Tribal Proposal Regarding 2003 Groundfish Harvests

Jim Harp

Black Rockfish - The 2003 tribal harvest guidelines will be set at 20,000 pounds for the management area between the US/Canada border and Cape Alava, and 10,000 pounds for the management area located between Destruction Island and Leadbetter Point. No tribal harvest restrictions are proposed for the management area between Cape Alava and Destruction Island.

Sablefish - The 2003 tribal set aside for sablefish will be set at 10 percent of the Monterey through Vancouver area OY. Allocations among tribes and among gear types, if any, will be determined by the tribes.

Pacific Whiting - For the 2003 Pacific whiting fishery, the tribal set aside will be as provided in the Makah tribes' sliding scale allocation framework.

Lingcod - Tribal fisheries will be restricted to 300 lbs. per day, not to exceed 900 lbs. per week, limits for all fisheries.

For all other tribal groundfish fisheries the following trip limits will apply:

Thornyhead rockfish - Tribal fisheries will be restricted to a 300 pound per trip limit. This trip limit will be for short and longspine thornyheads combined.

Canary rockfish - Tribal fisheries will be restricted to a 300 pound per trip limit.

Other Minor Nearshore, Shelf and Slope Rockfish - Tribal fisheries will be restricted to a 300 lbs. per trip limit for each species group, or the limited entry trip limits if they are less restrictive than the 300 lbs. per trip limit.

Yelloweye Rockfish – The tribes will consider area and depth restrictions in their 2003 fisheries to avoid yelloweye rockfish. They are also considering bait restrictions based on preliminary evidence of reduced yelloweye bycatch associated with some baits.

Mid-water Trawl Fishery- Treaty mid-water trawl fishermen will be restricted to a cumulative limit for yellowtail rockfish of 30,000 lbs. per vessel per two month period. Their landings of widow rockfish must not exceed 10% of the poundage of yellowtail rockfish landed in any given period. Fishermen will not be permitted to carry-over portions of the cumulative limit that are not used in any previous two month period. A tribe may adjust the cumulative limit for any two month period to minimize the incidental catch of canary and widow rockfish, provided the average cumulative limit does not exceed 30,000 lbs. (e.g. – 45,000 lbs. in one period, and 15,000 lbs. in a following period). Trip limits may also be adjusted downward by the trawl fishing tribes if there is greater participation than expected in the fishery.

Bottom Trawl Fishery - Treaty fishermen using bottom trawl gear will be subject to the trip limits applicable to the limited entry fishery for pacific cod, petrale sole, English sole, rex sole, arrowtooth flounder, and other flatfish. Because of the relatively small expected harvest, the trip limits for the tribal fishery will be those in place at the beginning of the season in the limited entry fishery and will not be adjusted downward, nor will time restrictions or closures be imposed, unless in-season catch statistics demonstrate that the tribes have taken ½ of the harvest in the tribal area. Fishermen will be restricted to PFMC approved trawl gear.

Observer Program - The Makah tribe will develop and implement an observer program to monitor and enforce the limits proposed above.

ITEM 3.C. C2

SPORTFISHING ASSOCIATION OF CALIFORNIA

1084 BANGOR STREET
SAN DIEGO, CALIFORNIA 92106
(619) 226-6455 FAX (619) 226-0175

AGENDA ITEM C 3

ROBERT C. FLETCHER
PRESIDENT

JUNE 18, 2002

W. A. NOTT
PRESIDENT-EMERITUS

TESTIMONY OF BOB FLETCHER, PRESIDENT, SPORTFISHING ASSOCIATION OF CALIFORNIA RE: REBUILDING ANALYSES FOR BOCACCIO

I am Bob Fletcher, President of the Sportfishing Association of California (SAC). SAC is a non-profit, political organization representing the interests of the commercial passenger fishing vessel (CPFV) fleet in southern California. Many of the SAC vessels rely heavily on the catch of rockfish during the year, and the new stock assessment information on bocaccio fails to truly represent the status of the bocaccio stocks, especially that portion of the resource south of Point Conception. The unanimous opinion of the skippers and boat owners in SAC is that since 1998 when the ocean regime shifted and cooled, the rockfish resource and especially bocaccio has recovered remarkably. Today on virtually every offshore bank and underwater ridge the bocaccio stocks are flourishing, with several different year classes in evidence. The lack of a fishery independent survey of rockfish stocks south of Conception the last 25 years, coupled with the empirical evidence of bocaccio abundance from the fishermen, raises significant questions about the accuracy of the bocaccio stock assessment.

To support this contention I understand that the assessment shows a more productive and abundant resource south of Point Conception, but that the STAR panel refused to allow the author to 'partition' the stock assessment geographically. If this had been done, additional bocaccio would have been made available to recreational and commercial fishermen in the zone from Conception to Mexico.

Speaking of Mexico, there is an additional 250 miles of good bocaccio habitat and resource south of the border, and this portion of the bocaccio stock is lightly exploited. This area holds large populations of bocaccio that helps buffer the stock from the kinds of impacts that take place to the north. Based on all the foregoing information, I would urge the Council to consider splitting the assessment at Point Conception, and then work with the recreational and commercial industry reps on ways to maximize the angler and fisherman opportunity in the area south of Point Conception for the 2003 regulations. I would gladly be involved in any such effort.

Thank you for the opportunity to testify on this critical issue for the CPFV fleet.

Sincerely,

Bob Fletcher

Bob Fletcher, President

Exhibit C.1.a
Supplemental NMFS Report
June 2002

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic Atmospheric Administration
National Marine Fisheries Service
Sustainable Fisheries Division
7600 Sand Point Way N. E., Building. 1, Bin C15700
Seattle, WA 98115-0070

DATE: June 13, 2002

TO: DISTRIBUTION

FROM: F/NWR2 -Becky Renko

SUBJECT: PRELIMINARY Report #2 -- 2002 Pacific Whiting Fishery

This report consolidates preliminary state, federal, and tribal data for the 2002 Pacific whiting fishery off Washington, Oregon, and California. The catcher/processor and non-tribal mothership fishery started on May 15. The mothership fishery was projected to reach its allocation and was closed on June 6. As in previous years, the catcher/processor fishery for whiting continues at a slower pace. The shore-based season in most of the Eureka area (between 42°- 40°30' N. lat.) began on April 1, and the fishery south of 40° 30' N. lat. opened April 15. The shore-based fishery north of 42° N. lat.will begin on June 15.

	Allocation		Catch (mt)	Thru [date]	Status	Percent of allocation taken
	Percentages	Metric Tons				
California (south of 42 N lat.)	(5% shore alloc'n; included in WOC shore allocation)	2,245	1,552	5/30	CA season started April 1; 5% alloc'n	69.0%
Oregon	--	NA			start 6/15	
Washington	--	NA			start 6/15	
WOC shoreside	42% commercial OY	**44,906**	1,552			3.5%
Mothership (n. of 42 N. lat.)	24% commercial OY	**25,661**	26,506	6/6	started 0001 hrs 5/15/00 & closed 5 AM June 6	103.3%
Catcher/processor (n. of 42 N. lat.)	34% commercial OY	**36,353**	15,790	6/12	started 0001 hrs 5/15/00	43.4%
Total nontribal	commercial OY (86% OY)	106,920	43,848		--	41.0%
Tribal (Makah)	14% OY	**22,680**	0	6/12		0.0%
Total	OY=optimum yield	129,600	43,848	--	--	34.0%

* Catch includes discards from at-sea processors; weigh-backs from shore-based catcher vessels; and small amounts landed under the 20,000-pound trip limit between the seasons. The data for at-sea processing (catcher/processors and motherships) are preliminary and are based on reports from NMFS-certified observers. Data for shoreside processors also are preliminary and are provided by each State to NMFS for the purpose of monitoring the fishery. If you have questions on shoreside landings, please contact the appropriate state fishery management agency. Preliminary data for the Makah fishery will be from a NMFS-trained observer. All weights are round weight (the weight of the whole fish before processing) or round-weight equivalents. One metric ton is 2,204.6 pounds.

Exhibit C.1.a
Supplemental NMFS Report 2
June 2002

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE

Fishery Resource Analysis and Monitoring Division
Northwest Fisheries Science Center
2725 Montlake Boulevard East
Seattle, Washington 98112

May 28, 2002

MEMORANDUM FOR: F/NW – Mr. Robert Lohn

FROM: F/NWC – Dr. Usha Varanasi

SUBJECT: 2002 FRAM Division Fishery Resource Survey Activity off Washington, Oregon, and California

This memorandum is to inform you of research activity to be conducted by the Fishery Resource Analysis and Monitoring (FRAM) Division off Washington, Oregon, and California in the summer of 2002. We will be conducting a resource assessment survey to characterize the relative abundance and distribution of the deepwater slope groundfish species complex, i.e. Dover sole, sablefish, shortspine thornyhead, longspine thornyhead, and other species in that zone. This survey will be carried out aboard four chartered commercial trawlers and will employ quantitative bottom trawl sampling techniques according to a stratified random survey design. The vessels will operate in pairs, the first pair starting its operations near Cape Flattery, Washington in late June and working its way southwards over the next five weeks to conclude at San Diego, California. The second pair of vessels will start in mid-August and follow the same north-to-south pattern over the next five weeks.

This activity is official National Marine Fisheries Service research directed at assessing the status of fishery resources managed under the West Coast Groundfish Fishery Management Plan. Cruise plans for this survey are on file with FRAM Division at the Northwest Fisheries Science Center (NWFSC). By this memorandum, I am approving and authorizing the research to be conducted. The vessel names, radio call signs, and planned dates of operation are listed below:

VESSEL NAME	CALL SIGN	DATES
Captain Jack	WBP 9045	6/20 – 8/1
Ms. Julie	WDA 7365	"
Excalibur	WAW 2731	8/15 – 10/15
Sea Eagle	WBI 3471	"

If you have any concerns or need any additional information, please contact Dr. Elizabeth Clarke at (206) 860-5616 or Teresa Turk at (206) 860-3460.

cc: F/NWC4 - L. Jones
F/NWC4 - E. Clarke
F/NWC4 - R. Methot
F/NWC4 - M. Lemon

Exhibit C.1
Situation Summary
June 2002

NATIONAL MARINE FISHERIES SERVICE REPORT ON GROUNDFISH MANAGEMENT

Situation: The National Marine Fisheries Service (NMFS) will report on its regulatory activities, developments relevant to groundfish fisheries, and other issues of interest to the Council.

Council Task: Discussion.

Reference Materials: None.

Agenda Order:

a. Agendum Overview — Bill Robinson
b. Reports and Comments of Advisory Bodies
c. Public Comment
d. Council Discussion

Groundfish Fishery Strategic Plan (GFSP) Consistency Analysis
This agenda item is not expected to require Council decision making that raises issues of consistency with the GFSP.

PFMC
06/04/02

Exhibit C.2.c
Supplemental GAP Report
June 2002

GROUNDFISH ADVISORY SUBPANEL STATEMENT ON STOCK ASSESSMENTS FOR BOCACCIO, CANARY ROCKFISH, AND SABLEFISH

The Groundfish Advisory Subpanel (GAP) received presentations on the most recent stock assessments for bocaccio rockfish, canary rockfish, and sablefish. Before commenting on the individual assessments, the GAP has comments on the assessment process in general.

A key factor in determining whether a stock is considered overfished is the calculation of virgin biomass or B_0. Unfortunately, there seems to be no standard method for making this calculation. Indeed, the value of B_0 can change for the same species over the course of assessments. Since, theoretically, B_0 represents an unfished state, the value should be constant over the range of assessments. In addition, the means of calculating it should logically be the same regardless of species.

The GAP has previously recommended the Council convene an independent review utilizing the expertise of the Scientific and Statistical Committee (SSC), independent experts, and with appropriate participation by advisory bodies to examine how B_0 should be calculated and whether it is the appropriate value on which to base determinations of overfishing. The GAP is again making that recommendation.

The GAP further notes that groundfish scientists are beginning to consider the possibility of an ocean regime shift and the influence of environmental factors on fish populations. However, not all stock assessments appear to have caught up with this modern concept. The GAP recommends the Council direct stock assessment authors to fully examine environmental influences on fish populations as a reasonable alternative to density dependence and have those results available for review by Stock Assessment Review (STAR) Panels.

As a final general comment, the GAP notes that some stock assessments may not fully explore the effect management actions have had on population size. While new data, including historical data, is constantly being uncovered, the GAP believes all stock assessments presented for STAR Panel review include at least one model run using as the base the model previously presented and accepted, updated only with recent data. This will allow the Council to examine whether its management measures are having any noticeable effect on population size. The GAP recommends the Council include such instructions to stock assessment authors.

Turning to the assessments being presented, the GAP notes the author of the bocaccio assessment has recommended the assessment be re-done in 2003 with additional data that were not available to the author this year. This should include in one model run the newly developed analysis of foreign catch data. The GAP also notes that survey data available on bocaccio from the Northwest Science Center may not have been made known to the assessment author. Since the bocaccio population does extend beyond the range of the current assessment, it would be advisable for the two science centers to communicate more fully with each other, so the entire suite of data are available.

The GAP also has concerns with the conduct of the spawning survey conducted by the Southwest Science Center, since it only encompasses a short period of time in the late spring/early summer. Such a limited survey may not - based on anecdotal data presented to the GAP - represent the full range (both temporal and geographic) of spawning activity. The GAP strongly recommends the survey be examined and expanded.

PFMC
06/18/02

Read by John DeVore

Exhibit C.2.c
Supplemental SSC Report
June 2002

SCIENTIFIC AND STATISTICAL COMMITTEE REPORT ON STOCK ASSESSMENTS FOR BOCACCIO, CANARY ROCKFISH, AND SABLEFISH

The Scientific and Statistical Committee (SSC) was briefed by Drs. Alec MacCall, Rick Methot, and Steve Ralston on bocaccio, canary rockfish and sablefish (respectively) assessments, Stock Assessment Review (STAR) Panel results, and rebuilding updates (where appropriate). The SSC endorses all three stock assessments as being the best available science.

Dr. MacCall reviewed Exhibit C.2, Attachment 1 (Status of Bocaccio off California in 2002), Exhibit C.3 (Bocaccio Rebuilding Analysis for 2002) and Exhibit C.2, Attachment 2 (Bocaccio STAR Panel Report). The SSC would like to emphasize several points:

- Although separate assessments were done for central and southern California bocaccio, the STAR Panel recommended a single California assessment.

- The data used in the current assessment are much improved over those used in the 1999 assessment. A number of new data sets were used, and some of the old data sets were extended back in time.

- The only major change from the previous assessment is the estimate of recruitment of the 1999 year-class (Figure 19, stock assessment). The previous assessment set 1999 year-class strength equal to that of the 1988 year-class, since there were preliminary indications that it might be fairly strong. As a result of new data, the current assessment predicts a much lower 1999 year-class recruitment. This represents the best current estimate of the 1999 year-class strength. However, this estimate is still imprecise and should improve in the next several years as new data become available.

- The change in 1999 year-class recruitment extends the rebuilding time to 106 years. Dr. MacCall points out that this should not be a surprise in that this outcome was presented to the Council 3 years ago under a "low 99 recruitment" scenario.

Dr. Methot then reviewed Exhibit C.2, Attachment 3 (Status of the Canary Rockfish Resource off California, Oregon and Washington in 2001), Exhibit C.2, Attachment 4 (Canary Rockfish STAR Panel Meeting Report) and Exhibit C.3, Supplemental Attachment 4 (Rebuilding Analysis for Canary Rockfish: Update to Incorporate Results of Coastwide Assessment in 2002). The SSC notes that in this new stock assessment, natural mortality for female canary is allowed to increase with age and is tied to maturity (Fig.25, stock assessment). In addition, selectivity is dome-shaped and fishery- specific. We note that although progress has been made in modeling selectivity and natural mortality, future analysis of historical unprocessed data may help provide further resolution of this issue.

Dr. Ralston then reviewed the abbreviated sablefish assessment - Exhibit C.2, Attachment 5 (Status of the Sablefish Resource off the Continental U.S. Pacific Coast in 2002) and Exhibit C.2, Attachment 6 (Review of the Updated 2002 Sablefish Stock Assessment). This is the first of the expedited stock assessment updates. It serves to update the last full sablefish assessment conducted in 2001. The terms of reference (SSC Minutes, April 2002) specify that an expedited stock assessment update should "carry forward its fundamental structure from a model that was previously reviewed and endorsed by a full STAR Panel." The SSC discussed this issue at length, in that estimates of the selectivities and catchability (Q) of the slope trawl survey changed markedly from the previous assessment. This was due primarily to the fact the 1999 year-class provides the first real opportunity to estimate age selectivity of the slope survey. When this is done, selectivity of young sablefish is estimated to be low to the slope survey (Fig. 23, Stock Assessment), and survey catchability declines from 0.6 to 0.46. This causes a marked increase in estimated stock biomass (Fig. 21, Stock Assessment). The SSC would like to emphasize that this estimate of Q and the implied estimate of sablefish optimum yield, remain highly uncertain, and this should be taken into account when management decisions are made.

PFMC
06/18/02

Tom Jagielo

CHARGER SPORTFISHING
8655 Graves Ave. #30
Santee, Ca. 92071

June 5, 2002

Mr. Hans Radtke
Chairman, Pacific Fisheries Management Council
7700 NE Ambassador Place, Suite 200
Portland, Oregon 97220-1384

Dear Chairman Radtke and Council members,

It is unfortunate that I find myself unable to attend the Council Meeting of June 17th, 2002. The affordability of transportation and the time away from my business makes it impossible to attend. The issues concerning shelf rockfish and boccacio are very important to all of us and I would appreciate it if you would except my testimony via this letter.

It is hard to believe that the scientific reports to this council are leading you to believe that boccacio stocks of Southern California remain at dangerously low numbers. It has done no good in the past to question the scientific method used by the biologists to arrive at their stock assessments, so I'm not going to waste time by asking you to re-evaluate their methods now. What I am asking is, please consider the possibility that the biologist's evaluations could be wrong.

My charter business depends on the shelf rockfish eight months of the year. There are many months that the migratory species are not available to target due to the natural conditions of the Southern California fishery. For twenty-six years, twenty-one of them as a U.S.C.G. licensed captain, I have been on the fishing grounds from Point Conception to the Mexican border. It is my career. Thousands of days taking the citizens of this state out to the reefs to catch their fresh fish dinners should give me some credibility. What I have experienced in the past two years is the opposite of what you are asked to believe by the biologists. The amounts and the size of not only the boccacio, but of all shelf rockfish has made for the easiest limit fishing I have seen in twenty years. My toughest task of the day is running from areas that are overloaded with boccacio, which hold the two fish per person limit.

It is my belief that the greatest contributing factor to such a radical change for what I am witnessing is, better management of the resource. As a commercial passenger boat operation I have always had strictly enforced passenger limits with the method of catching being a fishing pole, reel, line, sinker and a hook. Finally, the commercial "fish for sale" operations have had a quantity limit and gear restriction imposed upon them for shelf rockfish. When a new crewman on a commercial boat asks the captain, what is our limit?

The answer is no longer "all we can catch", "all we can hold", "all we can sell". The placing of gill nets, use of drag nets, and set lines with up to 150 hooks were too effective for such a slow growing species. Allowing these types of gear that, in some cases, did not even require the commercial vessel, captain, or crew to be present for their destructive harvest was devastating to the resource, and criminal to allow.

Continued good management of our boccacio and shelf rockfish is the answer to an eventual complete recovery and stability of this precious resource. A twelve-month emergency closure is not the necessary action to take for the continued rapid recovery that I declare witness to, and we all seek. This type of unnecessary action should be considered a reckless and spiteful blow to those of us that have always had enforced limitations set forth by this state. We have lived by all local, state, and federal regulations to maintain the privilege and pride of being a United States Coast Guard licensed and inspected passenger vessel, that engages in Sportfishing.

Sincerely,

Richard Wayne Craddick

Richard W. Craddick

Owner/Captain C.P.F.V. CHARGER

Exhibit C.2
Attachment 1
June 2002

STATUS OF BOCACCIO OFF CALIFORNIA IN 2002

by

Alec D. MacCall

Santa Cruz Laboratory
Southwest Fisheries Science Center
National Marine Fisheries Service, NOAA
110 Shaffer Road., Santa Cruz CA 95060

May 2002

ERRATA

Revised projections in bocaccio assessment (Tables on pages 15 and 16). Please replace the tables on pages 15 and 16 with the following tables:

Case	Base Model	50% Early SoCal Commercial	Unadjusted RecFIN Catch	200% Commercial in 2000, 2001
TotBiomass2002(MT age2+)	2958	2896	3367	2907
SpOut2002/Bunfished	4.8%	4.1%	5.3%	4.8%
SPRsustainable	49%	51%	51%	49%
Exploitation rate 2001	6.4%	6.5%	3.9%	7.1%
Years to Rebuild@F=0	97	103	99	97
Rebuilding OY2003 (MT)	5.8	4.9	6.4	5.3

Case	M=0.15	M=0.20	M=0.25
TotBiomass2002(MT age2+)	2820	2958	4397
SpOut2002/Bunfished	4.5%	4.8%	6.9%
SPRsustainable	39%	49%	61%
Exploitation rate 2001	6.8%	6.4%	4.9%
Years to Rebuild@F=0	64	97	257
Rebuilding OY2003 (MT)	9.8	5.8	1.5

Group Emphasis (x10)	Base Model	Central Calif	Southern Calif
TotBiomass2002(MT,2+)	2958	1695	5015
SpOut2002/Bunfished	4.8%	3.8%	7.0%
SPRsustainable	49%	47%	46%
Exploitation rate 2001	6.4%	10.6%	4.0%
Years to Rebuild@F=0	97	106	47
Rebuilding OY2003 (MT)	5.8	2.5	39.1

Group Emphasis (x10)	Base Model	Length Comp	Abundance Indexes
TotBiomass2002(MT,2+)	2958	2126	4146
SpOut2002/Bunfished	4.8%	3.2%	9.5%
SPRsustainable	49%	47%	48%
Exploitation rate 2001	6.4%	9.0%	4.5%
Years to Rebuild@F=0	97	94	77
Rebuilding OY2003 (MT)	5.8	5.2	7.9

EXECUTIVE SUMMARY

SPECIES/AREA: Bocaccio rockfish (*Sebastes paucispinis*) occurring in waters off the state of California. For management purposes, the stock may be considered to reside in U.S. waters south of Cape Mendocino. This stock assessment treats the resource in Southern and Central California as a combined unit (see unresolved problems below).

YEAR	1951	1961	1971	1976	1981	1986	1991	1996	1999	2000	2001	2002
BIOMASS (MT, 2+)	58,754	36,856	108,159	81,031	56,986	26,981	14,112	6,874	4,373	3,738	3,364	2,914
CATCH (MT)	5,119	5,079	5,478	11,825	5,742	3,172	1,757	599	213	233	215	
EXPLOITATION RATE	0.087	0.138	0.051	0.146	0.101	0.118	0.125	0.087	0.049	0.062	0.064	

CATCHES: Catches have been in severe decline for the last two decades, reflecting both a long-term decline in abundance and progressive restrictions on harvest of bocaccio. Values of catches in recent years are imprecise, for example because of undocumented discarding. In the base model of this assessment, recreational catches may have been slightly overestimated and commercial catches underestimated. Some alternative values were explored. All interpretations of total catch indicate that the 100 MT OY established by the PFMC for 2000-2002 has been exceeded.

DATA AND ASSESSMENT: The last assessment was conducted in 1999. Like the previous assessment, this assessment uses a length-based stock synthesis model. Whereas the previous assessment extended back to 1969, this assessment extends back to 1951. Data included catches from seven fisheries segments reflecting four gears and two areas (trawl, setnet, hook&line, and recreational; the latter three segments were divided into Southern and Central California areas), length compositions from eight sources (all seven fisheries segments, and the Triennial Survey), three indexes of abundance in Central California (trawl logbook CPUE, recreational CPUE, and the Triennial Survey), two indexes of abundance in Southern California (CalCOFI index of spawning abundance and recreational CPUE), and two indexes of recruitment (Central California Juvenile Rockfish Survey, and Southern California Power Plant Impingement Index).

UNRESOLVED PROBLEMS AND MAJOR UNCERTAINTIES: The relationship between stock segments in Southern and Central California is unclear, and the status and productivity in those two areas may differ. Results of area-specific models indicates that Southern California is relatively less depleted (ca. 10% of unfished abundance), and may have greater capacity for rebuilding. Central California, which appears to be more severely depleted, has a higher unfished biomass, but a lower productivity rate, suggesting a tendency to large natural fluctuations in abundance, with consequent difficulty in rebuilding the stock. Even in the combined model, the historical variability in recruitment produces a very imprecise estimate of unfished abundance (see reference points below), with similar imprecision in the rebuilding target.

REFERENCE POINTS: Population reproductive potential is measured as spawning output (units of billion eggs). Unfished abundance cannot be estimated reliably from the stock and recruitment due to lack of curvature in the relationship. An imprecise estimate of unfished spawning output of 14850 (CV=31%) was obtained by multiplying the average recruitment (1953 to 1998) by SPR(F=0). The PFMC proxy of 50% SPR is supported by the average recruitment success (recruits/spawning output), which indicates that a 49% SPR is sustainable (however, the CV is 51%).

STOCK BIOMASS: Estimated spawning output in 2002 is 720 billion eggs, or 4.8% of the estimated unfished level. The estimated 2002 total biomass (age 2+) is 2958 MT.

RECRUITMENT: The last significant recruitment appeared as age 1 fish in 1989. The following decade was remarkable for consistent recruitment failure. Although the 1999 yearclass is the strongest in several years, it now appears to be weak relative to the range of possibilities considered in the 1999 assessment.

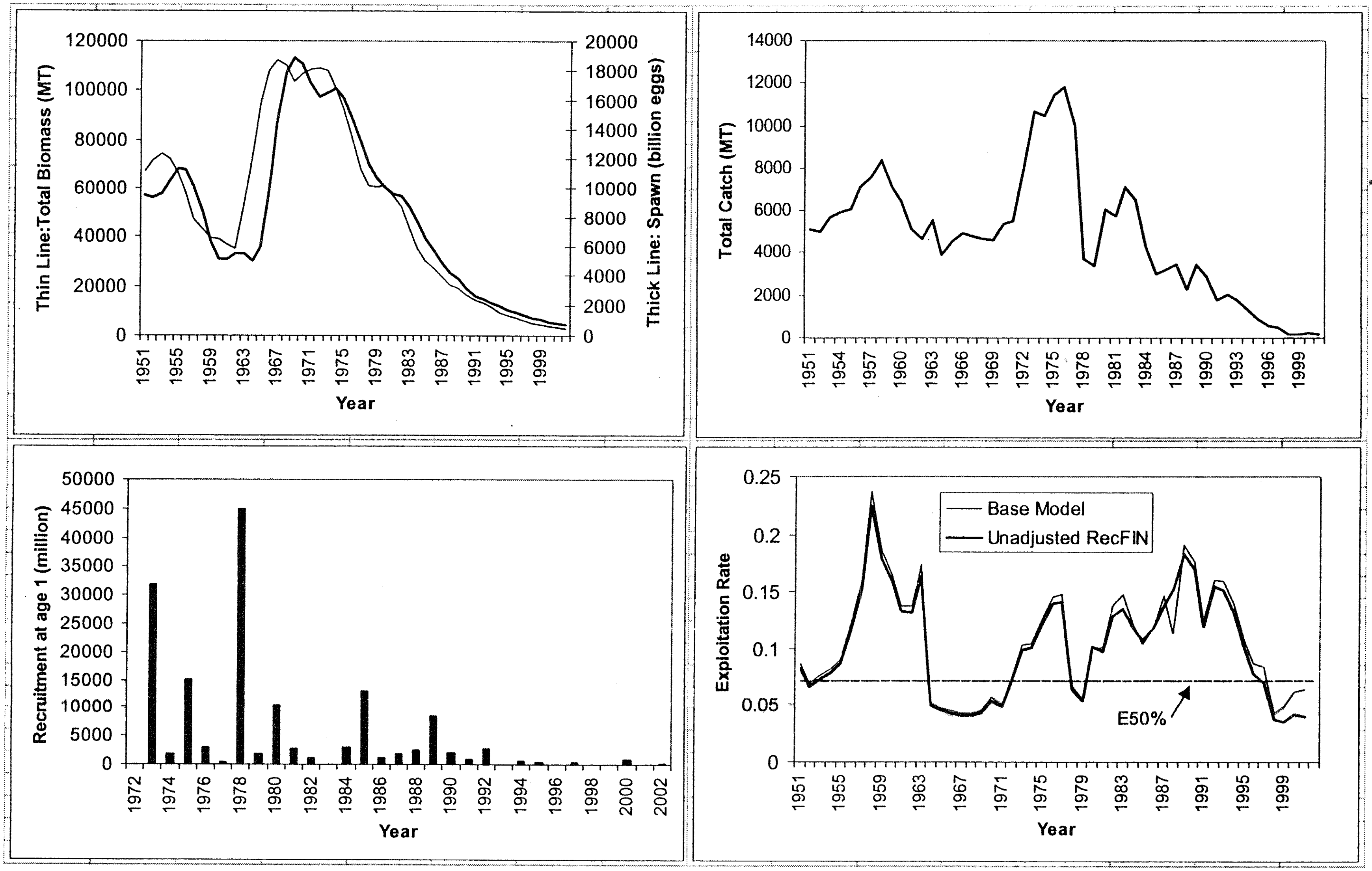
EXPLOITATION STATUS: Estimated exploitation rate (catch/total biomass age 2+) in 2001 depends on the values of catch taken by recreational and commercial fisheries (see CATCHES above). Exploitation rate in the base model was 6.4%, which is slightly below the 50%SPR level of 0.0717 used as a proxy MSY rate by the PFMC. If catches have been overestimated, the exploitation rate would be correspondingly lower.

MANAGEMENT PERFORMANCE: In hindsight, the stock has been heavily overfished during the entire period of PFMC management. Stock assessments have identified biomass as being below 25% of the unfished level since 1991, but due to mistaken confidence in the correctness of the F35% proxy, insufficient effort was made to slow the decline in abundance (note that the decline could not have been halted because of weak recruitments). Recent catches have exceeded the 100 MT rebuilding target set for 2000-2002, indicating need for re-evaluation of management measures, especially in view of the drastically reduced catch levels that are now estimated to be required for rebuilding.

FORECASTS: Spawning output will continue to decline for several years due to past recruitment failures, with no improvement being likely in the next five to ten years. Stock projections were conducted using stock synthesis and the SSC rebuilding simulation developed by Andre Punt. The projections indicate that the median time to rebuild to 40% of Bunfished is approximately 91 years in the absence of fishing. The 1999 assessment was overly optimistic due to erroneous assumptions regarding the strength of the 1999 yearclass. According to this new assessment, the 38-year rebuilding timeframe based on medium yearclass strength scenario of the 1999 assessment is not feasible even if all fishing mortality is eliminated.

RECOMMENDATIONS: A revised rebuilding analysis will be prepared. Annual catches of bocaccio must be reduced to a near-zero level. An abbreviated assessment and review in 2003 would address some data problems and help resolve the strength of the 1999 yearclass.

REFERENCES: STAR Panel Report.



Long-term patterns of bocaccio abundance, catch, recruitment and exploitation rate.

STATUS OF BOCACCIO OFF CALIFORNIA IN 2002

Introduction

Previous stock assessments (Bence and Hightower 1990, Bence and Rogers 1992, Ralston et al. 1996, MacCall et al. 1999) demonstrated that the bocaccio (*Sebastes paucispinis*) resource off California has been declining since 1969, the earliest year for which abundances could be estimated reliably. On the basis of the 1996 assessment by Ralston et al., the stock was declared formally as overfished. A rebuilding plan was implemented beginning in 2000, but formal adoption as a Groundfish Plan Amendment has been delayed. The rebuilding plan and associated Plan Amendment is expected to be revised according to the updated view of the resource developed in this assessment. Also, in January 2001 the National Marine Fisheries Service received a petition to consider listing of bocaccio under the Endangered Species Act. This stock assessment is intended to serve as one of the documents supporting the required Biological Review in response to that petition.

Two aspects of this assessment are of special significance:

1999 Year Class. The rebuilding policy adopted by the Pacific Fishery management Council (PFMC) beginning in 2000 was strongly influenced by the assumed strength of the 1999 year class which had been observed in unusual abundance at the San Onofre power plants. This year class is the first significant year class in several years, and became available to the southern California recreational fishery in 2000 and 2001. However, the 1999 year class still has not made a significant showing in Central California north of Avila/Port San Luis. Determination of the strength of the 1999 year class will help formulate the rebuilding policy.

Southern California Information. Previous bocaccio assessments were based mainly on data from Central California (especially the Triennial Survey). This assessment utilizes new information relevant to Southern California. It examines both combined assessment models and individual models for each area, and contributes to an understanding of the relationship between those two segments of the population.

History of Management

Bocaccio have long been a dominant species in groundfish catches taken off California. In 1962 and 1963, bocaccio comprised over 40% of the rockfish taken by trawling off California, and comprised well over 50% of the rockfish taken by trawl south of San Francisco (Nitsos 1965). There were few restrictions on harvest other than area closures and minimum mesh size requirements prior to federal management of the fishery.

The Pacific Fishery Management Council (PFMC) assumed management responsibility for west coast groundfish when the Groundfish Fisheries Management Plan (FMP) became effective in September 1982. For all practical purposes, full-time groundfish management by the PFMC began in 1983. The history of bocaccio management is summarized in Table 1.

The PFMC routinely adopted an acceptable biological catch (ABC) for bocaccio of 4,100 MT for the Monterey INPFC area and 2,000 MT for the Conception area from 1983 through 1990. Landings in other areas were considered too small to warrant a separate ABC. These ABC's were based solely on historical landings during selected periods.

In response to concerns about bocaccio stock conditions, an assessment was conducted in 1990 (Bence and Hightower, 1990). The results of that assessment were used by the PFMC to establish an 800 MT ABC for the combined Conception-Monterey-Eureka INPFC areas for 1991. The PFMC, after hearing public testimony, established a harvest guideline of 1,100 MT for those INPFC areas. The ABC and harvest guideline applied to all gears and include the recreational fishery. The same ABC and harvest guideline were in effect through 1992. During those two years, actual harvest exceeded the harvest guideline by 300-500 tons.

In 1992, the PFMC reviewed a new assessment for bocaccio (Bence and Rogers, 1992). That assessment stated, "...under current harvesting rates, although fishing mortality is estimated to be below F35%, the expected stock biomass and spawning capacity is projected to decline further, and possibly fall to less than 20% of the levels seen in 1980....we recommend harvesting at the current harvest guideline [1100 MT]." Nonetheless, the PFMC adhered strictly to its F35% policy and recommended that the 1993 ABC be increased to 1,540 MT and that the harvest guideline be set equal to the ABC in the same INPFC areas. The new assessment accommodated some expected discard in the trawl and set net fisheries that often fished to the trip limits. By 1994 the Council had determined that few trips were being impacted by trip limits and the reduction to account for discard was unnecessary. Therefore, the 1,540 MT ABC and harvest guideline, in effect since 1993, were adjusted to 1,700 MT for 1995 and was extended through 1996. Actual landings fell short of these ABC levels and declined so rapidly that even an 1100 MT harvest guideline would have had little effect.

A stock assessment conducted in 1996 (Ralston et al., 1996) showed the resource to be in severe decline, and the PFMC drastically reduced the ABC to 265 MT in 1997, and to 230 MT with adoption of an F40% policy in 1998 and 1999. Moreover, the long string of recruitment failures during the 1990's continued. In 1999, the stock was formally designated as "overfished" according to the requirements of the newly amended MSFCMA and the Overfished/Rebuilding Threshold for groundfish adopted by the PFMC in Groundfish FMP Amendment 11. The incoming 1999 year class appeared to be relatively strong, helping to buffer the catch restrictions needed to accomplish rebuilding. The rebuilding policy adopted by the PFMC held the rebuilding OY constant at 100 MT for the years 2000-2002, with the intention of switching to a constant fishing rate policy beginning in 2003.

During the 1983-1990 period bocaccio were managed in combination with other rockfish in the Sebastes complex. Trip and frequency limits were used to constrain total complex landings only. After 1990, various bocaccio trip limits were used to keep total commercial landings within established harvest guidelines. These limits have been specific to the area south of Cape Mendocino and remain nested within overall Sebastes complex limits. Constraints on the recreational take of bocaccio were limited to daily bag limits for combined rockfish. Beginning in 2001, a two-fish daily bag limit was imposed for bocaccio, and time-area closures were implemented in 2002 to reduce the recreational catch of bocaccio.

Life History

In most respects bocaccio is typical of other rockfishes. It displays a primitive form of viviparity (Wourms, 1991), with 50% of females maturing by 48 cm FL (Gunderson *et al.*, 1980). Fish copulate early in the fall (Moser, 1967), although fertilization is delayed (Wyllie Echeverria, 1987). Embryonic development takes at least a month to complete and the larvae hatch internally (Moser, 1967). The total fecundity of bocaccio ranges from 250,000-2,500,000 larvae, resulting in weight-specific fecundities of 250-400 larvae/gm (Phillips, 1964). Parturition occurs during the winter months (Wyllie Echeverria, 1987) and larvae eventually metamorphose into pelagic juveniles (Moser and Boehlert, 1991), a stage that takes months to complete (Woodbury and Ralston, 1991). Settlement to littoral and demersal habitats begins in late spring and extends throughout the summer months. Even though subadult growth can be very rapid in absolute terms (24 cm at age I), adults grow slowly (Wilkins, 1980). Moreover, growth is sexually dimorphic, with females reaching larger sizes than males (ca. 90 versus 75 cm). The diet of bocaccio is primarily fish.

New Aspects of this Assessment

The following list highlights the major changes that have been implemented here relative to the last assessment that was conducted on bocaccio (MacCall et al., 1999):

– Separate stock assessments are considered for waters north and south of Pt. Conception (but the final model combines the two areas).

– The beginning of the estimated time series of abundances is 18 years earlier than in previous assessments (previously 1969, now 1951).

– Commercial landings have been re-estimated from port sampling data, and the years 1978 and 1979 have been added.

– Recreational landings have been re-estimated from the MRFSS database, replacing blank strata (formerly treated as zero catch) with estimated catches. Northern California partyboat landings and length compositions are from the CDF&G sampling program, and also fill in recreational fishing information for years 1990-92 in which MRFSS did not conduct sampling.

– Many of the indexes were produced by a delta-lognormal general linear model (GLM), avoiding the potential distortions caused by adding an arbitrary constant before taking logarithms of values. Precision of indexes was estimated by a grouped jacknife approach.

– The Triennial Survey index of abundance and length compositions have been recalculated with off-bottom "water hauls" omitted. This affects abundance estimates and size compositions for the earlier years. The index is based on a GLM.

– New indexes of spawning biomass are based on GLMs of revised CalCOFI larval abundances for Southern California and Central California, from 1951 to 2000 in Southern California, and from 1955 to 2000 in Central California.

– A new Central California partyboat recreational CPUE index (GLM based on CDF&G observers) from 1987 to 1998 is introduced.

– A Southern California recreational CPUE index (GLM, based on MRFSS) from 1980 to 2001 is introduced.

– A recruitment index based on a GLM of impingement rates at five Southern California power plants from 1972 to 2000 is introduced.

Stock Structure

Previous assessments of bocaccio included the Conception, Monterey and Eureka INPFC areas, mainly as a matter of convenience. Although catches of bocaccio occur regularly to the north, especially off Cape Flattery and in Canadian waters, very little northern information is available for purposes of stock assessment. At the time of the 1999 assessment, genetic information indicated lack of intermixing between the fish off the Pacific Northwest and the fish off California. More recent work indicates a somewhat higher possibility of intermixing (Vetter, pers. comm., SWFSC, La Jolla). Historical surveys reported in the 1999 assessment indicated a consistent lack of bocaccio off Northern California and Southern Oregon, which is interpreted as a discontinuity between the Pacific Northwest fish and those off California. For management purposes, the stock off California is considered to be separate and independent of the stock off the Pacific Northwest. Bocaccio off Northern Baja California are presumably associated with the California stock, but no information on catches is available. CalCOFI larval abundances are available for some years during the 1970's and 1980's, but were not worked up for this assessment.

An important unresolved question is the relationship between the Southern California and Central California segments of the resource (the nominal dividing line is Pt. Conception). Current management treats these two areas as a single well-mixed unit. Although a fully developed migration model is not available, this stock assessment uses available tools to examine consequences of partial stock separation.

Sources of Data and Model Setup

Landings Statistics

Landings by major fishery segments are summarized in Table 1. The total landings are taken from standard sources, or are estimated from available limited information (especially pre-1980). In some cases, such as recent recreational estimates, landings estimates may be subject to controversy, and alternative values can be obtained by various estimation methods and from alternative data sources. The recreational landings used here are not identical to the official RecFIN estimates (some blanks were filled with estimates if catch in number of fish was available, and some zero catch estimates were replaced with positive estimates). A sensitivity analysis using the unaltered RecFIN landings is included later in the document.

Early landings: Estimated landings for the pre-monitoring period follows the estimates developed in the 1996 assessment, except that this assessment requires historical catches for southern and central California separately. The estimated statewide bocaccio commercial landings were apportioned north and south of Pt. Conception according to the corresponding fractions of the recorded rockfish landings reported in CDF&G Fish Bulletins. In Central California, catch by gear was apportioned as in the 1996 assessment. Southern California trawl landing prior to 1978 were assumed to be negligible, and the commercial catch was assumed to be from the hook and line fishery. Pre-monitoring recreational catches were similarly apportioned to Southern and Central California in proportion to the partyboat landings for those two areas reported in CDF&G Fish Bulletins.

Post-1978 monitoring: In previous assessments, statistics of monitored landings began in 1980, but the database now includes commercial landings for 1978 and partial data for 1979. California's port sampling methodology is based on the statistical methodology of Sen (1986). The expansions of the sampled landings and length frequencies to the estimated statewide landings are described by Pearson and Erwin (1997), and reside in the COMCAL database maintained at the Santa Cruz Laboratory. The expansions have been recalculated since the previous assessment, resulting in a somewhat different time series of landings. Use of nominal landings categories, i.e., "bocaccio-chilipepper" received greater emphasis in the new expansions.

Changes in the recreational catch estimates from the MRFSS database mainly reflect the replacement of blank values (treated as zero in conventional queries) with approximate values. If a catch in numbers is available for the wave, region and fishing mode, the numbers are multiplied by the average weights in the preceding and following wave. If only estimated trips are available, the angler trips is multiplied by the average catch per trip in the preceding and following wave. Estimates for the 1993-95 Central California partyboat catch are not available from MRFSS; values were provided by Deb Wilson-Vandenberg (CDF&G, Pers. Comm.) based on the CDF&G partyboat monitoring program. Catches for the unsampled recreational segments in the1993-95 period were estimated as a linear trend between adjacent known values.

The combined effect on the estimated statewide landings (MT) by individual fishery segments is summarized for the period 1980 to 1998 in the following table:

	Differences from 1999 Assessment							Revised
Years	Trawl	SetNet	H&L	Rec'l	Com'l	Total	% Change	Total Landings
1980-84	-15	541	-59	-275	468	193	0.7%	29626
1985-89	121	2801	-359	112	2563	2674	21.1%	15343
1990-94	-81	840	198	377	957	1334	15.8%	9781
1995-98	5	93	-4	65	94	159	7.9%	2167
Total	30	4276	-225	279	4081	4360	8.3%	56917

Surveys and Abundance Indexes

Methodological Note on Delta-Lognormal GLMs and Jacknife Procedures: The previous assessment used GLMs based on log-transformed observations ln(OBS + c) where c is a small constant. This approach has the drawback that the resulting indexes are influenced by the value of c, the value of which is arbitrary. Several of the following indexes were developed from a delta-lognormal GLM, which allows estimation of a multiplicative effects (log-additive) model without use of the arbitrary added constant.

The probability of observing a positive value in a cell is given by a GLM with marginal (i.e., year, location, month) probabilities,

$$P(\text{positive})_{ijk} = PYEAR_i * PMONTH_j * PLOCATION_k * \text{error}.$$

The marginal probabilities are fit under logit transform. A separate GLM is applied to logarithms of the positive observations only, generating another set of marginal effects:

$$\ln(\text{CELL VALUE})_{ijk} = LYEAR_i + LMONTH_j + LLOCATION_k + \text{error}.$$

The year indexes from the delta-lognormal GLM are the product of the two back-transformed marginal year effects. Back-transformation from the logit model is

$$PYEAR_i = \exp(y_i+y_o)/(1+\exp(y_i+y_o))$$

where y_i is the year effect and y_o is the fitted constant under logit transformation. The back-transform of estimated marginal year effects (x_i) from the second GLM for positive values is simply its exponentiated value, so the year index is given by

$$\text{Year Index}_i = PYEAR_i*\exp(LYEAR_i)\ .$$

The fitted constant from the second (logarithmic) model component and the traditional bias correction are omitted because they have no effect on the utility of the output as an index.

Estimation of standard errors of the year indexes utilizes resampling methodology. Erik Williams (pers. comm. SEFSC, Beaufort) has designed a bootstrapping procedure, but that approach seems to encounter estimation problems if the data contain a high proportion of zero values. A simple alternative is to use a grouped jackknife procedure (Efron and Gong 1983), where the variance is estimated by

$$s^2(\theta) = ((N_{groups}-1)/N_{groups}))\Sigma w_i(\theta_i-\theta\bullet)^2$$

where N_{groups} is the number of sets of observations to be deleted, w_i is a weighting factor based on group sample size given to each subset (the values of w_i have unit mean), θ_i is the estimate of parameter θ with the ith subset of observations deleted, and $\theta\bullet$ is the mean of the N_{groups} different values of θ_i. The estimated standard error (SE) is the square root of this estimated variance, and the estimated coefficient of variation (CV) is the ratio of the SE to the estimated parameter value.

CalCOFI Indexes of Spawning Biomass: Abundances of larval bocaccio observed on CalCOFI surveys from 1951 to 2000 (Moser et al. 2000) provide indexes of historical spawning biomass for Southern California and Central California. Development of these two indexes is described separately. In both indexes, jacknifing used five groups of deleted stations, chosen to be widely distributed geographically.

Southern California CalCOFI Index: Years with very limited coverage (less than 50 samples) were deleted, leaving 37 years with sufficient data to calculate annual indexes of abundance. Observations from December through April were used, based on consistency of station occupations and positive occurrences. CalCOFI Lines 80 (off Pt. Conception) to 93 (off San Diego) were included in the Southern California index. Offshore stations with rare occurrences of bocaccio larvae were deleted, leaving a total of 39 standard stations. Of the 7215 (37 years x 39 stations x 5 months) cells in this design, there were 3726 observations, 907 of which were positive for bocaccio larvae. These data were fit by a delta-lognormal GLM, estimating year effects (Figure 1), station (location) effects, and month effects. Five jackknife groups were formed from groups of stations chosen to cover the north-south and inshore-offshore range, with approximately equal numbers of observations, and so that no station contained all zero observations within a group. CVs ranged from 20-30% in the early years to 50-80% in recent years due to the progressively rarer occurrence of bocaccio larvae (Figure 1).

Central California CalCOFI Index: Bocaccio larvae from CalCOFI Lines 60 (off San Francisco) to 73 (off Piedras Blancas) Conception have only been identified thoroughly since 1972, and were rarely occupied after 1984. However, Line 77 (off Avila) has been identified since 1954, and continued to be occupied through 2000. Year effects from GLMs using Line 77 only and using Lines 60 to 73 are similar for the years 1972-1984, indicating that Line 77 is sufficiently representative of Central California to extend the time series from 1954 to 2000. Numbers of positive stations are so few (especially in more recent years) that years were combined into nominal years to produce estimates that could be jackknifed for estimation of standard errors. The combined years (and corresponding nominal years) are

1962=61+62
1959=58+59
1966=65+66
1979=1978+1979
1981=1980+1981+1982
1984=1983+1984+1985
1987=1986+1987+1988
1990=1989+1990+1991
1995=1992+1993+1994+1995+1996+1997+1998
2000=1999+2000.

Only the three peak reproductive months of January, February and March, and 26 CalCOFI stations were used. The final design comprised 1404 cells (18 years * 26 stations * 3 months) in which there were 568 observations and 154 positive observations.

As was done for Southern California, these data were fit by a delta-lognormal GLM, estimating year, station (location), and month effects. Five jackknife groups were formed from groups of stations chosen to cover the north-south and inshore-offshore range, with approximately equal numbers of observations, and so that no station contained all zero observations within a group. CVs for the Central California Index are much larger than for Southern California and average well over 100%. The most precise estimates are from 1960 to 1972 (average CV approximately 50%), a period during which bocaccio appear to have been significantly less abundant than in the following decade (Figure 2).

The Central California CalCOFI Index was used only in the exploratory Central California model, and was not used in the final combined model.

CalCOFI Index Selectivity: Although the Stock Synthesis program computes spawning biomass (or spawning output), it does not include an option for fitting a spawning biomass index directly. An approximate selectivity curve was derived by fitting a logistic model to the relationship of weight specific fecundity (proportion mature * eggs/weight) and length (Figure 3). This selectivity curve was applied to the female abundances to obtain predicted values of the CalCOFI indexes.

***Triennial Survey Index* (Central California):** The Alaska Fisheries Science Center has conducted bottom trawl surveys every three years off the west coast since 1977, with the most recent survey in 2001. The Monterey INPFC area was sampled on every survey, but the Conception area was not sampled on the 1980, 1983 and 1986 surveys. The 1977 survey did not sample the 55-91m depth range, but Ralston et al (1996) showed that very few bocaccio tend to be encountered in this range, so no attempt is made in this assessment to adjust the 1977 index for this small difference. Recent analysis of historical Triennial Survey trawl performance identified a problem with the extent of bottom contact by the net during the early years of the survey (Zimmerman et al. 2001). The questionable trawl samples have been deleted from the Triennial Survey data used in this analysis (pers. comm., Mark Wilkins, AFSC).

I used a simple log-transformed GLM to obtain bocaccio abundance indexes from the triennial survey stratum means; the GLM treatment provided a means of estimating the index despite the Conception region not having been surveyed in some years. Factors were survey year, area (Conception vs. Monterey), and depth stratum (nearshore, 55-183m, vs. and offshore, 184-366m). Values from the Eureka INPFC area were not included, as bocaccio were too rare in the catches to be informative. The coefficient of variation of the GLM index was assumed to be the same as the directly-calculated CV for the combined strata. The resulting index was imprecise, with CVs ranging from 30% to 80% (Figure 4).

Recreational Fishery CPUE: Two separate indexes of abundance were developed from GLM treatment of catch rates of bocaccio in recreational fisheries.

<u>Central California Partyboat CPUE:</u> The California Department of Fish and Game has conducted intensive sampling of partyboat catches in Central California (Deb Wilson-Vandenberg, Pers. Comm.), providing a basis for a CPUE index. The GLM was based on year (1987 through 1998), quarter (4) and boat (29) effects. Boat effects were a surrogate for location effects, and boats with low catch rates or short-term participation were deleted. The database contained 3632 observations, of which 1336 were positive for bocaccio. Quarters were used as groups for deletion in the jackknife procedure. Except for the1987 index, precision was good, with CVs ranging from about 10% to 25% (Figure 5).

<u>Southern California Recreational CPUE:</u> The MRFSS database provides a basis for estimating a Southern California partyboat CPUE. The GLM was based on bimonthly mean catch per angler according to year (1980-1989, 1993-2001), season (4 bimonthly sampling waves excluding the summer season, i.e., November through June), and fishing mode (partyboat vs. private). Sampling waves were used as groups for deletion in the jackknife procedure. Most of the CVs were in the 30%-50% range, with a few larger or smaller values (Figure 6).

Trawl Fishery CPUE **(<u>Central California</u>):** Ralston (1999) developed a CPUE index of bocaccio abundance based on California trawl logbooks (Figure 7). Because the logbooks do not identify most individual species such as bocaccio, Ralston applied species compositions from local port sampling to the overall catch rates of rockfish from the trawl logbooks. This assessment uses Ralston's "area-weighted" index of bocaccio CPUE, and the associated standard errors (average CV is 29%).

Recruitment Indexes: Two separate recruitment indexes were developed, for Central and Southern California respectively.

Trawl Survey Recruitment Index (Central California): Midwater trawl surveys for juvenile rockfish have been conducted by the Santa Cruz Laboratory in May-June of each year since 1983. The survey region from Monterey to Pt. Reyes is divided into seven geographic strata, with three to five standard trawl locations within each stratum. The geographic area is surveyed three times ("sweeps"). In each year, the two sweeps that encountered the largest number of juvenile bocaccio in all areas combined were retained for use in the GLM (in a few cases of approximately equal catch rates, all three sweeps were retained). All trawls conducted in the same region and year were considered to be equivalent iid observations, yielding 745 observations, of which 171 were positive for bocaccio juveniles. The GLM was based on year and region effects (Figure 8). Three groups of individual trawl stations within the geographic strata were used for deletion in the jacknife procedure. Estimated CVs were quite variable with individual year effects ranging from very precise (ca. 10%) to very imprecise (over 100%).

Power Plant Recruitment Index (Southern California): Annual impingement rates (bocaccio per volume of intake water) at five Southern California electrical generating stations (Kevin Herbinson, pers. comm., Southern California Edison) from 1972 to 2000 form the basis of a recruitment index. These data were fit by a delta-lognormal GLM, estimating year (recruitment index) and station (location) effects. Observations from the three separate units at San Onofre were given fractional weightings summing to unity at that location for each year. Standard errors for the year effects were estimated by a grouped jacknife, deleting individual power plants (Ngroups=5). The only years in which no bocaccio were impinged at any location were the two El Niño years of 1983 and 1998. In three other years (1982, 1993 and 1994) bocaccio were impinged at only one location, preventing jackknife estimates of precision of those years; approximate standard errors for these five recruitment index values were inferred from the approximately linear relationship between standard error and corresponding year index near the origin (Figure 9). The coefficients of variation average about 2, indicating extreme imprecision in this index.

The strength of the1999 year class has been of particular interest since it was first observed in the power plant entrainments at San Onofre. This database shows that the 1999 year class was observed at only two of the five locations, and was abundant only at San Onofre. The corresponding 1999 index value is extremely imprecise (CV=600%), but is more similar to the "low" (1991 year class equivalent strength) than to the "medium" (1988 year class equivalent strength) case considered in the 1999 assessment and rebuilding analysis.

Age Determinations

The break-and-burn method of age determination from otolith circuli is considered to be more reliable than surface readings, and tends to result in older age determinations (pers. comm., Don Pearson, SCL, SWFSC). However, Ralston et al. (1996) and Ralston and Ianelli (1998) found that use of the age composition information for bocaccio conflicted with length composition information, and caused peculiar shifts in the years associated with major bocaccio recruitments. The true year of recruitment is clearly established by known length of young-of-the-year fish and clear modal patterns in the length compositions (Figure 10). The results of the previous assessment indicate that an unknown but probably systematic pattern of errors in the age determinations is present, and the age composition information provides misleading information. Age compositions are not used in this assessment, but break-and-burn age determinations are assumed to be approximately correct for purposes of estimating length-at-age and maximum longevity.

Sample Sizes

Determination of appropriate sample sizes has been a recurring problem in maximum likelihood models such as stock synthesis. Catch and survey samples are taken as clusters of fish, and several mechanisms can cause within-cluster variance to be severely reduced relative to an equivalent number of iid samples. An empirical estimate of "effective" sample size (N_{eff})is provided by the synthesis model, based on the ratio of the variance of the expected proportion (p) from a multinomial distribution to the mean squared error of the observed proportion (p'), i.e., $N_{eff} = \text{sum}[p(1-p)]/\text{sum}[(p-p')^2]$. Rather than direct use of N_{eff} (e.g., McAllister and Ianelli, 1997), this assessment follows the iterative regression "smoothing" approach developed in the 1999 bocaccio assessment: actual sample sizes are replaced by nominal sample sizes based on the predicted effective sample sizes from a regression of N_{eff} on actual number of fish measured (actual sample size is used if it is a smaller number than is predicted by the regression). After the first iteration the effective sample size values from the regression predictions tend to be stable. The relationships between actual and effective sample sizes are shown for various sources in Figure 11. The ratios of nominal to actual and effective (based on the final model) to actual sample sizes is given in Table 4. The nominal sample sizes used in this assessment are higher than final effective sample sizes because the nominal sizes were derived from separate Southern and Central California models in which length compositions could be fit more precisely than in the combined model. Because the fits in the separate models were better, the quantity $\text{sum}[(p-p')^2]$ was lower, producing higher estimated effective sample sizes than are given by the combined model.

Natural Mortality Rate

Previous estimates of the natural mortality rate (M) have decreased over the history of bocaccio stock assessments, partially due to improvements in age determination methods and resulting increases in maximum observed ages: Bence and Hightower (1990) used 0.25, Bence and Rogers (1992) used 0.20, and in 1996, Ralston et al. used 0.15 (the units yr^{-1} are omitted). In 1999, MacCall et al. returned to use of 0.20. This assessment assumes M=0.2, but examines implications of the alternative values of 0.15 and 0.25.

Growth

This assessment is based on length compositions rather than age compositions, and the growth curve has nearly as large an influence as the natural mortality rate in determining the stock dynamics. The influence of abundant small fish in some years of the Triennial Survey length compositions tended to "trap" the estimated length at age 1.5 at an unrealistically small value (abundance, length and selectivity were confounded), so the initial (age 1.5) length was fixed at 27cm for both sexes, and the asymptotic length was fixed at 75.89cm for females and at 65.56cm for males. The growth rate parameter was estimated freely for each sex.

Model Results

The calculations utilize the length-based version of the Stock Synthesis model (Methot 1990). During model development, separate models were constructed for Southern and Central California. However, the STAR Panel preferred a final assessment model using combined data for both areas. The results presented here are for the combined model (Table 4 and Appendix 1). The projections are based on either the stock synthesis program with separate selectivity patterns for each fishery or Andre Punt's rebuilding simulation model, using the composite selectivity pattern given in Appendix 1 (see section on Stock Projections for more details).

Selectivity: Length-based selectivity patterns were examined in the 1996 and 1999 assessments. Because of potential interactions with isolated strong year classes, time-varying selectivity was not considered. As in the previous assessments, most selectivity patterns have a strong descending limb. In previous assessments, male-female differences were seen only in the trawl selectivities; this assessment found no sex-related difference in the Central California trawl selectivities. Trawl size compositions from the Southern California fishery were available only for two years, and produced highly questionable selectivity curves with a very narrow peak. Consequently, the Southern California trawl length compositions were deleted from the likelihood function, and selectivity of the Central California trawl fishery was also applied to trawl catches from Southern California. The is no clear systematic relationship between selectivity curves of equivalent gears in Central and Southern California (Figure 12).

Fits to abundance indexes: The fit to the Triennial Survey (Figure 13) reflects the high error variability shown in Figure 4; a precise fit should not be expected. In addition, the model had difficulty identifying an appropriate selectivity curve for the length composition information from the Triennial Survey; the final selectivity curve favors smaller fish (Figure 12). Fits to the trawl CPUE (Figure 14) and Central and Southern California recreational CPUE (Figures 15 and 16) are good.

The fit to the Central California recruitment index is similar to that seen in the previous assessment (Figure 17). The survey identifies some, but not all of the stronger year classes. The fit to the Southern California recruitment index similarly shows general agreement (Figure 18), but with some strong differences for individual years. This is expected, given the imprecision of the Southern California recruitment index.

Recruitment

Minimum recruitment was set at 50,000 fish. Recruitment estimates for several of the weakest years, especially El Niño years, were constrained by this bound. The model did not include a likelihood component for the fit to a stock-recruitment relationship. Recruitment estimates for the 1950's and 1960's are not based on length compositions, so are not reliable for date, but only for magnitude when averaged over decadal time scales. As has been seen in previous assessments, recruitment is irregular (Figure 19). The stock-recruitment relationship (Figure 20) suggest that larger recruitments have been associated with higher abundances, but shows no curvature. The relative reproductive success (measured by the logarithm of recruits per spawning output) is level over the range of spawning abundances (Figure 21), indicating that the recent history of bocaccio reproduction shows no evidence of density dependent compensation. In the 30 year history shown in Figure 21, recruitment exceeded the replacement level in only eight years. The most recent successful reproduction was in 1999, which is the leftmost point above the horizontal replacement line. The CV on the estimated strength of the 1999 yearclass is estimated to be approximately 78% based on treating estimates obtained by omitting individual likelihood components (see the sensitivity analysis of component emphasis, documented below) as a grouped jacknife.

The history of recruitments and parental abundances provides the basis for estimating an approximate sustainable fishing rate. The 41-year average recruitment per spawning output was 1.466. The spawning output per recruit (SPR) at F=0 is 1.379. A fishing rate that reduces SPR to 1/1.466 = 0.682 or 49% should be sustainable. Thus, the F50% proxy being used by the PFMC to manage rockfish stocks is sustainable for bocaccio. This calculation does not indicate whether F50% would produce MSY, however.

Abundance

The trend of abundances after 1969 (the initial year in the previous assessment) resembles those from previous stock assessments except that the size of the resource is now estimated to have been about 50% larger (Figure 22). Extension of the assessment back to 1951 reveals that abundances were lower in the two decades preceding the 1969 peak, and shows the fluctuating pattern that would be expected from dynamics based on rare large recruitments. The spawning output lags the total biomass by a few years, reflecting the time to maturity. The unfished abundance (Bunfished) is estimated based on the average recruitment from 1955 to 1995 multiplied by the spawning output per recruit in the absence of fishing, giving an estimated unfished spawning output of 14850 million eggs (shown as a horizontal line in Figure 22). This estimate is very imprecise (CV=31%) due to the extreme variability of recruitment. The current (2002) spawning output is estimated to be 720 million eggs, or 4.8% of the estimated unfished level, and the estimated current total (age 2+) biomass is 2958MT.

Fishing rate time series: Figure 23 shows the history of exploitation rate (catch as a fraction of total (age 2+) biomass. Exploitation rates have exceeded F50% in most years since 1951.

Sensitivity Analysis

Random restarts: Convergence properties of the base model are demonstrated by varying the starting parameters by plus-or-minus 30%, and re-estimating the maximum likelihood fit. The result of this procedure (Figure 24) indicates good convergence of the model.

Retrospective analysis: Some forms of bias can be detected by simulating a time series of model estimates with progressively earlier final years of the analysis (note that the GLM indexes of abundance were not recomputed). The retrospective pattern of the bocaccio assessment shows no bias, but does show an irregular effect due to the Triennial Survey data that contributes a new data point only every third year (Figure 25).

Effect of alternative catch data: The estimates of bocaccio catch used as data in this assessment are a major source of uncertainty. Catches for the pre-1978 years are approximations based on very limited information. Catches in the most recent years pose a different problem. Commercial landings do not include the portion of the catch that was discarded at sea, and anecdotal information suggests that discards have been increased substantially in 2000 and 2001 due to the restrictive limit on landings. Recreational catch have become imprecise, with an increasing number of two-month waves in which no bocaccio are estimated to have been landed by recreational fishery segments. This seems questionable in view of frequent complaints by recreational fishermen and partyboat operators that bocaccio are abundant and impossible to avoid.

Results of some alternative catch scenarios relative to the base model are examined in the following table. Following the base model, the first case represents a pre-1978 catch history where Southern California catches are half the values used in the base model (recreational and Central California commercial catches are considered to be more reliable). The second case uses the RecFIN data from 1980 to present without adjustment for unsampled waves or zero catch estimates. The third case assumes that commercial catches in 2000 and 2001 have been twice the reported landings due to at-sea discards.

Case	Base Model	50% Early SoCal Commercial	Unadjusted RecFIN Catch	200% Commercial in 2000, 2001
TotBiomass2002(MT age2+)	2958	2896	3367	2907
SpOut2002/Bunfished	4.8%	4.1%	5.3%	4.8%
SPRsustainable	49%	51%	51%	49%
Exploitation rate 2001	6.4%	6.5%	3.9%	7.1%
Years to Rebuild@F=0	91	92	90	92
Rebuilding OY2003 (MT)	1.8	0.0	0.3	2.3

The alternative catch scenarios do not alter the model results substantially. Use of the alternative recent catches result in similar estimates of current relative abundance, and do not indicate substantially different rebuilding scenarios. The smaller historical Southern California catch results in a lower estimate of Bunfished, but that is offset by a slightly lower productivity rate. The RecFIN catches indicate a lower current exploitation rate (consistent with lower current catch), but the 2001 data were incomplete (lacking wave 6) at the time of model development. It is likely that the base model overestimates recent recreational catches and underestimates recent commercial catches; however, the results are influenced mainly by the magnitude of combined removals, irrespective of fishery segment.

Effect of alternative natural mortality rates: The natural mortality rate of bocaccio is not known, and use of M=0.20 in the base model is based on convention rather than on knowledge of the true rate. To examine this source of uncertainty, the population model was run at two alternative natural mortality rates, M=0.15 and 0.25, which are thought to bracket the likely range of true values. Results are shown in the following table.

Case	M=0.15	M=0.20	M=0.25
TotBiomass2002(MT age2+)	2820	2958	4397
SpOut2002/Bunfished	4.5%	4.8%	6.9%
SPRsustainable	39%	49%	61%
Exploitation rate 2001	6.8%	6.4%	4.9%
Years to Rebuild@F=0	65	91	Not feasible
Rebuilding OY2003 (MT)	11.5	1.8	0

Models based on the three alternative natural mortality rates roughly agree on the present level of depletion relative to estimated unfished conditions. Use of a higher natural mortality rate results in generally higher estimated biomasses and recruitments throughout the time series, but the relative decline indicates lower per capita productivity. Use of M=0.15 yields an average recruit per spawner ratio that implies sustainability at a higher fishing rate, whereas use of M=0.25 would indicate a sustainable fishing rate that is lower than the current proxy of F50%. The differences in productivity are most noticeable in the projected median rebuilding times: Whereas the M=0.15 case indicates a more rapid rebuilding trajectory and a sightly higher rebuilding OY, the M=0.25 case achieves no substantial rebuilding even at 150 yr.

Effect of alternative emphasis values: Emphasis was set at 1.0 for all likelihood components in the base model so that the likelihood function and model properties can be given standard statistical interpretation. In this sensitivity analysis, emphasis factors for likelihood component groups were set individually at 0.1 or 10.0 to determine how the interactions among the components influence the final model (Table 5). Model results are unusually stable with regard to changes in emphasis, perhaps partially as a result of having a wide variety of separate data sources. The main pattern in Table 5 is that the Southern California components tend to raise the ending biomass estimate (and the status relative to the unfished level), suggesting that the resource may less depressed in Southern California relative to the condition in Central California.

Alternative emphases on groups of components are alsi informative. The difference between relative condition of the resource in Central and Southern California is clear in the results of the respective group emphases. Also, the Southern California components indicate a potential for more rapid attainment of the rebuilding target. [IMPORTANT NOTE: This does not mean that a separate Southern California rebuilding OY of 41.6 MT is a viable management option–the results in Table 6 are based on combined catch data for both areas and cannot be separated in this model.]

Group Emphasis (x10)	Base Model	Central Calif	Southern Calif
TotBiomass2002(MT,2+)	2958	1695	5015
SpOut2002/Bunfished	4.8%	3.8%	7.0%
SPRsustainable	49%	47%	46%
Exploitation rate 2001	6.4%	10.6%	4.0%
Years to Rebuild@F=0	91	101	48
Rebuilding OY2003 (MT)	1.8	1.7	41.6

There is similar contrast between the model results emphasizing surveys and abundance indexes vs. the model emphasizing length compositions, with the length compositions tending to indicate a more depleted resource. However, in this case the difference in current status does not result in a difference in median rebuilding time.

Group Emphasis (x10)	Base Model	Length Comp	Abundance Indexes
TotBiomass2002(MT,2+)	2958	2126	4146
SpOut2002/Bunfished	4.8%	3.2%	9.5%
SPRsustainable	49%	47%	48%
Exploitation rate 2001	6.4%	9.0%	4.5%
Years to Rebuild@F=0	91	92	74
Rebuilding OY2003 (MT)	1.8	4.5	5.7

Stock Projections

The stock projections presented in this analysis utilize both stock synthesis (sample size = 100 simulations) and the rebuilding simulation developed by Andre Punt for the SSC (sample size = 10,000 simulations). Strength of future model recruitments is based on randomly resampling the historical reproductive success(recruits per spawning output, R/S) from recruitment (age 1) years 1954 to 2000, and multiplying by the parental spawning output for the year being simulated.

As shown in Figure 21, the mean and distribution of R/S values have been invariant with stock abundance, justifying this approach. The resulting projections are very imprecise. Spawning success has exceeded replacement level (the condition necessary for population growth) in relatively few historical years (Figure 21),

Long-term projections: In the absence of fishing, the median time to reach the rebuilding target spawning output of 5935 million eggs is 91 (SE= 3) years. The rebuilding target of 0.4*Bunfished is imprecisely estimated, with a 50% probability that the true value lies between 4700 and 7200 million eggs. Based on stock synthesis projections, this range of rebuilding targets translates to rebuilding times of 82 to 97 years. The distribution of projected abundances after 100 years without fishing is shown in Figure 26 (this projection is from stock synthesis).

If the rebuilding time frame is extended by one mean generation time (12 yr), less the 3 years already elapsed, the new rebuilding horizon is 99 yr. (Note that the version of the rebuilding simulation used here assumes Tmax is 98 years because it treats 1999 as year 1 of the rebuilding period, rather than as year 0. The appropriate correction for elapsed rebuilding time needs to be resolved, but in this case, the one-year uncertainty does not substantially affect the rebuilding scenario). The allowable catch under rebuilding is very small, between 1 and 2 MT. These results indicate that the previously adopted 38 yr rebuilding time frame is not feasible, and the draft rebuilding plan will need to be revised. It is worth noting that these results are consistent with the "low-1999" projections in the previous stock assessment and rebuilding analysis (which indicated a minimum rebuilding time of 76 years and allowable catches of less than10MT).

Near-term projections: In Figure 27, stock abundance is projected (using stock synthesis) to the year 2025 for a condition of no fishing. Median abundance declines slightly at the beginning and rises slightly toward the end, but is level overall. Because of the effect of a few strong yearclasses, the average projected abundance begins to rise within 10 years. Given the present assessment, it is unlikely that the resource condition will change significantly in the coming decade.

There are many sources of error and imprecision both inside and outside the model. Within the model, alternative assumptions of the natural mortality rate and emphasis on Southern and Central California data give different results (see sensitivity analyses), but do not radically change the outlook. The ocean climate was extraordinarily bad during the 1990s, and if the climate has changed to a more favorable state, the probability of strong year classes in the near future may be higher than in this analysis. If strong yearclasses appear during the coming decade, they will not only contribute to an increase in abundance, but will also contribute to a higher frequency of good reproductive successes in future stock projections, giving some hope for more liberal fishing opportunities. However, such strong yearclasses must first be documented quantitatively, e.g., in recruitment surveys and power plant impingements.

STAT Team Comment on Southern vs. Central California

During development of the assessment model, the STAT Team examined separate models for Southern and Central California, but the STAR Panel preferred a single combined model. The two independent models were statistically well-behaved (lacking internal conflicts among data elements), and provided an alternative view of resource dynamics. Estimated yearclass strengths were highly correlated for the strong recruitments, but were independent for the weaker recruitments. This could result from migration of fish between the two regions, or from parallel responses to widespread oceanic conditions (or both). Abundances and recruitment strengths averaged two to three times higher in Central California than in Southern California, but exploitation reduced the abundance in the Central California segment to a greater extent than that in the Southern California segment, indicating a condition of localized depletion that cannot be modeled under the STAR Panel's preferred combined model. Reproductive successes were somewhat higher in the Southern California model, and were lower but more variable in the Central California model. This leads to the inference that the Southern California segment may be more resilient, while the Central California segment, although historically larger, may have lower resilience, and may be subject to wide fluctuations in a natural condition. This kind of differential variability in geographically separated segments of a single population is a well-known phenomenon (MacCall 1990), would provide a justifiable basis for area-specific management, including area-specific rebuilding goals and programs. Ideally, a model with explicit diffusion (larvae) and migration (adults) components would allow exploration of geographic structure and implications for bocaccio management. However, the necessary model does not currently exist in a form that is compatible with the length-based bocaccio data.

Recommendations for Next Assessment

A minimal bocaccio reassessment, utilizing the new expedited stock assessment review process, is recommended in 2003. The strength of the 1999 year class continues to have a strong influence on stock status and rebuilding projections. This year class will be more evident in the length compositions, and new information on discard rates may be available for the observer program. Under consultation with knowledgeable fishery scientists, it may be worthwhile to reconsider the value of the assumed natural mortality rate (presently 0.20). Use of M=0.15 results in slightly higher estimated productivity, but must be justified objectively.

The next full assessment should attempt to explore the geographic relationships of the Southern and Central California segments of the stock. This will require development of new modeling tools.

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Table 1. Historical summary of bocaccio management.

YEAR	ABC	HG	ACTUAL	RELEVANT QUOTES AND (NOTES)
1983	6100		6486	(4100 MT Monterey, 2000mt Conception, managed as "other rockfish")
to				
1987	6100		3461	
1988	6100		2287	"ABC may be too high [will be revised pending new assessment]"
1989	6100		3429	"ABC may be too high [GMT hopes a new assessment will be available]"
1990	6100		2836	"no new analysis has been conducted"
1991	800	1100	1757	"The spawning biomass in 1991 is probably less than 25% of the average, unfished level"
1992	800	1100	2054	"The spawning biomass in 1991 is probably less than 25% of the average, unfished level"
1993	1540	1540	1811	"catch in 1991[1700MT]...was near the target catch level now indicated by application of the F35% harvest policy"
1994	1540	1540	1333	"biomass has declined substantially since 1980 and is approaching 20 percent of its estimated unfished level" "there is some risk in maintaining harvests at this level"
1995	1700	1700	865	"weak recruitments since 1979 will cause the stock to decline unless total harvest is kept closer to 1100MT, However, reported commercial catch in 1994 totaled only 1,260MT."
1996	1700	1700	600	"weak recruitments since 1979 will cause the stock to decline unless total harvest is kept closer to 1100MT, However, reported commercial catch in 1994 totaled only 1,025MT."
1997	265		488	"unlikely that the current stock is greater than 17 to 20 percent of the 1970 level"
1998	230		215	(Fmsy proxy changed to F40%) "a one-fish daily bag limit would be necessary to accomplish a reduction in recreational catch"
1999	230		213	"OY account[s] for unavoidable bycatch...under existing management of other rockfish species"
2000	100		233	Rebuilding initiated assuming "medium" 1999 year class strength
2001	100		214	
2002	100			

Table 2. Recent bocaccio fishing regulations.

January 2001

Recreational

- Bag limit: 10 rockfish, only 2 bocaccio, 10" minimum size
- North of Cape Mendocino: open year round
- Cape Mendocino-Pt Conception: Closed March-June except inside 20 fathoms - open May-June
- Pt Conception South: Closed January-February except inside 20 fathoms (open all year)

Commercial

- Limited Entry (fixed and trawl):
- Southern Area: 300 lbs/month Jan-April and Nov-Dec, otherwise 500 lbs/month
- Open Access: 200 lbs/month, year round

January 2002

Recreational

- Bag limit: 10 rockfish, no more than 2 bocaccio if not prohibited
    - Inside 20 fathoms, central area: recreational fishing allowed May-June and Sept-Oct, but bocaccio may not be retained
    - Outside 20 fathoms, central area: open January-February and July-August
- All southern waters: open March-October

Commercial

- Limited Entry Trawl: Jan-April 600 lbs/2 months, May-Oct. 1,000 lbs/2 months, Nov-Dec 600lbs/2 months
- Limited Entry Fixed Gear:
    - North of Cape Mendocino: 200lbs/month
    - Cape Mendocino - Pt Arguello: 200 lbs/month Jan-Feb and July-Aug, closed otherwise
    - South of Pt. Arguello: 200 lbs/month March-Oct, closed otherwise
- Open Access:
    - North of Cape Mendocino: 200lbs/month
    - Cape Mendocino - Pt. Arguello: 200 lbs/month Jan-Feb and July-Aug, closed otherwise
    - South of Pt. Arguello: 200 lbs/month March-Oct, closed otherwise

Table 3. Estimated historical bocaccio landings (MT) in California (for assessment use only).

	Southern California					Northern California					Statewide
	Trawl	H&L	Setnet	Rec'l	Total	Trawl	H&L	Setnet	Rec'l	Total	Total
1950	0	428	0	39	468	2816	438	0	86	3339	3807
1951	0	471	0	35	506	3895	620	0	98	4613	5119
1952	0	366	0	45	411	3866	630	0	86	4582	4993
1953	0	298	0	56	355	4494	750	0	72	5316	5671
1954	36	547	0	122	705	4401	750	0	91	5242	5946
1955	1305	504	0	213	2023	3451	492	0	108	4051	6074
1956	942	540	0	256	1738	4608	689	0	121	5418	7155
1957	1296	522	0	138	1956	4803	678	0	120	5601	7557
1958	1199	604	0	95	1899	5041	1249	0	193	6483	8382
1959	444	611	0	57	1113	4691	1185	0	160	6036	7149
1960	1054	609	0	63	1725	3922	636	0	125	4683	6408
1961	826	654	0	72	1552	2821	612	0	94	3527	5079
1962	690	670	0	68	1427	2460	642	0	109	3210	4637
1963	953	657	0	67	1677	3102	617	0	111	3830	5507
1964	492	555	0	94	1140	2177	459	0	85	2721	3861
1965	559	654	0	117	1330	2508	540	0	132	3179	4509
1966	800	630	0	170	1600	2571	564	0	142	3277	4877
1967	1086	713	0	210	2010	2162	483	0	140	2785	4795
1968	961	655	0	223	1838	2173	495	0	166	2834	4673
1969	906	611	0	212	1728	2190	479	0	154	2823	4551
1970	888	529	0	289	1706	2908	523	0	204	3634	5340
1971	642	603	0	244	1489	3031	791	0	167	3988	5477
1972	1266	814	0	339	2419	4302	1066	0	226	5595	8013
1973	1532	875	0	401	2808	6043	1553	0	260	7855	10663
1974	376	2262	0	459	3097	5673	1441	0	289	7403	10500
1975	1941	1058	0	450	3449	6132	1586	0	276	7993	11442
1976	2424	1015	0	417	3856	6113	1608	0	248	7969	11825
1977	2286	895	0	377	3558	4969	1330	0	218	6517	10075
1978	587	145	83	350	1165	2243	35	47	196	2522	3686
1979	2423	1507	0	445	4375	1479	228	3	242	1952	6327
1980	39	84	121	1691	1936	3607	215	77	190	4090	6026
1981	84	161	213	844	1302	3904	76	227	233	4439	5741
1982	217	301	176	1010	1703	4123	559	423	329	5433	7136
1983	356	156	135	261	907	3941	138	1227	272	5578	6486
1984	63	75	242	170	550	3125	131	385	47	3688	4238
1985	18	81	305	309	714	1205	36	973	67	2281	2995
1986	13	147	327	395	882	1033	20	1065	172	2290	3172
1987	52	73	253	104	482	1101	181	1585	113	2979	3461
1988	0	144	76	111	332	1226	172	505	52	1955	2287
1989	0	112	193	266	572	1120	172	1476	88	2857	3429
1990	0	198	8	233	439	1102	143	1061	91	2397	2836
1991	1	26	174	200	401	703	157	404	92	1356	1757
1992	6	335	98	167	606	484	212	659	92	1448	2054
1993	1	270	160	135	565	558	222	366	99	1245	1811
1994	13	151	53	195	412	514	86	268	43	911	1323
1995	1	21	62	43	127	376	50	281	30	738	865
1996	1	36	27	78	142	287	64	76	30	457	600
1997	1	24	7	66	97	229	34	31	97	391	488
1998	1	12	4	30	47	72	29	37	29	168	215
1999	0	3	2	60	66	45	18	5	80	148	213
2000	0	2	0	59	61	19	5	1	147	172	233
2001	0	3	0	105	108	13	5	1	87	107	214

Table 4. Summary of historical estimates from bocaccio base model. Recruits are at age 1.

Year	Bage2+ (MT)	SpOut(10^9eggs)	Recruits(10^3)	Catch	ExploitRate
pre-51	58754	9521	12168	3807	6.5%
1951	58754	9522	61065	5119	8.7%
1952	71522	9374	175	4993	7.0%
1953	74110	9609	90	5670	7.7%
1954	72372	10537	50	5947	8.2%
1955	66730	11402	50	6074	9.1%
1956	58322	11324	50	7155	12.3%
1957	47224	10133	96	7557	16.0%
1958	35294	8365	53201	8382	23.7%
1959	38311	6296	9922	7149	18.7%
1960	38779	5135	580	6409	16.5%
1961	36856	5166	769	5079	13.8%
1962	33771	5538	8713	4638	13.7%
1963	31600	5526	169111	5508	17.4%
1964	74859	5066	388	3861	5.2%
1965	95179	6006	232	4510	4.7%
1966	108008	9753	219	4877	4.5%
1967	112425	14630	256	4794	4.3%
1968	110057	17909	478	4673	4.2%
1969	102533	18927	7360	4551	4.4%
1970	93780	18429	92424	5341	5.7%
1971	108159	17121	154	5478	5.1%
1972	108763	16216	50	8013	7.4%
1973	103319	16526	31983	10664	10.3%
1974	100394	16808	1752	10500	10.5%
1975	90591	16150	15045	11443	12.6%
1976	81031	14840	2955	11825	14.6%

Year	Bage2+ (MT)	SpOut(10^9eggs)	Recruits(10^3)	Catch	ExploitRate
1976	81031	14840	2955	11825	14.6%
1977	67893	13233	455	10075	14.8%
1978	54849	11621	44923	3686	6.7%
1979	60297	10731	1779	3401	5.6%
1980	59619	10065	10397	6024	10.1%
1981	56986	9678	2660	5742	10.1%
1982	51931	9459	1127	7138	13.7%
1983	43686	8735	50	6486	14.8%
1984	34817	7666	3053	4238	12.2%
1985	28647	6629	12986	2994	10.5%
1986	26981	5699	1170	3172	11.8%
1987	23673	4867	1801	3462	14.6%
1988	20169	4249	2587	2286	11.3%
1989	17865	3846	8436	3427	19.2%
1990	16110	3222	2078	2836	17.6%
1991	14112	2703	998	1757	12.5%
1992	12791	2466	2732	2053	16.1%
1993	11382	2239	50	1811	15.9%
1994	9474	1976	795	1324	14.0%
1995	7993	1749	569	864	10.8%
1996	6874	1556	50	599	8.7%
1997	5863	1383	379	489	8.3%
1998	5006	1217	52	214	4.3%
1999	4373	1089	50	213	4.9%
2000	3738	961	971	233	6.2%
2001	3364	832	93	215	6.4%
2002	2914	720	316		

Table 5. Effects of varying emphasis on individual likelihood components.

	TotBiomass2002(MT, 2+)		SpOut2002/Bunfished		SPRsustainable	
Base Model Value	2914		4.83%		49.5%	
GROUP	EMPH=10	EMPH=0.1	EMPH=10	EMPH=0.1	EMPH=10	EMPH=0.1
Length Comps						
TrawlCenCal	2036	3234	3.68%	5.33%	46.9%	49.4%
H&L CenCal	2197	3047	3.42%	5.24%	49.0%	49.4%
SetNetCenCal	2629	3079	3.98%	5.22%	36.6%	50.9%
Rec'lCenCal	3485	2848	5.97%	4.79%	50.5%	49.3%
TriennialSurvCenCal	4791	2747	6.66%	4.82%	56.6%	48.1%
H&LSoCal	2175	2974	3.43%	5.09%	46.8%	49.4%
SetNetSoCal	1953	3048	3.47%	5.13%	42.0%	50.3%
Rec'lSoCal	2647	3421	4.37%	5.70%	51.5%	49.2%
Abundance Indexes						
Rec'lCPUECenCal	2971	2914	5.03%	4.95%	49.5%	49.5%
TrawlCPUECenCal	2574	2994	4.52%	5.06%	49.5%	49.4%
TriennialSurvCenCal	1998	3214	3.70%	5.34%	48.2%	49.4%
Rec'lCPUESoCal	5609	1759	7.73%	3.43%	49.2%	48.6%
CalCOFISoCal	5563	2167	8.81%	3.67%	46.6%	47.6%
Recruitment Indexes						
JuvenileSurvCenCal	2685	3563	4.93%	5.47%	51.5%	48.9%
PowerPlantsSoCal	2841	3109	4.90%	5.20%	53.1%	49.2%

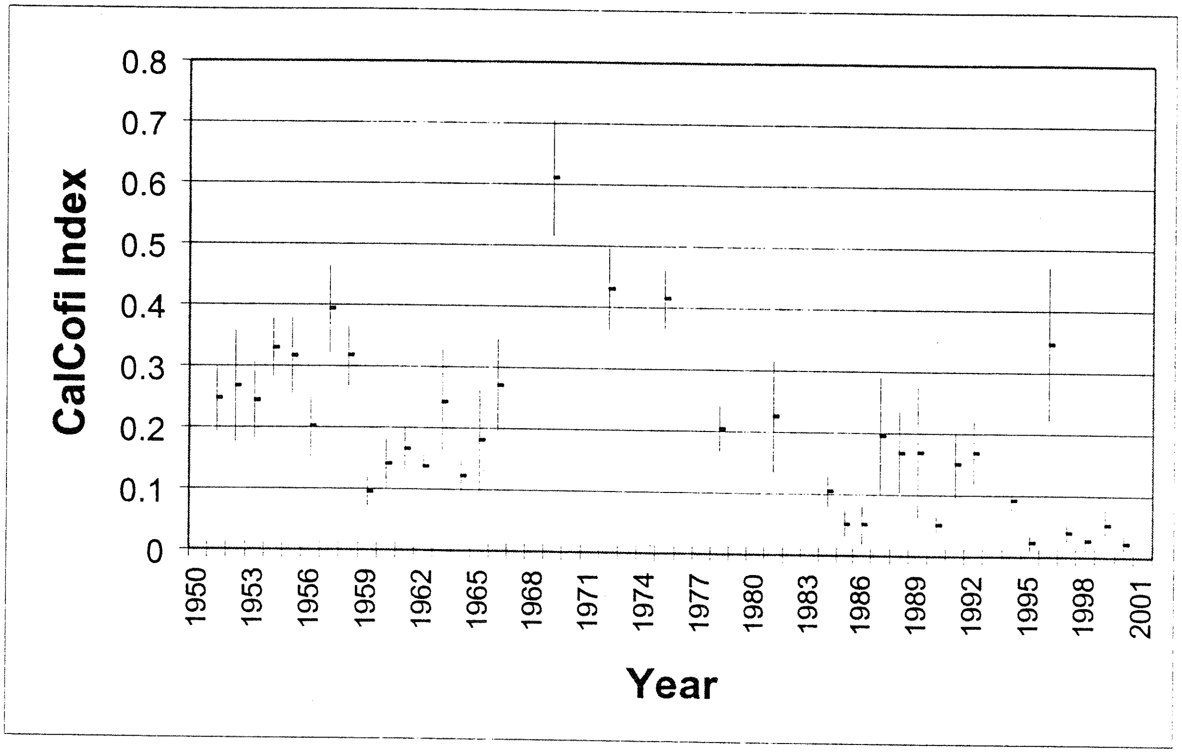

Figure 1. Index of bocaccio spawning abundance from GLM of larval densities from CalCOFI Surveys in Southern California. Error bars are ±1SE.

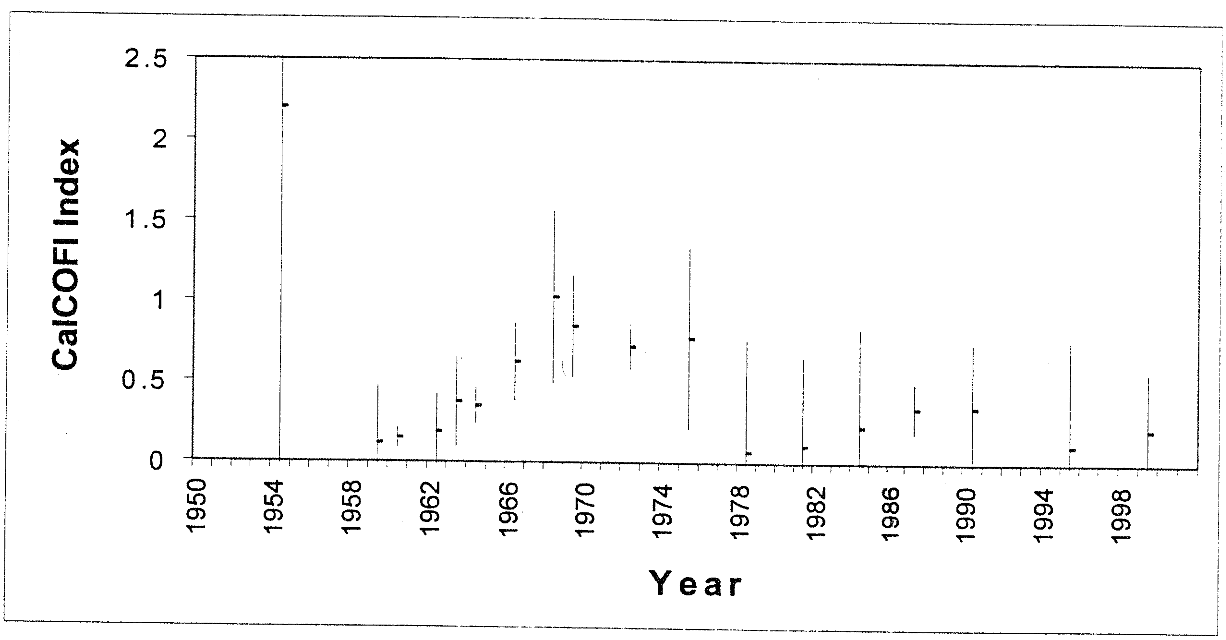

Figure 2. Index of bocaccio spawning abundance from GLM of larval densities from CalCOFI Surveys in Central California. Error bars are ±1SE.

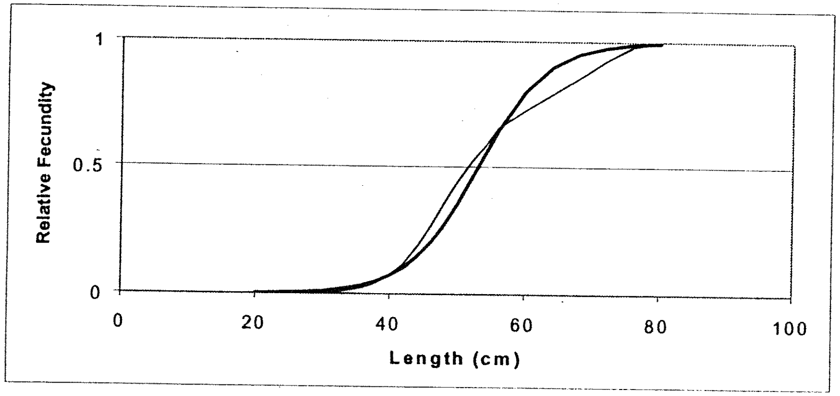

Figure 3. Bocaccio fecundity per weight, relative to maximum. Thin line is best estimate, thick line is logistic approximation used as selectivity curve.

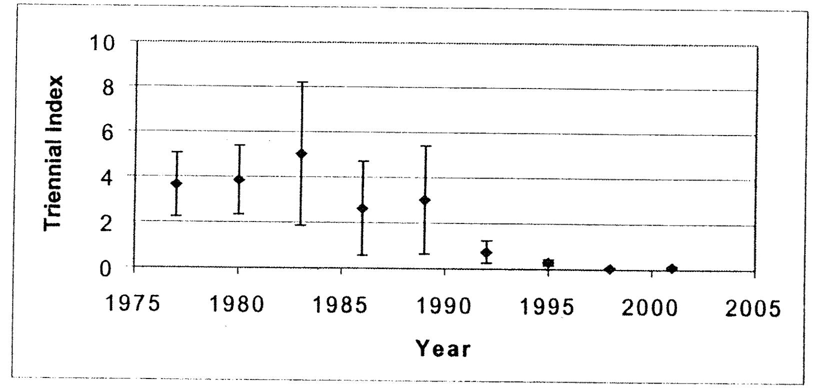

Figure 4. Triennial Trawl Survey GLM index of abundance for Central California (Monterey and Conception INPFC areas). Error bars are ±1SE.

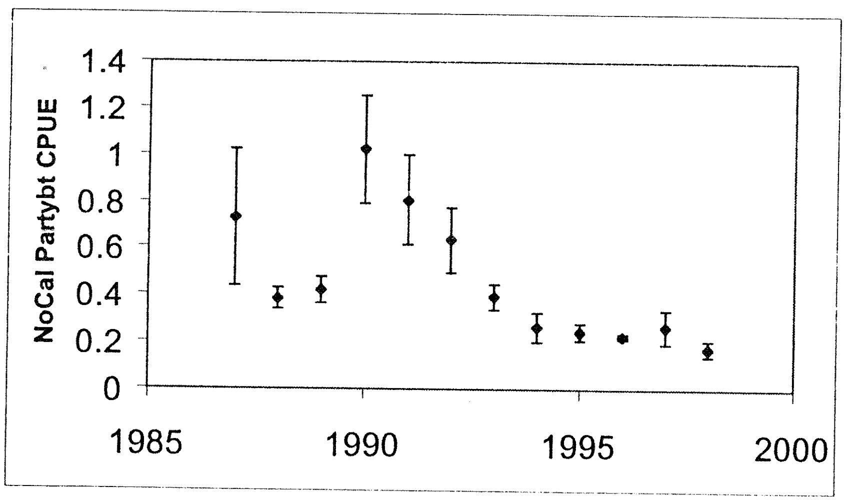

Figure 5. CPUE index of Central California bocaccio abundance from GLM of CDF&G observed partyboat catches. Error bars are ±1SE.

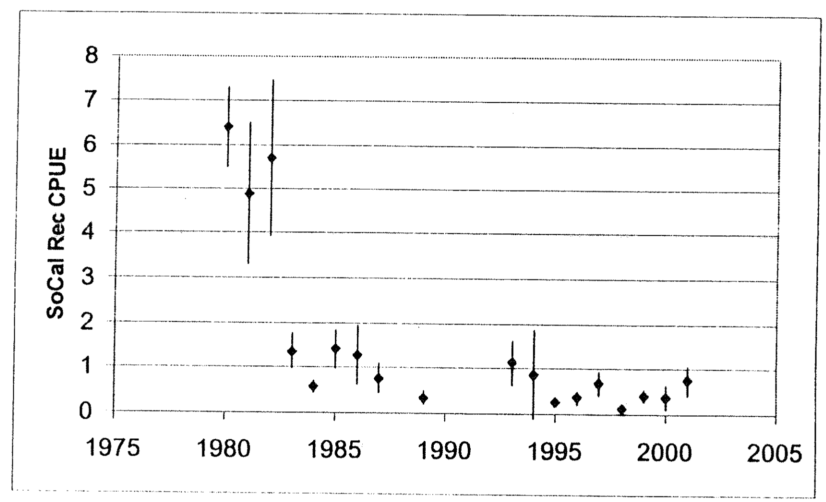

Figure 6. CPUE index of Southern California bocaccio abundance from GLM of MRFSS observed private and partyboat catches. Error bars are ±1SE.

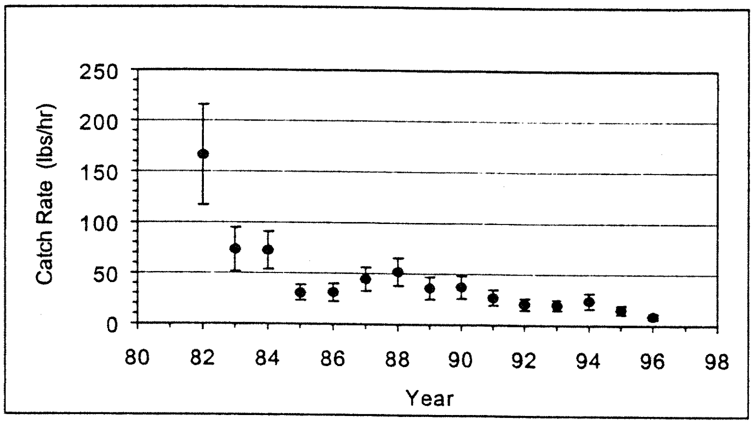

Figure 7. CPUE index of Central California bocaccio abundance from California trawl fishery logbooks (Ralston 1999). Error bars are ±1SE.

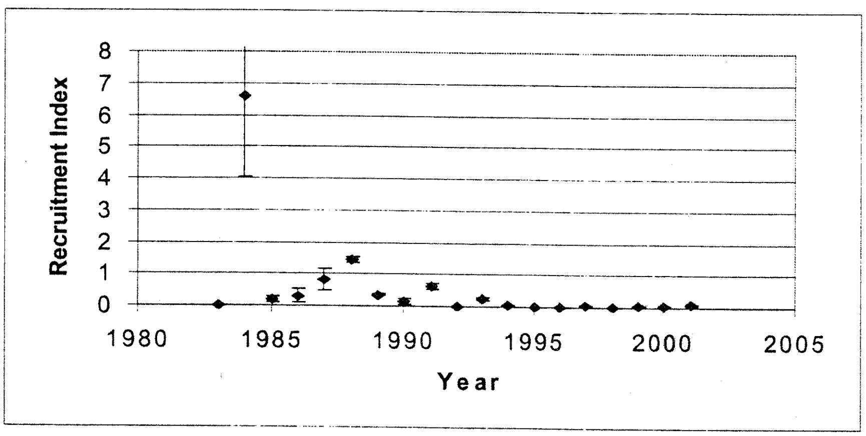

Figure 8. Central California bocaccio recruitment index (at age 0) from GLM of juvenile boccacio catch rates on Santa Cruz Laboratory midwater trawl surveys. Error bars are ±1SE.

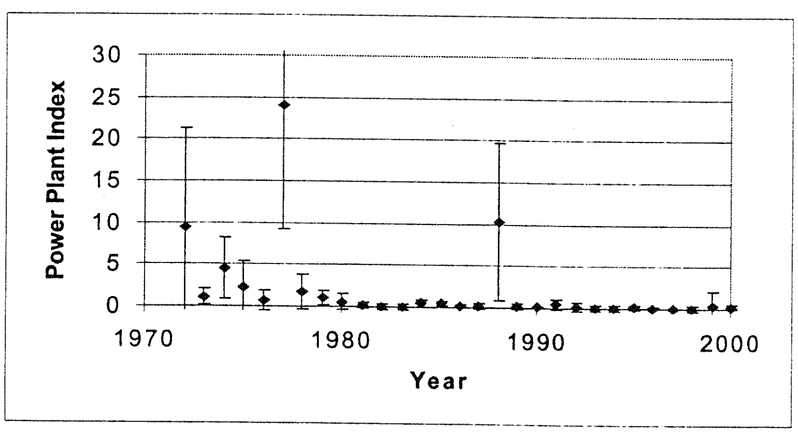

Figure 9. Southern California bocaccio recruitment index from GLM of impingement rates at five electrical power plants. Error bars are ±1SE.

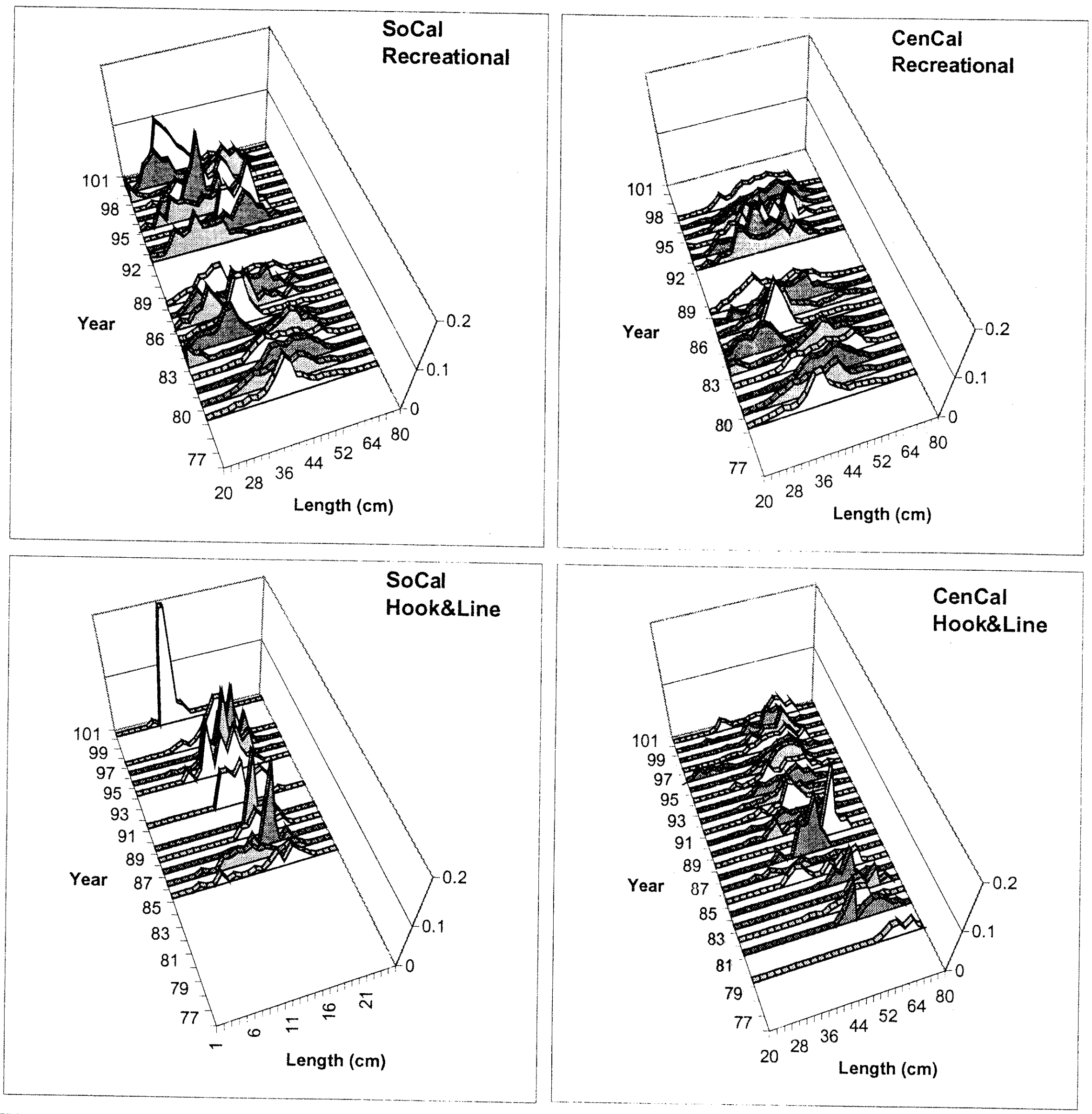

Figure 10. Length frequencies of female bocaccio used in the assessment.

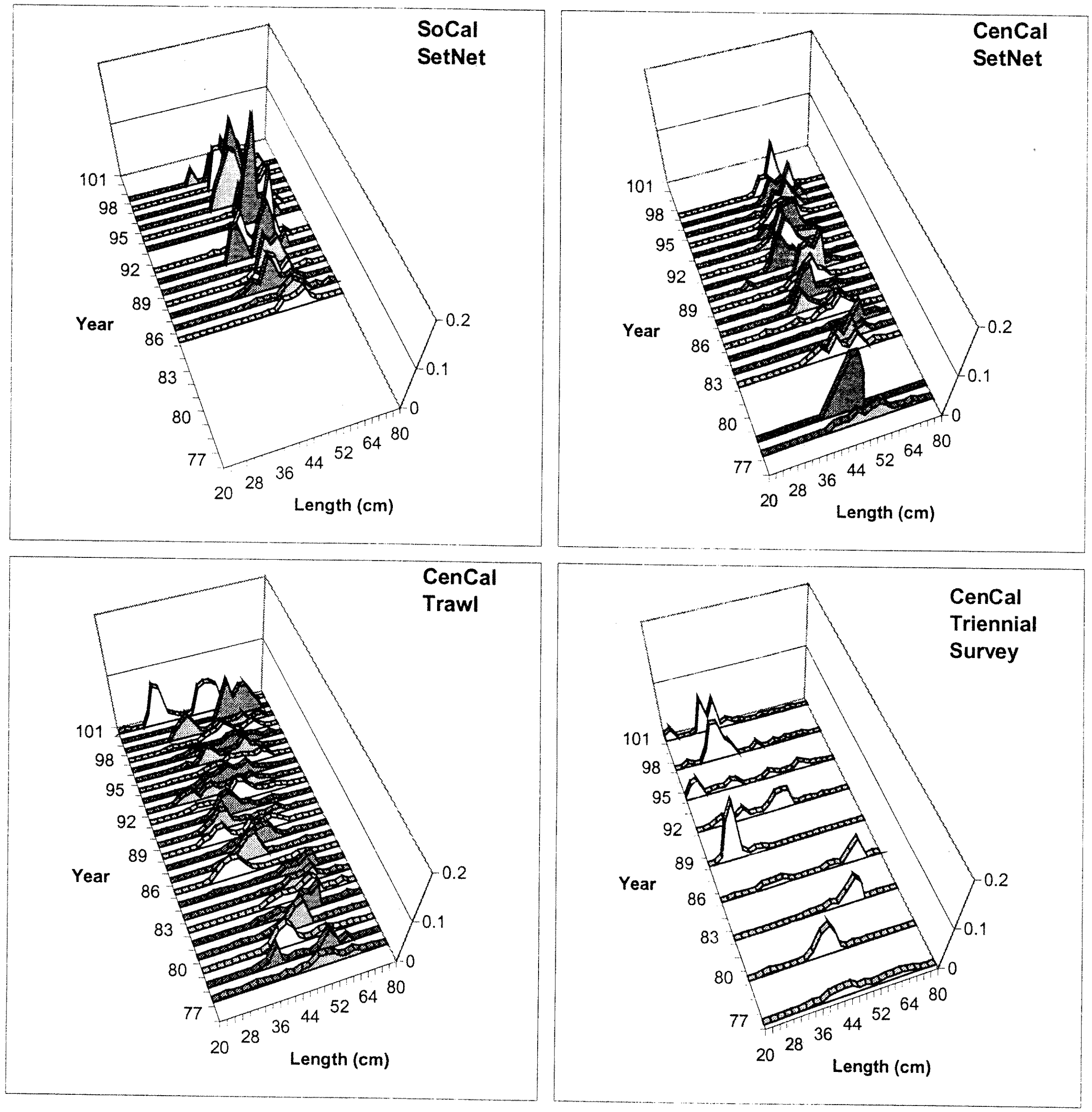

Figure 10 cont. Length frequencies of female bocaccio used in the assessment.

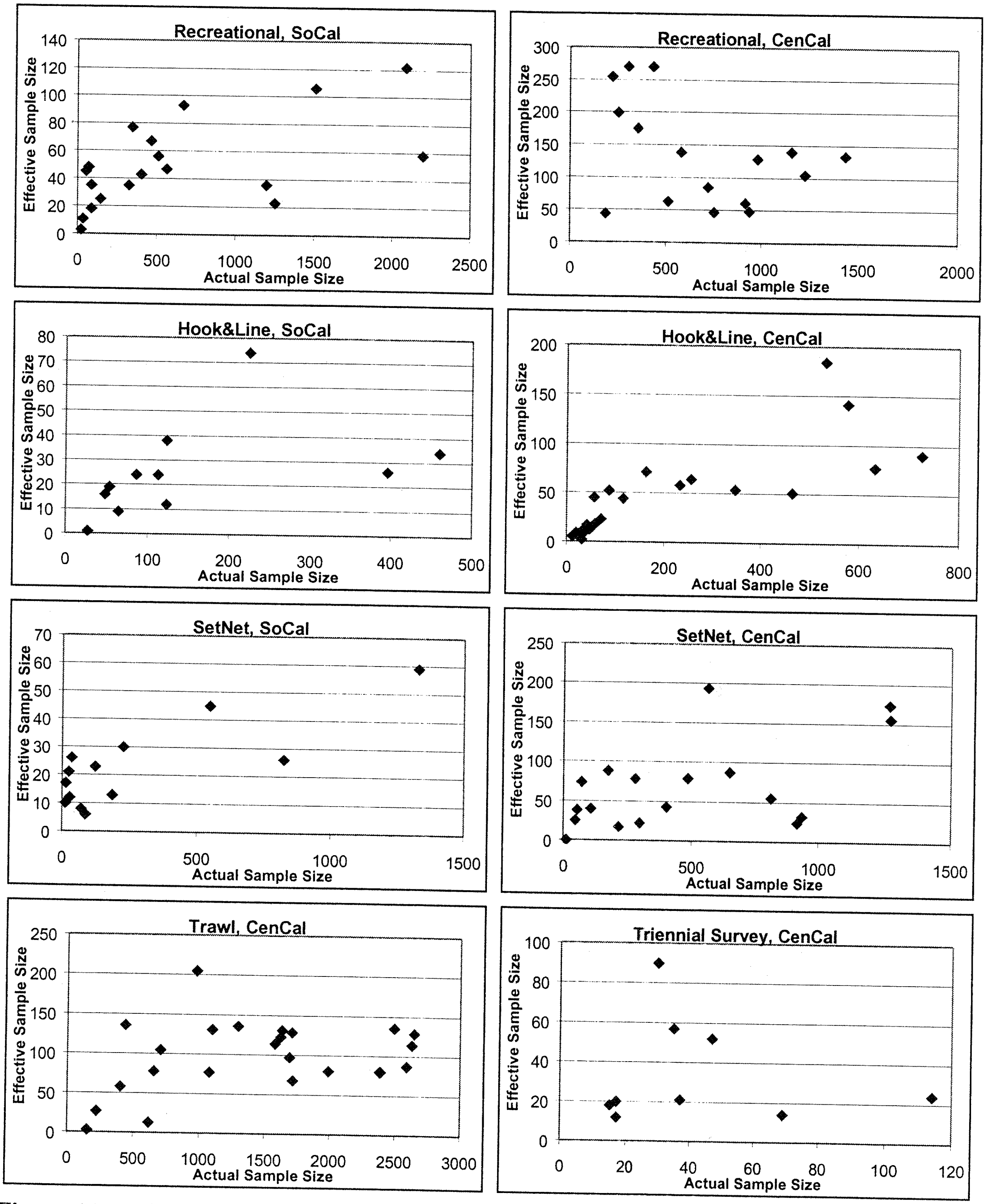

Figure 11. Relationships between effective sample size and number of fish examined for various data sources.

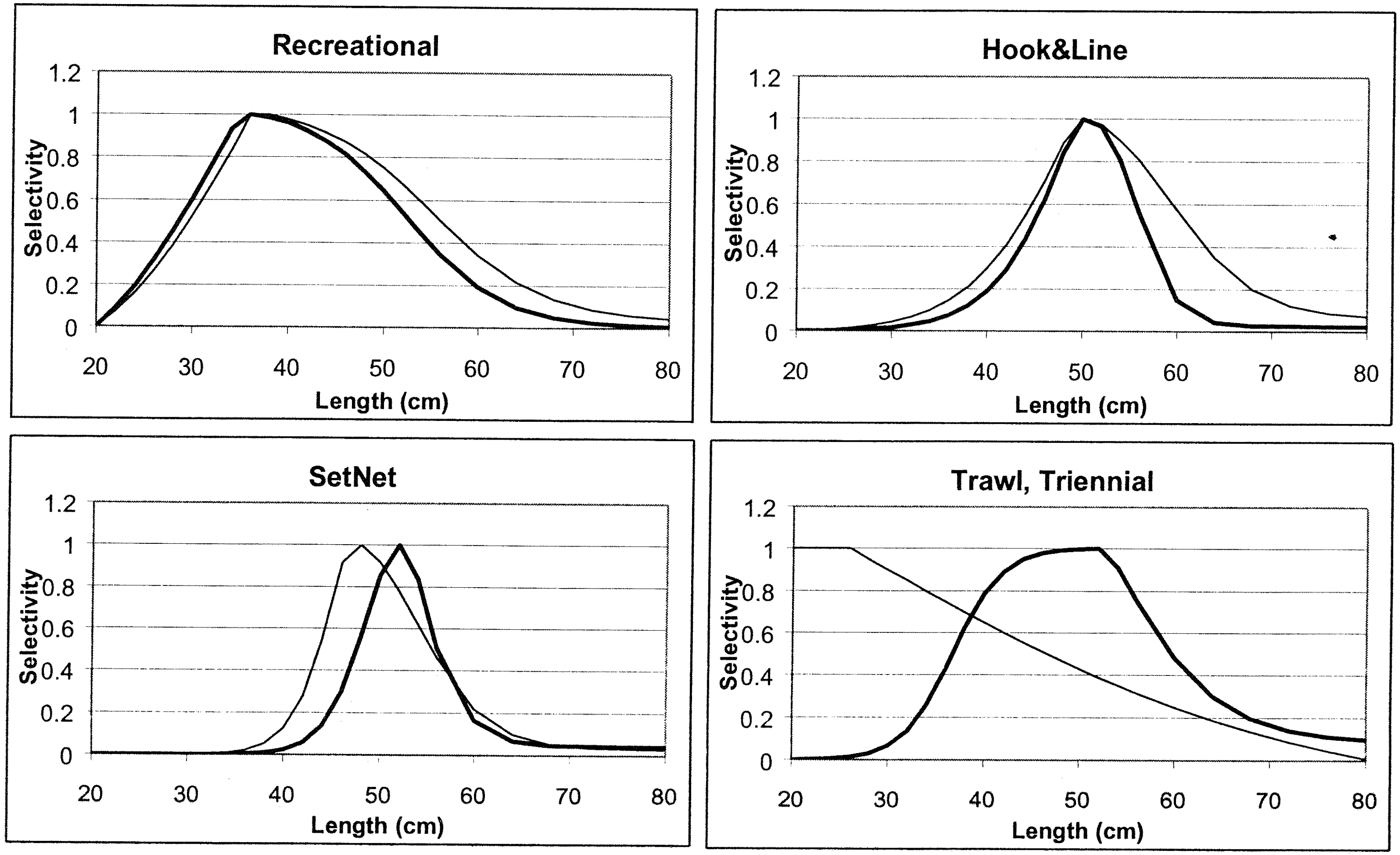

Figure 12. Fitted selectivity curves for size compositions in the bocaccio model. Thick line is Southern California, thin line is Central California. Lower right pane: Thick line is Central California trawl, thin line is Triennial Survey.

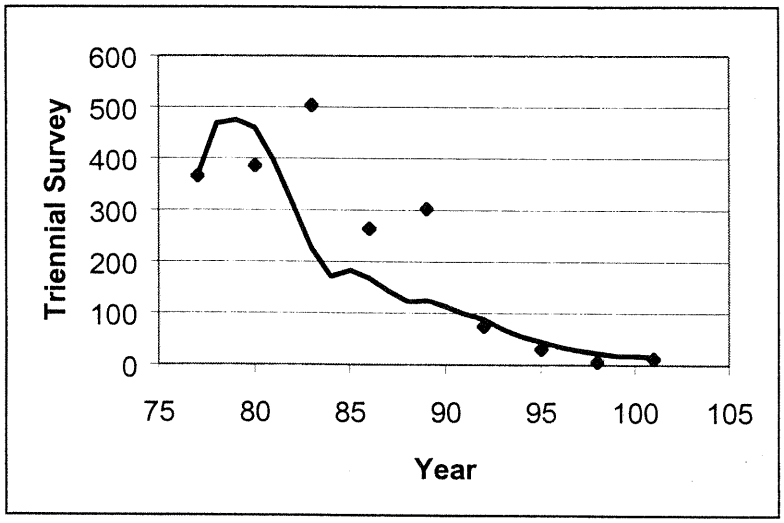

Figure 13. Fit to Triennial Survey abundances.

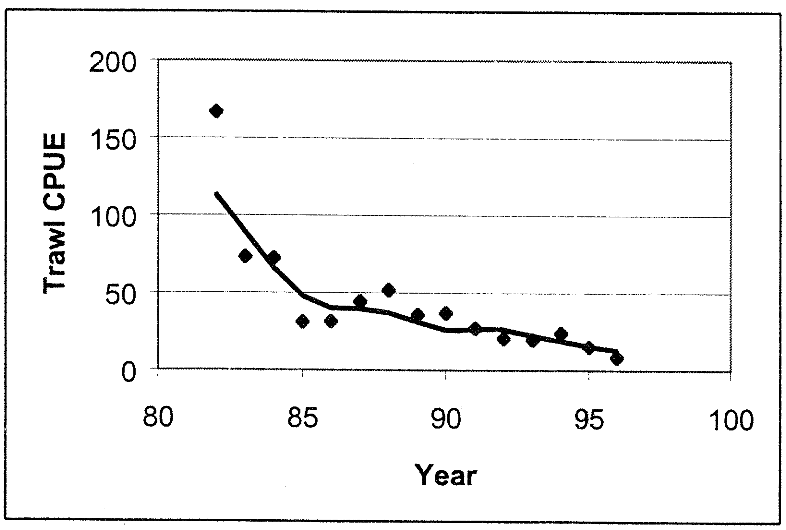

Figure 14. Fit to Central California Trawl CPUE.

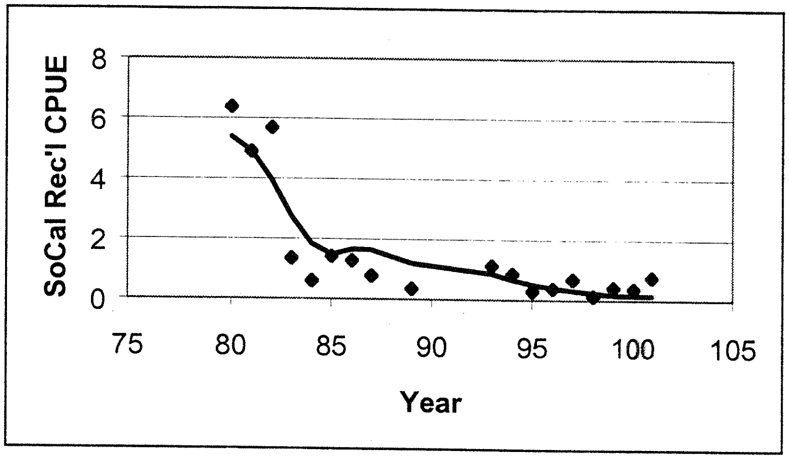

Figure 15. Fit to Southern California recreational CPUE.

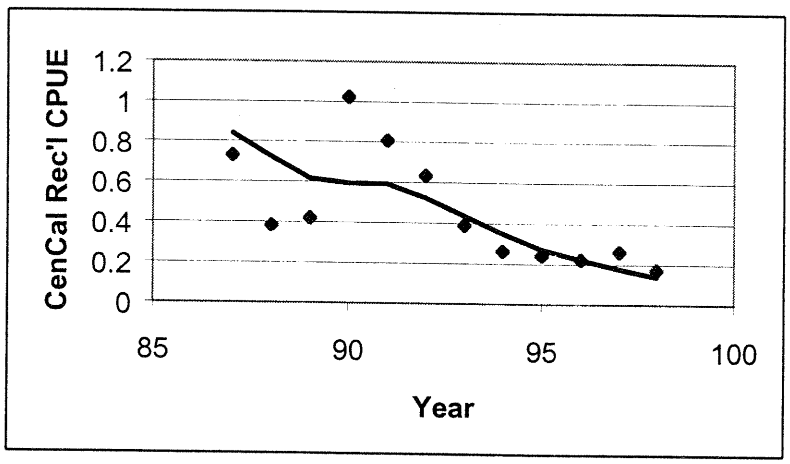

Figure 16. Fit to Central California recreational CPUE.

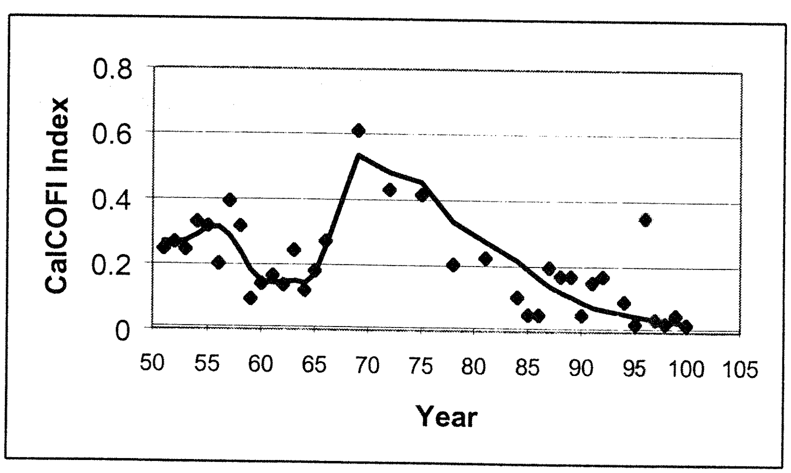

Figure 17. Fit to CalCOFI larval abundance index.

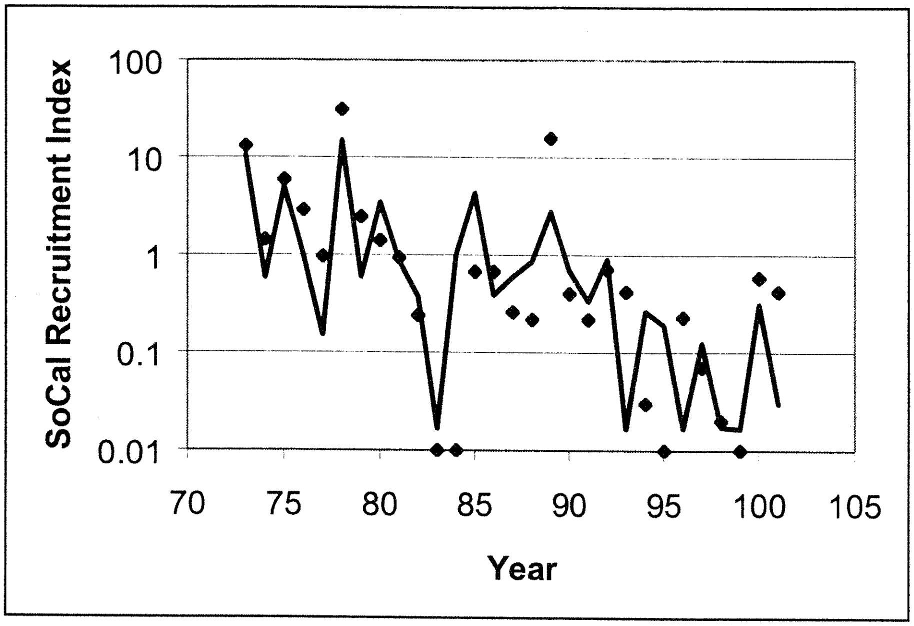

Figure 17. Fit to Southern California (power plant) recruitment index.

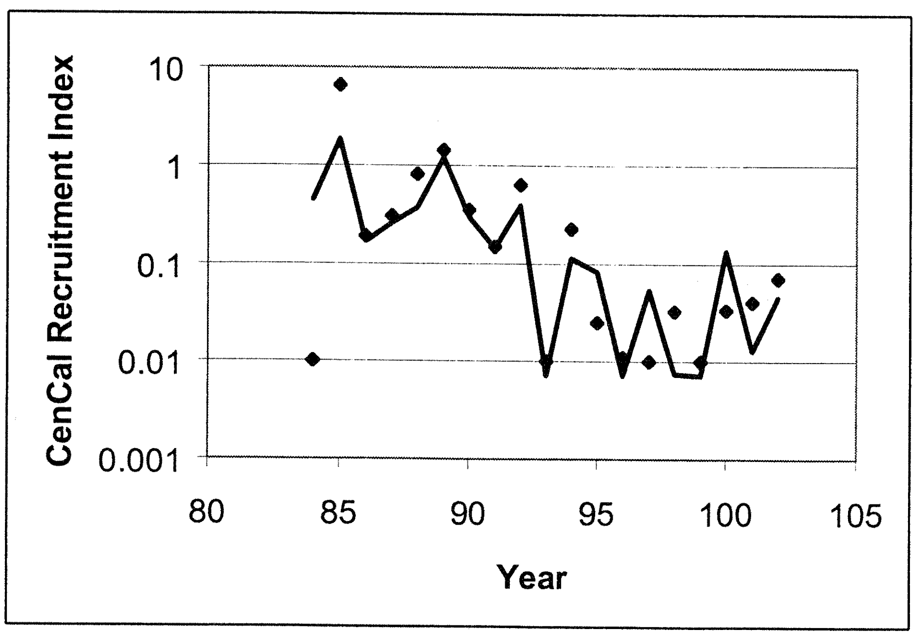

Figure 18. Fit to Central California (midwater trawl survey) recruitment index.

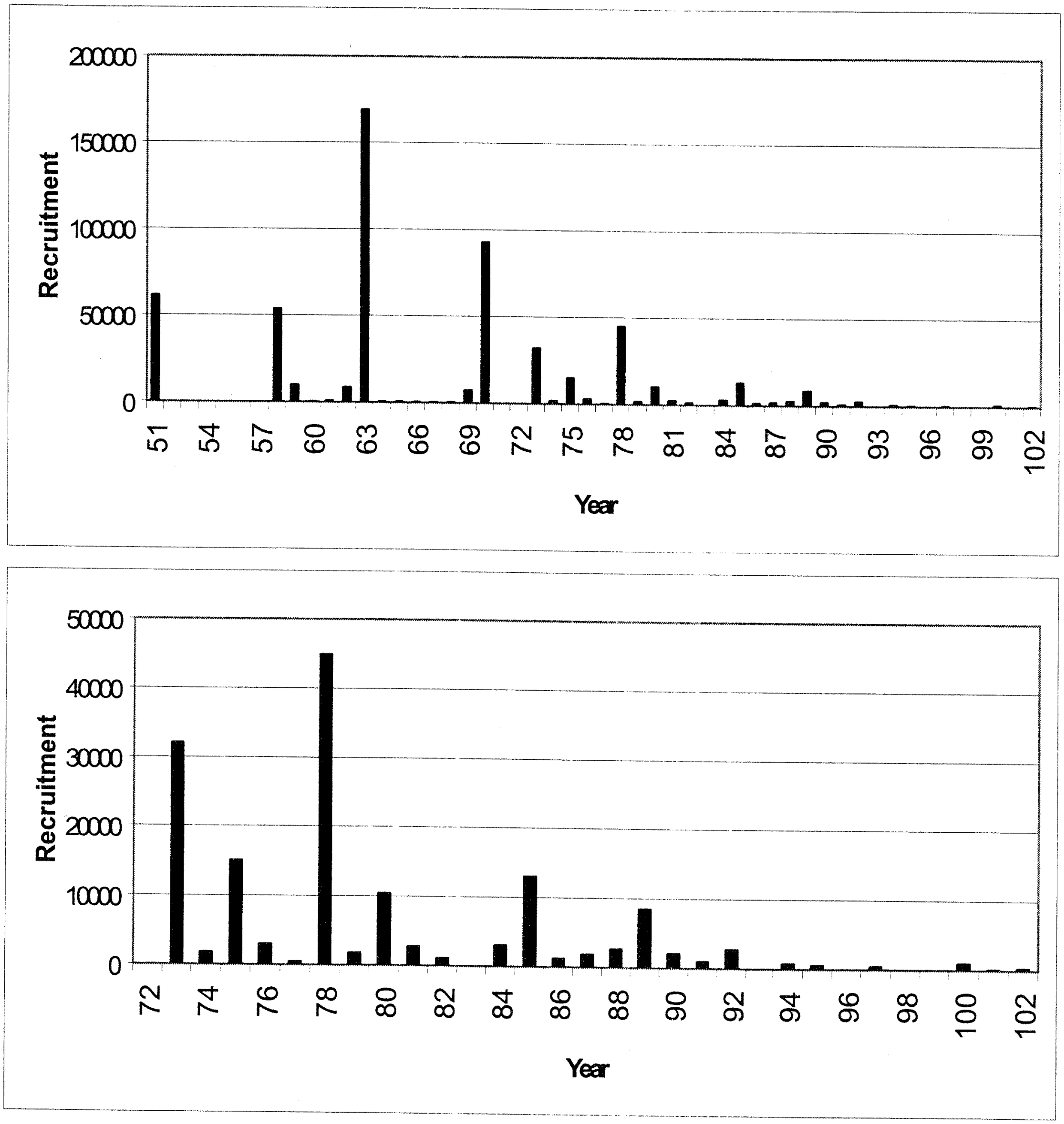

Figure 19. Estimated bocaccio recruitment strengths. Lower panel shows detail of recent years.

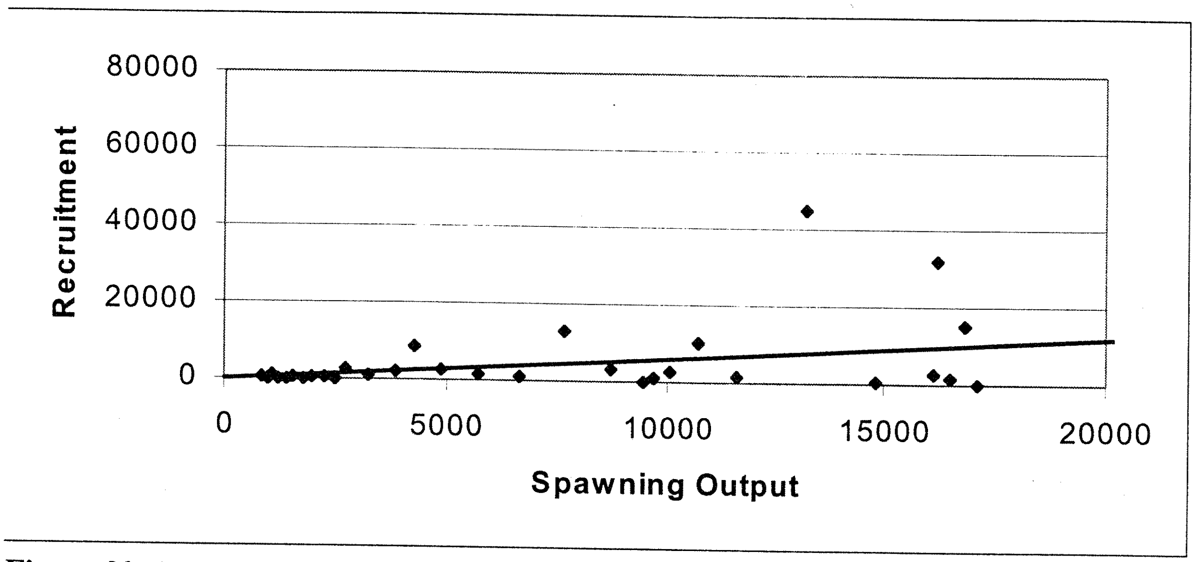

Figure 20. Bocaccio stock and recruitment relationship. Diagonal line is replacement level in the absence of fishing.

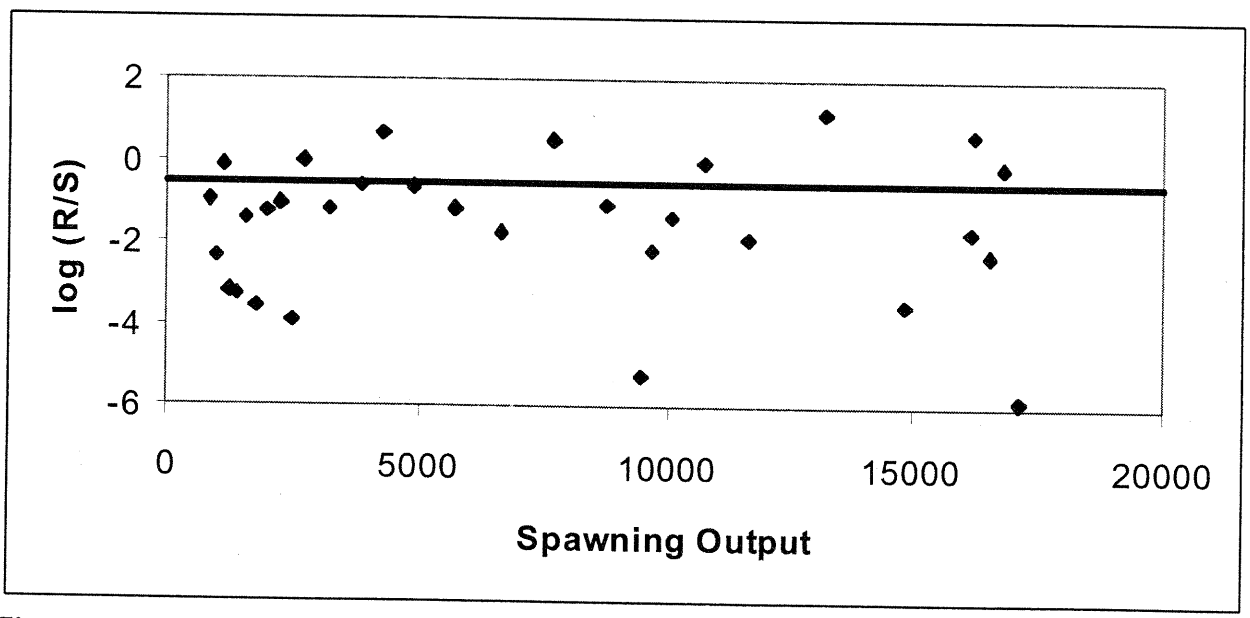

Figure 21. Historical reproductive success related to parental abundance. Horizontal line is replacement level in the absence of fishing.

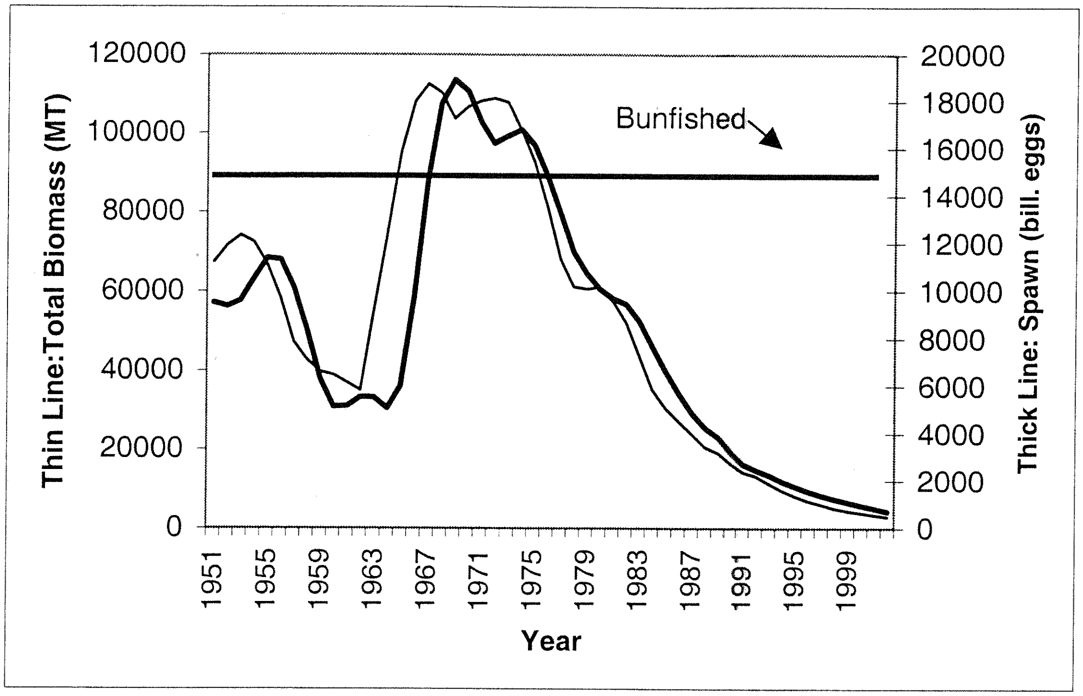

Figure 22. Estimated historical bocaccio abundances. Horizontal line is estimated unfished spawning output (Bunfished).

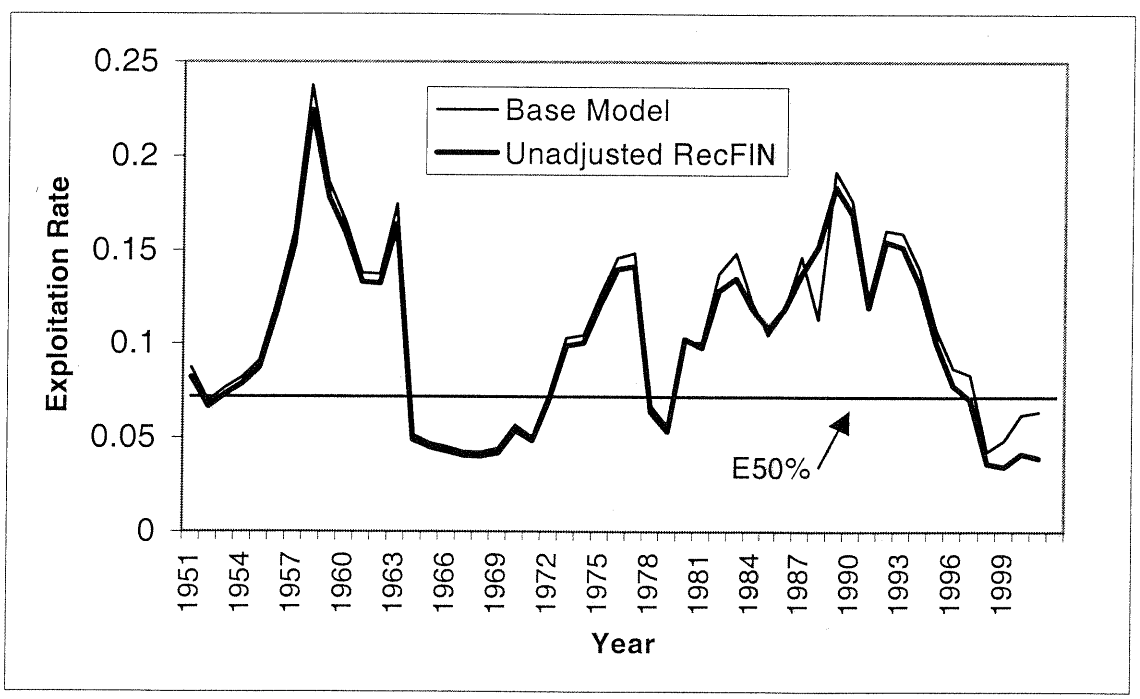

Figure 23. History of bocaccio exploitation rates. Horizontal line is E50% (exploitation rate at SPR=50%).

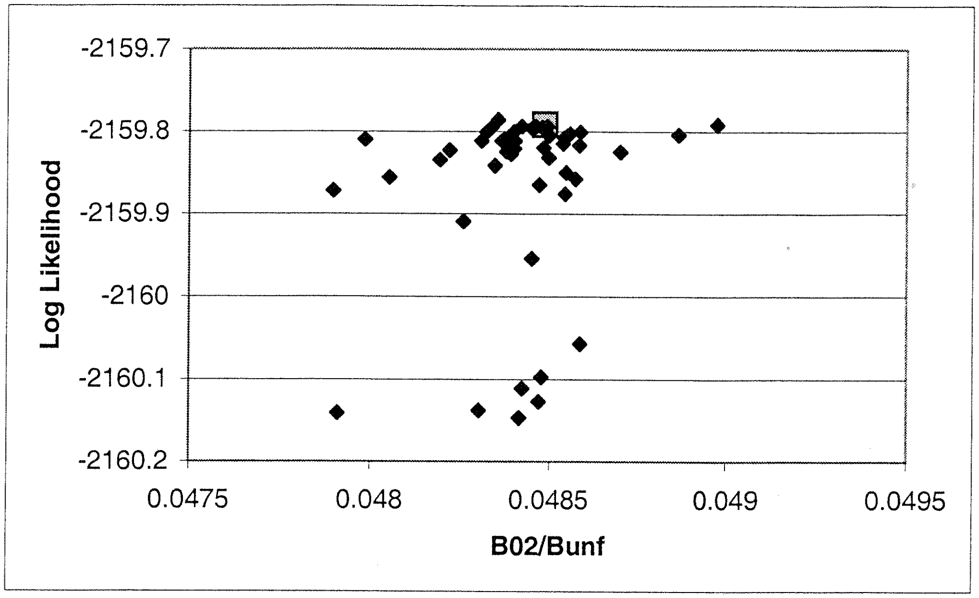

Figure 24. Convergence test of bocaccio model (N=50). Square symbol is base model.

