STOCK ASSESSMENT REVIEW (STAR) PANEL TERMS OF REFERENCE FOR 2009

Full assessments for Pacific sardine and Pacific mackerel typically occur every third year, necessitating a three-year cycle for the Coastal Pelagic Species (CPS) Stock Assessment Review (STAR) process. The last full assessments occurred in 2007. Because CPS populations are so dynamic and because work to improve the Pacific mackerel and Pacific sardine assessments continues, the Council recommended the next set of full assessments be convened in 2009 rather than 2010 as previously planned.

Two STAR Panels are planned for 2009 with tentative dates as follows: (1) a May 4-8, 2009 STAR Panel to review the full assessment of Pacific mackerel and Pacific sardine surveys planned for 2009 and (2) a September 21-25, 2009 STAR panel to review the full assessment of Pacific sardine. Both STAR Panels are proposed to occur at the National Marine Fisheries Service, Southwest Fisheries Science Center in La Jolla, California. There will be no updated assessments for CPS in 2009.

To help guide and coordinate stock assessment authors and reviewers, the Pacific Fishery Management Council (Council) is developing a *Terms of Reference for a Coastal Pelagic Species Stock Assessment Review Process* (Terms of Reference). At its November 2008 meeting, the Council adopted the recommendations of the Scientific and Statistical Committee (SSC) and the Coastal Pelagic Species Management Team (CPSMT) and directed these groups to revise the Terms of Reference accordingly. The most significant revisions pertain to the completion and review of CPS assessment updates. These revisions were completed by mid-January 2009 when the document (Agenda Item C.1.b, Attachment 1) was posted to the Council web page.

The Terms of Reference were again reviewed by the CPSMT and the Coastal Pelagic Species Advisory Subpanel (CPSAS) at their February 10-12, 2009 meetings where both groups recommended the document be adopted as final by the Council (Agenda Item C.1.c, CPSMT Report and CPSAS Reports). The SSC will evaluate the Terms of Reference at the March 2009 Council meeting where the Council is scheduled to approve a final version.

The Council may also discuss and provide final guidance on the STAR schedule for 2009, including plans for full assessments of Pacific mackerel and Pacific sardine, as well as a potential review of new survey methodologies.

Council Action:

Adopt Final Terms of Reference for Coastal Pelagic Species STAR Panels and Provide Final Guidance on the 2009 STAR Schedule.

Reference Materials:

1. Agenda Item C.1.b, Attachment 1: Review Draft Terms of Reference for a Coastal Pelagic Species Stock Assessment Review Process (including tracked edits to the document since November 2008, to review the document without tracked edits, visit the Council web site)
2. Agenda Item C.1.b, Supplemental SSC Report.
3. Agenda Item C.1.c, CPSMT Report.
4. Agenda Item C.1.c, CPSAS Report.

Agenda Order:

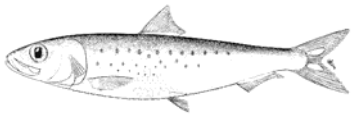
a. Agenda Item Overview — Mike Burner
b. Scientific and Statistical Committee Report — Steve Ralston
c. Reports and Comments of Agencies and Advisory Bodies
d. Public Comment
e. **Council Action**: Adopt Final Terms of Reference for Coastal Pelagic Species STAR Panels

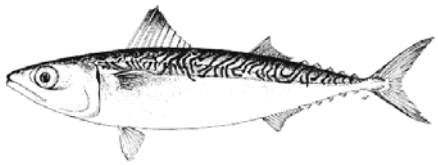
PFMC
02/19/08

Agenda Item C.1.b
Attachment 1
March 2009

TERMS OF REFERENCE
FOR A
COASTAL PELAGIC SPECIES
STOCK ASSESSMENT REVIEW PROCESS

PUBLIC REVIEW DRAFT
PLEASE DO NOT CITE





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PUBLIC REVIEW DRAFT
TERMS OF REFERENCE FOR A COASTAL PELAGIC SPECIES
STOCK ASSESSMENT REVIEW PROCESS

JANUARY 2009

Introduction

The purpose of this document is to convey expectations and responsibilities for various participants in the coastal pelagic species (CPS) stock assessment review (STAR) process, and to help the Pacific Fishery Management Council (Council) family and others understand the process. Parties involved in the CPS STAR process are the National Marine Fisheries Service (NMFS); state agencies; the Council and its advisors, including the Scientific and Statistical Committee (SSC), Coastal Pelagic Species Management Team (CPSMT), Coastal Pelagic Species Advisory Subpanel (CPSAS), and Council staff; and ~~interested persons~~the public. The STAR process is a key element in an overall process designed 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 the results are as accurate and error-free as possible. The STAR process is designed to assist in balancing these somewhat conflicting goals of timeliness, completeness, and openness.

Stock assessments for Pacific sardine and Pacific mackerel are conducted annually to assess the abundance, trends, and appropriate harvest levels for these species[1/] . Assessments[2] use statistical population models to simultaneously analyze and integrate a combination of survey, fishery, and biological data. Since 2004, the CPS assessments have undergone an assessment cycle and peer review process. There are two distinct types of assessments which are subject to different review procedures. “Full assessments” involve a re-examination of the underlying assumptions, data, and model parameters used to assess the stock, while “update assessments” maintain the model structure of the previous full assessment and are generally restricted to the addition of new data that have become available since the last assessment.

Full assessments for Pacific sardine and Pacific mackerel typically occur every third year, necessitating a three-year STAR Panel cycle. If entirely new, structurally changed or significantly revised assessments are developed, a STAR Panel must be convened to review the assessment prior to its use for setting harvest guidelines (HG). Full stock assessment reports are developed and distributed following each STAR Panel review. Updated assessments are conducted during interim years and involve a less formal review by the CPSMT and the SSC. Details from interim-year assessments are documented in executive summaries.

1/ Stock assessments are conducted for species "actively" managed under the Coastal Pelagic Species Fishery Management Plan (FMP). That is, fisheries for Pacific sardine and Pacific mackerel are actively managed via annual harvest guidelines and management specifications, which are based on current stock assessment information. Jack mackerel, northern anchovy, and market squid are "monitored" species under the FMP. Annual landings of these species are monitored and reported in the annual Stock Assessment and Fishery Evaluation (SAFE) report, but harvest guidelines are not set for them.

2/ 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 CPS 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 CPS assessment and review process are to:

1. Ensure that CPS stock assessments provide the kinds and quality of information required by all members of the Council family.
2. Satisfy the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) and other legal requirements.
3. Provide a well-defined, Council-oriented process that ensures CPS 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.
4. Provide an independent external review of CPS stock assessment work.
5. Increase understanding and acceptance of CPS stock assessment and review work by all members of the Council family.
6. Identify research needed to improve assessments, reviews, and fishery management in the future.
7. Use assessment and review resources effectively and efficiently.

Responsibilities

Shared Responsibilities

All parties have a stake in assuring adequate technical review of stock assessments. NMFS 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 ensure 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 review of current stock assessments requires a routine, dedicated effort that simultaneously meets the needs of NMFS, the Council, and others. Leadership, in the context of the stock assessment review process for CPS species, means consulting with all interested parties to plan, prepare terms of reference, and develop a calendar of events and a list of deliverables. Coordination means organizing and carrying out review meetings, distributing documents in a timely fashion, and making sure that assessments and reviews are completed according to plan. Leadership and coordination both involve costs, both monetary and time, which have not been calculated, but are likely substantial.

The Council and NMFS share primary responsibility for a successful STAR process. The Council will sponsor the process and involve its standing advisory committees, especially the SSC. The chair of the SSC CPS subcommittee will coordinate, oversee, and facilitate the process. Together NMFS and the Council will consult with all interested parties to plan, prepare terms of reference,

and develop a calendar of events and a list of deliverables. NMFS and the Council will share fiscal and logistical responsibilities.

The CPS STAR process is sponsored by the Council, because the Federal Advisory Committee Act (FACA) limits the ability of NMFS to establish advisory committees. FACA specifies a procedure for convening advisory committees that provide consensus recommendations to the federal government. The intent of FACA was to limit the number of advisory committees; ensure that advisory committees fairly represent affected parties; and ensure that advisory committee meetings, discussions, and reports are carried out and prepared in full public view. Under FACA, advisory committees must be chartered by the Department of Commerce through a rather cumbersome process. However, the Sustainable Fisheries Act exempts the Council from FACA per se, but requires public notice and open meetings similar to those under FACA.

CPS STAR Coordination

The SSC CPS subcommittee chair will work with the Council, Council staff, other agencies, groups or interested persons that carry out assessment work to coordinate and organize Stock Assessment Team (STAT) Teams, STAR Panels, and reviews of assessment updates. The objective is to make sure that work is carried out in a timely fashion according to the calendar and terms of reference.

The SSC CPS Subcommittee chair, in consultation with the SSC and the Southwest Fisheries Science Center (SWFSC), will coordinate the selection (including number) of external reviewers. Criteria for reviewer qualifications, nomination, and selection will be established by the SWFSC in consultation with the SSC, and will be based principally on a candidate's knowledge of stock assessments and familiarity with West Coast CPS fisheries. The public is welcome to nominate qualified reviewers. The majority of panelists should be experienced stock assessment scientists, i.e., individuals who have conducted stock assessments using current methods (generally statistical age- and or length-structured assessment models). It is, however, 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 the ideal.

Following any modifications to the stock assessments resulting from STAR Panel reviews and prior to distribution of stock assessment documents and STAR Panel reports, the SSC CPS Subcommittee chair will ensure that the stock assessments and panel reports are reviewed for consistency with the terms of reference, especially completeness. If inconsistencies are identified, authors will be requested to make appropriate revisions in time to meet the deadline for distributing documents for the CPSMT meeting at which HG recommendations are developed.

Individuals (employed by NMFS, state agencies, or other entities) that conduct assessments or technical work in connection with CPS stock assessments are responsible for ensuring their work is technically sound and complete. The Council's review process is the principal means for review of complete stock assessments, although additional in-depth technical review of methods and data is desirable. Stock assessments must be completed and reviewed in full accordance with the terms of reference (Appendices A and B).

CPSMT Responsibilities

The CPSMT is responsible for identifying and evaluating potential management actions based on the best available scientific information. In particular, the CPSMT makes HG recommendations to the Council based on agreed control rules. The CPSMT will use stock assessments, STAR Panel reports, and other information in making their HG recommendations. Preliminary HG recommendations will be developed by the CPSMT according to the management process defined in Council Operating Procedures (COP-9). A representative of the CPSMT will be appointed by the CPSMT Chair and will serve as a liaison to each assessment update review meeting (in most cases, the entire CPSMT participates in assessment update reviews) or STAR Panel, and will participate in review discussions. The CPSMT representative will not serve as a member of a STAR Panel. The CPSMT representative should be prepared to advise the STAT Team and STAR panel on changes in fishing regulations or practices that may influence data used in the assessment and the nature of the fishery in the future. The CPSMT will not seek revision or additional review of stock assessments after they have been reviewed by a STAR Panel. The CPSMT 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., CPSMT) work depends on stock assessment documents and STAR reviews being completed by the time the CPSMT meets to discuss preliminary HG levels. However, the CPSMT can request additional model projections, based on reviewed model scenarios, to develop a full evaluation of potential management actions.

CPSAS Responsibilities

The chair of the CPSAS will appoint a representative to track each assessment and participate at an assessment update review meeting or STAR Panel meeting. The CPSAS representative will serve as an advisor to the STAT Team and STAR Panel. It is especially important that the CPSAS 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. This coordination should first occur via telephone or email. Council funded travel for coordination between the STAT Team and the CPSAS representative requires advanced approval by the Council or the Council Executive Director. It is the responsibility of the CPSAS representative to ensure that industry concerns about the adequacy of data being used by the STAT Team are expressed at an early stage in the process. The CPSAS representative will participate in review discussions as an advisor to the STAR Panel, in the same capacity as the CPSMT advisor.

The CPSAS representative will attend the CPSMT meeting at which preliminary HG recommendations are developed. The CPSAS representative will also attend subsequent CPSMT, Council, and other necessary meetings.

The CPSAS representative may provide appropriate data and advice to the assessment update review meeting, STAR Panel, and CPSMT, and will report to the CPSAS on STAR Panel and other meeting proceedings.

SSC Responsibilities

The SSC will participate in the stock assessment review process and will provide the CPSMT and Council with technical advice related to stock assessments and the review process.

The SSC will assign at least two (ideally three) members from its CPS subcommittee to each assessment update review meeting. The SSC representatives at the review meeting will prepare a meeting summary and present it to the full SSC at its next regular meeting. The SSC will review any additional analytical work required or carried out by the CPSMT after the stock assessments have been reviewed at the update review meeting. In addition, the SSC will review and advise the CPSMT and Council on harvest guideline recommendations.

The SSC will assign at least one member from its CPS Subcommittee to each STAR Panel for reviewing full assessments. This member will chair the STAR Panel and will be expected to attend the assigned STAR Panel meeting, the CPSMT meeting at which HG recommendations are made, and the Council meetings when the STAR Panel reviewed stock assessment is discussed. The SSC representative on the STAR Panel will present the STAR Panel report at CPSMT, SSC, and Council meetings. The SSC representative will communicate SSC comments or questions to the CPSMT. The SSC will review any additional analytical work on any of the stock assessments required or carried out by the CPSMT after the stock assessments have been reviewed by the STAR Panels.

The SSC, during their normally scheduled meetings, will serve as arbitrator to resolve disagreements between the STAT Team, the CPS subcommittee, STAR Panel, the CPSAS or CPSMT. The STAT Team and the STAR Panel (CPS subcommittee in the case of update reviews)~~,~~ may disagree on technical issues regarding an assessment. In this case, the stock assessment report must include a point-by-point response by the STAT Team to each of the STAR Panel (CPS subcommittee) recommendations. Estimates and projections representing all sides of the disagreement need to be presented, reviewed, and commented on by the SSC.

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 most recent version of the Terms of Reference for the ~~2009~~ CPS STAR process adopted by the Council. The Council staff officer will coordinate materials and presentations for Council meetings relevant to final Council adoption of CPS 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 CPS stock assessment documents, Scientific and Statistical Committee (SSC), Coastal Pelagic Species Management Team (CPSMT), and Coastal Pelagic Species Advisory Subpanel (CPSAS) comments and reports, letters from the public, and any other relevant information. At a minimum, the stock assessments (Stock Assessment Team (STAT) reports, STAR Panel reports, and stock summaries) should be published and distributed in the Council annual stock assessment and fishery evaluation (SAFE) document.

A primary role for the Council staff officer assigned to the STAR process will be to monitor STAR Panel and SSC activities to ensure compliance with these Terms of Reference. The Council staff officer will attend all STAR Panels to ensure continuity and adherence to these 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 coordinate with the STAR Panel chair and the National Marine Fisheries Service (NMFS) in a review of STAT documents to assure they are received on time, are consistent with the Terms of Reference, and are complete. The Council staff officer will review the Executive Summary for consistency with the Terms of Reference. 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. Inconsistencies will be identified and the authors requested to make appropriate revisions in time for the appropriate SSC, CPSMT, and CPSAS 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~~COP 4.

National Marine Fisheries Service Responsibilities

NMFS Southwest Fisheries Science Center (SWFSC) will provide staff 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 SWFSC will work with assessment authors to develop a draft list of assessments to be considered by the Council. The SWFSC also will develop a draft STAR Panel schedule for review by the Council. The SWFSC will identify independent STAR panelists following criteria for reviewer qualifications. –The costs associated with these reviewers will be borne by NOAA Fisheries. The SWFSC will coordinate with the STAT 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 SWFSC 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, CPSMT, and CPSAS meetings.

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. The schedule and goals of the 2009 STAR panel cycle is provided in Appendix C. The objective of a 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 summaries of stock status (prepared by STAT Teams) for inclusion in the SAFE document.

STAR Panels normally include an SSC chair, at least one "external" member (i.e., outside the Council family and not involved in management or assessment of West Coast CPS, typically designated by the Center for Independent Experts [CIE]), and ~~one~~ two additional members. The total number of STAR Panel members should be at least "n+3~~2~~" where n is the number of stock assessments and "3~~2~~" counts the chair and external reviewer(s). Occasionally, STAR Panels are charged with the review of matters associated with, but distinct from stock assessments (i.e. survey methodology or sampling designs). In these circumstances additional reviewers with specific expertise may be warranted.

In addition to Panel members, STAR meetings will include CPSMT and CPSAS advisory representatives with responsibilities as laid out in their terms of reference. STAR Panels normally meet for one week. The number of assessments reviewed per Panel should not exceed two.

The STAR Panel chair is responsible for: 1) developing an agenda, 2) ensuring that STAR Panel members at 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, 5) coordinating review of final assessment documents, and 6) providing Council staff with a camera ready and suitable electronic version of the Panel's report for inclusion in the annual SAFE report.

The STAR Panel, STAT Team, the CPSMT and CPSAS representatives, and the public~~all interested parties~~ are legitimate meeting participants that ~~must~~ should 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 is responsible for determining if a stock assessment document is sufficiently complete according to Appendix A. It is 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 Panels' report.

The STAR Panel's terms of reference solely concern technical aspects of stock assessment work. It is therefore important that the Panel 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 Confidence intervals of indices and model outputs, as well as other measures of

uncertainty that could affect management decisions, should be provided in completed stock assessments and the reports prepared by STAR Panels.

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 of ~~(?)~~ work that is required.

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~~ additional runs, ~~additional~~ further 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 STAT 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 to rectify whatever perceived shortcomings may exist.

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 STAR Panel report as part of the record of the review meeting. The SSC will then review all information pertaining to the dispute, and issue its recommendation.

Additional analyses required in the stock assessment should be completed during the STAR Panel meeting. 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 and ~~potentailly revise~~possibly revise the scope of the request(s) ~~to fit~~given the available time. ~~In particular, t~~The Panel chair is responsible for communicating with all Panel members (by phone, email, 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 CPSMT meeting where the assessments and preliminary HG levels are discussed.

Suggested Template for STAR Panel Report

- Summary of the STAR Panel meeting, containing:
    - Names and affiliations of STAR Panel members, and
    - List of analyses requested by the STAR Panel, the rationale for each request, and a brief summary the STAT responses to each request.
- Comments on the technical merits and/or deficiencies in the assessment and recommendations for remedies.
- Explanation of areas of disagreement regarding STAR Panel recommendations:
    - among STAR Panel members (including concerns raised by the CPSMT and CPSAS representatives), and
    - between the STAR Panel and STAT Team.
- Unresolved problems and major uncertainties, e.g., any special issues that complicate scientific assessment, questions about the best model scenario.
- Management, data or fishery issues raised by the public and CPSMT and CPSAS representatives during the STAR Panel.
- Prioritized recommendations for future research and data collection.

Terms of Reference for CPS STAT Teams

The STAT Team will carry out its work according to these terms of reference for full assessments.

Each STAT Team will appoint a representative to coordinate work with the STAR Panel and attend the STAR Panel meeting.

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 CPSAS representative informed of the specific data being used in the stock assessment. The STAT team is expected to initiate contact with the CPSAS 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 CPSMT representative for information about changes in fishing regulations that may influence data used in the assessment.

Each STAT Team will appoint a representative who will attend the CPSMT, CPSAS, and Council meetings where preliminary harvest levels are discussed. In addition, a representative of the STAT Team should attend the CPSMT and Council meeting where final HG recommendations are developed, if requested or necessary. At these meetings, the STAT Team member shall be available to give a presentation of the assessment and answer questions about the STAT Team report.

The STAT Team is responsible for preparing three versions of the stock assessment document: (1) a complete "draft", including an executive summary, for discussion at the stock assessment review meeting; (2) a "revised draft" for distribution to the CPSMT, CPSAS, SSC, and Council for discussions about preliminary harvest levels; and (3) a "final" version to be published in the SAFE report. Other than authorized changes, only editorial and other minor changes should be made between the "~~complete~~ revised draft" and "final" versions. Post-STAR Panel drafts must be reviewed by the ~~STAR~~ Panel chair 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 distribute "draft" assessment documents to the STAR Panel, Council, and CPSMT and CPSAS 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 STAR Panel chair will make an initial recommendation, which will then be reviewed by the SSC CPS subcommittee members and Council staff if the chair determines that the draft assessment is not sufficiently complete. The draft document should include all elements listed in Appendix A except a) the point-by-point responses to current STAR Panel recommendations, and 2) acknowledgements. Incomplete assessments will be postponed to a subsequent assessment cycle.

The STAT Team is responsible for bringing computerized data and working assessment models to the review meeting in a form that can be analysed 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 at least one week before the CPSMT meeting at which harvest guidelines are discussed.

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 recommendations. Estimates and projections representing all sides of any disagreements need to be presented, reviewed by, and commented on by the SSC.

Electronic versions of final assessment documents, parameter files, data files, and key output files must be provided to Council staff. Any tabular data that are inserted into the final documents in an 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. For CPS, this typically occurs during two years out of every three because that is the default cycle for CPS assessments. In this context, a "model" refers not only to the population dynamics model *per se*, but also 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 and the basis for the harvest guideline (HG). These terms of reference establish a procedure for a limited, but still rigorous, review for stock assessments 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, and these terms of reference allow for the possibility of limited modifications to an existing "model". ~~.~~ However, a full assessment and review might still be necessary if an updated assessment could not be accomplished without incorporating major structural changes to the model. A full assessment would then be scheduled for the next year.

Qualification

The Scientific and Statistical Committee (SSC) will determine whether a stock assessment qualifies as an update under these terms of reference. 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,~~ (b~~c~~) the software used in programming the assessment, (c~~d~~) the assumptions and structure of the population dynamics model underlying the stock assessment, (d~~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 (e~~g~~) the analytical treatment of model outputs in determining management reference points. A stock assessment update is appropriate in situations where no significant change in these five factors has occurred. In general, the only changes to a previously reviewed and endorsed assessment would be that the data time series is extended using the most recent information. However, changes to: (a) the analytical methods used to summarize data prior to input to the model, such has how the compositional data are pooled across sampling strata, (b) the weighting of the various data components (including the use of methods for tuning the variances of the data components), and (c) how selectivity is modeled, such as the time periods for the selectivity blocks, ~~A stock assessment update is appropriate in situations where no significant change in these seven factors has occurred, other than extending the time series of elements within particular data components used by the model, e.g., adding information from a recently completed survey and an update of landing~~ are acceptable as long the update assessment clearly documents and justifies the changes. ~~Extending catch per unit of effort (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 the criteria for assessment models described above that are applicable to CPUE standardization models. In practice t~~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 CPS subcommittee of the SSC will conduct the review of stock assessment updates. A lead reviewer for each updated assessment will be designated by the chair of the CPS subcommittee from among the membership of this subcommittee, 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 CPSMT and one designee from the CPSAS will ~~designate one person each to~~ participate in the review in an advisory capacity.

Review Format

Stock assessment updates will be reviewed during a single two-day meeting of the SSC CPS Subcommittee~~, although in situations where a STAT team arrives with a well-considered, thorough assessment, it may be that the review could take place in less time~~although there may be situations where the update review could take place in less time, i.e., early dismissal of a STAT Team is an option ~~for well-constructed assessments~~. ~~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~~ the participants in the update review 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 ~~large numbers of~~extensive 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~~can the ~~results that~~ from 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 in the next year. If the review meeting ~~agrees~~concludes that it is not possible to update the stock assessment, the SSC will consider all of the model runs examined during the review meeting and will select one as a basis for the harvest guideline to be presented to the CPSMT and the Council. ~~HG based on those model runs~~.

STAT Team Deliverables

~~Since there will be limited opportunities for revision during the review meeting, i~~It is the STAT Team's responsibility to provide the review 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 review panel 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. Similarly, if any ~~minor~~ changes to the "model" structure are adopted, above and beyond updating specific data streams, the impact of this needs to be

documenteda ~~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 B)
- Introduction
- Documentation of updated data sources
- Short description of overall model structure
- Base-run results (largely tabular and graphical)
- Uncertainty analysis, including retrospective analysis.

Review Panel Report

The ~~review panel~~SSC Subcommitee members 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
- List of analyses requested by the review panel, the rationale for each request, and a brief summary the STAT responses to each request
- Explanation of areas of disagreement among panelists and between the panel and STAT Team
- Recommendation regarding the adequacy of the updated assessment for use in management

Appendix A: Outline for CPS Stock Assessment Documents

This is an outline of items that should be included in stock assessment reports for CPS 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. Items flagged by asterisks (*) are optional for draft assessment documents prepared for STAR Panels, but should be included in the final assessment 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.

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

2. Executive Summary (see attached template in Appendix B). This also serves as the STAT summary included in the SAFE)

3. Introduction
   a. Scientific name, distribution, the basis for the choice of stock structure, including differences in life history or other biological characteristics that should form the basis for management units
   b. A map depicting the scope of the assessment and identifying boundaries for fisheries or data collection strata.
   c. Important features of life history that affect management (e.g., migration, sexual dimorphism, bathymetric demography)
   d. Important features of the current fishery and relevant history of fishery
   e. Summary of management history (e.g., changes in management measures, harvest guidelines, or other management actions that may have significantly altered selection, catch rates or discards)
   e. Management performance - a table or tables comparing annual biomass, harvest guidelines, and landings for each management subarea and year

4. Assessment
   a. Data
      i. Landings by year and fishery, catch-at-age, weight-at-age, survey and catch-per-unit-effort (CPUE) data, data used to estimate biological parameters (e.g., growth rates, maturity schedules, and natural mortality) with coefficients of variances (CVs) or variances if available. Include complete tables and figures (if practical) and date of extraction.
      ii. Sample size information for length and age composition data by area, year, gear, market category, etc. including the number of trips and fish sampled.
      iii. Information on all data sources that were excluded from the assessment.

b. History of modeling approaches used for this stock - changes between current and previous assessment models
   i. Response to STAR Panel recommendations from the ~~most recent~~last assessment
   ii. Report of consultations with CPSAS and CPSMT representatives regarding the use of various data sources in the stock assessment.

c. Model description
   i. Complete description of any new modeling approaches
   ii. Definitions of fleets and areas
   iii. Assessment program with last revision date (i.e., date executable program file was compiled)
   iv. List and description of all likelihood components in the model
   v. Constraints on parameters, selectivity assumptions, natural mortality, assumed level of age reader agreement or assumed ageing error (if applicable), and other assumed parameters
   vi. Description of stock-recruitment constraints or components
   vii. Critical assumptions and consequences of assumption failures
   viii. Description of how the first year that is included in the model was selected and how the population state at that time is defined (e.g. B_0, stable age-structure)

d. Model selection and evaluation
   i. Evidence of search for balance between realistic (but possibly over-parameterized) and simpler (but not realistic) models
   ii. Comparison of key model assumptions, include comparisons based on nested models (e.g., asymptotic vs. domed selectivities, constant vs. time-varying selectivities)
   iii. Summary of alternative model configurations that were tried, but rejected
   iv. 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.
   v. Residual analysis for the base-run (or proposed base-run model for a draft assessment undergoing review) configuration, e.g., residual plots, time series plots of observed and predicted values, or other
   vi. Convergence status and convergence criteria for base-run model (or proposed base-run model)
   vii. Randomization run results or other evidence of search for global best estimates
   viii. Evaluation of model parameters. Do they make sense? Are they credible?
   xi. Point-by-point response to the STAR Panel recommendations*

e. Base-run(s) results
   i. Table listing all 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
   ii. Time-series of total and spawning biomass, recruitment and fishing mortality or exploitation rate estimates (table and figures)

iii. Selectivity estimates (if not included elsewhere)
iv. Stock-recruitment relationship

f. Uncertainty and sensitivity analyses.
   i. The best approach for describing uncertainty and range of probable biomass estimates in CPS assessments may depend on the situation. Possible approaches include:
      A. Sensitivity analyses (tables or figures) that show ending biomass levels or likelihood component values obtained while systematically varying emphasis factors for each type of data in the model
      B. Likelihood profiles for parameters or biomass levels
      C. CVs for biomass estimated by bootstrap, Bayesian, or asymptotic methods
      D. Subjective appraisal of magnitude and sources of uncertainty
      E. Comparison of alternate models
      F. Comparison of alternate assumptions about recent recruitment
   ii. If a range of model runs (e.g., based on CVs or alternate assumptions about model structure or recruitment) is used to depict uncertainty, then it is important that some qualitative or quantitative information about relative probability be included. If no statements about relative probability can be made, then it is important to state that all scenarios (or all scenarios between the bounds depicted by the runs) are equally likely
   iii. 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 to the value for the HG
   iv. Retrospective analysis, where the model is fitted to a series of shortened input data sets, with the most recent years of data input being dropped.
   v. Historic analysis (plot of actual estimates from current and previous assessments)
   vi Simulation results

5. Harvest Control Rules

Pacific Sardine

The CPS FMP defines the maximum sustainable yield (MSY) control rule for Pacific sardine. This formula is intended to prevent Pacific sardine from being overfished and maintain relatively high and consistent catch levels over a long-term. The harvest formula for sardine is:

HG = (TOTAL STOCK BIOMASS - CUTOFF) x FRACTION x U.S. DISTRIBUTION,

where harvest guideline (HG) is the total U.S. (California, Oregon, and Washington) harvest recommended for the next fishing year, TOTAL STOCK BIOMASS is the estimated stock biomass (ages 1+) at the start of the next year from the current assessment, CUTOFF (150,000 mt) is the lowest level of estimated biomass at which harvest is allowed,

FRACTION is an environment-based percentage of biomass above the CUTOFF that can be harvested by the fisheries, and U.S. DISTRIBUTION is the percentage of TOTAL STOCK BIOMASS in U.S. waters.

The value for FRACTION in the MSY control rule for Pacific sardine is a proxy for F_{MSY} (i.e., the fishing mortality rate that achieves equilibrium MSY). Given F_{MSY} and the productivity of the sardine stock have been shown to increase during relatively warm-water ocean conditions, the following formula has been used to determine an appropriate (sustainable) FRACTION value:

$$\text{FRACTION or } F_{MSY} = 0.248649805(T^2) - 8.190043975(T) + 67.4558326,$$

where T is the running average sea-surface temperature at Scripps Pier, La Jolla, California during the three preceding years. Under the harvest control rule, F_{MSY} is constrained and ranges between 5% and 15% depending on the value of T.

Pacific Mackerel
The CPS FMP defines the MSY control rule for Pacific mackerel as:

HG = (BIOMASS-CUTOFF) x FRACTION x STOCK DISTRIBUTION,

where HG is the U.S. harvest guideline, CUTOFF (18,200 mt) is the lowest level of estimated biomass at which harvest is allowed, FRACTION (30%) is the fraction of biomass above CUTOFF that can be taken by fisheries, and STOCK DISTRIBUTION (70%) is the average fraction of total BIOMASS in U.S. waters.

CUTOFF and FRACTION values applied in the Council's harvest policy for mackerel are based on simulations published by MacCall et al. in 1985. BIOMASS is the estimated biomass of fish age 1 and older for the whole stock as of July 1. As for Pacific sardine, FRACTION is a proxy for F_{MSY}.

~~6. Target Fishing Mortality Rates (if changes are proposed)~~

6~~7~~. Management Recommendations

7~~8~~. Research Needs (prioritized)

8~~9~~. 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)*

9~~10~~. Literature Cited

10~~11~~. Complete Parameter Files and Results for Base Runs (for a draft undergoing review, these listings can be provided as text files or in spreadsheet format.)

Appendix B: Template for Executive Summariesy 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.

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) – 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 the HG values for the most recent 10 years (when available), actual catch and discard.

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

Appendix C: Proposed 2009 STAR Panel Schedule

Both STAR Panels to be conducted at the SWFSC in La Jolla, California.

Panel	Dates	Goal	Reviewers 1/
1	May 4-8	1. Review Pacific mackerel assessment 2. Review Pacific sardine surveys: (a) Pacific NW Aerial Survey (b) SWFSC CCE/CalCOFI Survey	5 total (n+4): 2 members of the SSC – one of whom will serve as the panel chair, 2 outside reviewers designated by the CIE with stock assessment and survey expertise, 1 outside reviewer – designated by the SSC and the SWFSC.
2	Sept. 21-25	1. Review Pacific sardine assessment	4 total (n+3): 2 members of the SSC – one of whom will serve as the panel chair, 1 outside reviewers designated by the CIE, 1 outside reviewer – designated by the SSC and the SWFSC.

1/ One member of the CPSMT and one member of the CPSAS will attend each panel as advisors.

COASTAL PELAGIC SPECIES ADVISORY SUBPANEL REPORT ON THE STOCK ASSESSMENT REVIEW (STAR) PANEL TERMS OF REFERENCE FOR 2009

Mr. Mike Burner reviewed the amended language in the *Terms of Reference for a Coastal Pelagic Species Stock Assessment Review Process* (Agenda Item C.1.b, Attachment 1) including the language that provides greater flexibility to the stock assessment team (STAT) and the assessment reviewers for stock assessment updates. The Coastal Pelagic Species Advisory Subpanel (CPSAS) appreciates and is supportive of these changes.

Dr. Nancy Lo reviewed plans for STAR Panel membership. The CPSAS is supportive of having one representative identified by the Center of Independent Experts (CIE) and two external reviewers identified by the Southwest Fisheries Science Center and the Scientific and Statistical Committee. It is anticipated that the STAR Panel representation will include adequate expertise on coastal pelagic species, stock assessments, and survey design.

CPSAS Vice Chair Mike Okoniewski will represent the CPSAS at both CPS STAR Panels in 2009. In the event that Vice Chair Okoniewski is unable to attend a STAR Panel, Ms. Diane Pleschner-Steele will serve as an alternate.

Given the limited indices of abundance for Pacific sardine, the CPSAS recommends that indices of abundance developed by Canada be considered for inclusion in the 2009 Pacific sardine full assessment and be reviewed during the May 2009 STAR Panel. Further the CPSAS recommends that the STAT conduct an exhaustive search for other appropriate data sources for inclusion in the full assessment of Pacific sardine.

PFMC
02/19/09

COASTAL PELAGIC SPECIES MANAGEMENT TEAM REPORT ON THE STOCK ASSESSMENT REVIEW (STAR) PANEL TERMS OF REFERENCE FOR 2009

The Coastal Pelagic Species Management Team (CPSMT) briefly reviewed the draft *Terms of Reference for a Coastal Pelagic Species Stock Assessment Review Process* (Agenda Item C.1.b, Attachment 1) at its February 10-11, 2009 meeting in La Jolla, California and recommends the Council adopt the document as final.

The Oregon Department of Fish and Wildlife member of the CPSMT was selected to represent the CPSMT at the proposed May 2009 Stock Assessment Review Panel.

PFMC
02/19/09

SCIENTIFIC AND STATISTICAL COMMITTEE REPORT ON STOCK ASSESSMENT REVIEW (STAR) PANEL TERMS OF REFERENCE FOR 2009

The Scientific and Statistical Committee (SSC) reviewed the revised Coastal Pelagic Species (CPS) Stock Assessment Review (STAR) Panel Terms of Reference for 2009. The revised Terms of Reference provide more flexibility in the completion and review of the CPS stock assessment updates. The SSC recommends making the following change in the last sentence in the Review Format section on page 13 of Agenda Item C.1.a, Attachment 1.

If the review meeting concludes that it is not possible to update the stock assessment, the SSC will consider all of the model runs examined during the review meeting and will provide fishing level recommendations ~~select one as a basis for the harvest guideline~~ to ~~be presented to the CPSMT and~~ the Council.

The SSC also recommends the following table, currently in Appendix C, to be a standalone recommendation to guide the 2009 stock assessment process.

Panel	Dates	Goal	Reviewers [1/]
1	May 4-8	1. Review Pacific mackerel assessment 2. Review Pacific sardine surveys: (a) Aerial Survey, and (b) Egg Production Survey	5 total (n+4): 2 members of the SSC – Dr. André Punt (Chair), Dr. Owen Hamel, 1 outside reviewer designated by the CIE with stock assessment expertise, 2 outside reviewers – designated by the SSC and the SWFSC with stock assessment and survey expertise.
2	Sept. 21-25	1. Review Pacific sardine assessment	4 total (n+3): 2 members of the SSC – Dr. André Punt (Chair), Dr. Selina Heppell 1 outside reviewer designated by the CIE, 1 outside reviewer – designated by the SSC and the SWFSC.

1/ One member of the CPSMT and one member of the CPSAS will attend each panel as advisors.

PFMC
3/8/09

EXEMPTED FISHNG PERMIT (EFP) FOR SARDINE RESEARCH

At its November 2008 meeting, the Council adopted harvest specifications and management measures for the 2009 Pacific sardine survey. As part of the management measures the Council set aside 1,200 metric tons (mt) of the 2009 harvest guideline (HG) as a research set aside. The intent of the research set aside is to continue and expand on a pilot aerial survey that was conducted in 2008 by industry representatives in the Pacific Northwest (PNW). No research set aside was adopted for the 2008 pilot survey which was conducted during the directed fishery. The 2008 Pacific sardine fishery experienced early HG attainment and fishery closures which made for less than ideal conditions for conducting research. In response, the Coastal Pelagic Species (CPS) Advisory Bodies advised improving the potential for additional research in 2009 by setting aside a portion of the 2009 HG for research that can be conducted, at least in part, outside of the directed fishery. Because this activity is proposed to happen during an otherwise closed period, and exempted fishing permit from the National Marine Fisheries Service will likely be required.

The pilot survey conducted in 2008 was limited to areas in the PNW. Expanding the geographic scope of the survey is of interest to both the scientific and fishing communities. Industry representatives from California as well as the PNW have been working to develop a program to achieve this expansion of new research. Two similar proposals for 2009 research have been submitted for Council and Advisory Body consideration in March, one by Northwest Sardine Survey, LLC (Agenda Item C.2.a, Attachment 1) and one by the California Wetfish Producers Association (Agenda Item C.2.a, Attachment 2). While there is general similarity between these two proposals, areas of difference include recommended geographic distribution of the research set aside and hydroacoustic sampling techniques and equipment. Additionally, opinions differ on whether the survey methods employed in the PNW in 2008 and proposed for 2009 can be replicated in California.

At the March meeting the Council is tasked with adopting a proposal for 2009 Pacific sardine research for public review. Detailed survey designs for this proposed research are scheduled for review by the May Stock Assessment Review Panel meeting as well as the June meeting of the Scientific and Statistical Committee. National Marine Fisheries Service will likely publish a public notice announcing its intent to consider exempted fishing permits for the proposed research in advance of the June Council meeting where the Council is scheduled to make final recommendation on whether the proposed research should be conducted and whether an exempting fishing permit should be considered for issuance. Should the exempted fishing permits be denied and the proposed research not occur outside of the directed fishery, the 1,200 mt set aside is scheduled to be reallocated to the third period (September 15-December 31) as adopted by the Council in November 2008 and implemented in regulation by NMFS.

Council Action:

Adopt Exempted Fishing Permit for Public Review.

Reference Materials:

1. Agenda Item C.2.a, Attachment 1: West Coast Sardine Survey, Justification for an Exempted Fishing Permit in 2009.
2. Agenda Item C.2.a, Attachment 2: California Aerial and Acoustic Sardine Survey, Justification for an Exempted Fishing Permit in 2009.
3. Agenda Item C.2.b, Supplemental SSC Report.
4. Agenda Item C.2.b, Supplemental CPSMT Report.
5. Agenda Item C.2.b, Supplemental CPSAS Report.
6. Agenda Item C.2.c, Public Comment 1: February 18, 2009 letter to Mr. Mike Burner from Mr. Jerry Thon, Northwest Sardine Survey, LLC.
7. Agenda Item C.2.c, Public Comment 2: February 18, 2009 letter to Mr. Don Hansen and Dr. Donald McIsaac from Ms. Diane Pleschner-Steele, California Wetfish Producers Association.

Agenda Order:

a. Agenda Item Overview — Mike Burner
b. Reports and Comments of Agencies and Advisory Bodies
c. Public Comment
d. **Council Action**: Adopt EFP for Public Review

PFMC
02/20/09

West Coast Sardine Survey

Justification for Exempted Fishing Permit in 2009

February 17, 2009

Northwest Sardine Survey, LLC

12 Bellweather Way, Suite 209

Bellingham, Washington 98225

The purpose of this Exempted Fishing Permit (EFP) request is to obtain approval to utilize the portion of sardine quota (1200 mt), which the Pacific Fishery Management Council has set-aside for sardine research in 2009, to improve upon and continue the aerial sardine survey work started on a pilot scale in 2008.

In 2008, the Northwest Sardine Survey LLC (NWSS), a consortium of the Northwest Sardine Industry, conducted a "proof of concept" project to determine if high quality, quantitative digital aerial imagery could be collected and processed on a scale large enough and rapidly enough for a practical fisheries stock assessment application – namely the in-season enumeration and measurement of sardine schools (Wespestad et al. 2008). The project was successful in this endeavor. In approximately one month's time (from late August through late September 2008), over 2000 images were processed by one scientific technician, who discerned and individually measured the surface area of over 3000 sardine schools. Furthermore, every school selected and measured on the digital images was documented and archived to allow for subsequent examination and review by other observers.

While aerial counts of school number and measurements of school cover (m^2) as collected in 2008 are recognized as useful metrics to begin to develop an index of abundance extending over a period of years for the sardine stock, a direct point estimate of biomass is also desired to more quickly characterize the stock status. Our initial work has shown that point sets, coupled with quantitative digital imagery, are a promising method to establish the relationship between sardine cover (m^2) and biomass (mt) for this purpose.

Sampling limitations in 2008, however, resulted in too few samples to quantify this relationship with good accuracy or precision. A research set-aside of sardine quota was not available in 2008 and it was necessary to conduct research sampling opportunistically during the fishery. As a result, short and intense fishing periods and poor weather conditions limited our ability to fully test the methodology in our pilot project year.

The objective of this EFP request is to provide an opportunity to collect the data needed to improve our quantification of sardine school density under more controlled conditions and in a directed manor -- separate from the open period of the fishery. The survey design to be employed in 2009 largely follows the plan developed and executed successfully in 2008. The primary differences in 2009 will be 1) the opportunity to make use of the portion of the sardine quota explicitly set-aside for research (1200 mt), to obtain better estimates of sardine school density than could otherwise be obtained during the directed fishery, 2) to extend the coverage of the survey to both the north and the south along the Pacific Coast.

Materials and Methods

Biological Sampling

As in 2008, samples will be routinely collected from vessels delivering at fish processing plants. Fishermen will keep observed research hauls (point sets) separate from the bulk of landings so total tonnage of observed hauls may be determined. Port sampling will be conducted opportunistically throughout the open fishing periods, and additionally during the EFP set-aside opening for research. Samples will be collected from unsorted catch while being pumped from the vessel. Fish will be taken at the start, middle, and end of a delivery as it is pumped. The three samples will then be combined and a random subsample of fish will be processed.

Length, weight, and maturity over the course of the season are of primary interest. Sardine weights will be taken using an electronic scale accurate to 0.5 gm. Sardine lengths will be taken using a millimeter length strip provided attached to a measuring board. Standard length will be determined by measuring from sardine snout to the last vertebrae. Random otolith samples will also be taken for aging analysis. Sardine maturity will be established by referencing maturity codes (female- 4 point scale, male- 3 point scale) supplied by Beverly Macewicz NMFS, SWFSC (Wespestad et al 2008, Table 1a).

Aerial Survey

Survey design

As in 2008, our survey will employ the belt transect method using a systematic sampling design, with each transect a single sampling unit (Elzinga et al 2001). From a random starting point, parallel transects will be conducted in an east-west orientation, generally parallel to the gradient of sardine schools distributed along the coast. To fully encompass the expected width of the sardine school distribution transects will originate at the shoreline and will extended westward for 35 miles but possibly further offshore to the south. Transects will be spaced 10 miles apart. In 2008, 10 parallel transects were sampled off the coast of Washington-Oregon with three replicate surveys. The intention of NWSS for 2009 is to expand the spatial coverage of the survey northward (to the Canadian border), and southward (to the Northern California border) from the area covered in 2008.

Considerable effort was expended in 2008 by NWSS to establish and validate the quantitative aerial survey methodology by conducting a proof of concept study in the Northwest (Wespestad et al. 2008); however, the technique has not been validated for the waters off California. If it can be demonstrated that the same methods used by NWSS in the Northwest in 2008 can be implemented in California, the NWSS welcomes a collaboration to extend the spatial coverage of the survey southward from the Northern California border to the Monterey Bay area. Such a southward extension of the survey would benefit the project considerably by allowing for a single coordinated synoptic survey effort that would extend from Cape Flattery to Monterey Bay.

Data collection

The photogrammetric-aerial digital camera mounting system and data acquisition system used in 2008 will be used to acquire digital images and to log data along the transects (Aerial Imaging Solutions; see Wespestad et al. 2008, Appendix A). The system records altitude, position, and spotter observations, which are directly linked to the time stamped quantitative digital imagery. Surveys will be flown with Piper Super Cub PA18 aircraft(s) at a speed of 80-90 mph. Surveys will be conducted on days when weather conditions permit clear visibility of the ocean surface from an altitude of 8000 ft (2438 m). Using standard photogrammetric relationships (see below), the approximate width-swept by the camera with a 24 mm lens is 12,000 ft (3657 m) at that altitude. Digital images will be collected with 60% overlap to ensure seamless coverage along the length of the transects.

In 2008, quantitative aerial photogrammetry was validated by collecting digital imagery of an object of known size (an airplane hangar) at a series of altitudes ranging from 500 ft. to 8000 ft. Additional validation will be conducted in 2009 to determine if a calibration constant can (or should) be used to improve accuracy based on this ground-truth information.

Digital images will be analyzed to determine the number, size, and shape of sardine schools on each transect. Adobe *Photoshop Lightroom 2.0* software will be used to bring the sardine schools into clear resolution and measurements of sardine school size (m^2) and shape (perimeter, circularity) will be made using Adobe *Photoshop CS3-Extended*. Transect width will be determined from the digital images using the basic photogrammetric relationship:

$$\frac{I}{F} = \frac{GCS}{A}$$

and solving for *GCS*:

$$GCS = \frac{I}{F}A$$

where I = Image width of the camera sensor (e.g. 36 mm), F = the focal length of the camera lens (e.g. 24mm), A = altitude, and *GCS* = "ground cover to the side" or width of the field of view of the digital image. Transect width is then obtained by taking the average of *GCS* for all images collected along the transect. Transect length is obtained from the distance between start and stop endpoints using the GPS data logged by the data acquisition system. Transect area is then the product of mean transect *GCS* and transect length.

As in 2008, purse seine vessels operating during periods of open fishing will again be used opportunistically to capture fish (i.e. "point sets") in conjunction with aerial over-flights to determine the relationship between school surface area (as documented with quantitative aerial photographs) and the biomass of fish schools (as measured from the

landed weight of fully captured schools). For fully captured schools, the total weight of the school will be recorded and numbers per unit weight will also be determined.

Point set data collected in 2008 were limited in scope. Few valid point sets were obtained, and those that were collected generally fell on the upper tail of the school size distribution as recorded during the aerial survey. For 11 point sets in 2008, school cover from aerial photographs ranged from 657.4 m^2 to 9308.4 m^2 with a mean of 3055.7 m^2 ; however, the majority of school size measurements taken from photographs along aerial survey transects fell between 200 – 2000 m^2 (cf. Wespestad et al 2008, Table 6 and Figure 8). To obtain better precision and representativeness in 2009, we will attempt to conduct a larger number of point sets, and will stratify point set sampling by school size. This effort will be facilitated by focused point set sampling which will be conducted during the EFP portion of the fishery, which will allow us to obtain additional point sets beyond those which could be obtained opportunistically during the fishery alone.

The project Principal Investigator(s) will specify how to spatially distribute the research set-aside portion of the sardine quota. It is critical that the limited research set-aside (1200 mt) is used sparingly and wisely to achieve the best scientific result. If the necessary proof of concept work can be completed in California (comparable quantitative aerial photography coupled with point sets, and associated echo sounding to measure school depth), a portion of the research set-aside may also be utilized in California to conduct point sets to compare spatial variation in the relationship between school surface area and biomass with observations from the Northwest.

Data analysis

School density. Belt or strip transects represent a special case of quadrat sampling; with the additional consideration that all transects may not be of equal length or area. In our survey, unequal transect areas can result from either 1) variation of transect width (e.g. from a lower visibility causing reduced flight altitude) or 2) variation in transect length (e.g. due to premature transect termination due to fog or other weather conditions). To account for this contingency, we will employ an unequal-area transect density estimator computed by dividing the mean number of sardine schools per transect by the mean transect area (Stehman and Salzer 2000). In this formulation

$$\hat{D} = \frac{\bar{y}}{\bar{a}}$$

Where $\hat{D}$ = the sample-based estimator of density, $\bar{y}$ = sample mean number of schools per transect, and $\bar{a}$ = sample mean transect area. The estimated variance of $\hat{D}$ is derived from standard ratio estimation theory as

$$\hat{V}(\hat{D}) = \frac{1}{\bar{a}^2}\left(\frac{N-n}{N}\right)\frac{s_e^2}{n} \quad \text{(Thompson 1992)}$$

where N = the total number of transects in the region, n = the number of transects sampled in the region, and $s_e^2 = \sum_u (y_u - \hat{D}a_u)^2 / (n-1)$ where y_u = the number of schools in transect u, and a_u = the area of transect u. Stehman and Salzer (2000) note that, while $\hat{V}(\hat{D})$ is an approximation generally valid for a sample size of 30 (Cochran 1977), simulations suggest it may also be valid for smaller sample sizes if the distribution of transect areas is nearly symmetric, or if the correlation between a and y is close to 1.

Total number of schools. Given the estimate of density $(\hat{D})$ and the total study area (A), an estimate of the total number of schools $(\hat{T})$ is

$$\hat{T} = \hat{D}A$$

and its standard error $\widehat{SE}(\hat{Z})$

$$\widehat{SE}(\hat{T}) = \widehat{SE}(\hat{D})A \quad .$$

School cover and biomass. Our measurements of the surface area of individual sardine schools from the digital imagery affords us the opportunity to estimate total sardine school cover. Cover is defined as the vertical projection of an object from the ground as viewed from above (Elzinga et al 2001). Let z_u denote the value for sardine school cover (m^2) on transect u. Cover for the entire study area $(\hat{Z})$ can then be estimated using the unbiased estimator for a population total, $\hat{Z} = N\bar{z}$, with estimated variance

$$\hat{V}(\hat{Z}) = \frac{N^2\left(1-\frac{n}{N}\right)s_z^2}{n}$$

where s_z^2 is the sample variance of z.

To estimate sardine biomass for the study area using school cover data, the relationship between individual school cover and school biomass is required,. An initial examination of this relationship in 2008 was explored by examining a scatter plot of school cover (m^2) vs. school biomass (mt) using the fishery point set data. As noted above, in 2009 we will attempt to increase the sample size and representativeness to improve quantification of this relationship.

Hydroacoustic Measurement of the Vertical Dimension

In 2009, NWSS will again use vessels equipped with echo sounders to attempt to measure the depth and height of schools in the Northwest. Each vessel will be equipped with a Simrad ES 60 recording echo sounders and connected to the ships 50/200 mHz

single beam transducers. This configuration will allow for recording of the water column under the ship. Our objectives in 2009 are: 1) to record school vertical dimensions prior to taking a purse seine set, and 2) to run portions of transects with the aerial survey to estimate the portion of sardine schools unobserved from the air.

As in 2008, echo sign will again be recorded continually throughout the season; however, in 2009, a directed effort will also be made during the EFP portion of the fishery to collect paired echo sign and aerial survey observations.

EFP Purse Seine Vessel Selection and On-Board Observation

Our priorities for selecting vessels to participate under this EFP will include: 1) vessels having demonstrated a previous successful involvement in the survey, 2) vessels which have installed the necessary electronic equipment or have the capacity to install this equipment, and 3) vessels having the ability to separate the point sets into different hatches. It must also be understood that we have limited funds for this project so it will be necessary that any vessel selected will have to work basically at cost.

At sea observation of point sets may be accomplished by volunteer observers from state or federal agencies, or from paid observers if funding permits. Alternatively, it may be preferable to obtain independent verification of the point set data via videotaping or other electronic methods. This will be further discussed at the STAR Panel meeting in May.

Disposition of fish harvested under the EFP

Fish harvested under this EFP will be sold to fund the sardine research described above. Participating processors will be identified prior to any fish deliveries made under this EFP, and they will process the fish at cost. Fish Tickets will be tabulated to verify that the sardine harvested under the EFP do not exceed the amount of harvest allocated for the research set-aside, and that the amounts harvested correspond to the total of the amounts harvested while conducting the point set research.

Budget

Funds derived from the capture and sale of the 1200 mt sardine research set-aside will be used to pay for the research to be conducted under this proposed EFP. The costs of the project will be paid for by the sale of the fish captured during the point sets. Fishing vessels will be chartered to catch the sardines and conduct echo soundings of fish schools. Participating processors will not profit on the sale of the EFP sardine quota; rather, they will process the fish at cost. Airplanes conducting the surveys and assisting in point set captures will work under hourly rates. Equipment needs, operational costs and scientific support will also be subtracted from the sale of the 1200 mt research quota. We anticipate the revenue from the fish sales will be sufficient to cover the costs to capture, process, and conduct the survey.

Conclusion

In summary, the proposed EFP will contribute substantially toward improving the data available to assess the sardine stock for management on the Pacific Coast. Building on the successful pilot survey work conducted in the Northwest in 2008, the EFP in 2009 will enable us to obtain critical information needed to convert aerial survey measurements of sardine school surface area into estimates of sardine biomass. Our efforts to accomplish this in 2008 were hampered without a set-aside of sardine OY for research. The research set-aside of OY under the EFP will provide a reliable source of funds and will allow us to conduct our work in a controlled, methodical manor, separate from the race for fish which ensues during the open access fishery. This will enable us to obtain a larger and more representative sample of point-sets to more precisely and accurately estimate sardine school density – an important parameter needed for sardine biomass estimation using the aerial survey method. If the methods applied in the Northwest in 2008 by NWSS can also be implemented in California we also welcome the opportunity to extend the survey southward to include Monterey Bay and nearby areas.

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California Aerial and Acoustic Sardine Survey

Justification for Exempted Fishing Permit in 2009

To be conducted in coordination with the PNW Survey to
extend the survey area synoptically along the Pacific Coast into California

February 18, 2009

California Wetfish Producers Association

PO Box 1951

Buellton, CA 9342

Background

This proposal is submitted to the Pacific Fishery Management Council to justify and request the use of up to 600 mt* of Pacific sardine through the Exempted Fishing Permit (EFP) process specified in the CPS Fishery Management Plan for use in California. The proposed survey is to expand and improve upon survey methods developed by the Northwest Sardine Survey LLC, a consortium of the Northwest Sardine Industry (PNW) during 2008 and 2009. The CWPA proposal closely follows the PNW EFP proposal in basic survey methods, and to ensure close approximation of techniques, employs the PNW proposal narrative extensively in this proposal.

(*Note: CA use of the set aside will be taken under the guidance of CA scientists, in coordination with PNW scientists, with the goal to achieve representative samples for school size, density and volume in both regions.)

The PNW survey conducted in 2008, was essentially a "proof of concept" project to determine if high quality, quantitative digital aerial imagery could be collected and processed on a scale large enough and rapidly enough for a practical fisheries stock assessment application – namely the in-season enumeration and measurement of sardine schools (Wespestad et al. 2008). The project was successful in developing the methodology and we intend to follow those survey methods as closely as possible to conduct a similar aerial survey of northern California coinciding with the PNW survey, and with intensive utilization and further enhancement of hydroacoustic methods in Monterey Bay, California.

