may be registered for use with a single vessel during the primary sablefish season described at §660.372. Privileges, responsibilities, and restrictions associated with stacking permits to participate in the primary sablefish fishery are described at §660.372 and at §660.334(d).

(iv) Changes in permit ownership and permit holder —

(A) General. The permit owner may convey the limited entry permit to a different person. The new permit owner will not be authorized to use the permit until the change in permit ownership has been registered with and approved by the SFD. The SFD will not approve a change in permit ownership for limited entry permits with sablefish endorsements that does not meet the ownership requirements for those permits described at §660.334 (d)(4). Change in permit owner and/or permit holder applications must be submitted to SFD with the appropriate documentation described at §660.335(g).

(B) Effective date. The change in ownership of the permit or change in the permit holder will be effective on the day the change is approved by SFD, unless there is a concurrent change in the vessel registered to the permit. Requirements for changing the vessel registered to the permit are described at paragraph (e) of this section.

(C) Sablefish-endorsed permits. If a permit owner submits an application to transfer a sablefish-endorsed limited entry permit to a new permit owner or holder (transferee) during the primary sablefish season described at §660.372(b) (generally April 1 through October 31), the initial permit owner (transferor) must certify on the application form the cumulative quantity, in round weight, of primary season sablefish landed against that permit as of the application signature date for the then current primary season. The transferee must sign the application form acknowledging the amount of landings to date given by the transferor. This certified amount should match the total amount of primary season sablefish landings reported on state fish tickets. As required at §660.303(c), any person landing sablefish must retain on board the vessel from which sablefish is landed, and provide to an authorized officer upon request, copies of any and all reports of sablefish landings from the primary season containing all data, and in the exact manner, required by the applicable state law throughout the primary sablefish season during which a landing occurred and for 15 days thereafter.

(v) <u>Changes in vessel registration-transfer of limited entry permits and gear endorsements</u> —

(A) General. A permit may not be used with any vessel other than the vessel registered to that permit. For purposes of this section, a permit transfer occurs when, through SFD, a permit owner registers a limited entry permit for use with a new vessel. Permit transfer applications must be submitted to SFD with the appropriate documentation described at §660.335(g). Upon receipt of a complete application, and following review and approval of the application, the SFD will reissue the permit registered to the new vessel. Applications to transfer limited entry permits with sablefish endorsements, as described at §660.334(d), will not be approved until SFD has received complete documentation of permit ownership as required under §660.334(d)(4)(iv).

(B) Application. A complete application must be submitted to SFD in order for SFD to review and approve a change in vessel registration. At a minimum, a permit owner seeking to transfer a limited entry permit shall submit to SFD a signed application form and his/her current limited entry permit before the first day of the cumulative limit period in which they wish to participate. If a permit owner provides a signed application and current limited entry permit after the first day of a cumulative limit period, the permit will not be effective until the succeeding cumulative limit period. SFD will not approve a change in vessel registration (transfer) until it receives a complete application, the existing permit, a current copy of the USCG 1270, and other required documentation.

(C) Effective date. Changes in vessel registration on permits will take effect no sooner than the first day of the next major limited entry cumulative limit period following the date that SFD receives the signed permit transfer form and the original limited entry permit. No transfer is effective until the limited entry permit has been reissued as registered with the new vessel.

(D) Sablefish-endorsed permits. If a permit owner submits an application to register a sablefish-endorsed limited entry permit to a new vessel during the primary sablefish season described at §660.372(b) (generally April 1 through October 31), the initial permit owner (transferor) must certify on the application form the cumulative quantity, in round weight, of primary season sablefish landed against that permit as of the application signature date for the then current primary season. The new permit owner or holder (transferee) associated with the new vessel must sign the application form acknowledging the amount of landings to date given by the transferor. This certified amount should match the total amount of primary season sablefish landings reported on state fish tickets. As required at §660.303(c)), any person landing sablefish must retain on board the vessel from which sablefish is landed, and provide to an authorized officer upon request, copies of any and all reports of sablefish landings from the primary season containing all data, and in the exact manner, required by the applicable state law throughout the primary sablefish season during which a landing occurred and for 15 days thereafter.

(vi) Restriction on frequency of transfers. Limited entry permits may not be registered for use with a different vessel (transfer) more than once per calendar year, except in cases of death of a permit holder or if the permitted vessel is totally lost as defined in §660.302. The exception for death of a permit holder applies for a permit held by a partnership or a corporation if the person or persons holding at least 50 percent of the ownership interest in the entity dies.

(A) A permit owner may designate the vessel registration for a permit as “unidentified,” meaning that no vessel has been identified as registered for use with that permit. No vessel is authorize to use a permit with the vessel registration designated as “unidentified.” A vessel owner who removes a permit from his vessel and registers that permit as “unidentified” is not exempt from VMS requirements at §660.312 unless specifically authorized by that section.

(B) When a permit owner requests that the permit's vessel registration be designated as “unidentified,” the transaction is not considered a “transfer” for purposes of this section. Any subsequent request by a permit owner to change from the “unidentified” status of the permit in order to register the permit with a specific vessel will be considered a change in vessel registration (transfer) and subject to the restriction on frequency and timing of changes in vessel registration (transfer).

(vii) Application and supplemental documentation. Permit holders may request a transfer (change in vessel registration) and/or change in permit ownership or permit holder by submitting a complete application form. In addition, a permit owner applying for renewal, replacement, transfer, or change of ownership or change of permit holder of a limited entry permit has the burden to submit evidence to prove that qualification requirements are met. The owner of a permit endorsed for longline or trap (or pot) gear applying for a tier assignment under §660.334 (d) has the burden to submit evidence to prove that certain qualification requirements are met. The following evidentiary standards apply:

(A) For a request to change a vessel registration and/or change in permit ownership or permit holder, the permit owner must provide SFD with a current copy of the USCG Form 1270 for vessels of 5 net tons or greater, or a current copy of a state registration form for vessels under 5 net tons.

(B) For a request to change a vessel registration and/or change in permit ownership or permit holder for sablefish-endorsed permits with a tier assignment for which a corporation or partnership is listed as permit owner and/or holder, an Identification of Ownership Interest Form must be completed and included with the application form.

(C) For a request to change the vessel registration to a permit, the permit holder must submit to SFD a current marine survey conducted by a certified marine surveyor in accordance with USCG regulations to authenticate the length overall of the vessel being newly registered with the permit. Marine surveys older than 3 years at the time of the request for change in vessel registration will not be considered “current” marine surveys for purposes of this requirement.

(D) For a request to change a permit's ownership where the current permit owner is a corporation, partnership or other business entity, the applicant must provide to SFD a corporate resolution that authorizes the conveyance of the permit to a new owner and which authorizes the individual applicant to request the conveyance on behalf of the corporation, partnership, other business entity.

(E) For a request to change a permit's ownership that is necessitated by the death of the permit owner(s), the individual(s) requesting conveyance of the permit to a new owner must provide SFD with a death certificate of the permit owner(s) and appropriate legal documentation that either: specifically transfers the permit to a designated individual(s); or, provides legal authority to the transferor to convey the permit ownership.

(F) For a request to change a permit's ownership that is necessitated by divorce, the individual requesting the change in permit ownership must submit an executed divorce decree that awards the permit to a designated individual(s).

(G) Such other relevant, credible documentation as the applicant may submit, or the SFD or Regional Administrator may request or acquire, may also be considered.

(viii) Application forms available. Application forms for the change in vessel registration (transfer) and change of permit ownership or permit holder of limited entry permits are available from the SFD (see part 600 for address of the Regional Administrator). Contents of the application, and required supporting documentation, are specified in the application form.

(ix) Records maintenance. The SFD will maintain records of all limited entry permits that have been issued, renewed, transferred, registered, or replaced.

(5) Small fleet.

(i) Small limited entry fisheries fleets that are controlled by a local government, are in existence as of July 11, 1991, and have negligible impacts on the groundfish resource, may be certified as consistent with the goals and objectives of the limited entry program and incorporated into the limited entry fishery. Permits issued under this subsection will be issued in accordance with the standards and procedures set out in the PCGFMP and will carry the rights explained therein.

(ii) A permit issued under this section may be registered only to another vessel that will continue to operate in the same certified small fleet, provided that the total number of vessels in the fleet does not increase. A vessel may not use a small fleet limited entry permit for participation in the limited entry fishery outside of authorized activities of the small fleet for which that permit and vessel have been designated.

(c) QS permit. A quota share (QS) permit is a conditional privilege that allows a person to control quota share for designated species and species groups in the shoreside IFQ Program described at XXXXXX. A QS permit is not a limited entry permit. The provisions for the QS permit, including eligibility, renewal, change of permit ownership, accumulation limits, fees, and appeals are described at §660.140, subpart D, paragraph ().

(d) First Receiver Site License. The first receiver site license is a conditional privilege that allows a first receiver to receive, purchase, or take custody, control or possession of IFQ species/species groups onshore directly from a vessel fishing in the IFQ fishery. The first receiver site license is issued for a person and a unique physical site consistent with the terms

and conditions required to account and weigh the landed species. A first receiver site license is not a limited entry permit. The provisions for the First Receiver Site License, including eligibility, registration, change of ownership, fees, and appeals are described at §660.140, subpart D, paragraph ().

(e) Coop permit [Reserved]

(1) MS coop permit [Reserved]

(2) C/P coop permit [Reserved]

(f) Permit fees. The Regional Administrator is authorized to charge fees to cover administrative expenses related to issuance of permits including initial issuance, renewal, transfer, vessel registration, replacement, and appeals. The appropriate fee must accompany each application.

(g) permit appeals *process.*

*(1) General. For permit actions, including issuance, renewal, change in vessel registration, change in permit owner or permit holder, and endorsement upgrade, the Assistant Regional Administrator for Sustainable Fisheries will make an initial administrative determination (IAD) on the action. In cases where the applicant disagrees with the IAD, the applicant may appeal that decision. Final d*ecisions on appeals of *IADs* regarding issuance, renewal, change in vessel registration, change in permit owner or permit holder, and endorsement upgrade, will be made in writing by the Regional Administrator *acting on behalf of the Secretary of Commerce* and will state the reasons therefore. *This section describes the procedures for appealing the IAD on permit actions made in this title under subpart C through G of part 660. Additional information regarding appeals of an IAD related to the trawl rationalization program is contained in the specific program sections under Subpart D of part 660.*

(2) Who may appeal. Any person who receives an IAD that denies any part of their application may file a written appeal. For purposes of this section, such person will be referred to as the "applicant."

(3) Submission of appeals.

(i) The appeal must be in writing, must allege *credible* facts or circumstances to show why the criteria in this subpart have been met, *and must include any relevant information or documentation to support the appeal.*

(ii) Appeals must be mailed or faxed to: National Marine Fisheries Service, Northwest Region, Sustainable Fisheries Division, ATTN: Appeals, 7600 Sand Point Way NE, Seattle, WA, 98115; Fax: 206-526-6426; or delivered to National Marine Fisheries Service at the same address.

(4) Timing of appeals.

(i) If an applicant appeals an IAD, the appeal must be postmarked, faxed, or hand delivered to NMFS no later than 30 calendar days after the date on the IAD. If the applicant does not appeal the IAD within 30 calendar days, the IAD becomes the final decision of the Regional Administrator acting on behalf of the Secretary of Commerce.

(ii) The time period to submit an appeal begins with the date on the IAD. If the last day of the time period is a Saturday, Sunday, or Federal holiday, the time period will extend to the close of business on the next business day.

(5) Address of record. For purposes of the appeals process, NMFS will establish as the address of record, the address used by the applicant in initial correspondence to NMFS. Notifications of all actions affecting the applicant after establishing an address of record will be mailed to that address, unless the applicant provides NMFS, in writing, with any changes to that address. NMFS bears no responsibility if a notification is sent to the address of record and is not received because the applicant's actual address has changed without notification to NMFS.

(6) Decisions on appeals.

(i) For the appeal of an IAD related to the application and initial issuance process for the trawl rationalization program listed in subpart D of part 660, the RA shall appoint an appeals officer. After determining there is sufficient information and that all procedural requirements have been met, the appeals officer will review the record and issue a recommendation on the appeal to the RA, which shall be advisory only. The recommendation must be based solely on the record. Upon receiving the findings and recommendation, the RA shall issue a final decision on the appeal in accordance with paragraph (g)(6)(ii).

(ii) Final decision on appeal. The RA will issue a written decision on the appeal which is the final *decision* of the *Secretary* of Commerce.

(7) Status of permits pending appeal

(i) For all permits actions, except those actions related to the application and initial issuance process for the trawl rationalization program listed in subpart D of part 660, the permit registration remains as it was prior to the request until the final decision has been made.

(ii) For permit actions related to the application and initial issuance process for the trawl rationalization program listed in subpart D of part 660, the status of permits pending appeal is as follows:

(A) For permit and endorsement qualifications and eligibility appeals (i.e., QS permit, Mothership permit, MS/CV endorsement, C/P endorsement) and not QS amounts or whiting catch history assignment amounts, any permit or endorsement under appeal after December 31, 2010, may not participate in the Pacific Coast groundfish fishery until a final decision on the appeal has been made. If the permit or endorsement will be issued, the permit or endorsement will be effective upon approval, except for QS permits, which will be effective at the start of the next fishing year.

(B) For a QS amount for specific IFQ management unit species under appeal after December 31, 2010, the QS amount for the IFQ species under appeal will remain as that previously assigned to the associated QS permit before the appeals process. The QS permit may participate in the Pacific Coast groundfish fishery with the QS amounts

assigned to the QS permit before the appeal. Once a final decision on the appeal has been made and if a revised QS amount for a specific IFQ species will be assigned to the QS permit, the QS amount associated with the QS permit will be effective at the start of the next calendar year.

(C) For a whiting catch history assignment associated with a MS/CV endorsement under appeal after December 31, 2010, the catch history assignment will remain as that previously assigned to the associated MS/CV endorsed limited entry permit before the appeals process. The MS/CV endorsed limited entry permit may participate in the Pacific Coast groundfish fishery with the catch history assigned to the MS/CV endorsed permit before the appeal. Once a final decision on the appeal has been made and if a revised catch history assignment will be issued, the whiting catch history assignment associated with the MS/CV endorsement will be effective at the start of the next calendar year.

(h) Permit sanctions.

(1) *All* permits *and licenses* issued or applied for under *Subparts C through G* are subject to sanctions pursuant to the Magnuson Act at 16 U.S.C. 1858(g) and 15 CFR part 904, subpart D.

(2) All shorebased IFQ fishery permits (QS permit, first receiver site license), QS accounts, vessel accounts, and Coop fishery permits (MS permit, MS/CV endorsed permit, C/P endorsed permit, coop permit) issued under Subpart D:

(i) are considered permits for the purposes of 16 U.S.C. 1857, 1858, and 1859;

(ii) may be revoked, limited, or modified at any time in accordance with the Magnuson Act, including revocation if the system is found to have jeopardized the sustainability of the stocks or the safety of fishermen;

(iii) shall not confer any right of compensation to the holder of such permits, licenses, and accounts if it is revoked, limited, or modified;

(iv) shall not create, or be construed to create, any right, title, or interest in or to any fish before the fish is harvested by the holder; and

(v) shall be considered a grant of permission to the holder of the permit, license, or account to engage in activities permitted by such permit, license, or account.

§ 660.26 Pacific whiting vessel licenses.

§ 660.30 Compensation with fish for collecting resource information – EFPs.

§ 660.40 Overfished species rebuilding plans.

§ 660.50 Pacific Coast Treaty Indian fisheries.

§ 660.5 Washington coastal tribal fisheries management measures.

§ 660.55 Allocations.

(a) General. *An allocation is the apportionment of a harvest privilege for a specific purpose, to a particular person or group of persons. The opportunity to harvest Pacific Coast groundfish is allocated among participants in the fishery when the OYs for a given year are established in the biennial harvest specifications. For certain species, primarily trawl-dominant species, separate allocations for the trawl fishery and nontrawl fishery (which for this purpose includes limited entry fixed gear, open access, and recreational fisheries) will be established biennially or annually using the procedures described in Section 11 of the PCGFMP. Section 11 of the PCGFMP provides the allocation structure and percentages for species allocated between the trawl and nontrawl fisheries.* For *most* species and/or areas, separate allocations for the limited entry and open access fisheries will be established biennially or annually using the procedures described in this subpart or the PCGFMP. *Allocation of Sablefish north of 36° N. lat. is described in paragraph XXXX and in the PCGFMP. Allocation of Pacific whiting is described in paragraph XXXX and in the PCGFMP. Allocation of black rockfish is described in paragraph XXXX. Allocation of Pacific halibut bycatch is described in paragraph XXXX. Allocations not described in the PCGFMP are specified in regulation through the biennial harvest specifications and are described in Tables 1 a through c and Tables 2 a through c.*

(b) Trawl / Nontrawl Allocations. Amendment 21 to the PCGFMP established allocations between the trawl and nontrawl (limited entry fixed gear, open access, and recreational) fisheries. Amendment 21 species are listed in Table 11-1 in the PGCFMP. Under this allocation structure, the OY is reduced by estimates for Pacific Coast treaty Indian tribal catch; projected research catch, estimates of fishing mortality in non-groundfish fisheries, as necessary, and set-asides for EFPs. The remaining OY after these deductions is the fishery harvest guideline or quota, which is divided into trawl and nontrawl (limited entry fixed gear, open access, and recreational) fisheries.

(i) Trawl Allocation. The allocation for the limited entry trawl fishery is derived by applying the trawl allocation percentage or amount by species specified in the PCGFMP to the fishery harvest guideline.

(ii) Nontrawl Allocation. The allocation for the nontrawl fishery is the fishery harvest guideline minus the allocation to the trawl fishery. These amounts will equal the nontrawl allocation percentage or amount by species specified in the PCGFMP. The nontrawl allocation will be further divided between the limited entry fixed gear, open access, and recreational fisheries.

(c) Limited Entry / Open Access Allocations. Amendment 6 to the PCGFMP established a limited entry system and allocations between the limited entry and open access fisheries. If a species is declared overfished, the open access/limited entry allocation may be suspended for the duration of the rebuilding plan.

(i) Limited entry allocation. The allocation for the limited entry fishery is the commercial harvest guideline minus any allocation to the open access fishery.

(ii) Open access allocation. The allocation for the open access fishery is derived by applying the open access allocation percentage to the annual commercial harvest guideline or quota. For management areas or stocks for which quotas or harvest guidelines for a stock are not fully utilized, no separate allocation will be established for the open access fishery until it is projected that the allowable catch for a species will be reached.

(A) Open access allocation percentage. For each species with a harvest guideline or quota, the initial open access allocation percentage is calculated by:

(1) Computing the total catch for that species during the window period *for the limited entry program* by any vessel that *did* not initially receive a limited entry permit.

(2) Dividing that amount by the total catch during the window period by all gear.

(3) The guidelines in this paragraph apply to recalculation of the open access allocation percentage. Any recalculated allocation percentage will be used in calculating the following biennial fishing period's open access allocation.

(B) [Reserved.]

(d) Catch accounting between the limited entry and open access fisheries. Any groundfish caught by a vessel with a limited entry permit will be counted against the limited entry allocation while the limited entry fishery for that vessel's limited entry gear is open. When the fishery for a vessel's limited entry gear has closed, groundfish caught by that vessel with open access gear will be counted against the open access allocation. All groundfish caught by vessels without limited entry permits will be counted against the open access allocation.

(e) Treaty Indian fisheries. Certain amounts of groundfish *will* be set aside biennially or annually for tribal fisheries prior to dividing the balance of the allowable catch between the *non-tribal* fisheries. Tribal fisheries conducted under a set-aside are not subject to the regulations governing limited entry and open access fisheries.

(f) Recreational fisheries. Recreational fishing for groundfish is outside the scope of, and not affected by, the regulations governing limited entry and open access fisheries. Certain amounts of groundfish *will be set aside for* the recreational fishery *during the biennial specifications process.* These amounts will be estimated prior to dividing the commercial harvest guideline between the limited entry and open access fisheries.

(g) Sablefish allocations *(north of of 36° N. lat.)*

(1) Tribal-nontribal allocation. The sablefish allocation to Pacific coast treaty Indian tribes identified at §660.324(b) is 10 percent of the sablefish total catch OY for the area north of 36° N. lat. This allocation represents the total amount available to the treaty Indian fisheries before deductions for discard mortality. The annual tribal sablefish allocations are provided in §660.385(a).

(2) Between the limited entry and open access fisheries. Sablefish is allocated between the limited entry and open access fisheries according to the procedure described in *paragraph (c) and in Section 11 of the PCGFMP.*

(3) Between the limited entry trawl and limited entry fixed gear fisheries. The limited entry sablefish allocation is further allocated 58 percent to the trawl fishery and 42 percent to the limited entry fixed gear (longline and pot/trap) fishery.