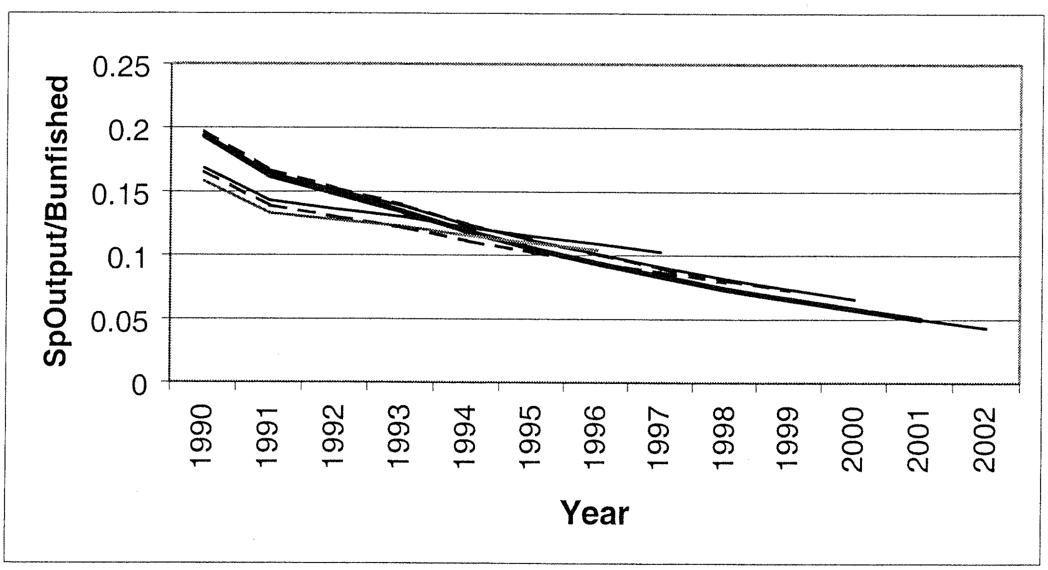

Figure 25. Retrospective pattern of relative abundance estimates.

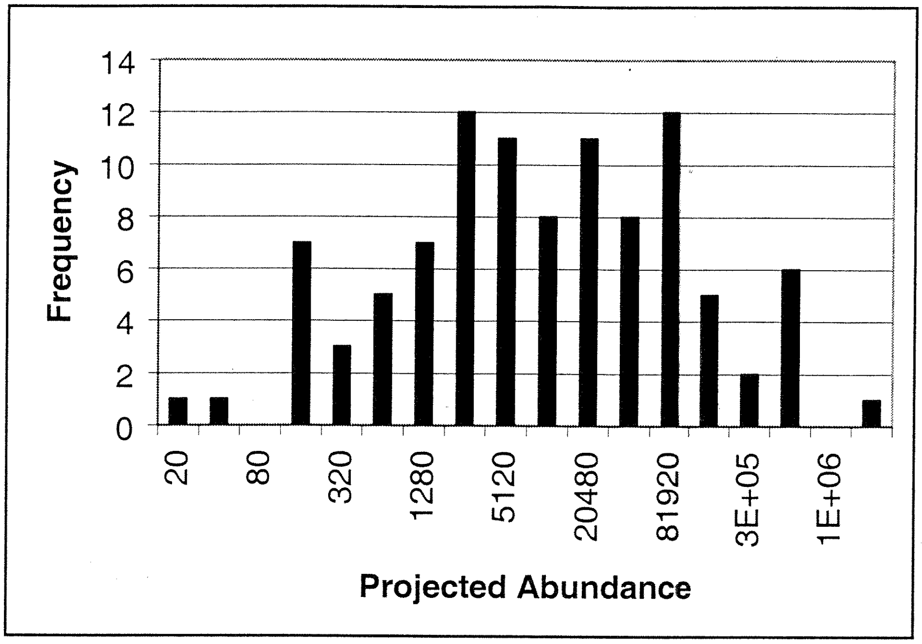

Figure 26. Distribution of projected bocaccio abundances (spawning output, log scale) after 100 yr with no fishing (N=100 simulations).

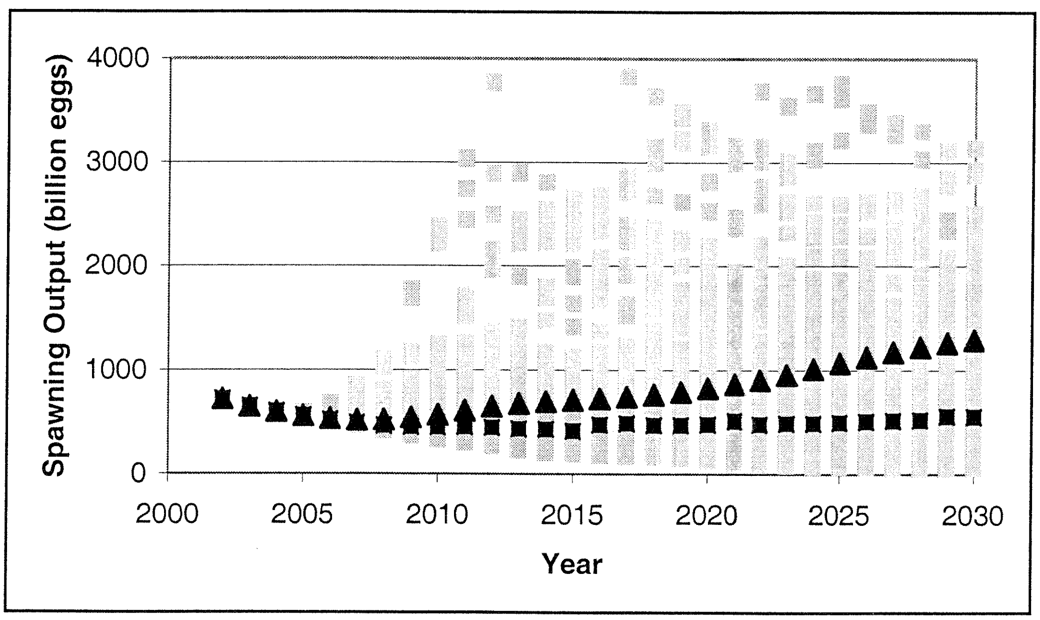

Figure 27. Near-term projections (N=100) of bocaccio abundance in the absence of fishing. Light symbols are individual outcomes; lower dark symbols (squares) are median value, upper dark symbols (triangles) are average value.

BOCACCIO

STAR Panel Report
Northwest Fisheries Science Center
Seattle, Washington
April 15-19, 2002

STAR Panel Members:

Gary Stauffer, STAR Chair, NMFS AFSC, Seattle, WA,
Stephen Ralston, SSC Representative, NMFS SWFSC, Santa Cruz, CA
Larry Jacobson, NMFS, NEFSC, Woods Hole, MA
Paul Medley, Rapporteur, Center for Independent Experts, University of Miami, FL
Mark Saelens, Groundfish Management Team Representative, ODFW, Newport Oregon
Tom Ghio, Groundfish Advisory Panel Representative

STAT Team Member Present:

Alec MacCall, NMFS, SWFSC, Santa Cruz, CA

FINAL STAR Report, May xx, 2002

Bocaccio STAR Panel Report

Overview

The STAR Panel reviewed the draft assessment report by the STAT Team for the Bocaccio resource. The review took place during the week of April 15-19, 2002 at the Montlake Laboratory of NMFS Northwest Fisheries Science Center in Seattle, Washington. The STAT Team provided the STAR Panel members with a partial draft report in advance of the STAR workshop. Dr. Alec MacCall, the sole member of the STAT team, was present during the week. On the first day MacCall summarized his draft document including descriptions of the fishery, the biology of canary rockfish, and available data. The relevant features of his stock synthesis model and assumptions, and initial results of alternative modeling scenarios were reviewed. Considerable discussion followed over the week concerning the quality of the data, appropriateness of model assumptions, base model configurations, potential alternative configurations, and interpretation of results. The Panel requested additional alternative model analyses to examine sensitivity of assessment results focusing on areas of data uncertainties and configuration assumptions. Concern was expressed that the early trawl catch numbers used in the analysis maybe too high in Southern California. Before 1978 an arbitrary allocation was made between the hook and line and trawl fishery on total rock fish catch. As well as allocation to gear, the allocation to species may also be uncertain. It was assumed to be 40% Bocaccio. Some late information suggested between 1962-1963 that bocaccio landings could be as high 60%. The reference points based on unexploited biomass were sensitive to this issue. The reference points based on unexploited biomass were sensitive to this issue.

The STAR panel and STAT team discussions resulted in developing a new baseline model that treated the Bocaccio resource off southern and central California as one stock. The STAR panel accepts a single stock model with separate selectivities for all gears split between central and southern California and M=0.2 $year^{-1}$ as the base model, and is satisfied that this assessment provides the best scientific management advice available. There is no evidence that central and southern California belong to separate stocks, but greater accuracy in the assessment might be obtained in the future from modeling the spatial differences between management areas explicitly. However, the single population model remains the most robust for providing advice at this time.

Using the average SPR 68-95 rather than SPR 55-95 to calculate the relative sustainable SPR gives estimates suggesting that the southern California management area is unable to sustain even very small levels of fishing, which is clearly incorrect. The time series 1955-1967 is important in producing a realistic assessment. The magnitude of the early catches also affects the results. There is an unrealistically high recruitment event estimated for 1963. This estimate contaminates the recruits-per-spawner estimate which would be used to simulate rebuilding times. Direct observations for recruitment indices exist for 1972 onwards and this probably represents the most reliable period to draw recruitment estimates from for the projection. Alternatives to this base case could be used for the decision table, for example, using all 1955-2001 recruits as opposed to using only the more recent recruitments (e.g. 1980-2001). However, an assessment based on only the most recent recruitments, may indicate that the stock is not able to recover even with no fishing. Some strong recruitments, as seen before 1980, may be a necessary prerequisite for any recovery.

Two decision tables, one projecting the two separate management areas and the other considering the consequences of high and low average recruitment around the base model for the whole stock were suggested. The latter was thought the best to take forward to provide management advice as it would capture the essential uncertainty of the assessment. Although the STAR Panel has had only limited opportunity to review these latter results, we conclude that Alec's approach to addressing range of uncertainty is appropriate, is presented in a format that should be helpful to the Council decision process, and captures the range of uncertainty.

The Team and the Panel agreed on the base line model to be used in the assessment although a review of the base line model and associated results was not available in time to be included in the STAR panel review report. Even though the final draft STAT document was not available, the new assessment offers a much greater insight into the bocaccio stock and its structure. The Panel anticipates the final results to very useful in directing Council action of managing for the recovery of the Bocaccio stock. The STAR Panel commends the STAT team on their hard work during the STAR panel meeting and the Team's co-operation with the requests of the Panel.

I. Analyses Requested by the STAR Panel

1) **Carry out a sensitivity analysis for the different sources by weighting (de-emphasizing each survey in turn).** It was found that the triennial composition conflicts with the recruitment index. The CalCOFI index also shows some conflict with the size composition data and models.

2) **Plot all abundance indices, with appropriate lag and scale, on the same graph for direct comparison.** The trends in the indices were similar within and between the two areas. This should raise confidence in the estimate of the current state of the stock.

3) **Produce a likelihood profile for natural mortality.** A comparison between the low (0.15), base (0.2) and high (0.25) for Southern and Central California was undertaken. For Southern California, there was little to choose statistically between the levels of natural mortality. For Central California, 0.25 year^{-1} was inconsistent with the data, and no realistic fit could be found. There was little to choose between natural mortality of 0.15 and 0.2 year^{-1}.

4) **Carry out a retrospective analysis for each stock assessment.** For Southern California, the estimates for the spawning output and total biomass remain stable. The analysis of Central California suggests slight systematic overestimation of the same indices, but the bias applies to the whole series rather than just the most recent values.

5) **Apply a uniform selectivity curve for the triennial survey.** The triennial age composition was found to be inconsistent with other size and age compositions when a uniform selectivity was forced. It was generally felt that the triennial survey selectivity pattern was implausible, but there is no clear way to improve it. However, this problem largely disappeared when combining the areas into a single population assessment. The selectivity parameters for the two-stock model may have been trapped at a local optimum.

6) **Apply an asymptotic selectivity curve for the commercial trawl fishery.** Commercial

trawl selectivity changes other selectivity curves, suggesting it is very informative on the size/age structure. Although the asymptotic selectivity curve was a simpler model and could be justified using a statistical test (Akaike criterion, +15.4 log-likelihood on 9 degrees of freedom; there was uncertainty about the error degrees of freedom), a domed selectivity was more plausible from what is known of the species and gear. Therefore, although there was little improvement in the fit, the domed selectivity was kept in as the base model.

7) **Conduct a sensitivity analysis on historical 1951-1977 and 1979 catches for Southern California apportioning between trawl and hook and line.** All catches were allocated to hook and line and 1979 catch was estimated through linear interpolation between 1978 and 1980. This appears to have little impact on the results, although it was generally agreed that the allocation to hook and line was probably closer to reality.

8) **Carry out a sensitivity analysis on historical 1950-1977 and 1979 catches for Southern California changing the proportion of the total rockfish catch which is being allocated to bocaccio.** The results suggested that the model fits lower catches worse than higher catches. Increasing catches has little effect on the current SSB relative to 1951. However, the ratio of the average 1951-1975 spawning output to the estimated unexploited spawning output is very sensitive to the initial catches assumption. The current exploitation rate is not sustainable if the 1951-1977 catches are reduced to 25%, and sustainable if the catches are 125% of those used in the base model. It was decided to use two scenarios with 40% (base) and 20% allocation of the total rockfish landings to bocaccio. Subsequently, information became available that suggests that in some cases as much as 60% of rockfish landings were bocaccio, so clearly more research is required on this issue.

9) **As well as the two-stock model, carry out a single-stock assessment.** Fit a single population model, but different selectivities (i.e. fisheries remain separate) for northern and southern fisheries to accommodate differences in commercial gear. The single stock assessment fitted the data less well, although many fewer recruitment parameters were required. In particular, the recreational and trawl size compositions, and recruitment indices fit less well for the combined population model. The single stock model was preferred as the base model despite fitting the data less well because all available evidence suggests that bocaccio in central and southern California belong to the same stock. Managers may define northern and southern management areas but this question was not in the scope of the assessment.

10) **Present a single stock model assessment, but with the north and south fisheries with the same selectivity curves.** The results were similar to the combined model with separate selectivity except the set net and hook and line size compositions fitted less well. A formal test (Akaike) suggests this model should be rejected in favor of the model with separate selectivity.

II Comments on the Assessment

1) The STAR panel accepts the single stock model with separate selectivities for all gears split between central and southern California and M=0.2 year^{-1} as the base model, and is

satisfied that this assessment provides the best scientific management advice available. There is no evidence that central and southern California belong to separate stocks, but greater accuracy in the assessment might be obtained in the future from modeling the spatial differences between management areas explicitly. However, the single population model remains the most robust for providing advice at this time.

2) For many of the indices, the delta lognormal was used. This is a mixture model between a presence-absence probability (binomial with n=1) and lognormal distributions. The probability that a cell is greater than zero is estimated by a logit model. The mean value, given it is positive, is estimated by the lognormal. This avoids a linear transformation (adding an arbitrary constant) before taking logs to remove problems with zero values. While theoretically better, it was pointed out that this model has had problems in other assessments and has attracted substantial criticism in the recent scientific literature. The problem stems from using the log-normal, which down-weights higher values, may be a poor approximation to small discrete values (such as size-specific survey trawl catches) and may introduce significant bias. Alternative probability models, such as quasi-likelihood Poisson, negative binomial or an alternative mixture model (e.g. replacing the log-normal in the above model with the normal) were suggested as alternatives. The problems caused by a high frequency of zero cells are more likely to occur in overexploited stocks which are recovering, as in this case.

3) The assessment assuming two separate stocks suggests growth and recruitment is very similar between the areas. Previous research also suggests that they are very similar genetically. Only recruits-per-spawner and the level of depletion were different, but these apparent differences might be due to estimation error. However, these differences may be better explained by a migration model between two connected populations rather than separate stocks. The main implication for the current assessment is that uncertainty about migration increases the uncertainty of unexploited biomass estimate, which in turn makes the target biomass for the rebuilding program less certain.

4) The problem of modeling two management areas was considered appropriate for further research. In particular, it would be most useful to parameterise migration or connectedness between the areas rather than having separate models which represent the extremes of what is probably a continuum. It should be noted that if the stock is split, there may be further implications for the way it is managed.

5) It was suggested that the central California population is probably towards the edge of the California stock range (Pt. Arena) and therefore may be less resilient to climatic effects and exploitation. Recovery in the central area may take longer than Southern California and may be difficult to predict.

6) Retrospective analysis suggests predictions and estimates of state of the resource are stable as new data were added for Southern California. Central California indicates the estimate of spawning falls as data are added. Spawning may be overestimated although it will make little difference to the final results as it is very low already. This bias may be due to the abundance index series, which are short (with the exception of the CalCOFI) for the Central region and will probably disappear as data are accumulated.

7) Concern was expressed that the early trawl catch numbers used in the analysis maybe too high in Southern California. No facilities for landing trawl-caught bocaccio existed before 1977 and therefore the trawl fishery was not well developed. Before 1978 an arbitrary allocation was made between the hook and line and trawl fishery on total rock fish catch. As well as allocation to gear, the allocation to species may also be uncertain. It was assumed to be 40% bocaccio. Some late information suggested between 1962-1963 that bocaccio landings could be as high 60%. The reference points based on unexploited biomass were sensitive to this issue.

8) Mexico may have CalCOFI data which could be included. This had already been considered. There may be some by-catch of bocaccio in Mexico, but it is probably small.

9) Some correction may be required to the CalCOFI data allocation between the southern and central areas, as there was a geographical boundary change during the series.

10) Bocaccio spawns more than once per year and the spawning season extends beyond that assumed in the development of the spawning index. Some concern was expressed as to whether this would affect the index. It was argued that the index used data from the mid-season period, so it probably represented the whole season adequately, but multiple spawning was not taken into account. The index could overestimate the number of spawners or recruits per spawner depending on how and where multiple spawning occurs. Conversely recruitment may be underestimated with a second recruitment not included in the index. Multiple spawning is more likely in the south and may also explain the higher recruits per spawner estimate.

11) Overall, the results are moderately sensitive to the assumed natural mortality rate. Natural mortality cannot be estimated as it is confounded with the growth rate parameter (among others) in the assessment, and therefore must be supplied as a known value. There was a slight improvement in fit with lower natural mortality for the assessments split between regions. There was significant improvement with higher M for the combined model, but this improvement continued on to unrealistic values for natural mortality. Abundance relative to the unexploited biomass remained unchanged, although absolute abundance increased with natural mortality in Southern California. Natural mortality affects the estimate of the sustainable exploitation rate and other important indicators from the assessment.

12) Using the average SPR 68-95 rather than SPR 55-95 to calculate the relative sustainable SPR gives estimates suggesting that the southern California management area is unable to sustain even very small levels of fishing, which is clearly incorrect. The time series 1955-1967 is important in producing a realistic assessment. The magnitude of the early catches also affects the results. A reduction in early catches lowers the productivity of the assessment area, but also makes it less depleted. These two factors cancel each other out to some extent, so the time to rebuild the stock is less affected than might be expected. Nevertheless, the estimates of the unexploited biomass are dependent the early catch time series, which needs to be reassessed. One member of the STAR panel suggested that spawner-recruit and productivity calculations for a portion of the stock (i.e. a management area) were not meaningful because neither spawners nor recruits were measured for the whole stock.

13) There is an unrealistically high recruitment event estimated for 1963. This estimate contaminates the recruits-per-spawner estimate which would be used to simulate rebuilding times. Direct observations for recruitment indices exist for 1972 onwards and this probably represents the most reliable period to draw recruitment estimates from for the projection. Alternatives to this base case could be used for the decision table, for example, using all 1955-2001 recruits as opposed to using only the more recent recruitments (e.g. 1980-2001). However, an assessment based on only the most recent recruitments, may indicate that the stock is not able to recover even with no fishing. Some strong recruitments, as seen before 1980, may be a necessary prerequisite for any recovery.

14) For projecting recruitment, the average recruit-per-spawner 1955-95 and its observed coefficient of variation should be used. Average recruitment is an important source of uncertainty as it affects both the target and current status. It was suggested that the rebuilding projections should use high and low mean recruitment as a source of uncertainty (+/- 1 SE). Also, the target could be based on median (from simulations) rather than mean SSB. The median may be a more robust target than that based on the mean and should be considered as an alternative for future research.

15) Sensitivity analyses using random initial parameter estimates were carried out during and after the STAR panel meeting. Results suggest that likelihood surfaces for the bocaccio model were complex, which made identification of the global maximum likelihood estimates uncertain. It seems possible that the model for bocaccio was sensitive to noise in the length or age composition data. A simpler model or different parameterization might be used in the next assessment.

16) Most of the model runs examined at and after the STAR panel meeting suggest that the triennial survey is basically a young fish survey for bocaccio because estimated selectivity patterns declined with size. It is not clear if the estimated selectivity patterns were reasonable, given the type of gear, areas surveyed and biology of bocaccio rockfish. The hypothesis that triennial survey data could be used to derive a recruitment index for bocaccio rockfish should be addressed in the next assessment.

17) Two decision tables, one projecting the two separate management areas and the other considering the consequences of high and low average recruitment around the base model for the whole stock were suggested. The latter was thought the best to take forward to provide management advice as it would capture the essential uncertainty of the assessment.

III Explanation of Areas of Disagreement Regarding STAR Panel Recommendations

There were no areas of disagreement among STAR panel members or between the STAR panel and the STAT team. It is the consensus conclusion of the review panel that the assessment represents the best available scientific information regarding the status of the Boccacio stock.

IV Unresolved Problems and Major Uncertainties

There were a number of substantial unresolved issues pertaining to details in the standardization of abundance indices for bocaccio rockfish. Use of the delta-lognormal distribution and jackknife variance calculations were chief among these. Southwest Fisheries Science Center Administrative Report LJ-96-06 indicates, for example, that trends in CalCOFI indices for boccacio rockfish are sensitive to the model used in standardization. Evidence presented suggested that trends in abundance data for bocaccio rockfish were relatively robust and similar. If trends are similar, questions about variance calculations are relatively unimportant. The STAR panel decided to accept the abundance indices for bocaccio as presented. However, they should be carefully evaluated for the next assessment.

An important uncertainty is the method used to model future recruitment. The past recruitment has been much higher than recent recruitment. Recovery will be much slower and may not occur in the central California area, unless there are some strong year classes produced by recruitments similar to the beginning of the series.

If the recruitment is driven by the environment, recruitments more similar to the initial part of the time series are possible. Alternatively, if recruitment is driven by spawning stock size, more recent recruitments may be a better indicator of future recruitments. Which of these two hypotheses is correct cannot be resolved.

The degree to which the central and southern California management areas are connected is unclear. This issue does not affect the assessment of the status of the overall stock much, but may affect the way the stock recovers. The separate stock models fitted the observations better. A model with separate adult populations, parameterised migration and a common recruitment pool distributed proportionally to the recruitment indices could significantly improve future assessments.

The unexploited biomass is inaccurately estimated, as it depends on poorer catch data from the early part of the time series. While this does not put its overfished status in doubt, it will lead to greater uncertainty over when the stock has recovered. This estimate should be improved by further work on the catch series.

V Recommendations for Future Research and Data Collection

1) Ichthyo-plankton CALCOFI data from northern and central California (including "Russian" data) from 1970-1982 was missing from the analysis. The CalCOFI ichthyo-plankton samples for the region north of Avila Beach for bocaccio and other *Sebastes* spp. should be traced and worked up into appropriate indices. If of good enough quality, they should be included in future analyses.

2) A two area model for the bocaccio stock could be developed which would allow migration between the two main regions. It was suggested that the model might have two separate adult populations, but shared recruitment and other parameters as appropriate. The degree of mixing between the populations could be parameterized, rather than having two different models representing extreme ends of the hypothesis. This model could be

used explore the implications of different levels of adult migration between the areas, and choose some reasonable level. This model could form the basis for exploring the issue of how to handle two separate areas in the assessment.

3) The assessment is sensitive to the way past rockfish catches are allocated between species and, to a lesser extent, gear. Information on rockfish landings composition may be available for the earlier years which will improve estimates. Also it may be possible to fit a species abundance curve to those years where information on species composition is available. Species abundance curves may improve interpolation and extrapolation of species composition to those years where only total catch is available.

4) RecFIN has data missing, which needs to be addressed by the RecFIN committee to provide reasonable estimates for missing values for each species. RecFIN data is becoming increasingly important as recreational catch is becoming the largest proportion of the catch for this species.

5) Research on the effect of multiple spawning on the CalCOFI spawning index is required. The number of spawnings may differ between northern and southern California.

6) Trawl logbooks from 1950-1980 exist and should be entered into a database to obtain rockfish catch and effort data for this period. This would provide valuable data for many species as well as bocaccio.

7) Party logbook data exist and indices for bocaccio should be updated for the next assessment.

8) The current reference points may not be robust to the uncertainties in the model. Reference points might be developed based on robust median estimates rather than means for the unexploited SSB.

9) Conventional stock assessment model calculations which rely on assumptions about lognormal measurement errors in abundance data are problematic when applied to stocks that are naturally rare or depleted (e.g. bocaccio) because zeroes are common in abundance data and the assumption of lognormal errors is not tenable. The next assessment should explore approaches (e.g. maximum likelihood using the Poisson, negative binomial distributions) that make statistical assumptions about measurement errors that might be more appropriate.

Status of the Canary Rockfish Resource off California, Oregon and Washington in 2001

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DRAFT for final STAR panel review
April 26, 2002

Executive Summary

Stock: The current assessment was performed on the species canary rockfish (*Sebastes pinniger*) found from California to the U.S. Canada Border. This was a departure from the previous assessments completed in 1999 which analyzed separate stocks north and south of the Eureka-Columbia INPFC border.

Catches:
The catches of canary rockfish have declined throughout the time-series, but the declines have been most dramatic since 1999. Catch prior to 2000 have come primarily from trawl gears but the most recent landing have shown the increasing importance of recreational catches.

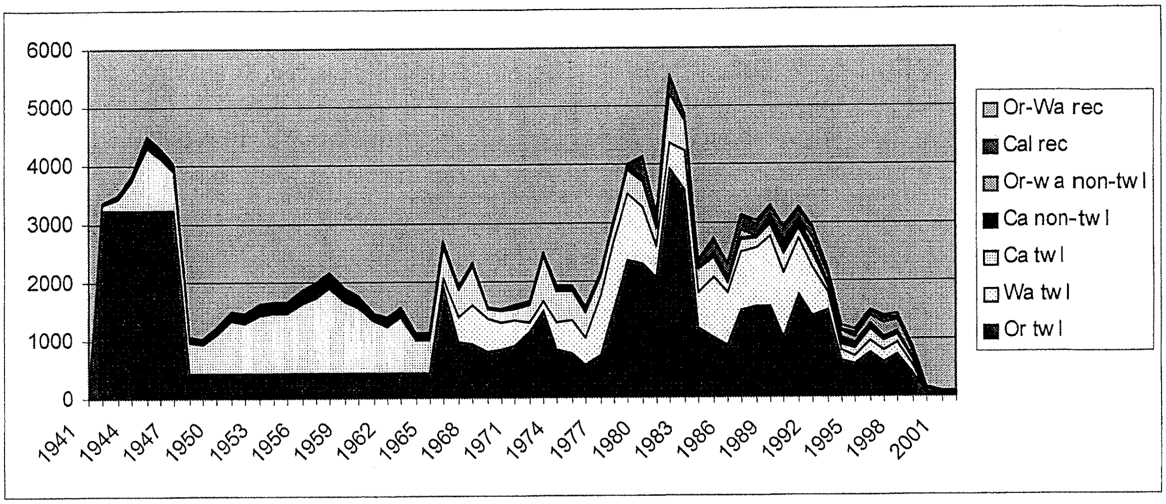


Figure 1exec. The time series of landings by gear group and state used within this assessment.

Table 1exec. The catch and discard estimates by gear and state.

year	Or twl	Cal twl	Wa twl	Ca nontwl	Or/Wa nontwl	Cal rec	Or/Wa rec	discard
1991	1778	972	143	131	27	157	43	0.0123
1992	1402	825	232	133	151	170	32	0.0123
1993	1514	290	85	84	115	65	59	0.0123
1994	644	150	121	113	104	51	37	0.16
1995	551	161	133	97	100	72	54	0.16
1996	765	190	216	104	140	64	29	0.16
1997	587	203	169	84	214	95	47	0.16
1998	717	203	154	65	210	25	70	0.16
1999	388	140	121	14	104	67	49	0.16
2000	26	8	11	2	9	85	36	0.16
2001	14	7	8	1	9	33	18	0.16
2002	13	7	8	1	9	33	18	0.16

Data and assessment: The assessment model was the age-structured version of the stock synthesis assessment tool (Methot, 2000). The data available include the following: catch from trawl by state and the associated length and to a lesser extent age distributions, catch of non-trawl and length distributions form California, recreational catch and length distributions from all states, a shelf trawl survey and associated length and age compositions, a southern trawl CPUE index, a southern recreational party boat CPUE index, and a central California juvenile trawl survey. The recreational party boat CPUE was a new data source for this assessment. This assessment also incorporates into a single model the two hypotheses of higher female mortality but lower selectivity. This was done using an increasing female natural mortality linked to maturity but also allowing selectivity to be domed as well.

Unresolved problems and uncertainties: The role of availability and mortality in the deficit of older female canary rockfish in all data sources was a source of uncertainty with the assessment. Several analyses were presented and generally accepted by the STAR Panel that indicated that female rockfish have a higher mortality rate after the onset of maturity. It was also believed that larger canary rockfish may congregate in un-sampled areas and that magnitude of each on the deficit of female canary was uncertain. It was also a source of concern that the artificial stock boundary at the U.S./Canada border does not accurately depict stock distribution and future work should aim to explicitly include Canadian data.

Management targets and references: The traditional target fishing rate for canary rockfish corresponds to an $F_{50\%SPR}$ rate and the biomass target is a population with a spawning biomass equal to 40% of the un-fished biomass. Over-fishing occurs when current harvest rates exceed $F_{50\%SPR}$ and a population is over-fished when the spawning biomass is reduced to levels below 25% of the unfished state. The model suggests that exploitation was greater than this rate throughout much of the exploitation history and the stock now exists at spawning biomass levels below 10% of an un-fished state. Although there is uncertainty in the assessment results, there is little doubt that the spawning biomass has been depleted to levels below the over-fished thresholds.

The new assessment includes estimation of the recruitment-spawner relationship to quantify the degree to which recruitment has declined as the spawning stock has declined. This relationship has a very low steepness, which basically means that canary rockfish recruitment is not resilient to declines in spawning stock. The model's internal estimate of steepness indicates that recruitment is at 28.9% of its unfished level when spawning stock is at the 20% level. When the steepness parameter is estimated outside of the assessment model per se, the value rises to 36%, which is still estraordinarily low compared to productive species. A steepness of 36% indicates that Fmsy is F69%, Bmsy is at 43% of the unfished level, and MSY is 919 mt.

Stock Biomass: The current biomass of canary rockfish is at a very low level, and was at roughly 8% of the un-fished spawning biomass at the beginning of 2002. Biomass has declined throughout the time period and no one period has seen an estimated relatively stable trend.

Figure 2exec. The trend in spawning biomass and age 1+ biomass (both sexes) from the most recent assessment.

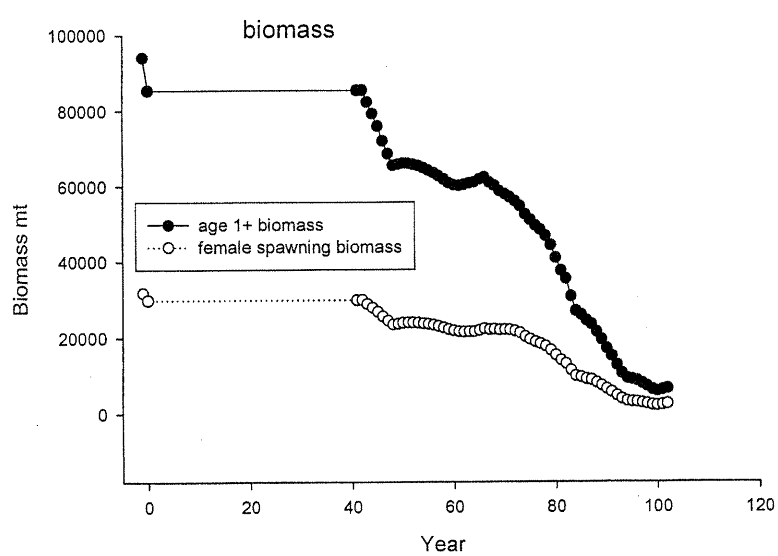
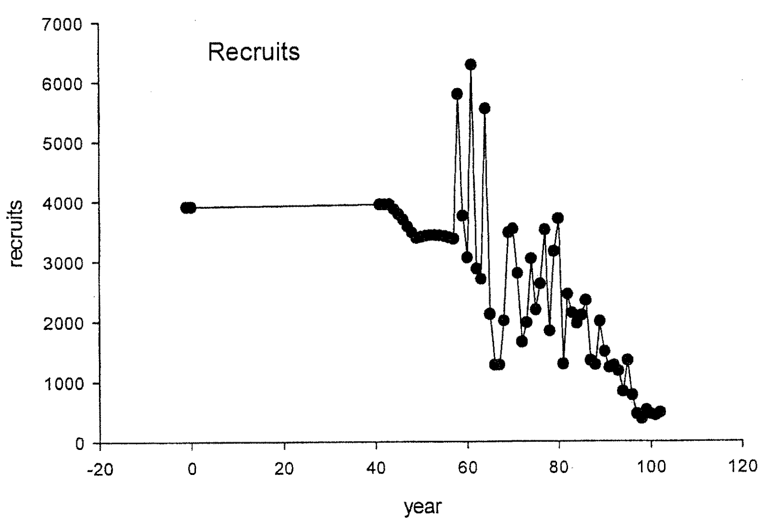


Table 2exec. The most recent estimates of beginning year, mid-year, spawning biomass as well as recruits from this assessment.

YEAR	BEG BIO	MID BIO	SP.BIO	RECRUIT
90	17090	14910	6438	1488
91	15118	12805	5667	1227
92	12739	10690	4683	1255
93	10644	9075	3831	1169
94	9286	8325	3254	830
95	8969	8053	3130	1342
96	8657	7566	3037	766
97	7899	6895	2762	449
98	7160	6149	2512	374
99	6266	5589	2195	516
100	5887	5591	2102	454
101	6197	5926	2312	435
102	6540	6254	2524	477
Ratio to unfished:	**0.07**	**0.07**	**0.08**	**0.12**

Recruitment: The recruitment estimated within the model has declined throughout the time-series (Figure 3exec). Recruitment was estimated to be at very low levels in the 1990's. Recruitment in 1999 and 2000 was not estimated because of a lack of information on those year-classes. Thus the potential effect of a potential recent oceanic regime shift is not at present known. The actual numbers of recruits for the most recent years are given in Table 2exec of the executive summary.

Figure 3exec. The time-series of estimated recruits from the base model run.



Exploitation Status: The exploitation rates of canary rockfish increase rapidly in the 1980's from relatively low levels prior to that period (Figure 4exec). The most recent years have seen a dramatic decline of the exploitation rates due to management regulations. The actual percent of available biomass that was taken with the last few years is given in Table 3exec.

Figure 4exec. The percent of available biomass taken by each fishery is given for each year.

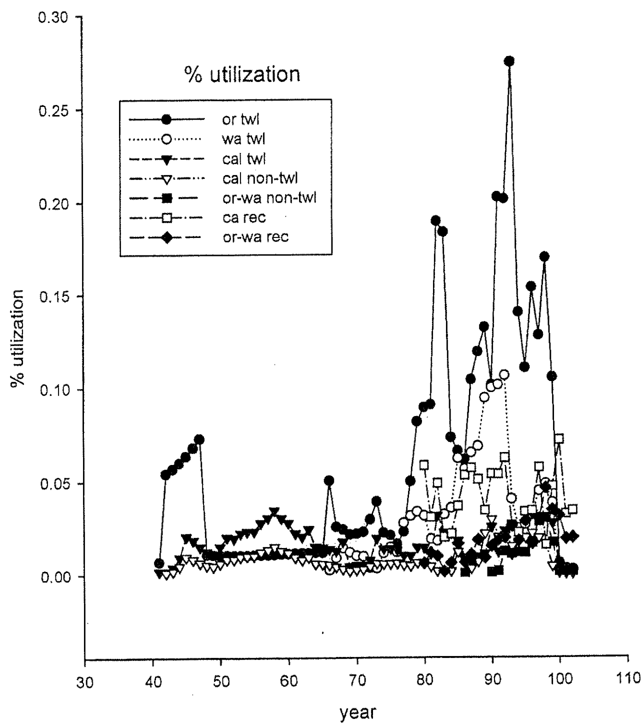


Table 3exec. The actual percent of available biomass taken are given by year.

Year	OR twl	Wa twl	Ca twl	Ca non-twl	Or-Wa non-twl	Ca rec	Or-Wa rec
90	0.1011	0.0996	0.0254	0.0293	0.001	0.0537	0.0151
91	0.2021	0.101	0.0119	0.0201	0.0018	0.0535	0.0182
92	0.2011	0.106	0.0234	0.0209	0.0123	0.0622	0.0195
93	0.2742	0.0402	0.0105	0.0151	0.0112	0.0263	0.0258
94	0.14	0.0244	0.0174	0.0222	0.0117	0.0224	0.018
95	0.1101	0.0266	0.0194	0.0196	0.0116	0.0335	0.0283
96	0.1535	0.0316	0.0322	0.022	0.0168	0.034	0.0162
97	0.1276	0.0445	0.0307	0.0195	0.0282	0.0571	0.0296
98	0.1694	0.0484	0.0306	0.0163	0.0302	0.0157	0.0461
99	0.105	0.0382	0.0274	0.0043	0.017	0.0471	0.0345
100	0.0059	0.0022	0.0026	0.0007	0.0016	0.0716	0.0313
101	0.0029	0.0017	0.0017	0.0003	0.0015	0.0323	0.019
102	0.0024	0.0015	0.0015	0.0003	0.0014	0.034	0.0196

Management Performance: The landed catch (given the assumed discard) has decreased in accordance with the intentions of managers since canary rockfish was declared overfished.

Table 4exec. The coast-wide ABC, landings, discard rate and total catch of canary rockfish from 1990-2001.

Year	ABC(mt)	Landings (mt)	Assumed Discard	Total Catch(mt)
1990	3500	2680	0.0123	2928
1991	2900	3104	0.0123	3251
1992	2900	2713	0.0123	2945
1993	2900	2188	0.0123	2212
1994	2900	1208	0.0123	1220
1995	1250	1032	0.16	1168
1996	1250	1322	0.16	1508
1997	1130	1246	0.16	1399
1998	1130	1272	0.16	1444
1999	1130	778	0.16	883
2000	287	175	0.16	177
2001	228	90	0.16	90

Decision Table for Rebuilding and Harvest Forecasts: The forecast of potential yield of canary rockfish is linked to the probability of rebuilding in the statutory time frame. The initial rebuilding analysis based upon the northern assessment calculated the minimum time to 50% probability of rebuilding (T_{min}) to be 41 years. The T_{max} adds one mean generation time of 17 years. The current harvest policy is based upon the rebuilding analysis' calculation that an annual total catch of 93 mt will have at least a 50% probability of rebuilding by the year 2057.

A complete update of the rebuilding analysis has not been conducted, but the forecasting module of the assessment model has been used to explore potential rates of rebuilding. A more complete rebuilding analysis can be prepared pending further direction from the PFMC and its technical committees.

The new coastwide assessment provides a more complete evaluation of the initial recruitment levels and unfished biomass. These levels are higher than estimated in the 1999 assessment, thus the rebuilding targets are higher. The new assessment indicates that the spawning biomass had already been fished down to about the 70% level by the mid 1960s.

A critical exploration in the new assessment was with regard to the degree of increase in natural mortality for old females. The best estimate and baseline model is at a level of old female M=0.12, and old M levels of 0.10 and 0.14 were used to provide a range of plausible levels. The driving factor resulting from the range of old M is the associated estimate of spawner-recruitment steepness. Because the rate of rebuilding is most dependent on the steepness, the decision analysis boils down to a contrast between the steepness level initially estimated within the model (0.289) and the steepness level estimated through a focused examination of the recruitment-spawner information (0.360). We believe that the 0.36 value is more indicative of the level of recruitment to be expected as the stock begins to rebuild. Even with the higher rebuilding targets resulting from the new assessment, the steepness of 0.36 indicates that the stock has a 50% probability of rebuilding by 2044 with no additional fishing. This is essentially the same as the current T_{min}. The following table contrasts the probability of rebuilding with no catch, constant catch of 93 mt, and constant harvest rate of F90%.

Steepness	Pr(rebuild by 2057) with F=0	Pr(rebuild by 2057) with catch=93 mt	Pr(rebuild by 2057) with F=F90%	2003 OY with F=F90%
0.289	17%	<1%	1%	47 mt
0.360	99%	79%	80%	47 mt

If the steepness truly is as low as 0.289, then the current estimate of Tmin equal to 41 years is untenable.. With steepness equal to 0.289, then a preliminary recalculation of Tmin is the year 2064, the associated Tmax would be 2080, but the stock does not have a 50% probability of reaching the rebuilt level until 2085 at F90% and until 2089 with catch = 93 mtons.

Recommendations:
The following research and monitoring efforts would improve the accuracy of the canary rockfish assessment and provide better monitoring of its rebuilding.

(1) *Abundance surveys*: Research surveys need to be conducted more frequently. The three-year span between consecutive surveys necessarily confounds interpretation of time series, including biological distributions (age and size) and CPUE indices.

(2) *Habitat relationships*: The historical and current relationship between canary rockfish distribution and habitat features should be investigated to provide more precise estimates of abundance from the surveys, and to guide survey augmentations that could better track rebuilding.

(3) *Expanded Assessment Region*: Given the high occurrence of canary rockfish close to the US-Canada border and the good consistency of the survey trend and model fits through preliminary inclusion of Canadian data, we recommend a joint US-Canada assessment in the future.

(4) *At-sea observer programs*: The observer program, which began in August 2001, will soon begin to provide useful information on the total catch of canary rockfish from all gear types. These data should be analyzed and included in the next canary assessment.

(5) *Pre-recruit surveys*: Although the midwater trawl juvenile rockfish survey was not included in the current assessment, we recommend further work to evaluate its applicability, especially because of recent efforts to expand the geographic scope of this survey.

(6) *Stock-recruitment evaluations*: The new estimate of the spawner-recruitment relationship developed in this assessment needs to be evaluated against time series of climate data.

(7) *Absence of old female canary rockfish in the sample data*: Given the premise of this and past assessments that much of the uncertainty in the overall analyses stems from a lack of understanding regarding the discrepancy between age distributions of male and female canary rockfish, efforts should be undertaken that address this issue, including: (1) obtaining fish that have been sampled (through the fishery or survey) by gears other than trawls, e.g., vertical longlines are used by the open access fishery to catch rockfish; (2) developing laboratory-based programs to rigorously evaluate the physiology of the two sexes, particularly, the females.

Status of the Canary Rockfish Resource off California, Oregon and Washington in 2001

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Pacific Fishery Management Council (PFMC)

26 April 2001

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PREFACE

This document has been prepared by a stock assessment team (STAT) consisting of Richard Methot, and Kevin Piner of the Fishery Resource Analysis and Monitoring Division (FRAMD) of the Northwest Fisheries Science Center (NWFSC) located in Seattle, WA (Montlake Laboratory). The researchers with FRAMD in conjunction with state resource agencies charged with data collection, coordinated this assessment and were involved in the preparation of data sets, modeling, and documentation presented here.

Canary rockfish were last assessed in 1999 by two STAT teams. A NMFS/NWFSC team updated the northern (Oregon and Washington) assessement that has been conducted periodically since 1984. A first time assessment was completed for canary rockfish off California by a NMFS/SWFSC team In this document we update those assessment within a single analysis. Our efforts have been focused on taking a coast-wide look at the canary rockfish resource with the assumption that canary rockfish coast-wide exchange sufficient biological information as to be considered one unit stock. In this effort we have tried where possible to follow similar dataset preparation methods as those used in previous assessment (ex. Similar weighting schemes to derive length composition). We will outline within the document those areas where we deviated form the methodologies used in the prior assessments.

Because the canary resource is considered over-fished; a separate rebuilding analysis will also be completed. Although some of the analysis used in the rebuilding will be included within this assessment, including those parameters necessary to do the rebuilding analysis, this document contains the assessment of the status of the resource with limited projections and is not a rebuilding plan.

INTRODUCTION

Distribution

Canary rockfish, (*Sebastes pinniger*) are distributed in the northeastern Pacific Ocean from the western Gulf of Alaska to northern Baja California; however, the species is generally believed to be most abundant from southeastern Alaska to central California (Miller and Lea 1972; Hart 1988; Kramer and OConnell 1995). Canary rockfish are members of a diverse groundfish assemblage that is found off the U.S. Pacific coast, which includes over 60 species of rockfish (*Sebastes*). Adult canary rockfish, like many other species of rockfish in the genus *Sebastes*, are primarily found along the continental shelf from 250 fm (457 m) inshore to 25 fm (46 m).

Life History

Canary rockfish off the U.S. Pacific coast exhibit a protracted spawning period from September through March, probably peaking in December and January off Washington and Oregon (Johnson et al. 1982; Hart 1988). Female canary rockfish reach sexual maturity at roughly 8 years of age. Like many members of *Sebastes*, canary rockfish are ovoviviparous, whereby eggs are internally fertilized within females and hatched eggs are released as live young (Bond 1979; Golden and Demory 1984; Kendall and Lenarz 1987). Canary rockfish are a relatively fecund species, with egg production being correlated with size, e.g., a 49-cm female can produce roughly 0.8 million eggs and a female that has realized maximum length (say 60 cm) produces approximately 1.5 million eggs (Gunderson et al. 1980). Very little is known about the early life history strategies of canary rockfish, but limited research indicates larvae are strictly pelagic (near ocean surface) for a short period of time, begin to migrate to demersal waters during the summer of their first year of life, and develop into juveniles around nearshore rocky reefs, where they may congregate for up to three years (Boehlert 1980; Sampson 1996). Evaluations of length distributions by depth developed from NMFS shelf trawl survey data generally supported other research that suggests this species is characterized by an increasing trend in mean size of fish with depth (Boehlert 1980; Archibald et al. 1981). Female canary rockfish generally grow faster and reach slightly larger sizes than males, but do not appear to live longer than males. Adult canary rockfish feed primarily on small fishes, as well as planktonic creatures, such as krill and euphausiids (Phillips 1964; Love 1991). Life history characteristics of the canary rockfish population inhabiting northern INPFC areas are discussed in further detail below (see Biological Parameters).

Stock Structure

In this assessment, we assumed the canary rockfish population that inhabits waters off California, Oregon and Washington (U.S. Vancouver INPFC area through the Monterey INPFC area) represents a single unit stock (**Figure 1**). This was a departure from the past assessments of the coast-wide canary resource. Management of canary rockfish is presently based upon two assessments; one done in the northern area (Crone et al. 1999) and one in the Southern area (Williams et al. 1999). A plot of the cumulative proportion of canary catch from the shelf survey (summed by weight) by latitude indicated that the highest density of catch existed near headlands and along INPFC boundaries (see **Figure 14**). Thus splitting stocks or assessments at any INPFC boundaries divides high density areas that most likely are in biological communication. There exists little published information, however regarding the stock structure of canary rockfish off the U.S. Pacific coast, but some genetic-related research, in addition to differences observed in the species compositions of mixed-rockfish landings in each state, indicate that distinct canary rockfish stocks may exist between the southern and northern portions of its range (Boehlert 1980; Wishard et al.

1980). A comparison of growth curves, however, that were developed on a year and sex-specific basis indicates as much variability at small spatial scales (eg. Within a state) as across larger spatial scales (see **Appendix 1**). This lack of larger differences in growth at larger scales relative to smaller scales is not supportive of a separation of independent stock. Given the limited information available on canary rockfish biology (e.g., spatial and temporal migration habits) and no clear information regarding the status of distinct biological populations along the West Coast of the United States, we felt it was more appropriate, from theoretical and analytical standpoints as well as facilitating concise management, to assume a single stock of canary rockfish, rather than multiple stocks, inhabited the U.S. west coast areas (U.S. Vancouver-Monterey).

Commercial Fishery and Management

The rockfish fishery off the U.S. Pacific coast became established during the early 1940s, when the United States became involved in World War II and wartime shortages of red meat created an increased demand for other sources of protein (Alverson et al. 1964; Browning 1980). At this time (1942-47), the trawl fishery off Washington and Oregon expanded and diversified rapidly to meet food fish demands brought on by the War (Niska 1976). Off of California the dominant gear of the 1940s was longline. Historically, the vast majority of canary rockfish off the U.S. Pacific coast have been harvested by commercial trawling vessels, followed by hook-and-line (primarily vertical longline), shrimp trawls, and various miscellaneous gears (e.g., nets and pots). In 1977, when the Magnuson Fishery Conservation and Management Act (MFCMA) was enacted, the foreign-dominated rockfish fishery shifted to a domestically owned resource that continues today. Canary rockfish are also sought by recreational anglers and are considered a moderately important species caught in the private vessel and charter boat fisheries off Washington, Oregon, and northern California.

From the late 1940s to the mid 1960s, annual catches of rockfish (including canary rockfish) dropped substantially and averaged less than 500 mt (Golden and Wood 1990) in the northern INPFC areas. Beginning in the late 1960s and continuing into the early 1990s, landings of canary rockfish increased in conjunction with flourishing Asian markets, with average annual catches generally ranging between 2,000 and 4,000 mt. In 1993 and 1994, commercial fishermen communicated that fewer canary rockfish were being caught in their rockfish tows (PFMC 1998a). The 1994 canary rockfish stock assessment (Sampson and Stewart 1994) confirmed that the observed declines in the field were likely the result of a population that had not responded favorably to recent levels of fishing pressure and further, recommended that the canary rockfish quota (Acceptable Biological Catch or ABC) be reduced to allow the stock to recover. Beginning in 1995, the ABC for canary rockfish was reduced nearly 60%, where it has remained at roughly 1,000 mt to the present.

The first regulations established on the canary rockfish fishery off the U.S. Pacific coast were implemented in 1983 as trip limits (40,000 lb per trip) on the *Sebastes* complex (a market category that includes mixed-rockfish species) harvested from the U.S. Vancouver and Columbia INPFC areas (PFMC 1998a) (Table 1). That is, at this time, commercial vessels were not required to separate rockfish catches into individual species, but rather, only into mixed-species categories, such as the *Sebastes* complex. Port biologists in each state routinely sample particular market categories (e.g., *Sebastes* complex) to determine the actual species composition of these mixed-species categories. Since 1967, various port sampling programs have been utilized by state and federal marine fishery agencies to determine the species compositions of the commercial groundfish landings off the U.S. Pacific coast (Sampson and Crone 1997). Stratified, multistage sampling designs are currently used in the port sampling programs for purposes of evaluating the species compositions of the total landings, as well as for obtaining biological data on individual species (Sen 1986; Crone 1995).

From 1983 through 1994, canary rockfish were monitored as part of the *Sebastes* complex, with various trip limits imposed over this 10-yr span. In 1995, trip limits specific to canary rockfish (cumulative monthly trip limit of 6,000 lb) were imposed and commercial vessels were expected to sort the canary rockfish from the mixed-species categories, such as the *Sebastes* complex. For 1998, catches of canary rockfish were regulated using a two-month cumulative trip limit of 40,000 lb for the *Sebastes* complex, of which, no more than 15,000 lb (38%) could be composed of canary rockfish, i.e., although this species was allocated its own market category, it is still being managed as part of the mixed-species complex.

From 1998 to present, commercial fishing for canary has been drastically reduced and the only significant take is that from accidental catch or auxiliary catch. Canary rockfish has become a limiting factor for other fisheries that target other commercially important species upon the shelf. A shift in management focus to reduce the catch and by-catch of canary rockfish was a product of the low estimated biomass relative to unfished biomass in the 1999 assessment. Canary rockfish remains one of the most intensively followed species by regulatory agencies, NGO's (conservation) and industry. **Table 1** summarizes the coast-wide ABC's and catch in recent years as well as important management decisions that have been taken during that period.

ASSESSMENT

Data Sources

The following sources of information were used in this assessment, either directly within the assessment model or indirectly in examinations outside of the model: (1) commercial fishery landings (1967-99); (2) commercial fishery biological data (1980-98); (3) research survey abundance and biological data (1977-98); and (4) independent research studies that addressed canary rockfish growth, maturity, mortality, and fishery-related discard and (5) recreational fishery landings and biological data (1980-2001). Additionally, commercial fishermen trawl logbook data; a juvenile trawl survey and recreational fishery data were investigated as potential sources of auxiliary information to include in the assessment model. Note that the following descriptions of the data sources used in this assessment are applicable to the northern INPFC areas only (U.S. Vancouver and Columbia), unless otherwise stated. The specific data sources are presented under broad categories: Fishery Data; Survey Data; and Biological Parameters.

Fishery Data

Overview

Commercial landings of rockfish harvested from the northern INPFC areas (U.S. Vancouver-Columbia) were first sampled for scientific purposes beginning in the early 1960s (Niska 1976). Statewide sampling programs to determine species compositions of the landed catches began in the late 1960s (Golden and Wood 1990). The first rigorous monitoring programs that included collection of biological data (e.g., sex, age, size, maturity states, etc.) were begun in 1980. Currently, port biologists employed by each state fishery agency (California Department Fish and Game, Oregon Department of Fish and Wildlife - ODFW, and Washington Department of Fish and Wildlife - WDFW) collect species-composition information and biological data from the landed catches of commercial trawling vessels that have completed their fishing trips. The sampling sites are commonly processing facilities located at ports along the coasts of California, Oregon and Washington. The monitoring programs currently in place are generally based on stratified, multistage sampling designs.

Additionally, rockfish catches made by marine recreational anglers (primarily, charter boat parties) have been summarized to varying degrees by fishery agencies, such as the state-administered (ODFW) Ocean Boat Recreational Angler Survey (OBRAS) and the federally-coordinated Marine Recreational Fishery Statistics Survey (MRFSS). In recent years attempts have been made to combine the state collected recreational data with the MRFSS data into the RecFIN database. RecFIN is analogous to PacFIN except that it compiles and computes recreational statistics instead of commercial statistics. The best estimates of recreational landings have been included in that database.

Landings

The time series of landing statistics used in this assessment begins in 1941 and goes through 2001. Golden and Wood (1990) and Sampson (1996) and Jean Rogers (2001) examined reports produced by the U.S./Canada Technical Subcommittee (TSC) of the U.S./Canada Groundfish Committee, analyzed early groundfish-catch databases (e.g., Historical Annotated Landings or HAL database), and spoke with state marine fishery agency personnel (e.g., CDF&G, ODFW and WDFW) to estimate annual catches of canary rockfish from 1967 to 1980. Landing estimates of canary rockfish from 1981 to 1999 were generated from the PacFIN database (Daspit 1996; Daspit et al. 1997), with the exception of California landings, which were derived from the CalComm database and expanded by procedures described in Pearson and Erwin (1997). A separate time-series of landings for California were developed because of potential differences in the species composition estimates used to expand the landings within the two data accumulation and estimation proceedures. A comparison of the time-series of landings from the two sources, however indicates that although there are some year-specific differences the two sources detail almost exactly the same cumulative removals over the time period (**Figure 15**).

On a yearly basis, since 1967, catches of canary rockfish off the U.S. Pacific coast have primarily come from the U.S. Vancouver and Columbia INPFC areas, with a majority of the annual landings attributed to these northern INPFC areas (Table 2). From 1967 to 1998, annual catches from the northern INPFC areas ranged from a low of roughly 20 mt in 2001 to a high of nearly 4,400 mt in 1982. Canary rockfish landings from southern INPFC areas (primarily Eureka and Monterey) have ranged from approximately 20 to 500 mt since the mid 1980s.

From the late 1960s through the early 1970s, foreign trawling enterprises harvested considerable amounts of rockfish off Washington and Oregon, and along with the domestic trawling fleet, landed the vast majority of commercially caught canary rockfish. New foreign catch estimates in 1966-1976 (Table 2a) were based on an overall effort to allocate the foreign rockfish catch to all species (Rogers in review). The previous estimates were based on Golden and Demory (1984). Sampson (1996) later assigned 44.3% of the Vancouver INPFC canary catch to the U.S. portion in all years. The revised U.S. portions varied from year to year, and averaged 30% over 1966-1974. No catch was allocated to the U.S. portion in 1975 and 1976 because foreign trawling was prohibited. Revised species proportions applied to foreign catch estimates resulted from two methods of species assemblage allocation based on foreign Pacific hake catch, information on foreign targeting in the literature, and 1966-1976 Soviet Union survey assemblages. The Soviet Union, a primary source of foreign catch, appeared to target either slope rockfish or Pacific hake in the U.S. Vancouver and Columbia INPFC areas. The domestic fishery did not generally target Pacific hake and Pacific ocean perch was generally less than one-third of domestic landings in those areas. An attempt at repeating the method of Golden and Demory (1984) resulted in 12% canary in the Columbia INPFC foreign rockfish catch and 21% in U.S. Vancouver catch. In the two revised methods, the percentage of canary rockfish in the total foreign rockfish catch was 8% and 2% in the Columbia INPFC and 5% and 3% in the U.S. Vancouver INPFC. Average estimates from the two methods were used in this assessment.

In 1977, following the federally mandated MFCMA, shoreside landings of canary rockfish increased considerably and U.S.-owned trawling vessels continue to harvest the vast majority of canary rockfish off the U.S. Pacific coast. Recreational anglers (primarily in Oregon) landed roughly 5 to 55 mt of canary rockfish on an annual basis since 1967. Historically, vertical longline vessels in Oregon have landed minor amounts of canary rockfish, but recently these catches have increased and now compose roughly 40% of the total landings of canary rockfish in the state (Table 2). Since 1974, nearly all of the canary rockfish landed in Washington are harvested by commercial trawls. For the last several years, the majority (nearly 80%) of the canary rockfish catches made in the northern INPFC areas have been landed in Oregon. Estimates of commercial landings have been generated for each state and major gear type.

Recreational landing were also examined and used in this assessment. Estimates of recreational catch from 1980-2001 were generated by the RecFIN information system. Estimates have typically been gathered by MRFFS sampling protocols, but in the last few years state-specific estimates have also been implemented. The MRFFS procedure has generally been to estimate effort of recreational fishermen by use of phone surveys and estimates of catch through port sampling of individual trips. Recreational catch has become in the last years of the time series a more significant proportion of the total catch. This is due primarily to a reduction in landings from the commercial catch and not an increase in the recreational catch. In all cases, recreational catch histories were developed for each state and include landed fish and those released dead (in RecFIN database A+B1). **Table 2** and **Figure 2** summarizes the landings history of canary rockfish.

Size Distributions

Size (fork length in cm) distributions were developed by fishery (California, Oregon and Washington), sex, gear and year (1967-2001) (Figure 3). Fisheries are defined as state-specific gear types and includes in all states a commercial trawl and recreational fishery and also in states with sufficient catch and biological sampling a composite commercial fishery made up of all other commercial gears. The numbers of samples (number of boat trips and total number of specimens) collected for each fishery are presented in **Table 3.**

For the Oregon commercial trawl fishery (1980-2001), a weighted estimator was used to develop size distributions, where samples from boat trips with market-category landings (i.e., landings of canary rockfish) that were large in size were given more weight in deriving mean estimated distributions than boat trips with relatively small landing sizes (see Crone 1995 for sampling design and estimation methods). As previously discussed, canary rockfish were not required to be separated from the large rockfish complex market category until 1995 (see Commercial Fishery and Management); therefore, from 1980 to 1994, ODFW port biologists also collected species-composition data from boat-trip samples (i.e., large rockfish complex market category samples within boat trips), along with biological data, so that the contribution of canary rockfish in the large rockfish complex category could be used as the weight in the estimation method. However, for the Washington commercial trawl fishery (1969-2001), a weighted estimation approach was also used, but given the sampling design and data processing programs that were used from 1980 to 1994 it was not as specific. A weighted estimator was also used to generate the size distributions in California both trawl (1980-2001) and non-trawl (1986-2000), although that was done by agency responsible for collection of the California data and presented in the CalCOM database (Pearson and Erwin 1997). Because of the small sample sizes of landings data for non-trawl gear, gears other than trawl and both sexes were combined to produce the length distributions for California non-trawl gear. Size distributions for the recreational fisheries (Ca 1980-01, Or 1980-01 and Wa 1980-1988) also were developed for combined sexes using a weighted estimator as described by (Van Buskirk per. Comm.) and taken directly from the RecFIN website.

Size distributions consisted of 29 length bins: 1 bin for all fish <11 cm; 27, 2-cm bins for fish between 12 and 65 cm; and 1 bin for all fish >66 cm For both Northern fisheries (Oregon and Washington), there has been a consistent decline in the mean size of canary rockfish (both male and female) landed over the past two decades. In Oregon, the mean size of male canary rockfish in the landed catch has declined from roughly 49 to 44 cm from 1980 to 1998, and the mean size of females has decreased from approximately 53 to 46 cm. In Washington, the mean size of the males in the landings has steadily declined from roughly 49 to 43 cm from 1980 to 1998, and the mean size of females has dropped from 49 to 45 cm . Catch-at-size (length) matrices for canary rockfish by commercial and recreational fishery and sex (where available) are presented in **Table 4** and **Figure 3**.

Age Distributions

Age (yr) distributions were developed by fishery (California, Oregon and Washington), sex, and year (1980-2001). The numbers of samples (number of boat trips and total number of specimens) collected for each fishery are presented in **Table 3**. In general, age distributions were derived for each fishery using similar estimation methods that were used for size distributions above.

Age distributions used in the modeling consisted of 25 age bins: a bin for each age from 1 to 24; and a bin for all fish >25 years old. The age distributions from each fishery were generally similar (**Table 5** and **Figure 4**), with the mean age of fish, particularly males, declining steadily over the 18-year span. The mean age for males in the Oregon and Washington trawl landings decreased from roughly 18 to 11 years from 1980 to 1998. The mean age of females from the Oregon fishery declined from approximately 17 to 11 years from 1980 to 1998, whereas the decrease in mean age for females from the Washington landings was much less steep over the same time period, dropping from approximately 12 to 11 years and never falling below 9 years of age.

As was observed in the previous assessments of canary rockfish (Golden and Wood 1990; Sampson and Stewart 1994; Sampson1996), the age distributions of canary rockfish were characterized by a noticeable absence of old females as compared with males (see age bins >20). The sex-specific differences between the age distributions were the basis for alternative modeling scenarios used in past assessments. Two different hypotheses provide reasonable explanations for the deficit of old females relative to old males: (1) the females die at an earlier age than males (e.g., age-dependent natural mortality for females); or (2) the females are less vulnerable to the fishing and sampling gears (e.g., dome-shaped selectivity for females and asymptotic selectivity for males). This discrepancy in the age structures between male and female canary rockfish has been observed in other species (Archibald et al. 1981; Tagart et al. 1997), but, if real (1 above) and not a sampling bias (2 above), is generally viewed as an atypical life history strategy for groundfish stocks commercially exploited off the U.S. Pacific coast.

Sex Ratios

The sex ratios of the canary rockfish landings from the trawl fisheries off Oregon and Washington were generally similar over the last two decades, with a mean, annual male to female sex ratio for each fishery estimated to be roughly 1.33 to 1, or 57% males to 43% females. The sex ratios in each of the fisheries have been particularly consistent throughout the 1990's, with slightly higher numbers of males being landed than females. The predominance of male canary rockfish in the sample information has also been observed off British Columbia (Archibald et al. 1981). This discrepancy in the sex ratio of canary rockfish does not appear to be a seasonal phenomenon, but rather a year-round occurrence, as indicated in the relatively consistent sampling conducted throughout a year. Detailed analysis regarding age-specific sex ratios indicated that the percentage of females in the sample data began to decline at roughly age 12-15, and continued to decline steadily into the older ages.

Discards

Discard of canary rockfish by commercial trawling vessels was assumed to be minor prior to 1995, when trip limits specific to this species went into effect. Some research (Barss and Demory 1985; Sampson and Stewart 1994 from Pikitch et al. 1988), albeit limited in scope, indicated market-induced discard (e.g., unacceptable sizes or lack of a market) was insignificant and the small amounts (roughly 1%) of discard in the 1980s and early 1990s were due to management-related causes (e.g., regulations on rockfish species in general). There is no information available regarding current discard rates of canary rockfish made by groundfish trawling vessels off the U.S. Pacific coast.

In the previous assessment conducted in 1996 (Sampson 1996), a discard rate of 1.23% was used for trawl-related catches made from 1983 to 1994, when canary rockfish where regulated as part of the *Sebastes* complex, and a rate of 16% was used for 1995-present, when trip limits specific to canary rockfish went into effect. The 16% discard rate for the trawl fishery was established by the Groundfish Management Team (GMT) of the Pacific Fishery Management Council (PFMC) following discussions regarding predicted levels of discard (150 mt) associated with the newly adopted harvest guideline in 1995 for canary rockfish in the northern INPFC areas (roughly 1,000 mt) (Sampson 1996).

In this assessment, in the absence of any newly acquired at-sea observer data on current levels of discard in the rockfish fishery off Washington and Oregon, we used a similar time series of discard rates as Sampson (1996) (Table 1). Beginning in 2000, highly restrictive trips limits were put in place to implement the rebuilding plan for canary rockfish. The PFMC's GMT has estimated canary rockfish discard that would be associated with bycatch in other target fisheries. Pending validation of these estimates with the new west coast observer program, we have assumed that the canary rockfish catch in 2000 – 2002 was equal to the total catch OY. Because this OY is set at less than 1% of the estimated stock abundance, the impact of inaccuracy in this 2000-2002 catch estimate is very small over the 3 year period. Subsequent assessments will have access to more precise measurement of contemporary discard levels and may be able to adjust these total catch estimates for 2000-2002.

Fishery Logbooks

Effort and CPUE information from commercial fishermen trawl logbooks was not used in the previous Northern assessment model for the following reasons: (1) as was discussed in the 1994 assessment (Sampson and Stewart 1994), a simple sum of trawling hours as an index of effort would not provide a valid index of fishing mortality, given the difficulties associated with standardizing the time series in conjunction with changes in fishing power, location, strategies (e.g., due to regulations), etc; (2) up until 1995, species-specific data were unavailable from the logbooks (see Commercial Fishery and Management), which coupled with the lack of discard information (see Discards), precluded developing an accurate time series; and finally, (3) the abbreviated time series (1995-01) of canary rockfish CPUE that could be developed from the logbook data was considered much too short to be an informative auxiliary data source in the assessment model. An analysis of commercial trawl logbook data was used in the previous Southern assessment covering the period 1982-1996. A CPUE time series was derived by applying a GLM to censored logbook data, with individual terms for year, vessel, month and area fished. Decomposition of the resulting nominal rockfish catch rates to canary rockfish was accomplished by applying species-, year-, and port-specific proportions estimated from the landings. The resulting time-series of CPUE is plotted in **Figure 12**, and covers only catch from California waters.

In addition, the California Department of Fish and Game collects charter boat logbooks (a type of recreational vessel). **Figure 8** depicts the trend in abundance of canary rockfish CPUE estimated using a simple GLM model (log (CPUE +0.01)= year+quarter+vessel+error). The factors were significant but the overall fit was poor. This fact coupled with the limited geographic coverage (California only) indicates that this time-series may not be appropriate for use in this assessment. It is included in the assessment, but with nil emphasis in early model configurations and with a density-dependent catchability coefficient in final model configurations.

Survey Data

Overview

Currently, the primary source of survey data regarding the abundance of canary rockfish is the triennial, shelf trawl survey conducted by NMFS starting in 1977 (1977-2001). The sampling methods used in the survey over the 21-year period are generally described in Weinberg et al. (1994) and NOAA (1995). Sample data collected within the 30- to 200-fm (55-366 m) depth strata from the southern border of the Monterey INPFC area (36°00' N. latitude) north to the U.S./Canada border (49°00' N. latitude) were analyzed in this assessment. These depths and areas were similar across the surveys, which allowed trends in biomass to be evaluated objectively. In general, all of the surveys were conducted in the mid summer through early fall: the survey in 1977 was conducted from early July through late September; the surveys from 1980 through 1989 ran from mid July to late September; the survey in 1992 spanned from mid July through early October; the survey in 1995 was conducted from early June to late July; the 1998 survey ran from early June through early August; and the 2001 survey was conducted in May-July.

Size Distributions

Size distributions (fork length in cm) were calculated following the estimation methods described in Weinberg et al. (1994). The numbers of samples (total number of specimens) collected from the shelf trawl survey are presented in Table 3. Size distributions were developed using the same bin structure as described above for the fishery-dependent data (see Fishery Data, Size Distributions). As was observed in the length distributions (both male and female) derived from the commercial trawl landings, a noticeable shift to smaller and smaller fish was evident in the canary rockfish sampled from the research surveys conducted from 1977 to 2001 (**Figure 5**). The mean size of canary rockfish, both male and female, sampled from the survey has declined from roughly 51 to 39 cm from 1977 to 1998. It is important to note that few samples were collected from the most shallow depth stratum (30-50 fm) during the early surveys conducted in 1977 and 1980 (Sampson and Stewart 1994), i.e., in general, canary rockfish are believed to segregate by size and age according to depth (**Figure 13**), with small fish (<30 cm) in shallow waters (<50 fm) and larger fish in deeper waters (Boehlert 1980; Archibald et al. 1981). The representativeness of the size (and age) distributions from the early surveys, particularly the contribution of small (young) fish, is suspect, due to sampling-related biases. Thus the size and age composition information from the 1977 survey was removed and the 1980 data were down-weighted in the assessment model. Catch-at-size (length) matrices by sex for canary rockfish sampled in the survey for the years 1977-2001 are presented in **Table 6** and **Figure 5**.

Age Distributions

Age distributions (yr) were calculated using by use of an age-length key to estimate the proportion of each length that was from a specific age. The age-length key was sex- and year-specific to account for differences in growth between males and females and possibly between years. The numbers of samples (total number of specimens) collected from the shelf trawl surveys are presented in **Table 3**. Age distributions were developed using the same bin structure as described above for the fishery-dependent data. In general, age distributions (both male and female) from the survey showed a similar declining trend in the proportion of old fish as that observed from the commercial fishery data; however, the survey time series was more variable than the fishery-related data.. The mean age for males and females from the survey data also declined from 1977 to 2001 from roughly 13 years to 10-11 years of age, but this statistic fluctuated widely over the time series. Note that no otoliths were analyzed from the surveys conducted in 1986 and 1998. Catch-at-age matrices by sex for canary rockfish sampled in the survey for the years 1977-2001 are presented in **Table 7** and **Figure 6**.

Sex Ratios

For the most part, the sex ratios of the canary rockfish from the survey information mimicked the sex ratios observed from the trawl fisheries, with a mean, annual male to female sex ratio estimated to be approximately 1.33 to 1, or 57% males to 43% females. With the exception of 1992, the sex ratios were skewed toward males in each of the survey years. A detailed analysis of the ratio of estimated numbers of males and females within the same age-classes and sizes classes was completed. The proportion male become the majority (>50% and increasing) beginning around age 12 (**Figure 9**) and increasing through the remainder of the age-classes. This would support the hypothesis that old females begin to suffer a higher natural mortality rate than males shortly after maturation (approximately 7-8yrs), and not old females becoming difficult to sample. If the absence of older females was due to larger old females leaving the areas of data collection or inhabiting un-sampled areas we would expect the shift in proportions of each sex at age to be more abrupt. In addition plots of the ratio of each sex by individual length indicates that around 50 cm the proportion female dominates the ratio due to it larger asymptotic size (**Figure 10**). This dominance of the sex ratio by females after a particular size is typical of rockfish and supports the notion that all sizes of female canary rockfish are being collected by the survey (ie large females are not absent).

Index of Abundance

A relative index of stock biomass was derived from the triennial shelf trawl survey (**Figure 7 and Table 9**). The catch-per-unit-effort (CPUE) index was the swept-area estimates of biomass (Gunderson and Sample, 1980) from samples in the 30-200 fm (55-366 m) depth range. In the assessment model, estimates (biomass in mt) were treated as relative indices and not considered as absolute values.

The initial year of the survey in 1977 was based on a sampling design that spanned from 50 to 260 fm (91 to 475 m), i.e., it did not come as far inshore (30 fm) as the subsequent surveys conducted on a triennial basis from 1980 to 2001. The index was constrained in all years to only Monterey-US Vancouver INPFC areas and depths from 55-366m to produce the only consistent time-series available. The index was further constrained to only include tows that caught at least 1kg of "bottom material" to preclude water hauls. This exclusion of water hauls only affected the 1977 survey biomass estimate due to the exclusion of a large canary tow that did not catch 1kg of "bottom material". A more comprehensive explanation of the water haul issue can be found in Zimmerman (2001). Because of the predominant number of water hauls eliminated in 1977 were in the US Vancouver INPFC area, and because the sampling depths were not the same as the other years, the 1977 survey year was not used in the assessment. The trend in estimated biomass of canary rockfish remained relatively stable through the 1980s, declined in the early 1990s, and is appears to have remained stable at low biomass levels in the 1990's (**Figure 7**). The biomass estimates in the 1990s (2,500 mt) are roughly 25% of that estimated in the 1980s (10,000 mt). **Table 9** lists the estimated biomass (water-hauls removed) for each INPFC area and year.

Additional Indices Considered

One additional index of relative abundance is the SWFSC's midwater trawl survey of juvenile rockfish off the central coast of California from $36^0 30$'N to $38^0 20$'N. This information was evaluated as a potential tuning index for the southern area in the previous Southern canary assessment (Williams et al. 1999), but was not included in their final model. Since this survey has limited spatial coverage and does not exhibit correlation with recruitments estimated in the assessment, it is not used in this coast-wide assessment.

Canadian data

Although the areas of Southern Canada were not formally included in the assessment modeling, we do present basic information on the status of the Canadian stock. **Figure 11** depicts the trend in Canadian catch from off of southern Vancouver and off of all of Vancouver Island (the area most likely in direct biological contact with the U.S. stock). The trend in catch was very high throughout the late 1980's and early 1990's but has dropped off to levels under 600mt in recent years. The trend in biomass in the shelf survey for the corresponding area from the shelf survey is plotted in **Figure 7** and depicts a declining trend similar to that of U.S. waters. Addition of the U.S. and Canadian portions of the survey biomass (with interpolation for the lack of 1986 survey data in Canada) indicates that a substantial proportion of the coastwide biomass is in the Canadian zone and that the degree of decline is greater when the Canadian portion is included.

Biological Parameters

Overview

Commercial fishery and research survey data were used to evaluate important biological factors (commonly referred to as parameters, relationships, or models) that strongly influence the growth, maturation, and mortality of the canary rockfish population off Oregon and Washington. The following stock parameters were estimated: length-at-age relationships (by sex), weight-length relationships (by sex), maximum ages and maturity-at-age and maturity-at-length relationships (females only). Two other important biological parameters (instantaneous rates of natural mortality and stock-recruit relationship) were also examined given these parameters were either estimated interactively within the model (see Stock-recruit Relationship) or based largely on information regarding fish populations in general (see Natural Mortality Rates). For the most part, analyses involved estimating biological parameters from each of the three primary sources of data (Oregon fishery, Washington fishery, and NMFS survey), as well as from combinations of the data sources. Biological parameters from the 1999 assessment were used in this 2002 assessment. Numerous models were constructed in an effort to provide a parsimonious set of stock parameters that accurately described the biology of the canary rockfish population being assessed.

Length-at-age Relationships

The Von Bertalanffy growth equation was used to derive the relationship between length (cm) and age (yr)

$$L_A = L_\infty\left(1 - e^{-K(A - t_0)}\right) ,$$

for canary rockfish:
where L_A is length-at-age A, L_∞ (or L infinity) is the theoretical maximum size (length) of the fish, K is the growth coefficient of the fish, and t_0 (or t zero) is the theoretical age at which the fish would have been zero length if it had always grown according to Equation (1). Ultimately, length-at-age data were used along with weight-length estimates to develop weight-at-age estimates that were incorporated into the assessment model (see Weight-length Relationships and Weight-at-age Relationships).

Preliminary analysis involved developing several models based on the three primary sources of data (Oregon fishery, Washington fishery, and NMFS survey) to investigate the extent to which the different data sources provided different interpretations of the relationship between length and age of this species of groundfish (Table 8). The survey-related data were supplemented with additional young (▸2 years of age) fish in an effort to develop a representative length-at-age relationship that was applicable to the full range of ages (as well as lengths) that currently compose the overall age distribution of the canary rockfish population off Oregon and Washington. That is, the survey data provide the best available snapshot of the population-at-large of the three primary data sources. The additional sample included several small fish that were collected on board commercial trawling vessels in conjunction with a voluntary observer program that was conducted from 1996-98 off Oregon and Washington, as well as a few small fish collected from recreational angler surveys conducted in Oregon in 1998. The additional sample of small, young fish was not included in the fishery-related growth analyses, given these data sources were used to evaluate the characteristics of the catch removed from the population-at-large. It is important to note that biological parameters are generally considered to be based on the genetic makeup of the species (as well as environmental conditions) and thus, should not be data source-specific; however, fishing gears (both fishery and survey) are selective and likely sample different segments of the population, e.g., commercial fishing operations are commonly believed to capture the faster growing fish in the population (see Selectivity). We critically examined the growth of canary rockfish within and between data sources to make certain that the most appropriate length-at-age models were used in the assessment model. Finally, a subset of each annual data set was used to ensure that the time period between estimated ages more closely represented a full year of growth than if sample data collected throughout the year were included in the analysis. The subsets included only fish collected during January through March of a given year. For example, if two specimens had similar dates of birth (say January 1995), but were collected in different months of the same year (say January 1999 and September 1999, respectively), then although both would be interpreted as 4-yr old fish, ones estimated length would reflect roughly an additional half-year of growth, which would necessarily result in an additional source of bias when analyzing length and age data from a particular sample.

There was evidence of sexual dimorphism in the growth (in length and age) of canary rockfish, with females growing faster and realizing a slightly larger maximum size than males. For example, in general, males took roughly 16 years to reach 50 cm in size, whereas females reached this length in only 12 years. Estimated parameters of the Von Bertalanffy growth equation were generally similar between the various data sources: L_∞ ranged from roughly 52 to 54 cm for males and from approximately 58 to 62 cm for females; growth rate (K) was between 0.162 and 0.189 for males and from 0.111 to 0.146 for females; and t_0 was from -1.84 to -0.47 for males and between -2.56 and -0.84 for females. The growth equations used are given in **Table 8.**

Weight-length Relationships

The weight-length analysis for canary rockfish was conducted in a similar fashion as was done with the length-at-age data, including developing several sets of weight-length models based on the same sources of data (Table 8). The following power function was used to determine the relationship between weight (g)

$$W_L = a\ (L^b)\ ,$$

and length (cm) of canary rockfish:
where W_L is weight-at-length L, and a and b are the estimated regression coefficients.

Estimated parameters from Equation (2) were very similar between data sources and between sexes and the final parameters are given in **Table 8**. Ultimately, the weight-length relationship used in the calculations of weight-at-age was based on data from all sources and was applicable to both sexes (a = 0.0155 and b = 3.03). On average, canary rockfish were roughly: 46 g (0.05 kg, 0.10 lb) at 14 cm; 1,109 g (1.1 kg, 2.4 lb) at 40 cm; 2,179 g (2.28 kg, 4.8 lb) at 50 cm, and realized over 4,600 g (4.6 kg, 10.1 lb) at 64 cm.

Weight-at-age Relationships

Weight-at-age estimates used in the assessment model were calculated from the length-at-age and weight-length estimates described above (see Length-at-age Relationships and Weight-length Relationships). The weight-at-age relationships are used in the model to convert population-at-age or catch-at-age in numbers to biomass. The sex-specific weight-at-age relationships for canary rockfish for each of the primary sources of data (Oregon fishery, Washington fishery, and NMFS survey) were generally similar for fish up to roughly age 13 and then differed slightly for the older fish. Males were approximately 0.1 kg (0.2 lb) at age 1, 0.7 kg (1.5 lb) at age 5, 2.1 kg (4.6 lb) at age 15, and 2.5 kg (5.5 lb) for ages >25. Females were approximately 0.1 kg (0.2 lb) at age 1, 0.7 kg (1.5 lb) at age 5, 2.6 kg (5.7 lb) at age 15, and 3.6 kg (7.9 lb) for ages >25.

Maximum Ages and Maximum Lengths

Estimates of maximum age are often used to establish baseline estimates of instantaneous rate of natural mortality, or M (Hoenig 1983). Maximum ages (A_{max}) and sizes (L_{max}) observed in the primary sources of data are presented in **Table 8**. That is, percentiles are often more desirable when evaluating the maximum lifespan of a *typical* specimen of a species, rather than using the maximum age of a *single* specimen observed in the sample data.

In general, sample data suggest males live considerably longer than females (see Natural Mortality Rates), but reach slightly smaller lengths than females. That is, although maximum ages indicate the two sexes are capable of reaching nearly 70 years of age (see A_{max} in **Table 8**), very few females greater than 30 years old were observed in the sample data (see $A_{99\%}$ in **Table 8**). Further, the 95th percentile for the age of females was just 22 years, but nearly 35 years for males. Finally, it is important to note that preliminary analysis regarding the weight-at-age for canary rockfish indicated that a few old females appeared to be outliers in the analysis, with their growth (in weight) being much more characteristic of that exhibited by males, i.e., it is possible that some of the older females were incorrectly identified and were actually males. The 99th percentile for the age of males was approximately 45 years old. The maximum length of females ranged from 65 to 69 cm and the maximum length of males was slightly smaller (61-63 cm) (Table 6). The 99th percentile for the length of canary rockfish also indicated females (60 cm) reach a slightly larger size than males (55 cm).

Maturity Schedules

Maturity schedules (or maturity-at-age and maturity-at-length relationships) for female canary rockfish were estimated for the various data sources (**Table 8**). Maturity information was generally sparse within these data sources and for the most part, was not collected in a systematic fashion across time. Additionally, it has been demonstrated that the time of sampling is an important variable in maturity studies (Hunter et al. 1992) and thus, analyses should consider this variation to ensure results do not include additional sources of bias that would hamper statistical interpretation. Given the reasons above, for fishery-dependent data sources (Oregon fishery and Washington fishery), we developed maturity schedules based on specimens sampled during the months of September through February, which generally represent the spawning months for canary rockfish off Oregon and Washington. For survey-related data, the maturity schedules were based on specimens collected from June through September. Additionally, the following modifications to the maturity data sets were conducted to minimize biases likely present in the original sample data: (1) maturity information for ages (and lengths) with extremely low sample sizes (e.g., <10 specimens) was omitted from the maturity-related analysis, e.g., only four, age-4 fish were sampled for purposes of maturity determination from the fishery-dependent data from 1980 to 1998; and (2) as was done in the previous assessments (Sampson and Stewart 1994; Sampson 1996), several old (and large) fish (e.g., >20 years of age and >55 cm in length) that were recorded as immature were removed from the analysis, given the strong likelihood that the maturity of these animals was misidentified, e.g., it is probable that the animals had previously spawned and were in a resting stage. Fecundity was assumed to be proportional to female body weight, i.e., estimates of spawning biomass in the assessment model were in units of mature female body weight.

Logistic response functions have been found to be appropriate and effective statistical tools to describe the proportion of sexually mature fish in a population (Hunter et al. 1990). The following logistic functions were used to estimate the relationship between maturity and age (yr), and maturity and length (cm) for female fish:

$$M_A = \frac{1}{1 + e^{-a - b[\ln(A)]}} \text{, and } M_L = \frac{1}{1 + e^{-a - b[\ln(L)]}} ,$$

where M_A and M_L are the estimated probabilities that a fish is mature based on age A and length L, and the estimated regression coefficients are a and b.

The maturity schedules based on age and length are presented in **Table 8**. Estimated parameters from Equation (3) were generally similar across fisheries, with schedules based on Oregon fishery data indicating females mature earlier (based both on age and length) than that observed from schedules based on Washington fishery data. Maturity schedules based on fishery-independent data (i.e., research surveys) showed females mature at an earlier age and size than indicated from either of the fishery-dependent data sources (Table 8). Ultimately, a maturity schedule for female canary rockfish based on age that included data from the combined fisheries was used in the assessment model (a = -9.249, b = 4.557, and $M_{A50\%}$ =

7.6 yr). The age-at-50% maturity ($M_{A50\%}$) for female canary rockfish ranged from 5.7 yr (survey) to 7.7 yr (Washington fishery), depending on the data source. The length-at-50% maturity ($M_{L50\%}$) for female canary rockfish ranged from 34.2 cm (survey) to 43.4 cm (Washington fishery), depending on the data source.

History of Assessments

Previous Assessments

The first formal assessment of the canary rockfish resource off the U.S. Pacific coast was done in 1984 (Golden and Demory 1984). The final results from the initial assessment in 1984 were largely based on qualitative examinations of trends in age and size distributions generated from both fishery and survey data. The 1984 research also included exploratory efforts to fit realistic dynamic models to time series data, using tools such as, Virtual Population Analysis and Stock Reduction Analysis; however, due largely to highly variable and unavailable sample data, results from the modeling were not considered scientifically valid. The 1984 assessment concluded that the canary rockfish resource was generally stable at that time and that the current restrictions were still applicable, i.e., the ABC for canary rockfish was roughly 2,700 mt in the early 1980s.

The canary rockfish assessment conducted in 1990 (Golden and Wood 1990) was the first evaluation to incorporate separable catch-at-age analysis and in particular, the first to use the Stock Synthesis Model (Methot 1989, 1990, 1998). All subsequent stock assessments have used the Stock Synthesis Model to evaluate the status of the canary rockfish population off the U.S. Pacific coast; the model has undergone considerable development since the first program was presented in 1988. The theoretical foundation and parameter estimation techniques utilized in the model are described fully in Methot (2000). Data sources included in the assessment model used in 1990 were commercial landings from the fishery (1967-89), age-distribution data from the fishery (1980-88), commercial trawl effort index from the fishery (logbook data from 1980-87), CPUE index from the survey (1977-89), and size-distribution data from the survey (1977-89). The Columbia INPFC area was the only portion of the canary rockfish resource formally modeled in 1990. The 1990 assessment was the first to propose the two, broad assumptions (alternative scenarios or states of nature) regarding the absence of old females in the sample information relative to males: (1) the females are subject to a different rate of natural mortality than males (e.g., age-dependent natural mortality for females or possibly, constant, but elevated natural mortality rates for females); or (2) the females are less vulnerable to the fishing and sampling gears (e.g., dome-shaped selectivity for females and asymptotic selectivity for males). The scenarios above have been generally utilized in all subsequent assessments, including the current assessment presented here. Based on a $F_{35\%}$ management model (see Target Fishing Mortality Rates), results from the 1990 assessment indicated the ABC for the canary rockfish resource in the Columbia INPFC area should be decreased by roughly 30% from 2,100 mt to 1,500 mt; no changes were recommended for ABCs for the other INPFC areas (800 mt for the U.S. Vancouver INPFC area and 600 mt for the Eureka INPFC area). Through 1989, the fishery had not achieved the ABCs recommended for canary rockfish.

The assessment conducted in 1994 again utilized the age-based version of the Stock Synthesis Model to evaluate the status of the canary rockfish population in the Columbia INPFC area, as well as the U.S. Vancouver INPFC area (Sampson and Stewart 1994). The data sources in the previous assessment (1990) were updated with statistics from the 1990s, with the exception of the commercial trawl effort index from the fishery that was omitted from the set of data sources due to sample and estimation biases associated with logbook data (see Commercial Fishermen Trawl Logbooks). Results from the 1994 assessment (for both scenarios described above) clearly indicated that the current level of F exerted on the canary rockfish population exceeded $F_{20\%}$ (the overfishing threshold) and thus, the researchers recommended that the ABC be reduced to allow the stock to recover (Sampson and Stewart 1994). Ultimately, the Pacific Fishery Management Council (PFMC) adopted an ABC for canary rockfish of 1,250 mt for 1995-96, which was a substantial reduction (nearly 60%) from the previous allocation of 2,900 mt (1991-94).

In 1996, the canary rockfish stock was assessed using generally similar modeling assumptions and methods as were used in the previous assessment conducted in 1994 (Sampson 1996). Data sources were again updated with newly derived statistics (1995-96) and an age-based version of the Stock Synthesis Model was employed. One difference between the 1994 and 1996 assessments was the manner in which error associated with age-distribution data from the fisheries was accommodated. In the 1996 assessment, a single, percent-agreement error structure was used to describe the variability in the age-related data, whereas in 1994, an error-transition matrix was used to standardize multiple sets of age estimates generated from two age readers (see Major Changes Between Current and Previous Assessment and Age-determination Error). Newly obtained data supported findings from the 1994 analyses and final results further indicated that the canary rockfish stock had suffered fishing in excess of $F_{20\%}$. For both scenarios, annual yields based on $F_{35\%}$ were estimated to be roughly 1,200 mt per year for 1997-99.

In 1999 two age-structured assessments were completed. An assessment was completed by Williams et al. in 1999 for the southern INPFC areas (Eureka and Monterey). A separate assessment was done for the Northern INPFC areas (Columbia and US Vancouver) by Crone et al. 1999. Both assessments concluded that the canary rockfish resource was at levels below the overfished threshold. A major source of uncertainty was the role natural mortality and movements played in the relative lack of old females. The northern assessment was done using an age-based stock synthesis model and relied on age distributions to summarize changes in the age-structure. The Southern assessment was a length based (age-structured) model in an ADMB format. The paucity of otolith-aged fish in the Southern area was the reason why lengths were used in the south to describe changes in the age –structure. That assessment also tried to account for effects of sized based removals on population growth. The rebuilding analysis conducted by Methot (2000) relied upon recruitment information from the northern area where the larger portion of the stock occurs.

Major Changes Between Current and Previous Assessment

The following data sets and modeling approaches were modified from the previous assessment in accordance with critical evaluations conducted in the current assessment:

The stock was defined in this assessment as being coast-wide from Monterey INPFC area to the US Canadian INPFC area. The Monterey INPFC area is functionally the southern extent of the canary population as seen through the shelf survey. The Canadian border, however, is not the northern extent of the population and we hope to include Canadian data in future assessment as warranted. An exploratory model run is conducted with catch and some survey data from the Canadian zone.

New data that became available since the previous assessment conducted in 1999 were:

Commercial fisheries landing data for 1999-2001;

Biological data from the commercial trawl fisheries for 1999-2001, including sex, age, and length information. Additionally, some maturity and weight data for individual specimens were also collected, but these data were very limited (see Recommendations);

Research survey data from the NMFS shelf trawl survey for 2001, including CPUE and biological data.
CPUE from the California recreational fishery

The two states of nature (model scenarios) that were considered in previous assessments were investigated again in this 2002 assessment. These scenarios include age-dependent *M* for females versus dome-shaped female selectivity. In this assessment a compromise scenario is developed in which the age-dependent M is defined to follow a pattern linked to the fraction mature. The degree of increase in natural mortality is profiled in the model and the associated degree of dome-shaped female selectivity is estimated for each level of natural mortality.

Model Description

Overview

The Stock Synthesis Model is used to assess the status of the canary rockfish population. The mathematical properties and concepts used in the model are similar to those introduced by Fournier and Archibald (1982) and are described fully in Methot (2000). The Stock Synthesis Model is an age-structured stock assessment approach that separates fishing mortality into an age-specific and year-specific component. The estimation approach is based on the method of maximum likelihood. In general, the model distributes the residual error (deviations between observed and model-predicted values) among various types of data according to levels of variability and confidence (emphasis levels) associated with each data source (or likelihood component) and in concert with the consistency of the observed and predicted values. Specifically, estimated parameters are derived by maximizing the log(likelihood), log(L), of the observed values, given the model structure and parameter estimates. The value for the total log(L) is calculated as a weighted sum of the estimated likelihoods for each data source. The maximum likelihood estimates generated in the model are based on a multinomial probability distribution for biological data (e.g., age- and size-distribution information) and a lognormal probability distribution for survey data (e.g., CPUE information).

In past assessments of canary rockfish off Oregon-Washington, only the age-based version of Synthesis was used. In 1999, a length-based model was constructed using ADMB and used to assess canary rockfish off California (Williams et al., 1999). Here in 2002, both the age-based version of synthesis and the age-length version of synthesis were used. Age-based synthesis models selectivity as a function of age only, but the model can examine the fit to size data through the use of an age-length key (Methot 2000). The age-length synthesis treats the population as having age and length structure, integrates estimation of the population growth curve, and estimates the size-based selectivity for each fishery and survey (Methot 2000). The ADMB model developed by Williams went a step further and included size-based survivorship in the model formulation. Although inclusion of size-based survivorship is a desirable model feature and a rudimentary capability is built into age-length synthesis, the simpler version of age-length synthesis will be used because of the quality of available data and some uncertainties regarding performance of the ADMB model developed by Williams.

Model Scenarios

Scenario 1: Selectivity is age-based and asymptotic for the trawl fisheries and trawl survey. Older females have increased natural mortality to account for the deficit of older females in the data. Growth parameters estimated for each fishery and survey are used to define the weight-at-age for that fishery. Growth parameters from all data combined are used to define the age-length key used to fit length data.

Scenario 2: Age-based asymptotic selectivity was assumed for males and dome-shaped selectivity for females. This scenario was based on the supposition that older female canary rockfish did not have elevated rates of natural mortality, but rather were less available to the fishing and sampling gears than males. Growth as in Scenario 1.

Scenario 3: Selectivity is size-based and asymptotic for the trawl fisheries and trawl survey. Older females have elevated natural mortality. The level of elevated natural mortality is set equal to that estimated in model scenario 1. Population growth parameters are estimated within the model, and fishery-specific weight-at-age is derived from interaction between population size-at-age and fishery-specific size-selectivity.

Compromise Scenario: A compromise scenario is developed in which the age-dependent M is defined to follow a pattern linked to the fraction mature. The degree of increase in natural mortality is profiled in the model and the associated degree of dome-shaped female selectivity is estimated for each level of natural mortality.

Data Elements

The model contained the following data sources:

(1) Oregon trawl fishery catch, including historical foreign catch and estimated discard;
(2) Oregon trawl fishery age distribution (split sex);
(3) Oregon trawl fishery size distribution (split sex);
(4) Washington trawl fishery catch;
(5) Washington trawl fishery age distribution (split sex);
(6) Washington trawl fishery size distribution (split sex);
(7) California trawl fishery catch;
(8) California trawl fishery age distribution (split sex);
(9) California trawl fishery size distribution (split sex);
(10) California non-trawl fishery catch (Note that Williams (1999) combined setnet with trawl. Here we combine setnet with hook-and-line because of overall more similar size distributions);
(11) California non-trawl fishery size distribution (combined sex)
(12) Oregon-Washington non-trawl fishery catch (assume same selectivity pattern as in CA)
(13) California recreational fishery catch;
(14) California recreational fishery size distribution (combined sexes):
(15) Oregon-Washington recreational fishery catch;
(16) Oregon-Washington recreational fishery size distribution (combined sexes);
(17) Trawl survey CPUE, expressed as swept-area biomass;
(18) Trawl survey age distribution (split sex);
(19) Trawl survey size distribution (split sex);
(20) California trawl fishery CPUE
(21) California recreational fishery CPUE.

In addition, trawl survey data from just the northern zone and just the southern zone were included in the basic model data and parameter files. This facilitated rapid evaluation of alternative model configurations using coast-wide versus northern versus southern data.

Selectivity

A revised age-selectivity function used to model the relationship between each fishery and the canary rockfish stock. In previous age-based synthesis models of canary rockfish, selectivity was defined as a double-logistic function for each sex and male selectivity was multiplied by an additional factor scaling it relative to female selectivity. There are two shortcomings of this formulation. First, double-logistic functions have confounding of left-hand ascending and right-hand descending components. This confounding can hinder model convergence. Second, allowing male selectivity to be scaled relative to female selectivity may over-parameterize the model when female natural mortality is allowed to differ from male natural mortality in Scenario 1. The formulation used in 2002 introduces a parameter to define the transition from the left-hand to the right-hand portions of the curve. The left-hand side is defined as a two-parameter logistic function for each sex. The inflection of this function is allowed to vary between time periods (see below). The right-hand side is a simple one-parameter exponential decline for each sex. For data sources without split sex data, the male parameters are set equal to the female parameters. For model scenario 1 with increasing female natural mortality, selectivity for the trawl fisheries and for the trawl survey is forced to be asymptotic at 1.0 for each sex by setting the right-hand exponential decline parameters to zero. Selectivity for the non-trawl fishery and the recreational fishery is allowed to be dome-shaped for both males and females in both model scenarios.

The parameters for each fishery and the trawl survey are:

1. Female, logistic inflection (as fraction of the range between age 1 and the transition age)
2. Female, logistic slope
3. Female, age at transition
4. Female, exponential decline at ages above transition (model uses negative of value)
5. Male, logistic inflection
6. Male, logistic slope
7. Male, age at transition (set equal to female value)
8. Male, exponential decline at ages above transition
9. Male, scalar relative to female selectivity (set equal to 1.0)

Parameters 1 and 5 are allowed to vary synchronously over time (see below).

Size Selectivity

The size-selectivity pattern used in the age-length version of synthesis is similar to that used in the age-based model. This size-based pattern has the potential to be more complex and flexible than that used in the age-based model, but not all this flexibility is freed up in this canary rockfish application. The pattern includes an inflection size, logistic functions on either side of the inflection, and defined terminal values at the minimum and maximum size bins. The parameters are:

1. both sexes, size at transition
2. Female, selectivity at minimum size (set equal to 0.0 at 10 cm)
3. Female, logistic inflection (as fraction of the range between min size and the transition size)
4. Female, logistic slope on left-hand, ascending side

5. Female, selectivity at maximum size (66 cm)
6. Female, logistic inflection (as fraction of the range between the transition size and max size)
7. Female, logistic slope on right-hand, descending side (not estimated; set equal to 1.0)
8. Male, selectivity at transition size (set equal to 1.0; female selectivity at transition size is 1.0 by definition)
9. Male, selectivity at minimum size (set equal to 0.0 at 10 cm)
10. Male, logistic inflection (as fraction of the range between min size and the transition size)
11. Male, logistic slope on left-hand, ascending side
12. Male, selectivity at maximum size (66 cm)
13. Male, logistic inflection (as fraction of the range between the transition size and max size)
14. Male, logistic slope on right-hand, descending side (not estimated; set equal to 1.0)

Male parameters are set equal to female parameters for those data sources without sex-specific data. Parameters 3 and 10 are allowed to vary synchronously over time (see below).

Time-Varying Selectivity

In the 1996 assessment (Sampson 1996), selectivity evaluations resulted in time-varying selectivity being used for the Oregon fishery, with one period defined from 1967 to 1982 and another from 1983 to 1995; the time series of age distributions for the Washington fishery and NMFS survey were each characterized by a single (constant) selectivity function (1967-95).

In the 1999 northern assessment (Crone et al., 1999), the selectivity inflection age was allowed to be year-specific (constant for 1967-80, annually from 1981-98. In the 1999 southern assessment (Williams et al., 1999), inspection of trends in the composition data led to two time periods for the trawl fishery selectivity (1950-1988 and 1989-1998), and two for hook-and-line fishery selectivity (1950-1991 and 1992-1998).

Here we use a time stanza approach, rather than the year-specific approach used by Crone et al (1999). By inspection of apparent transitions in the appearance of young/small fish, the following stanzas were identified:

Oregon trawl fishery:	41-82, 83-94, 95-99, 00-
Washington trawl fishery:	41-81, 82-92, 93-96, 97-
California trawl fishery:	41-79, 80-86, 87-96, 97-
California non-trawl fishery:	41-91, 92-98, 99-
California recreational fishery:	41-81, 82-95, 96-99 (interpolate between 95 and 00), 00-
OR-WA recreational fishery:	constant
Trawl survey:	constant

Age-determination Error

Otoliths were analyzed by three different laboratories, where two of the three facilities used independent techniques and criteria for purposes of age determination: the Pacific Fisheries Environmental Laboratory (PFEL, NMFS, Southwest Fisheries Science Center, Pacific Grove, CA) determined ages for specimens collected from all NMFS research trawl surveys (1977, 1983, 1989, 1992, and 1995) using sectioned otoliths (see Boehlert and Yoklavich (1984) for a description of otolith preparation methods); the Ageing Unit of the Oregon Department of Fish and Wildlife (ODFW, Marine Resources Division, Newport, OR) used a break and burn method to provide age data for fish collected from the commercial fishery from

1980 to 1994 (see Christensen (1964) for a description of laboratory methods); and the Cooperative Fish Ageing Unit (CFAU, Fishery Resource Analysis and Monitoring Division, NMFS, Northwest Fisheries Science Center and ODFW, Newport, OR) also used break and burn methods to analyze fish collected from the commercial fishery from 1994 to 1998. Note that the CFAU was established jointly with the ODFW and in effect, the staff at these two laboratories use generally similar training methods and work agendas. In this assessment, we examined the extent to which possible biases existed in the age-related results from the commercial fishery (1990-98) and the research survey (1977-95) due to differences between ageing criteria and methods used at two laboratories (PFEL and CFAU) and within the CFAU (double-read data within PFEL were not available). The results from the examinations were remarkably consistent between the two laboratories and within the CFAU and thus, evidence of systematic bias of age determination was considered to be negligible and inconsequential for modeling purposes. In the canary rockfish assessment conducted in 1994, the analysts noted that some bias was evident between members of the ageing team (two age readers) of the ODFW for commercial fishery data collected from 1980 to 1989 and addressed this issue by using an age-to-age transition matrix (Sampson and Stewart 1994); however, in the following assessment conducted in 1996, the researcher decided upon a percent-agreement error structure in place of the transition matrix to best describe the variability associated with the derived age distributions (see Sampson (1996) and Major Changes Between Current and Previous Assessment).

The percent agreement between age readers (Kimura and Lyons 1990), commonly referred to as double-read analysis, is often used to develop an ageing error structure that can be incorporated into modeling procedures to provide an estimate of precision associated with estimated age distributions. Given the consistent findings above, we developed a single ageing error structure based on a percent-agreement distribution generated from double-read analyses conducted by the ODFW and the CFAU that was applied to all age distributions used in the assessment model. That is, we have assumed that the estimated ages are unbiased estimates of true ages, but that there was variability in the assigned ages.

In general, the percent agreement declines from 75% to 85% agreement at young ages (ages 1-5), to 25% to 45% at middle ages (ages 6-13), to roughly 16% for fish 25 years of age. Stock Synthesis calculates a normal distribution of ageing error that corresponds to the level of observed percent agreement by taking into account the probability that two readers will agree on an age, but both be incorrect. Ageing error was used in the model to blur the expected, actual age distribution before comparing the result to the observed age distribution. Thus, the model may identify a year class as strong, even though the observed age distribution reflected a broad mode.

Natural Mortality – biological information

Biological-based estimates of natural mortality were conducted in the 1999 assessment and have not been investigated further in 2002. This past investigation is described below. Estimates of instantaneous rate of natural mortality (M) for canary rockfish inhabiting U.S. Pacific coast waters have received considerable attention in past assessments, primarily due to the paucity of older females in the sample data. A similar pattern is seen in yellowtail rockfish (Tagart, xxxx). One of the possible explanations for the observed absence of old females is that M is different between sexes, with females experiencing generally higher rates of natural mortality (constant or age-dependent) than males. It is certainly plausible that M would be age-dependent in an animal population, e.g., generally speaking, juveniles are likely more vulnerable to predation than adults, and very old adults may die at higher rates than younger individuals due to senescence or reproductive costs (Roff 1984). Beverton and Holt (1959) suggested that the life history phenomenon of increasing M with age likely characterizes fish populations more often than constant M across all ages. This scenario with the canary rockfish resource is specifically perplexing, given not only the sex-specific aspects of the phenomenon, but more importantly, because the difference between the age distributions of the two sexes is considerable, with fewer females than males being observed in the catches (both fishery-dependent and fishery-independent data) starting at roughly age 12.

An alternative interpretation for old females being less abundant in the sample data would be that they were less vulnerable to the trawling gears (e.g., they remain higher in the water column or possibly, inhabit untrawlable grounds) and in effect, have a lower selectivity at older ages than males. Estimates of *M* are necessarily difficult to determine objectively, given selectivity can lead to similar findings from the sample information. Estimating *M* often relies on investigating particular life history traits exhibited by the species that are believed to be correlated with natural mortality, such as longevity (Hoenig 1983) and rates of growth (Roff 1984), as well as physical parameters of the environment (Pauly 1980).

Golden and Demory (1984) assumed *M* was 0.10 for both sexes in an early assessment of the canary rockfish resource found off the U.S. Pacific coast. Golden and Wood (1990) used both assumptions above regarding the absence of old females in the data to model the canary rockfish resource inhabiting the Columbia INPFC area: an estimate of $M = 0.06$ for males and females across all ages; and an estimate of $M = 0.06$ for males of all ages and young females and 0.15 for old females. Subsequent assessments conducted in 1994 (Sampson and Stewart 1994) and 1996 (Sampson 1996) relied on similar assumptions and used roughly the same estimates of *M* as was done in the 1990 assessment, with a constant *M* of 0.06 for males of all ages and young females (less than 9 years of age), and age-dependent *M* for older females that increased in a linear fashion from 0.06 (age 9) to roughly 0.18 (ages 25). Research applicable to groundfish stocks found off the Pacific coast of Canada also indicated that old female canary rockfish were much less common in the sample data than were males, and supported total mortality estimates (*Z*) for males in the range of 0.03-0.07 and 0.11-0.24 for females (Archibald et al. 1981). Recent assessments of the canary rockfish stock off British Columbia, Canada have assumed generally similar rates of natural mortality as those evaluated here (R. Stanley, Canada DFO, Pacific Biological Station, Nanaimo, B.C., Canada, personal communication, 1999).

According to Hoenig (1983), the average relationship between maximum observed age and total mortality is defined as, $\ln(Z) = a + b\,[\,\ln(t_{\max})\,]$, where *Z* is the instantaneous rate of total mortality, $a = 1.44$ and $b = -0.982$ (estimated regression coefficients), and t_{max} is the maximum age. Based on Equation (4) and $A_{99\%}$ for males of approximately 47 years and 31 years for females (see Maximum Ages and Maximum Lengths), generated an estimated *Z* of 0.096 for males and 0.145 for females.

Research (Beverton and Holt 1959; Pauly 1980; Roff 1984; Clark 1991) also indicates that *M* for many fish stocks is likely linked to their size (say L_∞ and asymptotic maximum weight, W_∞) and rate of growth (say *K*) (see Length-at-age Relationships). For example, Roff (1984) proposed that a growth-rate parameter (*K*), age-at-first reproduction (e.g., age-at-50% maturity or $M_{A50\%}$), and the maximum rate of natural mortality (*M*) of a fish population are correlated due to evolutionary adjustments to offset costs of reproduction:

$$M = \frac{3\ K\ e^{-K\,(M_{A50\%})}}{1\ -\ e^{-K\,(M_{A50\%})}}\ .$$

Relying on Equation (5) and estimates from Table 8, a maximum value of *M* for females would be 0.212, which is only slightly higher than that approximated by past researchers assuming age-dependent *M* for females. Maturity data for male canary rockfish were also sparse and are commonly subject to more severe field-related examination errors than females and thus, were not considered adequate for inclusion in the assessment model. Pauly (1980) used empirical data from various fish populations throughout the world to investigate how particular life history parameters (such as K) and environmental parameters (such as water temperature) are related to M. Estimates of M from Pauly's model are often similar to those derived from Roff's approach above, but can be substantially different, particularly for schooling fishes, such as Clupeids. Estimates of M for canary rockfish from Pauly's method were very high (M = 0.247-0.324 for males and M = 0.191-0.268 for females). Pauly (1980) did suggest conversion factors to adjust estimates for schooling species, but cautioned that the model generated highly variable results for particular fish stocks.

Model Selection and Evaluation

Natural Mortality

The baseline configurations in the current assessment model were: Scenario 1: M = 0.06 for males (all ages) and young females and M = estimated level for old females; and Scenario 2: M = 0.06 for both sexes. The pattern of increased natural mortality for females in preliminary modeling with scenario 1 used either a linear ramp or a step function for the increase. Since the rationale for increased female natural mortality is usually linked to the accumulated stress of spawning, the final model configuration invoked a linkage between female natural mortality and the fraction mature:

$$M_a = M1 + m_a{}^{\kappa}(M2 - M1)$$

where:
M_a is age-specific natural mortality
M1 is natural mortality at young ages; fixed at 0.06
M2 is natural mortality at old ages; estimated as a free model parameter
M_a is the fraction mature at age
κ is an estimated coefficient to allow the increase in natural mortality to lag the increase in fraction mature. Since the best model fit occurs with a steep increase in natural mortality at age 13, the estimated κ coefficient is allowed to increase up to a value of 3.0.

Start Year

Past northern canary rockfish models have started in 1967 with the assumption that the abundance and age composition at that time was in equilibrium with a historical average catch of 1,000 mt. However, this 1,000 mt level had previously been derived from the average of a much higher level of 3,226 mt annually during the mid 1940s, and a level of 445 mt beginning in 1948 (Golden and Wood, 1990). The southern canary model started the model time series in 1950, just prior to a pulse of landings. In the initial model runs we start the model in 1941 with the assumption that catch prior to that time was small enough to be considered negligible. Following further inspection of historical catch levels by the STAR panel, the final model was configured to be in equilibrium with a historical annual catch of 500 mt in 1941. Then beginning in 1942, the estimated annual catch is used in the model to calculate the degree of biomass reduction and change in age composition that occurred prior to significant biological data collection in the late 1970s.

Stock-recruit Relationship

Past assessments used one parameter to set the level of virgin recruitment and one parameter for each subsequent year's recruitment. This resulted in a noisy time series of recruitment, although a noticeable pattern of strong and weak yearclasses is not apparent in the data. In the absence of clear yearclass patterns in the composition data, and in the presence of age determination error, the model can estimate widely varying recruitment parameters to achieve marginal improvements in overall model fit. There is no independent verification of this recruitment variability, and the high level of estimated variability introduces much variability in the forecast of future stock rebuilding.

A spawner-recruitment function is used in this assessment in order to stabilize the variability in recruitment estimates and to provide a parametric basis for forecasting future recruitment levels. The model was allowed to estimate the two parameters of a Beverton-Holt spawner-recruitment curve. An alternative formulation with a Ricker curve provide indistinguishably different fits to the recruitment estimates. The level of lognormal recruitment variability was set at a moderate level of 0.5 in initial model runs, then decreased to a level of 0.4 in final model runs to more closely match the estimated level to which the estimated recruitments deviated from the spawner-recruitment curve (root mean squared error typically was approximately 0.38). The level of virgin recruitment set the initial, unfished equilibrium prior to all fishing. Recruitments during 1941-1963 were taken from the estimated spawner-recruitment curve and multiplied by the log-transformation bias correction factor because the spawner-recruitment curve is being fit to the logarithm of the 1964-2001 recruitments. Recruitments during 1964-2001 were estimated as model parameters and a likelihood component was computed from the deviation between the estimated recruitment and the level predicted by the curve. This likelihood component was given a nominal emphasis weight of 0.1. Because the virgin recruitment level in this model formulation is linked to all the recruitment information, the model's estimate of unfished spawning biomass is considered the best estimate for subsequent evaluation of overfishing thresholds. In the final model configuration, the range of years with individual estimates of recruitment was revised to include the years 1958-1998 in order to respond to more of the age composition information available beginning in 1980 and to avoid over-sensitivity to the low amount of small/young fish information in the last few years of the time series.

Model Variance Elements

Most data elements available for canary rockfish are not accompanied by an independent estimate of data variability.

For the trawl survey, tow-to-tow variability in catch does produce an estimate of variability in the survey biomass estimate, and these values are used in the assessment. The CVs for survey biomass are typically 0.3 to 0.5.

For the CA trawl and recreational CPUE indexes, the GLM model used to produce the index provided estimates of variability which appeared to be unrealistically low. Instead, the root mean squared error of the fit to these data in preliminary model runs was used as a reasonable estimate of their true variability. This CV value was 0.5.

Estimation of data variability is most problematic for the size and age composition data. The previous northern model used the value 200 for the effective sample size of each Oregon or Washington fishery age or size composition, 100 for the survey length comp, and 50 for the survey age comp. In the southern model, a preliminary model run was used to calculate an effective sample size based upon the average deviation between expected and observed proportions within each observation. These values ranged from

6 to 497 (Table 12 in Williams et al., 1999). Here we take a similar approach. A preliminary model run with sample size set equal to 50 was conducted and the effective sample size was calculated for each observation. The median effective sample size was calculated within each type of data and rounded to produce an assigned maximum N:

Source	Kind	N obs	median	assign max(N)
OR-Trawl	age	22	154	150
OR-Trawl	size	22	226	200
WA-trawl	age	21	149	150
WA-trawl	size	33	108	100
CA-trawl	age	12	28	25
CA-trawl	size	24	41	50
CA-nontrawl	size	15	29	50
CA-recr	size	19	53	50
OR-recr	size	19	65	50
survey	age	5	47	50
survey	size	7	106	100

Each observation was then assigned a sample size equal to the minimum of: (preliminary calculated effective N, or assigned maximum N). The maximum values are similar to the values used for all observations in the 1999 northern assessment. The year-specific values are similar to those derived by the comparable method in the 1999 southern assessment, although capping with the assigned maximum N distributes model influence over more observations.

Likelihood Components

The fit to each data component listed in the Model Data section depends on the level of measurement variability associated with that data element, and on any additional emphasis/de-emphasis assigned to the data element. In general, emphasis levels were set to 1.0 for each of the likelihood components. Exploratory model runs alternately set either the age or size composition emphasis levels to 0.1 in order to investigate model sensitivity. In the final model run, all age composition data received an emphasis of 0.9, all size composition data received an emphasis of 0.1, the trawl survey biomass and the CA trawl and CA recreational CPUE received an emphasis of 1.0, and the recruitment deviations received an emphasis of 0.1.

Model Parameters

The parameter file for the final baseline model is included as appendix xxx.

Convergence Criteria

The iterative process for determining numerical solutions in the model was continued until the difference between successive likelihood estimates was less than 0.001. Exploratory model configurations were run several times to corroborate convergence. A test with the final baseline model was run 60 times, with each run jittering the initial parameter values within a range of +/- 20% of their final value. All runs returned to the neighorhood of the final model; 34 runs returned to within 0.01 log-likelihood units of the best model; and all but 3 runs were within 0.1 log-likelihood units. Two of the other three runs converged on all data types except the CA non-trawl size comp; and one of the three poor fits was poor only for the CA recreational size comps. Among the 57 good fits, the ending biomass ranged from 6420 to 6510 mt. The 3 poor fits had ending biomasses of 6092 to 6400 mt. We conclude that model convergence is good.

MODEL EVALUATION and SELECTION

The following sections briefly describe the model configurations explored prior to the STAR panel review and presented to the panel on April 15-19. This is followed by an outline of the model features considered during the panel meeting prior to acceptance of the final model configuration.

Model Scenario 1 (higher female M)

Model runs were conducted under a range of conditions which de-emphasized size data, age data, north data, or south data in order to determine which data sources were most influential in determining model results. These run conditions and results are presented in Table 10.

First, we examine the North scenarios which used only catch from Oregon and Washington and data from the northern zone. Figure 16 shows, in terms of female spawning biomass, that the results in this 2002 assessment are highly consistent with the results obtained in 1999. Figure 17 shows that recruitment estimates are very similar through the early 1990s. The low-high pattern during the mid 1990s estimated in the 1999 assessment is now smoothed out, then followed by a sharp decline at the end of the time series. The low-high pattern estimated at the end of the 1999 assessment was based upon very little information in the size composition of the 1998 trawl survey and an indication of the uncertainty associated with recruitment estimates at the end of the time series. The recruitment decline at the end of the 2001 assessment presumably has similar uncertainty.

The South scenario uses only catch from California and southern zone data. The new estimate of the recruitment time series is quite similar to that estimated by Williams in 1999 (Figure 18). However, the spawning biomass time series are extraordinarily different at the beginning of the time series (Figure 19). Consultation with Erik Williams suggests possibility of a programming error in the 1999 southern assessment that caused the low calculation of biomass at the beginning of the time series.

Adding the south biomass to the north biomass produces a time series of female spawning biomass that is extraordinarily similar to that obtained from the coastwide model (Figure 20). This result provides confidence in proceeding with only the coastwide model in further examinations.

The greatest difference in Scenario 1 results occurs when the survey biomass data is de-emphasized (Run 5 in Table 10). This model has biomass and recruitment at the beginning of the time series that is similar to the baseline Scenario 1 model, but recruitment in run 5 stays high through the 1990s and biomass is increasing. This pattern of higher recruitment and biomass is similar to that in Scenario #2 below (Figures 22-23). Such a pattern produces a poor fit to the trawl survey biomass (Table 10 and Figure 21). The fit to the trawl fishery CPUE is also degraded (Table 10), but the fit to the age and size composition data is improved by only a few likelihood units (Table 10). This large change in ending biomass accompanied with little change in model fit means that the model result is rather indeterminate without the survey CPUE data to provide information on the recent stock trend.

Model run 8 obtains all annual recruitments from the estimated spawner-recruitment curve. It estimates the S-R steepness to be 0.30, which is quite low and consistent with the observed long-term decline in recruitment. Run 2 is configured similarly, but also estimates 38 individual year recruitment parameters. These 38 parameters improve the model likelihood by only 68 units, which indicates that little of the pattern in the age and size composition data is explainable by the year-to-year variability in recruitment. Run 2 has a S/R steepness of 0.37, which is still quite low in comparison to other exploited fish species (Myers ---). The baseline (run 1) which equally emphasize the age and size composition data, has slightly higher recruitments at the end of the time series and an estimates S/R steepness of 0.41.

Run 2 with size composition data de-emphasized is more similar to the 1999 model which had nil emphasis on the size composition data. Run 2 produces lower recruitment during the 1990s, lower ending biomass, and a better fit to the trend in the survey CPUE and the trawl fishery CPUE. However, the degree to which the age composition data are fit better by this scenario is less than the degree of degradation in fit to the size composition data (Table 10).

Model Scenario 2 (domed selectivity)

Scenario 2 (Runs 14-16 in Table 10) produces higher biomass than scenario 1 because the dome-shaped selectivity allows a large fraction of the older portion of the stock to be unavailable to any of the fisheries or surveys. The fit to the trend in the survey CPUE is degraded relative to Scenario 1 (Figure 21 and Table 10). Scenario 2 produces higher recruitment during the 1990s relative to Scenario 1 (Figure 22), which causes higher biomass at the end of the time series (Figure 23). Overall, Scenario 2 Run 14 fits better than Scenario 1 Run 1 by just 5 likelihood units due to improvement in fit to some of the size composition data. Some improvement in fit by Scenario 2 is expected because Scenario 2 estimates 4 parameters for the dome in the 3 trawl fisheries and the trawl survey, whereas Scenario 1 estimates just 1 parameter for increasing female natural mortality. With the size composition data de-emphasized (Run 15 versus Run 2), Scenario 1 fits better than scenario 2 by 36 units. With the age composition data de-emphasized (Run 16 versus Run 3), Scenario 2 fits better than scenario 1 by 20 units.

Model Scenario 3 (size-based, with higher female M)

It is extremely satisfying to see that the age-size version of synthesis produces results that are highly similar to those produced by the age version. The baseline Scenario 3 (Run 17) fits 9 units better than the baseline in Scenario 1. The improvement in fit increases to 23 units when the size model is allowed to re-estimate the growth parameters. The original and revised parameter values are:

Parameter	F - Original	F - New	M - Original	M - New
L at age 1.5	14.1	13.26	13.0	= F
K	0.146	0.1475	0.189	0.1962
L_∞	58.9	59.44	52.3	52.19
CV at age 1	0.13	0.0889	0.10	= F
CV at age 25	0.04	0.0447	0.04	= F

The re-estimated growth parameters have higher L_∞ which is more similar to that estimated independently for the survey and the WA fishery. The re-estimated parameters also have a lower CV in size at younger ages. This occurs because the independently derived estimated is contaminated by ageing error, where synthesis takes the effects of ageing error into account when examining the age data. Overall, there is no overwhelming reason to switch to the size model because of the small improvement in model fit with the size model, the similarity of biomass estimates to Scenario 1 age model, and the longer time to run the more detailed size model.

Retrospective Analysis

Run 12 is similar to the Scenario 1 base model in 1999. Run 12 produces a somewhat steeper decline at the end of the time series than was observed in the 1999 model. This result is partly due to the change in use of the survey age and size composition. In the 1999 assessment, survey data from 1977 and 1980 were included. These two years had very low occurrence of small/young canary, but subsequent years of data did not corroborate poor recruitments from those years. Consequently, the 1977 and 1980 survey data tend to pull the survey selectivity towards larger sizes. Then the 1998 survey had low biomass but a showing of small fish. Because the survey selectivity was right-shifted, these small fish were translated into moderately high recruitment estimates at the end of the time series. The new model removes the anomalous 1977 and 1980 survey size composition data. This allows the survey selectivity to shift towards smaller fish and fit the 1998 size composition data without producing large ending recruitments. In the final model configuration, the 1980 size composition data were added back into the model because there was no independent rationale for exclusion of these data. However, the poor fit to these data resulted in a low assigned sample size and, consequently, little effect on the model.

Models Explored During the STAR panel

Historical Catch
The assumption of zero catch prior to 1942 was found to be implausible during the STAR review. A level of historical average catch of 500 mt was derived from examination of trends in the early catch time series from California and Oregon.

Another examination explored the sensitivity of the model to the level of catch during the early years of the model. Much of this early catch is based upon estimates of total rockfish catch and rather sparse estimates of the proportion canary rockfish. All catch during 1942-1975 was increased by 10% in one model run and decreased by 10% in another run. The result was an approximately +/- 7% change in the initial biomass level of the model and less than 1% change in the ending biomass. Although the current estimates of historical catch are considered to be accurate, this sensitivity illustrates that any future improvements in historical catch estimates should be carried into the next canary rockfish assessment.

Canada
A single model run was conducted by including the Canadian catch and by adding the trawl survey biomass from the region between the US-Canada border and approximately 49 degrees N. The resulting survey biomass trend is somewhat smoother and has a steeper decline than the U.S. only time series. The resulting model fit appears to fit the survey time series well and to produce a higher initial biomass declining to approximately the same level as in the baseline model. Since much of the canary rockfish biomass occurs near the US-Canada border, we recommend further exploration of this northward expansion in the next canary rockfish assessment.

Natural mortality
Additional model runs conducted during the STAR panel explored the effect of linear ramp versus step function to describe the increase in female natural mortality in Scenario #1 (Figure 24). The best fit occurred with a step function at age 13. However, all biological arguments for such an increase are related to the accumulated stress of spawning. In the final model configuration, the increase in natural mortality was linked to the fraction mature cubed (Figure 25).

Emphasis Levels

The relative weighting of age versus size composition data was explored in the preliminary model runs presented to the STAR panel. Final model runs were conducted with an emphasis of 0.9 on age composition and 0.1 on size composition data.

Fishery CPUE

Delete 1982 trawl CPUE point because of extreme deviation.

Add the CA recreational CPUE into the model.

Add exponent to the relationship between expected CPUE and the model's estimate of fishery available biomass. This exponent allows the model to track trends in CPUE, without making the strong assumption that CPUE is strictly proportional to biomass. This is necessary because of uncertainty in the calibration of CPUE to account for fishermen search time, and in this case because the CPUE data do not cover the range of the stock. Such a non-linear relationship has been found for other stocks, such as northern cod off eastern Canada. The ability of models like Stock Synthesis to estimate such an exponent was demonstrated in the NRC evaluation of stock assessment methods (reference).

Blended Mortality/Selectivity Scenario

In the 1999 and previous assessments, Scenario 1 and Scenario 2 were presented as equally plausible alternatives. However, the weight of evidence appears to favor Scenario 1 because:

1. Degraded fit to survey CPUE trend with Scenario 2
2. Implausible that older females would consistently be so much less available than old males
3. Extensive examination of similar phenomenon for yellowtail rockfish resulted in rejection of Scenario 2.

Although scenario #1 appears to have greater support, there are no definitive field data available to confirm that old females have asymptotic selectivity. A blend of scenario #1 and scenario #2 was developed by fixing the increase in female natural mortality at various levels, and allowing the model to estimate the degree of dome-shaped female selectivity for the trawl fisheries and the trawl survey. When profiled over the old female natural mortality (Figure 26 and Tables 11-12), the best fit occurs at a level of 0.12, and levels of 0.10 and 0.14 appear to bracket the range of plausible model results. The probability profile presented in Figure 26 does not exactly represent all potential contributions to variability in the model result, but it does approximate the plausible range of variability represented by the various model configurations. Thus, the model result with old female natural mortality set to 0.12 is considered the best model configuration and the baseline for making management calculations. The natural mortality range of 0.10 to 0.14 will be used to contrast the potential outcomes if the baseline model is not accurate.

Model Results

Residual Patterns

Figure 27 shows the fit of the model to the survey and fishery CPUE trends. For the fishery CPUE, a non-baseline fit without the density-dependent catchability is also shown.

Figure 28 shows the residuals to the fit to the size and age composition data for the baseline model. Age composition data have an emphasis of 0.9 in these runs, so there is greater pattern to the residuals of the fit to the size composition data which have an emphasis of 0.1. The fact that the model cannot simultaneously achieve a better fit to all sources of data is not surprising since these data come from different regions of the coast. Regional differences in growth, ageing imprecision, and recruitment patterns will interfere with the model's ability to fit all data. Trial adjustments in the model configuration could improve the fit to some of these, while degrading others, but all resulted in a similar trend in abundance.

Catch

Historical catches were as high as 5000mt as recently as the early 1980's but have declined due to management actions throughout the 1990's. Beginning in 1983 and extending through 1994, canary rockfish were monitored as part of the *Sebastes* complex, with various trip limits imposed over this 10-yr span. In 1995, trip limits specific to canary rockfish were imposed and commercial vessels were expected to sort the canary rockfish from the mixed-species categories, such as the *Sebastes* complex. In 2000, catch was drastically reduced to levels under 200mt and in 2001 under 100mt as part of the rebuilding process resulting from the 1999 assessments.

Stock Biomass

Canary rockfish stock biomass (1+ yr old fish at the beginning of the year) has declined markedly over the last three decades and is now at historically low levels near 6500mt **(Table 12; Figure 29).** The stock biomass trend does show a small upturn in the most recent years but this result is uncertain and due to variability in the biomass estimate from the shelf survey. The shelf survey biomass estimate itself is without obvious trend during 1992-2001.

Female Spawning Biomass

Canary rockfish female spawning biomass (mature females as defined by the age-based maturity schedule) has declined considerably and is now near historically low levels. The current estimate of female spawning biomass was roughly 2500 mt; which is approximately 8% of the unfished state. The time series of female spawning biomass is presented in **Table 12** and **Figure 29.**

Recruitment

Estimates of canary rockfish recruitment (age-1 fish) have fluctuated widely, with annual estimates ranging from a low of roughly 400,000 fish in the late 1990's to a high of over 6,000,000 fish in 1961. In general, lower levels of annual recruitment were observed more recently (say after 1980) in the time series than in previous years (during the 1960s and 1970s), which suggests recruitment patterns are at least generally related to spawning stock size. The time-series of recruitment is presented in **Table 12** and **Figure 29.**

Population Numbers

The numbers at age for the period 1978-2001 are shown in Table 14.

Fishing Mortality Rate

The percentage of available biomass taken each year generally increased over the last 30 years until management regulations in the late 1990's, particularly for the Oregon and Washington trawl fisheries and the California recreational fishery (**Table 13; Figure 30**). In the early part of the 1990's, the percent of available biomass taken peaked at over 27% and 10% for the Oregon and Washington trawl fisheries, respectively. Currently, the recreational fishery take 2-3% of available biomass and the commercial gears take less than 1%.

Selectivity Patterns

The patterns of age-specific selectivity for the baseline model with M=0.12 are shown in Figure 31.

Spawner-Recruitment

The relationship between recruitment and female spawner biomass is shown for the baseline model in Figure 32. The estimated steepness is only 0.289 in the Beverton-Holt formulation. A B-H steepness of 0.289 means that average recruitment is 28.9% of its virgin level when the spawning biomass is reduced to

20% of its virgin level. An essentially identical curve is derived from a Ricker formulation, so for simplicity of presentation only the B-H is used in subsequent evaluations.

This spawner-recruitment curve is estimated within the model, so it provides the estimated fit to the individually estimated recruitments AND it provides the actual recruitment levels used in the earliest and latest years in the model. Figure xxx shows that the curve underestimates many of the recruitments during the early-mid 1990s. Inspection of the model fit to fishery size and age composition data from 2000-2001 indicates that the low occurrence of small/young fish in these samples is pulling the S/R curve downwards in order to provide a slightly better fit to these imprecise data. The model is configured to allow some change in fishery selectivity in 2000 because of the radical changes in management at that time. However, these changes in selectivity may not be flexible enough to account for all the actual changes in fishery selectivity. Although the best overall model fit occurs at steepness equal to 0.289, the best fit to the S/R likelihood component occurs at about 0.32, the estimate of steepness is 0.36 when fit a curve is fit to the recruitments outside of synthesis, and when the synthesis model is re-fit with steepness fixed at 0.40 the overall fit only degrades by 0.5 log likelihood units. Although these may seem like trivially small changes in the estimate of steepness, in fact such changes make a large impact on the estimated level of surplus recruitment available to rebuild the stock. Thus we conclude that the initial estimated steepness of 0.289 is not the best estimate that should be considered for forecasts. A steepness of 0.36 will be contrasted to the initial model estimate of 0.289.

Although the S/R steepness appears to be extremely low; it is possible that this estimate is depressed as a consequence of measuring canary rockfish productivity during an unproductive decadal scale environmental regime, rather than a reflection of the true, long-term productivity averaged over good and bad environmental regimes. There are indications of another environmental shift in 1999 and some other species are showing signs of a positive biological response. At this time, canary rockfish have not shown such a response, even in the central California juvenile rockfish recruitment index. The degree of biological response (increased recruitment) for canary rockfish over the next 5 years should be highly informative regarding their productivity.

TARGET FISHING MORTALITY RATES

$F_{50\%}$ is currently intended as a proxy for the harvest rate that would produce Maximum Sustainable Yield (F_{MSY}) for rockfish species exploited off the U.S. Pacific coast. The statistic $F_{50\%}$ is the fishing mortality rate that would reduce average, lifetime egg production (spawning biomass) per female entering the stock to 50% of its unfished level. However, this calculation does not take into account the degree to which recruitment will decline as the spawning stock declines. The S/R steepness estimated within the baseline model run is only 0.289, with an alternative estimate of 0.36. Thus, there is little surplus production. These steepness levels are extraordinarily low relative to the 0.7 level seen for other stocks, and indicate that $F_{50\%}$ is not a sustainable rate for canary rockfish. When steepness is 0.289, the exploitation rate that would produce maximum sustainable yield (MSY) is 0.0135 (Figure 36), which is only a third of the exploitation rate at $F_{50\%}$. $F_{69\%}$ corresponds with F_{msy} for steepness of 0.36 (Figure 37), and $F_{80\%}$ corresponds for a steepness of 0.289. Figures 36 and 37 also show the expected long-term outcomes from fishing at $F_{90\%}$. This rate is more conservative than the F_{msy} rates and will be one of the rates included in the rebuilding forecasts.

With a S/R steepness of 0.289 and with fishing at a rate of $F_{80\%}$, the equilibrium yield would be 591 mt and the female spawning biomass would be at 49% of its unfished level. With a S/R steepness of 0.360 and with fishing at a rate of $F_{69\%}$, the equilibrium yield would be 919 mt and the female spawning biomass would be at 43% of its unfished level. In summary:

Steepness	F_{spr} for MSY	MSY	B_{msy}
0.289	$F_{80\%}$	591 mt	49% of B_0
0.360	$F_{69\%}$	919 mt	43% of B_0

HARVEST PROJECTIONS and REBUILDING FORECASTS

Forecasts are conducted in the following manner:

1. The target female spawning biomass for rebuilding is set at 40% of the unfished female spawning biomass (B_0). B_0 is taken from the model's estimate of initial biomass, thus takes into account the cumulative removals throughout the history of exploitation and is linked to the spawner-recruitment curve which provides a sufficient fit to the year-specific recruitments. In the 1999 stock assessment and 2000 rebuilding analysis, the B_0 was based upon average recruitment during 1967-1977 multiplied by the unfished spawning biomass per recruit. The 1999 and current assessment clearly show that the spawning biomass and recruitment had already been substantially reduced by that 1967-1977 era. Mean recruitment during 1967-1977 is currently estimated to be 2.52 million, which is close to the current estimate of expected recruitment at MSY (2.46 million in Figure 37). During an earlier era (1958-1970) when spawning biomass was still above 2/3 of its unfished level, the mean recruitment is estimated to be 3.36 million. The mean unfished recruitment level is 3.90 million.

2. Time to rebuild – This depends on the time to rebuild with no fishing (**Tmin**), plus up to one mean generation time. In the initial rebuilding analysis, the time to rebuild with no fishing was 41 years and the mean generation time was 17 years, so rebuilding needed to occur by 2058. The new estimates of mean generation time are 17.7 years, 16.1 years and 15.0 years at M=0.10, 0.12, And 0.14 respectively. However, recognition that the true B0 is higher than that calculated from 1967-1977 recruitments means that the time to rebuild with no fishing is longer also. These new calculations will be presented here, as well as the probability of rebuilding in the initial maximum allowable time (year 2057). Note that any new calculations of the time to rebuild with no fishing need to take into account the impact of the catch that has already occurred during the initial years since the overfished determination. All calculations in the current document simply calculate the time to rebuild with no future fishing and do not retroactively calculate what would have occurred in fishing mortality was zero in 2001-2002.

3. Future recruitments are generated by first calculating the expected recruitment from the spawner-recruitment curve, then multiplying this recruitment by a lognormal error with the lognormal standard deviation set at 0.4, the same level as in the assessment model. This approach differs from the resampling of recruits or resampling of recruits per spawner approaches used in other west coast groundfish rebuilding analyses, but is the same as the approach used in rebuilding analyses for New England groundfish. The use of the spawner-recruitment curve effectively compromises between the R and R/S approaches, and lets the historical data determine the level of future recruitment. The use of the lognormal distribution versus the resampling of residuals provides a smoother distribution of future recruitments.

Three model results, with ending female natural mortality of 0.10, 0.12, and 0.14, were considered to bracket the plausible range of model results; with the run at 0.12 providing the best fit to the data and considered to have the greatest probability of being correct. These three runs differ rather little in many model outcomes, but they have greatly different rebuilding forecasts. At M=0.10, the estimated current depletion is 10%, the spawner-recruitment steepness is 0.305, and the probability of rebuilding to B40% by the year 2057 is 70% with no fishing after 2002. At M of 0.12 and 0.14, the level of current depletion decreases to 8% and 6.7% respectively, the S/R steepness decreases to 0.289 and 0.268; and the probability of rebuilding decreases dramatically to 17% and <1%. In contrast, the probability of rebuilding increases to 99% with M=0.12 and the alternative steepness of 0.36. Although the original intention was to contrast results between different levels of natural mortality, the action is in the steepness and this will be the focus of these rebuilding projections.

Table 15 and Figures 33-35 exhibit the results of several rebuilding forecasts. In each case, 1000 simulations of up to 200 years are conducted and the results summarize the number of simulations that first achieve the rebuilt level in the specified year. These results are intended to illustrate the range of plausible results. Final calculations will be conducted per guidance of the Council's technical advisors.

1. Runs 1-3 (Figure 33 and Table 15) show the results with no fishing for each of the three natural mortality levels, as described above.
2. Runs 4-7 show results with various harvest options and M=0.10. At a constant catch of 93 mt (the current policy), the probability of rebuilding by 2057 is only 11%, but there is a 50% probability of rebuilding by 2068, which is 15 years after the time to rebuilding with no fishing.
3. Runs 8-10 use the M=0.14 model scenario and show that the rate of rebuilding is extraordinarily slow because of the low steepness associated with this scenario.
4. Run 11 shows that rebuilding is slightly sooner if based upon resampling of recruits per spawner. This is probably because these R/S values do not show the range of variability seen throughout the time series and included in the lognormal approach.
5. Run 12 shows the impact of the higher B0 in the current analysis. As expected, the original, lower target is reached sooner.
6. Runs 13-14 show that neither the current 93 mt harvest or an alternative F90% harvest rate has an appreciable chance of achieving the rebuilding target in the original time frame. They would reach the rebuilt level about 20-25 years after the preliminary recalculation of Tmin.
7. Runs 15-22 are conducted with the baseline model (M=0.12), but with the alternative steepness level of 0.36.
    a. Run 15 shows that a new Tmin of 2044 would be very similar to the current Tmin of 2041.
    b. Runs 16-18 show that either the current 93 mt harvest or an alternative F90% harvest rate would have an approximately 80% probability of achieving the rebuilt level by 2057.
    c. Runs 19-22 show that the results are sensitive to the selectivity curve for the future fishery. If the future selectivity curve is like that for the recreational fishery, then the fishery will primarily take young, small fish and will have a greater impact per ton of harvest than will a future fishery will a trawl-like selectivity pattern that takes fewer young fish and spreads harvest over a broad range of older age groups. At F90%, the young selectivity pattern can harvest about 30 mt while the old selectivity pattern could take 60 mt. Runs 1-18 used a blend of selectivities which would put approximately 50% of the catch in the recreational fishery and 50% spread across the other fisheries.

RECOMMENDATIONS

The following research and monitoring efforts would improve the accuracy of the canary rockfish assessment and provide better monitoring of its rebuilding.

(1) *Abundance surveys*: Research surveys need to be conducted more frequently. The three-year span between consecutive surveys necessarily confounds interpretation of time series, including biological distributions (age and size) and CPUE indices.

(2) *Habitat relationships*: The historical and current relationship between canary rockfish distribution and habitat features should be investigated to provide more precise estimates of abundance from the surveys, and to guide survey augmentations that could better track rebuilding.

(3) *Expanded Assessment Region*: Given the high occurrence of canary rockfish close to the US-Canada border and the good consistency of the survey trend and model fits through preliminary inclusion of Canadian data, we recommend a joint US-Canada assessment in the future.

(4) *At-sea observer programs*: The observer program, which began in August 2001, will soon begin to provide useful information on the total catch of canary rockfish from all gear types. These data should be analyzed and included in the next canary assessment.

(5) *Pre-recruit surveys*: Although the midwater trawl juvenile rockfish survey was not included in the current assessment, we recommend further work to evaluate its applicability, especially because of recent efforts to expand the geographic scope of this survey.

(6) *Stock-recruitment evaluations*: The new estimate of the spawner-recruitment relationship developed in this assessment needs to be evaluated against time series of climate data.

(7) *Absence of old female canary rockfish in the sample data*: Given the premise of this and past assessments that much of the uncertainty in the overall analyses stems from a lack of understanding regarding the discrepancy between age distributions of male and female canary rockfish, efforts should be undertaken that address this issue, including: (1) obtaining fish that have been sampled (through the fishery or survey) by gears other than trawls, e.g., vertical longlines are used by the open access fishery to catch rockfish; (2) developing laboratory-based programs to rigorously evaluate the physiology of the two sexes, particularly, the females.

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As with all fishery stock assessments, this assessment is the cumulative effort of several agencies, their scientists and technicians. We are indebted to all involved in collecting and providing data for this assessment, and to those who have previously conducted the assessment for canary rockfish and laid the foundation for our work in 2002. Members of the fishing industry have provided valuable insights regarding interpretation of the data and helped us understand the behavior of this species and the fishermen who harvest it. Finally, we thank the members of the STAR panel, Gary Stauffer, Stephen Ralston, Larry Jacobson, Paul Medley, Mark Saelens, and Tom Ghio who provided critical examination of our assumptions, methods, and presentation, and helped us prepare a better assessment.