The PNW survey recognizes that aerial counts of school number and measurements of school coverage (m2) as collected in 2008 are useful metrics to develop an index of abundance extending over a period of years for the sardine stock. PNW initial work has shown that point sets (setting a purse seine on a school of sardine to land and document actual school tonnage), coupled with quantitative aerial digital imagery, are a promising method to establish the relationship between sardine cover (m2) and biomass (mt) for this purpose. CWPA intends to further quantify this metric by using digital split beam scientific echosounders (one now owned by CWPA and a second transducer to be obtained). In addition, improving on the core survey protocol, we will also be working in partnership with acousticians from NMFS, SWFSC, who will deploy advanced acoustic equipment to further improve quantification of sardine schools (see Appendix A attached).

Because PNW incurred sampling limitations in 2008 that resulted in too few samples to quantify point sets with good accuracy or precision during the open derby fishing period, they are seeking a parallel research set-aside of sardine quota which was not available in 2008. CWPA also intends to conduct research sampling opportunistically during the directed fishery and, for similar reasons, we believe it necessary to have access to a portion of the research set aside, not to exceed 600 mt (*see note above), to focus undivided attention on conducting the survey with scientific rigor following the open access period.

During 2008, California Wetfish Producers Association (CWPA) tested the availability of sardine schools for aerial photographic surveys in Monterey Bay California. During four flights over Monterey Bay during daylight in summer and fall months, sardine schools of various sizes and depths in the water column were photographed, with pilot estimates of tonnage and actual landings recorded. These photographs were reviewed and enhanced to reveal that sardines were available during daylight hours and could be photographed as was done in PNW. Recent discussions with scientists of NMFS, SWFSC

resulted in the opportunity to improve the acoustic confirmation of sardine school size, volume, and density using advanced acoustic techniques and gear developed at SWFSC (see attached Appendix A). CWPA has reached agreement with SWFSC to cooperate in this survey in Monterey Bay in summer 2009, in conjunction with the aerial survey work planned by CWPA, and in coordination with the PNW survey.

The objective of this EFP request and that of PNW is to provide an opportunity to collect the scientific data needed to improve our quantification of sardine school density and improve understanding of the coast-wide sardine resource. The survey design to be employed by CWPA in California follows the plan developed by PNW, and will be timed to occur synoptically with the survey planned in the PNW, with close coordination and communication among contracted PNW and CA scientists.

Materials and Methods

Biological Sampling

As in 2008 and as proposed by PNW, samples will be routinely collected from vessels delivering at fish processing plants. Fishermen will keep observed research hauls (point sets) separate from the bulk of landings so total tonnage of observed hauls may be determined. Port sampling will be conducted opportunistically throughout the open fishing periods, and additionally during the EFP set-aside opening for research. Samples will be collected from unsorted catch while being pumped from the vessel. Fish will be taken at the start, middle, and end of a delivery as it is pumped. The three samples will then be combined and a random subsample of fish will be processed.

Length, weight, and maturity over the course of the season are of primary interest. Sardine weights will be taken using an electronic scale accurate to 0.5 gm. Sardine lengths will be taken using a millimeter length strip provided attached to a measuring board. Standard length will be determined by measuring from sardine snout to the last vertebrae. Random otolith samples will also be taken for aging analysis. Sardine maturity will be established by referencing maturity codes (female- 4 point scale, male- 3 point scale) supplied by Beverly Macewicz NMFS, SWFSC (Wespestad et al 2008, Table 1a).'

Aerial Survey

Survey design

Following PNW protocol, the CWPA survey will employ the belt transect method using a systematic sampling design; with each transect a single sampling unit (Elzinga et al 2001). From a random starting point, parallel transects will be conducted offshore along the coast. To fully encompass the expected width of the sardine school distribution transects will originate at the shoreline and will extended offshore to include the extent of sardine schools. Transects will be spaced approximately 10 miles apart. An estimated 24 transects is planned, based on survey design by PNW scientists, intended to survey the coast from the OR/CA border to at least Monterey Bay. The full scope of the CWPA survey spatial coverage will be determined by the actual level of funding derived from the sale of the EFP sardine set-aside for research and CWPA contributions to the research project.

Data collection

CWPA will use photogrammetric-aerial digital camera mounting equipment and data acquisition systems similar to the PNW system. CWPA will use the same techniques described by PNW below:

'The system will record altitude, position, and spotter observations, which are directly linked to the time stamped quantitative digital imagery. Surveys will be flown with Piper Super Cub PA18 aircraft(s) at a speed of 80-90 mph. Surveys will be conducted on days when weather conditions permit clear visibility of the ocean surface from an altitude of 8000 ft (2438 m). Using standard photogrammetric relationships (see below), the approximate width-swept by the camera with a 24 mm lens is 12,000 ft (3657 m) at that altitude. Digital images will be collected with 60% overlap to ensure seamless coverage along transects.

In 2008, PNW validated quantitative aerial photogrammetry by collecting digital imagery of an object of known size (an airplane hangar) at a series of altitudes ranging from 500 ft. to 8000 ft. Additional validation will be conducted in 2009 to determine if a calibration constant can (or should) be used to improve accuracy based on this ground-truth information.

Digital images will be analyzed to determine the number, size, and shape of sardine schools on each transect. Adobe Photoshop Lightroom 2.0 software will be used to bring the sardine schools into clear resolution and measurements of sardine school size (m2) and shape (perimeter, circularity) will be made using Adobe Photoshop CS3-Extended. Transect width will be determined from the digital images using the basic photogrammetric relationship:

$$\frac{I}{F} = \frac{GCS}{A}$$

and solving for GCS:

$$GCS = \frac{I}{F}A$$

where I = Image width of the camera sensor (e.g. 36 mm), F = the focal length of the camera lens (e.g. 24mm), A = altitude, and GCS = "ground cover to the side" or width of the field of view of the digital image. Transect width is then obtained by taking the average of GCS for all images collected along the transect. Transect length is obtained from the distance between start and stop endpoints using the GPS data logged by the data acquisition system. Transect area is then the product of mean transect GCS and transect length.

As in 2008, purse seine vessels operating during periods of open fishing will again be used opportunistically to capture fish (i.e. "point sets") in conjunction with aerial over-flights to determine the relationship between school surface area (as documented with quantitative aerial photographs) and the biomass of fish schools (as measured from the landed weight of fully captured schools). For fully captured schools, the total weight of the school will be recorded and numbers per unit weight will also be determined.

Point set data collected in 2008 by PNW were limited in scope. Few valid point sets were obtained, and those that were collected generally fell on the upper tail of the school size distribution as recorded during the aerial survey. For 11 point sets in 2008, school cover from aerial photographs ranged from 657.4 m2 to 9308.4 m2 with a mean of 3055.7 m2 ; however, the majority of school size measurements taken from

photographs along aerial survey transects fell between 200 – 2000 m2 (cf. Wespestad et al 2008, Table 6 and Figure 8). Thus, to obtain better precision and representation in 2009, the PNW will attempt to conduct a larger number of point sets, and will stratify point set sampling by school size. This effort will be facilitated by focused point set sampling which will be conducted during the EFP portion of the fishery, which will allow the survey to obtain additional point sets beyond those which could be obtained opportunistically during the fishery alone. The CA survey also will conduct a number of point sets to provide a scientifically acceptable sample size, and will target schools of varying sizes.

Data analysis (from PNW request)

Note: To ensure consistency of survey analysis the CA survey will follow the procedure proposed by PNW for data analysis:

Belt or strip transects represent a special case of quadrat sampling; with the additional consideration that all transects may not be of equal length or area. In our survey, unequal transect areas can result from either 1) variation of transect width (e.g. from a lower visibility causing reduced flight altitude) or 2) variation in transect length (e.g. due to premature transect termination due to fog or other weather conditions). To account for this contingency, we will employ an unequal-area transect density estimator computed by dividing the mean number of sardine schools per transect by the mean transect area (Stehman and Salzer 2000). In this formulation

$$\hat{D} = \frac{\bar{y}}{\bar{a}}$$

Where $\hat{D}$ = the sample-based estimator of density, $\bar{y}$ = sample mean number of schools per transect, and $\bar{a}$ = sample mean transect area. The estimated variance of $\hat{D}$ is derived from standard ratio estimation theory as

$$\hat{V}(\hat{D}) = \frac{1}{\bar{a}^2}\left(\frac{N-n}{N}\right)\frac{s_e^2}{n} \quad \textbf{(Thompson 1992)}$$

where N = the total number of transects in the region, n = the number of transects sampled in the region, and $s_e^2 = \sum_s \left(y_u - \hat{D}a_u\right)^2 /(n-1)$ where y_u = the number of schools in transect u, and a_u = the area of transect u. Stehman and Salzer (2000) note that, while $\hat{V}(\hat{D})$ is an approximation generally valid for a sample size of 30 (Cochran 1977), simulations suggest it may also be valid for smaller sample sizes if the distribution of transect areas is nearly symmetric, or if the correlation between a and y is close to 1.

Total number of schools. Given the estimate of density $(\hat{D})$ and the total study area (A), an estimate of the total number of schools $(\hat{T})$ is

$\hat{T}=\hat{D}A$

and its standard error $\widehat{SE}(\hat{Z})$

$\widehat{SE}(\hat{T})=\widehat{SE}(\hat{D})_{\mathrm{A}}$.

School cover and biomass. Our measurements of the surface area of individual sardine schools from the digital imagery affords us the opportunity to estimate total sardine school cover. Cover is defined as the vertical projection of an object from the ground as viewed from above (Elzinga et al 2001). Let zu denote the value for sardine school cover (m2) on transect u. Cover for the entire study area $(Z^{\wedge})$ can then be estimated using the unbiased estimator for a population total, $\hat{Z} = N\bar{z}$, with estimated variance

$$\hat{V}(\hat{Z}) = \frac{N^2\left(1-\frac{n}{N}\right)s_z^2}{n}$$

where s_z^2 is the sample variance of z.

To estimate sardine biomass for the study area using school cover data, the relationship between individual school cover and school biomass is required. An initial examination of this relationship in 2008 was explored by examining a scatter plot of school cover (m2) vs. school biomass (mt) using the fishery point set data.'

Hydroacoustics

CWPA will use vessels equipped with echo sounders to attempt to measure the depth and height of schools from the fishing vessels. CWPA will simultaneously deploy BioSonics DT~X digital scientific split beam transducers to quantify school size and density. In Monterey Bay this protocol will be enhanced by deployment of SWFSC acoustic equipment operated by SWFSC acousticians as described in Appendix A. This additional acoustic measurement will be conducted in cooperation with CWPA and in conjunction/communication with the PNW survey.

Our objectives are: 1) ground truth aerial observations by recording school size and density prior to making a purse seine "point set", and 2) to compare/quantify acoustic transects with the aerial survey to estimate the portion of sardine schools observed and unobserved from the air.

EFP Purse Seine Vessels and On-Board Observation

Three purse seine vessels (CWPA members) have agreed to participate in this survey, fishing at cost. They will cooperate with NMFS and CDFG to ensure full compliance with the EFP.

As with PNW, at sea observation of point sets may be accomplished by volunteer observers from state or federal agencies, or from paid observers if funding permits. Alternatively, it may be preferable to obtain independent verification of the point set data via videotaping or other electronic methods. This will be further discussed at the STAR Panel meeting in May.

Disposition of fish harvested under the EFP

Fish harvested under this EFP will be sold to fund the sardine research described above. Participating processors have been identified for fish deliveries made under this EFP, and they will process the fish at cost. Fish Tickets will be tabulated to verify that the sardine harvested under the EFP do not exceed the amount of harvest allocated for the research set-aside, and that the amounts harvested correspond to the total of the amounts harvested while conducting the point set research.

Budget

Funds derived from the capture and sale of up to 600 mt of the sardine research set-aside taken during point sets outside the directed fishing period will be used to pay for the research to be conducted under this proposed EFP. Participating processors will not profit from the sale of the EFP sardine quota; rather, they will process the fish at cost and remit the proceeds to CWPA. As a 501(c) nonprofit, CWPA will serve as repository for the proceeds of fish sold in the California portion of the research survey. Fishing vessels will be chartered to catch the sardines and conduct echo soundings of fish schools. Airplanes conducting the surveys and assisting in point set captures will work under hourly rates. Equipment needs, operational costs and scientific support will also be subtracted from the sale of the 600 mt research quota. As with PNW, CWPA anticipates the revenue from the fish sales will be sufficient to cover the costs to capture, process, and conduct the survey.

Conclusions

As we testified in November 2008, we believe developing a second index of sardine abundance is essential to achieve effective sardine management, and we support the aerial survey methodology developed by the Pacific Northwest sardine industry. CWPA and CA members of the CPS Advisory Subpanel also supported increasing the research set aside from 600 mt to 1,200 mt to enable the CA wetfish industry to participate in a synoptic [or near synoptic] aerial survey in the summer of 2009, when

CA sardines are present and visible at the surface during daylight hours. Extending the survey into California this year is important to improve understanding of the extent of the resource and coast-wide migration patterns. As noted above, we request a portion of the research set aside to conduct this survey in California. CA use of the set aside will be taken under the guidance of CA scientists, in coordination with PNW scientists, with the goal to achieve representative samples for school size, density and volume in both regions.

We have invested substantial time and money into sardine research, and like PNW industry, we require both the undivided time outside the derby fishery and proceeds from the sale of research fish to effectively accomplish this research in a scientifically approved manner. We have offered, and continue to offer, to work cooperatively in conjunction with PNW scientists to conduct a successful survey that will both improve survey methodology through the use of advanced acoustic technology, and expand knowledge of the sardine resource. Developing a repeatable annual summer survey to measure the [near] coast-wide extent of the sardine resource, augmenting spring egg production surveys, will achieve our ultimate goal to inform and improve the coast-wide stock assessment.

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Appendix A. Proposed Quantitative Acoustic Ground Truth of Sardine School Aerial Surveys in Monterey Bay.

Contact: David Demer, SWFSC (david.demer@noaa.gov)

Methods

Aerial surveys are to be conducted for schools of sardine. The remote observations of near-surface fish schools will be used to estimate fish abundance. These estimates are to be validated by purse-seine capture of a number of schools. Here we propose to augment these measurements with active-acoustic measurements made with a multi-frequency split-beam echosounder system (Simrad EK60), and a single-frequency multi-beam sonar (Kongsberg-Mesotech SM20/2000). After a fish school is spotted, and before it is netted, a vessel equipped with the acoustic instrumentation will drive around the school to acoustically estimate the size and shape of the school; and then drive over the school multiple times to acoustically estimate the fish density.

EK60 multi-frequency echosounder

Throughout the survey, volume backscattering strengths (Sv; dB re 1 m) and in-situ target strengths (TS; dB 1 m2) will be measured continuously by four calibrated Simrad EK60 split-beam echosounders operating at frequencies of 38, 70, 120, and 200 kHz. The echosounders will be configured with Simrad ES38-12, ES70-7C, ES120-7C, and ES200-7C transducers. The four split-beam transducers will be pole mounted on the side of the ship's hull, and positioned approximately 2m beneath the water surface. Synchronized pulses of 1024 μs will be transmitted downward every 0.5 seconds, received with bandwidths of 0.8745, 1.6375, 2.3435, 2.7785, and 2.986 kHz, respectively, digitized to a range of 150 m, and stored in .raw-data format. Except for the EK60 sounders being used for these surveys, all other echo sounders and sonars operating at or near the survey frequencies will be secured.

SM20/SM2000 Multi-beam sonar

A Kongsberg-Mesotech SM2000 200 kHz multi-beam sonar (180 degree-head with a nominal 155 degree usable swath) and an SM20 processor will be used. The system forms 128 beams that insonify a 180 degree swath. The SM2000 has two transducers: a cylindrical array that can be used to both transmit and receive when operating in imaging mode; and a long stave that can be used as the transmitter, when operated in echosounding mode, with receiving on the cylindrical array. This survey will be conducted in echosounding mode only. The SM2000 sonar head will also be mounted on a pole, attached at an angle of 30 degrees off vertical at a depth of apx. 2 m below the mean water surface.

Triggering

One of the EK60s and the SM2000 both operate at 200 kHz. Therefore, the EK60s and the SM20 processor surface telemetry board (STB) will be triggered using a multiplexer unit. Triggering will be synchronous for all EK60s, and asynchronous (alternating) between the EK60s and the SM20 to prevent interference. That is, a trigger pulse will be sent to the EK60s every second; one-half second after the pulse is sent to the EK60s, a pulse will be sent to the SM20.

COASTAL PELAGIC SPECIES ADVISORY SUBPANEL REPORT ON AN EXEMPTED FISHING PERMIT (EFP) FOR SARDINE RESEARCH

The Coastal Pelagic Species Advisory Subpanel (CPSAS) reviewed and discussed the exempted fishing permit application for a Pacific Coast sardine survey to utilize the 1,200 metric tons set-aside by the Council at its November 2008 meeting for survey work in the second period of the 2009 directed fishery. The CPSAS supports the application and unanimously recommends its implementation and its adoption by the Council for public review. The CPSAS understands that survey design and implementation will be under the oversight of Dr. Tom Jagielo and Dr. Vidar Wespestad. The CPSAS understands that the EFP survey design will be vetted by the May 2009 stock assessment review panel. The CPSAS also anticipates that this survey work will continue into the future.

PFMC
03/04/09

COASTAL PELAGIC SPECIES MANAGEMENT TEAM REPORT ON AN EXEMPTED FISHING PERMIT (EFP) FOR SARDINE RESEARCH

The Coastal Pelagic Species Management Team (CPSMT) reviewed a draft exempted fishing permit (EFP) proposal submitted by Northwest Sardine Survey, LLC at its February 10-11, 2009 meeting in La Jolla, California. A revised proposal from Northwest Sardine Survey, LLC (Agenda Item C.2.a, Attachment 1) and a proposal submitted by the California Wetfish Produces Association (Agenda Item C.2.a, Attachment 2) were submitted for the March 2009 briefing book and were unavailable for CPSMT review in February. The CPSMT has repeatedly recommended that additional fishery-independent indices of Pacific sardine abundance be developed to achieve this goal. The CPSMT endorses the effort by the coastwide sardine fishing industry to conduct a cooperative sardine survey to provide sound scientific data for inclusion in the stock assessments for Pacific sardine. However, the CPSMT stresses that such a survey should be well coordinated, synoptic in coverage, and repeatable on a systematic basis. It is imperative that a rigorous data collection plan be in place at the onset of a new survey-based time series that is intended to be included as relative index of abundance in stock assessment modeling efforts.

The CPSMT recommends the development of a detailed sampling design and area coverage estimate that utilizes the 1,200 mt research set-aside with the goal of providing the most extensive geographic coverage and ultimately, statistically sound results for future management. The sampling design should be prepared for review by the Stock Assessment Review Panel in May 2009 and the Scientific and Statistical Committee in June. To benefit both public and scientific review of an EFP proposal, the CPSMT recommends that representatives of the Pacific sardine industry provide a single proposal as soon as feasible for publication on the Council website. The proposal should include: a list of the principal and cooperating investigators and a clear definition of their roles, a detailed sampling design, estimates of geographic coverage with sample sizes, a description of the vessels that will potentially participate in the survey, and a detailed budget.

PFMC
03/04/09

SCIENTIFIC AND STATISTICAL COMMITTEE REPORT ON EXEMPTED FISHING PERMIT (EFP) FOR SARDINE RESEARCH

The Scientific and Statistical Committee (SSC) reviewed two Exempted Fishing Permit (EFP) applications submitted for 2009 research on aerial surveys for estimation of sardine biomass. At issue is the allocation of 1200 MT of sardine for research. The SSC heard presentations by representatives of each of the EFP applicants: Tom Jagielo of the Northwest Sardine Survey, who presented results of a pilot study from 2008, and Diane Pleschner-Steele of California Wetfish Producer's Association, who presented plans for surveys in California.

The Northwest Sardine Survey has made methodological progress through their pilot study and is planning additional data collection to relate aerial survey photos to school biomass. This is essential if a broad-scale aerial survey is to be used to estimate total stock biomass or to develop an index of abundance for use in stock assessment. Both EFP applicants agree to work together on aerial transect and photo methodology to assure that data are compatible for analysis.

We support an aerial survey from Cape Flattery to Monterey Bay using standardized sampling to determine school distribution and abundance. However, the SSC notes that this does not cover the entire range of the stock. The surveys in the north and south portions of this range should be synchronous to avoid potential biases due to school migration. The study plan should clarify how the researchers will confirm that schools identified by pilots are sardine, as opposed to anchovy or other schooling fish. The visual characteristics of non-sardine schools should be identified to assure proper exclusion during analysis of the aerial transect data. The estimated biomass of confirmed sardine schools then needs to be determined through point set sampling. The preliminary data suggest that biomass is variable among schools of similar surface area; this variability needs to be characterized for schools of different sizes in different geographic regions. Variable environmental conditions, depth of schools, fish density within schools and capture techniques may lead to differences in the predicted relationship between school surface area and biomass. A review of historical sardine aerial surveys may provide information on fish behavior and day-night differences. The SSC recommends that the point set sampling for the 2009 EFP be allocated to cover the spatial extent of the study area and sample schools of different sizes.

It will take some time to fully develop survey methods to generate rigorous, reliable data for use in stock assessment. Given the set-aside for 2009 and the biomass of medium to large-sized schools (50+ MT each), it is unlikely that all of these issues can be addressed this year. Mr.

Jagielo will have an initial power analysis complete for the May STAR Panel meeting for a discussion of appropriate sample sizes to characterize variability. A full survey design will be needed three weeks in advance of this meeting. A full survey report, and diagnostics of sources of uncertainty will be needed for the STAR Panel review in September. The SSC will ultimately need to assess the utility of the aerial survey approach for stock assessment.

Both groups of researchers should continue to work together on standardized methods to assure that their results can be combined for evaluation. The SSC commends the applicants for their cooperation and industry collaboration in this important research.

PFMC
03/08/09

Pacific Fisheries Management Council

Mike Burner,

We felt it necessary to explain our position with regards to the Exempted Fishing Permit (EFP) Application. As you may know the California Wetfish Producers Association (CWPA- Ms. Diane Pleschner-Steele) and the Northwest Sardine Survey, LLC did not reach an agreement on how to jointly manage a coastal sardine survey. Sadly, we will be submitting our EFP Application separately.

The purpose of the aerial survey was to document an abundance of sardines greater than what was predicted by the current assessment model with the final goal of having this data included in the model. To meet this objective it is best to survey as much of the Pacific Coast as possible. And, the EFP Application does include a plan to extend the survey into California. The last thing we want is to limit the surveys to the Northwest. Expanding the survey to only help our efforts.

We fully encourage CWPA and anyone from California to develop a program that gets us better data about sardines. Having said that it is far from certain that the Monterey sardines can be photographed from an airplane during daylight hours the same way they can in the PNW. We suspect that there is a method to capture fish with digital equipment and to quantify their abundance but it may mean employing different tools or taking photographs at night. We feel that it is reasonable to ask for a "proof of concept" development as opposed to a blind assumption that the research will track in the exact fashion as it did in the PNW.

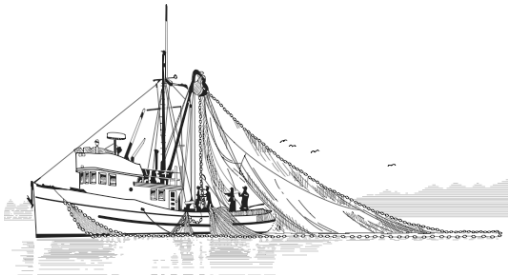
As we worked to accommodate CWPA in our EFP Application it became apparent that they would not allow for a “proof of concept” study prior to deciding where the 1200 ton EFP be used. Our proposal was to have the designers of the Northwest Sardine Survey, Mr. Tom Jagielo and Dr. Vidar Wespestad involved to administer and direct a “proof of concept” survey in California. They would then decide how best to use the 1200 ton set aside. It is not important whether they decide that best use of the EFP is in the Northwest or California. What is important is that 1200 tons be used to achieve the best scientific outcome.

It is still possible to move forward for the benefit of all industry participants in the Northwest and California. We request that the CWPA acquire a digital camera system mounted in an airplane with the same capabilities as used in the NW survey, set up a computer with adequate software to record and measure the surface area of fish schools and a scientific recording depth sounder to measure the thickness of fish schools on a fishing vessel. The task is not difficult, especially with our help.

We are still very much committed to assisting the Californians in performing a scientifically accepted survey but it must follow a proven method in order to satisfy the Stock Assessment Review Panel and the Scientific and Statistical Committee. Anything short of this will be wasting the 1200 ton EFP.

Regards,

Jerry Thon
Northwest Sardine Survey, LLC



CALIFORNIA WETFISH PRODUCERS ASSOCIATION

Representing California's Historic Fishery

VISIT WWW.CALIFORNIAWETFISH.ORG FOR INFORMATION

Mr. Don Hansen, Chair &
Dr. Don McIsaac, Executive Director
Pacific Fishery Management Council
7700 NE Ambassador Place #200
Portland OR 97220-1384

RE: Agenda Item C.2.c.: Experimental Fishing Permit (EFP) for Sardine Research (including CA)

Dear Chairman Hansen, Dr. McIsaac and Council members,

The California Wetfish Producers Association (CWPA) represents the majority of sardine processors and active wetfish fishermen from both Monterey and southern California. We very much appreciate this opportunity to address the Council on the subject of Pacific sardine research.

As we testified in November 2008, we believe developing a second index of sardine abundance is essential to achieve effective sardine management, and we support the aerial survey methodology developed by the Pacific Northwest sardine industry. CWPA and CA members of the CPS Advisory Subpanel also supported increasing the research set aside from 600 mt to 1,200 mt to enable the CA wetfish industry to participate in a synoptic [or near synoptic] aerial survey in the summer of 2009, when CA sardines are present and visible at the surface during daylight hours. Extending the survey into California this year is important to improve understanding of the extent of the resource and coast-wide migration patterns. We request a portion of the research set aside to conduct this survey in California this year. CA use of the set aside will be taken under the guidance of CA scientists, in coordination with PNW scientists, with the goal to achieve representative samples for school size, density and volume in both regions that can be integrated to improve knowledge of the sardine resource.

Based on early communications with PNW industry, we had planned to participate in a joint EFP and aerial survey this summer, with CWPA's contracted scientist coordinating the CA portion in cooperation with PNW scientists. However, our recent efforts to integrate the CA survey elements into the draft EFP developed by PNW coordinators were rejected by PNW industry, revised and replaced with caveats and preconditions to 'prove up' that may be virtually impossible to meet within the short opening expected for the summer directed sardine fishery. Absent this arbitrary 'approval' prior to the conclusion of directed fishing, CA would be denied access to a portion of the research allocation, according to the 'final' modified PNW EFP proposal that we received late afternoon on Tuesday, February 17. We view this late-blooming lack of cooperation from PNW industry with dismay, particularly in light of enthusiastic communications among PNW and CA scientists.

PO BOX 1951 BUELLTON, CA 93427 TELEPHONE 805-693-5430 FAX 805-686-9312
EMAIL <DPLESCH@EARTHLINK.NET>

Of necessity, we are submitting a parallel EFP, outlining the CA portion of the survey, and omitting the preconditions.

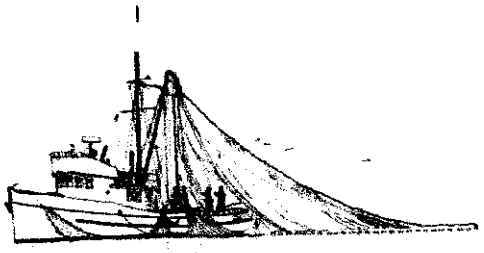
The parallel EFP submitted by CWPA follows the basic methodology developed by the PNW in 2008, and in fact adopts most of the original text re: methods and analysis. It simply fleshes out the CA portion of the survey, and requests that CA be allowed to use 'up to 600 mt' of the research set aside, with the understanding that CA use of the set aside will be taken under the guidance of CA scientists, in coordination with PNW scientists, with the goal to achieve representative samples for school size, density and volume in both regions.

CWPA's contracted scientist and PNW scientists have agreed to cooperate to facilitate a science-based survey in 2009, to occur synoptically in both PNW and California/Monterey. SWFSC acoustic experts also have expressed interest in working cooperatively with the research team to improve hydroacoustic measurement of sardine schools in the context of this aerial survey.

We appreciate the Council's interest in this research and urge the Council to approve the EFP, and to allow CA to participate in this research project outside the summer directed fishing period.

Thank you for your consideration.
Best regards,

Diane Pleschner-Steele
Executive Director



CALIFORNIA WETFISH PRODUCERS ASSOCIATION

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RE: Agenda Item C.2.c.: Experimental Fishing Permit (EFP) for Sardine Research (including CA)

Dear Chairman Hansen, Dr. McIsaac and Council members,

As we testified in November 2008 and indicated in comments on this EFP, we believe developing a second index of sardine abundance is essential to achieve effective sardine management. CWPA and CA members of the CPS Advisory Subpanel also supported increasing the research set aside from 600 mt to 1,200 mt to enable the CA wetfish industry to participate in a synoptic [or near synoptic] aerial survey in the summer of 2009. Extending the survey into California this year is important to improve understanding of the extent of the resource and coast-wide migration patterns.

In response to objections voiced by PNW industry that the planned survey methodology might not be repeatable in daylight in CA, hence their requirement for "proof of concept" prior to being allowed to participate in the EFP, we prepared the attached powerpoint presentation for the Science and Statistical Team.

We note for the record that sardines ARE readily available in daylight hours: we documented this in 2008 by sending Dr. Doyle Hanan to Monterey twice during the open fishing period to photograph sardines from the air. **We plan to use the same methodology as described in the PNW EFP proposal, including the same camera and hydroacoustic equipment, deployed in the same way to record school shape.**

In addition, we will also use the Biosonics DT-X, deployed with both down-sound and side-looking capabilities to better quantify school density. Further, the SW Fisheries Science Center is interested in participating in expanded hydroacoustic research, and has offered to deploy its state-of-the-art acoustic equipment in conjunction with our summer survey, with the intent of developing an acoustic estimate of abundance.

We appreciate the offer of assistance from the PNW industry extended in the cover letter to the PNW EFP proposal, and we suggest that since we've already demonstrated that sardine are readily available during daytime and our core methodology parallels the protocol initiated by PNW industry in 2008, the NWSS agree to remove the "proof of concept" requirements from their EFP and join with CA to expand this survey as we've described, under guidance from the scientists from both PNW and CA.

PO Box 1951 Buellton, CA 93427 Telephone 805-693-5430 Fax 805-686-9312
Email <dplesch@earthlink.net>

We again request that the Council authorize a portion of the research set aside to conduct this survey in California this year – [without preconditions that will be impossible to meet in the very short open fishing period].
CA use of the set aside will be taken under the guidance of CA scientists, in coordination with PNW scientists, with the goal to achieve representative samples for school size, density and volume in both regions that can be integrated to improve knowledge of the sardine resource.

CWPA's contracted scientist and PNW scientists have agreed to cooperate to facilitate a science-based survey in 2009, to occur synoptically in both PNW and California/Monterey.

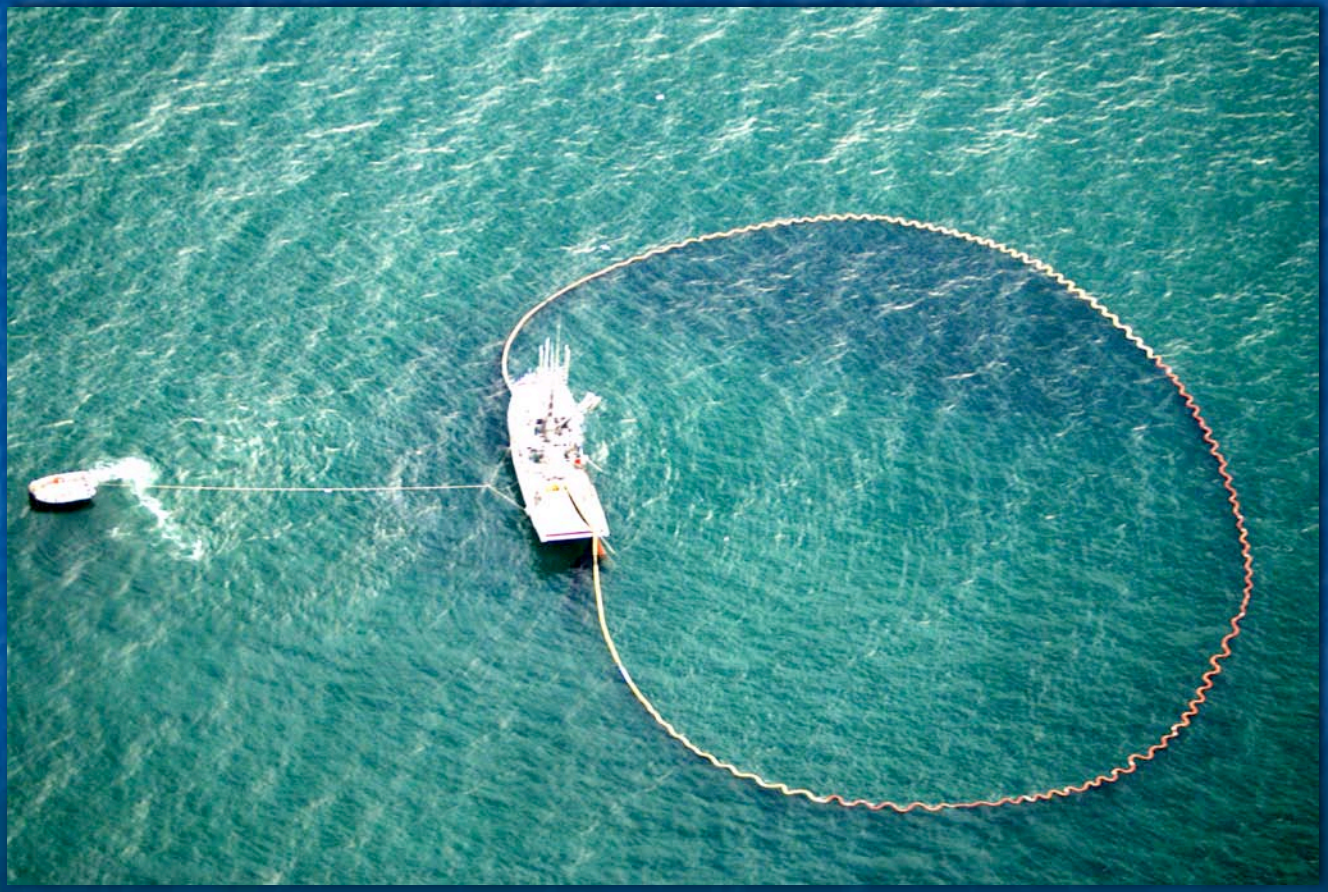
Again, we appreciate the Council's interest in this research and urge the Council to approve the EFP without preconditions, allowing CA to participate in this research project outside the summer directed fishing period.

Thank you for your consideration.
Best regards,

Diane Pleschner-Steele

Diane Pleschner-Steele
Executive Director

CWPA 2009 Proposed Sardine Research Summary

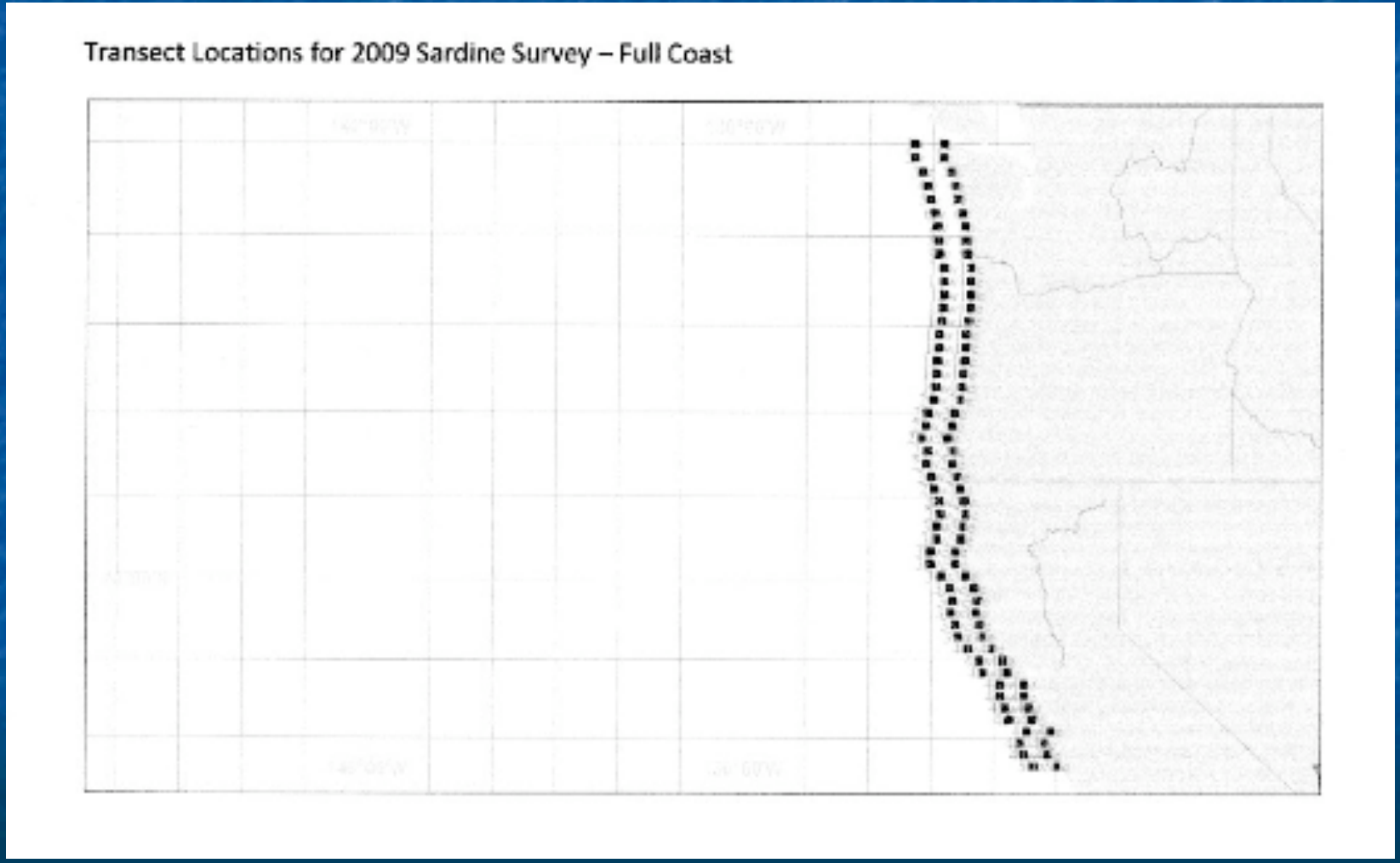


CWPA RESEARCH OBJECTIVES:

- 1. Reproduce PNW sardine aerial survey methods in CA
  - Use **Aerial Imaging Solutions FMC Mount System** on Piper Cub (same camera system, same plane) and Simrad ES 60 recording echosounder connected to vessel's 50/200 mHz single beam transducer to document school dimensions and relative density (same acoustic measurement)
  - Deploy **Biosonics DT-X** to measure school size, density and volume
  - Goal: achieve representative samples of school size in both PNW and CA to illustrate [synoptically] range of sardine resource on west coast and enhance scientific acceptance of this method

- 2. In addition, SWFSC scientists volunteered to work with the research team to quantify measurement of sardine schools in conjunction with aerial surveys, deploying state-of-the art acoustics

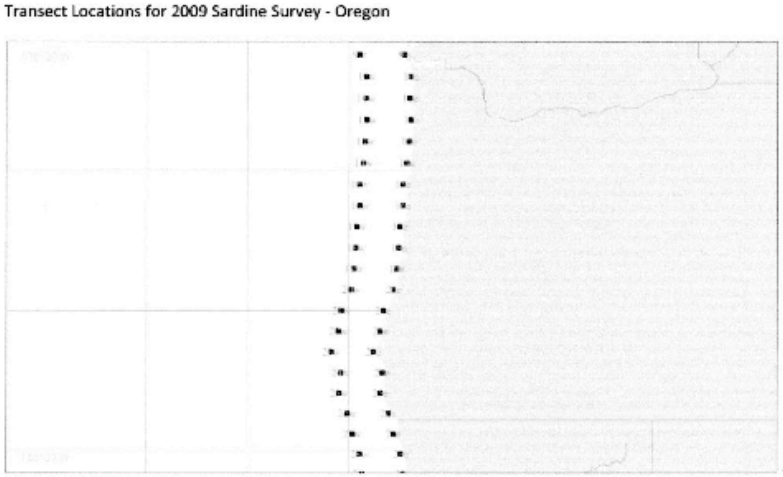
Example: PROPOSED TRANSECT LINES (developed by PNW science advisor)

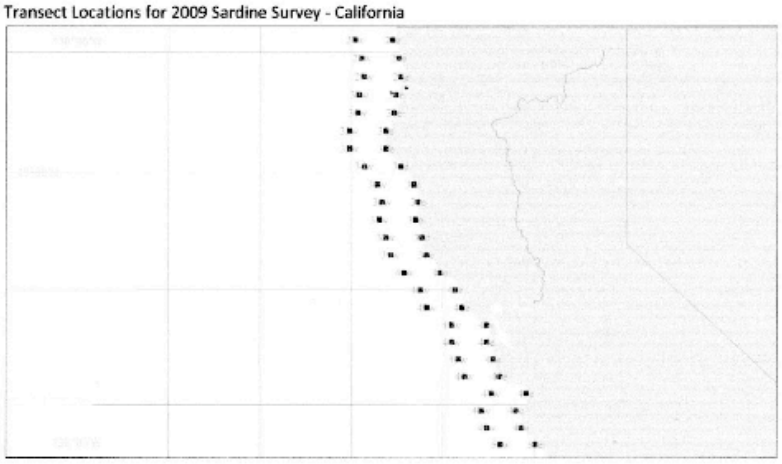


Example: PROPOSED TRANSECT LINES (developed by PNW science advisor)

Proposed transects run approx. every 10 miles from random point at coast offshore to far extent of sardine population

Estimated 24 transects in CA





BioSonics

DT-X Digital Scientific Echosounder

The Industry Standard

World's Most Widely Used System

Reliable, Consistent, & Accurate

Digital Technology

Cleaner Signal & Better Data

Unique Multiplexing Capabilities

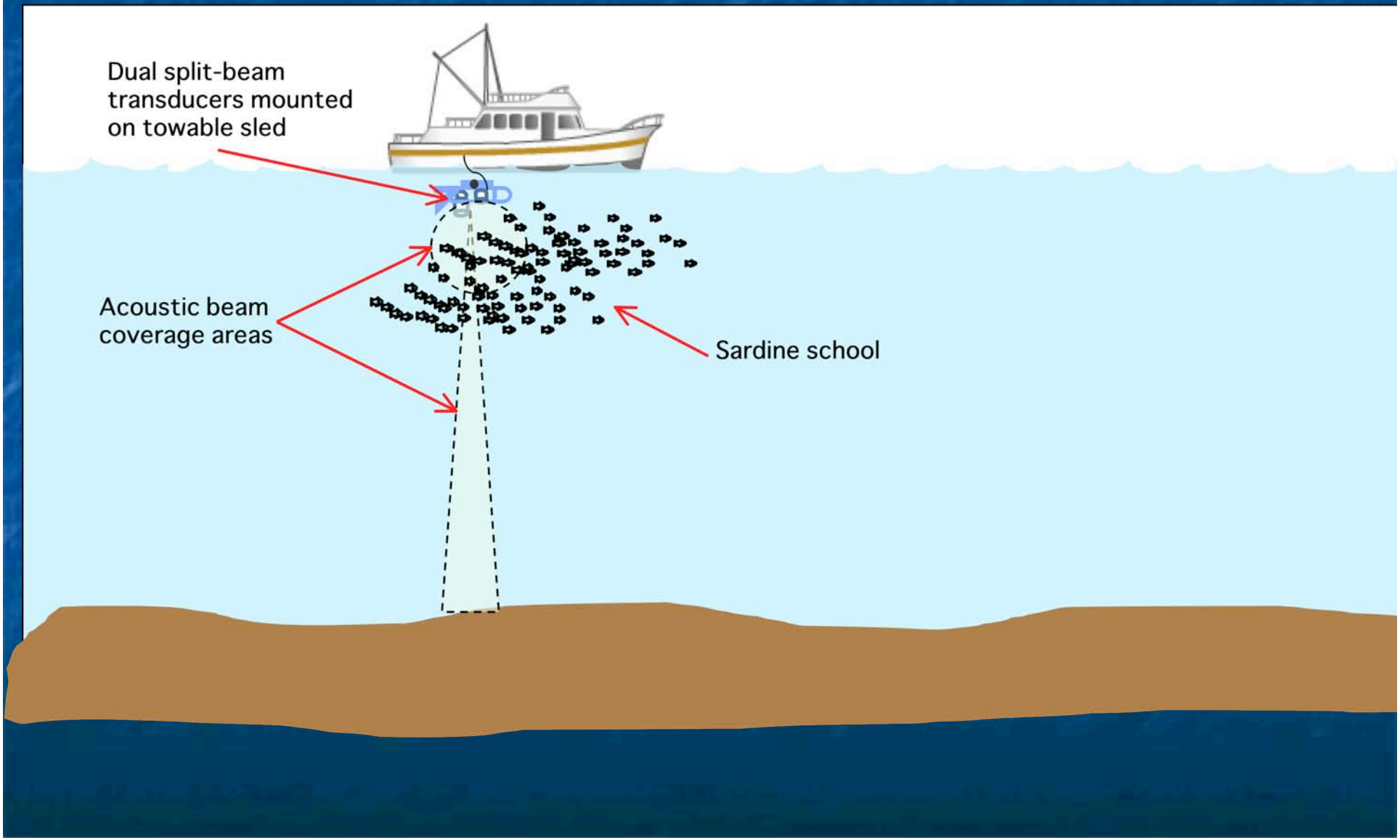
Lower Cost, Less Maintenance, Easier Set Up

BioSonics

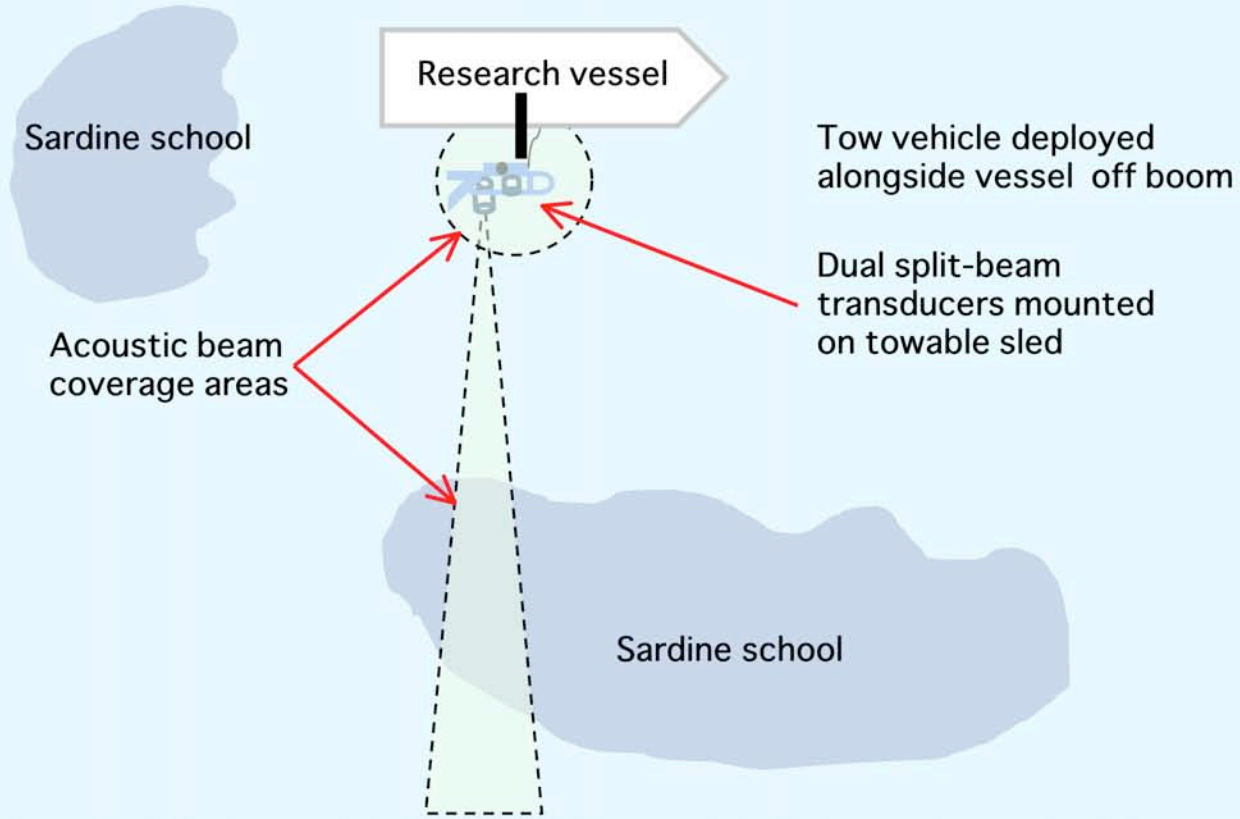
BioFin Towing Body for Transducer Mounting

- Adaptable towing bodies for inland waters or ocean applications
- Rugged, dead-weight design provides stable platform for fisheries hydroacoustic sensors
- Attaches quickly and easily to research vessel

Hydroacoustic Survey- Profile View
Multiplexing with 2 Transducers -Vertical and Horizontal



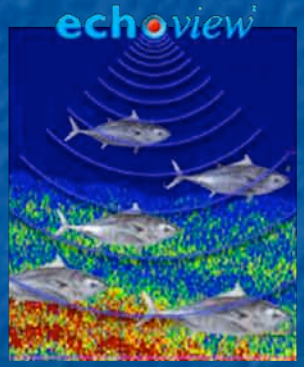
Hydroacoustic Survey- Plan View
Multiplexing with 2 Transducers -Vertical and Horizontal

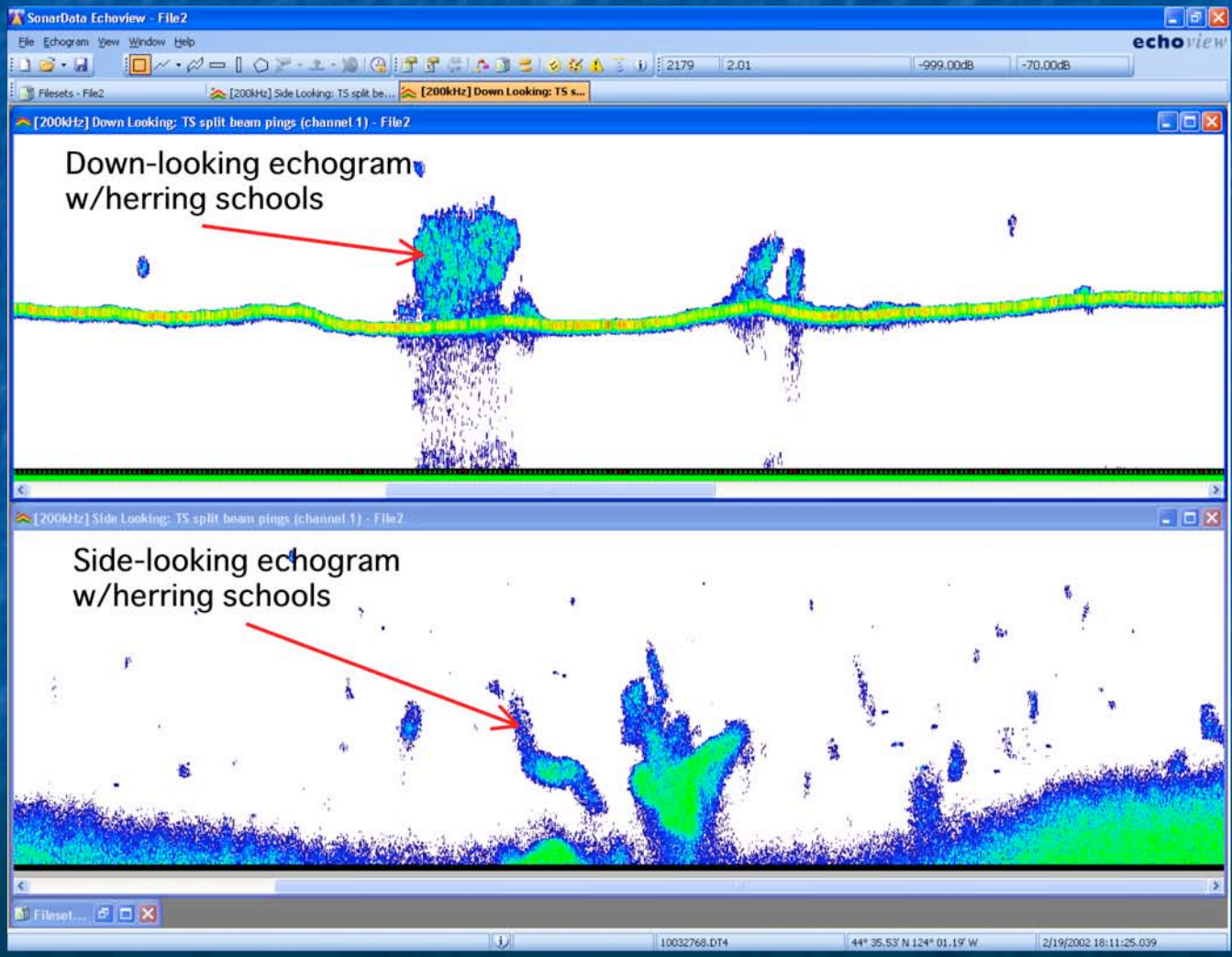


BioSonics

Data Analysis Using EchoView Software

School detection & biomass estimation using echo integration techniques





CA Sardine are readily available in Monterey during daylight hours in summertime

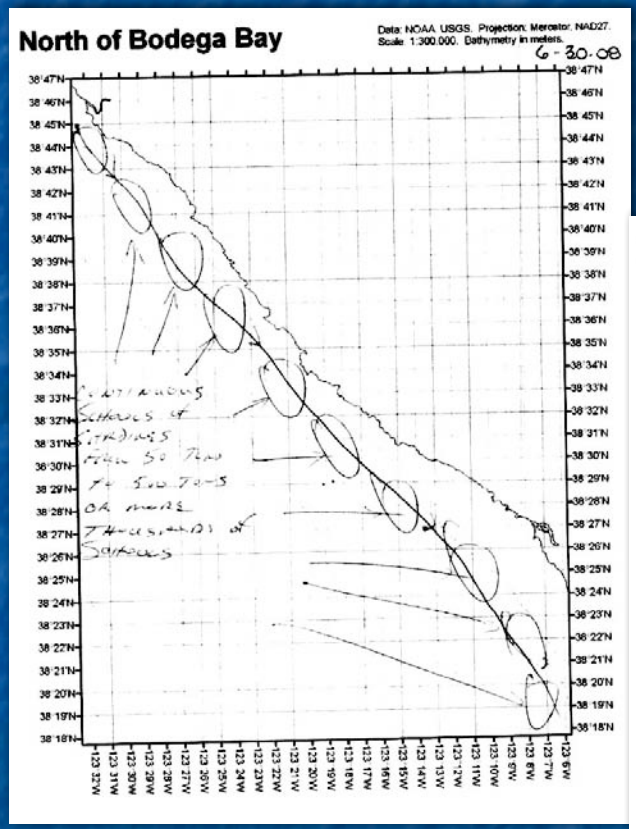
- Example:
  daylight flight from Warrenton to Monterey
  June 30, 2008