(4) Between the limited entry fixed gear primary season and daily trip limit fisheries. Within the limited entry nontrawl sector allocation, 85 percent is reserved for the primary season described in §660.372(b), leaving 15 percent for the limited entry daily trip limit fishery described in §660.372(c).

(5) Ratios between tiers for sablefish-endorsed limited entry permits. The Regional Administrator will biennially or annually calculate the size of the cumulative trip limit for each of the three tiers associated with the sablefish endorsement such that the ratio of limits between the tiers is approximately 1:1.75:3.85 for Tier 3:Tier 2:Tier 1, respectively. The size of the cumulative trip limits will vary depending on the amount of sablefish available for the primary fishery and on estimated discard mortality rates within the fishery. The size of the cumulative trip limits for the three tiers in the primary fishery will be announced in §660.372.

(h) Pacific whiting Allocation. The allocation structure and percentages for Pacific whiting are described in the PCGFMP.

(1) Annual treaty tribal whiting allocations are provided in §660.385(e).

(2) The non-tribal commercial harvest guideline allocations for specific whiting sectors (shoreside, mothership, C/P) in a given calendar year are found in tables 1a and 2a of this subpart.

(i) At-sea Whiting Trawl Fishery Set-Asides. Set-asides are not formal allocations; they are projections of incidental catch by a fishery. For the at-sea whiting fishery (MS and C/P), set-asides will be deducted from the limited entry trawl fishery allocation. Set-aside amounts are specified in regulation at XXXX and may be adjusted through the biennial harvest specifications and management measures process.

(j) Black rockfish harvest guideline. The commercial tribal harvest guideline for black rockfish off Washington State is specified at § 660.XXX, Subpart C.

(k) Pacific halibut Bycatch Allocation. The Pacific halibut fishery off Washington, Oregon and California (Area 2A in the halibut regulations) is managed under regulations at XXXXXX. The PCGFMP sets a trawl mortality bycatch limit for legal and sublegal halibut at 15% of the Area 2A constant exploitation yield (CEY) for legal size halibut, not to exceed 130,000 pounds for the first four years of trawl rationalization and not to exceed 100,000 pounds starting in the fifth year. This total bycatch limit may be adjusted downward or upward through the biennial specifications and management measures process. Part of the overall total catch limit is a set-aside of 10 mt of Pacific halibut, 5 mt to accommodate bycatch in the at-sea whiting fishery and 5 mt to accommodate shoreside trawl bycatch south of 40°10' N lat.

§ 660.60 Specifications and management measures.

§ 660.65 Groundfish harvest specifications.

§ 660.70-99 Closed Area - GCA's and EFH

* ABC/OY Tables –Tables (1a), OY tables (1b), Allocation tables (1c), Tables 2a, 2b, and 2c
* Vessel Capacity Rating Table - Table 2 to Part 660

3. A new Subpart D is added to read as follows:
Subpart D – West Coast Groundfish – Trawl Fisheries

§ 660.100 Purpose and Scope.

In addition to the purpose and scope listed at § 660.10, subpart C, this subpart covers the Pacific Coast Groundfish limited entry trawl fishery. Under the trawl rationalization program, the limited entry trawl fishery consists of the shorebased IFQ Program, the Mothership Coop Program, and the C/P Coop Program.

§ 660.111 Trawl Fishery Definitions.

These definitions are specific to the limited entry trawl fisheries. General groundfish definitions are defined at § 660.11, Subpart C.

Catch history assignment means a percentage of the mothership sector allocation of Pacific whiting based on a vessel's catch history and which is specified on the MS/CV endorsed limited entry permit.

Catcher/processor coop means a harvester group that includes all eligible catcher/processor at-sea whiting endorsed permit owners who voluntarily form a coop and who manage the catcher/processor-specified allocations through private agreements and contracts.

Coop agreement means a private agreement between a group of MS/CV endorsed limited entry permit owners or C/P whiting endorsed permit owners that contains all information specified at §§ 660.XXX and 660.XXX, Subpart D.

Coop Member means all permit owners of MS/CV endorsed permits for the Mothership Program or C/P endorsed permits for the C/P Program that are legally obligated to the coop.

Coop permit means the Federal permit required to participate as a Pacific whiting coop in the catcher/processor or mothership sectors.

Designated coop manager means an individual appointed by a permitted coop who is identified in the coop agreement and is responsible for actions described at 660.XMPX and 660.XCPX.

Individual Fishing Quota (IFQ) means a quantity of fish, expressed as a percentage of the total allowable catch of a fishery that may be received or held for exclusive use by a person. IFQ is a harvest privilege that may be revoked at any time. IFQ species for the shorebased IFQ fishery are listed at 660.XXX.

IFQ first receivers mean persons who receive, purchase, or take custody, control, or possession of catch onshore directly from a vessel that harvested the catch while fishing under the Shorebased IFQ Program described at § 660.140.

IFQ landing means an offload of fish harvested under the Shorebased IFQ Program described at § 660.140, Subpart D.

IFQ Program means the Shorebased IFQ Program described at § 660.140, Subpart D.

Inter-coop means two or more permitted coops that have submitted an accepted inter-coop agreement to NMFS that specifies a coordinated strategy for harvesting pooled allocations of Pacific whiting and non-whiting groundfish.

Inter-coop agreement means a written agreement between two or more permitted mothership coops and which contains private contractual arrangements for sharing catch with one another.

Material change means, for the purposes of a coop agreement, a change to any of the components of the coop agreement which was submitted to NMFS during the application process for the coop permit and is further defined at § 660.XXX, Subpart D.

Mothership coop means a group of MS/CV endorsed limited entry permit owners that are authorized by means of a coop permit to jointly harvest and process from a single coop allocation.

Mutual agreement exception means, for the purpose of § 660.XXX, Subpart D, an agreement that allows the owner of a MS/CV endorsed limited entry permit to withdraw the catcher vessel's obligation to a permitted mothership processor and to deliver to a different permitted mothership processor.

Pacific halibut set aside means an amount of Pacific halibut annually allocated to a permitted coop or the non-coop fishery and which is based on the allocation of Pacific whiting.

Pacific whiting shoreside or shore-based fishery means Pacific whiting shoreside vessels and Pacific whiting shoreside first receivers.

Pacific whiting shoreside first receivers means persons who receive, purchase, or take custody, control, or possession of Pacific whiting onshore directly from a Pacific whiting shoreside vessel.

Pacific whiting shoreside vessel means any vessel that fishes using midwater trawl gear to take, retain, possess and land 4,000 lb (1,814 kg) or more of Pacific whiting per fishing trip from the Pacific whiting shore-based sector allocation for delivery to a Pacific whiting shoreside first receiver during the primary season.

Processor obligation means an annual requirement for a MS/CV endorsed limited entry permit limited entry permit to deliver its catch to a particular mothership processor permit.

Midwater whiting fishery means a trip in which a vessel registered to a shore-based IFQ endorsed limited entry permit uses legal midwater groundfish trawl gear with a valid declaration for Limited entry midwater trawl, Pacific whiting IFQ, as specified at §660.13 (d)(5) during the dates what the midwater whiting season is open.

Quota pounds means the round weight of fish that must be used to cover total catch (landings and discards) in the shorebased IFQ Program. QP are issued annually to QS permit owners based on the amount of QS they own and the amount of fish allocated to the IFQ *fishery. QP have the same species/species group, area, and sector designations as the QS from which it was issued.*

Quota share (QS) means a permit, the face amount of which is used as the basis for the annual calculation and allocation of a person's IFQ. QS is expressed as a percentage and is designated for the species/species group, area, and trawl sector to which it applies. Species for which QS will be issued for the Shorebased IFQ Program are listed at 660.XXX, Subpart D.

Vessel limits means the amount of quota pounds a vessel can hold, acquire, or use.

Vessel account means an account held by the vessel owner where QP are registered for use by a vessel in the Shorebased IFQ Program.

§ 660.112 Limited entry trawl fishery prohibitions.

§ 660.113 Recordkeeping and reporting.

§ 660.116 Trawl Fishery Observer requirements.

§ 660.120 Crossover provisions – Areas, Gears, Trawl Fisheries. [Reserved]

§ 660.130 Limited entry trawl fishery management measures.

§ 660.131 Pacific Whiting Fishery Management Measures.

§ 660.140 Shorebased IFQ Program.

(a) General. The IFQ Program applies to qualified participants in the Pacific Coast Groundfish fishery and includes a system of transferable QS for most groundfish species or species groups and trip limits or set-asides for the remaining groundfish species or species groups. The IFQ Program is subject to area restrictions (GCAs, RCAs, and EFHCAs) listed at 660.XXX. The shorebased IFQ fishery may be restricted or closed as a result of projected overages within the shorebased IFQ Program, the Mothership Coop Program, or the C/P Coop Program. As determined necessary by the Regional Administrator, area restrictions, season closures, or other measures will be used to prevent the trawl sector in aggregate or the individual trawl sectors (shorebased IFQ, Mothership Coop, or C/P Coop) from exceeding an OY, or formal allocation specified in the PCGFMP or regulation at § 660.XXX subpart XX.

(b) Participation requirements. [Reserved]

(1) QS Permit Owners [Reserved]

(2) IFQ Vessels [Reserved]

(c) IFQ Species and Allocations.

(1) IFQ Species. IFQ species are those groundfish species for which QS will be issued. QS will carry designations for the species/species groups, area, and trawl sector to which it applies. QS and QP species groupings and area subdivisions will be those for which OYs are specified in the ABC/OY tables (XXXXXXX) and those for which there is an area-specific precautionary harvest policy. QS for remaining minor rockfish will be

aggregated for the shelf and slope depth strata (nearshore species are excluded as described at § 660.XXX). The following are the IFQ species:

IFQ Species	
ROUNDFISH	ROCKFISH
Lingcod	Pacific ocean perch
Pacific cod	Widow rockfish
Pacific whiting	Canary rockfish
Sablefish north of 36° N. lat.	Chilipepper rockfish
Sablefish south of 36° N. lat.	Bocaccio
FLATFISH	Splitnose rockfish
Dover sole	Yellowtail rockfish
English sole	Shortspine thornyhead north of 34° 27' N. lat.
Petrale sole	Shortspine thornyhead south of 34° 27' N. lat.
Arrowtooth flounder	Longspine thornyhead north of 34° 27' N. lat.
Starry flounder	Cowcod
Other Flatfish stock complex	Darkblotched
	Yelloweye
	Minor Rockfish North slope species complex
	Minor Rockfish North shelf species complex
	Minor Rockfish South slope species complex
	Minor Rockfish South shelf species complex

(2) <u>IFQ Program Allocations</u>. [Reserved]

(d) <u>QS permits and QS accounts</u>.

(1) <u>General</u>. In order to obtain and control QS, a person must apply for a QS permit. NMFS will determine if the applicant is eligible to acquire QS and complies with the accumulation limits found at §660.XXX(x), Subpart D. For those persons that are found to be eligible for a QS permit, NMFS will establish a QS account. QP will be issued annually at the start of the year to a QS account based on the percent of QS registered to the account. QS owners must transfer their QP from their QS account to a vessel account in order for those QP to be fished.

(2) <u>Eligibility and registration</u>. [Reserved]

(3) <u>Renewal, change of permit ownership, and transfer</u>. [Reserved]

(4) <u>Accumulation limits</u>.

(i) QS control limits are an accumulation limit and are the amount of QS that a person, individually or collectively, may control. These amounts are as follows:

Species Category	*QS Control Limit*
Nonwhiting Groundfish Species	*2.7%*
Lingcod - coastwide	*2.5%*
Pacific Cod	*12.0%*
Pacific whiting (shoreside)	*10.0%*
Sablefish	
N. of 36° (Monterey north)	*3.0%*
S. of 36° (Conception area)	*10.0%*
PACIFIC OCEAN PERCH	*4.0%*
WIDOW ROCKFISH *	*5.1%*
CANARY ROCKFISH	*4.4%*
Chilipepper Rockfish	*10.0%*
BOCACCIO	*13.2%*
Splitnose Rockfish	*10.0%*
Yellowtail Rockfish	*5.0%*
Shortspine Thornyhead	
N. of 34°27'	*6.0%*
S. of 34°27'	*6.0%*
Longspine Thornyhead	
N. of 34°27'	*6.0%*
COWCOD	*17.7%*
DARKBLOTCHED	*4.5%*
YELLOWEYE	*5.7%*
Minor Rockfish North	
Shelf Species	*5.0%*
Slope Species	*5.0%*
Minor Rockfish South	
Shelf Species	*9.0%*
Slope Species	*6.0%*
Dover sole	*2.6%*
English Sole	*5.0%*
Petrale Sole	*3.0%*
Arrowtooth Flounder	*10.0%*
Starry Flounder	*10.0%*
Other Flatfish	*10.0%*
Other Fish	*5.0%*
Pacific Halibut	*5.4%*

(ii) <u>Individual and collective rule</u>. The QS that counts toward a person's accumulation limit will include:

(A) the QS owned by them, and

(B) a portion of the QS owned by an entity in which that person has an interest, where the person's share of interest in that entity will determine the portion of that entity's QS that counts toward the person's limit.

(iii) Control means, but is not limited to the following:

(A) the person has the right to direct, or does direct, the business of the entity to which the QS are registered;

(B) the person has the right to direct, or does direct, the delivery of groundfish harvested under a permit registered to a different person;

(C) the person has the right in the ordinary course of business to limit the actions of or replace, or does limit or replace, the chief executive officer, a majority of the board of directors, any general partner, or any person serving in a management capacity of the entity to which the QS is registered;

(D) the person has the right to direct, or does direct, the transfer of QS;

(E) the person, through loan covenants, has the right to restrict, or does restrict, the day to day business activities and management policies of the entity to which the QS is registered;

(F) the person has the right to control, or does control, the management of, or to be a controlling factor in, the entity to which the QS is registered;

(G) the person has the right to cause, or does cause, the sale of QS;

(H) the person absorbs all of the costs and normal business risks associated with ownership and operation of the entity to which the QS is registered; and

(I) the person has the ability through any means whatsoever to control the entity to which QS is registered.

(iv) <u>Divestiture</u>. An adjustment period will be provided for QS permit owners that are found to exceed the accumulation limits. QS will be issued for amounts in excess of accumulation limits only for holders of limited entry permits transferred by November 8, 2008, if such transfers have been registered with NMFS by November 30, 2008. The holder of any permit transferred after that time will be eligible to receive an initial allocation for that permit of only those QS that are within the accumulation limits. Anyone who qualifies for an initial allocation of QS in excess of the accumulation limits will be allowed to receive that allocation but must divest themselves of the excess QS during years three and four of the IFQ program. Holders of QS in excess of the control limits may receive and use the QP associated with that excess, up to the time their divestiture is completed. At the end of year 4 of the IFQ program, any QS held by a person in excess of the accumulation limits in place at the time of the initial issuance of QS will be revoked and redistributed to the remainder of the of the QS holders in proportion to the QS holdings. At the start of the 5th year of the IFQ Program, QP will not be issued for QS held in excess of the accumulation limits. No compensation will be due for any revoked shares.

(5) <u>Appeals</u>. [Reserved]

(6) Fees. The Regional Administrator is authorized to charge fees for administrative costs associated with the issuance of a QS permit consistent with the provisions given at §660.25(f), Subpart C.

(7) [Reserved]

(8) Application Requirements and Initial Issuance for QS Permit and QS.

(i) Eligible Applicant.

(A) For harvesters, only an owner of a valid trawl limited entry permit is eligible to apply to NMFS for an initial issuance of a QS permit and its associated QS amount. NMFS will not accept an application from a person that does not meet the eligibility requirements. NMFS will not recognize any other person as permit owner other than the person listed as permit owner in NMFS permit database at the time of receipt of the application.

(B) For shoreside processing entities, only those shoreside whiting first receivers recorded in the database that was extracted from PacFIN by NMFS on [INSERT DATE PROPOSED RULE PUBLISHED IN Federal Register], as having received landings of 1 mt or more of whiting from whiting trips in each of any 2 years from 1998 through 2004 are eligible to apply for an initial issuance of whiting QS. For the purposes of initial issuance of whiting QS, the following further define eligible shoreside processor applicants:

(1) a whiting trip is a fishing trip where greater than or equal to 50 percent by weight of the landing of groundfish is whiting as recorded in the database that was extracted from PacFIN by NMFS on [INSERT DATE PROPOSED RULE PUBLISHED IN Federal Register].

(2) a shoreside processor is an operation, working on US soil, that takes delivery of trawl caught groundfish that has not been processed; and that thereafter engages that fish in shoreside processing. Entities that received fish that have not undergone at-sea processing or shoreside processing and sell that fish directly to consumers shall not be considered a processor for purposes of QS allocations. Shoreside processing is defined as either of the following:

(i) Any activity that takes place shoreside; and that involves: cutting groundfish into smaller portions; or freezing, cooking, smoking, drying groundfish; or packaging that groundfish for resale into 100 pound units or smaller for sale or distribution into a wholesale or retail market.

(ii) The purchase and redistribution into a wholesale or retail market of live groundfish from a harvesting vessel.

(ii) Qualifying Criteria for QS.

(A) Non-whiting, non-overfished species QS. QS for non-whiting, non-overfished species will be calculated based on a limited entry trawl-endorsed permit's relative landings history from 1994 through 2003, dropping the 3 worst years of landings. The calculation will be based on the following:

(1) State landing receipts (fish tickets) as recorded in the database that was extracted from PacFIN by NMFS on [INSERT DATE PROPOSED RULE PUBLISHED IN Federal Register], for non-whiting landings (that is, for trips on which whiting is less than 50% of the total landings) will be used by NMFS to calculate landings for each limited entry trawl-endorsed permit's shoreside deliveries.

(2) Relative landings history will be calculated for each qualifying year by dividing the total catch of each non-whiting, non-overfished IFQ species for the vessel(s) registered to the permit by the sum of the total catch of that IFQ groundfish species from all vessel(s) meeting the qualifying criteria for a QS permit.

(3) The 3 worst years of landings means the 3 years with the lowest landings by weight for a specific non-whiting, non-overfished IFQ species.

(4) The current limited entry permit's landings history includes the landings history of any permits that have been previously combined with that permit. If two or more limited entry trawl permits have been simultaneously registered to the same vessel, NMFS will split the landing history evenly between both permits.

(5) History of illegal landings will not count toward the allocation of QS. Any landings made under an EFP in excess of the cumulative limits in place for the non-EFP fishery will not count towards the allocation of QS.

(6) Landings history from Federal limited entry groundfish permits that were retired through the Federal buyback program will be divided equally among qualifying QS permits, as described at paragraph (D).

(B) Whiting QS.

(1) For harvesters, whiting QS will be calculated based on a limited entry trawl-endorsed permit's relative landings history from 1994 through 2003, dropping the 3 worst years of landings. State landing receipts (fish tickets) as extracted by NMFS from PacFIN for whiting landings will be used to calculate landings for each limited entry trawl-endorsed permit's shoreside deliveries. The current limited entry permit's landings history includes the landings history of any permits that have been previously combined with that permit. If two or more limited entry trawl permits have been simultaneously registered to the same vessel, NMFS will split the landing history evenly between both permits. History of illegal landings will not count toward the allocation of QS. Any landings made under an EFP in excess of the cumulative limits in place for the non-EFP fishery will not count towards the allocation of QS. Landings history from the Federal limited entry trawl permits that were retired through the Federal buyback program will be divided equally among qualifying QS permits, as described at paragraph (D).

(2) For shoreside processors, whiting QS will be calculated based on a processor's relative landings history from 1994 through 2003, dropping the 2 worst years of landings. State landing receipts (fish tickets) as extracted by NMFS from PacFIN for whiting trips will be used to make the calculation. For purposes of making an initial issuance of whiting QS to a shoreside processor, NMFS will attribute landing history to the first receiver/processor reported on the landing receipt (the entity responsible for filling out the state fish ticket) as recorded in the database that was extracted from PacFIN by NMFS on [INSERT DATE PROPOSED RULE PUBLISHED IN Federal Register], except history may be reassigned to a shoreside processor/first receiver not on the landings receipt if both parties agree or if, through the initial issuance and appeals process, NMFS determines that the first receiver that filed the fish ticket is not, in fact, the entity that first processed the fish.

(C) Overfished Species QS. QS for overfished species will be calculated for each permit using a formula of target species QS (i.e., non-overfished species QS), logbook data, and WCGOP data. NMFS will apply the fleetwide average bycatch rates from the WCGOP to each permit's depth and latitude distributions from state logbooks and to each permit's target species QS allocations. Fleetwide average bycatch rates for latitudinal areas are divided shoreward and seaward of the RCA and are based on WCGOP data from 2003 through 2006. If there are no state logbooks associated with a specific permit for a given year, then fleetwide averages will be used.

(1) Minimum QP Allocation for Canary Rockfish. For recipients of non-whiting QS that are issued less than 50 lb (QP) of canary rockfish, those recipients will receive additional canary rockfish QP in their QS account to bring their QP issued up to 50 lb. These additional canary rockfish QP will come from the 10 percent non-whiting QS that is reserved for the Adaptive Management Program. QS permit owners may not continue to receive this minimum canary rockfish QP after the first two years of the trawl rationalization program.