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Table 1. Recent management regulations, landed catch and total catch (landed plus assumed discard) of Canary rockfish from all INPFC areas from 1990-2001. Important regulation changes are also given below the landings table.

Year	ABC(mt)	Landings (mt)	Assumed Discard	Total Catch(mt)
1990	3500	2680	0.0123	2928
1991	2900	3104	0.0123	3251
1992	2900	2713	0.0123	2945
1993	2900	2188	0.0123	2212
1994	2900	1208	0.0123	1220
1995	1250	1032	0.16	1168
1996	1250	1322	0.16	1508
1997	1130	1246	0.16	1399
1998	1130	1272	0.16	1444
1999	1130	778	0.16	883
2000	287	175	0.16	*177
2001	228	90	0.16	90

- drastic change in total catch/ABC due to implementation of the 40-10 policy and low biomass from the 1999 assessment

Recent Management Regulations

1996 Coast-wide two month trip limit of 18,000 pounds of Canary rockfish
1997 Changed to month cumulative limit of 75,000 pounds of Sebastes Complex south of Cape Mendecino, of which no more than 10,000 lbs may be Canary rockfish.
1998 Coast-wide cumulative two month trip limit of Canary rockfish
10/1/1998 prohibited catch of canary rockfish coast-wide for the remainder of the year.
2000 Canary rockfish stock declared overfished
2001 Rebuilding plan due for canary rockfish.

Table 2(a) .Landing in mt of canary rockfish from each state and gear type. Total catch by state is summarized in the final column of the state tables and total catch of all states is summarized at the end of the Washington table. The first table is the California Landings by each gear and year. Missing cells are assumed to be zero.

state	Ca	Ca	Ca	Ca	Ca	Ca	Ca	Ca	Ca	Ca
gear	hkl	net	tls	twl	msc	pot	tws	rec	for	total
year										
1941	0			0						**0**
1942	22			113						**135**
1943	42			220						**262**
1944	98			512						**610**
1945	203			1058						**1261**
1946	170			889						**1059**
1947	130			677						**807**
1948	99			518						**617**
1949	91			475						**566**
1950	124			646						**770**
1951	168			876						**1044**
1952	164			854						**1018**
1953	187			974						**1161**
1954	193			1007						**1200**
1955	194			1010						**1204**
1956	228			1190						**1418**
1957	246			1282						**1528**
1958	272			1421						**1693**
1959	233			1217						**1450**
1960	209			1092						**1301**
1961	165			863						**1028**
1962	150			783						**933**
1963	179			936						**1115**
1964	113			564						**677**
1965	115			555						**670**
1966	105			490					38	**633**
1967	83			375					103	**561**
1968	60			263					415	**738**
1969	38			160					5	**203**
1970	44			186					0	**230**
1971	46			194					0	**240**
1972	68			285					13	**366**
1973	91			383					379	**853**
1974	84			365					152	**601**
1975	86			391					107	**584**
1976	84			396					53	**533**
1977	67			327						**394**
1978	61			311						**372**
1979	80			420						**500**
1980	79			436				327		**842**
1981	33	0	18	300				158		**510**
1982	15	0	6	805				276		**1101**
1983	14	1	0	486	0			106		**607**
1984	9	11	0	401				107		**528**
1985	13	109	1	319	0			168		**610**

1986	71	4	1	153	0			227		456
1987	23	4		178	1			231		437
1988	43	14	0	163	0			196		417
1989	149	24	0	171	0			124		469
1990	195	7	12	342	3					559
1991	129		1	141	1					271
1992	125	8	0	229	1	0				362
1993	79	4	0	84	0			65		233
1994	109	2	2	119	1	0	0	50		283
1995	93	2	1	107	0	1	4	72		281
1996	97	0	7	176	0	0	6	64		350
1997	77	3	4	139	0	0	3	95		321
1998	59	1	4	126	0	0	3	25		220
1999	13	1	0	99		0	2	67		182
2000	2	0	0	11	0	0	0	85		98
2001	1	0	0	8	0	0	0	33		42

Table 2a. continued-Oregon landings by year and gear

state	Or	Or	Or	Or	Or	Or	Or	Or	Or	Or
gear	hkl	pot	tls	twl	tws	Rec	Eur	Stw	for	total
year										
1941				0						0
1942				3186						3186
1943				3186						3186
1944				3186						3186
1945				3186						3186
1946				3186						3186
1947				3186						3186
1948				440						440
1949				440						440
1950				440						440
1951				440						440
1952				440						440
1953				440						440
1954				440						440
1955				440						440
1956				440						440
1957				440						440
1958				440						440
1959				440						440
1960				440						440
1961				440						440
1962				440						440
1963				440						440
1964				440						440
1965				440						440
1966				440					1495	1935
1967	50			159			47	22	685	963
1968	50			485			55	23	294	907
1969	50			611			63	25	52	801
1970	50			596			78	25	75	824
1971	50			581			112	19	113	875
1972	50			597			128	40	319	1134
1973	50			766			92	64	524	1496

1974	50			515			109	65	80	**819**
1975	50			365			131	43	154	**743**
1976	50			161			143	75	119	**548**
1977	50			483			96	97		**726**
1978	50			978			356	132		**1516**
1979	50			1729			292	208		**2279**
1980				2281		28				**2309**
1981				1942	115	47				**2104**
1982				3807	86	42				**3935**
1983				3510	27	4				**3540**
1984				1171	3	21				**1195**
1985				1017		60				**1077**
1986	15			853	38	21				**928**
1987	158			1446	30	30				**1664**
1988				1264	292	57				**1612**
1989				1532	21	26				**1579**
1990	17			965	53					**1035**
1991	27			1719	37					**1783**
1992	151			1363	22					**1536**
1993	115			1449	47	49				**1659**
1994	104			627	10	33				**773**
1995	95		2	458	5	50				**610**
1996	135	0	2	625	18	26				**805**
1997	204	0	5	483	11	43				**745**
1998	203	0	2	594	8	49				**856**
1999	97		2	294	32	43				**467**
2000	5	0	1	16	10	32				**65**
2001	5		1	11	2	15				**35**

Table 2a continued- Washington landings by year and gear and total of all states

state	Wa	Wa	Wa	Wa	Wa	Wa	Wa	Wa	All states
gear	hkl	tls	twl	tws	Rec	Misc	for	total	total
year									
1941								**0**	**0**
1942								**0**	**3321**
1943								**0**	**3448**
1944								**0**	**3796**
1945								**0**	**4447**
1946								**0**	**4245**
1947								**0**	**3993**
1948								**0**	**1057**
1949								**0**	**1006**
1950								**0**	**1210**
1951								**0**	**1484**
1952								**0**	**1458**
1953								**0**	**1601**
1954								**0**	**1640**
1955								**0**	**1644**
1956								**0**	**1858**
1957								**0**	**1968**
1958								**0**	**2133**
1959								**0**	**1890**
1960								**0**	**1741**

1961								**0**	**1468**
1962								**0**	**1373**
1963								**0**	**1555**
1964								**0**	**1117**
1965								**0**	**1110**
1966							111	**111**	**2678**
1967	0		321			0	88	**409**	**1934**
1968	0		554			0	109	**663**	**2307**
1969	0		540			0	12	**552**	**1555**
1970	0		432			0	35	**467**	**1521**
1971	0		383			0	66	**449**	**1564**
1972	0		94			0	67	**161**	**1661**
1973	0		77			0	68	**145**	**2494**
1974	0		186			0	289	**475**	**1895**
1975	0		568		3	0	0	**571**	**1898**
1976	0		449		2	4	0	**455**	**1536**
1977	0		979		3	42		**1024**	**2144**
1978	0		1113		8	0		**1121**	**3009**
1979	0		1105		4	3		**1112**	**3891**
1980			934		7			**941**	**4092**
1981			508		17			**525**	**3139**
1982			430		8			**438**	**5474**
1983			643		4			**647**	**4794**
1984			605		7			**612**	**2335**
1985			1025		9			**1034**	**2720**
1986			888		4			**892**	**2275**
1987			1004		9			**1014**	**3115**
1988			967		9			**976**	**3005**
1989			1194		4			**1198**	**3245**
1990			1086					**1086**	**2680**
1991			960					**960**	**3014**
1992			815					**815**	**2713**
1993			286		10			**296**	**2188**
1994			148		4			**152**	**1208**
1995	3	0	133	2	4			**142**	**1032**
1996	3	0	158	2	4			**166**	**1322**
1997	4	0	170	1	5			**180**	**1246**
1998	3	2	169	1	21			**197**	**1272**
1999	4	1	116	1	6			**129**	**778**
2000	2	0	7	1	4			**14**	**176**
2001	3	0	7	0	3			**13**	**90**

Information for Oregon and Washington from the years 1967-80 (domestic) are from Golden and Wood (1990) and Sampson (1996).
Information for California 1950-1979 were taken from a series of Fish Bulletins from the state of California as described by William et al. (1999)
Information for foreign catch comes from Rogers (2002).

Gear abbreviations: Pot=pot
Rec=recreational For=foreign
Misc=unidentified Hkl=hook and line
Tws=shrimp trawl Twl=trawl Tls=troll

Table 2 b. Landings of canary rockfish by state and gear for the year 1941-2001 as used in the modeling (after combining gears and applying the discard rate). All commercial landings have been adjusted by the assumed discard rate; which is also given in the table.

Year	OR trawl	WA trawl	CA trawl	CA nontwl	OR-WA nontwl	CA rec	OR-WA rec	discard rate
1941	500	0	0	0	0	0	0	0.0123
1942	3226	0	115	22	0	0	0	0.0123
1943	3226	0	223	42	0	0	0	0.0123
1944	3226	0	518	98	0	0	0	0.0123
1945	3226	0	1071	203	0	0	0	0.0123
1946	3226	0	900	170	0	0	0	0.0123
1947	3226	0	685	130	0	0	0	0.0123
1948	445	0	525	99	0	0	0	0.0123
1949	445	0	481	91	0	0	0	0.0123
1950	445	0	654	124	0	0	0	0.0123
1951	445	0	887	168	0	0	0	0.0123
1952	445	0	865	164	0	0	0	0.0123
1953	445	0	986	187	0	0	0	0.0123
1954	445	0	1019	193	0	0	0	0.0123
1955	445	0	1023	194	0	0	0	0.0123
1956	445	0	1205	228	0	0	0	0.0123
1957	445	0	1298	246	0	0	0	0.0123
1958	445	0	1439	272	0	0	0	0.0123
1959	445	0	1232	233	0	0	0	0.0123
1960	445	0	1106	209	0	0	0	0.0123
1961	445	0	873	165	0	0	0	0.0123
1962	445	0	793	150	0	0	0	0.0123
1963	445	0	947	179	0	0	0	0.0123
1964	445	0	571	113	0	0	0	0.0123
1965	445	0	562	115	0	0	0	0.0123
1966	1940	111	534	105	0	0	0	0.0123
1967	972	413	482	83	0	0	0	0.0123
1968	920	670	681	60	0	0	0	0.0123
1969	815	558	167	38	0	0	0	0.0123
1970	838	472	188	44	0	0	0	0.0123
1971	889	454	196	46	0	0	0	0.0123
1972	1149	163	302	68	0	0	0	0.0123
1973	1513	146	766	91	0	0	0	0.0123
1974	836	477	521	84	0	0	0	0.0123
1975	754	578	503	86	0	0	0	0.0123
1976	563	461	453	84	0	0	0	0.0123
1977	746	1037	331	67	0	0	0	0.0123
1978	1549	1135	315	61	0	0	0	0.0123
1979	2363	1126	426	80	0	0	0	0.0123
1980	2309	946	442	79	0	327	35	0.0123
1981	2083	514	303	52	0	159	63	0.0123
1982	3941	435	815	21	0	276	50	0.0123
1983	3581	651	492	15	0	106	8	0.0123
1984	1188	613	406	19	0	107	28	0.0123
1985	1029	1038	322	123	0	168	68	0.0123
1986	902	899	155	75	16	227	25	0.0123
1987	1494	1017	180	28	158	231	40	0.0123
1988	1575	979	165	58	0	196	66	0.0123
1989	1573	1209	173	174	0	124	40	0.0123
1990	1030	1100	346	217	17	175	43	0.0123
1991	1778	972	143	131	27	157	43	0.0123

1992	1402	825	232	133	151	170	32	0.0123
1993	1514	290	85	84	115	65	59	0.0123
1994	644	150	121	113	104	51	37	0.16
1995	551	161	133	97	100	72	54	0.16
1996	765	190	216	104	140	64	29	0.16
1997	587	203	169	84	214	95	47	0.16
1998	717	203	154	65	210	25	70	0.16
1999	388	140	121	14	104	67	49	
2000	26	8	11	2	9	85	36	
2001	14	7	8	1	9	33	18	
2002	13	7	8	1	9	33	18	

Note: Non-trawl gears include hook and line as well as net fisheries. Recreational gears include all shore, boat and partyboat catches including those caught but released dead.

Table 3. Sample sizes and the number of trips associated with each data source. Sample sizes are given in terms of trips and the number of fish sampled.

Area	gear	year	# trips	# lengths	# ages
Wa	twl	1968	1	162	
Wa	twl	1969	1	293	
Wa	twl	1971	2	345	
Wa	twl	1972	2	513	
Wa	twl	1973	1	230	
Wa	twl	1974	4	1010	
Wa	twl	1975	6	1240	
Wa	twl	1976	4	1033	
Wa	twl	1977	6	1316	
Wa	twl	1978	6	1067	
Wa	twl	1979	7	699	
Wa	twl	1980	14	973	688
Wa	twl	1981	19	1527	593
Wa	twl	1982	14	1198	547
Wa	twl	1983	17	1600	283
Wa	twl	1984	17	1496	399
Wa	twl	1985	18	1750	150
Wa	twl	1986	16	1499	781
Wa	twl	1987	24	1299	649
Wa	twl	1988	6	300	300
Wa	twl	1989	11	538	538
Wa	twl	1990	6	300	300
Wa	twl	1991	6	300	300
Wa	twl	1992	6	300	300
Wa	twl	1993	10	498	498
Wa	twl	1994	14	699	699
Wa	twl	1995	22	1100	1100
Wa	twl	1996	15	750	672
Wa	twl	1997	17	847	788
Wa	twl	1998	23	844	446
Wa	twl	1999	20	753	489
Wa	twl	2000	7	229	0
Wa	twl	2001	12	424	83

Area	gear	year	# trips	# lengths	# ages
Or	twl	1980	20	908	908
Or	twl	1981	8	633	633
Or	twl	1982	20	1418	1481
Or	twl	1983	29	2804	2692
Or	twl	1984	18	1754	1754
Or	twl	1985	25	1304	1204
Or	twl	1986	16	805	805
Or	twl	1987	33	1651	1350
Or	twl	1988	25	1354	896
Or	twl	1989	23	1130	1095
Or	twl	1990	22	1098	549
Or	twl	1991	22	851	661
Or	twl	1992	34	1363	1011
Or	twl	1993	22	1110	1110
Or	twl	1994	15	749	200
Or	twl	1995	16	847	794
Or	twl	1996	19	1162	943
Or	twl	1997	38	2030	1484
Or	twl	1998	36	1895	434
Or	twl	1999	31	1607	428
Or	twl	2000	40	690	68
Or	twl	2001	52	962	133

Area	gear	year	# trips	# lengths	# ages
coast	survey	1977	17	1125	720
coast	survey	1980	18	1225	968
coast	survey	1983	48	2807	1455
coast	survey	1986	48	3020	599
coast	survey	1989	88	1328	139
coast	survey	1992	47	583	280
coast	survey	1995	49	384	240
coast	survey	1998	107	560	276
coast	survey	2001	77	439	

Table 3 continued. Sample sizes and the number of trips associated with each data source. Sample sizes are given in terms of trips and the number of fish sampled.

Area	gear	year	# boat trips	# len	# age
Ca	Twl	1978		34	
Ca	Twl	1979		16	
Ca	Twl	1980		28	239
Ca	Twl	1981		16	151
Ca	Twl	1982		36	213
Ca	Twl	1983		27	272
Ca	Twl	1984		32	339
Ca	Twl	1985		39	405
Ca	Twl	1986		42	
Ca	Twl	1987		39	
Ca	Twl	1988		30	
Ca	Twl	1989		52	
Ca	Twl	1990		37	
Ca	Twl	1991		35	
Ca	Twl	1992		166	
Ca	Twl	1993		153	
Ca	Twl	1994		212	
Ca	Twl	1995		148	
Ca	Twl	1996		158	
Ca	Twl	1997		134	
Ca	Twl	1998		53	
Ca	Twl	1999		95	
Ca	Twl	2000		18	
Ca	Twl	2001		37	

Table 4. The proportion of fish within each length class by gear, state and sex. The first table is the California commercial and recreational, followed by Oregon and Washington.

state	Ca	Ca	Ca	Ca	Ca	Ca	Ca	Ca	Ca	Ca	Ca	Ca	Ca	Ca
gear	twl	twl	twl	twl	twl	twl	twl	twl	twl	twl	twl	twl	twl	twl
sex	male	female	male	female	male	female	male	female	male	female	male	female	male	female
year	1979	1979	1980	1980	1981	1981	1982	1982	1983	1983	1984	1984	1985	1985
16cm	0	0	0	0	0	0	0	0	0	0	0.0032	0.0016	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0.0035	0	0	0	0.0001	0	0	0	0.0001
32	0	0	0.0349	0	0	0	2E-05	4E-05	0.0025	0.0017	0.0014	0.0011	0.0057	0.0016
34	0	0	0.0726	0.0365	0	0.0035	0.0217	1E-05	0.0016	0.0019	0.0013	0.0206	0.02	0.0027
36	0	0	0.0396	0.1061	0.0057	0.0007	0.0188	0.0319	0.0185	0.0089	0.0154	0.0845	0.0132	0.036
38	0.0211	0.005	0.0737	0.0763	0.0668	0.0022	0.0172	0.0034	0.0336	0.0201	0.0277	0.0057	0.049	0.0524
40	0.0292	0.005	0.0179	0.0032	0.0259	0.0094	0.0438	0.0032	0.0568	0.0432	0.0421	0.0581	0.0864	0.0728
42	0.0812	0.0152	0.0236	0.0374	0.0585	0.0827	0.0581	0.0614	0.0723	0.0174	0.04	0.0457	0.0613	0.0544
44	0.048	0.005	0.098	0.0034	0.0523	0.0245	0.0979	0.0707	0.0422	0.0056	0.0492	0.0566	0.0661	0.0182
46	0.0708	0.015	0.0684	0.0091	0.1278	0.0698	0.0511	0.0781	0.0727	0.0874	0.1081	0.0338	0.0551	0.0373
48	0.1053	0	0.1023	0.0344	0.0611	0.0831	0.0562	0.0756	0.0792	0.0122	0.051	0.053	0.0747	0.0146
50	0.1283	0.0253	0.0413	0.0354	0.0486	0.0412	0.1429	0.0457	0.0779	0.014	0.0342	0.0447	0.0601	0.0574
52	0.1207	0.0493	0.0137	0.0338	0.0079	0.0513	0.0453	0.0485	0.0879	0.1467	0.0594	0.0567	0.0453	0.0089
54	0.1315	0.0107	0	0.0236	0	0.068	1E-05	0.0232	0.0079	0.055	0.0129	0.0126	0.0079	0.045
56	0.0056	0.0649	0.0026	0.0081	0	0.0883	0	0.0052	0.0008	0.0172	0.0052	0.0398	0	0.0437
58	0.0054	0.0378	0	0.0033	0	0.0174	0	7E-05	0.0023	0.0124	0	0.034	0	0.0103
60	0	0.0011	0	0	0	0	0	1E-05	0	0	0	0.0002	0	0
62	0	0.0075	0	0	0	0	0	0	0	0	0	0	0	0
64	0.0082	0.0029	0.0009	0	0	0	0	0	0	0	0	0	0	0

state	Ca	Ca	Ca	Ca	Ca	Ca	Ca	Ca	Ca	Ca	Ca	Ca	Ca	Ca
gear	twl	twl	twl	twl	twl	twl	twl	twl	twl	twl	twl	twl	twl	twl
sex	male	female	male	female	male	female	male	female	male	female	male	female	male	female
year	1986	1986	1987	1987	1988	1988	1989	1989	1990	1990	1991	1991	1992	1992
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0.0016	0	0.0015	0	0	0	0	0	0	0	0.0002	0	0	0
30	0	0.0016	0	0	0.0005	0.0011	0.0016	0.0221	0	0	0.0006	0	0	0
32	0.0001	0	0.0029	0	0.0016	0.0639	0.0441	0.0288	0.004	0.0056	0.0215	0.0006	0.0011	0.0014
34	0.0001	0.0004	0.0981	0.066	0.0643	0.0029	0.0799	0.0045	0.021	0.0222	0.0054	0.0084	0.0081	0.0258
36	0.02	0.0135	0.085	0.0905	0.1316	0.066	0.0828	0.0811	0.0362	0.0054	0.0631	0.0223	0.0398	0.0081
38	0.0528	0.0274	0.1186	0.0545	0.0753	0.0718	0.065	0.0492	0.0538	0.0228	0.112	0.046	0.0435	0.0443
40	0.118	0.0688	0.0422	0.0292	0.013	0.0691	0.0887	0.0744	0.0385	0.04	0.0852	0.0607	0.072	0.0316
42	0.1455	0.0283	0.0596	0.0319	0.135	0.0061	0.0505	0.0337	0.0918	0.0634	0.0927	0.0799	0.0644	0.0368
44	0.0832	0.0426	0.0601	0.0644	0.0728	0.0048	0.0193	0.0079	0.081	0.0327	0.1513	0.0652	0.1003	0.0924
46	0.0958	0.0519	0.0478	0.0221	0.0682	0.0043	0.055	0.006	0.0961	0.0138	0.0399	0.0347	0.0957	0.027
48	0.0636	0.0795	0.018	0.0495	0.0698	0.0047	0.0703	0.0071	0.0985	0.0566	0.0283	0.0496	0.0574	0.0854

50	0.024	0.0326	0.0131	0.026	0.0652	0.0013	0.0308	0.0265	0.0411	0.0751	0.0032	0.0084	0.0325	0.0307
52	0.0019	0.0247	0.0008	0.0038	0.0006	0.0045	0.0067	0.0318	0	0.0697	0	0.009	0.0781	0.0082
54	0.0006	0.0136	0	0.0044	0	0.0009	0	0.0056	0.0023	0.0169	0	0.0116	0	0.0123
56	0	0.0069	0	0.0036	0	0.0005	0.0029	0.0223	0	0.0029	0	0	0	0
58	0	0.001	0	0.0036	0	0	0	0.0014	0	0.0018	0	0	0	0.0031
60	0	0	0	0.0029	0	4E-05	0	0	0	0.0068	0	0	0	0
62	0	0	0	0	0	0	0	0	0	0	0	0	0	0
64	0	0	0	0	0	0	0	0	0	0	0	0	0	0

state	Ca	Ca	Ca	Ca	Ca	Ca	Ca	Ca	Ca	Ca	Ca	Ca	Ca	Ca
gear	twl	twl	twl	twl	twl	twl	twl	twl	twl	twl	twl	twl	twl	twl
sex	male	female	male	female	male	female	male	female	male	female	male	female	male	female
year	1993	1993	1994	1994	1995	1995	1996	1996	1997	1997	1998	1998	1999	1999
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0.0064	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0.0106	0.0027	9E-05	0	0	0	0	0	0	0
32	0.0314	0	0.0275	0.0015	0.016	0.0239	0.0036	0.0005	0	0	0.0079	0.0016	0	0
34	0	0	0.0015	0.0007	0.0418	0.0363	0.0203	0.0207	0.0003	0.0002	0.005	0.0371	0.0062	0.0084
36	0.0207	0.0128	0	0.0279	0.1055	0.074	0.1094	0.0257	0.0325	0.0015	0.0295	0.0353	0.0669	0.0164
38	0.0194	0	0.0569	0.0007	0.0936	0.0801	0.0835	0.0571	0.0726	0.0003	0.0311	0.0621	0.0589	0.0265
40	0.1646	0.0107	0.1644	0.0297	0.0956	0.0699	0.059	0.0272	0.1267	0.0335	0.015	0.0143	0.085	0.1078
42	0.0275	0.0008	0.0937	0.0729	0.0477	0.0408	0.1402	0.0437	0.105	0.0332	0.0737	0.005	0.0737	0.0932
44	0.3008	0.1348	0.0919	0.1743	0.0536	0.0426	0.1222	0.0125	0.0361	0.103	0.1399	0.0914	0.1104	0.1396
46	0.1326	0.0004	0.0738	0.0479	0.0325	0.04	0.0789	0.0652	0.032	0.0941	0.005	0.0703	0.0121	0.0417
48	0	0.128	0.0429	0.0103	0.018	0.0287	0.0059	0.0544	0.058	0.166	0.031	0.1278	0.0251	0.0983
50	0	0.0092	0.0152	0.0364	0.0106	0.006	0.0117	0.0349	0.001	0.034	0.0034	0.0913	0.008	0.0153
52	0	0	0	0.0272	0.0074	0.0188	0.0059	0.0059	0.042	9E-05	0.0294	0.031	0	0.0041
54	0	0	0	0.0026	0	0.0017	0	0	0	0.009	0	0.0603	0	0.0022
56	0	0	0	0.0001	0	0.0017	0	0.0117	0	0	0	0	0	0
58	0	0	0	0	0	0	0	0	0	0.001	0	0.0016	0	0
60	0	0	0	0	0	0	0	0	0	0	0	0	0	0
62	0	0	0	0	0	0	0	0	0	0	0	0	0	0
64	0	0	0	0	0	0	0	0	0	0.018	0	0	0	0

state	Ca	Ca	Ca	Ca
gear	twl	twl	twl	twl
sex	male	female	male	female
year	2000	2000	2001	2001
16	0	0	0	0
18	0	0	0	0
20	0	0	0	0
22	0	0	0	0
24	0	0	0	0
26	0	0	0	0
28	0	0	0	0
30	0	0	0	0
32	0	0	0	0
34	0.0067	0.0033	0	0
36	0.0453	0.0067	0.0419	0.0167

38	0.0839	0.0906	0.0172	0.0093
40	0.1757	0.0854	0.0361	0.0814
42	0.1187	0.0952	0.1311	0.072
44	0.0753	0.0975	0.1089	0.0942
46	0.0202	0.0184	0.0917	0.1157
48	0	0.0386	0.0091	0.0637
50	0	0	0	0.028
52	0	0	0	0.0495
54	0	0	0	0.0167
56	0	0.0386	0	0
58	0	0	0	0.0167
60	0	0	0	0
62	0	0	0	0
64	0	0	0	0

state	Ca	Ca	Ca	Ca	Ca	Ca	Ca	Ca	Ca	Ca	Ca	Ca	Ca	Ca
gear	rec	rec	rec	rec	rec	rec	rec	rec	rec	rec	rec	rec	rec	rec
sex	comb	comb	comb	comb	comb	comb	comb	comb	comb	comb	comb	comb	comb	comb
year	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1993	1994	1995	1996
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0.0028	0.0072	0.0017	0.02	0.0228	0.0063	0.0006	0.0072	0.0043	0.0075	0.017	0	0.0038	0.0072
20	0.0137	0.0024	0.0045	0.0201	0.0664	0.0233	0.0094	0.0132	0.0235	0.0425	0.0227	0.0105	0.0152	0.013
22	0.0114	0.0024	0.0383	0.0579	0.0883	0.0644	0.0291	0.0434	0.0593	0.0188	0.0463	0.0234	0.0183	0.0276
24	0.0637	0.0082	0.051	0.0418	0.1057	0.1023	0.0695	0.045	0.1055	0.066	0.122	0.0815	0.1114	0.0433
26	0.1083	0.0223	0.099	0.1075	0.0958	0.1324	0.1085	0.0591	0.119	0.108	0.1612	0.1236	0.0955	0.0811
28	0.1031	0.0242	0.1145	0.1366	0.0879	0.1223	0.154	0.0953	0.1969	0.1908	0.2148	0.1848	0.2327	0.126
30	0.1329	0.0582	0.1418	0.1286	0.0941	0.1127	0.2016	0.1019	0.1649	0.1906	0.1405	0.2299	0.1591	0.1856
32	0.1424	0.055	0.1358	0.1278	0.1125	0.1022	0.1445	0.0988	0.0934	0.1123	0.1144	0.155	0.1499	0.1631
34	0.1548	0.1202	0.1023	0.1094	0.0909	0.1148	0.1096	0.1117	0.0773	0.0908	0.0698	0.0888	0.0884	0.1411
36	0.0906	0.1273	0.0849	0.0873	0.0785	0.0809	0.0775	0.0964	0.0506	0.0613	0.0333	0.0495	0.0527	0.1015
38	0.0605	0.1617	0.0686	0.0686	0.0669	0.0555	0.0277	0.0524	0.0655	0.0358	0.0186	0.031	0.0356	0.0406
40	0.0218	0.1484	0.0638	0.0427	0.0239	0.0368	0.0147	0.0384	0.0154	0.0151	0.0146	0.0134	0.0128	0.0176
42	0.0184	0.0959	0.0344	0.0138	0.0171	0.014	0.0075	0.0371	0.0068	0.0146	0.0169	0.0035	0.0022	0.023
44	0.0348	0.0542	0.012	0.0032	0.0238	0.0151	0.0102	0.0687	0.0042	0.0147	0.003	0	0.0022	0.0113
46	0.0084	0.0369	0.0101	0.0068	0.0056	0.0013	0.0076	0.051	0.0047	0.0069	0.0011	0	0	0.0122
48	0.0239	0.0064	0.0141	0.0062	0.0061	0.0088	0.0084	0.0407	0.0043	0.0015	0.003	0	0	0.0056
50	0.0054	0.021	0.0083	0.0074	0.01	0.0014	0.0058	0.013	0.0022	0.0059	0	0	0.0022	0
52	0.0003	0.0106	0.0038	0.0041	0.001	0.0023	0.0099	0.0086	0.0022	0.0125	0.0009	0	0.0131	0.0002
54	0.0019	0.0099	0.0029	0.0041	0.0028	0.0015	0.0027	0.0096	0	0.0019	0	0	0	0
56	0	0.0148	0.0041	0.0021	0	0	0.0006	0.0061	0	0.0025	0	0.0048	0	0
58	0	0.002	0	0.0041	0	0.0015	0	0.0018	0	0	0	0	0	0
60	0.001	0.0066	0.0042	0	0	0	0	0	0	0	0	0	0	0
62	0	0.0011	0	0	0	0.0003	0	0.0009	0	0	0	0	0.0047	0
64	0.0001	0.0032	0	0	0	0	0.0006	0	0	0	0	0	0	0
66	0	0	0	0	0	0	0	0	0	0	0	0	0	0

state	Ca	Ca	Ca	Ca	Ca
gear	rec	rec	rec	rec	rec
sex	comb	comb	comb	comb	comb
year	1997	1998	1999	2000	2001
10	0	0	0	0	0
12	0	0	0	0	0
14	0	0	0	0	0
16	0	0	0	0	0
18	0.0015	7E-05	0	0	0
20	0.0095	0.0131	0	0	0
22	0.0271	0.0278	0.0809	0	0
24	0.0413	0.0557	0.0707	0	0
26	0.0911	0.0458	0.0502	0.0282	0
28	0.1014	0.0689	0.0606	0.0343	0.0956
30	0.1365	0.2266	0.1107	0.1054	0
32	0.1105	0.1354	0.0477	0.0538	0.1912
34	0.1008	0.0819	0.0707	0.0561	0.0956
36	0.0826	0.0745	0.029	0.0444	0.1329
38	0.0751	0.0903	0.078	0.1057	0.0747
40	0.0576	0.0447	0.2053	0.1508	0.1555
42	0.0623	0.0285	0.1021	0.1339	0.1304
44	0.0405	0.0373	0.0428	0.1588	0.0869
46	0.0281	0.0241	0.0171	0.0492	0
48	0.0132	0.0147	0	0.0576	0.0373
50	0.0093	0.028	0.0342	0.0218	0
52	0.0054	0.0025	0	0	0
54	0.0038	0	0	0	0
56	0.0025	0	0	0	0
58	0	0	0	0	0
60	0	0	0	0	0
62	0	0	0	0	0
64	0	0	0	0	0
66	0	0	0	0	0

state	cal	cal	cal	cal	cal	cal	cal	cal	cal	cal	cal	cal	cal	cal	cal
gear	non-twl	non-twl	non-twl	non-twl	non-twl	non-twl	non-twl	non-twl	non-twl	non-twl	non-twl	non-twl	non-twl	non-twl	non-twl
sex	comb	comb	comb	comb	comb	comb	comb	comb	comb	comb	comb	comb	comb	comb	comb
year	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0.0042	0	0.0004	0	0	0	0
20	0	0	0	0	0	0	0.0043	0.0216	0.0087	0.0054	0.0021	0.0052	0	0	0
22	0	0	0	0	0	0	0.0112	0.0234	0.0107	0.0072	0.0144	0.0003	0	0	0
24	0	0	0	0	0.0088	0	0.0425	0.1024	0.0253	0.0344	0.0391	0.004	0.0555	0	0
26	0	0	0.0386	0	0	0.0019	0.0688	0.0908	0.0563	0.049	0.0894	0.0432	0.203	0	0
28	0	0	0	0.0763	0.0575	0.0255	0.0691	0.0865	0.0801	0.1089	0.1133	0.0757	0.1036	0	0
30	0	0	0.0386	0.0002	0.0487	0.0264	0.0924	0.1095	0.1014	0.1099	0.1242	0.1271	0.0563	0	0
32	0.0815	0	0	0.0015	0.1594	0.1031	0.1118	0.0716	0.0998	0.1292	0.1117	0.1351	0.0123	0	0
34	0.1872	0.112	0.0835	0.0778	0.0398	0.1313	0.1092	0.0722	0.0857	0.1331	0.1365	0.1475	0.0288	0.0606	0.05
36	0.1608	0.1273	0.0777	0.0998	0.1578	0.1258	0.121	0.0729	0.1124	0.1194	0.0703	0.1277	0.0604	0.0909	0.1
38	0.1521	0.1452	0.0908	0.2655	0.2695	0.1556	0.0971	0.0797	0.0997	0.1001	0.0452	0.0999	0.0965	0.1212	0.15

40	0.1449	0.0715	0.0827	0.3224	0.1804	0.0477	0.0696	0.0762	0.0794	0.0539	0.061	0.0802	0.088	0.3333	0
42	0.1934	0.1271	0.0966	0.0964	0.0781	0.0999	0.0498	0.0635	0.0869	0.044	0.0626	0.046	0.0271	0.2424	0.15
44	0.0591	0.156	0.1963	0.0127	0	0.0946	0.042	0.0482	0.0481	0.0374	0.0575	0.0277	0.0677	0.1515	0.3
46	0.0155	0.1435	0.2683	0.0279	0	0.0103	0.0244	0.0376	0.0394	0.0226	0.0238	0.0218	0.0488	0	0.05
48	0.0056	0.0232	0.027	0.0096	0	0.1112	0.0249	0.015	0.0244	0.0151	0.028	0.0185	0.0565	0	0.1
50	0	0.0592	0	0.0032	0	0.0368	0.0272	0.0143	0.0143	0.0193	0.0113	0.0215	0.0325	0	0.05
52	0	0.0188	0	0.0064	0	0.024	0.0152	0.0089	0.0174	0.0045	0.0068	0.0136	0.0187	0	0
54	0	0.012	0	0	0	0.0026	0.009	0.0036	0.0036	0.0041	0.0011	0.0038	0.0125	0	0
56	0	0	0	0.0003	0	0	0.0078	0.0019	0.0016	0.0025	0.0008	0.0007	0.0221	0	0.05
58	0	0	0	0	0	0.0033	0.0018	0.0002	0.0004	0	0.0003	0.0004	0.0097	0	0
60	0	0.0042	0	0	0	0	0.0007	0	0.0003	0	0	0	0	0	0
62	0	0	0	0	0	0	0.0002	0	0	0	0	0	0	0	0
64	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
66	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 4. continued with Oregon length-at-age proportions

state	Or	Or	Or	Or	Or	Or	Or	Or	Or	Or	Or	Or	Or	Or	Or
gear	twl	twl	twl	twl	twl	twl	twl	twl	twl	twl	twl	twl	twl	twl	twl
sex	male	female	male	female	male	female	male	female	male	female	male	female	male	female	male
year	1980	1980	1981	1981	1982	1982	1983	1983	1984	1984	1985	1985	1986	1986	1987
12cm	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0.0062	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0.0042	0	0	0	0	0.0076	0	0	0	0.0061	0	0	0	0
30	0	0	0	0	0	0.004	0.0254	0	0.0043	0.0043	0.0051	0.0051	0	0.0036	0
32	0.003	0.0121	0.0061	0	0.0007	0	0.0216	0.0216	0	0.0074	0.0131	0.0131	0.0062	0.0031	0.004
34	0.0078	0.0052	0.0052	0.0052	0.0058	0.0203	0.0325	0.0093	0.0095	0.0127	0.0487	0.0674	0.0053	0.008	0.0069
36	0.0158	0.0045	0.009	0.0068	0.005	0.0075	0.0442	0.0161	0.0192	0.0055	0.0551	0.0941	0.0046	0.0207	0.006
38	0.0255	0.0079	0.0334	0.0157	0.0329	0.0131	0.0281	0.0211	0.0168	0.0096	0.068	0.0651	0.0341	0.0261	0.0184
40	0.0466	0.0225	0.0449	0.0173	0.0539	0.027	0.0463	0.0247	0.0253	0.0084	0.0647	0.0647	0.0547	0.0318	0.0462
42	0.0382	0.0306	0.0673	0.026	0.0852	0.0545	0.0628	0.0273	0.0448	0.0168	0.022	0.0419	0.0827	0.0437	0.0715
44	0.0557	0.0313	0.049	0.0367	0.0849	0.0394	0.0608	0.0267	0.0581	0.0399	0.049	0.0392	0.1139	0.0681	0.0855
46	0.0851	0.0328	0.073	0.039	0.095	0.0366	0.1022	0.0326	0.0698	0.0356	0.0596	0.021	0.0758	0.0646	0.0781
48	0.1049	0.0459	0.1017	0.0437	0.1073	0.0402	0.0899	0.043	0.1215	0.0454	0.041	0.0142	0.096	0.0547	0.0906
50	0.1213	0.0691	0.1303	0.0612	0.0682	0.0583	0.0653	0.0423	0.1265	0.0349	0.0484	0.0142	0.0534	0.0373	0.0449
52	0.0965	0.0393	0.085	0.0501	0.0529	0.0439	0.0464	0.0399	0.0983	0.0644	0.0155	0.0258	0.0219	0.0338	0.0454
54	0.0268	0.0252	0.0301	0.0277	0.0209	0.0236	0.0116	0.032	0.0377	0.0358	0.0106	0.0141	0.015	0.0208	0.0141
56	0.0045	0.0171	0.0074	0.0097	0.0041	0.0091	0.0027	0.0053	0.0063	0.0272	0.0021	0.0053	0.0053	0.0076	0.0089
58	0.0041	0.0041	0.0034	0.0095	0.0015	0.0015	0.0012	0.0061	0	0.0116	0.002	0.0039	0	0.0048	0.0009
60	0	0.0056	0	0.0044	0	0.0007	0	0.0022	0	0.0023	0	0	0	0.0019	0.0008
62	0	0.0006	0	0.0012	0	0.0013	0	0.001	0	0	0	0	0	0.0006	0
64	0	0	0	0	0	0.0005	0	0	0	0	0	0	0	0	0

state	Or	Or	Or	Or	Or	Or	Or	Or	Or	Or	Or	Or	Or	Or	Or
gear	twl	twl	twl	twl	twl	twl	twl	twl	twl	twl	twl	twl	twl	twl	twl
sex	female	male	female	male	female	male	female	male	female	male	female	male	female	male	female
year	1987	1988	1988	1989	1989	1990	1990	1991	1991	1992	1992	1993	1993	1994	1994
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0.0061	0	0.011	0	0	0	0	0	0	0	0.004	0.004
30	0	0	0.0096	0.0308	0.0103	0	0.0093	0	0	0	0	0	0	0.0134	0.0034
32	0	0.0082	0.0246	0	0.0131	0	0	0	0	0	0	0.0117	0.0233	0.0286	0.0229
34	0.0069	0.0492	0.0141	0.0113	0.015	0.0135	0	0	0	0	0.0136	0.0634	0.0134	0.0393	0.0197
36	0.009	0.0366	0.0366	0.0293	0.0228	0.0352	0.0117	0.0065	0.0065	0.0118	0.0177	0.0492	0.0347	0.0638	0.0511
38	0.0158	0.0106	0.016	0.0312	0.0142	0.0512	0.0153	0.0453	0.0113	0.0515	0.0206	0.0884	0.0783	0.0632	0.0409
40	0.0254	0.0748	0.0234	0.0499	0.0299	0.072	0.0405	0.0647	0.0199	0.0906	0.0498	0.0888	0.0666	0.0653	0.0425
42	0.0409	0.0455	0.029	0.0685	0.0397	0.0637	0.0279	0.0352	0.0264	0.0647	0.0481	0.0727	0.0766	0.0723	0.0621
44	0.0636	0.0663	0.0184	0.0766	0.0413	0.1062	0.0602	0.094	0.0431	0.0785	0.0464	0.0507	0.0559	0.0656	0.0476
46	0.0504	0.0692	0.0461	0.0826	0.058	0.076	0.0602	0.1156	0.0666	0.1116	0.0478	0.0547	0.0469	0.0633	0.0495
48	0.0614	0.0533	0.0296	0.09	0.0442	0.0769	0.0712	0.1228	0.0315	0.1118	0.0573	0.0379	0.0197	0.0403	0.03
50	0.0607	0.0882	0.0294	0.0727	0.0413	0.0437	0.0514	0.0909	0.0369	0.0414	0.0388	0.0114	0.0165	0.0308	0.0271
52	0.0562	0.063	0.0339	0.0388	0.0245	0.021	0.021	0.0592	0.0463	0.0305	0.0305	0.0057	0.0149	0.0068	0.0093
54	0.0435	0.033	0.0484	0.0129	0.0188	0.0106	0.0339	0.0164	0.0211	0.0021	0.0256	0.0042	0.0084	0.0069	0.0123
56	0.0298	0	0.0201	0.0054	0.0139	0	0.0097	0.0043	0.0278	0	0.0039	0	0.0057	0.0007	0.0098
58	0.0073	0.0055	0.011	0	0.0059	0	0.0053	0	0.0078	0	0.0053	0	0	0	0.0026
60	0.0067	0	0.0051	0	0.0009	0	0.0016	0	0	0	0	0	0	0	0.0012
62	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
64	0	0	0.0014	0	0	0	0	0	0	0	0	0	0	0	0

state	Or	Or	Or	Or	Or	Or	Or	Or	Or	Or	Or	Or	Or	Or
gear	twl	twl	twl	twl	twl	twl	twl	twl	twl	twl	twl	twl	twl	twl
sex	male	female	male	female	male	female	male	female	male	female	male	female	male	female
year	1995	1995	1996	1996	1997	1997	1998	1998	1999	1999	2000	2000	2001	2001
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0.0011	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0.0006	0	0.0046	0	0	0	0	0	0	0.0034	0	0
26	0	0	0.0005	0.0007	0.0013	0	0.001	0	0	0	0	0.0009	0	0.0009
28	0.0015	0	0	0.0003	0.0003	0	0.0004	0.0047	0	0	5E-05	0.0005	0.0002	0.0031
30	0.0018	0	0.0009	0.0035	0.0019	0	0.0007	0.0044	0	0.0005	0.0005	0.009	0.002	0.0057
32	0.0335	0	0.0044	0.0028	0.0036	0.0007	0.0067	0.0129	0.0021	0.0012	0.0135	0.0087	0.0054	0.0096
34	0.0296	0.0324	0.023	0.0254	0.0095	0.004	0.009	0.0267	0.0065	0.0049	0.0308	0.0243	0.0282	0.0205
36	0.077	0.0339	0.0395	0.0359	0.031	0.0118	0.0441	0.0512	0.0357	0.0102	0.0925	0.048	0.047	0.0609
38	0.063	0.0453	0.0853	0.0373	0.0572	0.017	0.0596	0.0629	0.0499	0.0388	0.083	0.0515	0.0865	0.0609
40	0.0781	0.0302	0.0867	0.0701	0.0985	0.0423	0.0757	0.0522	0.0675	0.0463	0.0748	0.0365	0.0768	0.0464
42	0.0757	0.0399	0.0754	0.0547	0.1145	0.0461	0.1038	0.0539	0.0807	0.0542	0.1081	0.0353	0.0936	0.0527
44	0.093	0.0468	0.0605	0.0524	0.1125	0.0586	0.0899	0.054	0.0881	0.0718	0.1014	0.0473	0.0773	0.0419
46	0.059	0.0493	0.0498	0.0421	0.0864	0.0562	0.0768	0.0333	0.0817	0.0705	0.0627	0.0357	0.0586	0.0451

48	0.0326	0.0549	0.0535	0.0399	0.0531	0.0508	0.0504	0.0315	0.0553	0.0554	0.032	0.0403	0.0324	0.0381
50	0.0182	0.0526	0.0463	0.0312	0.0222	0.0527	0.0321	0.0271	0.0184	0.0573	0.0126	0.0157	0.0185	0.0322
52	0.0087	0.023	0.0195	0.0223	0.0096	0.0243	0.0097	0.0132	0.0175	0.0437	0.003	0.0111	0.0098	0.0158
54	0.0026	0.0061	0.0069	0.0179	0.0043	0.0084	0.0048	0.0032	0.0056	0.0184	0.0036	0.0079	0.0017	0.0142
56	0.0005	0.0072	0.0003	0.005	0.0022	0.0089	0.0008	0.0019	0.0006	0.0112	0.0007	0.0008	0.0005	0.0094
58	0	0.0009	0.001	0.0025	0.0003	0.003	0	0.0002	0.0001	0.0046	0	0.003	0.0003	0.0025
60	0	0.0001	0	0.0017	8E-05	0.0012	0	0	0.0001	0.0005	0	0.0004	0	0.0012
62	0	0	0	0	0.0002	0.0007	0	0	0	0.0001	0	0	0	0
64	0	0.0025	0	0.0002	0	0	0	0	0.0003	0.0001	0	0	0	0

state	Or	Or	Or	Or	Or	Or	Or	Or	Or	Or	Or	Or	Or	Or
gear	Rec	Rec	Rec	Rec	Rec	Rec	Rec	Rec	Rec	Rec	Rec	Rec	Rec	Rec
sex	comb	comb	comb	comb	comb	comb	comb	comb	comb	comb	comb	comb	comb	comb
year	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1993	1994	1995	1996
12	0	0	0	0	0	0	0	0	0.0101	0	0	0	0	0
14	0	0	0	0	0	0.0009	0	0.0079	0.0101	0	0	0	0.0044	0
16	0	0	0.0038	0	0	0	0.0095	0.0137	0	0	0	0.0042	0	0
18	0	0	0.0089	0.0701	0.013	0.0201	0	0.0225	0.0101	0.0074	0.0028	0.0139	0.0021	0.0076
20	0.0099	0.0382	0	0	0.0373	0.0407	0	0.0868	0.0683	0.0181	0.0606	0.0294	0.0111	0.0086
22	0.0156	0.0596	0.0531	0	0.0787	0.0532	0.0282	0.1133	0.0843	0.0911	0.059	0.0793	0.0591	0.0483
24	0.0755	0.1639	0.0661	0.0911	0.094	0.0966	0.0691	0.1713	0.1253	0.1279	0.1107	0.1305	0.0896	0.1695
26	0.1914	0.1512	0.1248	0.2027	0.1685	0.0568	0.0781	0.1184	0.229	0.243	0.158	0.1837	0.1646	0.1651
28	0.0991	0.1579	0.1649	0.371	0.1255	0.0855	0.1003	0.1177	0.1437	0.1423	0.1842	0.1776	0.1515	0.135
30	0.1616	0.1356	0.1547	0.0977	0.1447	0.1302	0.0154	0.1304	0.1527	0.1496	0.1286	0.155	0.1623	0.2015
32	0.1331	0.1044	0.1896	0.0138	0.1047	0.1229	0.0593	0.0617	0.0636	0.0835	0.1073	0.085	0.1153	0.1269
34	0.0761	0.1046	0.1085	0.0277	0.1087	0.0933	0.0227	0.0566	0.0582	0.0642	0.0594	0.0638	0.0683	0.0645
36	0.0387	0.0382	0.0186	0.0138	0.0516	0.0612	0.0707	0.0248	0.0113	0.0233	0.0364	0.022	0.0441	0.0189
38	0.0831	0.0066	0.01	0.0911	0.0295	0.0553	0.0196	0.0089	0.0101	0.0256	0.0158	0.0141	0.0417	0.0381
40	0.0033	0.0066	0.0186	0	0.0198	0.035	0.0487	0.017	0.0018	0.0096	0.0247	0.0116	0.0147	0.0039
42	0.005	0	0.0373	0	0.0077	0.0619	0.1499	0.0042	0	0	0.0099	0.0106	0.0107	0.0046
44	0.0885	0.0066	0.0373	0	0.0092	0.0049	0.1662	0.0115	0.0095	0.0085	0.011	0.0053	0.0153	0
46	0.0164	0	0	0	0	0.0522	0.0341	0.0042	0	0	0.0108	0.0067	0.0227	0.006
48	0.0026	0	0	0	0	0.0028	0.0943	0.0169	0	0.0059	0.0104	0.0028	0.013	0
50	0	0.0199	0	0	0.0048	0.0128	0.0227	0.0121	0.0018	0	0.0057	0.0023	0.0048	0
52	0	0.0066	0	0	0.0022	0	0.0114	0	0	0	0	0	0.0034	0
54	0	0	0	0.021	0	0.0009	0	0	0.0101	0	0	0	0	0.0015
56	0	0	0.0038	0	0	0.0128	0	0	0	0	0.0009	0	0.0013	0
58	0	0	0	0	0	0	0	0	0	0	0.0029	0	0	0
60	0	0	0	0	0	0	0	0	0	0	0.0009	0.0023	0	0
62	0	0	0	0	0	0	0	0	0	0	0	0	0	0
64	0	0	0	0	0	0	0	0	0	0	0	0	0	0

state	Or	Or	Or	Or	Or
gear	Rec	Rec	Rec	Rec	Rec
sex	comb	comb	comb	comb	comb
year	1997	1998	1999	2000	2001
12	0	0	0	0	0
14	0.0015	0	0	0	0
16	0	0.0016	0	0	0
18	0.024	0.0081	0.0112	0.0092	0
20	0.0335	0.0326	0.0227	0.028	0.0138
22	0.0898	0.0549	0.0793	0.0909	0.027

24	0.1622	0.1532	0.1172	0.1091	0.1377
26	0.1423	0.1158	0.1215	0.1843	0.1418
28	0.1378	0.1558	0.1817	0.211	0.227
30	0.1356	0.1007	0.1176	0.1433	0.1485
32	0.0792	0.0913	0.0961	0.0678	0.1065
34	0.082	0.0877	0.0635	0.0327	0.0477
36	0.0205	0.0607	0.0573	0.0222	0.0349
38	0.0262	0.0247	0.0405	0.0292	0.0171
40	0.0118	0.0288	0.0304	0.022	0.0162
42	0.0129	0.0303	0.0201	0.0166	0.0056
44	0.0156	0.0136	0.019	0.0253	0.0604
46	0.0173	0.0123	0.0103	0.0085	0.012
48	0.0041	0.0141	0.0057	0	0.0037
50	0.0007	0.0047	0.0029	0	0
52	0.0033	0.004	0	0	0
54	0	0.0023	0.0029	0	0
56	0	0.0012	0	0	0
58	0	0	0	0	0
60	0	0.0016	0	0	0
62	0	0	0	0	0
64	0	0	0	0	0

Table 4 continued. The proportion-at-length of Washington caught fish

state	Wa	Wa	Wa	Wa	Wa	Wa	Wa	Wa	Wa	Wa	Wa	Wa	Wa	Wa
gear	twl	twl	twl	twl	twl	twl	twl	twl	twl	twl	twl	twl	twl	twl
sex	male	female	male	female	male	female	male	female	male	female	male	female	male	female
year	1968	1968	1969	1969	1971	1971	1972	1972	1973	1973	1974	1974	1975	1975
16cm	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	5E-04
26	0	0	0	0	0	0	0	0	0	0	0	0	0.002	9E-04
28	0	0	0	0	0	0	0	0	0	0	0	0	0.008	0.008
30	0	0	0	0	0	0	0	0	0	0	0	0	0.004	0.009
32	0	0	0	0	0	0	0	0	0	0	0	0	0.02	0.016
34	0	0	0	0	0	0	0	0	0.004	0	0	0	0.03	0.017
36	0.006	0	0	0	0.002	0	0	0	0	0	0	6E-04	0.072	0.058
38	0	0	0.003	0	0	0	2E-04	0	0	0	3E-04	0	0.084	0.063
40	0.025	0	0.014	0.014	0.011	0.004	0.003	3E-04	0.009	0	0.003	0.002	0.088	0.088
42	0.043	0.006	0.02	0	0.021	0.01	0.01	0.007	0.017	0.004	0.009	6E-04	0.038	0.07
44	0.106	0.025	0.031	0.01	0.079	0.026	0.037	0.021	0.074	0.017	0.033	0.002	0.007	0.022
46	0.093	0.019	0.061	0.01	0.116	0.053	0.099	0.019	0.139	0.052	0.086	0.004	0.013	0.009
48	0.143	0.05	0.177	0.02	0.162	0.051	0.172	0.075	0.174	0.1	0.172	0.029	0.03	0.003
50	0.149	0.087	0.266	0.038	0.154	0.067	0.118	0.078	0.1	0.061	0.198	0.062	0.062	0.009
52	0.093	0.068	0.157	0.048	0.114	0.045	0.126	0.088	0.057	0.096	0.157	0.077	0.054	0.022
54	0.037	0.031	0.075	0.027	0.031	0.028	0.05	0.037	0.009	0.043	0.052	0.053	0.036	0.019
56	0	0.019	0.014	0.014	0.006	0.014	0.013	0.044	0.004	0.035	0.018	0.027	0.01	0.019
58	0	0	0	0	0.004	0.002	1E-04	0.001	0	0.004	0.002	0.009	0	0.006
60	0	0	0	0	0	0	0	5E-04	0	0	0	0	0	0.002
62	0	0	0	0	0	0	0	0	0	0	0	0	0	4E-04

64	0	0	0	0	0	0	0	1E-04	0	0	0	0	0	0

state	Wa	Wa	Wa	Wa	Wa	Wa	Wa	Wa	Wa	Wa	Wa	Wa	Wa	Wa
gear	twl	twl	twl	twl	twl	twl	twl	twl	twl	twl	twl	twl	twl	twl
sex	male	female	male	female	male	female	male	female	male	female	male	female	male	female
year	1976	1976	1977	1977	1978	1978	1979	1979	1980	1980	1981	1981	1982	1982
16	0	0.001	0	0	0	0	0	0	9E-06	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0.001	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0	0.001	0	0	8E-05	0
30	0	6E-06	0	0	0	0	0	0	0	6E-04	3E-04	3E-04	0	0.001
32	0	0	3E-04	0	0	3E-05	0	0	0.003	0.005	8E-04	6E-04	0.001	0
34	0.001	0.002	0	0	0	3E-05	0	5E-04	0.005	0.003	0.001	0.001	0.005	0.015
36	0.003	0.002	0.002	0	5E-05	0.002	0.002	0	0.013	0.005	0.002	0.003	0.001	0.002
38	0.005	0.002	0.015	7E-05	1E-04	0.002	2E-04	0.005	0.021	0.007	0.012	0.005	0.019	0.008
40	0.021	0.006	0.024	0.003	0.011	0.004	0.018	0.005	0.027	0.016	0.017	0.006	0.048	0.023
42	0.026	0.015	0.028	0.002	0.024	0.016	0.021	0.013	0.036	0.026	0.029	0.016	0.071	0.061
44	0.029	0.022	0.039	0.009	0.051	0.033	0.135	0.041	0.067	0.03	0.038	0.019	0.068	0.03
46	0.061	0.016	0.063	0.013	0.102	0.042	0.083	0.041	0.078	0.039	0.063	0.031	0.085	0.027
48	0.15	0.031	0.136	0.032	0.111	0.045	0.139	0.054	0.107	0.07	0.117	0.035	0.098	0.046
50	0.185	0.047	0.201	0.039	0.168	0.047	0.182	0.021	0.109	0.068	0.169	0.069	0.088	0.037
52	0.139	0.075	0.145	0.065	0.126	0.056	0.105	0.023	0.087	0.074	0.112	0.088	0.072	0.075
54	0.032	0.07	0.054	0.056	0.033	0.055	0.057	0.016	0.027	0.03	0.05	0.046	0.022	0.042
56	0.009	0.033	0.012	0.036	0.011	0.039	0.002	0.02	0.009	0.017	0.013	0.023	0.018	0.024
58	0	0.013	0.003	0.019	0	0.014	0	0.017	0.003	0.011	0.006	0.018	0.005	0.006
60	6E-06	0.003	7E-05	0.003	0	0.006	0	1E-05	0	0.003	0	0.006	0	0.002
62	0	0.002	0	8E-04	7E-04	0	0	0	0	0.001	0	0.002	0	7E-04
64	0	0	0	0	0	0	0	0	2E-05	0	0	0	0	1E-04

state	Wa	Wa	Wa	Wa	Wa	Wa	Wa	Wa	Wa	Wa	Wa	Wa	Wa	Wa
gear	twl	twl	twl	twl	twl	twl	twl	twl	twl	twl	twl	twl	twl	twl
sex	male	female	male	female	male	female	male	female	male	female	male	female	male	female
year	1983	1983	1984	1984	1985	1985	1986	1986	1987	1987	1988	1988	1989	1989
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	1E-04	0	0	0	5E-05	0	0	0	0	0	0	5E-05	2E-04	0
30	6E-04	7E-04	0.003	5E-04	4E-04	5E-05	0	5E-05	0	2E-05	2E-05	3E-04	0.001	6E-04
32	0.003	0.002	0.002	0.002	1E-04	3E-04	2E-05	0.002	5E-04	1E-04	2E-04	5E-04	4E-04	0.001
34	0.015	0.003	0.004	0.004	0.002	0.001	0.002	2E-04	7E-04	3E-04	0.001	3E-04	0.007	0.001
36	0.019	0.005	0.006	0.002	0.004	0.003	0.008	0.007	8E-04	6E-04	0.003	0.002	0.008	0.008
38	0.03	0.015	0.008	0.002	0.013	0.01	0.012	0.008	0.004	0.002	0.003	0.001	0.012	0.008
40	0.03	0.025	0.016	0.004	0.015	0.012	0.04	0.017	0.009	0.02	0.008	0.003	0.044	0.019
42	0.065	0.038	0.028	0.01	0.029	0.018	0.065	0.04	0.052	0.026	0.026	0.01	0.061	0.037
44	0.058	0.048	0.061	0.036	0.052	0.048	0.097	0.046	0.059	0.032	0.065	0.028	0.072	0.053
46	0.094	0.048	0.061	0.05	0.108	0.052	0.093	0.051	0.058	0.037	0.094	0.084	0.083	0.074
48	0.078	0.047	0.128	0.041	0.115	0.048	0.114	0.068	0.099	0.057	0.089	0.059	0.108	0.043

50	0.096	0.041	0.135	0.03	0.119	0.083	0.069	0.051	0.092	0.074	0.105	0.063	0.1	0.049
52	0.064	0.06	0.129	0.077	0.061	0.053	0.036	0.065	0.076	0.091	0.076	0.063	0.056	0.041
54	0.018	0.056	0.051	0.049	0.024	0.06	0.028	0.038	0.018	0.085	0.04	0.082	0.021	0.033
56	0.006	0.015	0.008	0.029	0.009	0.04	0.011	0.015	0.011	0.063	0.003	0.049	0.008	0.025
58	0.002	0.009	0	0.018	0.003	0.014	0.004	0.008	3E-04	0.018	0.011	0.018	0	0.024
60	0	0.005	0	0.006	0	0.003	0.001	0.003	1E-04	0.013	0	0.011	2E-04	5E-04
62	0	0.001	0	6E-04	0	0	0	2E-04	0	0	0	0.001	0	2E-04
64	0	0	0	0	0	0	0	0	0	4E-07	0	4E-04	0	0

state	Wa	Wa	Wa	Wa	Wa	Wa	Wa	Wa	Wa	Wa	Wa	Wa	Wa	Wa
gear	twl	twl	twl	twl	twl	twl	twl	twl	twl	twl	twl	twl	twl	twl
sex	male	female	male	female	male	female	male	female	male	female	male	female	male	female
year	1990	1990	1991	1991	1992	1992	1993	1993	1994	1994	1995	1995	1996	1996
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	2E-04	0	1E-04	0
26	0	0	0	0	0	7E-04	0	6E-05	0	0	2E-04	0	8E-04	4E-04
28	0.003	0	0	0	2E-04	0	2E-04	0	1E-04	4E-04	7E-04	3E-04	4E-04	1E-03
30	9E-04	6E-04	0	0	6E-04	0.002	2E-04	0	6E-04	4E-04	0.002	0.001	0.001	0.001
32	0.001	3E-04	7E-05	0	0.003	0.005	0.005	0.005	0.01	0.002	0.003	0.002	0.003	0.002
34	0.008	0.002	2E-04	3E-05	0.006	0.015	0.012	0.002	0.003	0.002	0.012	0.008	0.01	0.005
36	0.015	0.007	0.003	0.002	0.014	0.019	0.038	0.012	0.007	0.013	0.027	0.012	0.014	0.01
38	0.025	0.01	0.016	0.007	0.024	0.025	0.046	0.038	0.024	0.006	0.04	0.029	0.02	0.02
40	0.043	0.028	0.038	0.011	0.039	0.036	0.082	0.049	0.049	0.04	0.072	0.061	0.025	0.015
42	0.057	0.02	0.043	0.023	0.024	0.024	0.095	0.065	0.113	0.064	0.105	0.053	0.089	0.037
44	0.09	0.05	0.08	0.046	0.066	0.036	0.086	0.071	0.079	0.047	0.089	0.062	0.114	0.04
46	0.099	0.061	0.114	0.061	0.097	0.048	0.086	0.074	0.102	0.077	0.064	0.094	0.093	0.047
48	0.097	0.075	0.136	0.048	0.091	0.037	0.048	0.044	0.07	0.025	0.053	0.079	0.07	0.062
50	0.066	0.056	0.101	0.058	0.058	0.039	0.025	0.055	0.074	0.064	0.027	0.044	0.081	0.093
52	0.033	0.041	0.061	0.059	0.05	0.051	0.009	0.02	0.033	0.034	0.01	0.024	0.03	0.058
54	0.025	0.048	0.014	0.034	0.014	0.08	0.004	0.021	0.012	0.024	0.003	0.013	0.014	0.032
56	0.004	0.023	0.009	0.026	8E-05	0.057	0	0.01	4E-05	0.021	0	0.001	0	0.005
58	0	0.007	0.001	0.007	0	0.033	0	1E-04	0	0.002	0.003	0.007	0	0.004
60	0	0.003	0	3E-04	0	4E-04	0	1E-04	0	1E-03	0	2E-04	0.002	4E-04
62	0	0	0	0.001	0	0.006	0	0	0	0	0	0	0	0
64	0	0	1E-04	0	0	0	0	0	0	0	0	3E-04	0	0

state	Wa	Wa	Wa	Wa	Wa	Wa	Wa	Wa	Wa	Wa
gear	twl	twl	twl	twl	twl	twl	twl	twl	twl	twl
sex	male	female	male	female	male	female	male	female	male	female
year	1997	1997	1998	1998	1999	1999	2000	2000	2001	2001
16	0	0	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	8E-05	0	0	0	0	0
26	0	0	0	0	0	2E-04	0	0	0	0
28	0.002	0	0.002	0	0	6E-04	0.003	0	0	0
30	0.002	1E-04	0.003	3E-04	0.003	1E-04	0	0.002	0	0
32	0.003	0.003	0.007	0.001	0.005	0.002	0.01	0.016	0.003	0
34	0.021	0.006	0.008	0.006	0.01	0.005	0.009	0.015	0.007	0.002
36	0.011	0.012	0.029	0.015	0.012	0.007	0.024	0.024	0.017	0.006

38	0.021	0.01	0.049	0.017	0.021	0.007	0.046	0.022	0.003	0.008
40	0.07	0.02	0.067	0.043	0.046	0.012	0.029	0.044	0.027	0.01
42	0.08	0.042	0.063	0.072	0.04	0.023	0.057	0.023	0.049	0.023
44	0.1	0.09	0.075	0.072	0.078	0.061	0.108	0.076	0.146	0.043
46	0.078	0.055	0.114	0.066	0.116	0.062	0.147	0.055	0.116	0.067
48	0.078	0.06	0.05	0.054	0.107	0.03	0.064	0.071	0.099	0.058
50	0.059	0.065	0.028	0.055	0.092	0.087	0.025	0.052	0.09	0.07
52	0.016	0.044	0.016	0.028	0.019	0.055	0.004	0.016	0.013	0.04
54	0.006	0.023	0.006	0.036	0.003	0.057	0.002	0.03	0.018	0.038
56	9E-04	0.016	0.001	0.01	0.002	0.031	0.001	0.001	0	0.032
58	0	0.006	0	0.005	0.003	0.004	0	0.024	0.006	0.005
60	0	9E-04	0	0	0	0	0	0	0	0
62	0	0	0	0.003	0	0	0	0	0	0.001
64	0	0	0	0	0	2E-04	0	0	0	0

state	Wa	Wa	Wa	Wa	Wa	Wa	Wa	Wa
gear	rec	rec	rec	rec	rec	rec	rec	rec
sex	comb	comb	comb	comb	comb	comb	comb	comb
year	1980	1981	1982	1983	1984	1985	1987	1988
16	0	0	0	0	0	0	0	0
18	0	0	0	0	0	0	0	0
20	0.014	0	0	0	0	0	0.085	0
22	0.049	0	0	0	0	0	0.041	0
24	0	0.121	0	0	0	0	0.128	0.091
26	0.035	0	0	0.082	0.082	0.073	0.041	0.181
28	0.014	0.032	0	0.037	0.037	0.034	0.041	0.204
30	0.033	0.137	0	0.074	0.074	0.032	0	0.091
32	0.095	0	0	0.22	0.22	0.133	0	0.091
34	0.068	0	0.167	0.248	0.248	0.095	0	0
36	0.225	0.178	0	0.128	0.128	0.145	0.044	0
38	0.064	0.178	0	0.064	0.064	0.18	0	0
40	0.091	0	0	0.018	0.018	0.092	0.138	0
42	0.091	0.178	0.167	0.018	0.018	0.121	0.092	0.114
44	0.101	0.089	0.167	0	0	0	0.081	0.046
46	0.061	0.089	0.333	0	0	0.061	0.079	0.183
48	0.027	0	0	0.037	0.037	0.034	0.138	0
50	0	0	0.167	0.018	0.018	0	0.053	0
52	0	0	0	0.018	0.018	0	0	0
54	0	0	0	0.037	0.037	0	0	0
56	0	0	0	0	0	0	0	0
58	0	0	0	0	0	0	0	0
60	0	0	0	0	0	0	0	0
62	0	0	0	0	0	0	0	0
64	0.034	0	0	0	0	0	0.041	0

Table 5. The proportion of fish-at-age from trawl caught fish from California, followed by Oregon and Washington.

area	Cal	Cal	Cal	Cal	Cal	Cal	Cal	Cal	Cal	Cal	Cal	Cal
gear	Twl	Twl	Twl	Twl	Twl	Twl	Twl	Twl	Twl	Twl	Twl	Twl
sex	male	female	male	female	male	female	male	female	male	female	male	female
year	1980	1980	1981	1981	1982	1982	1983	1983	1984	1984	1985	1985
age												
1	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0.04	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	0	0	0	0
5	0.02	0	0	0.01	0	0	0.01	0.01	0	0	0	0
6	0.05	0.04	0.05	0.01	0.04	0.03	0	0.01	0.01	0.08	0	0.01
7	0.02	0.12	0.01	0.02	0.02	0.07	0.08	0.04	0.02	0.03	0.07	0.08
8	0.11	0.15	0.22	0.06	0.04	0.07	0.08	0.09	0.09	0.07	0.04	0.08
9	0.17	0.03	0.1	0.1	0.13	0.07	0.08	0.13	0.08	0.11	0.11	0.17
10	0.04	0.02	0.06	0.16	0.12	0.2	0.06	0.03	0.07	0.09	0.12	0.11
11	0.06	0.09	0.06	0.07	0.09	0.12	0.21	0.11	0.1	0.09	0.07	0.14
12	0.11	0.12	0.03	0.03	0.05	0.21	0.03	0.01	0.13	0.07	0.07	0.05
13	0.02	0.18	0.13	0.12	0.04	0.01	0.04	0.08	0	0.01	0.07	0.07
14	0.06	0.05	0.1	0.09	0.01	0.06	0.02	0.04	0.02	0.12	0.03	0.01
15	0.03	0.03	0.13	0.06	0.01	0.08	0.01	0.13	0.05	0.03	0.03	0.04
16	0.04	0.03	0.04	0.06	0.03	0	0.06	0.03	0.02	0.1	0.03	0.05
17	0.01	0.03	0	0.05	0.03	0.02	0.04	0.04	0.03	0.01	0.05	0.01
18	0.06	0	0	0	0.02	0.04	0	0.01	0.04	0.01	0.05	0.01
19	0.02	0	0	0.02	0	0	0.03	0.01	0	0.01	0	0.03
20	0.03	0	0.01	0	0.1	0	0.07	0	0.02	0.03	0.03	0.01
21	0.05	0.04	0.04	0.03	0.02	0	0.03	0.04	0	0	0.01	0.04
22	0	0	0	0.05	0.05	0	0	0	0.02	0	0.04	0
23	0	0	0.01	0	0.07	0.02	0.02	0.05	0.03	0.02	0.01	0.01
24	0.01	0	0	0.01	0	0	0.01	0.02	0	0.02	0.02	0.02
25	0.09	0.08	0	0.04	0.1	0	0.1	0.12	0.26	0.11	0.15	0.08

Table 5 continued. Oregon age compositions

state	Or	Or	Or	Or	Or	Or	Or	Or	Or	Or	Or	Or	Or	Or	Or	Or
gear	twl	twl	twl	twl	twl	twl	twl	twl	twl	twl	twl	twl	twl	twl	twl	twl
sex	male	female	male	female	male	female	male	female	male	female	male	female	male	female	male	female
year	1980	1980	1981	1981	1982	1982	1983	1983	1984	1984	1985	1985	1986	1986	1987	1987
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0	3E-04	0	0	0	0.002	0	0	0
5	0	0	0	0	1E-04	0	7E-04	0.003	6E-04	8E-04	0.001	0	0.007	0.004	0.001	2E-04

6	2E-04	2E-05	0	0.002	0.001	1E-04	0.005	0.003	0.008	0.005	0.006	0.008	0.015	0.015	0.004	0.003
7	3E-04	0.001	0.003	0	0.004	0	0.018	0.013	0.012	0.011	0.032	0.019	0.032	0.034	0.009	0.006
8	0.003	0.001	0.013	0.016	0.013	0.005	0.045	0.026	0.025	0.018	0.05	0.023	0.066	0.029	0.058	0.027
9	0.007	0.007	0.025	0.011	0.024	0.022	0.057	0.034	0.055	0.032	0.076	0.05	0.059	0.034	0.082	0.047
10	0.023	0.003	0.054	0.011	0.04	0.024	0.055	0.046	0.055	0.042	0.064	0.062	0.074	0.054	0.051	0.055
11	0.023	0.012	0.017	0.061	0.027	0.017	0.026	0.036	0.045	0.049	0.046	0.054	0.05	0.056	0.101	0.049
12	0.044	0.031	0.039	0.049	0.035	0.031	0.024	0.032	0.029	0.028	0.034	0.035	0.049	0.063	0.063	0.064
13	0.032	0.032	0.04	0.034	0.038	0.049	0.027	0.035	0.028	0.019	0.023	0.032	0.014	0.036	0.024	0.052
14	0.036	0.041	0.05	0.039	0.042	0.03	0.035	0.033	0.021	0.031	0.016	0.021	0.02	0.015	0.026	0.035
15	0.027	0.024	0.025	0.019	0.027	0.026	0.022	0.029	0.032	0.018	0.02	0.019	0.006	0.025	0.013	0.007
16	0.021	0.058	0.02	0.013	0.018	0.013	0.014	0.013	0.025	0.012	0.017	0.019	0.005	0.015	0.014	0.016
17	0.046	0.048	0.045	0.015	0.018	0.007	0.016	0.007	0.014	0.006	0.011	0.017	0.011	0.022	0.003	0.005
18	0.031	0.029	0.04	0.03	0.016	0.01	0.016	0.011	0.007	0.009	0.009	0.01	0.006	0.004	0.007	0.015
19	0.043	0.047	0.029	0.007	0.063	0.01	0.012	0.013	0.011	0.007	0.007	0.004	0.008	0.003	0.017	0.015
20	0.025	0.036	0.02	0.008	0.04	0.011	0.023	0.011	0.015	0.005	0.002	0.004	0.003	0.005	0	6E-04
21	0.027	0.016	0.005	0.035	0.05	0.023	0.017	0.01	0.023	0.017	0.012	0.005	0.002	0	0.004	0.012
22	0.028	0.02	0.052	0.021	0.023	0.016	0.021	0.008	0.024	0.008	0.01	0.01	0.007	0.013	0.012	0.002
23	0.04	0.018	0.038	0.001	0.013	0.004	0.018	0.008	0.019	0.012	0.007	0.011	0.022	0.011	0.01	5E-04
24	0.026	0.011	0.016	0.009	0.015	0.002	0.014	0.009	0.015	0.008	0.006	0.006	0.004	0.003	0.016	1E-05
25	0.069	0.013	0.064	0.023	0.166	0.028	0.129	0.023	0.167	0.03	0.119	0.02	0.072	0.027	0.053	0.021

state	Or	Or	Or	Or	Or	Or	Or	Or	Or	Or	Or	Or	Or	Or	Or	Or
gear	twl	twl	twl	twl	twl	twl	twl	twl	twl	twl	twl	twl	twl	twl	twl	twl
sex	male	female	male	female	male	female	male	female	male	female	male	female	male	female	male	female
year	1988	1988	1989	1989	1990	1990	1991	1991	1992	1992	1993	1993	1994	1994	1995	1995
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3	1E-04	0.001	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4	0.003	0.004	0	1E-04	0	0	0	0	0	0	3E-05	0	1E-03	0	0	0
5	0.003	0.011	2E-04	2E-04	7E-04	3E-04	7E-04	0.005	0.004	0.006	0.002	5E-04	0	1E-03	0.009	0.004
6	0.011	0.012	0.005	0.003	0.003	0.008	0.008	0.008	0.021	0.006	0.01	0.01	0.006	0.015	0.046	0.021
7	0.031	0.016	0.017	0.01	0.027	0.02	0.027	0.021	0.052	0.026	0.029	0.025	0.015	0.014	0.06	0.038
8	0.046	0.023	0.029	0.018	0.028	0.022	0.059	0.047	0.049	0.04	0.074	0.047	0.076	0.011	0.082	0.032
9	0.077	0.086	0.039	0.043	0.047	0.044	0.083	0.057	0.083	0.057	0.07	0.048	0.079	0.048	0.072	0.073
10	0.057	0.072	0.079	0.061	0.058	0.038	0.079	0.044	0.061	0.058	0.065	0.042	0.095	0.058	0.07	0.087
11	0.051	0.056	0.057	0.069	0.069	0.084	0.059	0.06	0.044	0.047	0.041	0.074	0.019	0.043	0.077	0.078
12	0.047	0.075	0.041	0.05	0.07	0.07	0.039	0.067	0.041	0.028	0.028	0.06	0.014	0.036	0.029	0.045
13	0.037	0.043	0.038	0.037	0.044	0.043	0.023	0.044	0.035	0.049	0.02	0.042	0.068	0.009	0.02	0.035
14	0.015	0.034	0.029	0.031	0.025	0.063	0.027	0.027	0.023	0.027	0.027	0.048	0.033	0.017	0.01	0.024
15	0.006	0.017	0.015	0.029	0.011	0.027	0.023	0.023	0.012	0.026	0.014	0.022	0.04	0.012	0.01	0.003
16	0.003	0.014	0.014	0.018	0.005	0.027	0.005	0.016	0.019	0.016	0.021	0.024	0.003	0.015	0.006	0.012
17	0.005	0.008	0.004	0.013	0.021	0.016	0.008	0.008	0.006	0.023	0.01	0.025	0.044	0.018	0.004	0
18	0.006	0.005	0.015	0.009	0.004	0.013	0.011	0.012	0.008	0.007	0.009	0.013	0.012	1E-03	0.011	0.004
19	0.005	0.003	0.006	0.016	0.008	0.009	0.005	0.004	0.007	0.007	0.004	0.013	0.012	0.006	0.009	0
20	0.004	0.009	0.023	0.012	0.009	0.009	0.015	4E-04	0.005	0.006	0.007	0.006	0	0.012	0	0.004
21	0.001	0.003	0.007	0.006	0.005	0.005	0	0.005	0.002	0.004	0.006	0.008	0.012	0.012	0.009	0
22	0.006	0.002	0.001	0.009	2E-04	0.005	0.005	0.004	0.005	0.002	0.008	0.004	0	0.012	0	0
23	0.005	0.005	0.006	2E-04	0.003	0.002	0.006	0.002	0.008	0.002	0.012	0.003	0	0.012	5E-04	0.004
24	0.002	0.01	0.012	2E-04	0.003	0	0.011	0	0.002	0.002	0.004	4E-04	0.003	0	2E-04	0
25	0.054	0.014	0.098	0.028	0.037	0.016	0.05	0.004	0.067	0.005	0.019	0.008	0.118	0	0.009	0.004

state	Or	Or	Or	Or	Or	Or	Or	Or	Or	Or	Or	Or
gear	twl	twl	twl	twl	twl	twl	twl	twl	twl	twl	twl	twl
sex	male	female	male	female	male	female	male	female	male	female	male	female
year	1996	1996	1997	1997	1998	1998	1999	1999	2000	2000	2001	2001
1	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0
4	2E-04	3E-04	9E-04	0	0	0	0	0	0	0	0	0
5	0.011	0.013	2E-04	7E-04	0.003	0.001	0.003	4E-04	0.01	0.005	0.001	0.007
6	0.029	0.039	0.011	0.003	0.012	0.009	0.002	0.001	0.079	0.038	0.021	0.048
7	0.057	0.051	0.04	0.015	0.046	0.028	0.022	0.019	0.07	0.036	0.051	0.077
8	0.065	0.051	0.063	0.033	0.063	0.051	0.052	0.045	0.152	0.061	0.081	0.072
9	0.043	0.048	0.096	0.069	0.096	0.068	0.046	0.035	0.083	0.025	0.098	0.07
10	0.06	0.039	0.093	0.055	0.085	0.067	0.049	0.062	0.054	0.048	0.06	0.076
11	0.061	0.059	0.077	0.057	0.074	0.05	0.061	0.054	0.048	0.056	0.074	0.044
12	0.04	0.057	0.073	0.061	0.056	0.031	0.051	0.066	0.043	0.015	0.041	0.016
13	0.026	0.021	0.035	0.046	0.037	0.03	0.037	0.065	0.035	0.015	0.033	0.045
14	0.009	0.009	0.016	0.036	0.024	0.018	0.052	0.04	0.046	0.01	0.018	0.024
15	0.01	0.014	0.016	0.015	0.017	0.01	0.021	0.03	0	0.015	0.003	0.002
16	0.012	0.019	0.007	0.008	0.014	0.012	0.019	0.028	0.019	0	0.002	0.01
17	0.015	0.01	0.006	0.004	0.004	0.008	0.01	0.021	0.01	0.002	0	0.008
18	9E-04	0.012	0.002	0.005	0.008	0.006	0.009	0.008	0	0	0	0.003
19	0.008	0.004	0.005	0.006	0.009	0.003	0.01	0.01	0.007	0	0	0
20	0.01	0.005	0.002	0.003	0.004	0.003	0.009	0.005	0	0.007	0	0
21	0.006	0	0.002	0.003	0.001	0.003	0.008	0.007	0.002	0	0	0
22	0.02	0	0.001	0.003	0.004	0	0.003	0.003	0	0.004	0	0
23	0.006	0	0.003	0.003	0.009	0.001	0.005	0	0	0	0	0
24	0.001	0	0.005	5E-05	0.002	0	0.003	0	0.002	0	0	0
25	0.052	0.005	0.018	0.005	0.03	0.003	0.023	0.006	0	0	0.014	0

Table 5 continued. The Washington age compositions

state	Wa	Wa	Wa	Wa	Wa	Wa	Wa	Wa	Wa	Wa	Wa	Wa
gear	Twl	twl	Twl	twl	Twl	twl	Twl	twl	Twl	twl	Twl	twl
sex	male	female	male	female	male	female	male	female	male	female	male	female
year	1980	1980	1981	1981	1982	1982	1983	1983	1984	1984	1985	1985
1	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0.00145	0	0	0	0	0	0	0	0	0	0
4	0.00291	0.00291	0	0.00175	0.00366	0.00183	0.00353	0.00353	0.00251	0	0	0
5	0.01453	0.00872	0.00484	0.014	0.00548	0.01463	0.03534	0.01413	0.00752	0.02005	0	0
6	0.02035	0.01453	0.01614	0.01925	0.02559	0.02011	0.02827	0.0212	0.00752	0.00752	0.00667	0
7	0.04942	0.03052	0.04035	0.021	0.06033	0.02194	0.0318	0.01413	0.01253	0.00501	0.01333	0.02667
8	0.03052	0.03052	0.06295	0.05949	0.07495	0.06216	0.0424	0.02827	0.0401	0.02506	0.03333	0.03333
9	0.02326	0.03779	0.04358	0.04899	0.05667	0.05119	0.04947	0.0318	0.04762	0.03008	0.10667	0.07333
10	0.05523	0.03488	0.04196	0.04374	0.03656	0.0457	0.0636	0.0742	0.04762	0.04762	0.08	0.02
11	0.05669	0.06977	0.0468	0.03849	0.03656	0.04022	0.03887	0.02827	0.03509	0.05013	0.08	0.04
12	0.03488	0.04506	0.04358	0.06474	0.03291	0.06764	0.03887	0.03887	0.02506	0.01253	0.02667	0.06
13	0.0189	0.02471	0.03389	0.03499	0.01828	0.03656	0.05654	0.053	0.02256	0.03759	0.02667	0.01333
14	0.01599	0.01017	0.01453	0.01925	0.04205	0.02011	0.04947	0.04594	0.04261	0.02757	0.02	0.02667
15	0.01163	0.00581	0.00807	0.007	0.0128	0.00731	0.02473	0.01767	0.01504	0.03759	0.02667	0.02
16	0.02907	0.00436	0.00484	0.00524	0.00914	0.00548	0.0212	0.0106	0.01754	0.01504	0.03333	0.00667
17	0.0189	0.01017	0.00807	0.0035	0.00548	0.00366	0	0.0106	0.00752	0.02256	0	0.01333
18	0.0218	0.01308	0.01937	0.0105	0.01645	0.01097	0	0.00707	0.02005	0.01003	0.02	0.01333

19	0.02616	0.01163	0.01291	0.00524	0.00731	0.00548	0.00707	0.00707	0.01253	0.00251	0.02	0.00667
20	0.0189	0.00145	0.02098	0.00175	0.00914	0.00183	0.0106	0.00353	0.02256	0.01253	0.00667	0
21	0.01163	0	0.01775	0	0.01463	0	0	0	0.01253	0.00501	0.01333	0
22	0.01599	0.00581	0.01453	0.0035	0.0128	0.00366	0.00707	0.00353	0.02506	0.00752	0.02	0
23	0.01744	0.00145	0.00969	0	0.00914	0	0.00353	0	0.03008	0	0	0
24	0.00872	0.00436	0.00969	0	0.00366	0	0	0	0.01504	0	0	0
25	0.11337	0.01453	0.11782	0.00524	0.08044	0.00548	0.0636	0.0106	0.15038	0.00501	0.1	0.01333

state	Wa	Wa	Wa	Wa	Wa	Wa	Wa	Wa	Wa	Wa	Wa	Wa
gear	Twl	twl	Twl	twl	Twl	twl	Twl	twl	Twl	twl	Twl	twl
sex	male	female	male	female	male	female	male	female	male	female	male	female
year	1986	1986	1987	1987	1988	1988	1989	1989	1990	1990	1991	1991
1	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0.00186	0	0	0	0	0
4	0.00128	0	0	0	0	0.00333	0.00372	0.01301	0	0.00333	0	0
5	0.0064	0.00256	0.00308	0	0.00667	0.01333	0.01487	0.01115	0	0	0	0
6	0.02049	0.02049	0.01541	0.01079	0.05333	0.02	0.0316	0.02231	0.03667	0.01667	0	0.00333
7	0.0653	0.04994	0.01849	0.01541	0.05667	0.02667	0.04647	0.0316	0.07667	0.03	0.05	0.01
8	0.08451	0.08195	0.08166	0.05855	0.03333	0.01333	0.05576	0.05205	0.07	0.04333	0.05	0.02333
9	0.05762	0.04994	0.06472	0.07242	0.05667	0.04667	0.07249	0.06134	0.05	0.07	0.04667	0.04
10	0.09859	0.08195	0.05393	0.06163	0.06667	0.05	0.07993	0.0539	0.05333	0.06667	0.06	0.05667
11	0.06274	0.04097	0.05701	0.06934	0.04	0.05667	0.04833	0.03903	0.05333	0.06667	0.06667	0.06
12	0.02561	0.04738	0.04468	0.05701	0.04667	0.04667	0.05762	0.03903	0.06	0.05333	0.05667	0.03667
13	0.02305	0.01921	0.01849	0.0416	0.01667	0.04333	0.0316	0.02416	0.02	0.02667	0.05	0.02333
14	0.01024	0.01409	0.01233	0.02311	0.00667	0.01667	0.02788	0.01673	0.01333	0.01667	0.02667	0.02667
15	0.0128	0.01152	0.00308	0.01695	0.01333	0.01333	0.00743	0.00929	0.02333	0.01667	0.02333	0.01
16	0.0128	0.00384	0.00616	0.02003	0.01667	0.01333	0.00743	0.00558	0.01	0.00667	0.02	0.00667
17	0.00384	0.00256	0.00308	0.01233	0.01333	0.01667	0.00743	0.00929	0.01	0.01	0.01667	0.01333
18	0.00256	0.00128	0.00925	0.01695	0.00667	0	0.00558	0.00186	0.00667	0.00667	0.01	0.01
19	0.0064	0.00256	0.00616	0.00616	0	0.00333	0.01115	0.00186	0.00333	0.00667	0.00667	0.01333
20	0.00512	0	0.00616	0.00616	0.00333	0.00333	0.00558	0	0	0	0.01667	0.00333
21	0	0.00256	0.00616	0.00154	0.01	0	0.00743	0.00372	0.01	0	0.02	0.01
22	0.00768	0.00384	0.00616	0.00154	0.01333	0.00333	0	0	0.01	0.01	0.01	0.01
23	0.00256	0	0.0077	0.00154	0.00333	0	0.00372	0	0.00333	0	0.01	0
24	0.00256	0	0.00154	0.00308	0.00333	0	0.00372	0	0	0	0.00667	0
25	0.04866	0.00256	0.0678	0.01079	0.12333	0.02	0.06506	0.00744	0.03333	0.00667	0.08667	0.01

state	Wa	Wa	Wa	Wa	Wa	Wa	Wa	Wa	Wa	Wa	Wa	Wa
gear	Twl	twl	Twl	twl	Twl	twl	Twl	twl	Twl	twl	Twl	twl
sex	male	female	male	female	male	female	male	female	male	female	male	female
year	1992	1992	1993	1993	1994	1994	1995	1995	1996	1996	1997	1997
1	0	0	0	0	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	0.00803	0.00803	0.00143	0.00143	0.00091	0.00091	0.0119	0.00744	0.00381	0.00254
5	0.01	0.00667	0.04418	0.02209	0.0329	0.02146	0.03182	0.01818	0.02083	0.0253	0.01015	0.00761
6	0.01333	0.03333	0.03815	0.05221	0.06152	0.0515	0.05909	0.03727	0.08631	0.05655	0.01777	0.01396
7	0.06	0.03667	0.07028	0.04619	0.05293	0.04578	0.08273	0.07	0.08333	0.06399	0.04822	0.0368
8	0.07667	0.07667	0.08032	0.07229	0.0701	0.04292	0.08909	0.07182	0.07738	0.06845	0.05584	0.06345
9	0.08667	0.04333	0.06627	0.06627	0.07153	0.0701	0.05455	0.05364	0.06845	0.04018	0.08503	0.04188
10	0.06667	0.03333	0.04819	0.06225	0.05579	0.0515	0.07727	0.06364	0.05655	0.04613	0.07107	0.05838
11	0.05333	0.07333	0.05422	0.03414	0.04149	0.03434	0.05364	0.05364	0.04464	0.0506	0.06218	0.06218
12	0.04667	0.03667	0.03012	0.02008	0.04149	0.04721	0.03364	0.04364	0.0253	0.03423	0.04949	0.04822

13	0.02333	0.02333	0.01205	0.02008	0.01574	0.02289	0.00818	0.02364	0.01935	0.02232	0.02792	0.04188
14	0.01667	0.01	0.02008	0.00602	0.02289	0.00572	0.01091	0.01091	0.00744	0.00893	0.03553	0.03046
15	0.01	0.01667	0.00602	0.01004	0.01574	0.01717	0.00364	0.00727	0.00595	0.00744	0.01396	0.01015
16	0.03667	0.00667	0.01004	0.01205	0.00858	0.01001	0.00455	0.00364	0.00595	0.01339	0.00635	0.00888
17	0.01	0	0.00402	0.00602	0.00572	0.00715	0.00273	0.00364	0.00595	0.00298	0.00381	0.00635
18	0.01	0	0.00803	0.01004	0.00572	0.00286	0.00182	0.00182	0.00149	0.00446	0.01015	0.00508
19	0.00333	0.01	0	0.00602	0.00572	0.00429	0.00182	0.00182	0.00446	0.00149	0.00381	0.00635
20	0.00333	0.00667	0.00201	0	0.00429	0.00429	0.00182	0.00182	0.00446	0	0.00381	0.00381
21	0.01333	0	0	0	0.00286	0	0	0.00182	0.00298	0.00149	0.00381	0.00508
22	0.00333	0	0.00201	0.00602	0.00143	0.00286	0	0.00182	0	0.00149	0.00254	0
23	0.00333	0	0.00201	0	0.00286	0.00143	0.00182	0.00091	0	0	0.00127	0.00254
24	0	0	0	0	0	0.00286	0.00727	0.00091	0	0	0.00381	0.00254
25	0.03667	0.00333	0.01606	0.01807	0.02432	0.00715	0	0	0.01042	0	0.01777	0.00381

state	Wa	Wa	Wa	Wa	Wa	Wa	Wa	Wa
gear	Twl	twl	Twl	twl	Twl	twl	Twl	twl
sex	male	female	male	female	male	female	male	female
year	1998	1998	1999	1999	2000	2000	2001	2001
1	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0
4	0.00224	0.00224	0.00417	0.00833	0	0	0	0
5	0.00897	0	0.00208	0.01875	0	0	0.0092	0
6	0.02242	0.0157	0.02208	0.01208	0	0	0.01839	0.0092
7	0.04709	0.03587	0.04917	0.04458	0	0	0.05162	0.0092
8	0.08072	0.04933	0.08333	0.0525	0	0	0.05369	0.01572
9	0.06502	0.08969	0.05625	0.05833	0	0	0.05725	0.0092
10	0.08744	0.06054	0.05083	0.065	0	0	0.07861	0.07772
11	0.0583	0.02915	0.0725	0.04958	0	0	0.02403	0.06645
12	0.03587	0.06951	0.03708	0.04583	0	0	0.06853	0.06289
13	0.03139	0.04036	0.03708	0.02458	0	0	0.07416	0.04568
14	0.02466	0.02915	0.02292	0.02708	0	0	0.02966	0.05369
15	0.00897	0.02018	0.025	0.01667	0	0	0.0445	0.03886
16	0.01121	0.00673	0.01458	0.00625	0	0	0.0092	0.01483
17	0.00224	0.00224	0.01042	0.01042	0	0	0.01483	0.0092
18	0	0.01121	0.00417	0.01875	0	0	0	0
19	0.00897	0.01121	0.00167	0.00625	0	0	0	0.01483
20	0	0.00897	0.00417	0.00625	0	0	0	0.02966
21	0	0.00448	0.00625	0.00208	0	0	0	0.0092
22	0.00224	0	0.00625	0	0	0	0	0
23	0	0	0	0.00208	0	0	0	0
24	0.00224	0	0.00208	0.00208	0	0	0	0
25	0.00897	0.00448	0.00833	0.00208	0	0	0	0

Table 6. The proportion-at-length of canary rockfish by sex and year taken by the shelf survey 1977-2001.

state	coast	coast	coast	coast	coast	coast	coast	coast	coast	coast	coast	coast	coast	coast	coast	coast	coast	coast
gear	shelf	shelf	shelf	shelf	shelf	shelf	shelf	shelf	shelf	shelf	shelf	shelf	shelf	shelf	shelf	shelf	shelf	shelf
sex	male	female	male	female	male	female	male	female	male	female	male	female	male	female	male	female	male	female
year	1977	1977	1980	1980	1983	1983	1986	1986	1989	1989	1992	1992	1995	1995	1998	1998	2001	2001
10cm	0	0	0	0	0	0	0	0	0	0	0.01	0.01	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0.01	0.01	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	0.01	0.01	0	0	0	0.02	0	0
16	0	0	0	0	0	0	0	0	0.01	0.01	0.01	0.01	0	0	0.01	0	0	0
18	0	0	0	0	0	0	0	0	0.01	0	0.02	0.02	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0.01	0.01	0	0	0	0.01	0.01	0.01
22	0	0	0	0	0	0	0	0	0	0	0.01	0.01	0.01	0	0.01	0.01	0	0
24	0	0	0	0	0	0	0	0	0	0	0.01	0.02	0.01	0	0.01	0.01	0.01	0.02
26	0	0	0	0	0.01	0.01	0.02	0	0.01	0.01	0.01	0.02	0.02	0	0	0	0.01	0
28	0	0	0	0	0.03	0.02	0.01	0	0.01	0.01	0.01	0.02	0.03	0.02	0	0.02	0.01	0
30	0	0	0	0	0.04	0.04	0.01	0.01	0.02	0.02	0.02	0.02	0.06	0.03	0.01	0.01	0.02	0.02
32	0	0	0	0	0.03	0.02	0.01	0.01	0.02	0.02	0.01	0.02	0.06	0.04	0.02	0.03	0.03	0.01
34	0	0	0	0	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.03	0.04	0.04	0.05	0.05	0.08	0.06
36	0	0	0.01	0	0.02	0.02	0.03	0.01	0.02	0.02	0.05	0.06	0.03	0.03	0.05	0.06	0.1	0.13
38	0	0	0	0	0.02	0.02	0.03	0.03	0.02	0.02	0.05	0.05	0.03	0.01	0.06	0.06	0.06	0.09
40	0.01	0	0.01	0.01	0.02	0.03	0.05	0.04	0.04	0.02	0.05	0.06	0.01	0.02	0.05	0.05	0.05	0.05
42	0.04	0.01	0.06	0.01	0.02	0.02	0.05	0.05	0.03	0.03	0.03	0.08	0.02	0.02	0.04	0.04	0.03	0.03
44	0.05	0.02	0.13	0.01	0.04	0.03	0.05	0.05	0.03	0.02	0.02	0.04	0.02	0.01	0.07	0.03	0.02	0.02
46	0.08	0.04	0.13	0.06	0.06	0.06	0.06	0.03	0.05	0.03	0.02	0.01	0.05	0.02	0.05	0.03	0.02	0.02
48	0.12	0.04	0.13	0.07	0.09	0.04	0.07	0.03	0.09	0.02	0.02	0.01	0.06	0.02	0.03	0.03	0.01	0.02
50	0.18	0.04	0.09	0.09	0.06	0.03	0.06	0.04	0.08	0.05	0.03	0.01	0.09	0.03	0.03	0.01	0.01	0.02
52	0.12	0.05	0.04	0.03	0.04	0.04	0.06	0.04	0.08	0.05	0.03	0.01	0.06	0.03	0.01	0.01	0	0.01
54	0.05	0.07	0.04	0.04	0.01	0.04	0.02	0.03	0.01	0.03	0	0.01	0.02	0.03	0.01	0.01	0	0
56	0.01	0.05	0	0.02	0	0.02	0	0.03	0	0.03	0	0.01	0	0.02	0	0	0	0.01
58	0	0.01	0	0	0	0.01	0	0.02	0	0.01	0	0	0	0.02	0	0	0	0
60	0	0	0	0	0	0	0	0.01	0.01	0.01	0	0.01	0	0.02	0	0	0	0
62	0.01	0.01	0	0	0	0	0	0	0	0.01	0	0.01	0	0	0	0	0	0
64	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 7. The proportion-at-age of canary rockfish by sex and year taken in the shelf survey 1977-2001.

area	coast	coast	coast	coast	coast	coast	coast	coast	coast	coast	coast	coast	coast	coast
gear	shelf	shelf	shelf	shelf	shelf	shelf	shelf	shelf	shelf	shelf	shelf	shelf	shelf	shelf
sex	male	female	male	female	male	female	male	female	male	female	male	female	male	female
year	1977	1977	1980	1980	1983	1983	1989	1989	1992	1992	1995	1995	2001	2001
age														
1	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.003	0.000	0.000	0.000	0.000	0.000
2	0.000	0.000	0.001	0.002	0.003	0.003	0.000	0.000	0.006	0.003	0.000	0.000	0.000	0.001
3	0.000	0.000	0.002	0.000	0.006	0.008	0.003	0.003	0.010	0.004	0.002	0.000	0.000	0.000
4	0.000	0.000	0.003	0.002	0.112	0.103	0.000	0.002	0.019	0.094	0.048	0.007	0.018	0.023
5	0.000	0.000	0.002	0.000	0.061	0.056	0.083	0.072	0.047	0.026	0.063	0.046	0.025	0.048
6	0.001	0.000	0.001	0.003	0.028	0.032	0.008	0.001	0.051	0.047	0.065	0.037	0.085	0.069
7	0.000	0.000	0.018	0.007	0.023	0.042	0.035	0.013	0.092	0.120	0.043	0.054	0.102	0.129
8	0.019	0.005	0.046	0.013	0.032	0.024	0.066	0.045	0.062	0.124	0.042	0.018	0.050	0.069
9	0.064	0.034	0.048	0.019	0.027	0.034	0.017	0.047	0.023	0.060	0.044	0.024	0.058	0.029
10	0.071	0.047	0.087	0.038	0.025	0.025	0.042	0.031	0.018	0.024	0.014	0.022	0.030	0.045
11	0.040	0.038	0.089	0.063	0.020	0.028	0.056	0.055	0.010	0.013	0.051	0.045	0.027	0.048
12	0.056	0.024	0.078	0.078	0.015	0.014	0.060	0.038	0.009	0.009	0.002	0.003	0.015	0.027
13	0.099	0.039	0.079	0.051	0.022	0.015	0.031	0.012	0.015	0.010	0.036	0.023	0.011	0.015
14	0.111	0.043	0.044	0.026	0.023	0.022	0.025	0.007	0.014	0.009	0.055	0.030	0.007	0.006
15	0.071	0.055	0.041	0.023	0.017	0.023	0.041	0.020	0.006	0.004	0.016	0.010	0.007	0.010
16	0.061	0.038	0.036	0.009	0.008	0.007	0.011	0.024	0.009	0.004	0.011	0.014	0.005	0.004
17	0.038	0.015	0.022	0.007	0.009	0.004	0.016	0.003	0.003	0.001	0.013	0.013	0.003	0.005
18	0.019	0.005	0.019	0.008	0.008	0.006	0.000	0.018	0.001	0.006	0.011	0.003	0.003	0.005
19	0.005	0.000	0.007	0.001	0.005	0.003	0.038	0.003	0.000	0.004	0.015	0.006	0.001	0.001
20	0.000	0.001	0.007	0.001	0.005	0.005	0.008	0.002	0.001	0.001	0.018	0.013	0.001	0.002
21	0.000	0.000	0.003	0.000	0.009	0.004	0.000	0.000	0.005	0.000	0.000	0.006	0.000	0.000
22	0.000	0.000	0.005	0.000	0.006	0.002	0.000	0.002	0.003	0.003	0.000	0.007	0.002	0.001
23	0.000	0.000	0.001	0.000	0.007	0.002	0.000	0.003	0.011	0.000	0.027	0.003	0.002	0.000
24	0.000	0.000	0.001	0.000	0.003	0.000	0.010	0.000	0.001	0.000	0.006	0.000	0.001	0.000
25	0.000	0.000	0.010	0.000	0.055	0.008	0.035	0.015	0.015	0.000	0.035	0.000	0.009	0.000

Note: no otoliths were aged for 1986 and 1998.

Table 8. Biological parameters for canary rockfish developed from the three primary data sources (Oregon fishery - OR fishery, Washington fishery - WA fishery, and NMFS survey). Units are as follows: length is cm; age is yr; weight is g; and maturity is proportion mature. Bold indicates estimated parameters that were used in assessment model.

		Data source				
Biological parameter	Sex[a]	OR fishery	WA fishery	OR and WA fishery	NMFS survey	All
Length-at-age						
L_{∞}	M	**51.9**	**52.8**	52.1	**53.6**	52.3
	F	**58.2**	**61.6**	58.6	**61.4**	58.9
	M and F	53.4	53.9	53.5	55.6	54.0
K	M	**0.167**	**0.162**	0.168	**0.179**	0.189
	F	**0.143**	**0.111**	0.137	**0.130**	0.146
	M and F	0.182	0.168	0.177	0.168	0.183
t_0	M	**-1.84**	**-1.66**	-1.66	**-0.47**	-0.50
	F	**-1.46**	**-2.56**	-1.62	**-1.01**	-0.84
	M and F	-0.71	-1.16	-0.87	-0.49	-0.36
Weight-length						
a	M	0.1259	0.1230	0.1259	0.0123	0.0155
	F	0.0245	0.7943	0.0302	0.0132	0.0151
	M and F	0.2818	0.0550	0.0603	0.0126	**0.0155**
b	M	2.49	2.49	2.49	3.09	3.03
	F	2.91	2.01	2.86	3.07	3.03

Table 8. Cont'd

Biological parameter	Sex[a]	OR fishery	WA fishery	OR and WA fishery	NMFS survey	All
	M and F	2.28	2.70	2.68	3.08	**3.03**
Maximum age						
A_{max}	M	67	60	67	66	67
	F	52	69	69	57	69
$A_{99\%}$	M	45	47	46	44	47
	F	32	30	31	27	31
Maximum length						
L_{max}	M	63	61	63	61	63
	F	66	69	69	65	69
$L_{99\%}$	M	55	56	56	56	55
	F	60	60	60	60	60
Age-at-recruitment						
	M	4-5	4-7	4-7	3	3-7
	F	4-5	4-6	4-6	3-4	3-6
Length-at-recruitment						
	M	20-34	24-36	20-36	14-22	14-36
	F	26-34	26-36	26-36	14-26	14-36

Table 8 cont'd.

Biological parameter	Sex[a]	OR fishery	WA fishery	OR and WA fishery	NMFS survey	All
Maturity-at-age						
a	F	-6.054	-11.580	**-9.249**	-8.230	-8.756
b	F	3.224	5.696	**4.557**	4.757	4.397
$M_{A50\%}$	F	6.6	7.7	**7.6**	5.7	7.3
Maturity-at-length						
a	F	-21.590	-64.236	-37.352	-32.875	-24.777
b	F	6.071	17.041	10.097	9.314	6.834
$M_{L50\%}$	F	35.0	43.4	40.5	34.2	37.6

Table 8. Contiued

[a] M is male and F is female.

Table 9. The estimated shelf survey biomass in each INPFC area and for each survey year from 1977-2001 are given below. Values are presented for the water-hauls excluded calculations and in mt.

	Conception	Monterey	Eureka	Columbia	US Vancouver
1977	46	1186	36	6528	275
1980	*	103	1904	3379	275
1983	*	7772	420	6835	5088
1986	*	0	746	5439	2658
1989	4	755	139	3763	3929
1992	0	98	18	1278	448
1995	0	1095	73	1924	61
1998	2	670	146	262	458
2001	8	98	164	2294	710

* denotes that the INPFC area was not sampled in those years

Table 10. Model runs in preliminary assessment presented to STAR. Each section has emphasis levels, followed by log(likelihoods).

	TOTAL	OR trawl Age	OR trawl Size	WA trawl Age	WA trawl Size	CA trawl Age	CA trawl Size	CA non-tr Size	CA recr Size	OR recr Size	Surv All CPUE	Surv All Age	Surv All Size	Surv N CPUE	Surv N Age	Surv N Size	Surv Surv CPUE	Surv Surv Age	Surv S Size	CA trawl CPUE	S / R	EndBio
Scenario #1 (NatMort)		1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	1	0.1	
Size Emph = 0.1		1	0.1	1	0.1	1	0.1	0.1	0.1	0.1	1	1	0.1	0	0	0	0	0	0	1	0.1	
Age emph = 0.1		0.1	1	0.1	1	0.1	1	1	1	1	1	0.1	1	0	0	0	0	0	0	1	0.1	
Survey Emphasis = 10.		0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	10	0	0.1	0	0	0	0	0	0	0.1	0.1	
Survey Emphasis = 0.1		1	1	1	1	1	1	1	1	1	0.1	1	1	0	0	0	0	0	0	1	0.1	
South emph = 0.1		1	1	1	1	0.1	0.1	0.1	0.1	1	1	1	1	0	0	0	0	0	0	0.1	0.1	
North emph = 0.1		0.1	0.1	0.1	0.1	1	1	1	1	0.1	1	1	1	0	0	0	0	0	0	1	0.1	
Equil Recr; Size Emph = 0.1		1	0.1	1	0.1	1	0.1	0.1	0.1	0.1	1	1	0.1	0	0	0	0	0	0	1	0.1	
1: Baseline	-1776	-269	-177	-288	-287	-88	-239	-52	-89	-118	-1.7	-58	-113	-11.2	-49	-100	-13.1	-51	-87	2.4	13	9976
2: Size Emph = 0.1	-749	-240	-226	-253	-364	-81	-268	-56	-95	-129	-0.7	-51	-138	-7.4	-48	-105	-13.2	-49	-90	2.5	15	5720
3: Age emph = 0.1	-1079	-359	-151	-412	-240	-98	-233	-52	-87	-116	-1.0	-63	-109	-9.1	-51	-101	-12.7	-54	-87	2.4	11	9526
4: Survey Emphasis = 10.	-176	-287	-173	-296	-288	-88	-236	-91	-94	-119	0.1	-61	-112	-4.4	-49	-100	-13.4	-52	-87	2.3	19	6576
5: Survey Emphasis = 0.1	-1773	-267	-178	-288	-287	-88	-240	-51	-88	-117	-8.1	-59	-113	-27.1	-50	-98	-17.0	-51	-85	1.4	11	22530
6: South emph = 0.1	-1351	-267	-179	-288	-286	-92	-246	-53	-95	-116	-0.9	-56	-113	-8.6	-48	-99	-12.9	-50	-88	2.4	12	8118
7: North emph = 0.1	-733	-300	-187	-316	-301	-81	-236	-52	-86	-127	-0.3	-55	-105	-4.6	-48	-99	-13.7	-51	-83	2.4	18	5283
8: Equil Recr; Size Emph = 0.1	-817	-282	-222	-273	-388	-75	-277	-55	-110	-125	-0.7	-57	-138	-5.4	-52	-106	-14.2	-51	-89	2.4	0	3972
North Catch and Data Only		1	1	1	1	0	0	0	0	1	0	0	0	1	1	1	0	0	0	0	0.1	
Size Emph = 0.1		1	0.1	1	0.1	0	0	0	0	0.1	0	0	0	1	1	0.1	0	0	0	0	0.1	
Size Emph = 0.1; nil S/R emph		1	0.1	1	0.1	0	0	0	0	0.1	0	0	0	1	1	0.1	0	0	0	0	0	
Size Emph = 0.1; nil S/R; retro to 99		1	0.1	1	0.1	0	0	0	0	0.1	0	0	0	1	1	0.1	0	0	0	0	0	
9: Baseline	-1287	-271	-181	-286	-287					-120	-0.2	-54	-120	-5.3	-48	-91					12	4415
10: Size Emph = 0.1	-629	-244	-230	-252	-363					-132	-0.6	-53	-129	-5.4	-46	-100					13	3534
11: Size Emph = 0.1; nil S/R emph	-630	-244	-230	-252	-363					-132	-0.6	-52	-130	-5.4	-46	-100					-40	3463
12: Size Emph = 0.1; nil S/R; retro to 99	-560	-203	-226	-237	-334					-122	-0.9	-48	-127	-1.1	-42	-89					-8	2161
South Catch and Data Only		0	0	0	0	1	1	1	1	0	0	0	0	0	0	0	1	1	1	1	0.1	
13: Baseline	-553					-76	-224	-53	-72		-2.3	-76	-141				-12.4	-43	-74	3.6	-15	556
Scenario #2 (Dome)		1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	1	0.1	
Size Emph = 0.1		1	0.1	1	0.1	1	0.1	0.1	0.1	0.1	1	1	0.1	0	0	0	0	0	0	1	0.1	
Age emph = 0.1		0.1	1	0.1	1	0.1	1	1	1	1	1	0.1	1	0	0	0	0	0	0	1	0.1	
14: Baseline	-1771	-280	-175	-284	-274	-88	-242	-52	-86	-112	-11.9	-61	-108	-28.2	-102	-187	-18.0	-91	-121	0.3	11	36298
15: Size Emph = 0.1	-785	-265	-236	-254	-365	-79	-284	-53	-89	-122	-9.0	-52	-132	-25.6	-114	-221	-17.2	-101	-138	0.6	13	29859
16: Age emph = 0.1	-1059	-382	-149	-414	-226	-105	-235	-52	-85	-111	-4.4	-68	-104	-19.5	-118	-217	-15.5	-108	-135	2.1	11	23192
Scenario #3 (size model)		1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	1	0.1	
Re-estimate growth		1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	1	0.1	
South emph = 0.1		1	1	1	1	0.1	0.1	0.1	0.1	1	1	1	1	0	0	0	0	0	0	0.1	0.1	
North emph = 0.1		0.1	0.1	0.1	0.1	1	1	1	1	0.1	1	1	1	0	0	0	0	0	0	1	0.1	
Size Emph = 0.1		1	0.1	1	0.1	1	0.1	0.1	0.1	0.1	1	1	0.1	0	0	0	0	0	0	1	0.1	
17: Baseline	-1767	-292	-164	-289	-263	-91	-237	-53	-104	-94	-2.9	-58	-123	-19.2	-52	-236	-14.5	-50	-107	2.3	12	11092
18: Re-estimate growth	-1753	-294	-162	-282	-257	-92	-236	-53	-105	-94	-2.8	-59	-119	-18.6	-55	-232	-14.4	-51	-106	2.3	13	10686
19: South emph = 0.1	-1305	-294	-162	-273	-247	-102	-272	-77	-113	-94	-1.0	-57	-121	-11.5	-53	-229	-13.4	-50	-106	2.4	12	7330
20: North emph = 0.1	-742	-329	-205	-335	-308	-80	-223	-52	-99	-97	-0.3	-55	-109	-8.2	-51	-237	-13.0	-51	-107	2.4	14	5232
21: Size Emph = 0.1	-766	-248	-247	-256	-355	-84	-257	-73	-117	-102	-1.3	-51	-138	-11.9	-52	-234	-13.6	-47	-107	2.4	15	7231

Table 11. Likelihoods in model runs profiled on natural mortality for old females. The final baseline model configuration has M=0.12.

Fem. M	TOTAL	OR TWL AGE	OR TWL LEN	WA TWL AGE	WA TWL LEN	CA TWL AGE	CA TWL LEN	CA N-TWL LEN	CA RECR LEN	OR-WA RECR LEN	SVY-A BIO	SVY-A AGE	SVY-A LEN	CA TWL CPUE	CA RECR CPUE	STOCK-RECR INDIV
0.0900	-670.6	-245.4	-225.7	-246.9	-352.1	-78.7	-264.9	-56.8	-86.5	-100.6	-2.4	-52.7	-135.1	5.7	7.7	18.8
0.0925	-669.7	-245.0	-225.8	-246.6	-352.4	-78.6	-264.5	-56.8	-86.4	-100.2	-2.2	-52.6	-135.3	5.7	7.7	18.8
0.0950	-668.9	-244.7	-225.9	-246.3	-352.7	-78.6	-264.3	-56.8	-86.3	-99.7	-2.1	-52.5	-135.5	5.7	7.7	18.8
0.0975	-668.1	-244.4	-226.1	-246.1	-353.0	-78.5	-263.9	-56.8	-86.2	-99.3	-2.0	-52.5	-135.5	5.7	7.7	18.8
0.1000	-667.5	-244.2	-226.3	-245.8	-353.3	-78.5	-263.7	-56.9	-86.1	-98.9	-1.8	-52.4	-135.6	5.7	7.7	18.8
0.1025	-666.8	-244.0	-226.6	-245.6	-353.6	-78.5	-263.4	-56.9	-86.0	-98.6	-1.7	-52.4	-135.8	5.8	7.7	18.7
0.1050	-666.3	-243.8	-226.8	-245.4	-353.9	-78.5	-263.0	-57.0	-85.9	-98.3	-1.6	-52.3	-135.9	5.8	7.7	18.7
0.1075	-665.9	-243.7	-227.0	-245.2	-354.2	-78.5	-262.7	-57.0	-85.8	-98.1	-1.4	-52.3	-136.0	5.8	7.7	18.8
0.1100	-665.5	-243.7	-227.2	-245.0	-354.6	-78.5	-262.5	-57.1	-85.8	-97.8	-1.3	-52.2	-136.1	5.8	7.7	18.8
0.1125	-665.1	-243.6	-227.4	-244.8	-355.0	-78.5	-262.2	-57.1	-85.8	-97.6	-1.2	-52.2	-136.2	5.8	7.7	18.7
0.1150	-664.9	-243.6	-227.6	-244.7	-355.4	-78.5	-261.9	-57.2	-85.8	-97.4	-1.1	-52.1	-136.4	5.8	7.7	18.7
0.1175	-664.7	-243.6	-227.8	-244.6	-355.8	-78.5	-261.5	-57.3	-85.8	-97.3	-1.0	-52.1	-136.5	5.8	7.7	18.8
0.1200	-664.5	-243.6	-228.0	-244.5	-356.2	-78.6	-261.3	-57.4	-85.8	-97.2	-0.9	-52.0	-136.6	5.8	7.7	18.7
0.1225	-664.5	-243.7	-228.1	-244.5	-356.6	-78.6	-260.9	-57.6	-85.8	-97.1	-0.8	-51.9	-136.8	5.8	7.7	18.7
0.1250	-664.5	-243.7	-228.1	-244.5	-357.5	-78.6	-260.5	-57.9	-85.9	-97.1	-0.7	-51.8	-137.0	5.8	7.7	18.7
0.1275	-664.6	-243.6	-228.4	-244.6	-357.9	-78.7	-260.4	-58.0	-85.9	-97.1	-0.7	-51.8	-137.1	5.8	7.7	18.5
0.1300	-664.9	-243.6	-229.0	-244.8	-358.4	-78.8	-260.2	-58.3	-86.0	-97.1	-0.7	-51.7	-137.2	5.8	7.7	18.5
0.1325	-665.3	-243.7	-229.6	-245.0	-358.9	-78.9	-260.1	-58.7	-86.1	-97.1	-0.6	-51.7	-137.4	5.8	7.8	18.5
0.1350	-665.9	-243.8	-230.5	-245.2	-359.3	-79.0	-260.3	-58.7	-86.1	-97.2	-0.6	-51.6	-137.4	5.8	7.8	18.3
0.1375	-666.7	-244.0	-231.6	-245.5	-359.9	-79.2	-260.4	-58.8	-86.2	-97.2	-0.6	-51.6	-137.5	5.8	7.8	18.2
0.1400	-667.6	-244.3	-232.8	-245.8	-360.4	-79.4	-260.7	-58.9	-86.3	-97.3	-0.6	-51.6	-137.5	5.8	7.8	18.0
0.1425	-668.7	-244.7	-234.2	-246.2	-361.0	-79.6	-261.1	-58.9	-86.4	-97.3	-0.6	-51.5	-137.6	5.8	7.8	18.0
0.1450	-669.9	-245.2	-235.6	-246.6	-361.6	-79.8	-261.7	-58.9	-86.4	-97.4	-0.6	-51.5	-137.6	5.8	7.8	17.5
0.1475	-671.3	-245.8	-237.2	-247.0	-362.2	-80.0	-262.1	-59.0	-86.5	-97.4	-0.6	-51.5	-137.7	5.8	7.8	17.4
0.1500	-672.9	-246.6	-238.9	-247.4	-362.9	-80.2	-263.0	-59.0	-86.6	-97.4	-0.6	-51.5	-137.7	5.8	7.8	17.4

Table 12. Key parameters and outcomes for model runs profiled on natural mortality of old females.

		Female Sp. Bio.			Spawner-Recruitment		
Fem. M	ENDING BIOMASS	Virgin	2002	2002/Vir	Virgin	Steepness	Survey Q
0.0900	10666	41118	4787	11.6%	3786	0.308	0.414
0.0925	10192	40119	4512	11.2%	3798	0.307	0.417
0.0950	9813	39165	4281	10.9%	3809	0.307	0.419
0.0975	9468	38270	4074	10.6%	3821	0.307	0.421
0.1000	9109	37410	3869	10.3%	3831	0.306	0.423
0.1025	8766	36591	3677	10.0%	3842	0.304	0.425
0.1050	8404	35795	3484	9.7%	3850	0.303	0.428
0.1075	8043	35061	3298	9.4%	3861	0.301	0.431
0.1100	7711	34335	3127	9.1%	3869	0.299	0.434
0.1125	7370	33641	2958	8.8%	3877	0.297	0.437
0.1150	7045	32998	2799	8.5%	3888	0.294	0.441
0.1175	6739	32377	2652	8.2%	3897	0.292	0.444
0.1200	6520	31789	2541	8.0%	3908	0.291	0.446
0.1225	6211	31239	2403	7.7%	3919	0.286	0.449
0.1250	5844	30699	2244	7.3%	3930	0.283	0.454
0.1275	5712	30126	2178	7.2%	3933	0.281	0.455
0.1300	5475	29639	2077	7.0%	3944	0.277	0.458
0.1325	5262	29154	1987	6.8%	3953	0.273	0.460
0.1350	5202	28720	1957	6.8%	3967	0.270	0.460
0.1375	5068	28206	1899	6.7%	3967	0.269	0.461
0.1400	4971	27793	1857	6.7%	3978	0.265	0.462
0.1425	4926	27353	1834	6.7%	3984	0.264	0.462
0.1450	4899	26908	1818	6.8%	3986	0.262	0.461
0.1475	4813	26478	1782	6.7%	3989	0.259	0.461
0.1500	4803	26091	1773	6.8%	3995	0.258	0.461

Table 13. Biomass, spawning biomass and numbers of recruits from the base model run (M-0.12).

YEAR	BEG BIO	MID BIO	SP.BIO	RECRUIT
-1	94062	90531	31782	3907
0	85325	81834	29848	3907
41	85326	81835	29848	3948
42	85331	80279	29847	3948
43	82235	77231	28852	3948
44	79153	74075	27860	3867
45	75842	70532	26792	3783
46	71975	66922	25538	3691
47	68496	63714	24417	3579
48	65438	62400	23449	3476
49	65720	62699	23626	3384
50	66016	62872	23829	3401
51	66029	62734	23941	3420
52	65686	62414	23919	3431
53	65325	61987	23871	3429
54	64769	61429	23725	3424
55	64147	60825	23525	3410
56	63505	60091	23294	3391
57	62625	59184	22960	3369
58	61731	58236	22577	5788
59	60790	57465	22134	3750
60	60237	57017	21803	3058
61	60040	56981	21561	6281
62	60276	57265	21481	2871
63	60670	57552	21521	2703
64	60937	58049	21582	5547
65	61668	58759	21895	2116
66	62263	58479	22268	1275
67	60889	57562	22060	1271
68	60066	56558	22142	2007
69	58585	55527	22015	3467
70	57769	54747	22078	3530
71	56881	53857	21982	2795
72	55841	52790	21662	1653
73	54592	51129	21124	1973
74	52392	49344	20159	3035
75	50859	47873	19455	2182
76	49347	46616	18792	2618
77	48302	45288	18314	3513
78	46650	43217	17622	1833
79	44149	40293	16596	3158
80	40822	37054	15246	3701
81	37514	34387	13968	1288
82	35365	30986	13106	2443
83	30699	26897	11340	2134
84	26897	24645	9883	1962
85	25885	23482	9543	2091
86	24436	22332	9083	2341
87	23415	20887	8788	1344
88	21395	18993	8088	1275
89	19404	16930	7355	1986
90	17090	14910	6438	1488
91	15118	12805	5667	1227
92	12739	10690	4683	1255
93	10644	9075	3831	1169
94	9286	8325	3254	830
95	8969	8053	3130	1342
96	8657	7566	3037	766
97	7899	6895	2762	449
98	7160	6149	2512	374
99	6266	5589	2195	516
100	5887	5591	2102	454
101	6197	5926	2312	435
102	6540	6254	2524	477
ratio	**0.07**	**0.07**	**0.08**	**0.12**

Table 13. The percent utilization (catch / age 3+ biomass) from each fishery.

Year	OR twl	Wa twl	Ca twl	Ca non-twl	Or-Wa non-twl	Ca rec	Or-Wa rec
0	0.0084						
41	0.0067		0.0017				
42	0.054		0.0019	0.001			
43	0.0567		0.0039	0.0019			
44	0.0598		0.0094	0.0046			
45	0.0634		0.0206	0.0096			
46	0.068		0.0186	0.0082			
47	0.0728		0.0151	0.0064			
48	0.0107		0.0123	0.005			
49	0.0106		0.0112	0.0045			
50	0.0105		0.015	0.0061			
51	0.0104		0.0202	0.0083			
52	0.0103		0.0196	0.0082			
53	0.0103		0.0223	0.0095			
54	0.0103		0.0232	0.0099			
55	0.0104		0.0234	0.0101			
56	0.0104		0.0279	0.0121			
57	0.0106		0.0305	0.0132			
58	0.0108		0.0345	0.0148			
59	0.0111		0.0303	0.0129			
60	0.0113		0.0278	0.0117			
61	0.0115		0.0223	0.0092			
62	0.0116		0.0204	0.0079			
63	0.0116		0.0244	0.0092			
64	0.0117		0.0148	0.0058			
65	0.0117		0.0145	0.0055			
66	0.0504	0.0024	0.0136	0.0051			
67	0.0258	0.0089	0.0125	0.0041			
68	0.0243	0.0143	0.0175	0.0029			
69	0.0216	0.012	0.0043	0.0019			
70	0.0219	0.0102	0.0048	0.0024			
71	0.0229	0.0098	0.0049	0.0027			
72	0.0295	0.0036	0.0076	0.0043			
73	0.039	0.0033	0.0194	0.0059			
74	0.0224	0.0115	0.0137	0.0056			
75	0.021	0.0145	0.0139	0.0058			
76	0.0165	0.012	0.0132	0.006			
77	0.0229	0.0275	0.0102	0.005			
78	0.0499	0.0314	0.0101	0.0046			
79	0.0816	0.0336	0.0146	0.0063			
80	0.0891	0.0314	0.0143	0.0064		0.0582	0.006

81	0.0906	0.0189	0.0109	0.0043		0.0306	0.0116
82	0.1892	0.0179	0.0315	0.0018		0.0487	0.0097
83	0.1833	0.032	0.0226	0.0014		0.0199	0.0015
84	0.0731	0.0355	0.0219	0.0018		0.0218	0.006
85	0.066	0.062	0.018	0.012		0.0366	0.0165
86	0.0613	0.0561	0.0091	0.0076	0.0007	0.053	0.0064
87	0.1038	0.0649	0.0094	0.003	0.0069	0.0569	0.0107
88	0.1189	0.0684	0.0095	0.0067		0.0507	0.0185
89	0.132	0.0941	0.0111	0.0218		0.0342	0.0087
90	0.1011	0.0996	0.0254	0.0293	0.001	0.0537	0.0151
91	0.2021	0.101	0.0119	0.0201	0.0018	0.0535	0.0182
92	0.2011	0.106	0.0234	0.0209	0.0123	0.0622	0.0195
93	0.2742	0.0402	0.0105	0.0151	0.0112	0.0263	0.0258
94	0.14	0.0244	0.0174	0.0222	0.0117	0.0224	0.018
95	0.1101	0.0266	0.0194	0.0196	0.0116	0.0335	0.0283
96	0.1535	0.0316	0.0322	0.022	0.0168	0.034	0.0162
97	0.1276	0.0445	0.0307	0.0195	0.0282	0.0571	0.0296
98	0.1694	0.0484	0.0306	0.0163	0.0302	0.0157	0.0461
99	0.105	0.0382	0.0274	0.0043	0.017	0.0471	0.0345
100	0.0059	0.0022	0.0026	0.0007	0.0016	0.0716	0.0313
101	0.0029	0.0017	0.0017	0.0003	0.0015	0.0323	0.019
102	0.0024	0.0015	0.0015	0.0003	0.0014	0.034	0.0196

Table 14. Estimated number of fish at age for the most recent years by sex.

	Female Age																								
Year	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**
78	916	1654	1161	911	1192	725	565	885	1022	906	467	259	225	321	714	294	263	488	202	212	281	140	120	104	795
79	1579	863	1558	1093	857	1114	674	521	801	906	782	392	213	183	258	573	235	211	391	163	172	229	115	101	775
80	1850	1487	813	1466	1028	799	1034	619	469	703	768	638	310	165	140	198	438	180	161	301	127	135	180	94	744
81	644	1742	1400	753	1296	910	719	931	548	405	588	620	499	238	126	106	149	331	136	123	231	98	104	146	708
82	1221	607	1640	1306	681	1170	832	657	838	483	346	484	495	391	184	97	82	115	255	105	95	180	77	85	725
83	1067	1150	570	1488	1163	609	1063	753	580	711	386	258	339	334	259	121	64	54	76	169	70	64	121	56	653
84	981	1005	1082	528	1370	1070	558	952	640	456	518	268	174	227	222	172	80	42	36	51	114	48	44	90	578
85	1046	924	945	1002	484	1256	983	507	837	539	369	408	208	134	174	170	131	62	32	28	40	89	38	36	566
86	1170	985	868	864	895	429	1126	875	436	688	425	284	310	157	101	130	127	98	46	25	21	31	70	31	509
87	672	1102	925	785	768	795	386	1008	762	365	555	335	221	239	121	77	100	97	75	36	19	17	25	58	460
88	638	633	1034	830	686	672	705	339	854	612	279	410	243	159	171	86	55	71	69	54	26	14	13	19	431
89	993	601	594	935	730	602	598	620	287	682	462	203	292	172	111	120	60	39	50	49	39	19	11	10	375
90	744	935	564	544	841	642	530	515	508	219	488	317	136	195	114	74	79	40	26	34	34	28	14	8	318
91	613	700	878	508	476	715	549	446	414	384	157	337	215	92	131	76	49	53	27	18	24	25	20	11	268
92	628	577	657	790	444	408	617	464	353	298	252	97	202	128	54	77	45	29	31	16	11	15	16	14	222
93	584	591	541	579	661	371	343	507	356	245	189	150	56	116	73	31	44	25	17	18	10	7	9	11	184
94	415	550	555	491	502	570	321	289	402	256	160	115	89	33	67	42	18	25	15	10	11	6	4	6	152
95	671	391	517	505	429	437	498	276	241	319	193	117	83	63	23	47	30	12	18	10	7	8	4	3	131
96	383	632	367	466	433	367	377	424	227	190	242	144	86	61	46	17	35	22	9	13	8	5	6	3	111
97	225	361	594	334	399	368	311	311	331	167	134	166	98	58	41	31	11	23	15	6	9	5	4	4	92
98	187	211	339	536	275	329	310	258	245	246	118	92	113	66	39	27	21	8	16	10	4	6	4	3	77
99	258	176	199	309	452	230	279	256	200	175	165	77	59	71	42	25	17	13	5	10	6	3	4	3	62
100	227	243	166	183	264	386	200	240	212	156	132	121	56	42	51	30	17	12	9	3	7	5	2	3	53
101	218	214	229	153	156	228	345	182	219	191	140	117	107	49	37	45	26	15	11	8	3	6	4	2	50
102	238	205	201	213	137	140	209	319	168	200	173	126	105	95	43	33	40	23	13	9	7	3	6	4	45

Table 14. Estimated numbers at age continued

YR	Males																								
AGE	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**
78	916	1654	1161	911	1192	725	564	882	1024	920	484	277	250	371	862	373	354	695	305	335	463	240	216	195	1973
79	1579	863	1558	1093	857	1114	673	518	799	912	799	413	234	211	313	729	315	299	588	258	284	391	203	183	1835
80	1850	1487	813	1467	1028	799	1031	615	465	699	768	653	333	189	170	252	586	254	241	474	208	229	315	163	1626
81	644	1743	1400	753	1296	910	717	922	542	401	581	620	522	266	150	136	201	468	202	192	378	166	182	252	1428
82	1221	607	1641	1306	681	1170	830	653	830	477	340	479	506	424	216	122	110	163	380	165	156	308	135	148	1367
83	1067	1150	570	1488	1163	609	1060	747	571	689	363	243	334	350	294	149	85	76	113	263	114	108	213	93	1048
84	981	1005	1082	529	1371	1070	556	931	604	423	489	255	169	233	244	205	104	59	53	79	184	79	75	148	796
85	1046	924	945	1002	484	1256	980	499	801	499	344	395	205	137	188	197	165	84	48	43	64	148	64	61	762
86	1170	985	868	864	896	429	1121	858	417	645	395	271	311	162	108	148	155	130	66	38	34	50	117	51	651
87	672	1102	925	785	768	795	385	991	731	344	523	319	219	251	131	87	120	126	106	54	30	27	41	95	568
88	638	633	1034	830	686	672	701	332	811	568	261	393	240	164	189	98	65	90	95	79	40	23	21	31	498
89	993	601	594	935	730	601	594	605	270	622	423	193	290	177	121	139	73	48	66	70	59	30	17	15	391
90	744	935	564	544	842	641	525	499	471	196	436	294	134	202	123	84	97	51	34	46	49	41	21	12	284
91	613	701	878	508	476	713	543	430	383	341	138	306	207	94	142	87	60	69	36	24	33	35	29	15	210
92	628	578	658	791	444	407	610	443	316	253	214	85	189	128	58	88	54	37	43	22	15	20	22	18	140
93	584	591	541	579	661	370	339	483	314	201	153	128	51	113	76	35	53	32	22	26	13	9	12	13	95
94	415	550	555	492	503	569	317	278	357	207	125	93	78	31	68	46	21	32	20	13	16	8	5	7	66
95	671	391	517	505	429	436	493	269	225	274	155	93	69	58	23	51	34	16	24	15	10	12	6	4	55
96	383	632	367	466	433	366	373	411	215	174	210	118	71	53	44	18	39	27	12	18	11	8	9	5	45
97	225	361	594	334	399	367	306	298	307	153	123	148	83	50	37	31	12	28	19	9	13	8	5	6	35
98	187	212	339	536	275	328	305	246	224	221	108	86	104	59	35	26	22	9	20	13	6	9	6	4	30
99	258	176	199	309	453	229	275	244	179	153	147	72	57	69	39	23	18	15	6	13	9	4	6	4	22
100	227	243	166	183	264	386	198	232	194	137	115	110	54	43	52	29	18	13	11	4	10	7	3	5	20
101	218	214	229	153	156	228	345	181	213	179	127	106	102	50	40	48	27	16	12	10	4	9	6	3	22
102	238	205	201	213	137	140	209	319	168	198	166	118	99	95	46	37	45	25	15	11	10	4	8	6	24

Table15. Summary of projections. Probabilities are based on 1000 independent projections.

REF.	NAT.MORT.	Bzero	F or CATCH	RECRUITS	50% REBUILT	60% REBUILT	% REBUILT IN 2057	2003 OY
1	0.10	MODEL	0	MODEL	2053	2055	70.3%	0
2	0.12	MODEL	0	MODEL	2064	2066	17.3%	0
3	0.14	MODEL	0	MODEL	2079	2082	0.5%	0
4	0.10	MODEL	93 mt	MODEL	2068	2070	10.8%	93
5	0.10	MODEL	F90%	MODEL	2068	2071	11.0%	61
6	0.10	MODEL	F=0.005	MODEL	2058	2060	45.9%	20
7	0.10	MODEL	50 mt	MODEL	2060	2062	37.5%	50
8	0.14	MODEL	93 mt	MODEL	--	--	--	93
9	0.14	MODEL	F90%	MODEL	2110	2115	0.0%	39
10	0.14	MODEL	F=0.005	MODEL	2087	2090	0.0%	12
11	0.12	MODEL	0	R/S 78-97	2060	2061	29.9%	0
12	0.12	R 58-70	0	MODEL	2054	2056	70.6%	0
13	0.12	MODEL	F90%	MODEL	2085	2088	0.6%	47
14	0.12	MODEL	93 mt	MODEL	2089	2092	0.2%	93
15	0.12	MODEL	0	MODEL; steep=0.36	2044	2045	99.4%	0
16	0.12	MODEL	93 mt	MODEL; steep=0.36	2052	2054	78.9%	93
17	0.12	MODEL	F90%	MODEL; steep=0.36	2052	2053	82.9%	47
18	0.12	MODEL	F90%	MODEL; steep=0.36	2052	2054	79.9%	47
19	0.12	MODEL	93 mt; recr	MODEL; steep=0.36	2055	2057	64.3%	93
20	0.12	MODEL	F90%; recr	MODEL; steep=0.36	2052	2054	81.4%	30
21	0.12	MODEL	F90%; trawl	MODEL; steep=0.36	2052	2054	79.3%	59
22	0.12	MODEL	93 mt; trawl	MODEL; steep=0.36	2049	2050	93.4%	93

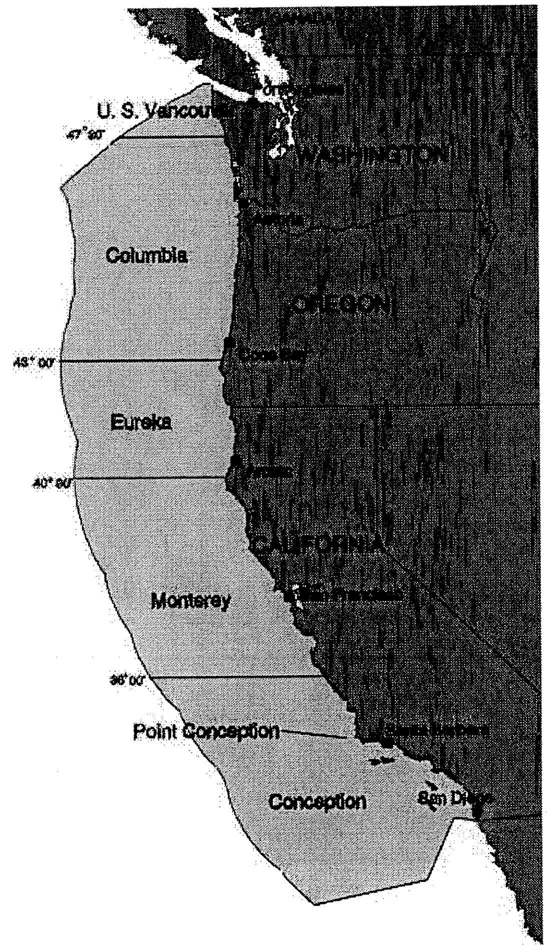


Figure 1. A map of the U.S. West Coast and description of the location of the INPFC Statistical areas discussed in this Assessment.

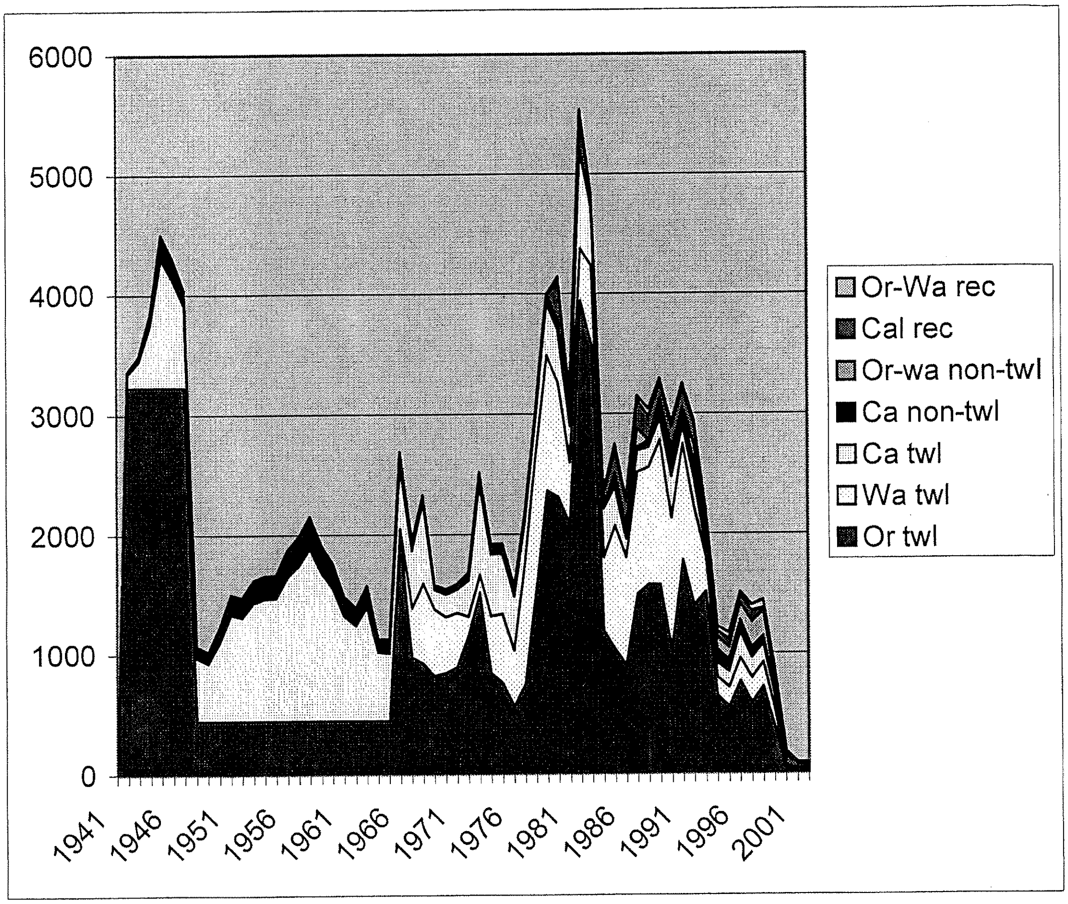


Figure 2. Landings of Canary rockfish from 1940-2001 by state and summarized gear type.