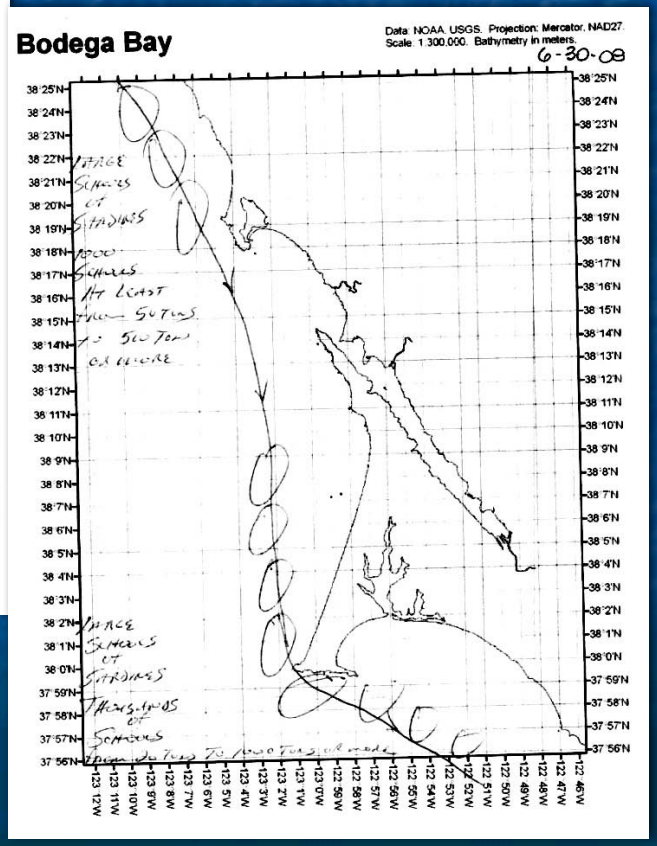
Pilot Notes for N.CA:

N.Bodega - continuous schools from 50-500 tons or more…

Bodega - large schools, at least 1,000 schools from 50-500 tons or more

Pt Reyes - large schools, thousands of schools from 20-1,000 tons or more



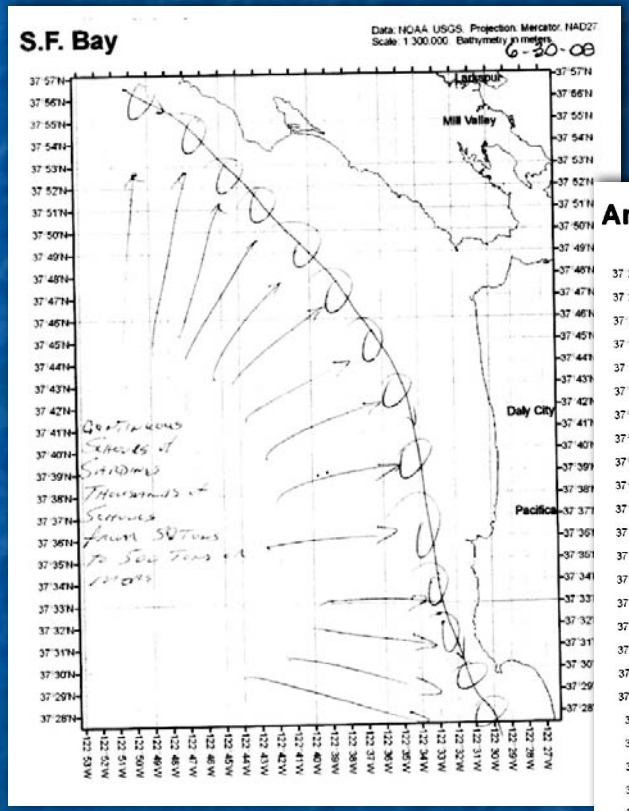


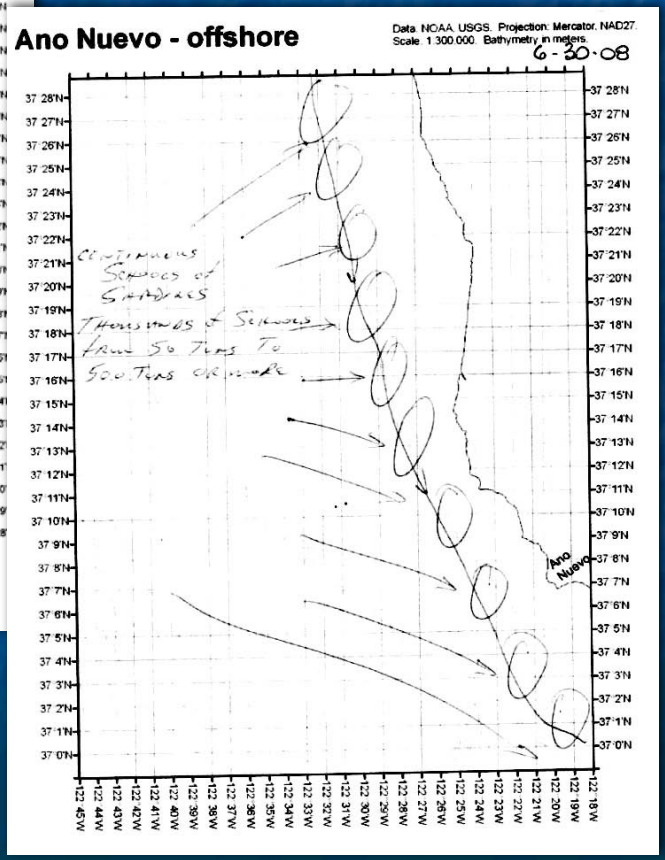
Flight June 30, 2008
- SF Bay, Año Nuevo offshore

Pilot Notes :

SF Bay - Año Nuevo

Continuous schools - thousands of schools 50-500 tons or more



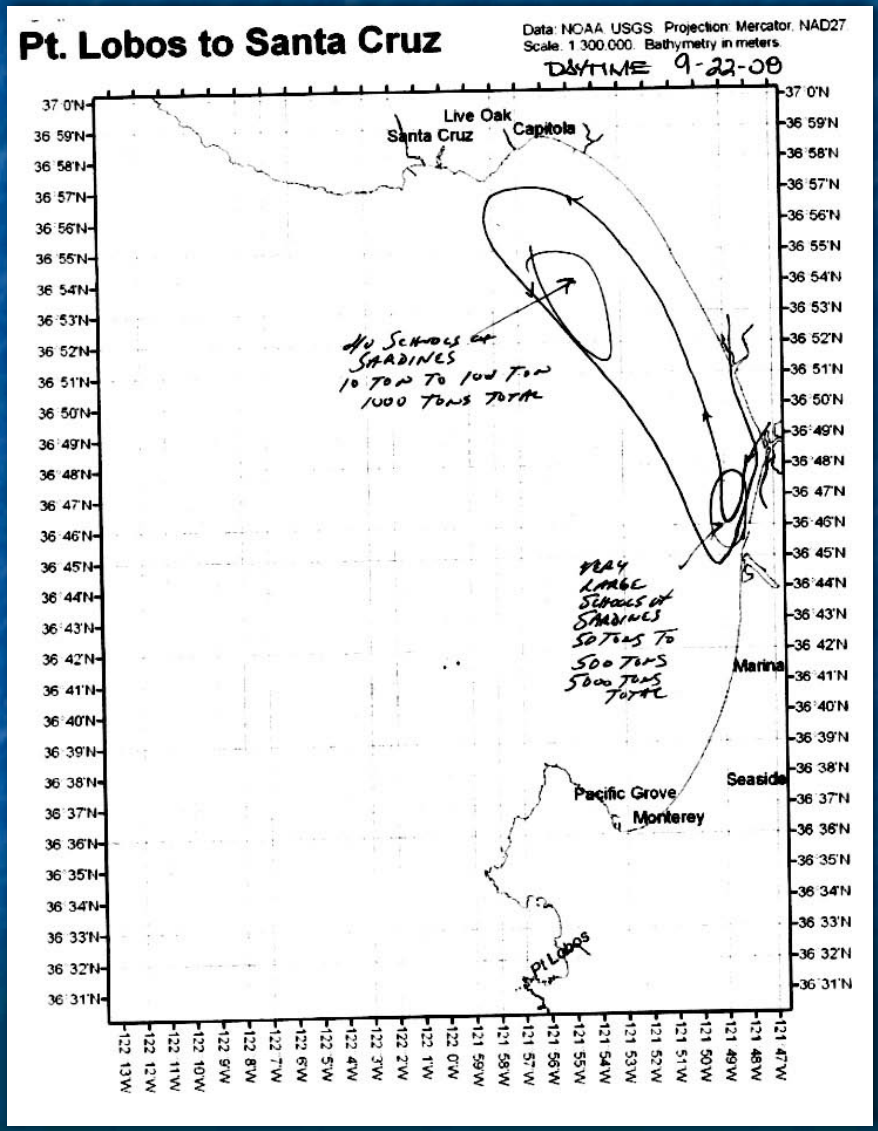


Pt. Lobos to Santa Cruz - Sept. 22, 2008

Pilot Notes :

40 sardine schools -
10-100 tons:
1000 tons total

Very large schools -
50-500 tons:
5000 tons total



Monterey Bay
September 22, 2008

Unenhanced

Aerial Photo documenting sardine photographed in daylight in CA (emailed to J.Thon January 25, 2009)

J.Thon comment:

"As you can see, the fish look similar to ours from the airplane. It appears it would be easy to measure surface area of these schools with calibrated camera system."

Conclusion

- **CA requests opportunity to participate in expanded research in 2009 and access up to 600 mt of research set aside under guidance and coordination of scientists in CA and PNW**

  (without preconditions impossible to meet during very short open fishing period)

- **CWPA intends to replicate PNW methodology and enhance hydroacoustic measurements**

- **CA contracted scientist and PNW scientists agree to work together to expand the survey to CA waters.**

FISHERY MANAGEMENT PLAN (FMP) AMENDMENTS TO IMPLEMENT ANNUAL CATCH LIMIT (ACL) REQUIREMENTS

The Magnuson-Steven 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 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. (Agenda Item C.3.a, Attachment 1). NMFS has provided an overview of the amended NS1 guidelines in the presentation presented in Agenda Item C.3.a, Attachment 2.

The MSRA and amended NMFS guidelines introduce new fishery management concepts including overfishing levels (OFLs), 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 and end overfishing. One important change in the final guidelines is that ACTs are no longer mandatory, rather they are included an optional accountability tool intended for the management for fisheries without inseason monitoring and harvest controls. These important aspects of the MSRA are required to be implemented by 2011 for most species and by 2010 for those species designated as overfished. It is anticipated the Council will need to amend some or all of its Fishery Management Plans (FMPs) to accommodate the new NS1 guidelines. Regarding timing to complete this endeavour, it is important to note that current CPS management involves no stocks undergoing overfishing and no stocks are designated as overfished.

Under this Agenda Item, the Council is scheduled to review the amended NS1 guidelines as they pertain to Council operation in general and to specifically scope out initial issues and a proposed timeline for potentially amending its FMP governing coastal pelagic species. The Council is scheduled to discuss specific NS1 issues relative to salmon management under Agenda Item D.6. on Wednesday, March 11, 2009. The Council is tentatively scheduled to discuss the same topic for groundfish and highly migratory species management at its April meeting in Millbrae, California.

As the Council has stated in previous letters to NMFS on MRSA implementation, the Council has a strong history of preventing overfishing and rebuilding overfished species through science-based approaches to setting harvest specifications and inseason fishery monitoring and control, and the Council's Coastal Pelagic Species (CPS) FMP is no exception.

Precautionary harvest control rules exist for the actively managed species in the CPS FMP (Pacific sardine and Pacific mackerel), control rules which provide a solid foundation for the implementation of new fishery management provisions such as OFLs and ACLs. The CPS FMP's monitored stocks are either exempt from the new requirements because of their short life-cycle (market squid) or are currently harvested at relatively low levels (anchovy, jack mackerel). ACLs for monitored stocks may be appropriately implemented with greater flexibility but greater precaution than the actively managed species because they are assessed with less frequency.

Unique to the CPS FMP is the "prohibited harvest" stock category which currently includes all species of krill in the West Coast Exclusive Economic Zone. Although the Council prohibited the harvest of krill in recognition of its import ecosystem functions, the broad harvest prohibition may have more management implications than was intended for the "ecosystem component" species category described in the NS1 guidelines. A summary of issues and timelines related to the amendment of the CPS FMP is included under Agenda Item C.3.a, Attachment 3.

Council Action:

1. **Review final NMFS guidance on NS1.**
2. **Discuss initial issues for CPS management and potential FMP amendment to meet the new NS1 guidelines.**
3. **Provide guidance on the scope and schedule for amending the CPS FMP.**

Reference Materials:

1. Agenda Item C.3.a, Attachment 1: Final rule to amend the NMFS guidelines for National Standard 1 (74 FR 3178).
2. Agenda Item C.3.a, Attachment 2: NMFS presentation on NMFS guidelines for National Standard 1.
3. Agenda Item C.3.a, Attachment 3: Summary of Potential Issues and Timelines for amending the CPS FMP for compliance with NS1.
4. Agenda Item C.3.b, Supplemental CPSMT Report.
5. Agenda Item C.3.b, Supplemental CPSAS Report.

Agenda Order:

a. Agenda Item Overview — Mike Burner
b. Reports and Comments of Agencies and Advisory Bodies
c. Public Comment
d. **Council Action**: Scope and Plan FMP Amendments to Implement ACL Requirements

PFMC
02/20/09

Federal Register

Friday,

January 16, 2009

Part III

Department of Commerce

National Oceanic and Atmospheric Administration

50 CFR Part 600

Magnuson-Stevens Act Provisions; Annual Catch Limits; National Standard Guidelines; Final Rule

§600.310 National Standard 1 – Optimum Yield

Table of Contents for the Codified Text
in the Jan. 16, 2009, FR Notice of the Final NS1 Guideline Revisions

DEPARTMENT OF COMMERCE

National Oceanic and Atmospheric Administration

50 CFR Part 600

[Docket No. 070717348–81398–03]

RIN 0648–AV60

Magnuson-Stevens Act Provisions; Annual Catch Limits; National Standard Guidelines

AGENCY: National Marine Fisheries Service (NMFS); National Oceanic and Atmospheric Administration (NOAA); Commerce.

ACTION: Final rule.

SUMMARY: This final action amends the guidelines for National Standard 1 (NS1) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA). This action is necessary to provide guidance on how to comply with new annual catch limit (ACL) and accountability measure (AM) requirements for ending overfishing of fisheries managed by Federal fishery management plans (FMPs). It also clarifies the relationship between ACLs, acceptable biological catch (ABC), maximum sustainable yield (MSY), optimum yield (OY), and other applicable reference points. This action is necessary to facilitate compliance with requirements of the Magnuson-Stevens Act to end and prevent overfishing, rebuild overfished stocks and achieve OY.

DATES: Effective February 17, 2009.

ADDRESSES: Copies of the Regulatory Impact Review (RIR)/Regulatory Flexibility Act Analysis (RFAA) can be obtained from Mark R. Millikin, National Marine Fisheries Service, 1315-East-West Highway, Room 13357, Silver Spring, Maryland 20910. The RIR/RFAA document is also available via the internet at *http://www.nmfs.noaa.gov/msa2007/catchlimits.htm*. Public comments that were received can be viewed at the Federal e-Rulemaking portal: *http://www.regulations.gov.*

FOR FURTHER INFORMATION CONTACT: Mark R. Millikin by phone at 301–713–2341, by FAX at 301–713–1193, or by *e-mail: Mark.Millikin@noaa.gov.*

SUPPLEMENTARY INFORMATION:

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I. Overview of Revisions to the NS1 Guidelines

The MSA serves as the chief authority for fisheries management in the U.S. Exclusive Economic Zone (EEZ). The Act provides for ten national standards (NS) for fishery conservation and management, and requires that the Secretary establish advisory guidelines based on the NS to assist in the development of fishery management plans. Guidelines for the NS are codified in subpart D of 50 CFR part 600. NS1 requires that conservation and management measures ''shall prevent overfishing while achieving, on a continuing basis, the optimum yield from each fishery for the United States fishing industry.''

The Magnuson-Stevens Fishery Conservation and Management Reauthorization Act of 2006 (MSRA) amended the MSA to include new requirements for annual catch limits (ACLs) and accountability measures (AMs) and other provisions regarding preventing and ending overfishing and rebuilding fisheries. To incorporate these new requirements into current NS1 guidance, NMFS initiated a revision of the NS1 guidelines in 50 CFR 600.310. NMFS published a notice of intent (NOI) to prepare an environmental impact statement (EIS) and commenced a scoping period for this action on February 14, 2007 (72 FR 7016), and proposed NS1 guidelines revisions on June 9, 2008 (73 FR 32526). Further background is provided in the above-referenced **Federal Register** documents and is not repeated here. The proposed guidelines provided a description of the reasons that overfishing is still occurring and the categories of reasons for overfishing likely to be addressed by new MSA requirements combined with the NS1 guidelines. The September 30, 2008 NMFS Quarterly Report on the Status of U.S. Fisheries indicates that 41 stocks managed under Federal FMPs are undergoing overfishing.

NMFS solicited public comment on the proposed NS1 guidelines revisions through September 22, 2008, and during that time, held three public meetings, on July 10, 2008 (Silver Spring, Maryland), July 14, 2008 (Tampa, Florida), and July 24, 2008 (Seattle, Washington), and made presentations on the proposed revisions to each of the eight Regional Fishery Management Councils (Councils). NMFS received over 158,000 comments on all aspects of the proposed NS1 guidelines revisions. Many of the comment letters were form letters or variations on a form letter. In general, the environmental community supported the provisions in the proposed action but commented that they needed to be strengthened in the final action. Alternatively, comments from the fishing industry and some of the Councils said the proposed revisions were confusing, too proscriptive or strict, and lacked sufficient flexibility.

II. Major Components of the Proposed Action

Some of the major items covered in the proposed NS1 guidelines were: (1) A description of the relationship between MSY, OY, overfishing limits (OFL), ABC, ACLs, and annual catch targets (ACT); (2) guidance on how to combine the use of ACLs and AMs for a stock to prevent overfishing when possible, and adjust ACLs and AMs, if an ACL is exceeded; (3) statutory exceptions to requirements for ACLs and AMs and flexibility in application of NS1 guidelines; (4) ''stocks in the fishery'' and ''ecosystem component species'' classifications; (5) replacement of MSY control rules with ABC control rules and replacement of OY control rules with ACT control rules; (6) new requirements for scientific and statistical committees (SSC); (7) explanation of the timeline to prepare new rebuilding plans; (8) revised guidance on how to establish rebuilding time targets; (9) advice on action to take at the end of a rebuilding period if a stock is not yet rebuilt; and (10) exceptions to the requirements to prevent overfishing.

III. Major Changes Made in the Final Action

The main substantive change in the final action pertains to ACTs. NMFS proposed ACT as a required reference point that needed to be included in FMPs. The final action retains the concept of an ACT and an ACT control rule, but does not require them to be included in FMPs. After taking public comment into consideration, NMFS has decided that ACTs are better addressed as AMs. The final guidelines provide that: ''For fisheries without inseason management control to prevent the ACL from being exceeded, AMs should utilize ACTs that are set below ACLs so that catches do not exceed the ACL.''

In response to public comment, this final action also clarifies text on ecosystem component species, OFL, OY specification, ABC control rule and specification, SSC recommendations, the setting of ACLs, sector-ACLs, and AMs, and makes minor clarifications to other text. Apart from these clarifications, the final action retains the same approaches described in the proposed guidelines with regard to: (1) Guidance on how to combine the use of ACLs and AMs for a stock to prevent overfishing when possible, and adjust ACLs and AMs, if an ACL is exceeded; (2) statutory exceptions to requirements for ACLs and AMs and flexibility in application of NS1 guidelines; (3) ''stocks in the fishery'' and ''ecosystem component species'' classifications; (4) new requirements for SSCs; (5) the timeline to prepare new rebuilding plans; (6) rebuilding time targets; (7) advice on action to take at the end of a rebuilding period if a stock is not yet rebuilt; and (8) exceptions to the requirements to prevent overfishing. Further explanation of why changes were or were not made is provided in the ''Response to Comments'' section below. Detail on changes made in the codified text is provided in the ''Changes from Proposed Action'' section.

IV. Overview of the Major Aspects of the Final Action

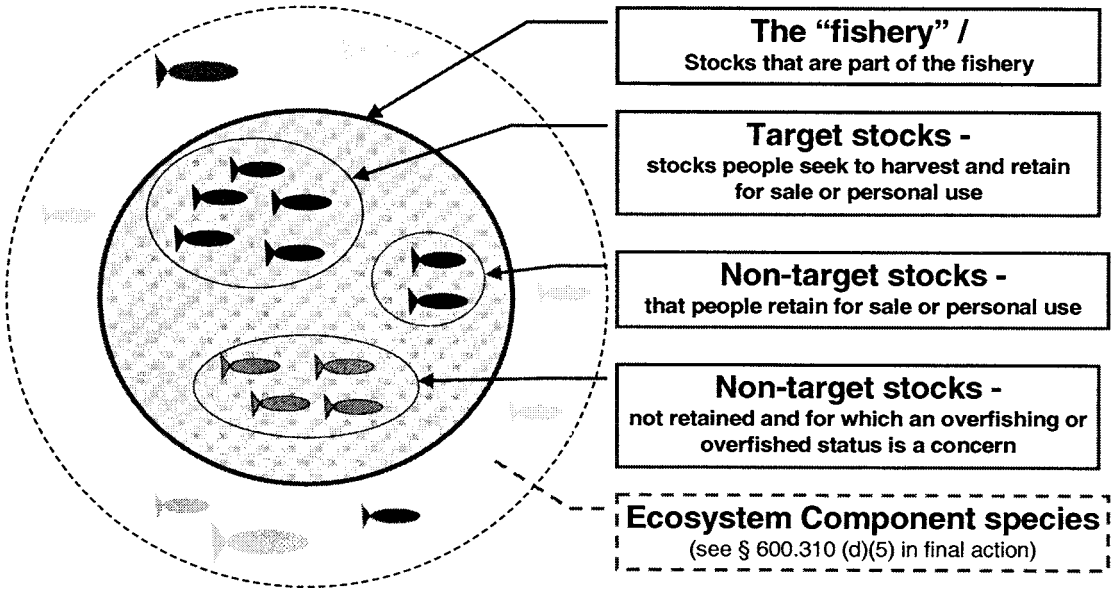
A. Stocks in the Fishery and Ecosystem Component Species

The proposed NS1 guidelines included suggested classifications of ''stocks in the fishery'' and ''ecosystem component (EC) species.'' *See* Figure 1 for diagram of classifications. Public comments reflected confusion about this proposal, so NMFS has clarified its general intent with regard to these classifications. More detailed responses to comments on this issue are provided later in this document.

The classifications in the NS1 guidelines are intended to reflect how FMPs have described ''fisheries,'' and to provide a helpful framework for thinking about how FMPs have incorporated and may continue to incorporate ecosystem considerations. To that end, the proposed NS1 guidelines attempted to describe the fact that FMPs typically include certain target species, and sometimes certain non-target species, that the Councils and/or the Secretary believed required conservation and management. In some FMPs, Councils have taken a broader approach and included hundreds of species, many of which may or may not require conservation and management but could be relevant in trying to further ecosystem management in the fishery.

NMFS wants to encourage ecosystem approaches to management, thus it proposed the EC species as a possible classification a Council or the Secretary could—but is not required to—consider. The final NS1 guidelines do not require a Council or the Secretary to include all target and non-target species as ''stocks in the fishery,'' do not mandate use of the EC species category, and do not require inclusion of particular species in an FMP. The decision of whether conservation and management is needed for a fishery and how that fishery should be defined remains within the authority and discretion of the relevant Council or the Secretary, as appropriate. NMFS presumes that stocks or stock complexes currently listed in an FMP are ''stocks in the fishery,'' unless the FMP is amended to explicitly indicate that the EC species category is being used. ''Stocks in the fishery'' need status determination criteria, other reference points, ACL mechanisms and AMs; EC species would not need them. NMFS recognizes the confusion caused by wording in the proposed action and has revised the final action to be more clear on these points.

Figure 1. General Framework for "Stocks in the Fishery" versus "Ecosystem Component Species." This figure describes the kind of stocks or stock complexes that might fall into the two classifications, but should not be viewed as requiring FMPs to include specific stocks or stock complexes in either category.

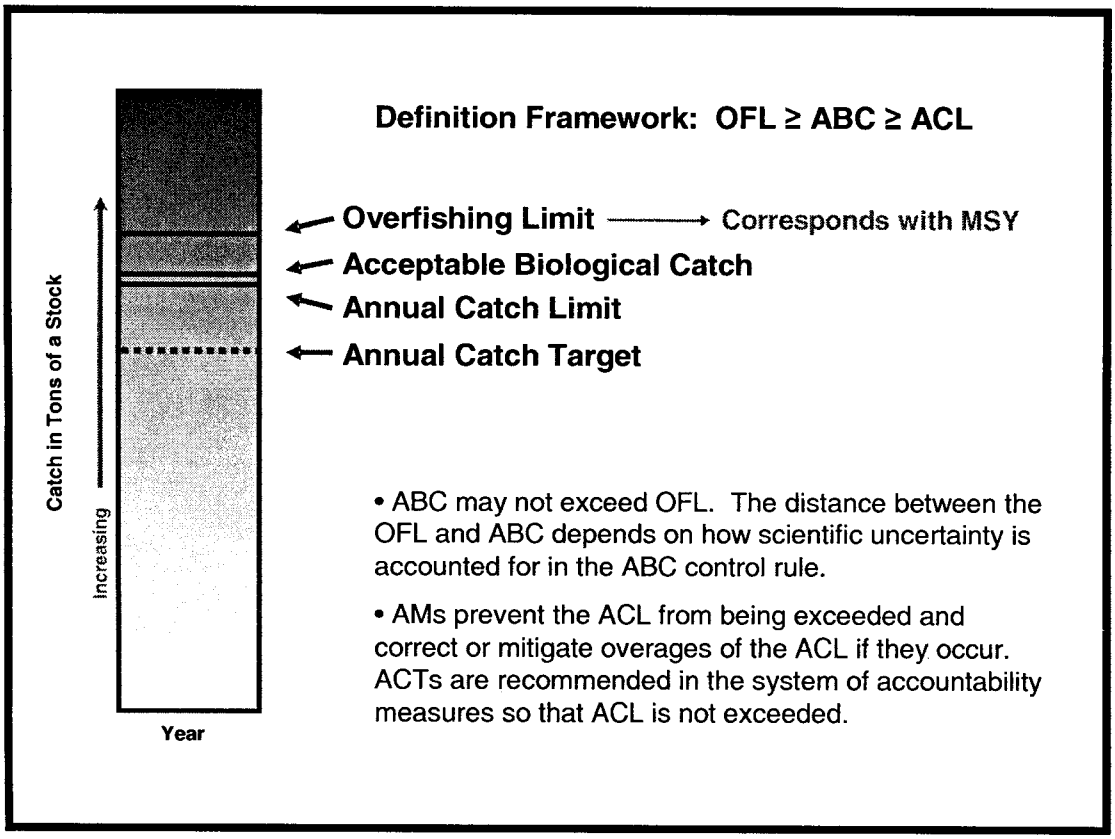


B. Definition Framework for OFL, ABC, and ACL

The MSRA does not define ACLs, AMs, and ABC, so NMFS proposed definitions for these terms in the proposed action. NMFS also proposed definitions for the terms OFL and ACT because it felt that they would be useful tools in helping ensure that ACLs are not exceeded and overfishing does not occur. The proposed NS1 guidelines described the relationship between the terms as: OFL ≥ ABC ≥ ACL ≥ ACT. In response to public comment, the final action revises the definition framework as: OFL ≥ ABC ≥ ACL. As described above, NMFS has retained ACT and the ACT control rule in the NS1 guidelines, but believes that they are more appropriate as AMs. NMFS believes ACTs could prove useful as management tools in fisheries with poor management control over catch (i.e., that frequently exceed catch targets).

NMFS received many comments on the definition framework, and some commenters stated that it should be revised as: OFL > ABC > ACL. Having considered public comment and reconsidered this issue, NMFS has decided to keep the framework as: OFL ≥ ABC ≥ ACL. However, NMFS believes there are few fisheries where setting OFL, ABC, and ACL all equal to each other would be appropriate. While the final action allows ABC to equal OFL, NMFS expects that in most cases ABC will be reduced from OFL to reduce the probability that overfishing might occur in a year. NMFS has added a provision to the final NS1 guidelines stating that, if a Council recommends an ACL which equals ABC, and the ABC is equal to OFL, the Secretary may presume that the proposal would not prevent overfishing, in the absence of sufficient analysis and justification for the approach. See figure 2 for an illustration of the relationship between OFL, ABC, ACL and ACT. Further detail on the definition framework and associated issues is provided in the ''Response to Comments'' section below.

Figure 2: Relationship between OFL, ABC, ACL and ACT



C. Accountability Measures (AMs)

Another major aspect of the revised NS1 guidelines is the inclusion of guidance on AMs. AMs are management controls to prevent ACLs, including sector-ACLs, from being exceeded, and to correct or mitigate overages of the ACL if they occur. NMFS has identified two categories of AMs, inseason AMs and AMs for when the ACL is exceeded. As described above, ACTs are recommended in the system of AMs so that ACLs are not exceeded. As a performance standard, if catch exceeds the ACL for a given stock or stock complex more than once in the last four years, the system of ACLs and AMs should be re-evaluated, and modified if necessary, to improve its performance and effectiveness.

D. SSC Recommendations and Process

Section 302(h)(6) of the MSA provides that each Council is required to ''develop annual catch limits for each of its managed fisheries that may not exceed the fishing level recommendations of its scientific and statistical committee or the peer review process established under subsection (g).'' MSA did not define ''fishing level recommendations,'' but in section 302(g)(1)(B), stated that an SSC shall provide ''recommendations for acceptable biological catch, preventing overfishing, maximum sustainable yield, and achieving rebuilding targets,'' and other scientific advice.

NMFS received a variety of public comments regarding interpretation of ''fishing level recommendations.'' Some commenters felt that the SSC's ''fishing level recommendations'' that should constrain ACLs is the overfishing limit (OFL); other commenters stated that ''fishing level recommendations'' should be equated with MSY. NMFS does not believe that MSA requires ''fishing level recommendations'' to be equated to the OFL or MSY. As described above, the MSA specifies a number of things that SSCs recommend to their Councils. Of all of these things, ABC is the most directly relevant to ACL, as both ABC and ACL are levels of annual catch.

The preamble to the proposed NS1 guidelines recommended that the Councils could establish a process in their Statement of Organization, Practices and Procedures (SOPPs) for: establishing an ABC control rule, applying the ABC control rule (i.e., calculating the ABC), and reviewing the resulting ABC. NMFS believes that this may have caused confusion and that some commenters misunderstood the intent of this recommendation. NMFS received comment regarding inclusion of the ABC control rule in the SOPPs, and wants to clarify that the actual ABC control rule should be described in the FMP. NMFS believes it is important to understand how the Councils, SSC, and optional peer review process work together to implement the provisions of the MSA and therefore recommends that the description of the roles and responsibilities of the Council, SSC, and optional peer review process be included in the SOPPs, FMP, or some other public document. The SSC recommends the ABC to the Council whether or not a peer review process is utilized.

E. Management Uncertainty and Scientific Uncertainty

A major aspect of the revised NS1 guidelines is the concept of incorporating management and scientific uncertainty in using ACLs and AMs. Management uncertainty occurs because of the lack of sufficient information about catch (*e.g.*, late reporting, underreporting and misreporting of landings or bycatch). Recreational fisheries generally have late reporting because of the method of surveying catches and the lack of an ability for managers to interview only marine recreational anglers. NMFS is addressing management uncertainty in the recreational fishery by implementing a national registry of recreational fishers in the Exclusive Economic Zone (EEZ) (see proposed rule published in the **Federal Register** (73 FR 33381, June 12, 2008)) and a Marine Recreational Implementation Program that will, in part, revise the sampling design of NMFS's marine recreational survey for fishing activity.

Management uncertainty also exists because of the lack of management precision in many fisheries due to lack of inseason fisheries landings data, lack of inseason closure authority, or the lack of sufficient inseason management in some FMPs when inseason fisheries data are available. The final NS1 guidelines revisions provide that FMPs should contain inseason closure authority that gives NMFS the ability to close fisheries if it determines, based on data that it deems sufficiently reliable, that an ACL has been exceeded or is projected to be reached, and that closure of a fishery is necessary to prevent overfishing. NMFS believes that such closure authority will enhance efforts to prevent overfishing. Councils can derive some idea of their overall extent of management uncertainty by comparing past actual catches to target catches to evaluate the magnitude and frequency of differences between actual catch and target catch, and how often actual catch exceeded the overfishing limit for a stock.

Scientific uncertainty includes uncertainty around the estimate of a stock's biomass and its maximum fishing mortality threshold (MFMT); therefore, any estimate of OFL has uncertainty. Stock assessment models have various sources of scientific uncertainty associated with them and many assessments have shown a repeating pattern that the previous assessment overestimated near-future biomass, and underestimated near-future fishing mortality rates (i.e., called retrospective patterns).

V. Response to Comments

NMFS received many comments about the proposed definition framework (OFL ≥ ABC ≥ ACL ≥ ACT), especially regarding the ACT and ACT control rule. Some commenters suggested that the ACT and ACT control rule should not be required, while others supported their use. NMFS also received comments expressing: That the proposed terminology should not be required; OFL should always be greater than ABC; and concern that too many factors (i.e., management and scientific uncertainty, and ACT) will reduce future target catches unnecessarily. Some commenters felt additional emphasis should be placed on T_{min} in the rebuilding provisions. Councils, for the most part, are very concerned about the challenge of implementing ACLs and AMs by 2010, and 2011, as required. Some commenters felt the international fisheries exception to ACLs is too broad. Several commenters stated that an EIS should have been or should be prepared and two commenters stated an Initial Regulatory Flexibility Analysis under the Regulatory Flexibility Act should be prepared. NMFS also received many comments regarding the mixed-stock exception.

NMFS received many comments expressing support for the proposed revisions to the Magnuson-Stevens Act National Standard 1 guidelines. Comments included: This good faith effort to implement Congress' intent will work to end overfishing and protect the marine ecosystem; these guidelines reduce the risk of overfishing and will work to rebuild depleted stocks through the use of science based annual catch limits, accountability measures, 'buffers' for scientific and management uncertainty, and protections for weak fish stocks; and this solid framework will ensure not only healthy stocks but healthy fisheries.

Comment 1: Several comments were received regarding NMFS's decision to not prepare an environmental impact statement or environmental assessment for this action. Some supported the decision, while others opposed it and believed that a categorical exclusion under the National Environmental Policy Act (NEPA) is not appropriate.

Response: NMFS believes a categorical exclusion is appropriate for this action. Under §§ 5.05 and 6.03c.3(i) of NOAA's Administrative Order (NAO) 216–6, the following types of actions may be categorically excluded from the requirement to prepare an EA or EIS: ''* * * policy directives, regulations and guidelines of an administrative, financial, legal, technical or procedural nature, or the environmental effects of which are too broad, speculative or conjectural to lend themselves to meaningful analysis and will be subject later to the NEPA process, either collectively or case-by-case. * * *''

In this instance, a Categorical Exclusion is appropriate for this action, because NMFS cannot meaningfully analyze potential environmental, economic, and social impacts at this stage. This action revises NS1 guidelines, which are advisory only; MSA provides that NS guidelines ''shall not have the force and effect of law.'' MSA section 301(b). *See Tutein* v. *Daley*, 43 F. Supp.2d 113, 121–122 (D. Mass. 1999) (reaffirming that the guidelines are only advisory and holding that the national standards are not subject to judicial review under the

MSA). The NS1 guidelines are intended to provide broad guidance on how to comply with new statutory requirements. While the guidelines explain in detail how different concepts, such as ACL, ABC, MSY, and OY, should be addressed, the guidelines do not mandate specific management measures for any fishery. It is not clear what Councils will or will not do in response to the NS1 guidelines. Thus, it is not possible to predict any concrete impacts on the human environment without the necessary intervening actions of the Councils, e.g., consideration of best available scientific information and development of specific conservation and management measures that may be needed based on that information. Any analysis of potential impacts would be speculative at best.

None of the exceptions for Categorical Exclusions provided by § 5.05c of NAO 216–6 apply. While there is controversy concerning the NS1 guidelines revisions, the controversy is primarily related to different views on how new MSA requirements should be interpreted, rather than potential environmental consequences. The NS1 guidelines would not, in themselves, have uncertain environmental impacts, unique or unknown risks, or cumulatively significant or adverse effects upon endangered or threatened species or their habitats. Moreover, this action would not establish a precedent or decision in principle about future proposals. As noted above, the guidelines provide broad guidance on how to address statutory requirements but do not mandate specific management actions.

Comment 2: One commenter criticized NMFS' approach as placing unnecessary burden on the Councils to conduct the NEPA analysis.

Response: No change was made. One of the Councils' roles is to develop conservation and management measures that are necessary and appropriate for management of fisheries under their authority. NMFS believes that Councils should continue to have the discretion to determine what measures may be needed in each fishery and what alternatives should be considered and analyzed as part of the fishery management planning process. Councils routinely incorporate NEPA into this process, and the actions to implement ACLs in specific fisheries must address the NEPA requirements, regardless of the level of analysis conducted for the guidelines. Therefore, having reviewed the issue again, NMFS continues to find that a categorical exclusion is appropriate for this action.

Comment 3: Two commenters stated that NMFS should have prepared an initial regulatory flexibility analysis under the RFA for this action. They said it was not appropriate to certify under the RFA because in their opinion, this action will have significant economic impacts on a substantial number of small entities.

Response: No change was made. The final NS1 guidelines will not have significant economic impacts on a substantial number of small entities. The guidelines are advisory only; they provide general guidance on how to address new overfishing, rebuilding, and related requirements under the MSA. Pursuant to MSA section 301(b), the guidelines do not have the force and effect of law. When the Councils/Secretary apply the guidelines to individual fisheries and implement ACL and AM mechanisms, they will develop specific measures in their FMPs and be able to analyze how the new measures compare with the status quo (e.g., annual measures before the MSRA was signed into law and the NS1 guidelines were revised) with respect to economic impacts on small entities. At this point, any analysis of impacts on small entities across the range of diverse, Federally-managed fisheries would be highly conjectural. Therefore, a certification is appropriate.

Comment 4: Several comments were received that the guidelines are too complex and they contain guidance for things, such as the ACT that are not required by the MSA. They suggested removing these provisions from the guidance, or only providing guidance for terms specifically mentioned in the statute.

Response: NMFS agrees that the guidelines can appear complex. However, the purpose of the guidelines is not simply to regurgitate statutory provisions, rather it is to provide guidance on how to meet the requirements of the statute. As discussed in other comments and responses, MSRA includes new, undefined terms (ABC and ACL), while retaining other long-standing provisions, such as the national standards. In considering how to understand new provisions in light of existing ones, NMFS considered different ways to interpret language in the MSA, practical challenges in fisheries management including scientific and management uncertainty, the fact that there are differences in how fisheries operate, and public comment on proposed approaches in the NS1 guidelines. MSA does not preclude NMFS from including additional terminology or explanations in the NS1 guidelines, as needed, in order to facilitate understanding and effective implementation of MSA mandates. In the case of NS1, conservation and management measures must prevent overfishing while achieving, on a continuing basis, the optimum yield. This is inherently challenging because preventing overfishing requires that harvest of fish be limited, while achieving OY requires that harvest of fish occur. In developing the guidelines, NMFS identified the reasons that overfishing was still occurring in about 20 percent of U.S. Fisheries, and wrote the guidelines to address the primary causes. These include:

(1) Setting OY too close to MSY,

(2) Failure to consider all sources of fishing mortality,

(3) Failure to adequately consider both uncertainty in the reference points provided by stock assessments (scientific uncertainty) and uncertainty in management control of the actual catch (management uncertainty),

(4) Failure to utilize best available information from the fishery for inseason management, and

(5) Failure to identify and correct management problems quickly.

NMFS believes that the guidelines address these causes and appropriately provide practical guidance on how to address them, while providing sufficient flexibility to acknowledge the differences in fisheries. NMFS believes that Congress intended that the ACLs be effective in ending and preventing overfishing. Simply amending the FMPs to include ACL provisions is not enough—the actual performance of the fishery is what ultimately matters. NMFS believes that all of the provisions in the guidelines are essential to achieving that goal, and that if the guidelines are followed, most of the problems that have led to continued overfishing will be addressed. NMFS has made changes in the final action to clarify the guidelines and simplify the provisions therein, to the extent possible. One specific change is that the final guidelines do not require that ACT always be established. Instead, NMFS describes how catch targets, such as ACT, would be used in a system of AMs in order to meet the requirements of NS1 to prevent overfishing and achieve OY. More details on these revisions are covered in responses pertaining to comments 8, 32, 44, 45, and 48.

Comment 5: Several commenters stated that Councils' workloads and the delay of final NS1 guidelines will result in some Councils having great difficulty or not being able to develop ACLs and AMs for overfishing stocks by 2010, and all other stocks by 2011.

Response: The requirements in MSA related to 2010 and 2011 are statutory; therefore ACLs and AMs need to be in place for those fishing years such that overfishing does not occur. NMFS understands that initial ACL measures for some fisheries have been developed before the NS1 guidelines were finalized in order to meet the statutory deadline, and thus may not be fully consistent with the guidelines. ACL mechanisms developed before the final guidelines should be reviewed and eventually revised consistent with the guidelines.

Comment 6: Several commenters stated that certain existing FMPs and processes are already in compliance with the ACL and AM provisions of the MSA and consistent with the proposed guidelines. One commenter stated that NMFS should bear the burden of determining whether current processes are inconsistent with the MSA, and indicate what action Councils should take. Another commenter stated that Congress intended Total Allowable Catch (TAC), which is already used in some fisheries, to be considered to be an ACL. NMFS also received comments stating that certain terms have had longstanding use under FMPs, and changing the terminology could cause too much confusion.

Response: NMFS believes that some existing FMPs may be found to need little or no modification in order to be found to be consistent with the MSA and NS1 guidelines. In general, these are fisheries where catch limits are established and the fishery is managed so that the limits are not exceeded, and where overfishing is not occurring. NMFS agrees that, in some fisheries, the TAC system currently used may meet the requirements of an ACL. However, there are a wide variety of fisheries that use the term TAC, and while some treat it as a true limit, others treat it simply as a target value on which to base management measures. Therefore, NMFS does not agree that the use of a TAC necessarily means the fishery will comply with the ACL and AM provisions of the MSA. NMFS will have to review specific FMPs or FMP amendments. In addition, upon request of a Council, NMFS can provide input regarding any changes to current processes that might be needed for consistency with the MSA and guidance in the NS1 guidelines.

Regarding the comment about terminology, the preamble to the proposed action provided that Councils could opt to retain existing terminology and explain in a proposed rule how the terminology and approaches to the FMPs are consistent with those set forth in the NS1 guidelines. NMFS has given this issue further consideration and believes that a proposed rule would not be necessary or appropriate. Instead, a Council could explain in a **Federal Register** notice why its terminology and approaches are consistent with the NS1 guidelines.

Comment 7: Some commenters thought that before requiring implementation of a new management system, it should first be demonstrated that the current management system is not effective at preventing overfishing or rebuilding stocks that are overfished, and that a new management system would be more effective. Changing a management system that is effective and responsive would not be productive.

Response: While NMFS understands that current conservation and management measures prevent overfishing in some fisheries, the MSA requires a mechanism for specifying ACLs and AMs in all fisheries, including those that are not currently subject to overfishing, unless an exception applies. There is no exception to the requirement for ACLs and AMs for fisheries where other, non-ACL management measures are preventing overfishing. NMFS is required by the MSRA to implement the new provisions in all FMPs, unless an exception applies, even on those whose current management is preventing overfishing. NMFS believes the guidance provides the tools for Councils to implement ACLs in these fisheries that will continue to prevent overfishing without disrupting successful management approaches. The guidelines provide flexibility to deviate from the specific framework described in the guidelines, if a different approach will meet the statutory requirements and is more appropriate for a specific fishery (*see* § 600.310(h)(3) of the final action).

Comment 8: Some commenters supported the use of ACT to address management uncertainty in the fishery. Others did not support ACTs, and commented that ACTs are not required under the MSA and that inclusion of ACTs in the guidelines creates confusion and complexity. One commenter stated that the proposed guidelines were ''out of line'' with NMFS's mandate and authority provided under the MSA because the guidelines for ACTs and associated control rules completely undermine the clear directive Congress provides in National Standard 1 to achieve optimum yield on an ongoing basis.

Response: The proposed guidelines stressed the importance of addressing scientific and management uncertainty in establishing ACL and AM mechanisms. Scientific uncertainty was addressed in the ABC control rule, and management uncertainty was addressed in the ACT control rule. Use of catch targets associated with catch limits is a well-recognized principle of fishery management. The current NS1 guidelines call for establishment of limits, and targets set sufficiently below the limits so that the limits are not exceeded. The revised guidelines are based on this same principle, but, to incorporate the statutory requirements for ABC and ACLs, are more explicit than the current guidelines. While MSA does not refer to the term ACT, inclusion of the term in the NS1 guidelines is consistent with the Act. The NS1 guidelines are supposed to provide advice on how to address MSA requirements, including how to understand terminology in the Act and how to apply that terminology given the practical realities of fisheries management. In developing the proposed guidelines, NMFS considered a system that used ABC as the limit that should not be exceeded, and that required that ACL be set below the ABC to account for management uncertainty. This had the advantage of minimizing the number of terms, but would result in the ACL having been a target catch level. NMFS decided, that since Congress called for annual catch limits to be set, that the ACL should be considered a true limit—a level not to be exceeded. ACT was the term adopted for the corresponding target value which the fishery is managed toward so that the ACL is not exceeded.

Taking public comment into consideration, NMFS has decided to retain ACTs and ACT control rules in the final guidelines, but believes they are better addressed as AMs for a fishery. One purpose of the AMs is to prevent the ACL from being exceeded. Setting an ACT with consideration of management uncertainty is one way to achieve this, but may not be needed in all cases. In fisheries where monitoring of catch is good and in-season management measures are effective, managers may be able to prevent ACLs from being exceeded through direct monitoring and regulation of the fishery. Therefore, the final guidelines make ACTs optional, but, to prevent ACLs from being exceeded, Councils must adequately address the management uncertainty in their fisheries using the full range of AMs.

NMFS disagrees that ACTs undermine NS1. NS1 requires that conservation and management measures prevent overfishing while achieving, on a continuing basis, the OY. The MSA describes that OY is based on MSY, as reduced based on consideration of

several factors. In some cases, the amount of reduction may be zero, but in no case may the OY exceed MSY. Therefore, if OY is set close to MSY, the conservation and management measures in the fishery must have very good control of the amount of catch in order to achieve the OY without overfishing.

The amount of fishing mortality that results in overfishing is dictated by the biology of the stock and its environment, and establishes a limit that constrains fisheries management. However, the specification of OY and the conservation and management measures for the fishery are both set by fishery managers. To achieve the dual requirements of NS1, Councils must specify an OY and establish conservation and management measures for the fishery that can achieve the OY without overfishing. The closer that OY is set to MSY, the greater degree of control over harvest is necessary in order to meet both objectives. The choice of conservation and management measures for a fishery incorporates social and economic considerations. For example, a Council may prefer to use effort controls instead of hard quotas to have a year-round fishery without a ''race for fish,'' and to provide higher average prices for the fishermen. However, compared to hard quotas, management with effort controls gives more uncertainty in the actual amount of fish that will be caught. Because of this increased uncertainty, the OY needs to be reduced from MSY so that overfishing does not occur. Thus the social and economic considerations of the choice of management measures should be considered in setting the OY.

In cases where the conservation and management measures for a fishery are not capable of achieving OY without overfishing occurring, overfishing must be ended even if it means the OY is not achieved in the short-term. Overfishing a stock in the short term to achieve OY jeopardizes the capacity of the stock to produce OY in the long term, and thus cannot be sustained. Preventing overfishing in a fishery on an annual basis is important to ensure that a fishery can continue to achieve OY on a continuing basis. The specification of OY and the associated conservation and management measures need to be improved so that OY can be achieved without overfishing occurring. In a fishery where the NS1 objectives are fully met, the OY specification will adequately account for the management uncertainty in the associated conservation and management measures. Overfishing will not occur, and the OY will be achieved.

Comment 9: Commenters stated that the designation of the Virgin Islands Coral Reef Monument was not being taken into account in the Caribbean Council's FMPs.

Response: NMFS does not believe any revision of the NS1 guidelines is necessary in response to this comment but will forward the comment to the Council for its consideration.

Comment 10: NMFS received comments in support of the flexibility given to councils to manage stocks for which ACLs are not a good fit, such as management of Endangered Species Act listed species, stocks with unusual life history characteristics, and aquaculture operations. Commenters noted that Pacific salmon should be treated with flexibility under the NS1 guidelines, because they are managed to annual escapement levels that are functionally equivalent to ACLs, and there are accountability, review, and oversight measures in the fishery.

Response: NMFS agrees that flexibility is needed for certain management situations, and clarifies that § 600.310(h)(3) provides for flexibility in application of the NS1 guidelines but is not an exception from requirements of MSA section 303(a)(15) or other sections.

Comment 11: Congress did not mandate that all fisheries be managed by hard quotas, and so NMFS should include guidance for the continuation of successful, non-quota management systems, such as that used to successfully manage the Atlantic sea scallop fishery.

Response: NMFS agrees that the conservation and management measures for a fishery are not required to be ''hard quotas.'' However, NMFS believes that the ACL was intended by Congress to be a limit on annual catch. Therefore, conservation and management measures must be implemented so that the ACL is not exceeded, and that accountability measures must apply whenever the ACL is exceeded. Congress did not exempt any fisheries from the ACL requirement on the basis that current management was successful. If the current conservation and management measures are effective in controlling harvest of sea scallops such that the ACL is not regularly exceeded, the ACL would have little effect on the fishery. If the current management measures are not effective in keeping catch from exceeding the ACL, then consistent with the ACL requirement in the MSA, additional management action should be taken to prevent overfishing.

Comment 12: The summary list of items to be included in FMPs should be ''as appropriate'' (see § 600.310(c) of the final action).

Response: No change was made. NMFS believes that if any item does not apply to a particular fishery, the Council can explain why it is not included, but believes that ''as appropriate'' would create further confusion as there is no clear definition of what appropriate means in this context.

Comment 13: The list of items to include in FMPs related to NS1 is extremely long, and it is unclear whether each item on the list needs to be addressed for all stocks that are ''in the fishery,'' which is a very broad term. Including the extra information is unlikely to materially improve management.

Response: As a default, all the stocks or stock complexes in an FMP are considered ''in the fishery'' (see § 600.310(d)(1)), unless they are reclassified as ecosystem component stocks through an FMP amendment process. Further explanation of these classifications is provided below in other comments and responses. The benefit of including this list of items is to provide transparency in how the NS1 guidelines are being met. In addition, Councils should already have some of the items in their FMPs (ex: MSY, status determination criteria (SDC), and OY). The other items are new requirements of the MSA or a logical extension of the MSA.

Comment 14: NMFS received several comments both supporting and opposing the proposed ''stocks in a fishery'' and ''ecosystem component species'' (EC) classifications of stocks in a FMP. Comments included: EC species are not provided under the MSA and should not be required in FMPs; EC species classification is needed but may lead to duplication in different FMPs; support for the distinction between ''stocks in a fishery'' and EC species; and clarify how data collection only species should be classified.

Response: NMFS provided language for classifying stocks in a FMP into two categories: (1) ''Stocks in the fishery'' and (2) ''ecosystem component species.'' MSA requires that Councils develop ACLs for each of their managed fisheries (see MSA sections 302(h)(6) and 303(a)(15)), but Councils have had, and continue to have, considerable discretion in defining the ''fishery'' under their FMPs. As a result, some FMPs include one or a few stocks (*e.g.* , Bluefish FMP, Dolphin-Wahoo FMP) that have been traditionally managed for OY, whereas others have begun including hundreds of species (e.g., Coral Reef Ecosystem of the Western Pacific Region FMP) in an

effort to incorporate ecosystem approaches to management.

While EC species are not explicitly provided in the MSA, in the MSRA, Congress acknowledged that certain Councils have made significant progress in integrating ecosystem considerations, and also included new provisions to support such efforts (*e.g.*, MSA section 303(b)(12)). As noted in the preamble of this action, NMFS wants to continue to encourage Councils to incorporate ecosystem considerations, and having classifications for ''stocks in the fishery'' versus ''ecosystem component species'' could be helpful in this regard. Thus, the final guidelines do not require Councils or the Secretary to change which species are or are not included in FMPs, nor do the guidelines require FMPs to incorporate the EC species classification. NMFS has revised the final guidelines to state explicitly that Councils or the Secretary may—but are not required to—use an EC species classification.

In developing the text regarding EC species and ''stocks in the fishery,'' NMFS examined what existing FMPs are already doing and utilized that in its description of these classifications. For example, based on existing FMPs, the guidelines envision that species included for data collection and other monitoring purposes could be considered EC species (assuming they meet the criteria described in § 600.310(d)(5)(i)). However, such species could also be ''stocks in the fishery,'' as described under the NS3 guidelines (§ 600.320(d)(2)). NMFS recognizes the desire for greater specificity regarding exactly which species could or could not be considered EC species, but does not believe that further detail in the guidelines could clarify things definitively. Determining whether the EC category is appropriate requires a specific look at stocks or stock complexes in light of the general EC species description provided in the NS1 guidelines as well as the broader mandates and requirements of the MSA. If Councils decide that they want to explore potential use of the EC species classification, NMFS will work closely with them to consider whether such a classification is appropriate.

Comment 15: NMFS received several comments regarding the level of interaction that would be appropriate for the EC classification. Comments included: *de minimis* levels of catch should be defined to clarify the difference between ''stocks in a fishery'' and EC species; all stocks that interact with a fishery should be included as ''stocks in a fishery''; requiring non-target stocks to be considered part of the fishery as written supersedes NS9; guidelines should clarify that EC species do not have significant interaction with the fishery; and, bycatch species should not be included as ''stocks in a fishery.''

Response: NMFS is revising the final guidelines to clarify preliminary factors to be taken into account when considering a species for possible classification as an EC species. Such factors include that the species should: (1) Be a non-target species or non-target stock; (2) not be determined to be subject to overfishing, approaching overfished, or overfished; (3) not 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 retained for sale or personal use. Factors (2) and (3) are more relevant to species that are currently listed in FMPs and that have specified SDCs. With regard to factor (4), the final guidelines add new language in § 600.310(d)(5)(i)(D)—''not generally retained for sale or personal use''—in lieu of ''*de minimis* levels of catch'' and clarify that occasional retention of a species would not, in itself, preclude consideration of a species in the EC classification. The NS1 guidelines provide general factors to be considered, as well as some examples of possible reasons for using the EC category. However, the decision of whether to use an EC classification requires consideration of the specific fishery and a determination that the EC classification will be consistent with conservation and management requirements of the MSA.

Under the MSA, a Council prepares and submits FMPs for each fishery under its authority that requires conservation and management, and there is considerable latitude in the definition of the fishery under different FMPs. The definition of ''fishery'' is broad, and could include one or more stocks of fish treated as a unit for different purposes, as well as fishing for such stock (see MSA section 3(13)(B)). While some comments encouraged inclusion of all species that might interact with a fishery, all bycatch species, or all species for which there may be ''fishing'' as defined in MSA section 3(13)(B), NMFS does not believe that MSA mandates such a result. MSA does not compel FMPs to include particular stocks or stock complexes, but authorizes the Councils or the Secretary to make the determination of what the conservation and management needs are and how best to address them. Taking the broader approaches noted above would interfere with this discretion and also could result in overlapping or duplicative conservation and management regimes in multiple FMPs under different Council jurisdictions. As National Standard 6 requires that conservation and management measures, where practicable, minimize costs and avoid unnecessary duplication, NMFS believes that Councils should retain the discretion to determine which fisheries require specific conservation and management measures. With regard to bycatch, regardless of whether a species is identified as part of a fishery or not, National Standard 9 requires that FMPs, to the extent practicable, minimize bycatch and to the extent it cannot be avoided minimize bycatch mortality. Additional protections are afforded to some species under the Endangered Species Act, regardless of whether they are listed as stocks in a fishery. Further, as a scientific matter, NMFS disagrees that every bycatch species would require conservation and management measures to protect the species from becoming overfished, because some bycatch species exhibit high productivity levels (*e.g.*, mature early) and low susceptibilities to fishery (*e.g.*, rarely captured) that preclude them from being biologically harmed or depleted by particular fisheries.