(2) [Reserved]

(D) Equal Division of Buyback Permit History. NMFS will make an equal division of the pool of non-overfished species QS from the Federal limited entry trawl permits that were retired through the Federal buyback program (i.e., buyback permit) (70 FR 45695, August 8, 2005) among all qualifying QS Permits for all QS species/species groups or areas. The QS pool associated with the buyback permits will be the buyback permit history as a percent of the total fleet history for the allocation period. The calculation will be based on total absolute pounds with no other adjustments and no dropped years.

(iii) Prequalified Application. A "prequalified application" is a partially pre-filled application where NMFS has preliminarily determined the landings history that may qualify the applicant for an initial issuance of QS.

(A) For harvesters, NMFS will mail a prequalified application to all current trawl limited entry permit owners, as listed in NMFS permit database, who are found to qualify for QS. NMFS will mail the application by certified mail to the current address of record in the NMFS permit database. The application will contain the basis of NMFS's calculation of their QS for each species/species group or area based on the database that was extracted from PacFIN by NMFS on [INSERT DATE PROPOSED RULE PUBLISHED IN Federal Register].

(B) For shoreside first receivers/processors, NMFS will mail a prequalified application to all shoreside processors who are found to qualify from PacFIN data for an initial issuance of whiting QS. NMFS will mail the application by certified mail to qualified shoreside processors to the current address of record given by the state in which entity is registered. For all qualified shoreside processors who meet the eligibility requirement at paragraph XXX, the application will provide the basis of NMFS's calculation of the initial issuance of whiting QS based on the database that was extracted from PacFIN by NMFS on [INSERT DATE PROPOSED RULE PUBLISHED IN Federal Register].

(iv) Applicants Not Prequalified. If a current permit owner of a trawl-endorsed limited entry permit or a whiting shoreside processor does not receive a prequalified application, and such persons believe they qualify for an initial issuance of QS, the person must contact NMFS in writing prior to the application deadline. The person must provide valid PacFIN data that substantiates that the person may be qualified for an initial issuance of QS. If NMFS finds that the person may qualify for QS, NMFS will allow the person to make an application. If the permit owner or shoreside processor fails to contact NMFS by the application deadline date, they forgo the opportunity to receive consideration for an initial issuance of QS.

(v) Corrections to the Application. If the applicant disagrees with the basis of NMFS' determination in the prequalified application, the applicant must provide in writing which parts of NMFS' determination are not accurate, and must include additional information to substantiate the correction. The corrections must be provided with the completed application form by the application deadline date. Corrections may only be submitted for the following:

(A) errors in NMFS' extraction, aggregation, or expansion of data, including:

(1) errors in NMFS extraction of landings data from PacFIN;

(2) errors in NMFS extraction of state logbook data from PacFIN;

(3) errors in the permit owner, permit combinations, or vessel registration as listed in NMFS permit database.

(B) Reassignment of whiting landings history for shoreside first receivers. For shoreside first receivers of whiting, the landing history may be reassigned to another person. In order for landing history to be reassigned to another person an authorized representative for the shoreside first receiver given on the state landing ticket must submit by the application deadline date for initial issuance of QS a letter which requests that the whiting landings history during the qualifying

years be conveyed to another person. The letter must be signed by an authorized representative of the shoreside first receiver named on the state landing tickets and signed by an authorized representative of the person the whiting landing history will be reassigned to. The letter must give the legal name of the person, business address and the name and phone number of the person receiving the whiting landing history. If a valid contract agreement exists that reassigns the landing history, that document must be provided to NMFS.

(vi) Submission of the Application and Application Deadline.

(A) Submission of the Application. Submission of the complete, certified application includes, but is not limited to, the following:

(1) The applicant is required to sign and notarize the application.

(2) The applicant must certify that they qualify to own QS and indicate whether they agree or disagree with NMFS' determination of initial issuance of QS provided in the application.

(3) The applicant is required to provide a complete Trawl Identification of Ownership Interest Form.

(4) Business entities are required to submit a corporate resolution or any other credible documentation as proof that the representative of the entity is authorized to act on behalf of the entity; and

(5) NMFS may request additional information of the applicant as necessary to make an IAD.

(B) Application Deadline. A complete, certified application must be postmarked no later than [insert date 60 calendar days after publication of the final rule in the FEDERAL REGISTER]. NMFS will not accept or review any applications received after the application deadline. There are no hardship provisions for this deadline.

(vii) Permit transfer during application period. At any time during the application process for initial issuance of QS and until a final decision is made by the Regional Administrator on behalf of the Secretary of Commerce, a permit owner cannot transfer ownership of the permit until the final decision for that application has been made.

(viii) Initial Administrative Determination (IAD). NMFS will issue an IAD for all complete, certified applications received by the application deadline date. If NMFS approves an application for initial issuance of QS, the applicant will receive a QS Permit specifying the amounts of QS the applicant has qualified for and will be registered to a QS Account. If NMFS disapproves an applicant's request to correct the application, the IAD will provide the reasons NMFS did not accept the corrections. As part of the IAD, NMFS will indicate if the QS Permit owner has QS in amounts that exceed the accumulation limits and are subject to divestiture provisions given at XXXXXX. If the applicant does not appeal the IAD within 30 calendar days of the date on the IAD, the IAD becomes the final decision of the Regional Administrator acting on behalf of the Secretary of Commerce.

(ix) Appeals. For QS permits issued under this section, the appeals process and timelines are specified at § 660.25(g), Subpart C. For the initial issuance of QS and the

QS permits, the basis for appeal are described in paragraph (d)(8)(v). Items not subject to appeal include, but are not limited to, the following:

(A) the accuracy of permit landings data or shoreside first receiver landings data from PacFIN;

(B) the formula used to calculate initial issuance of QS;

(C) the allocation of IFQ species to the shoreside trawl fishery.

(e) Vessel accounts. [Reserved]

(f) First Receiver Site License. [Reserved]

(g) Retention requirements (whiting and non-whiting vessels). [Reserved]

(h) Observer Requirements. [Reserved]

(i) [Reserved]

(j) Shoreside Catch Monitor requirements for IFQ first receivers. [Reserved]

(k) Catch weighing requirements. [Reserved]

(l) Gear Switching. [Reserved]

(m) Adaptive Management Program. [Reserved]

§ 660.150 Mothership (MS) Coop Program.

(a) General. The MS Coop Program is a limited access program that applies to eligible harvesters and processors in the mothership sector of the Pacific whiting at-sea trawl fishery. Eligible harvesters and processors, including MS permitted coop and non-coop fishery participants, must meet the requirements set forth in this section of the Pacific Coast groundfish regulations. In addition to the requirements of this section, the MS coop program is subject to the following groundfish regulations:

(1) Pacific whiting seasons §660.131, Subpart D

(2) Area restrictions specified for midwater trawl gear used to harvest Pacific whiting fishery specified at §660.131, Subpart D for GCAs, RCAs, Salmon Conservation Zones, BRAs, and EFHCAs.

(3) Regulations set out in the following sections of Subpart C: §660.11 Definitions, §660.XX Prohibitions, § 660.13 Recordkeeping and reporting, §660.14 VMS requirements, §660.15 Equipment requirements, §660.16 Groundfish Observer Program, §660.20 Vessel and gear identification, and §660.XXXAdd others plus the Pacific whiting measures at currently at 660.323XXX.

(4) Regulations set out in the following sections of Subpart D: §660.111 Trawl fishery definitions, §660.112 Trawl fishery prohibitions, §660.113 Trawl fishery recordkeeping and reporting, §660.116 Trawl fishery observer requirements, and §660.130 Limited entry trawl fishery management measures.

(5) The MS Coop program fishery may be restricted or closed as a result of projected overages within the MS Coop Program, the C/P Coop Program, or the shorebased IFQ Program. As determined necessary by the Regional Administrator, area restrictions, season closures, or other measures will be used to prevent the trawl sectors in aggregate or the individual sector (shorebased IFQ, MS Coop, or C/P Coop)) from exceeding an OY, or formal allocation specified in the PCGFMP or regulation at § 660.XXX subpart XX.

(b) Participation requirements. [Reserved]

(1) Mothership vessels. [Reserved]

(2) Mothership Catcher Vessels. [Reserved]

(3) MS Coop Formation and Failure. [Reserved]

(c) MS Coop Program Species and Allocations.

(1) MS Coop Program Species. MS Coop Program Species are as follows:

(i) Species with formal allocations to the MS Program: Pacific whiting, canary rockfish, darkblotched rockfish, Pacific Ocean perch, widow rockfish;

(ii) Species with set-asides for the MS and C/P Programs combined, as described in Table XXset-aside tableXX , Subpart C.

(2) Annual Mothership Sector sub-allocations. [Reserved]

(i) Mothership catcher vessel catch history assignments. [Reserved]

(ii) Annual Coop Allocations. [Reserved]

(iii) Annual Non-Coop Allocation. [Reserved]

(3) Reaching an allocation or sub-allocation. [Reserved]

(4) Non-whiting groundfish species reapportionment. [Reserved]

(5) Announcements. [Reserved]

(6) Redistribution of Annual Allocation. [Reserved]

(7) Processor obligation. [Reserved]

(8) Allocation accumulation limits [Reserved]

(d) MS Coop Permit and Agreement. [Reserved]

(e) Inter-coop Agreement. [Reserved]

(f) Mothership (MS) Permit.

(1) General. After January 1, 2011, only vessels registered to a MS permit can receive an at-sea whiting delivery in the mothership whiting sector. A vessel registered to MS permit may participate in a Mothership coop (subject to coop permit requirements and provisions of a private cooperative agreement) and/or may participate in the non-coop fishery at the same time or during the same year.

(i) Eligibility to Own or Hold a MS Permit. The only person that can acquire a MS permit is 1) a United States citizen; 2) a permanent resident alien; or 3) a corporation, partnership or other entity established under the laws of the United States or any State.

(ii) Vessel Size Endorsement. A MS permit does not have a vessel size endorsement assigned to it. The endorsement provisions at 660.334(c) do not apply to a MS permit.

(iii) Restriction on C/P Vessel Operating as MS. Restrictions on a vessel registered to C/P endorsed permit operating as a mothership are specified at § 660.XXC/P sxnX, Subpart D.

(2) Renewal, Change of permit ownership, or vessel registration. [Reserved]

(3) Accumulation Limit.

(i) MS Permit Usage Limit. No individual or entity who owns MS permit(s) may register the MS permit(s) to vessels that cumulatively process more than 45 percent of the annual mothership sector whiting allocation. For purposes of

determining accumulation limits, any person or entity subject to this limit must submit a complete trawl ownership interest form as part of annual renewal for the MS permit as provided for at 660.XXXXX. Also, an ownership interest form will be required when a new permit owner obtains a MS permit as part of a transfer request. Accumulation limits will be determined by calculating the percentage of ownership interest a person has in any MP permit. Ownership interest will subject to the individual and collective rule.

(ii) Individual and collective rule. The ownership that counts toward a person's accumulation limit will include:

(A) the MS permit owned by them, and

(B) a portion of the MS permit owned by an entity in which that person has an interest, where the person's share of interest in that entity will determine the portion of that entity's ownership that counts toward the person's limit.

(iii) Control means, but is not limited to the following:

(A) the person has the right to direct, or does direct, the business of the entity to which the permit is registered;

(B) the person has the right to direct, or does direct, the delivery of groundfish harvested under a permit registered to a different person;

(C) the person has the right in the ordinary course of business to limit the actions of or replace, or does limit or replace, the chief executive officer, a majority of the board of directors, any general partner, or any person serving in a management capacity of the entity to which the permit is registered;

(D) the person has the right to direct, or does direct, the transfer of the permit;

(E) the person, through loan covenants, has the right to restrict, or does restrict, the day to day business activities and management policies of the entity to which the permit is registered;

(F) the person has the right to control, or does control, the management of, or to be a controlling factor in, the entity to which the permit is registered;

(G) the person has the right to cause, or does cause, the sale of the permit;

(H) the person absorbs all of the costs and normal business risks associated with ownership and operation of the entity to which the permit is registered; and

(I) the person has the ability through any means whatsoever to control the entity to which permit is registered.

(4) Appeals. [Reserved]

(5) Fees. The Regional Administrator is authorized to charge fees for administrative costs associated with the issuance of a MS permit consistent with the provisions given at §660.25(f), Subpart C.

(6) Application Requirements and Initial Issuance for MS Permit.

(i) Eligible Applicant. An owner of a vessel that processed whiting in the mothership sector in the qualifying years may apply for a MS permit, except that in the case of bareboat charterers, the charterer of the bareboat may apply.

(ii) Qualifying Criteria for MS Permit. In order to qualify for a MS permit, a mothership vessel must have processed at least 1,000 mt of whiting in each of two years during the qualifying years of 1997 through 2003.

(iii) Prequalified Application. A "prequalified application" is a partially pre-filled application where NMFS has preliminarily determined the processing history that may qualify the applicant for MS permit. NMFS will mail a prequalified application to the owner of the vessel or charterer of the bareboat who are found to qualify for the MS permit. NMFS will mail the application by certified mail to the current address of record in the NMFS permit database or in the NORPAC database. The application will contain the basis of NMFS's determination that the mothership vessel meets the qualifying criteria for the MS permit based on Pacific Whiting observer data recorded in the database that was extracted from NORPAC by NMFS on [INSERT DATE PROPOSED RULE PUBLISHED IN Federal Register].

(iv) Applicants Not Prequalified. Owners of vessels that do not receive an prequalified application from NMFS, and believe they are qualified for a MS permit, must contact NMFS in writing by the application deadline date requesting clarification of their eligibility status and providing credible documentation to substantiate their claim. Credible documentation may include official NMFS observer records that demonstrate the vessel met the qualifying criteria given in paragraph (b) above. If NMFS finds that the person may qualify for a MS permit, NMFS will allow that person to make an application. If the person fails to contact NMFS in writing by the application deadline date, the person forgoes the opportunity to receive consideration for initial issuance of a MS permit.

(v) Corrections to the Application. If the applicant disagrees with the basis of NMFS' determination in the prequalified application, the applicant must provide in writing which parts of NMFS' determination are not accurate, and must include additional information to substantiate the correction. The corrections must be provided with the completed application form by the application deadline date. Corrections may only be submitted for errors in NMFS' extraction, aggregation, or expansion of the database that was extracted from NORPAC by NMFS on [INSERT DATE PROPOSED RULE PUBLISHED IN Federal Register] or errors in NMFS permit database.

(vi) Submission of the Application and Application Deadline.

(A) Submission of the Application. Submission of the complete, certified application includes, but is not limited to, the following:

(1) The applicant is required to sign and notarize the application.

(2) The applicant must certify that they qualify to own a MS permit and indicate whether they agree or disagree with NMFS' determination on initial issuance of the MS permit provided in the application.

(3) The applicant is required to provide a complete Trawl Identification of Ownership Interest Form.

(4) Business entities are required to submit a corporate resolution or any other credible documentation as proof that the representative of the entity is authorized to act on behalf of the entity;

(5) A bareboat charterer must provide credible evidence that demonstrates it was chartering the mothership vessel under a private contract during the qualifying years; and

(6) NMFS may request additional information of the applicant as necessary to make an IAD.

(B) Application Deadline. A complete, certified application must be postmarked no later than [insert date 60 calendar days after publication of the final rule in the FEDERAL REGISTER] [XX or February 1, 2011 XX]. NMFS will not accept or review any applications received after the application deadline. There are no hardship provisions for this deadline.

(vii) Initial Administrative Determination. NMFS will issue an IAD for all complete, certified applications received by the application deadline date. If NMFS approves an application, the applicant will receive a MS Permit. If NMFS disapproves an applicant's request to correct the application, the IAD will provide the reasons NMFS did not accept the corrections. If the applicant does not appeal the IAD within 30 calendar days of the date on the IAD, the IAD becomes the final decision of the Regional Administrator acting on behalf of the Secretary of Commerce.

(viii) Appeals. For a MS permit issued under this section, the appeals process and timelines are specified at § 660.25(g), Subpart C. For the initial issuance of a MS permit, the basis for appeal is described in paragraph (f)(5)(v). Items not subject to appeal include, but are not limited to, the following:

(A) the formula used to calculate initial issuance of a MS permit;

(B) the allocation of MS Coop species to the MS Coop fishery.

(g) Mothership catcher vessel (MS/CV) endorsed permit.

(1) General. NMFS will issue a MS/CV endorsement and catch history assignment on qualified limited entry "A" endorsed trawl permits. Within the MS whiting fishery, vessels registered to a MS/CV endorsed permit may participate in a MS coop or in the non-coop fishery.

(i) Catch History Assignment. A catch history assignment is permanently assigned to MS/CV endorsed permit. The catch history assignment is based the catch history in the MS whiting sector during qualifying years as described below. The catch history assignment is expressed as percentage of whiting of the total

MS whiting sector allocation. The catch history allocation accrues to the coop that the MS/CV permit is tied to through private agreement, or will be directed to the non-coop fishery if the MS/CV endorsed permit is not participating in the coop fishery.

(ii) MS/CV Endorsement Not Severable from Permit. A MS/CV endorsement is permanently affixed to the original qualifying limited entry permit, and cannot be transferred separately from the original qualifying limited entry permit.

(iii) Vessel Size Endorsement. All vessels registered to a MS/CV limited entry permit are be subject to vessel size endorsement regulations given at 50 CFR 660.334 (c)(1)(i) and (c)(2)(ii)

(iv) Renewal. In addition to the requirements at XXXX [LE permit requirements] the owner of a MS/CV endorsed permit must identify their intent to participate in the non coop or coop fishery for the following year.

(v) Restrictions on Processing by MS/CV endorsed Permit. A vessel registered to MS/CV endorsed permit in a given year shall not engage in processing of whiting during that year.

(2) Change of Permit owner, vessel registration, vessel owner, or combination. [Reserved]

(3) Accumulation Limits.

(i) MS/CV Permit Ownership Limit. No individual or entity shall own MS/CV permits for which the collective whiting allocation total is greater than 20 percent. For purposes of determining accumulation limits, NMFS requires that permit owners submit a complete trawl ownership interest form for the permit owner as part of annual renewal of a MS/CV endorsed permit. Also, an ownership interest form will be required when a new permit owner obtains a MS/CV permit as part of a transfer request. Accumulation limits will be determined by calculating the percentage of ownership interest a person has in any MS/CV permit and the amount of the whiting catch history assignment given on the permit. Ownership interest will subject to the individual and collective rule.

(A) Individual and collective rule. The whiting catch history assignment that counts toward a person's accumulation limit will include:

(1) the catch history assignment owned by them, and

(2) a portion of the catch history assignment owned by an entity in which that person has an interest, where the person's share of interest in that entity will determine the portion of that entity's catch history assignment that counts toward the person's limit.

(B) Control means, but is not limited to the following:

(1) the person has the right to direct, or does direct, the business of the entity to which the permit and catch history assignment are registered;

(2) the person has the right to direct, or does direct, the delivery of groundfish harvested under a permit registered to a different person;

(3) the person has the right in the ordinary course of business to limit the actions of or replace, or does limit or replace, the chief executive officer, a majority of the board of directors, any general partner, or any person serving in a management capacity of the entity to which the permit and catch history assignment are registered;

(4) the person has the right to direct, or does direct, the transfer of the permit;

(5) the person, through loan covenants, has the right to restrict, or does restrict, the day to day business activities and management policies of the entity to which the permit and catch history assignment are registered;

(6) the person has the right to control, or does control, the management of, or to be a controlling factor in, the entity to which the permit and catch history assignment are registered;

(7) the person has the right to cause, or does cause, the sale of the permit and associated catch history assignment;

(8) the person absorbs all of the costs and normal business risks associated with ownership and operation of the entity to which the permit and associated catch history assignment are registered; and

(9) the person has the ability through any means whatsoever to control the entity to which permit and associated catch history assignment are registered.

(C) Divestiture. If an individual or entity is found to exceed the ownership limit, NMFS will notify the applicant so that the applicant may comply with the MS/CV permit ownership limit requirement prior to issuance of the MS/CV endorsement.

(ii) Catcher Vessel Usage Limit. A vessel registered to MS/CV endorsed permit or a trawl limited entry permit shall not catch more than 30 percent of the mothership sector's whiting allocation.

(4) Appeals. [Reserved]

(5) Fees. The Regional Administrator is authorized to charge a fee for administrative costs associated with the issuance of a MS/CV endorsed permit as provided for at § 660.25(f), Subpart C.

(6) Application Requirements and Initial Issuance for MS/CV Endorsement.

(i) Eligible Applicant. Only a current owner of a trawl limited entry permit with a history of whiting deliveries in the MS whiting sector can apply for a MS/CV endorsement. Any past catch history associated with current trawl permit accrues to the current permit owner. NMFS will not accept an application from a person that does not meet the eligibility requirements. NMFS will not recognize any other person as permit owner other than the person listed as permit owner in NMFS permit database at the time of receipt of the application.