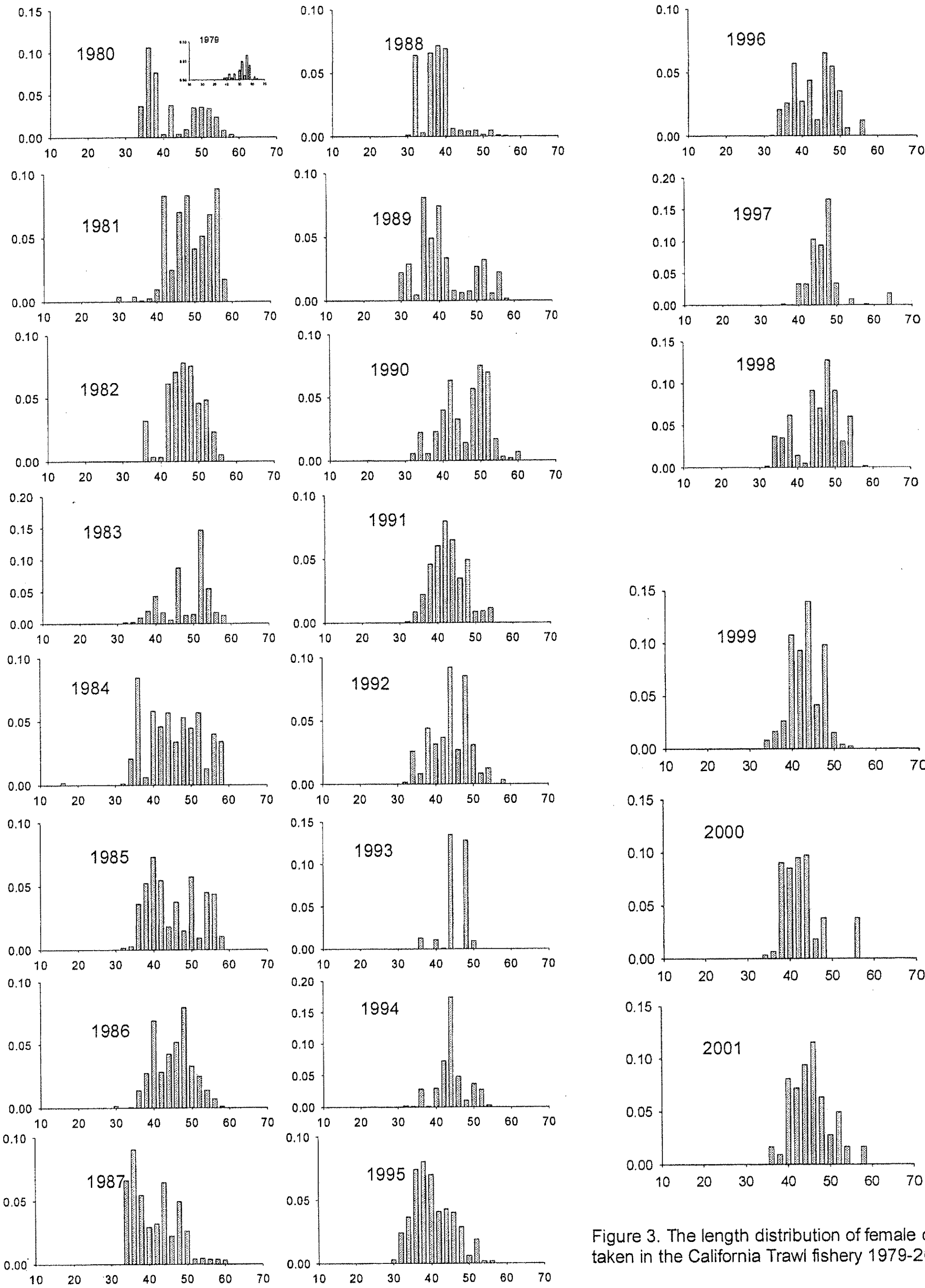


Figure 3. The length distribution of female canary taken in the California Trawl fishery 1979-2001.

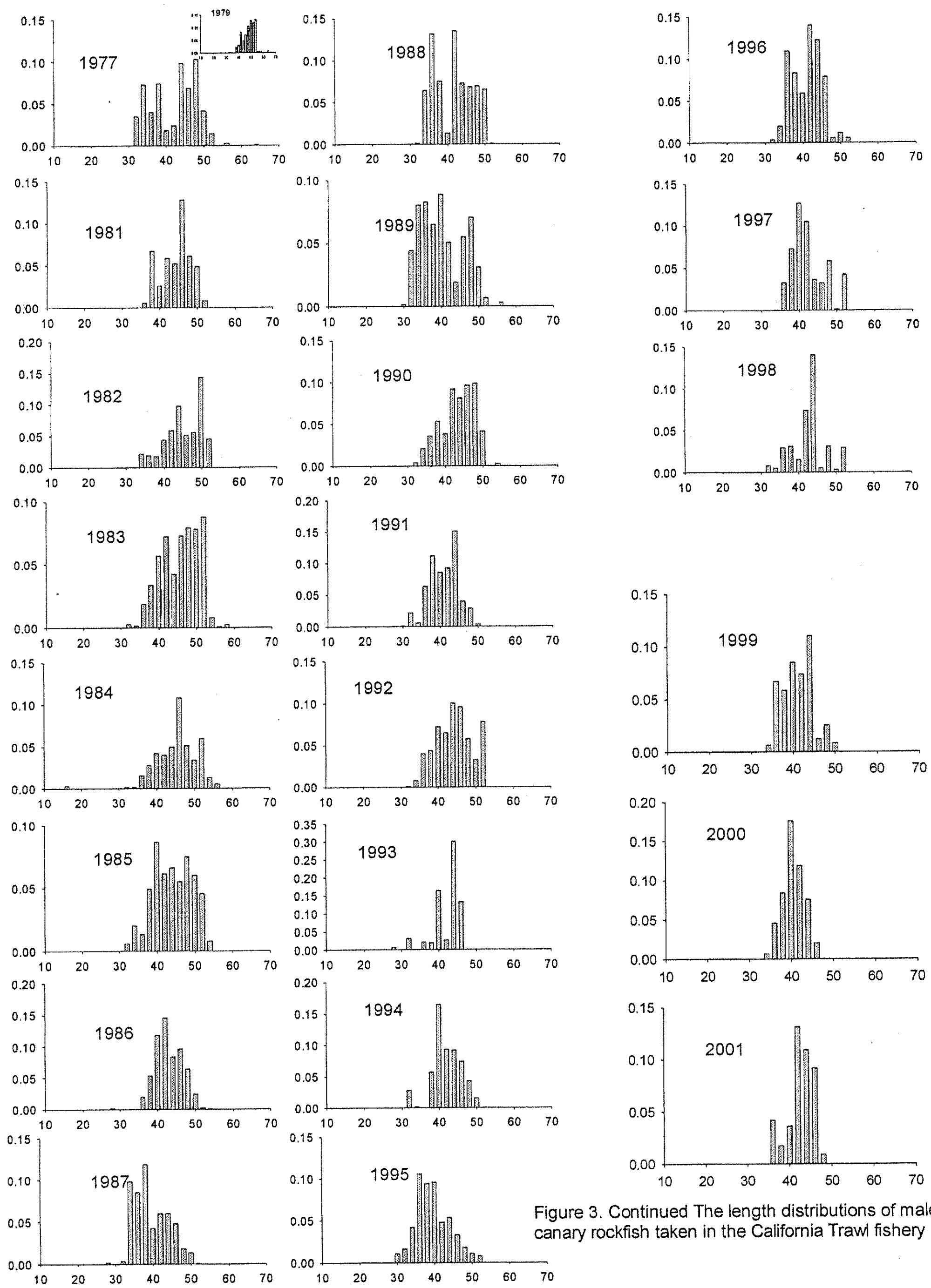


Figure 3. Continued The length distributions of male canary rockfish taken in the California Trawl fishery 1980-2001.

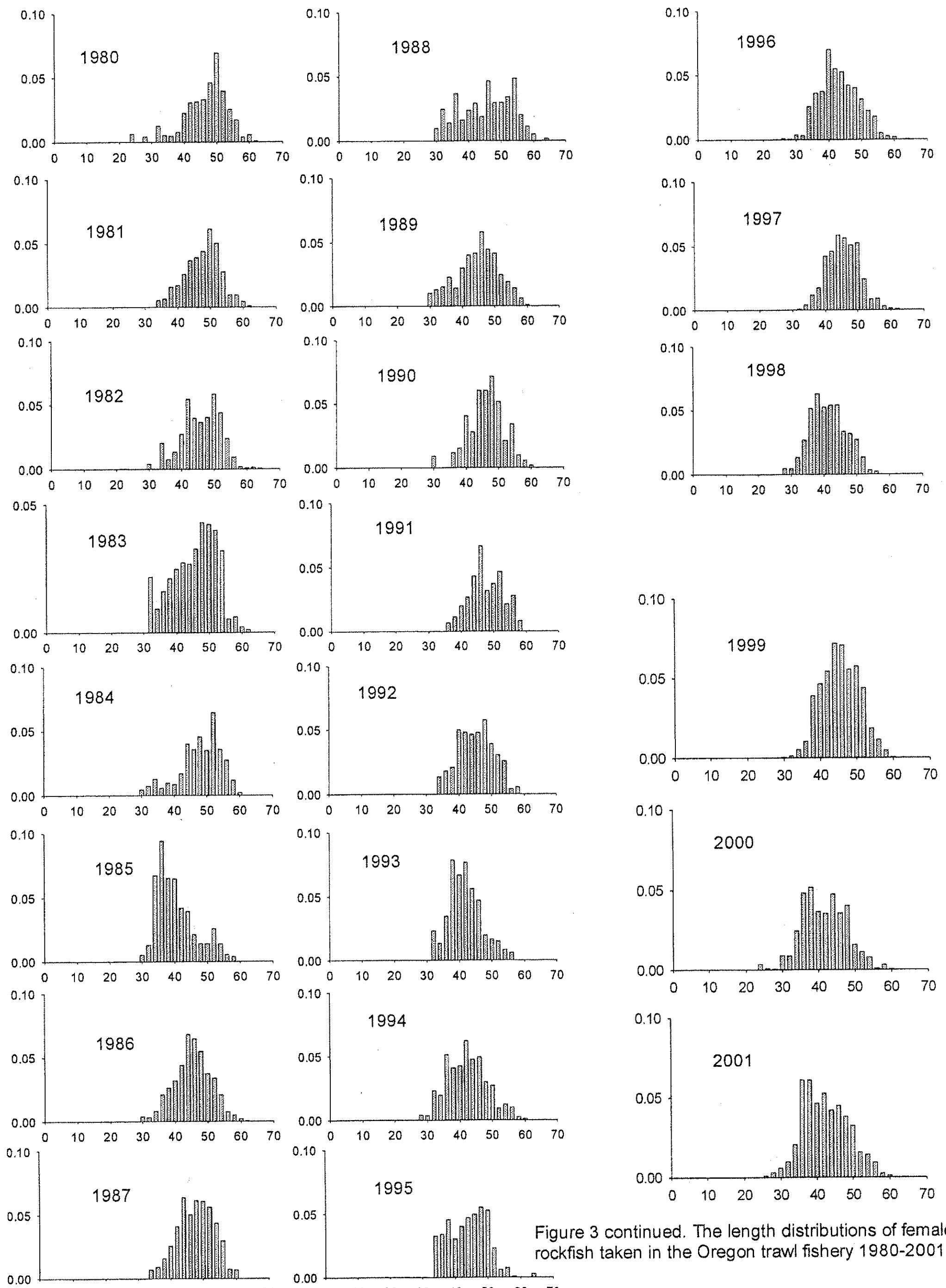


Figure 3 continued. The length distributions of female canary rockfish taken in the Oregon trawl fishery 1980-2001.

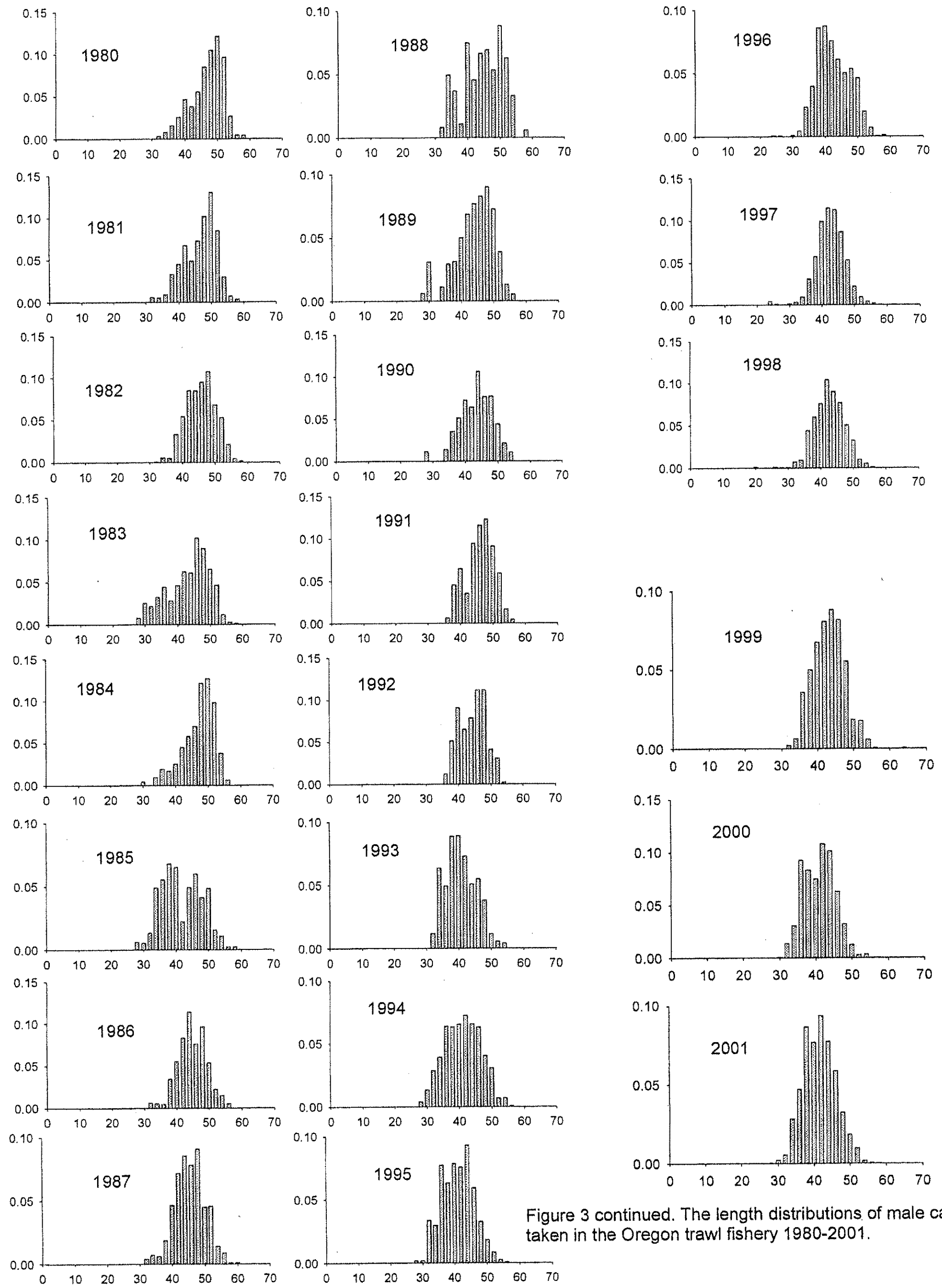


Figure 3 continued. The length distributions of male canary rockfish taken in the Oregon trawl fishery 1980-2001.

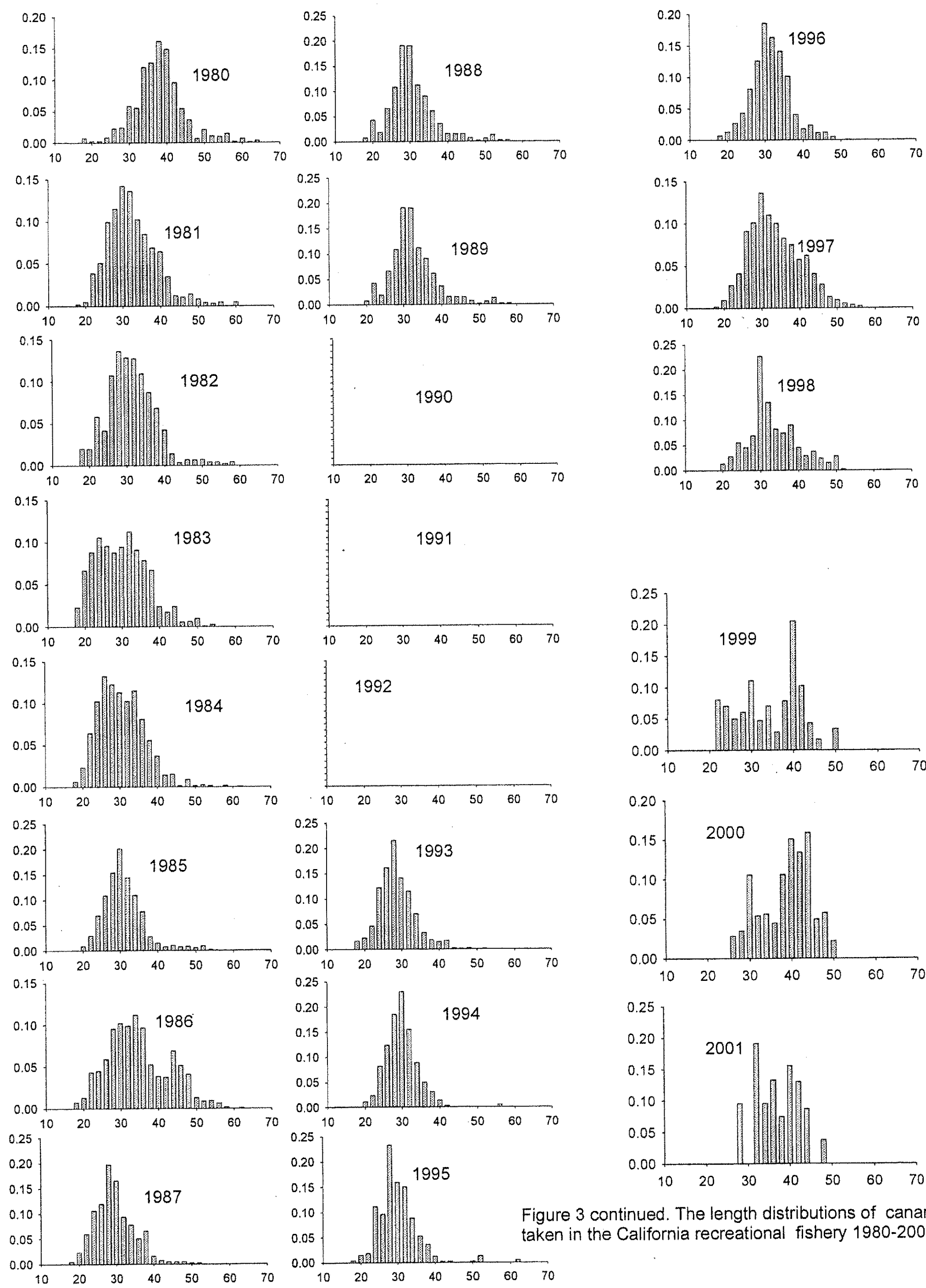
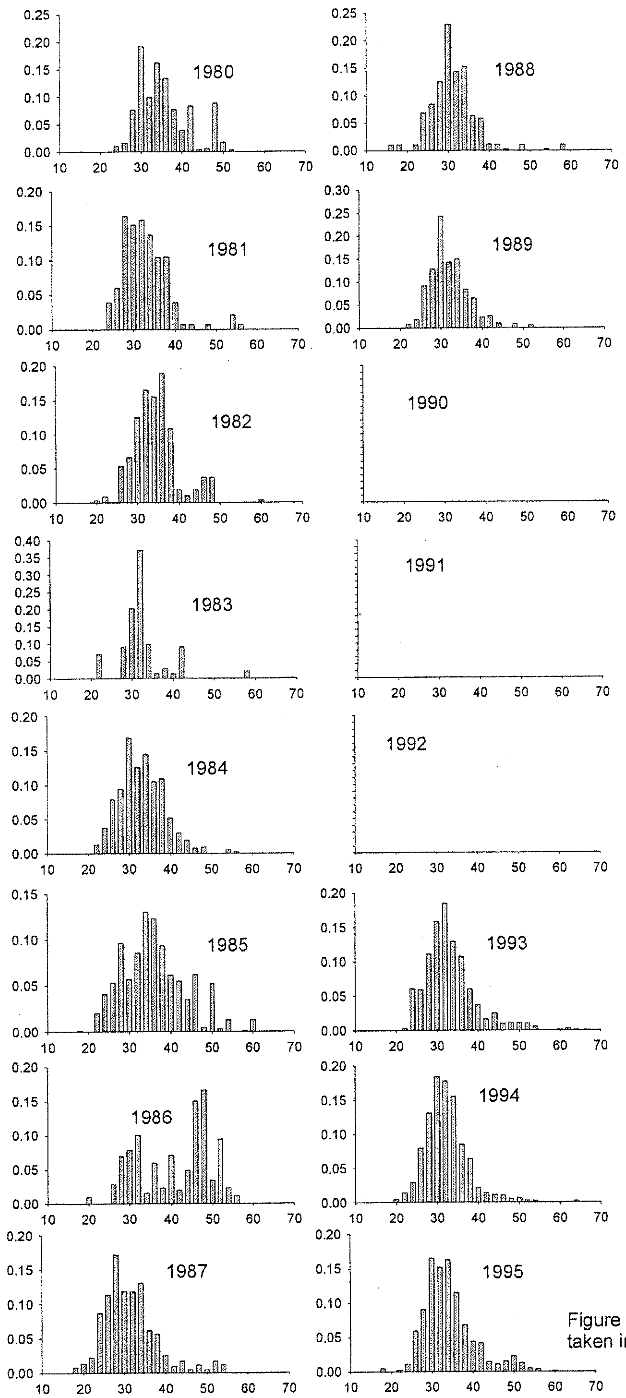


Figure 3 continued. The length distributions of canary rockfish taken in the California recreational fishery 1980-2001.



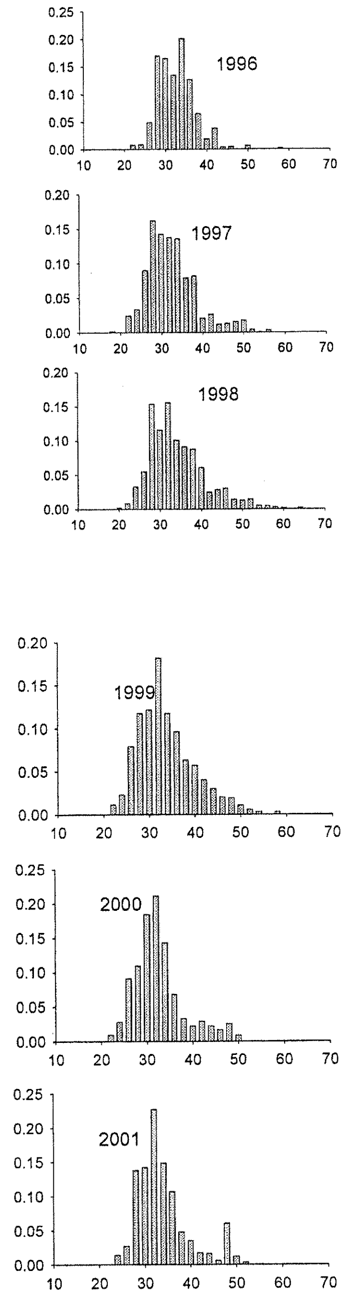


Figure 3 continued. The length distributions of canary rockfish taken in the Oregon recreational fishery 1980-2001.

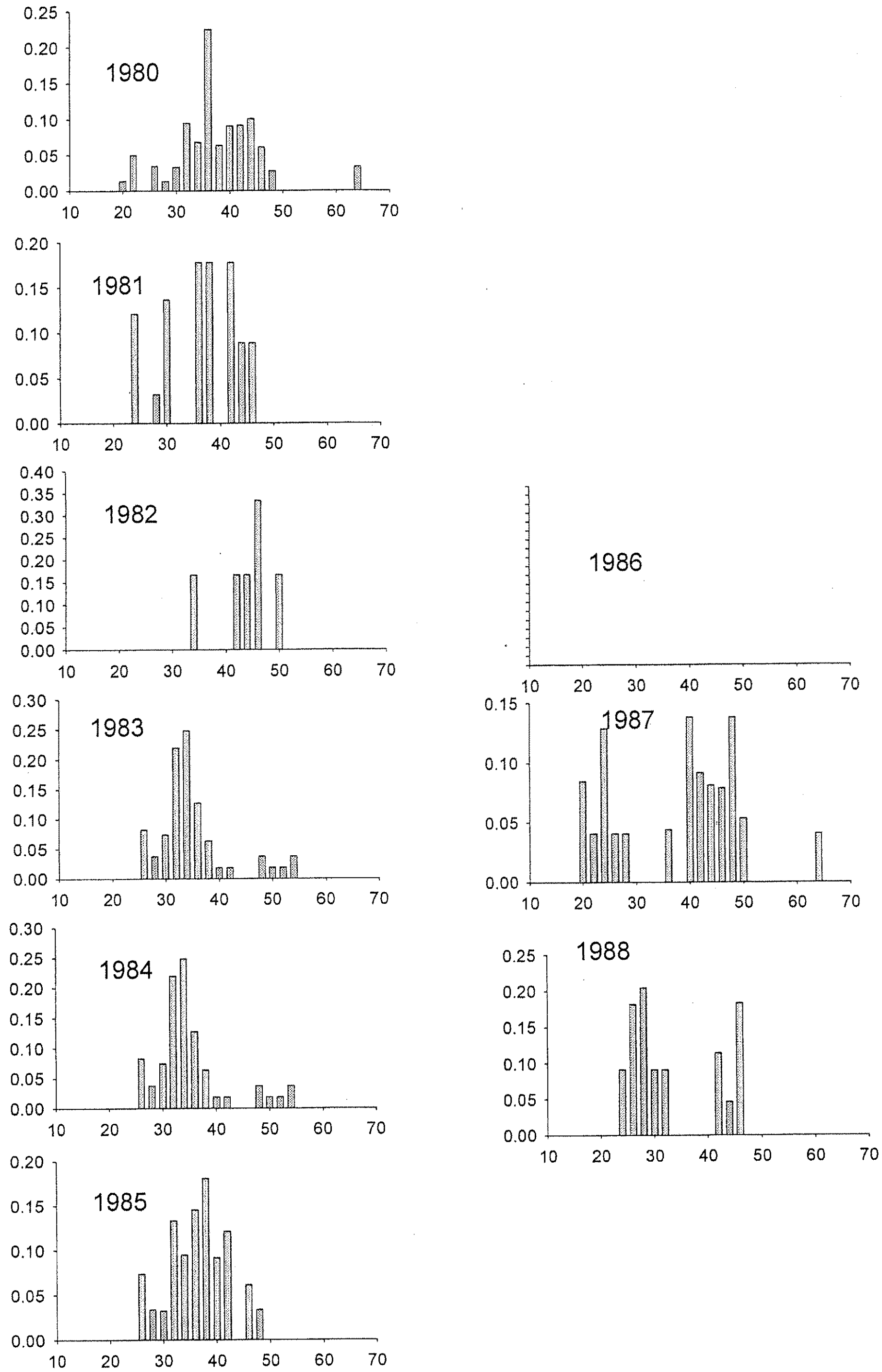


Figure 3 continued. The length distributions of canary rockfish taken in the Washington recreational fishery 1980-2001.

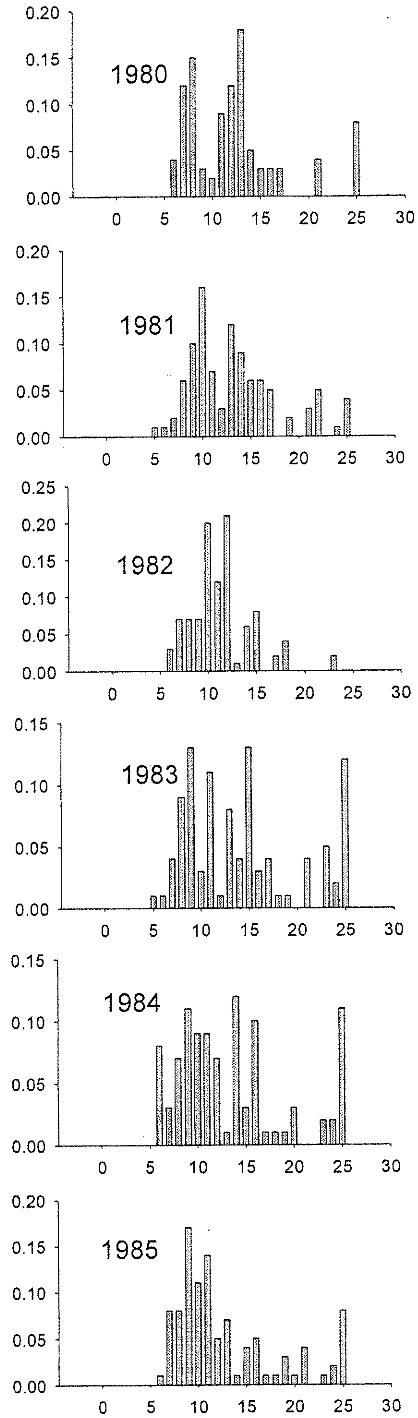


Figure 4. The age compositions of the female canary rockfish taken in the California commercial trawl fishery 1980-1985.

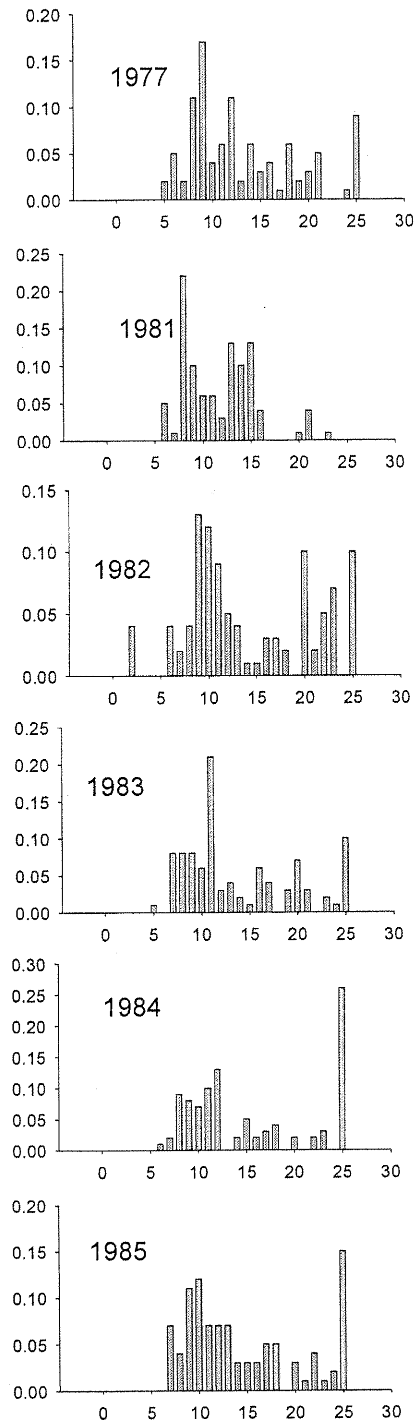


Figure 4 continued. The age distributions of male canary rockfish taken in the California trawl fishery 1980-1985.

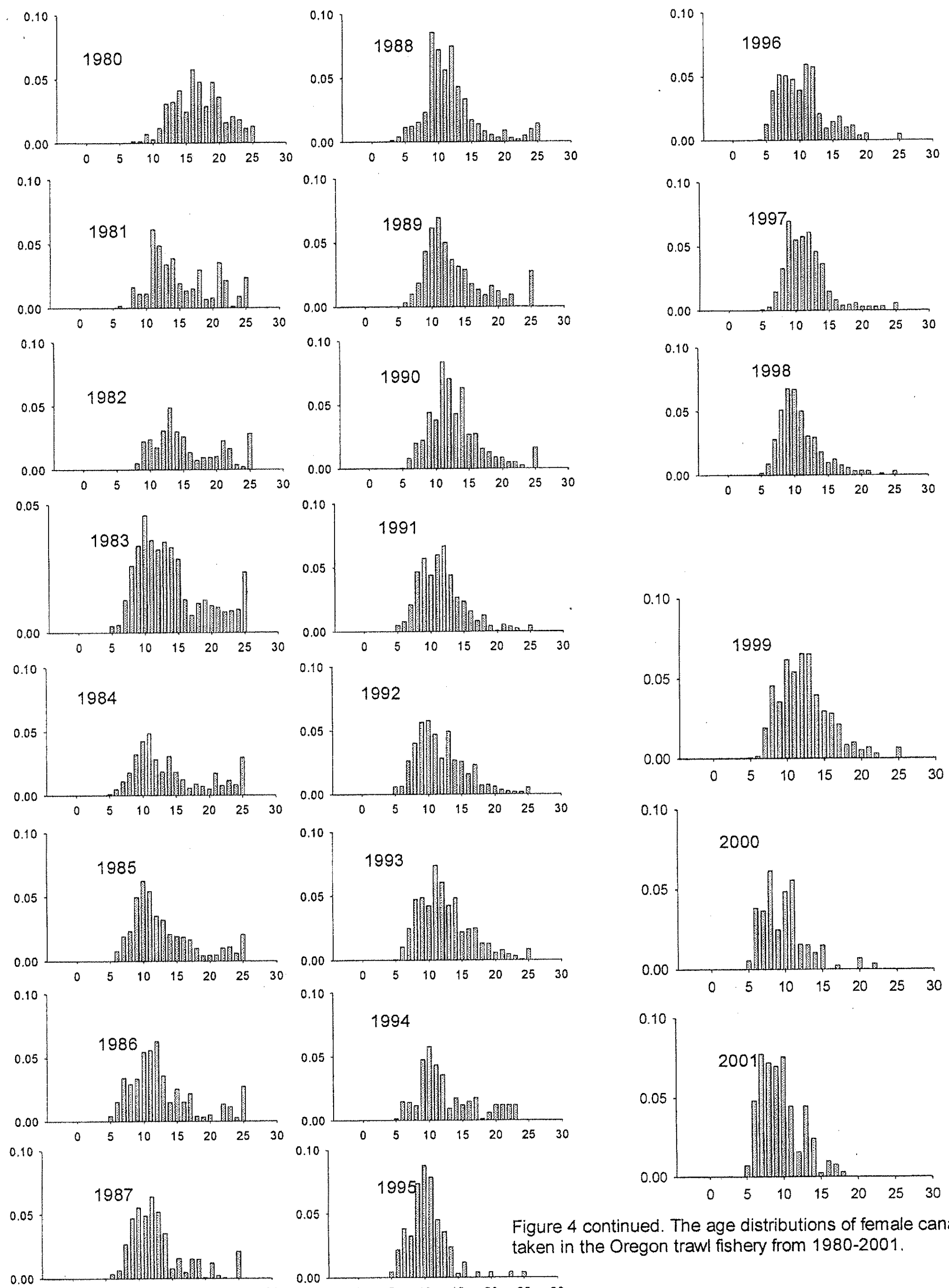
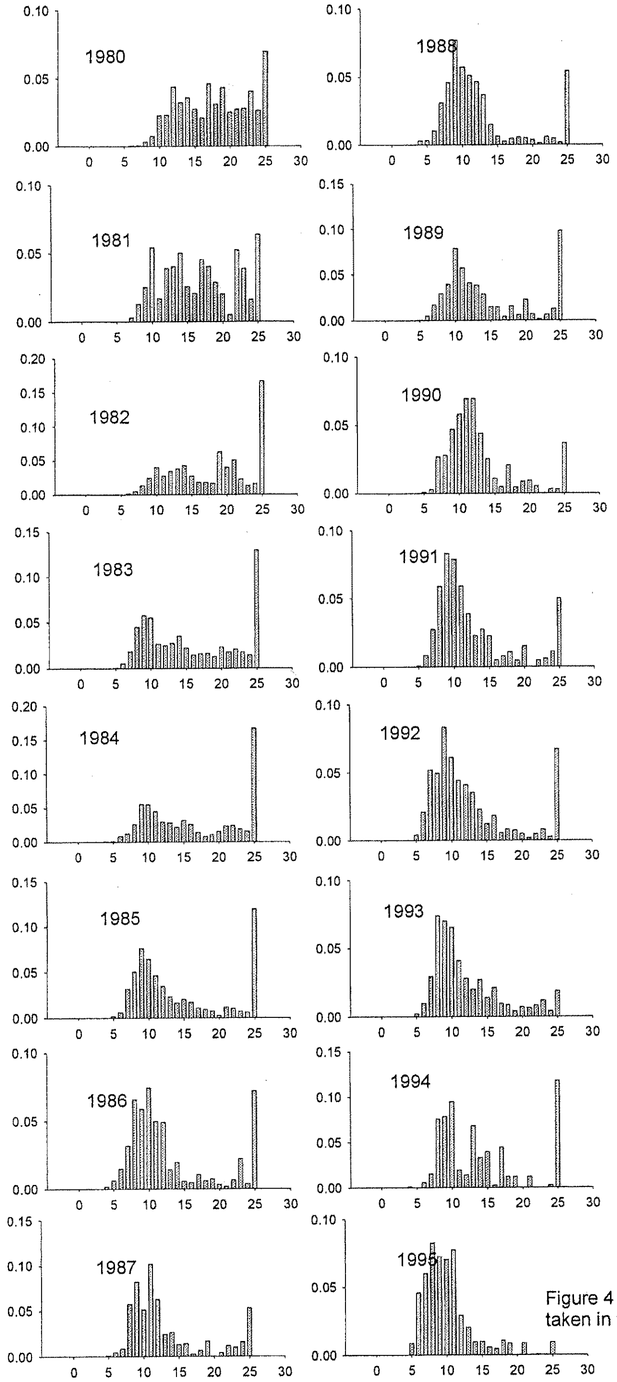


Figure 4 continued. The age distributions of female canary rockfish taken in the Oregon trawl fishery from 1980-2001.



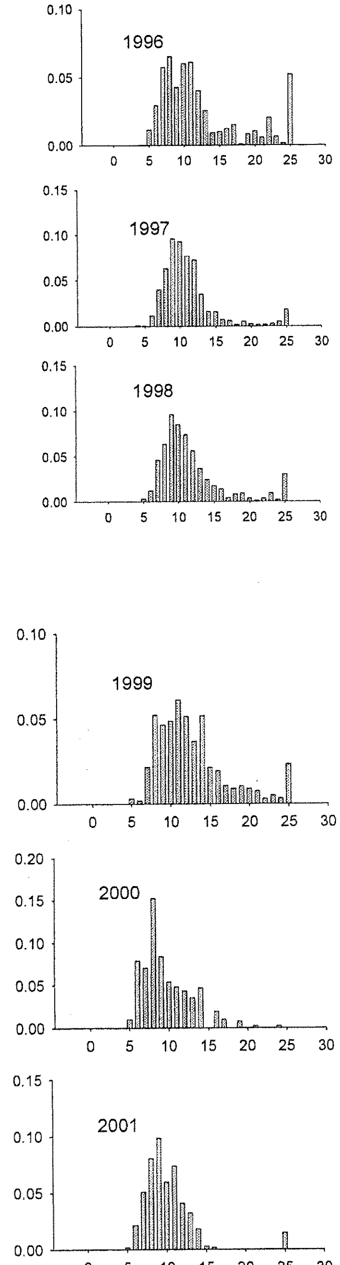
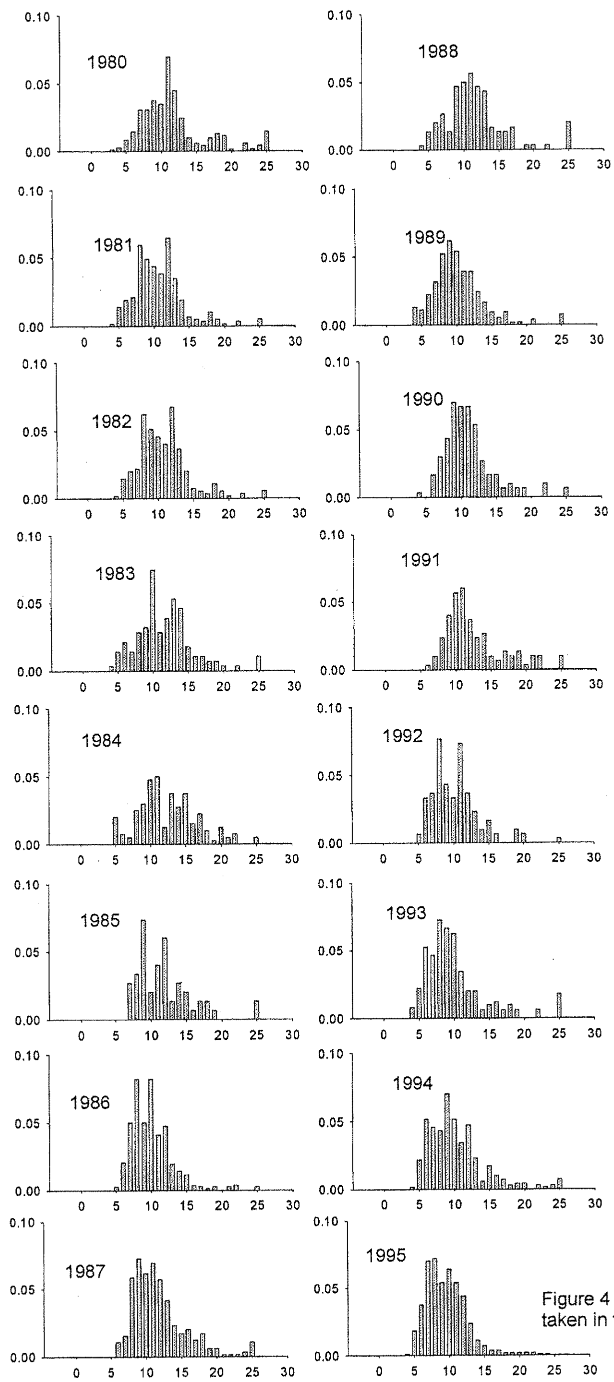


Figure 4 continued. The age distributions of male canary rockfish taken in the Oregon trawl fishery 1980-2001.



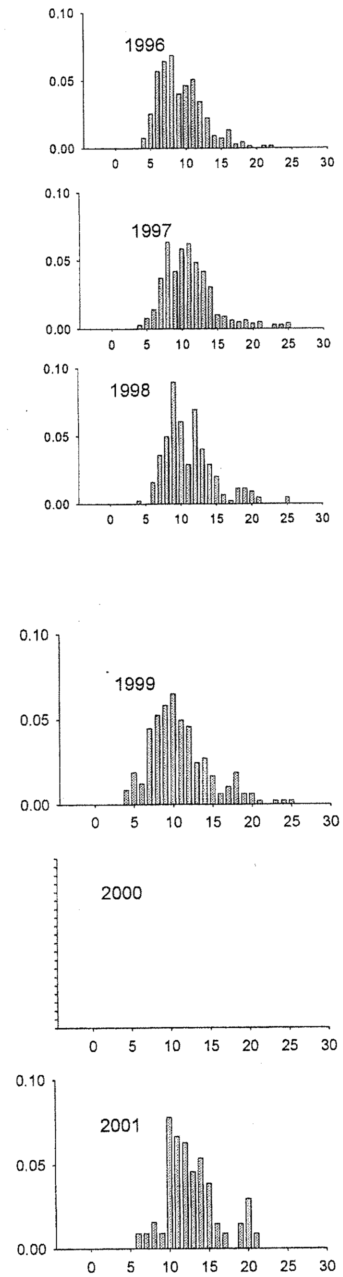


Figure 4 continued. The age distributions of female canary rockfish taken in the Washington trawl fishery 1980-2001.

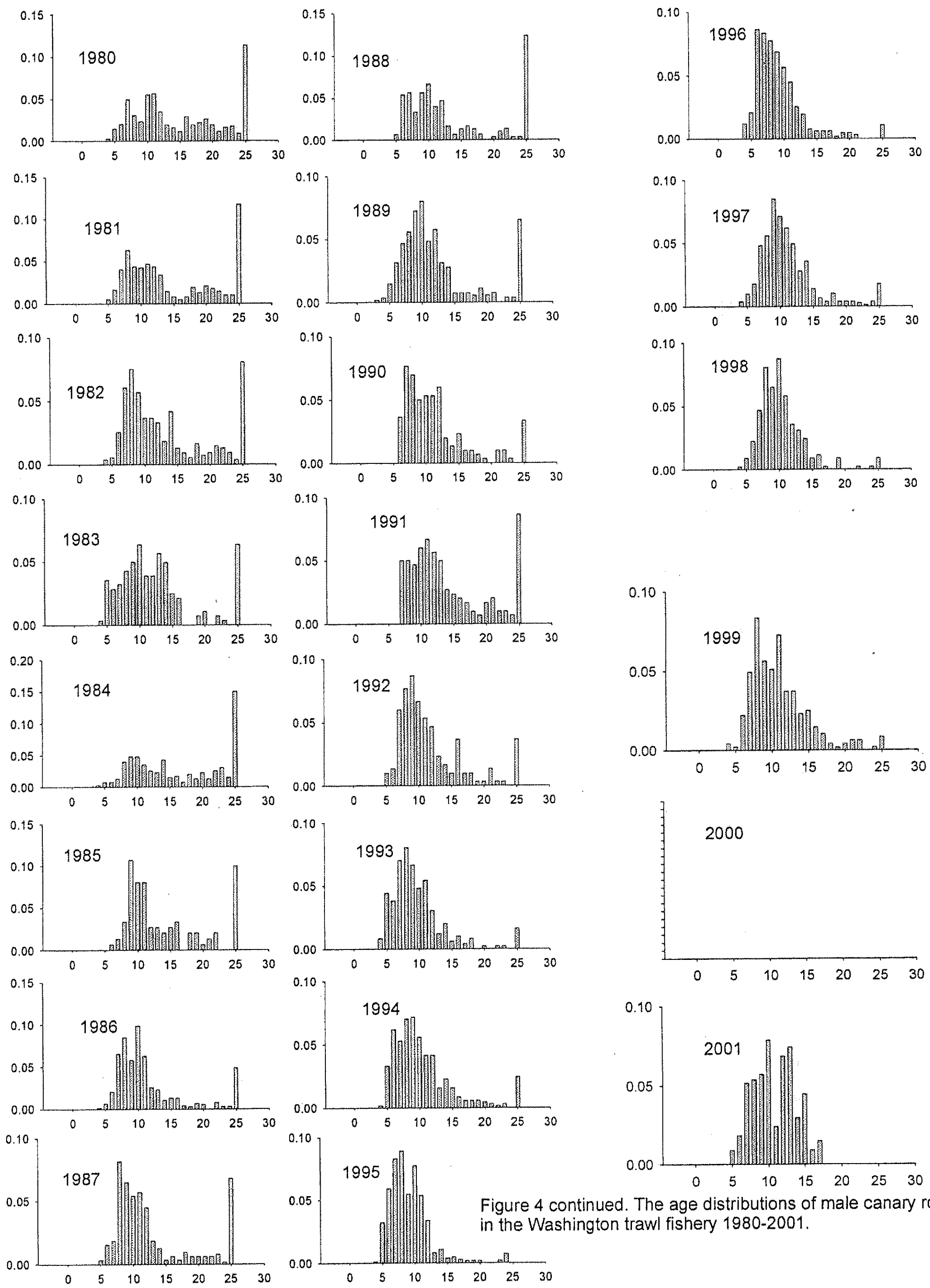


Figure 4 continued. The age distributions of male canary rockfish taken in the Washington trawl fishery 1980-2001.

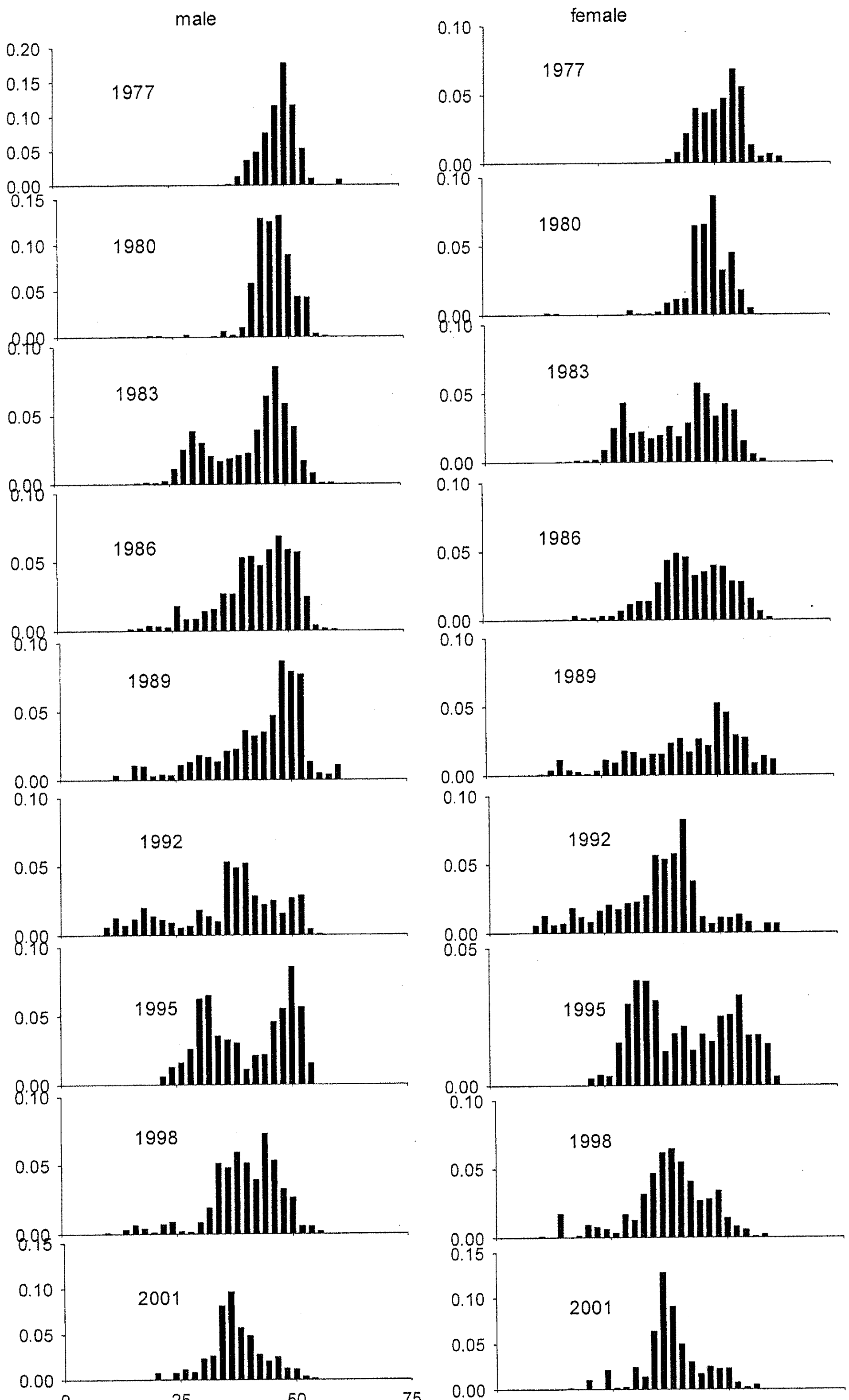


Figure 5 . The proportion-at-length of male and female canary rockfish taken in the shelf survey by year from 1977-2001.

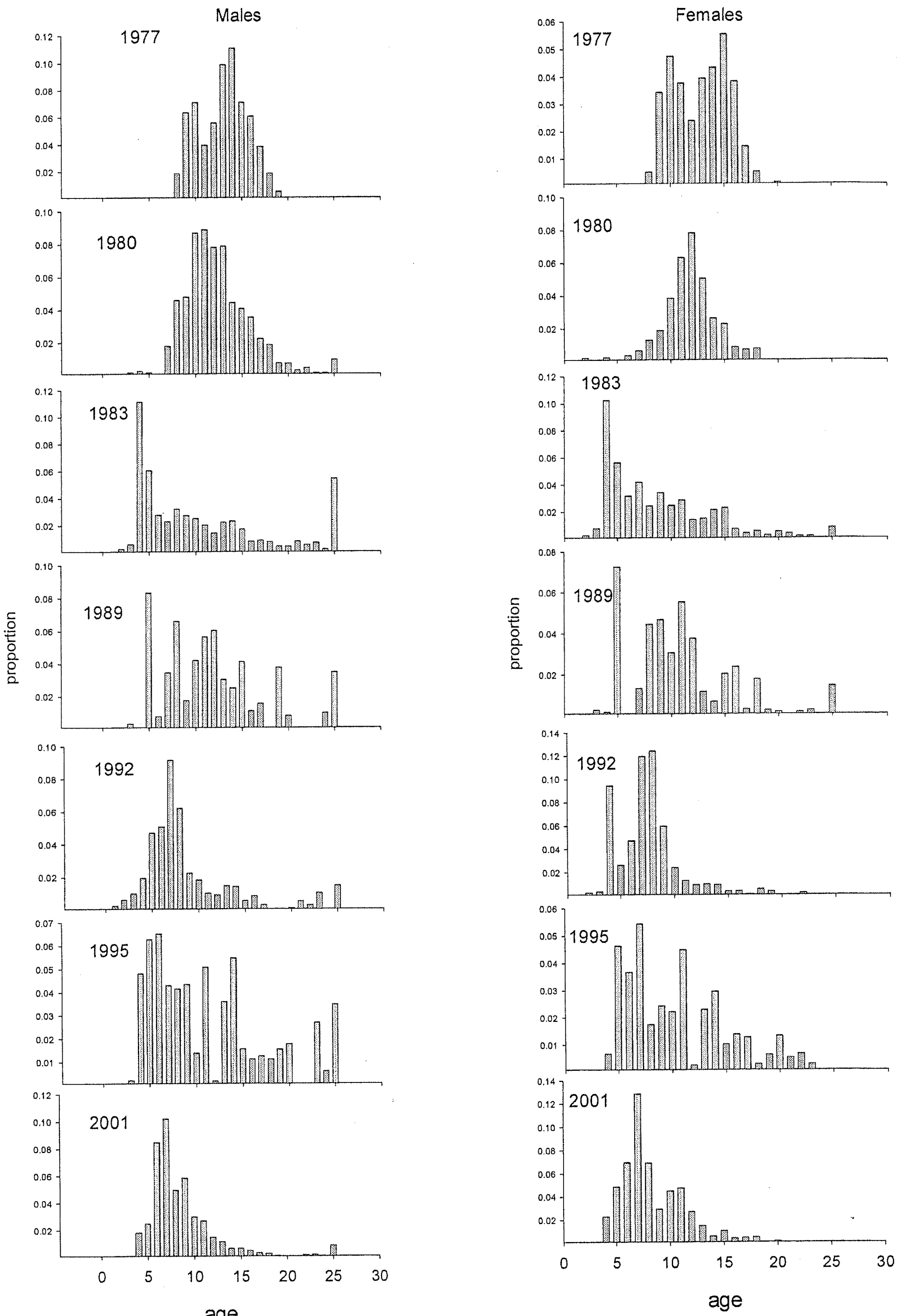


Figure 6. Canary rockfish age distributions from the shelf survey by sex for the years 1977-2001.

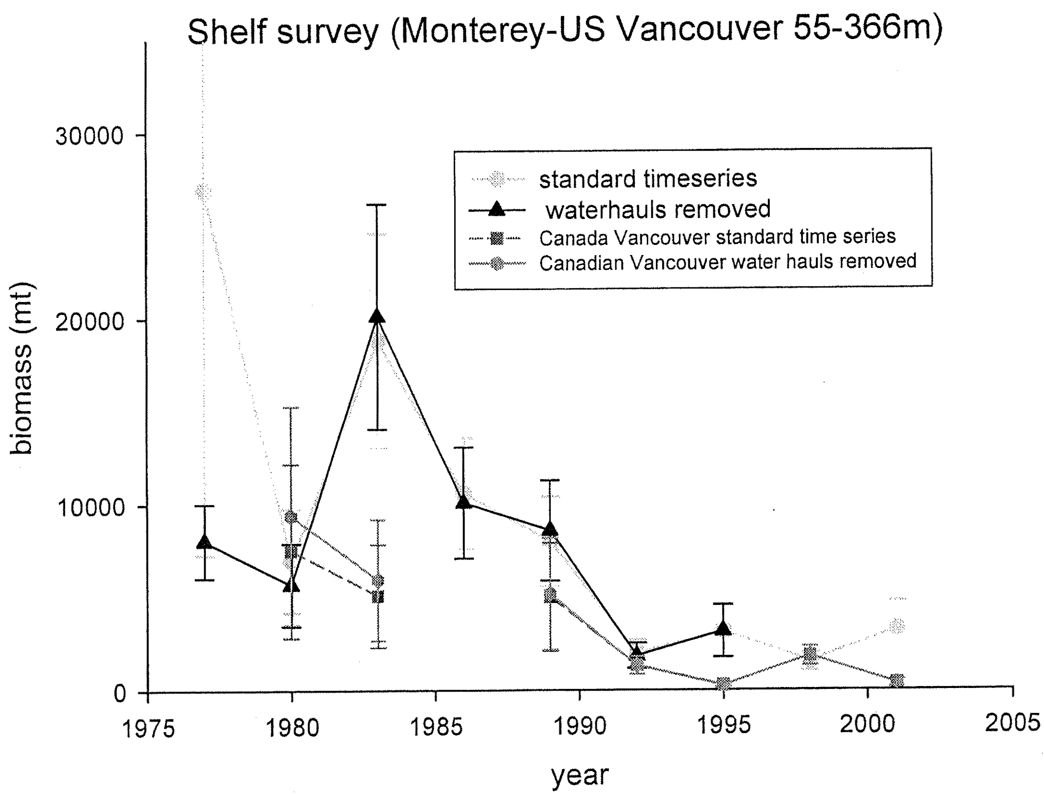


Figure 7. The estimated biomass of canary rockfish from the shelf survey 1977-2001. Time-series are given for the coastwide with and without waterhauls as well as for the Canadian Vancouver INPFC area not included in the coastwide assessment.

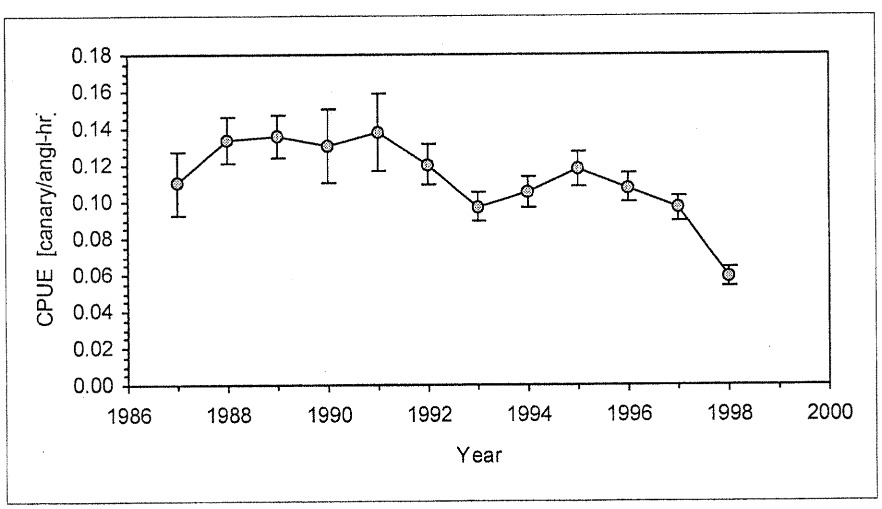


Figure 8. The estimated CPUE of canary rockfish from California commercial- party boat logbook information 1987-1998.

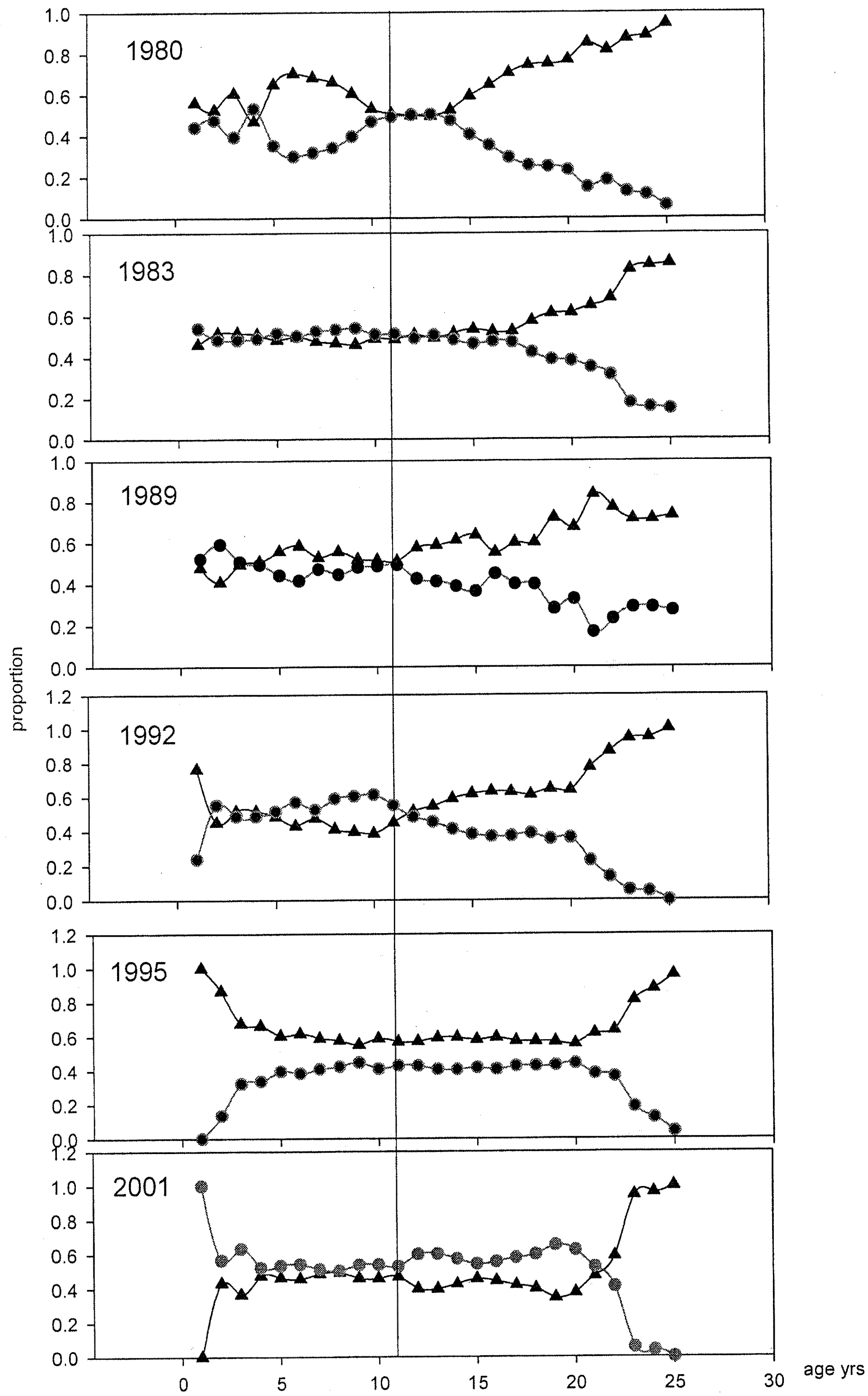


Figure 9. Proportions of each sex by age and year from the shelf survey. Female proportion is given in red circles and male proportion is given in blue triangles. Proportions are 5-year running averages.

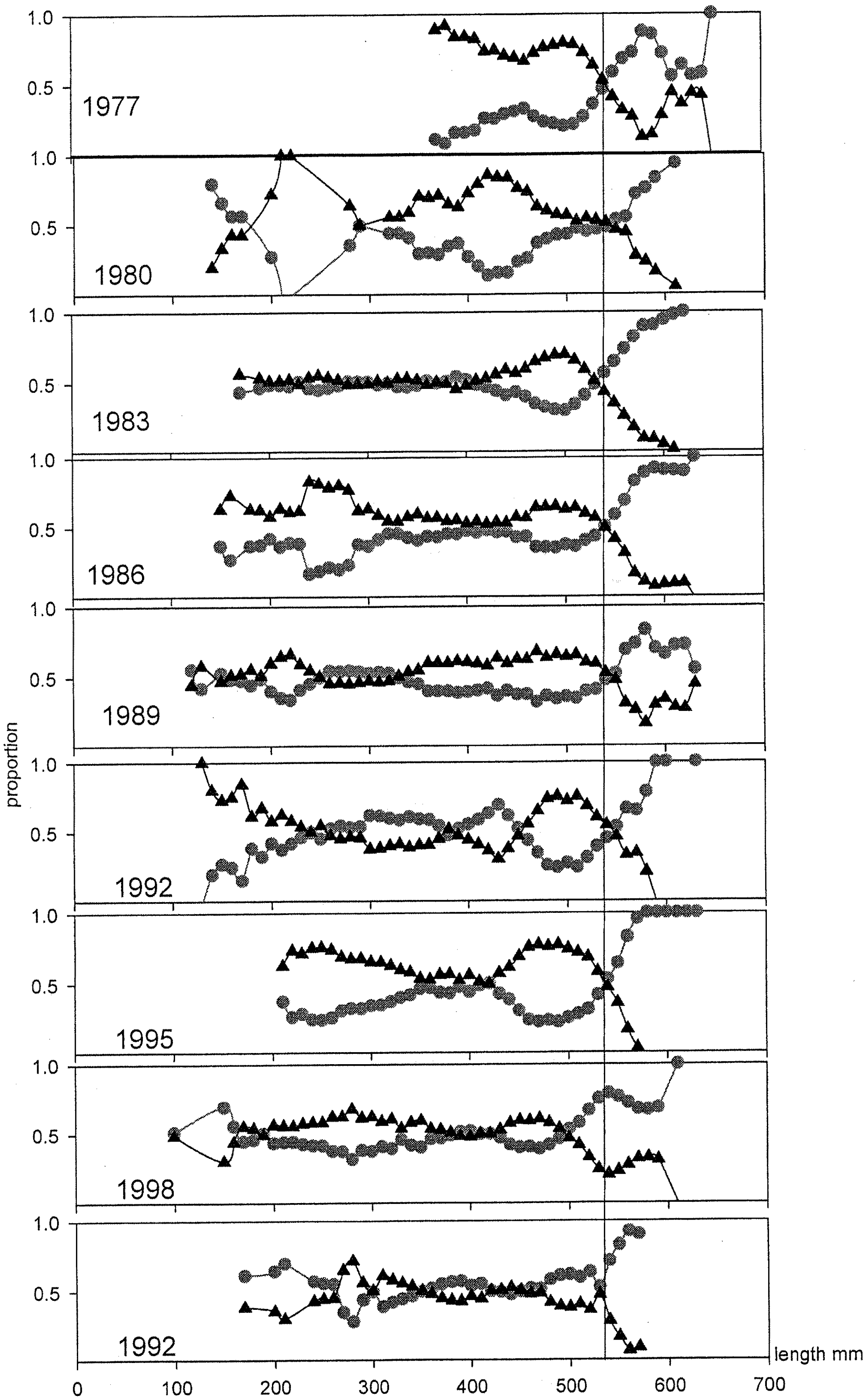


Figure 10. Sex ratio by length from the shelf survey 1977-2001. All proportions are based on a 5 year running average of numbers at length. Red circles are females and blue triangles are male proportions.

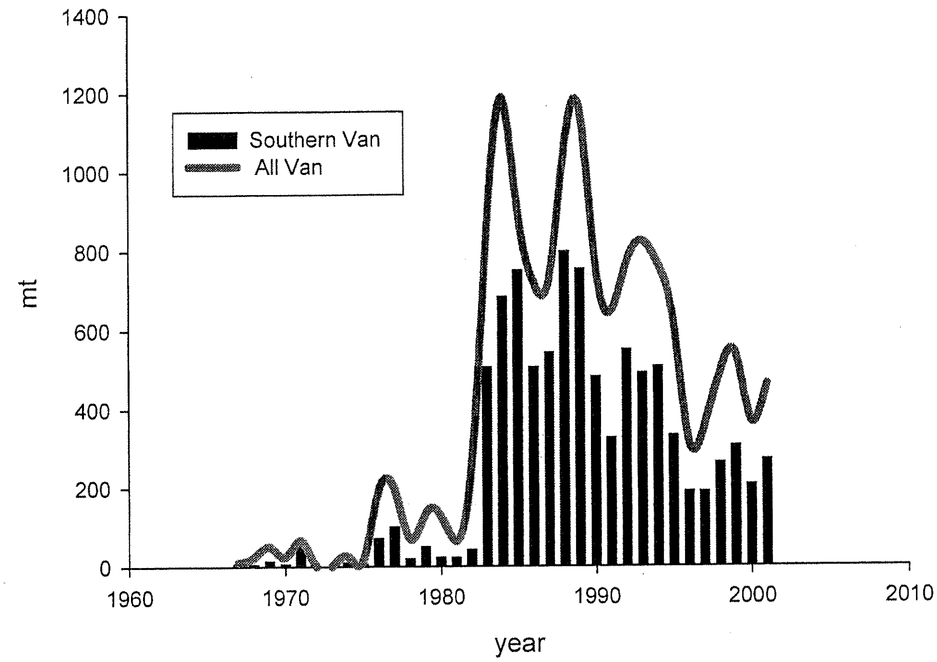


Figure 11. The Canadian catch of canary rockfish from waters off of southern Vancouver Island and from waters off all Vancouver Island from 1967-2001.

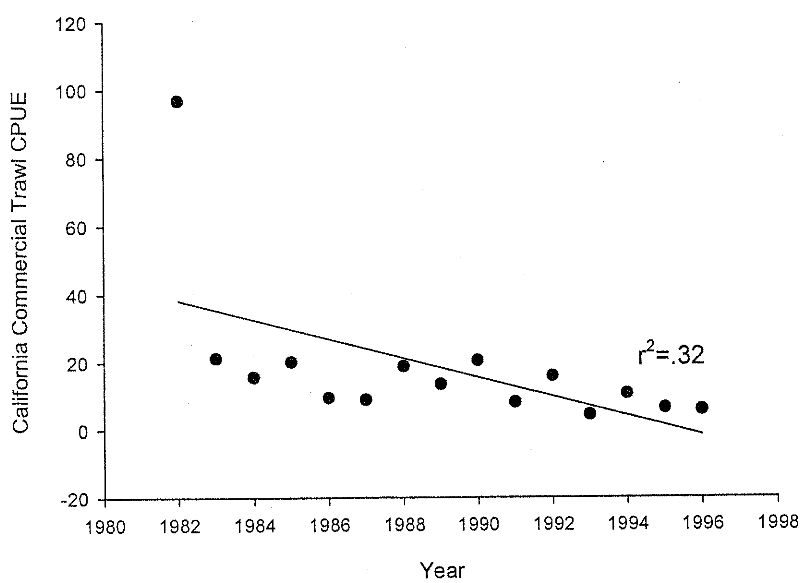


Figure 12. The estimated California commercial trawl CPUE from 1982-1996.

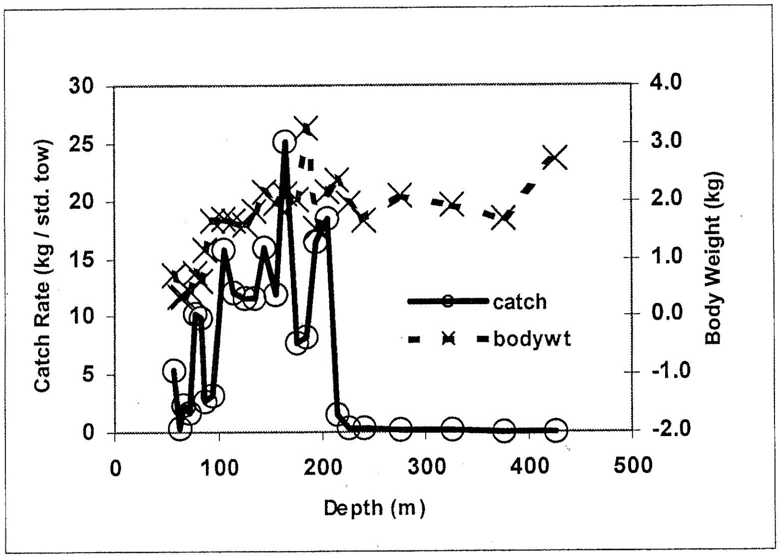


Figure 13. Plot of the mean body weight and catch of canary rockfish from the shelf survey (1977-2001) by depth.

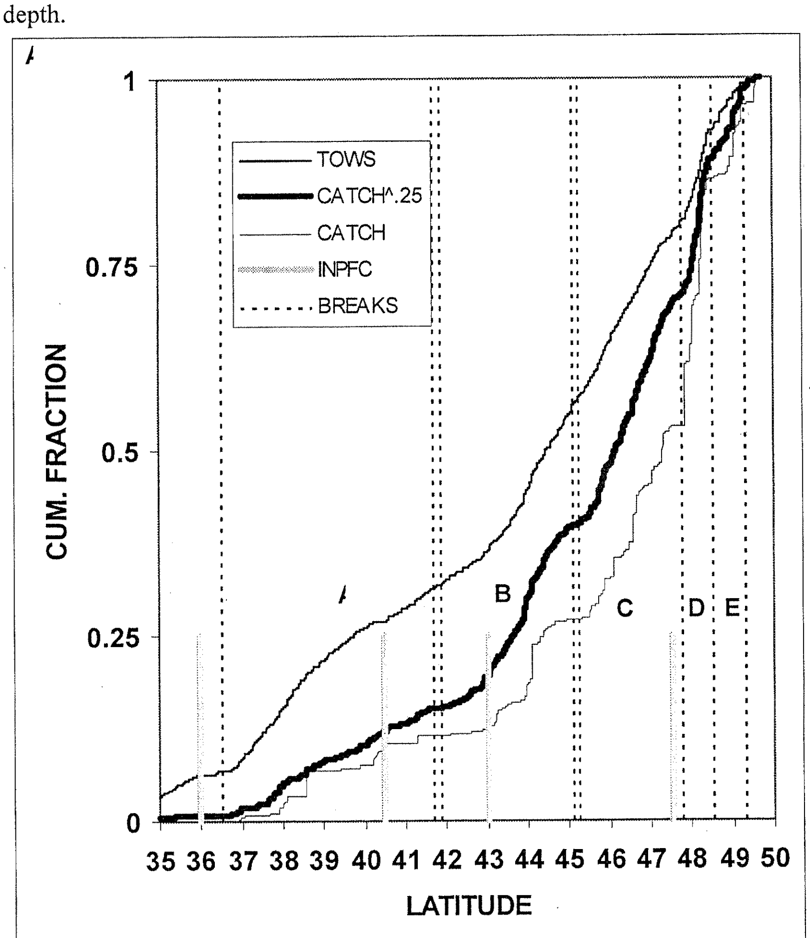


Figure 14. Plots of the cumulative proportion of canary rockfish catch from the shelf survey (1977-2001) by latitude. Vertical bars represent the boundaries between the INPC areas.

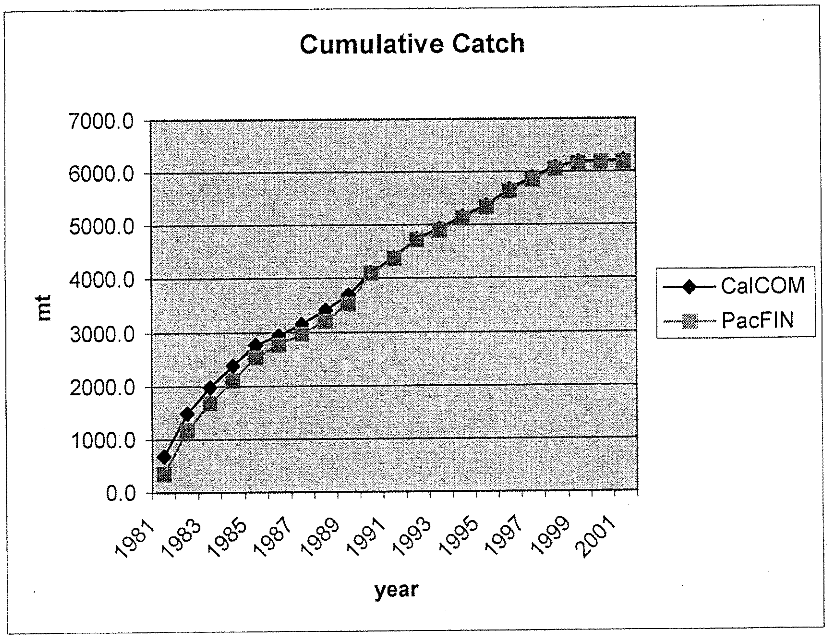


Figure 15. A plot of the cumulative estimated catch of all gears from California from both the CalCOM and PacFIN databases. The plots show nearly identical catch histories.

Figure 16. Time series of female spawning biomass from the 1996, 1999 and preliminary current assessment. See Table 10 for run descriptions.

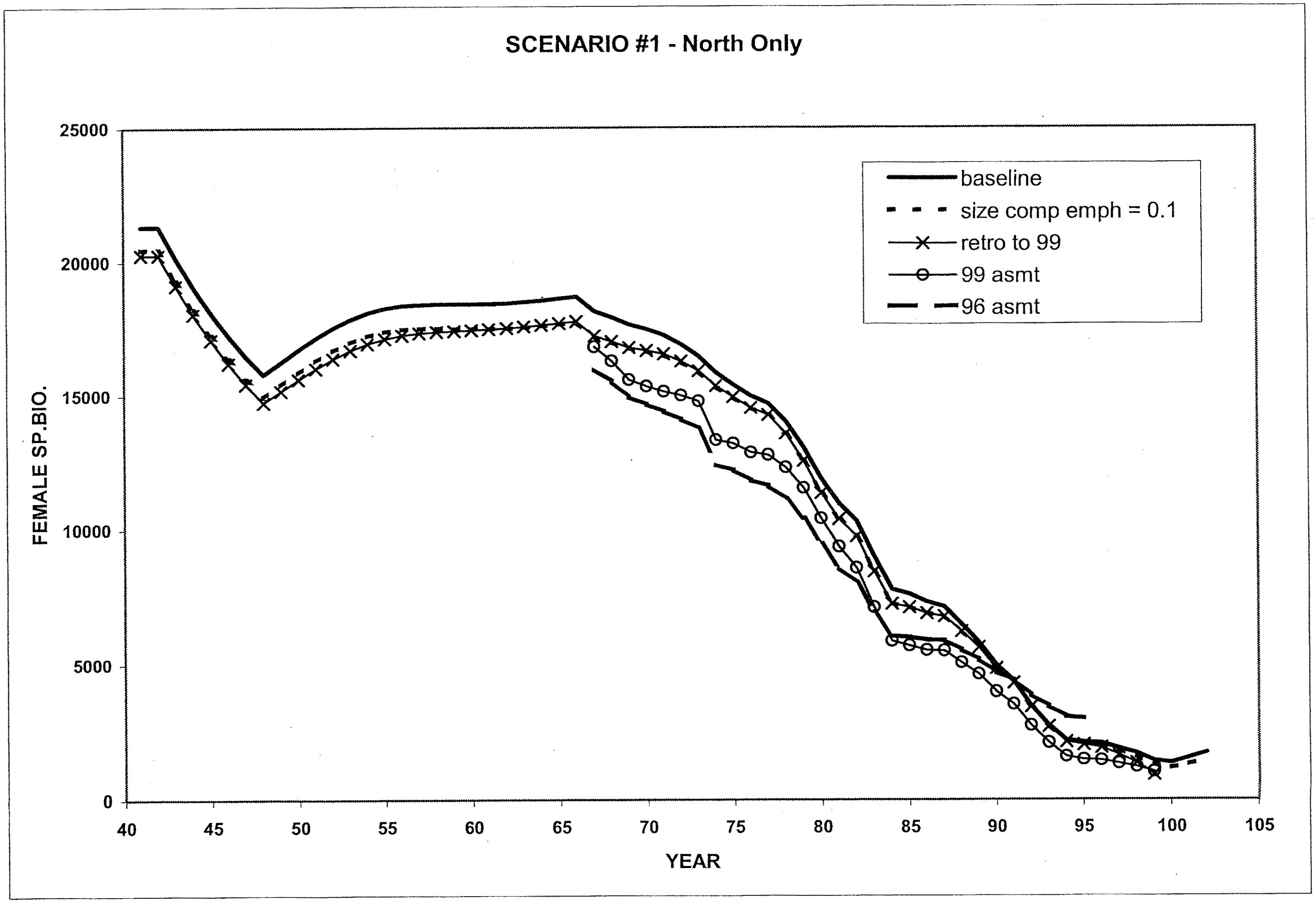


Figure 17. Time series of recruitment estimated in Scenario 1 by the 1999 assessment, and in the current Scenario 1 with size comp de-emphasized (Run 2).

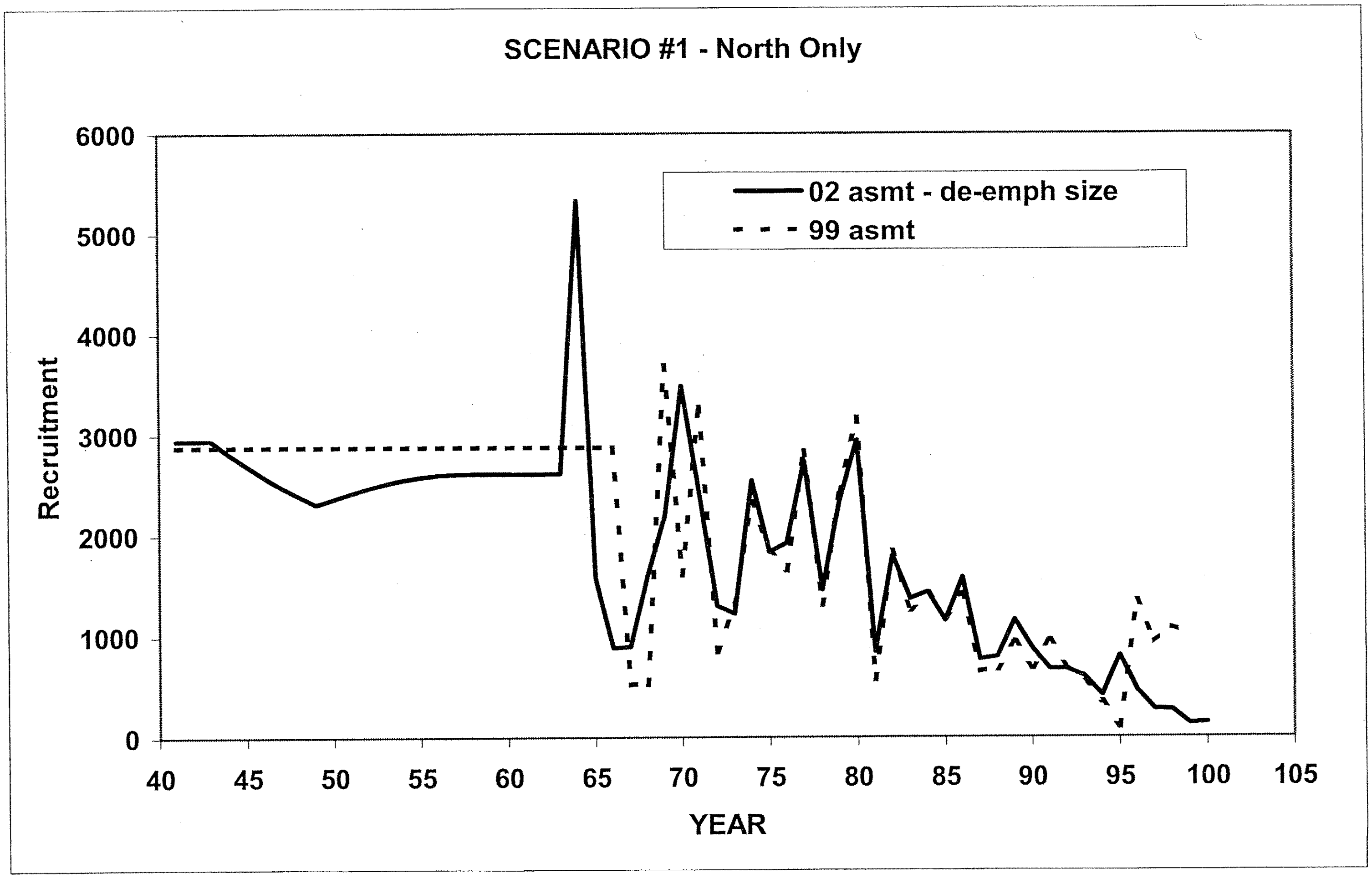


Figure 18. Time series of recruitment in the southern area as estimated in 1999 and in the current assessment.

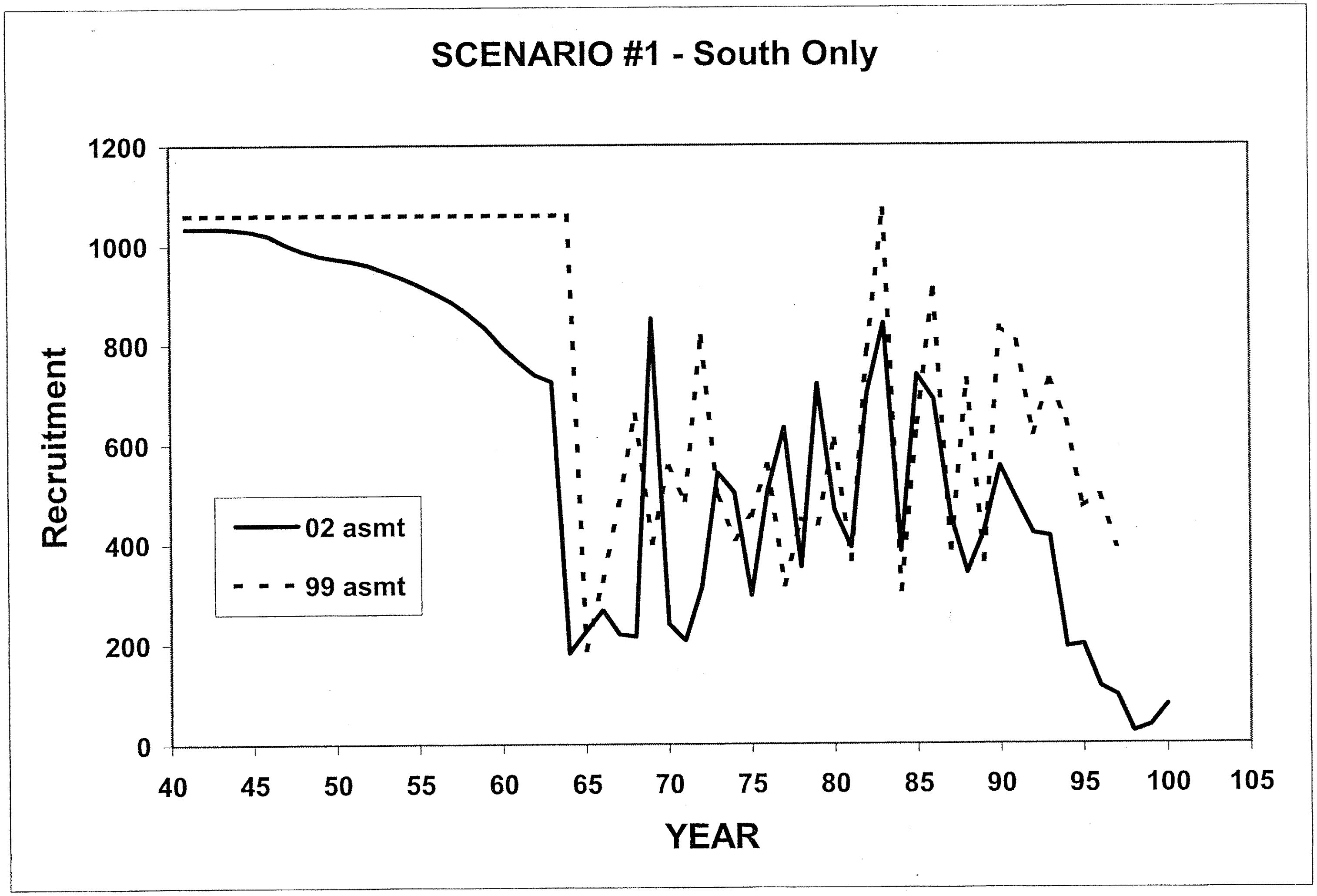


Figure 19. Time series of female spawning biomass in the southern area as estimated in 1999 and in the current assessment.

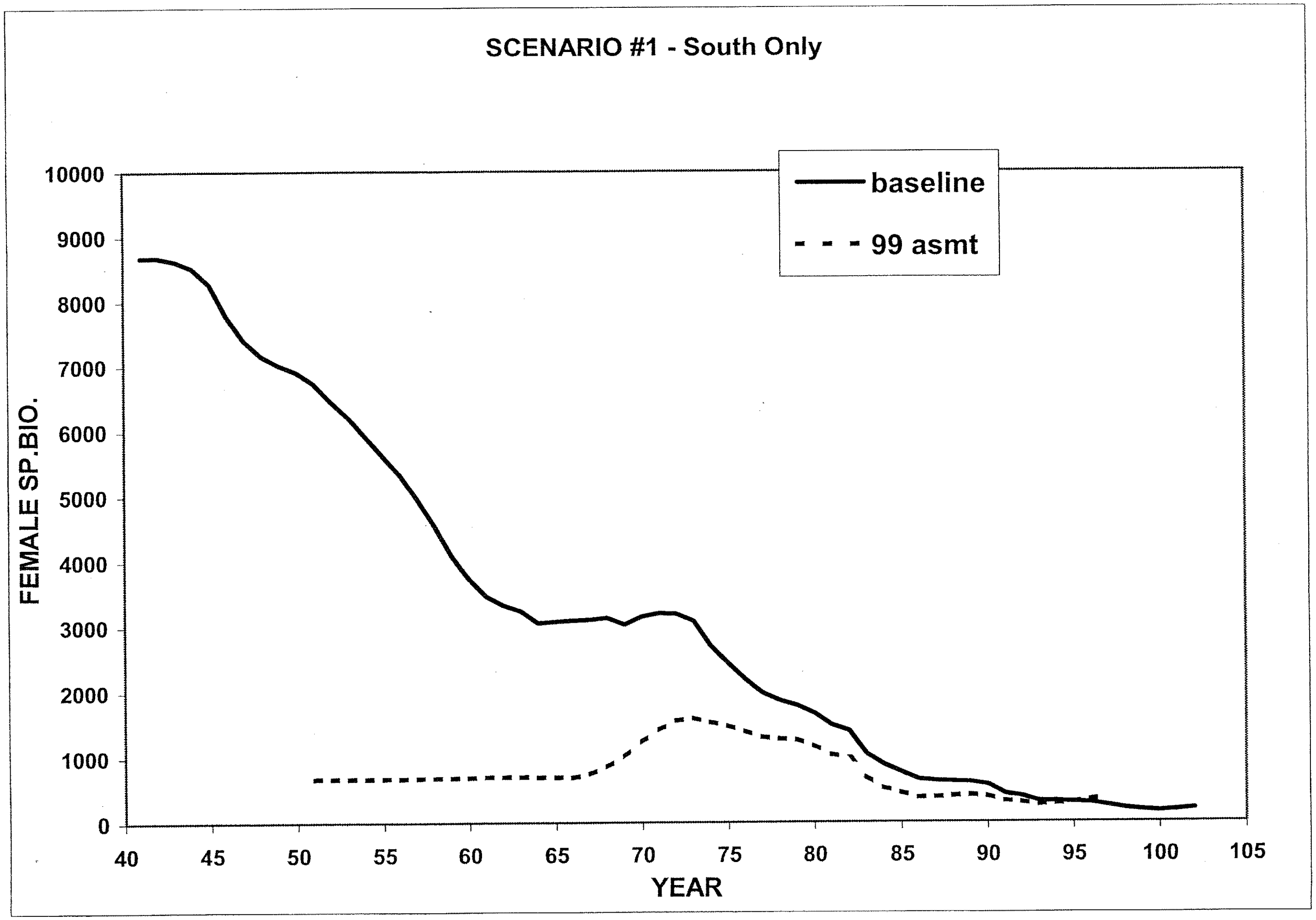


Figure 20. Time series of female spawning biomass from the coastwide model, and from adding the north and south model results.

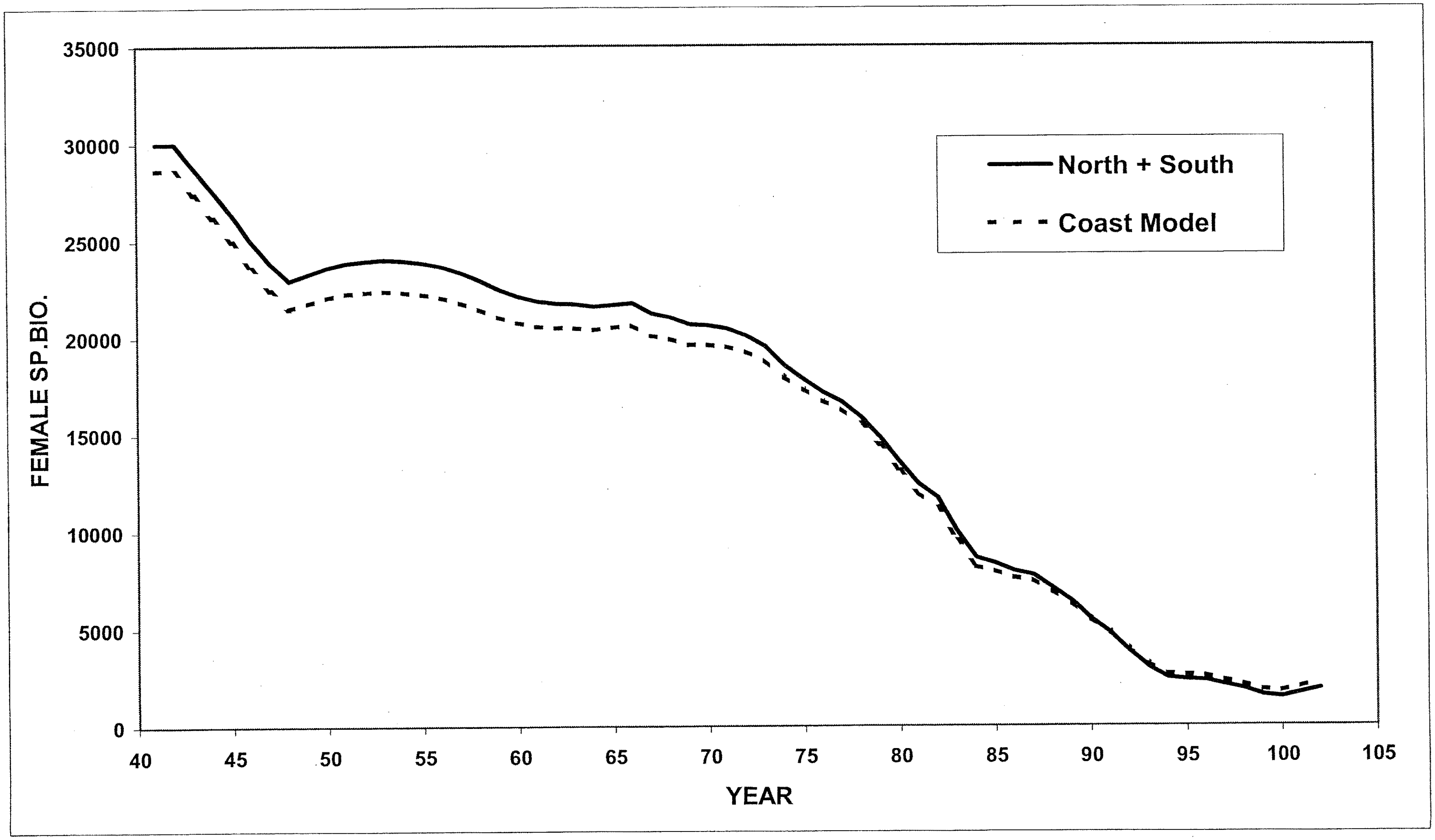


Figure 21. Observed and estimated time series of trawl survey CPUE in preliminary model runs (see Table 10)..

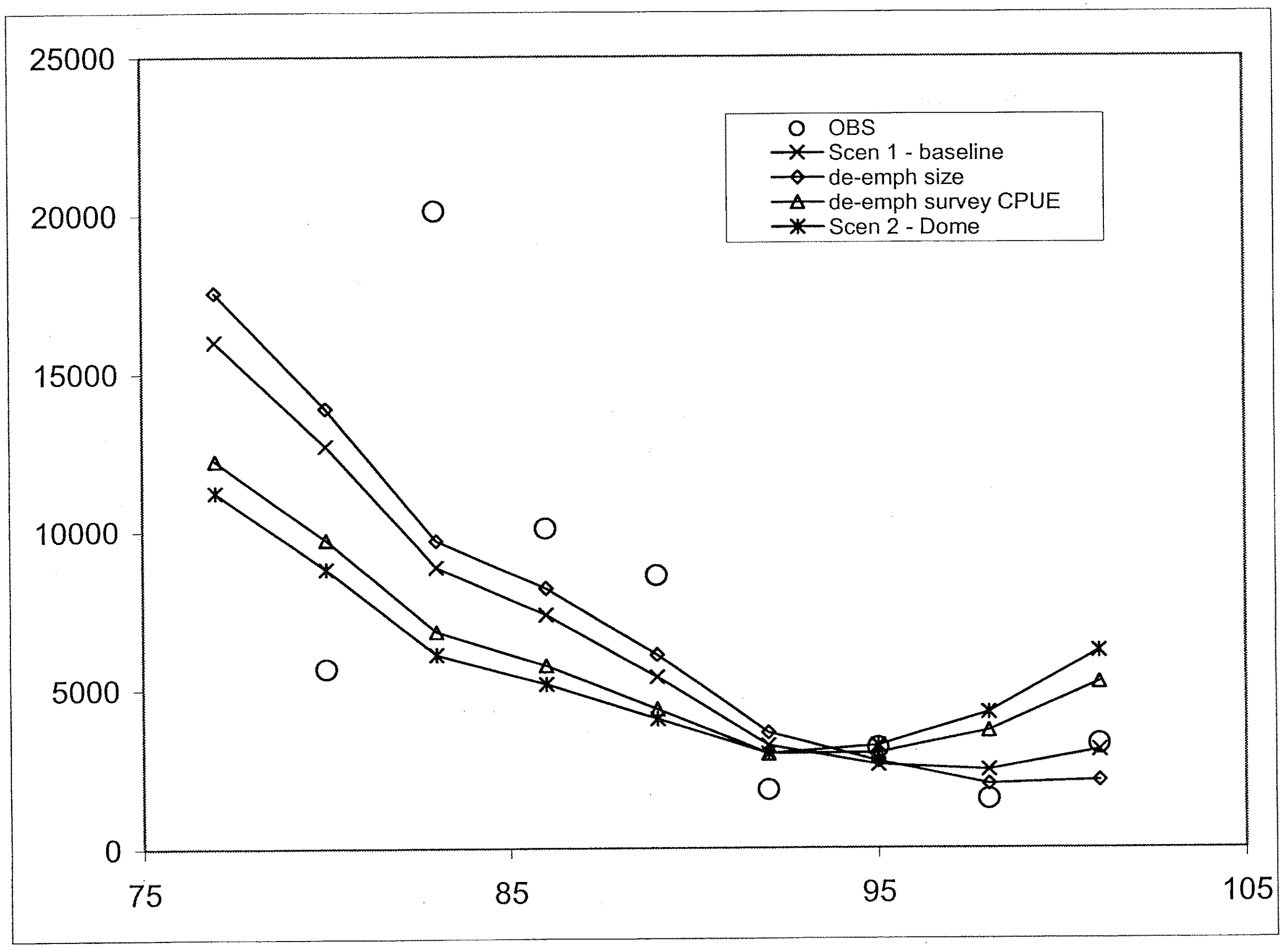
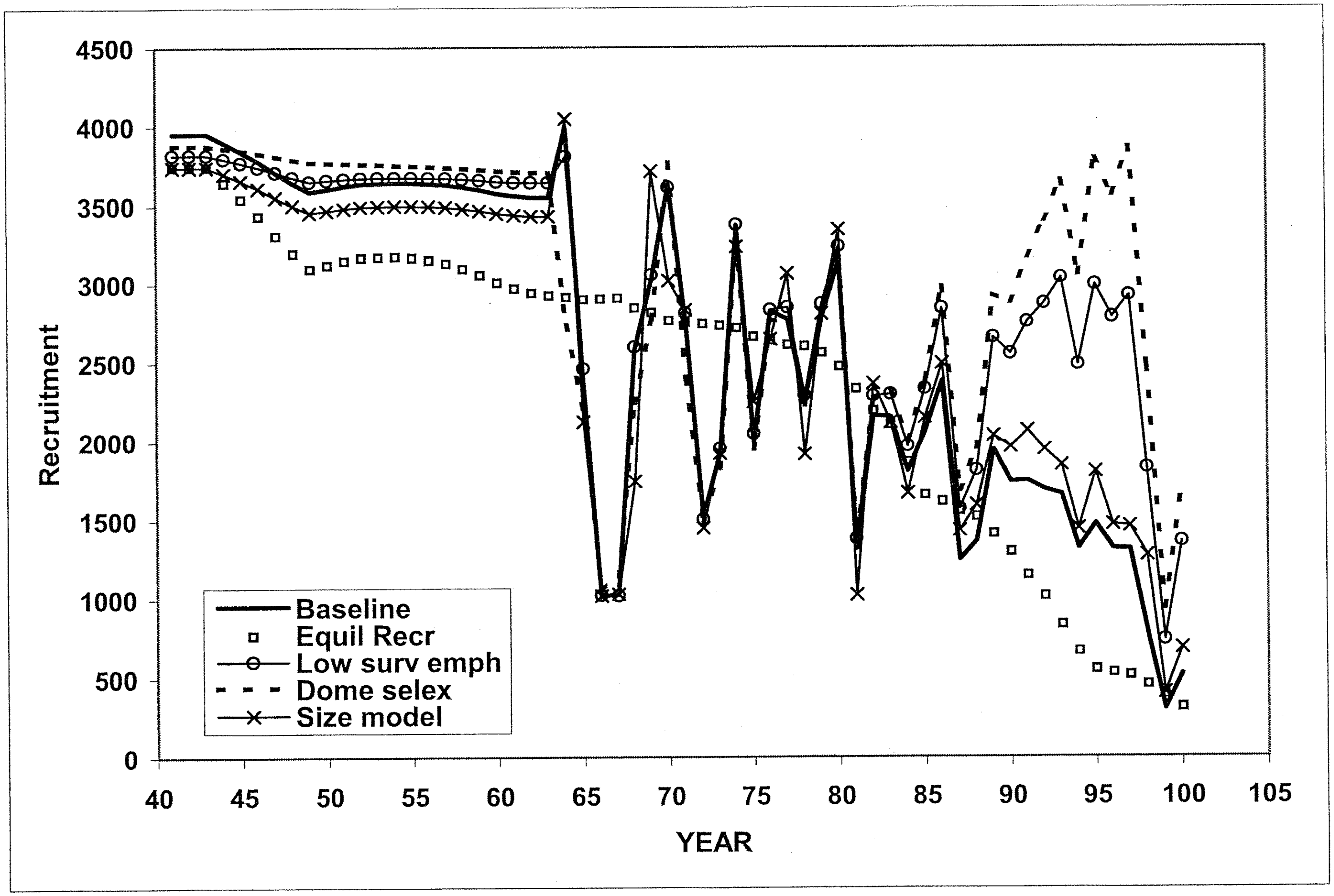


Figure 22. Time series of estimated recruitment in several preliminary model scenarios.



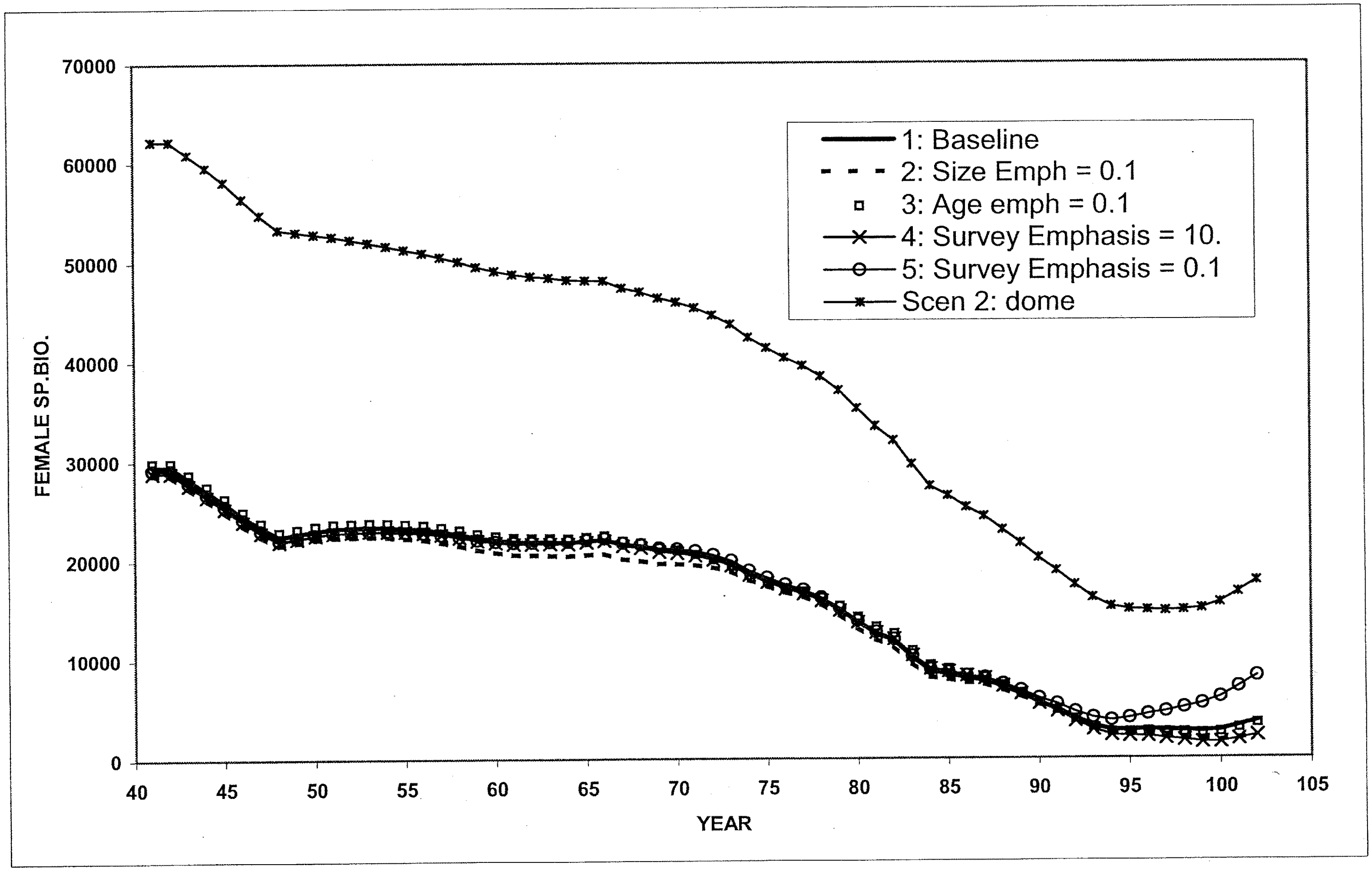


Figure 23. Time series of estimated female spawning biomass from several model scenarios.

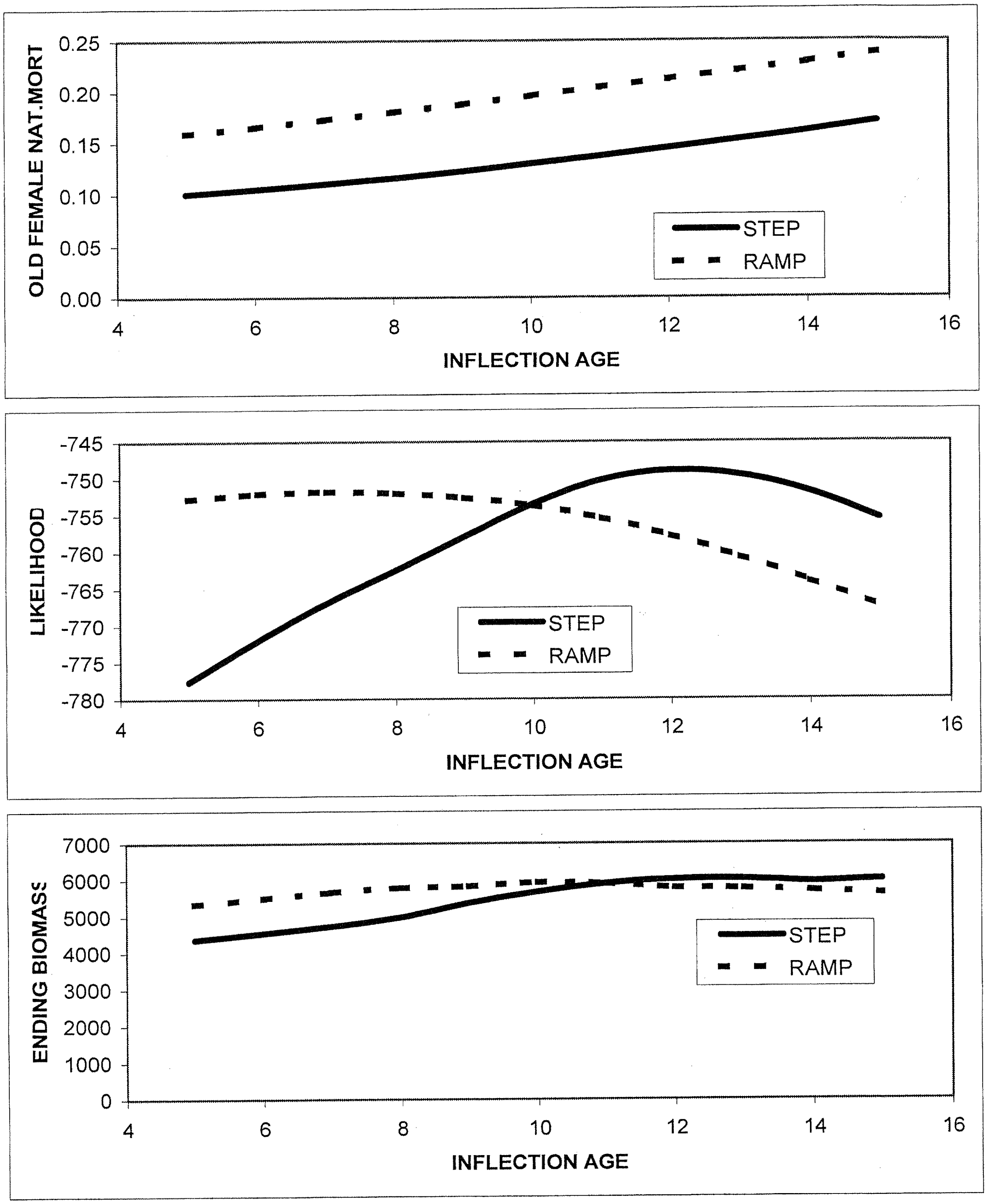


Figure 24. Profile on the inflection age for female natural mortality. These are preliminary model runs with asymptotic selectivity for females in the trawl fisheries.

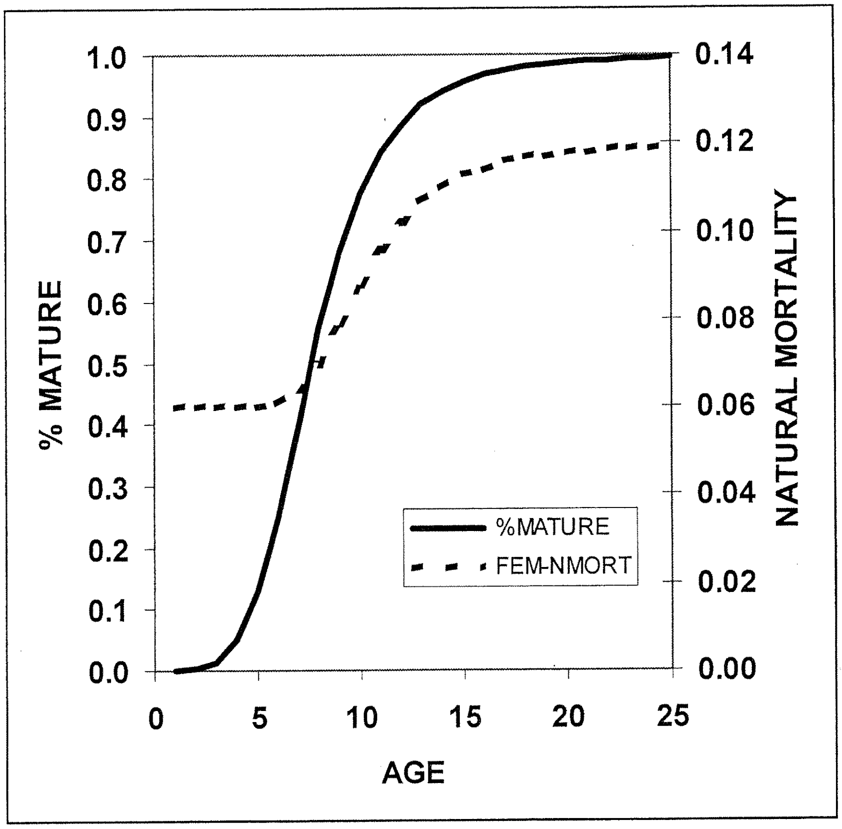


Figure 25. Age-specific fraction mature (female) and age-specific natural mortality as a function of maturity cubed as estimated in the final baseline model.

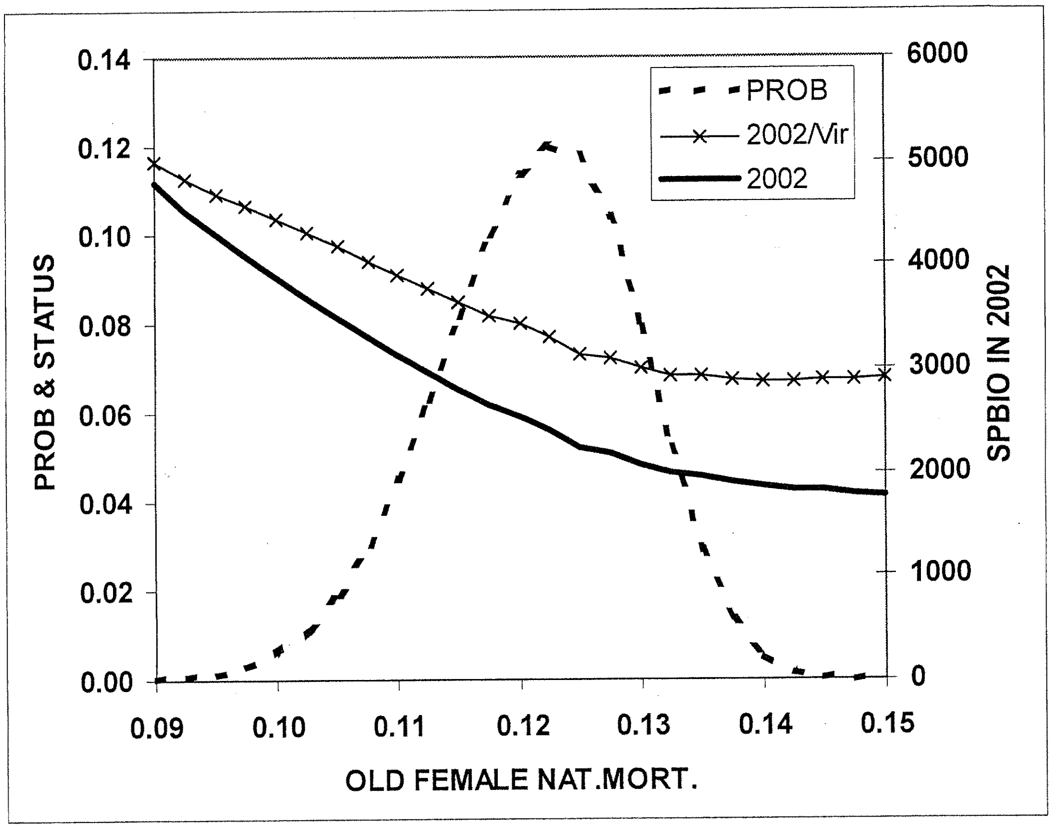


Figure 26. Profile of model results on the level of natural mortality for old females. Probability is calculated from the log-likelihood profile. Selection of M=0.12 as baseline and plausible range of 0.10 to 0.14 is based on this profile.

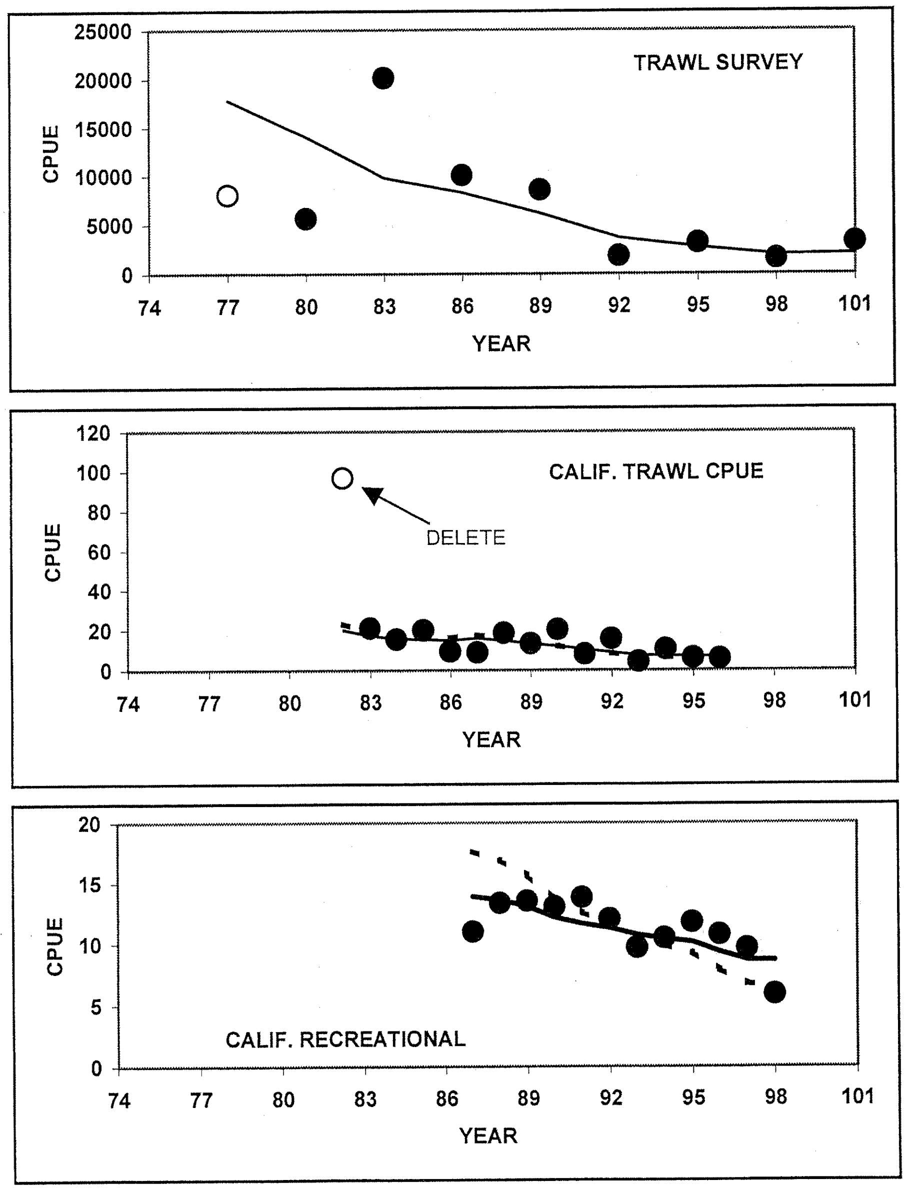


Figure 27. Fit to CPUE trends. For the fishery CPUEs, a trendline with (solid) and without (dashed) the density-dependent catchability is shown. 1977 survey and 1982 fishery CPUE are not used in fitting.

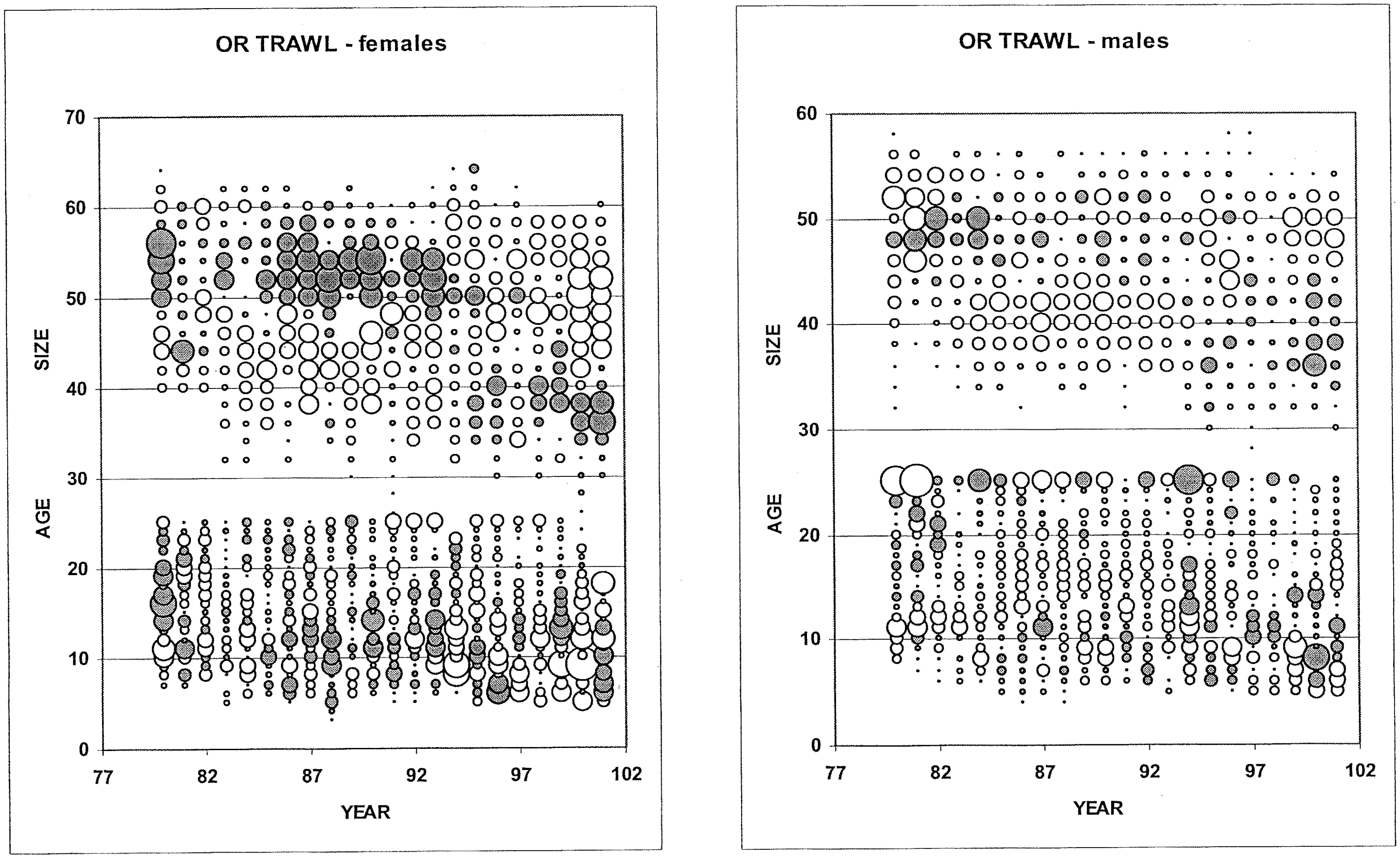


Figure 28a. Residuals for fit to Oregon Trawl fishery size (top) and age (bottom) composition for females (left) and males (right). The size of the bubble is proportional to the magnitude of the observed-expected proportion at age (or size). Positive residuals are filled bubbles.

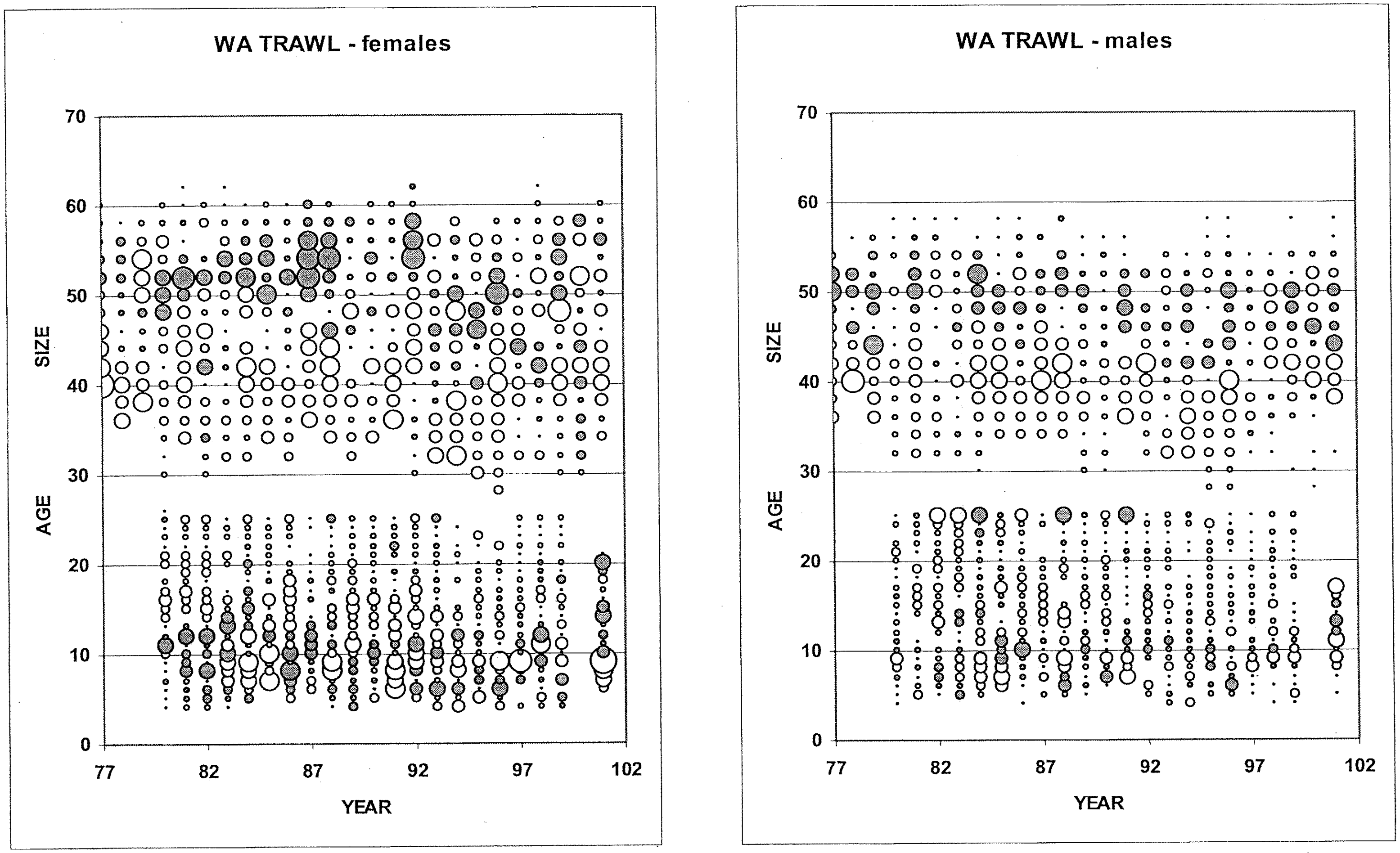


Figure 28b. Residuals for fit to Washingtom Trawl fishery size (top) and age (bottom) composition for females (left) and males (right). The size of the bubble is proportional to the magnitude of the observed-expected proportion at age (or size). Positive residuals are filled bubbles.

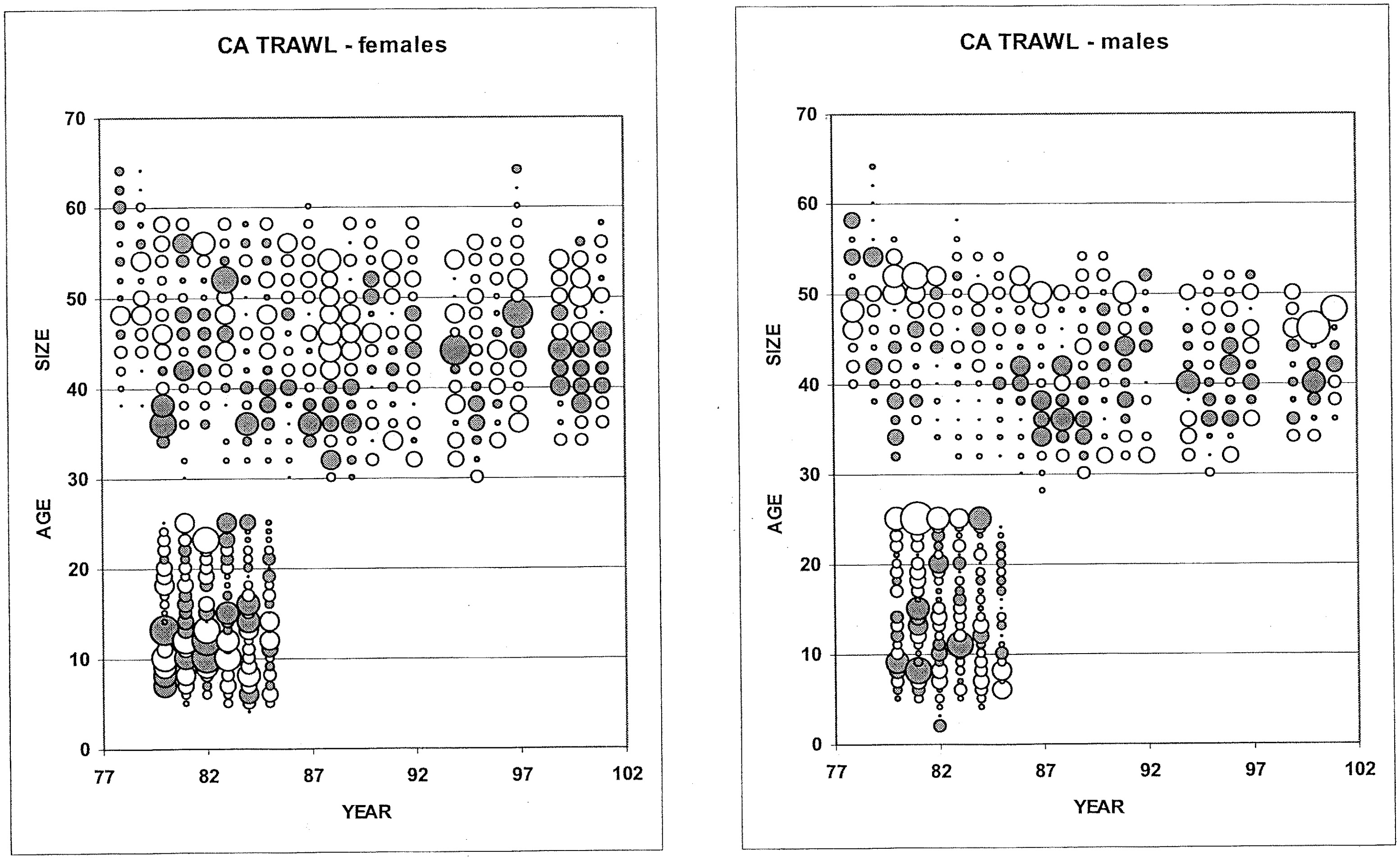
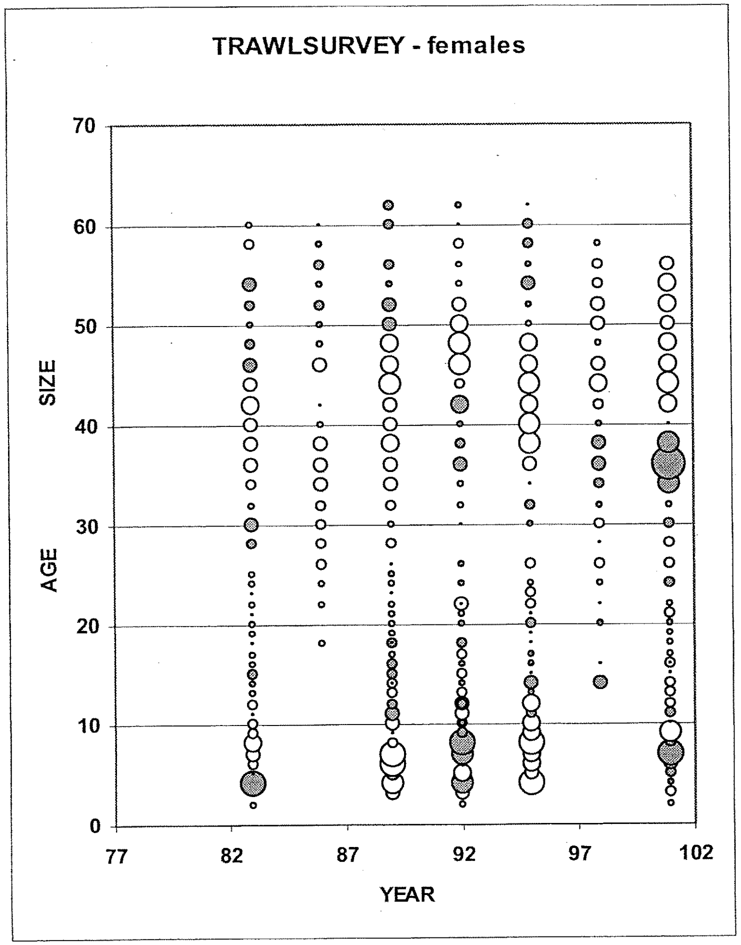


Figure 28c. Residuals for fit to California Trawl fishery size (top) and age (bottom) composition for females (left) and males (right). The size of the bubble is proportional to the magnitude of the observed-expected proportion at age (or size). Positive residuals are filled bubbles.



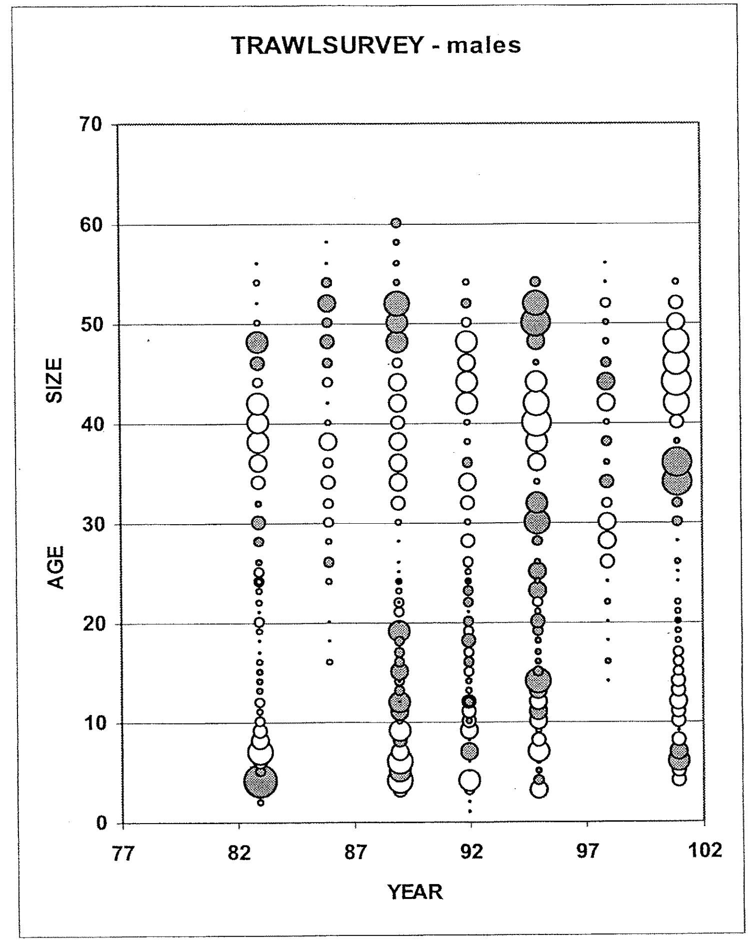


Figure 28d. Residuals for fit to trawl survey size (top) and age (bottom) composition for females (left) and males (right). The size of the bubble is proportional to the magnitude of the observed-expected proportion at age (or size). Positive residuals are filled bubbles.

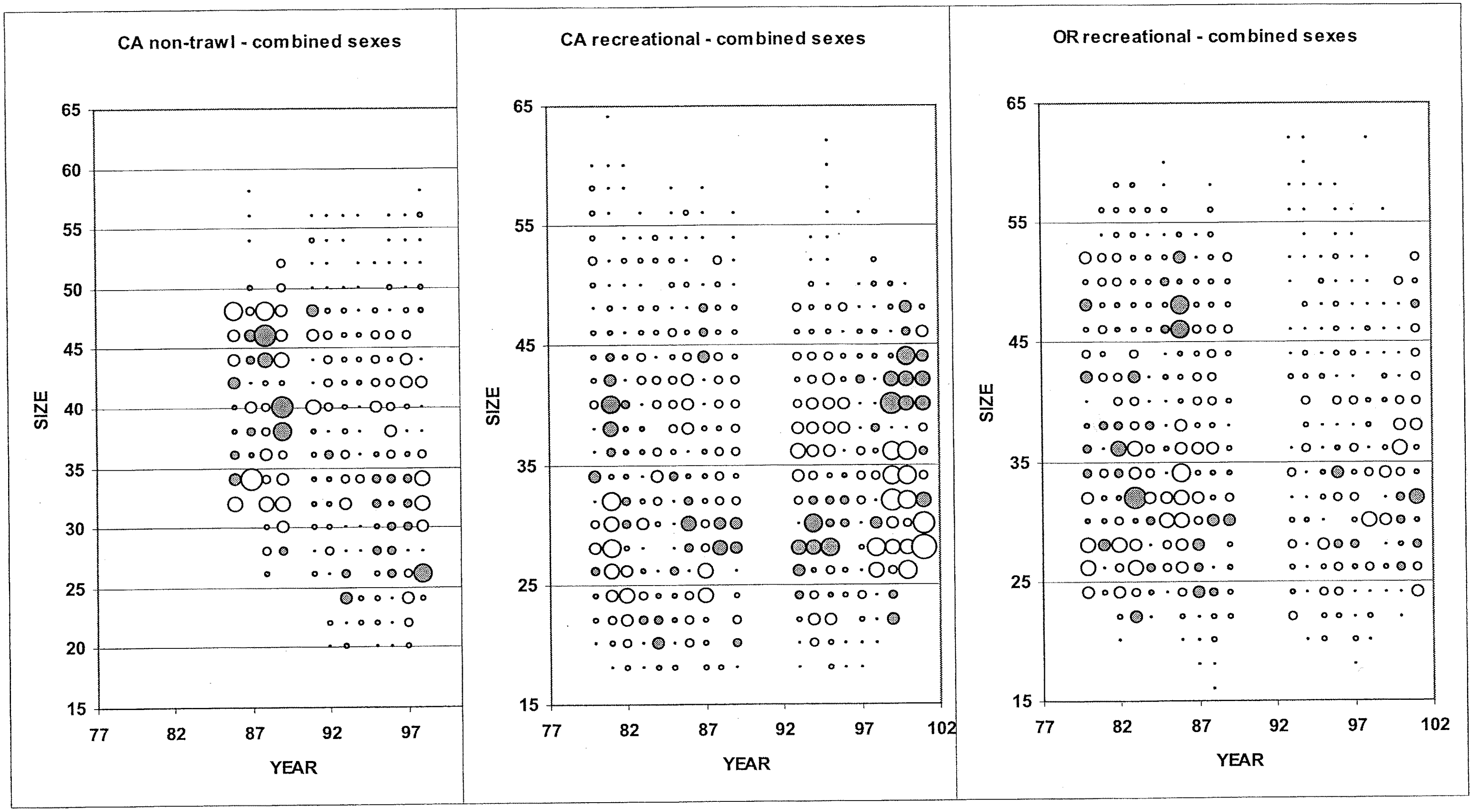
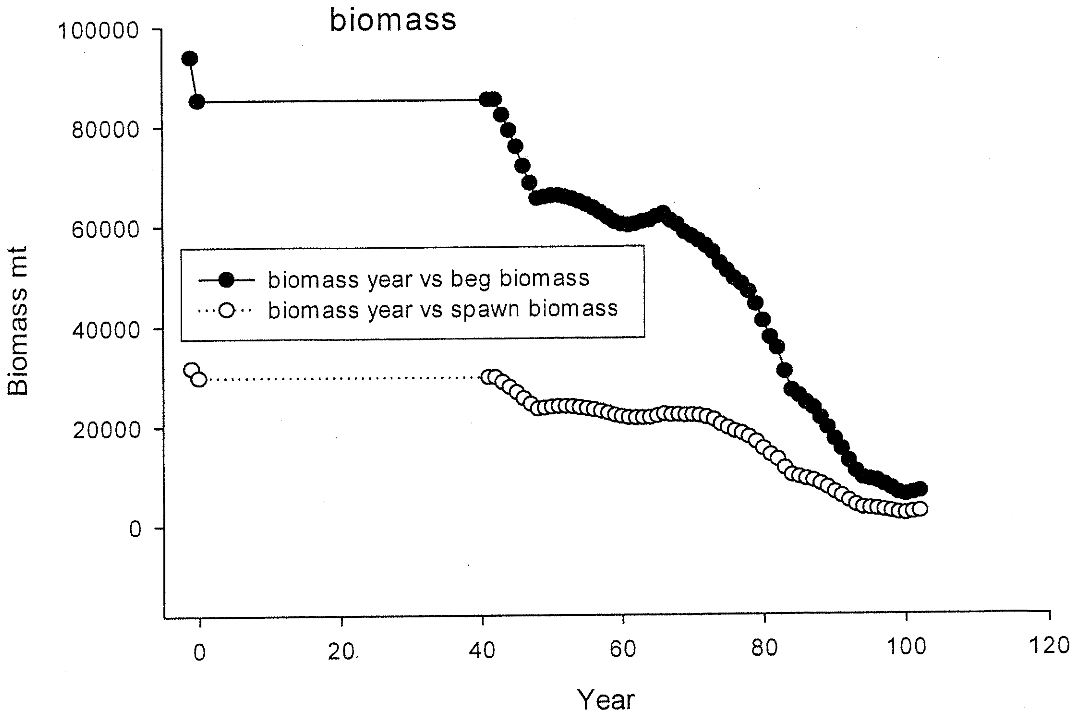


Figure 28e. Residuals for fit to CA non-trawl, CA recreational, and OR recreational size composition for combined sexes. The size of the bubble is proportional to the magnitude of the observed-expected proportion at age (or size). Positive residuals are filled bubbles.