Comment 16: NMFS received several comments requesting that the guidelines include a description of vulnerability and how it should be determined, since it is referenced throughout the guidelines.

Response: NMFS agrees, and has added § 600.310(d)(10) to the final action, to define vulnerability. In general, to determine the vulnerability of a species/stock becoming overfished, NMFS suggests using quantitative estimates of biomass and fishing rates where possible; however, when data are lacking, qualitative estimates can be used. NMFS is currently developing a qualitative methodology for evaluating the productivity and susceptibility of a stock to determine its vulnerability to the fishery, and anticipates the methodology to be finalized by February 2009. The methodology is based on the productivity-susceptibility analysis (PSA) developed by Stobutzki *et al.* (2001), which was suggested by many commenters. Stocks that have low susceptibilities (*e.g.*, rarely interact with the fishery, no indirect impacts to habitat, etc.) and high productivities (*e.g.*, mature at an early age, highly fecund, etc.) are considered to have a low vulnerability of becoming overfished, while stocks that have low productivities and high susceptibilities

to the fishery are considered highly vulnerable to becoming overfished.

Comment 17: Some commenters noted that the EC classification could be used to avoid reference point specification.

Response: NMFS believes that the guidelines provide mechanisms to address this issue. As a default, NMFS presumes that all stocks or stock complexes that Councils or the Secretary decided to include in FMPs are ''stocks in the fishery'' that need ACL mechanisms and AMs and biological reference points. Whether it would be appropriate to include species in the EC category would require consideration of whether such action was consistent with the NS1 guidelines as well as the MSA as a whole. If a Council or the Secretary wishes to add or reclassify stocks, a FMP amendment would be required, which documents rationale for the decision. However, the guidelines have been modified to note that EC species should be monitored to the extent that any new pertinent scientific information becomes available (*e.g.*, catch trends, vulnerability, etc.) to determine if the stock should be reclassified.

Comment 18: With regard to ecological, economic, and social (EES) factors related to OY, some commenters requested more specific guidance in incorporating the factors, and others commented that accounting for the factors is too time consuming. Other commenters expressed support for the reference to forage fish species and suggested including text on maximum economic yield and fish health.

Response: The NS1 guidelines generally describe OY as the long-term average amount of desired yield from a stock, stock complex, or fishery. OY is prescribed on the basis of MSY as reduced by EES factors (MSA section 3(33)). The NS1 guidelines set forth examples of different considerations for each factor, and NMFS believes the examples provide sufficient guidance on EES factors. NMFS has not made substantive changes from the proposed action, but has clarified that FMPs must address each factor but not necessarily each example.

Comment 19: NMFS received several comments in support of using stock complexes as a management tool in data poor situations and other comments that expressed concern about the use of stock complexes and indicator species. Comments included: stock complexes should only be used when sufficient data are lacking to generate species-specific SDCs and related reference points; there is little ecological basis for using indicator species to set ACLs for stock complexes (see Shertzer and Williams (2008)) as stocks within a stock complex exhibit different susceptibilities to the fishery; if used, stock complexes should be managed using the weakest or most vulnerable stock within the complex as a precautionary approach to management; it would be helpful to have examples of how a data poor stock could be periodically examined to determine if the stock is overfished or subject to overfishing.

Response: NMFS agrees that where possible Councils should generate stock-specific SDCs and related reference points for stocks in fishery; however, there are other circumstances in which stock complex management could be used. NMFS notes in § 600.310(d)(8) of the final action that 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 can not be defined on a stock-by-stock basis (see § 600.310(e)(1)(iii) of the final action); 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.

NMFS believes that the guidelines sufficiently addressed the issue that stock complexes should be managed using the most vulnerable stock within the complex. In § 600.310(d)(9) of the final action the guidelines note that ''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.'' Additionally, these guidelines address the concerns of Shertzer and Williams (2008), by recommending that both productivity and susceptibility of the stock (*i.e.*, vulnerability to the fishery) is considered when creating or re-organizing stock complexes.

Lastly, NMFS agrees and has modified the phrase in § 600.310(d)(9) of the proposed action ''Although the indicator stock(s) are used to evaluate the status of the complex, individual stocks within complexes should be examined periodically using available quantitative or qualitative information to evaluate whether a stock has become overfished or may be subject to overfishing'' to provide examples of quantitative or qualitative analysis.

Comment 20: NMFS received comments regarding the process for specifying the ACL for either a stock complex or for a single indicator species. The commenters were concerned that the proper data will not be utilized to determine whether the ACL should be set for the stock complex or for single indicator species. They feel that the use of single indicator species would not represent the stock's abundance, especially in the St. Thomas/St. John and St. Croix fisheries.

Response: NMFS understands the concern, but does not believe the guidelines need to be revised. NMFS will refer this comment to the Council.

Comment 21: NMFS received comments stating that the final action should clarify how SDCs and ACLs should be applied to stocks that are targeted in one fishery and bycatch in another, as well as circumstances where the stock is targeted by two or more FMPs that are managed by different regional councils.

Response: NMFS believes that the guidelines sufficiently addressed this issue in § 600.310(d)(7) of the final action, which notes ''* * * Councils should choose which FMP will be the primary FMP in which management objectives, SDC, the stock's overall ACL and other reference points for the stock are established.'' NMFS believes that the Councils should continue to have the discretion to make such determinations. NMFS, however, suggests that the primary FMP should usually be the FMP under which the stock is targeted. In instances where the stock is targeted in two or more FMPs (*e.g.*, managed by two or more Councils), Councils should work together to determine which FMP is the primary.

Comment 22: Several commenters requested further clarification on how prohibited species should be classified under the proposed classification scheme (see § 600.310(d)) because they felt it was unclear whether a species for which directed catch and retention is prohibited would be classified as ''in the fishery'' or as an ''ecosystem component''.

Response: NMFS believes that the information in § 600.310(d) provides a sufficient framework in which decisions can be made about how to classify a prohibited species under an FMP. Prohibition on directed catch and/or retention can be applied to either a stock that is ''in the fishery'' or an ''ecosystem component'' species. Managers should consider the classification scheme outlined in § 600.310(d) of the final action as well

as MSA conservation and management requirements generally. If a stock contains one of the ''in the fishery'' characteristics, then it belongs ''in the fishery'', regardless of the management tools that will be applied to it (*e.g.*, prohibition, bag limits, quotas, seasons, etc.). Also, if the intent is to prohibit directed fishing and retention throughout the exclusive economic zone (EEZ) for which a Council has jurisdiction, then the stock would, most likely, be identified in an FMP as ''in the fishery'' rather than as an ecosystem component of one particular FMP.

Comment 23: Several commenters asked at what level an ACL would be specified for a species for which directed catch and retention is prohibited. Setting the ACL at zero would not be logical because if even one was caught incidentally then AMs would be triggered. Setting it higher would also not be logical because the point is to ensure little to no catch of the stock.

Response: Prohibiting retention is a management measure to constrain the catch to a minimal amount. If listed as a stock in the fishery, the reference points for the species, such as OFL and ABC, should be set based on the MSY for the stock, or, if ESA listed, would be set according to the associated ESA consultation's incidental take statement, regardless of the management approach used. The ACL may not exceed the ABC, but should be set at a level so that the mortality resulting from catch and discard is less than the ACL.

Comment 24: NMFS received a comment stating that the specification of MSY must incorporate risk, be based on gear selectivity and support a healthy, functioning ecosystem. The commenter supported revisions to § 600.310(e)(1) of the proposed action but suggested that it should be strengthened to address ecosystem principles. The commenter cited NOAA Tech Memo NMFS–F/SPO–40 in contending that the concept of MSY contains inherent risks that must be addressed in establishing reference points. Other commenters stated that: Councils establish management measures with high probabilities of success (*e.g.*, 80 percent); ''fishery technological characteristics'' should be re-evaluated every two years; and MSY values normally equate to fishing down a population to forty percent of historic abundance and this may not be consistent with ecosystem based management.

Response: NMFS agrees that ecological conditions and ecosystem factors should be taken into account when specifying MSY and has added additional language to § 600.310(e)(1)(iv) of the final action to highlight this point. Such factors might include establishing a higher target level of biomass than normally associated with the specific stock's B_{msy}. In addition, ecological conditions not directly accounted for in the specification of MSY can be among the ecological factors considered when setting OY below MSY. Regarding the comment about establishing management measures with a high probability of success, this is addressed in comment #63. NMFS does not believe that the NS1 guidelines need to be revised to require that fishery technological characteristics be evaluated every 2 years; such characteristics would be routinely updated with each stock assessment. The MSA bases management of fishery resources on MSY, but provides that OY can be reduced from MSY for ecological factors. NMFS believes the guidelines are consistent with the MSA and allow Councils to implement ecosystem approaches to management.

Comment 25: Several comments requested the guidelines state that specification of reference points should not be required for a stock ''in the fishery'' if its directed catch and retention is prohibited because managers applied the prohibition in an effort to prevent overfishing.

Response: Prohibition of retention does not necessarily mean that overfishing is prevented. Even though the species cannot be retained, the level of fishing mortality may still result in overfishing. Many stocks for which prohibitions are currently in place are considered data-poor. NMFS acknowledges that specifying reference points and AMs will be a challenge for such stocks, but reiterates the requirement to establish ACLs and AMs for all managed fisheries, unless they fall under the two statutory exceptions (see § 600.310(h)(2) of the final action), and also the need to take into consideration best scientific information available per National Standard 2.

Comment 26: NMFS received comments voicing a concern about the NMFS process of determining the overfishing status of a fishery, because fishery management measures have been implemented to end overfishing, but stocks are still listed as subject to overfishing and require ACLs by 2010. The commenters felt that several species under the Caribbean Fishery Management Council's protection should currently be removed from the overfished species list.

Response: NMFS agrees that this is an important issue. Due to the process inherent in determining the status of a stock there is inevitably a lag time between implementation of management measures and a new assessment of the stock's status under those measures. NMFS is required by the MSA to establish new requirements to end and prevent overfishing through the use of ACLs and AMs. The fisheries subject to overfishing, including several in the Caribbean, are required to have ACLs by 2010, and all other fisheries must have ACLs by 2011. The Council's Comprehensive Amendment that implemented the Sustainable Fisheries Act in 2006 included measures designed to end overfishing. Although these measures may have ameliorated fishing pressure for some fishery resources in the U.S. Virgin Islands, the Council will need to evaluate the existing fishery management measures to determine whether they are sufficient to meet the new statutory requirements for ACLs and AMs.

Comment 27: Several commenters stated that NMFS should not include the OFL as the basis for overfishing SDC. Specific comments included: (1) The MSA does not define or require OFL, so NMFS should not use it in the guidelines; (2) catch-based SDC are inconsistent with the Magnuson-Stevens Act intent and SDC should only be based on the fishing mortality rate as it relates to a stock or stock complex's capacity to achieve MSY on a continual basis; (3) the Magnuson-Stevens Act does not require use of the long term average OFL as MSY; (4) NMFS increases the risk of overfishing when theoretical catch estimates or a constant fishing mortality rate (F) are used to manage a fishery especially when a retrospective pattern exists in a stock or stock complex.

Response: The term, OFL, is not defined in the MSA. However, OFL is directly based on requirements of the MSA, including the concept of MSY, and the requirement to prevent overfishing. NMFS does not believe that lack of a definition in the MSA precludes definition and use of OFL in order to meet the objectives of the MSA. The MSA defines overfishing as a rate or level of fishing mortality that jeopardizes the capacity of the stock to produce MSY. This mortality rate is defined by NMFS as the MFMT. The OFL for a year is calculated from the MFMT and the best estimate of biomass for a stock in that year, and thus is simply the MFMT converted into an amount of fish. The OFL is an annual level of catch that corresponds directly to the MFMT, and is the best estimate of the catch level above which overfishing is occurring. OFL is in terms

of catch, and thus is in the same units as ABC and ACL. NMFS believes, therefore, that comparing catch to OFL is a valid basis for determining if overfishing has occurred that year. The relationship of MSY to OFL is that MSY is the maximum yield that the stock can provide, in the long term, while OFL is an annual estimate of the amount of catch above which overfishing is occurring. The annual OFL varies above and below the MSY level depending on fluctuations in stock size. Since both MSY and OFL are related to the highest fishing mortality rate that will not result in overfishing, it is expected that the long-term average of OFLs would equate to MSY, provided that the stock abundance is high enough to support MSY.

The NS1 guidelines give the Councils flexibility to determine if overfishing occurs by using either MFMT (F > MFMT) or actual annual catch (catch > OFL) as the criteria for overfishing determinations. There are advantages and disadvantages of using either measure. The advantages of using OFL as a SDC are that catch can be easily understood by constituents, a determination can be made as soon as catch totals are available, and there is no retrospective problem with setting the SDC itself. Use of OFL might not be appropriate for stocks with highly variable recruitment that can not be predicted and therefore incorporated into the forecast of stock condition on which OFL is based. The advantage of using MFMT to determine if overfishing is occurring is because F is based on a stock assessment analyzing the past performance of the fishery. This means that the MFMT method is less sensitive than the OFL method to recent fluctuations in recruitment. However, F cannot not be calculated until an assessment has been updated, which may lag the fishery by several years. Therefore, a status determination based on MFMT could be less current than a determination based on OFL and catch, and reflects past, rather than current, fishery performance. Also, if there is a retrospective pattern in the assessment, then the hindsight estimate of F for a particular year used for the SDC will be different than the forecast estimate of stock condition used when setting target catch levels and management measures for that same year. The choice of SDC for a stock should consider things like the frequency of stock assessments, the ability to forecast future stock size, and any known retrospective patterns in the assessment. If the SDC are appropriately chosen, NMFS does not believe that one method necessarily presents more risk that overfishing will occur.

Comment 28: NMFS received one comment which proposed that instead of being required to choose between OFL or MFMT as the SDC, that Councils should have the flexibility to use both. The comment implied that this would allow Councils to use MFMT as the SDC in years in which there is an assessment and OFL in years in which there is not an assessment.

Response: The NS1 guidelines require documentation for the rationale a Council uses to select the SDC within the FMP including defining overfishing status in terms of the MFMT (*i.e.*, fishing mortality rate) or OFL (*i.e.*, annual total catch) in such a way that overfishing can be monitored and determined on an annual basis. A Council could develop SDC based on both criteria, if sufficient rationale is provided.

Comment 29: NMFS received two comments in opposition to the ''overfished'' definition used by NMFS in the proposed rule. They point out that the current overfished definition could include stocks that are ''depleted'' due to changing environmental conditions not caused by fishing pressure. They propose that NMFS should revise the definition of ''overfished'' and create a ''depleted'' category for stocks that have declined below the minimum stock size threshold (MSST) due to changing environmental conditions.

Response: The overfished definition used by NMFS is consistent with the MSA. NMFS acknowledges that factors other than fishing mortality can reduce stock size below the MSST but NMFS believes the definition of overfished should not be altered. For stocks in a FMP, the MSA requires the Councils to rebuild the stock to a level consistent with producing the MSY regardless of the contributing factors. In most cases, the variation in relative contribution of environmental and fishing factors from year to year in reducing stock abundance is not known. When specifying SDC the Council is required to provide an analysis of how the SDC were chosen and how they relate to the reproductive potential of the stock. Specifically, the MSST should be expressed in terms of reproductive potential or spawning biomass. Furthermore, the stock assessment process can adjust the B_{msy} estimates and associated SDC due to environmental and ecological factors or changes in the estimates of reproductive potential, size/age at maturity, or other biological parameters.

Comment 30: Several comments suggested that NMFS should strike § 600.310(e)(2)(iii)(B) from the proposed action as it contradicts § 600.310(e)(2)(iii)(A) and could increase fishing pressure on a depleted stock by attributing low stock abundance to environmental conditions. Commenters criticized the requirement at § 600.310(e)(2)(iii)(B) that Councils ''must'' take action to modify SDC, and stated that there is little scientific evidence to show linkages between stock size and environmental conditions (citing to Restrepo *et al.* 1998 and NMFS. 2000. Endangered Species Act—Section 7 Consultation Biological Opinion and Incidental Take Statement). Commenters asserted that there is no statutory basis for this provision in the MSA and the legal standard for the word ''affect'' is vague and inadequate for ending overfishing. The comments stated that, in a time of anthropogenic climate change, stock dynamics are likely to change and by establishing this provision in the final action NMFS will undermine the statute's mandate to end overfishing. Commenters asserted that fisheries managers have and will respecify SDC to justify circumventing rebuilding targets, and the final guidelines should establish a high burden of proof to modify SDC due to changing environmental conditions or ''regime change'' (citing Fritz & Hinckley 2005).

Response: Section 600.310(e)(2)(iii) of this final action is essentially the same as text at § 600.310(d)(4) in the current NS1 guidelines, except for clarifications noted below. There is no change in the usage of ''must'' between the current guidance and this final NS1 guidance at § 600.310(e)(2)(iii). NMFS believes that the requirement of NS2, that conservation and management measures be based on the best available science, applies to the establishment of SDC. Therefore, in cases where changing environmental conditions alter the long-term reproductive potential of a stock, the SDC must be modified. As stocks and stock complexes are routinely assessed, long-term trends are updated with current environmental, ecological, and biological data to estimate SDCs. NMFS allows for flexibility in these provisions to account for variability in both environmental changes and variation in a stock's biological reaction to the environment.

The guidelines include language requiring a high standard for changing SDC that is consistent with NMFS Technical Guidance (Restrepo *et al.* 1998). NMFS outlines the relationship of SDC to environmental change in both the short and long-term in

§ 600.310(e)(2)(iii) of the final action. Total mortality of fish stocks includes many factors other than fishing mortality. Short-term environmental changes may alter the size of a stock or complex, for instance, by episodic recruitment failures, but these events are not likely to change the reproductive biology or reproductive potential of the stock over the long-term. In this case the Council should not change the SDC. Other environmental changes, such as some changes in ocean conditions, can alter both a stock's short-term size, and alter long-term reproductive biology. In such instances the Councils are required to respecify the SDC based on the best available science and document how the changes in the SDC relate to reproductive potential. In all cases, fishing mortality must be controlled so that overfishing does not occur. NMFS notes that, depending on the impact of the environmental change on the stock, failure to respecify SDC could result in overfishing, or could result in failure to achieve OY. In both cases, the fishery would not meet the requirements of NS1.

One change from § 600.310(d)(4) of the current NS1 guidelines occurs in § 600.310(e)(2)(iii)(A) of this final action. NMFS clarified that SDC ''should not'' rather than ''need not'' be changed if the long-term reproductive potential of a stock has not been affected by a changing environment. NMFS feels that this is consistent with setting a high standard for changing the SDC due to environmental changes. In addition, this action changes the phrase ''long-term productive capacity'' from the current NS1 guidance to ''long-term reproductive potential.'' NMFS believes the latter phrase is clearer and more accurately reflects the language in MSA section 303(a)(10).

Any changes to SDC are subject to Secretarial approval (§ 600.310(e)(2)(iv) of the final action), and the NS1 guidelines set a high standard for respecification of SDC due to environmental change. The Council must utilize the best available science, provide adequate rationale, and provide a basis for measuring the status of the stock against these criteria, and the SDC must be consistent with § 600.310(e)(2)(iii) of the final action. If manmade environmental changes are partially responsible for the overfished condition, the Council should recommend restoration of habitat and ameliorative programs in addition to curtailing fishing mortality.

Comment 31: NMFS received several comments that state that by requiring reference points to be point estimates NMFS is not acknowledging the uncertainty inherent in fishery management science. The comments expressed that the best way to incorporate uncertainty was to express SDCs as ranges and not point estimates.

Response: NMFS believes that uncertainty in SDC, OFL, and other fishing level quantities is best dealt with by fully analyzing the probability that overfishing will occur and that the stock might decline into an overfished condition, but we recognize that such a full analysis is not possible in many data-limited situations. When using a probability based approach, the distribution of probabilities includes a point estimate and it extends along a range. A probability based approach is already used in many rebuilding plans, for example, what fishing level will provide at least a 70% chance that the stock will be rebuilt in 10 years. NMFS scientists are working on a technical document that will describe some of the currently available methods to do such calculations, as well as some proxy approaches that could be used in situations where available data and methods do not allow calculation of the probability distributions.

Comment 32: NMFS received a number of comments regarding the proposed description of the relationship between ACT and OY—that achieving the ACT on an annual basis would, over time, equate to the OY. Comments requested more clarification, or did not agree with the described ACT–OY relationship.

Response: NMFS has revised the final action to remove the requirement that ACT be established, and instead discussed how targets, including ACT, function within the system of AMs to prevent the ACL from being exceeded. NMFS has also removed the discussion about the relationship of ACT to OY, based on the comments received. The full range of conservation and management measures for a fishery, which include the ACL and AM provisions, are required to achieve the OY for the fishery on a continuing basis. NMFS interprets the phrase ''achieving, on a continuing basis, the optimum yield for each fishery'' to mean producing from each stock or stock complex or fishery a long-term series of catches such that the average catch is equal to OY, overfishing is prevented, the long-term average biomass is near or above B_{msy}, and overfished stocks and stock complexes are rebuilt consistent with timing and other requirements of section 304(e)(4) of the MSA and § 600.310(j) of the final NS1 guidelines. NMFS notes that for fisheries where stock abundance is below the level that can produce the OY without the fishing mortality rate exceeding the MFMT, the annual yield will be less than the long-term OY level. In the case of an overfished fishery, ''optimum'' with respect to yield from a fishery means providing for rebuilding to a level consistent with producing the MSY in such fishery. When stock abundance is above $B_{msy,}$ a constant fishing mortality control rule may allow the annual catch to exceed the long-term average OY without overfishing occurring, but frequent stock assessments need to be conducted to update the level of stock abundance.

Comment 33: One commenter stated that ''OY equates with the acceptable biological catch (''ABC''), which in turn is the level at which ACL should be set.'' Another commenter stated that, in specifying ACLs, a Council should not exceed MSY, because MSY—as opposed to ABC—is the ''fishing level recommendation'' that should not be exceeded per MSA 302(h)(6).

Response: MSA includes the terms ''fishing level recommendations,'' ''acceptable biological catch,'' and ''annual catch limits'' but does not define them. As such, NMFS has considered how to interpret these provisions in light of the statutory text and taking into consideration public comment during scoping and in response to the proposed NS1 guidelines. NMFS believes that ABC refers to a level of ''catch'' that is ''acceptable'' given the ''biological'' characteristics of the stock or stock complex. As such, OY does not equate with ABC. The specification of OY is required to consider a variety of factors, including social and economic factors, and the protection of marine ecosystems, which are not part of the ABC concept. The Councils determine the ACL, which may not exceed the fishing level recommendations of its science advisors. Of the several required SSC recommendations (MSA 302(g)(1)(B)), the ABC is most directly applicable as the constraint on the Council's ACL. Although MSY and ABC are both derived from a control rule, the ABC is the appropriate constraint on ACL because it is the annualized result of applying that control rule (thus is responsive to current stock abundance) whereas the MSY is the expected long-term average from a control rule. The Council should generally set the ACL lower than the ABC to take into account other factors related to preventing overfishing or achieving OY, or it may set the ACL equal to the ABC and take these additional factors into account when setting an ACT below the ACL.

Comment 34: Several commenters stated that NMFS's definition

framework for ACLs contains buffers that are not required by the Magnuson-Stevens Act and reduce or prevent the likelihood that OY can be achieved for a stock (Reducing a stock's OFL for scientific and management uncertainty, and OY factors results in too many reductions and makes it too difficult to achieve OY).

Response: NMFS believes that fisheries managers cannot consistently meet the requirements of the MSA to prevent overfishing and achieve, on a continuing basis, OY unless they address scientific and management uncertainty. The reductions in fishing levels that may be necessary in order to prevent overfishing should be only the amount necessary to achieve the results mandated by the MSA. Properly applied, the system described in the guidelines does not result in ''too many deductions,'' but rather, sets forth an approach that will prevent overfishing, achieve on a continuing basis OY, and incorporate sufficient flexibility so that the guidelines can be applied in different fisheries.

Comment 35: Several commenters suggested that NMFS clarify language to ensure that all aspects of fishing mortality (e.g., dead discards and post-release mortality) are accounted for in the estimates of ABC or when setting the ACL, and that all catch is counted against OY. NMFS also received comments that accounting for bycatch mortality in data poor situations should not be required.

Response: NMFS agrees that all sources of fishing mortality, including dead discards and post-release mortality from recreational fisheries must be accounted for, but believes that language in § 600.310(e)(3)(v)(C), (f)(2)(i) and (f)(3)(i) in both the proposed and final action sufficiently explains that catch includes fish that are retained for any purposes, mortality of fish that have been discarded, allocations for scientific research, and mortality from any other fishing activity. NMFS, however, disagrees that, when bycatch data is lacking, managers could ignore this known source of fishing mortality. Ignoring a known source of fishing mortality because data are lacking leads to underestimating catch. Unless this is factored in—for instance, as increased uncertainty leading to more conservative ABC and appropriate AMs (including ACT control rules)—overfishing could occur. NMFS's National Bycatch Report (due to be published in late 2008 or early 2009) provides comprehensive estimates of bycatch of fish, marine mammals, and non-marine mammal protected resources in major U.S. commercial fisheries. For instances where the National Bycatch Report does not provide bycatch data, NMFS suggests developing proxies based on National Bycatch Report bycatch ratios in similar fisheries until better data are available. For more information on the National Bycatch Report, *see http://www.st.nmfs.noaa.gov/st4/nop/Outreach/NBR_Factsheet_Final.pdf.* However, the decision about the best methodology for estimating bycatch should be made by the Council in consultation with its SSC, considering the best available scientific information.

Comment 36: One commenter requested clearer guidance for the specification of ABC and ultimately an ACL in cases where scientific uncertainty ''overwhelms'' the SSC's ability to make a valid ABC recommendation.

Response: The NS1 Guidelines recognize that precise quantitative assessments are not available for all stocks and some stocks do not have sufficient data for any assessment beyond an accounting of historical catch. It remains important to prevent overfishing in these situations, even though the exact level of catch that causes overfishing is not known. The overall guidance is that when stocks have limited information about their potential yield, harvest rates need to be moderated until such information can be obtained. Possible approaches include setting the ABC as 75% of recent average catch; see NMFS' Technical Guidance in Restrepo *et al.* (1998). NMFS is currently working on a report on control rules that will provide additional examples of possible approaches for data-limited situations as well as approaches that can use a better set of information.

Comment 37: ABC and ACT control rules should be revised to require consideration of life history characteristics (e.g., productivity, geographic range, habitat preferences, etc.) of a stock when setting control rules or catch limits.

Response: NMFS agrees that the productivity of stock, as well as the stocks susceptibility to the fishery should be considered when developing the ABC control rule. NMFS refers to these factors together as the vulnerability of stock, which is defined in § 600.310(d)(10) of the final action. The ABC control rule (see § 600.310(f)(4) of the final action) is based on scientific knowledge about the stock, which includes a stock's vulnerability to the fishery.

Regarding the ACT control rule, the final guidelines do not require that ACTs always be established, but provide that ACTs may be used as part of a system of AMs. When used, ACT control rules address management uncertainty, which is not related to the productivity of the stock. As noted in § 600.310(g)(3) of the final action, however, a Council could choose a higher performance standard (e.g., a stock's catch should not exceed its ACL more often than once every five or six years) for a stock that is particularly vulnerable to the effects of overfishing. In considering the performance standard, a Council should consider if the vulnerability of the stock has been accounted for in the ABC control rule, so as not to double count this type of uncertainty and provide unduly cautious management advice.

Comment 38: NMFS received comments requesting that text in § 600.310(f) of the proposed action be modified to clarify that ABC may not equal or exceed OFL; Councils are required to establish ABC control rules; the ABC and ACT control rules must stipulate the stock level at which fishing will be prohibited; and ACL cannot equal or exceed the ABC.

Response: NMFS does not agree that the guidelines should prohibit ABC from being equal to OFL, or ACL from being equal to ABC. NMFS has added text to the guidelines (§ 600.310(f)(3) and (f)(4)) to clarify that it believes that ABC should be reduced from OFL in most cases, and that if a Council recommends an ACL which equals ABC, and the ABC is equal to OFL, the Secretary may presume that the proposal would not prevent overfishing, in the absence of sufficient analysis and justification for the approach. NMFS agrees that an ABC control rule is required. NMFS does not agree, however, that the ABC and ACT control rules must stipulate the level at which fishing is prohibited. Here it is important to distinguish between setting an annual level of catch equal to zero because the stock biomass is low, from prohibiting landings for the remainder of a fishing year because the ACL has already been achieved. For the first type of prohibition, an ABC control rule could stipulate the level at which fishing is prohibited due to low stock biomass, but such a low level of biomass is likely to be below the MSST which will invoke development of a rebuilding plan with associated modification of the ABC control rule for the duration of the plan. NMFS, however, disagrees that the ACT control rule should have a similar stipulation as the primary function of this control rule is to account for management uncertainty and to serve as the target for inseason management actions.

Comment 39: NMFS received several comments that spatial-temporal management of ACLs should be employed as an integral part of effective catch-limit management. The commenters noted that apportioning ACLs by seasons and areas could reduce bycatch, protect sensitive habitats, reduce competition among fishery sectors, avoid localized and serial depletions of stocks, and ensure geographic and seasonal availability of prey to key predators.

Response: NMFS acknowleges that spatial and temporal considerations of fishery removals from a stock can be important. Many fisheries currently incorporate spatial and temporal considerations. However, in the context of NS1, these considerations would be relevant only if the overfishing definition or the OY definition for a stock included spatial or temporal divisions of the stock structure. NMFS believes the guidelines give Councils flexibility to consider spatial and temporal issues in establishing ACLs for a stock, and does not agree that the NS1 guidelines need to specifically address this issue. Apportioning ACLs by seasons and areas could be considered as Councils develop conservation and management measures for a fishery to meet the full range of MSA requirements, including the NS for basing conservation and management measures upon the best scientific information available (NS2); taking into account the importance of fishery resources to fishing communities to provide sustained participation and minimize adverse economic impacts (NS8); minimizing bycatch (NS9); and allocating fishing privileges among various U.S. fishermen that are fair and equitable, reasonably calculated, and carried out in such a manner that no particular entity acquires an excessive share of the catch (NS4).

Comment 40: NMFS received several comments about the role of the SSC in specifying ABC. Several commenters stated that the final ABC recommendation should be provided by the SSC (i.e., final peer review process), rather than an additional peer review process. Some commenters expressed concern that both the SSC and peer review process would recommend an ABC, leaving the Council to use the lower of the two recommended ABC values. One comment stated that the SSC should have the discretion to recommend an ABC that is different from the result of the control rule calculation in cases where there was substantial uncertainty or concern relating to the control rule calculated ABC.

Response: NMFS agrees that the SSC should provide the final ABC recommendation to their Council. In the preamble of the proposed NS1 revisions, NMFS acknowledged that the statutory language could be subject to different interpretations (*see* p. 32532 of 73 FR 32526; June 9, 2008). MSA refers to not exceeding fishing level recommendations of ''scientific and statistical committee or peer review process'' in one place and SSC recommendations for ABC and MSY in another place. Compare MSA sections 302(h)(6) and 302(g)(1)(B). Section 302(g)(1)(E) of the MSA provides that the Secretary and a Council may, but are not required to, establish a peer review process. NMFS feels that the Council should not receive ABC recommendations from two different sources (SSC and peer review). In order to avoid confusion, and in consideration of the increased role of SSCs in the MSA, NMFS believes that the SSC should provide the ABC recommendation and Councils should establish a clear process for receiving the ABC recommendation (as described in § 600.310(f)(3) of this action). The advance notice of proposed rulemaking (ANPR) (73 FR 54132; September 18, 2008) for potential revision of the National Standard 2 Guidelines includes consideration of the relationship between SSCs and peer review processes. NMFS believes the roles of the peer review process and the SSC complement each other. For example, a peer review process may conduct an extensive technical review of the details of each stock assessment. The SSC can then use the assessment document and its peer review, consider unresolved uncertainties, seek consistency with assessment decisions made for other stocks in the region, and arrive at an ABC recommendation. In addition, NMFS agrees that SSCs could provide an ABC recommendation that differed from the result of the ABC control rule calculation based on the full range of scientific information available to the SSC. The SSC would have explain why the recommendation differed from the calculated value. NMFS has added clarifying language into § 600.310(f)(3) of this action.

Comment 41: NMFS received a variety of comments on the role of the SSC and suggestions that the SSC role should be clarified. Comments included: There should be a mandatory peer review of significant SSC recommendations; the SSC should be directed to draw information and recommendations from the broadest possible range of scientific opinion; the SSC recommendation should include a discussion of alternative recommendations that were considered and alternative methodologies that were explored; what is the role of the SSC in providing recommendations for achieving rebuilding targets?; what is the SSC's role in providing ''reports on stock status and health, bycatch, habitat status, social and economic impacts of management measures and sustainability of fishing practices''?; the rule should clarify that the SSC is not charged with actually collecting the data and writing reports; the guidelines should specify the appropriate qualifications and membership of the SSCs and peer review process; the guidelines should specify the relative roles of the SSCs, peer review process, and Councils in establishing ACLs; the guidelines should specify the relative roles of NMFS, the Councils, the SSCs and the peer review process in selecting and evaluating AMs; NMFS should establish formal criteria for SSC membership, including formal training and/or experience in fisheries and/or ecological science or economics; NMFS should create oversight mechanisms and responsibility within NMFS to ensure that members are both qualified and acting in the public interest rather than representing stakeholders; NMFS should provide adequate training programs so that new members are well-prepared to meet these challenges; and NMFS should provide a mechanism for SSC members to identify and challenge political interventions, including potentially the development of a new scientific appeal function, staffed by a board of objective, external expert scientists.

Response: In developing the NS1 guidelines, NMFS focused on the SSC recommendation of the ABC as it is an important reference point for the Councils to use when developing ACLs. NMFS feels that the NS1 guidelines as proposed are clear in that the SSC provides the ABC recommendation and the Councils establish the ACLs. Both the ABC control rules and the ACT control rules could be developed with input from the SSC, Council, and peer review process as appropriate. NMFS believes that the NS1 guidelines adequately address the requirements for SSC recommendations that pertain to NS1. NMFS believes that other specific roles of the SSC would be more appropriately addressed in the National Standard 2 (NS2) guidelines.

Comment 42: Some commenters supported the proposed guidelines regarding the SSC, its relation to the Council, and provision of science advice such as ABC, but requested that the

guidelines further emphasize that managers follow the advice of their scientific advisors in all cases when setting catch limits. Other commenters opposed the provisions and stated that accounting for scientific uncertainty is a matter of policy, not science and therefore should be delegated to the Council. Instead, the commenters proposed that the SSC should be recommending the OFL and that the Council may not set an ACL in excess of the OFL as determined by the SSC.

Response: NMFS believes that determining the level of scientific uncertainty is not a matter of policy and is a technical matter best determined by stock assessment scientists as reviewed by peer review processes and SSCs. Determining the acceptable level of risk of overfishing that results from scientific uncertainty is the policy issue. The SSC must recommend an ABC to the Council after the Council advises the SSC what would be the acceptable probability that a catch equal to the ABC would result in overfishing. This risk policy is part of the required ABC control rule. The Council should use the advice of its science advisors in developing this control rule and should articulate the control rule in the FMP. In providing guidance on establishing a control rule for the ABC, NMFS recognizes that all estimates of the OFL are uncertain, and that in order to prevent overfishing with more than a 50 percent probability of success, the ABC must be reduced from the OFL. The guidance is clear that the control rule policy on the degree of reduction appropriate for a particular stock is established by the Council. To the extent that it results in the ABC being reduced from the OFL, the SSC is carrying out the policy established by the Council. NMFS disagrees that the SSC should recommend OFL and not ABC. The MSA specifies a number of things that make up the recommendations that SSCs provide to their Council including recommendations for ABC, preventing overfishing, MSY, achieving rebuilding targets, reports on stock status and health, bycatch, habitat status, social and economic impacts of management measures, and sustainability of fishing practices. Of these, the ABC is directly relevant as the fishing level recommendation that constrains the ACL.

Comment 43: One comment expressed that Councils must be allowed to specify information needed in the SAFE report.

Response: NMFS agrees. NMFS has removed the following sentence from § 600.310(b)(2)(v)(B) of the final action: ''The SSC may specify the type of information that should be included in the Stock Assessment and Fishery Evaluation (SAFE) report (see § 600.315).''

The contents of the SAFE report fall under the purview of the National Standard 2 (NS2) guidelines. NMFS is currently considering revising the NS2 guidelines, including modification of the language describing the content and purpose of SAFE reports. NMFS recently published an advance notice of proposed rulemaking (73 FR 54132; September 18, 2008) to revise the NS2 guidelines and encourages the public to provide comment.

Comment 44: One commenter believed the ACT should be a suggested component of a fishery management plan rather than a mandated component of an FMP. Although the ACT may clearly distinguish management uncertainty from other sources of uncertainty, adding a target does not fundamentally improve the process. It is more important to correctly adjust the ACL based on actual performance data than to create a separate target or ACT control rule based on theory to account solely for management uncertainty.

Response: The final guidelines do not require that ACTs always be established, but provide that ACTs may be used as part of a system of AMs. NMFS disagrees that a target does not fundamentally improve the process. ACL is to be treated as a limit—an amount of catch that the fishery should not exceed. The purpose of utilizing an ACT is so that, given uncertainty in the amount of catch that will result from the conservation and management measures in the fishery, the ACL will not be exceeded. Whether or not an ACT is explicitly specified, the AMs must address the management uncertainty in the fishery in order to avoid exceeding the ACL. ACLs are subject to modification by AMs.

Comment 45: One comment stated that the purpose of an ACT is to address ''management uncertainty'' which seems to be a very abstract and unquantifiable concept that the Councils are likely to struggle with.

Response: NMFS disagrees that management uncertainty is an abstract concept. It relates to the difference between the actual catch and the amount of catch that was expected to result from the management measures applied to a fishery. It can be caused by untimely catch data that usually prevents inseason management measures from being effective. Management uncertainty also results from underreporting, late reporting and misreporting and inaccurate assumptions about discard mortality of a stock in commercial and recreational fisheries. One way to estimate management uncertainty is to examine a set of annual actual catches compared to target catches or catch quotas for a stock. If all or most of the catches fall closely around their target catches and don't exceed the OFL then management uncertainty is low; if actual catches often or usually result in overfishing then the management uncertainty is high and should be accounted for when establishing the AMs for a fishery, which may include setting an ACT.

Comment 46: NMFS received several comments regarding scientific and management uncertainty. In general these comments included: Clarify the meaning of scientific uncertainty; clarify that some types of uncertainty may not be considered in the ABC control rule process; increase research efforts in order to deal with scientific uncertainty; provide flexibility in the guidelines regarding how the Councils deal with uncertainty; and recognize that recreational fisheries are unduly impacted by the guidelines due to delayed monitoring of catch.

Response: Scientific uncertainty occurs in estimates of OFL because of uncertainty in calculations of MFMT, projected biomass amounts, and estimates in F (i.e., confidence intervals around those parameter estimates). In addition, retrospective patterns in estimates of future stock biomass and F (i.e., biomass may be overestimated and F underestimated on a regular basis) occur in some stock assessments and should be accounted for in determining ABC. NMFS revised the guidelines to make clear that all sources of scientific uncertainty—not just uncertainty in the level of the OFL—must be considered in establishing the ABC, and that SSCs may incorporate consideration of uncertainty beyond that specifically accounted for in the ABC control rule, when making their ABC recommendation. Management uncertainty should be considered primarily in establishing the ACL and AMs, which could include ACTs, rather than in specification of the ABC.

Comment 47: The definition of ABC in § 600.310(f)(2)(ii) of the proposed rule provides that ABC is a level of catch ''that accounts for scientific uncertainty in the estimate of OFL'' and is specified based on the ABC control rule. Scientific uncertainty is not and should not be limited to the estimate of OFL. That restriction would make it more difficult to implement other appropriate methods for incorporating scientific uncertainty in other quantities such as distribution of long term yield.

Response: NMFS agrees. NMFS has revised §§ 600.310(f)(2)(ii), (f)(2)(iii),

and (f)(4) of the action to state that ABC accounts for scientific uncertainty in the estimate of OFL and other scientific uncertainty.

Comment 48: Several commenters stated that buffers, or margins of safety, need to be required between the overfishing level and annual catch limits to account for uncertainty, and that the final action should require the use of such buffers to achieve a high probability that overfishing does not occur. NMFS received comments suggesting that buffers between limit and target fishing levels reduce the chance that overfishing will occur and should be recognized as an accountability measure. Other commenters thought that the provision for setting ACT less than ACL meant that a Council has no discretion but to establish buffers. They said that while buffers may be appropriate in certain circumstances, they may also prevent achievement of OY in some circumstances.

Response: As noted elsewhere, NMFS has revised the final guidelines: they do not require that ACTs always be established, but provide that ACTs may be used as part of a system of AMs. The guidelines are intended only to provide Councils with direction on how the requirements of NS1 can be met, incorporating the requirement for ACLs and AMs such that overfishing does not occur. To prevent overfishing, Councils must address scientific and management uncertainty in establishing ABC, ACLs, and AMs. In most cases, some reduction in the target catch below the limit will result. NMFS does not believe that requiring buffers is appropriate, as there may be circumstances where that is not necessary to prevent overfishing. However, the guidelines require that AMs in a fishery be adequate to prevent ACLs from being exceeded, and that additional AMs are invoked if ACL is exceeded.

Comment 49: Some commenters stated that Councils needed flexibility to effectively tailor fishery management plans to the unique conditions of their fisheries, and that Councils should also have flexibility in how to account for scientific and management uncertainty.

Response: NMFS agrees that Councils should have flexibility, so long as they meet the requirements of the statute. ACLs to prevent overfishing are required, and management and scientific uncertainty must be considered and addressed in the management system in order to achieve that objective. NMFS also believes that Councils should be as transparent and explicit as possible in how uncertainty is determined and addressed, and believes the guidelines provide a good framework to meet these objectives.

Comment 50: One commenter supported NMFS' attention to scientific and management uncertainty, but thought that the better approach to deal with uncertainty is to reduce uncertainty. They stated that to accomplish this objective NMFS must increase its support for agency scientific research specific to stock assessments and ecosystem science.

Response: NMFS agrees. However, the processes proposed in the guidelines will address the current levels of uncertainty and accommodate reduced uncertainty in the future, as improvements in data are made.

Comment 51: Some commenters said that implementing ACLs would lead to economic disruption, particularly in the recreational fishing sector, because of a large degree of management uncertainty. One commenter cited difficulties in obtaining timely and accurate data, particularly for recreational fisheries, and asked if recreational allocations would have to be reduced due to delays in obtaining recreational harvest estimates.

Response: Preventing overfishing is a requirement of the MSA. The ACL mechanisms and AMs for a fishery must be adequate to meet that requirement, and in some cases, reductions in catch levels and economic benefits from a fishery may result. The specific impacts of implementing ACLs in a fishery will be analyzed when the ACLs are established in an FMP.

Comment 52: One commenter stated that the guidelines would require reducing catches well below existing OY levels, and that many species are known to be fished at low levels which are highly unlikely to lead to overfishing. They stated that this is inconsistent with responsible marine management and seems unlikely to represent the intent of Congress.

Response: Nothing in the guidelines would require a reduction in fishing if, in fact, the stocks are fished at low levels which are highly unlikely to lead to overfishing, and this conclusion is supported by science.

Comment 53: One commenter asked if OY could be specified for a fishery or a complex, or if the guidelines would require specification of OY for each species or complex.

Response: The guidelines provide that OY can be specified at the stock, stock complex or fishery level.

Comment 54: NMFS received several comments both supporting and opposing the use of inseason AMs (§ 600.310(g) of the proposed action). The commenters that supported the use of inseason AMs typically suggested that the Councils and NMFS improve their capability to use inseason AMs and/or that NMFS must make inseason closure authority a required element of FMPs. Opponents of inseason AMs commented that it is more reasonable to implement AMs after reviewing annual fishery performance data; there is no requirement in the law to impose inseason measures; inseason closures without individual transferable quotas will generate derby fisheries; and the requirement to use inseason AMs whenever possible would be difficult where monitoring data is not available.

Response: MSA provides for ACLs to be limits on annual catch, thus it is fully appropriate and consistent with the Act that available data be utilized to prevent ACLs from being exceeded. Conservation and management measures for a fishery should be designed so that ACLs are not routinely exceeded. Therefore, FMPs should contain inseason closure authority giving NMFS the ability to close fisheries if it determines, based on data that it deems sufficiently reliable, that an ACL has been exceeded or is projected to be reached, and that closure of the fishery is necessary to prevent overfishing. NMFS believes that the alternative result, which is that data are available inseason that show an ACL is being exceeded, but no management action is taken to prevent overfishing, would not meet the intent of the MSA. The MSA requires ACLs in all fisheries. It does not provide an exemption based on a concern about derby fishing. NMFS has modified the language in § 600.310(g)(2) of this action to indicate that ''For fisheries without inseason management control to prevent the ACL from being exceeded, AMs should utilize ACTs that are set below ACLs so that catches do not exceed the ACL.''

Comment 55: NMFS received some comments that generally expressed that AMs will be difficult to implement and that the provisions need to be clarified. Comments included: if an ACL is exceeded, a review by the Council must occur before implementation of the AMs; the Council must examine the ''problem'' that caused the overage—which means nothing will happen quickly; and it is not clear what ''biological consequences'' means in § 600.310(g)(3) of the proposed action.

Response: As proposed, AMs are management measures designed to prevent an ACL from being exceeded, as well as measures to address an overage of an ACL if it does occur. NMFS recommends that, whenever possible, Councils implement AMs that allow inseason monitoring and adjustment of

the fishery. The AMs should consider the amount of time required for a Council to conduct analyses and develop new measures. In general, AMs need to be pre-planned so they can be effective/available in the subsequent year, otherwise, there could be considerable delay from the time that an overage occurs to the time when measures are developed to address the overage. Not all overages may warrant the same management response. Consider hypothetically the example of a fishery for which a 3 fish bag limit with 16 inch minimum size is expected to achieve the target catch level without exceeding the ACL. For such a fishery, the Council might implement AMs such that, if the catch was under the ACL or exceeded it by less than 5 percent, the same bag and size limits would apply the following year. If the ACL was exceeded by 5–25 percent, the bag limit the following year would be reduced to 2 fish, and if the ACL was exceeded by more than 25 percent the bag limit would be reduced to 1 fish. The AMs could also address a situation where catch was below the target level, indicating that the initial measures might be too strict. The objective is to have pre-planned management responses to ACL overages that will be implemented in the next season, so that flawed management measures do not result in continuing overages for years while Councils consider management changes. An FMP must contain AMs (see § 600.310(c)(5) of the final action). However, NMFS believes that the FMP could contain more general framework measures and that specific measures, such as those described hypothetically above, could be implemented through harvest specifications or another rulemaking process.

By ''biological consequences,'' NMFS means the impact on the stock's status, such as its ability to produce MSY or achieve rebuilding goals. For example, if information was available to indicate that, because of stronger than expected recruitment, a stock was above its B_{msy} level and continued to grow, even though the ACL was exceeded for the year, that could indicate that the overage did not have any adverse biological consequences that needed to be addressed through the AM. On the other hand, if the ACL for a long lived stock with low reproductive potential was exceeded by 100 percent, AMs should be responsive to the likelihood that some long-term harm to the stock may have been caused by the overage.

Comment 56: One commenter expressed concern about the term ''re-evaluated'' in §§ 600.310(g)(3) and (g)(4) in the proposed action. They stated that this could imply that Councils simply have to increase ACLs when they have ACL exceedances, and suggested that, if catch exceeds ACL more than once in last four years, there should be automatic buffer increases in setting ACL below OFL to decrease likelihood of exceeding ACL.

Response: If the performance standard is not met, the Councils must re-evaluate the system of ACLs and AMs, and modify it if necessary so that the performance standard is met. Since the ACL cannot exceed the ABC recommended by the SSC, NMFS does not believe that the scenario described by the commenter would arise. NMFS also does not believe that the guidelines should recommend automatic buffer increases in this case. The specific factors that caused the performance standard to not be met need to be analyzed and addressed. NMFS also notes that, in addition to this re-evaluation of the system of ACLs and AMs, AMs themselves are supposed to prevent and address ACL overages.

Comment 57: Several comments were received related to accountability measures for when catch exceeds the ACL. Some comments supported the concept that a full payback of ACL overages should be required for all stocks. Comments included: Overage deductions should be normal business for rebuilding and healthy stocks alike; NMFS should require all overages to be accounted for in full for all managed fisheries no later than when the ACL for the following fishing year is determined; and overage deductions must be viewed as an independent requirement from actions geared to preventing overages from occurring in the future, such as modifications of management measures or changes to the full system of ACLs, ACTs, and AMs.

Response: MSRA is silent with regard to mandatory payback of ACL overages. However, in developing the ACL provisions in the MSRA, it appears that Congress considered mandatory paybacks and did not include that requirement in the MSRA. NMFS believes that paybacks may be an appropriate AM in some fisheries, but that they should not be mandated, but rather considered on a case by case basis for stocks and stock complexes that are not in a rebuilding plan.

Comment 58: Several comments opposed the concept of an overage adjustment when catch exceeds the ACL for stocks that are in rebuilding plans (§ 600.310(g)(3) of the proposed action). Comments included: The MSA does not require this, this provision was removed from the drafts of the MSRA, and a full ''payback'' the following year may be unnecessary. Other comments supported the concept but wanted to strengthen § 600.310(g)(3) of the guidelines to remove text that stated: ''unless the best scientific information available shows that a reduced overage adjustment, or no adjustment, is needed to mitigate the effects of the overages.''

Response: NMFS believes that more stringent requirements for AMs are necessary for stocks in rebuilding plans. MSA 304(e)(3) provides that, for overfished stocks, an FMP, FMP amendment, or proposed regulations are needed to end overfishing immediately in the fishery and rebuild overfished stocks. There are a number of examples where failure to constrain catch to planned levels early in a rebuilding plan has led to failure to rebuild and the imposition of severe catch restrictions in later years in order to attempt to meet the required rebuilding timeframe. Thus, for rebuilding stocks, NMFS believes that an AM which reduces a subsequent year's ACL by the amount of any overage is appropriate, and will help prevent stocks failing to rebuild due to annual rebuilding targets being exceeded. NMFS does provide that if there is an analysis to show that all or part of the deduction is not necessary in order to keep the stock on its rebuilding trajectory, the full overage payback is not necessary. For example, an updated stock assessment might show that the stock size has increased faster than expected, in spite of the overage, and that a deduction from the subsequent ACL was not needed. For most rebuilding stocks, assessments cannot be updated annually, and in the absence of such analytical information, NMFS believes that the guideline provision is necessary to achieve rebuilding goals for overfished stocks.

Comment 59: Some commenters expressed support for the AMs as proposed and agreed that AMs should prevent catch from exceeding the ACL and address overages if they should occur. Other commenters suggested that AMs should be tied to overfishing or that AMs should be triggered when catch exceeds the ABC (as opposed to the ACL). Some commenters expressed that the MSA does not require the application of AMs if the ACL is exceeded.

Response: In developing the guidelines, NMFS considered using OFL or ABC as a point at which mandatory AMs should be triggered. However, NMFS believes that Congress intended the ACL to be a limit, and as such, it should not be exceeded. In addition, ''measures to ensure accountability'' are required in association with the ACL in MSA section 303(a)(15). Therefore, it is

most appropriate to apply AMs if the ACL is exceeded. In addition, the purpose of ACLs is to prevent overfishing, and AMs triggered at the ACL level should be designed so that the ABC and OFL are not exceeded.

Comment 60: Several comments were received regarding the proposed performance standards. The performance standard that NMFS proposed in the proposed action stated that: ''If catch exceeds the ACL more than once in the last four years, the system of ACLs, ACTs and AMs should be re-evaluated to improve its performance and effectiveness.'' In cases where AMs are based on multi-year average data, the proposed performance standard stated: ''If average catch exceeds the average ACL more than once in the last four years, then the ACL, ACT and AM system should be re-evaluated.'' The commenters that supported the proposed performance standard suggested that it would allow the Council more flexibility in the management of their fisheries with ACLs. Commenters that disliked the proposed performance standard suggested that the Councils should have more flexibility in determining the performance standards, expressed concerns that the performance standard may not be precautionary enough, or expressed that it was arbitrary.

Response: NMFS believes it is important to establish a performance standard to establish accountability for how well the ACL mechanisms and AMs are working that is consistent across all Councils and fisheries. NMFS believes that ACLs are designed to prevent overfishing and that it is important to prevent catches from exceeding ACLs. NMFS also believes that, given scientific and management uncertainty, it is possible that catch will occasionally exceed ACL for a given stock or stock complex. However, it would be unacceptable to allow catch to continually exceed ACL. Therefore, NMFS proposed the performance standard to allow for some flexibility in the management system but also prevent overfishing. It should not limit a Council from establishing stronger performance measures, or from reevaluating their management measures more often. Notwithstanding the performance standard, if, at any time, a Council determines that the conservation and management measures for a fishery are not achieving OY while preventing overfishing, it should revise the measures as appropriate.

Comment 61: Several comments were received that suggested that fishery managers should or be required to re-evaluate the system of ACLs, ACT and AMs every time catch exceeds ACL. In addition, some expressed that NMFS should make clear that the ''reevaluation'' called for in the proposed action does not authorize simply raising ACLs or other numeric fishing restrictions in order to avoid the inconvenient fact that they have been exceeded.

Response: NMFS does not agree that a re-evaluation of the entire system of ACLs and AMs should be required every time an ACL is exceeded. If catch exceeds ACL in any one year, or if the average catch exceeds the average ACL, then AMs will be implemented and they should correct the operational issues that caused the overage, as well as any biological consequences resulting from the overage. Councils should be allowed the opportunity to see if their AMs work to prevent future overages of the ACL.

Comment 62: NMFS received comments that requested clarification or changes to the proposed performance standard. For example, one commenter suggested that NMFS should require a higher performance standard for vulnerable stocks. Two commenters expressed that the performance standard should apply at the stock or stock complex level as opposed to the fishery or FMP level. Another commenter questioned if the performance standard was if catch exceeds the ACL more than once in the last four years or if average catch exceeds the average ACL more than once in the last four years. NMFS also received some comments about the phrase ''to improve its performance and effectiveness'' in paragraph § 600.310(g)(3) of the proposed action. Those comments included: The phrase does not make sense in this context, because simply re-evaluating a system cannot improve its performance or effectiveness (only changing a system can do so); and use of this phrase in § 600.310(g)(3) is inconsistent with a similar sentence in paragraph § 600.310(g)(4) of the proposed action, where the same requirement is expressed, but this phrase does not appear.