(ii) Qualifying Criteria for MS/CV Endorsement. In order to qualify for a MS/CV endorsement, vessels registered to a valid trawl endorsed limited entry

permit must have caught and delivered at least 500 mt of whiting to motherships between 1994 through 2003. The calculation will be based on the following:

(A) The catch history will include any deliveries of whiting by vessels registered to limited entry trawl endorsed permits that were subsequently combined to generate the current permit. If two or more limited entry trawl permits have been simultaneously registered to the same vessel, NMFS will split the landing history evenly between both permits.

(B) History of illegal landings will not count.

(C) Landings history from Federal limited entry groundfish permits that were retired through the Federal buyback program will not count.

(iii) Qualifying Criteria for Catch History Assignment. A catch history assignment will be specified as a percent on the MS/CV endorsed permit. The whiting catch history assignment calculation for the MS/CV endorsed permit will be based on the whiting catch history of vessels registered to the permit in each year from 1994 through 2003, dropping two years. The calculation will be based on the following:

(A) Pacific whiting observer data as recorded in the database that was extracted from NORPAC by NMFS on [INSERT DATE PROPOSED RULE PUBLISHED IN Federal Register].

(B) Relative pounds will be calculated for each qualifying year by dividing the total catch of Pacific whiting for the vessel(s) registered to the permit by the sum of the total catch from all Pacific whiting vessel(s) meeting the qualifying criteria for a MS/CV endorsed limited entry permit.

(C) The eight years with the highest relative pounds of Pacific whiting will be selected and added together to generate the permit's official catch history. The catch history amount associated with a permit will include the catch history of all permits that were combined into the current permit to create a larger vessel size endorsement.

(D) The catch history will include any deliveries of whiting by vessels registered to limited entry trawl endorsed permits that were subsequently combined to generate the current permit. If two or more limited entry trawl permits have been simultaneously registered to the same vessel, NMFS will split the landing history evenly between both permits.

(E) History of illegal landings will not count.

(F) Landings history from Federal limited entry groundfish permits that were retired through the Federal buyback program will not count.

(iv) Prequalified Application. A "prequalified application" is a partially pre-filled application where NMFS has preliminarily determined the landings history that may qualify the applicant for MS/CV endorsement and associated catch history assignment. NMFS will mail a prequalified application to the owner of the vessel who is found to qualify for the MS/CV endorsement and associated catch

history assignment. NMFS will mail the application by certified mail to the current address of record in the NMFS permit database. The application will contain the basis of NMFS's determination that the vessel meets the qualifying criteria for the MS/CV endorsement and associated catch history assignment based on Pacific Whiting observer data recorded in the database that was extracted from NORPAC by NMFS on [INSERT DATE PROPOSED RULE PUBLISHED IN Federal Register].

(v) Applicants Not Prequalified. If a current owner of a limited entry trawl endorsed permit does not receive a prequalified application, and the permit owner believes the permit's catch history qualifies for a MS/CV endorsement and catch history assignment, the permit owner must contact NMFS in writing by the application deadline date requesting clarification of their eligibility status and catch history assignment and provide credible documentation to substantiate their claim. Credible documentation may include official NMFS observer records that demonstrate the vessel met the qualifying criteria given in paragraphs (ii) and (iii) above. If NMFS finds that the permit owner may qualify for a MS/CV endorsement and catch history assignment, NMFS will allow the permit owner to make an application. If the permit owner fails to contact NMFS in writing by the application deadline date, the person forgoes the opportunity to receive consideration for a MS/CV endorsement and catch history assignment.

(vi) Corrections to the Application. If the applicant disagrees with the basis of NMFS' determination in the prequalified application, the applicant must provide in writing which parts of NMFS' determination are not accurate, and must include additional information to substantiate the correction. The corrections must be provided with the completed application form by the application deadline date. Corrections may only be submitted for errors in NMFS' extraction, aggregation, or expansion of the database that was extracted from NORPAC by NMFS on [INSERT DATE PROPOSED RULE PUBLISHED IN Federal Register] or errors in NMFS permit database.

(vii) Submission of the Application and Application Deadline.

(A) Submission of the Application. Submission of the complete, certified application includes, but is not limited to, the following:

(1) The applicant is required to sign and notarize the application.

(2) The applicant must certify that they qualify to own a MS/CV endorsed permit and indicate whether they agree or disagree with NMFS' determination on initial issuance of the MS/CV endorsed permit and catch history assignment provided in the application.

(3) The applicant is required to provide a complete Trawl Identification of Ownership Interest Form.

(4) Business entities are required to submit a corporate resolution or any other credible documentation as proof that the

representative of the entity is authorized to act on behalf of the entity;

(5) NMFS may request additional information of the applicant as necessary to make an IAD.

(B) Application Deadline. A complete, certified application must be postmarked no later than [insert date 60 calendar days after publication of the final rule in the FEDERAL REGISTER]. NMFS will not accept or review any applications received after the application deadline. There are no hardship provisions for this deadline.

(viii) Initial Administrative Determination. NMFS will issue an IAD for all complete, certified applications received by the application deadline date. If NMFS approves the application, the applicant will receive a MS/CV endorsed limited entry permit and associated whiting catch history assignment. If NMFS disapproves an applicant's request to correct the application, the IAD will provide the reasons NMFS did not accept the corrections. If known at the time of the IAD, NMFS will indicate if the MS/CV endorsed permit owner has ownership interest in catch history assignments that exceed the accumulation limits and are subject to divestiture provisions given at XXXXXX. If the applicant does not appeal the IAD within 30 calendar days of the date on the IAD, the IAD becomes the final decision of the Regional Administrator acting on behalf of the Secretary of Commerce.

(ix) Appeals. For a MS/CV endorsed permit and associated catch history assignment issued under this section, the appeals process and timelines are specified at § 660.25(g), Subpart C. For the initial issuance of a MS/CV endorsed permit and associated catch history assignment, the basis for appeal is described in paragraph (g)(6)(vi). Items not subject to appeal include, but are not limited to, the following:

(A) the formulas used to calculate initial issuance of a MS/CV endorsement and associated catch history assignment;

(B) the allocation of MS Coop species to the MS Coop fishery.

(h) Retention requirements. [Reserved]

(i) Observer Requirements. [Reserved]

(j) [Reserved.]

(k) Catch weighing requirements. [Reserved]

§ 660.160 Catcher-Processor (C/P) Coop Program

(a) General. The C/P Coop Program is a limited access program that applies to vessels in the C/P sector of the Pacific whiting at-sea trawl fishery and is a single voluntary coop. Eligible harvesters and processors must meet the requirements set forth in this section of the Pacific Coast groundfish regulations. In addition to the requirements of this section, the C/P coop program is subject to the following groundfish regulations:

(1) Pacific whiting seasons §660.131, Subpart D.

(2) Area restrictions specified for midwater trawl gear used to harvest Pacific whiting fishery specified at §660.131, Subpart D for GCAs, RCAs, Salmon Conservation Zones, BRAs, and EFHCAs.

(3) Regulations set out in the following sections of Subpart C: §660.11 Definitions, §660.XX Prohibitions, § 660.13 Recordkeeping and reporting, §660.14 VMS requirements, §660.15 Equipment requirements, §660.16 Groundfish Observer Program, §660.20 Vessel and gear identification, and §660.XXXAdd others plus the Pacific whiting measures at currently at 660.323XXX.

(4) Regulations set out in the following sections of Subpart D: §660.111 Trawl fishery definitions, §660.112 Trawl fishery prohibitions, §660.113 Trawl fishery recordkeeping and reporting, §660.116 Trawl fishery observer requirements, and §660.130 Limited entry trawl fishery management measures.

(5) The C/P Coop program may be restricted or closed as a result of projected overages within the MS Coop Program, the C/P Coop Program, or the shorebased IFQ Program. As determined necessary by the Regional Administrator, area restrictions, season closures, or other measures will be used to prevent the trawl sectors in aggregate or the individual sector (shore-based IFQ, MS Coop, or C/P Coop) from exceeding an OY, or formal allocation specified in the PCGFMP or regulation at § 660.XXX subpart XX.

(b) C/P Coop Program Species and Allocations

(1) C/P Coop Program Species. C/P Coop Program Species are as follows:

(i) Species with formal allocations to the C/P Coop Program: Pacific whiting, canary rockfish, darkblotched rockfish, Pacific Ocean perch, widow rockfish;

(ii) Species with set-asides for the MS and C/P Programs combined, as described in Table XXset-aside tableXX , Subpart C.

(2) [Reserved]

(c) C/P Coop Permit and Agreement. [Reserved]

(d) C/P endorsed permit.

(1) General. Participation of a vessel in the non-tribal primary whiting fishery in the C/P sector during the season described at 50 CFR 660.XXX requires that an owner of that vessel register the vessel to a valid limited entry permit with a C/P endorsement. All permit owners and owners of the vessels registered to these C/P endorsed permits will be members of the C/P coop and that coop must be registered to C/P coop permit and operate under a coop agreement as described at: XXXXX

(i) C/P Endorsement Not Separable from Permit. A C/P endorsement is not separable from the limited entry permit, and therefore, the endorsement may not be transferred separately from the limited entry permit.

(ii) Vessel Size Endorsement. A C/P endorsed limited entry permit registered to a vessel that is more than 5' smaller the permit size endorsement will not result in a permanent reduction in the size endorsement of the permit. The provision given at 50 CFR 660.334 (c)(1)(i) does not apply to a C/P endorsed permit.

(iii) Restriction on C/P Vessel operating as CV. A vessel registered to C/P endorsed permit cannot operate as a catcher vessel delivering unprocessed whiting to another processor in the same calendar year.

(iv) Restriction on C/P Vessel Operating as MS. A vessel registered to C/P endorsed permit cannot operate as a mothership during the same year it participates in the CP fishery. At the time of permit renewal, the owner of the vessel registered to the C/P endorsed permit may declare whether it will operate solely as a MS in the year the permit is renewed for.

(2) Eligibility and Renewal for C/P endorsed permit. [Reserved.]

(3) Change in permit ownership, vessel registration, vessel owner, transfer or combination. [Reserved]

(4) Appeals. [Reserved]

(5) Fees. The Regional Administrator is authorized to charge fees for the administrative costs associated with review and issuance of a C/P endorsement consistent with the provisions at § 660.25(f), Subpart C.

(6) [Reserved]

(7) Application Requirements and Initial Issuance for C/P endorsement.

(i) Eligible Applicant. Only current permit owners of trawl endorsed limited entry permits that have been registered to catcher-processors that participated in the catcher-processor fishery are eligible to apply for a C/P endorsement. Any past catch history associated with current trawl permit accrues to the current permit owner. NMFS will not accept an application from a person that does not meet the eligibility requirements. NMFS will not recognize any other person as permit owner other than the person listed as permit owner in NMFS permit database at the time of receipt of the application.

(ii) Qualifying Criteria for C/P Endorsement. In order to qualify for a C/P endorsement, a vessel registered to a valid trawl endorsed limited entry permit must have caught and processed any amount of whiting during a primary catcher-processor season between 1997 through 2003. The calculation will be based on the following:

(A) Pacific Whiting Observer data recorded in the database that was extracted from NORPAC by NMFS on [INSERT DATE PROPOSED RULE PUBLISHED IN Federal Register] and NMFS permit data on limited entry trawl endorsed permits will be used to determine whether a permit meets the qualifying criteria for a C/P endorsement.

(B) Only whiting regulated by this subpart that was taken with midwater (or pelagic) trawl gear will be considered for the C/P endorsement.

(C) Permit catch and processing history includes only the catch/processing history of whiting for a vessel when it was registered to that particular permit during the qualifying years.

(D) History of illegal landings will not count.

(E) Landings history from Federal limited entry groundfish permits that were retired through the Federal buyback program will not count.

(iii) Prequalified Application. A "prequalified application" is a partially pre-filled application where NMFS has preliminarily determined the landings history that may qualify the applicant for C/P endorsement. NMFS will mail a prequalified application to the owner of the vessel who is found to qualify for the C/P endorsement. NMFS will mail the application by certified mail to the current address of record in the NMFS permit database. The application will contain the basis of NMFS's determination that the vessel meets the qualifying criteria for the C/P endorsement based on Pacific Whiting observer data recorded in the database that was extracted from NORPAC by NMFS on [INSERT DATE PROPOSED RULE PUBLISHED IN Federal Register].

(iv) Applicants Not Prequalified. If a current owner of a limited entry trawl endorsed permit does not receive a prequalified application, and the permit owner believes the permit's catch history qualifies for a C/P endorsement, the permit owner must contact NMFS in writing by the application deadline date requesting clarification of their eligibility status and provide credible documentation to substantiate their claim. Credible documentation may include official NMFS observer records that demonstrate the vessel met the qualifying criteria given in paragraph (ii) above. If NMFS finds that the permit owner may qualify for a C/P endorsement, NMFS will allow the permit owner to make an application. If the permit owner fails to contact NMFS in writing by the application deadline date, the person forgoes the opportunity to receive consideration for a C/P endorsement.

(v) Corrections to the Application. If the applicant disagrees with the basis of NMFS' determination in the prequalified application, the applicant must provide in writing which parts of NMFS' determination are not accurate, and must include additional information to substantiate the correction. The corrections must be provided with the completed application form by the application deadline date. Corrections may only be submitted for errors in NMFS' extraction, aggregation, or expansion of the database that was extracted from NORPAC by NMFS on [INSERT DATE PROPOSED RULE PUBLISHED IN Federal Register] or errors in NMFS permit database.

(vi) Submission of the Application and Application Deadline.

(A) Submission of the Application. Submission of the complete, certified application includes, but is not limited to, the following:

(1) The applicant is required to sign and notarize the application.

(2) The applicant must certify that they qualify to own a C/P endorsed permit and indicate whether they agree or disagree with NMFS' determination on initial issuance of the C/P endorsed permit provided in the application.

(<u>3</u>) Business entities are required to submit a corporate resolution or any other credible documentation as proof that the representative of the entity is authorized to act on behalf of the entity;

(<u>4</u>) NMFS may request additional information of the applicant as necessary to make an IAD.

(B) <u>Application Deadline</u>. A complete, certified application must be postmarked no later than [<u>insert date 60 calendar days after publication of the final rule in the FEDERAL REGISTER</u>]. NMFS will not accept or review any applications received after the application deadline. There are no hardship provisions for this deadline.

(vii) <u>Initial Administrative Determination</u>. NMFS will issue an IAD for all complete, certified applications received by the application deadline date. If NMFS approves the application, the applicant will receive a C/P endorsed limited entry permit. If NMFS disapproves an applicant's request to correct the application, the IAD will provide the reasons NMFS did not accept the corrections. If the applicant does not appeal the IAD within 30 calendar days of the date on the IAD, the IAD becomes the final decision of the Regional Administrator acting on behalf of the Secretary of Commerce.

(viii) <u>Appeal</u>. For a C/P endorsed permit issued under this section, the appeals process and timelines are specified at § 660.25(g), Subpart C. For the initial issuance of a C/P endorsed permit, the basis for appeal is described in paragraph (d)(7)(v). Items not subject to appeal include, but are not limited to, the following:

(A) the formula used to calculate initial issuance of a C/P endorsement;

(B) the allocation of C/P Coop species to the C/P Coop Program.

(e) <u>Retention requirements</u>. [Reserved]

(f) <u>Observers Requirements</u>. [Reserved]

(g) [Reserved]

(h) <u>Catch weighting requirements</u>. [Reserved]

(i) <u>C/P Coop failure</u>. [Reserved]

* Figure 1
* Trip Limit Tables - Table 3 North and South

SCIENTIFIC AND STATISTICAL COMMITTEE REPORT ON REGULATORY DEEMING FOR FISHERY MANAGEMENT PLANS AMENDMENT 20 – TRAWL RATIONALIZATION AND AMENDMENT 21 – INTERSECTOR ALLOCATION AND PLANNING FOR COMMUNITY FISHERY ASSOCIATIONS (CFA)

The Scientific and Statistical Committee (SSC) was briefed by Dr. Todd Lee, Northwest Fisheries Science Center (NWFSC) on a report by the National Marine Fisheries (NMFS) NWFSC Economics Group on "Mandatory Economic Data Collection Program Design for Groundfish Trawl Rationalization" (NMFS Report 5). The report provides initial discussion regarding design of a program to address the PFMC's mandatory economic data collection requirement for trawl rationalization and the Magnuson-Stevens Act monitoring requirement for Limited Access Privilege Programs.

Currently, the NWFSC conducts voluntary economic surveys of limited entry and open-access harvesting vessels, and the NMFS Regional Offices conduct voluntary processor surveys for their processed products reports. The NWFSC economic surveys provide data from groundfish trawlers on (1) ownership, homeport, and physical vessel characteristics, (2) annual revenue by source – including landings outside the west coast (including Alaska), west coast at-sea deliveries, sale/lease of vessel permits, and fishery disaster relief payments, (3) annual fixed and variable costs (not specific to fishery), and (4) crew compensation and fuel use associated with participation in the west coast groundfish trawl fishery.

While the current NWFSC economic surveys (and the Regional Offices' processor surveys) have many useful applications, the voluntary nature of those surveys - e.g., inadequate samples for some vessel and processor strata and some communities – make them poorly suited for considering the effects of rationalization.

The SSC endorses the mandatory economic data collection requirement and makes the following recommendations:

- Vessel and processor data should be collected for several years prior to rationalization as well as post-rationalization, to provide a basis for comparison.
- Collection of revenue, cost, and employment data from vessels and processors should be mandatory for all fisheries in which they participate – not just the groundfish trawl fishery. Mandatory collection is needed to ensure that data for all fisheries are available to place the effects of rationalization in the context of each business entity's overall economic activity and to evaluate potential spillover effects of rationalization on other fisheries.

The SSC concurs with the NWFSC report that design of the economic data collection will require collaboration with the Council, its advisory bodies, and industry participants, and that respondent burden should be minimized to the extent possible. Consultation with the NMFS Regional Offices will likely be needed to evaluate available processor data and how it can be supplemented for purposes of monitoring rationalization effects.

PFMC
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ALASKAN OBSERVERS

29 December 2009

Dr. Jane Lubchenco
National Oceanographic and Atmospheric Administration
1401 Constitution Ave., NW
Room 5128
Washington, DC 20230

Dear Dr. Lubchenco,

Since 1990, Alaskan Observers, Inc. (AOI) has provided over 300,000 observer coverage days to fisheries in Alaska and off the West Coast of the US, and we plan to be involved in observer programs for the foreseeable future. To that end, I have been following with some interest the development of the Sector Management Plan in New England, set for implementation in May, 2010.

The National Marine Fisheries Service (NMFS) is considering the use of monitors (who would be required to hold a high school diploma) as opposed to observers (who would be required to hold a bachelors degree) for at-sea data collection once New England fisheries convert to sector management. I've heard similar talk, albeit on an unofficial level, at Pacific Council meetings as plans take shape to establish Individual Trawl Quotas on the West Coast beginning in 2011. Given the draft NOAA Catch Shares Policy that was published earlier this month, I expect every region may eventually debate the question of monitors vs. observers.

Proponents of the shift to using monitors advance it as a way to save money, and the fact that catch share programs will tend to recover monitoring costs from fishermen lends urgency to this concern. At the same time, the assumption seems to be that these new monitor-staffed programs will continue to support the science, research, and fisheries and protected resources compliance monitoring that current observer programs support. As catch shares spread from fishery to fishery in the years ahead, the need to independently verify fishermen's self-reported data is only going to grow, so I certainly understand that scaling back observer program functions isn't realistic or desirable. This combination of lowering qualifications and maintaining or even increasing program functions sounds too good to be true. That's because it is. I'm skeptical that any forecast savings associated with switching to monitors will ever actually materialize.

In fact, significant program costs will increase if the at-sea data collectors no longer have degrees in the natural sciences. For instance, training would need to be significantly longer so that

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monitor candidates could be introduced to the basics of statistics and random sampling and be taught to use dichotomous keys to identify fish to species. Debriefing efforts by program staff will be more involved and time consuming, particularly during the early part of a given monitor's tenure. Also, the fact that bachelor's degree holders in the natural sciences are professionally vested in their work contributes to one of the greatest sources of cost savings in programs like the North Pacific and West Coast groundfish programs–that being observer retention. I believe deploying monitors in place of observers will decrease retention rates, further exacerbating training costs. And more newly trained people gathering data on commercial boats, regardless of their qualifications, means more failed trips wherein data quality is so compromised that the data must be tossed out. Lost data carries costs that can be immediate–having defensible data is critical to the success of fisheries managed by catch-share schemes–to long term, insofar as managers pondering a dodgy database are inclined to set conservative quotas.