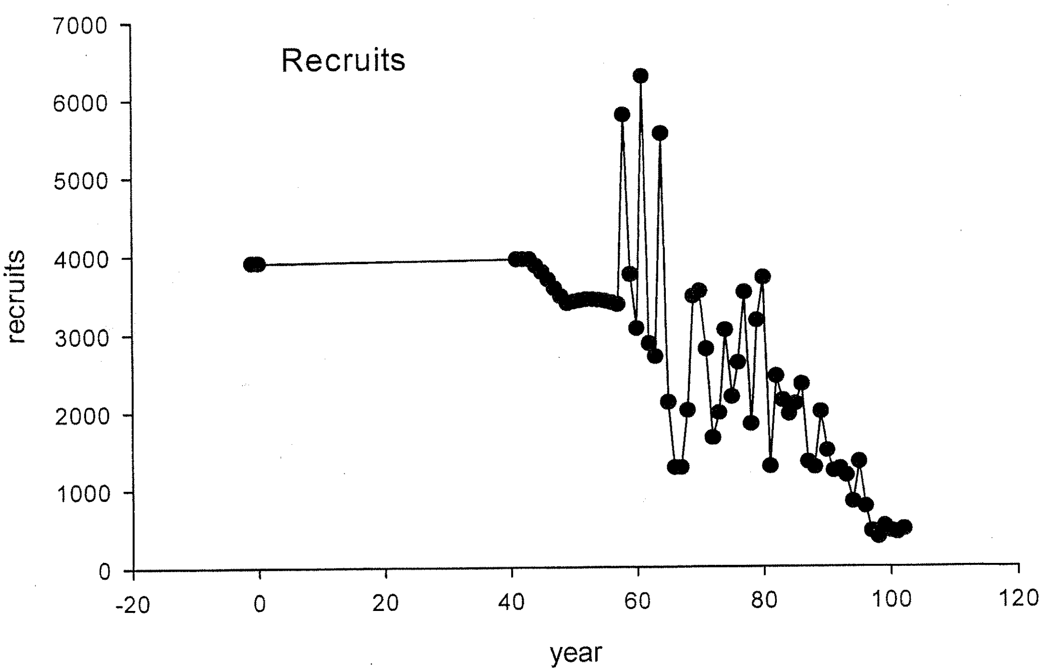


Figure 29. Time series of estimated biomass and recruitment in the baseline model with M=0.12 for old females.

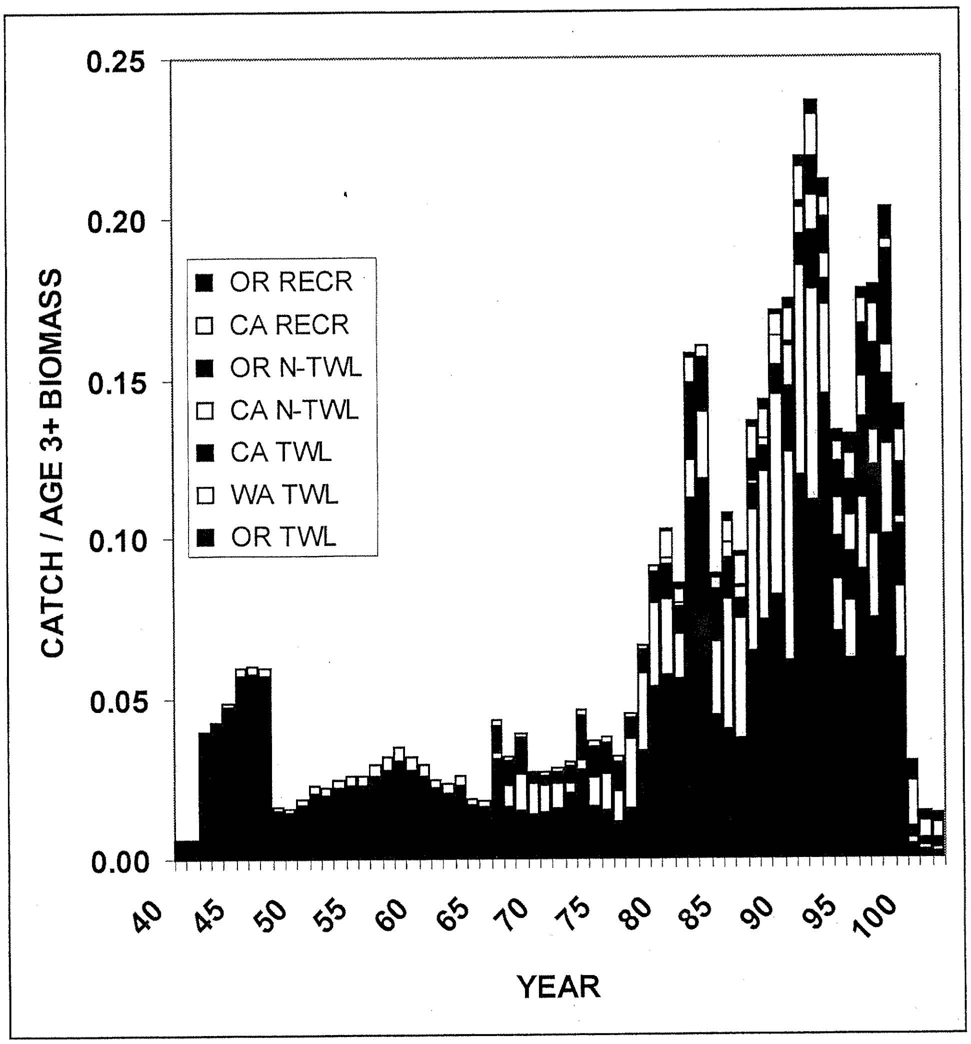


Figure 30. Exploitation rate in baseline model run.

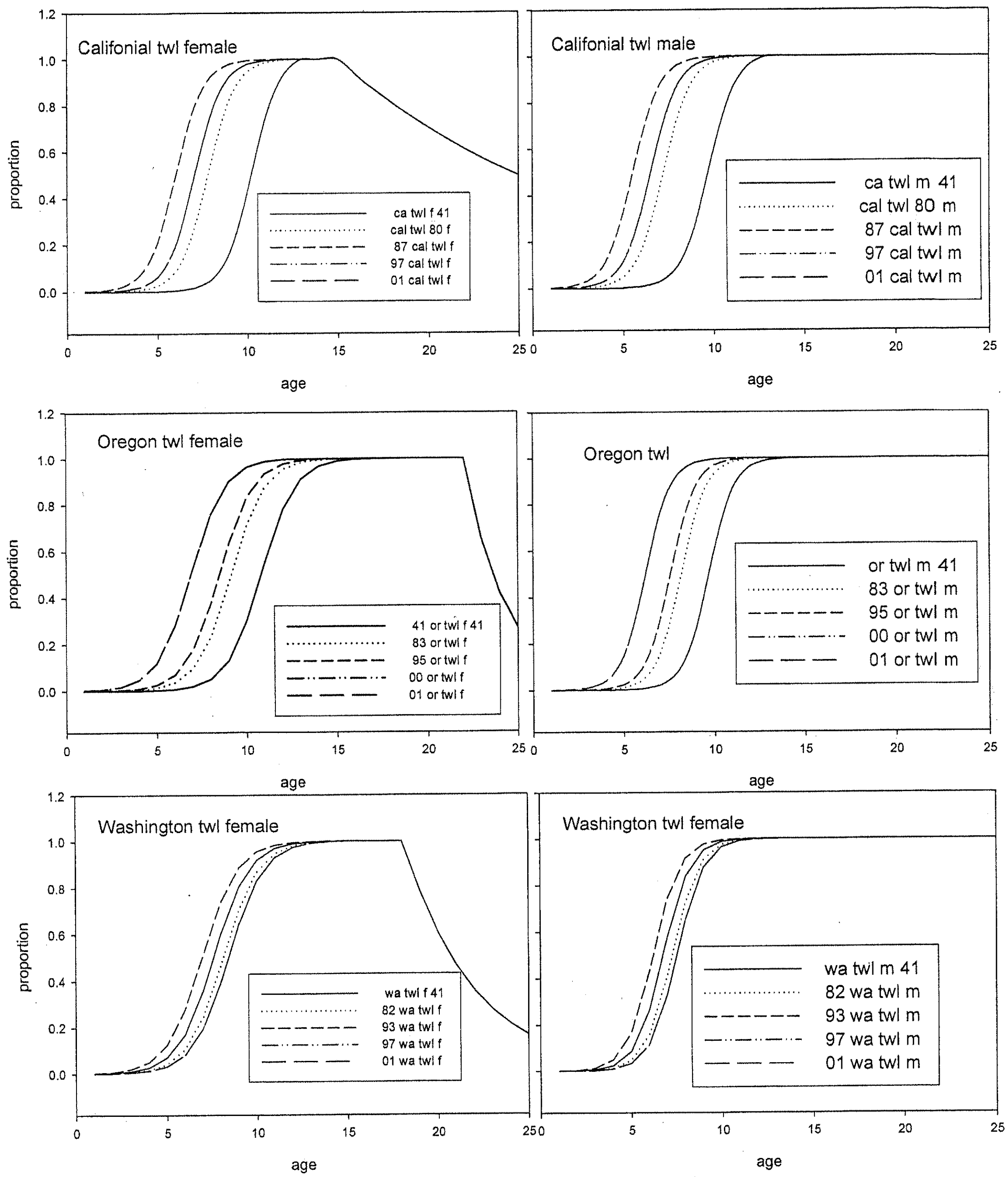


Figure 31a. Age-specific selectivity for trawl fisheries in baseline model.

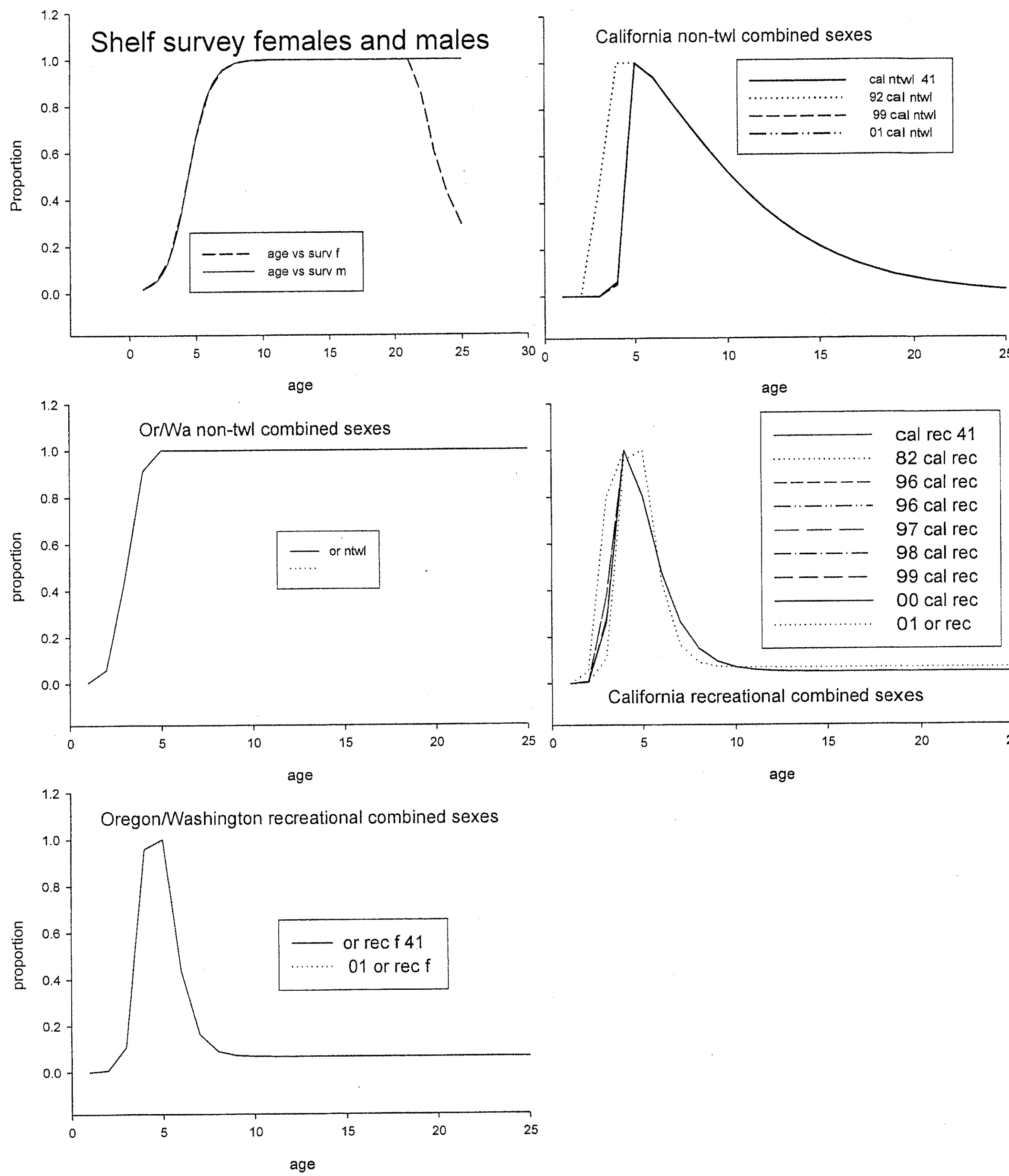


Figure 31b. Age-specific selectivities for survey and for non-trawl fisheries.

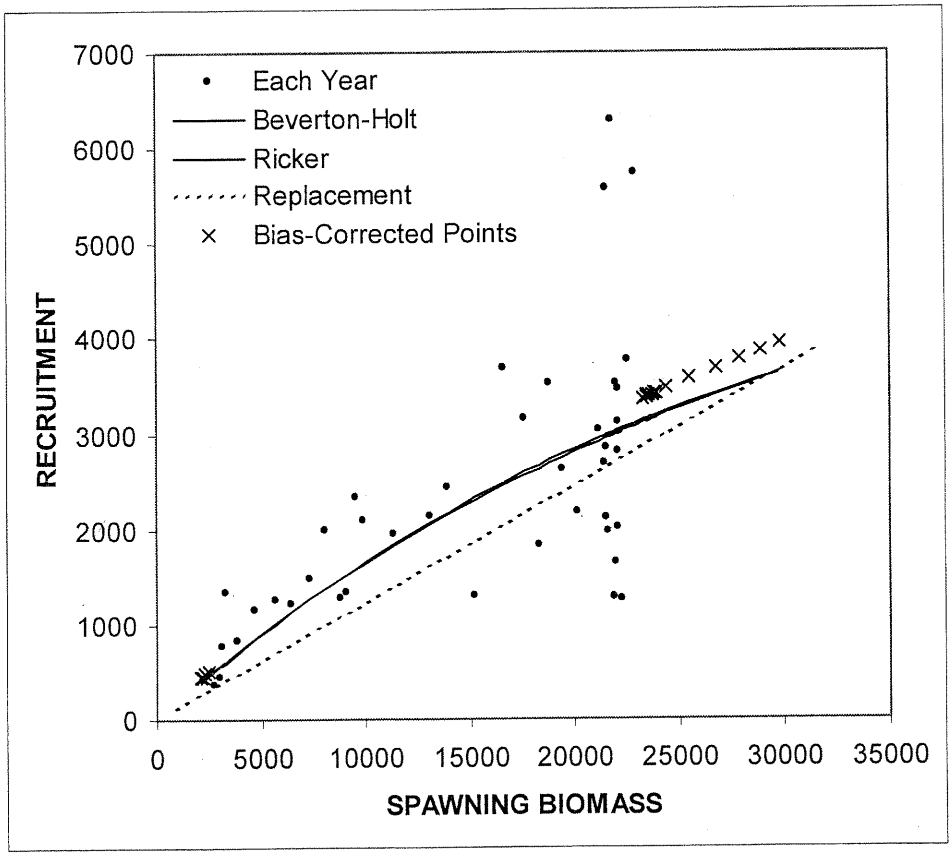


Figure 32. Recruitment-Spawner relationship. The recruitments for individual years are shown as points. Year's with recruitment taken from the curve and then corrected for logarithmic bias are shown as an "X".

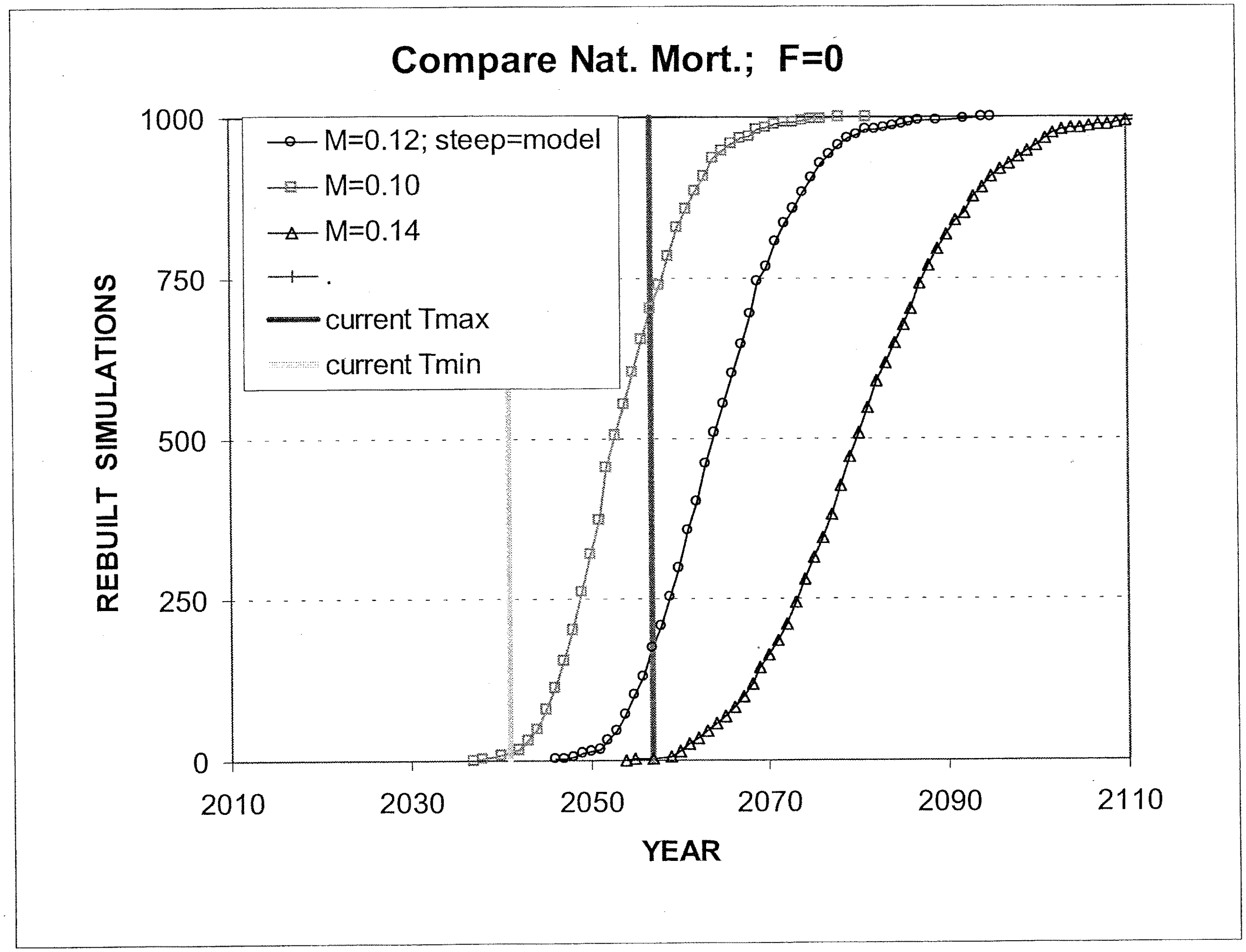


Figure 33. Effect of model's old female natural mortality level on forecast.

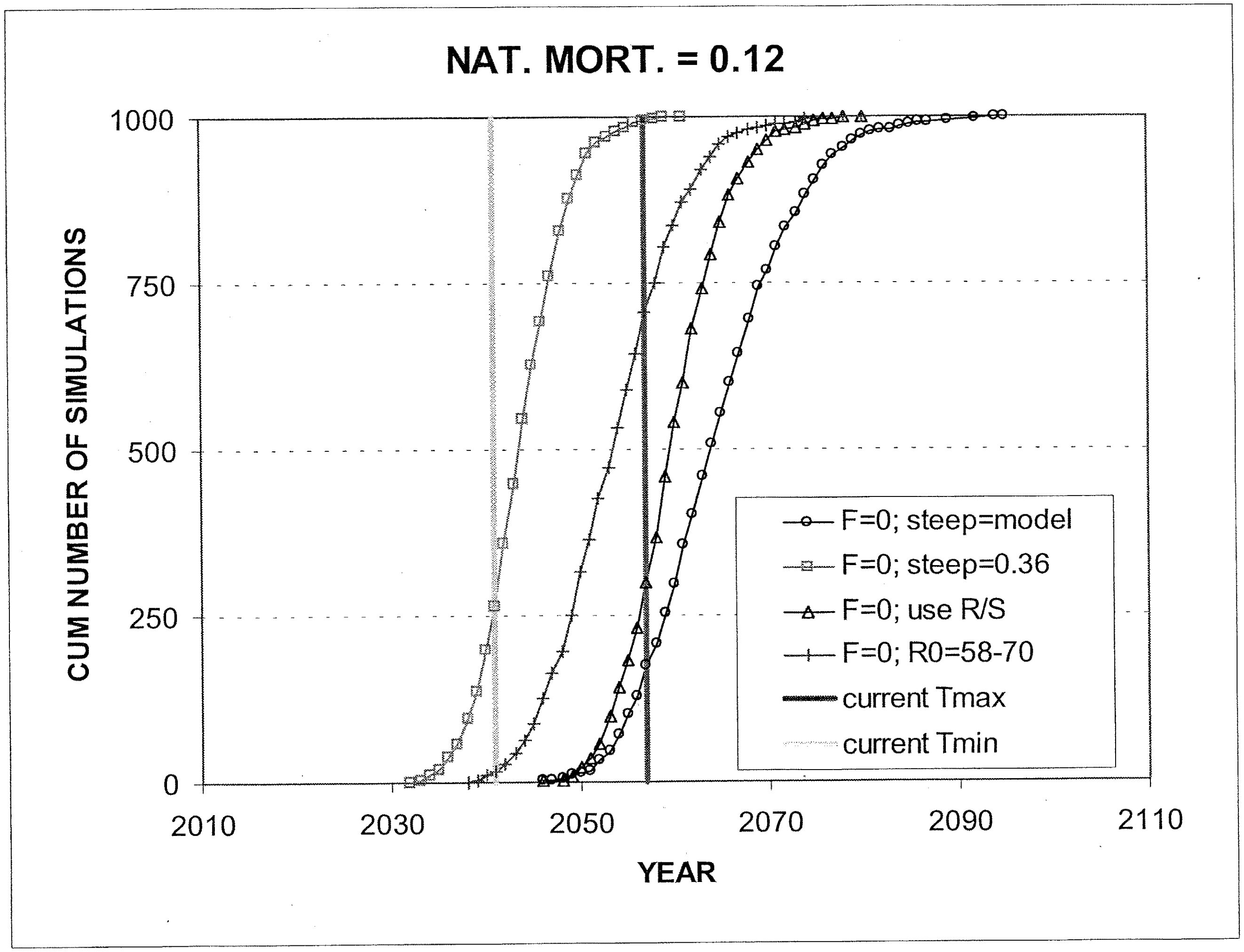


Figure 34. Effect of alternative Bzero and spawner-recruitment steepness values on the time to rebuild with no fishing.

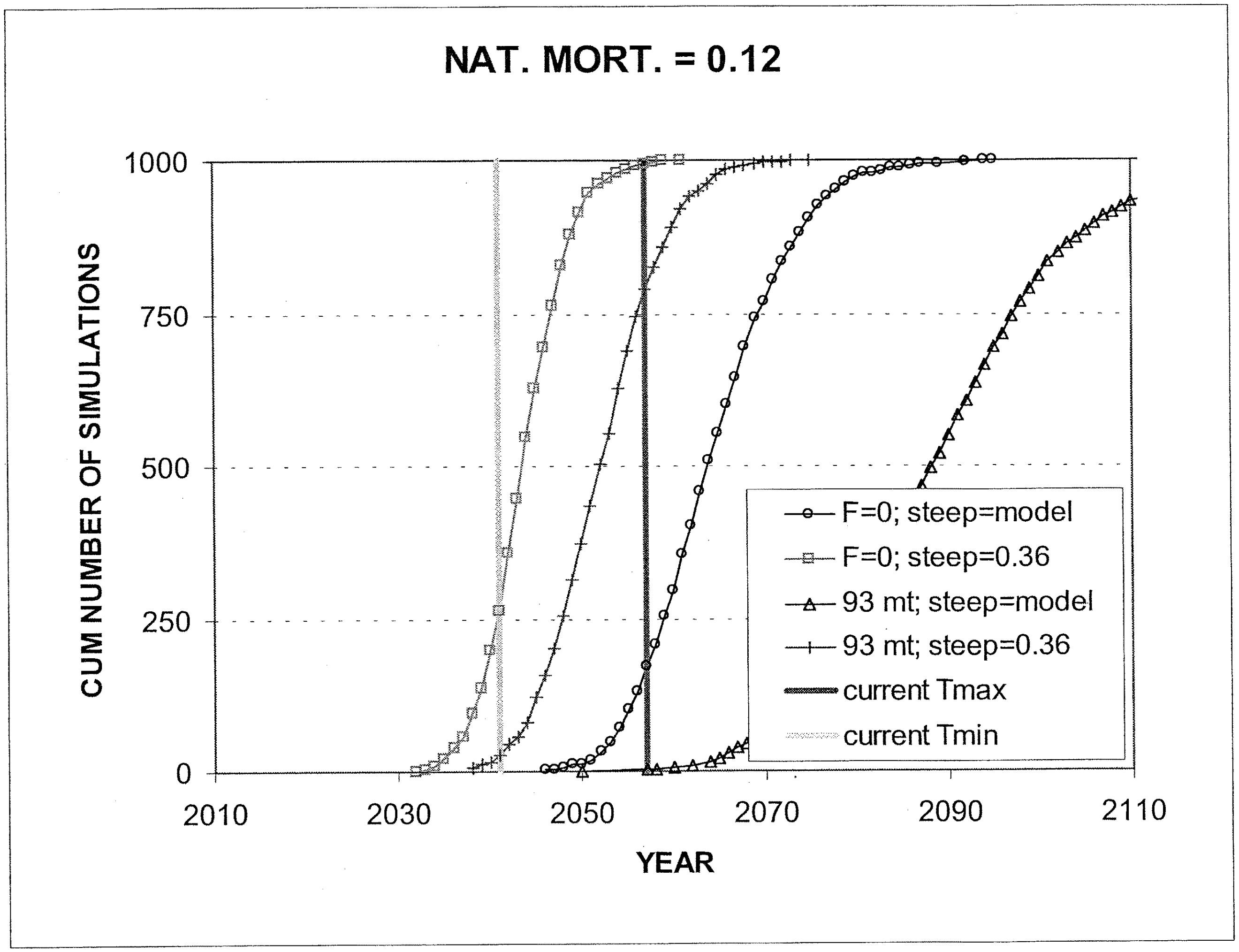


Figure35. Probability of rebuilding with 93 mt per year of catch compared to the no catch forecast.

ENTER VIRGIN RECRUITMENT: **3907**

	ENTER CRITER.	EXPLOIT	CONSTANT RECR. F.SP.BIO.	CONSTANT RECR. YIELD	DEN.-DEP. RECRUIT. RECRUIT	DEN.-DEP. RECRUIT. F.SPBIO	DEN.-DEP. RECRUIT. B* / B0	DEN.-DEP. RECRUIT. YIELD
VIRGIN	-------	0.0000	31786	0	3907	31786	100%	0
MSY	0.289	0.0135	-------	-------	2366	15437	49%	591
SPR	50%	0.0463	15893	2067	0	0	0%	0
SPR	90%	0.0063	28608	521	3213	23529	74%	428

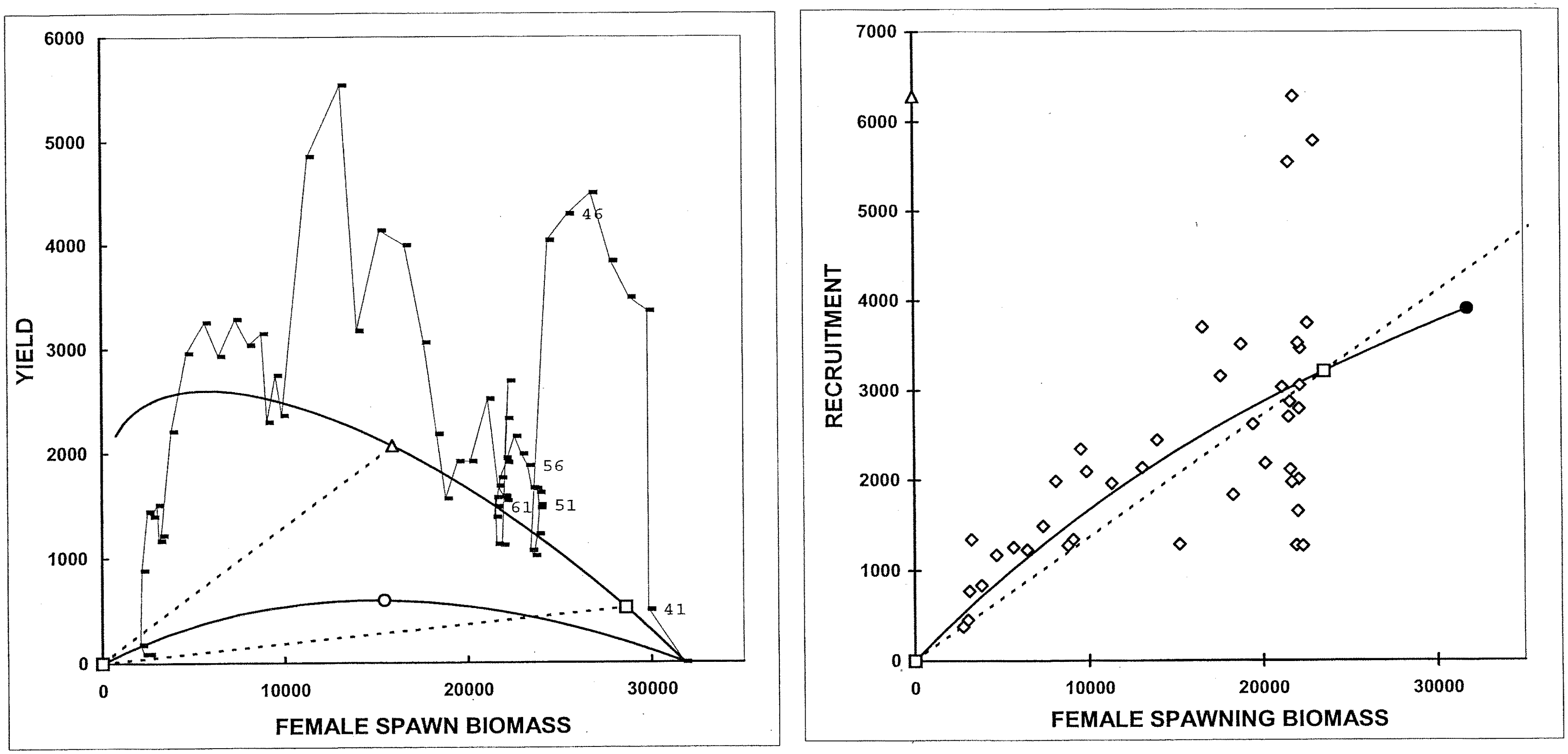
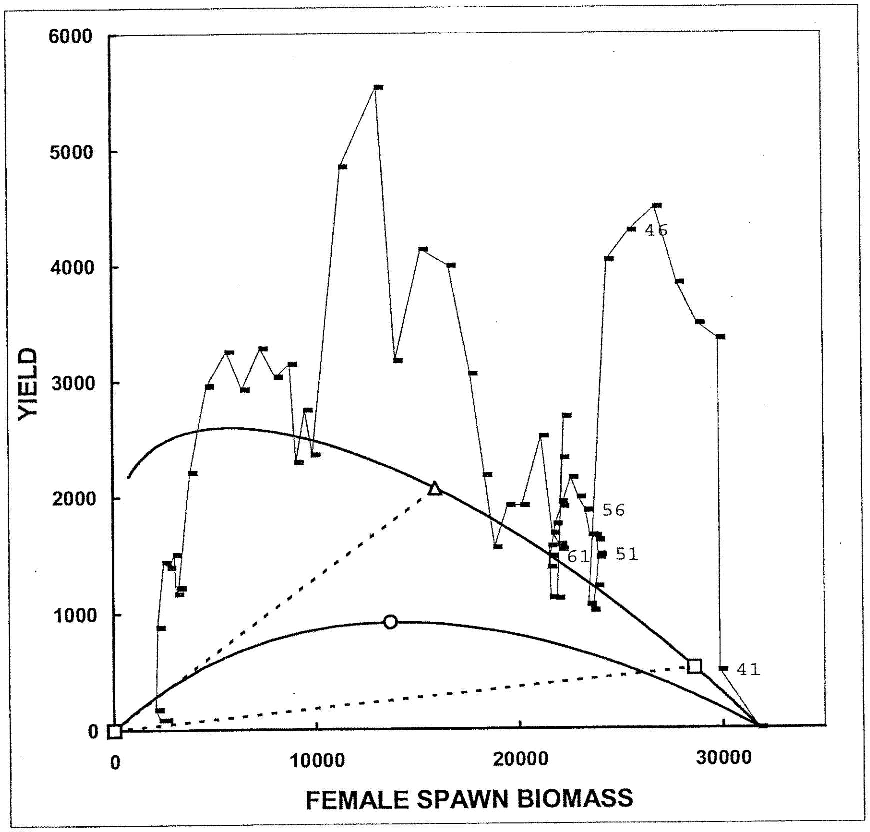


Figure 36. Calculation of MSY with spawner-recruitment steepness at 0.289 (baseline model level).

ENTER VIRGIN RECRUITMENT: **3907**

	ENTER CRITER.	EXPLOIT	CONSTANT RECR. F.SP.BIO.	CONSTANT RECR. YIELD	DEN.-DEP. RECRUIT. RECRUIT	DEN.-DEP. RECRUIT. F.SPBIO	DEN.-DEP. RECRUIT. B* / B0	DEN.-DEP. RECRUIT. YIELD
VIRGIN	-------	0.0000	31786	0	3907	31786	100%	0
MSY	0.360	0.0240	-------	-------	2458	13659	43%	919
SPR	50%	0.0463	15893	2067	777	3179	10%	409
SPR	90%	0.0063	28608	521	3560	26065	82%	474



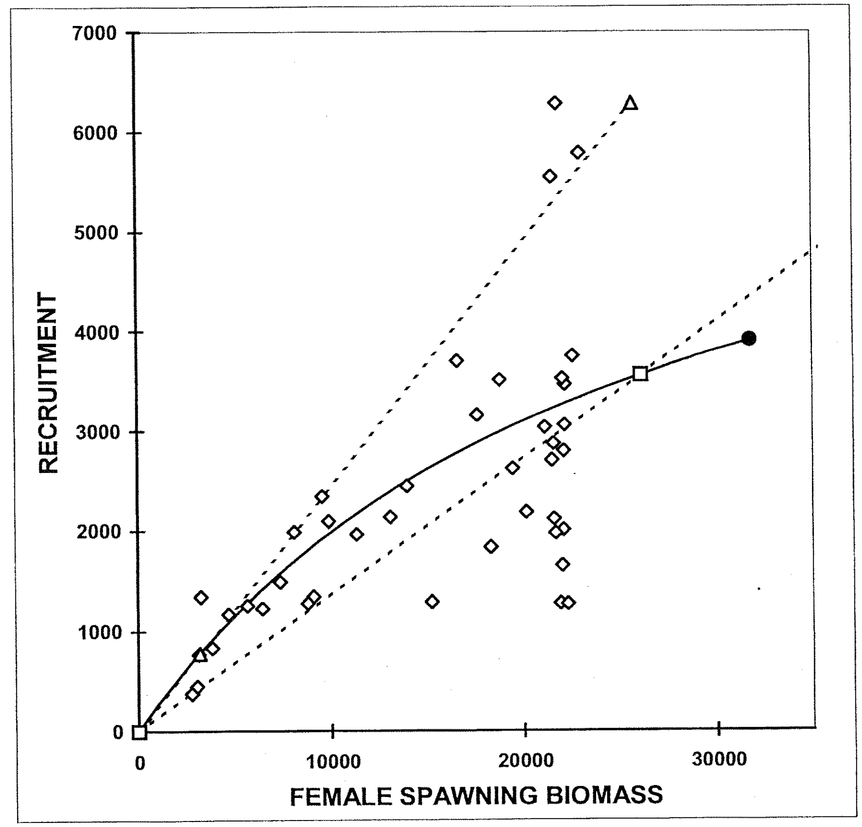


Figure 37. Calculation of MSY with spawner-recruitment steepness set to 0.360.

CANARY ROCKFISH
STAR Panel Meeting Report

Northwest Fisheries Science Center
Seattle, Washington
April 15-19, 2002

STAR Panel Members:

Gary Stauffer, STAR Chair, NMFS AFSC, Seattle, WA,
Stephen Ralston, SSC Representative and second rapporteur, NMFS SWFSC, Santa Cruz, CA
Larry Jacobson, Rapporteur, NMFS, NEFSC, Woods Hole, MA
Paul Medley, Center for Independent Experts, University of Miami, FL
Mark Saelens, Groundfish Management Team Representative, ODFW, Newport Oregon
Tom Ghio, Groundfish Advisory Panel Representative

STAT Team Members Present:

Richard Methot, NMFS, NWFSC, Seattle, WA
Kevin Piner, NMFS, NWFSC, Seattle, WA

FINAL STAR Report, May 7, 2002

Canary Rockfish STAR Panel Report

Overview

The STAR Panel reviewed the draft assessment report by the STAT Team for the canary rockfish resource. The review took place during the week of April 15-19, 2002 at the Montlake Laboratory of NMFS Northwest Fisheries Science Center in Seattle, Washington. The STAT Team provided the STAR Panel members with a draft report in advance of the STAR workshop documenting the analyses completed prior to the meeting. The STAT team of Rick Methot and Kevin Piner was present during the week. On the first day Methot and Piner summarized their draft document including descriptions of the fishery, the biology of canary rockfish, available data, relevant features of their stock synthesis model and assumptions, and initial results of alternative modeling scenarios. Considerable discussion followed over the week concerning the quality of the data, appropriateness of model assumptions, base model configurations, potential alternative configurations, and interpretation of results. The Panel requested additional alternative model analyses to examine sensitivity of assessment results focusing on areas of data uncertainties and configuration assumptions. The STAR panel and STAT team discussions resulted in developing a new baseline model that treated the canary resource off California, Oregon, and Washington as one stock, assumed catches for pre-1941 period to 500 mt per year, modeled female mortality as an increasing function of maturity (age), allowed female dome-shaped selectivity at older ages, used of B-H spawner-recruit relationship to estimate current recruitments, use of a parametric bootstrap of residuals and fitted stock recruitment curve for forecasting future recruitments and projecting rebuilding rates. There was agreement that future assessment efforts should include Canadian data because the west coast stock of canary rockfish most likely extends into British Columbia. Agreement was reached on how best to provide model results that capture the range of uncertainty in the assessment and how to best depict the uncertainty in a figure that would assist the Council decision process. The team developed a figure that shows the probability of stock recovery to B40 over time for three assumed levels of asymptotic female natural mortality for alternative values of F or annual catch. The week following the STAR meeting the Team revised the draft canary report incorporating the work conducted during the STAR meeting and, specifically, analyses for the uncertainty/decision figures. They provided the simulation results to project stock rebuilding forecasts given current status of the resource using the new baseline model assuming 3 levels of asymptotic female natural mortality ($M = 0.10$, 0.12, and 0.14) and for as many as 5 levels of fishing, i.e. 50 mt, 93 mt, $F = 0$, $F = 0.005$, F90%. In addition the STAT team also re-evaluated the steepness estimate for the spawner-recruit relationship from the baseline model. This estimate was 0.289 for $M = 0.12$, yet the best fit of steepness estimated from direct fit of the estimates of recruits and spawning biomass from model output is 0.330. Because this range in steepness parameter has a major impact on the rebuilding forecasts, the Team included the range of steepness in their rebuilding forecast. Although the STAR Panel has had only limited opportunity to review these latter results, we conclude that their approach to addressing range of uncertainty is appropriate, is presented in a format that should be helpful to the Council decision process, and captures the range of uncertainty. The consensus of the STAR Panel is that the canary assessment model is sufficient for assessing the current status of the resource and provides the basis for re-analysis of the rebuilding the canary rockfish stock.

CANARY ROCKFISH
STAR Panel Meeting Report

Northwest Fisheries Science Center
Seattle, Washington
April 15-19, 2002

STAR Panel Members:

Gary Stauffer, STAR Chair, NMFS AFSC, Seattle, WA,
Stephen Ralston, SSC Representative and second rapporteur, NMFS SWFSC, Santa Cruz, CA
Larry Jacobson, Rapporteur, NMFS, NEFSC, Woods Hole, MA
Paul Medley, Center for Independent Experts, University of Miami, FL
Mark Saelens, Groundfish Management Team Representative, ODFW, Newport Oregon
Tom Ghio, Groundfish Advisory Panel Representative

STAT Team Members Present:

Richard Methot, NMFS, NWFSC, Seattle, WA
Kevin Piner, NMFS, NWFSC, Seattle, WA

FINAL STAR Report, May 7, 2002

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I. Minutes of the STAR Panel Meeting

The STAR Panel commends the canary rockfish STAT team for their work on the canary rockfish stock assessment. Relatively complete and clear documents were distributed early. All additional analyses were carried out quickly and with considerable technological innovation. The analysis, even before alterations suggested by the STAR panel, involved substantial improvements to the understanding of canary rockfish.

<u>Analyses Requested by the STAR Panel</u>

Monday, 15 April

1) Determine the sensitivity of virgin biomass and depletion estimates to assumptions about catch prior to 1941. In particular, determine if estimates are sensitive to the assumption that the stock was unfished in 1940.

2) Determine the sensitivity of virgin biomass, depletion ratio, and recent biomass trends to treatment of triennial survey data for 1977 and 1980. Model runs already discussed used the survey biomass (trend) estimate for 1980 but not the length composition data for 1980 and neither the survey biomass nor length composition data for 1977. In the first sensitivity analysis, incorporate the length composition data for 1980. In the second run, incorporate the survey biomass and length composition for 1977 as well.

3) Plot preliminary recruitment estimates from the stock synthesis model against the Tiburon pelagic juvenile trawl data to see if the latter might be useful as a recruitment index for canary rockfish.

4) As a sensitivity analysis, add survey and catch data from Canadian waters to the model. This suggestion is technically sensible because canary rockfish on both sides of the US/Canadian border are believed to belong to the same biological stock. Consequently, inclusion of all pertinent Canadian information should be pursued in future assessments. However, the preliminary nature of the Canadian data precluded their use in this assessment. For this reason the STAR panel recommends that sensitivity analysis runs with Canadian data not be used for management purposes.

5) Make certain that any assumptions (or estimates) about catch during 2000 and 2001 are the same as used by the GMT.

6) Selectivity curves for California non-trawl, California recreational and Oregon recreational fisheries were implausibly peaked in preliminary runs. As explained by the STAT Team, this tendency was probably exacerbated by relatively sharp modes in length composition data and relatively large assumed variances in length at age. Basically, a single age group is assumed associated with a range of lengths that is wide enough to explain the range of lengths in the modes of length composition data. As a sensitivity analysis, reduce the assumed variance in size at age and re-run the model to see if selectivity curves are less peaked and are more credible.

7) Preliminary projections and reference point calculations used averaged relative F's and average selectivities for commercial and recreational fishery sectors during 1997-2001. However, the relative importance of commercial and recreational fisheries changed substantially in 2000 due to restrictions on the commercial catch. Furthermore, changes in length composition data seem to suggest changes in selectivity for some sectors at about the same time. Use a shorter time period or different approach to estimating relative F's by sector and overall fishery selectivity for use in projections and rebuilding plans.

8) Plot proposed natural mortality schedules as a function of length, as well as age, and indicate the lengths at first, median, and full maturity (i.e., length data may be easier to interpret than age data and are less subject to error).

9) Calculate a CV for current biomass based on the delta or other method.

10) Provide a straw man format for a decision table analysis.

Tuesday, April 16

11) In base model runs, assume catches pre-1941 were ~500 mt per year, rather than zero. This is discussed below.

12) Devise a model that blends the hypotheses that: i) natural mortality increases with age in females; and ii) fishery selectivity declines with age in females. This might be done by fixing an increasing trend and level of natural mortality while allowing the model to estimate declining selectivity with age.

13) As a sensitivity analysis, devise a model scenario that has high fishery selectivity on females throughout the historical and recent periods to see if such a pattern can explain the relative absence of large females from recent fishery data.

14) It was agreed that a parametric bootstrap for process errors in a spawner-recruit relationship would be a reasonable way to simulate rebuilding trajectories. However, it is necessary to examine the actual distribution of residuals (e.g. lognormal, gamma, etc.) and to determine if they are autocorrelated.

15) Organize software to construct likelihood-based confidence intervals (based on the chi-square distribution) for recent biomass/virgin biomass and other key parameters. This will involve profiling over a range of values for a suitable parameter (e.g. triennial trawl survey Q or natural mortality rate M) and taking the confidence interval for Q (or M) as a confidence interval for biomass ratios and other parameters.

II. Comments on the Technical Merits and/or Deficiencies in the Assessment and Recommendations for Remedies

Monday, 15 April

1) It was agreed that use of the annual catch data during 1941-1966 was better than using an average value calculated from the same data, if only to capture the apparent peak in catches during 1941-1946. However, there was considerable discussion about assuming that the stock was unfished in 1940 because this implies an abrupt increase in catch from zero to about 3,000 mt per year during 1940-1941. Sensitivity analyses were requested to determine effects of assumptions on estimates of virgin biomass (see above).

2) It is sensible to start the model in 1941, rather than 1967, so that the time series of historical catches can be used to full advantage.

3) There is no evidence that canary rockfish in the northern and southern stock assessment areas are different biological stocks. It is sensible to model canary rockfish as a single coast-wide stock.

4) It is not clear if length composition data computed as weighted averages are better estimates of catch length composition than a simply combining samples. The STAR Panel saw no reason to recommend one or the other.

5) Treatment of triennial trawl survey data for 1977 and 1980 were discussed at length. Lack of complete coverage in shallow water in 1977, sensitivity of mean catch rates for 1977 to exclusion of 'water hauls', and lack of length measurements from tows with small catches during 1977 and 1980 are key issues. However, relatively few canary rockfish are present in the strata skipped during 1977, water-haul tows are now excluded routinely, and length composition data may have been little affected by lack of measurements from small catches. Sensitivity analyses were requested to determine if estimates of virgin biomass and trend were sensitive to assumptions about the 1977 and 1980 survey data.

6) Preliminary Canadian catch data should be verified; it is possible that estimates prior to 1983 are too low due to a correctable error.

7) It was agreed that modeling of CPUE data with an exponent to account for nonlinearity was a reasonable approach for the canary rockfish assessment.

8) The STAR Panel agreed with the STAT team's conclusion that some lack of fit in residual plots from the age-based synthesis model were unavoidable because it is not possible, in the age-based synthesis model, to change growth patterns sufficiently to fit age and length composition data from the same survey perfectly. Despite some residual patterns, it was agreed that goodness of fit to age and length composition data was good overall and was generally acceptable.

9) It was agreed that extremely peaked selectivity patterns for non-trawl and recreational fishery segments were implausible. A different parameterization might be helpful. In addition, sensitivity analyses were requested to determine if an overestimate of the variance in size at age might be contributing to the problem.

10) It was agreed that base model runs should assume or accommodate the notion that the natural mortality rate (M) increases in larger/older females, based on extensive analysis in the draft stock assessment. The alternate hypothesis that selectivity decreases may hold as well, but increased natural mortality in large/old females seems quite probable.

11) In the next assessment all party boat logbook data sources should be investigated and updated where possible.

12) Decisions about time periods for selectivity parameters seemed reasonable given recent changes in management of the fishery. However, estimating new parameters starting in 2000 (when regulations changed) means that recent age and size composition data provide little information for parameter estimation.

13) Use of the stock recruitment curve as an estimate of recent recruitments seems reasonable but we have to acknowledge almost complete lack of information concerning the strength of recent recruitments.

14) The STAR panel agreed with the STAT Teams decision to base projections on a parametric bootstrap of residuals and an underlying stock recruitment curve.

15) At the end of the first day of discussion, there were major technical uncertainties related to how to measure and express uncertainty in estimates of virgin biomass and current stock size. Typical variance estimates are not available in the age structure stock synthesis model.

16) It was agreed that the assessment reviewed by the STAR panel should provide the building blocks for rebuilding time analyses but that it may be impossible to carry the analyses out in the assessment itself.

Tuesday, 16 April

17) The STAR panel agreed with the STAT team's decision to use an emphasis of 0.1 for all length composition data sets and a value of 0.9 for age composition data when both length and age composition data were available. This approach uses all available information, emphasizes use of the age data (which are more informative), and avoids "double counting".

18) There was considerable rockfish catch in California, Oregon and Washington prior to 1941 and the best available information (from limited sampling after 1941 in central California) suggest that roughly 18% was canary. Thus, the assumption that the canary fishery was unexploited in 1940 seems untenable. A quick calculation (to be elaborated upon in the

assessment document) suggests that canary catches prior to 1940 was about 500 mt per year. The base model run should assume that the stock was in equilibrium with a catch of 500 mt per year in 1940.

19) Two explanations regarding the relative scarcity of old and large female canary rockfish in age and length composition data was discussed. One hypothesis asserts that the scarcity is due to reduced selectivity for large females. The other hypothesis asserts that the scarcity is due to higher natural mortality in large females, presumably due to stress from reproduction. The draft assessment presented information and arguments suggesting that natural mortality increases. The selectivity hypothesis is supported by certain life history considerations, which suggest that some species of rockfish move to deeper and rockier habitats as they age. Previous assessments portrayed these hypotheses as competing and presented 'extreme' alternate model scenarios assuming one hypothesis or the other.

20) The STAR panel pointed out that the two hypotheses were independent, rather than competing because an increase in natural mortality might occur with or without reduced selectivity for older females. In fact, based on available age composition data, maximum age information, and general biological considerations, the majority of the STAR panel felt that both hypotheses were likely valid to some extent. That is, it seems plausible that older females have elevated natural mortality and potentially reduced fishery selectivity.

21) An approach to building a blended model starts with the relatively certain conclusion that natural morality increases with age and the hypothesis that increased natural mortality is linked to maturity and stress due to spawning. In particular, it seems reasonable that the increase in natural mortality should be linked to the increase in proportion mature with size and age.

22) Starting with the assumed natural mortality rate for young females (M_{base}), the model should be able to estimate a parameter m that increments natural mortality as (for example) $M(a) = M_{base}+p(a)*m$ where $p(a)$ is maturity at age (or some function of maturity at age). It may be possible to simultaneously estimate both the mortality increment parameter and domed shape selectivity for females. This approach embraces both hypotheses while using the data to estimate parameters for both.

Wednesday, April 17

23) After some exploration, the STAT team proposed to use a relationship between natural mortality and age of the form $M(a) = M_{base}+p(a)^3*m$ because the cubic exponent delays the onset of increased mortality somewhat. The STAR panel agreed with this proposal.

24) Estimated declines in selectivity and increases in maturity for females occur at ages near the accumulator age (23 years) used in the current assessment. Canary are a relatively long-lived fish and, in future assessments, it might be advisable to use an older age as (e.g. 30-35 years) as a plus group.

25) The STAR panel agrees that the 1982 logbook catch rate for canary is an outlier that should be omitted from the analysis.

26) The STAR and STAT panel agreed that a reasonable approximation to confidence interval on current biomass, current biomass/virgin biomass and other parameters could be formed by considering a likelihood profile on the female natural mortality rate parameter (*m*, see above). One end of the interval is defined at *m*=0 (no increment to natural mortality for females) because the probability that m=0 is likely near zero. Under the circumstances, it seems reasonable to interpret the likelihood profile as a probability distribution in associating probabilities with each value of the female increment mortality parameter *m*.

27) Variability in recruitment appears to be autocorrelated in canary with periods of higher and lower recruitment than expected based on the estimated spawner-recruit curve. Autocorrelation may have important ramifications in rebuilding time calculations when starting at low stock biomass levels. In particular, autocorrelation may increase rebuilding time. If possible, sensitivity of rebuilding time calculations to assumptions about autocorrelations in recruitment should be evaluated.

28) There is uncertainty in the distribution of residuals around the stock-recruitment curve. The lognormal distribution is assumed traditionally but it may not mimic the true distribution of very large and very small residuals. Assumptions about lognormal distributions have attracted considerable criticism in the literature. If possible, sensitivity of rebuilding time calculations to assumptions about the distribution of recruitment variability should be evaluated.

29) Rebuilding time calculations may be sensitive to errors in biomass estimates, particularly if the rebuilding plan uses harvest rates. Errors in biomass estimates and implementation errors (e.g. overages in catch due to unaccounted bycatch) should be included in rebuilding time calculations.

Thursday, April 18

30) Addition of the Canadian data and the triennial shelf survey catch rates from the Canadian Vancouver area results in a better fit to the overall survey trend (root mean squared error = 0.39 vs. 0.57). The terminal biomass is almost identical to the model with the Canadian information excluded, but the initial biomass is slightly larger. For that reason the depletion level is slightly lowered. Recruitments variability is unaffected, because no age or length composition information is available, but the time series is marginally shifted up. In the sensitivity analysis, the survey catchability (Q) went from 0.4 to 0.6 with the Canadian information included, ostensibly because the survey trend showed a greater decline.

31) Preliminary rebuilding trajectories were calculated using the Stock Synthesis projection module. Graphs were presented showing preliminary results from 1,000 realizations with a terminal female mortality rate equal to 0.10 for old large individuals (in the base model it is 0.12). If rebuilding is projected using the same approach as previously employed (R/S and no catch) the minimum time to rebuild is 10 years greater than before. The STAT team also used the spawner-recruit curve to project with no fishing, which shifted the cumulative probability distribution slightly to the right (i.e., longer times to rebuild).

32) If one uses trawl selectivity to project with 93 mt fixed catch, then 50% of the preliminary simulations rebuilt 3 years after the maximum time allowable (T_{max}); if recreational selectivity is used to project the population, then the stock will reach the rebuilding target with 50% probability 14 years after T_{max}. With a blended selectivity curve (trawl and recreational) and a constant harvest rate equal to F=0.005 the stock could rebuild within the current T_{max}. However, initial catches under that preliminary scenario are quite low (~20 mt)

33) Due to the importance of the fishery selectivity curve used in projections, the STAR panel recommended that projections should include a variety of assumptions about selectivity, ranging from full trawl to full recreational selectivity curves.

34) The STAR selected a base model that had the female natural mortality rate linked to the maturity curve, increasing to a maximum value of 0.12.

35) The STAT team indicated that they would include an evaluation of the Canadian data in the assessment document as a sensitivity analysis only.

III. Explanation of Areas of Disagreement Regarding STAR Panel Recommendations

There were no areas of disagreement, either among STAR panel members or between the STAR panel and the STAT team. It is the consensus conclusion of the review panel that the assessment represents the best available scientific information regarding the status of the canary rockfish stock and that its conclusions will useful in providing guidance on management and the likelihood of stock rebuilding.

IV. Unresolved Problems and Major Uncertainties

The STAR panel and STAT team agreed that a uncertainty/decision graph would be constructed that represented three states of nature, i.e., terminal female natural mortality rate equal to 0.10, 0.12, and 0.14 yr^{-1}. Results presented by the STAT team showed that range covered the likely extent of plausible values in the base model. Moreover, over that range of terminal M values the stock is estimated to be 7-11% of the unexploited biomass, which is consistent with the previous stock assessment and rebuilding analysis. Over that range spawning biomass in 2002 is estimated to be approximately 2,000-4,000 mt. To capture the range of uncertainty for the Council decision process, the Team provided the simulation results to project stock rebuilding forecasts given current status of the resource using the new baseline model assuming the 3 levels of asymptotic female natural mortality (M = 0.10, 0.12, and 0.14) and for as many as 5 levels of fishing, i.e. 50 mt, 93 mt, F = 0, F = 0.005, F90%. In addition the STAT team also re-evaluated the steepness estimate for the spawner-recruit relationship from the baseline model. This estimate was 0.289 for M = 0.12, yet the best fit of steepness estimated from direct fit of the estimates of recruits and spawning biomass from model output is 0.330. This approach external to the model is reasonable because, unlike the spawner-recruit models fit within stock synthesis, external estimates are less affected by data for years outside the range of spawner-recruit estimates used to fit the curves. These analyses suggest that the spawner-recruit steepness parameter (which measures average spawner-recruit productivity at low spawning biomass levels) for canary rockfish is low relative to other groundfish species. Thus, surplus production of canary rockfish at low biomass levels is expected to be relatively low and rebuilding times are expected to be relatively long, even at zero or low levels of fishing. Although this general pattern appears certain, uncertainty in estimates of the spawner-recruit steepness is a key uncertainty in rebuilding time calculations. Sensitivity and rebuilding analyses carried out after the STAR Panel meeting show that minor changes in estimation procedures give rise to relative small changes in steepness estimates that have substantial changes to estimated distributions for rebuilding times. Although it does not appear possible to resolve the uncertainty in steepness, the Team will prepare a likelihood profile for steepness using the new baseline model for M = 0.12. Because this range in steepness parameter has a major impact on the rebuilding forecasts, the STAR panel encourages the Team to include the range of steepness in their rebuilding forecast scenarios.

V. Recommendations for Future Research and Data Collection

1) In the future it would be desirable to incorporate all Canadian data sources (i.e., catches, survey abundance statistics, and age/length compositions) into the modeling framework because a significant portion of the canary rockfish stock resides to the north of the assessment area. This will require close cooperation with Canadian scientists.

2) There is inadequate information to identify the benthic habitats to which very young fish recruit. If such habitats were known, it would be desirable to sample them to develop a pre-recruitment survey.

3) There is a large quantity of trawl logbook data from all three States that dates back to the 1950's and has not been computerized. Those data should be identified, keypunched and combined in an analytical framework that utilizes port-specific species composition information to try and extend the trawl logbook time series of canary rockfish CPUE.

4) A re-examination of canary rockfish otoliths from ODF&W collections may reveal whether there has been a systematic change in age determinations over the last 20 years. This is especially important for the 25+ accumulator age group.

5) Due to the increased significance of non-trawl fisheries, particularly in the northern area, it is important that adequate resources be devoted to acquisition of information from the fixed gear fisheries, including the recreational sector.

6) Some uncertainty remains about whether the scarcity of old female canary rockfish is due to an accelerated natural mortality schedule, to decreased availability to sampling devices, or to a combination of factors. Hook-and-line and ROV/submersible surveys could prove useful in determining if older females are located in areas that are inaccessible to surveys and commercial fisheries. Although it is impossible to determine fish ages using visual sampling methods, if specific locations are identified that contain very large canary rockfish, these could then be targeted with hook-and-line gear (perhaps vertical longlines).

7) Monitoring of canary rockfish rebuilding will depend critically on the continuation of existing fishery-independent surveys (e.g., the shelf trawl survey). New and innovative survey methodologies (e.g., ichthyoplankton surveys to estimate female spawning biomass) should also be considered.

8) Party boat logbook data should be updated for the next assessment.

9) Variance estimates by some standard means (e.g., bootstrapping, MCMC, etc.) should be produced for the next assessment. There are no technical obstacles to generating these useful and standard estimates of uncertainty.

10) Selectivity functions used for canary rockfish in the stock synthesis model tend to be implausibly peaked, with first and second derivatives that change abruptly with age and size. Smoother distributions, with continuous derivatives should be investigated in future assessments.

Status of the Sablefish Resource off the Continental U.S. Pacific Coast in 2002

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Version 1.3

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Executive Summary

This document serves as an update to the last full assessment conducted for sablefish in 2001 (Schirripa and Methot 2001). This update, by definition, seeks to document changes in the estimates of the status of the stock by only considering newly available data for 2001 while not considering any new changes in the model structure or model assumptions.

The 2001 data was highlighted by two relatively strong incoming cohorts, the 1999 and 2000 year classes. The strength of these two year classes was evident not only in the traditional data sources such as the surveys of the continental shelf and slope, but also in the bycatch of the whiting fishery as documented by the Shoreside Whiting Observer Program. These year classes recruited into the population immediately following ten years of below average recruitment and correspond very well with environmental changes that have taken place in the North Pacific Ocean (often referred to as "regime shift"). They should be fully recruited into the fishery in 2003 and 2004.

The addition of the 2001 data increased the estimate of absolute spawning stock biomass but had little effect on the estimate of spawning stock biomass relative to virgin. While the estimate of B_{cur}/B_0 remained relatively the same as the previous assessment, the catch that would result from applying the '40:10' rule increased. This increase was due to a decrease in the re-estimated value of the slope survey Q, an estimate which has associated with it a high degree of uncertainty. How much the catch could increase was dependent upon the level of future recruitment as well as the value of Q for the slope survey. Alternatively, catch could remain at current levels and a rebuilding of the stock to the target spawning stock biomass could occur in a shorter time than previously estimated.

Introduction

Along with the traditional sources of data included in the previous assessment (Schirripa and Methot 2001), two new sources of data are considered in this update. These include sablefish bycatch data from the whiting fishery as well as the introduction of environmental data . Although neither data set was explicitly included in the modeling of the status of the stock, both provide further insight into the population dynamics of the sablefish stock. Furthermore, given the satisfactory results from this cursory examination of the data, both data sets were shown to have the potential of being used explicitly in the next full assessment.

Fishery Dependent Data

Commercial Fishery Landings

Landings. Catch information used in this analysis consisted of landing data (mt) from 1956 through 1980 that are archived in the Historical Annotated Landings (HAL) database (Lynde 1986), along with landing data from 1981 through 2001 that are maintained in the Pacific Fisheries Information Network (PacFIN) database. The landing values by INPFC area and major gear (longline, pot, and trawl) presented in Table 1 have changed slightly since the previous assessment was conducted in 2001, because of recent updates to the PacFIN central database. The revisions largely reflect landings that were reallocated to different INPFC areas based on new information that was made available regarding actual locales of particular catches. Gears other than longline, pot, and trawl are combined into a single miscellaneous category.

Landings of sablefish decreased in 2001 (Figure 1), however this is due to a reduction in the Acceptable Biological Catch (ABC) from 9.7 thousand metric tones in 2000 to 4.6 thousand metric tons in 2001.

Size Distributions. Sampled size compositions of the catch were expanded based on a weighting factor calculated from catch partitioned by year, gear, state, condition, grade, and sex. Details of this procedure are given in Schirripa and Methot (2001).

The most significant change in the fishery length compositions for 2001 was due to a change in the minimum size regulation:

Federal Register / Vol. 65, No. 195 / Friday, October 6, 2000 /Rules and Regulations (page 59753)

> *"Sablefish in the southern areas tend to be smaller than those in the northern areas. To reduce the discard of small fish that are otherwise marketable, fishers requested that the Council remove the per-trip limit of 500 lb (227 kg) for sablefish smaller than 22 inches (56 cm). In response to this request, the Council recommended removing the length requirement for the remainder of 2000."*

This change in regulation had a noticeable effect on the sizes of sablefish being retained, especially by trawl and hook & line gear (Figure 2). To account for this regulatory change, we estimated a new block of selectivity for all three fishery gear types starting in the year 2001.

Discards. No new direct observations of discards were available for this update. Consequently, the 2000 discard rate calculated from the Extended Data Collect Program (EDCP) was used for 2001 and 2002. With the change in size regulation mentioned above, rate of discarding may have gone down. Subsequent estimates of discards in the future will come from regular direct observations made by on-board observers.

Shoreside Whiting Observer Data

Overview. The Shoreside Whiting Observer Program (SWOP) is conducted by the Oregon Department of Fish and Wildlife. The information below was kindly provided by S. Parker as part of the SWOP annual report (Parker 2001). The SWOP was established in 1992 to provide information for evaluating bycatch in the directed Pacific whiting (*Merluccius productus*) fishery and for evaluating conservation measures adopted to limit the catch of salmon and other prohibited species. Though instituted as an experimental monitoring program, it has been continued annually to account for all catch in targeted whiting trip landings, potential discards, and accommodate the landing and disposal of non-sorted catch from these trips. In 1995, the SWOP's emphasis changed from a high observation rate (50% of landings), to a lower rate (10% of landings) and increased collection of biological information (e.g. otoliths, length, weight, sex, and maturity) from Pacific whiting and selected bycatch species (yellowtail and widow rockfish, sablefish, Pacific mackerel, and jack mackerel). The required observation rate was decreased as studies indicated that fish tickets were a good representation of what was actually being landed. Focus shifted again due to 1997 changes in the allocation of yellowtail rockfish and increases in yellowtail bycatch rates. Since then, yellowtail bycatch in the shoreside whiting fishery has been dramatically reduced because of increased awareness by fishermen of the bycatch and allocation issues involved in the SWOP program.

The SWOP is a cooperative effort between the fishing industry and state and federal management agencies to observe and collect information on directed Pacific whiting landings at shoreside processing plants. Participating vessels apply for and carry exempted fishing permits (EFPs) issued by the National Marine Fisheries Service (NMFS). Permit terms require vessels to land unsorted whiting at designated shoreside processing plants. Permitted vessels are not penalized for landing prohibited species (e.g. Pacific salmon, Pacific halibut, Dungeness crab), nor are the held liable for overages for groundfish trip limits. Participants in the SWOP are mid-water trawlers carrying EFPs, designated shoreside processing plants in California, Oregon, and Washington, the PFMC, the NMFS, the Pacific States Marine Fisheries Commission (PSFMC), the Oregon Department of Fish and Wildlife (ODFW), the California Department of Fish and Game (CDFG), and the Washington Department of Fish and Wildlife (WDFW).

Although the SWOP data was not included explicitly in the population model, we feel that it contributes to the overall confidence in the estimation of year class strengths that was observed in the shelf survey.

Survey Indices. The bycatch of sablefish in the shoreside whiting fishery had been declining almost every year from 1993 to 2000, until 2001 when there was a marked increase (Figure 3). This increase coincides directly with the marked increase in the estimated biomass observed in 2001 in the AFSC shelf survey (see below). Unfortunately, there are only three collection years coincident between the SWOP and the AFSC shelf survey (1995, 1998, and 2001), however, both trends suggest that sablefish biomass on the continental shelf reached a low in the late 1990's. Although in 2001 the whiting fishery began in April, no sablefish bycatch was observed until June of that year (Figure 4). Sablefish bycatch increased notably in mid July and peaked at the end of July and the beginning of August. Although the fishery continued until September 30, no more sablefish were observed after the last week of August.

Size Distributions. Size distributions of sablefish where available from 1995-2001. Sizes ranged from 30 to 83 cm with a mean of 45 cm, although the majority of fish sampled were less than 50 cm (Figure 5). Upon initial inspection there is a noticeable agreement between the length frequencies of the SWOP data and those from the trawl survey of the continental shelf. In 1995, both data sources indicate a lack of fish between 40 and 50 cm; in 1998, both data sources indicate a lack of fish between 30 and 40 cm; and in 2001 both data sources indicate a high abundance of fish between 30 and 40 cm (age 1) and between 40 and 50 cm (age 2). The lack of recruitment suspected in the late 1990's is evidenced in the SWOP data by the absence of fish between 30 and 40 cm during this time. In fact, the length compositions suggest that perhaps a single cohort may have tracked through fishery as an almost unimodal distribution can be seen shifting to slightly larger fish from 1997 to 2000.

While considering these length compositions for inclusion in the population model, one observation in particular stood out as unclear. The high abundance of age 2 fish in 2001 were not seen as age 1 fish in 2000. Because the presence of age 2 fish in 2001 was verified by the length compositions from the 2001 continental shelf survey, there was not a high degree of confidence that the SWOP data represented the entire population. Nonetheless, given the annual collection of this data source, and the high degree of agreement between it and the shelf survey observations, further investigation for possible inclusion to the population model is warranted.

Fishery Independent Data

Trawl Survey on the Continental Slope

Survey Indices. As in 2000, estimates of sablefish biomass on the continental slope were conducted by two independent surveys in 2001. The first survey, conducted in the summer, was accomplished by the NWFSC using the Industry Cooperative Survey. The second survey, conducted in the autumn, was accomplished by the AFSC aboard the *R/V Miller Freemen*. Biomass estimates from the AFSC survey were derived using an arithmetic mean for each sampling strata (Lauth 2001). Biomass estimates from the combined survey were derived using the data from the *R/V Miller Freeman* as well as data collected from the industry vessels. A Generalized Linear Model (GLM) approach was used to estimate biomass from both surveys (analysis provided by T. Helser, NWFSC).

Biomass as estimated from data considering only the *R/V Miller Freeman* and using the arithmetic mean was up slightly in 2001 compared to 2000. However, biomass as estimated from data considering both the *R/V Miller Freeman* and industry vessels via the GLM method were down slightly from the previous year (Figure 6).

Size Distributions. As in 2000, estimates of the length composition of the continental slope survey were derived from samples taken from both the NWFSC Industry Cooperative Survey and the AFSC slope survey. Observations from each survey were combined into the 10 strata designations (5 INPFC areas and 2 depths) defined by the NWFSC survey. On the stratum level, the size compositions for each tow were normalized to 1 and then multiplied by the total expanded (unobserved) number of fish, then tows summed to the stratum level. At the stratum level, the GLM predicted biomass were converted to numbers by dividing the average weight per fish into the biomass estimate and then all spatial cells summed to get the annual size composition.

An increased number of small sablefish were evident in 2001 length compositions (Figure 7). This agrees well with observations of the shelf survey (see below) and those of the whiting bycatch (see above). Furthermore, a bimodal distribution is further evidence of the "missing" year classes of the late 1990's.

Although not formally considered in this update, it is worth noting the high number of age 0 (2001 year class) sablefish observed in the 2001 slope survey. Given the fact that the slope survey generally does not sample the shelf, and the low selectivity of the survey and gear for sablefish that small, it is unusual that 3% of the length composition fell within the age 0 size range (i.e. between 21 and 31 centimeters).

Age Distributions. Further evidence of a relatively strong 1999 year class was seen by the dominance of age two sablefish in the age composition of the 2001 slope survey (Figure 8). Also evident was the near absence of the 1996 year class. Although age 1 sablefish were not as abundant as other data sources suggest, the slope gear was estimated to have a very low selectivity for this age (see below).

Trawl Survey on the Continental Shelf

Survey Indices. Estimates of sablefish biomass from the continental shelf survey in 2001 (99,552 mt) were the highest since the beginning of the survey in 1980 (65,981 mt) (Figure 9).
Sablefish were present in 405 of the 507 total tows made, or approximately 80 percent of the all tows. Although sablefish were captured throughout the entire coast, the highest catch rates were observed between approximately latitudes 44°N and 48°N, and also between latitudes 37°N and 40°N (Figure 10). As has been the case in past shelf surveys, highest sablefish densities were observed in areas around Heceta Bank. Because of the high degree of skewness in the distribution, catch rates were log transformed for subsequent analysis.

Variation in sablefish catch rates decreased with depth (Figure 11). Catch rates were most variable inside depths of 250 meters and much less variable between 250 and 500 meters in depth. A polynomial fit to the observations reveals an increasing trend in catch rates up to 250 meters, after which the catch rates level off and remain quite consistent. Although the highest observed catch rate came from inside 250 meters, it is also here where tows absent of sablefish were most frequent. Tows absent of sablefish were concentrated mostly between 57 meters and 163 meters in depth. In fact, only three of the 224 tows made deeper than 163 meters did not contain sablefish. Variation in sablefish catch rates showed no obvious trend when examined in relation to latitude of capture (Figure 12). A polynomial fit to the observations revealed the same trend as pointed out above: catch rates were highest off of Oregon and again off of the southern half of California. Tows absent of sablefish were fairly evenly dispersed throughout all latitudes.

One of the concerns that need to be addressed with using the shelf survey data is ensuring that large biomass estimates, as was seen in 2001, are not derived from a relatively few tows that contained large numbers of sablefish. Although two out of the 507 tows did stand out as having caught a great deal of sablefish, the evidence shown above shows convincingly that the catch of sablefish occurred throughout the entire coast, catch of sablefish was frequent, and that the variation in catch rate was not indicative of a extremely dispersed distribution. Consequently, biomass estimates from the shelf survey were assumed to be reliable and useful for this analysis.

Size Distributions. Length compositions from the 2001 continental shelf survey indicated a high abundance of both age 1 (approximately 30-40 cm) and age 2 (approximately 40-50 cm) fish, suggesting relative strength in both the 1999 and 2000 year classes (Figure 13). This is a marked contrast to the observations of 1998, which suggested a virtual absence of age 1 and 2 sablefish.

Environmental Data

The previous assessment (Schirripa and Methot 2001) demonstrated what appeared to be a meaningful relationship between sablefish year class strength (estimated as the number of age 1 fish the following year) and anomalies of abundance for boreal shelf copepods. This relationship suggested that the recent upturn in sablefish recruitment may have been part of the recent overall "regime shift" that took place in the North Pacific. Although this relationship was quite revealing, the analysis suffered from a lack of annual observations of copepods for the entire time series of available recruitment estimates (1971-2000). In an effort to remedy this and increase sample size of the independent variable, sea level height was investigated as an alternative. Sea level height is often used as a proxy to quantify the southerly and offshore movement of water as a result of the California Current as well as the coastal upwelling index (Hickey 1998). Lower sea level height s correspond to increased movement of water equatorward and offshore while higher sea levels correspond to decreased flows equatorward and offshore. Based on a significant relation between the copepod anomalies and sea level height , it was hypothesized that it was variations in this equatorward and offshore movement that may in fact be driving the copepod anomalies, and consequently may be a similar measurement of the same processes. Sea level height data were provided by the NOAA archives, through the Sea and Lake Levels Branch. Sea level height from the monitoring station off of Crescent City, California was used based on the stations proximity and long time series available (1933-present). The overall annual mean sea level was considered as well as individual monthly means. A GLM model was used to test for significance.

A significant relationship was found between mean sea level in July and sablefish year class strength that same year ($P = 0.009$, $r^2 = 0.22$) (Figure 14). Furthermore, the addition of estimates of spawning stock biomass to the GLM model added virtually no explanatory power to the model while adding to the probability of a Type I error ($P = 0.030$, $r^2 = 0.23$). These results suggest that environmental processes may play a significantly larger role than spawning stock biomass in determining sablefish year class strength. Given the above model, it should be possible to draw some very preliminary conclusions concerning year class strength of cohorts not yet available to the survey gear (the continental shelf survey). The latest data currently available for Crescent City sea level in July of 2001 is 7.13 feet, which is depicted in Figure 15 by the cross-hair symbol and labeled '2001'. The July 2001 sea level is lower than either the 1999 (7.21) or the 2000 (7.18) level.

Possible Historic Year Class Strengths. If recruitment is driven more by environmental fluctuations, such as those that drive fluctuations in sea level, and less by spawning stock biomass, then examination of the historical record of sea level may offer some insight into what historical recruitment may have been like. Sea level anomalies at Crescent City from 1931 to 2001 form four somewhat distinct groups

(Figure 15). From 1933 to 1963 anomalies were predominately positive, perhaps suggesting a period of relatively low recruitment. However, after 1963 the anomalies turn decidedly negative and continue essentially negative until 1990, suggesting a shift to a higher recruitment regime. In 1990 sea level height anomalies again turned positive, coincidence with the marked decline in sablefish recruitment. Finally, the return to negative anomalies in 1998 and 1999 corresponds very well with the recent marked increase discussed in the previous section.

Based on these observations, the regression described above, and the assumption that recruitment is primarily environmentally driven, it was possible to speculate what historic year class strengths may have been (Figure 16). All historic sea level observations fall within the bounds of the regression. The overall mean year class strength for 1933-2000 (118.46m fish) was not dissimilar to the mean estimated from the population model for 1974-2000 (132.83m fish).

Current Status of the Stock

Model Configuration. As directed by the Terms of Reference and the Scientific and Statistical Committee (SSC), the parameters of the population model remained unchanged from the previous assessment (Schirripa and Methot 2001). The only change requested for this update was the addition and interpretation of any new data. Towards this end, data sources were added one at a time in a progressive manner (model and data configurations 1-6) to see exactly what effect each new data source had on the model outcome. The summary of this procedure is summarized (Table 2). The final model of the series, model 6, incorporates all the new available data and will be the model of discussion below.

Fit to Indices. The model 6 fit to the shelf survey biomass is shown in Figure 17. The only meaningful difference to the fit with the addition of the new data was that the biomass estimate was scaled up slightly from the 2001 estimate. However, the model 6 fit to the slope survey biomass was scaled down from the 2001 estimate with a slower rate of decline (Figure 18).

Estimated length compositions from the 2001 shelf survey fit well to those observed (Figure 19). However, this is not surprising as it is the last year of data and the youngest fish. Perhaps more encouraging is the fit to the 2001 slope survey length compositions (Figure 20). Not only can the recent strong year classes be seen in the fit, but also the very weak year classes of 1997 and 1998 (fish approximately 53 cm in length).

Population Trends. Several changes arose in the current perception of the status of the stock as a result of adding the 2001 data. The most notable change was in the 2001 spawning stock biomass, which increased from 55,448 mt to 72,352 mt (Figure 21). The two data sources responsible for this increase were: 1.) the shelf survey biomass and length compositions; and 2.) the slope survey length compositions. Although the shelf survey biomass alone dramatically increased the year class strength of the 2000 cohort (age 1 fish) (Figure 22), it was the shelf survey length compositions that distributed these fish into both the 1999 and 2000 cohorts (age 1 and age 2 fish), thus increasing the estimate of spawning stock biomass.

The second notable change that took place was the estimate of the 2000 recruitment, which increased from 47.83m fish to 221.18m fish, and the estimate of the 2001 recruitment, which was previously unknown but was now estimated at 235.86m fish.

Adding the fishery length compositions had the effect of lowering the initial selectivity of the slope survey from a previously bound estimate of 0.99 to an unbound estimate of 0.18 (Figure 23), mostly due to the increase of small fish in the catch due to the relaxation of the minimum legal size requirements.(Table 2). However, the estimate of slope initial selectivity returned to the previous level of 0.99 when a new selectivity block was defined starting in 2001 (as a response to the relaxed regulation). The addition of the 2001 shelf survey length compositions again decreased the estimate of slope survey initial selectivity to 0.27. This is due to the strong 1999 year class not showing strongly in the 2000 slope surveys. Finally, the addition of the 2001 slope survey length compositions decreased the estimate to 0.21.

Profile Analysis. Given the importance, as well as the elusory nature, of the Q parameter, a profile analysis was conducted on Q with standardized total likelihood as the response variable. The best fit estimate of Q decreased from an estimate of 0.60 in 2001 to an estimate of 0.46 in 2002 (Figure 24). This resulted in approximately an 18% increase in the estimate of spawning stock biomass. It should be noted that the profile surface is quite flat. For example, between the 2002 values of $Q = 0.30$ and 0.60 there is less than a 1 likelihood unit difference between the total likelihoods. This is similar to the surface of the 2001 estimate, where the range of Q for less than 1 likelihood unit difference was $Q = 0.40$ to 0.70.

Possible Future Status of the Stock

Alternate States of Nature. As was done in the previous assessment, four options were considered as possible states of nature. The four states of nature assume two possible levels of mean virgin recruitment (R_0) and two possible levels of future recruitment (used in the projections). The two levels of mean virgin recruitment each use different year in the calculation of the mean. The "density dependent" state of nature uses the years 1975-1991, the beginning of the a time series when exploitation was assumed to be relatively low. The hypothesis under this state of nature is that recruitment is density dependent and that increases in recruitment will only be brought about by increases in spawning stock biomass. The second state of nature, referred to as "regime shift", uses the entire time series of recruitment (1975-2001) to calculate the mean virgin recruitment. The hypothesis under this state is that recruitment is driven more by changes in the environment rather than levels of spawning stock biomass. Consequently, the concept of mean virgin recruitment could included several 'regimes' of various recruitment levels, some high and some low depending on which environmental regime was in existence at any particular time.

The first possible level of future recruitment was calculated as the mean of years with relatively low recruitment (1992-1998, 'low', mean = 41.83m fish). This hypothesis assumes that recruitment will stay relatively low, due perhaps to low spawning stock biomass. The second level of future recruitment considered uses the mean of entire time series of available recruitment (1975-2001, 'high', mean = 132.83m fish) This hypothesis assumes that future recruitments will continue to deviate around the overall past mean value and could be either relatively high or low in any given future year. These four states of nature were derived to fit as closely as possible with the states of nature decided upon during the review of the previous assessment.

In addition to the four states of nature applied to model 6 as described above, a model 7 was configured that was identical to model 6 except that the slope survey *Q* was fixed at the value estimated in the previous assessment (Q = 0.60). This had the effect of maintaining the original scale of the biomass at the level estimated in the previous assessment. In all cases, Virgin biomass (B_0) was calculated by multiplying the virgin recruitment (R_0) by the model calculated value of spawners-per-recruit (*SPR*). Projections were run assuming the '40:10' rule and a target F45%. For comparison, the decision table of the four states of nature produced from the previous assessment (model 0) is given here in Table 3, the four states of nature under model 6 in Table 4A, and the four states of nature under model 7 in Table 5A. Table 4B and 5B shows the model outcomes of choosing a ten year constant catch equal to the 2003 'high' recruitment value but actually realizing a 'low' recruitment level as well as choosing a ten year constant catch equal to the 2003 'low' recruitment value but actually realizing a 'high' recruitment (i.e. the risk of incorrectly choosing between 'low' and 'high' projected recruitment).

Estimates of the B_{cur}/B_0 for both models 6 and 7 and for all four states of nature ranged from 26 to 39% and so were all above the overfished level of 25 percent. Although not currently overfished, both the 'density dependent' and 'regime shift' models assuming 'low' future recruitment predicted a decreasing catch as well as a decreasing spawning biomass ratio for the next ten years. However, both of these models predicted either stable or slightly increasing catch and spawning stock biomass under the 'high' recruitment hypothesis. These outcomes are not at all dissimilar to those arrived at in the previous assessment, however the level of catch for 2003 under the 40:10 rule has risen from a previous estimate of approximately 3600-4600 mt to an current estimate of either 7600-8400 mt for model 6, or 5200-6000 mt for model 7. Although the terms 'high' and 'low' are used to here as relative terms to distinguish between the two assumptions of future recruitment, the mean recruitment used for the 'high' case scenario (132.83m fish) is still lower than the estimate of recruitment for either 2000 (221.18m fish) or 2001 (235.86m fish).

The consequences of choosing incorrectly between a 'low' and a 'high' projected recruitment are shown in Table 4B for model 6 and 5B for model 7. The fact that the 2000 and 2001 recruitments are already established at levels significantly larger than the mean recruitments used in the projections initially buffers the consequence of an incorrect decision. These two strong year classes maintain spawning stock biomass to a certain extent as these cohorts progress through the population. However, even though the spawning stock biomass ratios in 2012 are somewhat similar (25% versus 23%) the incorrect choice results in more rapid decrease of this ratio as well as much higher exploitation rates. Furthermore, the fact that future catch was modeled as a constant results in a situation of incorrectly choosing 'high' as getting progressively worse incorrectly choosing a 'low' recruitment results in a progressively larger stock size. This is because: 1.) the 2000 and 2001 recruitments are already established at levels significantly larger than the mean recruitments used in the projection; and 2.) the catch is held constant at the 2003 level instead of increased annually.

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Appendix 1. Summary and requests from SSC for further analysis via conference call May 6, 2002

1. We have tentatively accepted model 6, which estimates the slope survey Q within the model.

2. We are concerned about the change to last year's model that allowed for a new selectivity period for commercial fisheries beginning in 2001. Particularly, that change may have strongly influenced the estimate of 2001 recruitment and all projections. Consequently, the panel requests that a sensitivity analysis be conducted as follows: remove the new 2001 time-varying selectivity period and any "emphasis" on the 2001 commercial compositional data (length or age). Conduct projections with the new model and compare with model 6.

This task was completed and is labeled "model 6B". Results were added to Table 2 and summarized in Table 4C. To summarize, the above modification resulted a lower estimate of slope Q (from 0.46 to 0.43) which increased the estimate of ending biomass from 155,445 mt to 164,978 mt. Year class strength changed marginally: YC 99: from 2.2118 to 2.3571; YC 100: from 2.3586 to 2.4908. Because of the increase in ending biomass, catch recommendations for 2003 for all four 'states of nature' increased approximately 5-6 thousand metric tons.

3. We request that confidence intervals be placed on survey biomass statistics presented in figures that show the fit of the model to those data (e.g., figures 17 and 18).

This task was completed and Figures 17 and 18 revised to reflect coefficients of variation around the biomass estimates.

4. If time allows, it would be useful to compare the density-dependent projections developed from model 6 (columns 2 & 3 in Table 4a), which resample from the 1992-98 time period, to projections that resample from the 1992-2001 time period. The later projections should be more optimistic.

This task was completed and results are summarized in Table 4D. As suspected, when compared to results projected with 1992-1998 mean recruitment (Table 4A) estimates of catch using the '40:10' rule are slightly higher. Furthermore, the spawning stock biomass ratio does not drop below 25% within the ten year projection.

Appendix 2. Summary and requests from the GMT for further analysis via phone call May 14, 2002.

To date, all projections presented in this document have assumed an exploitation rate of F45% SPR. On May 14, 2002, a request was made by the Groundfish Management Team (GMT) that further projections be made with the Model 6, density-dependent 'state-of-nature' that would assume various levels of exploitation other than the F45% SPR.

The results of this request are given in Table 4E, however, there are several critical factors that should be considered when interpreting these (and all other) projection results. In accordance with the stated Terms of Reference for Expedited Stock Assessment Updates, updated projections were made in the same manner as the last full assessment (i.e. assuming some level of constant recruitment). By assuming constant annual recruitment the explicit assumption has been made that future recruitment is totally independent of any changes spawning stock biomass. In other words, the assumption is that recruitment is driven not by the spawning stock biomass but rather by the environment. This, by definition, is truly a "regime shift" hypothesis. Consequently, even though projections are run assuming a state-of-nature termed either "density-dependent" of "regime shift", because both assume constant future recruitment both are by definition "regime shift" models.

Because future recruitment is assumed to be constant in each of the projections (= 7932), and because this level of recruitment is less than the assumed "virgin recruitment" level (= 16431), the level of maximum rebuilding of spawning stock biomass is mathematically constrained to the equilibrium value *7932/16431 = 48%,* even under a $F = 0$ scenario. Furthermore, because the equilibrium value is reached asymptotically, the rate at which this level is reached will decrease each year. **As a consequence, the runs provided may under estimate the long term response of the SSB ratio to the associated catch levels.** However, because the 1999 and 2000 year class strengths are already established, short term projections (3 years) should not be effected.

The most logical way around the above mentioned caveats is to project recruitment as a function of spawning stock biomass (assuming this is an acceptable hypothesis). However, the parameters of the stock-recruitment function for sablefish is not well estimated within the model (as remarked on by the 2001 STAR Panel). This would lead to an arbitrary selection of the stock-recruitment steepness parameter, which is generally considered an unacceptable solution. Recent increases in recruitment may offer an opportunity for more credible estimates of the steepness parameter. In a future sablefish assessment, this may alleviate the need to assume constant recruitment.

Table 1. Sablefish catch (mt) by INPFC area, gear, and year harvested off the U.S. Pacific coast (1935-2001)

	INPFC area																				
	Vancouver-Columbia				Eureka-Monterey				Conception				Unknown				Combined				
Year	HKL	POT	TWL	MISC	HKL	POT	TWL	MISC	HKL	POT	TWL	MISC	HKL	POT	TWL	MISC	HKL	POT	TWL	MISC	TOTAL
1935-52	1047	0	313	0	0	0	0	0	0	0	0	0	0	0	0	0	1047	0	313	0	1360
1956	748	0	1578	0	383	0	884	0	0	0	19	0	0	0	0	0	1131	0	2481	0	3612
1957	1629	0	347	0	423	0	557	0	0	0	10	0	0	0	0	0	2051	0	914	0	2965
1958	712	0	313	0	144	0	634	0	0	0	1	0	0	0	0	0	855	0	948	0	1803
1959	1291	0	507	0	108	0	760	0	0	0	6	0	0	0	0	0	1399	0	1273	0	2672
1960	1851	0	545	0	130	0	954	0	0	0	11	0	0	0	0	0	1980	0	1510	0	3491
1961	997	0	335	0	145	0	942	0	0	0	119	0	0	0	0	0	1142	0	1396	0	2538
1962	954	0	1028	0	156	0	818	0	0	0	101	0	0	0	0	0	1110	0	1947	0	3057
1963	873	0	308	0	67	0	726	0	0	0	167	0	0	0	0	0	940	0	1201	0	2141
1964	959	0	197	0	469	0	738	0	0	0	198	0	0	0	0	0	1428	0	1133	0	2562
1965	632	0	168	0	530	0	1058	0	0	0	147	0	0	0	0	0	1162	0	1373	0	2534
1966	282	0	185	0	717	0	367	0	0	0	139	0	0	0	0	0	999	0	691	0	1691
1967	1611	0	158	0	1963	0	715	0	0	0	60	0	0	0	0	0	3574	0	933	0	4508
1968	972	0	170	0	947	0	831	0	32	0	15	0	0	0	0	0	1951	0	1016	0	2967
1969	3033	0	191	0	1157	0	1288	0	0	0	26	0	0	0	0	0	4200	0	1505	0	5705
1970	1397	114	1099	0	0	0	1312	0	7	0	11	0	0	0	0	0	1404	114	2422	0	3940
1971	914	120	1096	0	598	73	1355	0	0	0	80	0	0	0	0	0	1512	193	2531	0	4236
1972	2137	1	1124	0	1360	353	2309	0	3	3	29	0	0	0	0	0	3500	357	3462	0	7319
1973	876	413	526	0	246	440	3260	0	4	25	14	0	0	0	0	0	1126	878	3800	0	5805
1974	2266	389	462	0	176	2854	2563	0	2	1	22	0	0	0	0	0	2444	3244	3047	0	8735
1975	1737	5280	464	0	0	416	2849	0	0	0	79	0	0	0	0	0	1737	5696	3392	0	10825
1976	1149	7803	609	0	76	9165	2845	0	0	2772	100	0	0	0	0	0	1225	19740	3554	0	24518
1977	1445	552	1164	0	0	2518	2450	0	0	1070	51	0	0	0	0	0	1445	4140	3665	0	9250
1978	1641	591	1752	0	75	2720	4182	0	6	2599	52	0	0	0	0	0	1722	5910	5986	0	13617
1979	3596	4299	2582	0	641	3302	4889	0	1	4971	92	0	0	0	0	0	4238	12572	7563	0	24373
1980	1097	2381	1546	0	298	595	2346	0	45	801	37	0	0	0	0	0	1440	3777	3929	0	9146
1981	1185	1549	1810	55	750	1846	3641	30	2	502	46	0	2	0	0	0	1939	3897	5497	85	11418
1982	1026	2884	4631	141	661	2706	5562	68	1	906	39	1	0	0	0	0	1688	6495	10231	210	18625

Table 1 (cont). Sablefish catch (mt) by INPFC area, gear, and year harvested off the U.S. Pacific coast (1935-2001)

	INPFC area																				
	Vancouver-Columbia				Eureka-Monterey				Conception				Unknown				Combined				
Year	HKL	POT	TWL	MISC	HKL	POT	TWL	MISC	HKL	POT	TWL	MISC	HKL	POT	TWL	MISC	HKL	POT	TWL	MISC	TOTAL
1983	755	2208	3803	193	283	1525	3466	540	0	1667	85	174	0	0	0	0	1038	5400	7354	906	14698
1984	970	2440	4638	375	52	455	3450	624	0	928	140	1	0	0	0	0	1023	3822	8228	1000	14073
1985	2289	2365	3298	298	489	1268	3526	308	1	15	422	35	0	0	0	0	2779	3649	7246	640	14314
1986	2737	1447	2478	0	875	655	3372	1166	4	44	284	226	0	0	0	0	3615	2146	6134	1391	13287
1987	3215	1480	3185	0	925	533	2954	63	14	21	344	11	0	36	4	0	4155	2070	6487	73	12785
1988	2783	1381	2648	0	381	619	2364	352	14	15	294	23	0	0	1	0	3178	2015	5308	375	10875
1989	2139	1059	2728	0	360	972	2554	124	78	1	410	13	0	0	0	0	2577	2032	5692	136	10437
1990	1569	872	2441	0	535	516	2320	291	93	91	363	74	0	8	3	2	2197	1488	5128	367	9180
1991	2434	638	2498	0	875	326	2209	102	109	100	193	10	1	0	0	0	3419	1064	4900	112	9495
1992	1996	363	2645	0	975	217	2421	154	90	187	284	24	1	0	3	0	3063	766	5353	178	9360
1993	1743	613	2728	0	503	181	1955	18	81	55	266	2	1	0	0	0	2327	849	4949	19	8145
1994	1498	1048	2079	0	727	296	1572	68	113	0	161	14	0	0	0	0	2339	1345	3812	83	7579
1995	1981	749	1872	0	879	311	1750	26	113	2	214	3	0	0	3	0	2974	1062	3838	29	7903
1996	1919	522	2119	0	1311	227	1873	4	125	1	214	0	0	0	0	0	3355	750	4206	4	8316
1997	2106	356	1873	0	1372	227	1741	2	106	1	154	1	0	0	3	0	3584	584	3772	3	7943
1998	1190	384	1081	2	468	63	975	4	99	0	112	0	0	0	1	0	1756	448	2169	6	4379
1999	1909	628	1727	0	713	125	1360	1	97	2	82	0	0	0	0	0	2718	755	3169	1	6643
2000	1986	619	1435	0	673	190	1129	2	83	1	37	1	0	0	94	0	2741	810	2696	2	6249
2001	1612	517	1635	1	611	162	934	1	109	2	29	0	0	0	7	0	2332	681	2605	2	5621

Table 2. Selected parameter estimates from model runs as data sources were progressively added.

DATA SOURCE / PARAM	0	1	2	3	4	5	6	6B	7
2001 Landings/Lengths		X	X	X	X	X	X	\	X
2001 Selectivity Blocked			X	X	X	X	X		X
2001 Shelf Biomass				X	X	X	X	X	X
2001 Shelf Lengths					X	X	X	X	X
2001 Slope Biomass						X	X	X	X
2001 GLM Lths, MF Ages							X	X	X
Fix Slope Q at 2001 value									X
N Parms	115	116	123	123	123	123	123	117	122
Likelihood	-922.404	-943.234	-932.587	-943.838	-955.396	-951.644	-965.326	-950.412	-966.206
Ending Biomass	107481	163493	96797	148058	138281	137394	155445	164978	118340
Shelf Q	1.740488	2.14649	1.84928	1.82188	2.2102	2.21653	2.1272	1.7221	2.4159
Slope Q	0.600967	0.869823	0.664627	0.668446	0.5623	0.5441	0.4600	0.4310	0.6011
SLP-L FINAL SEL	0.2698	0.2366	0.2531	0.2526	0.2518	0.2521	0.2542	0.2621	0.2462
SLP-L INFLECT	0.1126	0.1198	0.1002	0.1023	0.1040	0.1043	0.1197	0.1287	0.1165
SLP-L SLOPE	0.3590	0.3409	0.3559	0.3524	0.3508	0.3522	0.3454	0.3528	0.3412
SLP INITIAL SEL	0.9900	0.1863	0.9900	0.9900	0.2710	0.2725	0.2117	0.2097	0.2064
RECR 100 YC 99 (x10000)	0.4783	2.0182	0.4927	0.5058	2.232	2.2112	2.2118	2.3571	1.7190
RECR 101 YC 100		15.0000	1.3620	13.1519	2.973	2.9437	2.3586	2.4908	1.8459
SPBIO: -1	188960	176040	187527	188235	197294	197116	206322	208061	192339
SPBIO:101	55448	38715	51499	51019	61870	61558	72352	76067	56093
SPBIO:102	50738	37688	47394	47309	58888	58571	69142	72788	52910

Table 3. Decision table from the 2001 sablefish assessment STAR Panel meeting for STAT Team 1, July 15, 2001.

Model 0		STAT 1 Density-Dependent	Regime Shift	Density-Dependent	Regime Shift
Range for mean virgin recruitment		1975-1991	1975-2000	1975-1991	1975-2000
Mean Virgin Recruitment (1000s of age 1 fish		15171	11121	15171	11121
Virgin SpawnBiomass		202541	148469	202541	148469
2001 SpawnBiomass		55448	55448	55448	55448
2001/Virgin		0.27	0.37	0.27	0.37
		Projections (1992-2000 recruitment) and 40:10 rule and F45%			
		(1992-1998 Recruitment)		(1975-2001 Recruitment	
Recruitment		3470	3470	11121	11121
SSP/Virgin	2002	0.25	0.34	0.25	0.34
	2003	0.24	0.32	0.24	0.32
	2004	0.22	0.30	0.23	0.31
	2005	0.21	0.28	0.24	0.31
	2006	0.20	0.27	0.24	0.32
	2007	0.20	0.26	0.25	0.33
	2008	0.19	0.25	0.26	0.34
	2009	0.18	0.24	0.27	0.35
	2010	0.18	0.23	0.27	0.36
	2011	0.18	0.22	0.28	0.37
Total Catch	2002	3877	4565	3935	4630
	2003	3573	4231	3911	4616
	2004	3338	3976	4193	4934
	2005	3130	3744	4619	5379
	2006	2931	3520	5058	5809
	2007	2750	3315	5458	6179
	2008	2591	3135	5810	6491
	2009	2451	2976	6125	6766
	2010	2336	2842	6412	7015
	2011	2234	2724	6668	7237
Catch/ age 2+ biomass	2002	0.039	0.046	0.038	0.045
	2003	0.038	0.045	0.037	0.044
	2004	0.037	0.045	0.039	0.046
	2005	0.036	0.044	0.041	0.049
	2006	0.035	0.043	0.043	0.051
	2007	0.034	0.042	0.045	0.052
	2008	0.033	0.041	0.046	0.053
	2009	0.032	0.040	0.047	0.054
	2010	0.031	0.039	0.048	0.054
	2011	0.030	0.039	0.048	0.055

Table 4A. Decision table for model 6 (includes all sources of new data and estimates Q withing the model).

MODEL 6		Density-Dependent	Regime Shift	Density-Dependent	Regime Shift
Years (at age 1 recruitment)		1975-1991	1975-2001	1975-1991	1975-2001
Mean Recruitment (10000 of age 1 fish)		16431	13283	16431	13283
Virgin Spawning Biomass		220931	178603	220931	178603
2002 Spawning Biomass		69150	69150	69150	69150
2002 / Virgin		0.31	0.39	0.31	0.39
		Projections and 40:10 rule and F45%			
		(1992-1998 Recruitment)		(1975-2001 Recruitment)	
		4183	4183	13283	13283
SSP/Virgin	2003	0.31	0.39	0.31	0.39
	2004	0.32	0.39	0.32	0.39
	2005	0.32	0.39	0.32	0.40
	2006	0.32	0.39	0.33	0.40
	2007	0.31	0.38	0.34	0.41
	2008	0.30	0.37	0.34	0.41
	2009	0.29	0.35	0.34	0.42
	2010	0.28	0.33	0.35	0.42
	2011	0.27	0.32	0.35	0.42
	2012	0.25	0.30	0.35	0.43
Total Catch	2003	7640	8325	7742	8437
	2004	7659	8285	7968	8620
	2005	7471	8026	8176	8777
	2006	7132	7622	8357	8889
	2007	6708	7146	8512	8960
	2008	6250	6648	8640	9017
	2009	5791	6159	8743	9066
	2010	5354	5699	8832	9108
	2011	4954	5282	8910	9147
	2012	4591	4905	8978	9182
Catch / age 2+ Biomass	2003	0.048	0.052	0.048	0.053
	2004	0.049	0.053	0.049	0.053
	2005	0.049	0.053	0.050	0.054
	2006	0.048	0.052	0.050	0.054
	2007	0.047	0.051	0.050	0.054
	2008	0.046	0.050	0.051	0.054
	2009	0.045	0.049	0.051	0.054
	2010	0.044	0.048	0.051	0.054
	2011	0.043	0.047	0.051	0.054
	2012	0.042	0.046	0.051	0.054

Table 4B. Decision table for model 6 (includes all sources of new data and estimates Q withing the model) with a constant catch assuming high projected recruitment and a realization of low projected recruitment.

MODEL 6		Density-Dependent	Regime Shift	Density-Dependent	Regime Shift
Years (at age 1 recruitment)		1975-1991	1975-2001	1975-1991	1975-2001
Mean Recruitment (10000 of age 1 fish)		16431	13283	16431	13283
Virgin Spawning Biomass		220931	178603	220931	178603
2002 Spawning Biomass		69150	69150	69150	69150
2002 / Virgin		0.31	0.39	0.31	0.39
		Projections and 40:10 rule and F45%			
		(1992-1998 Recruitment)		(1975-2001 Recruitment)	
		4183	4183	13283	13283
SSP/Virgin	2003	0.31	0.39	0.31	0.39
	2004	0.32	0.39	0.32	0.39
	2005	0.32	0.39	0.32	0.40
	2006	0.32	0.39	0.33	0.40
	2007	0.31	0.38	0.34	0.41
	2008	0.30	0.36	0.35	0.42
	2009	0.28	0.34	0.35	0.42
	2010	0.27	0.32	0.36	0.43
	2011	0.25	0.29	0.36	0.44
	2012	0.23	0.27	0.37	0.44
Total Catch	2003	7742	8437	7640	8325
	2004	7742	8437	7640	8325
	2005	7742	8437	7640	8325
	2006	7742	8437	7640	8325
	2007	7742	8437	7640	8325
	2008	7742	8437	7640	8325
	2009	7742	8437	7640	8325
	2010	7742	8437	7640	8325
	2011	7742	8437	7640	8325
	2012	7742	8437	7640	8325
Catch / age 2+ Biomass	2003	0.048	0.053	0.048	0.052
	2004	0.049	0.054	0.047	0.052
	2005	0.051	0.056	0.046	0.051
	2006	0.053	0.058	0.046	0.050
	2007	0.055	0.061	0.045	0.050
	2008	0.058	0.065	0.044	0.049
	2009	0.062	0.070	0.043	0.049
	2010	0.067	0.076	0.043	0.048
	2011	0.072	0.082	0.042	0.048
	2012	0.078	0.090	0.042	0.047

Table 4C. Decision table for model 6B (includes all sources of new data and estimates Q withing the model, no new selectivity block, and no fishery lengths for 2001).

MODEL 6B		Density-Dependent	Regime Shift	Density-Dependent	Regime Shift
Years (at age 1 recruitment)		1975-1991	1975-2001	1975-1991	1975-2001
Mean Recruitment (10000 of age 1 fish)		16796	13690	16796	13690
Virgin Spawning Biomass		224143	182693	224143	182693
2002 Spawning Biomass		72796	72796	72796	72796
2002 / Virgin		0.32	0.40	0.32	0.40
		Projections and 40:10 rule and F45%			
		(1992-1998 Recruitment)		(1975-2001 Recruitment)	
		4400	4400	13690	13690
SSP/Virgin	2003	0.33	0.40	0.33	0.40
	2004	0.33	0.40	0.33	0.40
	2005	0.33	0.40	0.34	0.41
	2006	0.33	0.40	0.34	0.41
	2007	0.32	0.39	0.34	0.42
	2008	0.31	0.37	0.35	0.42
	2009	0.30	0.36	0.35	0.42
	2010	0.28	0.34	0.35	0.43
	2011	0.27	0.32	0.36	0.43
	2012	0.26	0.31	0.36	0.43
Total Catch	2003	8229	8899	8231	8901
	2004	8996	9645	9040	9688
	2005	8988	9573	9430	10003
	2006	8363	8898	9537	10028
	2007	7555	8020	9577	9998
	2008	6839	7255	9652	10018
	2009	6259	6643	9740	10064
	2010	5774	6137	9826	10114
	2011	5358	5706	9907	10163
	2012	4989	5327	9981	10209
Catch / age 2+ Biomass	2003	0.048	0.052	0.048	0.052
	2004	0.053	0.057	0.052	0.056
	2005	0.055	0.059	0.053	0.057
	2006	0.053	0.057	0.053	0.057
	2007	0.050	0.054	0.053	0.056
	2008	0.047	0.051	0.053	0.056
	2009	0.046	0.049	0.053	0.055
	2010	0.044	0.048	0.053	0.055
	2011	0.043	0.047	0.053	0.055
	2012	0.042	0.046	0.053	0.055

Table 4D. Decision table for model 6 projecting recruitment with the mean recruitment from 1992–2001.

MODEL 6		Density-Dependent	Regime Shift
Years (at age 1 recruitment)		1975-1991	1975-2001
Mean Recruitment (10000 of age 1 fish)		16431	13283
Virgin Spawning Biomass		220931	178603
2002 Spawning Biomass		69150	69150
2002 / Virgin		0.31	0.39
		Projections and 40:10 rule and F45%	
		(1992-2001 Recruitment)	
		7932	7932
SSP/Virgin	2003	0.31	0.39
	2004	0.32	0.39
	2005	0.32	0.39
	2006	0.32	0.39
	2007	0.32	0.39
	2008	0.32	0.39
	2009	0.31	0.38
	2010	0.31	0.37
	2011	0.30	0.36
	2012	0.30	0.35
Total Catch	2003	7682	8371
	2004	7786	8423
	2005	7761	8335
	2006	7634	8149
	2007	7444	7911
	2008	7221	7649
	2009	6987	7385
	2010	6760	7134
	2011	6552	6906
	2012	6362	6699
Catch / age 2+ Biomass	2003	0.048	0.052
	2004	0.049	0.053
	2005	0.049	0.053
	2006	0.049	0.053
	2007	0.049	0.053
	2008	0.048	0.052
	2009	0.048	0.052
	2010	0.047	0.051
	2011	0.047	0.051
	2012	0.046	0.050

Table 5A. Decision table for model 7 (includes all sources of new data and fixes Q at the level estimated within the 2001 assessment (Schirripa and Methot 2001).

MODEL 7		Density-Dependent	Regime Shift	Density-Dependent	Regime Shift
Years (at age 1 recruitment)		1975-1991	1975-2001	1975-1991	1975-2001
Mean Recruitment (10000 of age 1 fish)		15030	11805	15030	11805
Virgin Spawning Biomass		202093	158730	202093	158730
2002 Spawning Biomass		52910	52910	52910	52910
2002 / Virgin		0.26	0.33	0.26	0.33
		Projections and 40:10 rule and F45%			
		(1992-1998 Recruitment)		(1975-2001 Recruitment)	
		3458	3458	11805	11805
SSP/Virgin	2003	0.26	0.33	0.26	0.33
	2004	0.26	0.33	0.26	0.33
	2005	0.27	0.34	0.27	0.34
	2006	0.27	0.34	0.28	0.35
	2007	0.27	0.33	0.29	0.36
	2008	0.26	0.32	0.30	0.37
	2009	0.25	0.31	0.31	0.38
	2010	0.24	0.30	0.31	0.38
	2011	0.23	0.28	0.32	0.39
	2012	0.22	0.27	0.32	0.40
Total Catch	2003	5236	5940	5321	6037
	2004	5329	5975	5588	6266
	2005	5275	5847	5878	6508
	2006	5096	5602	6167	6747
	2007	4838	5290	6443	6975
	2008	4540	4951	6691	7181
	2009	4231	4610	6911	7362
	2010	3930	4286	7105	7524
	2011	3652	3989	7279	7668
	2012	3396	3719	7429	7795
Catch / age 2+ Biomass	2003	0.043	0.049	0.044	0.050
	2004	0.044	0.050	0.045	0.051
	2005	0.045	0.050	0.046	0.051
	2006	0.044	0.050	0.047	0.052
	2007	0.044	0.049	0.047	0.052
	2008	0.043	0.048	0.048	0.053
	2009	0.042	0.047	0.049	0.053
	2010	0.040	0.046	0.049	0.053
	2011	0.039	0.045	0.049	0.054
	2012	0.038	0.044	0.050	0.054

Table 4E. Decision table for model 6 assuming different levels of exploitation (F%SPR).

MODEL 6		Density-Dependent	Density-Dependent	Density-Dependent	Density-Dependent	Density-Dependent
Years (at age 1 recruitment)		1975-1991	1975-1991	1975-1991	1975-1991	1975-1991
Mean Recruitment (10000 of age 1 fish)		16431	16431	16431	16431	16431
Virgin Spawning Biomass		220931	220931	220931	220931	220931
2002 Spawning Biomass		69150	69150	69150	69150	69150
2002 / Virgin		0.31	0.31	0.31	0.31	0.31
Projections and 40:10 rule and F%SPR =		F45%	F50%	F60%	F70%	F80%
Projected Recruitment (1992-2001 mean)		7932	7932	7932	7932	7932
SSP/Virgin	2003	0.31	0.31	0.31	0.31	0.31
	2004	0.32	0.32	0.32	0.33	0.33
	2005	0.32	0.33	0.33	0.34	0.34
	2006	0.32	0.33	0.34	0.35	0.36
	2007	0.32	0.33	0.35	0.36	0.37
	2008	0.32	0.33	0.35	0.36	0.38
	2009	0.31	0.33	0.35	0.37	0.38
	2010	0.31	0.32	0.35	0.37	0.39
	2011	0.30	0.32	0.34	0.37	0.39
	2012	0.30	0.31	0.34	0.36	0.39
Total Catch	2003	7682	6517	4614	3110	1886
	2004	7786	6679	4812	3286	2017
	2005	7761	6727	4930	3406	2116
	2006	7634	6683	4977	3476	2185
	2007	7444	6578	4974	3509	2231
	2008	7221	6436	4936	3514	2260
	2009	6987	6278	4878	3502	2277
	2010	6760	6118	4812	3480	2286
	2011	6552	5968	4746	3456	2292
	2012	6362	5828	4680	3429	2295
Catch / age 2+ Biomass	2003	0.048	0.041	0.029	0.019	0.012
	2004	0.049	0.042	0.030	0.020	0.012
	2005	0.049	0.042	0.030	0.020	0.012
	2006	0.049	0.042	0.030	0.021	0.013
	2007	0.049	0.042	0.030	0.021	0.013
	2008	0.048	0.042	0.030	0.021	0.013
	2009	0.048	0.041	0.030	0.021	0.013
	2010	0.047	0.041	0.030	0.021	0.013
	2011	0.047	0.041	0.030	0.021	0.013
	2012	0.046	0.040	0.030	0.020	0.013

Table 5B. Decision table for model 7 (includes all sources of new data and fixes Q at the level estimated within the 2001 assessment (Schirripa and Methot 2001) with a constant catch assuming high projected recruitment and a realization of low projected recruitment.

MODEL 7		Density-Dependent	Regime Shift	Density-Dependent	Regime Shift
Years (at age 1 recruitment)		1975-1991	1975-2001	1975-1991	1975-2001
Mean Recruitment (10000 of age 1 fish)		15030	11805	15030	11805
Virgin Spawning Biomass		202093	158730	202093	158730
2002 Spawning Biomass		52910	52910	52910	52910
2002 / Virgin		0.26	0.33	0.26	0.33
		Projections and 40:10 rule and F45%			
		(1992-1998 Recruitment)		(1975-2001 Recruitment)	
		3458	3458	11805	11805
SSP/Virgin	2003	0.26	0.33	0.26	0.33
	2004	0.26	0.33	0.26	0.33
	2005	0.27	0.34	0.27	0.34
	2006	0.27	0.34	0.28	0.35
	2007	0.27	0.33	0.29	0.37
	2008	0.26	0.32	0.30	0.38
	2009	0.25	0.30	0.32	0.39
	2010	0.24	0.28	0.33	0.40
	2011	0.22	0.27	0.34	0.41
	2012	0.21	0.25	0.35	0.43
Total Catch	2003	5321	6037	5236	5940
	2004	5321	6037	5236	5940
	2005	5321	6037	5236	5940
	2006	5321	6037	5236	5940
	2007	5321	6037	5236	5940
	2008	5321	6037	5236	5940
	2009	5321	6037	5236	5940
	2010	5321	6037	5236	5940
	2011	5321	6037	5236	5940
	2012	5321	6037	5236	5940
Catch / age 2+ Biomass	2003	0.044	0.050	0.043	0.049
	2004	0.044	0.051	0.042	0.048
	2005	0.045	0.052	0.041	0.047
	2006	0.046	0.054	0.039	0.045
	2007	0.048	0.056	0.038	0.044
	2008	0.051	0.059	0.037	0.043
	2009	0.053	0.063	0.036	0.042
	2010	0.056	0.068	0.035	0.041
	2011	0.060	0.072	0.034	0.040
	2012	0.064	0.078	0.033	0.039

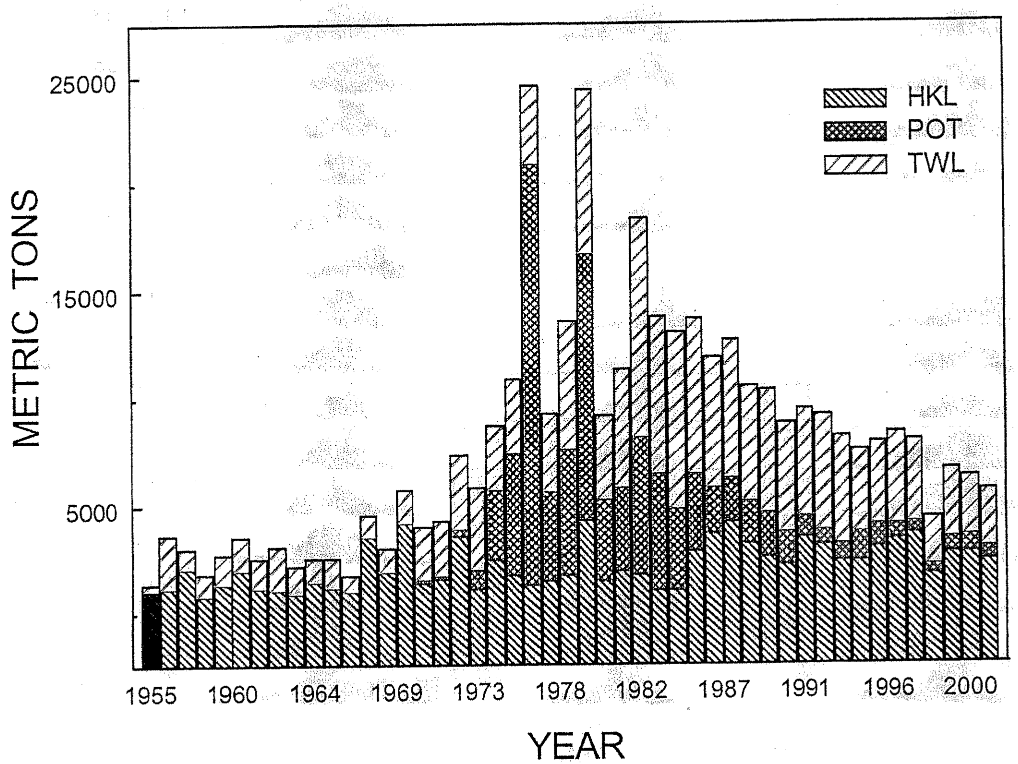

__Figure 1__. Landings, including foreign catch, by year, of west coast sablefish, 1955-2001.

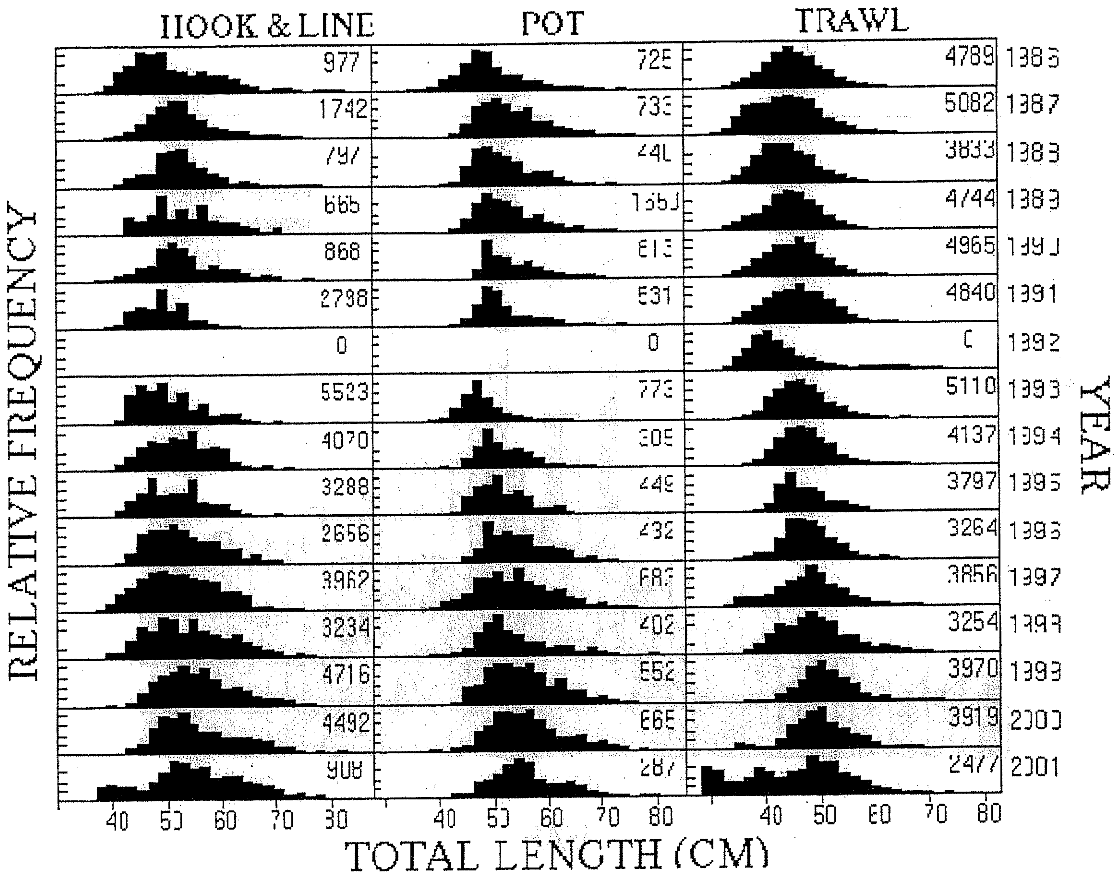

Figure 2. *Length frequencies by gear for female sablefish caught off the U.S. west coast, 1986-2001.*

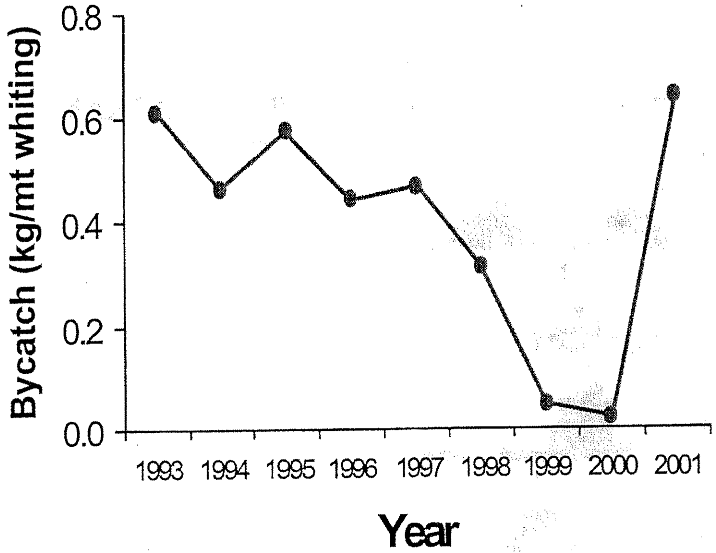

Figure 3. *Bycatch of sablefish from the whiting fishery as observed from the Shoreside Whiting Observer Program, 1993-2001.*

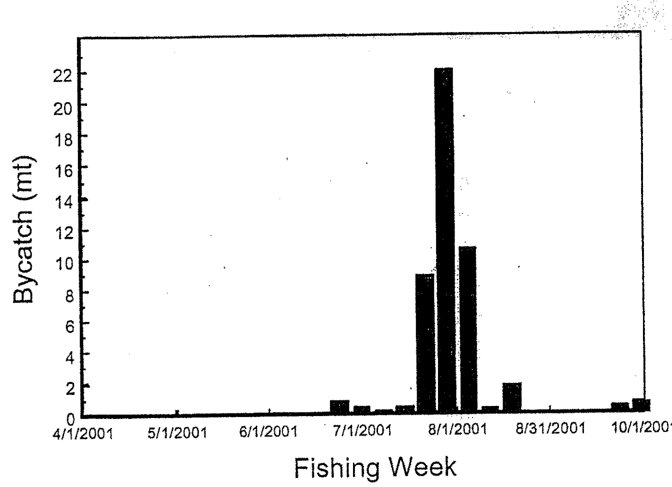

Figure 4. *Weekly bycatch of sablefish from Washington, Oregon, and California from the Shoreside Whiting Observer Program, 04/01/2001-09/26/2001.*

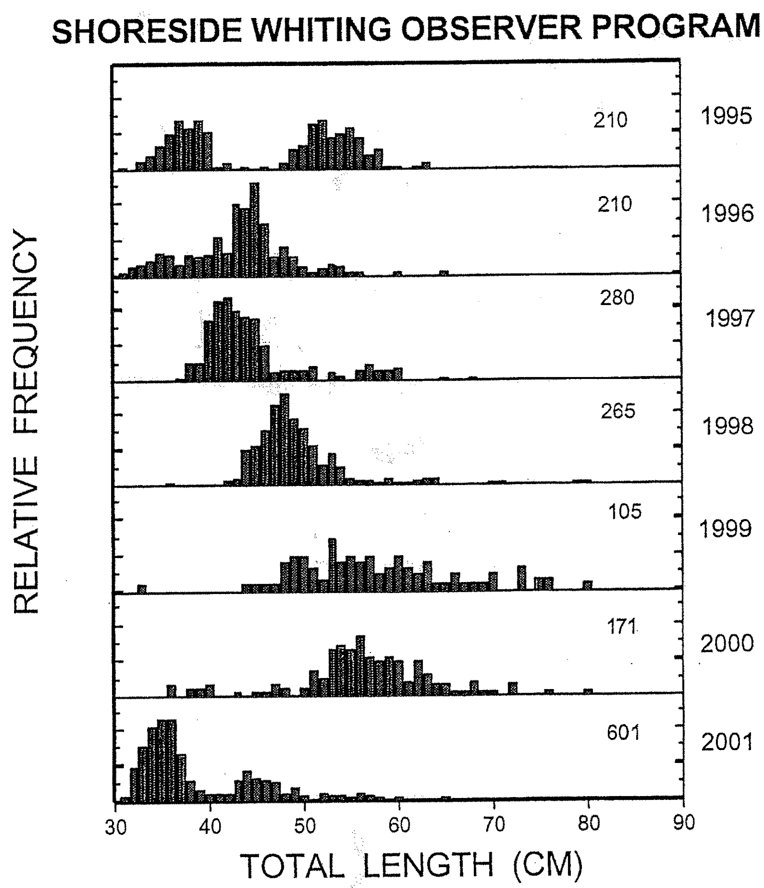

Figure 5. Length frequencies of sablefish as bycatch from the whiting fishery as observed by the Shoreside Whiting Observer Program, 1995-2001.

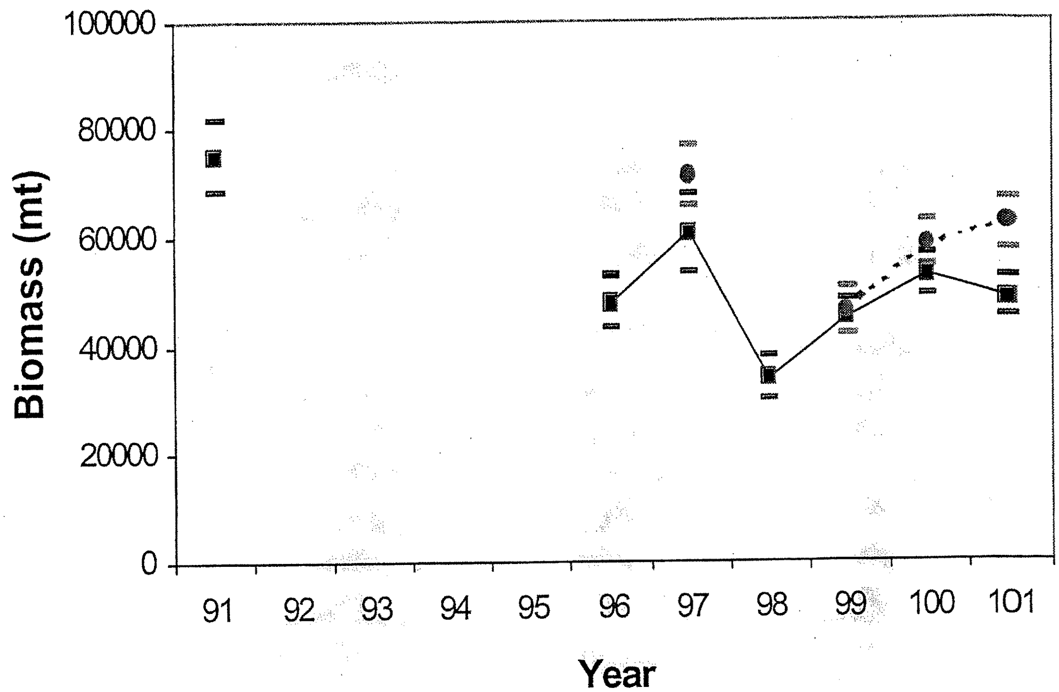

Figure 6. *Estimates of sablefish biomass from the NWFSC slope survey from the AFSC slope survey expanded to Point Conception (dashed line) and the NWFSC GLM estimate (solid line), also expanded to Point Conception.*

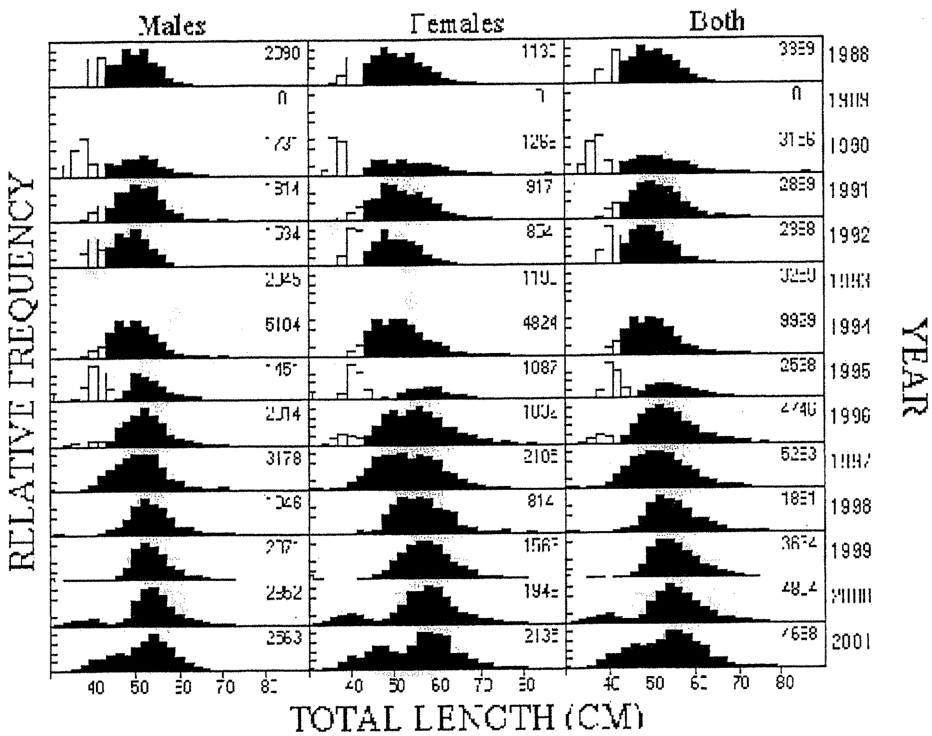

Figure 7. Length frequencies of west coast sablefish from the AFSC Miller Freeman Slope Survey, 1988-2001, and the NWFSC Industry Cooperative Survey, 1998-2001. Empty bars were not included in the modeling procedures; number represents sample size of lengths.

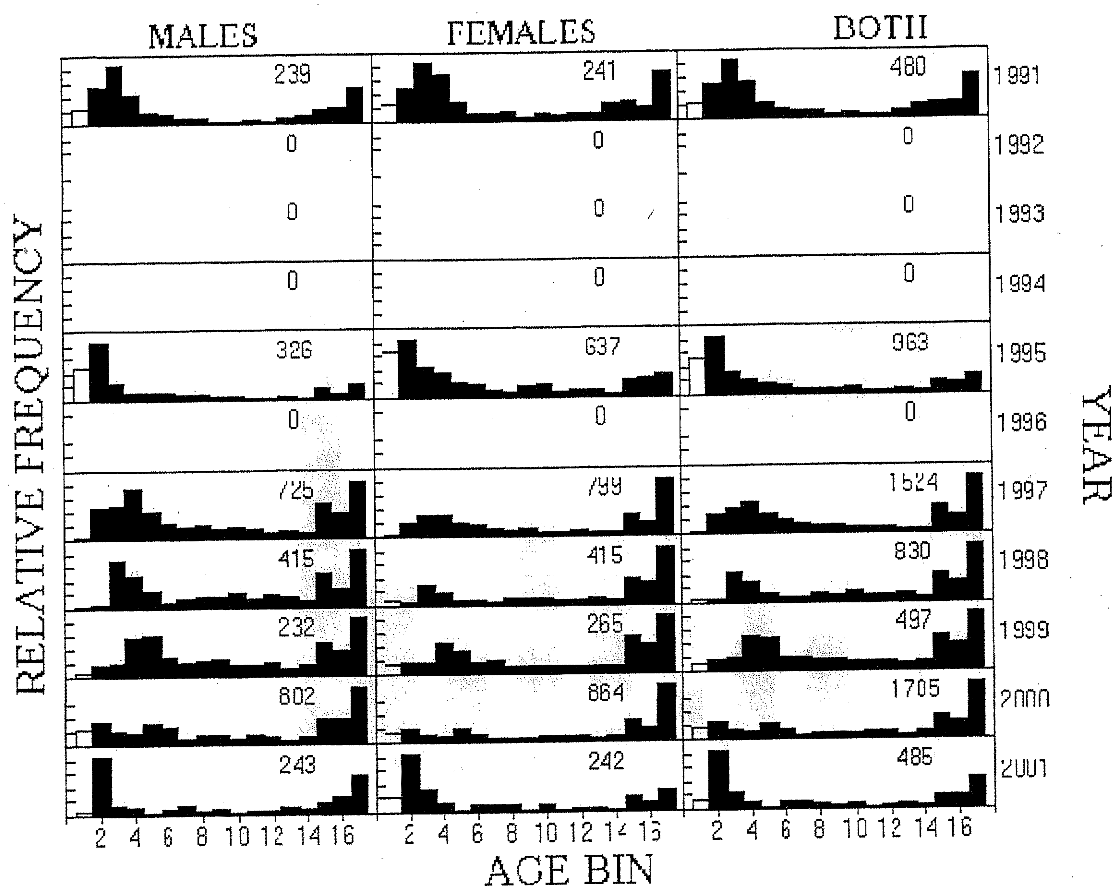

Figure 8*. Age frequencies of west coast sablefish from the AFSC FRV Miller Freeman slope survey, 1988-2001, and the NWFSC Industry Cooperative Survey, 1998-2000. Empty bars were not included in the modeling procedures; number represents sample size of age.*

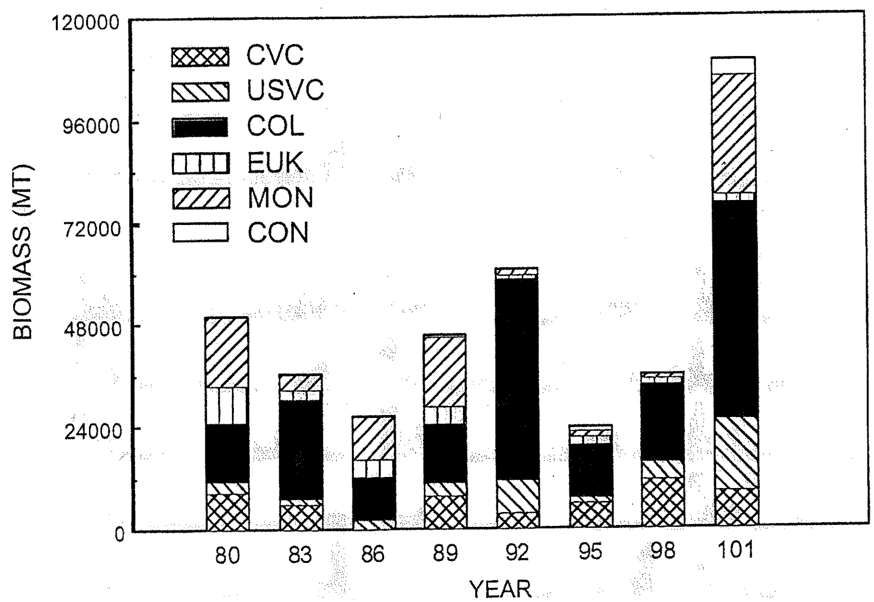

Figure 9*. Estimated biomass of west coast sablefish from the AFSC shelf survey by INPFC area, 1980-2001.*

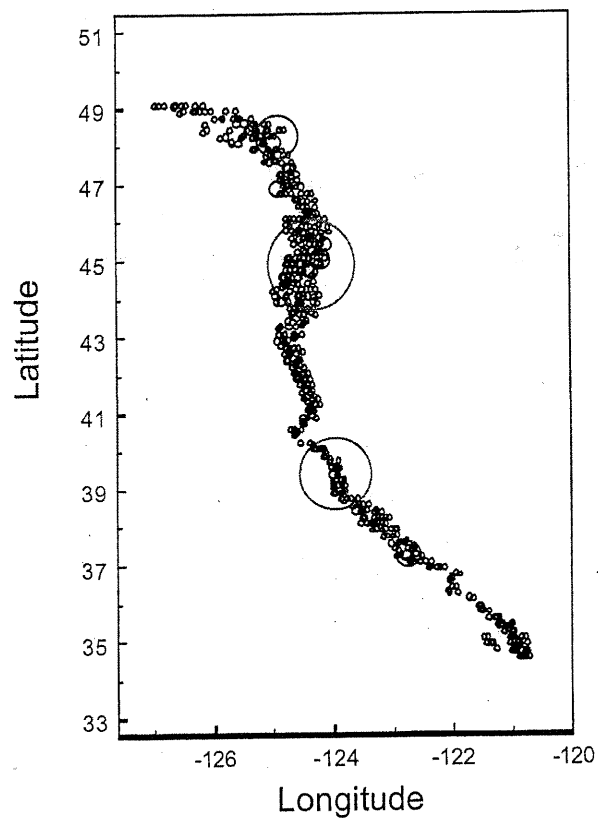

Figure 10*. Location of tows that caught sablefish from the 2001 AFSC shelf survey. Size of circle is proportional to catch per unit effort.*

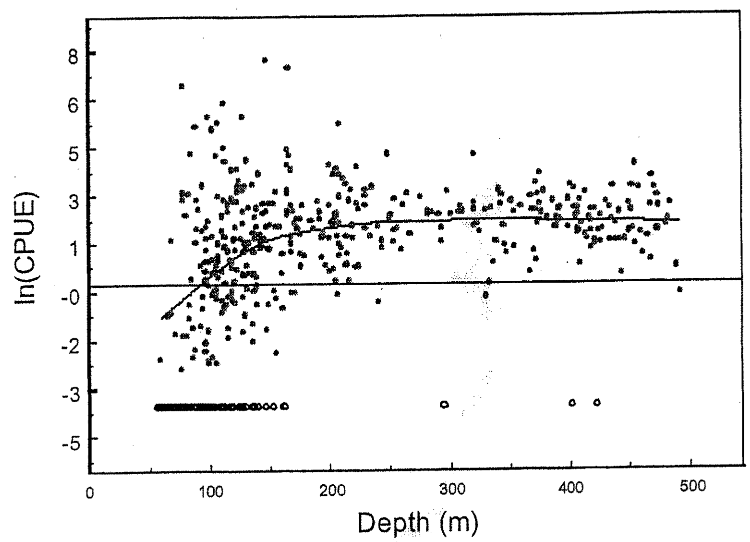

__Figure 11__. Log of CPUE as a function of depth from the 2001 AFSC shelf survey. Empty circles represent "zero tows".

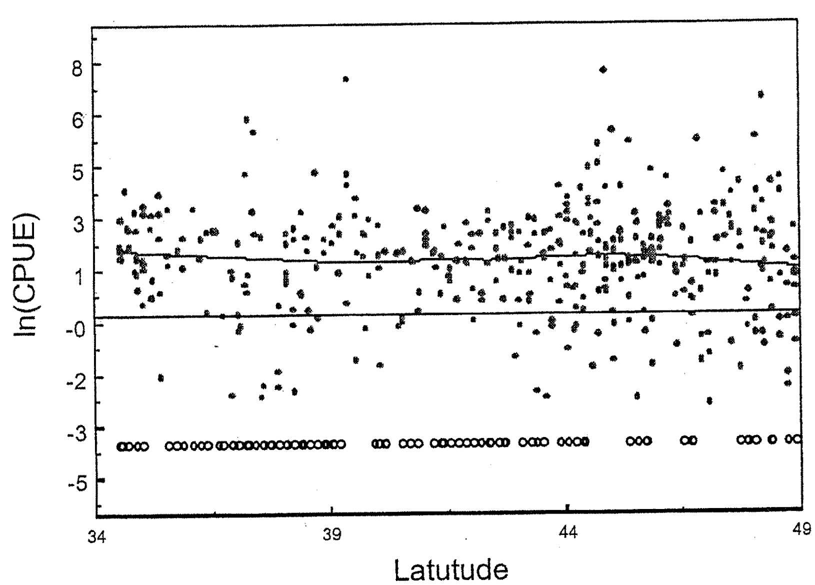

__Figure 12__. Log of CPUE as a function of latitude from the 2001 AFSC shelf survey. Empty circles represent "zero tows".