Response: NMFS stated in the preamble of the proposed guidelines that a Council could choose a higher performance standard for a stock that is particularly vulnerable to the effects of overfishing. While NMFS agrees that a higher performance standard could be used for a stock or stock complex that is particularly vulnerable, NMFS believes the discretion to use a higher performance standard should be left to the Council. To reiterate this point, NMFS is adding additional language in § 600.310(g)(3) of the final action. NMFS intended that the performance standards would apply at the stock or stock complex level and is adding additional clarifying language in the regulatory text. The National Standard 1 guidelines as proposed offered two performance standards, one applies when annual catch is compared to the ACL for a given stock or stock complex, as described in paragraph § 600.310(g)(3) of this action, the other performance standard applies in instances when the multi-year average catch is compared to the average ACL, as described in § 600.310(g)(4) of this action. NMFS intended that in both scenarios, if the catch exceeds the ACL more than once in the last four years, or if the average catch exceeds the average ACL more than once in the last four years, then the system of ACLs and AMs should be re-evaluated and modified if necessary to improve its performance and effectiveness. NMFS has modified language to § 600.310(g)(3) and (4) of this action to clarify this issue.

Comment 63: NMFS received several suggestions to require a specific and high probability of success in either preventing overfishing, preventing catch from exceeding the ACL, or achieving the ACT. Comments included: The rule should make clear that management measures must have a high probability of success in achieving the OY or ACT; we recommend a probability of at least eighty percent of achieving the OY or ACT; NMFS should establish a performance standard that defines low risk, as well as an acceptable probability of successfully managing catch levels of 90 percent; National Standard guidelines should explicitly define the maximum acceptable risk of overfishing. One commenter cited to several court cases (NRDC v. Daley, Fishermen's Dock Coop., and Coastal Conservation Ass'n) and stated that the ACT control rule should be revised to state that the risk of exceeding the ACL due to management uncertainty is no greater than 25 percent.

Response: Considering and making appropriate allowances for uncertainty in science and management is emphasized in the NS1 guidelines. NMFS believes that, if this is done, ACLs will not often be exceeded, and when they are, the overages will typically be small and will not jeopardize the status of the stock. Fisheries where ACLs are exceeded regularly or by large amounts should be quickly modified to improve the measures.

During the initial scoping period, NMFS received many comments on the topic of setting a specific probability of success; some commenters expressed that a 50 percent probability of success is all that is legally required, while other

commenters expressed that the probability of success should be higher (e.g. 75 or 100 percent). When developing the definition framework of OFL, ABC, ACL, and ACT, NMFS considered including specific probabilities of success regarding preventing overfishing or preventing catch from exceeding ACL. NMFS did not specify a particular probability in the NS1 guidelines, for a number of reasons. NMFS did not believe it had a basis for picking a specific probability number that would be appropriate for all stocks and stock complexes in a fishery. Councils should analyze a range of alternatives for the probability that ACL will not be exceeded or that overfishing will not occur. NMFS recognizes that fisheries are different and that the biological, social and economic impacts of managing at a specific probability will differ depending on the characteristics of the fishery. NMFS also recognizes that it is not possible to calculate a probability of success in many fisheries, due to data limitations.

NMFS does not believe that MSA and relevant case law require use of specific probabilities. However, a 50 percent probability of success is a lower bound, and NMFS believes it should not simply be used as a default value. Therefore, in § 600.310(f)(4) of the final action, NMFS states that the determination of ABC should be based, when possible, on the probability that catch equal to the stock's ABC would result in overfishing, and that this probability cannot exceed 50 percent and should be a lower value.

To determine if the system of ACLs was working adequately, NMFS decided to establish a performance standard in terms of the frequency that ACLs were exceeded. The comparison of catch to an ACL is a simpler task than calculating a probability of success, and can be applied to all fisheries, albeit some fisheries have more timely catch data than others. This does not preclude the Councils from using the probability based approach to setting limits and targets in their fisheries if they are able to do so.

Comment 64: Several comments were received urging NMFS to either require or encourage the use of sector ACLs and AMs and hold each sector accountable. Comments expressed that to provide the right incentives for conservation, catch reductions and increases must be tied to compliance and performance in adhering to ACLs. One commenter stated that MSA 303(a)(14) compels distinct ACLs and AMs for each sector due in part to the variation in management uncertainty among sectors. Sector management should be required in FMPs to ensure equitable treatment for all stakeholder groups including harvest restrictions and benefits to each sector.

Response: Separate ACLs and AMs for different fishery sectors may be appropriate in many situations, but the Councils should have the flexibility to determine this for each fishery. The decision to use sectors should be at the discretion of each Council. NMFS agrees that, if Councils decide to use sectors, each sector should be held accountable if catches for a sector exceed sector-ACLs. In addition, the NS1 guidelines provide that the ACL/AM system must protect the stock or stock complex as a whole. NMFS does not believe that MSA necessarily compels use of sector ACLs and AMs, thus the final action does not require their use. However, in developing any FMP or FMP amendment, it is important to ensure consistency with MSA 303(a)(14), NS 4, and other MSA provisions. Section 303(a)(14) pertains to allocation of harvest restrictions or recovery benefits fairly and equitably among commercial, recreational, and charter fishing sectors. NS 4, in part, pertains to fair and equitable allocations.

Comment 65: Some commenters expressed that managing recreational fisheries with ACLs and AMs will be difficult as they typically lack timely data. Comments included: The initiative to set ACLs and AMs for any fishery that has a recreational component cannot be done and any attempt will be arbitrary at best; in-season management is impractical in most recreational fisheries; current data collection programs used to evaluate recreational fishing activity do not offer a level of confidence to fisheries managers or fishermen to implement ACL in the recreational sector; and NMFS should improve recreational data collection to a level where inseason management is possible.

Response: NMFS acknowledges that recreational fisheries often do not have timely catch data and that is why NMFS suggested the multi-year averaging provision for AMs. NMFS and the Council still need to meet the mandate of the MSA and have ACLs for all fisheries. NMFS is developing a new data collection program for recreational fisheries to improve the data needed to implement the new provisions of the MSA.

Comment 66: Some commenters suggested that for recreational fisheries, catch limits should be expressed in terms of fishing mortality rates or in terms of numbers of fish instead of pounds of fish.

Response: NMFS intends that ACLs be expressed in terms of weight or numbers of fish. In fact, the definition of ''catch'' in the proposed guidelines indicates that catch is measured in weight or numbers of fish. NMFS disagrees that ACL can be expressed in terms of fishing mortality rates. While conservation and management measures for a fishery can be designed to achieve a target fishing mortality rate, the fishing mortality rates that are achieved can only be estimated by performing a stock assessment. Stock assessments usually lag the fishery by a year or more, and are not suitable as the basis for ACL accountability measures.

Comment 67: One commenter suggested that when recreational fisheries account for a significant portion of the catch, the buffers should be correspondingly larger to account for the management uncertainty.

Response: NMFS believes that management uncertainty should be addressed in all fisheries. Accountability measures may include an ACT set below the ACL based on the degree of uncertainty that the conservation and management measures will achieve the ACL. This applies to all fisheries, commercial or recreational.

Comment 68: NMFS received a few comments expressing that Councils should have flexibility when specifying AMs.

Response: NMFS agrees and believes that the guidelines provide this flexibility.

Comment 69: AMs should be approved by the Secretary of Commerce, should be subject to regular scientific review, and should provide opportunities for public comment; performance must be measurable and AMs must be modified if not working; AMs should be reviewed annually as part of the catch specification process.

Response: AMs will be implemented through public processes used for amending FMPs and implementing regulations. There is no need for additional guidance in the NS1 guidelines.

Comment 70: NMFS received comments that support the use of AMs based on comparisons of average catch to average ACL, if there is insufficient data to compare catch to ACL, either inseason or on an annual basis. In recreational fisheries, the use of a three-year rolling average ACL would moderate wild swings in ACLs due to variable fishing conditions and participation from year to year. Flexibility, such as the use of a multi-year average for the recreational sector, is needed due to limitations in the data collection. However, some commenters

expressed concerns about using the multi-year averaging approach and stated that it should be used rarely. In order to use such an approach, Councils should provide clear and compelling reasons in their FMPs as to why the use of multi-year average data are necessary and a plan for moving the fishery to AMs based on annual data. The guidelines should make it clear that AMs will be triggered annually in cases where the average catch exceeds the average ACL. NMFS should engage its quantitative experts in an investigation of the performance of using multi-year averages for managing highly variable fisheries with poor inseason data. Until such results are available, NMFS should use annual statistics for management of all fisheries, including those involving highly variable stocks or catch limits.

Response: Use of AMs based on comparison of average catch to average ACL is only appropriate in a limited number of fisheries, such as fisheries that have high variability in the estimate of total annual catch or highly fluctuating annual catches and no effective way to monitor and control catches inseason. NMFS intends that a comparison of the moving average catch to the average ACL would be conducted annually and that AMs would be implemented if average catch exceeds the average ACL. If the average catch exceeds the average ACL more than once in the last four years, then the system of ACLs and AMs should be re-evaluated and modified if necessary to improve its performance and effectiveness. NMFS agrees that the Council should analyze and explain why they are basing AMs on multi-year averaged data. NMFS has added clarifying language to § 600.310(g)(4) of the final action to make these points clear. Future improvements in data and management approaches should also be pursued so that true annual accountability for catch can be achieved. In addition, NMFS believes that AMs such as the use of ACT may be appropriate in fisheries that use the multi-year averaging approach.

Comment 71: Several comments were received regarding ACLs and AMs for fisheries that occur partly in state waters. Some comments stated that accountability measures for State-Federal fisheries could use further elaboration and should specifically address fisheries where management had been delegated to the state. Some commenters supported separate ACLs and AMs for Federal and state portions of the fishery, while others wanted combined overall ACLs and AMs. Some comments disagreed that closure of Federal waters while fishing continues in non-Federal waters is a preferred option, and that efforts should be made to undertake cooperative management that allows coordinated responses.

Response: When stocks are co-managed by Federal, state, tribal, and/or territorial fishery managers, the goal should be to develop collaborative conservation and management strategies to prevent overfishing of shared stocks and ensure their sustainability. NMFS encourages collaboration with state managers to develop ACLs and AMs that prevent overfishing of the stock as a whole. As FMPs currently consider whether overfishing is occurring for a stock or stock complex overall, NMFS thinks it is appropriate to specify an overall ACL for the stock or stock complex. This ACL could be subdivided into state and Federal ACLs, similar to the approach used for sector-ACLs. However, NMFS recognizes that Federal management authority is limited to that portion of the fishery under Federal jurisdiction and therefore the NS1 guidelines only require AMs for the Federal fishery. The AMs could include closing the EEZ when the Federal portion of the ACL is reached, closing the EEZ when the overall stock or stock complex's ACL is reached, or other measures. NMFS recognizes the problem that may occur when Federal fisheries are closed but fishing continues in state waters. NMFS will continue to work with states to ensure consistency and effectiveness of management measures. If Councils delegate management under an FMP to the states, the FMPs still need to meet the requirements of the MSA, including establishment of ACLs and AMs.

Comment 72: One commenter asked, in the case where ACLs are exceeded because of the regulatory failures of one state, if other states in the Council's or the Atlantic States Marine Fisheries Commission's (ASMFC) area of jurisdiction be affected through mandatory AMs. Barring state-by-state allocations for all species (as with summer flounder), the proposed regulations could punish commercial fishermen and anglers in all states in a region.

Response: The guidelines acknowledge that NMFS and the Councils cannot mandate AMs on state fisheries. However, NMFS encourages collaboration between state and Federal managers to develop ACLs and AMs to prevent overfishing for the stock as a whole. In cases where there is collaboration, accountability measures for the fishery should be designed to address this issue. Specific AMs that may be needed would have to be evaluated and addressed on a case-by-case basis.

Comment 73: NMFS received a question regarding the meaning of the phrase ''large majority'' in § 600.310(g)(5) of the proposed action. NMFS had stated that: ''For stocks or stock complexes that have a large majority of harvest in state or territorial waters, AMs should be developed for the portion of the fishery under Federal authority and could include closing the EEZ when the Federal portion of the ACL is reached, or the overall stock's ACL is reached, or other measures.'' The commenter stated that the meaning of the term ''large majority'' and its importance is not clear and should therefore be eliminated.

Response: NMFS agrees that ACL and AMs need to be established for all stocks and stock complexes in Federal fisheries regardless of the whether a large majority of harvest occurs in state waters. NMFS agrees the amount, *i.e.*, ''large majority,'' is not pertinent to this provision. Therefore, § 600.310(f)(5)(iii) and (g)(5) have been revised in the final action.

Comment 74: NMFS received several comments noting that NMFS should require or recommend the use of limited access privilege programs (LAPPs) or catch shares by Councils in the final rule. Many commenters referenced an article on catch shares (Costello *et al.* 2008).

Response: The article cited above and other articles note the potential benefits of LAPPs. NMFS supports use of LAPPs, and believes they can be a beneficial approach to use in implementing effective ACLs. However, while ACLs are required in all fisheries, under the MSRA, LAPPs are optional and at the discretion of each Council. NMFS does not have authority to require Councils to use LAPPs, but is currently developing guidelines on LAPPs that will be published for public comment in the future.

Comment 75: One comment requested that NMFS expand the concept of accountability measures to include effective catch monitoring, data collection and analysis, and enforcement. The commenter suggested that for accountability measures that are not LAPPs, managers should demonstrate how the measures will ensure compliance with the ACLs as well as improve data and enforcement, reduce bycatch, promote safety, and minimize adverse economic impacts at least as well as LAPPs.

Response: NMFS agrees that catch monitoring, data collection and analysis, and enforcement are all important to consider in developing

AMs for a fishery and believes the guidelines are adequate. Under § 600.310(i) of the final action, FMPs, or associated documents such as SAFE reports, must describe data collection methods. In addition, § 600.310(g)(2) of the final action, states that whenever possible, inseason AMs should include inseason monitoring and management measures to prevent catch from exceeding ACLs. NMFS believes the guidelines are clear that catch monitoring data is very important to consider when Councils establish their AMs. Councils are already directed to: minimize adverse economic impacts under National Standard 8; minimize bycatch and bycatch mortality under National Standard 9; and promote safety of human life at sea under National Standard 10. *See* MSA 301(a)(8), (9), and (10) (setting forth specific requirements of the national standards).

Comment 76: NMFS received comments expressing concern about establishing ACL and AM mechanisms in FMPs. One commenter expressed concern that if ACL and AM mechanisms were located in the FMP, it would require a multi-year process to change any measure. They instead suggested that Councils should have the ability to framework the mechanisms and establish an annual or multi-year process for making adjustments. Another commenter suggested that Councils should be required to modify their SOPPs to incorporate a mechanism for specifying ACLs and reviewing AMs annually through regular catch specification procedures. NMFS received another comment that disagreed with the idea that the Council's SOPPs are the proper place to describe the process for establishing ABC Control Rules, including the role of SouthEast Data Assessment and Review (SEDAR) and the SSC. This commenter recommended instead that ABC Control Rules be included in Fishery Management Plans and have the ability to refine management through framework actions.

Response: The FMP needs to contain the ACL mechanisms and AMs, as they are part of the conservation and management measures for the fishery. The ACL mechanisms and AMs can contain framework provisions and utilize specification processes as appropriate. NMFS does not agree that the ACL and AM mechanisms should be established in the SOPPs. Also, NMFS never intended that ABC control rules would be described in the SOPPs and agrees that the ABC control rules should be described in the Fishery Management Plans. However, it is important to understand how the Councils, SSC, and peer review process work together to implement the provisions of the MSA, and that can be explained in the SOPPs, FMP, or some other document.

Comment 77: NMFS received several comments supporting the exception to the ACL rule for stocks with a life cycle of approximately one year. Commenters asked for a list of species which fit the exception, specific guidance on how to set ACLs for these stocks if they become overfished, and expansion of the exception to species with a two year life cycle.

Response: Due to their unique life history, the process for setting ACLs does not fit well for stocks which have a life cycle of approximately one year. The exception for species with an annual life cycle allows flexibility for Councils to use other management measures for these stocks which are more appropriate for the unique life history for each stock and the specifics of the fishery which captures them. NMFS believes that the final guidance should not include a list of stocks which meets these criteria; this is a decision that is best made by the regional Councils. Even though ACLs are not required for these stocks, Councils are still required to estimate other biological reference points such as SDC, MSY, OY, ABC and an ABC control rule. However, the MSA limits the exception and clearly states that if overfishing is occurring on the stock, the exception can not be used, therefore ACLs would be required. MSA only provided for a 1-year life cycle exception, thus NMFS cannot expand the exception to two years. Section (h)(3) of the final action acknowledges that there may be circumstances when flexibility is needed in applying the NS1 guidelines. Whether such flexibility is appropriate for certain two year life cycle species would have to be considered on a case-by-case basis.

Comment 78: NMFS received many comments expressing different interpretations of the MSA's ACL international exception. Some commented that the exception only pertains to the 2010/2011 timing requirement. If fisheries under international agreements were intended to be exempt from ACLs, Congress could have drafted the exception to say that ACLs ''shall not apply'' to such fisheries, similar to language used in the one-year life cycle exception. Several comments stated that by requiring ACLs for U.S. fishermen, the U.S. would be in a better bargaining position in international fora by taking the ''higher ground.'' Others agreed with the exception as set forth in the proposed guidelines but requested clarification. For example, one comment was that the exception should be expanded to cover the US/Canada Resource Sharing Understanding and other arrangements that may not be formal international agreements. Other suggestions included clarifying that the exception applied where a regional fishery management organization had approved a stock assessment, where there were conservation and management measures under an international agreement, or where there were annual catch limits established under international agreement consistent with MSA overfishing and rebuilding requirements.

Response: The ACL international exception is set forth in an uncodified note to MSA section 303. MSRA, Public Law 109–479 section 104(b)(1). The text is vague, and NMFS has spent considerable time looking at different possible interpretations of this text in light of the plain language of the text, public comments, and other relevant MSA provisions. NMFS agrees that one possible interpretation, in light of the text of the one-year life cycle exception (MSRA section 104(b)(2)), is that stocks under international management are only exempt from timing requirements. However, Congress added significant new requirements under the MSRA regarding international fisheries, thus NMFS has tried to interpret the exception in light of these other statutory provisions.

In many fisheries, the U.S. unilaterally cannot end overfishing or rebuild stocks or make any measurable progress towards those goals, even if it were to stop all U.S. harvest. Thus, it has signed onto various treaties and negotiates binding, international conservation and management measures at regional fishery management organizations (RFMOs) to try to facilitate international efforts to end overfishing and rebuild overfished stocks. MSRA acknowledged the challenges facing the United States in international fisheries by, among other things, including a new ''International Overfishing'' section (MSA section 304(i)) that refers domestic regulations to address ''relative impact'' of U.S. vessels; changes to highly migratory species provisions (MSA section 102(b)–(c)); and amendments to the High Seas Driftnet Fishing Moratorium Protection Act, 16 U.S.C. 1826h–1826k, to encourage strengthening of RFMOs and establish a process for identification and certification of nations whose vessels engage in illegal, unreported or unregulated (IUU) fishing and bycatch of protected living marine resources.

While NMFS actively communicates and promotes MSA requirements regarding ending overfishing and rebuilding overfished stocks at the international level (*see*, *e.g.*, MSA section 102(c)), it is unlikely that RFMOs will adopt ACL/AM mechanisms as such mechanisms are understood and required in the context of U.S. domestic fisheries. Given the practical problem of ensuring the U.S. could negotiate such mechanisms, and Congress' clear recognition of U.S. fishing impact versus international fishing effort, NMFS believes that a reasonable interpretation of the exception is that it should apply to the ACL requirement, not just the effective date. If ACLs were required, a likely outcome is that U.S. fishermen may be subject to more restrictive measures than their foreign counterparts, *e.g.*, each country may be assigned a catch quota but the U.S. portion may be subject to further restriction below the assigned amount. Further, requiring ACLs may raise potential conflicts with implementing legislation for some of the international fishery agreements.

NMFS believes that the intent of MSRA is to not unfairly penalize U.S. fishermen for overfishing which is occurring predominantly at the international level. In many cases, applying ACL requirements to U.S. fishermen on just the U.S. portion of the catch or quota, while other nations fished without such additional measures, would not lead to ending overfishing and could disadvantage U.S. fishermen. The guidance given for the international exception allows the Councils to continue managing the U.S. portion of stocks under international agreements, while the U.S. delegation works with RFMOs to end overfishing through international cooperation. The guidelines do not preclude Councils or NMFS from applying ACLs or other catch limits to stocks under international agreements, if such action was deemed to be appropriate and consistent with MSA and other statutory mandates.

NMFS considered different suggestions on how the exception might be clarified, *e.g.*, exception would only apply where there is an approved stock assessment, conservation and management measures, annual catch limits consistent with MSA overfishing and rebuilding requirements, etc. Regardless of how the exception could be revised, establishing ACL mechanisms and AMs on just the U.S. portion of the fishery is unlikely to have any impact on ending overfishing and rebuilding. For these reasons, and taking into consideration possible statutory interpretations and public comment, NMFS has decided not to revise the international exception.

With regard to whether an arrangement or understanding is an ''international agreement,'' it will be important to consider the facts and see if the arrangement or understanding qualifies as an ''international agreement'' as understood under MSA section 3(24) (defining ''international fishery agreement'') and as generally understood in international negotiation. The Case-Zablocki Act, 1 U.S.C. 112b, and its implementing regulations provide helpful guidance on interpreting the term ''international agreement.''

Comment 79: With regard to fisheries data (§ 600.310(i) of NS1 guidelines), comments included: data collection guidelines are burdensome, clarification is needed on how the Councils would implement the data collection requirements, and that data collection performance standards and real-time accounting are needed.

Response: NMFS believes that § 600.310(i) of the final action provides sufficient guidance to the Councils in developing and updating their FMPs, or associated public documents such as SAFE reports, to address data needed to meet the new requirements of the MSRA. There is a close relationship between the data available for fishery management and the types of conservation and management measures that can be employed. Also, for effective prevention of overfishing, it is essential that all sources of fishing mortality be accounted for. NMFS believes that detailing the sources of data for the fishery and how they are used to account for all sources of fishing mortality in the annual catch limit system will be beneficial. NMFS revised the final guidelines to clarify that a SAFE report, or other public document adopted by a Council, can be used to document the required fishery data elements.

Comment 80: NMFS received several comments requesting that better data be used when creating conservation and management measures.

Response: NMFS agrees that improvements in fishery data can lead to more effective conservation and management measures, including ACLs. NMFS is aware of the various gaps in data collection and analysis for FMPs in U.S. fisheries, and has ongoing and future plans to improve the data needed to implement the new provisions of the MSRA. NMFS programs and initiatives that will help produce better quality data include the: Marine Recreational Information Program (MRIP), National Permits System, and Fisheries Information and National Saltwater Angler Registry.

Comment 81: Some comments recognized the ongoing programs to improve data, but were concerned that the time that it would take to implement and fold these new data into the management process could cause overly restrictive measures when implementing ACLs on fisheries that are data poor (*e.g.* recreational fisheries).

Response: ACLs must be implemented using the best data and information available. Future improvements in data will allow corresponding improvements in conservation and management measures. This is an incremental process. NMFS believes that Councils must implement the best ACLs possible with the existing data, but should also look for opportunities to improve the data and the ACL measures in the future. It is important that the ACL measures prevent overfishing without being overly restrictive. In data poor situations, it is important to monitor key indicators, and have accountability measures that quickly adjust the fishery in response to changes in those indicators.

Comment 82: Some commenters noted they want more transparency in the data being used to manage fisheries.

Response: NMFS believes the NS1 guidelines provide sufficient guidance to the Councils in developing and updating their FMPs, or associated public documents such as SAFE reports, to address data needed to meet the new requirements of the MSRA. NMFS agrees that transparency in the Council process and NMFS decision process in regard to data and data analysis is critical to the public and user groups understanding of how fisheries are managed. NMFS is aware of this issue and will continue to seek improvements in such processes.

Comment 83: NMFS received several comments about the timing associated with submitting a rebuilding plan. Commenters asked for clarification on when the clock started for the implementation of the plan, stated that Councils should have two years to submit the plan to the Secretary, and suggested that a 6-month review/implementation period be used instead of a 9-month period. Commenters noted that MSA provides for specific time periods for Secretarial review.

Response: Ending overfishing and rebuilding overfished stocks is an important goal of the MSA and the performance of NMFS is measured by its ability to reach this goal. Currently, the Council has 12 months to submit an FMP, FMP amendment, or proposed

regulations to the Secretary, but there is no time requirement for implementation of such actions. MSA section 304(e)(3), which is effective July 12, 2009, requires that a Council prepare and implement an FMP, FMP amendment, or proposed regulations within 2 years of the Secretary notifying the council that the stock is overfished or approaching a condition of being overfished. The guidelines provide that such actions should be submitted to the Secretary within 15 months so NMFS has 9 months to review and implement the plan and regulations. NMFS recognizes that there are timing requirements for Secretarial review of FMPs and regulations (MSA section 304(a),(b)). The 15-month period was not intended to expand the time for Secretarial review, but rather, to address the new requirement that actions be implemented within two years. NMFS believes the timing set forth in the guidelines is appropriate as a general rule: it would continue to allow for 60 days for public comment on an FMP, 30 days for Secretarial review, and 6 months for NMFS to implement the rebuilding plan. However, in specific cases NMFS and a Council may agree on a schedule that gives the Council more time, if the overall objective can still be met.

Comment 84: NMFS received many comments in support of the language regarding ending overfishing immediately. One comment, however, stated that intent of the MSA is to end all overfishing, not just chronic overfishing, as described in the preamble.

Response: NMFS agrees that the intent of the MSA is to end overfishing, and in the context of a rebuilding plan, overfishing must be ended immediately. However, as long as fishing is occurring, there always is a chance that overfishing may occur given scientific and management uncertainty. The guidelines explain how to incorporate scientific and management uncertainty so that fishing may continue but with an appropriately low likelihood of overfishing. The term ''chronic overfishing'' is used to mean that annual fishing mortality rates exceed the MFMT on a consistent basis over a period of years. The MSA definition of overfishing is ''* * * a rate or level of fishing mortality that jeopardizes the capacity of a fishery to produce the maximum sustainable yield on a continuing basis.'' NMFS believes that the best way to ensure that overfishing does not occur is to keep annual fishing mortality rates below the MFMT. However, exceeding the MFMT occasionally does not necessarily jeopardize the capacity of a fishery to produce the MSY on a continuing basis. The more frequently MFMT is exceeded, the more likely it becomes that the capacity of a fishery to produce the MSY on a continuing basis is jeopardized. Thus, NMFS believes that ACLs and AMs should be designed to prevent overfishing on an annual basis, but that conservation and management measures need not be so conservative as to prevent any possibility that the fishing mortality rate exceeds the MFMT in every year.

Comment 85: NMFS received several comments regarding what happens when a rebuilding plan reaches T_{max} but the stock is not fully rebuilt. Commenters supported the approach in the proposed action that provided that the rebuilding F should be reduced to no more than 75 percent of MFMT until the stock or stock complex is rebuilt. One commenter suggested clarifying the final guidelines text to provide: ''If the stock or stock complex has not rebuilt by T_{max}, then the fishing mortality rate should be maintained at $F_{rebuild}$ or 75% of the MFMT, whichever is less.'' Other commenters stated that 75 percent MFMT is not precautionary enough and that 50 percent MFMT (or less) should be used.

Response: This new language in the guidelines fills a gap in the current guidelines which did not prescribe how to proceed when a stock had reached T_{max} but had not been fully rebuilt. NMFS believes that requiring that F does not exceed $F_{rebuild}$ or 75 percent MFMT, whichever is lower, is an appropriate limit, but Councils should consider a lower mortality rate to meet the requirement to rebuild stocks in as short a time as possible, pursuant to the provisions in MSA section 304(e)(4)(a)(i). NMFS agrees that the suggested edit would clarify the provision, and has revised the guidelines.

Comment 86: NMFS received many comments on the relationship between T_{min}, T_{target} and T_{max}. Some comments supported the proposed guidelines and others stated that the guidelines should be modified. Comments included: T_{min} is inconsistent with MSA's requirement to take into account needs of fishing communities and should include those needs when evaluating whether rebuilding can occur in 10 years or less; management measures should be designed to achieve rebuilding by the T_{target} with at least a 50% probability of success and achieve T_{max} with a 90% probability of success; as in the 2005 proposed NS1 guidelines revisions, T_{max} should be calculated as T_{min} plus one mean generation time for purposes of determining whether rebuilding can occur in 10 years or less; per *NRDC* v. *NMFS,* 421 F.3d 872 (9th Cir. 2005), T_{target} should be as close to T_{min} as possible without causing a short-term disaster; rebuilding timeframes should only be extended above T_{min} where ''unusually severe impacts on fishing communities can be demonstrated, and where biological and ecological implications are minimal;'' rebuilding times for stock complexes must not be used to delay recovery of complex member species; and the ''generation time'' calculation for T_{max} should refer to generation time of the current population.

Response: In developing the guidance for rebuilding plans, NMFS developed guidelines for Councils which, if followed, are strong enough to rebuild overfished stocks, yet flexible enough to work for a diverse range of fisheries. The timeline for a rebuilding plan is based on three time points, T_{min}, T_{target} and T_{max}. T_{min} is the amount of time, in the absence of any fishing mortality, for the stock to have a 50% probability of reaching the rebuilding goal, B_{msy}. T_{min} is the basis for determining the rebuilding period, consistent with section 304(e)(4)(A)(ii) of the MSA which requires that rebuilding periods not exceed 10 years, except in cases where the biology of the stock of fish, other environmental conditions, or management measures under an international agreement in which the United States participates dictate otherwise. T_{min} provides a biologically determined lower limit to T_{target}. Needs of fishing communities are not part of the criteria for determining whether a rebuilding period can or cannot exceed 10 years, but are an important factor in establishing T_{target}.

Just as T_{min} is a helpful reference point of the absolute shortest time to rebuild, T_{max} provides a reference point of the absolute longest rebuilding period that could be consistent with the MSA. T_{max} is clearly described in the guidelines as either 10 years, if T_{min} is 10 years or less, or T_{min} plus one generation time for the stock if T_{min} is greater than 10 years. NMFS agrees that this calculation can cause a discontinuity problem when calculating T_{max}, and proposed revisions to the NS1 guidelines in 2005 that would have addressed the issue by basing T_{max} on T_{min} + one generation time in all cases, which would have removed the requirement that T_{max} is 10 years in all cases where T_{min} was less than 10 years. NMFS did not finalize those revisions, but proposed the same changes to the MSA in the Administration's proposed MSA reauthorization bill. However,

when MSRA was passed, Congress did not accept the Administration's proposal and chose to keep the existing provision. NMFS has, therefore, not revised this aspect of the NS1 guidelines.

The generation time is defined in the guidelines as ''the average length of time between when an individual is born and the birth of its offspring.'' Typically this is calculated as the mean age of the spawners in the absence of fishing mortality (per Restrepo *et al.,* 1998), but the exact method is not specified in the guidance.

T_{max} is a limit which should be avoided. When developing a rebuilding plan, it is good practice for Councils to calculate the probability of the potential management alternatives to achieve rebuilding by T_{max}, in order to inform their decision.

T_{target} is bounded by T_{min} and T_{max} and is supposed to be established based on the factors specified in MSA section 304(e)(4). Section 600.310(j)(3) of the final action reiterates the statutory criteria on specifying rebuilding periods that are ''as short as possible,'' taking into account specified factors. Management measures put in place by the rebuilding plan should be expected (at least 50% probability) to achieve rebuilding by T_{target}. NMFS does not believe these sections should be revised to focus on ''short-term disasters'' or ''unusually severe'' community impacts, as the MSA provides for several factors to be considered. NMFS believes the final guidelines provide sufficient general guidance on the MSA requirements, but acknowledges that there is case law in different jurisdictions (such as NRDC v. NMFS), that fishery managers should consider in addition to the general guidance.

Comment 87: A commenter stated that § 600.310(j)(3)(i)(E) of the proposed action should be revised to state that ''as short as possible'' is a mandate, not just a priority.

Response: NMFS deleted the ''priority'' text in § 600.310 (j)(3)(i)(E) of the final action. That text is unnecessary given that § 600.310 (j)(3)(i) of the guidelines explains ''as short as possible'' and other rebuilding time period requirements from MSA section 304(e)(4).

Comment 88: Commenters raised several questions about the relationship of NS1 and National Standard 8 (NS 8), including whether NS 1 ''trumps'' NS 8 and whether the ACL guidance provides sufficient flexibility to address NS 8 considerations.

Response: NS 1 states: ''Conservation and management measures shall prevent overfishing while achieving, on a continuing basis, the optimum yield from each fishery for the United States fishing industry.'' MSA section 301(a)(1). NS 8 states: ''Conservation and management measures shall, *consistent with the conservation requirements of this Act (including the prevention of overfishing and rebuilding of overfished stocks,* take into account the importance of fishery resources to fishing communities by utilizing economic and social data that meet the requirements of paragraph (2) [*i.e.*, National Standard 2] , in order to (A) provide for sustained participation of such communities, and (B) to the extent practicable, minimize adverse economic impacts on such communities.'' MSA section 301(a)(8) (*emphasis added*).

The objectives in NS8 for sustained participation of fishing communities and minimization of adverse economic impacts do not provide a basis for continuing overfishing or failing to rebuild stocks. The text of NS8 explicitly provides that conservation and management measures must prevent overfishing and rebuild overfished stocks. MSA does provide, however, for flexibility in the specific conservation and management measures used to achieve its conservation goals, and NMFS took this into consideration in developing the revised NS1 guidelines.

Comment 89: NMFS received many comments regarding § 600.310(m) of the proposed action, a provision commonly called the ''mixed stock exception.'' One comment supported the revision as proposed. Some commenters noted that the provision is very important in managing specific mixed stock fisheries, and that changes in the proposed guidelines would make it impossible to use. Specific concern was noted about text that stated that 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.'' In addition, commenters stated that the proposed revisions do not allow for social and economic aspects to be taken in to account adequately and would negatively impact several fisheries and fishing communities. Many others commented that the provision should be removed entirely, because it is contrary to the intent of the MSA. The MSA, as amended by the MSRA, requires preventing and ending overfishing, and a mixed stock exception would allow for chronic overfishing on vulnerable fish stocks within a complex.

Response: MSRA amended overfishing and rebuilding provisions of the MSA, reflecting the priority to be given to the Act's conservation goals. NMFS believes that the final NS1 guidelines provide helpful guidance on the new statutory requirements and will strengthen efforts to prevent overfishing from occurring in fisheries. Preventing overfishing and achieving, on a continuing basis, the OY is particularly challenging in mixed stock fisheries. To address this issue, the proposed action retained a mixed stock exception. NMFS recognizes the concerns raised about how the exception will impact efforts to prevent and end overfishing, and thus, revised the current NS1 guidelines text in light of new MSRA provisions.

The current mixed stock exception allows overfishing to occur on stocks within a complex so long as they do not become listed under the Endangered Species Act (ESA). As explained in the proposed guidelines, NMFS believes that ESA listing is an inappropriate threshold, and that stocks should be managed so they retain their potential to achieve MSY. The revised guidelines propose a higher threshold, limiting F to a level that will not lead to the stock becoming overfished in the long term. In addition, if any stock, including those under the mixed stock exception, were to drop below its MSST, it would be subject to the rebuilding requirements of the MSA, which require that overfishing be ended immediately and that the stock be rebuilt to B_{msy} (see § 600.310(j)(2)(ii)(B) of the final action). The exception, as revised, addresses concerns regarding social, economic, and community impacts as it could allow for continued harvest of certain stocks within a mixed stock fishery.

Having considered public comments on the proposed guidelines, NMFS has decided to retain the mixed stock exception as proposed in the guidance. While NMFS has chosen in the NS1 guidelines to emphasize the importance of stock-level analyses, MSA refers to preventing overfishing in a fishery and provides for flexibility in terms of the specific mechanisms and measures used to achieve this goal. The mixed stock exception provides Councils with needed flexibility for managing fisheries, while ensuring that all stocks in the fishery continue to be subject to strong conservation and management. However, NMFS believes that the mixed stock exception should be applied with a great deal of caution, taking into consideration new MSRA requirements and NS1 guidance regarding stock complexes and indicator species. NMFS also believes that Councils should work to improve selectivity of fishing gear and practices in their mixed-stock fisheries so that the need to apply the mixed stock exception is reduced in the future.

VI. Changes From Proposed Action

Annual catch target (ACT) is described as a management option, rather than a required reference point in paragraphs (f)(1), (f)(2)(v), (f)(6), (f)(6)(i), and (g)(2) in the final action.

The following sentence was deleted from paragraph (b)(2)(v)(B): ''The SSC may specify the type of information that should be included in the Stock Assessment and Fishery Evaluation (SAFE) report (*see* § 600.315).'' Paragraph (b)(2)(v)(C) was revised to make some clarifying edits regarding the SSC and peer review process. The following sentence was included in (b)(2)(v)(D): ''The SSC recommendation that is the most relevant to ACLs is ABC, as both ACL and ABC are levels of annual catch.''

Paragraph (c)(5) is removed because ''ACT control rule'' is no longer a required part of the definition framework. Paragraph (c)(6) in the proposed action is re-designated as paragraph (c)(5) in the final action. Paragraph (c)(7) in the proposed action is re-designated as paragraph (c)(6) in the final action.

Paragraph (d)(1) was revised to clarify that Councils may, but are not required to, use the ''ecosystem component'' species classification. Paragraphs (d)(2) through (d)(7) were revised to better clarify the classification system for stocks in an FMP. Paragraph (d)(9) is revised to emphasize that indicator stocks are stocks with SDC that can be used to help manage more poorly known stocks that are in a stock complex. Paragraph (d)(10) has been added to describe in general how to evaluate ''vulnerability'' of a stock.

Paragraph (e)(1)(iv) was revised to clarify that ecological conditions should be taken into account when specifying MSY. The following sentence was added to paragraph (e)(2)(i)(C): ''The MFMT or reasonable proxy may be expressed either as a single number (a fishing mortality rate or F value), or as a function of spawning biomass or other measure of reproductive potential.'' The following sentence was added to paragraph (e)(2)(i)(D): ''The OFL is an estimate of the catch level above which overfishing is occurring.'' The following sentence was deleted from (e)(2)(ii)(A)(*1*): ''The MFMT must not exceed F_{msy}.'' Paragraph (e)(3)(iv) was revised to improve clarity. The following sentence was deleted from (e)(3)(v)(A): ''As a long-term average, OY cannot exceed MSY.''

Paragraph (f)(1) was revised to give examples of scientific and management uncertainty. Paragraphs (f)(2)(ii) and (iii) were revised to clarify that scientific uncertainty in the OFL and any other scientific uncertainty should be accounted for when specifying ABC and the ABC control rule. Paragraph (f)(3) was revised to improve clarity; to acknowledge that the SSC may recommend an ABC that differs from the result of the ABC control rule calculation; and to state that while the ABC is allowed to equal OFL, NMFS expects that in most cases ABC will be reduced from OFL to reduce the probability that overfishing might occur in a year. Paragraph (f)(4) on the ABC control rule was revised to include the following sentences: ''The determination of ABC should be based, when possible, on the probability that an actual catch equal to the stock's ABC would result in overfishing. This probability that overfishing will occur cannot exceed 50 percent and should be a lower value. The ABC control rule should consider reducing fishing mortality as stock size declines and may establish a stock abundance level below which fishing would not be allowed.'' Paragraph (f)(5)(i) was revised to include the following sentences: ''ACLs in coordination with AMs must prevent overfishing (see MSA section 303(a)(15)). If a Council recommends an ACL which equals ABC, and the ABC is equal to OFL, the Secretary may presume that the proposal would not prevent overfishing, in the absence of sufficient analysis and justification for the approach.'' Also, paragraph (f)(5)(i) was revised to clarify that ''a multiyear plan must provide that, if an ACL is exceeded for a year, then AMs are triggered for the next year consistent with paragraph (g)(3) of this section.'' Paragraph (f)(5)(ii) now clarifies that ''if the management measures for different sectors differ in degree of management uncertainty, then sector-ACLs may be necessary so appropriate AMs can be developed for each sector.'' Paragraphs (f)(5)(iii) and (g)(5) were revised to remove the phrase ''large majority'' from both provisions. The description of the relationship between OFL to MSY and ACT to OY was removed from paragraph (f)(7) and is replaced with the following sentence: ''A Council may choose to use a single control rule that combines both scientific and management uncertainty and supports the ABC recommendation and establishment of ACL and if used ACT.''

Paragraph (g)(2) on inseason AMs was revised to include the following sentences: ''FMPs should contain inseason closure authority giving NMFS the ability to close fisheries if it determines, based on data that it deems sufficiently reliable, that an ACL has been exceeded or is projected to be reached, and that closure of the fishery is necessary to prevent overfishing. For fisheries without inseason management control to prevent the ACL from being exceeded, AMs should utilize ACTs that are set below ACLs so that catches do not exceed the ACL.'' Paragraph (g)(3) was revised to improve clarity and to include the following sentence: ''A Council could choose a higher performance standard (e.g., a stock's catch should not exceed its ACL more often than once every five or six years) for a stock that is particularly vulnerable to the effects of overfishing, if the vulnerability of the stock has not already been accounted for in the ABC control rule.'' Paragraph (g)(4) on AMs based on multi-year average data was revised to clarify: That Councils should explain why basing AMs on a multi-year period is appropriate; that AMs should be implemented if the average catch exceeds the average ACL; the performance standard; and that Councils can use a stepped approach when initially implementing AMs based on multi-year average data.

Paragraph (h) was revised to include the sentence: ''These mechanisms should describe the annual or multiyear process by which specific ACLs, AMs, and other reference points such as OFL, and ABC will be established.'' Paragraph (h)(1)(v) was removed because the requirement to describe fisheries data is covered under paragraph (i). Paragraph (i) is revised to clarify that Councils must describe ''in their FMPs, or associated public documents such as SAFE reports as appropriate,'' general data collection methods.

Paragraph (j)(2)(ii)(C) was removed and paragraph (j)(2)(ii)(B) was revised to include information about stocks or stock complexes that are approaching an overfished condition. Paragraph (j)(3)(i)(E) was revised to remove the ''priority'' text. That text is unnecessary given that section (j)(3)(i) explains ''as short as possible'' and other rebuilding time period requirements from MSA section 304(e)(4). Paragraph (j)(3)(ii) was revised to clarify that ''if the stock or stock complex has not rebuilt by T_{max}, then the fishing mortality rate should be maintained at $F_{rebuild}$ or 75 percent of the MFMT, whichever is less.''

Introductory language (General) has been added to paragraph (l) to clarify the relationship of other national standards to National Standard 1. Also, paragraph (l)(4) has been revised to ensure that the description about the relationship between National Standard 8 with National Standard 1 reflects more

accurately, section 301(a)(8) of the Magnuson-Stevens Act.

The words ''should'' or ''recommended'' in the proposed rule are changed to ''must'' or ''are required'' or ''need to'' in this action's codified text if NMFS interprets the guidance to refer to ''requirements of the Magnuson-Stevens Act'' and ''the logical extension thereof'' (see section 600.305(c) of the MSA). In the following, items in paragraphs of § 600.310 are followed by an applicable MSA section that contains pertinent requirements:

Paragraph (b)(3) is revised to state that Councils ''must take an approach that considers uncertainty in scientific information and management control of the fishery'' because it needs to meet requirements in MSA section 303(a)(15).

Paragraph (c) is revised to state ''* * * Councils must include in their FMPs * * *'' because it needs to meet various requirements in MSA section 303(a).

Paragraph (c) is revised to state ''Councils must also describe fisheries data * * *'' because it needs to meet requirements of various portions of MSA sections 303(a) and 303(a)(15).

Paragraph (c) is revised to state ''* * * Councils must evaluate and describe the following items in their FMPs * * *'' because it needs to meet requirements of various portions of MSA sections 303(a) and 303(a)(15).

Paragraph (e)(1) is revised to state that ''Each FMP must include an estimate of MSY * * *'' because it needs to meet requirements of MSA section 303(a)(3).

Paragraph (e)(2)(ii) is revised to state that a Council ''must provide an analysis of how the SDC were chosen * * *'' because it needs to meet requirements of MSA section 303(a)(10).

Paragraph (e)(2)(ii)(A) is revised to state ''each FMP must describe which of the following two methods * * *'' because it needs to meet requirements of MSA section 303(a)(10).

Paragraph (e)(2)(ii)(B) is revised to state ''the MSST or reasonable proxy must be expressed in terms of spawning biomass * * *'' because it needs to meet requirements of MSA section 303(a)(10).

Paragraph (f)(4) is revised to state each Council ''must establish an ABC control rule * * *'' because it needs to meet requirements of MSA sections 303(a)(15) and 302(g)(1)(B).

Paragraph (f)(4) is revised to state ''The ABC control rule must articulate how ABC will be set compared to the OFL * * *'' because it needs to meet requirements of MSA sections 303(a)(15) and 301(a)(2).

Paragraph (f)(5)(i) is revised to state ''A multiyear plan must include a mechanism for specifying ACLs for each year * * *'' because it needs to meet requirements of MSA section 303(a)(15).

Paragraph (f)(5)(i) is also revised to state ''A multiyear plan must provide that, if an ACL is exceeded * * *'' because it needs to meet requirements of MSA section 303(a)(15).

Paragraph (f)(6)(i) is revised to state ''Such analyses must be based on best available scientific * * *'' because it needs to meet requirements of MSA section 301(a)(2).

Paragraph (g)(3) is revised to state a Council ''must determine as soon as possible after the fishing year if an ACL is exceeded * * *'' because it needs to meet requirements of MSA sections 303(a)(15), 301(a)(1) and 301(a)(2).

Paragraph (h) is revised to state FMPs or FMP amendments ''must establish ACL mechanisms and AMs * * *'' because it needs to meet requirements of MSA section 303(a)(15).

Paragraph (h)(3) is revised to state ''Councils must document their rationale for any alternative approaches * * *'' because it needs to meet requirements of MSA section 303(a)(15).

Paragraph (j)(2) is revised to state ''FMPs or FMP amendments must establish ACL and AM mechanisms in 2010 * * *'' because it needs to meet requirements of MSA section 303(a)(15).

Paragraph (j)(2)(i)(A) is revised to state that '' * * * ACLs and AMs themselves must be specified * * *'' because it needs to meet requirements of MSA section 303(a)(15).

Paragraph (k) is revised to state that ''The Secretary, in cooperation with the Secretary of State, must immediately take appropriate action at the international level * * *'' because it needs to meet requirements of MSA section 304(i)—INTERNATIONAL OVERFISHING.

Paragraph (k)(3) is revised to state that ''Information used to determine relative impact must be based upon the best available scientific * * *'' because it needs to meet requirements of MSA section 301(a)(2).

Paragraph (l)(2) is revised to state that ''Also scientific assessments must be based on the best information * * *'' because it needs to meet requirements of MSA section 301(a)(2).

VII. References Cited

A complete list of all the references cited in this final action is available online at: *http://www.nmfs.noaa.gov/msa2007/catchlimits.htm* or upon request from Mark Millikin [*see* **FOR FURTHER INFORMATION CONTACT**].

VIII. Classification

Pursuant to the Magnuson-Stevens Act, the NMFS Assistant Administrator has determined that these final NS1 guidelines are consistent with the Magnuson-Stevens Act, and other applicable law.

The final NS1 guidelines have been determined to be significant for purposes of Executive Order 12866. NOAA prepared a regulatory impact review of this rulemaking, which is available at: *http://www.nmfs.noaa.gov/msa2007/catchlimits.htm.* This analysis discusses various policy options that NOAA considered in preparation of the proposed action, given NOAA's interpretation of the statutory terms in the MSRA, such as the appropriate meaning of the word ''limit'' in ''Annual Catch Limit,'' and NOAA's belief that it has become necessary for Councils to consider separately the uncertainties in fishery management and the scientific uncertainties in stock evaluation in order to effectively set fishery management policies and ensure fulfillment of the goals to end overfishing and rebuild overfished stocks.

The Chief Counsel for Regulation of the Department of Commerce certified to the Chief Counsel for Advocacy of the Small Business Administration during the proposed rule stage that these revisions to the NS1 guidelines, if adopted, would not have any significant economic impact on a substantial number of small entities. The factual basis for the certification was published in the proposed action and is not repeated here. Two commenters stated that an initial regulatory flexibility analysis should be prepared, and NMFS has responded to those comments in the ''Response to Comments.'' After considering the comments, NMFS has determined that a certification is still appropriate for this action. Therefore, a regulatory flexibility analysis is not required for this action and none was prepared.

List of Subjects in 50 CFR Part 600

Fisheries, Fishing, Reporting and recordkeeping requirements.

Dated: January 9, 2009.

James W. Balsiger,

Acting Assistant Administrator, for Fisheries, National Marine Fisheries Service.

PART 600—MAGNUSON-STEVENS ACT PROVISIONS

■ 1. The authority citation for part 600 continues to read as follows:

Authority: 16 U.S.C. 1801 *et seq.*

■ 2. Section 600.310 is revised to read as follows:

§ 600.310 National Standard 1—Optimum Yield.

(a) *Standard 1.* Conservation and management measures shall prevent overfishing while achieving, on a continuing basis, the optimum yield (OY) from each fishery for the U.S. fishing industry.

(b) *General.* (1) The guidelines set forth in this section describe fishery management approaches to meet the objectives of National Standard 1 (NS1), and include guidance on:

(i) Specifying maximum sustainable yield (MSY) and OY;

(ii) Specifying status determination criteria (SDC) so that overfishing and overfished determinations can be made for stocks and stock complexes that are part of a fishery;

(iii) Preventing overfishing and achieving OY, incorporation of scientific and management uncertainty in control rules, and adaptive management using annual catch limits (ACL) and measures to ensure accountability (AM); and

(iv) Rebuilding stocks and stock complexes.

(2) *Overview of Magnuson-Stevens Act concepts and provisions related to NS1*—(i) *MSY.* The Magnuson-Stevens Act establishes MSY as the basis for fishery management and requires that: The fishing mortality rate does not jeopardize the capacity of a stock or stock complex to produce MSY; the abundance of an overfished stock or stock complex be rebuilt to a level that is capable of producing MSY; and OY not exceed MSY.

(ii) *OY.* The determination of OY is a decisional mechanism for resolving the Magnuson-Stevens Act's conservation and management objectives, achieving a fishery management plan's (FMP) objectives, and balancing the various interests that comprise the greatest overall benefits to the Nation. OY is based on MSY as reduced under paragraphs (e)(3)(iii) and (iv) of this section. The most important limitation on the specification of OY is that the choice of OY and the conservation and management measures proposed to achieve it must prevent overfishing.

(iii) *ACLs and AMs.* Any FMP which is prepared by any Council shall establish a mechanism for specifying ACLs in the FMP (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 (Magnuson-Stevens Act section 303(a)(15)). Subject to certain exceptions and circumstances described in paragraph (h) of this section, this requirement takes effect in fishing year 2010, for fisheries determined subject to overfishing, and in fishing year 2011, for all other fisheries (Magnuson-Stevens Act section 303 note). ''Council'' includes the Regional Fishery Management Councils and the Secretary of Commerce, as appropriate (*see* § 600.305(c)(11)).

(iv) *Reference points.* SDC, MSY, acceptable biological catch (ABC), and ACL, which are described further in paragraphs (e) and (f) of this section, are collectively referred to as ''reference points.''

(v) *Scientific advice.* The Magnuson-Stevens Act has requirements regarding scientific and statistical committees (SSC) of the Regional Fishery Management Councils, including but not limited to, the following provisions:

(A) Each Regional Fishery Management Council shall establish an SSC as described in section 302(g)(1)(A) of the Magnuson-Stevens Act.

(B) Each SSC shall provide its Regional Fishery Management Council recommendations for ABC as well as other scientific advice, as described in Magnuson-Stevens Act section 302(g)(1)(B).

(C) The Secretary and each Regional Fishery Management Council may establish a peer review process for that Council for scientific information used to advise the Council about the conservation and management of a 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 SSC or agency or international scientists, as appropriate. For Regional Fishery Management Councils, the peer review process is not a substitute for the SSC and should work in conjunction with the SSC. For the Secretary, which does not have an SSC, the peer review process should provide the scientific information necessary.

(D) Each Council shall develop ACLs for each of its managed fisheries that may not exceed the ''fishing level recommendations'' of its SSC or peer review process (Magnuson-Stevens Act section 302(h)(6)). The SSC recommendation that is the most relevant to ACLs is ABC, as both ACL and ABC are levels of annual catch.

(3) *Approach for setting limits and accountability measures, including targets, for consistency with NS1.* In general, when specifying limits and accountability measures intended to avoid overfishing and achieve sustainable fisheries, Councils must take an approach that considers uncertainty in scientific information and management control of the fishery. These guidelines describe how to address uncertainty such that there is a low risk that limits are exceeded as described in paragraphs (f)(4) and (f)(6) of this section.

(c) *Summary of items to include in FMPs related to NS1.* This section provides a summary of items that Councils must include in their FMPs and FMP amendments in order to address ACL, AM, and other aspects of the NS1 guidelines. As described in further detail in paragraph (d) of this section, Councils may review their FMPs to decide if all stocks are ''in the fishery'' or whether some fit the category of ''ecosystem component species.'' Councils must also describe fisheries data for the stocks, stock complexes, and ecosystem component species in their FMPs, or associated public documents such as Stock Assessment and Fishery Evaluation (SAFE) Reports. For all stocks and stock complexes that are ''in the fishery'' (see paragraph (d)(2) of this section), the Councils must evaluate and describe the following items in their FMPs and amend the FMPs, if necessary, to align their management objectives to end or prevent overfishing:

(1) MSY and SDC (see paragraphs (e)(1) and (2) of this section).

(2) OY at the stock, stock complex, or fishery level and provide the OY specification analysis (see paragraph (e)(3) of this section).

(3) ABC control rule (see paragraph (f)(4) of this section).

(4) Mechanisms for specifying ACLs and possible sector-specific ACLs in relationship to the ABC (see paragraphs (f)(5) and (h) of this section).

(5) AMs (see paragraphs (g) and (h)(1) of this section).

(6) Stocks and stock complexes that have statutory exceptions from ACLs (see paragraph (h)(2) of this section) or which fall under limited circumstances which require different approaches to meet the ACL requirements (see paragraph (h)(3) of this section).

(d) *Classifying stocks in an FMP*—(1) *Introduction.* Magnuson-Stevens Act section 303(a)(2) requires that an FMP contain, among other things, a description of the species of fish involved in the fishery. The relevant Council determines which specific target stocks and/or non-target stocks to include in a fishery. This section provides that a Council may, but is not required to, use an ''ecosystem component (EC)'' species classification. As a default, all stocks in an FMP are

considered to be ''in the fishery,'' unless they are identified as EC species (see § 600.310(d)(5)) through an FMP amendment process.

(2) *Stocks in a fishery.* Stocks in a fishery may be grouped into stock complexes, as appropriate. Requirements for reference points and management measures for these stocks are described throughout these guidelines.

(3) ''Target stocks'' are stocks that fishers seek to catch for sale or personal use, including ''economic discards'' as defined under Magnuson-Stevens Act section 3(9).

(4) ''Non-target species'' and ''non-target stocks'' are fish caught incidentally during the pursuit of target stocks in a fishery, including ''regulatory discards'' as defined under Magnuson-Stevens Act section 3(38). They may or may not be retained for sale or personal use. Non-target species may be included in a fishery and, if so, they should be identified at the stock level. Some non-target species may be identified in an FMP as ecosystem component (EC) species or stocks.

(5) *Ecosystem component (EC) species.* (i) To be considered for possible classification as an EC species, the species should:

(A) Be a non-target species or non-target stock;

(B) Not be determined to be subject to overfishing, approaching overfished, or overfished;

(C) 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

(D) Not generally be retained for sale or personal use.

(ii) Occasional retention of the species would not, in and of itself, preclude consideration of the species under the EC classification. In addition to the general factors noted in paragraphs (d)(5)(i)(A)–(D) of this section, it is important to consider whether use of the EC species classification in a given instance is consistent with MSA conservation and management requirements.

(iii) EC species may be identified at the species or stock level, and may be grouped into complexes. EC species may, but are not required to, be included in an FMP or FMP amendment for any of the following reasons: For data collection purposes; for ecosystem considerations related to specification of OY for the associated fishery; as considerations in the development of conservation and management measures for the associated fishery; and/or to address other ecosystem issues. While EC species are not considered to be ''in the fishery,'' a 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.''