It may well be that people with high-school diplomas can be trained to do the work observers currently do–my goal here really isn't to debate that question one way or the other. I only want to point out that, in the end, reducing qualifications in this way isn't the answer to holding down the costs of collecting reliable at-sea data. Holding down costs is possible, but it's going to be the product of hard work, work that will require coordination among observer providers, groups of vessels, processing plants, and NMFS, work that will need to be tailored fishery by fishery. The sooner people stop falling back on the easy answer of lowering educational requirements, the sooner those of us concerned with this problem can focus on real solutions.

Sincerely,

ALASKAN OBSERVERS, INC.

Michael Lake
President

cc: Dr. James Balsiger
Acting Director
National Marine Fisheries Service
1315 East-West Highway
Silver Spring, MD 20910

Dr. Ned Cyr
Supervisory Biologist
National Oceanographic and Atmospheric Administration
1100 Wayne Ave., No. 1210
Silver Spring, MD 20910

ecotrust

NORTH PACIFIC FISHERIES TRUST

February 16, 2010 | Agenda Item E6

David Ortmann, Chairman
Pacific Fishery Management Council
7700 NE Ambassador Place, Suite 200
Portland, Oregon 97220-1384

Re: Planning for Community Fishery Associations

Chairman Ortmann and Council Members,

In my oral testimony before the Council in June 2009, I mentioned that an ad hoc advisory committee to address the development of Community Fishing Associations (CFAs) would be a productive step for the Council to take. I am very pleased that the Council appears to be considering the development of such a committee.

As you know there are many "dock level" ideas about how CFAs could be used to adapt to the changing circumstances that the pending trawl TIQ program will produce.

Fisheries resources are very important assets that have powered and will continue to support the economic development of coastal communities in the PFMC region. Much innovation has been generated by fishing communities and their businesses in the last 40 years. CFAs hold the promise to add a new chapter to that innovation.

We support the establishment of an ad hoc advisory committee on Community Fishing Associations and request the Council to take this action.

We would like to suggest that the Council consider a wide complement of representation on the ad hoc CFA advisory committee should it be formed. We would like to propose that fishing communities, organizations with community economic development experience, representatives from existing and emerging community fishing associations and fisheries trusts be considered for membership for at least two different seats on the committee.

Thank you for you consideration,

Edward W. Bowles

Vice President, Community Ecosystem Services, Ecotrust
Chair of the Board, North Pacific Fisheries Trust

SAN DIEGO FISHERMEN'S WORKING GROUP
8021 LEMON AVE.LA MESA, CA 91941

February 17, 2010

Dave Ortmann, Chairman
Pacific Fisheries Management Council
7700 NE Ambassador Place, Suite 101
Portland, OR 97220-1384

Re: Item E.6 Regulatory Deeming for Fishery Management Plan Amendment 20–Trawl Rationalization and Amendment 21—Trawl Allocation, and Planning for Community Fishery Associations (CFA)

Dear Chairman Ortmann:

On behalf of the Directors of the San Diego Fishermen's Working Group, a recently formed Port Association representing the Commercial Fishermen of San Diego, California. We would like to offer some suggestions and alternatives regarding the planning for Community Fishery Associations (CFA).

As you are likely aware, the Unified Port of San Diego is completing a study titled, "The Commercial Fisheries Revitalization Plan," funded by the California Coastal Conservancy. The plan attempts to identify ways to reverse the local and nationwide trend of gentrification of urban ports through infrastructure improvements and improved public access to the fishing docks. Additionally, the plan is to develop a direct marketing approach for high value, low volume, sustainable seafood through dockside markets and other direct marketing systems.

In order to implement the revitalization plan, members of our association must have access to a wide variety of fisheries. Our idea is to create and utilize a portfolio based fisheries management system. We as a Commercial Fishing Industry need to recognize that fishermen need to participate in diverse fisheries in both state and federal waters. This includes access to both "limited entry" and "open access" fisheries, and target species with and without fishery management plans.

The success of direct marketing in reducing the carbon footprint and the sustainability of our markets relies on the availability of the community to access a wide variety of fish harvested by our local commercial fishing fleet. Groundfish fisheries are an important part of the portfolio of fisheries on the West Coast, and are a cornerstone of the sustainable fisheries of the future. Access to groundfish by the San Diego fishing fleet would be best served through the establishment of our association as a Community Fishery Association.

We are aware other organizations have asked the Pacific Fishery Management Council to contemplate the formation of an ad hoc Advisory Committee to address the CFA issue. We support the creation of an advisory committee and suggest the membership formation include representatives from existing and emerging community fishing associations, fishing communities, community economic development experts, and fisheries trusts.

In our opinion, the proper creation of Community Fishery Associations would help us meet our goals of viability and sustainability. It is our sincere belief that we need to move away from high quantity/low quality fisheries to that of high quality/low quantity diversified fisheries that are both economically viable and environmentally sustainable.

On behalf of the San Diego Fishermen's Working Group, we would like to thank you for your time and consideration of our suggestions and alternatives regarding the planning for Community Fishery Associations.

Sincerely,

Peter Halmay

San Francisco Community Fishing Association

Direct from the boat. Fairtrade fish and crabs. Est. 2009

Larry J. Collins • President Joe Garafolo • General Manager

February 16, 2010 Agenda Item E6

David Ortmann, Chairman
Pacific Fishery Management Council
7700 NE Ambassador Place, Suite 200
Portland, Oregon 97220-1384

Re: Planning for Community Fishery Associations

Chairman Ortmann and Council Members,

The San Francisco Community Fishing Association will be a marketplace for both the public and business to purchase locally caught seafood direct from the source: local independent fishermen who subscribe to sustainable fishing standards. While we wait to acquire funding to build this marketplace we are in the process of forming our association and this process should be completed sometime this spring.

We are pleased to see that the Council will start planning for Community Fishery Associations and we hope that this will result in an ad hoc advisory committee. In communities from San Diego to San Francisco, Port Orford to Neah Bay, there are active small-scale, typically day-boat, fisheries that are participating in low impact fisheries for a range of target species from urchins and crab to salmon and rockfish. Community fisheries trusts and related entities, notable community fishing associations, are emerging as the stewards and managers of fisheries economic assets, and can play an important role in providing jobs and sustainable seafood for the future.

To that end, fishing communities, community economic development experts, and representatives from existing and emerging community fishing associations and fisheries trusts should have seats on the ad hoc CFA advisory committee.

As we move forward with our plans, we will need guidance from the Council and we hope the Council will get good advice. It will be important to have groups like ours on the committee.

Thank you,

Larry Collins, President

David Bitts
President
Larry Collins
Vice-President
Tom Hart
Secretary
Marlyse Battistella
Treasurer
In Memoriam:
Nathaniel S. Bingham
Harold C. Christensen

PACIFIC COAST FEDERATION of FISHERMEN'S ASSOCIATIONS

http://www.pcffa.org

W.F. "Zeke" Grader, Jr.
Executive Director
Glen H. Spain
Northwest Regional Director
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Please Respond to:

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17 February 2010

Via: E-Mail and Facsimile

Mr. David Ortmann, Chair
Pacific Fishery Management Council
7700 NE Ambassador Place, Suite 101
Portland, OR 97220-1384

RE: Item E.6 Regulatory Deeming for Fishery Management Plan Amendment 20–Trawl Rationalization and Amendment 21—Trawl Allocation, and Planning for Community Fishery Associations (CFA)

Dear Chairman Ortmann and Council Members:

The Pacific Coast Federation of Fishermen's Associations (PCFFA) represents working men and women in the West Coast commercial fishing fleet. Our members engage in a number of different fisheries utilizing many different gear types including troll, small trawl, trap, gillnet, seine, hook-and-line, and long-lines. These different fisheries constitute the "portfolio" of fishing needed to sustain year-around, professional fishing men and women; they are also needed to maintain the diversity of fisheries essential for sustaining fishing communities/fishing ports.

Moreover, PCFFA members have a direct interest in the groundfish fishery. Some hold trawl permits, some are "open-access" trawlers (i.e., south-central and Southern California trawlers that were denied trawl permits at the onset of the program), fixed-gear permit holders and those in the "open access" rockfish fishery.

As you know, PCFFA has expressed grave doubt over the direction of the current trawl "rationalization" plan. That plan, Amendment 21, as now written, could lead to massive consolidation in the trawl fleet – which has been allocated the lion's share of groundfish resources. Consolidation of vessels and ownership threatens to deny access in the future to many fishing communities along the Pacific Coast to groundfish resources in the waters adjacent to their ports.

Community Fishing Associations, PCFFA believes, are an alternative to the privatization of public fishery resources and the consolidation and corporatization that follows most IFQ programs. CFA's give community-based organizations a stake and some management over their local fish stocks that, depending on structure, protect local fishing fleets, processors, port infrastructure, and the public's interest in its public-trust fishery resources. The biological transition from single-species management to ecosystem-based management also demands, PCFFA believes, a socio-economic transition away from the old industrial – and largely non-sustainable – high volume, low value fisheries to a post-industrial model based on smaller-scale operations (that may employ more individuals and vessels than the old systems, and certainly IFQ systems) in high value, low volume portfolio fisheries.

The last reauthorization of the Magnuson-Stevens Act required the regional fishery councils to consider development of CFA's in the context of limited access privilege programs (LAPPs). PCFFA is pleased the Pacific Council now contemplates the formation of an ad hoc Advisory Committee to address the CFA issue. PCFFA strongly supports the creation of an advisory committee and suggest the membership formation include representatives from existing and emerging community fishing associations, fishing communities, community economic development experts, and fisheries trusts.

PCFFA looks forward to the Pacific Council's March discussion of community fishing associations and is pleased to answer any questions or provide any additional information Council members or staff may have prior to your Sacramento meeting.

Sincerely,

W.F. "Zeke" Grader, Jr.
Executive Director

cc: Ms. Monica Medina, Chair, NOAA Catch Share Task Force

Port Orford Ocean Resource Team
P.O. Box 679
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February 17, 2010

Mr. Dave Ortmann, Chair
Pacific Fisheries Management Council
7700 NE Ambassador Place, Suite 101
Portland, OR 97220

RE: Item E.6 Regulatory Deeming for Fishery Management Plan Amendment 20–Trawl Rationalization and Amendment 21—Trawl Allocation, and Planning for Community Fishery Associations (CFA)

Dear Chairman Ortmann and Council Members:

The Port Orford Ocean Resource Team (POORT) is a community-based fisheries program established in 2003. Our mission is to engage Port Orford fishers and other community members in developing and implementing a strategic plan and framework that ensures the long-term sustainability of the Port Orford marine ecosystem and social system dependent on it. A board of commercial fishermen directs the work of the organization, and a Community Advisory Team links our projects with the broader community of Port Orford. Our fishermen use hook and line gear and pots with small boats (all under 40 feet) and participate in salmon, crab, blackcod, nearshore live fish, halibut and albacore fisheries.

We believe that the West Coast small boat fishing fleet has traditionally been successful because they participate in a portfolio of fisheries. Fishermen move in and out of fisheries in response to changes in access opportunities, generally driven by stock assessments. We are concerned about the future of small boat, portfolio fishing and view Community Fishery Associations (CFA's) as an opportunity to formalize local, small boat, community-based fishing initiatives. POORT also believes CFA's are an alternative to IFQ programs that promote consolidation, while doing nothing to protect fishing communities.

We are pleased that the PFMC will begin to address CFA's at your March meeting. We recognize the Council will seek advice and direction for CFA's, and support the Council immediately forming an advisory committee to work on this issue. In addition to POORT, there are fishing organizations in San Diego, San Francisco, Morro Bay and other west coast communities that are standing by to participate. We also ask that you include economists and economic development specialists on the committee so the full perspective of CFA's will be examined.

Thank you for your consideration.

Sincerely,

Leesa Cobb

Leesa Cobb, Director

Agenda Item E.6.c
Supplemental Public Comment PowerPoint (Burden)
March 2010

Overview of January and February Trawl Rationalization Monitoring Meetings

Workshops held in January and February to discuss monitoring under the trawl rationalization program

- Purpose was to provide a forum for discussing the ways in which catch will be documented under IFQ system
- Participants had an eye toward a system which would be “effective, but cost efficient”

Several points were discussed

- At sea observer system
- Shoreside monitor system
- State fish ticket system
- Port sampling system
- Enforcement's role
- IFQ transfer tools
- Private arrangements for cutting observer costs
- Federal, state, private responsibilities for program components

Key outcomes and potentially influential decision points

- Requirements for an at sea observer are specified in regulation
- Shoreside monitor may not necessarily have those same requirements
- Two possibilities exist for the role of state fish tickets in catch reporting under the IFQ system
- Role of enforcement in ensuring catch reporting compliance and accuracy may change fundamentally as a result of observers and catch monitors
- Catch reporting redundancy can be built into the system at opportunistic places to improve the reporting accuracy of observers and monitors
- Some industry members can potentially pool observers over a given time period to reduce costs

At Sea Observer Standards

Outlined in the document National Minimum Eligibility Standards for Marine Fisheries Observers

- *1) a bachelor's degree …with a major in one of the natural sciences and a minimum of 30 semester hours or equivalent in the biological sciences…*
- *RAs and Science Directors may waive the education and experience requirements … if a (candidate) has acquired … skills to be eligible for observer training through a NMFS authorized alternative training program….*

Shoreside monitor standards

Shoreside monitors may not need to meet the same requirements. Two options were discussed:

- Meet the same requirements as at sea observers
- Operate like the "weighmaster program" previously run by the Fishermen's Marketing Association

SS monitors as observers?

Discussion was that:

- Meeting such minimum standards may tend to result in a more “professional” individual
  - This may increase the confidence and accuracy of shoreside catch monitoring, potentially decreasing the need for data QA/QC as well as potentially decreasing the need for shoreside enforcement presence

SS monitors as "weigh masters"?

Discussion was:

- FMA had run a successful program in the past that was relatively low cost.
  - Combining weighmasters with the catch reporting incentives created by the IFQ program should result in quality catch reporting

State fish tickets in shoreside catch reporting

- Three catch data systems run alongside the IFQ program
  - At sea observer system
  - Shoreside monitor system
  - State fish ticket system
- Two alternative viewpoints were discussed regarding the role of state fish tickets systems
  - That the IFQ program be run entirely off at sea and shoreside monitor data
  - That state fish ticket data eventually replace shoreside monitor data

Alternative views regarding the role of state fish ticket systems

- State fish tickets not used for IFQ program management
  - Concept was that with a well-run shoreside monitor system, the need for state fish tickets may not necessary for management.
  - Fish ticket adjustments made several months after the fact make it difficult to administer and operate under the IFQ program

Alternative views (cont)

- State fish tickets replace shoreside monitor data
  - Concept was that state fish tickets which have been QA/QC are better catch reports than shoreside monitor reports
  - The signature of the harvester and processor on the fish ticket provides a vehicle for enforcing catch reporting

Opportunistic catch reporting redundancy to improve catch reporting

Appear to be opportunities for simple catch monitoring redundancies to improve the catch monitoring system

- Require that at sea observers estimate landings and discard of OFS
  - Compare estimates to SS monitor OFS estimates with at sea observer estimates → provide feedback to both persons to improve estimation over time
- Compare port sampler information to SS monitor information
  - Provide feedback to SS monitor to improve estimation over time

Improvements in observer and monitor reporting may reduce need for data QA/QC and improve management accuracy

Observer pooling to reduce cost

Some industry members and observer companies outlined a model to reduce private observer costs

- Long term contract between groups of fishermen and an observer company for a given number of observers
- Vessels share a smaller number of observers during that time period

- Long term contract reduces observer turnover which may reduce cost
- Sharing observers across a larger number of vessels may reduce cost

Control Rule and Collective Arrangements

Applying an effective control rule while allowing desirable collective arrangements between fishery participants

February 24, 2010
Prepared by:

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1. Introduction

The Pacific Fishery Management Council has adopted a strict limit on ownership, control, and use of quota share (QS) and quota pounds (QP) in the West Coast Groundfish trawl fishery rationalization (Amendment 20):

> QS Control Limit: A person, individually or collectively, may not control QS in excess of the specified limit (because there is no the grandfather clause). QS controlled by a person shall include those registered to that person, plus those controlled by other entities in which the person has a direct or indirect ownership interest, as well as shares that the person controls through other means. The calculation of QS controlled by a person will follow the "individual and collective" rule.
> Individual and Collective Rule: The QS that counts toward a person's accumulation limit will include 1) the QS or QP owned by them, and 2) a portion of the QS owned by any entity in which that person has an interest. The person's share of interest in that entity will determine the portion of that entity's QS that counts toward the person's limit.[1]

Such a limit is consistent with the Magnuson Stevens Fishery Conservation and Management Act (MSA) requirements that limited access privilege programs (LAPPs) be developed with limits to avoid any entity gaining control over an excessive share of a fishery.

While there are a couple of ways that control rules have been implemented in other LAPP programs – using the individual and collective rule or an "affiliate test" – in all cases regulating control by means other than ownership is a major challenge. The National Marine Fisheries Service (NMFS) and the Maritime Administration (MARAD) have developed useful tests and documentation to help track and monitor transactions and relationships that might implicate the control rule.

Given the potential complexity and the difficulty in regulating these relationships, these mechanisms will be most effective and fair if they seek to reveal and address certain classes of activities that implicate control across all QS holders, rather than attempt to single out particular types of fishery participants or types of relationships.

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[1] Draft Environmental Impact Statement (DEIS) for Rationalization of the Pacific Coast Groundfish Limited Entry Trawl Fishery, Appendix D, prepared by PFMC and NMFS, November 2009

The Conservancy strongly recommends that Amendment 20 be implemented with strict monitoring and regulation of all types of control over both QS and QP and that the Council establish a "safe harbor exemption" for certain types of collective arrangements (e.g., Community Fishing Associations, quota risk pools, observer sharing arrangements, etc.). This will ensure transparency in all matters that might relate to excessive control and to ensure that safe harbors are used in a way that is consistent with the policies, goals, and objectives that govern the West Coast Groundfish Trawl fishery. Moreover, it will create regulatory certainty for the participants in these types of arrangements.

2. <u>Establishing the Control Rule</u>

2a. MSA Provisions Relating to Excessive Control

The Magnuson-Stevens Fishery Conservation and Management Act (MSA)[2] provides that fishery management plans should be designed and implemented so as to prevent excessive control over a fishery by any one party or group of parties. Under Section 301(a) of the Act:

> (4) Conservation and management measures shall not discriminate between residents of different States. If it becomes necessary to allocate or assign fishing privileges among various United States fishermen, such allocation shall be (A) fair and equitable to all such fishermen; (B) reasonably calculated to promote conservation; and (C) carried out in such manner that no particular individual, corporation, or other entity acquires an excessive share of such privileges.[3]

Section 303A(c)(5) of the Act directs Regional Fishery Management Councils and the Secretary of Commerce, in developing limited access privilege programs, to:

> (D) ensure that limited access privilege holders do not acquire an excessive share of the total limited access privileges in the program by—
> (i) establishing a maximum share, expressed as a percentage of the total limited access privileges, that a limited access privilege holder is permitted to hold, acquire, or use; and
> (ii) establishing any other limitations or measures necessary to prevent an inequitable concentration of limited access privileges; and development of limited access privilege programs.[4]

In that same section, the Councils and Secretary are directed to:

> (B) consider the basic cultural and social framework of the fishery, especially through—
> (i) the development of policies to promote the sustained participation of small owner-operated fishing vessels and fishing communities that depend on the fisheries, including regional or port-specific landing or delivery requirements; and
> (ii) procedures to address concerns over excessive geographic or other consolidation in the harvesting or processing sectors of the fishery.

2b. Rationale for Excessive Control Provisions

The objectives of these excessive control provisions are to (1) discourage monopolistic behavior and (2) protect established fishing communities.[5] As such, the MSA advances both economic and social values.

Monopolistic behavior may manifest itself in at least three major ways. First, concentrations of quota share or access privileges may adversely affect the wages and working conditions of labor in the fishing

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[2] 16 U.S.C. §§ 1801 et seq., Pub. L. No. 109-479.
[3] 16 U.S.C. § 1851(a)(4)
[4] 16 U.S.C. § 1853a(c)(5)
[5] The Design and Use of Limited Access Privilege Programs, NOAA Technical Memorandum NMFS-S/SPO-86 (November 2007) at 51.

industry, especially in rural coastal areas where employment alternatives are limited.[6] Second, in a market dominated by a monopoly, firms may artificially reduce output so as to increase consumer prices and profits.[7] Third, a party may act as a monopolist in the market for quota share, thus reducing the transferability of quota and raising barriers to entry.[8]

Additionally, concentration of ownership share may undermine the traditional make-up of fisheries composed of diverse communities.[9] Regardless of whether an IFQ program increases or decreases economic efficiency, it may threaten valued social and community structures.[10] Many fisheries are based in coastal communities which receive significant economic input from the fishing industry.[11] In some of these communities, families have been engaged in fishing for generations.[12] Unless managed and implemented properly, IFQs can create new interests within the community that diverge from and erode the interests of these long-standing fishing communities. In the Senate Reports to the Magnuson-Stevens Conservation Act and the Act itself, Congress demonstrated a commitment to maintaining the stability of local fishing communities. In drafting provisions of the MSA authorizing issuance of quota to fishing communities, the Senate sub-committee on Commerce, Science, and Transportation stated that it was adopting a broad community based view and responding to concerns of communities and shoreside businesses.[13]

2c. Excessive Control Caps

Entities may exercise excessive control in a fishery in a variety of ways. The most straightforward exercise of excessive control would involve one entity directly owning an inordinate percentage of quota share. In more complicated cases, an entity would indirectly exercise excessive control by holding an interest in other quota share holders, or through contractual or financial arrangements that permit one party to control the way in which another party uses its QS or QP, or the disposition of fish harvested under QP. For example, a firm may have a minority ownership stake in all QS holders in a fishery, or finance the operations of QS holders under terms that give it control over the disposition of their catch. Different types of control caps, including the “individual and collective rule,” and the “affiliate test,” have been proposed to curb this type of indirect excessive control.