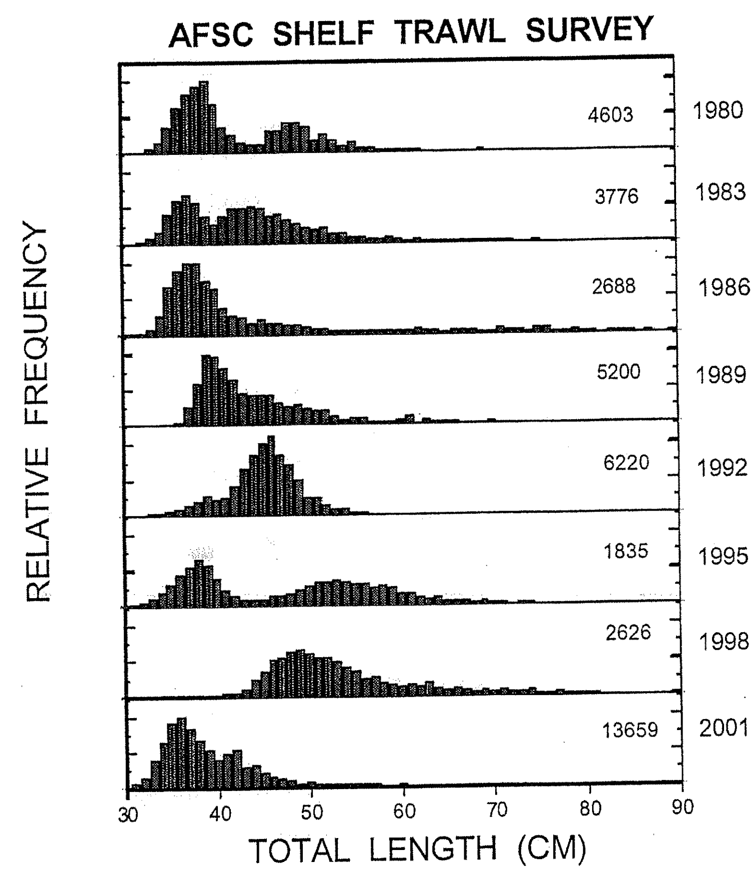

Figure 13. *Length frequencies of sablefish caught in the AFSC shelf survey, 1980-2001.*

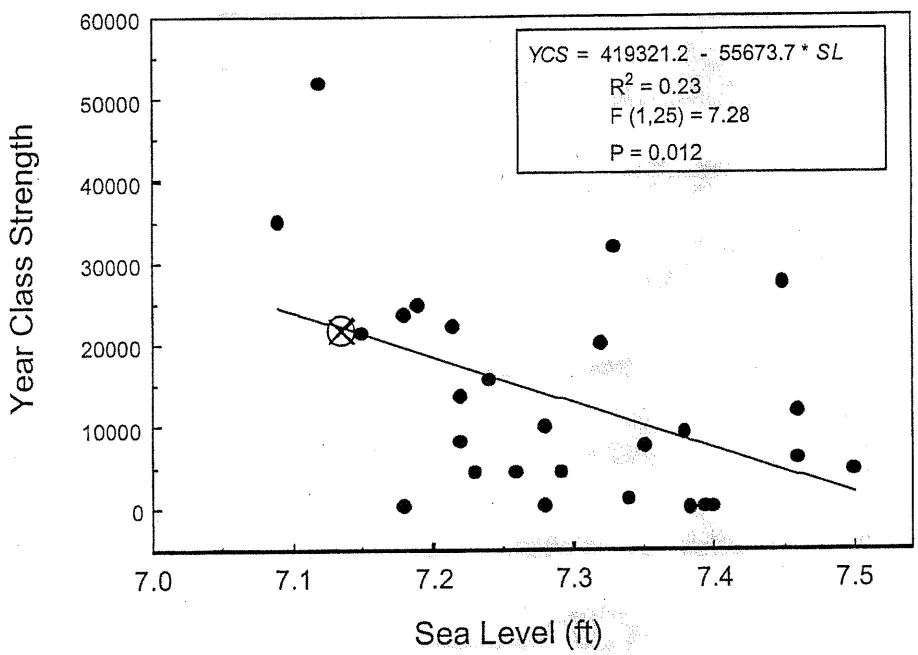

***Figure 14**. Year class strength (number of age 1 fish from model 6) as a function of mean July sea level record at Crescent City, California, 1975-2000. Cross represents the July 2001 sea level.*

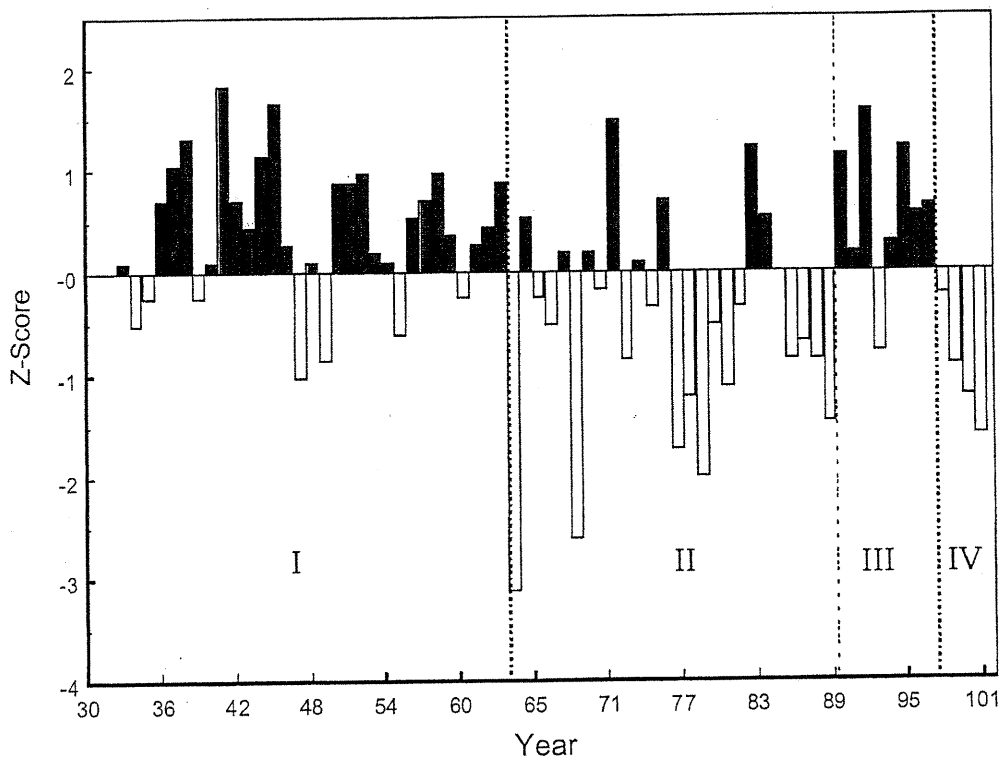

Figure 15. *Z-score of July sea level recorded at Crescent City, California, 1933-2001. Roman numerals represent blocks of time when sea level was either on average high or low.*

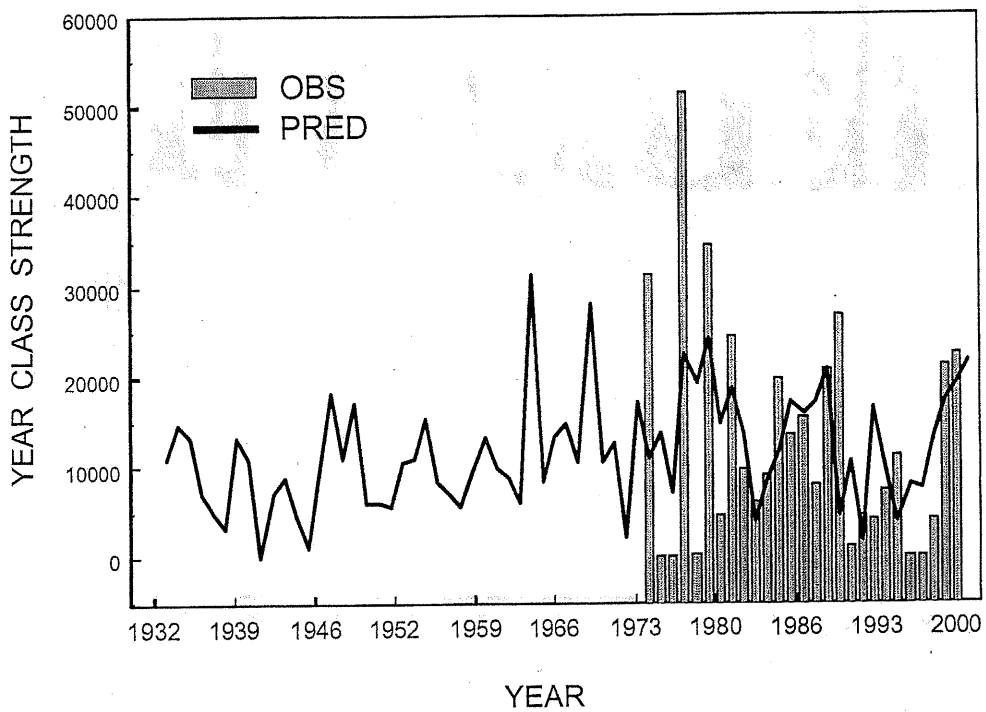

Figure 16. *Observed recruitment from the population model 6, 1975-2000, and regression predicted recruitment, 1932-2000.*

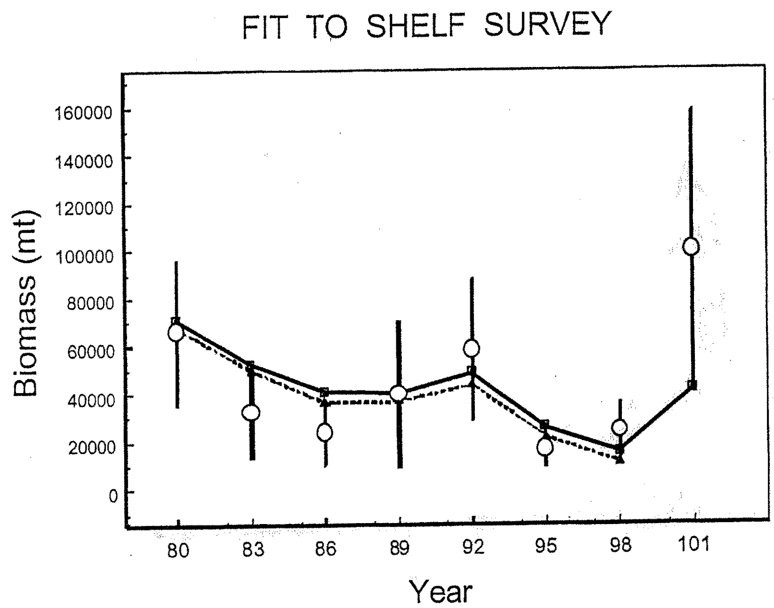

__Figure 17__. Observed and expected values for the shlef survey biomass estimates (with cv bars) from the 2001 assessment and 2002 update, model 6.

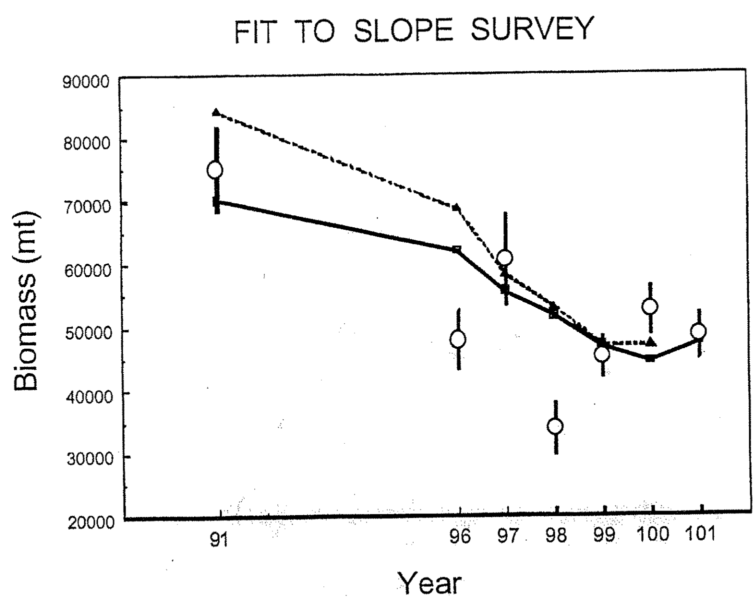

__Figure 18__. Observed and expected values for the slope survey biomass estimates from the 2001 assessment (dashed line) and 2002 update model 6 (solid line).

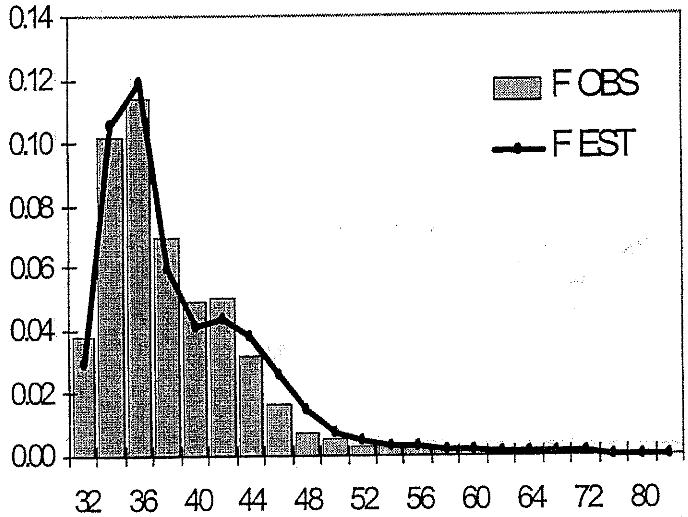

Figure 19. *Observed and estimated (model 6) length compositions from the 2001 AFSC shelf survey.*

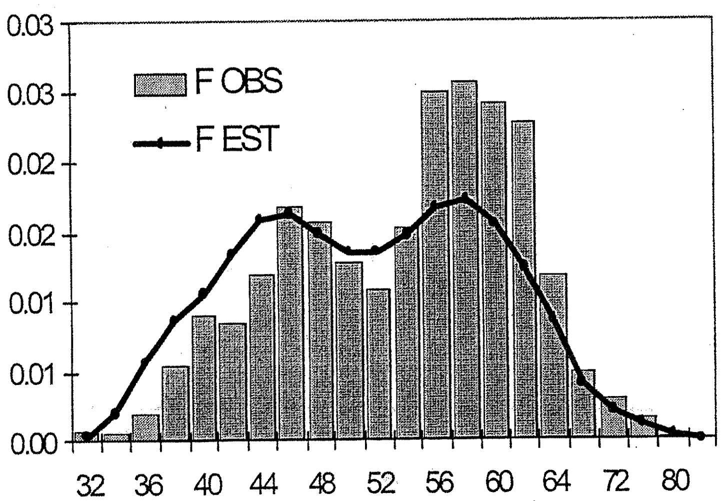

Figure 20. *Observed and estimated (model 6) length compositions from the 2001 NWFSC and AFSC slope surveys.*

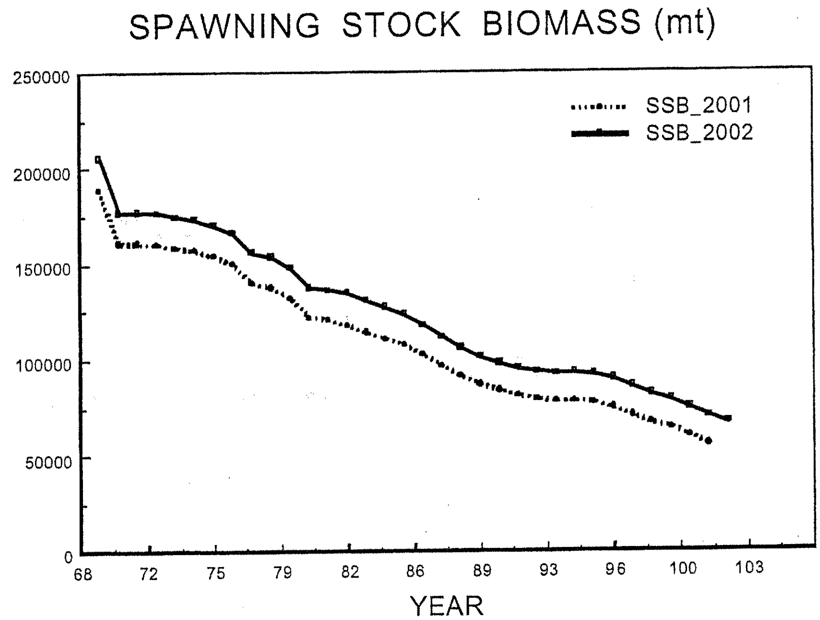

Figure 21. *Spawning stock biomass (mt) from the 2001 assessment and the 2002 update model 6.*

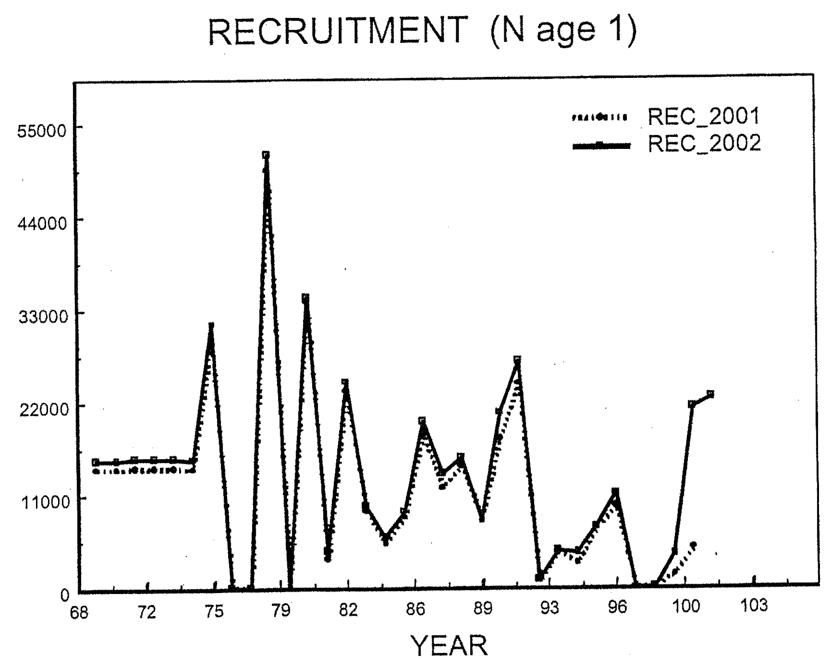

Figure 22. *Recruitment (number of age 1 fish) from the 2001 assessment and the 2002 update model 6.*

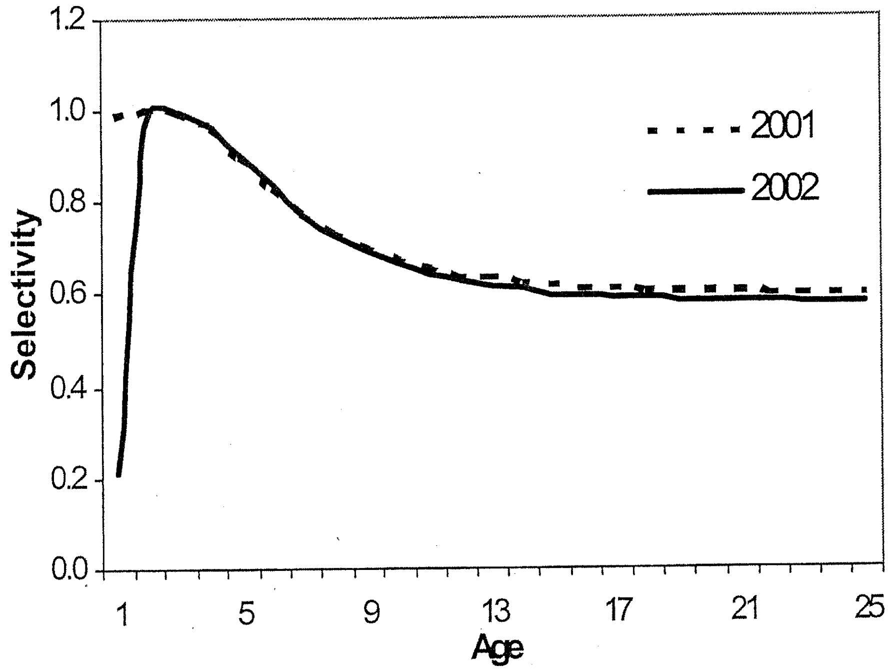

Figure 23. *Age specific selectivity for the combined AFSC and NWFSC slope survey from previous assessment (2001) and current update (2002). Note the decrease for age 1 fish.*

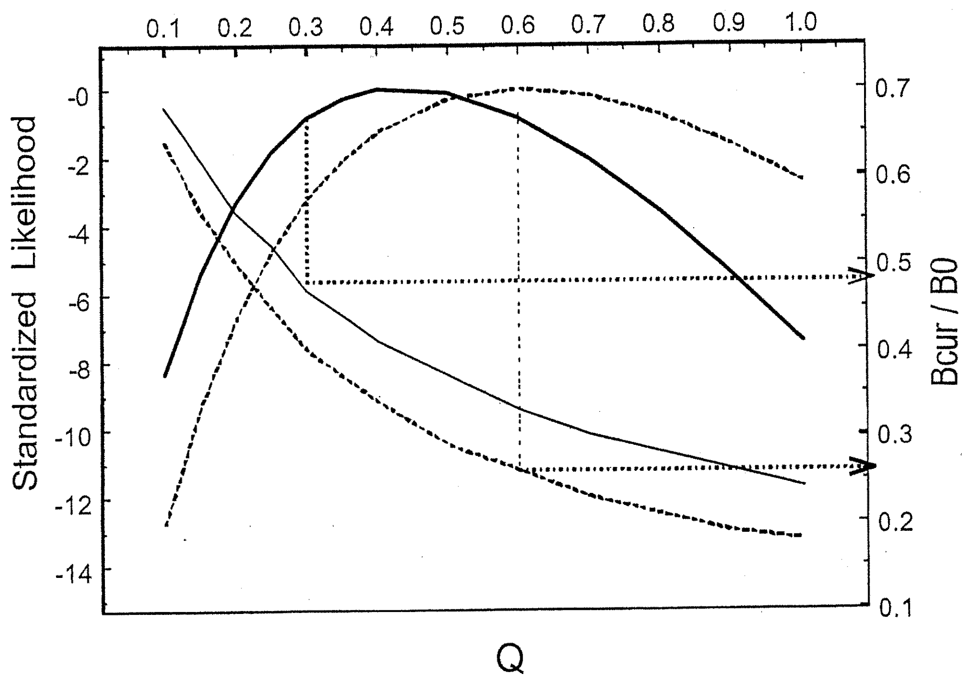

Figure 24. *Standardized total likelihood as a function of Q for the 2001 assessment (dashed convex line) and the 2002 update model 6 (solid convex line); ratio of Bcur/B0 for the 2002 update "density dependent" (dashed concave line) and the "regime shift" (solid concave line) state of nature. Dashed horizontal and vertical lines bound the estimate of 2003 Bcur/B0 by total standardized likelihoods that differ by less than 1 likelihood unit and considering both possible states of nature.*