(6) *Reclassification.* A Council should monitor the catch resulting from a fishery on a regular basis to determine if the stocks and species are appropriately classified in the FMP. If the criteria previously used to classify a stock or species is no longer valid, the Council should reclassify it through an FMP amendment, which documents rationale for the decision.

(7) *Stocks or species identified in more than one FMP.* If a stock is identified in more than one fishery, Councils should choose which FMP will be the primary FMP in which management objectives, SDC, the stock's overall ACL and other reference points for the stock are established. Conservation and management measures in other FMPs in which the stock is identified as part of a fishery should be consistent with the primary FMP's management objectives for the stock.

(8) *Stock complex.* ''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 can not 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 (this situation might be applicable to some salmon species).

(9) *Indicator stocks.* 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.

(10) *Vulnerability.* A stock's vulnerability is a combination of its productivity, which depends upon its life history characteristics, and its susceptibility to the fishery. Productivity refers to the capacity of the stock to produce MSY and to recover if the population is depleted, and susceptibility is the potential for the stock to be impacted by the fishery, which includes direct captures, as well as indirect impacts to the fishery (e.g., loss of habitat quality). Councils in consultation with their SSC, should analyze the vulnerability of stocks in stock complexes where possible.

(e) *Features of MSY, SDC, and OY.*— (1) *MSY.* Each FMP must include an estimate of MSY for the stocks and stock complexes in the fishery, as described in paragraph (d)(2) of this section).

(i) *Definitions.* (A) *MSY* is the largest long-term average catch or yield that can be taken from a stock or stock complex

under prevailing ecological, environmental conditions and fishery technological characteristics (e.g., gear selectivity), and the distribution of catch among fleets.

(B) *MSY fishing mortality rate (F_{msy})* is the fishing mortality rate that, if applied over the long term, would result in MSY.

(C) *MSY stock size (B_{msy})* means the long-term average size of the stock or stock complex, measured in terms of spawning biomass or other appropriate measure of the stock's reproductive potential that would be achieved by fishing at F_{msy}.

(ii) *MSY for stocks.* MSY should be estimated for each stock based on the best scientific information available (see § 600.315).

(iii) *MSY for stock complexes.* MSY should be estimated on a stock-by-stock basis whenever possible. However, where MSY cannot be estimated for each stock in a stock complex, then MSY may be estimated for one or more indicator stocks for the complex or for the complex as a whole. When indicator stocks are used, the stock complex's MSY could be listed as ''unknown,'' while noting that the complex is managed on the basis of one or more indicator stocks that do have known stock-specific MSYs, or suitable proxies, as described in paragraph (e)(1)(iv) of this section. When indicator stocks are not used, MSY, or a suitable proxy, should be calculated for the stock complex as a whole.

(iv) *Specifying MSY.* Because MSY is a long-term average, it need not be estimated annually, but it must be based on the best scientific information available (*see* § 600.315), and should be re-estimated as required by changes in long-term environmental or ecological conditions, fishery technological characteristics, or new scientific information. When data are insufficient to estimate MSY directly, Councils should adopt other measures of reproductive potential, based on the best scientific information available, that can serve as reasonable proxies for MSY, F_{msy}, and B_{msy}, to the extent possible. The MSY for a stock is influenced by its interactions with other stocks in its ecosystem and these interactions may shift as multiple stocks in an ecosystem are fished. These ecological conditions should be taken into account, to the extent possible, when specifying MSY. Ecological conditions not directly accounted for in the specification of MSY can be among the ecological factors considered when setting OY below MSY. As MSY values are estimates or are based on proxies, they will have some level of uncertainty associated with them. The degree of uncertainty in the estimates should be identified, when possible, through the stock assessment process and peer review (*see* § 600.335), and should be taken into account when specifying the ABC Control rule. Where this uncertainty cannot be directly calculated, such as when proxies are used, then a proxy for the uncertainty itself should be established based on the best scientific information, including comparison to other stocks.

(2) *Status determination criteria*—(i) *Definitions.* (A) *Status determination criteria (SDC)* mean the quantifiable factors, MFMT, OFL, and MSST, or their proxies, that are used to determine if overfishing has occurred, or if the stock or stock complex is overfished. Magnuson-Stevens Act (section 3(34)) defines both ''overfishing'' and ''overfished'' to mean a rate or level of fishing mortality that jeopardizes the capacity of a fishery to produce the MSY on a continuing basis. To avoid confusion, this section clarifies that ''overfished'' relates to biomass of a stock or stock complex, and ''overfishing'' pertains to a rate or level of removal of fish from a stock or stock complex.

(B) *Overfishing* (to overfish) occurs whenever a stock or stock complex is subjected to a level of fishing mortality or annual total catch that jeopardizes the capacity of a stock or stock complex to produce MSY on a continuing basis.

(C) *Maximum fishing mortality threshold (MFMT)* means the level of fishing mortality (F), on an annual basis, above which overfishing is occurring. The MFMT or reasonable proxy may be expressed either as a single number (a fishing mortality rate or F value), or as a function of spawning biomass or other measure of reproductive potential.

(D) *Overfishing limit (OFL)* means the annual amount of catch that corresponds to the estimate of MFMT applied to a stock or stock complex's abundance and is expressed in terms of numbers or weight of fish. The OFL is an estimate of the catch level above which overfishing is occurring.

(E) *Overfished.* A stock or stock complex is considered ''overfished'' when its biomass has declined below a level that jeopardizes the capacity of the stock or stock complex to produce MSY on a continuing basis.

(F) *Minimum stock size threshold (MSST)* means the level of biomass below which the stock or stock complex is considered to be overfished.

(G) *Approaching an overfished condition.* A stock or stock complex is approaching an overfished condition when it is projected that there is more than a 50 percent chance that the biomass of the stock or stock complex will decline below the MSST within two years.

(ii) *Specification of SDC and overfishing and overfished determinations.* SDC must be expressed in a way that enables the Council to monitor each stock or stock complex in the FMP, and determine annually, if possible, whether overfishing is occurring and whether the stock or stock complex is overfished. In specifying SDC, a Council must provide an analysis of how the SDC were chosen and how they relate to reproductive potential. Each FMP must specify, to the extent possible, objective and measurable SDC as follows (*see* paragraphs (e)(2)(ii)(A) and (B) of this section):

(A) *SDC to determine overfishing status.* Each FMP must describe which of the following two methods will be used for each stock or stock complex to determine an overfishing status.

(1) *Fishing mortality rate exceeds MFMT.* Exceeding the MFMT for a period of 1 year or more constitutes overfishing. The MFMT or reasonable proxy may be expressed either as a single number (a fishing mortality rate or F value), or as a function of spawning biomass or other measure of reproductive potential.

(2) *Catch exceeds the OFL.* Should the annual catch exceed the annual OFL for 1 year or more, the stock or stock complex is considered subject to overfishing.

(B) *SDC to determine overfished status.* The MSST or reasonable proxy must be expressed in terms of spawning biomass or other measure of reproductive potential. To the extent possible, the MSST should equal whichever of the following is greater: One-half the MSY stock size, or the minimum stock size at which rebuilding to the MSY level would be expected to occur within 10 years, if the stock or stock complex were exploited at the MFMT specified under paragraph (e)(2)(ii)(A)(1) of this section. Should the estimated size of the stock or stock complex in a given year fall below this threshold, the stock or stock complex is considered overfished.

(iii) *Relationship of SDC to environmental change.* Some short-term environmental changes can alter the size of a stock or stock complex without affecting its long-term reproductive potential. Long-term environmental changes affect both the short-term size of the stock or stock complex and the long-term reproductive potential of the stock or stock complex.

(A) If environmental changes cause a stock or stock complex to fall below its MSST without affecting its long-term reproductive potential, fishing mortality must be constrained sufficiently to allow rebuilding within an acceptable time frame (*also see* paragraph (j)(3)(ii) of this section). SDC should not be respecified.

(B) If environmental changes affect the long-term reproductive potential of the stock or stock complex, one or more components of the SDC must be respecified. Once SDC have been respecified, fishing mortality may or may not have to be reduced, depending on the status of the stock or stock complex with respect to the new criteria.

(C) If manmade environmental changes are partially responsible for a stock or stock complex being in an overfished condition, in addition to controlling fishing mortality, Councils should recommend restoration of habitat and other ameliorative programs, to the extent possible (see also the guidelines issued pursuant to section 305(b) of the Magnuson-Stevens Act for Council actions concerning essential fish habitat).

(iv) *Secretarial approval of SDC.* Secretarial approval or disapproval of proposed SDC will be based on consideration of whether the proposal:

(A) Has sufficient scientific merit;

(B) Contains the elements described in paragraph (e)(2)(ii) of this section;

(C) Provides a basis for objective measurement of the status of the stock or stock complex against the criteria; and

(D) is operationally feasible.

(3) *Optimum yield*—(i) *Definitions*—(A) *Optimum yield (OY).* Magnuson-Stevens Act section (3)(33) defines ''optimum,'' with respect to the yield from a fishery, as 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; that is prescribed 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, that provides for rebuilding to a level consistent with producing the MSY in such fishery. OY may be established at the stock or stock complex level, or at the fishery level.

(B) In NS1, use of the phrase ''achieving, on a continuing basis, the optimum yield from each fishery'' means producing, from each stock, stock complex, or fishery: a long-term series of catches such that the average catch is equal to the OY, overfishing is prevented, the long term average biomass is near or above B_{msy}, and overfished stocks and stock complexes are rebuilt consistent with timing and other requirements of section 304(e)(4) of the Magnuson-Stevens Act and paragraph (j) of this section.

(ii) *General.* OY is a long-term average amount of desired yield from a stock, stock complex, or fishery. An FMP must contain conservation and management measures, including ACLs and AMs, to achieve OY on a continuing basis, and provisions for information collection that are designed to determine the degree to which OY is achieved. These measures should allow for practical and effective implementation and enforcement of the management regime. The Secretary has an obligation to implement and enforce the FMP. If management measures prove unenforceable—or too restrictive, or not rigorous enough to prevent overfishing while achieving OY—they should be modified; an alternative is to reexamine the adequacy of the OY specification. Exceeding OY does not necessarily constitute overfishing. However, even if no overfishing resulted from exceeding OY, continual harvest at a level above OY would violate NS1, because OY was not achieved on a continuing basis. An FMP must contain an assessment and specification of OY, including a summary of information utilized in making such specification, consistent with requirements of section 303(a)(3) of the Magnuson-Stevens Act. A Council must identify those economic, social, and ecological factors relevant to management of a particular stock, stock complex, or fishery, and then evaluate them to determine the OY. The choice of a particular OY must be carefully documented to show that the OY selected will produce the greatest benefit to the Nation and prevent overfishing.

(iii) *Determining the greatest benefit to the Nation.* In determining the greatest benefit to the Nation, the values that should be weighed and receive serious attention when considering the economic, social, or ecological factors used in reducing MSY to obtain OY are:

(A) The benefits of food production are derived from providing seafood to consumers; maintaining an economically viable fishery together with its attendant contributions to the national, regional, and local economies; and utilizing the capacity of the Nation's fishery resources to meet nutritional needs.

(B) The benefits of recreational opportunities reflect the quality of both the recreational fishing experience and non-consumptive fishery uses such as ecotourism, fish watching, and recreational diving. Benefits also include the contribution of recreational fishing to the national, regional, and local economies and food supplies.

(C) The benefits of protection afforded to marine ecosystems are those resulting from maintaining viable populations (including those of unexploited species), maintaining adequate forage for all components of the ecosystem, maintaining evolutionary and ecological processes (e.g., disturbance regimes, hydrological processes, nutrient cycles), maintaining the evolutionary potential of species and ecosystems, and accommodating human use.

(iv) *Factors to consider in OY specification.* Because fisheries have limited capacities, any attempt to maximize the measures of benefits described in paragraph (e)(3)(iii) of this section will inevitably encounter practical constraints. OY cannot exceed MSY in any circumstance, and must take into account the need to prevent overfishing and rebuild overfished stocks and stock complexes. OY is prescribed on the basis of MSY as reduced by social, economic, and ecological factors. To the extent possible, the relevant social, economic, and ecological factors used to establish OY for a stock, stock complex, or fishery should be quantified and reviewed in historical, short-term, and long-term contexts. Even where quantification of social, economic, and ecological factors is not possible, the FMP still must address them in its OY specification. The following is a non-exhaustive list of potential considerations for each factor. An FMP must address each factor but not necessarily each example.

(A) *Social factors.* Examples are enjoyment gained from recreational fishing, avoidance of gear conflicts and resulting disputes, preservation of a way of life for fishermen and their families, and dependence of local communities on a fishery (e.g., involvement in fisheries and ability to adapt to change). Consideration may be given to fishery-related indicators (e.g., number of fishery permits, number of commercial fishing vessels, number of party and charter trips, landings, ex-vessel revenues etc.) and non-fishery related indicators (e.g., unemployment rates, percent of population below the poverty level, population density, etc.). Other factors that may be considered include the effects that past harvest levels have had on fishing communities, the cultural place of subsistence fishing, obligations under Indian treaties, proportions of affected minority and low-income groups, and worldwide nutritional needs.

(B) *Economic factors.* Examples are prudent consideration of the risk of overharvesting when a stock's size or reproductive potential is uncertain (*see* § 600.335(c)(2)(i)), satisfaction of consumer and recreational needs, and encouragement of domestic and export markets for U.S. harvested fish. Other factors that may be considered include: The value of fisheries, the level of capitalization, the decrease in cost per unit of catch afforded by an increase in stock size, the attendant increase in catch per unit of effort, alternate employment opportunities, and economic contribution to fishing communities, coastal areas, affected states, and the nation.

(C) *Ecological factors.* Examples include impacts on ecosystem component species, forage fish stocks, other fisheries, predator-prey or competitive interactions, marine mammals, threatened or endangered species, and birds. Species interactions that have not been explicitly taken into account when calculating MSY should be considered as relevant factors for setting OY below MSY. In addition, consideration should be given to managing forage stocks for higher biomass than B_{msy} to enhance and protect the marine ecosystem. Also important are ecological or environmental conditions that stress marine organisms, such as natural and manmade changes in wetlands or nursery grounds, and effects of pollutants on habitat and stocks.

(v) *Specification of OY.* The specification of OY must be consistent with paragraphs (e)(3)(i)–(iv) of this section. If the estimates of MFMT and current biomass are known with a high level of certainty and management controls can accurately limit catch then OY could be set very close to MSY, assuming no other reductions are necessary for social, economic, or ecological factors. To the degree that such MSY estimates and management controls are lacking or unavailable, OY should be set farther from MSY. If management measures cannot adequately control fishing mortality so that the specified OY can be achieved without overfishing, the Council should reevaluate the management measures and specification of OY so that the dual requirements of NS1 (preventing overfishing while achieving, on a continuing basis, OY) are met.

(A) The amount of fish that constitutes the OY should be expressed in terms of numbers or weight of fish.

(B) Either a range or a single value may be specified for OY.

(C) All catch must be counted against OY, including that resulting from bycatch, scientific research, and all fishing activities.

(D) The OY specification should be translatable into an annual numerical estimate for the purposes of establishing any total allowable level of foreign fishing (TALFF) and analyzing impacts of the management regime.

(E) The determination of OY is based on MSY, directly or through proxy. However, even where sufficient scientific data as to the biological characteristics of the stock do not exist, or where the period of exploitation or investigation has not been long enough for adequate understanding of stock dynamics, or where frequent large-scale fluctuations in stock size diminish the meaningfulness of the MSY concept, OY must still be established based on the best scientific information available.

(F) An OY established at a fishery level may not exceed the sum of the MSY values for each of the stocks or stock complexes within the fishery.

(G) There should be a mechanism in the FMP for periodic reassessment of the OY specification, so that it is responsive to changing circumstances in the fishery.

(H) Part of the OY may be held as a reserve to allow for factors such as uncertainties in estimates of stock size and domestic annual harvest (DAH). If an OY reserve is established, an adequate mechanism should be included in the FMP to permit timely release of the reserve to domestic or foreign fishermen, if necessary.

(vi) *OY and foreign fishing.* Section 201(d) of the Magnuson-Stevens Act provides that fishing by foreign nations is limited to that portion of the OY that will not be harvested by vessels of the United States. The FMP must include an assessment to address the following, as required by section 303(a)(4) of the Magnuson-Stevens Act:

(A) *DAH.* Councils and/or the Secretary must consider the capacity of, and the extent to which, U.S. vessels will harvest the OY on an annual basis. Estimating the amount that U.S. fishing vessels will actually harvest is required to determine the surplus.

(B) *Domestic annual processing (DAP).* Each FMP must assess the capacity of U.S. processors. It must also assess the amount of DAP, which is the sum of two estimates: The estimated amount of U.S. harvest that domestic processors will process, which may be based on historical performance or on surveys of the expressed intention of manufacturers to process, supported by evidence of contracts, plant expansion, or other relevant information; and the estimated amount of fish that will be harvested by domestic vessels, but not processed (*e.g.*, marketed as fresh whole fish, used for private consumption, or used for bait).

(C) *Joint venture processing (JVP).* When DAH exceeds DAP, the surplus is available for JVP.

(f) *Acceptable biological catch, annual catch limits, and annual catch targets.* The following features (see paragraphs (f)(1) through (f)(5) of this section) of acceptable biological catch and annual catch limits apply to stocks and stock complexes in the fishery (see paragraph (d)(2) of this section).

(1) *Introduction.* A control rule is a policy for establishing a limit or target fishing level that is based on the best available scientific information and is established by fishery managers in consultation with fisheries scientists. Control rules should be designed so that management actions become more conservative as biomass estimates, or other proxies, for a stock or stock complex decline and as science and management uncertainty increases. Examples of scientific uncertainty include uncertainty in the estimates of MFMT and biomass. Management uncertainty may include late catch reporting, misreporting, and underreporting of catches and is affected by a fishery's ability to control actual catch. For example, a fishery that has inseason catch data available and inseason closure authority has better management control and precision than a fishery that does not have these features.

(2) *Definitions.* (i) *Catch* is the total quantity of fish, measured in weight or numbers of fish, taken in commercial, recreational, subsistence, tribal, and other fisheries. Catch includes fish that are retained for any purpose, as well as mortality of fish that are discarded.

(ii) *Acceptable biological catch (ABC)* is a level of a stock or stock complex's annual catch that accounts for the scientific uncertainty in the estimate of OFL and any other scientific uncertainty (see paragraph (f)(3) of this section), and should be specified based on the ABC control rule.

(iii) *ABC control rule* means a specified approach to setting the ABC for a stock or stock complex as a function of the scientific uncertainty in the estimate of OFL and any other scientific uncertainty (*see* paragraph (f)(4) of this section).

(iv) *Annual catch limit (ACL)* is the level of annual catch of a stock or stock complex that serves as the basis for invoking AMs. ACL cannot exceed the ABC, but may be divided into sector-ACLs (*see* paragraph (f)(5) of this section).

(v) *Annual catch target (ACT)* is an amount of annual catch of a stock or stock complex that is the management target of the fishery, and accounts for management uncertainty in controlling the actual catch at or below the ACL. ACTs are recommended in the system of accountability measures so that ACL is not exceeded.

(vi) *ACT control rule* means a specified approach to setting the ACT for a stock or stock complex such that the risk of exceeding the ACL due to management uncertainty is at an acceptably low level.

(3) *Specification of ABC.* ABC may not exceed OFL (see paragraph (e)(2)(i)(D) of this section). Councils should develop a process for receiving scientific information and advice used to establish ABC. This process should: Identify the body that will apply the ABC control rule (*i.e.* , calculates the ABC), and identify the review process that will evaluate the resulting ABC. The SSC must recommend the ABC to the Council. An SSC may recommend an ABC that differs from the result of the ABC control rule calculation, based on factors such as data uncertainty, recruitment variability, declining trends in population variables, and other factors, but must explain why. For Secretarial FMPs or FMP amendments, agency scientists or a peer review process would provide the scientific advice to establish ABC. For internationally-assessed stocks, an ABC as defined in these guidelines is not required if they meet the international exception (*see* paragraph (h)(2)(ii)). While the ABC is allowed to equal OFL, NMFS expects that in most cases ABC will be reduced from OFL to reduce the probability that overfishing might occur in a year. Also, *see* paragraph (f)(5) of this section for cases where a Council recommends that ACL is equal to ABC, and ABC is equal to OFL.

(i) *Expression of ABC.* ABC should be expressed in terms of catch, but may be expressed in terms of landings as long as estimates of bycatch and any other fishing mortality not accounted for in the landings are incorporated into the determination of ABC.

(ii) *ABC for overfished stocks.* For overfished stocks and stock complexes, a rebuilding ABC must be set to reflect the annual catch that is consistent with the schedule of fishing mortality rates in the rebuilding plan.

(4) *ABC control rule.* For stocks and stock complexes required to have an ABC, each Council must establish an ABC control rule based on scientific advice from its SSC. The determination of ABC should be based, when possible, on the probability that an actual catch equal to the stock's ABC would result in overfishing. This probability that overfishing will occur cannot exceed 50 percent and should be a lower value. The ABC control rule should consider reducing fishing mortality as stock size declines and may establish a stock abundance level below which fishing would not be allowed. The process of establishing an ABC control rule could also involve science advisors or the peer review process established under Magnuson-Stevens Act section 302(g)(1)(E). The ABC control rule must articulate how ABC will be set compared to the OFL based on the scientific knowledge about the stock or stock complex and the scientific uncertainty in the estimate of OFL and any other scientific uncertainty. The ABC control rule should consider uncertainty in factors such as stock assessment results, time lags in updating assessments, the degree of retrospective revision of assessment results, and projections. The control rule may be used in a tiered approach to address different levels of scientific uncertainty.

(5) *Setting the annual catch limit*—(i) *General.* ACL cannot exceed the ABC and may be set annually or on a multiyear plan basis. ACLs in coordination with AMs must prevent overfishing (see MSA section 303(a)(15)). If a Council recommends an ACL which equals ABC, and the ABC is equal to OFL, the Secretary may presume that the proposal would not prevent overfishing, in the absence of sufficient analysis and justification for the approach. A ''multiyear plan'' as referenced in section 303(a)(15) of the Magnuson-Stevens Act is a plan that establishes harvest specifications or harvest guidelines for each year of a time period greater than 1 year. A multiyear plan must include a mechanism for specifying ACLs for each year with appropriate AMs to prevent overfishing and maintain an appropriate rate of rebuilding if the stock or stock complex is in a rebuilding plan. A multiyear plan must provide that, if an ACL is exceeded for a year, then AMs are triggered for the next year consistent with paragraph (g)(3) of this section.

(ii) *Sector-ACLs.* A Council may, but is not required to, divide an ACL into sector-ACLs. ''Sector,'' for purposes of this section, means a distinct user group to which separate management strategies and separate catch quotas apply. Examples of sectors include the commercial sector, recreational sector, or various gear groups within a fishery. If the management measures for different sectors differ in the degree of management uncertainty, then sector ACLs may be necessary so that appropriate AMs can be developed for each sector. If a Council chooses to use sector ACLs, the sum of sector ACLs must not exceed the stock or stock complex level ACL. The system of ACLs and AMs designed must be effective in protecting the stock or stock complex as a whole. Even if sector-ACLs and AMs are established, additional AMs at the stock or stock complex level may be necessary.

(iii) *ACLs for State-Federal Fisheries.* For stocks or stock complexes that have harvest in state or territorial waters, FMPs and FMP amendments should include an ACL for the overall stock that may be further divided. For example, the overall ACL could be divided into a Federal-ACL and state-ACL. However, NMFS recognizes that Federal management is limited to the portion of the fishery under Federal authority (*see* paragraph (g)(5) of this section). When stocks are co-managed by Federal, state, tribal, and/or territorial fishery managers, the goal should be to develop collaborative conservation and management strategies, and scientific capacity to support such strategies (including AMs for state or territorial and Federal waters), to prevent overfishing of shared stocks and ensure their sustainability.

(6) *ACT control rule.* If ACT is specified as part of the AMs for a fishery, an ACT control rule is utilized for setting the ACT. The ACT control rule should clearly articulate how management uncertainty in the amount of catch in the fishery is accounted for in setting ACT. The objective for establishing the ACT and related AMs is that the ACL not be exceeded.

(i) *Determining management uncertainty.* Two sources of management uncertainty should be accounted for in establishing the AMs for a fishery, including the ACT control rule if utilized: Uncertainty in the ability of managers to constrain catch so the ACL is not exceeded, and uncertainty in quantifying the true catch amounts (*i.e.,* estimation errors). To determine the level of management uncertainty in controlling catch, analyses need to consider past management performance in the fishery and factors such as time lags in reported catch. Such analyses must be based on the best available scientific information from an SSC, agency scientists, or peer review process as appropriate.

(ii) *Establishing tiers and corresponding ACT control rules.* Tiers can be established based on levels of management uncertainty associated with the fishery, frequency and accuracy of catch monitoring data

available, and risks of exceeding the limit. An ACT control rule could be established for each tier and have, as appropriate, different formulas and standards used to establish the ACT.

(7) A Council may choose to use a single control rule that combines both scientific and management uncertainty and supports the ABC recommendation and establishment of ACL and if used ACT.

(g) *Accountability measures.* The following features (see paragraphs (g)(1) through (5) of this section) of accountability measures apply to those stocks and stock complexes in the fishery.

(1) *Introduction.* AMs are management controls to prevent ACLs, including sector-ACLs, from being exceeded, and to correct or mitigate overages of the ACL if they occur. AMs 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. NMFS identifies two categories of AMs, inseason AMs and AMs for when the ACL is exceeded.

(2) *Inseason AMs.* Whenever possible, FMPs should include inseason monitoring and management measures to prevent catch from exceeding ACLs. Inseason AMs could include, but are not limited to: ACT; closure of a fishery; closure of specific areas; changes in gear; changes in trip size or bag limits; reductions in effort; or other appropriate management controls for the fishery. If final data or data components of catch are delayed, Councils should make appropriate use of preliminary data, such as landed catch, in implementing inseason AMs. FMPs should contain inseason closure authority giving NMFS the ability to close fisheries if it determines, based on data that it deems sufficiently reliable, that an ACL has been exceeded or is projected to be reached, and that closure of the fishery is necessary to prevent overfishing. For fisheries without inseason management control to prevent the ACL from being exceeded, AMs should utilize ACTs that are set below ACLs so that catches do not exceed the ACL.

(3) *AMs for when the ACL is exceeded.* On an annual basis, the Council must determine as soon as possible after the fishing year if an ACL was exceeded. If an ACL was exceeded, AMs must be triggered and implemented as soon as possible to correct the operational issue that caused the ACL overage, as well as any biological consequences to the stock or stock complex resulting from the overage when it is known. These AMs could include, among other things, modifications of inseason AMs or overage adjustments. For stocks and stock complexes in rebuilding plans, the AMs should include overage adjustments that reduce the ACLs in the next fishing year by the full amount of the overages, unless the best scientific information available shows that a reduced overage adjustment, or no adjustment, is needed to mitigate the effects of the overages. If catch exceeds the ACL for a given stock or stock complex more than once in the last four years, the system of ACLs and AMs should be re-evaluated, and modified if necessary, to improve its performance and effectiveness. A Council could choose a higher performance standard (e.g., a stock's catch should not exceed its ACL more often than once every five or six years) for a stock that is particularly vulnerable to the effects of overfishing, if the vulnerability of the stock has not already been accounted for in the ABC control rule.

(4) *AMs based on multi-year average data.* Some fisheries have highly variable annual catches and lack reliable inseason or annual data on which to base AMs. If there are insufficient data upon which to compare catch to ACL, either inseason or on an annual basis, AMs could be based on comparisons of average catch to average ACL over a three-year moving average period or, if supported by analysis, some other appropriate multi-year period. Councils should explain why basing AMs on a multi-year period is appropriate. Evaluation of the moving average catch to the average ACL must be conducted annually and AMs should be implemented if the average catch exceeds the average ACL. As a performance standard, if the average catch exceeds the average ACL for a stock or stock complex more than once in the last four years, then the system of ACLs and AMs should be re-evaluated and modified if necessary to improve its performance and effectiveness. The initial ACL and management measures may incorporate information from previous years so that AMs based on average ACLs can be applied from the first year. Alternatively, a Council could use a stepped approach where in year-1, catch is compared to the ACL for year-1; in year-2 the average catch for the past 2 years is compared to the average ACL; then in year 3 and beyond, the most recent 3 years of catch are compared to the corresponding ACLs for those years.

(5) *AMs for State-Federal Fisheries.* For stocks or stock complexes that have harvest in state or territorial waters, FMPs and FMP amendments must, at a minimum, have AMs for the portion of the fishery under Federal authority. Such AMs could include closing the EEZ when the Federal portion of the ACL is reached, or the overall stock's ACL is reached, or other measures.

(h) *Establishing ACL mechanisms and AMs in FMPs.* FMPs or FMP amendments must establish ACL mechanisms and AMs for all stocks and stock complexes in the fishery, unless paragraph (h)(2) of this section is applicable. These mechanisms should describe the annual or multiyear process by which specific ACLs, AMs, and other reference points such as OFL, and ABC will be established. If a complex has multiple indicator stocks, each indicator stock must have its own ACL; an additional ACL for the stock complex as a whole is optional. In cases where fisheries (e.g., Pacific salmon) harvest multiple indicator stocks of a single species that cannot be distinguished at the time of capture, separate ACLs for the indicator stocks are not required and the ACL can be established for the complex as a whole.

(1) In establishing ACL mechanisms and AMs, FMPs should describe:

(i) Timeframes for setting ACLs (e.g., annually or multi-year periods);

(ii) Sector-ACLs, if any (including set-asides for research or bycatch);

(iii) AMs and how AMs are triggered and what sources of data will be used (e.g., inseason data, annual catch compared to the ACL, or multi-year averaging approach); and

(iv) Sector-AMs, if there are sector-ACLs.

(2) *Exceptions from ACL and AM requirements*—(i) *Life cycle.* Section 303(a)(15) of the Magnuson-Stevens Act ''shall not apply to a fishery for species that has a life cycle of approximately 1 year unless the Secretary has determined the fishery is subject to overfishing of that species'' (as described in Magnuson-Stevens Act section 303 note). This exception applies to a stock for which the average length of time it takes for an individual to produce a reproductively active offspring is approximately 1 year and that the individual has only one breeding season in its lifetime. While exempt from the ACL and AM requirements, FMPs or FMP amendments for these stocks must have SDC, MSY, OY, ABC, and an ABC control rule.

(ii) *International fishery agreements.* Section 303(a)(15) of the Magnuson-Stevens Act applies ''unless otherwise provided for under an international agreement in which the United States participates'' (Magnuson-Stevens Act section 303 note). This exception applies to stocks or stock complexes

subject to management under an international agreement, which is defined as ''any bilateral or multilateral treaty, convention, or agreement which relates to fishing and to which the United States is a party'' (see Magnuson-Stevens Act section 3(24)). These stocks would still need to have SDC and MSY.

(3) *Flexibility in application of NS1 guidelines*. There are limited circumstances that may not fit the standard approaches to specification of reference points and management measures set forth in these guidelines. These include, among other things, conservation and management of Endangered Species Act listed species, harvests from aquaculture operations, and stocks with unusual life history characteristics (e.g., Pacific salmon, where the spawning potential for a stock is spread over a multi-year period). In these circumstances, Councils may propose alternative approaches for satisfying the NS1 requirements of the Magnuson-Stevens Act than those set forth in these guidelines. Councils must document their rationale for any alternative approaches for these limited circumstances in an FMP or FMP amendment, which will be reviewed for consistency with the Magnuson-Stevens Act.

(i) *Fisheries data*. In their FMPs, or associated public documents such as SAFE reports as appropriate, Councils must describe general data collection methods, as well as any specific data collection methods used for all stocks in the fishery, and EC species, including:

(1) Sources of fishing mortality (both landed and discarded), including commercial and recreational catch and bycatch in other fisheries;

(2) Description of the data collection and estimation methods used to quantify total catch mortality in each fishery, including information on the management tools used (i.e., logbooks, vessel monitoring systems, observer programs, landings reports, fish tickets, processor reports, dealer reports, recreational angler surveys, or other methods); the frequency with which data are collected and updated; and the scope of sampling coverage for each fishery; and

(3) Description of the methods used to compile catch data from various catch data collection methods and how those data are used to determine the relationship between total catch at a given point in time and the ACL for stocks and stock complexes that are part of a fishery.

(j) *Council actions to address overfishing and rebuilding for stocks and stock complexes in the fishery*—(1) *Notification*. The Secretary will immediately notify in writing a Regional Fishery Management Council whenever it is determined that:

(i) Overfishing is occurring;

(ii) A stock or stock complex is overfished;

(iii) A stock or stock complex is approaching an overfished condition; or

(iv) Existing remedial action taken for the purpose of ending previously identified overfishing or rebuilding a previously identified overfished stock or stock complex has not resulted in adequate progress.

(2) *Timing of actions*—(i) *If a stock or stock complex is undergoing overfishing*. FMPs or FMP amendments must establish ACL and AM mechanisms in 2010, for stocks and stock complexes determined to be subject to overfishing, and in 2011, for all other stocks and stock complexes (*see* paragraph (b)(2)(iii) of this section). To address practical implementation aspects of the FMP and FMP amendment process, paragraphs (j)(2)(i)(A) through (C) of this section clarifies the expected timing of actions.

(A) In addition to establishing ACL and AM mechanisms, the ACLs and AMs themselves must be specified in FMPs, FMP amendments, implementing regulations, or annual specifications beginning in 2010 or 2011, as appropriate.

(B) For stocks and stock complexes still determined to be subject to overfishing at the end of 2008, ACL and AM mechanisms and the ACLs and AMs themselves must be effective in fishing year 2010.

(C) For stocks and stock complexes determined to be subject to overfishing during 2009, ACL and AM mechanisms and ACLs and AMs themselves should be effective in fishing year 2010, if possible, or in fishing year 2011, at the latest.

(ii) *If a stock or stock complex is overfished or approaching an overfished condition*. (A) For notifications that a stock or stock complex is overfished or approaching an overfished condition made before July 12, 2009, a Council must prepare an FMP, FMP amendment, or proposed regulations within one year of notification. If the stock or stock complex is overfished, the purpose of the action is to specify a time period for ending overfishing and rebuilding the stock or stock complex that will be as short as possible as described under section 304(e)(4) of the Magnuson-Stevens Act. If the stock or stock complex is approaching an overfished condition, the purpose of the action is to prevent the biomass from declining below the MSST.

(B) For notifications that a stock or stock complex is overfished or approaching an overfished condition made after July 12, 2009, a Council must prepare and implement an FMP, FMP amendment, or proposed regulations within two years of notification, consistent with the requirements of section 304(e)(3) of the Magnuson-Stevens Act. Council actions should be submitted to NMFS within 15 months of notification to ensure sufficient time for the Secretary to implement the measures, if approved. If the stock or stock complex is overfished and overfishing is occurring, the rebuilding plan must end overfishing immediately and be consistent with ACL and AM requirements of the Magnuson-Stevens Act.

(3) *Overfished fishery*. (i) Where a stock or stock complex is overfished, a Council must specify a time period for rebuilding the stock or stock complex based on factors specified in Magnuson-Stevens Act section 304(e)(4). This target time for rebuilding (T_{target}) shall be as short as possible, taking into account: The status and biology of any overfished stock, the needs of fishing communities, recommendations by international organizations in which the U.S. participates, and interaction of the stock within the marine ecosystem. In addition, the time period shall not exceed 10 years, except where biology of the stock, other environmental conditions, or management measures under an international agreement to which the U.S. participates, dictate otherwise. SSCs (or agency scientists or peer review processes in the case of Secretarial actions) shall provide recommendations for achieving rebuilding targets (*see* Magnuson-Stevens Act section 302(g)(1)(B)). The above factors enter into the specification of T_{target} as follows:

(A) The ''minimum time for rebuilding a stock'' (T_{min}) means the amount of time the stock or stock complex is expected to take to rebuild to its MSY biomass level in the absence of any fishing mortality. In this context, the term ''expected'' means to have at least a 50 percent probability of attaining the B_{msy}.

(B) For scenarios under paragraph (j)(2)(ii)(A) of this section, the starting year for the T_{min} calculation is the first year that a rebuilding plan is implemented. For scenarios under paragraph (j)(2)(ii)(B) of this section, the starting year for the T_{min} calculation is 2 years after notification that a stock or stock complex is overfished or the first year that a rebuilding plan is implemented, whichever is sooner.

(C) If T_{min} for the stock or stock complex is 10 years or less, then the maximum time allowable for rebuilding (T_{max}) that stock to its B_{msy} is 10 years.

(D) If T_{min} for the stock or stock complex exceeds 10 years, then the maximum time allowable for rebuilding a stock or stock complex to its B_{msy} is T_{min} plus the length of time associated with one generation time for that stock or stock complex. ''Generation time'' is the average length of time between when an individual is born and the birth of its offspring.

(E) T_{target} shall not exceed T_{max}, and should be calculated based on the factors described in this paragraph (j)(3).

(ii) If a stock or stock complex reached the end of its rebuilding plan period and has not yet been determined to be rebuilt, then the rebuilding F should not be increased until the stock or stock complex has been demonstrated to be rebuilt. If the rebuilding plan was based on a T_{target} that was less than T_{max}, and the stock or stock complex is not rebuilt by T_{target}, rebuilding measures should be revised, if necessary, such that the stock or stock complex will be rebuilt by T_{max}. If the stock or stock complex has not rebuilt by T_{max}, then the fishing mortality rate should be maintained at $F_{rebuild}$ or 75 percent of the MFMT, whichever is less.

(iii) Council action addressing an overfished fishery must allocate both overfishing restrictions and recovery benefits fairly and equitably among sectors of the fishery.

(iv) For fisheries managed under an international agreement, Council action addressing an overfished fishery must reflect traditional participation in the fishery, relative to other nations, by fishermen of the United States.

(4) *Emergency actions and interim measures.* The Secretary, on his/her own initiative or in response to a Council request, may implement interim measures to reduce overfishing or promulgate regulations to address an emergency (Magnuson-Stevens Act section 304(e)(6) or 305(c)). In considering a Council request for action, the Secretary would consider, among other things, the need for and urgency of the action and public interest considerations, such as benefits to the stock or stock complex and impacts on participants in the fishery.

(i) These measures may remain in effect for not more than 180 days, but may be extended for an additional 186 days if the public has had an opportunity to comment on the measures and, in the case of Council-recommended measures, the Council is actively preparing an FMP, FMP amendment, or proposed regulations to address the emergency or overfishing on a permanent basis.

(ii) Often, these measures need to be implemented without prior notice and an opportunity for public comment, as it would be impracticable to provide for such processes given the need to act quickly and also contrary to the public interest to delay action. However, emergency regulations and interim measures that do not qualify for waivers or exceptions under the Administrative Procedure Act would need to follow proposed notice and comment rulemaking procedures.

(k) *International overfishing.* If the Secretary determines that a fishery is overfished or approaching a condition of being overfished due to excessive international fishing pressure, and for which there are no management measures (or no effective measures) to end overfishing under an international agreement to which the United States is a party, then the Secretary and/or the appropriate Council shall take certain actions as provided under Magnuson-Stevens Act section 304(i). The Secretary, in cooperation with the Secretary of State, must immediately take appropriate action at the international level to end the overfishing. In addition, within one year after the determination, the Secretary and/or appropriate Council shall:

(1) Develop recommendations for domestic regulations to address the relative impact of the U.S. fishing vessels on the stock. Council recommendations should be submitted to the Secretary.

(2) Develop and submit recommendations to the Secretary of State, and to the Congress, for international actions that will end overfishing in the fishery and rebuild the affected stocks, taking into account the relative impact of vessels of other nations and vessels of the United States on the relevant stock. Councils should, in consultation with the Secretary, develop recommendations that take into consideration relevant provisions of the Magnuson-Stevens Act and NS1 guidelines, including section 304(e) of the Magnuson-Stevens Act and paragraph (j)(3)(iv) of this section, and other applicable laws. For highly migratory species in the Pacific, recommendations from the Western Pacific, North Pacific, or Pacific Councils must be developed and submitted consistent with Magnuson-Stevens Reauthorization Act section 503(f), as appropriate.

(3) *Considerations for assessing ''relative impact.''* ''Relative impact'' under paragraphs (k)(1) and (2) of this section may include consideration of factors that include, but are not limited to: Domestic and international management measures already in place, management history of a given nation, estimates of a nation's landings or catch (including bycatch) in a given fishery, and estimates of a nation's mortality contributions in a given fishery. Information used to determine relative impact must be based upon the best available scientific information.

(l) *Relationship of National Standard 1 to other national standards—General.* National Standards 2 through 10 provide further requirements for conservation and management measures in FMPs, but do not alter the requirement of NS1 to prevent overfishing and rebuild overfished stocks.

(1) *National Standard 2 (see § 600.315).* Management measures and reference points to implement NS1 must be based on the best scientific information available. When data are insufficient to estimate reference points directly, Councils should develop reasonable proxies to the extent possible (*also see* paragraph (e)(1)(iv) of this section). In cases where scientific data are severely limited, effort should also be directed to identifying and gathering the needed data. SSCs should advise their Councils regarding the best scientific information available for fishery management decisions.

(2) *National Standard 3 (see § 600.320).* Reference points should generally be specified in terms of the level of stock aggregation for which the best scientific information is available (*also see* paragraph (e)(1)(iii) of this section). Also, scientific assessments must be based on the best information about the total range of the stock and potential biological structuring of the stock into biological sub-units, which may differ from the geographic units on which management is feasible.

(3) *National Standard 6 (see § 600.335).* Councils must build into the reference points and control rules appropriate consideration of risk, taking into account uncertainties in estimating harvest, stock conditions, life history parameters, or the effects of environmental factors.

(4) *National Standard 8 (see § 600.345).* National Standard 8 directs the Councils to apply economic and social factors towards sustained participation of fishing communities and to the extent practicable, minimize adverse economic impacts on such communities within the context of preventing overfishing and rebuilding overfished stocks as required under National Standard 1. Therefore, calculation of OY as reduced from MSY

should include economic and social factors, but the combination of management measures chosen to achieve the OY must principally be designed to prevent overfishing and rebuild overfished stocks.

(5) *National Standard 9 (see § 600.350).* Evaluation of stock status with respect to reference points must take into account mortality caused by bycatch. In addition, the estimation of catch should include the mortality of fish that are discarded.

(m) *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 a Council 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.

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Revisions to the National Standard 1 Guidelines:

Guidance on Annual Catch Limits and Other Requirements

January 2009

NOAA Fisheries Service
Office of Sustainable Fisheries
Silver Spring, MD

Note: This presentation provides only a summary of the National Standard 1 guidelines. Any discrepancies between this presentation and the National Standard 1 guidelines as published in the *Federal Register* on January 16, 2009 (74 FR 3178) will be resolved in favor of the *Federal Register.*

Statutory Requirements

National Standard (NS) 1

- "Conservation and management measures shall **prevent overfishing** while achieving, on a continuing basis, the **optimum yield** from each fishery for the United States fishing industry."
  - MSA Section 301(a)(1)

2007 MSA Amendments

- The Magnuson-Stevens Fishery Conservation and Management Reauthorization Act of 2006 *(MSRA)* added new requirements for annual catch limits (ACLs) and accountability measures (AMs).
- 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."

MSA Section 303(a)(15)

ACLs

- Exceptions to ACL requirement*:
  - Species with a life cycle of approximately one year, unless subject to overfishing
  - Stocks managed under an international agreement to which the U.S. is party
- Implementation in fishing year*:
  - 2010 for fisheries subject to overfishing
  - 2011 for all other fisheries
- May not exceed a Council's Scientific and Statistical Committee's (SSC) fishing level recommendation**

*MSA sec. 303 note, MSRA sec. 104(b)
**MSA sec. 302(h)(6)

New SSC requirements

- "Each scientific and statistical committee shall provide its Council ongoing scientific advice for fishery management decisions, including recommendations for
  - acceptable biological catch,
  - preventing overfishing,
  - maximum sustainable yield, and
  - achieving rebuilding targets, and
  - reports on stock status and health,
  - bycatch
  - habitat status
  - social and economic impacts of management measures, and
  - sustainability of fishing practices."

MSA Section 302(g)(1)(B)

For "overfished" stocks

- Effective July 12, 2009, within **2** years of an "overfished" or "approaching overfished" stock status notification, Councils (or Secretary for Atlantic HMS) must "prepare **and implement**" management measures to:
  - **Immediately** end overfishing
  - Rebuild affected stocks
    - Rebuilding time shall be "as short as possible"
    - "not exceed 10 years", unless biological or environmental circumstances, or management under an international agreement dictates otherwise

MSA Sec. 304(e)(3), MSRA sec. 104(c)

NMFS Objectives
in Revising the NS 1 Guidelines

Strong, Yet Flexible, Guidelines

- Ensure that the MSA mandate for ACLs and AMs to end and prevent overfishing is met and account for U.S. fisheries diversity:
  - Biological and ecological
  - Management approaches
  - Scientific knowledge
  - Monitoring capacity
  - Overlap in management jurisdiction
  - Resource users

Incorporate New Terms

- Define and provide guidance on the terms ACLs, AMs, and acceptable biological catch (ABC) that are required but not defined by MSA.
- Explain the relationship between ACLs, AMs, and ABC and other reference points such as the overfishing limit (OFL) and the annual catch target (ACT).

Consider Public Input

- Scoping: February – April 2007
  - Held 9 scoping sessions
- Proposed Guidelines: 73 FR 32526 (June 9, 2008)
- Public comment period: June 9 – September 22, 2008
  - Held 3 public meetings
  - Made presentations to each of the 8 Councils
  - Received over 150,000 comments
- Final Guidelines: 74 FR 3178 (January 16, 2009)

Themes From Comments Received (June 9th – September 22nd, 2008)

- Proposed definition framework (OFL ≥ ABC ≥ ACL ≥ ACT)
- Buffers between OFL and ABC
- Complexity of the guidelines
- Challenge of implementing ACLs and AMs by 2010 and 2011
- ACT and ACT control rule
- Analysis to support the action (i.e., Environmental Impact Statement)
- Ecosystem component species
- Spatial-temporal management as part of effective ACLs
- Specific guidelines for forage fish management
- Include a description of vulnerability to help classify stocks

See 74 FR 3178 (January 16, 2009) for full summary of comments and responses

Themes From Comments Received (continued)

- Addressing scientific and management uncertainty
- Use of catch shares or limited access privilege programs
- Encourage the use of sectors
- Support and opposition for the use of inseason AMs
- AMs for when the ACL is exceeded
- AMs for recreational fisheries
- ACLs and AMs for state-Federal fisheries
- Rebuilding provisions
- International fishing exception
- Mixed-stock exception

See 74 FR 3178 (January 16, 2009) for full summary of comments and responses

Changes from proposed to final NS1 guidance

Changes in final guidance

- ACTs and ACT control rules are optional accountability measures. For fisheries without inseason management control to prevent ACL from being exceeded, should utilize ACTs set below ACLs so catches do not exceed ACL.*
- If Council recommends OFL=ABC=ACL, Secretary may presume the proposal would not prevent overfishing, in the absence of sufficient analysis and justification. In most cases, expect ABC to be reduced from OFL to account for scientific uncertainty and reduce probability that overfishing might occur in a given year. **
- Clarification of statutory/mandatory provisions versus discretionary provisions.

*§ 600.310 (g)(2), **§ 600.310 (f)(3), **§ 600.310 (f)(5)(i)

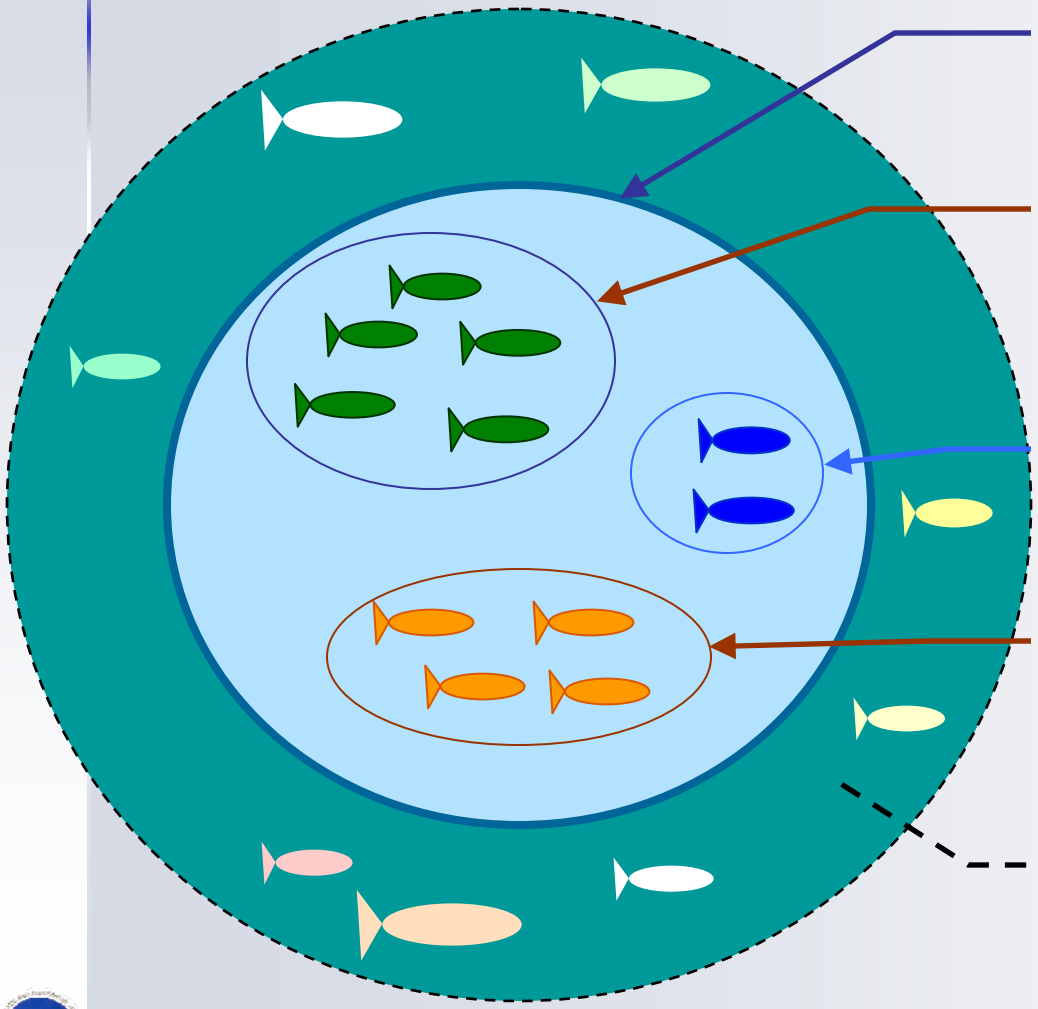
Major aspects of the NS1 guidelines

Stock classification in FMPs

- All stocks in FMP are considered “in the fishery” unless specified as ecosystem component (EC) species.
- EC classification is not required but is discretionary.
- To be considered for possible EC classification, species should, among other considerations:
  - Be a non-target species or non-target stock;
  - Not be determined to be subject to overfishing, approaching overfished, or overfished;
  - 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
  - Not generally be retained for sale or personal use.

§ 600.310 (d)(1)-(6)

Example of the kind of stocks that may fall into the two classifications.



The "fishery"
Stocks that are part of the fishery

Target stocks -
stocks people seek to harvest and retain for sale or personal use

Non-target stocks -
that people retain for sale or personal use

Non-target stocks -
not retained and for which an overfishing or overfished status is a concern

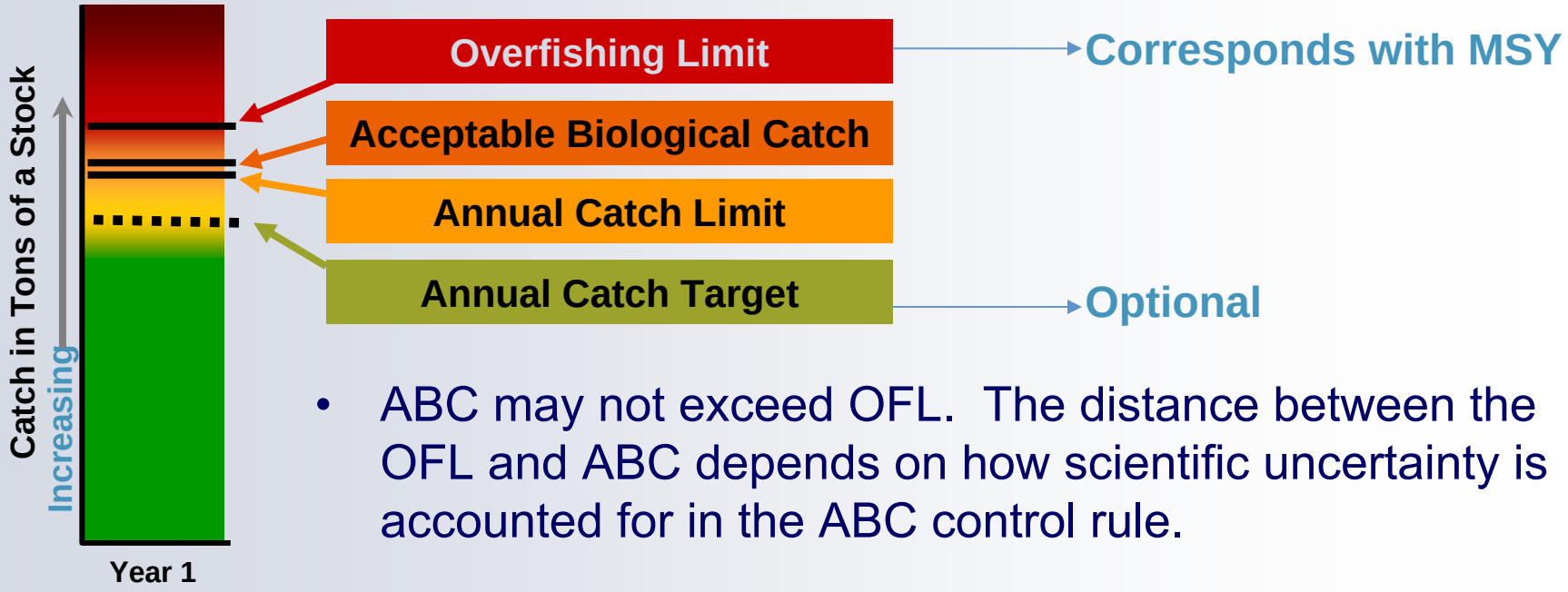
Ecosystem Component species

ACLs Apply to Stocks "in the Fishery"

- In practice, overfishing is determined at the stock or stock complex level. Therefore, ACLs should be applied at the stock or stock complex level.
- ACLs would apply only to stocks "in a fishery."
- ACLs would not apply to "ecosystem component species."

§ 600.310 (c)(4)
§ 600.310 (f)

Definition Framework
OFL ≥ ABC ≥ ACL



- ABC may not exceed OFL. The distance between the OFL and ABC depends on how scientific uncertainty is accounted for in the ABC control rule.
- The ACL may not exceed the ABC.
  - ABC is one of the fishing level recommendations under MSA section 302(h)(6).