The individual and collective rule has been adopted by the PFMC for the Pacific Coast Trawl Groundfish Fishery. Under the individual and collective rule, an individual’s quota share is calculated by multiplying the individual’s share of control or ownership in a quota share holder by the total quota shares owned by that holder. This calculation is completed, and the results are summed, for all quota share holders in which the individual has an interest. The total sum constitutes the quota share attributed to the individual. For example, if an individual had a ten percent ownership share in three vessels that each had ten percent quota share, the quantity share attributed to that individual would be three percent. Under the rule, no individual may own or control more than 10 percent of total quota share.

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[6] Sharing the Fish: Toward A National Policy on Individual Fishing Quotas, National Research Council (1999) at 174.
[7] The Design and use of Limited Access Privilege Programs at 51.
[8] *The Design and use of LAP at 51*
[9] *The Design and Use of LAP at 51*
[10] *The Design and Use of LAP at 51*
[11] Sharing the Fish at 181.
[12] Sharing the Fish at 181.
[13] Senate Committee on Commerce, Science, and Transportation, Magnuson-Stevens Fishery Conservation and Management Reauthorization Act of 2005 Report, 109 S. Rpt. 229.

The affiliate test has been adopted for the fisheries of the exclusive economic zone off Alaska.[14] Under the affiliate test, two entities are considered the same entity for the purposes of applying harvesting and processing caps when a relationship exists between those two entities in which one owns or controls more than ten percent of the other. Some have argued that this bright-line rule will be easier to administer than the individual and collective rule since regulators do not need to look at each and every connection between organizations. Once it has been determined that one organization owns or controls more than ten percent of another, the control cap inquiry comes to an end.

For both the individual and collective rule and the affiliate test, standards must be established to determine what constitutes interest or control in another entity. The rules for the Alaska Fishery have identified a number of standard situations in which control is deemed to exist other than where one entity owns ten percent or more of another entity with quota share. Specifically, control is deemed to exist where, among other things, an entity (1) has the authority to direct the business of the entity which owns the fishing vessel or processor, (2) has the authority to limit the action or replace the CEO, a majority of the board, or any general partner or any person serving in a management capacity of an entity that holds 10 percent or greater interest in a fishing vessel or processor, (3) has the authority to direct the transfer, operation, or manning of a fishing vessel or processor, (4) has the authority to control the management of or to be a controlling factor in the entity that holds ten percent or greater interest in a fishing vessel or processor, (5) absorbs all the costs and normal business risks associated with ownership or operation of a vessel or processor, (6) has the responsibility to procure insurance on the fishing vessel or processor, or assumes any liability in excess of insurance coverage, (7) has the authority to control a fishing cooperative through 10 percent or greater ownership or control over a majority of vessels in the cooperative, (8) has the authority to appoint, remove, or limit the actions of a majority of the board of directors of the cooperative, or (9) has the ability through any other means whatsoever to control the entity that holds 10 percent or greater interest in a fishing vessel or processor.[15]

3. Applying a Control Cap in Practice

A general performance standard is needed that says no one may own or control more than 2.7% of the QS and no more than 3.2% of QP may be placed on a single vessel. Specifically, this means identifying conditions of a transaction that may influence the harvest or delivery of fish harvested under the QS or QP that is the subject of the transaction. Implementing the Trawl Individual Quota Program for West Coast Groundfish will require development of new regulations and systems to determine the amount of QS an individual controls, either directly through ownership or indirectly through other means.

NMFS must determine whether or not relationships exist that implicate the control rule and the agency must have some means to act to enforce the control rule. They might then deny permission for a given QS or QP transaction, require fishery participants to either divest of excess QS or terminate or modify relationships that may constitute excessive control through means other than ownership. Such transactions must be monitored to ensure that the agency's order is complied with and that the deck chairs are not merely being rearranged with no net change to the amount of quota share implicated under the arrangement.

3a. Monitoring Ownership and Control

It may be useful for this exercise to think about how transfers of quota share are monitored in another IFQ fishery with strict limits on excessive control – the Alaskan halibut and sablefish fishery. While this is a very different fishery from the West Coast groundfish trawl fishery, the documentation developed for the

[14] *See* 50 C.F.R. § 679.2
[15] Id.

halibut and sablefish IFQ[16] provides a number of useful insights as to how the agency might reveal information relevant to matters of control. A summary of some of the key information that must be disclosed follows:

1. *Name, business address, and phone number of seller and buyer.* This is relevant to the control issue because a transfer of IFQ/QS between individuals who share office space or a business manager may indicate a close business relationship that may affect control.

2. *To be disclosed by the seller: What is the price per pound or unit of IFQ to be transferred? What is the total amount paid for the IFQ? What are your reasons for transferring? Is a broker being used and how much or what percentage of the transaction is being paid to them?* This is relevant as the price and quantity as well as the means of brokering the sale or lease could all offer some indication of a transaction that may have conditions attached that bear on control. For example, the terms of a lease agreement may include a variety of conditions that exert control over the business operations of the harvester including limits on where, when and how the individual may fish; where, when and to whom they must deliver their catch; and other significant constraints. In short, monitoring must reveal whether the transaction involves any control over delivery of fish harvested under the QS that is being transacted by either the seller or any one or more third parties.

3. *To be disclosed by the buyer: Will IFQ/QS being purchased have a lien attached and who is the lien holder? What is the primary source of financing for the purchase? How were the IFQ/QS located? What is the buyer's relationship to the seller? Is there any condition on the sale as to transfer back/return or resale of the IFQ/QS?* This is relevant because these factors (financing, lien conditions, and conditions on return or resale) could all be used to exert influence over the business operations of the buyer in a way that bears on control. For example, a buyer or a processor may provide financing for a QS purchase in exchange for an agreement that the QS owner will deliver all or some portion of the fish caught to that buyer, effectively giving the lender control over the borrower's business and the QS he or she holds.

Further, in that same fishery, documentation of relationships, partnerships, joint ventures, associations, etc. is also required to determine compliance with the "individual and collective" rule.[17] In other fisheries, and in regulations of the Maritime Administration[18] regarding the determination of U.S. ownership of a commercial fishing vessel, disclosure of ownership information down to the shareholder level is required. The disclosure can be quite lengthy as the agency seeks through all the layers of a large corporation to hit "flesh and bone" to determine ownership. Further, the agency may require disclosure of information about roles and responsibilities within the corporation to determine if any individual with the organization has such authority (e.g., to limit the action or replace the CEO, a majority of the board, or any general partner or any person serving in a management capacity of an entity) that their actual percentage ownership might belie the actual amount of control that individual wields.

In all likelihood, in the West Coast trawl fishery, NMFS will develop similar rules and tests to determine where relationships exist that might affect control and mechanisms to enforce the control rule. Initial allocation will likely include some sort of application process in which eligible applicants must answer a series of questions about their business relationships and their holdings that would allow the agency to accurately ascertain the amount of QS – both species and in aggregate – under that individual's control either directly or through other means. Further, it is likely that any subsequent QS transactions would

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[16] http://www.fakr.noaa.gov/ram/Transfer_app.pdf
[17] http://www.fakr.noaa.gov/ram/Ownchan.pdf
[18] *See* 46 C.F.R. § 356.5 regarding affidavit of U.S. citizenship and § 356.7 regarding methods for determining ownership.

involve a similar disclosure, as changes to an organization (e.g., new board members, new senior staff, changes in ownership) would be disclosed on an ongoing basis in case any of these changes would affect the amount of QS controlled by the organization or any of the individuals within the organization. These disclosure requirements, which should be part of the IFQ program, would help fishery managers track transactions – for example, those designed to ensure that the seller retains some degree of control despite giving up ownership or those designed to give an individual greater control than is appropriate.

3b. Enforcing the Control Limit

Presumably, the disclosures required would be reinforced by substantial penalties for false or incomplete statements, as is the case with documentation related to any required disclosure in other fisheries. Transactions in which disclosures revealed that the deal would put a party over the control cap have been rejected in other fisheries. Further, NMFS may investigate – generally either at their own instigation or acting upon a "tip" – potentially illegal arrangements that result in excessive control. Given the PFMC testimony heard regarding the potential complexity of relationships in this industry, the challenges of the individual and collective rule versus the affiliate test, the inherently limited investigative capacity of state and federal enforcement divisions, and the tremendous potential for disruptive and negative consequences for industry participants if the control rule is not applied well, NMFS should be as clear, strict and transparent as possible and avoid ambiguity in the control rules and disclosures required.

During the start up period of the IFQ program, requiring disclosure of this detailed information about ownership and relationships will help to implement the divestiture requirement. Fishery participants will have the information they need to make an informed decision about what QS they must divest. NMFS will have information necessary to monitor divestiture transactions to ensure that they do, in fact, result in a reduction in the amount of QS an individual both owns and controls. Further, this information will guide revocation of undivested excess QS at the end of the fourth year after implementation as stipulated in the Council motion.

3c. Implications of the Control Rule for Collective Arrangements

There are a number of different situations or arrangements that people could reasonably expect to have in place in the fishery that could be implicated under a strictly applied control standard. For example,

- *Any type of consensus-based arrangement in which decisions are subject to the agreement of all.* Individuals will pool their individually held bycatch quota in excess of a cap. If five fishermen each held a 1.3% share of canary rockfish, the pool would jointly control 6.2% of west coast wide quota share (approximately 3,000 lbs of canary rockfish and 1% over the limit on canary rockfish) through their pooling agreement. Does the pool represent an entity that controls an excessive share of canary rockfish? What if the agreement includes restrictions on timing, location, or gear type used in harvest operations of all members to reduce bycatch? Given that canary rockfish QS is necessary to harvest other groundfish species, does that control then also extend to the target species which canary rockfish is needed to harvest?
- *Agreements that may control quota pounds or quota share*. An annual agreement to pool quota pounds on a vessel is well within the vessel limits on quota pounds (but would exceed limits on quota share), but the agreement is renewed for five consecutive years. At what point is that agreement deemed to extend to control of the quota share from which those pounds are derived?
- *Financing arrangements.* A person offers financing to several fishermen with whom he works. One of the terms of the loan agreement is that the fishermen will deliver their catch to that person directly until the loan is repaid. Loans are made to five fishermen, each of whom purchases the equivalent of a 1% share in the groundfish fishery. If the amount of quota share owned by all the fishermen who are party to such arrangements with the same person exceeds the accumulation limit, does the lender now control an excessive share of the fishery?

All of these arrangements could violate the accumulation and control cap adopted by the PFMC. Some arrangements may be desirable and further the goals and objectives of the Rationalization Plan – others may not. To attempt to circumscribe any particular type of relationship or any type of fishery participant's role in such an arrangement runs the risk of unfairly singling out a particular group and, worse, of undermining the agency's effectiveness in regulating control.

A more strict and clear interpretation of control, is needed to provide certainty for the fleet and other fishery participants. Unfortunately, such an approach will also take potentially helpful tools out of the hands of the fleet and coastal communities.

4. Conclusion: Regulating and Monitoring Collective Arrangements

As the Council[19], members of the industry, the Magnuson Stevens Act and others have cited the usefulness of collective arrangements for risk pooling, sharing costs, or promoting community stability – such as using Community Fishing Associations (CFA) – the challenge is to authorize the arrangements without undermining implementation of the control rule.

This could be done by granting a safe harbor exemption from control rules for desirable collective arrangements, such as bycatch quota pools, CFAs, or observer sharing pools. During a series of workshops held on the West Coast during the summer of 2009 by TNC and EDF, this approach was identified as one that would help to ensure oversight and transparency in different types of relationships. In other words, the control rule would be strictly enforced across the fishery except under clearly defined exemptions that are consistent with the overall goals and objectives of the fishery management plan and which are carefully monitored.

It is not the purpose of this paper to argue for specific conditions for such a safe harbor exemption – rather to describe issues related to implementation of the control rule that bear on collective arrangements.

The authors acknowledge the guidance and support of Erika Feller, formerly of The Nature Conservancy of California, and Chuck Cook, Marine Program Director for The Nature Conservancy of California.

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[19] *PFMC March 2010 Briefing Book, Agenda Item E.6, Situation Summary, prepared by PFMC*

E.6.c
Supp. Public Comment 3

March 10, 2010

Mr. David Ortman
Chair, Pacific Fishery Management Council
7700 NE Ambassador Place, Suite 101
Portland, Oregon 97220-1384

Re: Agenda Item E.6, Regulatory Deeming for Fishery Management Plan Amendment 20: Trawl Rationalization

Dear Mr. Ortman:

Thank you for this opportunity to provide the Council with our comments on Amendment 20. We appreciate the tireless work that the Council has put into developing Amendment 20, which poses so many challenging issues. However, we remain deeply concerned about the feasibility of this program and its potentially devastating impacts on small fishing communities such as Fort Bragg. Our concerns continue to center around two issues: 1) restrictions on directed fishing due to extremely low quota shares of overfished species and the related economic windfalls that some will likely receive as a result; and 2) whether the high costs of paying for administrative costs and observers will drive participants out of the fishery who would otherwise continue to fish.

We engage in responsible fishing and support the concept of catch shares. However, Amendment 20 will not effectively implement that concept in a way that both encourages responsible and sustainable fishing, and also allows us to make a living wage by fishing. We urge the Council to consider the implications for the West Coast fisheries as a whole if the program results in the loss of a substantial number of trawl vessels.

In small communities such as Fort Bragg, the infrastructure to support all other commercial fisheries is highly dependent upon the business from the trawl sector. If we disappear, the economics for support infrastructure will start to crumble, and we will then likely see other gear types in other fisheries disappear from these small communities until they are no longer fishing communities. This is inconsistent with the Magnuson Act, which requires us to support fishermen as well as conserve fish. Are we creating new unintended problems in an effort to solve another one?

We appreciate the Council's attempt to preserve our ability to fish for our target species by adjusting QS for canaries and other overfished species. Unfortunately, even assuming a favorable stock assessment, the canary IFQs simply do not give us enough fish to go out after our other targets. If Amendment 20 is implemented as currently proposed, we could lose 50% of our traditional landings,maybe more if we were to catch one Yelloweye,or over 150 pounds of cannarys early in the year and could not cover it. We need an adequate IFQ for all overfished species caught incidentally to our target species, and under the current proposal, the only way that we will be able to obtain enough QP to do so will be by buying QS from those who have chosen not to participate in the fishery.

Frankly, that gives nonparticipants a windfall while making it even harder for those who want to keep fishing to earn a living. Since this is a common restraint for everyone who wants to continue fishing, why not try to figure out some kind of common solution that spreads the pain around equitably until these stocks are rebuilt? We think the idea of having some kind of "bank" of QP for overfished species is a concept worth exploring. The answer should not be to force everyone in the nonwhiting sector into cooperatives, or to have the use of the "adaptive management" shares become a point of controversy.

Finally, there will not be a sustainable small boat nonwhiting fishery if every vessel must pay the maximum 3% for agency administrative costs as well as pay for 100% observer coverage, and let's not forget the 5% to service the buyback loan. These costs would add up to around 20 to 30% of are gross incomes. This extra cost is also compounded by the fact that we will be losing at least 50% of the fish we have been landing due to the program.

Something has to give to make this cost burden bearable. At this point, Amendment 20 envisions the highest level of enforcement monitoring at every step of the process. Is this really necessary to ensure that we follow the rules? We ask that the Council seriously consider whether there is a less intense level of monitoring that will still achieve conservation and enforcement goals while making the costs sustainable. We are willing to work with the Council and the agency to see if we can meet in the middle and figure out a program that meets enforcement needs while letting us continue to make a living fishing.

We have submitted comments on Amendment 20 since its initial proposal. Our concerns expressed in those comments have not been addressed. We have also reviewed other comments on Amendment 20, including the Coos Bay Trawlers' Association, Inc. In its December 1, 2009 comment letter, the Coos Bay Trawlers' Association proposed a potential solution to one of the problems with Amendment 20; namely, allocating species to participants based on 1) equal shares of buy-back boats' historical catch and 2) their own historical catches. We see some merit to this proposal, and encourage the Council to consider it.

Sincerely,

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Agenda Item E.6.c
Supplemental Public Comment 4
March 2010

DRAFT SUMMARY OF JANUARY AND FEBRUARY MONITORING WORKSHOPS

Environmental Defense Fund hosted two public workshops in January and February 2010 to discuss a catch monitoring system for the west coast trawl rationalization program. The overall objective of this meeting was to achieve a greater understanding of the existing vision for monitoring the Pacific coast trawl fishery when it moves to rationalization, and to discuss ways in which a catch monitoring program could be developed that was effective, yet cost efficient. These objectives were outlined for a variety of reasons including the economic status of the industry and also due to objectives set forth by the PFMC at the outset of trawl rationalization program development. Specifically, at the March 2007 meeting of the PFMC the Council adopted a set of Goals, Objectives, Constraints and Guiding Principles. Some of those specifically address the need for an effective, but cost efficient monitoring system.

> *Goals:*
> *Create and implement a capacity rationalization plan that increases net economic benefits, creates individual economic stability, provides for full utilization of the trawl sector allocation, considers environmental impacts, and achieves individual accountability of catch and bycatch.*
>
> *Constraints and Guiding Principles*
> *9. Take into account the management and administrative costs of implementing and overseeing the IFQ or co-op program and complementary catch monitoring programs and the limited state and federal resources available.*

During this workshop, participants discussed many baseline issues that set the stage for the costs of implementing the monitoring system. Participants outlined an understanding about several issues including: data flow, definitions of – and standards that apply to – observers and catch monitors, and various other program mechanics. A summary of these discussions is included below.

At sea observers: workshop participants discussed at sea observers as a type of person that met the requirements outlined in the National Marine Fisheries Service Instruction 04-109-01, titled National Minimum Eligibility Standards for Marine Fisheries Observers.

> *Unless the Regional Administrator or Science Director has waived this requirement, observer candidates must have: 1) a bachelor's degree from an accredited college or university with a major in one of the*

natural sciences and a minimum of 30 semester hours or equivalent in the biological sciences; 2) at least one undergraduate course in math or statistics; and 3) experience with data entry on computers. All relevant course work must have been completed and performed at a level equivalent to similar course requirements at the candidate's academic institution.

Regional Administrators and Science Directors may waive the education and experience requirements of this section if an observer candidate has acquired the required skills to be considered eligible for observer training through a NMFS authorized alternative training program….

The role of these observers on board vessels would be to estimate discards of species on limited entry trawl vessels in addition to doing 'viability assessments' of discarded Pacific halibut. NWFSC staff also indicated that observers may estimate both discard and retained catch of overfished species. The data collected by these observers would include species identification, species lengths, and weight.

Part of the discussion around the at sea portion of the catch monitoring system involved the role of the vessel logbook in assisting the at sea observer. The at sea observer uses data from the trawl logbook in order to record location and, under the current program, to help estimate a discard rate. Workshop participants discussed the type of data being reported by the observer as being somewhat different under the trawl IQ program. Whereas the current program estimates a discard rate, observers under the trawl IQ program would estimate an actual discard amount. This means that the observer may not be as dependent on the trawl logbooks in estimating discard. However, observers may still use the trawl logbook in order to identify area of fishing activity.

Participants discussed the need for electronic logbooks versus continuing the current paper logbook. Since observers take much of the logbook data available and insert that data into their own records, it appears that it is possible to increase the speed at which logbook data gets into the system through the observer data flow. However, it is not clear that logbook data is necessary for estimating total mortality if the at sea observer is reporting a discard amount rather than estimating a discard rate. Therefore, it is not clear that a re-vamp of the logbook system (moving from paper logbooks to electronic logbooks, or increasing logbook data availability through the observer program data flow) is necessary. However, it is possible that some cost efficiencies may exist from doing so, though it is not clear at this time whether electronic logbooks would increase or decrease overall management costs.