Appendix 1. Model parameter file used in Model 6 and likelihoods.

```
sable1.CSV        LOOP1:  8  LIKE:   -965.32655  DELTA LIKE:       .00060 ENDBIO:   155445.
3c.out
3C.p01
Model 6 - Add Slope Lengths/Ages
    100.000000          .001000     BEGIN AND END DELTA F PER LOOP1
  3   .99                       FIRST LOOP1 FOR LAMBDA & VALUE
   .990                         MAX VALUE FOR CROSS DERIVATIVE
  1 READ HESSIAN
M07R06.H01
  1 WRITE HESSIAN
M07R06.H01
   .001                         MIN SAMPLE FRAC. PER AGE
  1  25    2  25                MINAGE, MAXAGE,  SUMMARY AGE RANGE
 71 102                         BEGIN YEAR, END YEAR
 1       12  0  0  0            NPER, MON/PER
 1.00                           SPAWNMONTH
  3  9 NFISHERY, NSURVEY
  2 N SEXES
   10000.  REF RECR LEVEL
  0 MORTOPT
     .070000      .010000   10.000000 'NAT-MORT          '  -2   1  0     .000000   .0000 !   1 NO PICK   .000       -1.     .0000000
-999.000000      .060000     .150000 'NATMORT           '   0   1  0     .000000   .0000 !   2 NO PICK   .000       -1.     .0000000
 HKL        TYPE:  1
  7 SELECTIVITY PATTERN
   0   2   0   3   4   0    0  AGE TYPES USED
     1.00000        .30 ' HKL CATCH          '  ! # =  1 VALUE:        .00000
     1.00000        .30 ' HKL AGECOMP        '  ! # =  2 VALUE:     -60.32889
     1.00000        .21 ' HKL SIZECOMP       '  ! # =  3 VALUE:    -210.79264
      .10000      -1.00 ' HKL SIZE@AGE       '  ! # =  4 VALUE:     399.26517
  1  1  0  1   1  1  SEL. COMPONENTS
  70.000000   45.000000   70.000000 'HKL TRANS         '  -2   1  0     .000000   .0000 !   3 NO PICK   .000       -1.     .0000000
    .000000    -.200000     .100000 'HKL INITIAL SEL   '   0  71  0     .000000   .0000 !   4 NO PICK   .000       -1.     .0000000
    .000000     .000000     .000000 'HKL-SML INFLECT   '   0  71  1     .000000   .0000 !   5 ENV FXN   .000       -1.     .0000000
    .393860     .010000    4.000000 'HKL-SML SLOPE     '   2  71  0    1.000000   .7000 !   6 OK        .000    -3529.     .0000000
   1.000000     .010000    1.000000 'HKL-L FINAL SEL   '  -2  71  0     .000000   .0000 !   7 NO PICK   .000       -1.     .0000000
    .500000     .010000     .900000 'HKL-L INFLECT     '   0  71  0     .500000   .7000 !   8 NO PICK   .000       -1.     .0000000
   1.000000     .001000    2.000000 'HKL-L SLOPE       '   0  71  0    1.000000   .7000 !   9 NO PICK   .000       -1.     .0000000
   3.000000   45.000000   65.000000 'AGE TRANS         '   0   1  0     .000000   .0000 !  10 NO PICK   .000       -1.     .0000000
   1.000000    -.200000     .100000 'AGE INITIAL SEL   '   0  71  0     .000000   .0000 !  11 NO PICK   .000       -1.     .0000000
    .500000     .000000     .000000 'AGE INFLECT       '   0  71  0     .000000   .0000 !  12 NO PICK   .000       -1.     .0000000
    .500000     .001000    4.000000 'AGE SLOPE         '   0  71  0     .000000   .0000 !  13 NO PICK   .000       -1.     .0000000
    .000000     .000000    1.000000 'HKL-F FINAL SEL   '   0  71  2     .000000   .0000 !  14 ENV FXN   .000       -1.     .0000000
    .188433     .010000     .900000 'HKL-F INFLECT     '   2  71  0     .000000   .0000 !  15 OK        .000     -936.     .0021306
    .591870     .001000    4.000000 'HKL-F SLOPE       '   2  71  0    1.000000   .7000 !  16 OK        .000      -69.     .0103462
    .960515     .200000    2.500000 'HKL-M FIN rel Fe'     2  71  0     .000000   .0000 !  17 OK        .000     -170.     .0000000
   2.000000    1.000000   24.000000 'HKL-M INFLECT     '   0  71  0     .000000   .0000 !  18 NO PICK   .000       -1.     .0000000
    .531064     .001000    5.000000 'HKL-M POWER       '   2  71  0     .500000   .7000 !  19 OK        .000      -15.     .0667594
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     1.00000        .30 ' POT AGECOMP        '  ! # =  6 VALUE:     -30.77409
     1.00000        .21 ' POT SIZECOMP       '  ! # =  7 VALUE:    -102.79424
      .10000      -1.00 ' POT SIZE@AGE       '  ! # =  8 VALUE:     301.07423
  1  1  0  1   1  1  SEL. COMPONENTS
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    .000000    -.200000     .100000 'POT INITIAL SEL   '   0  71  0     .000000   .0000 !  21 NO PICK   .000       -1.     .0000000
    .000000     .000000     .000000 'POT-SML INFLECT   '   0  71  3     .000000   .0000 !  22 ENV FXN   .000       -1.     .0000000
    .518204     .001000    4.000000 'POT-SML SLOPE     '   2  71  0    1.000000   .7000 !  23 OK        .000    -1175.     .0004577
    .730776     .001000    1.000000 'POT-L FINAL SEL   '   2  71  0     .000000   .0000 !  24 OK        .000      -52.     .0214754
    .499059     .010000     .900000 'POT-L INFLECT     '   2  71  0     .500000   .7000 !  25 OK        .000     -140.     .0079786
    .981733     .001000    2.000000 'POT-L SLOPE       '   2  71  0    1.000000   .7000 !  26 OK        .000       -4.     .2407317
   3.000000   45.000000   65.000000 'AGE TRANS         '   0   1  0     .000000   .0000 !  27 NO PICK   .000       -1.     .0000000
   1.000000    -.200000     .100000 'AGE INITIAL SEL   '   0  71  0     .000000   .0000 !  28 NO PICK   .000       -1.     .0000000
    .500000     .000000     .000000 'AGE INFLECT       '   0  71  0     .000000   .0000 !  29 NO PICK   .000       -1.     .0000000
    .500000     .001000    4.000000 'AGE SLOPE         '   0  71  0     .000000   .0000 !  30 NO PICK   .000       -1.     .0000000
    .000000     .000000    1.000000 'POT-F FINAL SEL   '   0  71  4     .000000   .0000 !  31 ENV FXN   .000       -1.     .0000000
    .097259     .010000     .900000 'POT-F INFLECT     '   2  71  0     .100000   .7000 !  32 OK        .000     -572.     .0019644
    .447695     .001000    4.000000 'POT-F SLOPE       '   2  71  0     .500000   .7000 !  33 OK        .000      -80.     .0062531
    .837002     .200000    2.500000 'POT-M FIN rel Fe'     2  71  0     .000000   .0000 !  34 OK        .000     -160.     .0069314
   2.000000    1.000000   24.000000 'POT-M INFLECT     '   0  71  0     .000000   .0000 !  35 NO PICK   .000       -1.     .0000000
    .402150     .001000    5.000000 'POT-M POWER       '   2  71  0     .500000   .7000 !  36 OK        .000      -30.     .0336592
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  7 SELECTIVITY PATTERN
   0  10   0  11  12   0   13  AGE TYPES USED
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     1.00000        .30 ' TRAWL AGECOMP      '  ! # = 10 VALUE:     -78.55630
     1.00000        .21 ' TRAWL SIZECOMP     '  ! # = 11 VALUE:    -150.39840
      .10000      -1.00 ' TRAWL SIZE@AGE     '  ! # = 12 VALUE:     885.39922
     1.00000      -1.00 ' TRAWL DISCARD      '  ! # = 13 VALUE:       -.17823
  1  1  0  1   1  1  SEL. COMPONENTS
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    .000000     .000000     .100000 'TWL INITIAL SEL   '   0  71  0     .000000   .0000 !  38 NO PICK   .000       -1.     .0000000
    .000000     .000000     .000000 'TWL INFLECT       '   0  71  5     .000000   .0000 !  39 ENV FXN   .000       -1.     .0000000
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    .135947     .010000     .900000 'TWL-L INFLECT     '   2  71  0     .500000   .7000 !  42 OK        .000    -6463.     .0002446
    .574797     .001000    2.000000 'TWL-L SLOPE       '   2  71  0    1.000000   .7000 !  43 OK        .000     -111.     .0173644
   3.000000   45.000000   65.000000 'AGE TRANS         '   0   1  0     .000000   .0000 !  44 NO PICK   .000       -1.     .0000000
   1.000000    -.200000     .100000 'AGE INITIAL SEL   '   0  71  0     .000000   .0000 !  45 NO PICK   .000       -1.     .0000000
    .500000     .000000     .000000 'AGE INFLECT       '   0  71  0     .000000   .0000 !  46 NO PICK   .000       -1.     .0000000
    .500000     .001000    4.000000 'AGE SLOPE         '   0  71  0     .000000   .0000 !  47 NO PICK   .000       -1.     .0000000
    .000000     .000000    1.000000 'TWL-F FINAL SEL   '   0  71  6     .000000   .0000 !  48 ENV FXN   .000       -1.     .0000000
    .110640     .010000     .900000 'TWL-F INFLECT     '   2  71  0     .500000   .7000 !  49 OK        .000    -3268.     .0000532
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  1.172671       .001000     4.000000 'TWL-F SLOPE      '   2  71  0      1.000000  .7000 !  50 OK          .001       -6.      .2339619
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  2.000000      1.000000    24.000000 'TWL-M INFLECT    '   0  71  0       .000000  .0000 !  52 NO PICK     .000       -1.      .0000000
   .610910       .001000     5.000000 'TWL-M POWER      '   2  71  0       .500000  .7000 !  53 OK          .000      -22.      .0538643
SHELF       TYPE:  4
 3 SELECTIVITY PATTERN
  0   0   0   0   0   0    0  AGE TYPES USED
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   .00010        .40 ' SHELF ABUND         ' ! # = 14 VALUE:      -6.28917
  1.000000       .000000     2.000000 'SHLF AGE 1       '   0 -80  0       .000000  .0000 !  54 NO PICK     .000       -1.      .0000000
  1.000000       .010000    38.000000 'SHLF MALE SEL    '   0 -80  0       .000000  .0000 !  55 NO PICK     .000       -1.      .0000000
SLFBIO      TYPE:  5
 7 SELECTIVITY PATTERN
  0  16   0  17   0   0    0  AGE TYPES USED
  1.788655  0  1  1 Q, QUANT, LOGERROR=1, BIO=1 or NUM=2
  1.00000        .40 ' SLFBIO ABUND        ' ! # = 15 VALUE:      -1.21445
  1.00000        .21 ' SLFBIO SIZE COMP    ' ! # = 16 VALUE:     -33.56705
  1.00000        .30 ' SLFBIO AGE  COMP    ' ! # = 17 VALUE:    -109.02013
 1  0  0  0  1  0  SEL. COMPONENTS
  1.000000      -.200000     1.000000 'SHELF INITIAL SE'    0 -80  0       .000000  .0000 !  56 NO PICK     .000       -1.      .0000000
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   .100000       .001000     4.000000 'SHELF-SML SLOPE '    0 -80  0       .000000  .0000 !  58 NO PICK     .000       -1.      .0000000
   .013858       .001000     1.000000 'SHELF-FA FINAL S'    2 -80  0       .000000  .0000 !  59 OK          .000  -168856.      .0000073
  1.100000      1.100000    24.000000 'SHELF-FA INFLECT'    2 -80  0       .000000  .0000 !  60 BOUND       .000       -1.      .0000000
   .702577       .001000     4.000000 'SHELF-FA SLOPE  '    2 -80  0      1.000000  .7000 !  61 OK        -.001      -84.      .0000000
N-POTSVY    TYPE:  6
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   .00000        .20 ' N-POTSVY SURV ABUND'  ! # = 18 VALUE:        .51280
  1.00000        .21 ' N-POTSVY AGE COMP  '  ! # = 19 VALUE:     -21.26299
  1.00000        .21 ' N-POTSVY SIZE COMP '  ! # = 20 VALUE:     -78.93275
   .10000       -.30 ' N-POTSVY SIZE@AGE  '  ! # = 21 VALUE:     129.84156
 1  1  0  1  1  1  SEL. COMPONENTS
 55.000000     40.000000    65.000000 'NPTSVY TRANS     '   0 -71  0       .000000  .0000 !  62 NO PICK     .000       -1.      .0000000
   .000000      -.200000     1.000000 'NPTSVY INITIAL S'    0 -71  0       .000000  .0000 !  63 NO PICK     .000       -1.      .0000000
   .000000       .000000      .000000 'NPTSVY-SML INFLE'    0 -71  7       .000000  .0000 !  64 ENV FXN     .000       -1.      .0000000
   .641521       .001000     4.000000 'NPTSVY-SML SLOPE'    2 -71  0       .000000  .0000 !  65 OK          .001     -865.      .0022494
  1.000000       .001000     1.000000 'NPTSVY-L FINAL S'    0 -71  0       .000000  .0000 !  66 NO PICK     .000       -1.      .0000000
   .500000       .010000      .900000 'NPTSVY-L INFLECT'    0 -71  0       .500000  .7000 !  67 NO PICK     .000       -1.      .0000000
  1.000000       .001000     8.000000 'NPTSVY-L SLOPE  '    0 -71  0      1.000000  .7000 !  68 NO PICK     .000       -1.      .0000000
  3.000000      1.000000    24.000000 'AGE TRANS       '    0 -71  0       .000000  .0000 !  69 NO PICK     .000       -1.      .0000000
  1.000000      -.200000      .100000 'AGE INITIAL SEL '    0 -71  0       .000000  .0000 !  70 NO PICK     .000       -1.      .0000000
   .500000       .000000      .000000 'AGE INFLECT     '    0 -71  0       .000000  .0000 !  71 NO PICK     .000       -1.      .0000000
   .500000       .001000     4.000000 'AGE SLOPE       '    0 -71  0       .000000  .0000 !  72 NO PICK     .000       -1.      .0000000
   .063416       .001000     1.000000 'NPTSVY-FA FINAL '    2 -71  0       .000000  .0000 !  73 OK          .000   -23026.      .0000000
   .106047       .010000      .900000 'NPTSVY-FA INFLEC'    2 -71  0       .500000  .7000 !  74 OK          .000    -7557.      .0000118
  1.166047       .001000     4.000000 'NPTSVY-FA SLOPE '    2 -71  0      1.000000  .7000 !  75 OK        -.002      -20.      .0000000
  1.558756       .500000     2.500000 'NPTSVY-M rel FEM'    2 -71  0       .000000  .0000 !  76 OK          .001     -112.      .0000000
  2.000000      1.000000    24.000000 'NPTSVY-M INFLECT'    0 -71  0       .000000  .0000 !  77 NO PICK     .000       -1.      .0000000
   .233320       .001000     8.000000 'NPTSVY-M POWER  '    2 -71  0       .500000  .7000 !  78 OK          .000     -172.      .0000000
N-BIGPOT    TYPE:  7
 2 SELECTIVITY PATTERN
  0   0   0   0   0   0    0  AGE TYPES USED
   .000181  0  1  2 Q, QUANT, LOGERROR=1, BIO=1 or NUM=2
  1.00000        .20 ' N-BIGPOT ABUND      ' ! # = 22 VALUE:      -8.24238
  6.000000      -.200000     1.000000 'BIGPOT SELTYPE  '    0 -71  0       .000000  .0000 !  79 NO PICK     .000       -1.      .0000000
 62.000000       .010000    55.000000 'BIGPOT MINSIZE  '    0 -71  0       .000000  .0000 !  80 NO PICK     .000       -1.      .0000000
100.000000       .001000     4.000000 'BIGPOT MAXSIZE  '    0 -71  0       .000000  .0000 !  81 NO PICK     .000       -1.      .0000000
SLOPE       TYPE:  8
 7 SELECTIVITY PATTERN
  0  24   0  25  26   0    0  AGE TYPES USED
   .460014 -1  1  1 Q, QUANT, LOGERROR=1, BIO=1 or NUM=2
   .460014       .050000     2.000000 'SURVEY Q        '    2 -88  0       .000000  .0000 !  82 OK          .000    -3669.      .0010213
   .000000     -1.000000     1.000000 'SURVEY BIO-Q    '    0 -88  0       .000000  .0000 !  83 NO PICK     .000       -1.      .0000000
  1.00000        .30 ' SLOPE SURV ABUND    ' ! # = 23 VALUE:       6.02979
  1.00000        .20 ' SLOPE AGE COMP      ' ! # = 24 VALUE:     -97.66321
  1.00000        .20 ' SLOPE SIZE COMP     ' ! # = 25 VALUE:    -124.45617
   .10000        .30 ' SLOPE SIZE@AGE      ' ! # = 26 VALUE:     424.60964
 1  1  0  1  0  0  SEL. COMPONENTS
 55.000000     40.000000    65.000000 'SLP TRANS       '    0 -88  0       .000000  .0000 !  84 NO PICK     .000       -1.      .0000000
  1.000000      -.200000     1.000000 'SLP INITIAL S   '    0 -88  0       .000000  .0000 !  85 NO PICK     .000       -1.      .0000000
   .500000       .000000      .000000 'SLP-SML INFLE   '    0 -88  0       .000000  .0000 !  86 NO PICK     .000       -1.      .0000000
   .500000       .001000     4.000000 'SLP-SML SLOPE   '    0 -88  0       .000000  .0000 !  87 NO PICK     .000       -1.      .0000000
   .254224       .100000      .900000 'SLP-L FINAL SEL '    2 -88  0       .000000  .0000 !  88 OK          .000    -1053.      .0000000
   .119727       .001000      .990000 'SLP-L INFLECT   '    2 -88  0       .100000  .7000 !  89 OK          .000    -1809.      .0002252
   .345434       .001000     4.000000 'SLP-L SLOPE     '    2 -88  0      1.000000  .7000 !  90 OK          .000     -388.      .0000000
   .211737       .100000      .990000 'SLP INITIAL SEL '    2 -88  8       .000000  .0000 !  91 OK          .000     -592.      .0034268
  1.100000      1.100000    10.000000 'SLP-YNG INFLECT '   -2 -88  0       .000000  .0000 !  92 NO PICK     .000       -1.      .0000000
  5.000000       .001000    10.000000 'SLP-YNG SLOPE   '   -2 -88  0       .000000  .0000 !  93 NO PICK     .000       -1.      .0000000
GLM1        TYPE:  9
 7 SELECTIVITY PATTERN
  0   0   0   0   0   0    0  AGE TYPES USED
   .000474  0  1  1 Q, QUANT, LOGERROR=1, BIO=1 or NUM=2
   .00000        .30 'GLM ALL 89-96         ' ! # = 27 VALUE:      -9.84421
 1  1  0  0  0  0  SEL. COMPONENTS
 48.000000     45.000000    65.000000 'GLM TRANS       '    0  71  0       .000000  .0000 !  94 NO PICK     .000       -1.      .0000000
   .000000      -.200000      .100000 'GLM INITIAL SEL '    0  71  0       .000000  .0000 !  95 NO PICK     .000       -1.      .0000000
   .400000       .000000      .000000 'GLM INFLECT     '    0  71  0       .000000  .0000 !  96 NO PICK     .000       -1.      .0000000
   .919242       .001000     4.000000 'GLM SLOPE       '    0  71  0       .000000  .0000 !  97 NO PICK     .000       -1.      .0000000
   .300000       .001000     1.000000 'GLM-L FINAL SEL '    0  71  0       .000000  .0000 !  98 NO PICK     .000       -1.      .0000000
   .260000       .010000      .900000 'GLM-L INFLECT   '    0  71  0       .000000  .0000 !  99 NO PICK     .000       -1.      .0000000
   .860000       .001000     2.000000 'GLM-L SLOPE     '    0  71  0       .000000  .0000 ! 100 NO PICK     .000       -1.      .0000000
GLM2        TYPE: 10
 7 SELECTIVITY PATTERN
  0   0   0   0   0   0    0  AGE TYPES USED
   .000531  0  1  1 Q, QUANT, LOGERROR=1, BIO=1 or NUM=2
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 1.00000          .30 'GLM ALL 78-88          '  ! # = 28 VALUE:          1.34982
1  1  0  0   0  0  SEL. COMPONENTS
 48.000000   45.000000    65.000000 'GLM TRANS          '   0  71  0     .000000   .0000 ! 101 NO PICK    .000       -1.      .0000000
   .000000   -.200000      .100000 'GLM INITIAL SEL '    0  71  0     .000000   .0000 ! 102 NO PICK    .000       -1.      .0000000
   .400000    .000000      .000000 'GLM INFLECT       '   0  71  0     .000000   .0000 ! 103 NO PICK    .000       -1.      .0000000
   .919242    .001000     4.000000 'GLM SLOPE          '   0  71  0     .000000   .0000 ! 104 NO PICK    .000       -1.      .0000000
   .300000    .001000     1.000000 'GLM-L FINAL SEL '    0  71  0     .000000   .0000 ! 105 NO PICK    .000       -1.      .0000000
   .260000    .010000      .900000 'GLM-L INFLECT     '   0  71  0     .000000   .0000 ! 106 NO PICK    .000       -1.      .0000000
   .860000    .001000     2.000000 'GLM-L SLOPE        '   0  71  0     .000000   .0000 ! 107 NO PICK    .000       -1.      .0000000
S-POTSVY    TYPE: 11
 2 SELECTIVITY PATTERN
 0  30   0  31  32   0    0  AGE TYPES USED
   .000173  0  1  2 Q, QUANT, LOGERROR=1, BIO=1 or NUM=2
   .00000         .20 ' S-POTSVY SURV ABUND'   ! # = 29 VALUE:        -15.85874
  1.00000         .21 ' S-POTSVY AGE COMP  '   ! # = 30 VALUE:        -23.33070
  1.00000         .21 ' S-POTSVY SIZE COMP '   ! # = 31 VALUE:        -53.22925
   .10000        -.30 ' S-POTSVY SIZE@AGE  '   ! # = 32 VALUE:        175.75252
  6.000000   -.200000     1.000000 'BIGPOT SELTYPE    '   0 -84  0     .000000   .0000 ! 108 NO PICK    .000       -1.      .0000000
 32.000000    .010000    55.000000 'BIGPOT MINSIZE    '   0 -84  0     .000000   .0000 ! 109 NO PICK    .000       -1.      .0000000
100.000000    .001000     4.000000 'BIGPOT MAXSIZE    '   0 -84  0     .000000   .0000 ! 110 NO PICK    .000       -1.      .0000000
S-BIGPOT    TYPE: 12
 2 SELECTIVITY PATTERN
 0   0   0   0   0   0    0  AGE TYPES USED
   .000132  0  1  2 Q, QUANT, LOGERROR=1, BIO=1 or NUM=2
  1.00000         .20 ' S-BIGPOT ABUND       '  ! # = 33 VALUE:          1.97735
  6.000000   -.200000     1.000000 'BIGPOT SELTYPE    '   0 -84  0     .000000   .0000 ! 111 NO PICK    .000       -1.      .0000000
 62.000000    .010000    55.000000 'BIGPOT MINSIZE    '   0 -84  0     .000000   .0000 ! 112 NO PICK    .000       -1.      .0000000
100.000000    .001000     4.000000 'BIGPOT MAXSIZE    '   0 -84  0     .000000   .0000 ! 113 NO PICK    .000       -1.      .0000000
 1 AGEERR: 1: MULTINOMIAL,   0: S(LOG(P))=CONSTANT,   -1: S=P*Q/N
200.000 : MAX N FOR MULTINOMIAL
 4 1=%CORRECT, 2=C.V., 3=%AGREE, 4=READ %AGREE @AGE
 .540  .510  .390  .380  .230  .200  .200  .220  .200  .100  .070  .070  .070
 .070  .070  .070  .070  .070  .070  .070  .070  .070  .070  .070  .070
   .100000    .010000      .300000 'OLD DISCOUNT      '   0 -83  0     .000000   .0000 ! 114 NO PICK    .000       -1.      .0000000
   .000000    .001000      .100000 '%MIS-SEXED        '   0 -71  0     .000000   .0000 ! 115 NO PICK    .000       -1.      .0000000
-3 CPUE FOR TYPE:   3
   .00001         .30 ' LOGBOOK CPUE          '  ! # = 34 VALUE:          5.26049
   .001023    .000001     1.000000 ' CPUE - Q         '   0  80  0     .000000   .0000 ! 116 NO PICK    .000       -1.      .0000000
   .000000  -1.000000     1.000000 ' BIO Q            '   0  80  0     .000000   .0000 ! 117 NO PICK    .000       -1.      .0000000
 0 END OF EFFORT
 0 FIX n FMORTs
 0  CANNIBALISM
 1  GROWTH: 1=CONSTANT, 2=MORT. INFLUENCE
 1.6600 25.0000  AGE AT WHICH L1 AND L2 OCCUR
 2 1=NORMAL, 2=LOGNORMAL
 38.400000   35.000000    45.000000 'FEMALE L1         '   0   1  9   38.400000   .0000 ! 118 ENV FXN    .000       -1.      .0000000
 65.020419   60.000000    85.000000 'FEMALE LINF       '   2   1 10   62.407500   .0000 ! 119 OK        -.002      -381.      .0024521
   .266505    .080000      .550000 'FEMALE K          '   2   1  0     .376200   .0000 ! 120 OK         .000-1868929.      .0000004
  1.931487   1.000000     3.000000 'FEMALE sdev1      '  -2   1  0     .000000   .0000 ! 121 NO PICK    .000       -1.      .0000000
  8.338638   2.000000    12.000000 'FEMALE sdev2      '   2   1  0    7.100000   .0000 ! 122 OK         .000       -38.      .0309031
-999.000000  35.000000    45.000000 'MALE L1           '   0   1  0     .000000   .0000 ! 123 NO PICK    .000       -1.      .0000000
 56.310804   50.000000    85.000000 'MALE LINF         '   2   1 11   56.746500   .0000 ! 124 OK         .001      -300.      .0036168
   .312804    .080000      .550000 'MALE K            '   2   1  0     .323700   .0000 ! 125 OK         .000    -24651.      .0000415
-999.000000   .020000     2.580000 'MALE sdev1        '   0   1  0     .000000   .0000 ! 126 NO PICK    .000       -1.      .0000000
  5.398448   2.000000     6.000000 'MALE sdev2        '   2   1  0    5.100000   .0000 ! 127 OK         .000      -112.      .0072267
          5  DEFINE MARKET CATEGORIES
 0  DEFINE N MARKET CAT. FOR FISHERY    1 HKL
 0  DEFINE N MARKET CAT. FOR FISHERY    2 POT
 2  DEFINE N MARKET CAT. FOR FISHERY    3 TWLFISH
   .000000    .000000      .000000 ' DISC-F INFL      '   0   1 12     .000000   .0000 ! 128 ENV FXN    .000       -1.      .0000000
   .000000  -1.500000     3.000000 ' DISC-M INFL REL'    0   1  0     .000000   .0000 ! 129 NO PICK    .000       -1.      .0000000
   .000000    .000000      .000000 ' DISC-F SLOPE     '   0   1 13     .000000   .0000 ! 130 ENV FXN    .000       -1.      .0000000
  1.000000    .010000     1.000000 ' DISC @ MINSIZE   '   0   1  0     .000000   .0000 ! 131 NO PICK    .000       -1.      .0000000
   .000000    .000000     1.000000 ' DISC @ MAXSIZE   '   0   1 14     .000000   .0000 ! 132 ENV FXN    .000       -1.      .0000000
14 ENVIRONMENTAL FXN:     [-INDEX]   [FXN TYPE(1-4)]   [ENVVAR USED]
SABLE.ENV
 -1  2  1
 -2  2  9
 -3  2  2
 -4  2  5
 -5  2  3
 -6  2  4
 -7  2  7
 -8  1 14
   .000000    .000000   100.000000 'ENV SLP init-A    '   0  71  0     .000000   .0000 ! 133 NO PICK    .000       -1.      .0000000
 -9  1  8
  1.000000  -5.000000   100.000000 'ENV L-1 OFFSET    '   0  71  0     .000000   .0000 ! 134 NO PICK    .000       -1.      .0000000
-10  1 12
  1.000000  -5.000000   100.000000 'ENV linf F SLOPE'    0  71  0     .000000   .0000 ! 135 NO PICK    .000       -1.      .0000000
-11  1 12
  1.000000  -5.000000   100.000000 'ENV linf M SLOPE'    0  71  0     .000000   .0000 ! 136 NO PICK    .000       -1.      .0000000
-12  2 10
-13  2 11
-14  2 13
 72 ESTIMATE N ENVIRON VALUES
  -71     1  YEAR,PARM.
   81  YEAR-END
   .828497    .100000      .990000 'ENV HKL 71        '   2  71  0     .000000   .0000 ! 137 OK         .000      -546.      .0006452
  -82     1  YEAR,PARM.
   85  YEAR-END
   .502984    .100000    19.000000 'ENV HKL 82-85     '   2  81  0     .000000   .0000 ! 138 OK         .000     -1027.      .0000000
  -86     1  YEAR,PARM.
   87  YEAR-END
   .445554    .100000      .900000 'ENV HKL 86-87     '   2  85  0     .000000   .0000 ! 139 OK         .000     -2773.      .0000006
  -88     1  YEAR,PARM.
   89  YEAR-END
   .572883    .100000      .990000 'ENV HKL 88-89     '   2  87  0     .000000   .0000 ! 140 OK         .000     -5974.      .0001451
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 -90    1  YEAR,PARM.
  91  YEAR-END
   .511114     .100000   19.000000 'ENV HKL 90-91    '   2  89  0   .000000   .0000 ! 141 OK       .000   -5406.    .0000000
 -92    1  YEAR,PARM.
  93  YEAR-END
   .419265     .050000    5.000000 'ENV HKL 92-93    '   2  91  0   .000000   .0000 ! 142 OK       .000   -3460.    .0003351
 -94    1  YEAR,PARM.
  95  YEAR-END
   .466618     .050000    5.000000 'ENV HKL 94-95    '   2  93  0   .000000   .0000 ! 143 OK       .000   -3726.    .0002500
 -96    1  YEAR,PARM.
  97  YEAR-END
   .487113     .050000    5.000000 'ENV HKL 96-97    '   2  93  0   .000000   .0000 ! 144 OK       .000   -4674.    .0001378
 -98    1  YEAR,PARM.
 100  YEAR-END
   .500116     .100000     .900000 'ENV HKL 98-100   '   2  97  0   .000000   .0000 ! 145 OK       .000   -4723.    .0000000
-101    1  YEAR,PARM.
 102  YEAR-END
   .370011     .100000     .900000 'ENV HKL 101-102  '   2  99  0   .000000   .0000 ! 146 OK       .000    -567.    .0019725
 -71    9  YEAR,PARM.
  87  YEAR-END
   .361997     .010000    1.000000 'ENV HKL-F 71-87  '   2  71  0   .000000   .0000 ! 147 OK       .000    -143.    .0000000
 -88    9  YEAR,PARM.
  91  YEAR-END
   .066120     .010000    1.000000 'ENV HKL-F 88-91  '   2  87  0   .000000   .0000 ! 148 OK       .000   -4539.    .0000000
 -92    9  YEAR,PARM.
  95  YEAR-END
   .318418     .010000    1.000000 'ENV HKL-F 92-95  '   2  91  0   .000000   .0000 ! 149 OK       .000    -354.    .0009462
 -96    9  YEAR,PARM.
  97  YEAR-END
   .064615     .010000    1.000000 'ENV HKL-F 96-97  '   2  91  0   .000000   .0000 ! 150 OK       .000   -1364.    .0004196
 -98    9  YEAR,PARM.
 100  YEAR-END
   .841927     .010000    1.000000 'ENV HKL-F 98-100'    2  97  0   .000000   .0000 ! 151 OK      -.002     -11.    .0000000
-101    9  YEAR,PARM.
 102  YEAR-END
  1.000000     .010000    1.000000 'ENV HKL-F 101-02'    2  99  0   .000000   .0000 ! 152 BOUND    .000      -1.    .0000000
 -71    2  YEAR,PARM.
  84  YEAR-END
   .822756     .100000     .990000 'ENV POT 71-84    '   2  71  0   .000000   .0000 ! 153 OK       .000    -549.    .0017380
 -85    2  YEAR,PARM.
  88  YEAR-END
   .802103     .100000     .990000 'ENV POT 85-88    '   2  84  0   .000000   .0000 ! 154 OK       .000   -1186.    .0000000
 -89    2  YEAR,PARM.
  92  YEAR-END
   .933778     .100000     .990000 'ENV POT 89-92    '   2  88  0   .000000   .0000 ! 155 OK       .000    -801.    .0013823
 -93    2  YEAR,PARM.
  96  YEAR-END
   .885823     .100000     .990000 'ENV POT 93-96    '   2  92  0   .000000   .0000 ! 156 OK       .000   -1310.    .0000000
 -97    2  YEAR,PARM.
 100  YEAR-END
   .918362     .100000     .990000 'ENV POT 97-100   '   2  96  0   .000000   .0000 ! 157 OK       .000    -614.    .0020023
-101    2  YEAR,PARM.
 102  YEAR-END
   .990000     .100000     .990000 'ENV POT 101-102  '   2  99  0   .000000   .0000 ! 158 BOUND    .000      -1.    .0000000
 -71    5  YEAR,PARM.
  88  YEAR-END
   .290571     .010000    1.000000 'ENV POT-F 71-88  '   2  71  0   .000000   .0000 ! 159 OK       .000    -214.    .0077351
 -89    5  YEAR,PARM.
  92  YEAR-END
  1.000000     .010000    1.000000 'ENV POT-F 89-92  '   0  88  0   .000000   .0000 ! 160 NO PICK  .000      -1.    .0000000
 -93    5  YEAR,PARM.
  96  YEAR-END
   .064741     .010000    1.000000 'ENV POT-F 93-96  '   2  92  0   .000000   .0000 ! 161 OK       .000    -794.    .0000000
 -97    5  YEAR,PARM.
 100  YEAR-END
   .555420     .010000    1.000000 'ENV POT-F 97-100'    2  96  0   .000000   .0000 ! 162 OK       .000     -20.    .0758620
-101    5  YEAR,PARM.
 102  YEAR-END
  1.000000     .010000    1.000000 'ENV POT-F 100-02'    2  99  0   .000000   .0000 ! 163 BOUND    .000      -1.    .0000000
 -71    3  YEAR,PARM.
  84  YEAR-END
   .304099     .100000     .990000 'ENV TWL 71-84    '   2  71  0   .000000   .0000 ! 164 OK       .000   -1506.    .0004966
 -85    3  YEAR,PARM.
  87  YEAR-END
   .391078     .100000     .990000 'ENV TWL 85-87    '   2  84  0   .000000   .0000 ! 165 OK       .000   -3179.    .0000000
 -88    3  YEAR,PARM.
  89  YEAR-END
   .363952     .100000     .990000 'ENV TWL 88-89    '   2  87  0   .000000   .0000 ! 166 OK       .000   -1052.    .0006247
 -90    3  YEAR,PARM.
  91  YEAR-END
   .447546     .100000     .990000 'ENV TWL 90-91    '   2  89  0   .000000   .0000 ! 167 OK       .000   -1192.    .0000000
 -92    3  YEAR,PARM.
  93  YEAR-END
   .565911     .100000     .990000 'ENV TWL 92-93    '   2  91  0   .000000   .0000 ! 168 OK       .000    -840.    .0008673
 -94    3  YEAR,PARM.
  95  YEAR-END
   .533184     .020000     .990000 'ENV TWL 94-95    '   2  93  0   .000000   .0000 ! 169 OK       .000    -754.    .0017011
 -96    3  YEAR,PARM.
  97  YEAR-END
   .196510     .020000     .990000 'ENV TWL 96-97    '   2  95  0   .000000   .0000 ! 170 OK       .000     -44.    .0138210
 -98    3  YEAR,PARM.
 100  YEAR-END
   .750633     .020000     .990000 'ENV TWL 98-100   '   2  97  0   .000000   .0000 ! 171 OK       .000   -1285.    .0000000
-101    3  YEAR,PARM.
 102  YEAR-END
   .020000     .020000     .990000 'ENV TWL 101-102  '   2  99  0   .000000   .0000 ! 172 BOUND    .000      -1.    .0000000
 -71    4  YEAR,PARM.
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 87  YEAR-END
   .184541      .010000     1.000000 'ENV TWL-F 71-87 '   2  71  0      .000000   .0000 ! 173 OK          .000   -1709.       .0004665
 -88    4  YEAR,PARM.
 89  YEAR-END
   .200751      .010000     1.000000 'ENV TWL-F 88-89 '   2  87  0      .000000   .0000 ! 174 OK          .000   -1711.       .0007488
 -90    4  YEAR,PARM.
 91  YEAR-END
   .355340      .010000     1.000000 'ENV TWL-F 90-91 '   2  89  0      .000000   .0000 ! 175 OK          .000    -451.       .0000000
 -92    4  YEAR,PARM.
 93  YEAR-END
   .469021      .010000     1.000000 'ENV TWL-F 92-93 '   2  91  0      .000000   .0000 ! 176 OK          .000    -162.       .0066840
 -94    4  YEAR,PARM.
 95  YEAR-END
   .540700      .010000     1.000000 'ENV TWL-F 94-95 '   2  93  0      .000000   .0000 ! 177 OK          .000    -107.       .0119367
 -96    4  YEAR,PARM.
 97  YEAR-END
  1.000000      .010000     1.000000 'ENV TWL-F 96-97 '   2  95  0      .000000   .0000 ! 178 BOUND       .000      -1.       .0000000
 -98    4  YEAR,PARM.
 100  YEAR-END
   .311578      .010000     1.000000 'ENV TWL-F 98-99 '   2  97  0      .000000   .0000 ! 179 OK          .000    -292.       .0000000
-101    4  YEAR,PARM.
 102  YEAR-END
  1.000000      .010000     1.000000 'ENV TWL-F 100-02'   2  99  0      .000000   .0000 ! 180 BOUND       .000      -1.       .0000000
 -71    7  YEAR,PARM.
 82  YEAR-END
   .724540      .100000      .990000 'ENV POTSVY 71-82'   2  71  0      .000000   .0000 ! 181 OK          .000   -2575.       .0005870
 -83    7  YEAR,PARM.
 100  YEAR-END
   .564326      .100000      .990000 'ENV POTSVY 83-10'   2  82  0      .000000   .0000 ! 182 OK          .000  -17592.       .0001114
 80     8  YEAR,PARM.
   .175539    -3.000000     3.000000 'AGE1 IN 80      '   1  79  0      .000000  5.0000 ! 183 OK          .000     -30.       .0332929
 83     8  YEAR,PARM.
 -1.122522    -3.000000     3.000000 'AGE1 IN 83      '   1  82  0      .000000  5.0000 ! 184 OK          .000     -10.       .0957955
 86     8  YEAR,PARM.
  -.533217    -3.000000     3.000000 'AGE1 IN 86      '   1  85  0      .000000  5.0000 ! 185 OK         -.002    -171.       .0062387
 88     8  YEAR,PARM.
 -2.560552    -3.000000     3.000000 'AGE1 IN 88      '   1  87  0      .000000  5.0000 ! 186 OK          .001      -6.       .0000000
 89     8  YEAR,PARM.
  1.683507    -3.000000     3.000000 'AGE1 IN 89      '   1  88  0      .000000  5.0000 ! 187 OK          .001     -13.       .0762215
 90     8  YEAR,PARM.
   .000000    -3.000000     3.000000 'AGE1 IN 90      '  -1  89  0      .000000  5.0000 ! 188 NO PICK     .000      -1.       .0000000
 91     8  YEAR,PARM.
   .000000    -3.000000     3.000000 'AGE1 IN 91      '  -1  90  0      .000000  5.0000 ! 189 NO PICK     .000      -1.       .0000000
 92     8  YEAR,PARM.
  -.648923    -3.000000     3.000000 'AGE1 IN 92      '   1  91  0      .000000  5.0000 ! 190 OK          .000      -2.       .1051883
 93     8  YEAR,PARM.
   .000000    -3.000000     3.000000 'AGE1 IN 93      '  -1  92  0      .000000  5.0000 ! 191 NO PICK     .000      -1.       .0000000
 95     8  YEAR,PARM.
   .440570    -3.000000     3.000000 'AGE1 IN 95      '   1  94  0      .000000  5.0000 ! 192 OK          .000 -919175.       .0000000
 98     8  YEAR,PARM.
   .000000    -3.000000     3.000000 'AGE1 IN 98      '   0  97  0      .000000   .0000 ! 193 NO PICK     .000      -1.       .0000000
 101    8  YEAR,PARM.
 -1.378193    -3.000000     3.000000 'AGE1 IN 2001    '   1 100  0      .000000   .0000 ! 194 OK          .000     -31.       .0348092
 -71   10  YEAR,PARM.
 84  YEAR-END
 42.800000    35.000000    50.000000 'DISC INFL 71-84 '   0  71  0      .000000   .0000 ! 195 NO PICK     .000      -1.       .0000000
 -85   10  YEAR,PARM.
 100  YEAR-END
 40.100000    35.000000    50.000000 'DISC INFL 85-100'   0  84  0      .000000   .0000 ! 196 NO PICK     .000      -1.       .0000000
 -71   11  YEAR,PARM.
 84  YEAR-END
  1.092000      .500000     5.000000 'DISC SLPE 71-84 '   0  71  0      .000000   .0000 ! 197 NO PICK     .000      -1.       .0000000
 -85   11  YEAR,PARM.
 100  YEAR-END
   .526000      .500000     5.000000 'DISC SLPE 85-100'   0  84  0      .000000   .0000 ! 198 NO PICK     .000      -1.       .0000000
 -85   13  YEAR,PARM.
 100  YEAR-END
   .219580      .001000      .500000 'DISC final 85-10'   2  84  0      .000000   .0000 ! 199 OK          .000   -2040.       .0005312
 -71   12  YEAR,PARM.
 72  YEAR-END
   .000000      .000000    25.000000 'early Linf offse'  -2   1  0      .000000   .0000 ! 200 NO PICK     .000      -1.       .0000000
 88    14  YEAR,PARM.
   .000000      .010000     2.000000 'slp init 88     '  -2 -87  0      .000000   .0000 ! 201 NO PICK     .000      -1.       .0000000
 90    14  YEAR,PARM.
   .000000      .010000     2.000000 'slp init 90     '  -2 -89  0      .000000   .0000 ! 202 NO PICK     .000      -1.       .0000000
 91    14  YEAR,PARM.
   .000000      .010000     2.000000 'slp init 91     '  -2 -90  0      .000000   .0000 ! 203 NO PICK     .000      -1.       .0000000
 92    14  YEAR,PARM.
   .000000      .010000     2.000000 'slp init 92     '  -2 -91  0      .000000   .0000 ! 204 NO PICK     .000      -1.       .0000000
 93    14  YEAR,PARM.
   .000000      .010000     2.000000 'slp init 93     '  -2 -92  0      .000000   .0000 ! 205 NO PICK     .000      -1.       .0000000
 95    14  YEAR,PARM.
   .000000      .010000     2.000000 'slp init 95     '  -2 -94  0      .000000   .0000 ! 206 NO PICK     .000      -1.       .0000000
 96    14  YEAR,PARM.
   .000000      .010000     2.000000 'slp init 96     '  -2 -95  0      .000000   .0000 ! 207 NO PICK     .000      -1.       .0000000
 97    14  YEAR,PARM.
   .000000      .010000     2.000000 'slp init 97     '  -2 -96  0      .000000   .0000 ! 208 NO PICK     .000      -1.       .0000000
 35 PENALTIES
   1.00000        -.89 'PARM. PENALTY        '  ! # = 35 VALUE:       -21.44254
 -1  1.0  1.0
209 ENVIRONMENT EFFECT ON EXP(RECR)
RECRENV.CSV
   .000000  -30.000000    30.000000 ' RECR-ENV        '   0   1  0      .000000   .0000 ! 209 NO PICK     .000      -1.       .0000000
 36  STOCK-RECR
  3 1=B-H, 2=RICKER, 3=new B-H
  0 0=USE S-R CURVE, 1=SCALE CURVE
    .00001        -.60 ' SPAWN-RECR-IND       '  ! # = 36 VALUE:      -210.14189
```

```
  .00001       -.30 ' SPAWN-RECR-MEAN      ' ! # = 37 VALUE:     -9065.18825
 1.281742     .200000   15.000000 'VIRGIN RECR MULT'  2   1  0     .000000   .0000 ! 210 OK          .000    -966.     .0037676
  .400000     .200000     .999000 'B/H  S/R PARAM  ' -2   1  0     .000000   .0000 ! 211 NO PICK     .000      -1.     .0000000
 1.000000     .100000   15.000000 'BACK. RECRUIT   '  0   1  0     .000000   .0000 ! 212 NO PICK     .000      -1.     .0000000
  .600000     .100000     .990000 'S/R STD.DEV.    '  0   1  0     .000000   .0000 ! 213 NO PICK     .000      -1.     .0000000
  .000000    -.100000     .100000 'RECR TREND      '  0   1  0     .000000   .0000 ! 214 NO PICK     .000      -1.     .0000000
 1.000000     .010000   10.000000 'RECR-MULT       '  0   1  0     .000000   .0000 ! 215 NO PICK     .000      -1.     .0000000
0 INIT AGE COMP
-1.553197     .001000   10.000000 'RECR 71  YC  70 '  0  71  0     .000000   .0000 ! 216 NO PICK     .000      -1.     .0000000
-1.553197     .001000   10.000000 'RECR 72  YC  71 '  0  72  0     .000000   .0000 ! 217 NO PICK     .000      -1.     .0000000
-1.551929     .001000   10.000000 'RECR 73  YC  72 '  0  73  0     .000000   .0000 ! 218 NO PICK     .000      -1.     .0000000
-1.545218     .001000   10.000000 'RECR 74  YC  73 '  0  74  0     .000000   .0000 ! 219 NO PICK     .000      -1.     .0000000
 3.174847     .001000   10.000000 'RECR 75  YC  74 '  2  75  0     .000000   .0000 ! 220 OK         -.001      -4.    1.2494730
  .009403     .001000   10.000000 'RECR 76  YC  75 '  2  76  0     .000000   .0000 ! 221 OK          .000    -105.     .0055379
  .006198     .001000   15.000000 'RECR 77  YC  76 '  2  77  0     .000000   .0000 ! 222 OK          .000    -256.     .0037351
 5.186269     .001000   15.000000 'RECR 78  YC  77 '  2  78  0     .000000   .0000 ! 223 OK          .000      -8.     .2131035
  .012720     .001000   15.000000 'RECR 79  YC  78 '  2  79  0     .000000   .0000 ! 224 OK          .000     -64.     .0206182
 3.493880     .001000   15.000000 'RECR 80  YC  79 '  2  80  0     .000000   .0000 ! 225 OK          .000     -14.     .1301317
  .434114     .001000   15.000000 'RECR 81  YC  80 '  2  81  0     .000000   .0000 ! 226 OK         -.001     -17.     .1476135
 2.484509     .001000   15.000000 'RECR 82  YC  81 '  2  82  0     .000000   .0000 ! 227 OK          .000     -26.     .0664257
  .978819     .001000   15.000000 'RECR 83  YC  82 '  2  83  0     .000000   .0000 ! 228 OK          .000     -85.     .0104559
  .596753     .001000   15.000000 'RECR 84  YC  83 '  2  84  0     .000000   .0000 ! 229 OK          .000     -46.     .0521315
  .920915     .001000   15.000000 'RECR 85  YC  84 '  2  85  0     .000000   .0000 ! 230 OK          .000     -64.     .0328140
 2.009104     .001000   15.000000 'RECR 86  YC  85 '  2  86  0     .000000   .0000 ! 231 OK          .001     -53.     .0322138
 1.365329     .001000   15.000000 'RECR 87  YC  86 '  2  87  0     .000000   .0000 ! 232 OK          .000     -67.     .0208627
 1.567899     .001000   15.000000 'RECR 88  YC  87 '  2  88  0     .000000   .0000 ! 233 OK          .001     -41.     .0309628
  .811022     .001000   15.000000 'RECR 89  YC  88 '  2  89  0     .000000   .0000 ! 234 OK          .000     -59.     .0165630
 2.134719     .001000   15.000000 'RECR 90  YC  89 '  2  90  0     .000000   .0000 ! 235 OK          .000     -28.     .0446497
 2.745712     .001000   15.000000 'RECR 91  YC  90 '  2  91  0     .000000   .0000 ! 236 OK          .001     -34.     .0469672
  .099095     .001000   15.000000 'RECR 92  YC  91 '  2  92  0     .000000   .0000 ! 237 OK          .000    -228.     .0000000
  .459470     .001000   15.000000 'RECR 93  YC  92 '  2  93  0     .000000   .0000 ! 238 OK          .000     -85.     .0149455
  .430838     .001000   15.000000 'RECR 94  YC  93 '  2  94  0     .000000   .0000 ! 239 OK          .000    -169.     .0084683
  .758661     .001000   15.000000 'RECR 95  YC  94 '  2  95  0     .000000   .0000 ! 240 OK          .000    -103.     .0162010
 1.171897     .001000   15.000000 'RECR 96  YC  95 '  2  96  0     .000000   .0000 ! 241 OK          .001    -100.     .0161536
  .001000     .001000   15.000000 'RECR 97  YC  96 '  2  97  0     .000000   .0000 ! 242 BOUND       .000      -1.     .0000000
  .007411     .001000   15.000000 'RECR 98  YC  97 '  2  98  0     .000000   .0000 ! 243 OK          .000  -28727.     .0000366
  .432737     .001000   15.000000 'RECR 99  YC  98 '  2  99  0     .000000   .0000 ! 244 OK          .000    -104.     .0125973
 2.211786     .001000   15.000000 'RECR 100 YC  99 '  2 100  0     .000000   .0000 ! 245 OK          .001     -21.     .0970341
 2.358643     .001000   15.000000 'RECR 101 YC 100 '  2 101  0     .000000   .0000 ! 246 OK          .001     -11.     .1657806
-1.010828     .001000   15.000000 'RECR 102 YC 101 '  0 102  0     .000000   .0000 ! 247 NO PICK     .000      -1.     .0000000
.0242  .0015  .0272
.0563  .0028  .0378
.0183  .0069  .0421
.0403  .0260  .0343
.0293  .0467  .0382
.0217  .1688  .0395
.0267  .0359  .0435
.0324  .0525  .0762
.0836  .1228  .0935
.0300  .0375  .0486
.0416  .0377  .0633
.0150  .0633  .1220
.0099  .0572  .0969
.0102  .0424  .1200
.0281  .0410  .1421
.0390  .0281  .1471
.0434  .0267  .1473
.0916  .0279  .1122
.0774  .0128  .1155
.0563  .0099  .0851
.0831  .0071  .0771
.0358  .0052  .0757
.0253  .0177  .0666
.0271  .0267  .0490
.0356  .0226  .0588
.0708  .0182  .0470
.0862  .0066  .0415
.0148  .0053  .0822
.0240  .0094  .0980
.0259  .0110  .0938
.0181  .0063  .0299
.0142  .0051  .0221
CONVERGENCE
LIKE CHANGE:        .0006  MAX PARM CHANGE: 192     AGE1 IN 95          .00181
CONVERGENCE PATH (LIKE, BIOMASS)
  -965.7364    150013.7
  -965.7082    150067.9
  -965.6652    150042.8
  -965.4810    149846.0
  -965.3677    151808.9
  -965.3360    154522.7
  -965.3272    155425.7
  -965.3265    155444.5
 NUMBER OF ESTIMATED PARAMETERS =        123
 N CATCHES WITH F ESTIMATED     =         96
 N SURV OBS WITH EMPH > 0.001   =         38
 N EFFORT OBS WITH EMPH > 0.001 =          0
 N COMPOSITION OBS WITH NAGES>1 =        198
 N COMPOSITION BINS WITH DATA   =       4774

PARAMETERS WITH CORRELATION > 0.7
  6 163     HKL-SML SLOPE         ENV POT-F 100-02    .9900
  6 178     HKL-SML SLOPE         ENV TWL-F 96-97     .9900
 15 163     HKL-F INFLECT         ENV POT-F 100-02    .9900
 15 178     HKL-F INFLECT         ENV TWL-F 96-97     .9900
 16 163     HKL-F SLOPE           ENV POT-F 100-02    .9900
 16 178     HKL-F SLOPE           ENV TWL-F 96-97     .9900
 17 163     HKL-M FIN rel Fe      ENV POT-F 100-02    .9900
 17 178     HKL-M FIN rel Fe      ENV TWL-F 96-97     .9900
 19 163     HKL-M POWER           ENV POT-F 100-02    .9900
 19 178     HKL-M POWER           ENV TWL-F 96-97     .9900
 23 163     POT-SML SLOPE         ENV POT-F 100-02    .9900
 23 178     POT-SML SLOPE         ENV TWL-F 96-97     .9900
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24	163	POT-L FINAL SEL	ENV POT-F 100-02	.9900
24	178	POT-L FINAL SEL	ENV TWL-F 96-97	.9900
25	163	POT-L INFLECT	ENV POT-F 100-02	.9900
25	178	POT-L INFLECT	ENV TWL-F 96-97	.9900
26	163	POT-L SLOPE	ENV POT-F 100-02	.9900
26	178	POT-L SLOPE	ENV TWL-F 96-97	.9900
32	163	POT-F INFLECT	ENV POT-F 100-02	.9900
32	178	POT-F INFLECT	ENV TWL-F 96-97	.9900
33	163	POT-F SLOPE	ENV POT-F 100-02	.9900
33	178	POT-F SLOPE	ENV TWL-F 96-97	.9900
34	163	POT-M FIN rel Fe	ENV POT-F 100-02	.9900
34	178	POT-M FIN rel Fe	ENV TWL-F 96-97	.9900
36	163	POT-M POWER	ENV POT-F 100-02	.9900
36	178	POT-M POWER	ENV TWL-F 96-97	.9900
40	163	TWL SLOPE	ENV POT-F 100-02	.9900
40	178	TWL SLOPE	ENV TWL-F 96-97	.9900
41	163	TWL-L FINAL SEL	ENV POT-F 100-02	.9900
41	178	TWL-L FINAL SEL	ENV TWL-F 96-97	.9900
42	163	TWL-L INFLECT	ENV POT-F 100-02	.9900
42	178	TWL-L INFLECT	ENV TWL-F 96-97	.9900
43	163	TWL-L SLOPE	ENV POT-F 100-02	.9900
43	178	TWL-L SLOPE	ENV TWL-F 96-97	.9900
49	163	TWL-F INFLECT	ENV POT-F 100-02	.9900
49	178	TWL-F INFLECT	ENV TWL-F 96-97	.9900
50	163	TWL-F SLOPE	ENV POT-F 100-02	.9900
50	178	TWL-F SLOPE	ENV TWL-F 96-97	.9900
51	163	TWL-M FIN rel Fe	ENV POT-F 100-02	.9900
51	178	TWL-M FIN rel Fe	ENV TWL-F 96-97	.9900
53	163	TWL-M POWER	ENV POT-F 100-02	.9900
53	178	TWL-M POWER	ENV TWL-F 96-97	.9900
119	163	FEMALE LINF	ENV POT-F 100-02	.9900
119	178	FEMALE LINF	ENV TWL-F 96-97	.9900
120	163	FEMALE K	ENV POT-F 100-02	.9900
120	178	FEMALE K	ENV TWL-F 96-97	.9900
122	163	FEMALE sdev2	ENV POT-F 100-02	.9900
122	178	FEMALE sdev2	ENV TWL-F 96-97	.9900
124	163	MALE LINF	ENV POT-F 100-02	.9900
124	178	MALE LINF	ENV TWL-F 96-97	.9900
125	163	MALE K	ENV POT-F 100-02	.9900
125	178	MALE K	ENV TWL-F 96-97	.9900
127	163	MALE sdev2	ENV POT-F 100-02	.9900
127	178	MALE sdev2	ENV TWL-F 96-97	.9900
137	163	ENV HKL 71	ENV POT-F 100-02	.9900
137	178	ENV HKL 71	ENV TWL-F 96-97	.9900
147	163	ENV HKL-F 71-87	ENV POT-F 100-02	.9900
147	178	ENV HKL-F 71-87	ENV TWL-F 96-97	.9900
153	163	ENV POT 71-84	ENV POT-F 100-02	.9900
153	178	ENV POT 71-84	ENV TWL-F 96-97	.9900
159	163	ENV POT-F 71-88	ENV POT-F 100-02	.9900
159	178	ENV POT-F 71-88	ENV TWL-F 96-97	.9900
164	163	ENV TWL 71-84	ENV POT-F 100-02	.9900
164	178	ENV TWL 71-84	ENV TWL-F 96-97	.9900
173	163	ENV TWL-F 71-87	ENV POT-F 100-02	.9900
173	178	ENV TWL-F 71-87	ENV TWL-F 96-97	.9900
181	163	ENV POTSVY 71-82	ENV POT-F 100-02	.9900
181	178	ENV POTSVY 71-82	ENV TWL-F 96-97	.9900
210	220	VIRGIN RECR MULT	RECR 75 YC 74	-.7813
210	163	VIRGIN RECR MULT	ENV POT-F 100-02	.9900
210	178	VIRGIN RECR MULT	ENV TWL-F 96-97	.9900
220	163	RECR 75 YC 74	ENV POT-F 100-02	.9900
220	178	RECR 75 YC 74	ENV TWL-F 96-97	.9900
221	163	RECR 76 YC 75	ENV POT-F 100-02	.9900
221	178	RECR 76 YC 75	ENV TWL-F 96-97	.9900
222	163	RECR 77 YC 76	ENV POT-F 100-02	.9900
222	178	RECR 77 YC 76	ENV TWL-F 96-97	.9900
223	163	RECR 78 YC 77	ENV POT-F 100-02	.9900
223	178	RECR 78 YC 77	ENV TWL-F 96-97	.9900
223	61	RECR 78 YC 77	SHELF-FA SLOPE	.8046
224	163	RECR 79 YC 78	ENV POT-F 100-02	.9900
224	178	RECR 79 YC 78	ENV TWL-F 96-97	.9900
225	163	RECR 80 YC 79	ENV POT-F 100-02	.9900
225	178	RECR 80 YC 79	ENV TWL-F 96-97	.9900
226	163	RECR 81 YC 80	ENV POT-F 100-02	.9900
226	178	RECR 81 YC 80	ENV TWL-F 96-97	.9900
227	163	RECR 82 YC 81	ENV POT-F 100-02	.9900
227	178	RECR 82 YC 81	ENV TWL-F 96-97	.9900
228	163	RECR 83 YC 82	ENV POT-F 100-02	.9900
228	178	RECR 83 YC 82	ENV TWL-F 96-97	.9900
229	163	RECR 84 YC 83	ENV POT-F 100-02	.9900
229	178	RECR 84 YC 83	ENV TWL-F 96-97	.9900
230	163	RECR 85 YC 84	ENV POT-F 100-02	.9900
230	178	RECR 85 YC 84	ENV TWL-F 96-97	.9900
231	163	RECR 86 YC 85	ENV POT-F 100-02	.9900
231	178	RECR 86 YC 85	ENV TWL-F 96-97	.9900
232	163	RECR 87 YC 86	ENV POT-F 100-02	.9900
232	178	RECR 87 YC 86	ENV TWL-F 96-97	.9900
233	163	RECR 88 YC 87	ENV POT-F 100-02	.9900
233	178	RECR 88 YC 87	ENV TWL-F 96-97	.9900
234	163	RECR 89 YC 88	ENV POT-F 100-02	.9900
234	178	RECR 89 YC 88	ENV TWL-F 96-97	.9900
235	163	RECR 90 YC 89	ENV POT-F 100-02	.9900
235	178	RECR 90 YC 89	ENV TWL-F 96-97	.9900
236	163	RECR 91 YC 90	ENV POT-F 100-02	.9900
236	178	RECR 91 YC 90	ENV TWL-F 96-97	.9900
237	163	RECR 92 YC 91	ENV POT-F 100-02	.9900
237	178	RECR 92 YC 91	ENV TWL-F 96-97	.9900
238	163	RECR 93 YC 92	ENV POT-F 100-02	.9900
238	178	RECR 93 YC 92	ENV TWL-F 96-97	.9900
239	163	RECR 94 YC 93	ENV POT-F 100-02	.9900
239	178	RECR 94 YC 93	ENV TWL-F 96-97	.9900
240	163	RECR 95 YC 94	ENV POT-F 100-02	.9900
240	178	RECR 95 YC 94	ENV TWL-F 96-97	.9900
241	163	RECR 96 YC 95	ENV POT-F 100-02	.9900
241	178	RECR 96 YC 95	ENV TWL-F 96-97	.9900
242	163	RECR 97 YC 96	ENV POT-F 100-02	.9900
242	178	RECR 97 YC 96	ENV TWL-F 96-97	.9900
242	179	RECR 97 YC 96	ENV TWL-F 98-99	.9900
242	186	RECR 97 YC 96	AGE1 IN 88	.9900
242	60	RECR 97 YC 96	SHELF-FA INFLECT	.9900
243	163	RECR 98 YC 97	ENV POT-F 100-02	.9900
243	178	RECR 98 YC 97	ENV TWL-F 96-97	.9900
244	163	RECR 99 YC 98	ENV POT-F 100-02	.9900
244	178	RECR 99 YC 98	ENV TWL-F 96-97	.9900
245	163	RECR 100 YC 99	ENV POT-F 100-02	.9900
245	178	RECR 100 YC 99	ENV TWL-F 96-97	.9900
246	152	RECR 101 YC 100	ENV HKL-F 101-02	.9900
246	163	RECR 101 YC 100	ENV POT-F 100-02	.9900
246	178	RECR 101 YC 100	ENV TWL-F 96-97	.9900
246	180	RECR 101 YC 100	ENV TWL-F 100-02	.9900
82	163	SURVEY Q	ENV POT-F 100-02	.9900
82	178	SURVEY Q	ENV TWL-F 96-97	.9900
138	163	ENV HKL 82-85	ENV POT-F 100-02	.9900
138	178	ENV HKL 82-85	ENV TWL-F 96-97	.9900
139	163	ENV HKL 86-87	ENV POT-F 100-02	.9900
139	178	ENV HKL 86-87	ENV TWL-F 96-97	.9900
140	163	ENV HKL 88-89	ENV POT-F 100-02	.9900
140	178	ENV HKL 88-89	ENV TWL-F 96-97	.9900
141	163	ENV HKL 90-91	ENV POT-F 100-02	.9900
141	178	ENV HKL 90-91	ENV TWL-F 96-97	.9900
142	163	ENV HKL 92-93	ENV POT-F 100-02	.9900
142	178	ENV HKL 92-93	ENV TWL-F 96-97	.9900
143	163	ENV HKL 94-95	ENV POT-F 100-02	.9900
143	178	ENV HKL 94-95	ENV TWL-F 96-97	.9900
144	163	ENV HKL 96-97	ENV POT-F 100-02	.9900
144	178	ENV HKL 96-97	ENV TWL-F 96-97	.9900
145	151	ENV HKL 98-100	ENV HKL-F 98-100	-.8405
145	163	ENV HKL 98-100	ENV POT-F 100-02	.9900
145	178	ENV HKL 98-100	ENV TWL-F 96-97	.9900
146	152	ENV HKL 101-102	ENV HKL-F 101-02	-.8897
146	163	ENV HKL 101-102	ENV POT-F 100-02	.9900
146	178	ENV HKL 101-102	ENV TWL-F 96-97	.9900
148	163	ENV HKL-F 88-91	ENV POT-F 100-02	.9900
148	178	ENV HKL-F 88-91	ENV TWL-F 96-97	.9900
149	163	ENV HKL-F 92-95	ENV POT-F 100-02	.9900
149	178	ENV HKL-F 92-95	ENV TWL-F 96-97	.9900
150	163	ENV HKL-F 96-97	ENV POT-F 100-02	.9900
150	178	ENV HKL-F 96-97	ENV TWL-F 96-97	.9900
151	163	ENV HKL-F 98-100	ENV POT-F 100-02	.9900
151	178	ENV HKL-F 98-100	ENV TWL-F 96-97	.9900
152	163	ENV HKL-F 101-02	ENV POT-F 100-02	.9900
152	178	ENV HKL-F 101-02	ENV TWL-F 96-97	.9900
154	163	ENV POT 85-88	ENV POT-F 100-02	.9900
154	178	ENV POT 85-88	ENV TWL-F 96-97	.9900
155	163	ENV POT 89-92	ENV POT-F 100-02	.9900
155	178	ENV POT 89-92	ENV TWL-F 96-97	.9900
156	163	ENV POT 93-96	ENV POT-F 100-02	.9900
156	178	ENV POT 93-96	ENV TWL-F 96-97	.9900
157	163	ENV POT 97-100	ENV POT-F 100-02	.9900
157	178	ENV POT 97-100	ENV TWL-F 96-97	.9900
158	163	ENV POT 101-102	ENV POT-F 100-02	.9900
158	178	ENV POT 101-102	ENV TWL-F 96-97	.9900
161	163	ENV POT-F 93-96	ENV POT-F 100-02	.9900
161	178	ENV POT-F 93-96	ENV TWL-F 96-97	.9900
162	163	ENV POT-F 97-100	ENV POT-F 100-02	.9900
162	178	ENV POT-F 97-100	ENV TWL-F 96-97	.9900
163	165	ENV POT-F 100-02	ENV TWL 85-87	.9900
163	166	ENV POT-F 100-02	ENV TWL 88-89	.9900
163	167	ENV POT-F 100-02	ENV TWL 90-91	.9900
163	168	ENV POT-F 100-02	ENV TWL 92-93	.9900
163	169	ENV POT-F 100-02	ENV TWL 94-95	.9900
163	170	ENV POT-F 100-02	ENV TWL 96-97	.9900
163	171	ENV POT-F 100-02	ENV TWL 98-100	.9900
163	172	ENV POT-F 100-02	ENV TWL 101-102	.9900
163	174	ENV POT-F 100-02	ENV TWL-F 88-89	.9900
163	175	ENV POT-F 100-02	ENV TWL-F 90-91	.9900
163	176	ENV POT-F 100-02	ENV TWL-F 92-93	.9900
163	177	ENV POT-F 100-02	ENV TWL-F 94-95	.9900
163	178	ENV POT-F 100-02	ENV TWL-F 96-97	.9900
163	179	ENV POT-F 100-02	ENV TWL-F 98-99	.9900
163	180	ENV POT-F 100-02	ENV TWL-F 100-02	.9900
163	182	ENV POT-F 100-02	ENV POTSVY 83-10	.9900
163	183	ENV POT-F 100-02	AGE1 IN 80	.9900
163	184	ENV POT-F 100-02	AGE1 IN 83	.9900
163	185	ENV POT-F 100-02	AGE1 IN 86	.9900
163	186	ENV POT-F 100-02	AGE1 IN 88	.9900
163	187	ENV POT-F 100-02	AGE1 IN 89	.9900
163	190	ENV POT-F 100-02	AGE1 IN 92	.9900
163	192	ENV POT-F 100-02	AGE1 IN 95	.9900
163	194	ENV POT-F 100-02	AGE1 IN 2001	.9900
163	199	ENV POT-F 100-02	DISC final 85-10	.9900
163	59	ENV POT-F 100-02	SHELF-FA FINAL S	.9900
163	60	ENV POT-F 100-02	SHELF-FA INFLECT	.9900
163	61	ENV POT-F 100-02	SHELF-FA SLOPE	.9900
163	65	ENV POT-F 100-02	NPTSVY-SML SLOPE	.9900

163	73	ENV POT-F 100-02	NPTSVY-FA FINAL	.9900
163	74	ENV POT-F 100-02	NPTSVY-FA INFLEC	.9900
163	75	ENV POT-F 100-02	NPTSVY-FA SLOPE	.9900
163	76	ENV POT-F 100-02	NPTSVY-M rel FEM	.9900
163	78	ENV POT-F 100-02	NPTSVY-M POWER	.9900
163	88	ENV POT-F 100-02	SLP-L FINAL SEL	.9900
163	89	ENV POT-F 100-02	SLP-L INFLECT	.9900
163	90	ENV POT-F 100-02	SLP-L SLOPE	.9900
163	91	ENV POT-F 100-02	SLP INITIAL SEL	.9900
165	178	ENV TWL 85-87	ENV TWL-F 96-97	.9900
166	178	ENV TWL 88-89	ENV TWL-F 96-97	.9900
167	178	ENV TWL 90-91	ENV TWL-F 96-97	.9900
168	178	ENV TWL 92-93	ENV TWL-F 96-97	.9900
169	178	ENV TWL 94-95	ENV TWL-F 96-97	.9900
170	178	ENV TWL 96-97	ENV TWL-F 96-97	.9900
171	178	ENV TWL 98-100	ENV TWL-F 96-97	.9900
172	178	ENV TWL 101-102	ENV TWL-F 96-97	.9900
174	178	ENV TWL-F 88-89	ENV TWL-F 96-97	.9900
175	178	ENV TWL-F 90-91	ENV TWL-F 96-97	.9900
176	178	ENV TWL-F 92-93	ENV TWL-F 96-97	.9900
177	178	ENV TWL-F 94-95	ENV TWL-F 96-97	.9900
178	179	ENV TWL-F 96-97	ENV TWL-F 98-99	.9900
178	180	ENV TWL-F 96-97	ENV TWL-F 100-02	.9900
178	182	ENV TWL-F 96-97	ENV POTSVY 83-10	.9900
178	183	ENV TWL-F 96-97	AGE1 IN 80	.9900
178	184	ENV TWL-F 96-97	AGE1 IN 83	.9900
178	185	ENV TWL-F 96-97	AGE1 IN 86	.9900
178	186	ENV TWL-F 96-97	AGE1 IN 88	.9900
178	187	ENV TWL-F 96-97	AGE1 IN 89	.9900
178	190	ENV TWL-F 96-97	AGE1 IN 92	.9900
178	192	ENV TWL-F 96-97	AGE1 IN 95	.9900
178	194	ENV TWL-F 96-97	AGE1 IN 2001	.9900
178	199	ENV TWL-F 96-97	DISC final 85-10	.9900
178	59	ENV TWL-F 96-97	SHELF-FA FINAL S	.9900
178	60	ENV TWL-F 96-97	SHELF-FA INFLECT	.9900
178	61	ENV TWL-F 96-97	SHELF-FA SLOPE	.9900
178	65	ENV TWL-F 96-97	NPTSVY-SML SLOPE	.9900
178	73	ENV TWL-F 96-97	NPTSVY-FA FINAL	.9900
178	74	ENV TWL-F 96-97	NPTSVY-FA INFLEC	.9900
178	75	ENV TWL-F 96-97	NPTSVY-FA SLOPE	.9900
178	76	ENV TWL-F 96-97	NPTSVY-M rel FEM	.9900
178	78	ENV TWL-F 96-97	NPTSVY-M POWER	.9900
178	88	ENV TWL-F 96-97	SLP-L FINAL SEL	.9900
178	89	ENV TWL-F 96-97	SLP-L INFLECT	.9900
178	90	ENV TWL-F 96-97	SLP-L SLOPE	.9900
178	91	ENV TWL-F 96-97	SLP INITIAL SEL	.9900
59	61	SHELF-FA FINAL S	SHELF-FA SLOPE	.8383
88	89	SLP-L FINAL SEL	SLP-L INFLECT	-.7457
88	90	SLP-L FINAL SEL	SLP-L SLOPE	.9333
89	90	SLP-L INFLECT	SLP-L SLOPE	.9065

TOTAL LIKELIHOOD: -965.33

LIKELIHOOD TYPE	EMPHASIS	VALUE	ERROR(IF APPROP)
1 HKL CATCH	1.000	.000	.300
2 HKL AGECOMP	1.000	-60.329	.300
3 HKL SIZECOMP	1.000	-210.793	.210
4 HKL SIZE@AGE	.100	399.266	-1.000
5 POT CATCH	1.000	.000	.300
6 POT AGECOMP	1.000	-30.774	.300
7 POT SIZECOMP	1.000	-102.794	.210
8 POT SIZE@AGE	.100	301.074	-1.000
9 TRAWL CATCH	1.000	.000	.300
10 TRAWL AGECOMP	1.000	-78.556	.300
11 TRAWL SIZECOMP	1.000	-150.398	.210
12 TRAWL SIZE@AGE	.100	885.399	-1.000
13 TRAWL DISCARD	1.000	-.178	-1.000
14 SHELF ABUND	.000	-6.289	.400
15 SLFBIO ABUND	1.000	-1.214	.400
16 SLFBIO SIZE COMP	1.000	-33.567	.210
17 SLFBIO AGE COMP	1.000	-109.020	.300
18 N-POTSVY SURV ABUND	.000	.513	.200
19 N-POTSVY AGE COMP	1.000	-21.263	.210
20 N-POTSVY SIZE COMP	1.000	-78.933	.210
21 N-POTSVY SIZE@AGE	.100	129.842	-.300
22 N-BIGPOT ABUND	1.000	-8.242	.200
23 SLOPE SURV ABUND	1.000	6.030	.300
24 SLOPE AGE COMP	1.000	-97.663	.200
25 SLOPE SIZE COMP	1.000	-124.456	.200
26 SLOPE SIZE@AGE	.100	424.609	.300
27 GLM ALL 89-96	.000	-9.844	.300
28 GLM ALL 78-88	1.000	1.350	.300
29 S-POTSVY SURV ABUND	.000	-15.859	.200
30 S-POTSVY AGE COMP	1.000	-23.331	.210
31 S-POTSVY SIZE COMP	1.000	-53.229	.210

32	S-POTSVY SIZE@AGE	.100	175.752	-.300
33	S-BIGPOT ABUND	1.000	1.977	.200
34	LOGBOOK CPUE	.000	5.260	.300
35	PARM. PENALTY	1.000	-21.443	-.890
36	SPAWN-RECR-IND	.000	-210.140	-.600
37	SPAWN-RECR-MEAN	.000	-9065.116	-.300
38	ENDING BIOMASS	.000	155444.539	.000

REVIEW OF THE UPDATED 2002 SABLEFISH STOCK ASSESSMENT

Panel Members:

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Martin Dorn, SSC, NMFS, AFSC, Sand Point Laboratory, WA
Andre Punt, SSC, University of Washington, Seattle, WA
Mark Saelens, GMT, ODF&W, Newport, OR
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Overview:

Schirripa and Methot (2001) completed a stock assessment of west coast sablefish, which was formally reviewed in Newport, OR by a complete STAR panel (Brodziak *et al*. 2001). Following completion of the review, information was presented that indicated a high abundance of sablefish in the 2001 AFSC shelf trawl survey. Based on the importance of this new information, the Pacific Fishery Management Council (PFMC), while utilizing the 2001 assessment to establish management measures for 2002, decided to undertake an update of the 2001 assessment in 2002. The PFMC also adopted Terms of Reference for Expedited Stock Assessment Updates (Appendix 1), to accommodate an expedited form of review. The Terms or Reference apply to situations where a “model” has already been critically examined and the objective is to simply update it by incorporating the most recent data.

Schirripa (2002) presented an update to the sablefish stock assessment using data recently made available. His results show that the 1999 and 2000 year-classes appear to be relatively strong, based on incorporation of the data from: (1) the 2001 AFSC shelf trawl survey, (2) the 2001 R/V Miller Freeman AFSC slope trawl survey, and (3) the NWFSC Industry Cooperative survey. In addition, the updated assessment estimates the slope trawl survey catchability coefficient (Q) to be lower than it was estimated to be in 2001.

List of Analyses Requested by the Review Panel:

Following completion of the May 6, 2001 sablefish STAR panel teleconference, the review panel Chair submitted three requests to Dr. Schirripa to clarify aspects of his analysis (e-mail dated Monday, May 6, 3:55 PM). These were (in priority order):

1. Conduct a sensitivity analysis and associated projections in which the selectivity block for 2001 is omitted, the selectivity for 2001 is assumed to be the same as that for 1998-2000, and any "emphasis" removed from the 2001 commercial length composition data. The panel made this request because it was concerned that the new selectivity block may have strongly influenced the estimate of 2001 recruitment and hence all the projections.

2. Place confidence intervals on the figures (e.g. Figures 17 and 18) that show the fit of the model to survey estimates of biomass .

3. Time permitting, compare the “density-dependent” projections based on model 6 (columns 2 & 3 in Table 4a), which resample recruits from those for 1992-98, with projections that resample recruits from those for 1992-2001. The panel anticipated

that the revised projections would be more optimistic.

Dr. Schirripa responded with an e-mail (dated Tuesday, May 7, 11:23 AM) with an attached updated document (sable02_v11.exe ==> sable02_v11.pdf), that included responses to all three requests. With respect to the first item, the panel noted that differences between model 6A (the STAT team's original model with a new 2001 selectivity block) and model 6B (a model without a distinct 2001 selectivity block, but with the 2001 fishery length data down-weighted) were relatively minor (i.e., 5% increase in ending biomass, an 8% increase in 2003 catch). This finding was reassuring to the panel, which was concerned that incorporating a new 2001 selectivity block might influence the spawner-per-recruit (SPR) and $F_{45\%}$ calculations. An increase in the selectivity of young fish would tend to reduce the full-recruitment F to maintain SPR at 45%. A slightly lower catch when F_{SPR} is calculated using the 2001 blocked selectivity curve is consistent with this.

The available evidence indicates that the new minimum size regulation for sablefish resulted in a change in the retention of small fish, not a more fundamental change in selectivity. However, it was not possible to model a change in retention because: (1) discard estimates for 2001 are not yet available, (2) there is no information on the size composition of discards that would allow re-estimation of the retention curve. Essentially, Model 6 attempts to get around the lack of discard data. While the panel doesn't actually believe that selectivity changed, by adding extra selectivity parameters the assessment team was able to model away the information content of the 2001 fishery compositional data so that it had little influence on the model fit to other data.

In the original assessment document the STAT team provided results for a model fit to the new data, but with slope survey Q fixed at the value estimated by Schirripa and Methot (2001). Following the teleconference, the panel engaged in considerable e-mail discussion concerning the merits of fixing or re-estimating the slope survey Q parameter. Results in Table 2 show that most of the change in Q resulted from the addition of the 2001 slope survey length composition. The 1999 year class was much more available to the 2001 shelf trawl survey than to the slope survey (Figs. 19 and 20). This resulted in a marked change in the selectivity of age-1 fish in the slope trawl survey (Table 2, Fig. 23). The decreased availability of very young fish to the slope survey resulted in a lowering of Q.

The 2001 STAR panel also considered the pros and cons of estimating catchability for the slope trawl survey within the assessment model, ultimately electing to do so (Brodziak *et al*. 2001). They state:

> "The STAT team provided information on uncertainty in slope survey catchability (Q) for the baseline models, although most baseline assessment models (3A-3F) assumed that the slope survey catchability was fixed at a value of Q=0.75. The panel asked that Q be estimated and that the uncertainty in slope survey catchability be characterized."
>
> "the estimated value of the slope survey Q was quite variable as evidenced by the flatness of the likelihood function over large range of Qs. Thus there remained a large degree of uncertainty in current stock biomass."

Given the more detailed and deliberate exploration of this issue by the 2001 review panel and the Terms of Reference for Expedited Stock Assessment Updates (Appendix 1), which dictates that in a stock assessment update the baseline model structure should be left intact to the greatest extent practicable, the panel ultimately decided that fixing Q based on the 2001 assessment was inappropriate. However, it should be noted that in the 2001 assessment the estimated value of Q

(0.601) was reasonably consistent with the previously fixed value of 0.75, which may have played a role in its acceptance, despite being poorly determined. In addition, Brodziak *et al*. (2001) were confronted with two distinct and disparate sablefish models (i.e., Schirripa and Methot [2001] and Hilborn *et al*. [2001]); estimation of Q within the two models was one way to achieve an melding and standardization of assessment results. This likely influenced the decision of the 2001 STAR panel to recommend that Q be estimated internally, rather than being fixed at a value of 0.75.

Comments on the Technical Merits of the Updated Stock Assessment:

The review panel found the updated assessment (Schirripa 2002) to be technically sound and to represent the best available scientific information regarding the status of the sablefish resource along the U. S. west coast. Importantly, the updated stock assessment followed closely the analysis presented in Schirripa and Methot (2001). While not formally incorporated into the assessment model, the panel found the discussion of (1) sablefish bycatch in the Pacific whiting fishery and (2) the relationship between sablefish year-class strength and sea-level anomalies to be illuminating and useful. These two auxiliary analyses provided supplemental information in support of the conclusion that sablefish reproductive success has improved substantially since 1998.

Explanation of Areas of Disagreement:

There were no substantial areas of disagreement among the members of the review panel and the assessment author. The principal difficulty encountered during the review was how to interpret a major change in slope survey catchability (see above and below). Nonetheless, the panel did reach consensus that re-estimation of this parameter was consistent with the findings and philosophy of the previous STAR panel (Brodziak *et al*. 2001) and that there was no *a priori* reason to presume that the re-estimated value was inferior to the original number, given that it was based on additional data.

A further area of discussion centered around the year-classes on which the "density-dependent" projections (see item 3 above) should be based. The recruitments in the next few years for such projections should be expected to be most similar to the most recently observed recruitments because that "density-dependent" scenario is based on the assumption that recruitment is directly linked to spawning biomass, and spawning biomass is not apt to change markedly in the next few years. Following the recommendation of the review panel the "density-dependent" projections were therefore altered to include the 1999-2001 year-classes (Table 4D). When considering the "density-dependent" hypothesis, the panel favored the use of the latter projections over those presented in Table 4A.

Although four types of projections are presented for Model 6, it is reasonable to down-weight two of them as internally inconsistent. Specifically, results from Model 6 using a density-dependent target (B_0 = 220,931 based on 1975-1991 recruitments), but a regime shift pool of recruitments for projection (1975-2001 year-classes), are self-contradictory. Likewise, results employing a regime shift target (B_0 = 178,603 based on 1975-2001 recruitments), but a density-dependent pool of recruitments for projection (1992-2001) are not consonant. When considering either of these alternative states of nature, both the virgin biomass estimate and the recruitment pool used for projections should be consistent with the hypothesis under question.

Recommendation Regarding the Adequacy of the Updated Assessment for Use in Management:

With certain reservations and caveats, the panel endorses the use of Model 6 for management of the west coast sablefish stock in 2003 and into the future (see Table 1 below). However, the panel strongly believes that decision-making based on that analysis, which estimates the catchability coefficient (Q) of the slope trawl survey as a part of the model-fitting process, is not without considerable risk due to uncertainty in the estimate of current and historical stock size. Specifically:

(4) The difference in estimated Q values (0.601 last year versus 0.460 this year) has a very large impact on the estimate of exploitable stock size (107,000 mt last year versus 155,000 mt this year (Table 2).

(5) The lower Q value translates into a dramatic change in the potential range of OYs (3,877-4,630 mt last year [Table 3] versus 7,640-8,437 mt this year [Table 4A]).

(6) The estimate of Q remains very imprecise (although less so than was the case in 2001; see Figure 24). Consequently, it is subject to change due to slight modifications to the data used in the assessment. Although it is not possible to determine whether the re-estimated value is superior to the original (i.e., it is closer to the truth), because it is based upon more data it should not be expected to be worse.

(7) When B_0 and the projections are based on the assumption of density-dependence in the stock-recruitment recruitment relationship (one of four cases considered), even Model 6 predicts that harvests based upon the default 40:10 rule will drive the resource towards the overfished threshold of 0.25 B_0 (Table 4D, repeated below).

(8) If all the new landings and survey information are updated, but Q is fixed at the value estimated in the 2001 assessment (results presented as Model 7 [Table 5A]), the 2003 OY is reduced from the Model 6 value by 28.4% (8,437 to 6,037 mt) under the "regime shift" hypothesis and 31.4% under the "density-dependent" hypothesis (7,640 to 5,236 mt). Nevertheless, these 2003 OYs remain higher by 43% and 34%, respectively, than the corresponding 2003 OY's from the 2001 assessment.

Given that (1) Q is poorly determined and that (2) at this time there is no compelling scientific basis to select between the two states of nature (density-dependent versus regime shift), the review panel concluded that a precautionary adjustment that would lower the "risk neutral" sablefish OY is warranted, in order to reduce the possibility of over-harvesting the resource. While, the amount of the adjustment is a policy decision appropriately left to managers, an increased level of precaution is generally indicated in situations where uncertainty is great.

Table 1. – "Risk-neutral" projections of the west coast sablefish stock under Model 6 using the density-dependent and regime shift hypotheses.

	Density-Dependent	Regime Shift
Year		SSB/B_0 40:10 OY SSB/B_0 40:10 OY

2003	0.31
	7,682
	0.39
	8,437
2004	0.32
	7,786
	0.39
	8,620
2005	0.32
	7,761
	0.40
	8,777
2006	0.32
	7,634
	0.40
	8,889
2007	0.32
	7,444
	0.41
	8,960
2008	0.32
	7,221
	0.41
	9,017
2009	0.31
	6,987
	0.42
	9,066
2010	0.31
	6,760
	0.42
	9,108
2011	0.30
	6,552
	0.42
	9,147
2012	0.30
	6,362
	0.43
	9,182

References:

Brodziak, J., R. Cook, S. Gavaris, J. Golden, A. Hoffman, R. Moore, S. Ralston, and M. Saelens. 2001. Sablefish STAR Panel Report, Hatfield Marine Science Center, Newport, OR, July 13-16, 2001. Pacific Fishery Management Council, 7700 NE Ambassador Place, Suite 200, Portland, OR 97220-1384.

Hilborn, R., J. L. Valero, and M. Maunder. 2001. Status of the sablefish resource off the U. S. Pacific coast in 2001. Pacific Fishery Management Council, 7700 NE Ambassador Place, Suite 200, Portland, OR 97220-1384.

Schirripa, M. J., and R. Methot. 2001. Status of the Sablefish Resource off the U. S. Pacific Coast in 2001 (version 1.6; August 10, 2001). Pacific Fishery Management Council, 7700 NE Ambassador Place, Suite 200, Portland, OR 97220-1384.

Schirripa, M. J. 2002. Status of the Sablefish Resource off the Continental U. S. Pacific Coast in 2002 (version 1.1; May 7, 2002). Pacific Fishery Management Council, 7700 NE Ambassador Place, Suite 200, Portland, OR 97220-1384.

Appendix 1: Terms of Reference for Expedited Stock Assessment Updates

While the ordinary STAR process is designed to provide a general framework for obtaining a comprehensive, independent review of a stock assessment, in other situations a less rigorous review of assessment results is desirable. This is especially true in situations where a “model” has already been critically examined and the objective is to simply update the model by incorporating the most recent data. In this context a model refers not only to the population dynamics model *per se*, but to the particular data sources that are used as inputs to the model, the statistical framework for fitting the data, and the analytical treatment of model outputs used in providing management advice, including reference points, the allowable biological catch (ABC) and optimum yield (OY). When this type of situation occurs, it is an inefficient use of scarce personnel resources to assemble a 6 person panel for a whole week to evaluate an accepted modeling framework. These terms of reference establish a procedure that can accommodate an abbreviated form of review for stock assessment models that fall into this latter category. However, it is recognized that what in theory may seem to be a simple update, may in practice result in a situation that is impossible to resolve in an abbreviated process. In these cases, it may not be possible to update the assessment – rather the assessment may need to be revised in the next full assessment review cycle.

Qualification

The Scientific and Statistical Committee (SSC) will determine when a stock assessment qualifies for an expedited 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 full STAR panel. In practice this means similarity in: (a) the particular sources of data used, (b) the analytical methods used to summarize data prior to input to the model, (c) the software used in programming the assessment, (d) the assumptions and structure of the population dynamics model underlying the stock assessment, (e) the statistical framework for fitting the model to the data and determining goodness of fit, (f) the weighting of the various data components, and (g) the analytical treatment of model outputs in determining management reference points, including F_{msy}, B_{msy}, and B_0. It is the SSC’s intention to employ an expedited stock assessment update in situations where no significant change in these 7 factors has occurred, other than extending time series of data elements within particular data components used by the model, e.g., adding information from a recently completed survey with an update of landings. In practice there will always be valid reasons for altering a model, as defined in this broad context, although, in the interests of stability, such changes should be resisted when possible. Instead, significant alterations should be addressed in the next subsequent full assessment and review. In principle, an expedited update is reserved for stock assessments that maintain fidelity to an accepted modeling framework, but the SSC does not wish to prescribe in advance what particular changes may or may not be implemented. Such a determination will need to be made on a case by case basis.

Composition of the Review Panel

The groundfish subcommittee of the SSC will conduct the review of an expedited stock assessment update. A review panel chairman will be designated by the chairman of the groundfish subcommittee from among its membership and it will be the panel chairman’s responsibility to insure the review is completed properly and that a written report of the proceedings is produced. Other members of the subcommittee will participate in the review to the extent possible, i.e., input from all members will not be required to finalize a report. At a minimum, one member of the SSC’s groundfish subcommittee will be needed to conduct a review (i.e., the panel chairman). In addition, the groundfish management team (GMT) and the groundfish advisory panel (GAP) will designate one person each to participate in the review, although the GMT and GAP panelists will serve in an advisory capacity only.

Review Format

Typically, a physical meeting will not be required to complete an expedited review of an updated stock assessment. Rather, materials can be distributed electronically. STAT and panel representatives will largely be expected to interact by email and telephone. A conference call will be held to facilitate public participation in the review.

The review process will be as follows. Initially, the STAT team that is preparing the stock assessment update will distribute to the review panelists a document that summarizes the team’s findings. In addition, Council staff will provide panelists with a copy of the last stock assessment reviewed under the full STAR process, as well as the previous STAR panel report. Each panelist will carefully review the materials provided. A conference call will be arranged by the panel chairman, which will provide an opportunity to discuss and clarify issues arising during the review, as well as provide for public participation. Notice of the conference call and a list of public listening stations will be published in the *Federal Register* (generally, 23 days in advance of the conference call) and a Meeting Notice will be distributed (generally, 14 days in advance). A dialogue will ensue among the panelists and the STAT team over a period of time that generally should not exceed one week. Upon completion of the interactive phase of the review, the panel chairman may, if necessary, convene a second conference call to reach a consensus among panel members and will draft a report of the panel's findings regarding the updated assessment. The whole process should be scheduled to occur within a two week period and the STAT team and panelists should be prepared to complete their work within that time frame. It will be the chairman's responsibility to insure that the review is completed in a timely manner.

STAT Team Deliverables

It is the STAT team's responsibility to provide a description of the updated stock assessment to the panel at the beginning of the review. To streamline the process, the team can reference whatever material it chooses, which was 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. Likewise, a decision table that highlights the consequences of mis-management under alternative states of nature would be useful to the Council in adopting annual specifications. Similarly, if any minor changes to the "model" structure are adopted, above and beyond updating specific data streams, a sensitivity analysis to those changes may be required.

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

- Title page and list of preparers
- Executive Summary (see Appendix C)
- Introduction
- Documentation of updated data sources
- Short description of overall model structure
- Base-run results (largely tabular and graphical)
- Uncertainty analysis, including retrospective analysis, decision table, etc.
- 10 year harvest projections under the default harvest policy

Review Panel Report

The expedited stock assessment review panel will issue a report that will include the following items:

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

STOCK ASSESSMENTS FOR BOCACCIO, CANARY ROCKFISH, AND SABLEFISH

Situation: Stock assessments were prepared in 2002 for bocaccio and canary rockfish (Exhibit C.2, Attachments 1 and 3, respectively). An expedited stock assessment update (the first ever) of last year's sablefish assessment was also done this year (Exhibit C.2, Attachment 5). Outlooks for bocaccio and canary rockfish are more pessimistic this year with evidence of poorer recruitment and stock productivity than originally assumed. In contrast, the sablefish assessment update indicates recent recruitments were higher than thought last year when recent year classes were not as well recruited to fisheries and survey gear.

A Stock Assessment Review (STAR) Panel was convened in April to review the bocaccio and canary rockfish assessments. The STAR Panel recommended both assessments for use in making 2003 management decisions. These STAR Panel reports are included as Attachments 2 and 4, respectively in this exhibit. The sablefish assessment update review was initiated as a teleconference on May 6 with STAR Panel members and interested public in attendance. Critical questions and uncertainties among STAR Panel members were subsequently resolved in group emails. The sablefish STAR Panel recommends the updated assessment be used for deciding 2003 harvest levels (Exhibit C.2, Attachment 6).

Council Task:

1. Discussion and provide guidance.

Reference Materials:

1. Status of Bocaccio off California in 2002 (Exhibit C.2, Attachment 1).
2. Bocaccio Star Panel Report (Exhibit C.2, Attachment 2).
3. Status of the Canary Rockfish Resource off California, Oregon, and Washington in 2001 (Exhibit C.2, Attachment 3).
4. Canary Rockfish Star Panel Meeting Report (Exhibit C.2, Attachment 4).
5. Status of the Sablefish Resource off the Continental U.S. Pacific Coast in 2002 (Exhibit C.2, Attachment 5).
6. Review of the Updated 2002 Sablefish Stock Assessment (Exhibit C.2, Attachment 6).

Agenda Order:

a. Agendum Overview — John DeVore
b. Overviews of 2002 Stock Assessment Review Reports
   i. Canary Rockfish — R. Methot/K. Piner
   ii. Bocaccio — Alec MacCall
   iii. Sablefish — Michael Schirripa
c. Reports and Comments of Advisory Bodies
d. Public Comment
e. Council Discussion and Guidance

Groundfish Fishery Strategic Plan (GFSP) Consistency Analysis

This agenda item is consistent with GFSP goals for science, data collection, monitoring, and analysis (Sec.II.B).

PFMC
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Supplemental Reference Materials

7. Exhibit C.2.c, Supplemental SSC Report.
8. Exhibit C.2.c, Supplemental GAP Report.
9. Exhibit C.2.d, Supplemental Public Comment.
10. Item C.2, Sportfishing Association of California Letter.

SCIENTIFIC AND STATISTICAL COMMITTEE REPORT ON REBUILDING ANALYSES FOR BOCACCIO, CANARY ROCKFISH, YELLOWEYE ROCKFISH, WIDOW ROCKFISH, AND WHITING

The Scientific and Statistical Committee (SSC) reviewed the documentation for the rebuilding software written by Dr. Andre Punt. This computer program was developed to implement the guidelines for rebuilding analyses developed by the SSC (SSC Terms of Reference for Groundfish Rebuilding Analyses, April 2001). It provides a default framework within which to evaluate rebuilding strategies, although individual assessment authors should continue to apply innovative approaches to evaluating rebuilding strategies. The software allows future recruitment to be generated from a density-dependent stock-recruitment relationship or by resampling recruitments or recruits/spawning output ratios from the historical estimates.

The software has been validated by comparing its results with those from computer programs developed by Drs. Alec MacCall, Rick Methot and Mr. Tom Jagielo. The SSC endorses the use of the software developed by Dr. Punt and notes that the application of the 40:10 rule in this software alters fishing mortality rather than catch. It recommends that the software be modified to correct this. This change to software would not impact any of the rebuilding analyses, except for Pacific whiting.

The SSC reviewed the rebuilding analyses for bocaccio, canary rockfish, yelloweye rockfish, widow rockfish, and Pacific whiting. The SSC agrees these rebuilding analyses are based on the assessments selected through the STAR process and conform to its guidelines and endorses them for use by the Council. Table 1 lists the years on which the calculation of B_0 and future recruitment are based. It also lists the first year in which rebuilding could have been initiated. The SSC recommends that, in the future, authors of rebuilding analyses document how T_{MIN}, the minimum possible recovery time, is calculated more clearly, including specifying the first year in which rebuilding could have been initiated. The SSC requests assessment authors to provide T_{MIN} and T_{MAX} (the maximum allowable recovery period) in actual years and well as in terms of the number of years from the year in which rebuilding could have been initiated.

The SSC notes that the basis for the choice of years on which B_0 and the future recruitment are based were not fully documented in the rebuilding analysis documents and recommends that rebuilding analyses address this issue prior to their incorporation in any rebuilding plans. The SSC identified an internal inconsistency in the rebuilding analyses for bocaccio and yelloweye rockfish. The SSC consequently recommends that future rebuilding analyses based on the density-dependent recruitment assumption compute B_0 using recruitments from early in the time-series and base generation of future recruitment on more recent years. The years used to define B_0 and to generate future recruitment should be non-overlapping.

Decisions regarding rebuilding plans are based on the Council selecting a T_{TARGET} between T_{MIN} and T_{MAX}. The SSC recommends, therefore, that figures along the lines of Fig. 4 of the canary rockfish rebuilding analysis be included routinely in future rebuilding analyses.

The SSC has the follow specific comments.

Widow Rockfish. The rebuilding analysis includes eight cases. The SSC recommends that the cases based on the revised catches and a catch of 856 tons for 2002 form the basis for the selection of a rebuilding strategy and a 2002 OY.

Yelloweye Rockfish. The rebuilding analysis for the Oregon/Washington area is based on extending the Oregon assessment by including the catches off Washington. No assessment for this combined area was presented to the 2001 yelloweye STAR Panel. The SSC notes that it is necessary to account for Washington to conduct a rebuilding analysis for yelloweye and support the approach taken in the yelloweye rebuilding analysis. The SSC was informed by the assessment author that alternative approaches exist for incorporating Washington in the assessment and encourage him to pursue this soon.

The SSC requests that, for consistency, the rebuilding analysis define B_0 for the regime-shift hypothesis (scenario 2) on recruitments for the years 1967-1993 and project future recruitment for the density-dependence hypothesis (scenario 1) on recruits/spawning output ratios for the years 1983-1993. The assessment author provided the SSC with revised rebuilding analysis results.

The SSC has no clear basis to choose between the two scenarios for yelloweye. These scenarios bound the range of possibilities. However, the SSC notes that the Terms of Reference for Groundfish Rebuilding Analysis (April 2001) suggest that the density-dependent scenario should be the default case, because stocks that have declined into an overfished condition are more likely to be unproductive (e.g., low spawner-recruit steepness).

The SSC notes that the catch of yelloweye off British Columbia appears to substantially exceed the levels of catch indicated by the either of the scenarios considered in the rebuilding analysis and suggests that the impact of this be examined, possibly by means of a joint assessment.

Bocaccio. The rebuilding analysis for bocaccio considers a number of scenarios based on alternative assessment assumptions. The SSC notes that the probability of recovery by T_{MAX} does not exceed 60% for any of these options even in the absence of catches. As noted in C.2, the SSC supports the approach used to estimate the 1999 year-class. The SSC notes that the choice of periods for defining B_0 and future recruitment are inconsistent for the reason noted above. Removing this inconsistency by basing B_0 on early recruitments would lead to lower OY values.

Canary rockfish. The rebuilding analysis for canary rockfish is based on the use of a stock-recruitment relationship to define B_0 and future recruitment. The SSC endorses the use of a stock-recruitment relationship in this instance because it provides a better fit to the recruitment and spawning output data (Fig. 3 of the canary rockfish rebuilding analysis). The estimate of F_{MSY} for canary rockfish takes account of the impact of reductions of spawning output on recruitment. This estimate corresponds to $F_{73\%}$, i.e., substantially lower than the current default F_{MSY} proxy for rockfish of $F_{50\%}$.

Pacific whiting. The rebuilding analysis for Pacific whiting follows the guidelines established by the SSC. However, this is a particularly complicated case owing to the highly variable nature of whiting recruitment and the short lifespan of Pacific whiting. This leads to a short rebuild period even if catches remain high, although, given recruitment variability, the probability of the resource dropping below the overfishing threshold following recovery is high. The predicted rapid recovery of the Pacific whiting spawning output in the rebuilding analysis is due to the presence in the population already of the above-average 1999 year-class. The rebuilding analysis contrasts the $F_{40\%}$, $F_{45\%}$, and $F_{50\%}$ F_{MSY} proxies in terms of the probability of the population becoming overfished following recovery. While the SSC considers the issue of reviewing the correct F_{MSY} proxy for whiting to be important, it did not have time to discuss the merits of moving from $F_{40\%}$ to another F_{MSY} proxy at this meeting.

The SSC recognizes that a rebuilding plan for Pacific whiting is mandated owing to its overfished status. However, it is important to note that unlike bocaccio, yelloweye rockfish, canary rockfish and widow rockfish, application of the 40:10 rule is adequate to achieve recovery to 0.4 B_0 within 10 years. The SSC recommends that any 40:10 rule OY values be based on the results of the assessment conducted in 2002 rather than the rebuilding software because that the 2002 assessment model includes multiple fisheries and time-varying weight-at-age. The 2002 whiting STAR panel concluded that "given concerns with the current formulation of the stock reconstruction model and the dependence of yield options beyond 2002 on continued recruitment of the 1999 year-class and recruitment from year-classes not actually observed, the Panel recommends against adopting 2003 projections until another assessment is conducted." The SSC again strongly supports this recommendation.

TABLE 1. Summary of the selections on which the rebuilding analyses are based. The range of recruitments on which B_0 and future recruitment are based are expressed in terms of brood year.

Species	B_0	Future recruitment	R/S or R	T_{INIT}
Widow	1965-1979	1983-1996	R/S	2001
Yelloweye (scenario 1)	1967-1982	1967-1993	R/S	2003
Yelloweye (scenario 2)	1967-1997	1967-1993	R	2003
Bocaccio	1952-1997	1952-1998	R/S	1999
Canary	S-R	S-R	S-R	2001
Pacific whiting	1970-1999	1970-1999	R	2003

1. T_{INIT}: First year in which rebuilding could have been initiated.
2. R/S: Projection based on resampling recruits/spawning output.
3. R: Projections based on resampling recruitments.
4. S-R: Projections and B_0 based on inferences from a stock-recruitment relationship estimated by fitting a stock-recruitment model to the recruitment and spawner output data for the entire period of the assessment.

PFMC
06/18/02

Revised Rebuilding Analysis for Widow Rockfish for 2002

André E. Punt[1] and Alec D. MacCall[2]

Introduction

The Pacific Fishery Management Council (PFMC) adopted Amendment 11 to its Groundfish Management Plan in 1998. This amendment established an overfishing definition of 25% of the unfished biomass ($0.25B_0$). NMFS determined that a rebuilding plan was required for widow rockfish (*Sebastes entomelas*) in January 2001 based on the most recent stock assessment at that time (Williams *et al.* 2000). One aspect of a rebuilding plan is a rebuilding analysis to contrast alternative levels of fishing mortality and catch in terms of the probability of recovery to the B_{MSY} proxy of $0.4B_0$. The Scientific and Statistical Committee of the PFMC developed a set of guidelines for conducting rebuilding analyses, and the analyses of this document are based on those guidelines.

This document provides an update to the rebuilding analysis conducted by MacCall and Punt (2001) following the discovery of a minor error in the projection phase of the calculations. In addition to simply updating the calculations of MacCall and Punt (2001) to correct this minor error, this document also provides alternative rebuilding analyses that make use of the most recent information on catches since 1999. In general, the analyses of this paper are based on the same input parameters as those of MacCall and Punt (2001). The information on stock and recruitment and the age-structure of the population at the start of 1999 are taken from the assessment by Williams *et al.* (2000). The life history parameters are, consistent with the selections made by MacCall and Punt (2001), a simplification of the two-area, two-sex model with time-varying selectivity used in the assessment.

The calculations of this document were performed using the rebuilding software developed by Punt (2002a) and the results are based on 1000 Monte Carlo replicates (see below for the reason for this selection). The definition of "recovery by year *y*" in this document is that the spawning output reaches $0.4B_0$ by year *y* (even if it subsequently drops below this level again due to recruitment variability). The input to the rebuilding program for the 'preferred' rebuilding analysis is given as Appendix 1.

Selection of the rebuilding period

The maximum allowable rebuild period is defined as ten years (if the resource can be rebuilt to $0.4B_0$ in ten years or less) or the minimum possible rebuild period (rebuilding period in the absence of fishing mortality) plus one mean generation if the resource cannot be rebuilt to $0.4B_0$ in ten years. In order to determine the maximum allowable rebuild period, it is therefore necessary *inter alia* to define B_0, how future recruitments are to be generated, and the mean generation time. The mean generation time, 16 years, is calculated from the net maternity function (product of survivorship and fecundity at age,

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left panel of Figure 1) and rounding down to the nearest integer. MacCall and Punt (2001) based their estimate of B_0 (41872 million eggs) on the mean recruitment from 1965-79 and generated future recruitment by resampling recruits-per-spawning output ratios with replacement from those for the years 1983-96 (see the right panel of Figure 1). In the absence of new assessment data, there seems no good reason to change the approaches used to define B_0 and to generate future recruitment.

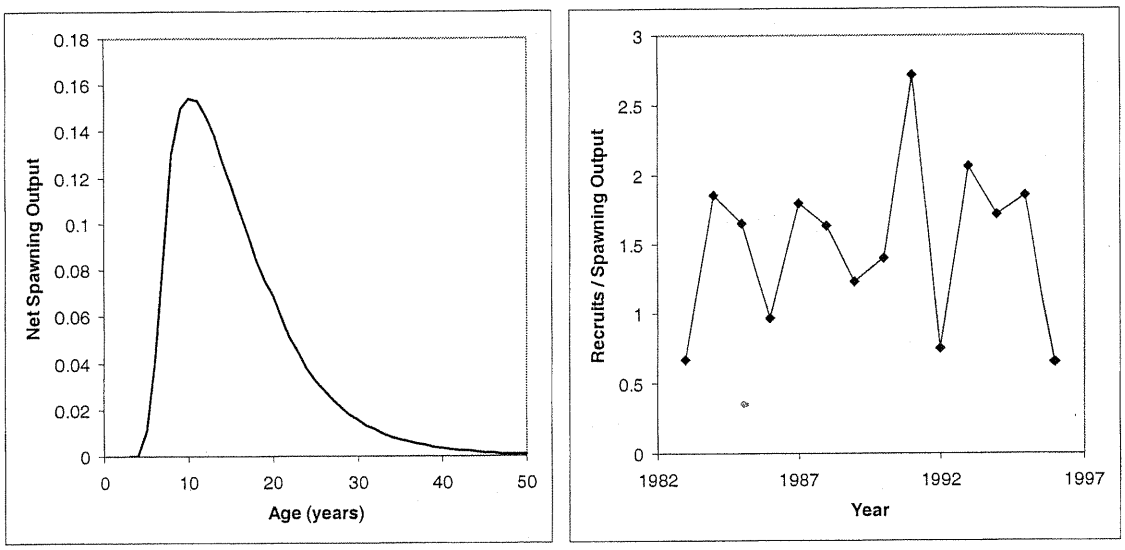

Figure 1. Net spawning output versus age (left panel) and the recruits-per-spawning output ratios used when generating future recruitment (right panel).

Catch data since 1999

The rebuilding analyses of MacCall and Punt (2001) were based on total catches (landed and discarded components) for 1999-2001 of 4363t, 4033t, and 2300t respectively. These catches have since been revised (Jim Hastie, NWFSC, pers. comm.) to 4894t, 4762t, and 2501t for 1999-2001. The 2002 OY selected by the PFMC was 856t.

The alternative rebuilding analyses

Even given the desire to make the same selections as MacCall and Punt (2001), a number of options exist concerning a revised rebuilding analysis.

- Should the revised catches be used in place of the catches on which the analyses of MacCall and Punt (2001) were based?
- Should the analyses assume that the 2002 catch will equal the 2002 OY already selected by the PFMC?
- Should the maximum allowable recovery period, T_{max}, be recalculated (this may be different from the 38 years (i.e. recovery by 2040) calculated by MacCall and Punt (2001)), given the revised catches and the selection of the 2002 OY?

Eight rebuilding analyses were considered based on all combinations of each of the three factors listed above (1999-2001 catches, 2002 catch, fix vs. estimate T_{max}; Table 1) to investigate the sensitivity of the results to these options. Cases 1 and 5 allow comparisons to made with the previous rebuilding analysis of MacCall and Punt (2001), while cases 2 and 4 (and 6 and 8) permit the impact of the recent catches on the outcomes from the rebuilding analysis to be assessed.

Table 1. The specifications for the eight rebuilding analyses.

Case No	Catch series	2002 Catch	T_{max}
1	Original	Estimated	Re-estimated
2	Revised	Estimated	Re-estimated
3	Original	856 t	Re-estimated
4	Revised	856 t	Re-estimated
5	Original	Estimated	Fixed at 38 yrs
6	Revised	Estimated	Fixed at 38 yrs
7	Original	856 t	Fixed at 38 yrs
8	Revised	856 t	Fixed at 38 yrs

It is necessary to specify the number of Monte Carlo replicates to apply the rebuilding software. The rebuilding software was therefore run to calculate the coefficients of variation for the 2002 OYs (by replicating the process of conducting a rebuilding analysis 20 times). Figure 2 shows the trend in these coefficients of variation with the number of Monte Carlo replicates, as well as how the range for the 2002 OY changes with this number. Results are shown in Figure 2 for the rebuilding analysis closest to that conducted by MacCall and Punt (2002) [case 1] as well as that which uses all of the most recent information on catches and fixes T_{max} to the value already selected by the PFMC [case 8]. Figure 2 suggests that conducting 1000 Monte Carlo replicates should lead to estimates with sufficient precision, and that increasing this number has relatively little benefit in terms of precision. Punt (2002b) can be consulted for more details concerning the impacts of Monte Carlo uncertainty when conducting rebuilding analyses.

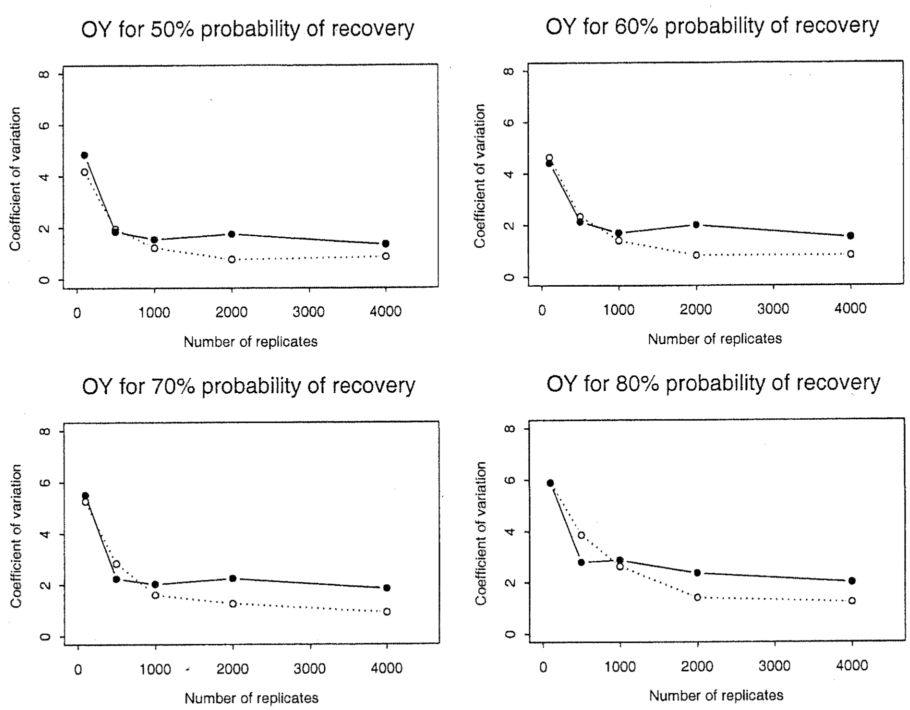

Figure 2(a). Coefficient of variation (%) for the 2002 OY (2003 OY for case 8) versus number of Monte Carlo replicates. Results are shown for case 1 (solid lines) and case 8 (dotted lines).

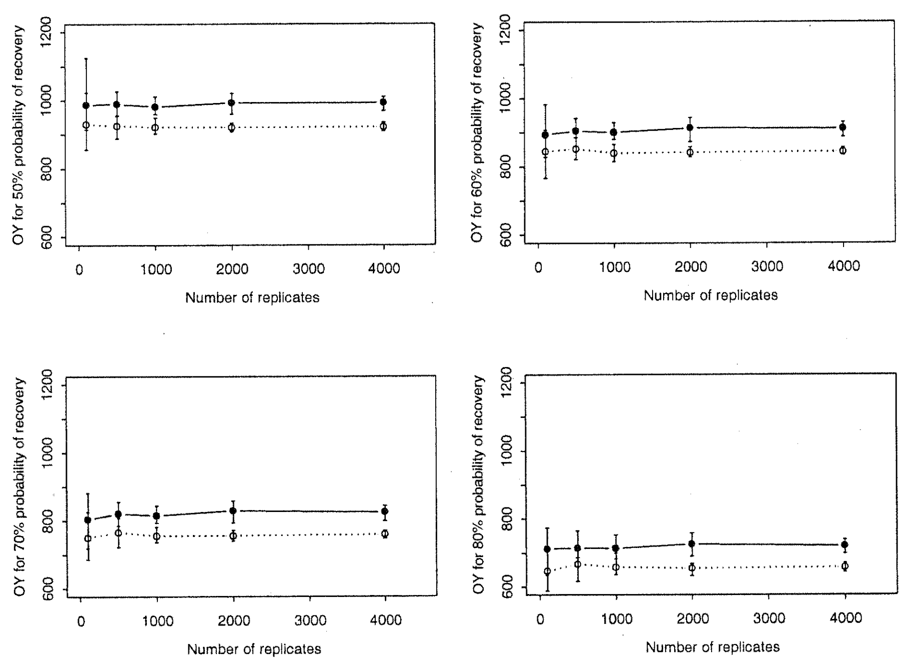

Figure 2(b). Mean and range for the 2002 OY (2003 OY for case 8) from 20 replications of the rebuilding analysis program versus the number of Monte Carlo replicates. Results are shown for case 1 (solid lines) and case 8 (dotted lines).

Results and discussion

Alternative rebuilding analyses

Table 2 lists the 2002 and 2003 OYs and the year by which recovery is expected to occur with the indicated probability, for the eight cases defined in Table 1. The 2002 OY for cases 3, 4, 7, and 8 is fixed at 856t, as this is one of the specifications for these cases. The 2002 OY selected by the PFMC was based on a 60% probability of recovery by 2040 so the discussion of Table 2 focuses on the OYs for 2003 for a 60% probability of recovery within the maximum allowable rebuild period, T_{max}. The 2003 OYs in Table 2 range from 903t (cases 3 and 7) to 832 t (case 8). Taking case 1 as a baseline, the 2003 OY for case 2 is lower than that for case 1 because the catches for 1999-2001 on which case 2 is based are larger (see above). In contrast, the 2003 OY for case 3 is larger than that for case 1 because the catch for 2002 for case 3 (856t) is less than that for case 1 (880t). Case 4 reflects the combination of the factors examined in cases 2 and 3, and consequently leads to a 2003 OY that is intermediate between those for cases 2 and 3. Fixing T_{max} to 38 (i.e. recovery to occur in 2040 with the pre-specified probability) leads to a lower 2003 OY for case 8 and a higher 2003 OY for case 5. This is because T_{max} for the corresponding cases that calculate T_{max} (cases 4 and 1) are one year greater and fewer than those for cases 8 and 5. The situation for case 4 is worth considering further. The value of T_{max} is higher for this case than for cases 1 and 2 because the population assessed to be more depleted at the start of 2003 given the higher catches for 1999-2000. It consequently takes longer to recover to $0.4B_0$ in the absence of catches.

Table 2. 2002 and 2003 OYs and the year by which recovery is expected to occur with the indicated probability, for the eight cases. Note that the value in the 2002 column for cases 3, 4, 7 and 8 is fixed at 856t.

Case	Catch Series	T_{max}	2002 OY 50%	2002 OY 60%	2002 OY 70%	2002 OY 80%	2003 OY 50%	2003 OY 60%	2003 OY 70%	2003 OY 80%
1	Original	Est=2039	965	880	794	687	952	870	787	682
2	Revised	Est=2040	921	839	758	666	913	833	755	665
3	Original	Est=2040	*856*	*856*	*856*	*856*	991	903	819	723
4	Revised	Est=2041	*856*	*856*	*856*	*856*	945	873	788	686
5	Original	2040	997	911	828	735	983	900	820	729
6	Revised	2040	921	839	758	666	913	833	755	665
7	Original	2040	*856*	*856*	*856*	*856*	991	903	819	723
8	Revised	2040	*856*	*856*	*856*	*856*	916	832	750	656

It is perhaps noteworthy that the 2002 OY for case 2 is lower than 856t. Therefore, the "benefit" of the revised rebuilding analysis evident from case 1 (a 2002 OY of 880t compared with 856t from the previous rebuilding analysis) is more than offset by the revisions to the catches for 1999-2001.

Detailed outputs for a preferred alternative

Choosing a preferred case involves selecting catches for 1999-2001, specifying how the 2002 catch will be determined, and deciding how to determine T_{max}. Guided by the need to base decisions on the 'best' and most recent data, we believe that the focus should be on cases 4 and 8 as they use the most recent information on catches. The choice between these two cases is a policy decision. We concentrate here on case 8 because this paper reflects changes to the data on which the rebuilding analysis is based, not on policy decisions. For similar reasons, we focus on a 60% probability of recovery by 2040. It should be noted that allowing T_{max} to change given the new information on catches (i.e. case 4) implies *inter alia* that it is acceptable to increase the (agreed) maximum time to recovery because the estimates of historical removals were previously under-estimated.

Table 3 lists some key output statistics for five rebuild strategies (probabilities of recovery in the maximum allowable rebuild period of 50%, 60%, 70% and 80% and the strategy of setting future fishing mortality to zero). The probabilities of recovery are not exactly 50, 60, etc. because of the limited number of recruitments on which the projections are based and the accuracy of the numerical search procedure employed. Figure 3 contrasts the time-trajectory of the probability of recovery for each of the five rebuild strategies in Table 3 along with the envelopes (5%, 25%, 50%, 75% and 95%) of the time-trajectories for catch and the ratio of spawning output to $0.4B_0$ for a 60% rebuild probability. Appendix 2 lists the envelopes for the annual catch and the ratio of the spawning output to the target level for a 60% probability of rebuild. Note that this ratio is calculated each point in time – the probability of having reached $0.4B_0$ sometime before a given year is at least as great as that listed in Appendix 2 and shown in the right panel of Figure 3 for that year. Appendix 3 lists the median catches for rebuild probabilities of 50%, 60%, 70%, and 80% as well as for the 40:10 rule.

Table 3. Four management-related quantities for five rebuild strategies.

Fishing mortality rate	0.0298	0.0271	0.0244	0.0213	0
OY_{2003} (mt)	916	832	750	656	0
Probability of recovery by 2040	50.1	60.1	69.9	80.1	99.8
Median years to rebuild from 2003	37.0	34.7	32.6	30.4	21.2

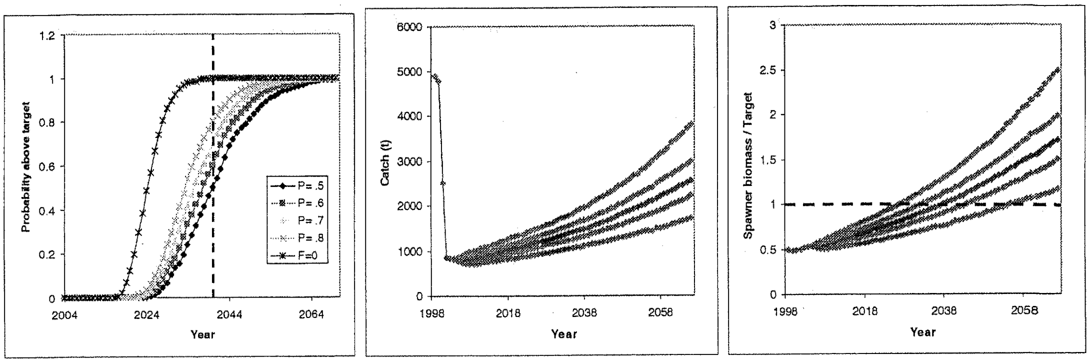

Figure 3. Time trajectories of the probability of recovery for five rebuild strategies, of the catch for a 0.6 probability of recovery, and of the spawning output expressed relative to $0.4B_0$ for a 0.6 probability of recovery. The vertical line in the first plot corresponds to the year in which recovery with the pre-specified probability is to occur and the horizontal line in the third panel is the target level.

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Acknowledgements

Dr Jim Hastie (NWFSC, NMFS, NOAA) is thanked for providing the revised estimates of widow rockfish catch for 1999-2001 and the widow rockfish OY estimate for 2002. John DeVore (PFMC) is thanked for his comments on a draft of this document.

Appendix 1: Data used in the rebuilding analysis (REBUILD.DAT file) – Case 8

#Title
Window rockfish - default assumptions
Number of sexes
2
Age range to consider (minimum age; maximum age)
3 20
First year of projection
1999
Year declared overfished
1999
Is the maximum age a plus-group (1=Yes;2=No)
1
Generate future recruitments using historical recruitments (1), historical recruits/spawner (2), or a stock-recruitment (3)
2
Constant fishing mortality (1) or constant Catch (2) projections
1
Pre-specify the year of recovery (or -1) to ignore
37
Fecundity-at-age
3 4 5 6 7 8 9 10
5.71571E-05,0.000192238,0.014959075,0.06416152,0.161188109,0.276595084,0.36866541,0.441150816,0.508537268,0.566615354,0.618765039,0.665202145,0.706388539,0.74275911,0.774748748,0.802838386,0.827408957,0.883903028
Age specific information (Females then males), M, weight, selectivity and numbers
Females
0.150000 0.150000 0.150000 0.150000 0.150000 0.150000 0.150000 0.150000 0.150000 0.150000 0.150000 0.150000 0.150000 0.150000 0.150000 0.150000 0.150000 0.150000
0.260608092 0.382403028 0.516070194 0.654578339 0.792170662 0.924895027 1.049946766 1.165864012 1.271881655 1.367769472 1.453797243 1.530488701 1.598486647 1.658533881 1.711419248 1.757704614 1.798297893 1.89163453
0.000593893 0.005686670 0.054780300 0.362629000 0.846479000 0.998077000 0.963625000 0.904980000 0.847668000 0.793880000 0.743284000 0.695263000 0.649123000 0.604100000 0.559340000 0.513919000 0.466977000 0.41801300
2958.5 7588.5 6246.5 6863.0 2061.5 5577.5 2272.0 1669.5 1646 1334.5 542.5 675 517 141 171 386.5 239 935
Males
0.150000 0.150000 0.150000 0.150000 0.150000 0.150000 0.150000 0.150000 0.150000 0.150000 0.150000 0.150000 0.150000 0.150000 0.150000 0.150000 0.150000 0.150000
0.303357216 0.410118829 0.515691806 0.615331188 0.706167139 0.787117388 0.857984578 0.919248338 0.971690941 1.016243337 1.053962138 1.085701311 1.112314822 1.134579656 1.153172796 1.168719902 1.181646637 1.20887895
0.000590021 0.005633680 0.054211900 0.359841000 0.844941000 0.998171000 0.962820000 0.902934000 0.844470000 0.789659000 0.738174000 0.689400000 0.642654000 0.597194000 0.552196000 0.506774000 0.460107000 0.41171100
2958.5 7588.5 6246.5 6863.0 2061.5 5577.5 2272.0 1669.5 1646 1334.5 542.5 675 517 141 171 386.5 239 935
Number of simulations
1000
Recruitment and Spanwer biomasses
Number of historical assessment years
32
Historical data: Year, Recruitment, Spawner biomass, Used to compute B0, Used to project based
on R, Used to project based on R/S
1968 29603 30662 1 0 0
1969 39748 30664 1 0 0
1970 37990 30668 1 0 0
1971 47532 30716 1 0 0
1972 39929 30910 1 0 0
1973 112579 31371 1 0 0
1974 42955 32096 1 0 0
1975 20667 33298 1 0 0
1976 11070 35254 1 0 0
1977 23596 37731 1 0 0
1978 39407 39189 1 0 0
1979 02219 39316 1 0 0
1980 73666 38032 1 0 0
1981 48325 32253 1 0 0
1982 24940 25329 1 0 0
1983 47876 19457 0 0 0
1984 62307 17592 0 0 0
1985 21667 17055 0 0 0
1986 13094 16665 0 1 1

1987 32540 16481 0 1 1
1988 28129 15782 0 1 1
1989 16110 14978 0 1 1
1990 29622 13019 0 1 1
1991 25813 11553 0 1 1
1992 18452 11079 0 1 1
1993 18265 10632 0 1 1
1994 31413 09860 0 1 1
1995 8327 09533 0 1 1
1996 21956 08985 0 1 1
1997 16901 08664 0 1 1
1998 17637 08261 0 1 1
1999 5917 08223 0 1 1
Number of years with pre-specified catches
4
catches for years with pre-specified catches
1999 4894
2000 4762
2001 2501
2002 856
Number of future recruitments to override
2
Process for overiding (-1 for average otherwise index in data list)
2000 -1
2001 28
Which probability to product detailed results for (1=0.5,2=0.6,etc.)
2
Steepness and sigma-R
0.5 0.5
Target SPR rate (FMSY Proxy)
0.5
Target SPR information: Use (1=Yes) and power
0 20
Discount rate (for cumulative catch)
0.1
Truncate the series when 0.4B0 is reached (1=Yes)
0
Set F to FMSY once 0.4B0 is reached (1=Yes)
0
Percentage of FMSY which defines Ftarget
0.9
Conduct MacCall transition policy (1=Yes)
0
Defintion of recovery (1=now only;2=now or before)
2
Produce the risk-reward plots (1=Yes)
0
Calculate coefficients of variation (1=Yes)
0
Number of replicates to use
20
First Random number seed
-89102

Appendix 2 : The envelopes (5%, 25%, 50%, 75% and 95% distribution points) for the annual catch and the annual ratio of the spawner output to $0.4B_0$. The results in this appendix pertain to case 8 and a 60% probability of recovery.

Year	Spawner output / $0.4B_0$					Annual catch (t)				
	5%	25%	50%	75%	95%	5%	25%	50%	75%	95%
1999	0.496	0.496	0.496	0.496	0.496	4894	4894	4894	4894	4894
2000	0.488	0.488	0.488	0.488	0.488	4762	4762	4762	4762	4762
2001	0.481	0.481	0.481	0.481	0.481	2501	2501	2501	2501	2501
2002	0.493	0.493	0.493	0.493	0.493	856	856	856	856	856
2003	0.512	0.512	0.512	0.512	0.512	832	832	832	832	833
2004	0.520	0.521	0.523	0.523	0.526	816	817	821	822	825
2005	0.519	0.523	0.530	0.533	0.540	776	785	808	814	839
2006	0.511	0.523	0.536	0.545	0.559	729	766	809	838	884
2007	0.504	0.527	0.545	0.561	0.580	707	774	823	867	924
2008	0.503	0.533	0.554	0.576	0.602	710	781	834	889	960
2009	0.502	0.540	0.564	0.590	0.621	712	790	848	907	989
2010	0.507	0.547	0.574	0.603	0.642	715	802	864	926	1011
2011	0.513	0.555	0.587	0.618	0.661	733	818	883	950	1043
2012	0.519	0.565	0.598	0.632	0.684	746	839	903	969	1074
2013	0.526	0.576	0.611	0.646	0.702	753	852	923	993	1098
2014	0.532	0.585	0.622	0.662	0.716	759	866	939	1014	1127
2015	0.538	0.596	0.634	0.677	0.738	775	882	958	1039	1152
2016	0.542	0.603	0.645	0.691	0.755	789	897	980	1068	1187
2017	0.548	0.610	0.657	0.706	0.771	801	911	1002	1089	1216
2018	0.557	0.620	0.672	0.720	0.795	811	932	1021	1112	1252
2019	0.565	0.630	0.684	0.733	0.813	827	946	1045	1139	1286
2020	0.572	0.641	0.698	0.750	0.835	838	962	1061	1159	1307
2021	0.581	0.650	0.707	0.766	0.852	853	977	1079	1182	1332
2022	0.585	0.659	0.722	0.784	0.870	862	990	1094	1215	1362
2023	0.594	0.672	0.733	0.799	0.890	867	1010	1118	1234	1402
2024	0.605	0.683	0.746	0.815	0.912	884	1026	1144	1264	1433
2025	0.612	0.695	0.761	0.830	0.927	907	1050	1168	1292	1466
2026	0.619	0.707	0.774	0.850	0.951	924	1066	1190	1320	1494
2027	0.628	0.718	0.789	0.867	0.975	931	1090	1213	1344	1533
2028	0.637	0.733	0.803	0.884	0.992	948	1122	1236	1374	1569
2029	0.643	0.748	0.817	0.901	1.014	954	1143	1261	1399	1596
2030	0.655	0.762	0.832	0.917	1.035	977	1159	1282	1418	1625
2031	0.662	0.773	0.846	0.934	1.060	993	1170	1311	1450	1669
2032	0.672	0.786	0.865	0.953	1.080	1014	1197	1334	1487	1712
2033	0.684	0.797	0.881	0.973	1.107	1035	1215	1361	1517	1741
2034	0.695	0.809	0.896	0.991	1.130	1050	1235	1387	1549	1784
2035	0.706	0.819	0.910	1.009	1.156	1056	1254	1414	1581	1826
2036	0.714	0.832	0.925	1.028	1.181	1065	1276	1435	1620	1876
2037	0.722	0.846	0.944	1.051	1.199	1072	1296	1464	1651	1912
2038	0.728	0.860	0.959	1.073	1.231	1106	1316	1483	1679	1963
2039	0.739	0.876	0.978	1.092	1.259	1136	1342	1505	1703	2009

Year	Spawner output / $0.4B_0$					Annual catch (t)				
	5%	25%	50%	75%	95%	5%	25%	50%	75%	95%
2040	0.754	0.890	0.993	1.106	1.287	1150	1370	1534	1738	2062
2041	0.768	0.905	1.007	1.127	1.315	1160	1391	1567	1776	2120
2042	0.775	0.922	1.027	1.150	1.348	1174	1419	1598	1814	2165
2043	0.790	0.937	1.043	1.175	1.378	1199	1446	1628	1844	2203
2044	0.800	0.954	1.063	1.200	1.412	1214	1475	1666	1884	2253
2045	0.806	0.972	1.089	1.220	1.449	1239	1501	1702	1932	2308
2046	0.820	0.989	1.106	1.234	1.478	1252	1517	1737	1966	2362
2047	0.827	0.999	1.130	1.266	1.511	1279	1547	1778	2014	2420
2048	0.840	1.012	1.153	1.294	1.551	1301	1575	1819	2049	2464
2049	0.859	1.031	1.174	1.319	1.571	1320	1606	1849	2105	2523
2050	0.872	1.050	1.194	1.347	1.600	1340	1632	1884	2138	2592
2051	0.883	1.067	1.220	1.371	1.642	1357	1677	1914	2194	2666
2052	0.897	1.086	1.240	1.399	1.675	1381	1707	1969	2233	2695
2053	0.907	1.107	1.259	1.426	1.715	1416	1733	2001	2277	2786
2054	0.924	1.126	1.279	1.452	1.765	1435	1765	2029	2320	2820
2055	0.937	1.144	1.308	1.480	1.799	1430	1791	2071	2361	2902
2056	0.950	1.163	1.327	1.514	1.846	1436	1823	2110	2411	2994
2057	0.961	1.178	1.354	1.544	1.890	1488	1857	2151	2481	3066
2058	0.966	1.195	1.384	1.579	1.931	1500	1892	2195	2535	3142
2059	0.982	1.222	1.401	1.612	1.962	1510	1926	2234	2590	3202
2060	0.993	1.247	1.423	1.649	2.010	1534	1969	2270	2641	3270
2061	1.002	1.268	1.446	1.677	2.066	1571	2012	2316	2694	3388
2062	1.018	1.286	1.477	1.707	2.120	1600	2047	2370	2744	3453
2063	1.038	1.310	1.513	1.743	2.178	1630	2072	2417	2779	3537
2064	1.044	1.329	1.538	1.771	2.225	1652	2109	2452	2843	3604
2065	1.064	1.356	1.565	1.810	2.274	1681	2165	2502	2909	3713
2066	1.077	1.387	1.588	1.841	2.311	1722	2213	2553	2978	3791
2067	1.097	1.419	1.619	1.882	2.354	1740	2256	2607	3053	3848
2068	1.117	1.446	1.646	1.919	2.414	1772	2299	2669	3103	3970
2069	1.125	1.457	1.678	1.955	2.465	1798	2328	2702	3158	4041
2070	1.153	1.481	1.711	1.984	2.540	1828	2366	2762	3190	4171
2071	1.171	1.502	1.746	2.015	2.595	1841	2395	2824	3273	4263

Appendix 3 : The median catches (t) for case 8 corresponding to rebuilding probabilities of 50, 60, 70, and 80%.

	Probability of recovery				
Year	P= .5	P= .6	P= .7	P= .8	40:10 Rule
1999	4894	4894	4894	4894	4894
2000	4762	4762	4762	4762	4762
2001	2501	2501	2501	2501	2501
2002	856	856	856	856	856
2003	916	832	750	656	1289
2004	902	821	741	650	1284
2005	886	808	730	642	1260
2006	886	809	733	645	1260
2007	900	823	746	657	1299
2008	912	834	757	667	1328
2009	926	848	770	680	1367
2010	943	864	786	694	1424
2011	963	883	804	710	1481
2012	984	903	822	727	1530
2013	1005	923	842	746	1575
2014	1020	939	856	760	1619
2015	1040	958	875	778	1653
2016	1062	980	896	797	1700
2017	1085	1002	917	816	1737
2018	1104	1021	936	834	1783
2019	1129	1045	959	856	1826
2020	1145	1061	974	871	1861
2021	1164	1079	993	889	1889
2022	1178	1094	1008	903	1910
2023	1203	1118	1031	925	1943
2024	1229	1144	1056	949	1974
2025	1254	1168	1079	971	2021
2026	1275	1190	1101	992	2053
2027	1298	1213	1123	1013	2076
2028	1322	1236	1146	1035	2115
2029	1347	1261	1169	1058	2164
2030	1369	1282	1191	1079	2178
2031	1397	1311	1219	1105	2199
2032	1420	1334	1243	1128	2211
2033	1448	1361	1269	1154	2237
2034	1473	1387	1295	1179	2251
2035	1500	1414	1321	1204	2297
2036	1521	1435	1342	1225	2302
2037	1549	1464	1371	1252	2334
2038	1567	1483	1390	1272	2326
2039	1589	1505	1413	1294	2336

Year	Probability of recovery P= .5	P= .6	P= .7	P= .8	40:10 Rule
2040	1619	1534	1441	1321	2337
2041	1650	1567	1474	1354	2348
2042	1683	1598	1505	1383	2388
2043	1713	1628	1535	1414	2407
2044	1750	1666	1573	1449	2446
2045	1785	1702	1608	1485	2467
2046	1820	1737	1643	1518	2470
2047	1861	1778	1684	1558	2489
2048	1902	1819	1723	1597	2510
2049	1930	1849	1755	1628	2551
2050	1965	1884	1791	1664	2565
2051	1994	1914	1819	1693	2587
2052	2048	1969	1875	1746	2576
2053	2080	2001	1907	1777	2613
2054	2107	2029	1938	1810	2600
2055	2148	2071	1979	1850	2612
2056	2186	2110	2018	1889	2607
2057	2226	2151	2060	1931	2607
2058	2268	2195	2104	1975	2665
2059	2306	2234	2144	2015	2665
2060	2340	2270	2182	2053	2689
2061	2385	2316	2228	2099	2673
2062	2439	2370	2282	2153	2702
2063	2484	2417	2330	2201	2711
2064	2518	2452	2366	2237	2708
2065	2565	2502	2417	2290	2722
2066	2614	2553	2470	2343	2736
2067	2667	2607	2525	2398	2751
2068	2726	2669	2587	2459	2763
2069	2757	2702	2622	2495	2764
2070	2816	2762	2682	2555	2760
2071	2875	2824	2747	2622	2756

Exhibit C.3
Situation Summary
June 2002

REBUILDING ANALYSES FOR BOCACCIO, CANARY ROCKFISH, YELLOWEYE ROCKFISH, WIDOW ROCKFISH, AND WHITING

Situation: New rebuilding analyses are expected to be available for five species for Council discussion and adoption. These rebuilding analyses can be used to decide 2003 groundfish harvest levels and management specifications, as well as to develop rebuilding plans for these species.

A revised widow rockfish rebuilding analysis (Exhibit C.3, Attachment 1) was necessary after the authors realized the previously-adopted analysis used an outdated version of the Scientific and Statistical Committee-(SSC) approved rebuilding program developed by Dr. Andre Punt. The Council was advised of this problem at the last Council meeting. Now the Council should consider reviewing and formally adopting the revised analysis. A rebuilding analysis for yelloweye rockfish was done for the first time this year based on the 2001 assessment the Council reviewed last year (Exhibit C.3, Attachment 2). Two of the overfished shelf rockfish species, bocaccio and canary rockfish, were re-assessed this year (Exhibit C.2). Rebuilding analyses consistent with these new assessments are available in this exhibit as supplemental attachments 3 and 4, respectively. Finally, a new rebuilding analysis for Pacific whiting, which comports with the stock assessment reviewed at the March Council meeting, is available for Council review and adoption (Exhibit C.3, Supplemental Attachment 5).

Council Action:

1. Adopt rebuilding analyses.

Reference Materials:

1. Revised rebuilding analysis for widow rockfish for 2002 (Exhibit C.3, Attachment 1).
2. Rebuilding analysis for yelloweye rockfish (Exhibit C.3, Attachment 2).
3. ✓ Rebuilding analysis for bocaccio (Exhibit C.3, Supplemental Attachment 3). - revised - 6/18/02
4. ✓ Rebuilding analysis for canary rockfish (Exhibit C.3, Supplemental Attachment 4). received 6/17/02
5. ✓ A rebuilding analysis of the West Coast Pacific whiting stock (Exhibit C.3, Supplemental Attachment 5). 6/17/02

Agenda Order:

a. Agendum Overview — John DeVore
b. Reports and Comments of Advisory Bodies
c. Public Comment
d. **Council Action:** Adopt Rebuilding Analyses

Groundfish Fishery Strategic Plan (GFSP) Consistency Analysis

This agenda item is consistent with GFSP goals for science, data collection, monitoring, and analysis (Sec. II.B).

PFMC
06/05/02

Supplemental Reference Materials

6. SSC Default Rebuilding Analysis (Exhibit C3, Supplemental Attachment 6)
7. Exhibit C.3.b, Supplemental SSC Report.
8. Exhibit C.3, Supplemental Attachment 2(a)

PFMC June, 2002 meeting 2/18/02
Rebuilding Analyses for Yelloweye Rockfish

Northern California

Scenario 1						
Fishing rate	0.0023	**0.0014**	0.0006	0	0	0
OY 2003 (mt)	0.4	**0.2**	0.1	0.0	0.0	0.0
Prob of recovery by 2255	50	**60**	70	77	77	0
Median time to rebuild	177	**165**	155	149	149	0
Scenario 2						
Fishing rate	0.0603	**0.0574**	0.0544	0.0508	0	0
OY 2003 (mt)	10.0	**9.5**	9.0	8.4	0.0	0.3
Prob of recovery by 2045	50	**60**	70	80	100	98.4
Median time to rebuild	43	**36.6**	32.1	28.9	14.8	18.5

Oregon

Scenario 1						
Fishing rate	0.0088	**0.0073**	0.006	0.0046	0	0
OY 2003 (mt)	4.0	**3.4**	2.8	2.1	0.0	0.0
Prob of recovery by 2115	50	**60**	70	80	96	0
Median time to rebuild	79	**70**	65	60	47	0
Scenario 2						
Fishing rate	0.0496	**0.048**	0.0457	0.0424	0	0
OY 2003 (mt)	22.8	**22.1**	21.1	19.6	0.0	3.7
Prob of recovery by 2049	50	**60**	70	80	100	98
Median time to rebuild	48	**43**	38	33	15	20

Oregon and Washington

Scenario 1						
Fishing rate	0.0062	**0.0048**	0.0036	0.0021	0	0
OY 2003 (mt)	3.50	**2.70**	2.00	1.20	0.00	0.00
Prob of recovery by 2123	50	**60**	70	80	90	0
Median time to rebuild	94	**85**	78	69	62	0
Scenario 2						
Fishing rate	0.0501	**0.0478**	0.0454	0.0421	0	0
OY 2003 (mt)	28.0	**26.8**	25.4	23.6	0.0	4.2
Prob of recovery by 2050	50	**60**	70	80	100	98
Median time to rebuild	48	**43**	37	33	15	21

Bocaccio Rebuilding Analysis for 2002

Alec D. MacCall and Xi He (June 2002)
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Introduction

In 1998, the PFMC adopted Amendment 11 of the Groundfish Management Plan, which established a minimum stock size threshold of 25% of unfished biomass. Based on the stock assessment by Ralston et al. (1996), bocaccio was declared formally to be overfished, thereby requiring development of a rebuilding plan for consideration by the Council in the fall of 1999. A new stock assessment (MacCall et al. 1999) found that under continuing recruitment failure, the index of bocaccio spawning output was about half the the estimate made in 1996, but at that time preliminary indications of a strong 1999 year class allowed some optimism.

The most recent stock assessment (MacCall 2002) is based on a wide variety of information from both Central and Southern California. The new estimate of the strength of the 1999 year class is at or below the low end of the range considered in the1999 analyses. The following rebuilding analysis utilizes the SSC Rebuilding Analysis (V1.5) developed by Andre Punt of the PFMC-SSC, and incorporates the information developed in the 2002 bocaccio stock assessment.

Management Reference Points

$B_{unfished}$. Unfished biomass is estimated by multiplying average recruitment by the spawning output per recruit achieved when the fishing mortality rate is zero ($SPR_{F=0}$ = 1.3806, spawning output in billion eggs, recruitment in thousand fish at age 1). The estimated unfished spawning output is 14857 billion eggs, based on the average recruitment between 1953 and 1998. Because recruitment is highly variable, this calculation is imprecise (CV = 31%) as can be seen in Figure 1.

B_{msy}. The rebuilding target is the spawning abundance level that produces MSY. This value cannot be determined directly for bocaccio, so we use the proxy value of 40% of estimated unfished spawning abundance. Estimated B_{msy} is 5943 billion eggs.

Mean generation time. Mean generation time of bocaccio can be estimated from the net maternity function, and is estimated to be 12 years.

Simulation Model

The rebuilding model tracks male and female abundances at age, with an accumulator at age 21+. Values of weights at age, composite selectivity and fecundity are taken from MacCall (2002), and are given in Appendix 1. Population simulations begin with the 2002 age composition. Subsequent recruitments are generated by a random draw of one of the historical values of R/S (from 1953 to 1999), which is multiplied by current spawning output (S) to obtain the following year's recruitment. Resampling R/S is supported by the nearly constant pattern of historical R/S values (Figure 2), whereas the strong historical decline in recruitment strengths argues against resampling recruitments directly (Figure 3). Simulations extend to a maximum of 500 years, and the maximum number of simulations allowed by the program (N=10000) was used to minimize the imprecision in the analysis.

Rebuilding is assumed to have begun in 2000, and three years of rebuilding have elapsed as of the beginning of 2003. The model accounts for further removals that occurred following the beginning of 2002; the catch in 2002 is still unknown but is assumed to be 100MT in the base model. Sensitivity analyses address the consequences of alternative catch scenarios.

The distribution of simulated times (number of years) to reach the rebuilding target at F=0 (T_{min}) is wide, ranging from about 20 years to over 500 years (Figure 4). The mode (most frequent) rebuilding time is about 60 years. The median (50% probability) rebuilding time is 97 yr (SE = 1 yr). The maximum length of time to rebuild is this value plus one generation time (12 yr), less the time already elapsed since the start of rebuilding (3 yr), or 106 years. The maximum allowable fishing mortality rate is that which allows the stock to achieve the target abundance in 106 years (i.e., calendar year 2108), with a probability of 50%. The constant fishing rate that achieves a 50% rebuilding success by year 2108 translates to a catch of 5.8 MT (SE = 0.6MT) in 2003. In most rebuilding plans, options with a higher probability of success (e.g., 60%) are considered. In the case of bocaccio, the maximum probability of rebuilding by year 2108 is 54% under no catch, so options for higher probabilities do not exist at the present time.

Simulated individual rebuilding trajectories are erratic (Figure 5). The time series of percentiles of simulated trajectories (Figure 6) is more informative. A peculiar feature of the boccacio simulations is that the median abundance (dark line in Figure 6) does not reach the target level after 106 years (T_{max}). Although 50% of the simulations achieved the target level <u>at some time</u> on or before 97 years (thus qualifying as having been rebuilt), many of those trajectories subsequently declined so that only about 30% are currently at or above the target after 97 years. This property is consistent with the behavior of individual simulations (Figure 5).

The rebuilding consequences of some of the uncertainties described in the bocaccio stock assessment are examined in Table 1. Most sources of uncertainty have little effect on rebuilding OYs. Note that cases emphasizing Central or Southern California information are for comparison only, and are not properly specified for use as management options.

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Table 1. Results of sensitivity analyses.

Model	Tmin	OY	Generation Time
Base Model (100t catch in 2002)	97	5.8	12
M = 0.15	64	9.8	14
M = 0.25	257	1.5	11
Emphasis on Southern California information	47	39.1	12
Emphasis on Central California information	106	2.5	12
Emphasis on abundance data	77	7.9	12
Emphasis on composition data	94	5.2	12
Use unaltered RecFin data	99	6.4	12
Early SoCalif commercial catch at 50%	103	4.9	12
Recent commercial catch at 2x landings	97	5.3	12
Assume 200t catch in 2002	99	5.6	12

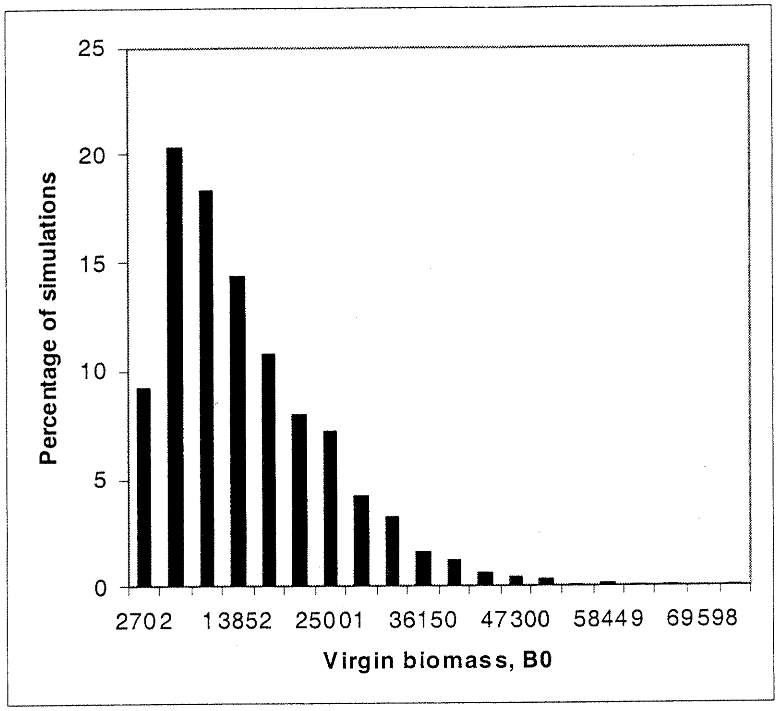

Figure 1. Distribution of simulated unfished abundances (measured as spawning output in billion eggs)

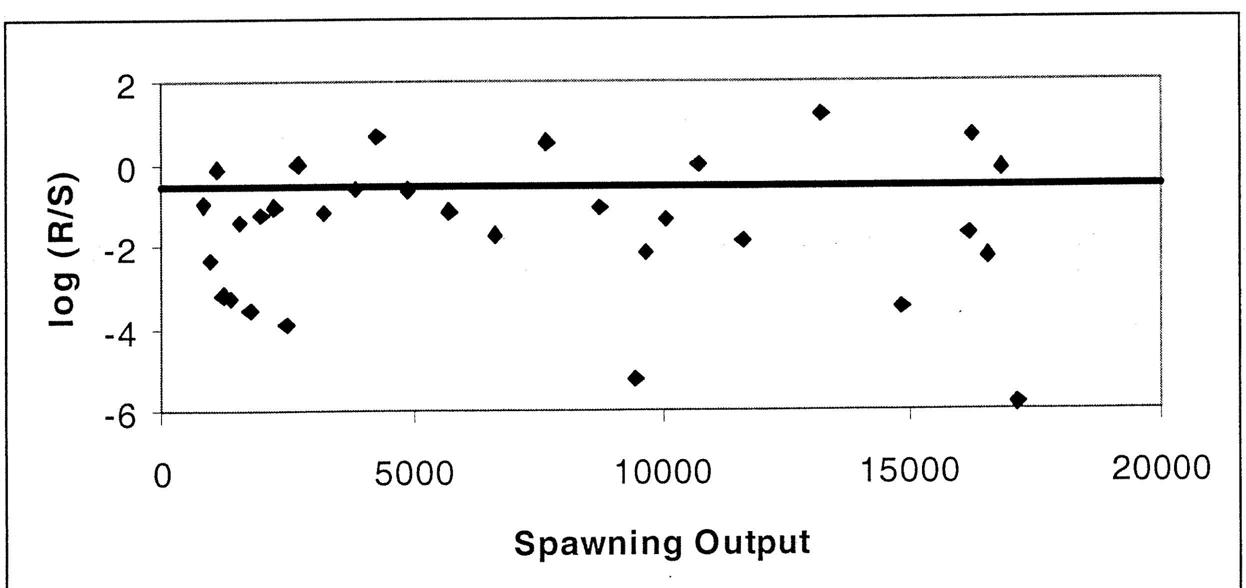

Figure 2. Historical bocaccio reproductive success related to parental abundance. Horizontal line is replacement level in the absence of fishing.

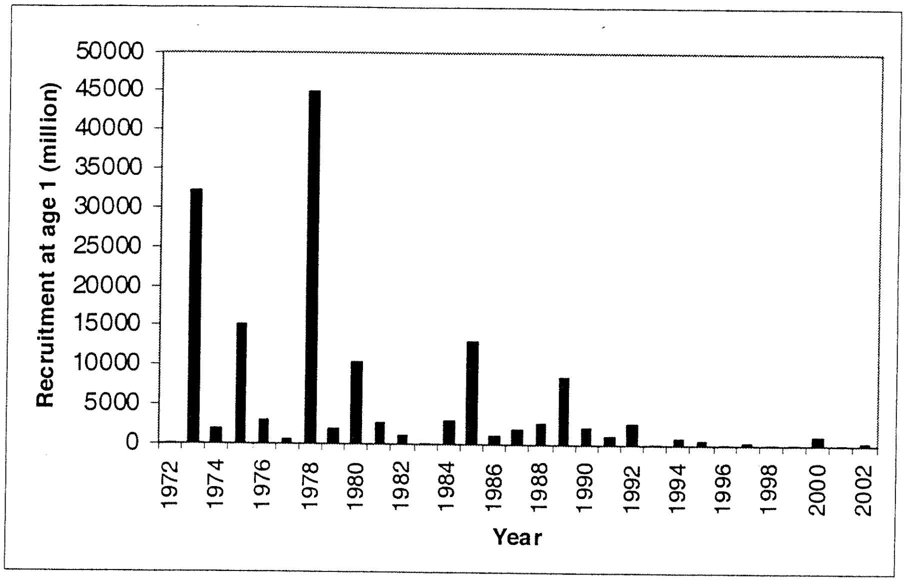

Figure 3. Historical series of bocaccio recruitments.

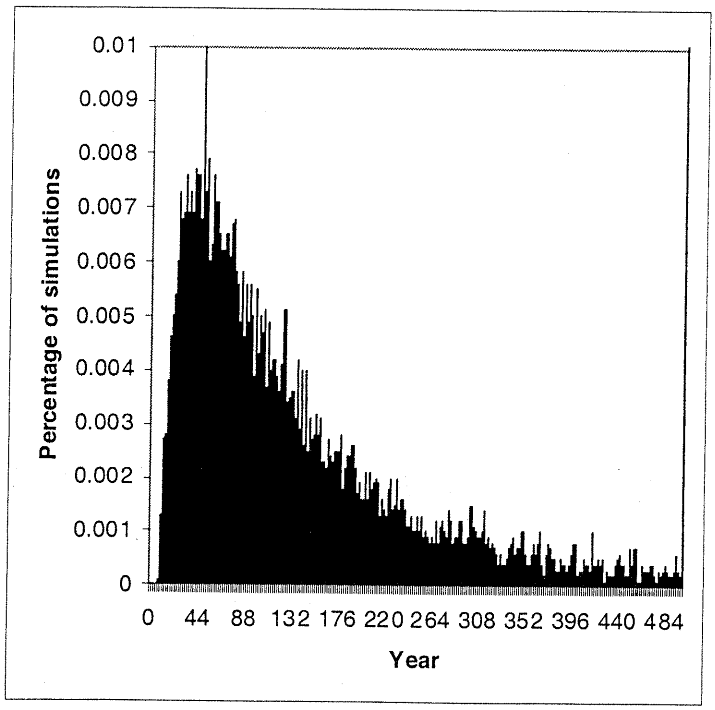

Figure 4. Distribution of simulated bocaccio rebuilding times in the absence of fishing.

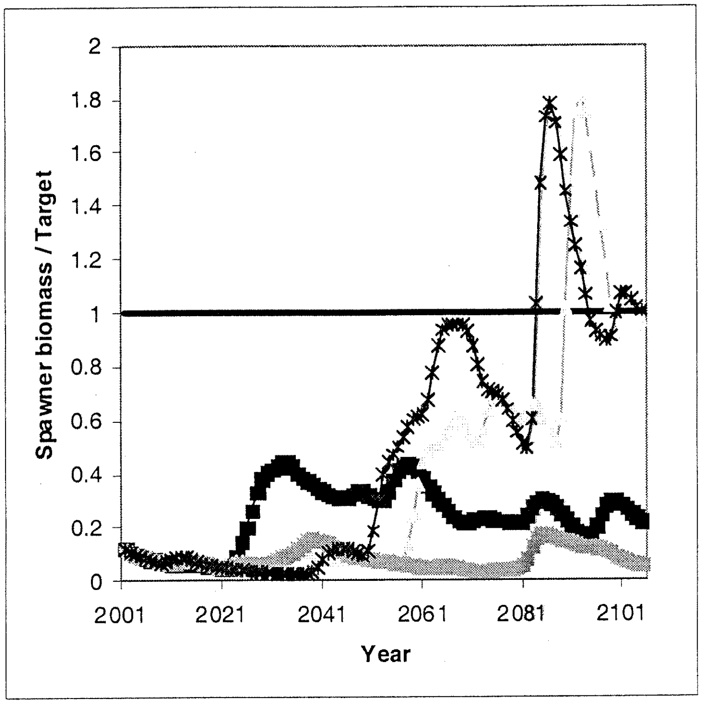

Figure 5. Simulated bocaccio rebuilding trajectories.

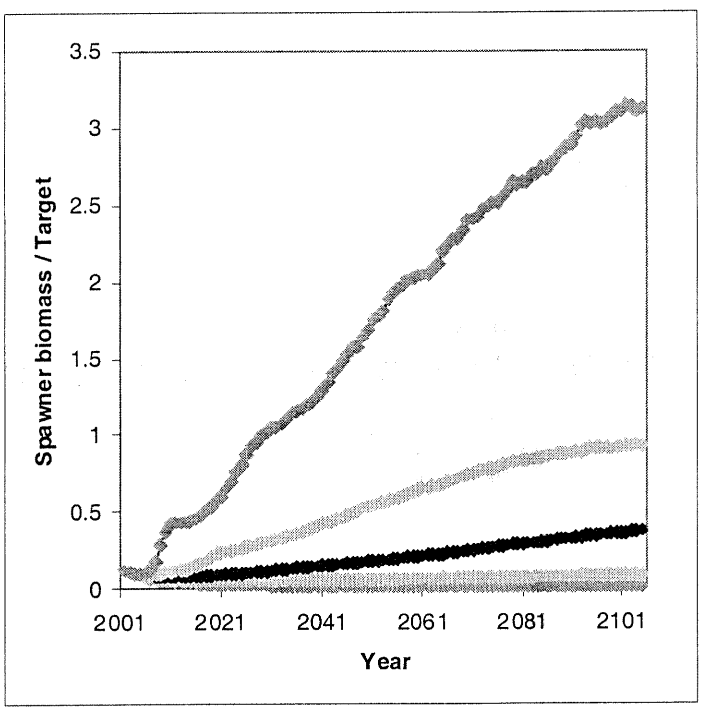

Figure 6. Time series of relative abundance expressed as percentiles (5, 25, 50, 75 and 95) of simulations.

Rebuilding Analysis for Canary Rockfish: Update to Incorporate Results of Coastwide Assessment in 2002

June 2002

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Summary

The rebuilding analysis for canary rockfish was first conducted in 2000 based on the 1999 stock assessment. This document updates the analysis based upon the 2002 assessment.

The target spawning stock biomass is 40% of the unfished spawning stock biomass (Bzero). The method to calculate Bzero is improved to incorporate more historical information and results in a higher level than estimated in 2000. Spawning stock abundance reached a low of 6.6% of the unfished level in 2000, the year of the overfished declaration. By 2002 it had increased to 7.9%.

The mean generation time is 19 years. The time to rebuild with no fishingis year 2057. This is longer than the previous estimate of 2041 primarily because of the higher Bzero level.

The rate of rebuilding is based on the estimated spawner-recruitment relationship with steepness of 0.33. Based on this relationship, Fmsy = F73%; MSY = 622 mt; Bmsy = 45% of Bzero; and ABC in 2003 is 116 mt at the estimated Fmsy and 256 mt at the default F50% proxy for Fmsy.

The table below shows the initial OY associated with a range of rebuilding targets.

Pr(rebuild by 2076)	Year to 50% Pr(rebuild)	OY in 2003
50%	2076	45 mt
60%	2074	41 mt
70%	2071	36 mt
80%	2068	30 mt

Rate of rebuilding is most sensitive to the steepness of the spawner-recruitment relationship. Improved ocean conditions could cause higher steepness, but no evidence yet. The level of allowable catch during rebuilding is sensitive to the recreational:commercial allocation because of their difference in selectivity for young versus old fish.

Introduction

The stock assessment for canary rockfish in 1999 documented that the stock had declined below the overfished level (25% of Bzero) in the northern area (Columbia and U.S. Vancouver INPFC areas; Crone et al., 1999) and in the southern area (Williams et al., 1999). Canary rockfish was determined to be in an "overfished" state on Jan. 1, 2000 which initiated development of a rebuilding plan. The first rebuilding analysis (Methot, 2000) used results from the northern area assessment to project rates of potential stock recovery. The stock was found to have extremely low productivity, defined as production of recruits in excess of the level necessary to maintain the stock at its current, low level. Rates of recovery were highly dependent upon the level of recent recruitment, which could not be estimated with high certainty. The initial rebuilding OY for 2001 and 2002 was set at 93 mt based upon: a 50% probability of rebuilding by the year 2057, a medium level for these recent recruitments, and maintaining a constant catch (93 mt) throughout the rebuilding period.

The purpose of this document is to use results of the updated canary rockfish stock assessment (Methot and Piner, 2002) to update estimates of the potential rate of rebuilding of canary rockfish. The basic results of this assessment are summarized in the Assessment Summary below. In addition to using results from the updated assessment, the following changes were made at the request of the Council's Groundfish Management Team:
a. Use a constant exploitation rate, as in most other rebuilding plans, rather than a constant catch;
b. Evaluate sensitivity to the allocation between recreational and commercial fishing sectors.

The rebuilding analysis was conducted using software developed by A. Punt (version 2.0). The analysis involves six steps:

(1) examine the recruitment-spawner information to determine levels of historical and current recruitment;
(2) determine unfished level of spawning biomass (Bzero) in order to calculate target levels for rebuilding (Btarget);
(3) calculate the generation time (Gentim), which affects the maximum allowable duration of rebuilding;
(4) determine expected levels of recruitment during the rebuilding period;
(5) calculate the time to 50% probability of rebuilding with no fishing mortality (Tmin);
(6) finally, calculate the year to 50% probability of rebuilding (Ttarget) associated with various levels of fishing mortality. This is subject to the constraint that Ttarget must be no more than Tmax. Tmax is 10 years if Tmin is less than 10 years, and is Tmin plus Gentim otherwise. The selection of Ttarget between Tmin and Tmax is a management decision and is beyond the scope of the rebuilding analysis.

Assessment Summary

The updated assessment for canary rockfish (Methot and Piner, 2002) has several features that influence the rebuilding analysis:

1. The assessment is now coastwide (California to Washington) so the ad hoc adjustment for the southern area is not needed as it was in Methot (2000). The previous assessments (Crone et al., 1999; Williams et al., 1999) did not have a strong biological rationale for the north-south split, and the present assessment's review of patterns in growth and distribution does not support a split at the Eureka-Columbia border. However, uncertainty regarding the contribution of canary rockfish in Canada to the U.S. assessment area remains unresolved.

2. The previous dichotomy between natural mortality and dome-shaped selectivity to explain the low occurrence of old females is blended into one assessment scenario that links female natural mortality to maturation and allows for dome-shaped selectivity. This does not fully resolve the issue, but does eliminate the need for a rebuilding analysis for each mortality/selectivity scenario.

3. The assessment start year was moved from 1967 back to 1941 because the previous assessment had found that historical catch levels were relatively large and that the model was estimating a historical recruitment level that was greater than the recruitment level of the 1967-1977 period. The recruitment level from 1967-1977 had been used to estimate the unfished recruitment in the previous rebuilding analysis, but this level is now seen to be a better estimate of the recruitment level at MSY, which is substantially less than the unfished recruitment level.

4. The strong pattern of declining recruitment at low spawning stock levels was noted in the previous assessment and is now quantified by fitting a spawner-recruitment curve. This curve allows calculation of maximum long-term average yield (MSY), the fishing mortality rate that would produce MSY (Fmsy), and the equilibrium level of spawning stock biomass associated with MSY (Bmsy). The curve also provides a basis for calculation of the level of unfished recruitment (Rzero) and projection of recruitment levels into the future.

5. A large focus of the uncertainty in the previous rebuilding analysis was with regard to the magnitude of recruitment from the 1995 to 1997 year classes as they appeared among the smallest size groups occurring in the 1998 trawl survey. The new assessment does not find these recruitments to be large in subsequent fishery and survey data, and the new method of projecting future recruitments from the spawner-recruitment curve diminishes the influence of any one year's estimate of recruitment.

Rebuilding Calculations

Spawner-Recruit Relationship

The level of recruitment has declined from a level of 3907 thousand fish in the unfished state, to 2549 thousand in 1967-1977, 1918 thousand during 1978-1993, and only 713 thousand during 1994-1999 (Table 1, Figure 1). As long as this lowest level of recruitment persists, the stock cannot rebuild to the 40% biomass level, even without fishing. However, the decline is considered to be primarily a result of the declining level of spawner abundance, so recruitment should increase as the spawning stock is rebuilt.

The critical factor influencing the rate of rebuilding is the degree to which recruitments will be above the replacement level, thus able to rebuild the stock and potentially support a small harvest during rebuilding. Since the level of recruitment is not much above the replacement level (Figure 2), rebuilding will be extremely slow. The expected level of recruitment is determined by the steepness parameter of the Beverton-Holt formula. The canary rockfish assessment in 2002 provides results for three levels of steepness: the steepness level initially estimated within the model (0.289, lower dashed line in Figure 2), the best-estimate of steepness obtained from a focused examination of the recruitment-spawner information (0.33, solid line), and a higher steepness level (0.36, upper dashed line) which provides a contrast to the 0.289 level. The steepness of 0.33 is the best estimate of the level of recruitment to be expected as the stock begins to rebuild.

This low level of steepness is conditional upon all the downward trend in recruitment being caused by the decline in spawner abundance. Other fish species often have steepness levels near 0.7 (Myers, 1999) and Dorn's (2000) meta-analysis of rockfish found a level of approximately 0.67. If some of this recruitment downtrend for canary rockfish has been because of long-term shifts in the ocean climate, then it is possible that a future shift in the ocean climate will cause an upward shift in recruitment and future estimates of the spawner-recruitment steepness will be higher and representative of a longer-term environmental average. As an illustration of such a shift, a spawner-recruitment curve with steepness of 0.5 is shown on Figure 2. Although there are signs of a shift in the ocean climate towards a more productive regime in 1999 and evidence of stronger sablefish, whiting, and salmon survival in 1999, there is yet no evidence of such a shift for canary rockfish. Only time will tell.

The year-to-year variability of recruitment is also important for the rebuilding analysis. The log-normal variability of recruitment about the curve is approximately 0.4, and this level will be used in the forecasts of future recruitment. This lognormal variability is used in lieu of resampling the from the individual year estimates of recruitment deviations.

ABC, Overfishing and Fmsy

The current Council policy for the calculation of ABC is to apply an exploitation rate based on F50%. This would be 256 mt in 2003. However, the calculation of the spawner-recruitment relationship demonstrates that F50% is not a sustainable harvest policy for canary rockfish because of the low spawner-recruitment steepness. The estimate of Fmsy is 0.0601 $year^{-1}$ and corresponds to F73% [1]. This rate would result in an ABC of 116 mt in 2003. Once rebuilt, fishing at F73% would be expected to produce an average catch of 622 mt from a biomass that would average 45% of the unfished level.

Unfished Abundance Level

The previous rebuilding analysis considered three possible methods for calculating the level of recruitment expected under unfished conditions. The selected method was based upon the estimated recruitments from the early (1967-1977) portion of the assessment time series, but an alternative based upon the model's higher estimate of initial recruitment levels was also considered. The new assessment starts in 1940 and provides stronger evidence that recruitment had already begun to decline by 1967. It shows that recruitment during 1967-1977 is at about the reduced level expected at MSY, rather than the higher level expected from an unfished stock.

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[1] This instantaneous fishing mortality rate is for the age(s) with selectivity equal to 1.0. Because of the dome-shaped selectivity pattern (Table 2), the rate for other ages is less.

This higher, unfished level of recruitment is used as the basis for Bzero in this updated rebuilding analysis, although a comparative run will be made using the updated estimates of the 1967-1977 recruitments. Bzero is calculated as the product of the initial, unfished level of recruitment in the assessment model (3907 thousand fish) and the level of female spawning biomass per recruit that occurs in the absence of fishing (8.135).

Expected Recruitment Level

Three methods of calculating recruitment during rebuilding were considered. These are random resampling of observed recruitment levels, random resampling of observed levels of recruits/spawner (R/S) and random generation of lognormal deviations from the estimated spawner-recruitment relationship. The first method is not reasonable because of the large change in recruitment level observed during the time series. The second method has been used in some other rebuilding analyses and the previous canary rockfish analysis, but there are aspects of this approach that may not be the best that can be done with available information. In particular, it is difficult to objectively select the time frame of the recent period from which to re-sample. If it is short enough to accurately represent recent recruitment, it will not have enough observations to fully represent the frequency distribution of future possible recruitments. Also, this method incorporates no population compensation. . It is effectively a linear spawner-recruitment relationship, so leads to exponential population growth as the stock increases above its current low level.

The third method incorporates compensation in the form of the spawner-recruitment curve and was used in this rebuilding analysis. This third method has several desirable features:
1. Reproduces current low recruitment levels while spawning biomass remains low;
2. Smoothly increases mean recruitment (and decreases recruits per spawner) towards the unfished level as spawning biomass increases;
3. Parametric sampling from the lognormal distribution generates a smoother frequency distribution of future recruitments (in comparison to resampling from the model's time series of annual recruitment deviations) thus provides rebuilding calculations that are less sensitive to individual historical recruitment estimates.

Rebuilding in the Absence of Fishing - Tmin

The best estimate of the unfished time to 50% probability of rebuilding is the year 2057 (Tmin in Table 4 for the BASELINE MODEL column). The level of steepness greatly affects the time to rebuild: year 2049 with a steepness of 0.36, 2057 with the best steepness estimate of 0.33, and 2077 with a steepness of 0.289.

With the previous method for calculating the unfished biomass level, the target biomass level is lower and would be achieved more quickly. There is a 50% probability of achieving this lower level by 2044 (Table 3), which is only 3 years greater than the Tmin (2041) calculated in the initial canary rockfish rebuilding analysis (Methot, 2000). However, this lower target biomass level is not the best estimate of Bzero. In fact, the recruitment level that generates the previous Bzero level is close to the expected recruitment at MSY (Methot and Piner, 2002).

Generation Time

Generation time is calculated as the mean age of female spawners, weighted by age-specific spawn production (Table 2), in an unfished population. It is calculated to be 19 years in the new assessment in which female natural mortality increases at older ages in proportion to maturation. This is intermediate between the 16.8 and 24.7 years calculated for the two natural mortality scenarios in the 1999 assessment (Crone et al., 1999) and used in the 2000 rebuilding analysis. Note that the generation time was erroneously reported as 16 years in the June 2002 version of the 2002 assessment document.

Maximum Allowable Rebuilding Time - Tmax

With Tmin at 2057, the Tmax would be 19 years greater, or 2076. However, two years have elapsed since the stock was declared overfished. The low level of catch during these two years has a small, but unquantified, delay on Tmin. Consequently, the Ttarget (year with 50% expectation of achieving the rebuilt level) should be set less than Tmax.

Rebuilding with Fishing

If the exploitation rate is set to Fmsy, then the stock will not have a 50% probability of rebuilding until 2094, even with the 40:10 adjustment which would set the OY to zero until the stock rebuilt to the 10% biomass level. The year 2094 exceeds Tmax and does not meet the requirement to have a 50% probability of rebuilding before 2076.

At a reduced fishing mortality rate of 0.0242 year^{-1} there is a 50% probability of rebuilding by 2076 (Table 4), and the OY in 2003 would be 45 mt. This harvest level corresponds to the maximum permissible Ttarget.

Lower harvest rates will result in an earlier Ttarget year, a higher probability of being rebuilt by Tmax, and a lower OY in 2003 (Figure 4). Results shown in Figure 4 and Figure 5 are calculated for 50, 60, 70 and 80% probabilities of being rebuilt by Tmax. For these probabilities, the OY in 2003 ranges from 30 to 45 mt. By 2023, the range of expected OY would be 57 to 81 mt (Figure 5). These calculations at 50, 60, 70 and 80% are particular points along a continuum (Figure 4). If socio-economic considerations lead to the need to consider other levels, then interpolation form the results presented here is technically reasonable.

Because future recruitment will vary around the spawner-recruitment relationship (Figure 2), there is variability in the estimate of time to rebuild. Figure 6 shows this variability for a 60% probability of rebuilding

Other Factors Affecting Rebuilding

One factor affecting the level of allowable harvest during rebuilding is the age selectivity of the combined fisheries. Because recreational fisheries take younger fish, their per-ton impact on rebuilding is greater than that of the commercial fisheries which take a broad age range of older fish. Table 4 shows the trade-off for 80:20, 50:50, and 20:80 splits of catch between recreational and commercial fisheries.

The most significant factor affecting the rate of rebuilding, and the level of sustainable fishery post-rebuilding, is the steepness of the spawner-recruitment relationship. If steepness is 0.289, rather than 0.33, then the Tmin is extended by 20 years!. Steepness levels near 0.7 are normal and Dorn's (2000) review of steepness for rockfish found an average value near 0.6 when he included rockfishes off Alaska and off the west coast. If future steepness for canary rockfish increases to 0.5 rebuilding will accelerate, but will still have a Tmin that is 30 years away (Table

3).

The assessment area extends northward to the US-Canada border, but the trawl survey which extends northward to about 49° N shows that canary rockfish abundance is often high near the border. Canadian catch has been near 200 mt in recent years, so the combined impact of the US and Canadian fisheries could be greater than the levels forecast here as necessary for rebuilding. A combined US and Canadian stock assessment is advised to improve the estimate of total fishery impact.

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Table 1. Time series of canary rockfish abundance, recruitment and total catch as estimated in Methot and Piner (2002).

Year	Total Biomass	Female Spawning Biomass	Age 1 Recruitment	Exploitation Rate	Total Catch
Unfished	94062	31782	3907	0	0
Initial Equilibrium	85325	29848	3907	0.006	500
1941	85326	29848	3948	0.006	500
1942	85331	29847	3948	0.040	3363
1943	82235	28852	3948	0.043	3491
1944	79153	27860	3867	0.049	3842
1945	75842	26792	3783	0.060	4500
1946	71975	25538	3691	0.060	4296
1947	68496	24417	3579	0.059	4041
1948	65438	23449	3476	0.016	1069
1949	65720	23626	3384	0.016	1017
1950	66016	23829	3401	0.019	1223
1951	66029	23941	3420	0.023	1500
1952	65686	23919	3431	0.023	1474
1953	65325	23871	3429	0.025	1618
1954	64769	23725	3424	0.026	1657
1955	64147	23525	3410	0.026	1662
1956	63505	23294	3391	0.030	1878
1957	62625	22960	3369	0.032	1989
1958	61731	22577	5788	0.035	2156
1959	60790	22134	3750	0.032	1910
1960	60237	21803	3058	0.029	1760
1961	60040	21561	6281	0.025	1483
1962	60276	21481	2871	0.023	1388
1963	60670	21521	2703	0.026	1571
1964	60937	21582	5547	0.019	1129
1965	61668	21895	2116	0.018	1122
1966	62263	22268	1275	0.043	2690
1967	60889	22060	1271	0.032	1950
1968	60066	22142	2007	0.039	2331
1969	58585	22015	3467	0.027	1578
1970	57769	22078	3530	0.027	1542
1971	56881	21982	2795	0.028	1585
1972	55841	21662	1653	0.030	1682
1973	54592	21124	1973	0.046	2516
1974	52392	20159	3035	0.037	1918
1975	50859	19455	2182	0.038	1921
1976	49347	18792	2618	0.032	1561
1977	48302	18314	3513	0.046	2181
1978	46650	17622	1833	0.066	3060
1979	44149	16596	3158	0.091	3995
1980	40822	15246	3701	0.103	4138
1981	37514	13968	1288	0.086	3174
1982	35365	13106	2443	0.158	5538
1983	30699	11340	2134	0.160	4853
1984	26897	9883	1962	0.089	2361
1985	25885	9543	2091	0.107	2748

Year	Total Biomass	Female Spawning Biomass	Age 1 Recruitment	Exploitation Rate	Total Catch
1986	24436	9083	2341	0.095	2299
1987	23415	8788	1344	0.136	3148
1988	21395	8088	1275	0.143	3038
1989	19404	7355	1986	0.171	3283
1990	17090	6438	1488	0.175	2932
1991	15118	5667	1227	0.219	3255
1992	12739	4683	1255	0.236	2960
1993	10644	3831	1169	0.212	2212
1994	9286	3254	830	0.134	1220
1995	8969	3130	1342	0.132	1168
1996	8657	3037	766	0.178	1508
1997	7899	2762	449	0.180	1399
1998	7160	2512	374	0.204	1444
1999	6266	2195	516	0.142	883
2000	5887	2102	454	0.030	177
2001	6197	2312	435	0.015	90
2002	6540	2524	477	0.014	89

Table 2. Life history parameters, fishery selectivity (with 50:50 commercial:recreational allocation) and population numbers at age in 2002.

	Females					Males			
Age	Fecundity	M	Weight	Selectivity	InitN	M	Weight	Selectivity	Init N
1	0.000	0.060	0.047	0.000	238.4	0.06	0.032	0.000	238.4
2	0.000	0.060	0.133	0.008	205.0	0.06	0.119	0.007	205.0
3	0.004	0.060	0.265	0.193	201.1	0.06	0.260	0.193	201.1
4	0.022	0.060	0.435	0.980	213.0	0.06	0.441	0.980	213.0
5	0.081	0.060	0.635	0.997	136.8	0.06	0.645	1.000	136.8
6	0.216	0.061	0.855	0.576	140.3	0.06	0.858	0.587	140.3
7	0.441	0.064	1.085	0.354	208.9	0.06	1.069	0.373	209.1
8	0.735	0.070	1.319	0.278	318.7	0.06	1.269	0.297	319.3
9	1.057	0.079	1.550	0.253	167.6	0.06	1.455	0.266	168.1
10	1.377	0.088	1.775	0.241	199.9	0.06	1.623	0.248	198.3
11	1.676	0.096	1.988	0.233	173.4	0.06	1.774	0.236	166.5
12	1.945	0.102	2.190	0.226	126.2	0.06	1.907	0.227	117.8
13	2.188	0.107	2.378	0.220	104.8	0.06	2.023	0.220	99.2
14	2.401	0.110	2.552	0.214	95.4	0.06	2.124	0.214	95.0
15	2.594	0.113	2.711	0.210	43.4	0.06	2.210	0.210	46.4
16	2.762	0.114	2.856	0.204	32.7	0.06	2.285	0.206	37.0
17	2.913	0.116	2.988	0.199	39.5	0.06	2.348	0.203	44.6
18	3.048	0.117	3.107	0.194	22.9	0.06	2.402	0.201	25.2
19	3.166	0.117	3.214	0.182	13.5	0.06	2.448	0.199	15.1
20	3.270	0.118	3.310	0.172	9.4	0.06	2.486	0.197	11.4
21	3.362	0.118	3.396	0.164	7.2	0.06	2.519	0.196	9.5
22	3.445	0.119	3.473	0.157	2.7	0.06	2.546	0.195	3.8
23	3.520	0.119	3.541	0.139	5.6	0.06	2.569	0.194	8.4
24	3.584	0.119	3.602	0.127	3.7	0.06	2.589	0.193	5.7
25	3.884	0.119	3.900	0.118	45.3	0.06	2.700	0.192	23.5

Table 3. Rebuilding results with alternative levels of Bzero or spawner-recruitment steepness. Baseline model with best steepness estimate is in Table 3.

	Rzero from 67-77 (old method)	Low Steepness	High Steepness	Recruitment Upshift **speculative**
Spawn-recruit steepness	0.33	0.289	0.36	0.50
comm:recr allocation	50:50	50:50	50:50	50:50
F(msy)	F73%	F79%	F69%	F55%
Bmsy/Bzero	45%	45%	43%	40%
MSY (mt)	622	461	728	1395
2003 ABC (mt)				
@ F50%	256	256	256	256
@ Fmsy	116	87	137	222
Btarget (fem. spawn biomass)	8296	12713	12713	12713
Tmin	2044	2077	2049	2032
Tmax	2063	2096	2068	2051
% reb. by Tmax	50%	50%	50%	50%
F	0.0272	0.0136	0.0322	0.0695
OY in 2003 (mt)	51	26	61	129
Yr to 50% reb.	2063	2096	2068	2051
% reb. by Tmax	60%	60%	60%	60%
F	0.0249	0.0116	0.0297	0.0665
OY in 2003 (mt)	47	22	56	124
Yr to 50% reb.	2061	2092	2066	2050
% reb. by Tmax	70%	70%	70%	70%
F	0.0226	0.0096	0.0265	0.0634
OY in 2003 (mt)	43	18	50	118
Yr to 50% reb.	2058	2089	2064	2048
% reb. by Tmax	80%	80%	80%	80%
F	0.0194	0.0071	0.0234	0.0592
OY in 2003 (mt)	36	13	44	110
Yr to 50% reb.	2055	2085	2062	2046
Fmsy with 40:10				
% reb. by Tmax	19%	13%	22%	35%
OY in 2003 (mt)	11	0	0	0
Yr to 50% reb.	2079	2127	2082	2058

Table 4. Rebuilding results with alternative selectivities based upon different commercial:recreational allocation.

	Recreational	BASELINE MODEL Even	Commercial
Spawn-recruit steepness	0.33	0.33	0.33
comm:recr allocation	20:80	50:50	80:20
F(msy)	F73%	F73%	F73%
Bmsy/Bzero	44%	45%	45%
MSY (mt)	525	622	749
2003 ABC (mt)			
@ F50%	218	256	309
@ Fmsy	99	116	140
Btarget (fem. spawn biomass)	12713	12713	12713
Tmin	2057	2057	2057
Tmax	2076	2076	2076
% reb. by Tmax	50%	50%	50%
F	0.0317	0.0242	0.0161
OY in 2003 (mt)	37	45	57
Yr to 50% reb.	2076	2076	2076
% reb. by Tmax	60%	60%	60%
F	0.0289	0.0220	0.0147
OY in 2003 (mt)	34	41	52
Yr to 50% reb.	2074	2074	2074
% reb. by Tmax	70%	70%	70%
F	0.0253	0.0193	0.0129
OY in 2003 (mt)	29	36	45
Yr to 50% reb.	2071	2071	2071
% reb. by Tmax	80%	80%	80%
F	0.0212	0.0161	0.0108
OY in 2003 (mt)	25	30	38
Yr to 50% reb.	2068	2068	2068
Fmsy with 40:10			
% reb. by Tmax	20%	19%	19%
OY in 2003 (mt)	0	0	0
Yr to 50% reb.	2093	2094	2094

Table 5. Time series of median catch, probability of rebuilding (with P=0.6 by 2076 and with F=0.0), anf the median spawning biomass relative to the unfished level.

Year	Median Catch P=0.6	Pr(rebuilt) P=0.6	Pr(rebuilt) F=0	Median(SPB)/Bzero P=0.6	Median(SPB)/Bzero F=0
2003	41	0.000	0.000	0.085	0.085
2004	42	0.000	0.000	0.090	0.091
2005	43	0.000	0.000	0.094	0.095
2006	45	0.000	0.000	0.097	0.099
2007	47	0.000	0.000	0.099	0.102
2008	48	0.000	0.000	0.101	0.104
2009	50	0.000	0.000	0.103	0.107
2010	52	0.000	0.000	0.105	0.110
2011	54	0.000	0.000	0.107	0.112
2012	55	0.000	0.000	0.109	0.116
2013	57	0.000	0.000	0.112	0.119
2014	59	0.000	0.000	0.115	0.123
2015	60	0.000	0.000	0.118	0.128
2016	62	0.000	0.000	0.122	0.132
2017	64	0.000	0.000	0.125	0.137
2018	65	0.000	0.000	0.128	0.141
2019	67	0.000	0.000	0.132	0.146
2020	69	0.000	0.000	0.136	0.151
2021	71	0.000	0.000	0.139	0.156
2022	73	0.000	0.000	0.142	0.161
2023	75	0.000	0.000	0.146	0.166
2024	77	0.000	0.000	0.150	0.171
2025	79	0.000	0.000	0.154	0.176
2026	81	0.000	0.000	0.157	0.182
2027	83	0.000	0.000	0.161	0.187
2028	85	0.000	0.000	0.165	0.192
2029	87	0.000	0.000	0.169	0.198
2030	89	0.000	0.000	0.173	0.204
2031	91	0.000	0.000	0.176	0.209
2032	93	0.000	0.000	0.181	0.216
2033	95	0.000	0.000	0.186	0.222
2034	98	0.000	0.000	0.190	0.229
2035	100	0.000	0.000	0.194	0.235
2036	103	0.000	0.000	0.198	0.241
2037	104	0.000	0.000	0.203	0.248
2038	106	0.000	0.000	0.208	0.255
2039	109	0.000	0.000	0.212	0.262
2040	111	0.000	0.000	0.217	0.269
2041	114	0.000	0.002	0.221	0.275
2042	117	0.000	0.005	0.226	0.283
2043	120	0.000	0.010	0.230	0.290

Year	Median Catch P=0.6	Pr(rebuilt) P=0.6	F=0	Median(SPB)/Bzero P=0.6	F=0
2044	122	0.000	0.018	0.235	0.297
2045	124	0.000	0.024	0.240	0.305
2046	127	0.000	0.033	0.245	0.312
2047	129	0.001	0.047	0.251	0.321
2048	131	0.001	0.072	0.256	0.329
2049	135	0.001	0.105	0.262	0.338
2050	137	0.002	0.143	0.267	0.346
2051	139	0.002	0.189	0.272	0.354
2052	141	0.004	0.229	0.278	0.362
2053	143	0.007	0.281	0.284	0.371
2054	145	0.009	0.331	0.289	0.378
2055	149	0.015	0.404	0.294	0.386
2056	152	0.020	0.457	0.298	0.393
2057	155	0.023	0.514	0.304	0.403
2058	157	0.032	0.558	0.310	0.411
2059	160	0.042	0.624	0.314	0.419
2060	163	0.057	0.696	0.319	0.427
2061	166	0.078	0.754	0.325	0.435
2062	169	0.093	0.797	0.330	0.443
2063	172	0.116	0.832	0.335	0.451
2064	174	0.140	0.856	0.341	0.460
2065	177	0.170	0.887	0.349	0.472
2066	180	0.207	0.905	0.356	0.482
2067	182	0.235	0.922	0.361	0.491
2068	185	0.278	0.940	0.367	0.498
2069	187	0.314	0.953	0.372	0.508
2070	191	0.359	0.963	0.378	0.516
2071	194	0.391	0.973	0.384	0.525
2072	197	0.432	0.980	0.390	0.534
2073	200	0.472	0.984	0.396	0.542
2074	202	0.508	0.989	0.401	0.550
2075	205	0.556	0.993	0.407	0.559
2076	207	0.601	0.994	0.413	0.568

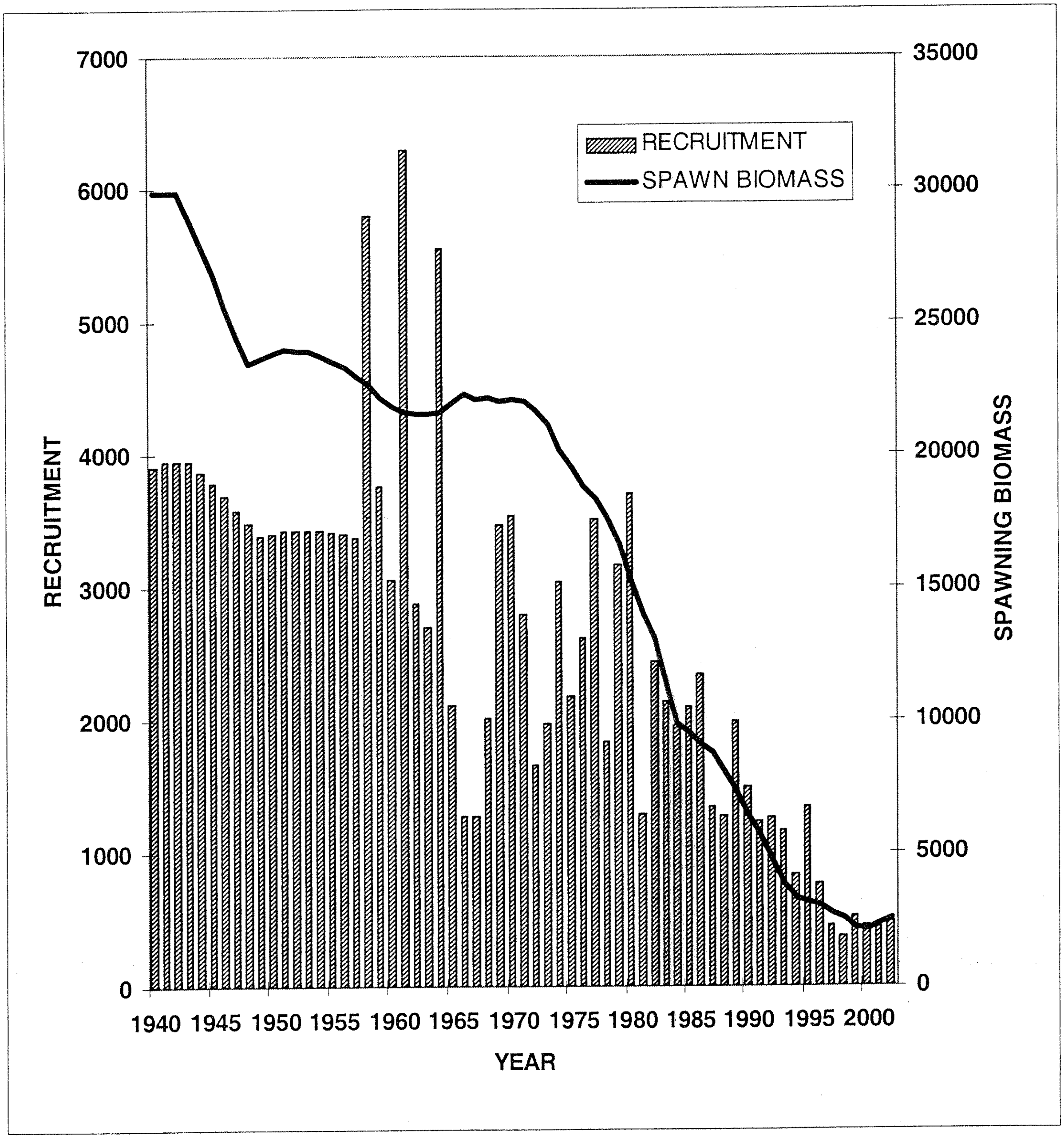


Figure 1 Time series of age 1 recruitment and female spawning biomass.

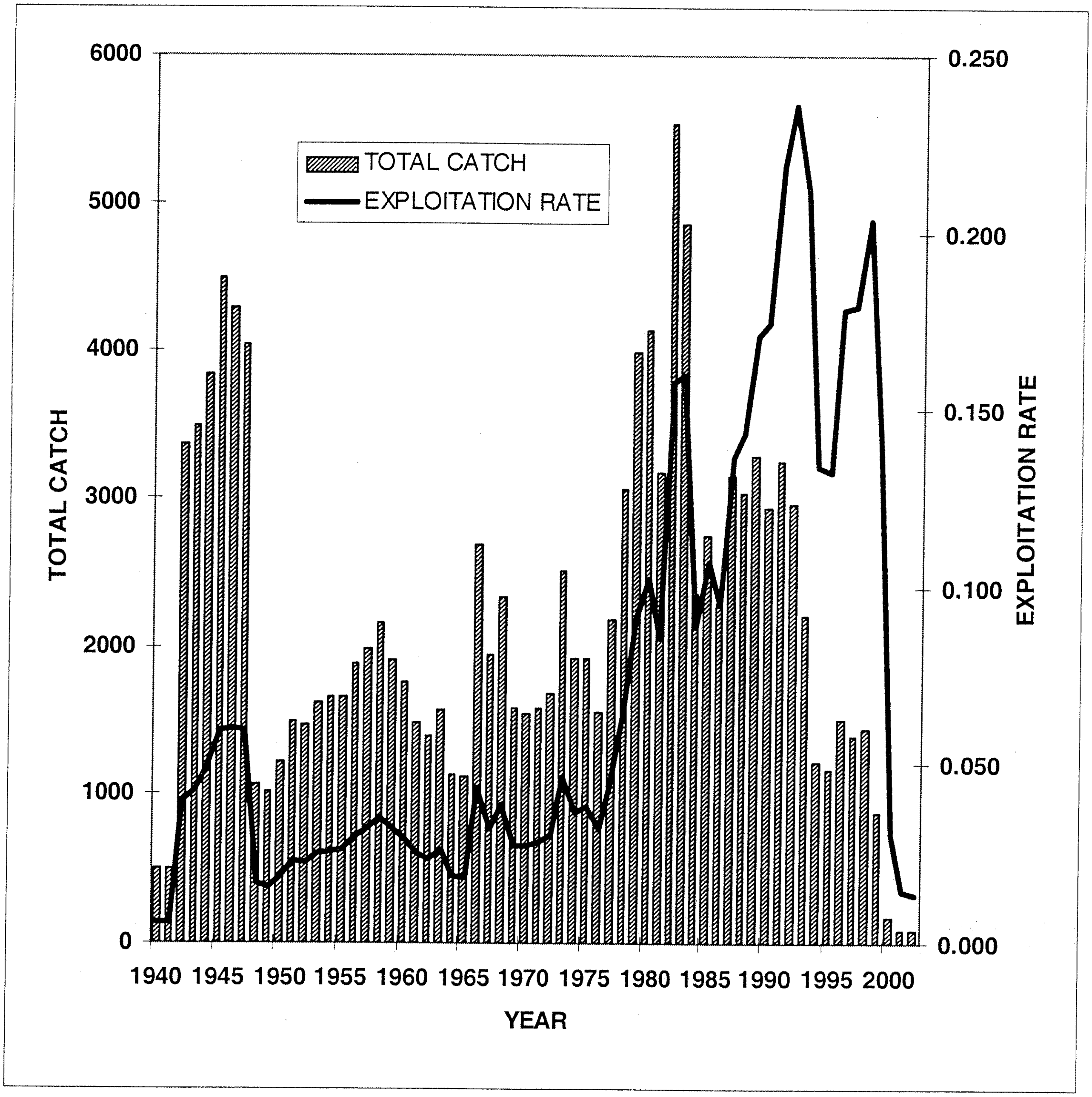


Figure 2 Time series of total catch and exploitation rate.

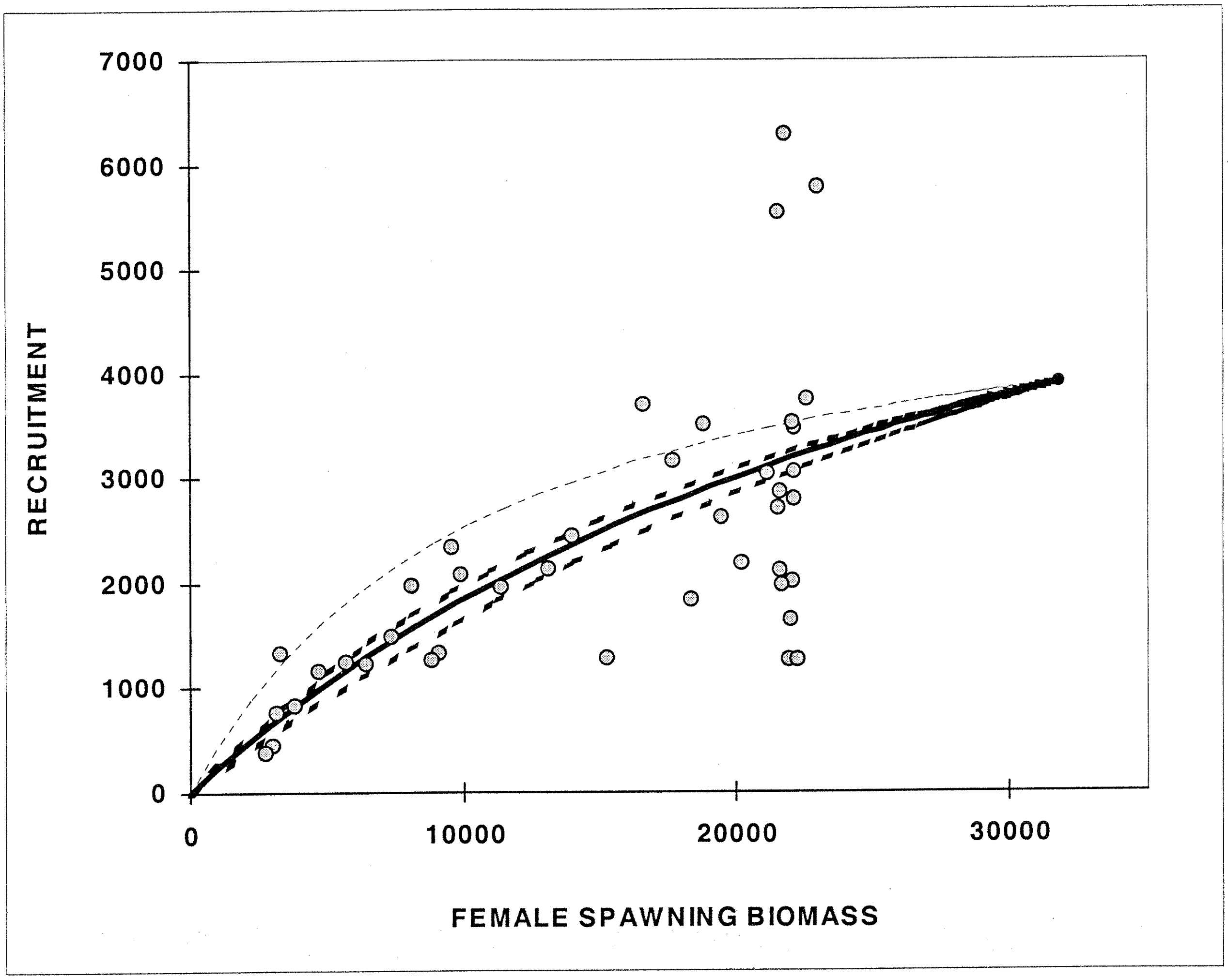


Figure 3 Recruitment-spawner relationship. Bold line is the best estimate of steepness (0.33). Bracketing dashed lines are steepness of 0.289 and 0.36. The light upper line has a steepness of 0.50 which is clips the upper edge of recent recruitments and is closer to the general rockfish steepness level estimated by Dorn (2000).

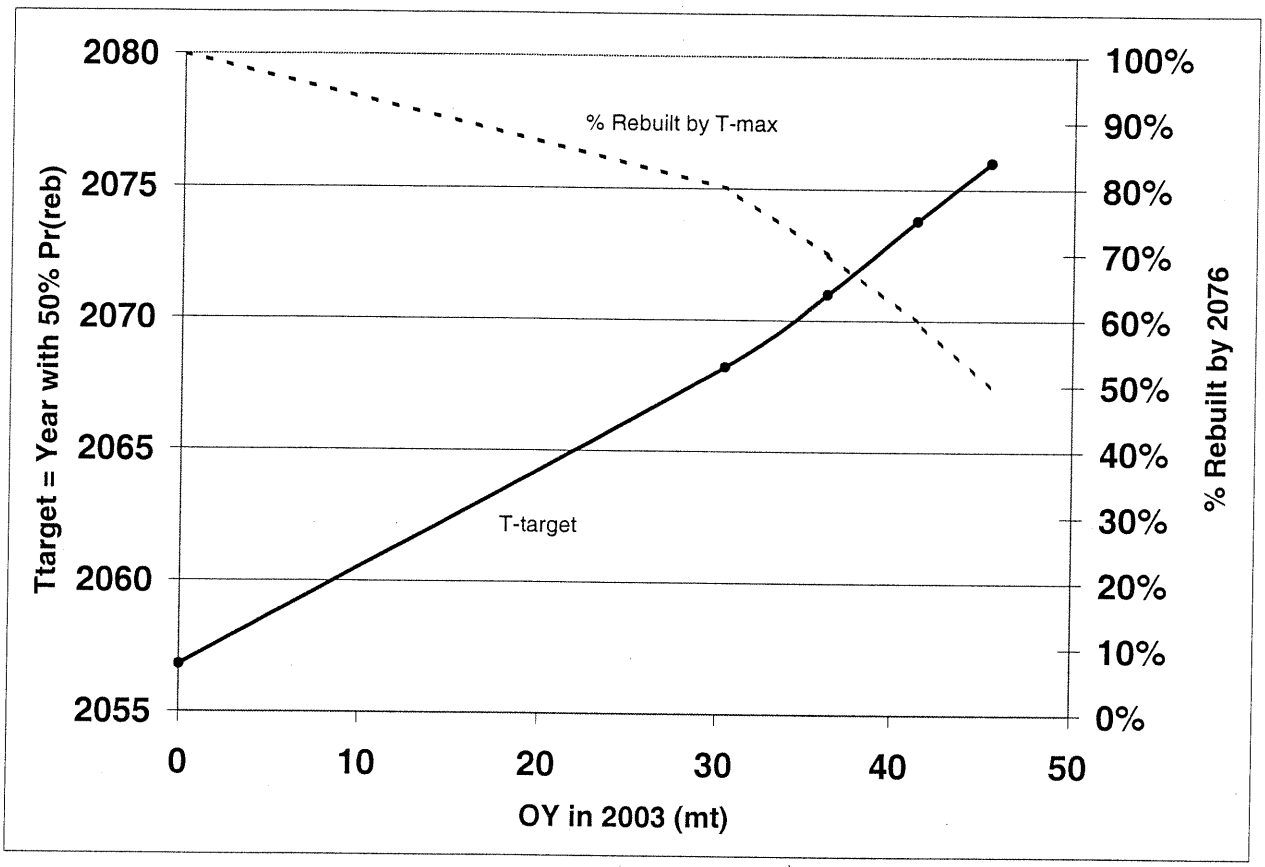


Figure 4 Trade-off between OY in 2003, the year (Ttarget) with 50% probability of achieving the rebuilt level, and the probability of achieving the rebuilt level before Tmax (2076). Each calculation is based upon a constant exploitation rate being applied throughout the rebuilding period.

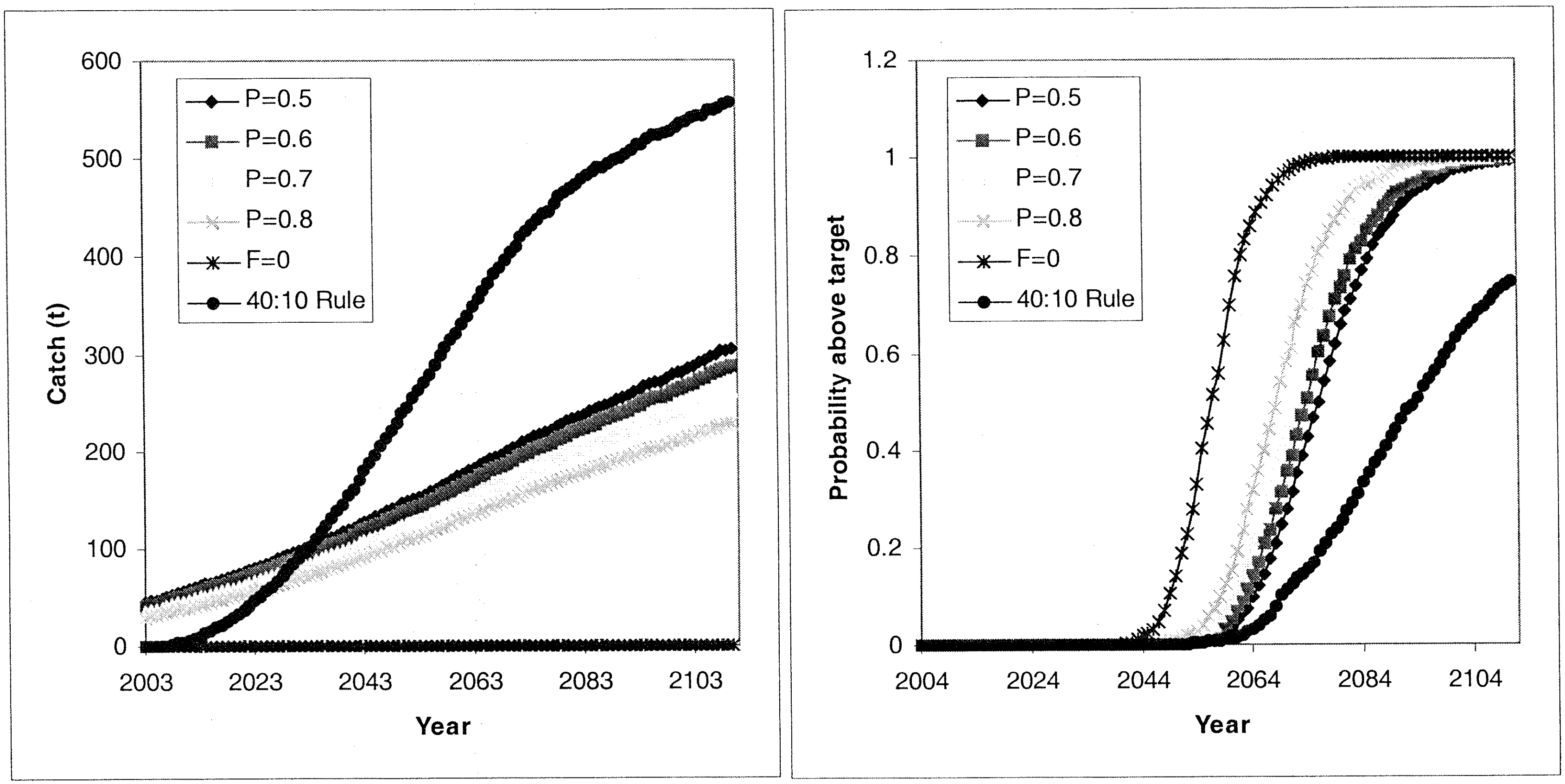
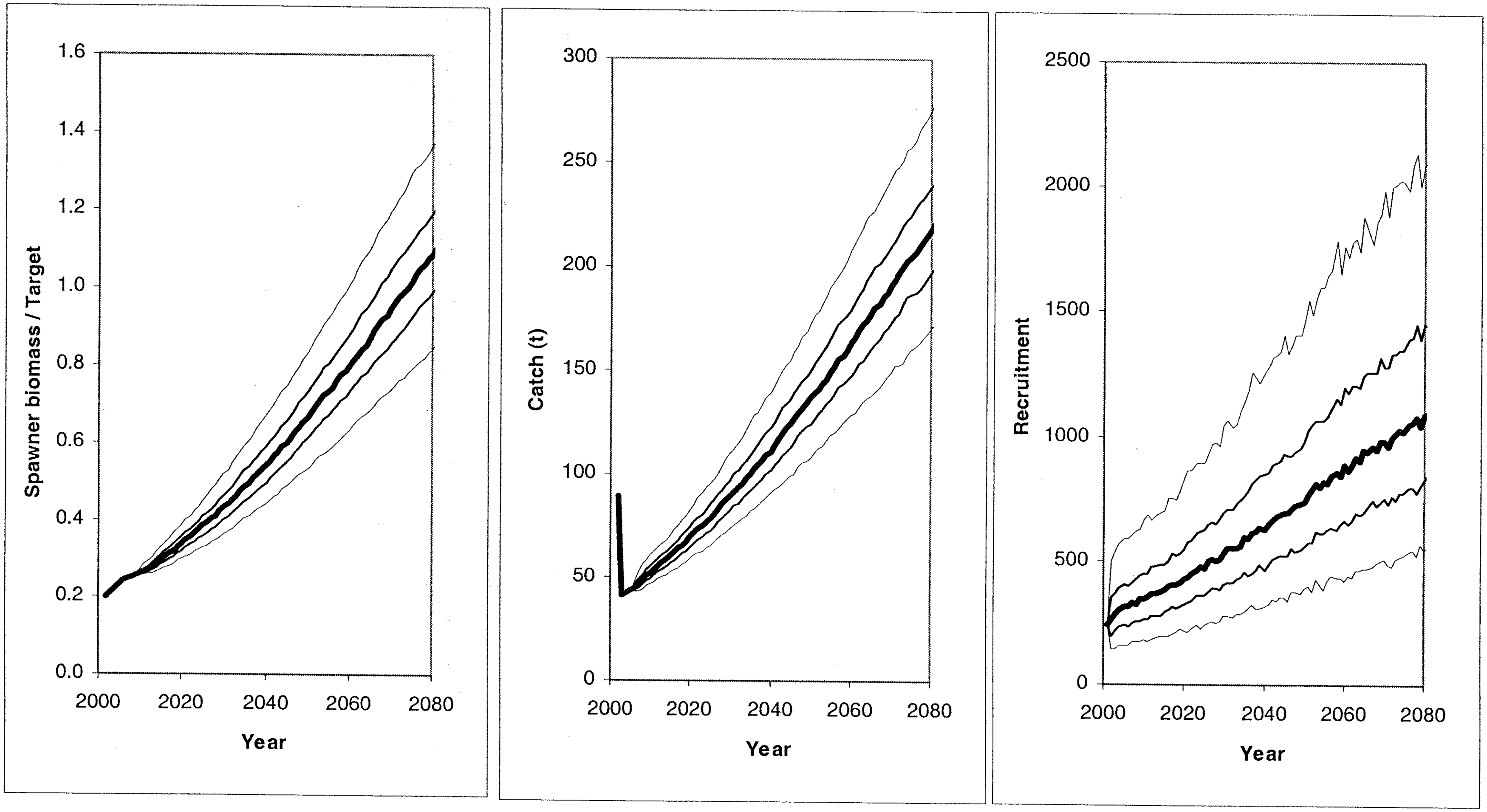


Figure 5. Time series of expected catch level and expected probability of achieving the rebuilt biomass level (40% of Bzero).

Figure 6. Time series of spawning biomass, catch and recruitment with probability of rebuilding by 2076 at 60%. The 5%, 25%, 50%, 75% and 95% percentiles are shown.



Appendix. Input file for rebuilding analysis.

#Title,
Canary rockfish - 50:50 comm:recr
Number of sexes,
2,
Age range to consider (minimum age; maximum age),
1,25
First year of projection,
2002,
Year declared overfished,
2000,
Is the maximum age a plus-group (1=Yes;2=No),
1,
Generate future recruit using: hist. recr (1); hist recr/spawn (2); or a stock-recruit (3),
3,
Constant fishing mortality (1) or constant Catch (2) projections,
1,
Pre-specify the year of recovery (or -1) to ignore,,,,,,,,,,,,,,,,,,,,,,,
-1,,,,,,,,,,,,,,,,,,,,,,,
FECUNDITY @ AGE,,,,,,,,,,,,,,,,,,,,,,,
AGES 1 25,,,,,,,,,,,,,,,,,,,,,,,
0,0.00027,0.00371,0.02219,0.08128,0.21632,0.44051,0.73468,1.0571,1.3774,1.67588,1.94472,
2.18776,2.40143,2.59443,2.76175,2.9133,3.04797,3.16579,3.27028,3.36204,3.44522,3.51975,
3.58399,3.8844,
AGE INFO: M,WT,SELEX,NUMBERS,,,,,,,,,,,,,,,,,,,,
FEMALE,,,,,,,,,,,,,,,,,,,,,,,
.06000, .06000, .06000, .06001, .06013, .06097, .06402, .07037,
.07903, .08804, .09594, .10201, .10672, .10999, .11259, .11425,
.11561, .11664, .11734, .11787, .11822, .11857, .11893, .11910,
.11928,
.04700, .13300, .26500, .43500, .63500, .85500, 1.08500, 1.31900,
1.55000, 1.77500, 1.98800, 2.19000, 2.37800, 2.55200, 2.71100, 2.85600,
2.98800, 3.10700, 3.21400, 3.31000, 3.39600, 3.47300, 3.54100,
3.60200, 3.90000,
.00026, .00760, .19323, .97956, .99727, .57631, .35398, .27796,
.25278, .24120, .23283, .22566, .21951, .21429, .20992, .20391,
.19868, .19413, .18210, .17184, .16358, .15690, .13934, .12706,
.11833,
238.35288, 204.98610, 201.08574, 212.96610, 136.79802, 140.27095, 208.92664,
318.68570, 167.58476, 199.88103, 173.39323, 126.20521, 104.82539, 95.38803,
43.40654, 32.73907, 39.54165, 22.86064, 13.47217, 9.44046, 7.20839,
2.67660, 5.62894, 3.65099, 45.27893,

MALE
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.06000, .06000, .06000, .06000, .06000, .06000, .06000, .06000,
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.06000,
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1.45500, 1.62300, 1.77400, 1.90700, 2.02300, 2.12400, 2.21000, 2.28500,
2.34800, 2.40200, 2.44800, 2.48600, 2.51900, 2.54600, 2.56900,
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.26567, .24776, .23562, .22675, .21991, .21443, .20996, .20628,
.20326, .20077, .19874, .19708, .19572, .19463, .19374, .19302,
.19245,
238.35288, 204.98708, 201.08975, 212.98472, 136.82954, 140.32663, 209.07910,
319.30972, 168.05285, 198.30151, 166.49020, 117.81606, 99.15396, 95.03106,
46.41686, 36.97260, 44.57084, 25.18530, 15.14766, 11.36878, 9.50305,
3.80037, 8.44462, 5.72975, 23.50413,
NUMBER OF SIMULATIONS,,,,,
1000,,,,
TIME SERIES,,,,,
NUMBER OF HISTORICAL YEARS + 2,,,,,
64,,,,,
YR, RECR, SPBIO,USE_IN_Bzero,USE_IN_R, USE_IN_R/S
#,,,,,
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1901,3907,29848,0,0,0
1941,3948,29848,0,0,0
1942,3948,29847,0,0,0
1943,3948,28852,0,0,0
1944,3867,27860,0,0,0
1945,3783,26792,0,0,0
1946,3691,25538,0,0,0
1947,3579,24417,0,0,0
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1953,3429,23871,0,0,0
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1955,3410,23525,0,0,0
1956,3391,23294,0,0,0
1957,3369,22960,0,0,0
1958,5788,22577,0,0,0
1959,3750,22134,0,0,0
1960,3058,21803,0,0,0
1961,6281,21561,0,0,0
1962,2871,21481,0,0,0
1963,2703,21521,0,0,0

1964,5547,21582,0,0,0
1965,2116,21895,0,0,0
1966,1275,22268,0,0,0
1967,1271,22060,0,0,0
1968,2007,22142,0,0,0
1969,3467,22015,0,0,0
1970,3530,22078,0,0,0
1971,2795,21982,0,0,0
1972,1653,21662,0,0,0
1973,1973,21124,0,0,0
1974,3035,20159,0,0,0
1975,2182,19455,0,0,0
1976,2618,18792,0,0,0
1977,3513,18314,0,0,0
1978,1833,17622,0,0,0
1979,3158,16596,0,0,0
1980,3701,15246,0,0,0
1981,1288,13968,0,0,0
1982,2443,13106,0,0,0
1983,2134,11340,0,0,0
1984,1962,9883,0,0,0
1985,2091,9543,0,0,0
1986,2341,9083,0,0,0
1987,1344,8788,0,0,0
1988,1275,8088,0,0,0
1989,1986,7355,0,0,0
1990,1488,6438,0,0,0
1991,1227,5667,0,0,0
1992,1255,4683,0,0,0
1993,1169,3831,0,0,0
1994,830,3254,0,0,0
1995,1342,3130,0,0,0
1996,766,3037,0,0,0
1997,449,2762,0,0,0
1998,374,2512,0,0,0
1999,516,2195,0,0,0
2000,454,2102,0,0,0
2001,435,2312,0,0,0
2002,477,2524,0,0,0

Number of years with pre-specified catches,,,,,
1,,,,,
catches for years with pre-specified catches,,,,,
2002,89,,,,
Number of future recruitments to override,,,,,
0,,,,,

Process for overiding (-1 for average otherwise index in data list),,,,,
Which probability to product detailed results for (1=0.5;2=0.6;etc.),,,,,
2,,,,,
Steepness and sigma-R,
0.330, 0.4
Target SPR rate (FMSY Proxy),
0.73
Target SPR information: Use (1=Yes) and power,
0 20
Discount rate (for cumulative catch),
0.1
Truncate the series when 0.4B0 is reached (1=Yes),
0
Set F to FMSY once 0.4B0 is reached (1=Yes),
0
Percentage of FMSY which defines Ftarget,
0.9
Conduct MacCall transition policy (1=Yes),
0,
Defintion of recovery (1=now only;2=now or before)
2
Produce the risk-reward plots (1=Yes)
0
Calculate coefficients of variation (1=Yes)
0
Number of replicates to use
1
First Random number seed
-89102

A Rebuilding Analysis of the West Coast Pacific Whiting (Hake) stock

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Introduction

Pacific whiting (*Merluccius productus*), also called Pacific hake, is a codlike species distributed off the west coast of North America from 25^0 N. to 51^0N. lat. It is among 11 other species of hakes from the genus, *Mercuccidae*, which are distributed in both hemispheres of the Atlantic and Pacific Oceans and constitute nearly two millions t of catches annually (Alheit and Pitcher 1995). The coastal stock of Pacific whiting is currently the most abundant groundfish population in the California current system. The fishery for Pacific whiting has supported total annual catches that have averaged 208,000 t and 282,000 t since 1966 and 1992, respectively (Table 1).

Age-structured assessment models have been used to assess Pacific whiting since the early 1980's. The most recent Pacific whiting assessment was conducted by Helser et al. (2002) using the age-structured model developed by Dorn et al. (1999) and implemented with the AD Model Builder software (Fournier 1996). Based on the 2002 assessment, mature female biomass in 2001 was estimated to be 20% of an unfished stock (Figure 1). Mature female biomass, however, was projected to rise gradually over the next three years due to the relatively strong 1999 year-class as it enters the mature biomass of the stock. Because mature female spawning biomass was estimated to be less than 25% of an unfished stock abundance (overfished threshold), the National Marine Fisheries Service declared the Pacific whiting stock to be overfished in 2002. A rebuilding analysis was undertaken, the results of which are presented in this report.

Input Data and Assumptions

The rebuilding analyses presented were performed using software developed by Punt (2002; V 2.0). The essence of the analysis is based on an age-structured stochastic projection model in which the initial age composition of the population is projected forward in time assuming time-invariant life history parameters and random realizations of future recruits drawn from the pool of historical recruitments estimated by the assessment model. Data inputs associated with initial conditions were taken from outputs generated from the age-structured Pacific whiting stock assessment by Helser et al. (2002), and include: 1) average fishery weights, 2) percentage of females mature, 3) female multiplier (proportion of females at age), 4) spawning output (product of weight at age, fraction mature and female multiplier), 5) average fishery selectivity, and 6) the initial population vector (numbers at age) (Table 2). The assessment model is structured for a U.S. and Canadian fishery in which catch and weights at age are used to estimate separate fishery selectivity patterns. Since the rebuilding software is not presently set up to deal with separate fisheries, the weights at age and selectivity at age used as inputs for the rebuilding analysis were taken as the averages at each age, weighted by the year- and age-specific catches from 1973-2001. For generating future recruitment, recruits to age 2 were selected at random from the entire historical times series, 1972-2001 (Table 1). Resampling recruits from the entire time period is consistent with the current calculation of B0 (unfished biomass)(Helser et al. 2002). Also, this choice assumes no relationship between spawning output and subsequent recruitment, but rather variation in recruitment pattern through time is environmentally driven (Figure 2). Furthermore, the projection results do assume that the environmental regime that has given rise to the observed life history characteristics and both the magnitude and variation in recruitment will on average persist over the rebuilding period. Population projections were configured to begin in 2001 (last year of the assessment) with the first projection year being 2002, in which catches were specified at 234,000 t and 162,000 t for the 2001 and 2002 fishing years, respectively.

Determination of Rebuilding

As indicated, unfished biomass (B0) was calculated as the product of virgin spawners-per-recruit (output from input life history vectors) and the average of the historical time series of recruitment (1972-2001). The estimated unfished biomass was 2,058,000 t with a target spawning output at 40%B0 (823,000 t) (Table 3). These estimates are substantially influenced by the very large 1980 (12 billion) and 1984 (9 billion) year classes. While recruitment events such as these are infrequent they have occurred greater than 5% within a 30 year period and should therefore be considered within reasonable bounds. Therefore, calculation of unfished biomass using the recruitment series excluding the very large year classes was not considered.

In the analysis that follows, the rebuilding strategy was based on the probability that the spawning output was exceeded by *X* percent during any year within the ten year rebuilding period. This definition allows for stocks such as Pacific whiting with extremely variable recruitment to recover to 40%B0 and then subsequently drop below this level. Fishing mortality rates associated with the different probability levels were set equal to F_{MSY} once the rebuilding target was met. If however, spawning biomass fell below the target then the 40:10 rule, which modifies the fishing rate gradually in response to declining stock sizes, was implemented.

The maximum rebuilding time for Pacific whiting was approximately 9 years, while the minimum rebuilding time was approx. 3 years (Table 3). The median time to rebuild depended upon the harvesting strategy during the interim rebuilding period, but in all cases the stock was able to rebuild within 10 years (Table 4). For instance, under the F40% (40:10) rule the median rebuilding time was 2.9 years with an 82 probability that spawning biomass would exceed the target in 10 years. On the other extreme, rebuilding the stock took there 7.7 years under the fishing rates consistent with a 50 probability of recovery within 10 years.

Rebuilding Strategies

Estimates of fishing mortality, optimal yield, probability of recovery (as defined above) and median time to rebuild were computed for five rebuilding strategies. These strategies were defined as the reference fishing mortality rates calculated in order to rebuild the stock by Tmax with specified probabilities as 1) 50%, 2) 60%, 3) 70%, 4) 80%, and 5) 40-10 harvest policy. The 40:10 rule option implements rule by modification of F_{MSY} immediately. As indicated earlier, the 40:10 rule is implemented for all other strategies when spawning biomass falls below the biomass target after recovery. The fishing mortality rates corresponding 50%, 60% and 70% probability of the stock rebuilding within 10 years were 0.41, 0.68 and 1.0, respectively. These mortality rates are all in excess of the current overfishing definition corresponding to F40%. At the 80% probability level the corresponding F was approx. 0.26. An F of 1.0 was the maximum allowable rate (user specified) and was used to contrast outcomes of the different strategies only, not to provide viable alternative strategies for F in excess of the overfishing definition. Under the most optimistic rebuilding policy, 50% probability of rebuilding within 10 years, the corresponding fishing mortality rate was 1.0 with a corresponding 2003 OY of 551,000 t (Table 4. Rebuilding under this strategy took 7.7 years and was roughly twice as long as the F (F=0.41) implemented to achieve a 70% probability of recovery. Under the later strategy, median time to rebuild was only 4.2 years with a 2003 OY of 277,000t. Thus, the general trend is that if higher probabilities to recover to the target within 10 years are required then more conservative harvest policies need to be implement, producing shorter rebuilding times and lower 2003 OYs. It should be noted that the probability of overfishing once the target has been reached increases with rebuilding strategies corresponding to higher rebuilding probabilities. This is because the shorter time it takes to rebuild to the target (lower Fs) the higher the likelihood the stock will become depleted again within the time remaining 10 year rebuilding time frame.

Although each of the rebuilding strategies were technically able to meet the specified "rebuilding" criterion in 10 years or less further examination of the trajectories of spawning biomass / target biomass ratios show that each of these are not equivalent with regards to risk to the stock. These risks are shown as the degree to which the spawning biomass / target biomass trajectory for each rebuilding strategy falls below a value of unity (biomass/target=823,000 t). Thus, any individual year within a given strategy's trajectory which falls below a value of 0.63 is below the overfished criterion (25%B0). For instance, the strategy having a 50% probability of rebuilding within 10 years shows a biomass/target ratio of less than 0.5 (~400,000 t) in the short term (Figure3). Since these are medians from 1000 simulations, this means that under this strategy there is greater than 50% chance that the stock will become overfished again. Under more conservative rebuilding strategies, such as the F corresponding to a 70% probability of recovery, the stock incurs relatively less risk of becoming overfished again in the short term. Figure 4 provides a more detailed examination of the spawning biomass / target biomass ratio trajectories showing the 5th, 25th, 50th, 75th, and 95th percentiles of the simulated realizations for the 50%, 60%, 70% and 80% probability strategies (detailed output for the 40:10 shown in Figure 3). It should be noted that each strategy converges to approximately the same spawning biomass / target biomass ratio over the long term. However, the fact that these trajectories stabilize at a ratio of less than 1.0 suggests that the biomass / target ratio distributions are extremely skewed owing most like to the fact that the underlying sampling distribution of recruitment is very skewed (Figure 4).

Outcomes from the rebuilding analysis also differ depending on the target SPR rates (F_{MSY} proxy) chosen. In the short term, moving from an F40% to F45% or F50% results in lower 2003 yields while the probability of rebuilding increases from 81.5% to 87.8% (Table 4). An interesting result to note is that risks of overfishing after the stock has been rebuilt decreases with a higher target SPR rate; F40%=32%, F45%=19.8%, and F50%=12.5% (Table 4). This feature is illustrated by the spawning biomass / target biomass trajectories (Figure 3a-3c). Here the spawning biomass / target biomass ratio converges to nearly the same value for all rebuilding strategies but depending on the SPR target rates (F_{MSY} proxy) the magnitude approaches the biomass target as the F_{MSY} proxy changes from F40% to F50% (Figure 3a-3c).

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Table 1. Historical time series of estimated biomass, recruitment, and utilization for 1972-2001 (Helser et al. 2002). Total exploitation rate is the catch in biomass divided by the total biomass of age 3+ fish at the start of the year. Population biomass is in millions of tons of age-3 and older fish at the start of the year. Recruitment is given in billions of age-2 fish.

Year	Population biomass (million t)	Female spawning biomass	Recruits (billion)	Total Catch (thousands t)	Total exploitation rate
1966	-	-	-	138	-
1967	-	-	-	214	-
1968	-	-	-	122	-
1969	-	-	-	180	-
1970	-	-	-	235	-
1971	-	-	-	155	-
1972	1.566	0.852	4.753	118	7.5%
1973	2.783	1.177	0.621	163	5.8%
1974	2.674	1.275	0.555	211	7.9%
1975	2.430	1.242	1.817	221	9.1%
1976	2.515	1.210	0.406	238	9.4%
1977	2.157	1.085	0.398	133	6.2%
1978	1.919	0.985	0.247	104	5.4%
1979	1.874	1.044	3.061	137	7.3%
1980	2.599	1.180	0.430	90	3.5%
1981	2.420	1.205	0.575	139	5.7%
1982	1.863	1.193	12.264	108	5.8%
1983	4.603	1.861	0.361	114	2.5%
1984	4.887	2.316	0.115	138	2.8%
1985	4.267	2.164	0.250	110	2.6%
1986	3.585	2.086	9.646	211	5.9%
1987	5.854	2.563	0.142	234	4.0%
1988	4.905	2.418	0.439	251	5.1%
1989	4.139	2.192	2.712	311	7.5%
1990	4.036	2.005	1.307	260	6.5%
1991	3.872	1.944	0.246	322	8.3%
1992	2.989	1.581	1.741	295	9.9%
1993	2.723	1.369	0.705	200	7.3%
1994	2.310	1.178	0.238	359	15.5%
1995	1.710	0.927	1.662	248	14.5%
1996	1.664	0.831	1.587	301	18.1%
1997	1.732	0.826	0.724	324	18.7%
1998	1.451	0.714	0.703	320	22.0%
1999	1.139	0.561	0.392	311	27.3%
2000	0.958	0.482	0.316	231	24.1%
2001	0.712	0.415	2.796	236	33.1%
Avg. 1972-98	2.744	1.363	1.707	208	10.31%

Table 2. Biological parameters used for Pacific whiting rebuilding analysis. Weights and fishery selectivities at each age shown were calculated as the catch (in numbers) weighted year and age specific weights and selectivity from the U.S. and Canadian fisheries (See Helser et al. 2002). Spawning output is the product of average weight, percent mature and the female multiplier

Age	Ave. fishery weight (kg)	Percent Mature	Female Multiplier	Spawning Output	Natural Mortality	Fishery Selectivity	2001 Age Composition (millions)
2	0.288	0.176	0.510	0.026	0.230	0.105	2796
3	0.407	0.661	0.511	0.137	0.230	0.473	238
4	0.491	0.890	0.510	0.223	0.230	0.756	145
5	0.563	0.969	0.512	0.279	0.230	0.881	175
6	0.612	0.986	0.522	0.315	0.230	0.930	110
7	0.654	0.996	0.525	0.342	0.230	0.979	131
8	0.691	1.000	0.535	0.370	0.230	1.000	101
9	0.726	1.000	0.543	0.394	0.230	0.992	10
10	0.756	1.000	0.547	0.414	0.230	0.967	19
11	0.810	1.000	0.569	0.461	0.230	0.919	27
12	0.846	1.000	0.568	0.480	0.230	0.856	2
13	0.911	1.000	0.572	0.521	0.230	0.783	9
14	0.919	1.000	0.581	0.533	0.230	0.580	14
15	0.949	1.000	0.589	0.559	0.230	0.230	84

Table 3. Outputs generated from rebuilding analysis determining maximum rebuild time, minimum rebuilding time and other reference points for different target SPR rates.

Outputs	Target SPR Rate (MSY Proxy) F40%	F45%	F50%
FMSY proxy	0.353	0.283	0.229
FMSY SPR / SPR(F=0)	0.400	0.450	0.500
Virgin SPR	1.205	1.205	1.205
Generation time	8	8	8
Minimum Rebuild Time	3	3	3
Maximum Rebuild Time	9	9	9
Selected rebuild time	9	9	9
Year for rebuild	2012	2012	2012
Virgin Spawning Output	2058	2058	2058
Target Spawning Output	823	926	1029
Current Spawning Output	387	387	387

Table 4. Estimates of fishing mortality, optimal yield, probability of recovery and median time to rebuild for five rebuilding strategies and applying F40%, F45% and F50% targets.

F40% Target SPR (MSY Proxy)

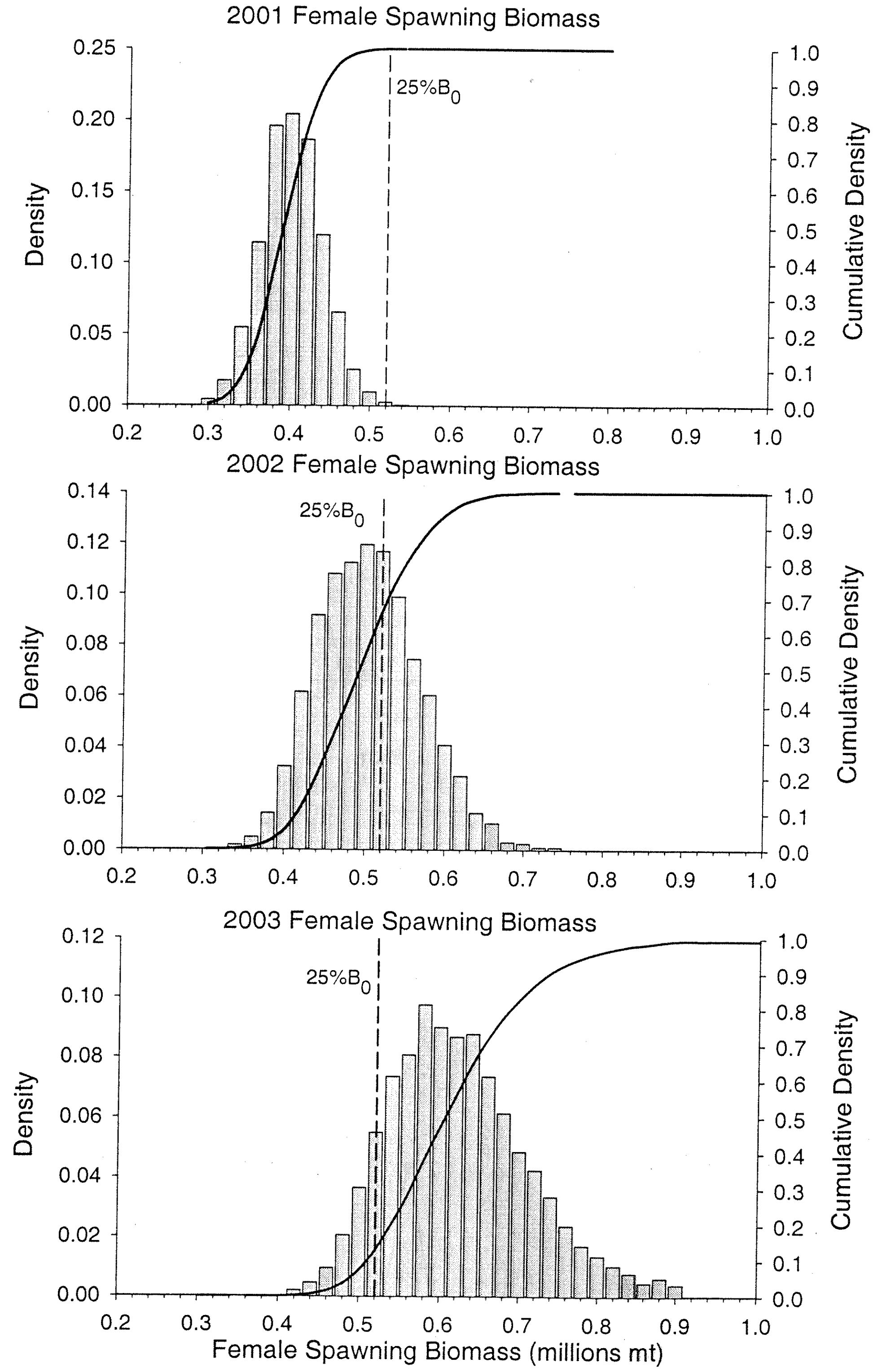
Quantity	50%	60%	70%	80%	F = 0	40:10 Rule
Fishing rate	1	0.675	0.4094	0.2562	0	0
OY	550.8	414.6	277.1	182.9	0	151.3
Prob to rebuild by Tmax	54.7	60	70	80	97.5	81.6
Median time to rebuild	7.7	5.9	4.2	3	1.5	2.9
Prob overfished after rebuild	23	24.8	29.1	31.9	0.5	31.9

F45% Target SPR (MSY Proxy)

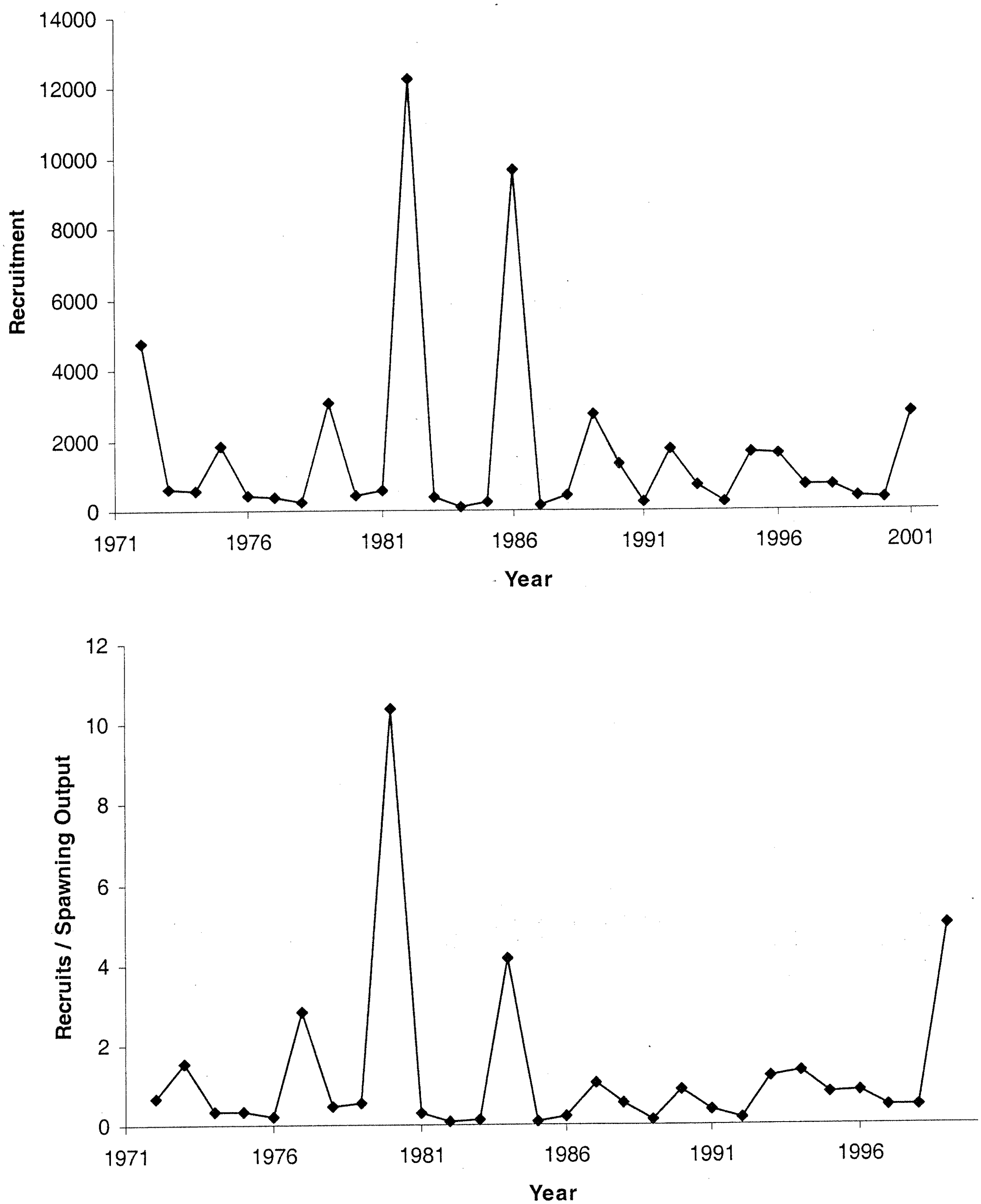
Quantity	50%	60%	70%	80%	F = 0	40:10 Rule
Fishing rate	1	0.675	0.4094	0.2562	0	0
OY	548.4	411.1	274.9	182.9	0	122.8
Prob to rebuild by Tmax	54.7	60	70	80	97.5	84.4
Median time to rebuild	7.7	5.9	4.2	3	1.5	2.7
Prob overfished after rebuild	12.4	13.5	16.9	19.7	0.5	19.8

F50% Target SPR (MSY Proxy)

Quantity	50%	60%	70%	80%	F = 0	40:10 Rule
Fishing rate	1	0.675	0.4094	0.2562	0	0
OY	542.3	411.1	273.5	182.5	0	100.7
Prob to rebuild by Tmax	54.7	60	70	80	97.5	87.8
Median time to rebuild	7.7	5.9	4.2	3	1.5	2.4
Prob overfished after rebuild	6.8	7.8	11	12	0.5	12.5



Fgure 1. Estimates of female spawning biomass of Pacific whiting in 2001, 2002, and 2003. Empirical distributions were derived from 1,000,000 Markov Chain Monte Carlo simulations (source: Helser et al. 2002).



Fgure 2. Time series of recruitment and recruits per spawning output used in Pacific whiting rebuilding analysis. Recruitment at age-2 in millions from Helser et al. 2002.

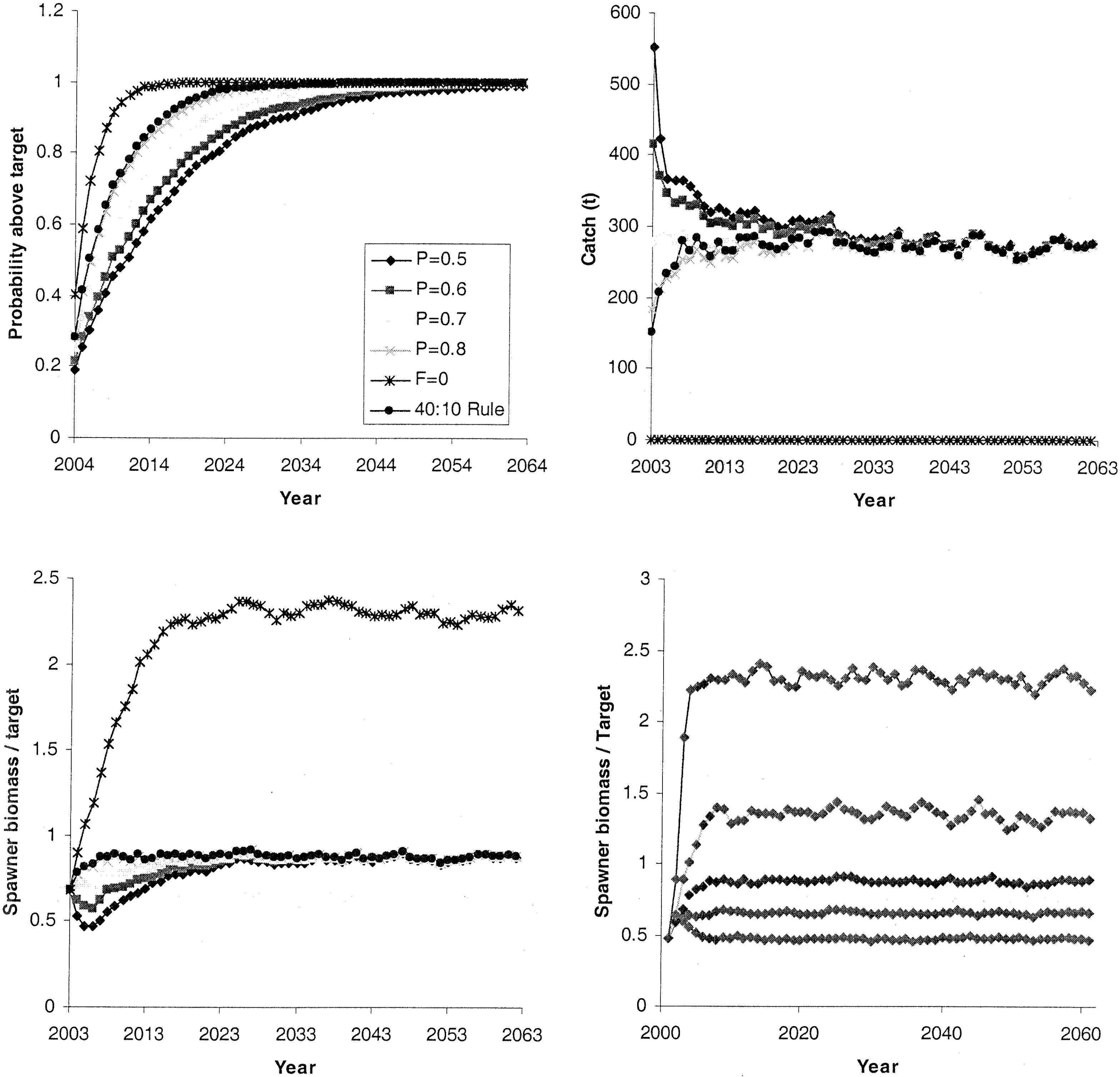


Figure 3a. Times series of probability above spawning biomass target, catch and spawning biomass to target biomass ratio for each rebuilding strategy under the F40% target SPR ratio (FMSY proxy). Lower right panel shows detailed output for the 40:10 rule.

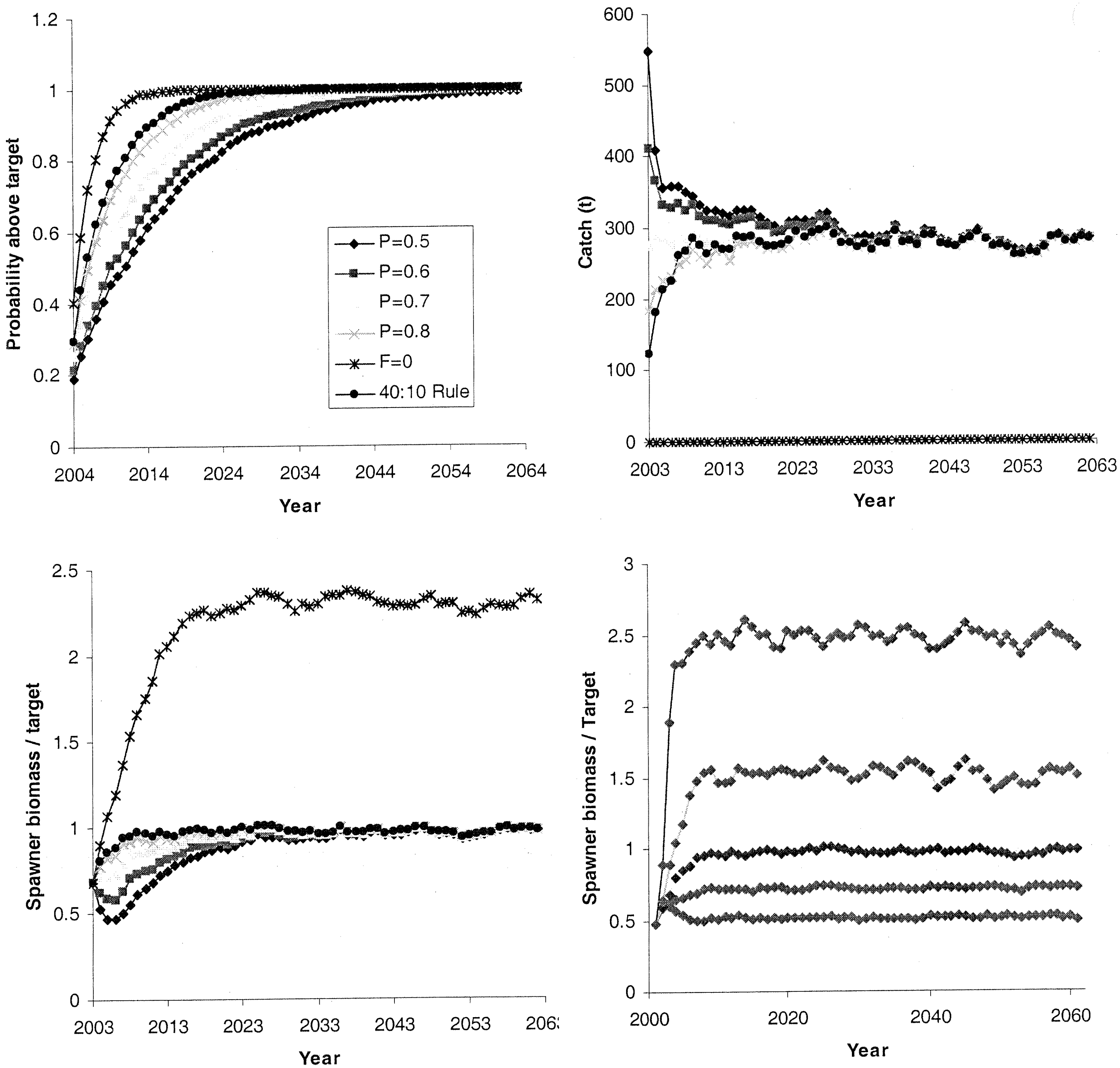


Figure 3b. Times series of probability above spawning biomass target, catch and spawning biomass to target biomass ratio for each rebuilding strategy under the F45% target SPR ratio (FMSY proxy). Lower right panel shows detailed output for the 40:10 rule.

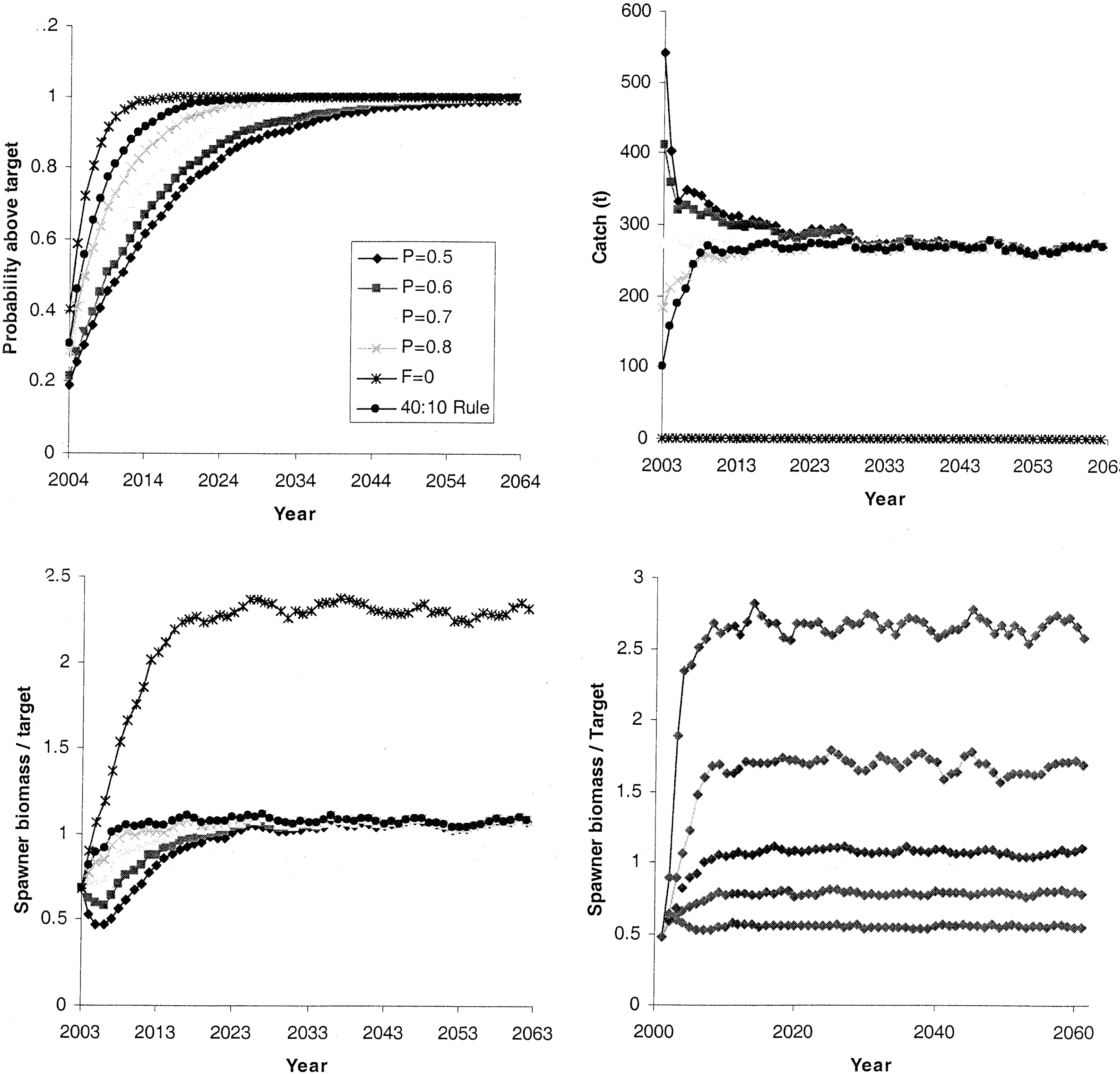


Figure 3c. Times series of probability above spawning biomass target, catch and spawning biomass to target biomass ratio for each rebuilding strategy under the F45% target SPR ratio (FMSY proxy). Lower right panel shows detailed output for the 40:10 rule.

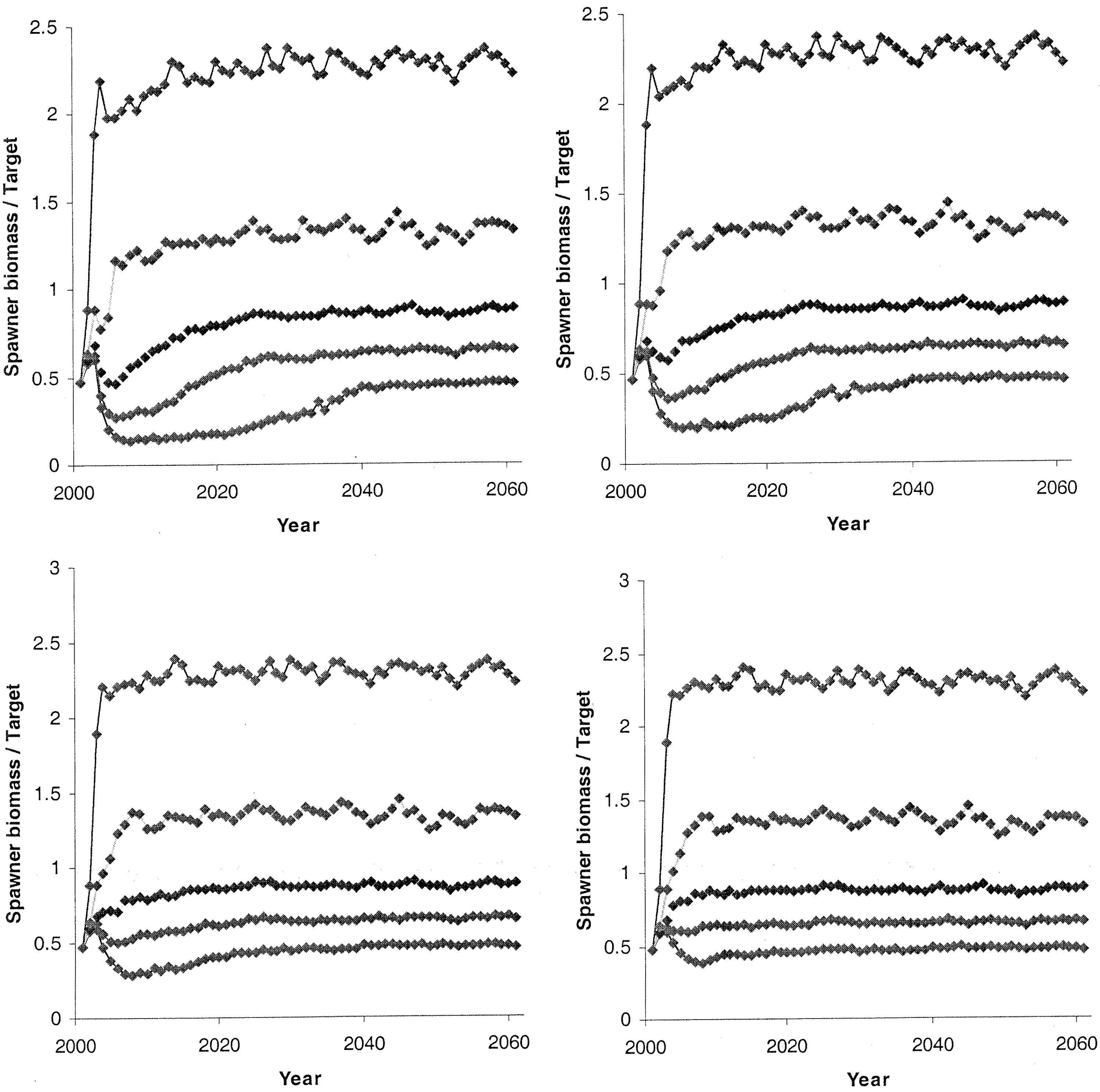


Figure 4. Detailed output from rebuilding program showing times series of spawning biomass to target ratios for the 50% probability (upper left), 60% probability (upper right), 70% probability (lower left) and 80% probability (lower right) rebuilding strategies. Detailed out for the 40:10 are shown in figure 3.

SSC DEFAULT REBUILDING ANALYSIS

Technical specifications and User Manual

Version 2.0
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TECHNICAL OVERVIEW

1. INTRODUCTION

The rebuilding analysis software performs the calculations developed by the Scientific and Statistical Committee of the Pacific Fishery Management Council (ref). The key steps in this process are:

a) Determine the maximum allowable rebuilding period (if this is not pre-specified by the user).
b) Determine the (generally constant) level of fishing mortality (or catch) that satisfies specifications regarding the probability of recovery within the maximum allowable rebuilding period.
c) Display various output statistics.

The modifications made to the software with each update are listed in Appendix A.

1.1 BASIC DYNAMICS

1.1.1 Dynamics equations

The dynamics of the population are modeled using an age- and sex-structured population dynamics model. The basic dynamics model depends on whether or not the oldest age (age $a_{\max}$) is treated as a plus-group (Equations 1a and 1b respectively):

$$N^s_{y,a} = \begin{cases} 0.5R_y & \text{if } a = a_{\min} \\ N^s_{y-1,a-1}\, e^{-Z^s_{y-1,a-1}} & \text{if } a_{\min} < a < a_{\max} \\ N^s_{y-1,a_{\max}-1}\, e^{-Z^s_{y-1,a_{\max}-1}} + N^s_{y-1,a_{\max}}\, e^{-Z^s_{y-1,a_{\max}}} & \text{if } a = a_{\max} \end{cases} \tag{1a}$$

$$N^s_{y,a} = \begin{cases} 0.5R_y & \text{if } a = a_{\min} \\ N^s_{y-1,a-1}\, e^{-Z^s_{y-1,a-1}} & \text{if } a_{\min} < a \end{cases} \tag{1b}$$

where $N^s_{y,a}$ is the number of animals of sex s (male m and female f) and age a at the start of year y,

$Z^s_{y,a}$ is the total mortality on animals of sex s and age a during year y:

$$Z^s_{y,a} = M^s_a + S^s_a F_y \tag{2}$$

M^s_a is the instantaneous rate of natural mortality on animals of sex s and age a,

S^s_a is the selectivity for animals of sex s and age a,

F_y is the fully-selected (i.e. $S^s_a \rightarrow 1$) fishing mortality during year y,

R_y is the recruitment (both sexes) during year y, and

$a_{\min}$ is the lowest age-class considered in the model.

1.1.2 Initial conditions

The numbers-at-age at the start of the first year of the rebuilding period (defined here as the period for which OY estimates are needed – in principle, the resource may already have a rebuilding plan and there may be a need to modify it based on new information), y_{start}, may differ from those at the start of the last year of the assessment, y_{init}. The numbers-at-age at the start of year y_{start} are obtained by projecting from the start of year y_{init} (for which the numbers-at-age are available from the assessment) to the start of year y_{start}. This projection involves removing the known catches for the years y_{init} to $y_{\text{start}}-1$.

1.1.3 Recruitment

Three options are available for generating future recruitment: random recruitment, random recruits per spawner, and the use of a stock-recruitment relationship. The first option involves selecting a recruitment at random from those for a pre-specified set of historical years and setting the recruitment for year *y* equal to that recruitment. The second option involves selecting a recruitment, R_{y*}, at random from those for a pre-specified set of historical years, calculating the recruits per spawner for that year, i.e. $\tilde{R}_{y*} = R_{y*} / SB_{y*-a_{\min}}$ where SB_y is the spawning output at the start of year *y*. The recruitment for year *y* is then $\tilde{R}_{y*}\,SB_y$. SB_y is defined by the equation:

$$SB_y = \sum_{a=a_{mat}}^{a_{\max}} \phi_a N^f_{y,a} \tag{3}$$

where ϕ_a is fecundity as a function of age, and

a_{mat} is the minimum age-at-maturity (the greater of $a_{\min}$ and 1 – animals of age 0 cannot be mature).

The final option (stock-recruitment relationship) involves generating future recruitment using either a Beverton-Holt (Equation 4a) or a Ricker (Equation 4b) relationship:

$$R_y = \frac{SB_{y-a_{\min}}}{\alpha + \beta\, SB_{y-a_{\min}}} e^{\varepsilon_y - \sigma_r^2/2} \qquad \varepsilon_y \sim N(0;\sigma_r^2) \tag{4a}$$

$$R_y = \alpha\, SB_{y-a_{\min}}\, e^{-\beta\, SB_{y-a_{\min}}} e^{\varepsilon_y - \sigma_r^2/2} \qquad \varepsilon_y \sim N(0;\sigma_r^2) \tag{4b}$$

where α, β are the parameters of the stock-recruitment relationship (determined from the virgin recruitment and the "steepness" of the stock-recruitment relationship), and

σ_r is the standard deviation of the logarithm of the multiplicative fluctuations in recruitment.

The software includes the feature to replace the random selection process by a process in which the recruitment (or recruits per spawner) used to generate future recruitment is pre-specified.

1.1.4 Determining annual fishing mortality

The annual fishing mortality, F_y, is either pre-specified (i.e. $F_y = F_{\text{ref}}$), determined from a "transitional" policy, or determined by solving the catch equation:

$$C_y = \sum_s \sum_{a=a_{\min}}^{a_{\max}} \frac{w_a^s N_{y,a}^s S_{y,a}^s F_y}{Z_{y,a}^s}(1-e^{-Z_{y,a}^s}) \tag{5}$$

where w_a^s is the weight of an animal of sex s and age a.

Three "transitional" policies are available. All of these depend on there being a "target" fishing mortality, F_{targ}, which can be considered to be a proxy for F_{MSY} and which is defined as the fishing mortality that reduces spawning-output-per-recruit to a pre-specified (x) percentage of its virgin level, i.e.:

$$\sum_{a=a_{mat}}^{a_{\text{last}}} \phi_a e^{-\sum_{a'=a_{\min}}^{a-1}(M_{a'}^f + S_a^f F_{\text{targ}})} = x \sum_{a=a_{mat}}^{a_{\text{last}}} \phi_a e^{-\sum_{a'=a_{\min}}^{a-1} M_{a'}^f} \tag{6}$$

where a_{last} is $5a_{\max}$ when the analysis incorporates a plus-group and $a_{\max}$ when it does not.

Restricting the summation to $5a_{\max}$ in Equation (6) will mean that the virgin spawning output will be under-estimated slightly. However, the magnitude of this will be negligible if $a_{\max}$ or M are reasonably high.

The four "transitional" policies are defined as follows (see also Figure 1):

- Change the level of fishing mortality to F_{targ} if the spawning output exceeds the target for rebuilding of 40% of the (expected) virgin spawning output (i.e. $0.4B_0$), i.e.:

$$F_y = \begin{cases} F_{ref} & \text{if } SB_y < 0.4B_0 \\ F_{\text{targ}} & \text{otherwise} \end{cases} \tag{7a}$$

- Modify the fishing mortality smoothly as the spawning output approaches $0.4B_0$:

$$F_y = \begin{cases} (1-\Omega_y)F_{\text{ref}} + \Omega_y\,\theta\,F_{\text{targ}} & \text{if } SB_y < 0.4B_0 \\ F_{\text{targ}} & \text{otherwise} \end{cases} \tag{7b}$$

θ is the factor by which the target fishing mortality is reduced when the spawning output is less than $0.4B_0$ to ensure that recovery to $0.4B_0$ does occur,

Ω_y is a weighting factor designed to mimic some of the intension of the 40:10 rule:

$$\Omega_y = \begin{cases} 0 & \text{if } SB_y \le 0.1\,B_0 \\ \left(\dfrac{SB_y / B_0 - 0.1}{0.3}\right)^{\chi} & \text{if } 0.1B_0 < SB_y < 0.4\,B_0 \\ 1 & \text{if } 0.4\,B_0 \le SB_y \end{cases} \tag{8}$$

χ is the power of the relationship.

- Base the fishing mortality rate on the 40:10 rule (i.e. Equation 8 with $\chi = 1$) once the spawning output has recovered to $0.4B_0$, i.e. the fishing mortality rate is F_{targ} from the beginning of rebuilding period until the spawning output first reaches $0.4B_0$ after which it is determined using the 40:10 rule.

- Modify the fishing mortality in a piecewise linear fashion as the spawning output approaches $0.4B_0$:

$$F_y = \begin{cases} \varphi\,F_{ref} & \text{if } SB_y \le B_{\text{trans}} B_0 \\ \theta F_{\text{targ}} + \dfrac{(\varphi\,F_{ref} - \theta\,F_{\text{targ}})(0.4 - SB_y / B_0)}{0.4 - B_{\text{trans}}} & \text{if } B_{\text{trans}} B_0 < SB_y < 0.4\,B_0 \\ F_{\text{targ}} & \text{if } 0.4\,B_0 \le SB_y \end{cases} \tag{7c}$$

φ is the fraction of the reference fishing mortality that is "set aside" to balance the increase in fishing mortality as the spawning output approaches $0.4B_0$, and

B_{trans} is the fraction of B_0 at which fishing mortality increases from its reference value; the value of B_{trans} can be solved for numerically given a value for F_{ref}, and a desired probability of recovery.

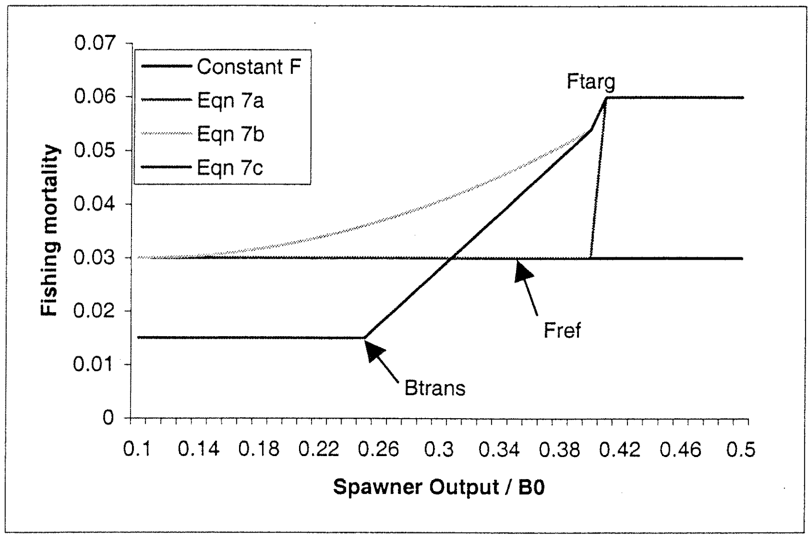

Figure 1 : Examples of policies that modify fishing mortality as the resource approaches $0.4B_0$.

Results are also shown for management based on the 40:10 rule used to manage stocks that are not overfished. This rule sets the fishing mortality for year y using the formula:

$$F_y = \begin{cases} 0 & \text{if } SB_y \leq 0.1B_0 \\ F_{\text{targ}}\left(\dfrac{SB_y / B_0 - 0.1}{0.3}\right) & \text{if } 0.1B_0 < SB_y < 0.4B_0 \\ F_{\text{targ}} & \text{if } 0.4B_0 \leq SB_y \end{cases} \tag{9}$$

1.2 DETERMINING THE MAXIMUM ALLOWABLE REBUILD PERIOD

The maximum allowable rebuild period, $T_{\max}$, can either be specified by the user or computed based on the guidelines in National Standard 1. If computed internally by the software, $T_{\max}$ is defined as 10 years if the population can be rebuilt (in the absence of catches) in less than 10 years from the time that it was declared to be overfished, or the time to rebuild in the absence of catches plus one generation if the population cannot be rebuilt within ten years. It is unclear how and whether the year by which rebuilding is to occur is updated based on new data. Uncertainty is incorporated in the definition of the maximum allowable rebuild period by accounting for variability in future recruitment and by defining the rebuild period in terms of the time for there to be at least a 0.5 probability that the spawning output exceeds the target level of $0.4B_0$, i.e.:

$$T_{\max} = \begin{cases} 10 + y_{\text{decl}} - y_{\text{start}} & \text{if } \Pr\text{ob}(SB_{10+y_{\text{decl}}} > 0.4B_0) \geq 0.5 \\ T_G + T_0 + y_{\text{decl}} - y_{\text{start}} & \text{otherwise} \end{cases} \tag{10}$$

where T_G is the generation time,

T_0	is the median of the (Monte Carlo) distribution for the lowest year, *y*, such that $\Pr ob(SB_{y+y_{\text{start}}} > 0.4B_0) \geq 0.5$ for $F_y = 0$ for $y \geq y_{\text{start}}$,
y_{decl}	is the year in which the population was declared to be overfished, and
y_{start}	is the first year of the projection period (i.e. one year beyond the last year for which catches are available).

The (expected) virgin spawning output, B_0, is defined using the equation:

$$B_0 = 0.5 R_0 \sum_{a=a_{mat}}^{a_{\text{last}}} \phi_a e^{-\sum_{a'=a_{\min}}^{a-1} M^f_{a'}} \tag{11}$$

where R_0 is the virgin recruitment (defined as the arithmetic average of the recruitments for a pre-specified period). The value of T_0 is determined by projecting the population in the absence of catches (i.e. $F_y = 0$ in Equation 1) and determining the first year in which the constraint $\Pr ob(SB_{y+y_{\text{start}}} > 0.4B_0) \geq 0.5$ is satisfied. The generation time, T_G, is defined using the equation:

$$T_G = Round\left(\sum_{a=a_{mat}}^{a_{last}} a \phi_a e^{-\sum_{a'=a_{\min}}^{a-1} M^f_{a'}} \Big/ \sum_{a=a_{mat}}^{a_{last}} \phi_a e^{-\sum_{a'=a_{\min}}^{a-1} M^f_{a'}} \right) \tag{12}$$

If the value for $T_{\max}$ is pre-specified rather than being determined by the algorithm described above, it should be noted that $T_{\max}$ is the number of years beyond the last year for which catches are pre-specified, y_{start} (i.e. the number of years for which the rebuilding fishing mortality (or catch) applies). It is NOT the number of years after year y_{init} or year y_{decl}. The software reports the year in which rebuilding will occur *inter alia* to assist the user to check that $T_{\max}$ has been correctly specified.

1.3 DETERMINING THE REBUILDING STRATEGY

The reference level of fishing mortality (or of constant catch) is selected to satisfy the equation:

$$z = \text{Prob}(SB_{T_{\max}+y_{\text{start}}} > 0.4\, B_0) \tag{13}$$

Two alternative definitions for $\text{Prob}(SB_y > X)$ are considered:

- The probability that the spawning output at the start of year *y* exceeds *X*, or
- The probability that the spawning output exceeded *X* any year from year y_{start} to year *y*.

The second definition is clearly less conservative than the first. However, it is designed to consider as "rebuilt" cases in which the population recovers to $0.4B_0$ and then subsequently drops below this level. This should be expected to occur if recruitment is highly variable or if a "transition" policy that is designed to stabilize the resource at $0.4B_0$ is examined.

1.5 OUTPUT STATISTICS

The key outputs from a rebuilding analysis are the 5th, 25th, 50th, 75th and 95th percentiles for the distributions for each future year of the catch (Equation 5), spawning output (Equation 3) expressed as a fraction of $0.4\,B_0$, recruitment, fishing mortality, exploitable biomass, and cumulative (discounted) catch for a pre-specified probability of recovery within the maximum allowable rebuilding period (this probability is generally 0.6). The exploitable biomass, B_t^e, and cumulative catch, $\tilde{C}_y$, are defined as:

$$B_y^e = \sum_s \sum_{a=a_{\min}}^{a_{\max}} w_a^s\, S_a^s\, N_{y,a}^s\, e^{-Z_{y,a}^s/2} \tag{14a}$$

$$\tilde{C}_y = \sum_{y=y_{\text{start}}}^{y} C_y\, e^{-\delta(y-y_{\text{start}})} \tag{14b}$$

where δ is the economic discount rate.

In addition to the key outputs, the software also outputs a histogram of the long-term biomass in the absence of fishing (i.e. the B_0 distribution – the B_0 on which the rebuilding analysis is based is the mean of this distribution), the histogram of the time to rebuild (from year y_{start}) in the absence of catches (T_0 is the median of this distribution), and the time-trajectory of the probability of being above the target level for a variety of alternative rebuilding strategies (i.e. alternative choices for z in Equation 13).

The implications of alternative rebuilding periods are explored through a series of plots which plot the year in which the probability is 0.5 of being at or above $0.4B_0$ against the probability of being at or above $0.4B_0$ in year $T_{\max} + y_{\text{start}}$ and by plotting these two quantities against the OY for year y_{start}.

The default harvesting strategy for many west coast species involves assuming that the fishing mortality at which the spawning-output-per-recruit is 40-50% of that in a virgin state, $F_{x\%}$ - where x is the percentage is 40-50% - is a proxy for F_{MSY}. The validity of this assumption has been questioned for some species (e.g. MacCall and Punt, 2001). The software produces estimates of mean and median replacement yield fishing mortality, F_{rep} (the fishing mortalities at which the recruits per spawner equals the mean recruits per spawner and the median recruits per spawner respectively). A check should be made to assess whether these F_{rep} values are substantially lower than $F_{x\%}$, as this may indicate that $F_{40\%}$ is a too aggressive harvest strategy. Note that care needs to be taken when interpreting F_{rep} because its expectation depends on the exploitation history of the stock. For example, F_{rep} should be close to 0 if its estimation is based on recruitment and spawning output data for the earliest years of exploitation (Jakobsen, 1993).

USER' S GUIDE

1. INTRODUCTION

The software consists of two program: a program (REBUILD.EXE), written in FORTRAN and that runs in DOS, that conducts the bulk of the calculations and a spreadsheet SUMMARY.XLS that includes macros that take the output from REBUILD.EXE and produce the summary tables and graphs required by the Scientific and Statistical Committee. The input files for REBUILD.EXE should be included in documentation supplied with a rebuilding analysis.

2. REBUILD

The program REBUILD.EXE implements the bulk of the calculations required to conduct a rebuilding analysis. It takes as input a file called REBUILD.DAT and produces a file called RES.CSV. The RES.CSV file is the input to the spreadsheet SUMMARY.XLS. Therefore, to use REBUILD.EXE, it is necessary to fill in the file REBUILD.DAT (see Appendix B for an example).

Warnings:

1. The program REBUILD.EXE expects (with the few exceptions noted below) input in all of the fields in the file REBUILD.DAT, even if the actual application will not be using all of the inputs. Lines in REBUILD.DAT that start with the hash (#) symbol are comments – these are ignored when the program is run. However, the location of these comments is hard-wired in the program and should not be added to or deleted. Doing so will result in the program failing to operate correctly.
2. Problems have been encountered running REBUILD.EXE on Windows NT machines. It is recommended that this program be run on machines installed with Windows 98 and Windows 2000.

2.1 REBUILD.DAT

This section lists each of the sections in REBUILD.DAT and what needs to be provided for each section.

a) Title – enter a title (up to 80 characters) – this title is displayed on the summary spreadsheet.
b) "Number of sexes": Enter "1" or "2" here.
c) "Age range to consider": Enter the lowest and greatest age to be considered in the rebuilding analysis ($a_{\min}$ and $a_{\max}$). The recruitment estimates must apply to age $a_{\min}$, and age $a_{\max}$ may be a plus-group.
d) "First year of the projection": This is the year from which the projection starts (year y_{init}). It will usually be the last year of the assessment.
e) "Year declared overfished": This is the year (y_{decl}) in which the population was declared overfished (see Section 1.2 for a description of how y_{decl} is related to the maximum allowable rebuild period, $T_{\max}$).

f) "Is the maximum age a plus group?": Enter "1" if age a_{max} is to be treated as a plus-group and "2" if all animals are assumed to die at age a_{max}.

g) "Generate future recruitments": Enter "1" to generate future recruitments using historical information on recruitment, "2" to generate future recruitments using historical information on recruits per spawner, "3" to generate future recruitment using a Beverton-Holt stock-recruitment relationship or "4" to generate future recruitment using a Ricker stock-recruitment relationship (see Section 1.1.3 of the technical description). The SSC default option is "2".

h) "Constant fishing mortality or constant catch": Enter "1" for the projections to be based on a constant level of fishing mortality or "2" for the projections to be based on a constant catch. The constant fishing mortality may be modified to change over time as the population approaches the target level (see input v) below and Section 1.1.4 of the technical description).

i) "Pre-specify the year of recovery". Enter "-1" here if Equation (10) is to be used to calculate the maximum allowable rebuild period, T_{max}. If T_{max} is not to be calculated using Equation (10), for instance because the value for T_{max} was set based on an earlier rebuilding analysis, the number of years beyond year y_{start} in which recovery is to be achieved should be provided here.

j) "Fecundity-at-age": Enter the relative spawning output for each age. The fecundity-at-age should be the same as was used in the assessment and may be weight-at-age, percentage maturity-at-age multiplied by the age-specific number of eggs per mature female, or some other appropriate measure of spawning output depending on what was assumed in the assessment.

k) For each sex (females then males), enter natural mortality-at-age (yr^{-1}), weight-at-age, selectivity-at-age, and the number of animals of each age at the start of year y_{init}. Note that if the number of sexes is 1, input should be provided for females and males combined. The weight-at-age provided here should be the weight-at-age in the catch – this is often the weight-at-age in the middle of the year.

l) "Initial age-structure (for Tmin)": For each sex (females then males), enter number of animals of each age at the start of the year in which the rebuilding plan first has an impact on the OY. In general, this year should be year in which the species / stock was declared overfished. However, it will be a year before y_{decl} if an assessment has not taken place since y_{decl}.

m) "Year for Tmin age-structure": Enter the year to which the previous input relates. This input should either be y_{decl} or y_{init} depending on whether an assessment has occurred since y_{decl} or not. An error message is produced is this is not the case.

n) "Number of simulations": Enter the number of simulations to conduct. It is recommended that 100 be selected for preliminary (explorative) analyses but that the final calculations be based on at least 1,000 simulations. The maximum permissible number of simulations is 10,000. Ideally, the number of simulations should be such that increasing this number does not improve the "smoothness" of the plots but also see input dd).

o) "Number of historical assessment years": Enter the number of years included in the original assessment and on which B_0 and future recruitment may be based.

p) "Historical data": Enter, for each year included in the original assessment, the year, recruitment, spawning output, whether the recruitment should be included in the calculation of B_0, whether the recruitment should be included in the determination of future recruitment if future recruitment is generated by sampling from past recruitments, and whether the recruits per spawner ratio should be included in the determination of future recruitment if future recruitment is to be generated by sampling from past recruits per spawner. A "yes" is indicated by a "1" for the last three questions. Note that entering a "1" in the recruits per spawner column indicates that the recruitment for the year concerned is included in the projections; the recruits per spawner ratio for year y is determined by dividing the recruitment for year y by the spawning output for year y-a_{min}. An error message is produced if the spawning output for the last year differs by more than 0.01% from the spawner output obtained by multiplying the initial age-structure by the fecundity-at-age. The last year of the series should be the first year of the projection period (see input d); if this is not the case an error message is output.

q) "Number of years with pre-specified catch": In many cases, the first year in which the rebuilding strategy will be applied, y_{start}, is several years beyond the last year of the assessment, y_{init}. Catches for the years between the last year of the assessment and the first year of the rebuilding program should either be known or assumed equal to the OY (for the current year). Enter here the number of years between the last year of the assessment and the first year in which the rebuilding strategy will be applied.

r) "Catches for years with pre-specified catches": Enter, for each year between the last year of the assessment and the first year of the rebuilding program, the observed catch (the catch for the current year will not be known and should be assumed equal to the OY).

s) "Number of future recruitments to override": For some rebuilding analyses, it may be desirable to pre-specify the strengths of some of the future (i.e. beyond year y_{init}) recruitments (because of the known impact of El Nino, for example). Enter here, the number of future recruitments that will be pre-specified.

t) "Process for overriding": Enter, for each year for which recruitments are to be overridden, the year (which is actually ignored by the program) and a code for how the recruitment is to be overridden. Current codes are: "-1" – replace the recruitment by its expected value, "0" – generate it as usual (the option is helpful if a recruitment for a year well into the future is to be pre-specified but this is not the case for many of the years between the last year of the assessment and that year), and a positive number, x. The recruitment for the last case is then taken to be that for the xth historical year (i.e. x=1 implies that the recruitment should be replaced by that for the first year of the assessment).

u) "Which probability to produce detailed outputs for": Enter "1" to produce detailed results for a probability of recovery of 0.5, "2" for 0.6, "3" for 0.7, and "4" for 0.8. Entering "5" produces detailed results for the 'F=0' strategy and entering "6" produces detailed results for the 40:10 rule.

v) "Steepness and sigma-R": Enter the value for the steepness of the stock-recruitment relationship (defined as the fraction of virgin recruitment to be expected at 20% of B_0) and the coefficient of variation of future recruitment. The values entered here are only used if "3" or "4" was entered at input g).

w) "Target SPR rate": This line lists the target spawning-output-per-recruit (F_{targ}). Enter the F_{MSY} proxy spawning-output-per-recruit here (this is usually 0.5).

x) "Target SPR information": This line allows the target fishing mortality to change as the population approaches the target level (see Equation 7b of the technical description). The inputs on this line are "1" (if this option is to be included in the rebuilding analysis) and the value of χ (see Equation 8 in the technical description).

y) "Discount rate": Enter the value for the discount rate, δ, to be used when reporting cumulative catches.

z) "Truncate the series when 0.4B0 is reached": Enter "1" here if the graphs showing time-trajectories of spawning output, catch, recruitment, fishing mortality, exploitable biomass, and cumulative (discounted) catch are to truncated once the probability of being above $0.4B_0$ exceeds 0.5.

aa) "Set F to FMSY once 0.4B0 is reached". Enter "1" to over-ride the policy of constant fishery mortality by setting the fishing mortality equal to F_{targ} once the spawning output exceeds $0.4B_0$ (see Equation 7a of the technical description). Note that under this option if the spawning output drops below $0.4B_0$ having recovered to this level, the fishing mortality is based on F_{targ} until the spawning output again recovers to $0.4B_0$. Enter "2" to use the 40:10 rule to set the fishing mortality once the spawning output first reaches $0.4B_0$. Note that under this option F_{targ} is ignored once the spawning output recovers to $0.4B_0$.

bb) "Percentage of FMSY which defines Ftarget": Enter the value of θ (see inputs y) and aa).

cc) "Maximum possible F for projections". This option specifies the maximum fishing mortality rate during the rebuilding period. Set it to a negative number leads to the maximum fishing mortality rate during the projection period being set equal to the compute value of F_{MSY}.

dd) "Conduct MacCall transition policy": Enter "1" if the calculations required to contrast different "transition" policies based on Equation 7c of the technical description are to be conducted and reported.

ee) "Definition of recovery": Enter "1" to use the first option for defining recovery and "2" for the second option (see Section 1.3).

ff) "Produce the risk-reward plots": Enter "1" to produce the plots of the probability of recovery in year $T_{\max} + y_{\text{start}}$ against the year in which there is a 50% probability of recovery. It is advised that this option be ignored ("0" entered) until the final calculations are conducted because this option is computationally intensive.

gg) "Calculate coefficients of variation". Enter "1" to quantify the Monte Carlo uncertainty associated with the OYs for the first projection year by repeating the calculations for a variety of random number seeds.

hh) "Number of replicates to use", Enter the number of times the calculations should be repeated to quantify the extent of Monte Carlo uncertainty (at least 10 is recommended). The value entered here is ignored unless "1" was entered at input dd).

ii) "Random number seed". Enter a number between –1 and –99999.

3. SUMMARY.XLS

The summary tables and plots are produced using the spreadsheet SUMMARY.XLS. The process for producing these tables and plots is to use the spreadsheet SUMMARY.XLS to load the CSV file produced by REBUILD (by default this file is RES.CSV) into Excel. The macro "clear output" is used first. It takes the CSV file whose name is given in cell B4 from the directory given in cell B3 (if no input is provided, the file is RES.CSV in the current directory). The "clear output" macro clears the plots, deletes any existing tables, and copies the data from CSV file into the sheet "Data" of spreadsheet "SUMMARY.XLS". The CSV file is then closed. It is advised that the RES.CSV file be renamed to something meaningful to prevent input files getting confused. The macro "Basic graphs" is then run to produce the summary graphs and tables based on the information in CSV file.

3.1. SUMMARY TABLES

The summary tables are located in the sheets "Main", "TransPolicy", and "Monte Carlo":

- Cells B7:B13 of sheet "Main" summarize the specifications related to the number of simulations, the oldest age, the method used to generate future recruitment, whether the projections are based on constant fishing mortality or on constant catch, the assumed discount rate, and the option used to define "recovery", and the policy to apply once the spawning output recovery to $0.4B_0$. The three options for the latter policy are to: (a) continue basing management on the fishing mortality during the recovery period; (b) set F to F_{MSY} when the spawning output exceeds $0.4B_0$ and set it to the fishing mortality during the recovery period if the spawning output drops below $0.4B_0$; and (c) use the 40:10 rule.
- Cells B17:B27 of sheet "Main" list the value for F_{targ}, the ratio of the spawning-output-per-recruit at $F = F_{\text{targ}}$ to the virgin spawning-output-per-recruit, the virgin spawning-output-per-recruit, the minimum possible rebuild time, T_0, the estimated generation time (T_G - see Equation 12 of the technical description), the maximum allowable rebuild time ($T_{\max}$ - see Equation 10 of the technical description), the rebuild time on which the analyses are based (which may differ from $T_{\max}$ - see input i) above), the year in which rebuilding is to occur, B_0, the target for rebuilding ($0.4B_0$), and the spawning output at the start of year y_{init}.
- Cells B30:B36 summarize the basis on which $T_{\min}$ and $T_{\max}$ were calculated.
- Columns B and C of sheet "Main" starting at row 52 list the historical time sequence of recruitments. The values highlighted in yellow form the basis for calculating the virgin recruitment.
- Columns J to U of sheet "Main" list the values for fecundity-at-age, natural mortality-at-age, selectivity-at-age, weight-at-age, and numbers-at-age at the start of year y_{init}. These values are taken from the input file supplied to REBUILD.EXE (see inputs j) and k) above).

- Cells B45:E49 of sheet "Main" summarize the results for rebuilding strategies based on probabilities of recovery of 0.5 (column B), 0.6 (column C), 0.7 (column D), and 0.8 (column E). The results presented for each probability are the constant level of fishing mortality, F_{ref}, (for rebuilding analyses based on constant fishing mortality), the catch during year y_{start}, the probability of recovery (expressed as a percentage), the median number of years until there is a 0.5 probability that the spawning output exceeds $0.4B_0$, and the probability (expressed as a percentage) that once the population recovers to 0.4 B_0 it subsequently drops below $0.25B_0$ (the overfished level) before $T_{\max}$. Cells F45:F49 of this sheet report results for the zero-catch strategy while cells G45:G49 report results if the 40:10 rule is used to manage the resource (note that F_{MSY} proxy used for the 40:10 rule is F_{targ} - see input u).
- Cells C2:G6 of the sheet "TransPolicy" summarize the results of analyses based on the "transition" policy framework outlined by MacCall and Punt (2001) [see Equation 7c of the technical description]. Results are shown for values from 0.1 to 0.5 for the fraction of the constant F "set aside" (columns C to G respectively). The results for each fraction are the relative biomass at which fishing mortality begins to increase (B_{trans}), the OY for the first year of the projection period, the probability of recovery, and the number of years before the fishing mortality begins to increase under the "transition" policy. Results are shown in column B for a constant fishing mortality policy. Note that this table is only produced if "1" is entered at input aa).
- Row 4 of the sheet "MonteCarlo" lists the coefficients of variance (expressed as percentages) for the minimum possible rebuild time, T_0, the maximum allowable rebuild period, $T_{\max}$, and the OYs for the first projection year corresponding to probabilities of recovery by year $T_{\max} + y_{\text{start}}$ of 50%, 60%, 70% and 80%. Row 3 of this sheet summarizes the mean values (across replicates based on different random number seeds) for these six quantities. The raw information used when calculating the values in rows 3 and 4 is given starting in row 6.

3.2 SUMMARY PLOTS

The summary plots are located in the sheets "Plots" and "TransPolicy". All but one of the plots is located in the sheet "Plots":

- The top left plot shows net spawning output against age.
- The second plot on the first row of plots shows the distribution for B_0 – the value of B_0 used for rebuilding is the mean of this distribution.
- The third and fourth plots on the top line of plots show the recruitments and recruits per spawner used to generate future recruitment. If no recruitments are selected at input n) of REBUILD.DAT, the plot for recruitment is dropped. Similarly if no recruits per spawner are specified, the recruits per spawner plot is not displayed.
- The fifth plot on the top line of plots is historical recruitment plotted against the corresponding spawner output with the specified stock-recruitment relationship

(see input t) above) imposed. This plot is only produced if the rebuilding analysis is based on a stock-recruitment relationship.

- The last plot on the top line of plots is historical recruitment plotted against the corresponding spawner output with the relationships between recruitment and spawner output based on Fs of 0, the pre-specified F_{MSY}, and two estimates of F_{rep} (lines placed through the median and mean of the pre-specified recruits per spawner output data). This plot is only produced if the rebuilding analysis is based on selecting recruits per spawner output at random from the pre-specified set of recruits per spawner output.
- The leftmost plot on the second row of plots shows the distribution of the time that it takes to recover to $0.4B_0$. The "minimum possible rebuild time", T_0, is the median of this distribution.
- The next three plots on the second row of plots show the probability of being above the target level, the median catch and the median of the ratio of spawning output to $0.4B_0$ as a function of time for six rebuild strategies (probabilities of being above $0.4B_0$ in year $y_{\text{start}} + T_{\max}$ of 0.5, 0.6, 0.7 and 0.8, the strategy of zero fishing mortality from year y_{start}, and the results of the use of the 40:10 rule).
- The plots on the third and fourth lines show the 5th, 25th, 50th (indicated in red), 75th and 95th percentiles of the distributions for the time-trajectories of spawning output (expressed relative to the target level), catch, recruitment, fishing mortality, exploitable biomass, and cumulative catch. The rebuilding strategy for these plots is the strategy highlighted in cells B29:E32 of the sheet "Main". If "1" was entered at input x), the trajectories are truncated once the spawning output reaches $0.4B_0$.
- The third plot on the fourth line shows the ratio of the spawning out to the target level for the first five simulations for the rebuilding strategy highlighted in cell B29:E32. The horizontal line indicates the target level.
- The fourth plot on the fourth line shows the distribution of the time for each simulation to first reach the target level for the rebuilding strategy highlighted in cells B29:E32, along with the probability for each year that the spawning output exceeds the target level in the year concerned (yellow line) and the probability for each year that the spawning output reached (but may have again dropped below) the target level (pink line). The difference between the pink and yellow lines indicates the fraction of simulations in which the spawning output drops below the target level once it has been reached. The black line indicates $T_{\max}$ and the probability associated with the selected rebuilding strategy.
- The plots on the fifth line show the relationship between OY, the time to recover to $0.4B_0$ with 50% probability, the probability of recovering to $0.4B_0$ by year $T_{\max} + y_{\text{start}}$, and the fishing mortality in the first year of the projection period. These plots are only produced if "1" is entered at input cc) and if the projections are based on a constant F strategy,
- If "1" is entered at input aa), the sheet "TransPolicy" contains a plot of catch against time for a constant F strategy (the one corresponding to the plots displayed on the third and fourth rows in sheet "Plots") and variants of this

strategy based on different values for the "fraction set aside" (see Equation 7c of the technical description).

4. USAGE NOTES AND WARNINGS

- If you want to know where in the sheet "Data" the data that were used to construct a particular plot are located, right click on the plot and go to the "Data sources" tab.
- The values in row 31 will not be exactly 50, 60, 70 and 80 because of the use of a numerical procedure to find the reference level of fishing mortality (and catch).
- To pre-specify B_0 (and hence $0.4B_0$), add a line to the historical data at input n) listing the virgin recruitment (B_0 divided by the virgin spawning-output-per-recruit), B_0 and indicating that this line (alone) will be used to define B_0.

5. REFERENCES

Jakobsen, T. 1993. The behaviour of F_{low}, F_{med} and F_{high} in response to variation in parameters used for their estimation. p. 119-125. In: S.J. Smith, J.J. Hunt and D. Rivard [Ed.] Risk evaluation and biological reference points for fisheries management. *Can. Spec. Publ. Aquat. Sci.* 120.

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Appendix A : The Modifications made to the Rebuilding Analysis Software

- 1.000002: Minor typographical errors in the documentation corrected.
- 1.000003:
  i. Additions:
    1. new diagnostic plots (probability of recovery in the maximum allowable rebuilding period versus a 50% probablity in some shorter period; time-trajectory of the distribution of the cumulative (discounted) catch);
    2. the ability to examine an additional "transitional" policy;
    3. the ability to select one of two definitions for "recovery";
    4. the ability to pre-specify the maximum allowable rebuilding period; and
    5. the ability to change from the fishing mortality defined in the rebuilding strategy to an F_{MSY} proxy once the resource recovers to $0.4B_0$.

  ii. Corrections: removed an error in the calculation of the maximum allowable rebuilding period.

  iii. Minor modifications: added the ability to omit the printing of results once $0.4B_0$ has been reached.
- 1.2:
  i. Additions:
    1. Added a plot showing the expected recruitment as a function of spawning output for F_{rep}, F=0, and F=F_{MSY}, along with the recruitment and spawning output data.
    2. Included the year when the population was declared overfished into the calculation of the maximum possible rebuild period.

  ii. Minor modifications:
    1. Added a warning if the predicted first-year spawning output differs from the pre-specified first-year spawning output.
    2. Added additional summary statistics (F_{MSY}).
- 1.3 (March 2002):
  1. Included specification of the random number seed as an input to allow sensitivity to this seed to be examined.
- 1.4 (April 2002):
  1. Improved the efficiency of the search for the "target" fishing mortalities.
  2. Added the ability to automatically quantify the Monte Carlo uncertainty associated with the calculation of the OYs for the first year of the projection period.
- 1.5 (May 2002):
  1. Modified the definition of T_{max} to take account of the time from being declared overfished until the first year of the projection.
  2. Added three additional graphical summaries.
- 2.0 (June 2002; Major update):
  1. Added additional error messages to capture mistakes in the input file related to the years to which the inputs relate.
  2. Modified the approach to compute T_{min} based on advice regarding its definition. The zero catches now commence immediately after year y_{decl}.

3. Added the ability to place constraints on the probability that a "recovered" stock drops below the overfished threshold of $0.25B_0$ due to recruitment variability.
4. Corrected an error that occurred if the population could not recover in the absence of catches within 500 years.
5. Automated the process of loading the CSV file.
6. Added the option to use the 40:10 rule once rebuilding has first occurred.

Appendix B : An example of REBUILD.DAT