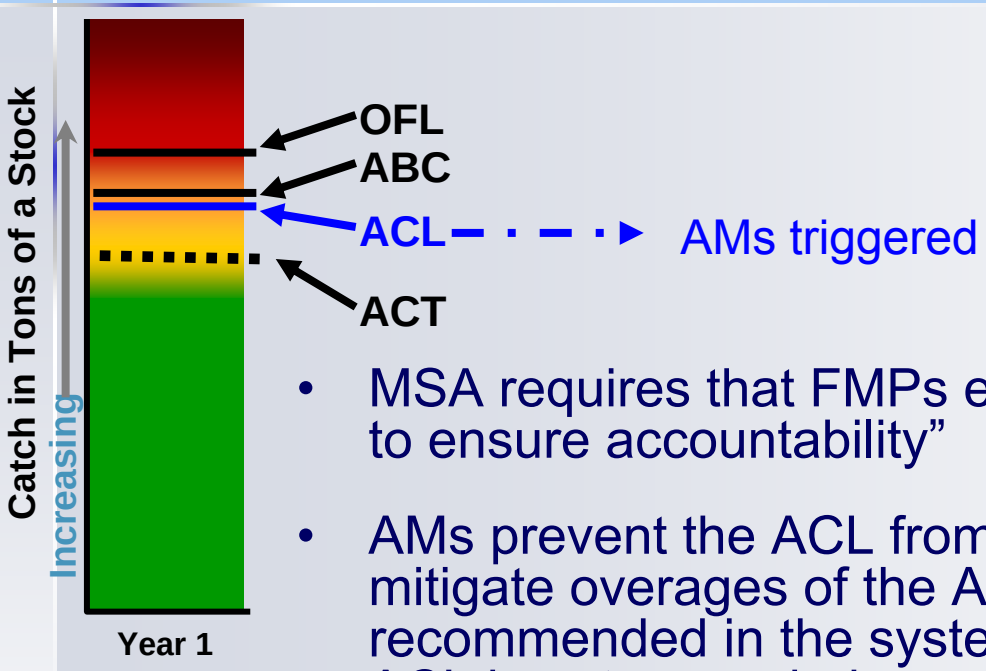
§ 600.310 (f)(1)-(7)

Approach for Setting Limits and AMs

- Councils must take an approach that considers uncertainty in **scientific** information and **management** control of the fishery.
- Scientific Uncertainty
  - ABC control rule: A specified approach to setting the ABC for a stock as a function of the scientific uncertainty in the estimate of OFL and any other scientific uncertainty. § 600.310 (f)(2)(iii)
  - Risk policy is part of ABC control rule: The determination of ABC should be based, when possible, on the probability that an actual catch equal to the stock's ABC would result in overfishing. This probability that overfishing will occur cannot exceed 50 percent and should be a lower value. § 600.310 (f)(4)
- Management Uncertainty
  - Address through a full range of AMs.
  - For fisheries without inseason management control to prevent the ACL from being exceeded, AMs should utilize ACTs that are set below ACLs so that catches do not exceed the ACL.

§ 600.310 (g)(2)

Accountability Measures (AMs)



- MSA requires that FMPs establish ACLs, "including measures to ensure accountability"
- AMs prevent the ACL from being exceeded and correct or mitigate overages of the ACL if they occur. ACTs are recommended in the system of accountability measures so that ACL is not exceeded.
- Two types of AMs:
  - Inseason measures to prevent exceeding the ACL
  - AMs for when the ACL is exceeded
    - Operational factors leading to an overage
    - Biological consequences to the stock, if any

§ 600.310 (g)(1)-(3)

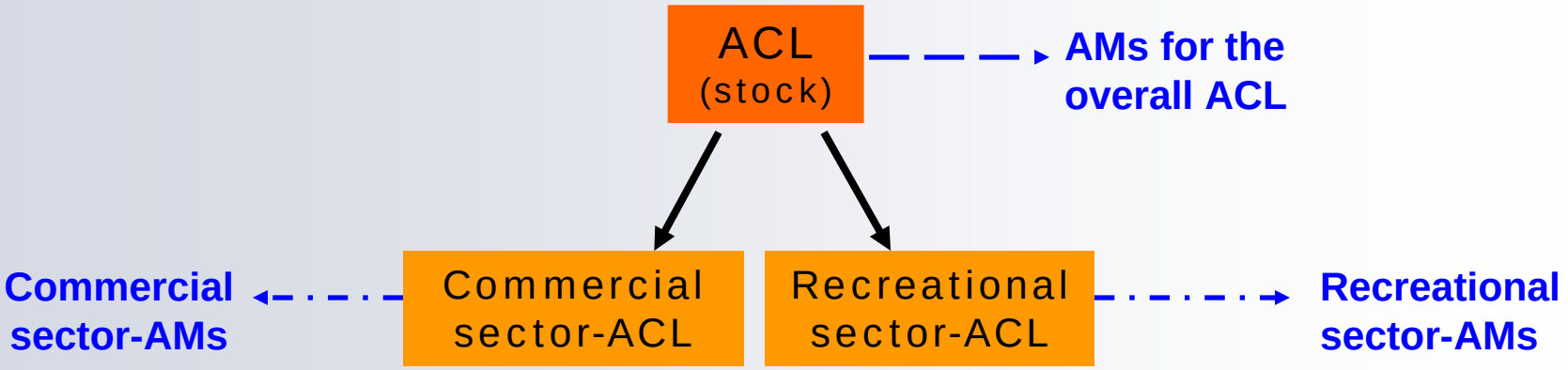
Performance Standards

- Because of scientific and management uncertainty, there is always a chance that overfishing could occur.
- The system of ACLs and AMs should be re-evaluated and modified if necessary, if the ACL is exceeded more than once in the last 4 years.
- A higher performance standard could be used if a stock is particularly vulnerable to the effects of overfishing.

§ 600.310 (g)(3)

ACLs & AMs for a Fishery Sector

- **Optional** to sub-divide a stock's ACL into "sector-ACLs".
- If the management measures for different sectors differ in the degree of management uncertainty, then sector ACLs may be necessary so that appropriate AMs can be developed for each sector.
- The sum of sector-ACLs must not exceed the overall ACL.
- For each sector-ACL, "sector-AMs" should be established.
- AMs at the stock level may be necessary.



§ 600.310 (f)(5)(ii)

State-Federal Fisheries

- ACL should be specified for the entire stock and may be further divided (e.g., Federal-ACL and state-ACL)
- AMs required for portion of fishery under Federal authority
- Goal should be to develop collaborative conservation and management strategies (including AMs) with Federal, state, tribal, and/or territorial fishery managers.

§ 600.310 (f)(5)(iii) & (g)(5)

ABC and ACL for Rebuilding Stocks

- For rebuilding stocks, the ABC and ACL should be set at lower levels during some or all stages of rebuilding than when a stock is rebuilt for two reasons:
  1. Overfishing should not occur, and
  2. Rebuilding at a rate commensurate with the stock's rebuilding plan should occur.
- ABC for overfished stocks: For overfished stocks and stock complexes, a rebuilding ABC must be set to reflect the annual catch that is consistent with the schedule of fishing mortality rates in the rebuilding plan.

§ 600.310 (f)(3)(ii)

AMs for Rebuilding Overfished Stocks

- If a stock is in a rebuilding plan and its ACL is exceeded, the AMs should include overage adjustments that reduce the ACL in the next fishing year by the full amount of the overage, unless the best scientific information available shows that a reduced overage adjustment, or no adjustment, is needed to mitigate the effects of the overage.
- This AM is important to increase the likelihood that the stock will continue to rebuild.

§ 600.310 (g)(3)

Summary of the Major Aspects of the NS1 Guidelines

- MSA requires:
  - ACLs and AMs to prevent overfishing,
  - ACLs not exceed fishing level recommendations of SSCs, and
  - ACLs and AMs in all managed fisheries, with 2 exceptions.
- NS1 guidelines:
  - ACLs and AMs for all stocks and stock complexes in a fishery, unless the 2 MSA exceptions apply.
  - Clearly account for both scientific and management uncertainty
  - AMs should prevent ACL overages, where possible, and always address overages, if they occur.
  - An optional “ecosystem component” category could allow flexibility in FMPs for greater ecosystem considerations.

Other Aspects of the NS1 Guidelines

Timeline for Implementing Rebuilding Plans After July 12, 2009

- For notifications that a stock or complex is **overfished or approaching an overfished condition,** a Council (or Secretary for Atlantic HMS) must prepare and implement management measures within 2 years of the notification.
- For timely implementation:
  - Councils should submit an FMP, FMP amendment, or proposed regulations within 15 months of notification.
  - This provides the Secretary 9 months to implement the measures, if approved.
- If the stock is overfished and overfishing is occuring, the rebuilding plan must end overfishing immediately.

§ 600.310 (j)(2)(ii)(B)

Establishing rebuilding time targets

- SSCs (or agency scientists or peer review processes in the case of Secretarial actions) shall provide recommendations for achieving rebuilding targets (see MSA sec. 302(g)(1)(B)).
- NS1 guidelines clarify calculation of **target time to rebuild (T_{target})** for stocks in rebuilding plans.

Minimum time for rebuilding (T_{min})

- **T_{target}** must be "as short as possible," taking into account factors set forth under MSA sec. 304(e)(4)(A)(i), and may not exceed 10 years, except as provided under sec. 304(e)(4)(A)(ii). See NS1 guidelines at § 600.310 (j)(3).
- T_{target} should be based on the **minimum time for rebuilding a stock (T_{min})** and the above factors.
- **T_{min}** is the amount of time the stock or complex is expected to take to rebuild to its MSY biomass level in the absence of any fishing mortality. In this context, the term "expected" means to have at least a 50% probability of attaining the B_{MSY}.

§ 600.310 (j)(3)(i)

Maximum Time Allowable for Rebuilding (T_{max})

- If T_{min} is ≤ 10 years, then T_{max} is 10 years.
- If T_{min} is > 10 years, then T_{max} is T_{min} + the length of time associated with one generation time for that stock or stock complex.
  - **Generation time** is the average length of time between when an individual is born and the birth of its offspring.
- T_{target} shall not exceed T_{max}, and should be calculated based on the factors described in § 600.310 (j)(3)

§ 600.310 (j)(3)(i)(A)-(E)

Action at the end of a rebuilding period if a stock is not yet rebuilt

- If a stock reaches the end of its rebuilding plan period and it is not yet determined to be rebuilt, then the rebuilding F should not be increased until the stock has been demonstrated to be rebuilt.
- If the rebuilding plan was based on a T_{target} that was less than T_{max}, and the stock is not rebuilt by T_{target}, rebuilding measures should be revised if necessary, such that the stock will be rebuilt by T_{max}.
- If the stock has not rebuilt by T_{max}, then the fishing mortality rate should be maintained at $F_{rebuild}$ or 75 percent of the MFMT, whichever is less.

§ 600.310 (j)(3)(ii)

International Overfishing - MSA section 304(i)

- Section 304(i) applies if the Secretary determines that a fishery is overfished or approaching overfished due to excessive international fishing pressure, and for which there are no management measures to end overfishing under an international agreement to which the U.S. is a party. Actions under section 304(i) include:
  - The Secretary, with Secretary of State, immediately takes action at the international level to end overfishing
  - Within 1 year, the Secretary and/or appropriate Council shall:
    - Recommend domestic regulations to address "relative impact" of U.S. fishing vessels
    - Recommend to Secretary of State and Congress, international actions to end overfishing and rebuild affected stocks, taking into account relative impact of vessels of other nations and vessels of the U.S.

§ 600.310 (k)

"Relative Impact"

- NMFS describes "relative impact":
  - May include consideration of factors that include, but are not limited to: domestic and international management measures already in place, management history of a given nation, estimates of a nation's landings or catch (including bycatch) in a given fishery, and estimates of a nation's mortality contributions in a given fishery.
  - Information used to determine relative impact should be based upon the best available scientific information.

§ 600.310 (k)(3)

Forming Stock Complexes

- Stock complex = a group of stocks sufficiently similar in geographic distribution, life history, and vulnerabilities to the fishery such that the impact of management actions on the stocks is similar.
- May be formed 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;
  - there is insufficient data to measure their status relative to SDC; or
  - it is not feasible for fishermen to distinguish individual stocks among their catch.
- The vulnerability of stocks to the fishery should be evaluated when establishing or reorganizing a complex.
- May be comprised of:
  - 1 or more indicator stocks, each with 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
  - 1 of more indicator stocks, each of which has SDC and management objectives, with an ACL for the complex as a whole (might be applicable to salmon species).

§ 600.310 (d)(8)

Indicator Stocks & Vulnerability

- 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 one 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.
- A stock's vulnerability is a combination of its productivity, which depends upon its life history characteristics, and its susceptibility to the fishery.
  - Productivity – refers to capacity of the stock to produce MSY and to recover if the population is depleted
  - Susceptibility – potential for the stock to be impacted by the fishery, which includes direct captures, as well as indirect impacts to the fishery

§ 600.310 (d)(9) & (10)

Status Determination Criteria (SDC)

- SDC must be expressed in a way that enables the Council to monitor each stock or complex in the FMP, and determine annually, if possible, whether overfishing is occurring and whether the stock or complex is overfished.
- In specifying SDC, a Council must provide an analysis of how the SDC were chosen and how they relate to reproductive potential.
- Two approaches may be chosen for SDC to determine overfishing:
  - **Fishing mortality rate exceeds MFMT.** Exceeding the MFMT for a period of 1 year or more constitutes overfishing.
  - **Catch exceeds the OFL.** If the annual catch exceeds the annual OFL for 1 year or more, the stock or complex is considered subject to overfishing.

§ 600.310 (e)(2)(ii)

Fisheries Data

- In their FMPs, or associated public documents such as SAFE reports as appropriate, Councils must describe general data collection methods, as well as any specific data collection methods used for all stocks in the fishery, and EC species, including:
  - Sources of fishing mortality;
  - Description of the data collection and estimation methods used to quantify total catch mortality in each fishery; and
  - Description of the methods used to compile catch data from various catch data collection methods and how those data are used to determine the relationship between total catch at a given point in time and the ACL for stocks and stock complexes that are part of a fishery.

§ 600.310 (i)(1)-(3)

Mixed stock exception

- Exceptions to the requirement to prevent overfishing could apply under certain limited circumstances.
- Fishery must not be in overfished condition and analysis must be performed that demonstrates the below conditions are satisfied:
  - Will result in long-term net benefits to the Nation;
  - 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
  - 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 Bmsy more than 50 percent of the time in the long term.

§ 600.310 (m)

Summary

- The NS1 guidelines provide guidance on the following topics:
- Rebuilding plans:
  - changing the timeline to prepare new rebuilding plans
  - guidance on how to establish rebuilding time targets
  - advice on action to take at the end of a rebuilding period if a stock is not yet rebuilt.
- Implementing MSA Section 304(i)
- Forming stock complexes and use of indicator stocks
- Two approaches for making overfishing status determinations
- Fisheries Data
- Mixed stock exception

Additional Information

- Additional information about ACLs and NS1 can be found at the following website:
  - http://www.nmfs.noaa.gov/msa2007/catchlimits.htm
- Public comments on the proposed revisions to the NS1 guidelines can be viewed at the Federal e-Rulemaking portal:
  - http://www.regulations.gov
  - You can search for documents regarding the NS1 guidelines under “Advanced docket search” using “0648-AV60” as the RIN keyword.

DRAFT

COUNCIL STAFF SUMMARY OF POTENTIAL ISSUES AND TIMELINES FOR AMENDING THE CPS FMP FOR COMPLIANCE WITH NATION STANDARD 1 GUIDELINES

ACTIVELY MANAGED STOCKS

Precautionary harvest control rules exist for the actively managed species in the Coastal Pelagic Species (CPS) Fishery Management Plan (FMP) (Pacific sardine and Pacific mackerel), control rules which provide a solid foundation for the implementation of new fishery management provisions such as overfishing levels (OFLs) and annual catch limits (ACLs). Pacific sardine is used in the following example.

The harvest control rule for Pacific sardine is as follows.

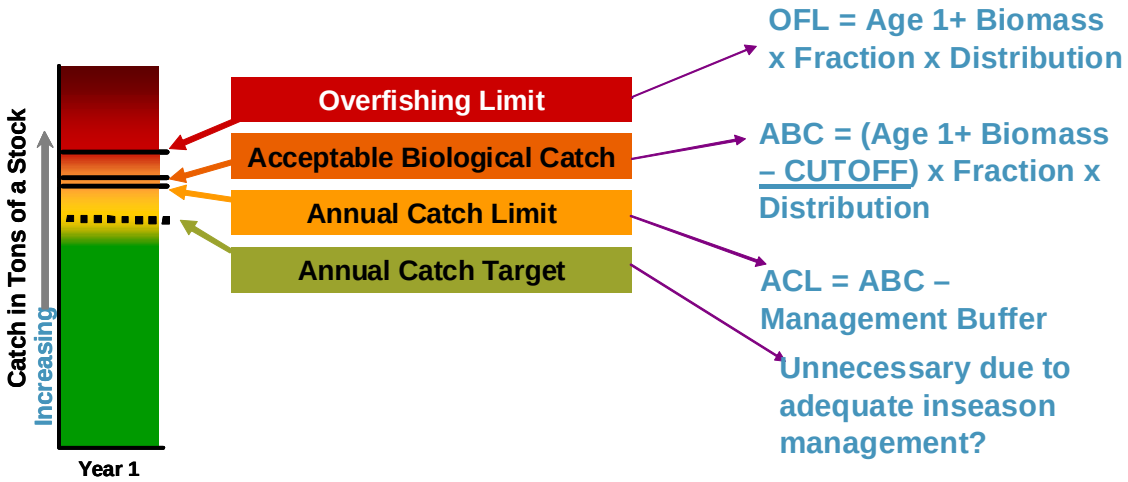
HARVEST = (BIOMASS-**CUTOFF**) x FRACTION x DISTRIBUTION

where:

FRACTION is the fraction of the BIOMASS above the CUTOFF value that can be harvested, this is an environmental driven component that is based on sea surface temperature.

DISTRIBUTION is the percentage of the stock assumed to be in U.S. waters.

CUTOFF is the is the lowest level of estimated biomass at which directed harvest. The general harvest control rule for CPS is compatible with the Magnuson-Steven Fishery Conservation and Management Reauthorization Act of 2006 (MSRA) and is useful for CPS that are important as forage. If the CUTOFF is greater than zero, then the harvest rate (H/BIOMASS) declines as biomass declines. By the time BIOMASS falls as low as CUTOFF, the harvest rate is reduced to zero. The CUTOFF provides a buffer of spawning stock that is protected from fishing and available for use in rebuilding if a stock becomes overfished. **CUTOFF serves a similar role as the proposed buffer between OFL and acceptable biological catch (ABC) in the NS1 guidelines.**



2009 Pacific Sardine Management

Status Quo compared to proposed mechanism under NS1 Guidelines

Management Parameter	Status Quo	Potential Under NS1 Guidelines
Overfishing Level (OFL)	NA	86,507 mt
Allowable Biological Catch (ABC)	66,932 mt	66,932 mt
Annual Catch Limit (ACL)	Directed HG set at 59,232 with 6,500 mt buffer for incidental fishery and management uncertainty.	ACL reduced from ABC to account for management uncertainty.
Annual Catch Target (ACT)	NA	Unnecessary due to inseason monitoring?
Accountability Measures	Preseason Incidental Set asides and inseason monitoring	Preseason Incidental Set asides and inseason monitoring

MONITORED STOCKS

Monitored species in the CPS FMP include northern anchovy, jack mackerel, and market squid. The Council has requested flexibility in the implementation of National Standard 1 (NS1) in regard to these species because of relatively low harvest and less assessment work. Monitored species could present the greatest challenge in implementing NS1.

The CPS FMP's monitored stocks are either exempt from the new requirements because of their short life-cycle (market squid) or are currently harvested at relatively low levels (anchovy, jack mackerel). ACLs for monitored stocks may be appropriately implemented with greater flexibility but greater precaution than the actively managed species because they are assessed with less frequency.

Northern anchovy and jack mackerel currently have threshold harvest levels beyond which the Council will consider moving the species to the actively managed category. These thresholds are based on dated, but valid stock assessments that could be updated should these species experience a substantial increase in harvest. Although relatively data-poor compared to actively managed stocks, with some flexibility, the existing knowledge and biological parameters can serve as the basis for developing a management regime in keeping with NS1.

PROHIBITED HARVEST SPECIES

Currently all species of euphausiids (krill) within the West Coast Exclusive Economic Zone (EEZ).

It is unclear whether krill would fit the Ecosystem Component as currently defined in the NS1 guidelines:

Ecosystem Component Species

(A) Be a non-target species or nontarget stock;

(B) Not be determined to be subject to overfishing, approaching overfished, or overfished;

(C) 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

(D) Not generally be retained for sale or personal use.
(ii) Occasional retention of the species would not, in and of itself, preclude consideration of the species under the EC classification.

Although krill meet the criteria listed in A-D above and the Council prohibited the harvest of krill in recognition of its import ecosystem functions, the broad harvest prohibition across all gear types and in all areas may have more management implications than was intended for the "ecosystem component" species category described in the NS1 guidelines.

Potential Timeline for CPS FMP Amendment

Stage	Most Aggressive Schedule Possible to Meet MRSA	Moderate Schedule to Meet MRSA
Final Rule	January 2009	January 2009
"Council Announces Scoping -EIS or EA Determination -Initiate FMP Amendments"	March 2009	March 2009
First FMP Amendment Drafts, Including Alternatives	June 2009	September 2009
Adopt Preliminary Preferred Alternative for Public Review	September 2009	March 2010
Final Council Action	November 2009	June 2010
Secretarial Approval	April 2010	January 2011
Changes in Existing Fishing Regulations	Second Half of 2010	2011

This schedule would likely require additional meetings of the Council's CPS advisory bodies and a redirection of Council staff, NMFS, and state agency work load.

PFMC
02/20/09

COASTAL PELAGIC SPECIES ADVISORY SUBPANEL REPORT ON FISHERY MANAGEMENT PLAN (FMP) AMENDMENTS TO IMPLEMENT ANNUAL CATCH LIMIT (ACL) REQUIREMENTS

The Coastal Pelagic Species Advisory Subpanel (CPSAS) heard a report by Mr. Mike Burner regarding National Marine Fisheries Service (NMFS) guidelines on National Standard 1 (NS1) including the implementation of ACLs. The CPSAS agreed that the Coastal Pelagic Species (CPS) FMP largely complies with the intent of NS1 to prevent overfishing. The CPSAS believes the precautionary approach of the CPS FMP currently provided adequate buffers against overfishing and the CPSAS expressed concerns with the potential for additional and unnecessary precautions that may negatively impact the directed fisheries. The CPSAS agreed that the Council staff proposal on pages 1 and 2 of Agenda Item C.3.a, Attachment 3 is a good starting point for developing ways to bring the CPS harvest control rules into compliance with the new NS1 guidelines.

In addition to the scoping issues presented in Agenda Item C.3.a, Attachment 3, the CPSAS identified the following items for the Council to consider during the amendment process:

- Improve accounting for landings in the live bait fishery and other sources of mortality such as release mortality.
- Improve inseason management and accounting through methods such as mandatory daily landings reporting to NMFS and more responsive and flexible fishery opening and closing mechanisms.
- Develop recommendations for bringing prohibited harvest species (krill) into compliance with NS1 while providing for small incidental catches.
- Explore changing the start date of the Pacific sardine fishery from January 1 to July 1 to allow additional time for stock assessment work and the development of new fishery-independent indices of abundance.

PFMC
03/04/09

COASTAL PELAGIC SPECIES MANAGEMENT TEAM REPORT ON FISHERY MANAGEMENT PLAN (FMP) AMENDMENTS TO IMPLEMENT ANNUAL CATCH LIMIT (ACL) REQUIREMENTS

The Coastal Pelagic Species Management Team (CPSMT) reviewed the National Marine Fisheries Service (NMFS) guidelines on National Standard 1 (NS1), including the implementation of Annual Catch Limits (ACLs), at its February 10-11, 2009 meeting in La Jolla, California. The CPSMT notes that the CPS FMP, through its CPS harvest control rules, recognizes the cyclical nature of CPS populations, buffers against overfishing, and explicitly reduces harvest as biomass declines. These and other aspects of the FMP make the current Council management of CPS amenable to the new NS1 guidelines.

The CPSMT reviewed and commented on the Council staff proposals in Agenda Item C.3.a, Attachment 3 and recommends continuing to develop the proposed approaches as the Council moves forward with efforts to bring the CPS FMP (including CPS harvest control rules) into compliance with the new NS1 guidelines.

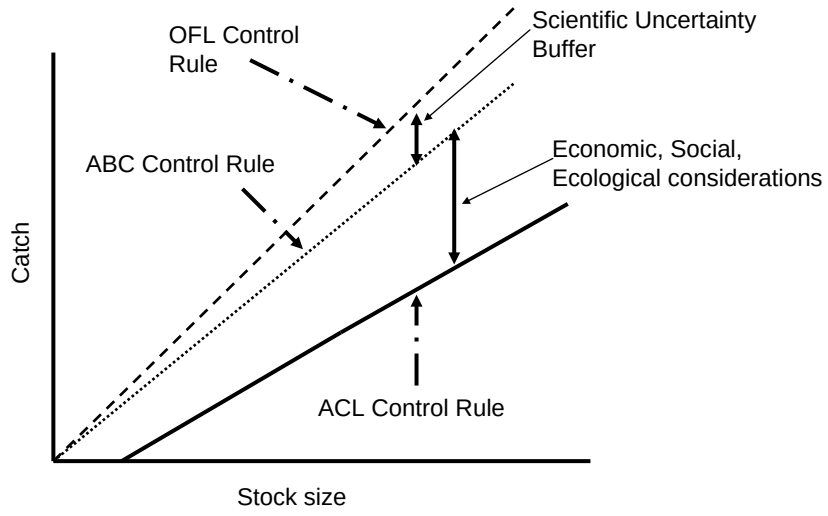
In addition to the scoping issues presented in Agenda Item C.3.a, Attachment 3, the CPSMT identified the following items for the Council to consider during the amendment process:

- Develop and define accountability measures for addressing potential future overfishing events. Both postseason and inseason accountability measures need to be refined and clearly defined in the FMP. The CPSMT discussed ways to improve the timeliness and accuracy of inseason landing reports, as well as ways to incorporate flexibility and efficiencies into the inseason release of available harvest and the closure of fisheries.
- The CPSMT recommends that the accounting of CPS in the live bait fishery, as well as CPS release mortality in the directed fishery, be included in the revision of the FMP. Inseason monitoring and management of the relatively small live bait landings largely occurs after the conclusion of the fishing season under the current regime. The CPSMT discussed a range of ways to address these minor sources of mortality. This is an issue that needs further development as the FMP amendment process proceeds.
- The CPSMT noted that the proposed amendment of the FMP provides a unique opportunity to ensure that all aspects of the FMP are contemporary and in compliance with the Magnuson-Stevens Fishery Conservation and Management Act and the National Standard guidelines. It would be efficient and helpful to the CPSMT and the Council if NMFS and the Council staff could summarize any known deficiencies in the CPS FMP, not only in regard to NS1 guidelines.
- The CPSMT discussed that the broad prohibition on krill harvest, although implemented largely on ecosystem principles, could prevent krill from being included in the FMP as an ecosystem component. If krill are considered “in the fishery” there will need to be further development of FMP language regarding the unique application of management measures including annual catch levels for a prohibited harvest species.

SCIENTIFIC AND STATISTICAL COMMITTEE REPORT ON FISHERY MANAGEMENT PLAN (FMP) AMENDMENTS TO IMPLEMENT ANNUAL CATCH LIMIT (ACL) REQUIREMENTS FOR CPS FISHERIES

All of the Council's Fishery Management Plans will need to be modified to some extent due to implementation of Annual Catch Limits (ACLs). The Council's Coastal Pelagics Fishery Management Plans already include harvest control rules which relate catch limits to assessment results and monitoring data. These harvest control rules could form the basis for satisfying the ACL requirements.

Three control rules will be needed to address the NS1 requirements. The overfishing limit (OFL) control is based on achieving maximum sustainable yield. Catches above the OFL constitute overfishing. Under the reauthorized Magnuson Act, the OFL and the acceptable biological catch (ABC) control rules differ due to scientific uncertainty (the scientific buffer). The ACL is lower than the ABC. The Council's current optimum yield (OY) control rules (such as the 40:10 control rule applied for groundfish management) account for the impact of ecological, social, and economic considerations. The Scientific and Statistical Committee (SSC) therefore recommends that the difference between the ABC and ACL control rules should account for ecological, social, and economic considerations. The figure below illustrates the three control rules in a hypothetic situation.



The SSC notes that there will not need for an annual catch target (ACT) control rule for Council fisheries for which management controls are successful. Such fisheries include groundfish and Coastal Pelagic Species (CPS).

The current Council harvest control rules do not explicitly account for scientific uncertainty. One way to include scientific uncertainty would be to base the ABC on a lower fishing mortality rate than that used to compute the OFL. The extent of difference between the fishing mortality rates used to compute the ABC and the OFL could be calculated based on scientific uncertainty

quantified by examining the variation in past assessment results and using the confidence intervals from a stock assessment. The aim of these examinations would be to assess how often the ABC from an assessment would exceed the OFL. It may be necessary to develop a tier system with, for example, three tiers, based on the level of scientific uncertainty, where the scientific buffer is larger for stocks that are more uncertain.

The SSC is required to provide recommendations for ABCs and hence needs to account for scientific uncertainty related to the estimation of OFL. A process should be established whereby the Council can evaluate the trade-off between the size of the scientific buffer and the risk of overfishing to establish a level of risk aversion. The SSC would then review the application of the scientific buffers based on that policy choice. It is not the role of the SSC to make policy decisions.

Coastal Pelagics issues

In relation to Coastal Pelagics species, the SSC notes that Pacific sardine, Pacific mackerel, northern anchovy, and jack mackerel would require ACLs. Market squid are short-lived and should be an exception under the ACL regulations. Agenda Item C.3.a, Attachment 3 suggests that the cutoffs included in the harvest control rules for Pacific sardine and Pacific mackerel provide a buffer for scientific uncertainty. The SSC does not support this suggestion because the cutoffs included in these harvest control rules were selected to maximize long-term yield given variation in recruitment (an MSY control rule). In relation to jack mackerel and northern anchovy, which are monitored species under the CPS Fishery Management Plan (FMP), the SSC recommends re-examining, or possibility updating, the existing assessments for these species and setting an ACL based on a low exploitation rate. If the catch exceeds this ACL, a stock assessment would be conducted. Even though krill is a prohibited harvest species, an ACL, based on the estimate of MSY included in the CPS FMP, may need to be set.

The SSC reviewed the two schedules in Item C.3.a, Attachment 3. Even the moderate schedule will be very difficult to achieve if additional analyses are required prior to the first FMP amendment drafts.

PFMC
3/8/09

OCEANA

Agenda Item C.3.c
Supplemental Public Comment
March 2009

HUNGRY OCEANS:

WHAT HAPPENS WHEN THE PREY IS GONE?

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oceana.org/prey

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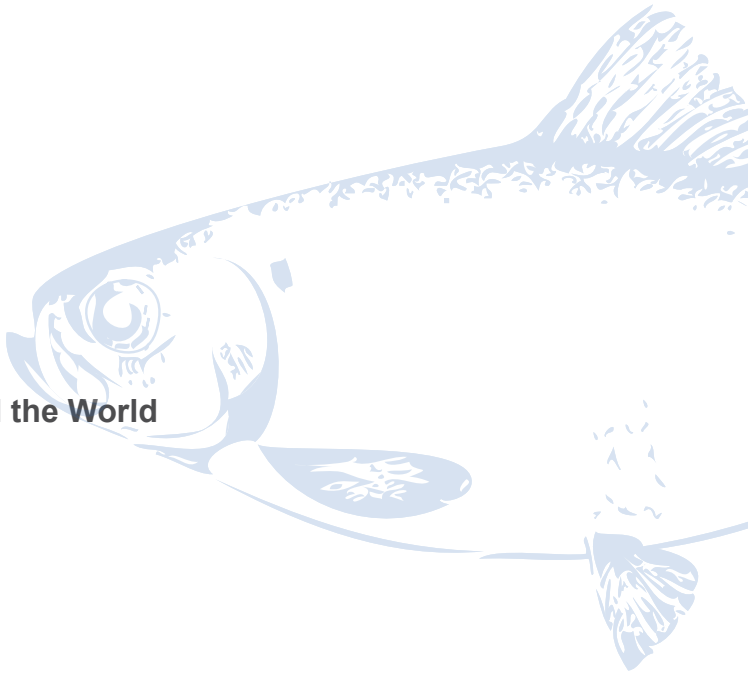


Overview

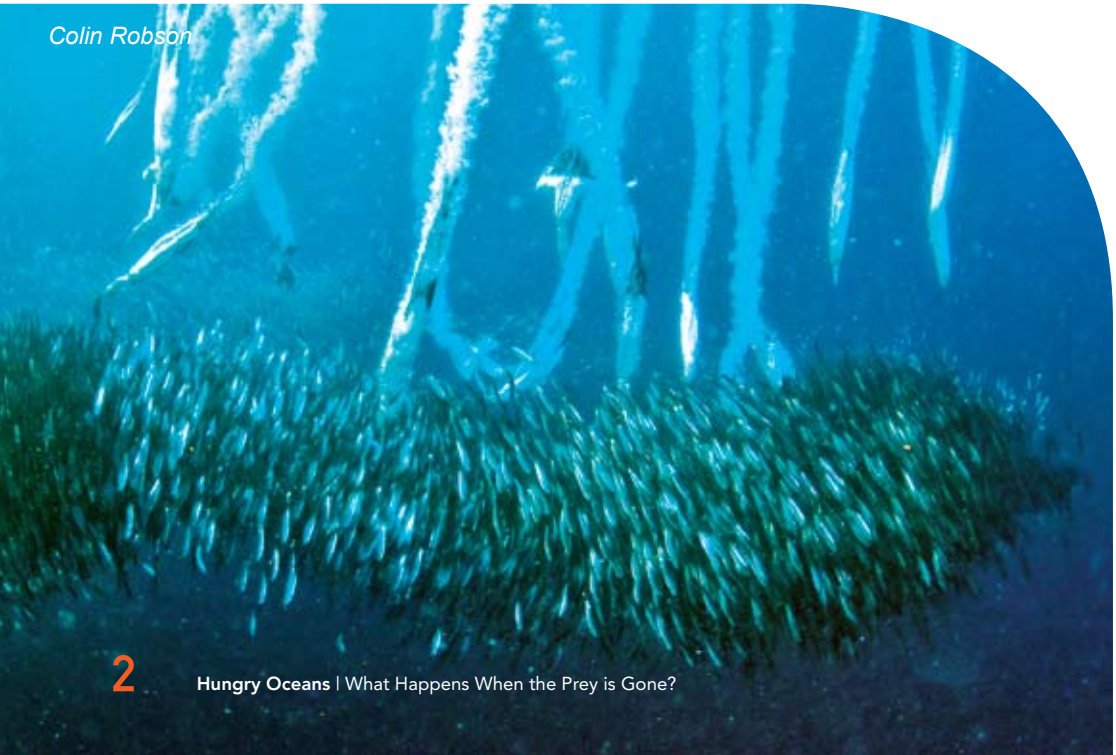
According to conventional wisdom, small, fast-growing fish are impossible to overfish because their populations are so large and grow so quickly. Yet we are now seeing disquieting signs that conventional wisdom is wrong. Most significantly, scientists are reporting ocean predators emaciated from lack of food, vulnerable to disease and without enough energy to reproduce. Scrawny predators—dolphins, striped bass, and even whales—have turned up along coastlines around the world. Recreational fishermen are losing both their target fish—and their bait. Fishing communities are losing their livelihoods.

Because we have overlooked hungry predators, we have allowed overfishing of their prey, causing food shortages in the ocean. In addition, by fishing where and when they are breeding, we are driving prey populations to the brink of disaster, and in some cases beyond it.

At the same time, our continued demand for salmon, tuna, and other large predators has driven explosive growth in aquaculture. Rather than relieving pressure on wild fish, growing these large carnivores requires a steady supply of prey that are caught and ground into oil and meal. As the industry grows, it is straining the existing supply of prey fish, putting additional pressure on populations that cannot supply the demand.

Because populations of many small prey species are sensitive to changes in temperature, ocean currents, and El Niño, they are particularly vulnerable to climate change. For predators, even small climate-driven shifts in the local availability of squid and other prey during breeding can lead to malnourished young or abandonment.

For many prey species, humans have replaced their natural predators—the other fish, the sea birds, the marine mammals—all the species that depend on them for their existence. Fishermen who catch prey species are beginning to turn up empty nets. Unless the current trends are reversed, we can look forward to a future with increasingly hungry oceans.



Colin Robson

Prey species underpin marine food webs around the world

Seabirds dive on a herring school

PREDATORS NEED THEIR PREY

The great predators of the ocean spend most of each day hunting for food. Scientists studying sperm whales estimate they spend nearly three quarters of their time searching for squid and other prey (Watwood et al. 2006). Abundant schooling fish fuel the blue marlin's speed and strength (Abitia Cardenas 1999), and are staples in the diet of many whales.

Hungry animals may fail to nurse or find enough food for their young, and sometimes skip breeding season entirely. During an eight-year prey shortage in the Faroe Islands, no Arctic tern chicks survived (Wright et al. 1996). During another food shortage, Galápagos penguins were forced to "desert their eggs and chicks to search for food to save themselves while their chicks starved to death." (Boersma et al. 2008) When long-lived animals like whales go hungry, the next generation is at risk.

Predators are normally forced to rely on less desirable, less nutritious, or less abundant prey for short periods of time. If this happens too often or for long periods of time, however, predators can become malnourished and vulnerable to disease. Poor health and food shortages may have left striped dolphins vulnerable to a 1990s plague in the Mediterranean that led to many deaths (Aguilar and Raga in Bearzi et al. 2003).

ECOSYSTEM RESILIENCE AT RISK

Only now that predators are going hungry are forage fish becoming recognized for their role at the foundation of marine food webs. Predators consume great quantities of tiny fish—often all the same species. Within an ecosystem perhaps only two or three species fill that role (Cury et al. 2000). If one prey population crashes, few options are left for its predators. This low level of redundancy can result in a lack of resilience to other stresses on the ecosystem.


Shannon Johnson

PREDATORS:

Bluefin Tuna and Other Big Fish

Loss of prey for large predatory fish translates to loss of prey for commercial fishermen and recreational anglers, as tuna, salmon, and striped bass go hungry. Species in recovery such as North Atlantic Bluefin Tuna or Striped Bass are particularly in need of abundant prey to rebuild their populations from overfishing.

Northern Atlantic Bluefin Tuna

Bluefin tuna (*Thunnus thynnus*) are some of the largest and fastest fish in the oceans—and also the most valuable, with a record of $173,600 for a single fish (Associated Press 2001). This demand has driven worldwide overfishing of this species, and in the western Atlantic populations have been reduced by more than 80 percent since 1975 (ICCAT 2006). Surprisingly, the basic biology of this fish is just beginning to be understood, including its food-centric migration.

Though bluefin tuna are top predators and opportunistic feeders, their diet is often dominated by one or two favorite prey species that provide optimal sources of energy (Chase 2002). Mass movements of bluefin are synchronized with spawning and feeding schools of various species of prey fish off the east coast of North America. At each step along the way, changing prey populations substantially affect regional aggregations of bluefin tuna, as illustrated in Figure 1.

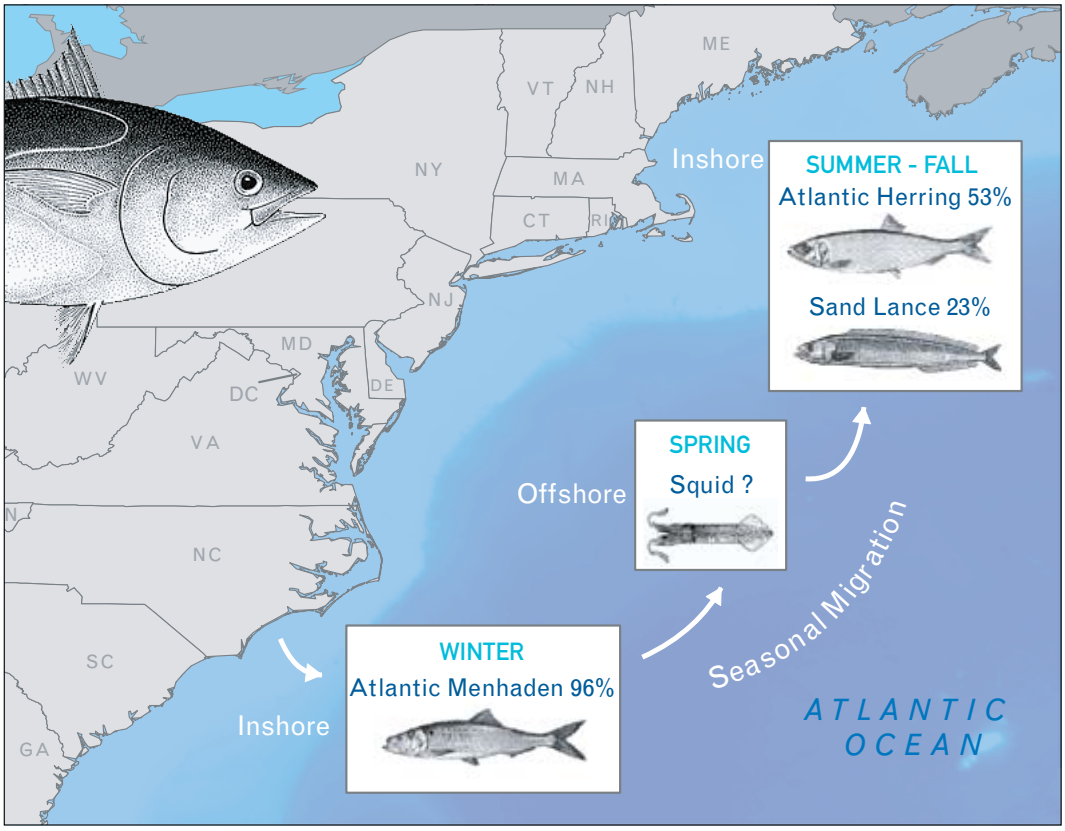


Figure 1. Seasonal prey of Atlantic Bluefin Tuna off the Northeast US
Source: Data in percent of bluefin tuna diet by weight from Chase 2002

Bluefin tuna in the Mediterranean

Oceana / Keith Ellenbogen

During winter months Atlantic bluefin tuna concentrate off the coast of North Carolina where they feast on Atlantic menhaden (*Brevoortia tyrannus*), the staple of their diet. In a recent study of stomach contents from commercially caught tuna, Atlantic menhaden were found 85 percent of the time and made up 95 percent of the bluefin prey by weight (Butler 2007). While predators such as bluefish, striped bass, and weakfish (as well as the commercial fishery) consume much greater quantities of menhaden than tuna, menhaden are essential to bluefin on their winter foraging grounds.

Bluefin tuna concentrate along the southeastern coast of the US during fall and winter, moving north through spring and summer to rich feeding grounds of the North Atlantic (Block et al. 2005). At each location their diet is dominated by one or two preferred fish or squid (Chase 2002). When Atlantic menhaden disperse from concentrated aggregations in North Carolina towards the end of March, bluefin tuna move offshore. Here their diet is poorly known, but they may shift to a wider variety of fish and squid (Dragovich 1970, Boustany, pers. comm.). In June and July bluefin tuna return inshore to New England feeding grounds and a diet dominated by one or two major prey species (Chase 2002).

Mediterranean bluefin tuna feed on squid and small fish, depending on where they live. For juvenile tuna, small schooling fish are particularly important (Sarà and Sarà 2007, Sinopoli et al. 2004).

Pacific Salmon

Like the bluefin tuna, wild Pacific salmon (*Chinook Oncorhynchus tshawytscha, Coho Oncorhynchus kisutch*) prey on krill and small fish throughout their migrations. As they leave their home rivers for the open sea, young chinook and coho salmon (*Oncorhynchus spp.*) feed heavily on Pacific herring, Pacific sand lance, and surf smelt. These prey species spawn in the intertidal zone of many beaches along the Pacific Northwest coast and serve as the first meal for juvenile salmon as they reach the sea, making possible their journey and survival into adulthood. Full-grown salmon range along the west coast of the United States, shifting between springtime krill, crabs and squid to a summertime diet of anchovy, smelt, and sand lance. (FishBase, Hunt 1999, Tyler et al. 2001, Zavolokin et al. 2007, Sakai et al. 2005, Sagawa et al 2007)

Chinook or King Salmon change their diet seasonally

Save Our Wild Salmon

Striped Bass

Striped bass (*Morone saxatilis*) also track the movements of their most important prey, migrating along the coast with Atlantic menhaden and moving between salt and fresh water with river herring. Each spring when striped bass are concentrated in the Chesapeake and Delaware Bay, their diet is dominated by Atlantic menhaden and river herring, and their diets shift to sand lance (also known as sand eel) and other prey as they migrate north each summer (Walter et al. 2003). In fall and winter, striped bass return to focus on menhaden in the bays of Maryland, Delaware, and North Carolina.

Striped bass may struggle with the steady decline of their major prey item, Atlantic menhaden (Uphoff 2003, D.Russell and J.Price, pers. comm.). Menhaden, herring, and bay anchovy are all important prey (Griffin and Magraff 2003, Manooch 1973).

TABLE 1. Recreational and Commercial Fishery Species Dependent on Prey

TARGET SPECIES	STATUS (FAO AND OTHER SOURCES)	SELECT PREY SPECIES
Pacific Salmon	Fully exploited to overexploited	Krill, Squid, Sand Lance, Herring, Sardine, Northern Anchovy, Juvenile Rockfish, Juvenile Atka Mackerel, Walleye Pollock, Lanternfish
Bluefin Tuna	Depleted to severely overexploited	Menhaden, Sand Lance, Herring, Mackerel, Squid
Striped Bass	Recovered	Menhaden, Bay Anchovy, Herring
Pacific Halibut	Fully exploited	Sand Lance, Herring, Walleye Pollock, Squid
South Pacific Hake	Fully exploited to depleted	Anchovy, Anchoveta, Squid, Sardine, Krill
European Hake	Overexploited	Blue Whiting, European Anchovy, European Pilchard, Lanternfish, Horse Mackerel
Southern Hake	Fully exploited to overexploited	Squid, Krill, Blue Whiting

Sources: Butler 2007, Boustany pers. comm., Cartes et al. 2004, Chase 2002, Dragovich 1970, Fishbase, Hunt 1999, IPHC 1998, FAO 2005, Mahe et al. 2007, Paya 1992, Sagawa et al. 2007, Sakai et al. 2005, Tam et al. 2006, Tyler et al. 2001, Velasco 1998, Walter et al. 2003, Zavolokin et al. 2007

John Rix / Fathom This Underwater Productions

Save Our Wild Salmon

Beccy Breach

"One cannot think well, love well, sleep well, if one has not dined well."

— Virginia Woolf

A humpback whale calf swims ahead of its mother

Bryant Austin

PREDATORS:
Whales, Penguins and Other Animals

Ocean predators also include whales, dolphins, seals, sea lions, and birds. Although many of these animals are protected under national and international law, they remain vulnerable to food shortages. They depend on nearby access to squid, krill, and small fish to provide energy reserves for daily survival and for their young.

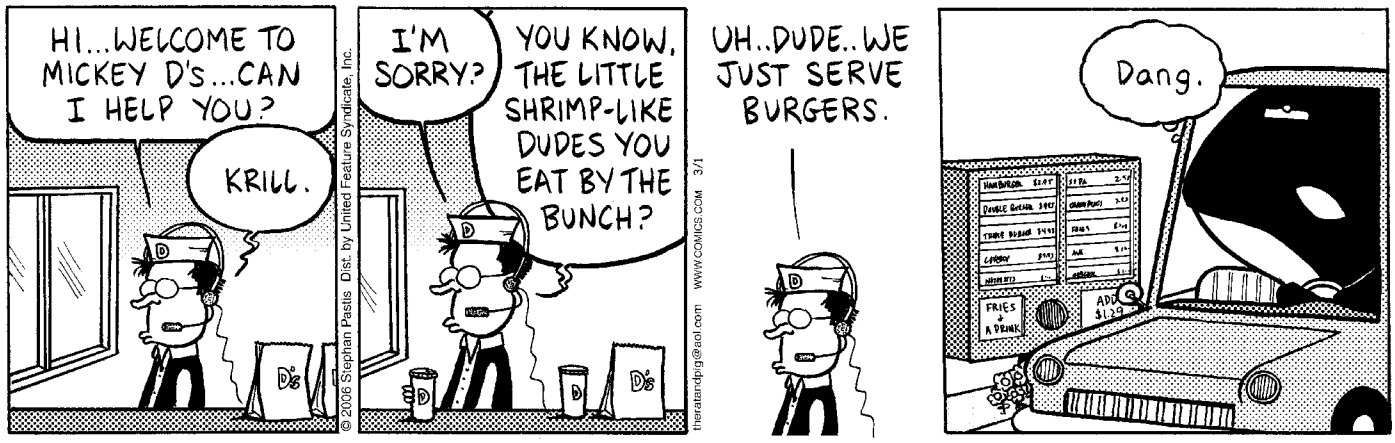
Endangered species are especially sensitive to food shortages and need abundant food to rebuild their populations. Starving whales are unable to nurse their young, and hungry seabirds may become susceptible to disease. Most animals feed heavily to gain weight before giving birth or after migration, and abundant prey is critical at these times.

Blue Whales in Southern Chile

The largest animals that have ever lived on earth are powered entirely by krill, and blue whales (*Balaenoptera musculus*) eat a lot to maintain their considerable bulk at 100 feet (30 m) and 200 tons (180 mt) (Clapham et al. 1999, Hucke-Gaete et al. 2006). Blue whales were hunted to the brink of extinction in the 20th century, reduced in the Southern Hemisphere to less than 3 percent of their original numbers (Hucke-Gaete 2003). Now blue whales need more food than ever, to fuel reproduction so their populations can recover.

Krill hotspots such as the Chiloé-Corcovado region in Southern Chile have historically been recognized as blue whale feeding sites. In 1907 a Norwegian whaling ship caught 37 whales in the area and in recent years blue whales have been sighted with increasing frequency; groups of more than 60 whales and cow-calf pairs have been observed (Hucke-Gaete et al. 2006, Hucke-Gaete 2003). The main reason why Southern Hemisphere blue whale populations nurse their calves in Chiloé-Corcovado is to take advantage of the abundant krill supply. This tiny crustacean fuels one of the most important feeding and nursing grounds for Southern Hemisphere blue whales, and is responsible for their gradual recovery from whaling.

Uwe Kils



Dolphins in the Mediterranean

Mediterranean bottlenose dolphins (*Tursiops truncatus*) have declined significantly, in part because of overfishing of sardines and anchovy that also led to collapse of the fishery in 1987 (Politi 2000). Scientists working in the eastern Ionian Sea found 40 percent of bottlenose dolphins visibly emaciated due to starvation and other causes (Politi et al. 2000).

Short-beaked common dolphins (*Delphinus delphis*) were formerly abundant throughout the Mediterranean, but are now concentrated in a much narrower range near Algeria, Tunisia, Malta, and in the Alboràn, Aegean, Tyrrhenian, and eastern Ionian Seas. Several factors likely contributed to their decline, including reduced access to prey due to overfishing (Bearzi et al. 2003). Poor nutrition may also increase dolphins' susceptibility to disease, an important factor in two mass mortality events in the Mediterranean (Bearzi et al. 2003).

Jesús Renedo / Oceana

A dolphin leaps from the Mediterranean

Marbled Murrelet

Deforestation, nest predation, and oil spills have previously been blamed for driving the marbled murrelet (*Brachyramphus marmoratus*) of central California to the endangered species list. While these factors clearly contributed, recent evidence suggests that the overfishing of sardines and other prey species is are also partly to blame. The diet of the marbled murrelet in the Monterey Bay ecosystem has drastically been altered over the past century (Becker and Beissinger 2006). Fisheries declines, especially the infamous 1950s collapse of the California sardine fishery, have reduced the availability of fish as food for the marbled murrelet. To make matters worse, a marbled murrelet must spend added time and energy catching 80 krill to match the energy found in a single Pacific sardine (Becker and Beissinger 2006).

The endangered Marbled Murrelet

Oregon State University

Magellanic Penguin

Penguins, cormorants, terns and other bird species are currently threatened by a developing anchovy fishery in the Patagonian ecosystem (Skegwar et al. 2007). The Southwest Atlantic anchovy (*Engraulis anchoita*) compose more than half of the Magellanic penguin diet (Skegwar 2007). Despite the central importance of anchovy to the Patagonian food web and the natural variation in its availability, some have pushed to expand the anchovy fishery. If the needs of the ecosystem as a whole are ignored, this fishery could drastically change the food web, with dire consequences for the seabirds of Patagonia.

TABLE 2. Endangered and Protected Species Dependent on Prey Species

ENDANGERED OR PROTECTED SPECIES	STATUS (IUCN)	SELECT PREY SPECIES
Sperm whale	Vulnerable	Squid
Blue whale	Endangered	Krill
Dolphins in the Mediterranean	Data deficient for some species	Anchovy, Sardine, Hake, Whiting, Cephalopods
Harbor porpoise	Vulnerable	Whiting, Herring, Sand Lance, Capelin, Cephalopods
Steller sea lion	Endangered	Sand Lance, Pollock, Herring, Capelin, Squid
Magellanic penguin	Near threatened	Anchovy, Cuttlefish, Hake, Squid, Krill
Marbled murrelet	Endangered	Sardine, Anchovy, Squid, Sand Lance, Herring, Krill, Capelin
Kittiwake	Red-legged: Vulnerable Black-legged: Least concern	Pollock, Herring, Sand Lance, Capelin
Puffin	Least concern	Capelin, Herring, Sand Lance, Squid, Lanternfish

Sources: Baillie and Jones 2003, Barrett and Furness 1990, Bearzi et al. 2003, Blanco et al. 2001, Börjesson 2002, Burkett 1995, COSEWIC 2003, Durant 2003, Falk 1992, Forero et al. 2002, Gandini et al. 1999, Gellatt et al. 2007, Hucke-Gaete et al. 2006, MacLeod et al. 2007, Ozturk et al. 2007, Pinto et al. 2006, Raga et al. 2006, Rodway and Montevecchi 1996, Santos and Pierce 2003, Sanger 1987, Scolaro et al. 1999, Silva 1999, Springer 1986, Spitz et al. 2007, Suryan 2000, Tonay 2007, Trites et al. 2007, Vanda et al. 2001, Wanless et al. 2004, Watwood et al. 2006, Winship and Trites 2003

Wetjens Dimmlich

Freshly caught sardines

OVEREXPLOITED PREY SPECIES

Fisheries targeting prey species have grown dramatically during the past century and are currently overdrawn, leaving predators with depleted food supplies. Early fisheries targeted only herring, sardines, and menhaden until expanding to meet the demand for cheap animal feed after World War II, and the more recent demand from carnivorous aquaculture (IFFO 2006a, Alder and Pauly 2006, Watson et al. 2006). Now more than 88 different prey stocks are caught everywhere from the tropics to the poles (FAO).