At Sea Observer Data Verification (QA/QC): Participants discussed a process where at sea observers would be required to debrief with staff of the Northwest Fisheries Science Center. In addition, NWFSC staff analysts would be added to the FRAM division with the purposes of utilizing and analyzing the at sea observer data. Both the debriefing process and the analysis process play a data verification role. Federal agencies would have “ownership” of the data and would finalize and make this data “official”.

Shoreside Catch Monitors: workshop participants discussed shoreside catch monitors as a type of person that is potentially different from those which must meet minimum eligibility standards for marine fisheries observers. Participants discussed potential minimum eligibility standards for these types of individuals. However, other than referring to existing regulations for these individuals (regulations which pertain to shoreside monitors in the shoreside portion of the Pacific whiting fishery), workshop participants did not appear to agree on what these standards should be, other than making the point that shoreside catch monitors must be independent, third party individuals. Alternative view points included:

- That shoreside catch monitors must meet the same eligibility standards as at sea marine observers. The theory behind this perspective is that these minimum standards would tend to result in a more “professional” individual, and that this would increase the confidence and accuracy of shoreside catch monitoring, potentially decreasing the need for data QA/QC as well as potentially decreasing the need for shoreside enforcement presence
- That shoreside catch monitors be similar to the “weighmaster” program previously run by the Fishermen’s Marketing Association. These individuals would be trained to identify fish species and would help insure that plant workers are accurately sorting and weighing landed species.

In either case, the majority of workshop participants discussed the role of shoreside monitors as playing a verification role. This role would be to verify that plant workers are accurately sorting and documenting the weight of species landed by LE trawl licensed vessels fishing under the rationalization program. There was some question among participants at the second workshop regarding when the monitor’s task is considered finished. For instance, catch can be sorted several times after a vessel has docked. Following sorting and weighing that is done for fish ticket reporting, catch may be sorted again when it reaches a processing line for several reasons – one example is that smaller fish can be in the mouths of larger fish and those smaller fish have not been documented during the initial sorting which has gone on the fish ticket. Participants did not appear to come to an agreement about when the monitor’s role should be finished.

A handful of participants at the first workshop spoke to the benefits of having monitors play the same role as at sea observers (documenting, sorting, and recording landed catch themselves). Having this shoreside monitor be the individual undertaking those tasks acts as a type of “check and balance”, and also insures that a professional third party is documenting catch that must be debited from a vessel’s quota account. Implied in this perspective is that shoreside monitors would be “observers” and must meet the minimum eligibility standards outlined above.

Participants at the first workshop discussed the role of the vessel and the shoreside buyer during the shoreside landings estimation process. The role of the vessel would be simply to notify the buyer that they intend to land. The buyer would be responsible for securing a shoreside catch monitor and notifying the vessel when the monitor is present so that the vessel can dock. If a monitor is not present, a vessel would not be allowed to dock. Participants at the second workshop expressed an interest in allowing the vessel to secure a shoreside monitor as this may provide the vessel with more flexibility in deciding where it lands.

Regardless of the type of person the shoreside monitor is (whether it is an "observer" or a different type of person), that individual would be responsible for submitting electronic landings data to the National Marine Fisheries Service. Shoreside plants would be responsible for submitting fish tickets to each of the west coast states for purposes of fisheries management and tax collection, among others. Participants discussed the possibility of the shoreside monitor reconciling catch estimates with the processor before fish tickets and monitor reports are submitted. Discussion seemed to suggest that doing so could enhance the quality of data being reported by both parties.

Oregon staff indicated that ODFW accepts electronic fish tickets. The two other states do not currently accept e-fish tickets. All three states have indicated the need for computer upgrades and staff to accommodate an electronic fish ticket program. Workshop participants envisioned each of the states as having "ownership" of the shoreside data that is submitted via fish tickets. There were two different perspectives regarding landed catch data ownership and its use in the IFQ program.

- Participants at the first workshop envisioned shoreside monitor data as being owned by the states. However, NMFS would use the Federally submitted electronic shoreside monitor data for purposes of IFQ management and not rely on the fish ticket information for IFQ program management. This was viewed as the most practical way to manage the IFQ program as state fish tickets are corrected up to 1 year after a landing has been made. This time lag would cause significant difficulties in carrying out the administration of the trawl IFQ program as well as fishing under the regulations of the IFQ program. Implied in much of this discussion was that the quality of the shoreside monitor data would be sufficiently high that QA/QC'd fish tickets would tend to be identical, or highly similar to, shoreside monitor data.
- Participants at the second workshop described a different model where shoreside monitor data was owned by NMFS, but could be overridden by state fish tickets that have undergone a QA/QC process. NMFS would use shoreside monitor data for IFQ program management until it is replaced by QA/QC'd fish ticket data submitted by the states.

Several participants spoke to the quality of shoreside monitors under status quo versus the quality of shoreside monitors under a trawl rationalization program. Participants expressed the understanding that the data reported by these monitors would be of substantially greater quality and that these quality improvements could come from several sources including A) more scrutiny of shoreside monitor activities by Federal and state agencies, B) a better degree of education from trainers to monitors regarding the expectations of shoreside monitors, and C) more scrutiny by processing companies and fishing vessel operators over landed catch due to incentives created by the IFQ program.

Shoreside Catch Data Verification (QA/QC): several processes were discussed by workshop participants that would lead to data quality control. Each of the shoreside catch monitors would go through a debriefing process alongside – or similar to – the at sea observers. This debriefing process would be used to verify and validate the electronic data that had been submitted to NMFS. Each of the three west coast states would continue to validate shoreside fish tickets. However, as indicated above, it is possible that NMFS would rely solely upon the debriefed shoreside monitor data for purposes of IFQ management due to time lags commonly associated with fish ticket corrections.

Role of NOAA in Shoreside and At Sea Catch Monitoring/Observing Coordination: Workshop participants discussed the role of NOAA in the coordination and management of at sea observers and shoreside monitors. This discussion stemmed from the ongoing deliberations and modifications to the observer program in the North Pacific where NOAA has been expressing intent to assume a greater role in the distribution of observers on board vessels and in the contracting of observers. Workshop participants discussed a system where industry would contract directly with independent observer companies, rather than NOAA coordinating much of that activity. Workshop participants received clarification from NOAA representatives that their intent was to allow for this type of direct contracting between industry and third party observer companies rather than following the model that is currently being developed within the North Pacific Fishery Management Council which has more direct NOAA involvement.

Access to At Sea and Shoreside Observer/Monitor Data and NMFS Interaction with the Fishing Industry: Participants at the workshop discussed access to shoreside and at sea catch data, primarily by members of the fishing industry. It was generally understood that fishing vessel owners and operators would have access to their own catch data for purposes of quota tracking. However, NMFS would not prevent the vessel operator from allowing others access to that catch data if the operator chose to allow other parties to access that information.

Several industry members also stressed the importance of allowing industry members to have a dialog with NMFS QA/QC analysts for purposes of catch verification. Industry members referred to experience from North Pacific fisheries where catch data had been incorrectly estimated and members of industry were able to assist NMFS staff in identifying and correcting those errors.

Port Sampling: Several discussions occurred at the workshop which involved state port sampling programs. While the role of port samplers is not expected to change (port samplers will continue to collect biological data such as otoliths), the number of port samplers may change due to changes in the quantity of shoreside landings and/or changes in the timing of landings.

Workshop participants discussed potential overlap between shoreside catch monitors and port samplers. State agencies indicated that they currently use port sampling data as one source of information for conducting quality control on state fish tickets.

Participants also discussed the possibility that a well trained and qualified shoreside catch monitor may be able to assume some of the roles of the port sampler. While such an individual may come at a higher cost than a less well trained individual, the need for formal port samplers may be reduced. In this vision, shoreside monitors may monitor/observe landings made by a trawl vessel and verify or document species and weight from that landing. Following this documentation, that shoreside monitor would engage in biological data collection which is submitted to the state. Such dual roles by a single person may allow for some streamlining of costs, however it may increase costs paid by industry if buyers are required to pay for the staffing for this person.

Opportunistic Catch Reporting Redundancy: One important piece of accurate catch monitoring is feedback to the observers and shoreside monitors in a manner that improves their ability to document or verify catch over time. In order to do this, workshop participants discussed ways in which the monitoring system could build in catch reporting redundancy at opportunistic places so that a comparison could be made between at least two of the data reporting systems.

One manner in which this redundancy could be built in opportunistically is to require at sea observers to periodically estimate total landed catch, or to require at sea observers to document retained catch of a select group of species. This information could then be compared with shoreside monitor data, providing feedback to both the shoreside monitor and the at sea observer via a comparison of both estimates. At the second monitoring workshop, staff at the NWFSC indicated that at sea observers may document retained catch of overfished species in addition to discards of all species and viability assessments of halibut. This would allow for a comparison of both shoreside monitor and at sea observer estimates of these species, but no others. Participants acknowledged that the need to be highly accurate in catch estimation is most important for overfished species due to the small management tolerance for many of these stocks.

Another manner in which this redundancy could be built in opportunistically is to compare port sampler data with shoreside monitor data during the debriefing of those shoreside monitors. This would provide feedback to and from two third party entities that would allow both entities to become more precise over time.

Enforcement: Unfortunately no enforcement representatives attended the first monitoring workshop, so discussions surrounding the role of enforcement in the catch monitoring system were limited during that workshop discussion. The second workshop had a more in depth discussion of enforcement's role in the program. During that discussion, participants outlined several roles of enforcement. When discussing the role of NOAA OLE, participants discussed a model that would involve a shift in the duties of enforcement personnel, rather than adding additional personnel. When discussing the role of state enforcement agents, state agency representatives expressed the need for additional staff, with 6 additional staff coastwide serving as the upper bound of additional personnel that may be necessary. However, as part of this discussion, workshop participants questioned whether the need for these additional staff should be attributed to the trawl rationalization program. The description of increased enforcement need involved enforcement of other fisheries and holes that exist in the system under status quo.

In addition to the points above, other concepts and points were discussed which shed light on the role of enforcement in the program. Assuming that having an enforcement presence in fishery management is a means toward ensuring catch is accurately documented, then the presence of an at sea and shoreside monitoring program may tend to change the role of enforcement in the fishery. Several workshop participants expressed their belief that the incentives created by an IFQ system will tend to add scrutiny of catch documentation between harvesters and buyers, potentially enhancing the quality of data reported. This tends to occur because quota is valuable, not just landed catch. For reference, participants described the existing system as one that tends to report relatively accurate data on species that have relatively high exvessel value. Since all species in the IFQ program will have either market value or quota value, added scrutiny will be applied to those species which may not have much market value, but which have quota value.

The role of monitors and observers in the trawl rationalization program is to accurately document or verify documentation of catch. Therefore, participants discussed the need for enforcement in the context of verifying whether observers and monitors are accurately reporting catch. A system with enhanced data integrity would tend to need less enforcement presence for catch record validation, and vice versa.

Enforcement would need to be made aware that vessels were planning to deliver to a processor. However, workshop participants discussed this interaction in a manner that would allow enforcement the opportunity and the notice to be present during an offload rather than require that enforcement be present during an offload. Several different mechanisms could be used to notify enforcement of an upcoming delivery, including phone, email, and fax.

Processor Production Reports: Discussions occurred at both workshops regarding processor production reports. Participants described their understanding that processor production reports serve as an enforcement tool. This tool would operate as a check against shoreside catch reports. Several participants questioned the need for this redundancy.

IFQ Transfer Tools and Processes: At the second workshop, participants heard two presentations on electronic tools that could be developed for dealing with quota pounds and quota shares between entities, or among a community of fishing-related entities. One presentation outlined a concept that is best described as a database that houses quota poundage and quota shares of each entity and that allows catch to be debited from vessel accounts by monitors and observers. This structure would operate as a central location for data storage, data reporting, and IFQ transfer activity.

Workshop participants discussed the possibility of a central data storage and IFQ transfer system. Structuring a system in this way would effectively mean abandoning the current data system where several different agencies are responsible for different forms of catch data. This multi-agency system is necessary for several reasons including the fact that various fisheries are managed by the different agencies, state agencies use fish ticket systems for tax collection purposes, and other matters. Should an IFQ fishery move to a data system that utilizes a single, central location for data system management, this would effectively be additive to the existing multi-agency system rather than acting as a replacement. This would occur because other fisheries would continue to be managed using the multi-agency system, resulting in the operation of a central system for the IFQ fishery and a multi-agency system for other fisheries. This approach does not appear to result in cost savings.

Participants at both workshops discussed the difficulties in engaging in IFQ transfers if catch data is updated several months after a catch event has occurred.

Private Arrangements to Reduce Observer Costs: Participants at both workshops discussed private arrangements that could be developed between observer companies and industry in order to cut costs. During both workshops, there were limited discussions about whether it was possible to change the type of person that engages in observer duties in order to cut costs. NOAA staff reiterated the difficulties in changing the type of person due to the requirements specified for observers. The dominant discussion on this topic at both workshops focused on vessels pooling observers in order to reduce cost. For example, if there are six vessels in a port, those six vessels could pool their resources and contract with four observers for a specified period of time. This is different from the "pay as you go" approach where vessels pay observers a simple daily rate.

Industry had different reactions to the observer pooling concept. Some vessel owners appeared to embrace that idea as a possibility, while other vessel owners indicated that limited time windows exist for fishing, and that this often means that vessels must all fish at the same time, making it impossible to pool observers.

Responsibilities in Monitoring: As part of the first workshop, participants itemized their vision of Federal, state, and private industry responsibilities. This itemization is included in the table below.

	Responsibility: Federal/State/Private	**Additional comments**
Staffing (Observers & Monitors)		
Observer recruitment	Private	
Observer training	Federal	
Observer outfitting (equipment)	Federal	

Maintain observer corps	Private	
SS monitor recruitment	Private	
SS monitor training	Federal	
SS monitor outfitting (equipment)	Federal	
Maintain shoreside monitor corps	Private	
Hail Out		
fishermen provides notice of fishing trip	Private	Vessel operator notifies Fed agencyl and observer co.
observer dispatched to vessel	Private	Observer co. dispatches to vessel
At Sea		
observer performs duties	private for Federal	
Hail In		
vessel provides notice of time & location of offload	vessel calls processor	
shoreside monitor dispatched to offload location	processor calls monitor	
Landings		
observer disembarks		
observer debrief	Federal	
shoreside monitor validates landings	private for Federal	
electronic reporting	processor	
port samplers collect samples	State	
Catch Accounting		
receive at sea observer data	Observer submits to Fed	
receive shoreside monitor data	Processor submits to Fed and State	
merge at sea and shore data	Federal	
data processing	Federal	States also process data, but Feds use Federally submitted data for IQ mgmt

UNITED CATCHER BOATS
Washington · Oregon · California · Alaska

March 9, 2010

Mr. Dave Ortmann, Chairman
Pacific Fishery Management Council
7700 NE Ambassador Pl., Suite 101
Portland, OR 97220

Dear Chairman Ortmann and Members of the PFMC,

We wish to provide the following comments to you relative to your discussion and action on Agenda Item E.6, Regulatory Deeming for Amendment 20 and 21. Many of the members of UCB participate in the Mothership and Shoreside Pacific Whiting fisheries. Our comments are focused on the draft program details and regulations relative to the offshore Mothership sector coop program.

First, we wish to thank the Council staff and NMFS staff that has put in countless hours working on the implementation details of the Council's recommended rationalization program. This program is very complex and multi-faceted. United Catcher Boats fully supports the rationalization of the West Coast trawl fisheries and believes the Agency is in the Red Zone so to speak and with a few more plays, the staff at the NMFS Sustainable Fisheries and Science Center will put the ball into the end zone. To this end, Bob Dooley and I are planning to be in Washington, DC next week to advocate for this program to key West Coast Congressional offices and the NMFS/NOAA headquarters staff.

The members of UCB have been strong advocates of the 'Coop' style of fishery management. We have reviewed the three key documents before you (NMFS Reports 1, 2 & 4, Clarifications Requested of Council, NMFS Interpretations of Council Intent, and Draft Proposed AM 20 & 21 Regulations) and wish to provide a few key comments relative to the Mothership Whiting Coop program. We have had the opportunity to meet with the staff of NMFS and the PFMC this week here at the Council meeting and also in Seattle over the past couple of months and provide them detailed comments on the proposed regulatory structure of the Mothership Coop program. We also have provided written comment on the DEIS to the Agency in mid-January and hope our comments are beneficial. Our comments are as follows.

MS CV Permits and Permit Transfer

Throughout the three documents there is reference to "vessel" when addressing the membership of a coop and/or an allocation of coop shares. This is incorrect as the member of the coop is a Permit and the coop shares are allocated to the coop and then down to the Permits, or holders of the permits, not the vessel(s). Allocation of catch history was purposely allocated to the *permit* as an endorsement rather than the vessel so that it could be transferred to any vessel with a west coast LE trawl permit. It was intended to be temporarily or permanently severable from the vessel. Should catcher vessel catch history transfers of quota occur on a temporary basis, they should be considered a lease and not subject to permit transfer limitations. We also support the ability of a [redacted] permit holder to sever the coop share amount from his West Coast Trawl Limited Entry Permit and place it onto another MS endorsed LE Trawl Permit.

We support the NMFS requirement of a coop permit approved by NMFS. We envision the formation and approval of a Coop Agreement that is a private contract between the members of the Coop, an application of a Coop Permit, and a requirement of an Annual Coop Report to the NMFS and PFMC.

Observers and Maximized Retention

We support the requirement of maximized retention of harvest by the MS fleet and discard of minor operational amounts of catch at sea so long as there is full accounting of discards. However, we continue to believe that placing observers on the MS catcher vessels 100% of the fishing time is a waste of observer resources and a less cost option is to pursue placing electronic monitoring systems on-board the catcher vessels. We support 100% enumeration and accounting of the harvest by observers on board the MS processor.

LAPP Fishery Determination

In our comments to the NMFS on the DEIS we provided reasons why we believe the LAPP determination is not appropriate for the MS Coop program. If a MS sector permit holder decides to not join a coop then the benefits of a rationalized fishery do not occur.

Secondly, if NMFS determines that the MS fishery is a LAPP, then the MSA requires it to be a separate LAPP fishery from the inshore fisheries and the C/P fishery and NMFS can only collect fees no greater than the cost of implementing and managing the specific LAPP fishery.

Allocation Qualification and Catch History Requirements

We have requested that the NMFS provide to the MS permit holders a complete spreadsheet of how the coop catch history of each permit is to be determined. This includes harvests on a year by year basis, which 'drop years' were used, and the total denominator for each of the catch history years in order for the permit holders to ground-truth NMFS' catch history determination to the individual permit. This will save the Agency a lot of time if the permit holders are able to quantify their assignment of catch history prior to implementation of the program and the appeal period.

Coop Member Declaration and MS CV Market (processor) Declaration

We support the requirement that a coop permit holder must declare by a date certain on an annual basis that it elects to be a member of a MS CV coop. We also support the requirement that on an annual basis a MS CV permit holder declares which MS processor it will deliver its harvest to. As to the dates of these declarations we are working on providing a recommendation to NMFS and you.

MS Coop Fishery Bycatch Management Program

Lastly, and perhaps most importantly, we support the Council's recommended hard cap management at the coop level of widow, canary, darkblotched rockfish and POP and the allocation methods presented in the DEIS and draft regulations. Sector and coop allocation of these species, along with the tools afforded to coop participants will be one of the biggest improvements to the management of the whiting fishery.

In closing, we again wish to thank the staff of the NMFS NW Region and PFMC for their tireless work in completing this project. We are behind them 100%.

Sincerely,

Brent Paine
Executive Director

Agenda Item E.6.c
Supplemental Public Comment 6
March 2010

Control Rule for Trawl Rationalization
Written Testimony submitted by The Nature Conservancy

As a follow-up to our conversations with you, we offer the following comments on the draft regulations implementing the Amendment 20 accumulation limits.

1. The regulations should include a general statement concerning the application of trawl IQ program accumulation limits. We suggest "no person shall own or control by any means whatsoever an amount of QS or QP that exceeds the IFQ program accumulation limits". This is consistent with the accumulation limit motion adopted by the Council, which provides that "QS controlled by a person shall include those registered to that person, plus those controlled by other entities in which that person has a direct or indirect ownership interest, as well as shares that the person controls through other means".

For purposes of this provision, the QP control limit would be the vessel use limit adopted by the Council. The regulations should apply the accumulation limits to persons who own or control QP as well as QS, because otherwise the QS accumulation limit could be circumvented by controlling the related QP.

2. The regulations should include a definition of "person". We suggest the definition of "person" be based on the definition in the Magnuson Stevens Act, i.e., person means "any individual, any corporation, partnership, association or other entity (whether or not organized under the laws of any State) and any Federal, State, local or foreign government or any entity of such government."

3. The method for calculating QS owned by a person in the draft regulations appear to be consistent with Council's adoption of the "individual and collective" rule. However, consistent with our comment above, we suggest that draft section 660.140(d)(4)(ii) regarding the application of that rule be amended as follows. (The additions are in red text.)