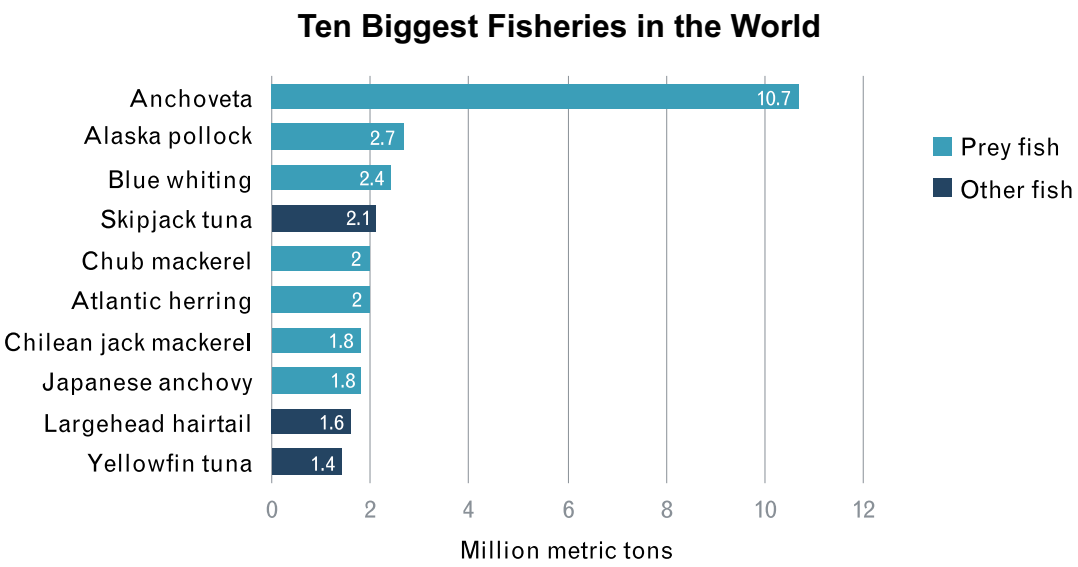


FIGURE 2. Ten Biggest Fisheries in the World
Source: FAO 2006

Prey species have become targets for the largest fisheries in the world, as populations of the bigger fish in the sea are exhausted (Jackson 2008, Pauly et al. 1998). Seven of the top ten fisheries rely on prey fish, as illustrated in Figure 2, and today's landings of prey fish are more than four times those of 1950 (FAO). More than 10 million metric tons of anchoveta alone are removed from the ocean every year, made unavailable as prey to seabirds, mammals, and predatory fish.

ANONYMOUS FISH

Prey are known by many names, in part because they are usually overlooked. Some are accurate yet vague, including "small pelagics" indicating that they are found in open water, or "schooling fish." Others such as "bait fish," "forage fish," and "prey fish" define them by their uses and fail to include non-fish species like squid and krill.

Squid fishing

Horeal Vidal Sabatte

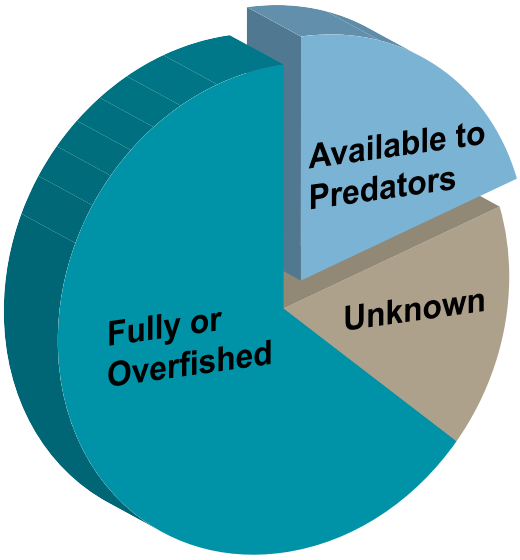


FIGURE 3. Prey Stocks that are Fully or Overfished
Source: Percentage of 88 assessed stocks from FAO 2005

Decades of intense fishing pressure have taken their toll. Among the stocks assessed by the FAO, the majority are fully or overexploited with no regard for predator needs (2005). For an additional 16 percent, their status is unknown and yet fishing continues. This leaves only 20 percent of currently fished prey populations with any potential to sustain natural predators (see Figure 3). Even fewer of these populations remain large enough to support growing pressures from fisheries, aquaculture, and climate change.

According to the United Nations Food and Agricultural Organization, all prey fisheries in the Southeast Pacific are between fully and overexploited, with the exception of squid. The fishery for sardina del Norte (*Sardinops sagax*) peaked in the mid-1980s before crashing to less than one percent of peak landings with no sign of recovery. Nearly all fisheries for prey in the North Atlantic, Central Atlantic, and North Pacific are fully exploited with no consideration for predators. This includes menhaden along the US coast, sand eels in Europe, and California market squid (*Loligo opalescens*).

THREATS: OVERFISHING

Prey fish are taken for granted in fisheries management, despite their critical role in marine food webs. Even in planning the recovery of endangered or overfished species, managers often give no consideration of the food supply needed for their populations to rebound. Squid, krill, and other prey remain ignored, unregulated and unaccounted for.

Disrupted Schooling Behavior

Schooling fish and “bait balls” protect individual fish from natural predators, and schools are also formed during spawning to increase the chances of future generations. Schooling prey are so important to tuna, whales, and other long-lived animals that they drive predator migrations, breeding, and nursing.

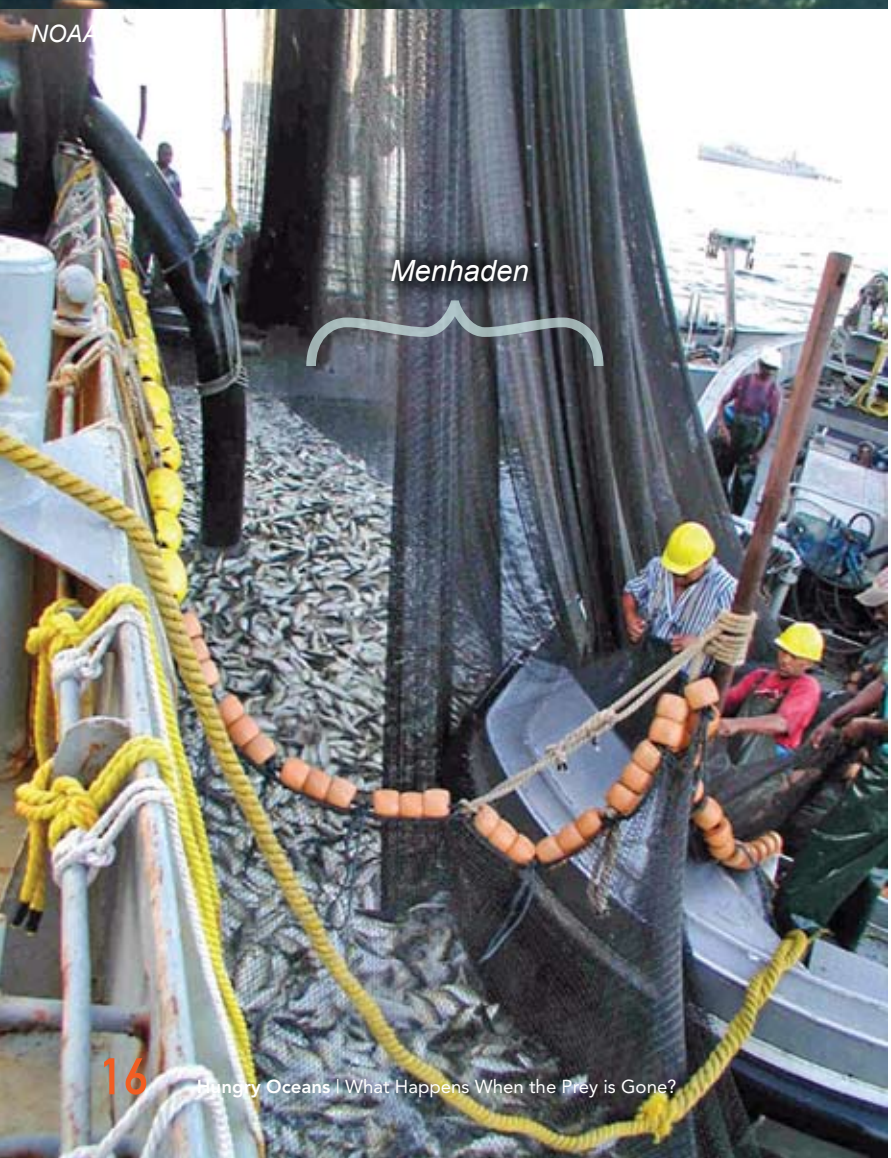
Unfortunately, schooling prey fish are easy targets for large nets (Alder et al. 2008, Watson et al. 2006) and can be quickly depleted or dispersed. Predators are forced to compete with industrial fishing vessels, and are sometimes captured incidentally while feeding on schools of fish.

Gordon Stroupe

Schooling prey fish surround a Sand Tiger Shark

Prey remain under the radar, unregulated and unaccounted for.

Gene Helfman



NOAA

Boom and Bust Populations

Many prey species have short life spans. As a result, some prey species are known for dramatic boom and bust cycles from year to year (Alder et al. 2008), often because an entire generation of fish or squid fails to make it to adulthood. Changes in the prevailing currents or temperature may sweep away newly hatched eggs and larvae (Chavez et al. 2003), or major weather events such as hurricanes can wipe out an entire generation of larval fish. In some cases, population crashes can be linked to particular events including oil spills or pollution (Peterson et al. 2003, Paine et al. 1996).

Overfishing can also drive population crashes by removing juveniles before they are old enough to reproduce, or by directly removing spawning adults. Population crashes may also be caused by increased competition or predation by other species in the food web. All of these factors combine over short periods of time to make it extremely difficult to predict prey availability.

Localized Depletion

Many predators depend on their prey to be available at a particular place and time. Depletion of prey populations in one local area can be extremely disruptive to their predators, even if distant populations remain strong (Furness and Tasker 2000). For example, during nesting season, seabirds have a very limited time away from their young to find food and return. If there are not enough prey where and when the birds expect, both chicks and parents are at risk for starvation or death (Hunt and Furness 1996).

Coastal communities and fishermen are also tied to a particular place and season to make their living. In North Carolina and in New England, bluefin tuna fishing depends on tuna arriving during the legal fishing season and staying as long as possible. When the herring is gone, hungry tuna may move on prematurely and the fishermen return empty-handed.

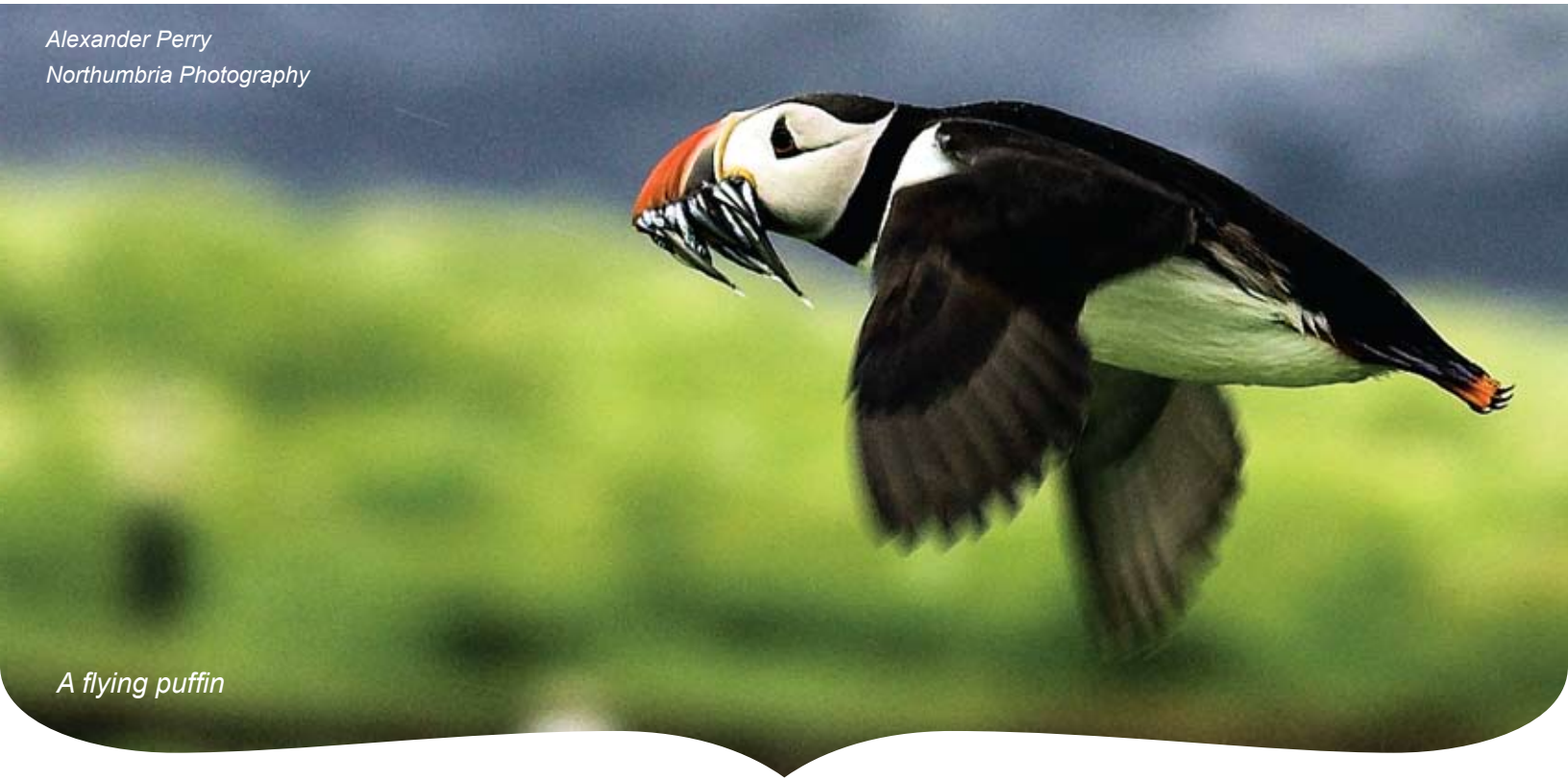
Predators and Natural Mortality

When no information is available on how much ocean predators consume, their needs are arbitrarily assumed to be low. Standard fishery models gloss over the needs of ocean predators in a single number known as “natural mortality” which is often flawed.

For example, recent analysis found that marine mammals and large fish are actually eating four times as many herring than assumed by the official government assessment (Read and Brownstein 2003). In failing to account for these predators, the typical approach overestimates the amount of fishing that can be sustained by their prey. For years we have been catching many more prey fish than can sustain both human fisheries and predators.

Shifting Baselines

Our current management framework assumes ecosystems with very low levels of natural predation. Large predatory fish have been overexploited and the legacy of whaling and depleted marine mammal populations remains. Ironically, as predatory fish recover and reclaim their share of prey species, we blame them for eating too much. In the Chesapeake Bay, some ask whether there will be enough menhaden left as striped bass recover. In the time that striped bass have been absent due to overfishing, human fishing has expanded - removing their prey.



Alexander Perry
Northumbria Photography

A flying puffin

For years we have been fishing on a deficit.

THREATS: AQUACULTURE

Increasingly, the driver behind overfishing of prey species is aquaculture. Salmon, tuna, and other high-value farmed fish are the fastest growing seafood products in the world (Delgado et al. 2003). As a result, an increasing number of new aquaculture operations specialize in fish that eat fish, which require constant supplies of high-calorie feed.

Aquaculture currently consumes more than 81 percent of the prey fish captured and "reduced" to fish oil, and approximately half of those captured for fishmeal (Tacon et al. 2006). The remaining prey fish are used in agriculture and to a lesser degree pet food and pharmaceuticals (Figure 4; Tacon et al. 2006, Delgado et al. 2003, Campbell and Alder 2006, FIN 2007a).

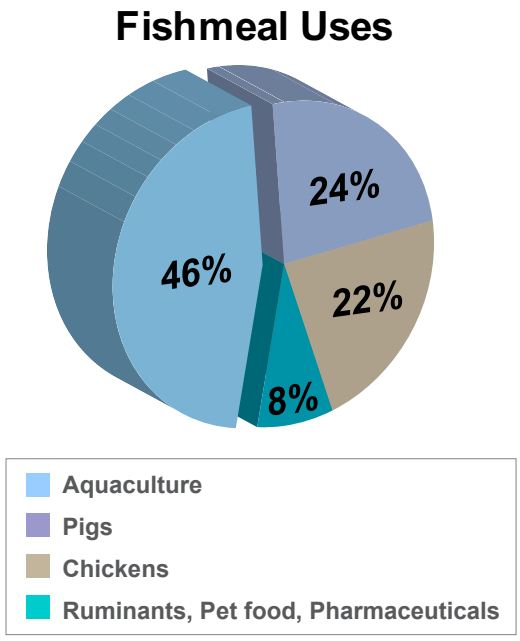


FIGURE 4. Fishmeal Consumption
Source: Data from Campbell and Alder 2008


Delta Aquaculture Equipment Co.

A third of all global fish landings are destined for fish meal and oil each year, caught mostly in dedicated reduction fisheries (Watson et al. 2006, FIN 2007b, IFFO 2006a, New and Wijkstrom, 2002). These fish are pressed, dried, and milled into concentrated fish oil and brown powder called fishmeal. A smaller percentage of fish meal is derived from byproducts of fish processing (FIN 2007b), and an unknown percentage is derived from unreported or illegal bycatch (Alder et al. 2008, Tuominen and Esmark 2003).

Among farmed fish, salmon consume more fish oil than all other aquaculture operations combined. In 2003, salmon pens alone consumed 51 percent of world fish oil and 19 percent of world fishmeal supplies respectively (FIN 2007b). In fact, the astronomical growth and success of Chile's salmon aquaculture industry is made possible by readily available fish oil supplies produced within the country (Campbell and Alder 2006). For salmon aquaculture, an estimated four to eleven pounds of prey fish are consumed to grow only one pound of farmed salmon (Fishmeal Information Network, Buschmann et al. 2006).

Further growth of the aquaculture industry is limited by the price of aquafeeds (Tuominen and Esmark 2003, Delgado et al. 2003, New and Wijkstrom 2002). Prices for fish oil and meal are expected to increase and will be highest when natural population cycles lead to diminished forage fish catches, creating powerful incentives for overfishing (Delgado et al. 2003).

2020 The year aquaculture outgrows the supply of fishmeal

— New and Wijkstrom, 2002

Cristián Gutiérrez / Oceana

Eric Cheng

Shoveling prey fish into net pens to feed farmed tuna

TUNA FATTENING

Tuna fattening has expanded in response to continued demand for full-grown bluefin tuna despite reduced supply due to overfishing. Juvenile bluefin are captured and held for varying lengths of time in net pens in Mexico, Canada, Australia, Japan, and throughout the Mediterranean (Ottolenghi et al. 2004, Volpe 2005). They are fed with frozen prey fish and later sold on the international market for sushi and sashimi, particularly in Japan and Korea.

Bluefin tuna are voracious predators, and require between two and ten percent of their body weight in prey fish every day of the peak summer season (Lovatelli 2003). This results in an estimated 225,000 metric tons of prey fish thrown into the Mediterranean tuna pens alone each year (Tudela et al. 2005).

Industry growth is limited by the supply of prey fish, and Mediterranean fattening operations already import 95 percent of the prey fish, mostly frozen sardines (Lovatelli 2003, Ottolenghi et al. 2004, Volpe 2005). In Mexico, more than half the catch of Pacific sardines is delivered directly to nearby tuna fattening pens, and much of the remaining catch is frozen or converted to fishmeal for use in other aquaculture operations. (Zertuche-González et al. 2008).

THREATS: CLIMATE CHANGE

Ocean predators are expected to suffer a wide range of impacts from global climate change, making them even more vulnerable to prey shortages. At the same time, climate change is also likely to affect prey species populations with changing temperatures, ocean currents, and sea ice.

Rising Temperatures

Prey fish and the food webs they support are highly sensitive to temperature changes, as seen in their dramatic population changes during El Niño and decade-long climate shifts (Anderson and Piatt 1999, Chavez et al. 2003). Small fish require favorable currents and temperatures to escape predators and to find enough to eat. The largest fishery in the world is vulnerable when warm El Niño waters bring Peruvian anchoveta toward the coast where they can be more easily caught. In 1972 this fishery crashed dramatically when heavy fishing coincided with an El Niño year (Clark 1976).

At the height of a 1950s cold period, temperature combined with heavy fishing to precipitate the collapse of the California sardine fishery made famous by John Steinbeck in his novel Cannery Row. Gulf of Alaska food webs are also tuned to temperature, and preferred prey such as capelin become scarce during warm periods, forcing marine mammals and seabirds to less nutritious options (Anderson and Piatt 1999). These prey shortages provide a preview of the likely effects of global warming.

Warm water in the North Sea brings fewer and smaller sand eels, the dominant prey for harbor porpoises (*Phocoena phocoena*), and could cause sand eels to hatch too soon for critical spring feeding time. Over the last thirty years, porpoises have suffered a 27 percent increase in starvation rates as sand eel populations shrink (Wanless et al. 2004, MacLeod et al. 2007a, 2007b). These climate-driven prey shortages are even more acute when prey populations are already overfished.

John Rix / Fathom This Underwater Productions

Steve Johnson

A puffin and an Arctic tern compete for prey

SEABIRDS AT RISK

Seabird populations are highly sensitive to their food supply, and increasingly threatened by human over-exploitation of prey fish. Crashes in fish populations in general have historically coincided with catastrophic seabird breeding failures, and climate-driven prey shortages may hit seabirds hardest.

When prey goes missing, seabirds rely on less nutritious alternatives and may become weak, delay their breeding season, and spend more time away from the nest searching for food (LeMaho et al. 1993). During herring declines in Norway's Lofoten Islands, the number of puffin burrows with chicks declined by 64 percent in the 1980s (Wright et al. 1996). Emaciated murres washed up on Norwegian shores after years of heavy fishing on capelin stocks, as populations of this usually common seabird plummeted by 56 to 80 percent (Hunt and Byrd 1999). In the eastern Bering Sea, both kittiwakes and murres starved to death during two decades of pollock shortages (Hunt and Byrd 1999, Springer et al. 1986).

Christopher Michel

Sea Ice

Polar predators and prey are under threat as the sea ice begins to melt (Smetacek and Nicol 2005, ACIA 2005). Krill aggregations feed on algae in a hidden sea ice ecosystem (Lizotte 2001, Loeb et al. 1997, Marschall 1988). As melting sea ice makes life harder in other ways, krill aggregations will shrink and in turn leave hungry penguins, whales, fish, and albatrosses in a weakened state. Warming and the decline of Antarctic krill have already been linked to reduced calving success of southern right whales that feed on this popular prey (Leaper et al. 2006)

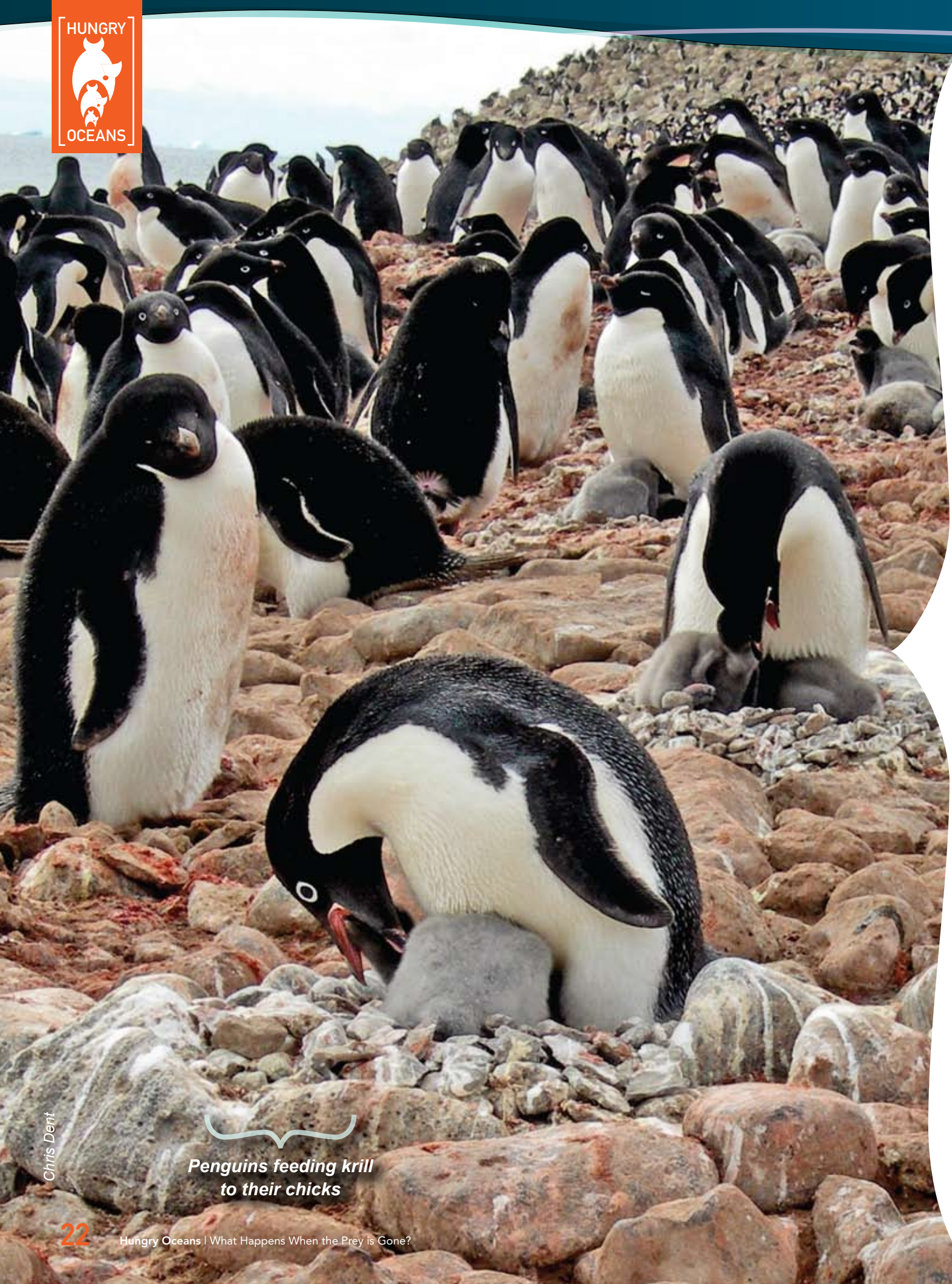
Arctic predators are also threatened by the loss of sea ice and their prey, including narwhals, ringed seals, ivory gulls, and Atlantic salmon. Their favorite foods include Arctic cod (*Boreogadus saida*), which hides in ice cracks and channels and feeds on tiny organisms in the associated ecosystem (Bluhm and Gradinger 2008, Gradinger and Bluhm 2002, Tynan and DeMaster 1997).

Geographic Range Shifts

As ocean temperatures and currents are altered by climate change, the geographic ranges for predators and their prey are expected to move poleward. Wild Pacific salmon are predicted to shift northward, and sockeye salmon could shift entirely into the Bering Sea within the next 50 years (Welch et al. 1998, Mote et al. 2003). While some populations may adapt to their new location, others will likely suffer prey shortages. Salmon will be forced to seek out different prey, which may be less abundant in their new surroundings, leaving them malnourished and less able to adapt to other climate stresses (Bilby et al. 2007).

Wetjens Dimmlich

Despite their name, Crabeater seals primarily eat krill



Chris Dent

Penguins feeding krill to their chicks

SOLUTIONS: GETTING STARTED

Despite the alarming global outlook, some progress has been made toward the evaluation and management of prey species with predator needs in mind, as highlighted below. Successful management of predator-prey relations is an important first step toward ecosystem-based management, and must include prohibiting new fisheries for prey species, setting conservative catch limits for existing fisheries, prioritizing uses of prey species, and anticipating and reducing fishing during prey declines.

Manage for Ecosystem Integrity

Protecting prey is fundamental to keeping ocean ecosystems intact. State, regional, and federal agencies in the U.S. are beginning to recognize that healthy prey populations should be a goal for fishery managers. Yet initial efforts have devoted a disproportionate amount of time to gathering background information, with minimal actions toward preventing the actual loss of prey populations. Catch levels need to be set with large predatory fish, marine mammals, sea birds, and other marine life in mind.

The U.S. federal government is taking steps toward appropriate management of prey species. In 2002, federal regulations identified prey as a component of essential fish habitat and recognized the loss of prey as a problem for fisheries. More recently, regional fishery management councils have begun food web modeling with implicit consideration of predator needs.

States are also recognizing the importance of prey species. Most notably, Washington State was one of the first to create a dedicated management plan for forage fish and to explicitly adopt the protection of prey and "the integrity of the ecosystem and habitat upon which marine resources depend" as a goal for the Washington Department of Fish and Wildlife. Washington's plan identifies knowledge gaps, addresses commercial and recreational catches, and describes the ecological role of prey fish. Along with Oregon and California, Washington has also banned fishing for krill, an important prey species. However, many states lag behind and in states with existing plans, management actions are urgently needed to actively protect prey fish.

Aziz T. Saltik

Actively protect prey fish
rather than taking them for granted.

Salvin's Albatross

Pablo Andrés Cáceres Contreras

No New Fisheries for Prey Species

The most conservative approach to protecting prey is to ban fishing on these species before it begins. In 1998, the federal government banned fishing for prey species except pollock in federal waters around Alaska. The North Pacific Fishery Management Council and NOAA Fisheries acted to protect valuable groundfish and salmon predators targeted by fisheries, as well as other predators such as whales, sea lions, and albatrosses. The prey or "forage fish" protected from being caught included entire families of species such as krill (Euphausiacea), capelin and smelts (Osmeridae), sand lance (Ammodytidae) and many others.

Fishing for krill will likely similarly be banned in federal waters of the West Coast of the United States. The Pacific Fishery Management Council and NOAA Fisheries created a prohibited harvest species category to "ensure the long-term health and productivity of the West Coast ecosystem." This proposed federal ban reinforces state bans on krill fishing established in California, Oregon, and Washington to prevent future exploitation of this important prey.

Set Conservative Catch Limits

Where fisheries on prey species already exist, conservative catch limits and careful monitoring are essential to prevent harm to natural predators. Squid, krill, and other prey fisheries sometimes remain unregulated or have incomplete management plans because they are not recognized as important.

Early management of Antarctic krill by the Convention on the Conservation of Antarctic Marine Living Resources (CCAMLR) exemplifies the conservative catch limits needed for prey species. With the ecosystem explicitly in mind, CCAMLR set initial catch limits for krill at nearly half the level of fishing mortality typically chosen for fisheries elsewhere in the world. Although there is substantial concern that this level is still too high, not fishing to the limit is an important start toward true ecosystem-based management.

Atlantic cod stocks have seen severe declines in recent decades and have yet to recover despite drastic cutbacks in fishing by the Canadian fleet (DFO 2005). Cod in the Northern Gulf of St. Lawrence also appear to be "starving to death" for unknown reasons which may include shortages of capelin, a preferred prey (DFO 2008, 2006). Conservative catch limits for capelin are an important component of Canada's recovery strategy for cod populations in Newfoundland and Labrador (DFO 2006, 2005).

Carlos Minguell

"To keep every cog and wheel is the first precaution of intelligent tinkering."

— Aldo Leopold

Prioritize Uses for Prey

In addition to setting conservative catch levels, managers should give predators top priority before we divide up their prey, to better ensure that prey species fisheries are managed for the long-term health of the ecosystem. This includes specific assessment and allocation for the ecosystem - for fish, invertebrates, marine mammals, sea turtles, and other marine life.

After predator needs have been met, catches of prey species should be destined for direct human consumption. These small, fast-growing fish can reliably serve as primary protein for people. Peruvians have seen an upswing in anchoveta consumption since a 2006 event featuring top chef Gastón Acurio, scientist Patricia Majluf, and 18,000 diners feasting on flavorful fish that are more typically ground up for animal feed (Jacquet 2007).

Historically, direct consumption has been prioritized over use for bait, aquaculture, and other activities. California's legislature in 1920 prohibited converting fish into oil and meal that would otherwise be fit for human consumption (Watson et al. 2006). The European Union later banned the use of Atlantic herring in fish meal in 2003, and England banned the use of fishmeal in ruminant feed due to concern over mad cow disease (Josupeit 2006, 2007). Peru banned the reduction of certain fish into oil and meal, including the South American pilchard (*Sardinops sagax*) and jurel or horse mackerel (*Trachurus murphyi*) (Watson et al. 2006).

Bait fish plays an important role in recreational and commercial fisheries, and should be prioritized after ecosystem and human needs. Aquaculture, animal feed, and all other uses for prey fish compete for these higher priority uses and require explicit acknowledgement and careful control. As aquaculture drives up prices for fishmeal and oil, prey fish now used for human consumption in developing regions are being diverted to industrial processing, with ethical implications (Alder and Pauly, 2006, FAO 2006, Delgado et al. 2003).

Fish Less During Natural Declines

Many prey species boom and bust with ocean temperature cycles, particularly sardines and anchovies. While it is normal for these populations to drop in response to changing conditions, heavy fishing during less productive phases could prevent the population from rebounding when favorable conditions return.

In the U.S., the Pacific Fishery Management Council is one of the first management organizations to explicitly account for the influence of ocean temperature cycles on sardines. This Council adopted a rule for managing Pacific sardine that adjusts the number of fish that can be caught according to sea surface temperature. Pacific sardines reproduce more slowly when the ocean is cooler, and fewer fish can be caught during this vulnerable time.

Sardines ready for human consumption

Cathou Cathare

An Arctic tern catches its next meal

Paul McDonnell

SOLUTIONS: LOOKING AHEAD

While the needs of natural predators are increasingly recognized in public policy, concrete management actions to protect them are still generally lacking. However, several emerging science-based approaches could improve management of prey species substantially.

Maintain a Reserve for Natural Predators

Quantitative food requirements for each predator group are increasingly becoming available (Read and Brownstein 2003, Hunt and Furness 1996, Field and Francis 2006). Prey reserves can now be set aside for natural predators when catch limits are set for prey fish, squid, and krill.

At the stock assessment level, the needs of predators should be more rigorously accounted for in estimates of natural mortality and the definition of optimum yield for fisheries. At the policy and management level, explicit allocations can be made for ecosystem needs or for natural predators.

Wetjens Dimmlich

Female elephant seal and pup

Protect Breeding Hotspots

For predators with clear needs for prey during spawning, nursing, or nesting season, closures on fishing for squid, anchovy, or other prey may be appropriate. This would prohibit fishing in very specific times and places to increase prey availability and reproductive success with the added benefit of reducing the number of predators caught in the nets. Unfortunately the specific needs of many predators remain unknown.

In Punta Tombo, Argentina, tracking experiments with Magellanic penguins clearly show their most important foraging areas in need of protection (Boersma 2008). In the North Sea, fishing activity and seabird feeding are concentrated in different locations suggesting the potential for successful zoning (Furness and Tasker 2000, Hunt and Furness 1996). Separating fishing from seabird feeding could minimize fishery impacts and prevent localized depletion of prey.

Save 10% for Climate Losses

In addition to planning for ecosystem needs, managers should leave a buffer for climate-driven losses in prey populations. In the absence of more quantitative decision rules based on temperature, managers should insure against climate change impacts with a reduction of ten percent in catch limits.

Manage in Real Time

Real-time monitoring during the fishing season is especially helpful for management of short-lived and infrequently counted prey fish and invertebrates. Daily updates on catch and effort for each vessel allow managers to monitor the status of the fishery and decide whether too many fish have been taken in a season. Real-time monitoring is currently active for the squid (*Loligo gahi*) fishery in the Falkland Islands and has been proposed for United States squid fisheries (Agnew et al. 1998). Real-time monitoring of fishing intensity has also been proposed to protect Peruvian anchoveta, which are more vulnerable to being caught as they move closer to shore during El Niño climate cycles (Bertrand et al. 2005).

SOLUTIONS SUMMARY

GOAL:

Protect prey species as fundamental to ocean ecosystems and fisheries.

SOLUTIONS:

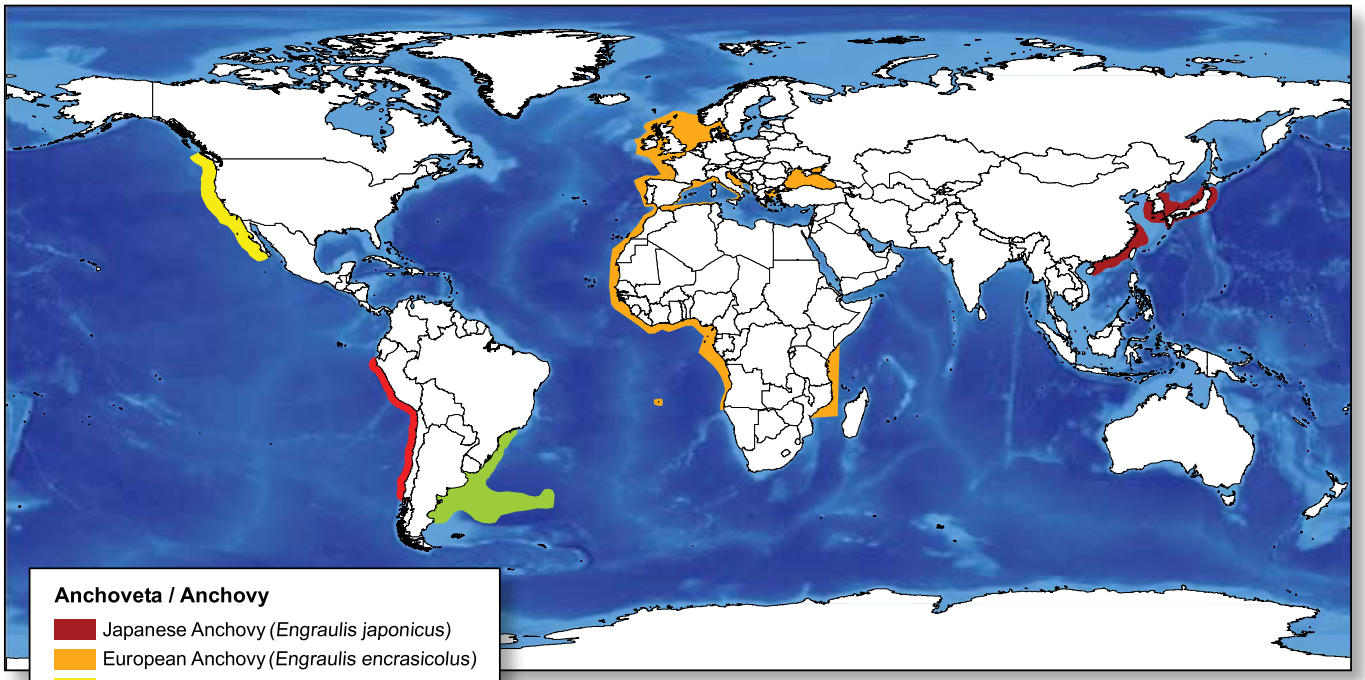
1. No new fisheries for prey
2. Set conservative limits for prey fisheries and save 10 percent for climate impacts
3. Protect breeding hotspots
4. Prioritize uses for prey—place ecosystem needs first

Bryant Austin

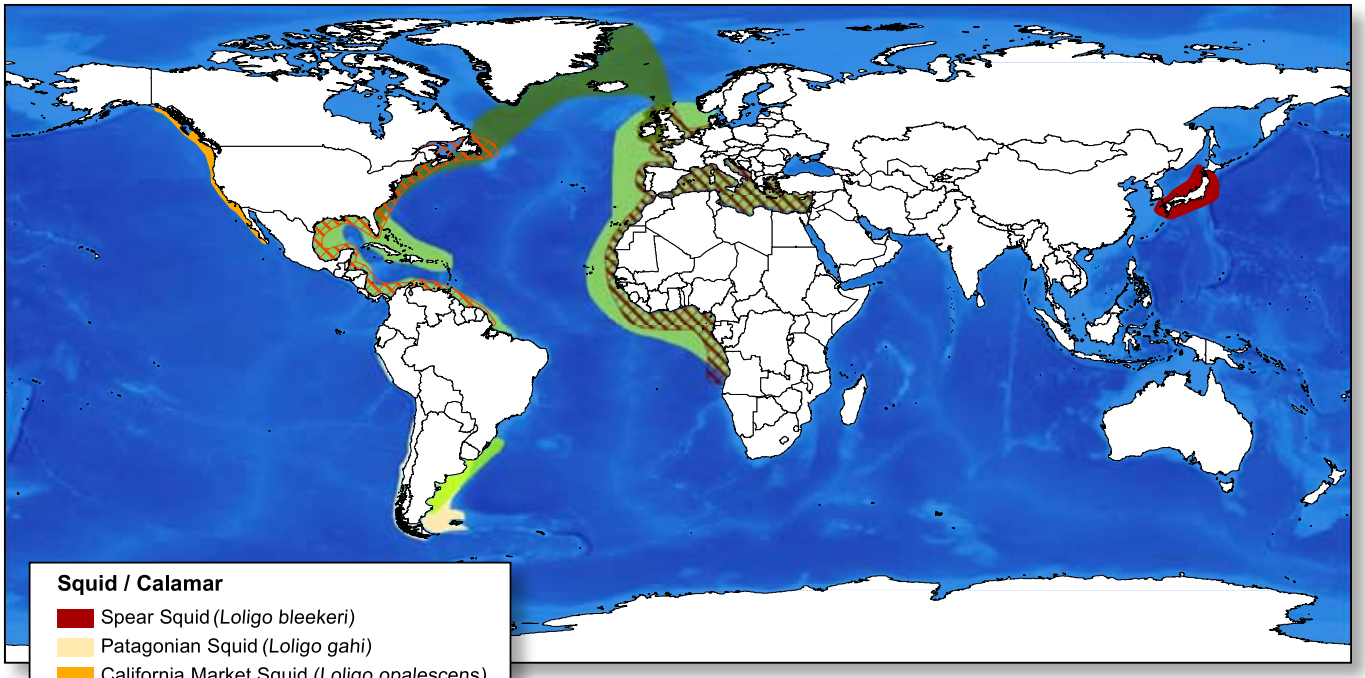
HUNGRY OCEANS

PREY SPECIES AROUND THE WORLD

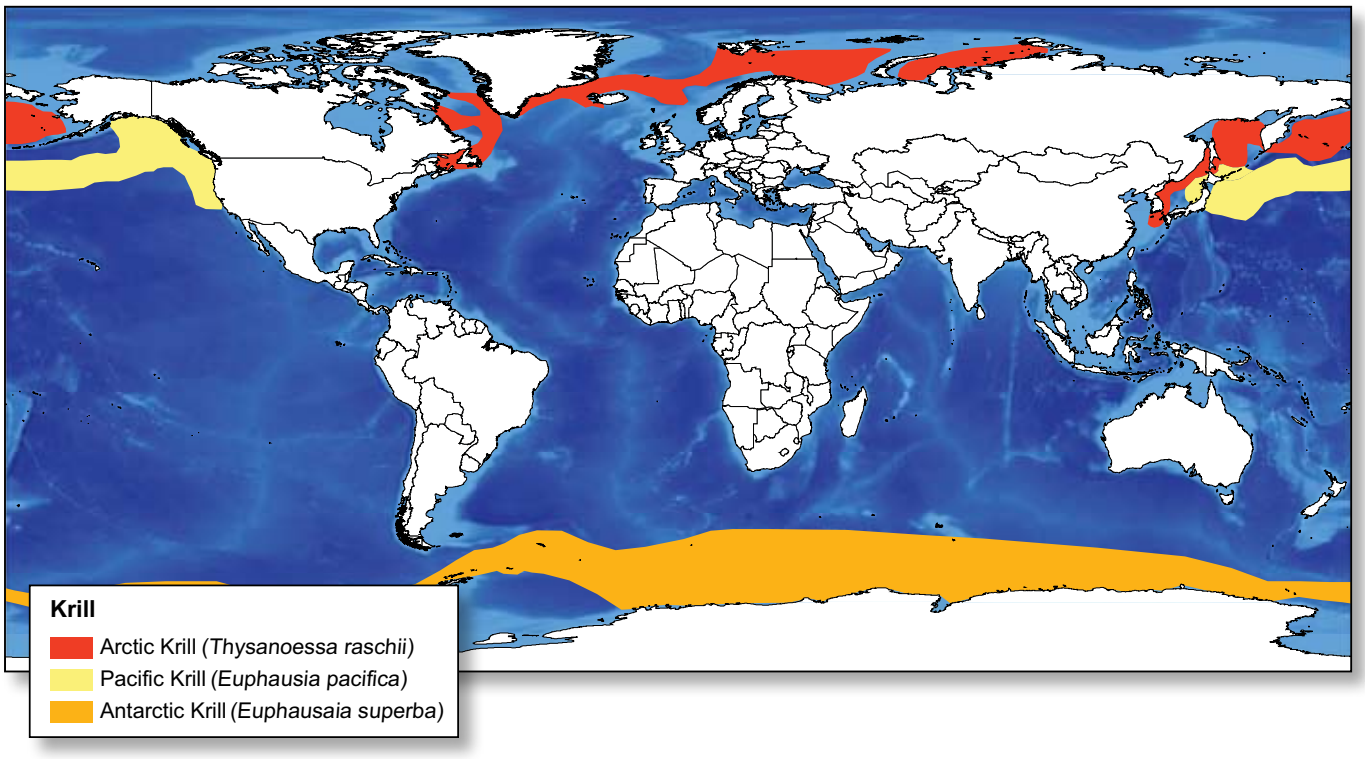
Anchovy



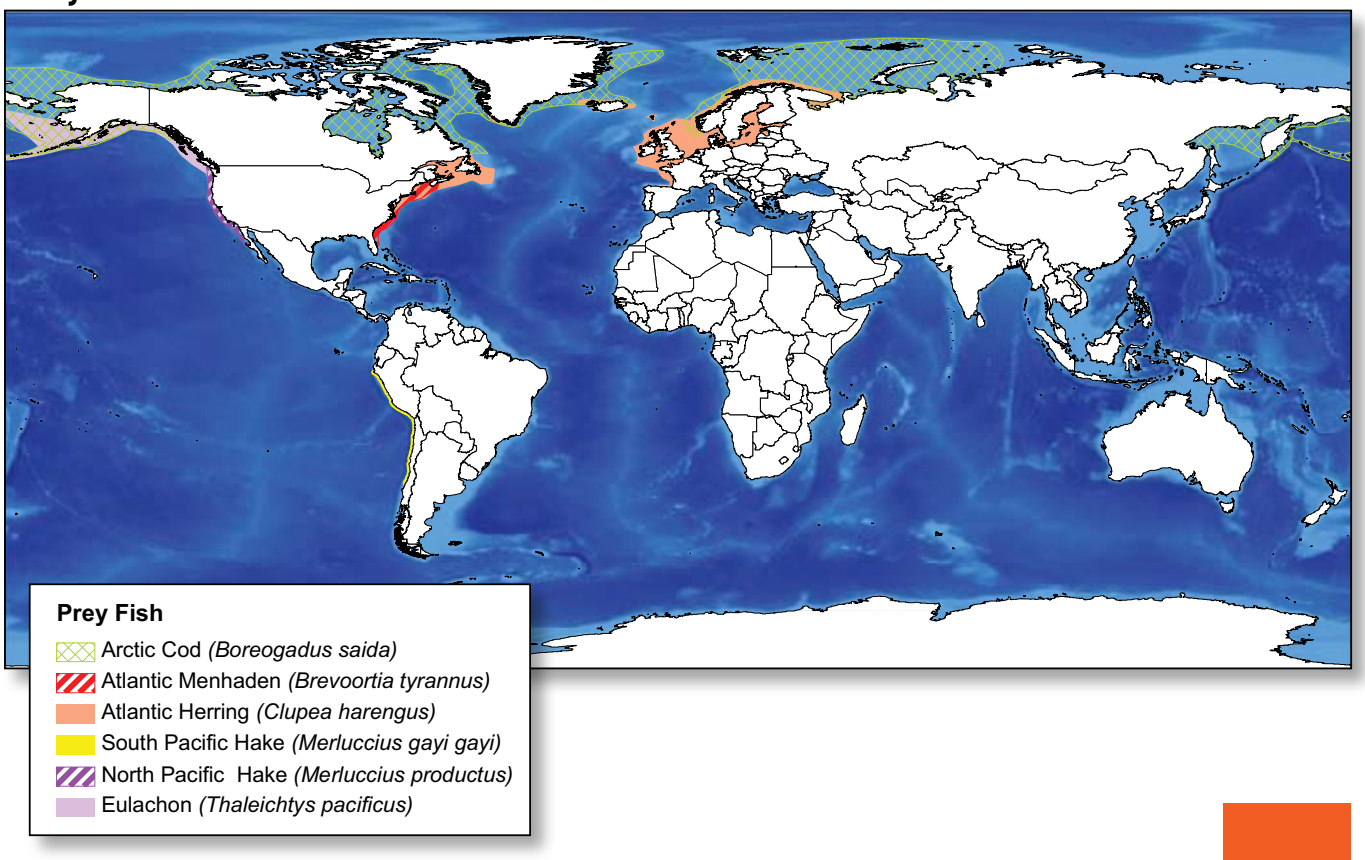
Squid



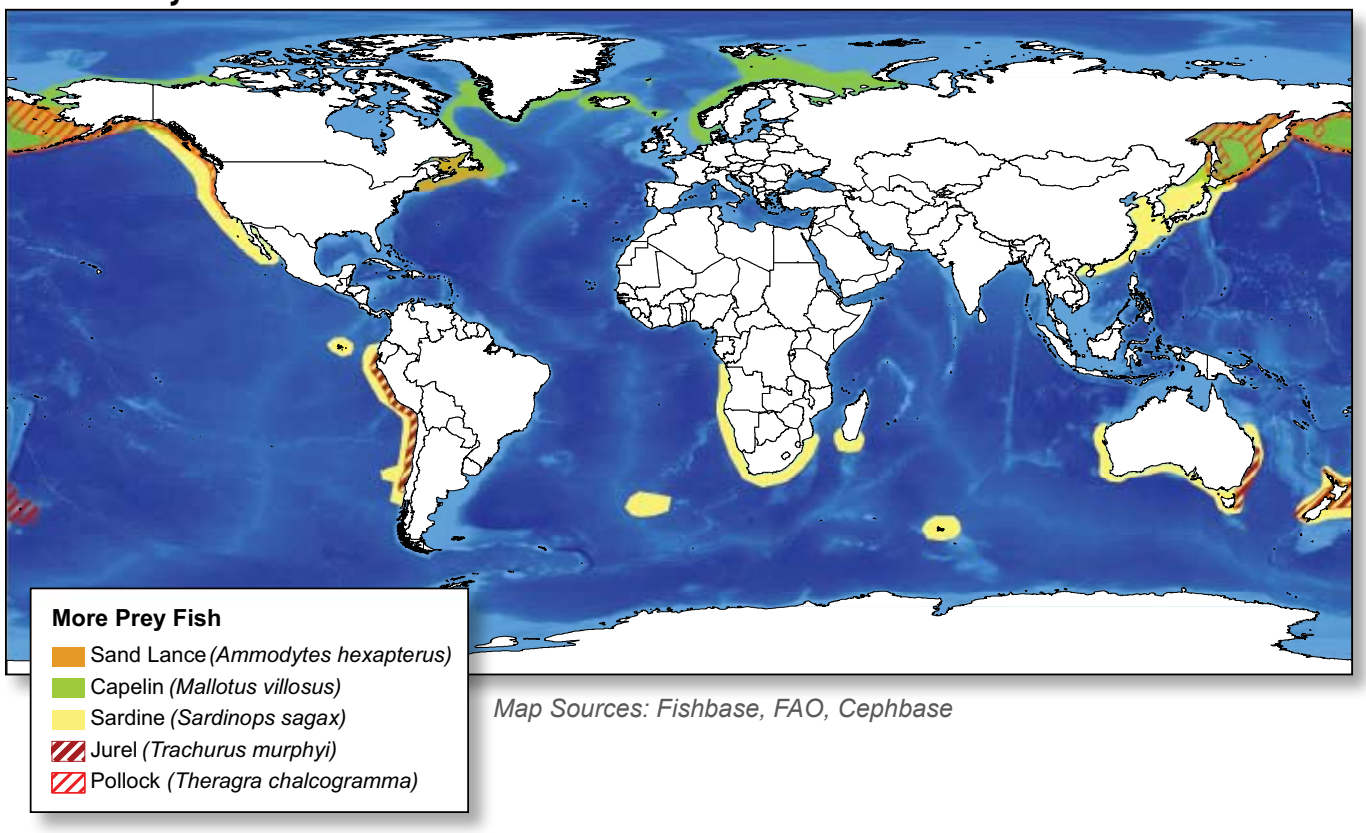
Krill



Prey Fish



More Prey Fish



Map Sources: Fishbase, FAO, Cephbase

Colin Robson

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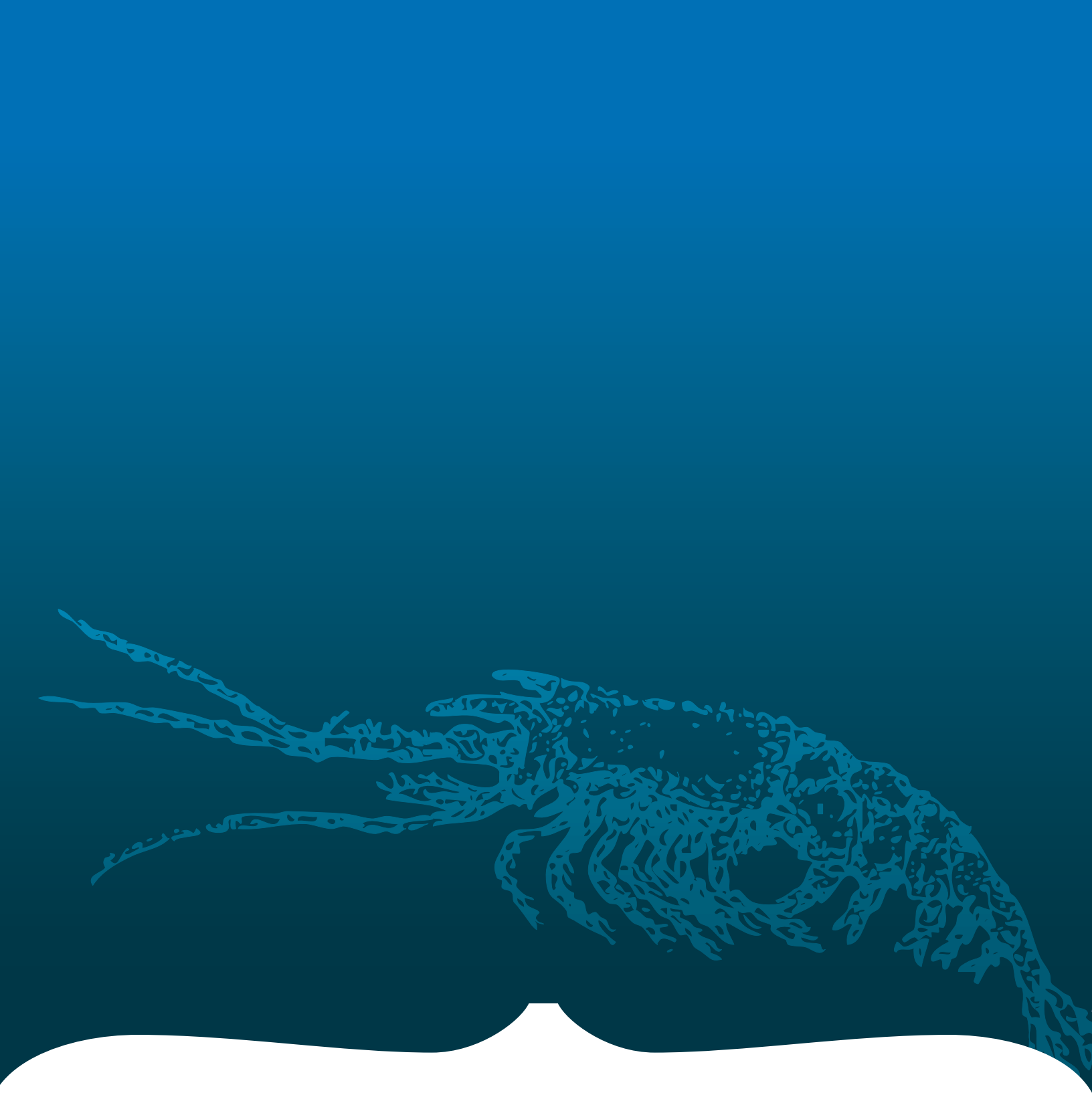

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