The QS or QP that counts toward a person's accumulation limit will include:

(A) the QS or QP owned by them, and
(B) a portion of the QS or QP owned by an entity in which that person has an interest, where the person's share of interest in that entity will determine the portion of that entity's QS or QP that counts toward the person's limit.

4. We suggest the following changes to the control provisions of the regulations (i.e., 660.140(d)(4)(iii)). (The additions are in red text and underlined.)

"(iii) Control means, but is not limited to the following:

(A) the person has the right to direct, or does direct, the business of the entity to which the QS or QP are registered;
(B) the person has the right to direct or restrict, or does direct or restrict, the delivery of groundfish harvested under QP~~a permit registered to a different person~~;
(C) the person has the right ~~in the ordinary course of business~~ to limit the actions of or replace, or does limit the actions of or replace, the chief executive officer, a majority of the board of directors, any general partner, or any person serving in a management capacity of the entity to which the QS or QP is registered;
(D) the person has the right to direct, or does direct, the transfer of QS or QP;
(E) the person, through loan covenants or any other means, has the right to restrict, or does restrict, the day to day business activities or management policies of the entity to which the QS or QP is registered;
(F) the person, through loan covenants or any other means, has the right to restrict, or does restrict, use of QS or QP, or disposition of fish harvested under QP;
(G) the person has the right to control, or does control, the management of, or to be a controlling factor in, the entity to which the QS or QP is registered;
(H) the person has the right to cause, or does cause, the sale, lease or other disposition of QS or QP; and
~~(H) the person absorbs all of the costs and normal business risks associated with ownership and operation of the entity to which the QS is registered~~; and
(I) the person has the ability through any means whatsoever to control the entity to which QS or QP is registered.

Please feel free to contact me if you have any questions or concerns.

Arctic Storm Management Group

400 N. 34th St. Suite 300

Seattle, WA 98103

Mr. Dave Ortmann, Chairman

Pacific Fishery Management Council

7700 NE Ambassador Pl., Suite 101

Portland, OR 97220

March 7, 2010

RE: NMFS Interpretations and Clarification Requests of Amendment 20 & 21 Council Actions

Dear Mr. Ortmann,

Arctic Storm Management Company appreciates the opportunity to comment on the National Marine Fisheries Service (NMFS) documents which describe the NMFS's *interpretation* of Council Action on Amendment 20 and 21. These amendments describe the final action taken by the Council to implement catch share programs in the west coast trawl fisheries as requested in earlier Congressional action. NMFS also seeks *clarification* of certain complex implementation issues. We appreciate that the agency is seeking further public input.

Arctic Storm manages two catcher vessels that participate in both the inshore and mothership sectors of the whiting fishery. It also manages two Motherships that participate in the Mothership sector fishery. Our company has worked in cooperation with the Mothership sector participants to develop a cooperative-style fishery for the Council's consideration in its development of A. 20. Most of that program was adopted by the Council. Our comments reflect our understanding of the program as developed by the sector and approved by the Council.

NMFS Interpretation of Council Intent

Issue 4: Permit transfers.

Allocation of catch history was purposely allocated to the *permit* as an endorsement rather than the vessel so that it could be transferred to any vessel with a west coast LE trawl permit. It was intended to be temporarily or permanently severable from the vessel. Should catcher vessel catch history transfers of quota occur on a temporary basis, they should be considered a lease and not subject to permit transfer limitations.

Issue 9. Endorsements

This section states that any LE trawl permitted vessel may participate in the coop portion of the MS fishery if they join a coop. This is incorrect. Only MS sector endorsed CVs can join a coop. Those CVs can lease their catch history to other LE trawl permitted vessels, but they will not become coop members. However, they must agree to abide by coop rules. They must also abide by MS catch history delivery obligations unless mutually agreed to do otherwise.

Issue 10. Observers

The Council action stated that observer coverage aboard MS CVs could be done by camera or by observer coverage. The agency document says that all boats will be required to have 100% observer coverage in order to properly account for all species caught. Because a MS CV tow is never brought onboard the vessel and is, instead, transferred directly to the MS where 100% observer coverage is already in place, this requirement is redundant and seems wasteful. Observers are already in short supply and a further shortage might prevent some fisheries from attaining OY because of a lack of available observers. Now that discards are prohibited in the MS fishery, this concern seems an enforcement issue better suited to camera surveillance than the skills of an observer which would go unutilized aboard a MS CV.

Issue 21. Coop Permit and Agreement

The agency has determined that a coop permit be required. This seems a reasonable approach to better inform and communicate with the coop and to ensure that catch limits are not exceeded. However, a coop agreement is a private contractual arrangement between members. It seems inappropriate that the agency should enforce the internal, private terms and conditions of the agreement.

Issue 22: Additional Information in MS Coop Agreement.

The agency suggests that a Coop Agreement list of all MS permits numbers and vessels to which the MS coop members' intent to deliver. A coop agreement in a long term agreement between MS catcher vessels that includes the rights and obligations of its members. MS are not permitted to be coop members. Coop members may change the MS to which they deliver fish on annual basis. Motherships may receive catch from CV in both the coop and non-coop fisheries. While the requested information may be useful to the agency in tracking deliveries, this information is not well suited for inclusion in a Coop Agreement.

Issue 24: Coop Failure or Dissolution

NMFS has interpreted a MS Coop failure to include failure of a coop to submit an annual report on time. This seems an extraordinary measure which would transform a rationalized fishery back into a race for fish because of a relatively minor infraction.

Issue 25 : Maximized Retention by MS Catcher Vessels.

Because a prohibition was added in 2009 that prohibits the sorting or discarding of any portion of the catch taken by MS catcher vessels prior to the catch being received on a mothership, it does not seem an effective or efficient measure to require observers on MS CVs. This seems a wasteful allocation of the valued skills of an observer who could not do any catch accounting aboard a MS CV because the cod end never comes aboard the vessel and is, instead, transferred from the sea directly to the MS where observers do a full accounting of the catch.

Issue 27: Non-Coop Fishery

Allocation of fish to the non-coop fishery is correctly described in the background section: "Each year NMFS will determine the distribution to be given to the non-coop fishery based on catch history calculation of permit holders registered to participate in that fishery." However, the agency chooses not to interpret that direction literally and, instead, intends to allocate catch history of permits that are not renewed or have expired to the non-coop fishery. The direction should be taken literally and as intended. If the non-coop fishery allocation is inflated it will attract participants to the non-coop fishery. This compromises the Council's intent which seemed to discourage participation in a non-coop fishery.

Issue 29: MS Coop Program Fishery Closures

NMFS has interpreted its obligation to monitor the catch in the coop and non-coop fisheries in the MS and CP fisheries to also mean that all at-sea sectors will be subject to closure based on attainment of the overall trawl whiting allocation. It seems inappropriate to close one sector or coop within a sector based on the overages of others. Those overages should be the subject of administrative action or a deduction in the following year rather than placing the burden on well-managed coops that might have their fishery pre-empted based on the actions of others.

Issue 31: Definition of "material change" to a Coop Agreement.

The agency has attempted to define the definition of "material change" to a coop agreement however some of the material changes identified are not appropriately assigned to a coop agreement and are better assigned to the annual report such as identification of the coop manager. Material changes seem best reported as part of the annual coop report rather than "immediately."

Clarifications Requested of the Council

Issue 2. Status of QS during appeal

Prefer Option A (NMFS preferred). While under appeal, the QS amount assigned will remain as previously assigned pending completion of appeals process.

Issue 3: 30-day clock for vessel overages.

Prefer Option B (NMFS preferred). The clock would start when the data from the trip is available.

Issue 7: What is an appropriate deadline for a coop permit (MS or CP) and for a MS/CV endorsed permit to declare in to a MS coop or non coop fishery?

Prior to final action for A. 20, the Council asked the MS sector to develop an alternative to the proposed linkage between a CV and a MS. Specifically, the Council voiced concern about the linkage provision that would require a CV to participate in the non-coop fishery for a year in order to move to another MS. The Council purposely did not want to encourage participation in the non-coop fishery. However, the Council wanted to include elements that would encourage stability for business planning purposes and to provide some market balance between CV and MS under a catch share program that awarded all quota to the catcher vessels.

The MS sector met for several hours and developed a "notification" process that would require each CV participating in the coop fishery to notify NMFS by September 1 which Mothership it would deliver its catch history to the following year. A CV would be required to give the MS notice by July 1 if it was considering moving to a different MS. This would provide time for the MS and CV to resolve any differences or to find another MS or CV with which to establish a market relationship with the following year's coop fishery.

These notifications are separate but complimentary to informing NMFS whether a CV intends to participate in the coop or non-coop fishery and for the coop to renew its application. They do not need to occur on the same date.

Issue 8. Permit Transfers

Should a MS/CV-endorsed permit allow two changes in vessel registration in a year, if participating in both the shorebased IFQ fishery and the MS fishery?

The intent of attaching the catch history allocation to the *permit* rather than vessel was to allow flexibility and severability on either a temporary or permanent basis. While temporary in-season transfers will likely take place through leasing rather than vessel registration changes, Option A seems to offer more flexibility as was intended.

Sincerely,

Donna Parker
Director Govt. Affairs
Arctic Storm

March 10, 2010

Agenda Item E.6.d
Public Comment 8
March 10, 2010

Mr. David Ortman
Chair, Pacific Fishery Management Council
7700 NE Ambassador Place, Suite 101
Portland, Oregon 97220-1384

Re: Agenda Item E.6, Regulatory Deeming for Fishery Management Plan Amendment 20: Trawl Rationalization

Dear Mr. Ortman:

Thank you for the chance to provide the council with my comments on Amendment 20. My name is Michelle Norvell. I am the grand-daughter, daughter and daughter-in-law of commercial trawl fisherman from FB. My maiden name is Tarantino, and I can honestly say I've grown up on the docks and in the fish houses at Noyo Harbor. The information I have on this industry comes from a life-long involvement in the trawl fishery.

I appreciate the work that the Council has put into Amendment 20, but we need to step back and (1) take a realistic look at whether or not this program as currently proposed should be implemented by January 1, 2011; and (2) take a hard look at whether or not this program as currently proposed is really feasible.

This program in its current form does not work for our Fort Bragg fisherman (the shoreside nonwhiting sector) for the following two reasons:

FIRST: THE SEVERE CONSTRAINTS IMPOSED BY QS/QP FOR INCIDENTAL CATCH OF OVERFISHED SPECIES

Overfished Species. I recognize and appreciate the Council's effort to preserve our fisherman's ability to fish for their target species by adjusting QS for canaries (at the Nov. Council meeting) and other overfished species. Unfortunately, even assuming a favorable stock assessment, the canary IFQs for example do not give them enough fish to successfully go after their other target species. The reason is once they have caught their quota (150 lbs of canaries); they cannot catch any more for the rest of the year. If they do, and they will if they continue to fish, heavy fines and penalties will be assessed. Do they have a choice? Yes, stop fishing for their target species once they catch their QS of the overfished species. Is that really a choice? No. It's not an option either because it puts the fisherman out of business. Amendment 20 must not be in the business of putting fisherman out of business. It is incumbent upon the council to protect the fishery while addressing conservation. The Council must craft Amendment 20 in the spirit of the Magnuson Act. The fishermen in Fort Bragg and across California are relying on you and have put their trust in you to do just that.

The fisherman need an adequate IFQ for ***all*** overfished species (canaries, bocaccio, yellow eye, and now halibut) or they will not be able to fish for their target species once they have reached their QS on the overfished species. Under the current proposal, the only way they will be able to obtain enough QP to successfully fish for their target species is to buy QS from those who have chosen not to participate in the fishery. That begs the question, who will sell their QP? Most everyone in the fishery needs theirs in order to fish their target species or they too will be out of business. The few fishermen who don't need them will no doubt sell to the highest bidder (putting small vessel owner out of the bidding). THAT IS WRONG and frankly it gives nonparticipants a financial windfall while making it even harder for those who want to keep fishing to earn a living.

SECOND. THE UNSPECIFIED BUT CLEARLY VERY HIGH COSTS OF ADMINISTRATION AND MANAGEMENT, INCLUDING OBSERVER COVERAGE THAT WILL BE CHARGED TO THE INDUSTRY

Costs. The costs estimates for Amendment 20 are unrealistic. The trawl fishery is about a $28 million dollar industry. The costs estimates vary between $6.5 million in implementation, $8 million in agency costs and between $6 to $20 million in observer/monitoring costs. As it stands now, the costs exceed the value of the industry. As of this date, no one can identify how and/or who will pay these costs. In the President's 2011 budget he has $12.7 million in for a Pacific Catch Shares Program (which is this program). Approximately $5 million are for observers (borne by NMFS for the first year of the program and subsequently, the cost would be borne by the industry. The remaining money goes for shoreside monitors; observer training; enforcement and IFQ management. This is only the administration's request, it has not been appropriated. There is no guarantee it will be nor that if it is, similar funding would be there in future years. What happens then? The fisherman are left holding the bag of a very expensive observer/monitoring cost program.

The entire trawl fishing fleet from Fort Bragg has said and continues to say that it cannot afford to brunt the costs of this program if it has to pay 100% observer coverage in addition to the 3% agency costs. I think it would be helpful for the Council to know some of the approximate costs associated with the annual operation of a trawl vessel. They include but are not limited to: crews wages $200,000, insurance $30,000, fuel $52,000, ice $14,000, ways $22,000, nets, cables, misc. gear $8,000, mooring basin $22,000, and buy-back at $35,000 plus. These figures also reflect an example of the amount of money each vessel adds to our local economy. If you multiply them by the 8 vessels you can easily see why our community's economic stability is so closely tied to our fishing industry.

The observer program is looking at a very sizable and comprehensive program with 100% coverage and a guarantee that the fisherman will provide full time work for the observers. Fisherman cannot guarantee anything in this industry. They have no control over industry costs, over shares or whether shares will be reduced or terminated mid-stream due to stock assessment. The observers cannot expect to be paid for a full time job from within an industry that is not full time. That type of mind-set needs to change in order to realistically begin to shave costs. I also believe that if the costs are to be borne by the industry, they should be spread among the active permits verses among the vessels. By spreading the costs among the vessels, it creates an unfair financial advantage as it relates to the costs of the program. For example, one fishing vessel stacking 2 or 3 permits pays the same as one vessel with one permit, which is not an equitable distribution of program costs when you consider the tremendous financial gain of stacking permits, which has been made possible by the program. Perhaps the costs should have a direct correlation to the QP/QS for each active permit – then and only then would we have a more equitable distribution of program costs.

I can see the major challenges facing the council. I want to thank you again for this opportunity to express my comments and I would be happy to answer any questions you have now or in the future regarding my comments. I think it is important to remember that people's lives are being drastically impacted by the current proposals of Amendment 20. Some people will be rewarded quit handsomely while others will suffer quite severely The program (as evidenced in QS/QP Allocation Tables) benefits some unfairly and penalizes others, without justification. That is unacceptable to the fisherman in Fort Bragg and I know it must be unacceptable to you. I urge the council not to rush to judgment during this process just to meet the January 2011 implementation date. There is too much at risk if this is not done right and the challenges are such that once into law, are not easily remedied.

Sincerely,

Michelle Tarantino-Norvell
20501 Nottingham Court
Fort Bragg, CA 95437
(707) 272-2817

INFORMATIONAL BRIEFING ON ENVIRONMENTAL IMPACT STATEMENT DEVELOPMENT FOR THE 2011-2012 MANAGEMENT SPECIFICATIONS AND MEASURES

The Council's November 2009 meeting marked the initiation of the harvest specifications and management measures decision-making process for 2011-2012 fisheries. The Council adopted a preliminary range of annual catch limits (ACLs) for each stock and stock complex as well as a preliminary range of management measures designed to stay within the harvest specifications. The range of ACLs adopted at the November 2009 Council meeting may need to be modified based on decisions made at this meeting under Agenda Item E.4 Amendment 23: Annual Catch Limits and Accountability Measures. Updated harvest specification tables will be available at the April 2010 Council meeting.

Over winter the Groundfish Management Team, Council staff, and the Northwest Region began preparations necessary for conducting the impact analysis and draft Environmental Impact Statement (DEIS) pursuant to the National Environmental Policy Act (NEPA). A key element has been structuring the alternatives in a way whereby the essential information is integrated in a logical fashion. Under this agenda item, the Council will receive an informational briefing on the process for determining the 2011-2012 harvest specifications and management measures as well as the rationale behind the preliminary range of integrated alternatives. Each integrated alternative includes a suite of ACLs for overfished species and selected target stocks, allocations and other mechanisms to apportion fishing opportunity among sectors, and the management measures necessary to constrain total catch within the ACLs contained in that alternative.

At the April 2010 Council meeting, the NEPA analyses will be brought forward and the Council is scheduled to adopt a reasonable range of alternatives for public review. Staff would then be able to prepare a preliminary impact analysis in support of Council final action at the June 2010 Council meeting. Final action involves choosing a preferred alternative falling within the range of alternatives adopted in April.

Council Action:

Discussion.

Reference Materials:

None.

Agenda Order:

a. Agenda Item Overview — Kelly Ames/Kit Dahl
b. Reports and Comments of Management Entities and Advisory Bodies
c. Public Comment
d. Council Discussion and Questions

PFMC
2/19/10

FINAL CONSIDERATION OF INSEASON ADJUSTMENTS – IF NEEDED

Consideration of inseason adjustments to 2010 groundfish fisheries may be a two-step process at this meeting. The Council will meet on Wednesday, March 10, 2010, and consider advisory body advice and public comment on inseason adjustments under Agenda Item E.5. If the Council elects to make final inseason adjustments under Agenda Item E.5, then this agenda item may be cancelled, or the Council may wish to clarify and/or confirm these decisions. If the Council tasks advisory bodies with further analysis under Agenda Item E.5, then the Council task under this agenda item will be to consider advisory body advice and public comment on the status of 2010 groundfish fisheries and adopt final inseason adjustments as necessary.

Council Action:

Consider information on the status of ongoing 2010 fisheries and adopt inseason adjustments as necessary.

Reference Materials: None.

Agenda Order:

a. Agenda Item Overview — Kelly Ames
b. Reports and Comments of Management Entities and Advisory Bodies
c. Public Comment
d. **Council Action:** Adopt or Confirm Final Adjustments to 2010 Groundfish Fisheries

PFMC
02/16/10

Agenda Item E.8.b
Supplemental GMT Report
March 2010

Projected mortality (mt) of overfished groundfish species updated with Council action on non-tribal whiting bycatch limits for canary rockfish and widow rockfish in March 2010.

Fishery	Bocaccio a/	Canary	Cowcod	Dkbl	POP	Widow	Yelloweye
Limited Entry Trawl - Non-whiting	16.1	21.3	1.5	230.6	100.8	21.6	0.6
Limited Entry Trawl - Whiting							
At-sea whiting motherships b/		**3.3**		6.0	0.5	**67**	0.0
At-sea whiting cat-proc b/		**4.8**		8.5	0.5	**95**	0.0
Shoreside whiting b/		**5.9**		10.5	4.7	**117**	0.0
Tribal whiting		4.3		0.0	7.2	5.0	0.0
Tribal							
Midwater Trawl		3.6		0.0	0.0	40.0	0.0
Bottom Trawl		0.8		0.0	3.7	0.0	0.0
Troll		0.5		0.0	0.0		0.0
Fixed gear		0.3		0.0	0.0	0.0	2.3
Fixed Gear Sablefish	0.0	2.5	0.0	4.5	0.4	0.0	0.9
Fixed Gear Nearshore	0.3	3.6	0.0	0.0	0.0	0.3	1.3
Fixed Gear Other	5.0	0.0	0.0	9.0	0.0	0.7	0.0
Open Access: Incidental Groundfish	2.0	0.9	0.0	0.0	0.0	4.0	0.3
Recreational Groundfish c/							
WA		20.9					5.1
OR						1.0	
CA	67.3	22.9	0.3			6.2	2.8
EFPs	11.0	1.3	0.2	1.5	0.1	11.0	0.4
Research: Includes NMFS trawl shelf-slope surveys, the IPHC halibut survey, and expected impacts from SRPs and LOAs.							
	2.0	4.5	0.2	2.0	2.0	5.7	3.3
TOTAL	103.7	101.3	2.2	272.6	119.9	374.5	17.0
2010 OY	288	105	4.0	291	200	509	17
Difference	184.3	3.7	1.8	18.4	80.1	134.5	0.0
Percent of OY	36.0%	96.5%	55.0%	93.7%	60.0%	73.6%	100.0%
Key		= either not applicable; trace amount (<0.01 mt); or not reported in available					

a/ South of 40°10' N. lat.

b/ Non-tribal whiting values for canary, darkblotched, and widow reflect Council recommended bycatch limits for the non-tribal whiting sectors. All other species' impacts are projected from the GMT's whiting impact projection model. The Council may elect to change these bycatch limits under any inseason action at any of their future meetings.

c/ Values in scorecard represent projected impacts for all species except canary and yelloweye rockfish, which are the prescribed harvest guidelines.