```
#Title
Window rockfish - default assumptions
# Number of sexes
2
# Age range to consider (minimum age; maximum age)
3 20
# First year of projection
1999
# Year declared overfished
2002
# Is the maximum age a plus-group (1=Yes;2=No)
1
# Generate future recruitments using historical recruitments (1), historical recruits/spawner (2), or a stock-recruitment (3)
2
# Constant fishing mortality (1) or constant Catch (2) projections
1
# Pre-specify the year of recovery (or -1) to ignore
-1
# Fecundity-at-age
# 3 4 5 6 7 8 9 10
 5.71571E-
05,0.000192238,0.014959075,0.06416152,0.161188109,0.276595084,0.36866541,0.441150816,0.508537268,0.566615354,0.6187650
39,0.665202145,0.706388539,0.74275911,0.774748748,0.802838386,0.827408957,0.883903028
# Age specific information (Females then males), M, weight, selectivity and numbers
# Females
 0.150000 0.150000 0.150000 0.150000 0.150000 0.150000 0.150000 0.150000 0.150000 0.150000 0.150000 0.150000 0.150000
0.150000 0.150000 0.150000 0.150000 0.150000
0.260608092 0.382403028 0.516070194 0.654578339 0.792170662 0.924895027 1.049946766 1.165864012 1.271881655
1.367769472 1.453797243 1.530488701 1.598486647 1.658533881 1.711419248 1.757704614 1.798297893 1.89163453
0.000593893 0.005686670 0.054780300 0.362629000 0.846479000 0.998077000 0.963625000 0.904980000 0.847668000
0.793880000 0.743284000 0.695263000 0.649123000 0.604100000 0.559340000 0.513919000 0.466977000 0.41801300
 2958.5 7588.5 6246.5 6863.0 2061.5 5577.5 2272.0 1669.5 1646 1334.5 542.5 675 517 141 171 386.5 239 935
# Males
 0.150000 0.150000 0.150000 0.150000 0.150000 0.150000 0.150000 0.150000 0.150000 0.150000 0.150000 0.150000 0.150000
0.150000 0.150000 0.150000 0.150000 0.150000
0.303357216 0.410118829 0.515691806 0.615331188 0.706167139 0.787117388 0.857984578 0.919248338 0.971690941
1.016243337 1.053962138 1.085701311 1.112314822 1.134579656 1.153172796 1.168719902 1.181646637 1.20887895
0.000590021 0.005633680 0.054211900 0.359841000 0.844941000 0.998171000 0.962820000 0.902934000 0.844470000
0.789659000 0.738174000 0.689400000 0.642654000 0.597194000 0.552196000 0.506774000 0.460107000 0.41171100
 2958.5 7588.5 6246.5 6863.0 2061.5 5577.5 2272.0 1669.5 1646 1334.5 542.5 675 517 141 171 386.5 239 935
# Initial age-structure (for Tmin)
 2958.5 7588.5 6246.5 6863.0 2061.5 5577.5 2272.0 1669.5 1646 1334.5 542.5 675 517 141 171 386.5 239 935
 2958.5 7588.5 6246.5 6863.0 2061.5 5577.5 2272.0 1669.5 1646 1334.5 542.5 675 517 141 171 386.5 239 935
# Year for Tmin Age-structure
1999
# Number of simulations
100
# Recruitment and Spanwer biomasses
# Number of historical assessment years
32
# Historical data: Year, Recruitment, Spawner biomass, Used to compute B0, Used to project based
# on R, Used to project based on R/S
1968  29603 30662 1 0 0
1969  39748 30664 1 0 0
1970  37990 30668 1 0 0
1971  47532 30716 1 0 0
1972  39929 30910 1 0 0
1973 112579 31371 1 0 0
1974  42955 32096 1 0 0
1975  20667 33298 1 0 0
1976  11070 35254 1 0 0
1977  23596 37731 1 0 0
1978  39407 39189 1 0 0
1979  02219 39316 1 0 0
1980  73666 38032 1 0 0
1981  48325 32253 1 0 0
1982  24940 25329 1 0 0
```

1983 47876 19457 0 0 0
1984 62307 17592 0 0 0
1985 21667 17055 0 0 0
1986 13094 16665 0 1 1
1987 32540 16481 0 1 1
1988 28129 15782 0 1 1
1989 16110 14978 0 1 1
1990 29622 13019 0 1 1
1991 25813 11553 0 1 1
1992 18452 11079 0 1 1
1993 18265 10632 0 1 1
1994 31413 09860 0 1 1
1995 8327 09533 0 1 1
1996 21956 08985 0 1 1
1997 16901 08664 0 1 1
1998 17637 08261 0 1 1
1999 5917 08223 0 1 1
Number of years with pre-specified catches
3
catches for years with pre-specified catches
1999 4363
2000 4033
2001 2300
Number of future recruitments to override
2
Process for overiding (-1 for average otherwise index in data list)
2000 -1
2001 28
Which probability to product detailed results for (1=0.5,2=0.6,etc.)
1
Steepness and sigma-R
0.5 0.5
Target SPR rate (FMSY Proxy)
0.5
Target SPR information: Use (1=Yes) and power
0 20
Discount rate (for cumulative catch)
0.1
Truncate the series when 0.4B0 is reached (1=Yes)
0
Set F to FMSY once 0.4B0 is reached (1=Yes; 2=Apply 40:10 rule after recovery)
0
Percentage of FMSY which defines Ftarget
0.9
Maximum possible F for projection (-1 to set to FMSY)
2
Conduct MacCall transition policy (1=Yes)
0
Defintion of recovery (1=now only;2=now or before)
2
Produce the risk-reward plots (1=Yes)
0
Calculate coefficients of variation (1=Yes)
0
Number of replicates to use
10
First Random number seed
-89102

Rebuilding Analysis for Yelloweye Rockfish

Final Draft for Council meeting
June 2002

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Introduction

Two separate assessments corresponding to yelloweye rockfish (*Sebastes ruberrimus*) found in waters off the northern California coast (PFMC areas 1B and 1C) and from waters off the Oregon coast were prepared for the PFMC in 2001 (Wallace, 2001). An assessment model was not developed for Washington due to limited length and age composition time series. However, Washington catch data was appended to the Oregon model to provide management with necessary information needed to base coastwide management decisions. Based on these stock assessments, the Pacific Fishery Management Council declared yelloweye to be overfished (for all modeled areas) in 2002. This document provides rebuilding projections for northern California, Oregon and Oregon-Washington coastal areas.

Projections in this document were performed using software developed by Punt (2002 version 2.0) and results are based on 1,000 Monte Carlo replicates. Analysis and documentation conforms to the SSC Terms of Reference for Groundfish Rebuilding Analysis.

Data Input

The analyses use data outputs generated from the length-based Stock Synthesis program developed by Methot (2000) for combined sexes. For each area, input of age specific data for ages 3-70+ include: 1) spawning output (product of the weight-at-age and % mature vectors) 2) natural mortality 3) weight (mid-year) 4) selectivity and 5) numbers of fish for year 2000 for each area (Tables 1-3). Vectors of annual recruitment (age 3 fish) and spawning biomass estimates were input for years 1970-2000 (Tables 4-6). Population projections were configured to begin in 2000 (last year of estimated recruitment) and catches were specified for three years beginning in 2000. Table 7 summarizes catch estimates and Table 8 details data source.

Selection of rebuilding

Two scenarios for estimating B_0 and generating recruitment during rebuild were considered. These two scenarios provide an evaluation of alternate assumptions of 1) density-dependent versus 2) environmentally driven recruitment on the calculation of stock reference points. The level of recruitment for yelloweye rockfish is relatively low throughout the time period and infrequently above replacement (Figure 1-3). In scenario

1, B_0 is based on an early time series of relatively high spawner biomass (1970-1985) and recruits-per-spawner data from 1970-1996 were used to generate recruitment. This scenario is consistent with a density-dependent hypothesis where recruitment is largely driven by spawner biomass. In Scenario 2, B_0 is based on the full time series (1970-2000) and recruitment data from 1970-1996 were used to generate recruitment. This scenario assumes that recruitment level is largely dependent on environmental conditions. There were too few data on which to adequately estimate recruitment past 1996, so these data are not included in estimates of recruitment or recruits-per-spawner.

Since median time to rebuild with no fishing was beyond 10 years in each scenario, total rebuilding time (T_{max}) is calculated as the minimum time to rebuild + one mean generation time. Mean generation time is calculated as the mean age weighted by the net maturity function.

Scenario 1

Rebuilding projections generated from these data result in extremely long rebuilding periods with low levels of catch. Unfished population size is well below the overfished threshold of $0.25B_0$ in all areas. The northern California population size is estimated to be 8% of the unfished stock; Oregon and Oregon-Washington stock size is 15% of the unfished stock.

Mean generation time is calculated to be 28 years for the northern California stock and 32 years for the Oregon and Oregon-Washington stock. Median time to rebuild for the northern California stock is 252 years. This compares to a median rebuild time of 112 years for the Oregon stock, and a 120-year median rebuild period for the Oregon-Washington stock (Table 9).

Scenario 2

Rebuilding projections generated from these data are much more optimistic compared to scenario 1. As a result, rebuilding periods are relatively shorter and allow for higher levels of catch. Current population size is well below the overfished threshold of $0.25B_0$ in all areas. The northern California population size is estimated to be 12% of the unfished stock; Oregon and Oregon-Washington stock size is 16% of the unfished stock.

Mean generation time is the same as that estimated in scenario 1. Median time to rebuild for the northern California stock is 42 years. This compares to a median rebuild time of 46 years for the Oregon and 47 years for the Oregon-Washington stock (Table 9).

Alternative rebuilding policies

For each scenario, estimates of fishing mortality, optimal yield, probability of recovery and median time to rebuild were computed for five rebuilding strategies. Rebuilding alternatives include 1) 50% probability of rebuilding by (T_{max}), 2) 60% probability of rebuilding by (T_{max}), 3) 70% probability of rebuild by (T_{max}), 4) F =0 harvest policy and 5) 40:10 harvest policy.

Scenario 1

The probability of recovery employing a F=0 policy is 66%, 86% and 85% for the northern California, Oregon and Oregon-Washington areas respectively. Corresponding median rebuild times are 224, 80 and 89 years. Given a 60% probability of recovery and a harvest of 0.1, 1.3 and 1.4 (metric tons), median rebuild time is 235, 102 and 110 years for the northern California, Oregon and Oregon-Washington areas respectively. Table 10 summarizes management values computed for other alternative rebuilding policies and

Scenario 2

Median rebuild time of recovery for the F=0 policy is 13, 14 and 14 years for the northern California, Oregon and Oregon-Washington areas respectively. With a 60% probability of recovery and a harvest of 11.2, 25.3 and 30.1 (metric tons) median rebuild time is 36, 40 and 42 years for the northern California, Oregon and Oregon-Washington areas respectively. Table 10 summarizes management values computed for other alternative rebuilding policies.

Summary

The two recruitment scenarios result in substantially different rebuilding projections. The data are insufficient to completely dismiss either scenario at this time. The time series of recruitment data are extremely "noisy" and population projections are very imprecise.

Scenario 1 is consistent with the observation that recruitment has declined noticeably in the 1990's and recruits-per-spawner have not. The spawner-recruitment plots also indicate a somewhat linear relationship with 0-intercept (Figures 1-3). This provides strong evidence for supporting the density-dependent hypothesis. This model is most consistent with our current understanding of yelloweye population dynamics and represents the author's preferred model.

Conversely, rare large recruitment events every 10-15 years appear somewhat independent of stock size suggesting recruitment may be largely dependent on environmental conditions (Figures 1-3). The estimated rebuild time period in scenario 2, however may be underestimated and the fishing rate too aggressive. Future recruitment generated in scenario 2 does not adequately represent the recent low recruitment or the increasing recruitment as the stock rebuilds towards B_{40}. Scenario 2 is very optimistic in the short term because the recruits-per-spawner plots clearly show lower recruitment in recent years. Furthermore, unfished biomass estimates in scenario 2 (based on the entire time series) are lower than those derived in scenario 1 (based on the early time series). This is especially evident in the northern California model where unfished spawning biomass is 30% lower than that estimated in scenario 1 (Table 9) and is approximately half of the synthesis estimate.

Recruitment is likely driven by a combination of decreased abundance of spawners and changes in ocean conditions. Further investigation and information on this stock is needed to satisfactorily assess rebuilding for this species. There are currently two studies scheduled for 2002 that may give us additional insight regarding yelloweye abundance and life history. This includes enhanced rockfish data collection during the annual

International Pacific Halibut Commission halibut survey and submersible survey work in north coastal Washington waters. Until additional information is collected and analyzed it is difficult to establish a definitive time line to reassess this species. Parameterization of the selectivity function in the current assessment has been recently reviewed and alternate model configurations investigated. Results support current projections.

If yelloweye are not retained in the fisheries, our ability to collect biological information and conduct age-structured assessments for this species is extremely limited. Strong consideration should be given to maximizing the information from any minimal harvest that may occur.

References

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Wallace F.R. 2000. Status of the yelloweye rockfish resource in 2001 for northern California and Oregon waters. *In* Appendix to the Status of the Pacific Coast Groundfish Fishery Through 2001 and Recommended Acceptable Biological Catches for 2002 Stock Assessment and Fishery Evaluation. Pacific Fishery Management Council 7700 NE Ambassador Pl, Ste. 200 Portland. Ore. 97220.

Table 1. Historical time series of spawning output, recruitment and yield for northern California.

Year	Biomass (mt) Total	Biomass (mt) Spawning	Recruits (3-year-old) 1,000's of fish	Exploitation	Total Yield
1970	2027	877	18	0.008	16.1
1971	2027	878	20	0.012	24.1
1972	1998	875	24	0.016	32.1
1973	1959	868	31	0.020	40.1
1974	1910	855	45	0.025	48.1
1975	1855	838	136	0.030	56.1
1976	1796	816	59	0.035	64.1
1977	1771	789	34	0.040	72.1
1978	1710	759	25	0.045	80.1
1979	1631	726	24	0.052	88.1
1980	1540	689	49	0.060	96.1
1981	1423	646	77	0.094	141.1
1982	1226	576	77	0.207	284.4
1983	1076	473	83	0.081	91.5
1984	1018	439	100	0.088	93.8
1985	959	406	34	0.109	110.2
1986	922	372	23	0.074	71.2
1987	865	351	30	0.112	102.5
1988	806	324	27	0.080	67.2
1989	752	307	16	0.121	96
1990	676	280	92	0.153	111.2
1991	568	245	18	0.238	152.1
1992	485	198	25	0.234	127.4
1993	420	164	15	0.132	58.7
1994	386	151	9	0.147	60.2
1995	350	137	14	0.141	52.5
1996	299	123	14	0.248	83.4
1997	236	98	6	0.293	79.7
1998	200	78	4	0.122	25.6
1999	187	74	4	0.099	19.3
2000	183	72	1	0.015	8.8

Table 2. Historical time series of spawning output, recruitment and yield for Oregon.

Year	Biomass (mt) Total	Biomass (mt) Spawning	Recruits (3-year-old) 1,000's of fish	Exploitation	Total Yield
1970	2692	1128	44	0.008	22.6
1971	2693	1129	49	0.009	25.6
1972	2675	1128	55	0.012	31.6
1973	2651	1125	65	0.014	37.6
1974	2622	1118	83	0.016	43.6
1975	2590	1108	132	0.019	49.6
1976	2559	1095	198	0.021	55.6
1977	2545	1079	72	0.024	61.6
1978	2559	1060	56	0.026	67.6
1979	2507	1036	46	0.040	103.8
1980	2438	1000	38	0.037	91.9
1981	2351	969	33	0.054	130.4
1982	2269	930	35	0.033	76
1983	2127	900	49	0.107	241.2
1984	1975	823	46	0.051	103.6
1985	1888	794	48	0.059	115.2
1986	1805	761	117	0.051	94.5
1987	1727	733	52	0.059	105.6
1988	1666	699	224	0.069	119.6
1989	1545	653	166	0.114	187.1
1990	1522	593	55	0.046	72.2
1991	1511	569	33	0.087	137.2
1992	1400	520	24	0.132	197.4
1993	1248	454	21	0.155	208.3
1994	1130	397	17	0.103	121.7
1995	986	362	12	0.224	246.9
1996	826	296	9	0.177	158.8
1997	676	255	8	0.268	207.2
1998	572	207	8	0.105	62.8
1999	515	198	9	0.166	92.5
2000	480	182	54	0.026	12.5

Table 3. Historical time series of spawning output, recruitment and yield for Oregon-Washington.

Year	Biomass (mt) Total	Spawning	Recruits (3-year-old) 1,000's of fish	Exploitation	Total Yield
1970	3428	1446	59	0.009	29.6
1971	3422	1444	65	0.009	32.6
1972	3396	1440	74	0.011	38.6
1973	3365	1434	86	0.013	44.6
1974	3330	1424	109	0.015	50.6
1975	3293	1411	165	0.017	57.1
1976	3259	1395	259	0.019	64
1977	3244	1375	92	0.022	72.9
1978	3271	1352	73	0.022	74.2
1979	3221	1326	60	0.033	109.8
1980	3139	1288	49	0.039	125.5
1981	3039	1246	44	0.044	138.2
1982	2953	1207	46	0.028	84.7
1983	2791	1175	65	0.096	281.4
1984	2608	1086	60	0.051	136.3
1985	2488	1047	63	0.063	161.3
1986	2374	1000	154	0.050	121.4
1987	2267	964	68	0.063	149.1
1988	2177	915	264	0.074	167.2
1989	1984	846	229	0.141	301.3
1990	1906	746	71	0.060	116.7
1991	1876	706	43	0.098	191.5
1992	1725	638	30	0.140	257.3
1993	1525	552	27	0.166	273.1
1994	1373	477	23	0.106	151.8
1995	1213	437	16	0.203	271.7
1996	1036	368	11	0.169	189.3
1997	865	322	11	0.242	235.8
1998	746	270	11	0.099	77.2
1999	666	258	12	0.184	133.8
2000	607	232	54	0.048	29.8

Table 4. Biological parameters used for the northern California rebuilding analysis.

AGE	Mean Weight	Percent Mature	Spawning Output	Natural Mortality	N-A-A 2000	Selectivity
3	0.321	0.018	0.006	0.040	0.6	0.199
4	0.410	0.046	0.018	0.040	4.2	0.259
5	0.509	0.095	0.046	0.040	3.4	0.329
6	0.618	0.164	0.097	0.040	4.4	0.405
7	0.734	0.250	0.176	0.040	9.3	0.482
8	0.856	0.344	0.284	0.040	8.1	0.555
9	0.983	0.439	0.418	0.040	4.6	0.623
10	1.115	0.529	0.572	0.040	6.6	0.683
11	1.250	0.610	0.742	0.040	8.9	0.735
12	1.387	0.681	0.922	0.040	5.2	0.780
13	1.526	0.742	1.105	0.042	21	0.817
14	1.665	0.791	1.290	0.044	2.9	0.848
15	1.804	0.832	1.473	0.045	4	0.874
16	1.943	0.866	1.652	0.047	3.6	0.895
17	2.081	0.892	1.826	0.049	2.2	0.913
18	2.218	0.914	1.995	0.051	2.6	0.927
19	2.352	0.931	2.158	0.052	6.4	0.939
20	2.484	0.944	2.314	0.054	4.4	0.948
21	2.614	0.955	2.465	0.056	3.3	0.956
22	2.741	0.963	2.610	0.058	2.7	0.963
23	2.864	0.970	2.749	0.060	1.4	0.968
24	2.985	0.976	2.883	0.061	0.6	0.972
25	3.102	0.980	3.011	0.063	0.5	0.976
26	3.216	0.983	3.135	0.065	0.6	0.979
27	3.326	0.986	3.253	0.067	0.9	0.982
28	3.433	0.989	3.367	0.068	1.7	0.984
29	3.536	0.990	3.477	0.070	0.5	0.986
30	3.636	0.992	3.582	0.072	0.3	0.987
31	3.732	0.993	3.682	0.074	0.2	0.989
32	3.824	0.994	3.779	0.075	0.1	0.990
33	3.913	0.995	3.871	0.077	0.1	0.991
34	3.999	0.996	3.960	0.079	0.4	0.992
35	4.081	0.996	4.045	0.081	0.3	0.992
36	4.160	0.997	4.127	0.083	0.3	0.993
37	4.235	0.997	4.205	0.084	0.3	0.994
38	4.308	0.997	4.279	0.086	0.2	0.994
39	4.377	0.998	4.350	0.088	0.2	0.994
40	4.444	0.998	4.418	0.090	0.2	0.995
41	4.507	0.998	4.483	0.091	0.2	0.995
42	4.568	0.998	4.546	0.093	0.2	0.995
43	4.626	0.999	4.605	0.095	0.1	0.996
44	4.682	0.999	4.662	0.097	0.1	0.996
45	4.735	0.999	4.716	0.098	0.1	0.996
46	4.785	0.999	4.767	0.100	0.1	0.996
47	4.833	0.999	4.816	0.102	0.1	0.997
48	4.879	0.999	4.863	0.104	0.1	0.997
49	4.923	0.999	4.908	0.105	0.1	0.997
50	4.965	0.999	4.950	0.107	0.1	0.997
51	5.005	0.999	4.991	0.109	0.1	0.997
52	5.042	0.999	5.030	0.111	0	0.997
53	5.078	0.999	5.066	0.113	0	0.997
54	5.113	0.999	5.101	0.114	0	0.997
55	5.145	0.999	5.134	0.116	0	0.997
56	5.176	0.999	5.166	0.118	0	0.998
57	5.206	1.000	5.196	0.120	0	0.998
58	5.234	1.000	5.224	0.121	0	0.998
59	5.261	1.000	5.251	0.123	0	0.998
60	5.286	1.000	5.277	0.125	0	0.998
61	5.310	1.000	5.302	0.127	0	0.998
62	5.333	1.000	5.325	0.128	0	0.998
63	5.355	1.000	5.347	0.130	0	0.998
64	5.375	1.000	5.368	0.132	0	0.998
65	5.395	1.000	5.388	0.134	0	0.998
66	5.414	1.000	5.407	0.136	0	0.998
67	5.431	1.000	5.425	0.137	0	0.998
68	5.448	1.000	5.442	0.139	0	0.998
69	5.464	1.000	5.458	0.141	0	0.998
70	5.542	1.000	5.540	0.143	0	0.998

Table 5. Biological parameters used for the Oregon rebuilding analysis.

AGE	Mean Weight	Percent Mature	Spawning Output	Natural Mortality	N-A-A 2000	Selectivity
3	0.308	0.002	0.001	0.040	54	0.137
4	0.387	0.005	0.002	0.040	8.9	0.176
5	0.481	0.013	0.006	0.040	7.3	0.245
6	0.585	0.032	0.018	0.040	6.6	0.336
7	0.697	0.067	0.045	0.040	6.5	0.432
8	0.816	0.124	0.097	0.040	8.1	0.522
9	0.941	0.202	0.184	0.040	10.4	0.601
10	1.070	0.297	0.308	0.040	11.2	0.670
11	1.203	0.399	0.466	0.040	10.9	0.729
12	1.338	0.499	0.651	0.040	12.9	0.780
13	1.475	0.591	0.852	0.041	18.2	0.822
14	1.613	0.672	1.060	0.042	45.2	0.856
15	1.752	0.739	1.269	0.043	50.3	0.884
16	1.890	0.794	1.473	0.044	9.6	0.907
17	2.028	0.838	1.671	0.045	17.8	0.925
18	2.164	0.873	1.859	0.046	6.1	0.940
19	2.299	0.900	2.038	0.047	4.8	0.951
20	2.432	0.921	2.208	0.048	4.3	0.960
21	2.562	0.937	2.370	0.049	2.6	0.968
22	2.689	0.950	2.523	0.050	2.1	0.973
23	2.814	0.959	2.670	0.051	2	0.978
24	2.935	0.967	2.810	0.052	2.1	0.982
25	3.054	0.973	2.943	0.053	2.2	0.984
26	3.169	0.978	3.071	0.054	2.5	0.987
27	3.280	0.982	3.193	0.055	6	0.989
28	3.388	0.985	3.310	0.056	3.5	0.990
29	3.493	0.987	3.422	0.057	2	0.992
30	3.594	0.989	3.529	0.058	1.4	0.993
31	3.691	0.991	3.632	0.059	1	0.994
32	3.785	0.992	3.731	0.060	0.8	0.994
33	3.875	0.993	3.826	0.061	0.7	0.995
34	3.962	0.994	3.917	0.062	1.1	0.996
35	4.046	0.995	4.003	0.063	1	0.996
36	4.126	0.995	4.087	0.064	0.9	0.996
37	4.203	0.996	4.166	0.065	0.8	0.997
38	4.277	0.996	4.242	0.066	0.8	0.997
39	4.347	0.997	4.315	0.067	0.7	0.997
40	4.415	0.997	4.385	0.068	0.6	0.998
41	4.480	0.997	4.451	0.069	0.6	0.998
42	4.542	0.997	4.515	0.070	0.5	0.998
43	4.601	0.998	4.576	0.071	0.5	0.998
44	4.658	0.998	4.634	0.072	0.5	0.998
45	4.712	0.998	4.689	0.073	0.4	0.998
46	4.763	0.998	4.742	0.074	0.4	0.998
47	4.812	0.998	4.792	0.075	0.4	0.999
48	4.859	0.998	4.840	0.076	0.3	0.999
49	4.904	0.999	4.885	0.077	0.3	0.999
50	4.947	0.999	4.929	0.078	0.3	0.999
51	4.987	0.999	4.971	0.079	0.3	0.999
52	5.026	0.999	5.010	0.080	0.2	0.999
53	5.063	0.999	5.048	0.081	0.2	0.999
54	5.098	0.999	5.083	0.082	0.2	0.999
55	5.131	0.999	5.117	0.083	0.2	0.999
56	5.163	0.999	5.150	0.084	0.2	0.999
57	5.193	0.999	5.180	0.085	0.1	0.999
58	5.222	0.999	5.210	0.086	0.1	0.999
59	5.249	0.999	5.237	0.087	0.1	0.999
60	5.275	0.999	5.264	0.088	0.1	0.999
61	5.300	0.999	5.289	0.088	0.1	0.999
62	5.323	0.999	5.313	0.089	0.1	0.999
63	5.345	0.999	5.335	0.090	0.1	0.999
64	5.366	0.999	5.357	0.091	0.1	0.999
65	5.386	0.999	5.377	0.092	0.1	0.999
66	5.406	0.999	5.397	0.093	0.1	0.999
67	5.424	0.999	5.415	0.094	0.1	0.999
68	5.441	0.999	5.433	0.095	0	0.999
69	5.457	0.999	5.449	0.096	0	0.999
70	5.558	0.999	5.554	0.097	0.4	0.999

Table 6. Biological parameters used for the Oregon-Washington rebuilding analysis.

AGE	Mean Weight	Percent Mature	Spawning Output	Natural Mortality	N-A-A 2000	Selectivity
3	0.308	0.002	0.001	0.040	54	0.136
4	0.387	0.005	0.002	0.040	11.3	0.175
5	0.481	0.013	0.006	0.040	9.4	0.243
6	0.585	0.032	0.018	0.040	8.4	0.333
7	0.697	0.067	0.045	0.040	8.3	0.429
8	0.816	0.124	0.097	0.040	10.3	0.518
9	0.941	0.202	0.184	0.040	13.2	0.598
10	1.070	0.297	0.308	0.040	14	0.667
11	1.203	0.399	0.466	0.040	13.6	0.726
12	1.338	0.499	0.651	0.040	16.2	0.777
13	1.475	0.591	0.852	0.041	22.9	0.819
14	1.613	0.672	1.060	0.042	61.6	0.854
15	1.752	0.739	1.269	0.043	58.8	0.882
16	1.890	0.794	1.473	0.044	12.5	0.906
17	2.028	0.838	1.671	0.045	23.6	0.924
18	2.164	0.873	1.859	0.046	7.9	0.939
19	2.299	0.900	2.038	0.047	6.3	0.950
20	2.432	0.921	2.208	0.048	5.7	0.959
21	2.562	0.937	2.370	0.049	3.4	0.967
22	2.689	0.950	2.523	0.050	2.7	0.973
23	2.814	0.959	2.670	0.051	2.6	0.977
24	2.935	0.967	2.810	0.052	2.7	0.981
25	3.054	0.973	2.943	0.053	2.9	0.984
26	3.169	0.978	3.071	0.054	3.2	0.987
27	3.280	0.982	3.193	0.055	7.9	0.989
28	3.388	0.985	3.310	0.056	4.4	0.990
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36	4.126	0.995	4.087	0.064	1.1	0.996
37	4.203	0.996	4.166	0.065	1	0.997
38	4.277	0.996	4.242	0.066	1	0.997
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45	4.712	0.998	4.689	0.073	0.5	0.998
46	4.763	0.998	4.742	0.074	0.5	0.998
47	4.812	0.998	4.792	0.075	0.5	0.998
48	4.859	0.998	4.840	0.076	0.4	0.999
49	4.904	0.999	4.885	0.077	0.4	0.999
50	4.947	0.999	4.929	0.078	0.4	0.999
51	4.987	0.999	4.971	0.079	0.3	0.999
52	5.026	0.999	5.010	0.080	0.3	0.999
53	5.063	0.999	5.048	0.081	0.3	0.999
54	5.098	0.999	5.083	0.082	0.2	0.999
55	5.131	0.999	5.117	0.083	0.2	0.999
56	5.163	0.999	5.150	0.084	0.2	0.999
57	5.193	0.999	5.180	0.085	0.2	0.999
58	5.222	0.999	5.210	0.086	0.2	0.999
59	5.249	0.999	5.237	0.087	0.2	0.999
60	5.275	0.999	5.264	0.088	0.1	0.999
61	5.300	0.999	5.289	0.088	0.1	0.999
62	5.323	0.999	5.313	0.089	0.1	0.999
63	5.345	0.999	5.335	0.090	0.1	0.999
64	5.366	0.999	5.357	0.091	0.1	0.999
65	5.386	0.999	5.377	0.092	0.1	0.999
66	5.406	0.999	5.397	0.093	0.1	0.999
67	5.424	0.999	5.415	0.094	0.1	0.999
68	5.441	0.999	5.433	0.095	0.1	0.999
69	5.457	0.999	5.449	0.096	0.1	0.999
70	5.559	0.999	5.556	0.097	0.5	0.999

Table 7. Catch estimates for northern California, Oregon and Oregon-Washington coastal waters.

Catch Estimates input to Rebuilding Model

Year	Recreational	Commercial	Total
Northern California			
2000	8.0	0.8	8.8
2001	5.1	2.8	7.9
2002	0.9	0.0	0.9
Oregon			
2000	8.2	4.3	12.5
2001	2.0	6.8	8.8
2002	3.8	0.0	3.8
Oregon-Washington			
2000	25.3	4.5	29.8
2001	12.5	0.8	13.3
2002	8.1	0.0	8.1

Table 8. Data source for estimated catches input into rebuilding model.

Catch Data Source

Year	Recreational	Commercial
Northern California		
2000	MRFSS[1]	PacFIN
2001	MRFSS	PacFIN
2002	Set to Council/GMT allocation proposal.	
Oregon		
2000	ODFW	PacFIN
2001	MRFSS	PacFIN
2002	Set to Council/GMT allocation proposal.	
Oregon-Washington		
2000	ODFW+WDFW	PacFIN
2001	MRFSS+WDFW	PacFIN
2002	Set to Council/GMT allocation proposal.	

[1] *Recently updated MRFSS estimate (5-6-02).*

Table 9. Comparison of management reference points between Scenario 1 and Scenario 2.

Outputs	Northern California Scenario 1	Northern California Scenario 2	Oregon Scenario 1	Oregon Scenario 2	Oregon-Washington Scenario 1	Oregon-Washington Scenario 2
FMSY proxy	0.042	0.042	0.037	0.037	0.034	0.034
FMSY SPR / SPR(F=0)	0.5	0.5	0.5	0.5	0.5	0.5
Virgin SPR	16.5	16.5	18.7	18.7	18.7	18.7
Generation time	28	28	32	32	32	32
Minimum Rebuild Time	225	15	81	15	89	16
Maximum Rebuild Time	252	42	112	46	120	47
Selected rebuild time	252	42	112	46	120	47
Year for rebuild	2255	2045	2115	2049	2123	2050
Virgin Spawning Output	860	602	1223	1119	1596	1440
Target Spawning Output	344	241	489	448	638	576
Current Spawning Output	72.4	72.4	184.6	184.6	236.1	236.1
B/B_0	0.08	0.12	0.15	0.16	0.15	0.16

Table 10. Estimates of fishing mortality, optimal yield, probability of recovery and median time to rebuild for six rebuilding strategies.

Northern California

	Scenario 1					
Fishing rate	0.0009	0.0004	0	0	0	0
OY_{2003} (mt)	0.1	0.1	0	0	0	0
Prob of recovery by 2255	50.1	60	65.6	65.6	65.7	0
Median time to rebuild	251.8	234.5	224.3	224.3	224.2	na
	Scenario 2					
Fishing rate	0.0708	0.0679	0.0643	0.0605	0	0
OY_{2003} (mt)	11.7	11.2	10.6	10	0	0.7
Prob of recovery by 2045	49.9	60	70	80	100	100
Median time to rebuild	42.1	36.1	31.9	28.5	13.3	16.1

Oregon

	Scenario 1					
Fishing rate	0.0039	0.0029	0.0019	0.0008	0	0
OY_{2003} (mt)	1.7	1.3	0.8	0.4	0	0
Prob of recovery by 2115	50	60	70	80.1	85.9	0
Median time to rebuild	112	101.5	93.7	85.3	80	na
	Scenario 2					
Fishing rate	0.0605	0.0577	0.055	0.0514	0	0
OY_{2003} (mt)	26.5	25.3	24.2	22.6	0	4.7
Prob of recovery by 2049	49.9	60.1	69.9	80.1	100	99.9
Median time to rebuild	46	40	35.1	30.9	13.7	18

Oregon and Washington

	Scenario 1					
Fishing rate	0.0033	0.0025	0.0016	0.0006	0	0
OY_{2003} (mt)	1.8	1.4	0.9	0.3	0	0
Prob of recovery by 2123	49.9	60.1	70	80	85	0
Median time to rebuild	120.1	110.2	101.3	93.6	88.9	na
	Scenario 2					
Fishing rate	0.0562	0.0539	0.0511	0.0481	0	0
OY_{2003} (mt)	31.4	30.1	28.6	26.9	0	4.9
Prob of recovery by 2050	49.9	60.1	69.9	80.1	100	99.9
Median time to rebuild	47.1	41.5	36.1	31.9	14.2	18.3

Northern Cailfornia

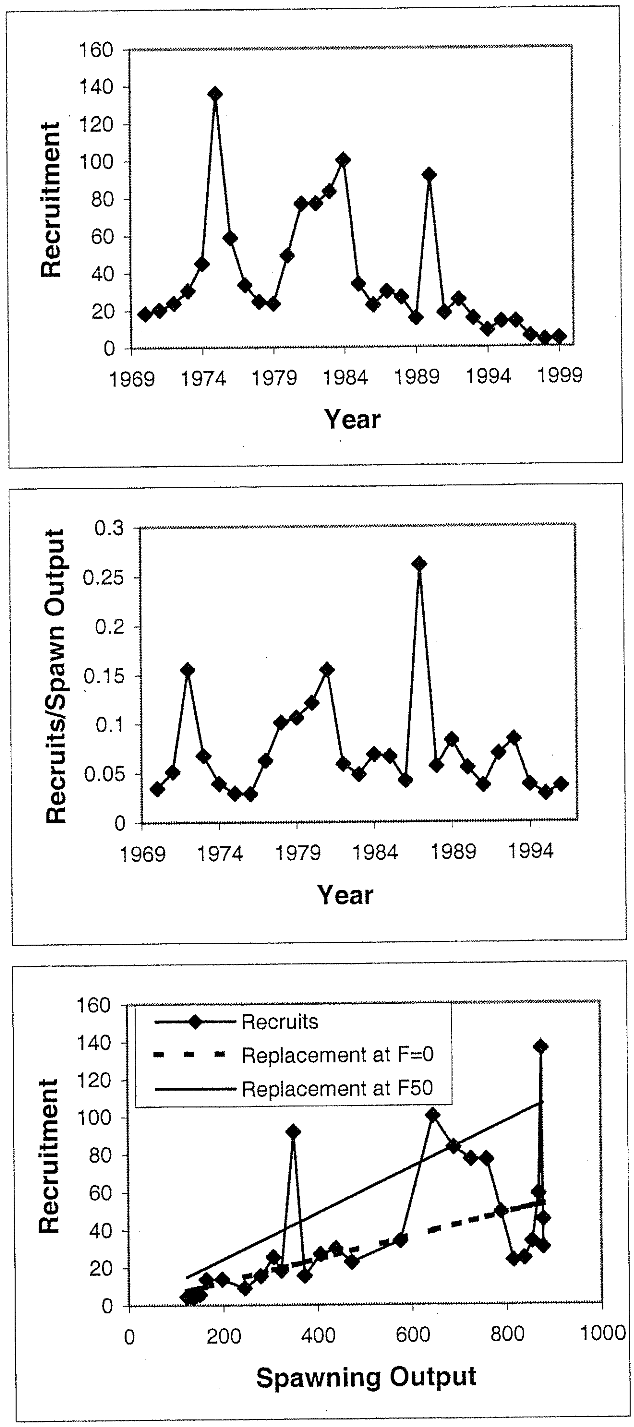

Figure 1. Time series of recruitment for yelloweye rockfish in northern California waters.

Oregon

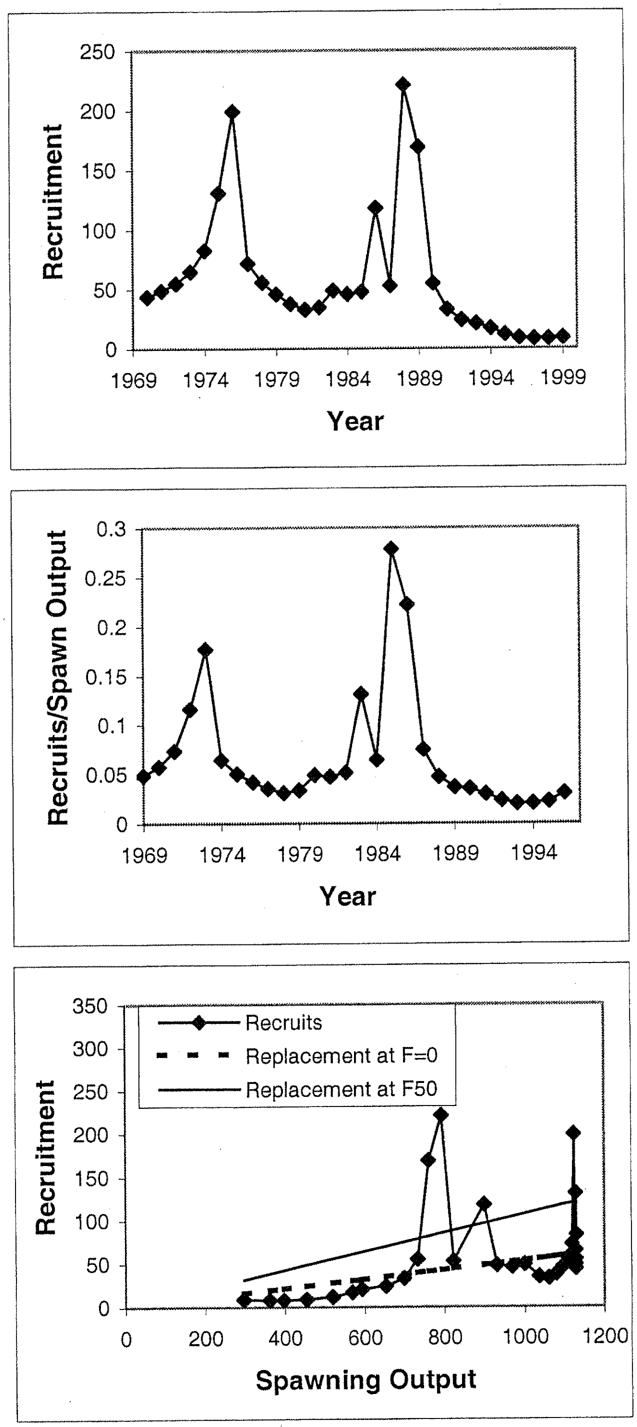

Figure 2. Time series of recruitment for yelloweye rockfish in Oregon waters.

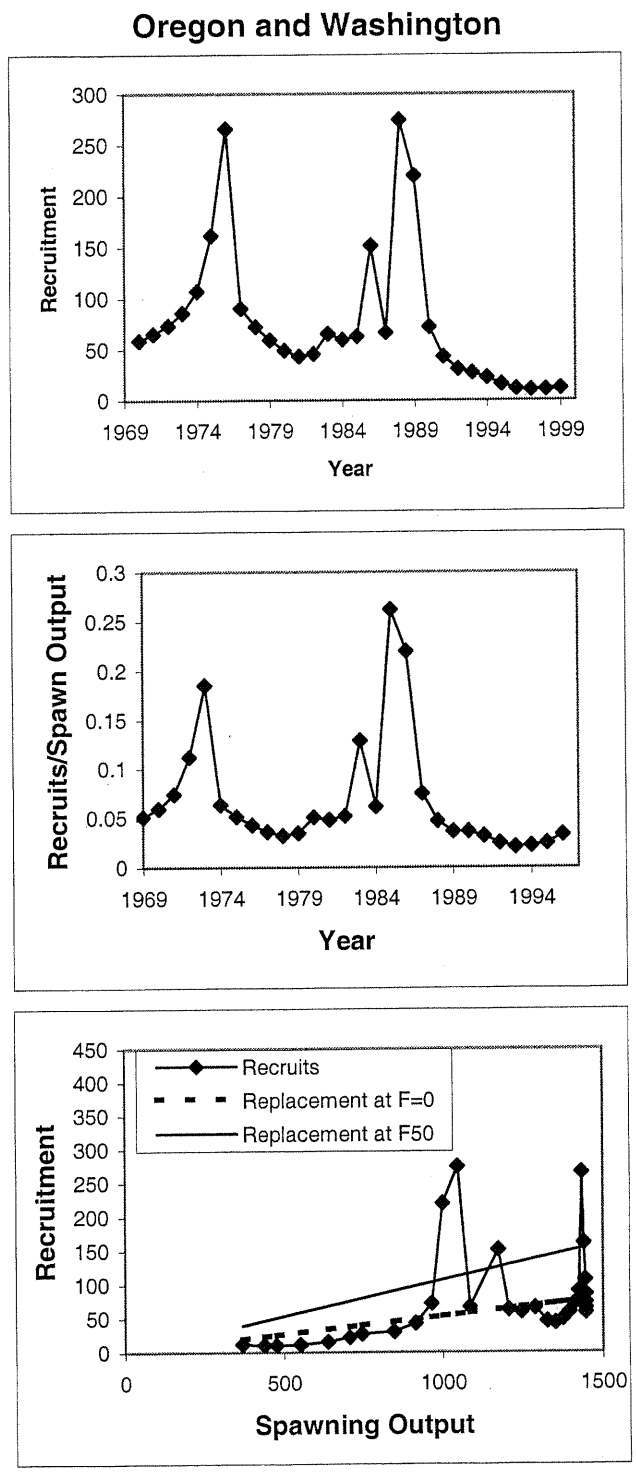

Figure 3. Time series of recruitment for yelloweye rockfish in Oregon and coastal Washington waters.

GMT RECOMMENDATIONS FOR ABCs AND OYs

In attached Table 2.1 Revised, the Groundfish Management Team (GMT) has provided the Council with recommendations for ABCs and OYs for the 2003 fishery. For three of the species, additional explanation of the values is provided below.

Yelloweye

The range of yelloweye harvest recommendations being forwarded by the team is in recognition of the different rebuilding scenarios contained within the rebuilding analysis, one based upon resampling of recruits per spawner and one based upon the resampling of recruits; the latter is also constrained to a more recent time series. Sampling of recruits per spawner is more consistent with density dependent recruitment, while resampling only recruits is consistent with environmentally driven recruitment. Since the SSC had not yet endorsed either scenario, the GMT is forwarding the current OY as the upper end of the range to be considered. The GMT also recognizes the uncertainty in the current assessment upon which the rebuilding is based and strongly endorses the current efforts being made to collect better information to support yelloweye rockfish management.

Whiting

The SSC has recommended carrying forward the STAR/PSARC advice of not increasing the OY until a new assessment is conducted. For purposes of Council consideration, the GMT has specified the 2002 OY as the low end of the range for whiting. It is our understanding that the formal rebuilding analysis for whiting has not been approved by the SSC. Based on this understanding, the GMT is not using the values listed in the rebuilding analysis in its proposed alternatives. The GMT-recommended intermediate value is taken from the $F_{45\%}$ 40-10 projection for 2003 yield from the 2002 stock assessment. The high OY option is taken from the $F_{40\%}$ 40-10 projection for 2003 yield.

Sablefish

The GMT-recommended high OY option for sablefish is derived from the $F_{45\%}$ 40-10 OY in the new stock assessment under the scenario referred to as "regime shift." The intermediate recommendation reflects the $F_{45\%}$ 40-10 OY under the scenario referred to as "density dependent." Under this latter scenario, the current spawning biomass is 31% of unfished and is projected to remain at or near that level over the next ten years. Because this level is close to the overfished threshold, and because of uncertainties in Q in the assessment, the GMT requested in May additional analysis from the assessment author of harvest options that would be more likely to increase the spawning biomass. The low OY option presented by the GMT reflects an $F_{60\%}$ 40-10 policy which is projected to increase the spawning stock to 35% of the unfished level within five years.

TABLE 2-1 **revised**. Acceptable biological catch (ABC) and total catch optimum yield (OY) alternatives for 2003 for the Washington, Oregon, and California region (metric tons) under the GMT-proposed alternatives. (Overfished stocks in CAPS).

	Status Quo Alternative 2002 ABCs/OYs		**Alternative 1** 2003 Low ABCs/OYs		**Alternative 2** 2003 Medium ABCs/OYs		**Alternative 3** 2003 High ABCs/OYs	
	ABC	OY	ABC	OY	ABC	OY	ABC	OY
LINGCOD	745	577	841	555 (80%)	841	651 (60%)	841	725 (50%)
Pacific Cod	3,200	3,200	188,000		3,200	3,200		173,600
PACIFIC WHITING (Coastwide)	166,000	129,600	~~235,000~~	129,600	~~235,000~~ 188,000	148,200 185,300 (F45%)	~~235,000~~ 188,000	~~217,000~~ (F40%)
Sablefish (North of Conception)	4,644	4,367	8,113	4,381	8,113	7,359	8,113	8,091
Conception INPFC area	333	229	441	233	441	323	441	346
PACIFIC OCEAN PERCH	640	350	689	311 (80%)	689	377 (70%)	689	496 (50%)
Shortbelly Rockfish	13,900	13,900			13,900	13,900		
WIDOW ROCKFISH	3,727	856	3,871	656 (80%)	3,871	832 (60%)	3,871	916 (50%)
CANARY ROCKFISH (50%-50%)	228	93	256	30 (80%)	256	41 (60%)	256	45 (50%)
(80% Comm.-20% Rec.)			309	38 (80%)	309	52 (60%)	309	57 (50%)
Chilipepper Rockfish	2,700	2,000			2,700	2,000		
BOCACCIO	122	100	198	0 (54%)			198	5.8 (50%)
Splitnose Rockfish	615	461			615	461		
Yellowtail Rockfish	3,146	3,146			3,146	3,146		
Shortspine Thornyhead	1,004	955			1,004	955		
Longspine Thornyhead	2,461	2,461			2,461	2,461		
S. of Pt. Conception	390	195			390	195		
COWCOD (S. Concep)	5	2.4			5	2.4		
N. Concep & Monterey	19	2.4			19	2.4		
DARKBLOTCHED	187	168	205	172 (80%)	205	184 (70%)	205	205 (50%)
YELLOWEYE - Coastwide	27	13.5	27	2.1 (70%)	27	3.9 (50%)	27	13.5 (2002)
N of 40°10' latitude	22	11	22	2.033 (70%)	22	3.633 (50%)	22	11 (2002)
Monterey	5	2.5	5	0.067 (70%)	5	0.267 (50%)	5	2.5 (2002)
Minor Rockfish North	4,795	3,115			4,795	3,115		
Minor Rockfish South	3,506	2,015			3,506	2,015		
Remaining Rockfish North	2,755				2,755			
Black	1,115				1,115			
Bocaccio	318				318			
Chilipepper - Eureka	32				32			
Redstripe	576				576			
Sharpchin	307				307			
Silvergrey	38				38			
Splitnose	242				242			
Yellowmouth	99				99			
Remaining Rockfish South	854				854			
Bank	350				350			
Blackgill	343				343			
Sharpchin	45				45			
Yellowtail	116				116			
Other Rockfish North	2,068				2,068			
South	2,652				2,652			
Dover Sole	8,510	7,440			8,510	7,440		
English Sole	3,100				3,100			
Petrale Sole	2,762				2,762			
Arrowtooth Flounder	5,800				5,800			
Other Flatfish	7,700				7,700			
Other Fish	14,700				14,700			

GROUNDFISH MANAGEMENT TEAM (GMT) STATEMENT ON RESEARCH HARVESTS

At its May meeting, the GMT reviewed a summary of research fishing catches compiled by the NW Region for 2001 activities in the EEZ and state of Oregon waters. This summary is not yet complete for all states, agencies, and institutions. Given the minimal OYs that will be available for decades for species such as bocaccio, cowcod, canary, and yelloweye rockfishes, and the paramount importance of achieving rebuilding harvest goals for these species, it is crucial that the GMT be as fully informed as possible, regarding all sources of fishing mortality affecting them. For some of these species, it is within the realm of possibility that research catches alone may exceed rebuilding targets. It is imperative that management efforts to achieve rebuilding targets be informed by the best possible understanding of all sources of mortality for these species.

The GMT has numerous concerns regarding protocols relating to the conduct, acknowledgment, and accounting of research fishing mortality. First, it is important that the states and other institutions are aware of the fact that the NMFS NW Region is attempting to coordinate the compilation of research catch data and its dissemination to the Council family for use in management. Second, existing projects which are providing data to the NW Region do not always provide estimates of catch weight for all rockfish species, or even all rockfish species of greatest concern. In the 2001 summary referenced above, 17 mt of catch were attributed to unspecified rockfish. For species such as yelloweye, where the coastwide rebuilding OYs are expected to be less than 2 mt, this level of resolution is unacceptable. Consequently, it is critical that the importance of enumerating removals of individual rockfish species and transmitting the information to the NW Region be conveyed through agency and institutional channels to those conducting these research projects. The GMT is asking for Council support in encouraging those individuals who are conducting research to 1) provide the NWR with an estimate the expected catch by species 2) enumerate and/or weigh research catch by species, and 3) to provide summary data to the NWR following the completion of the research.

An additional concern relates to the method of accounting for anticipated removals for research purposes in the annual specifications for the coming year. The existing approach for canary and darkblotched has been to deduct research catch from the OY. For other species the research catch is deducted from the ABC, to insure that overfishing is not occurring. For rebuilding species, the primary concern is not simply avoiding overfishing, but constraining total mortalities to be no greater than the adopted rebuilding OYs. **The GMT recommends that research catches for all species be subtracted from the adopted total catch OYs, for purposes of determining amounts remaining for commercial, recreational, and tribal fisheries.**

Given the minimal amounts of fishing mortality specified for many species, it is important that greater effort be made to prioritize the importance of individual research projects, within and among agencies, as well as, more broadly, between research and fishery uses. Further, there is now a greater need than ever to ensure that those undertaking research projects develop and share biological information for groundfish species of concern with stock assessment scientists. The GMT strongly believes that a high priority should continue to be placed on conducting the NMFS slope and shelf trawl surveys, independent of the catch of overfished species. However, with several shelf species facing rebuilding periods that are estimated to exceed 50 years, shelf survey frequency alternatives should be evaluated with regard to tradeoffs between the impact of removals on rebuilding success and the quality of the abundance time series generated. Also, development of new abundance surveys in the future should focus, where possible, on the use of techniques, such as visual or larval surveys, that minimize associated mortality. Finally, non-NMFS projects that will take fish in the EEZ normally request a letter of acknowledgment from NMFS for those research activities. And although NMFS cannot prohibit these activities, the GMT believes it is appropriate for NMFS to evaluate whether such letters should be routinely conveyed when a project contributes to an expected total research catch that exceeds or approaches rebuilding OYs for one or more species.

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Via Telefax

June 14, 2002

Bob Lohn
Regional Administrator
National Marine Fisheries Service
7600 Sand Point Way NE
Seattle, WA 98115-0070

Re: Treaty Indian Groundfish Fisheries in 2003

Dear Mr. Lohn:

We have been asked to write to you on behalf of the Makah Indian Tribe. Pursuant to 50 C.F.R. § 660.324(d), the Makah Tribe requests that provision be made for harvest of groundfish by Pacific coast treaty Indian tribes in 2003 by continuing the treaty regulations and allocations in effect in 2002, with adjustments to reflect changes in Optimum Yields as determined by the Pacific Fishery Management Council and the National Marine Fisheries Service for 2003. The Tribe has initiated discussions with other Pacific coast treaty Indian tribes regarding conservation measures for yelloweye, canary and bocaccio rockfish. Of these species, only yelloweye and canary rockfish are harvested to any material extent in treaty Indian fisheries. The Makah Tribe is exploring the possibility of an earlier opening for the treaty Indian halibut fishery to reduce yelloweye impacts, should that prove necessary.

In addition, please take notice that the Makah Tribe intends to open a treaty fishery for coastal pelagic species, focusing on sardines, in its usual and accustomed grounds in 2003. The Tribe does not believe that separate treaty regulations or an allocation are necessary to accommodate this fishery at this time. Should this change, the Tribe will notify you.

Tribal representatives will attend the Pacific Fishery Management Council meeting next week and can respond to questions you or your staff may have regarding the Tribe's planned 2003 fisheries.

Very truly yours,

ZIONTZ, CHESTNUT, VARNELL,
BERLEY & SLONIM

Marc Slonim

Marc D. Slonim

cc: Eileen Cooney
Russ Svec
Steve Joner

VMS Issues Identified By the PFMC Enforcement Consultants

Cleary

NOAA's Office for Law Enforcement (OLE) can support and implement a full Vessel Monitoring System (VMS) program for the Pacific Coast groundfish fishery once a full set of management measures and requirements have been established and funding secured. The selection of an appropriate system depends on seeking and receiving answers to specific questions and concerns. Keep in mind that the "Keep it Simple" principle applies to VMS. The more "bells and whistles", although nice to have, will add cost, time and complexity to the initial development and implementation.

The Enforcement Consultants are especially concerned thatVMS may not be effective if fishing with gear similar to the prohibited gear (i.e bottom trawl) is allowed in the closed areas. Our experience in each VMS program implemented to ensure compliance with other Magnuson Act fisheries closures in the EEZ is that they do not allow any fishing. Indeed, to facilitate enforcement in the New England fisheries requiring VMS, certain critical areas are even closed to transiting.

Another burden facing Enforcement officials involves solving the complex problem of enforcing a coast wide closure where vessels with VMS intending to fish seaward, or west, of the 150 fathom curve, must transit through the closed area to get to the fishing grounds. Consideration must be given to creating transit lanes, minimum vessel speeds, or some other innovative approach providing the ability to monitor vessel traffic effectively during transit to and from the fishing grounds.

VMS is only a tool. It does not replace the need for at sea vessel and air patrols.

The following is a sample of the questions and needs we need to begin considering:

GENERAL

1. Which fisheries and gear types will need VMS?

2. How many vessels are in each fishery. What are the sizes and electrical power capabilities of the vessels?

3. How will closed areas be defined? The enforcement consultants recommend using latitude and longitude to create the longest, straightest lines possible. Fathom curves are unenforceable.

4. If the closure is continuous along the entire west coast, how can we use VMS to monitor transiting through the closed areas? Are their other avenues or alternatives to those identified above (transit lanes and minimum speeds)?

5. Will there be season openings and closings? Shortening the current year long season would dramatically reduce the current enforcement burden and provide us the ability to focus limited resources. A value-added feature of VMS may allow a vessel to be at sea ready to set gear at the season opening and at sea, but with gear stowed and underway at the season closing. This scenario allows maximum fishing time and may be applicable to the fixed gear sablefish fishery.

6. How much consideration should be given to VMS requirements in other Pacific ocean fisheries? Some vessels authorized to fish in certain Alaska fisheries are operating under a new Alaska VMS requirement and many pelagic longline vessels carry a VMS as required by the Western Pacific Fishery Management Council. We need to avoid, if possible, requiring multiple vessel monitoring systems for vessels that engage in more than one fishery requiring this technology.

7. What will the requirement be regarding leaving the power and VMS unit on while vessels are in port? This has proven to be a significant issue in other VMS fisheries and requires special attention early in the decision making process. Allowing vessels to power down provides the opportunity to leave the unit off and fish undetected. Requiring the unit to remain on may create battery power-draining issues on the vessel.

POSITION REPORTING

8. What is the reporting interval i.e. 30 min., 1 hour, 2 hours, 4 hours, 12, 24 etc?

9. How much lag time is acceptable? No system is truly real time. INMARSAT is about 5 minutes and ARGOS can be several hours (depends on irregularly timed satellite passes).

10. Is random polling a requirement?

11. Do we want to establish buffer zones around the closed areas and initiate more frequent polling (like every 15 minutes) as vessels approach a closed area (2 miles, 1 mile, several hundred yards)?

12. Costs of transmitting position report varies from one system to another ranging from $1.00 per day to $5.00 per day. Over time, this can be a considerable financial burden. How much consideration should we give, up front, to these costs?

DATA

13. The position data generally comes from the GPS and is accurate to within about 50 meters. If the GPS malfunctions on an ARGOS system, the standard doppler positioning capability will initiate and is accurate only to about 300 meters. Boatracs is also only accurate to about 300 meters. Is the backup capability ARGOS provides important?

14. Do we want course and speed calculated through the transceiver's GPS or the base station? The base station is simpler but less accurate.

15. Will the Council or NMFS require electronic logbooks now or in the future?

16. If a vessel required to have VMS is allowed to change fisheries, either to another fishery where VMS is required or one where it is not, what is the notification procedure? Can this notification be made using the VMS?

17. Do we every foresee a need for sensor data i.e. water temperature, depth, air temperature, engine temp, engine rpm, etc.? Some of these capabilities are "off-the-shelf" and some, if truly important enough could be developed given the time, money and resources.

18. Do we need safety and distress functions?

Most of these questions/requirements go to the issue of one-way vs. two-way communication capabilities. ARGOS is one-way and INMARSAT is two-way.

COVERAGE

19. Different systems have different coverage capabilities. Boatracs will not generally work beyond 200 miles or in the Gulf of Alaska, Bering Sea or Hawaiian Islands. ARGOS was chosen in Alaska because it was believed to be the only system capable of providing full coverage.

VALUE ADDED SERVICES

20. Email?

21. Internet access?

22. News services?

23. Communication with owner, family, parts and supplies, shipyard, etc?

COSTS

24. Who pays? For:

25. The transceivers?

26. Communications?

27. Installation?

28. Maintenence?

29. Replacement?

30. Sensors?

31. Hardware and software for electronic log books?

HOW SOON CAN NMFS BE READY?

32. This question is hard to answer. All the above questions and more must be answered, regulations promulgated and implemented through final. And it depends on the number of vessels and complexity of the system. In general, a year is a good guess. If all the stops were pulled and we were working with a relatively small number of vessels with the funding in place and a system selected and the regulations implemented in final (and that alone is a 6 month process), we may be able to have a system in place in 6 months. However, that time frame is very optimistic.

WHERE WOULD THE DATA GO

33. Under the national VMS program, the data would be routed first to OLE in Seattle, then to OLE in HQ (Silver Spring, MD), then to the Coast Guard – all in near real time once OLE receives it from the Communications Service Provider.

34. Several OLE Divisions are developing a Web-based product to enable field agents to access the data, also in real time to increase response capability and efficiency.

35. The Coast Guard is also developing, or will develop, the ability to get the data to cutters and aircraft.

36. All individual vessel position data would be kept confidential.

GROUNDFISH ADVISORY SUBPANEL STATEMENT ON PRELIMINARY HARVEST LEVELS AND OTHER SPECIFICATIONS FOR 2003

The Groundfish Advisory Subpanel (GAP) has reviewed the proposed alternatives for 2003 groundfish harvest levels that were developed by the Scientific and Statistical Committee (SSC) and the Groundfish Management Team (GMT). Since these alternatives represent a range of possible options for public review and analysis, the GAP agrees they should be adopted with three exceptions.

In the case of yelloweye rockfish, the GAP notes that 2 alternative rebuilding scenarios have been developed: one which suggests a density-dependent stock and one which shows a stock influenced primarily by environmental factors. In order to encompass the full range of alternatives, the GAP believes Alternative 3 for this species should reflect a higher value as represented by a stock influenced by environmental factors.

In the case of Pacific whiting, the GAP notes that the rebuilding analysis provides a range of options. The SSC, in its review of the last whiting assessment, concluded that a harvest rate of $F_{40\%}$ was the default harvest rate for whiting and should be maintained. Both the Council and NMFS agreed with this position when establishing their respective - albeit disagreeing - harvest levels for whiting in 2002.

The GAP understands the SSC has essentially put the whiting rebuilding analysis aside for further deliberation and recommended a continuation of 2003 harvest levels. Absent an approved rebuilding analysis, the GMT has chosen to recommend that the 2003 alternatives reflect various harvest levels in the original stock assessment.

In order to provide the broadest range of analysis, the GAP recommends that Alternative 3 match the $F_{40\%}$ optimum yield with a 60% probability of rebuilding within T_{MAX} as shown on Table 4 of the Whiting Rebuilding Analysis (Exhibit C.3 Supplemental Attachment 5). This is consistent with previous GAP recommendations of using the 60% probability value for other species and follows the recommendations of the SSC regarding the default harvest rate for this species. The optimum yield value shown (for a coast-wide optimum yield) is 414,600 mt.

The GAP understands there have been concerns raised with the high level of harvest projected in this rebuilding analysis. However, if this rebuilding analysis - which was developed by the stock assessment author using models and methods approved by the SSC - is rejected simply because some are uncomfortable with the analysis, then it calls into question whether any of the rebuilding analyses (including those for bocaccio and canary rockfish) are valid, since the same methodology was used for those species. The GAP also notes that Canada has ignored the recommendations of the Stock Assessment Review (STAR) Panel by rolling over unused whiting harvest from 2001 into the 2002 fishery, thus effectively undermining the conservation measures undertaken by the United States. If Canada - which pushed hardest for conservative harvest at the STAR Panel meeting - thinks that stocks have rebuilt sufficiently since April, then perhaps we should follow their lead.

Finally, the majority of the GAP notes that the extremely low levels of bocaccio called for in the alternatives will result in substantial reductions in net national benefits and that no practical option exists to alleviate this loss. The GAP, therefore, believes that bocaccio should be treated as meeting the exception provided for in 50 CFR 600.310(d)(6) and that Alternative 3 reflect an appropriate optimum yield option.

A minority of the GAP disagrees with the use of the mixed stock exception.

PFMC
06/18/02

SCIENTIFIC AND STATISTICAL COMMITTEE REPORT ON PRELIMINARY HARVEST LEVELS AND OTHER SPECIFICATIONS FOR 2003

Dr. Jim Hastie presented an overview of the Groundfish Management Team (GMT) preliminary acceptable biological catch (ABC) and optimum yield (OY) determinations for 2003 (Exhibit C.4, Attachment 1). The Scientific and Statistical Committee (SSC) comments on ABC and OY determinations for Pacific whiting, sablefish, and yelloweye rockfish as follows:

Pacific whiting - Pacific whiting was declared overfished because of a recently completed assessment that estimated spawning biomass to be 20% of an unfished stock in 2001. The rebuilding analysis for whiting indicates that the 40-10 rule is adequate to achieve recovery to $B_{40\%}$ within 10 years. The potential rapid recovery of whiting is due to an above-average (but still uncertain) 1999 year-class that would increase spawning stock biomass as it becomes mature and due to the relatively high growth rate of whiting. The SSC recommends that any 40-10 rule OY values be based on the results of the assessment conducted in 2002 rather than the rebuilding software, because the 2002 assessment model includes multiple fisheries and time-varying weight-at-age. The 2002 whiting Stock Assessment Review (STAR) Panel concluded that "given concerns with the current formulation of the stock reconstruction model and the dependence of yield options beyond 2002 on continued recruitment of the 1999 year-class and recruitment from year-classes not actually observed, the Panel recommends against adopting 2003 projections until another assessment is conducted." The SSC again strongly supports this recommendation.

Sablefish - An updated assessment for sablefish was completed in 2002 and reviewed under the terms of reference for an expedited stock assessment update. Sablefish was considered for an expedited review, because of 2001 shelf survey results that suggested strong sablefish recruitment (primarily the 1999 year class) that was not included in the previous assessment. Contrast in the relative abundance of young fish in the shelf and slope surveys in 2001 resulted in a relatively large decrease in the slope survey catchability (Q), which translates into a substantial increase in the sablefish OY. The SSC cautions that the estimate of Q, and the implied estimate of sablefish OY remain highly uncertain. Management decisions should be made with the expectation that future sablefish assessments will result in similarly large swings in Q and the implied sablefish OY (both upwards and downwards).

Exhibit C.4, Attachment 1 show three alternatives for 2003 OY: a density-dependent recruitment scenario (alternative 2), a regime-shift scenario (alternative 3), and an $F_{60\%}$ density-dependent scenario that was developed by the Groundfish Management Team (GMT) to stabilize the spawning stock biomass (currently estimated to be 31% of unfished). Given the potential for an OY based on an imprecise stock assessment to reduce spawning stock biomass to a level approaching the overfished threshold, the SSC considers that a precautionary adjustment to the OY is warranted. This could be accomplished by setting the sablefish OY less than Alternative 2 of Exhibit C.4, Attachment 1, while Alternative 1 might usefully be considered as a lower bound to the sablefish OY.

Yelloweye rockfish - The yelloweye rockfish OY is based on a rebuilding analysis that considers two cases: a density-dependent hypothesis (scenario 1), and regime-shift hypothesis (scenario 2).

The SSC requests that, for consistency, the rebuilding analysis define B_0 for the regime-shift hypothesis (scenario 2) on recruitments for the years 1967-1993 and project future recruitment for the density-dependence hypothesis (scenario 1) on recruits/spawning output ratios for the years 1983-1993. The assessment author provided the SSC with revised rebuilding analysis results.

The SSC has no clear basis to choose between the two scenarios for yelloweye. These scenarios bound the range of possibilities. However, the SSC notes that the Terms of Reference for Groundfish Rebuilding Analysis (April 2001) suggest that the density-dependent scenario should be the default case, because stocks that have declined into an overfished condition are more likely to be unproductive (e.g., low spawner-recruit steepness).

PFMC
06/18/02

Exhibit C.4
Attachment 1
June 2002

TABLE 2-1. Acceptable biological catch (ABC) and total catch optimum yield (OY) alternatives for 2003 for the Washington, Oregon, and California region (metric tons) under the GMT-proposed alternatives. (Overfished stocks in CAPS).

	Status Quo Alternative 2002 ABCs/OYs		**Alternative 1** 2003 Low ABCs/OYs		**Alternative 2** 2003 Medium ABCs/OYs		**Alternative 3** 2003 High ABCs/OYs	
	ABC	OY	ABC	OY	ABC	OY	ABC	OY
LINGCOD	745	577		555		651		725
Pacific Cod	3,200	3,200			3,200	3,200		
PACIFIC WHITING	166,000	129,600						
Sablefish	4,644	4,367		4,381		7,359		8,091
Conception INPFC area	333	229		233		323		346
PACIFIC OCEAN PERCH	640	350	640	311	640	377	640	496
Shortbelly Rockfish	13,900	13,900			13,900	13,900		
WIDOW ROCKFISH	3,727	856	3,871	656	3,871	832	3,871	916
CANARY ROCKFISH	228	93		>20 ?				<50 ?
Chilipepper Rockfish	2,700	2,000			2,700	2,000		
BOCACCIO	122	100	198	0	198		198	14?
Splitnose Rockfish	615	461			615	461		
Yellowtail Rockfish	3,146	3,146			3,146	3,146		
Shortspine Thornyhead	1,004	955			1,004	955		
Longspine Thornyhead	2,461	2,461			2,461	2,461		
S. of Pt. Conception	390	195			390	195		
COWCOD (S. Concep)	5	2.4			5	2.4		
N. Concep & Monterey	19	2.4			19	2.4		
DARKBLOTCHED	187	168		172		184		208
YELLOWEYE - Coastwide	27	13.5	27	0.40?	27	1.10?	27	1.59?
N of 40°10' latitude	22	11	22	0.40?	22	1.03?	22	1.46?
Monterey	5	2.5	5	0.00?	5	0.07?	5	0.13?
Minor Rockfish North	4,795	3,115			4,795	3,115		
Minor Rockfish South	3,506	2,015			3,506	2,015		
Remaining Rockfish North	2,755				2,755			
Black	1,115				1,115			
Bocaccio	318				318			
Chilipepper - Eureka	32				32			
Redstripe	576				576			
Sharpchin	307				307			
Silvergrey	38				38			
Splitnose	242				242			
Yellowmouth	99				99			
Remaining Rockfish South	854				854			
Bank	350				350			
Blackgill	343				343			
Sharpchin	45				45			
Yellowtail	116				116			
Other Rockfish North	2,068				2,068			
South	2,652				2,652			
Dover Sole	8,510	7,440			8,510	7,440		
English Sole	3,100				3,100			
Petrale Sole	2,762				2,762			
Arrowtooth Flounder	5,800				5,800			
Other Flatfish	7,700				7,700			
Other Fish	14,700				14,700			

Obsolete per JGD 6/18/02

see GMT report

PRELIMINARY HARVEST LEVELS AND OTHER SPECIFICATIONS FOR 2003

Situation: Each year, the Council recommends harvest specifications for the upcoming year. This year, the task remains a two-meeting process that begins with the Council making preliminary recommendations at the June meeting and final recommendations at the September meeting. The fishery management plan (FMP) requires the Council to establish reference points for each major species or species complex: an acceptable biological catch (ABC), an optimum yield (OY), and overfishing threshold. In addition, OYs for some species are allocated between the open access, limited entry, tribal, and recreational fisheries.

Stock assessments were prepared in 2002 for bocaccio and canary rockfish (Exhibit C.2, Attachments 1 and 2, respectively). An expedited stock assessment update of last year's sablefish assessment was also done this year (Exhibit C.2, Attachment 3). Outlooks for bocaccio and canary rockfish are more pessimistic this year with evidence of poorer recruitment and stock productivity than originally determined. In contrast, the sablefish assessment update indicates recent recruitments were better than determined in last year's assessment.

New rebuilding analyses were also prepared this year for bocaccio, canary rockfish, yelloweye rockfish, widow rockfish, and Pacific whiting (Exhibit C.3, Attachments 1-5). The new shelf rockfish (bocaccio, canary rockfish, and yelloweye rockfish) rebuilding analyses reveal a more pessimistic outlook for these species. These species have recommended harvest levels much lower than previously considered. The Groundfish Management Team (GMT) considered these new assessments and analyses as well as the scientific advice of assessment scientists to develop a range of alternative harvest levels for species with new assessments and those declared overfished by the National Marine Fisheries Service (Exhibit C.4, Attachment 1). These harvest levels will have dramatic impacts on the types of management measures available for Council consideration in 2003 (Exhibit C.8).

Recommended alternative harvest levels for overfished species vary probabilities of rebuilding within the maximum allowable time (T_{MAX}) from 50% to 80%. The sablefish harvest level alternatives are based on two different assumed states of nature that affect future recruitment and productivity. A third alternative is based on a more conservative exploitation rate that projects increased spawning biomass in the next ten years. Recommended harvest levels for all other species and complexes are the same as specified for 2002.

Council Action:

1. Adopt proposed specifications for public review.

Reference Materials:

1. Table 2-1. Acceptable biological catch (ABC) and total catch optimum yield (OY) alternatives for 2003 for the Washington, Oregon, and California region (metric tons) under the GMT-proposed alternatives (Exhibit C.4, Attachment 1).

Agenda Order:

a. Agendum Overview — John DeVore
b. Preliminary Estimates of Acceptable Biological Catch, Optimum Yield, and Economic Analysis — Jim Hastie
c. Recommendation of the States, Tribes, and Federal Agencies
d. Reports and Comments of Advisory Bodies
e. Public Comment
f. **Council Action:** Adopt Proposed Specifications for Public Review

Groundfish Fishery Strategic Plan (GFSP) Consistency Analysis

The GFSP supports establishing an allowable level of catch that prevents overfishing while achieving OY based on best available science (Sec. II.A.2). The GFSP also supports establishing and maintaining a management process that is transparent, participatory, understandable, accessible, consistent, effective, and adaptable (Sec. II.C). The Council process of adopting harvest levels and other specifications is consistent with these GFSP principles.

PFMC
06/05/02

GROUNDFISH ADVISORY SUBPANEL COMMENTS ON ADOPTION OF
DRAFT REBUILDING PLANS FOR PUBLIC REVIEW FOR PACIFIC OCEAN PERCH, LINGCOD, COWCOD, WIDOW ROCKFISH, AND DARKBLOTCHED ROCKFISH

The Groundfish Advisory Subpanel (GAP) reviewed Draft Amendment 16 (Exhibit C.5, Attachment 2) and provides comments below on the options it contains. In addition, the GAP used the Draft Darkblotched Rebuilding Plan as a template to discuss rebuilding plans in general.

In regard to rebuilding efforts in general, the GAP continues to urge the use of the widest variety of science available. Although progress has been made, we continue to rely primarily on swept area trawl surveys of limited scope that cannot accurately assess many species, including several overfished species of rockfish. Larval surveys, while helpful, are of limited duration. The seafood industry and the public have suggested ways to better coordinate cooperative research, which have been ignored. If NMFS is truly committed to rebuilding populations designated as overfished and not just shutting down fishing as a way of sweeping the issue under the rug, then they need to start doing a better job.

In regard to the particular options in Draft Amendment 16, the GAP provides the following specific comments, which track the issues listed on pages 2-1 through 2-10:

Issue 1 - Form

The GAP believes the Council should try to maintain maximum flexibility within the bounds of legal requirements. The GAP supports using a regulatory amendment, rather than a plan amendment, for rebuilding plans, with the majority of specific details being included in annual regulations.

Issue 2 - Periodic Review

First, the GAP notes the section is written with the assumption that rebuilding will fall short of goals and not exceed goals. Review must take into account the fact that we could rebuild more quickly than anticipated. Second, the GAP suggests the review process be aligned as closely as possible with the stock assessment schedule and new multi-year management processes. This will reduce the number of times that a single stock will have to undergo a formal review.

Issue 3 - Adequacy of Progress

In line with our previous comments on the need for flexibility, the GAP recommends the Council adopt Option 3d with two modifications: first, the fishery management plan (FMP) needs to recognize that a rebuilding probability of 50% within T_{max} is the minimum that is legally acceptable; and second, that standards for adequacy of progress must also recognize that a stock may rebuild faster than projected in a rebuilding plan. We need to be prepared to deal with rebuilding that is more successful than initially assumed.

Issue 4 (Endangered Species Act [ESA] listing) and Issue 5 (Housekeeping)

The GAP has no specific recommendations or comments on these issues.

The GAP also suggests that an additional issue needs to be considered: where to set the “overfished” level in the Council’s control rule.

Under the National Standard Guidelines, Councils are advised to set control rules to deal with species that are below B_{msy}. For groundfish, the Council has developed the “40/10" rule which assumes $B_{40\%}$ as the proxy for MSY and sets the overfished level at $B_{25\%}$. However, the National Standard Guidelines also suggest the overfished level be set at ½ of B_{msy}. In the case of groundfish then, the level for groundfish could be $B_{20\%}$, not $B_{25\%}$. A minority of the GAP disagrees with this conclusions.

The GAP recommends the Council analyze two options in relation to the control rule: status quo, with the overfished level set at $B_{25\%}$; and a modification in line with the National Standard Guidelines that would set the overfished level at $B_{20\%}$. The analysis should include information on the biological and social and economic impacts of the alternatives.

In regard to rebuilding plans themselves, the GAP makes the following comments based on using the darkblotched rebuilding plan as a template:

1. Rebuilding plans need to analyze the effects of interspecific competition and predator / prey relationships in determining rebuilding. Very little emphasis has been given to problems that exist when one species at high levels is consuming another species at low levels and what effect this may have on rebuilding. Further, given that species can compete for the same habitat or ecological niche, it may not be possible to simultaneously recover some species.

2. Rebuilding plans need to explicitly analyze the trade-off between rebuilding times and availability of harvest. For example, a rebuilding time (T_{target}) that is less than allowable (T_{max}) might be achieved only by severely restricting catch. On the other hand, those catch restrictions could be somewhat relieved by adopting a T_{target} closer to T_{max}. This choice has obvious social and economic effects and needs to be analyzed and presented.

3. Analysis needs to be done on varying social and economic impacts that occur from a rapidly reduced fishery versus a fishery that is reduced in stages. If the option exists to stagger rebuilding adjustments, then it may be less harmful to reduce catches over time than to do it all at once, giving the seafood community time to adjust.

PFMC
06/18/02

Exhibit C.5.b
Supplemental HC Report
June 2002

HABITAT COMMITTEE REPORT ON ADOPTION OF DRAFT REBUILDING PLANS FOR PUBLIC REVIEW FOR PACIFIC OCEAN PERCH, LINGCOD, COWCOD, WIDOW ROCKFISH, AND DARKBLOTCHED ROCKFISH

The Habitat Committee recommends the draft rebuilding plans for darkblotched rockfish, Pacific ocean perch, cowcod, and lingcod be adopted for public review pending completion of socioeconomic and other incomplete analyses, and the following items identified by the Habitat Committee (HC):

Ensure language in all rebuilding plans is consistent with the final rule on essential fish habitat (EFH). The environmental consequences section should include an analysis of the various alternatives with respect to fishing activities that adversely affect EFH. The analysis should specify the type and function of affected habitat and the extent and frequency of disturbance. The description of the affected environment should specify benefits of existing management measures helping to minimize adverse effects of fishing gear on EFH.

The description of the affected environment for Pacific ocean perch (POP) (section 3.2.1) refers to spawning aggregations occurring in September and October. The analysis of the impacts from the alternatives should include the effects of fishing during this potentially vulnerable period on the stock productivity and bycatch of associated species.

The description of the affected environment for lingcod (section 3.1.1) describes male lingcod behavior patterns associated with nest guarding in relatively shallow areas, and the increased egg mortality associated with removal of the nest guarding male, but no mention of the impacts from the alternatives on the population is made in the analysis. We recommend that the effects of the alternatives on the population and spawning habitat be addressed, and at least one alternative include measures to restrict fishing impacts to those areas during critical time frames.

The effect of gear modification (e.g., reduced mouth trawls) on bycatch of lingcod, POP, and darkblotched rockfish is discussed in the analysis of impacts (section 4.2.1), but there is no mention of the relative effects on habitat of alternative gear types. The effects of any gear modifications included in alternatives should have a discussion of potential impacts, both positive and negative, on benthic habitat.

PFMC
06/19/02

Mark Powell

Exhibit C.5.b
Supplemental SSC Report
June 2002

SCIENTIFIC AND STATISTICAL COMMITTEE REPORT ON
ADOPTION OF DRAFT REBUILDING PLANS FOR PUBLIC REVIEW FOR PACIFIC OCEAN PERCH, LINGCOD, COWCOD, WIDOW ROCKFISH, AND DARKBLOTCHED ROCKFISH

Mr. Jim Seger briefly reviewed the draft document, “Process and Standards for Rebuilding Plans, Part A” (Exhibit C.5, Attachment 2) for the Scientific and Statistical Committee (SSC) and highlighted sections that he considered important for the SSC to review.

The SSC would like to make the following observations:

Amendment Issue 1: Form and Required Elements of Species Rebuilding Plans - As emphasized in the SSC’s March 2002 and April 2002 statements, the Council should expect numeric details of rebuilding plans (e.g., B_{MSY} in metric tons) to change over time – whether due to improved estimates of these parameters from updated stock assessments or due to technical errors that were not discovered in the previous stock assessment review. The use of hard numbers in the rebuilding amendment should be minimized in order to avoid the need to repeatedly amend the fishery management plan (FMP) with each stock assessment cycle. A case in point is the updated sablefish assessment conducted this year which resulted in a profound change to estimated biomass.

Amendment Issue 3: Mandated Revisions of Harvest Strategy - Option 3b under Adequacy of Progress (Standard Based on Negative Deviations) is not a sound scientific approach and should not be considered. This approach is biased, because it only considers stock projections below the rebuilding level and will result in a change in the probability of recovery. However, the SSC recommends an option be considered that re-estimates the target rebuilding exploitation rate while keeping T_{MAX} and the probability of recovery constant from the previous rebuilding analysis.

The SSC recognizes the importance of this amendment and the long-term impact it will have on future groundfish management. Given the amount of material necessary to review and the time constraints for the current meeting, a thorough review of the draft document and associated species rebuilding plans was not possible at this meeting. If requested by the Council, the Groundfish Subcommittee of the SSC would conduct a more detailed review of the documents and provide comments to the amendment authors before the September meeting.

PFMC
06/19/02

Quileute Natural Resources
QUILEUTE INDIAN TRIBE

401 Main Street • Post Office Box 187
LaPush, Washington 98350
Phone: (360) 374-5695 • Fax: (360) 374-9250

To: John DeVore
From: Mel Moon, Director

Re: Issues of concern to be addressed in the EIS for Pacific coast groundfish.

The Quileute Tribe's Treaty Fishing Rights in the Tribe's Usual and Accustomed (U&A) fishing area must be addressed in the EIS whenever NMFS management activities will occur in this U&A area.

Consideration in the EIS of the Quileute Tribe's treaty fishing rights, under the Magnuson-Stevens Act, when preparing any rebuilding plans, harvest restructuring, area closures or other fishing limitations for the non-treaty fisheries that may potentially impact the Tribe's fisheries.

The EIS must consider an analysis of non-treaty fisheries rebuilding parameters and if these strategies take place in the Tribe's Usual and Accustomed fishing area insure that the Tribe's fishing rights under the Treaty's are not adversely impacted.

All impacts and effects of fishing mortality management strategies as a result of non-treaty overcapitalization and overfishing must be addressed in the EIS and insure they do not impact the Tribe's fisheries.

The EIS must consider procedural review and revision of the rebuilding plans and insure that the Tribe is notified in a Government-to-Government process consistent with Presidential Executive Orders.

NRDC
THE EARTH'S BEST DEFENSE

NATURAL RESOURCES DEFENSE COUNCIL

May 30, 2002

BY FAX: 503-326-6831

John DeVore
Pacific Fishery Management Council
7700 NE Ambassador Pl., Suite 200
Portland, OR 97220

Dear Mr. DeVore :

The Natural Resources Defense Council hereby submits scoping comments on the environmental impact statement ("EIS") on Amendment 16 to the Pacific Coast Groundfish Fishery Management Plan ("FMP"). Amendment 16 is intended to serve as the vehicle for incorporating numerous rebuilding plans for overfished species into the groundfish FMP. The notice of intent for the EIS was published in the Federal Register at 67 Fed. Reg. 18,576 (April 16, 2002).

For each species covered by a rebuilding plan, it is essential that the EIS fully analyze all issues that are potentially relevant to the species's current overfished condition and to different available strategies for rebuilding the species. So, for example, the EIS must include a full, species-specific analysis of bycatch and must evaluate as alternatives and consider for adoption in the rebuilding plan all potentially practicable bycatch-reduction measures. Similarly, the EIS must fully analyze habitat needs and existing habitat impacts for each overfished species and must consider the full range of available alternatives for protecting and enhancing habitat for each species subject to a rebuilding plan. The EIS also must analyze the extent to which current management systems and strategies (including the year-round fishery goal and the use of small bimonthly trip limits) have contributed to the overfished status of each species and must consider all alternative management systems and strategies that might help rebuild each species faster or more effectively.

Sincerely,

Drew Caputo

Drew Caputo
Attorney

NEW YORK · WASHINGTON, DC · LOS ANGELES

www.nrdc.org

71 Stevenson Street, Suite 1825
San Francisco, CA 94105
TEL 415 777-0220 FAX 415 495-5996

Exhibit C.5.c
Supplemental Public Comment 2
June 2002

RECEIVED

JUN 11 2002

PFMC

CITY OF FORT BRAGG

Incorporated August 5, 1889
416 N. Franklin St.
Fort Bragg, CA 95437
FAX 707-961-2802

June 5, 2002

Dr. Donald O. McIssac
Pacific Fishery Management Council
7700 NE Ambassador Place, Suite 200
Portland, OR 97220-1384

RE: 2003 Management Plans

Dear Dr. McIssac:

There has been recent publicity in regional papers that the Council may impose severe measures on commercial and sport fishing for 2003. This raises concern in the City of Fort Bragg, because fishing is an important part of the economy. In addition, there are many residents who depend on local fish as a source of food.

I understand that the Council and its advisory committees will be meeting during the entire week of June 17 in San Francisco to prepare proposals and alternatives for public review. I will appreciate you informing the Council of the following:

1. The City of Fort Bragg is very interested in the management plans, seasons and rebuilding plans for the 2003 season; and,
2. The City of Fort Bragg will appreciate being included on the mailing list for the documents available for public review and comment.

Thank you for your attention to this request.

Sincerely,

Jere Melo
Mayor

CC: City Council, City Manager & City Clerk

Exhibit C.5
Attachment 2
June 2002

DRAFT

PROCESS AND STANDARDS FOR REBUILDING PLANS AND REBUILDING PLANS FOR:

DARKBLOTCHED ROCKFISH (Attachment 3)
PACIFIC OCEAN PERCH (Attachment 4)
COWCOD (Attachment 5)
LINGCOD (Attachment 6)

AMENDMENT 16

TO THE PACIFIC COAST GROUNDFISH FISHERY MANAGEMENT PLAN

INCLUDING DRAFT ENVIRONMENTAL IMPACT STATEMENTS AND REGULATORY ANALYSES

Prepared by the Pacific Fishery Management Council

Pacific Fishery Management Council
7700 NE Ambassador Place, Suite 200
Portland, Oregon 97220-1384
(503) 820-2280
www.pcouncil.org

JUNE 2002

This document prepared by the Pacific Fishery Management Council pursuant to National Oceanic and Atmospheric Administration Award Number NA17FC2235.

TABLE OF CONTENTS

ABBREVIATIONS AND ACRONYMS

ABC	Allowable Biological Catch
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
cm	centimeter
CMC	Center for Marine Conservation
CPS	Coastal Pelagic Species
DTS	Dover sole-Thornyhead-Sablefish
EEZ	Exclusive Economic Zone
EFH	Essential Fish Habitat
EIS	Environmental Impact Statement
EO	Executive Order
ESA	Endangered Species Act
FMP	Fishery Management Plan
FWS	U.S. Fish and Wildlife Service
GMT	Groundfish Management Team
IPHC	International Pacific Halibut Commission
kg	kilogram
m	meter
MBTA	Migratory Bird Treaty Act
MMPA	Marine Mammal Protection Act
MSA	Magnuson-Stevens Fishery Conservation and Management Act
MSST	Minimum Stock Size Threshold
MSY	Maximum Sustainable Yield
mt	metric ton
NEPA	National Environmental Policy Act
NMFS	National Marine Fishery Service
NOAA	National Oceanographic and Atmospheric Administration
NRDC	Natural Resources Defense Council
OY	Optimum Yield
RFA	Regulatory Flexibility Act (or Analysis)
RIR	Regulatory Impact Review

SFA	Sustainable Fisheries Act
SOPP	Statement of Organization, Practices, and Procedures
SSC	Scientific and Statistical Committee
STAR	Stock Assessment Review Panel
STAT	Stock Assessment Team
WOC	Washington-Oregon-California

OVERVIEW

Purpose of and Need for Amendment 16

To date nine species managed under the Pacific Fishery Management Council's Pacific Coast Groundfish Fishery Management Plan (Groundfish FMP) have been declared overfished by the Secretary of Commerce pursuant to provisions in Magnuson-Stevens Fishery Management and Conservation Act (MSA) and based on criteria in the Groundfish FMP. In response, the Council amended the Groundfish FMP to establish a framework process for adopting rebuilding plans and began developing rebuilding plans as species were declared overfished. Framework rebuilding plan measures were implemented through the annual specifications that control groundfish fishery harvests. However, in Natural Resources Defense Council, Inc. v. Evans, 2001 WL 1246622 (N.D. Cal. 2001) the Court found that the Council's rebuilding plans were not in compliance with the MSA because they were not in the form of an FMP or regulatory amendment. Because of these events the Council must establish a process for adopting rebuilding measures that conforms to MSA requirements. The Council also has to adopt the individual rebuilding plans and amend the FMP to incorporate rebuilding measures.

The overall purpose of this amendment package is to implement procedures to rebuild groundfish stocks declared overfished by the Secretary of Commerce. This purpose is addressed in two ways. First, this document establishes the contents of rebuilding plans and a process for implementing and periodically reviewing them (required by the MSA, §304(e)(7)). Second, rebuilding plans for a number of overfished stocks are incorporated into this document and adopted as plan amendments. Rebuilding plans for currently overfished species that are not covered by this amendment will be adopted in a subsequent plan amendment(s), pending the completion of new stock assessments and rebuilding analyses. Both the procedural provisions and the rebuilding plans themselves must meet the requirements of the MSA (and, in particular, National Standard 1 and §304(e), covering rebuilding plans) and should be consistent with FMP goals and objectives.

Organization of Amendment 16 Documentation

Drafting Amendment 16 poses a procedural challenge because it incorporates a number of components and the rebuilding plans are unlikely to be finished simultaneously. These components are separate actions with discrete consequences. However, the effects of all these actions in combination, or cumulatively, are likely to be complex and substantial. In order to overcome uncertainties about timing, ease adoption and consider the actions individually and cumulatively, this amendment document has a "modular" format. Taking this approach, each component is presented as an essentially stand-alone document; these are collected together under a uniting cover along with some generic elements, discussed below. The "modules" or document parts (procedural measures and individual rebuilding plans) have most of the elements required by the National Environmental Policy Act and other mandates, which require description and analysis of the effects of the proposed action in comparison to alternative methods to achieve the purpose of the action. These essential elements are: (1) a statement of purpose and need, (2) a description and comparison of alternatives, (3) a description of the affected environment, and (4) an analysis of the environmental consequences of each alternative if it were pursued. The modular format will allow individual rebuilding plans to be added to, or dropped from, the draft document during its preparation, depending on a range of contingencies that govern rebuilding plan completion (such as the availability of stock assessment and rebuilding analysis results). In combination the rebuilding plans are likely to have substantial cumulative effects and those plans not included in this document constitute "reasonably foreseeable actions." In order to address these effects, which may not be sufficiently analyzed in any one rebuilding plan or document module, a cumulative effects analysis appears separately in an appendix. This analysis may appear in future amendment documents, updated, that contain subsequent rebuilding plans. Some generic elements, such as a discussion of MSA National Standards and the specifics of mandates other than NEPA, may only appear in the "process and standards" module (Part A), and will be referenced in subsequent rebuilding plans.

This document is divided into several parts. Part A contains the "process and standards" alternatives and analysis of potential effects. The remaining Parts (A-I) are the rebuilding plans. Rebuilding plans incorporated in subsequent documents will also be identified by lettered parts.

PROCESS AND STANDARDS FOR REBUILDING PLANS

PART A

AMENDMENT 16 TO THE GROUNDFISH FISHERY MANAGEMENT PLAN

PACIFIC FISHERY MANAGEMENT COUNCIL
JUNE 2002

ABSTRACT

Nine species managed under the Pacific Fishery Management Council's Pacific Coast Groundfish Fishery Management Plan (groundfish FMP) have been declared overfished by the Secretary of Commerce pursuant to provisions in Magnuson-Stevens Fishery Management and Conservation Act (MSA) and based on criteria in the groundfish FMP. In 2000 the Council developed rebuilding plans for the three species declared overfished at that time. Through an amendment it also established a framework within the groundfish FMP that specified a process for adopting rebuilding plans. While the Secretary, through NMFS, approved the FMP changes incorporating the framework process in late 2000, the Council was asked to revise the three initial rebuilding plans so that they conformed to the adopted framework in the FMP. These initial plans, which were subsequently revised by the Council and approved by NMFS, took the form of policy documents. They contained both specific objectives for reduced harvest mortality levels and other parameters and provisions required by the MSA and NOAA guidelines. (These "National Standard Guidelines" interpret MSA requirements.) The Council has implemented management actions to achieve fishing mortality levels specified in all interim and adopted rebuilding plans through regulations developed annually to control groundfish fishery harvests. (This annual specification process is described in the groundfish FMP and implemented through associated regulations.) However, in Natural Resources Defense Council, Inc. v. Evans, 2001 WL 1246622 (N.D. Cal. 2001) the Court found that the Council's rebuilding plans were not in compliance with the MSA because they were not in the form of an FMP or regulatory amendment. **Therefore, the purpose of Part A of this FMP amendment is to specify the process and standards by which the Council will develop and adopt rebuilding plans that comply with the finding of the Court.** Based on scoping, this document will consider alternatives based on a number of major issues, including: (1) whether rebuilding plans should be established as plan amendments or regulatory amendments; (2) the broad elements of rebuilding plans to be incorporated into the FMP or adopted by regulation; (4) the specific parameters that will be so incorporated, how they will be specified (e.g. numerically, by algorithm) and whether they can be changed without a plan amendment, as new information becomes available; and (3) what schedule will be followed to review and evaluate progress made in rebuilding overfished stocks. The actual rebuilding plans are separate but related actions implemented in compliance with the process and standards described in this Part. This document is organized to address the requirements of the MSA, National Environmental Policy Act, Executive Order 12866, and the Regulatory Flexibility Act. In so doing it describes a range of "process and standards" alternatives and analyzes the environmental and socioeconomic impacts of these alternatives.

1.0 Introduction

1.1 How This Amendment is Organized

This document provides background information about and analysis of changes to the Pacific Coast Groundfish Fishery Management Plan incorporated as Amendment 16. The actual changes, or amended parts of the plan, appear in appendices. Fishery management plans (FMPs), and any amendments to them, must conform to the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act, or MSA), the principal legislation governing fishery management within the Exclusive Economic Zone (EEZ), which extends from the outer boundary of the territorial sea to a distance of 200 miles from shore. In addition to addressing MSA mandates, this amendment document is organized so that it contains the analyses required under the National Environmental Policy Act (NEPA), the Regulatory Flexibility Act (RFA), and Executive Order 12866 (Regulatory Impact Review or RIR).

Draft Amendment 16 is divided into a number of stand-alone Parts, including this document analyzing the processes and standards for adopting rebuilding plans for overfished fish stocks. Each Part is to a large degree an independent document with the essential elements and analyses required by NEPA and the other mandates listed above. (This includes a purpose and need statement, suite of alternatives, description of the affected environment, and environmental and socioeconomic impact analysis.) Some generic elements, such as a discussion of MSA national standards and the specifics of mandates other than NEPA, may only appear in this "process and standards" sub-document, and will be referenced in subsequent rebuilding plans. As of this writing, nine groundfish species have been declared overfished and the cumulative effects of foreseeable rebuilding plans bear scrutiny. This analysis appears as an appendix that may be referenced by or incorporated into the several Parts of this amendment. This somewhat unorthodox, "modular" approach is necessitated because individual plans have different expected completion dates. It would be unwise either to wait for all plans to be completed to prepare this analysis—which would entail some delay—or analyze each part in wholly separate documents without an appreciation of their relationship.

The rest of this section discusses the reasons for changing the FMP. This description of purpose and need defines the scope of the subsequent analysis. Section 2 outlines different alternatives that have been considered to address the purpose and need. One of these alternatives will be chosen by the Pacific Fishery Management Council (hereafter, the Council) as a plan amendment to be recommended to NMFS. Section 3 describes the affected environment. This information provides the basis for the analysis contained in Section 4, which assesses the potential environmental and socioeconomic impacts of the alternatives outlined in Section 2. Section 5 details how this amendment meets 10 National Standards set forth in the MSA (§301(a)) and Groundfish FMP goals and objectives. Section 6, provides information on those other law, in addition to the MSA, that an amendment must be consistent with and how this amendment has satisfied those mandates.

1.2 Purpose and Need

1.2.1 Problems for Resolution

As of February 2002 the Secretary of Commerce had declared nine groundfish stocks overfished. These are: bocaccio (*Sebastes paucispinis*), canary rockfish (*S. pinneger*), cowcod (*S. levis*), darkblotched rockfish (*S. crameri*), lingcod (*Ophiodon elongatus*), pacific ocean perch (*S. alutus*), widow rockfish (*S. entomelas*), yelloweye rockfish (*S. ruberrimus*) and Pacific whiting (*Merluccius productus*). These declarations, stemming from MSA requirements, are based on overfishing criteria adopted by the Council under Amendment 11 to the Pacific Coast Groundfish FMP. The MSA (§304(e)(3)) also requires councils to "prepare a fishery management plan, plan amendment, or proposed regulations" in order to prevent overfishing and implement a plan to rebuild the overfished stocks. The Pacific Council developed Amendment 12 to specify an effective process for implementing rebuilding plans. This amendment was approved by the Council in April 2000 and approved by NMFS on December 7, 2000. However, in Federal Court the Natural Resources Defense Council, an environmental organization, challenged the legality of the provisions in Amendment 12 related to rebuilding plans,[1/] based on the MSA and the National Environmental Policy Act (NEPA). The judge found that the rebuilding plans created in accordance with Amendment 12 did not comply with the MSA because the plans did not take the form of an FMP amendment or regulation. Therefore, the Council must specify rebuilding plans as an FMP or regulatory amendment.

Rebuilding plans are mandated when the size of a stock or stock complex falls below a level described in the FMP (the Minimum Stock Size Threshold or MSST). Diminished stock size may be caused or exacerbated by fishing. Regardless of the cause of the decline, fishing mortality needs to be controlled to prevent further deterioration in the condition of the stock, and if the stock has been overfished, to allow it to rebuild.[2/] Amendment 11 to the groundfish FMP established the "status determination criteria" (including MSST) that are used to determine whether overfishing is occurring and whether a stock has reached an overfished state. Rebuilding plans a specify how an overfished stock will be rebuilt.

Whether or not action is taken to reduce fishing mortality and rebuild the stocks, there are impacts on the natural environment, commercial and recreational fishing communities and those members of the public who benefit from a healthy fish stock. Additionally, when fishing mortality is reduced to rebuild, restrictions may need to be imposed on the harvest of co-occurring target species that would otherwise be sustainably harvested at their specified optimal yield.

1.2.2 Purpose of the Actions Proposed in this Part

The overall purpose of this Part of the amendment is to set the process and standards under which the Council will specify rebuilding plans for groundfish stocks declared overfished by the Secretary of Commerce. Both the procedural provisions and the standards established for rebuilding plans must meet the requirements of the MSA (and, in particular, National Standard 1 and §304(e), covering overfishing) and should be consistent with FMP goals and objectives.

1.3 Background

1.3.1 Requirements for Rebuilding Plans

National standard guidelines specify how rebuilding should occur and, in particular, establish constraints on council action (50 CFR660.310(e)). Rebuilding should bring stocks back to a population size that can support MSY (B_{MSY}). A rebuilding plan must specify a target year (T_{TARGET}) based on the time required for the stock to reach B_{MSY}. This target is bounded by a lower limit (T_{MIN}) defined as the time needed for rebuilding in the absence of fishing (i.e., F = 0). Rebuilding plans for stocks with a T_{MIN} less than 10 years must have a target less than 10 years. If, as is the case with most of the groundfish stocks considered in this amendment, the biology of a particular species dictates a T_{MIN} of 10 years or greater, then the maximum allowable rebuilding time, T_{MAX}, is the rebuilding time in the absence of fishing (T_{MIN}) plus "one mean generation time." Mean generation time is a measure of the time required for a female to produce a reproductively-active female offspring (Restrepo et. al, 1998; also see Pielou 1977). Managers should strive to rebuild stocks in the shortest feasible time. However, the target year may be greater than the minimum rebuilding time (T_{MIN}) in order to mitigate impacts to fishing communities.

Because of the uncertainty surrounding stock assessments and future population trends (due, for example, to variable recruitment), these limits and the target need to be expressed probabilistically. At the outset of the rebuilding period T_{TARGET} should be set so that there is at least a 50% probability of

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1/ The amendment also removed FMP provisions that allowed foreign fishing on groundfish stocks. This part of the amendment was not challenged and these changes to the FMP stand.

2/ But when environmental changes affect the long-term productive capacity of the stock, one or more components of the status determination criteria may be respecified and the need for a reduction in fishing moratlity reevaluated (50 CFR Section 600.310).

achieving it within the specified time period.[3] (The nature of probabilities associated with T_{MIN}, T_{TARGET} and T_{MAX} are discussed further in the next section.)

National standard guidelines identify a "mixed-stock complex" exception to the definition of overfishing (50 CFR 660.310(d)(6)), which is applicable to some overfished groundfish species. Different fish assemblages—some with healthy stocks and some with overfished stocks—can co-occur in a mixed-stock complex, and thus both can be caught simultaneously. An optimum yield (OY) harvest for the healthy stock can result in overfishing the depleted stock. The guidelines allow councils to authorize this type of overfishing if three conditions are met. First, an FMP (or plan amendment) must assess the overall benefits of such a policy in comparison to other measures, such as reducing the OY for the healthy stock (50 CFR 660.315(f)(6)). Second, councils must consider mitigating measures that reduce overfishing by, for example, modifying fishing strategy or gear configuration. The benefits of mitigation must be compared to those determined in the preceding assessment; the measures would only be implemented if they will result in greater benefits. Finally, permitted overfishing cannot result in eventual listing of the species (or evolutionarily significant unit thereof) under the Endangered Species Act. This mixed-stock exception may be considered in formulating rebuilding plans and could allow some modification in the recovery trajectory of overfished stocks.

1.3.2 Rebuilding Analyses

Each rebuilding plan is based on an analysis that specifies the parameters contained in the rebuilding plan. The elements of rebuilding analyses are described in the SSC Terms of Reference for Rebuilding Analyses (SSC 2002). This guidance has been incorporated into a computer program developed by Dr. Andre Punt of the University of Washington School of Fisheries and Aquatic Sciences (Punt 2002b). In the analysis the probability that the overfished stock will reach its target biomass is determined with respect to T_{MIN}, T_{MAX} and T_{TARGET}. Probability statements are an estimate that something may happen (in this case, that stocks will reach a given size in a specified time period) and thus also the level of risk associated with a given action. When interpreting rebuilding analyses it is important to understand how probability statements are derived, distinguish the basic policy choice from parameters that are essentially biological characteristics of the overfished stock, identify different sources of uncertainty, and appreciate that even "fixed" values can change as the system (or fish stock)—and our understanding of it—changes over time.

The rebuilding analysis program uses "Monte Carlo simulation" to derive a probability estimate for a given rebuilding strategy. This method projects population growth many times in separate simulations. It accounts for possible variability by randomly choosing the value of a key variable—in this case total recruitment or recruits per spawner—from a range of values. These values can be specified empirically, by listing some set of historical values, or by a relationship based on a model. The SSC recommends that the rebuilding analyses use historical values. Because of this variability in a key input value, each simulation will show a different pattern of population growth. As a result, a modeled population may reach the target biomass that defines a rebuilt stock (B_{40}) in a different year in each of the simulations. Figures 1-1a and 1-1b show the results of five such simulations each for widow rockfish and bocaccio at a specified level of fishing mortality.[4] The horizontal line represents target biomass. In Figure 1-1a, showing widow rockfish, the simulations reach this level in years ranging from 2035 to 2057. Bocaccio population growth simulations, shown in Figure 1-1b, are much more variable, reflecting variation in the historical recruitment data. Two of the simulations reach the target but subsequently fluctuates above and below this level; two others do not reach the target in the time period displayed; a third shows rapid growth to a level above the target near the end of the displayed time period. The number of simulations that reach the target biomass in any year before a specified year can be compared to the total number of

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[3] The use of a low bound 50% probability is not specified in regulations; it is the result of litigation (*Natural Resources Defense Council v. Daley, April 25, 2000, U.S. Court of Appeals for the District of Columbia Circuit*).

[4] Although these figures plot the results of the rebuilding analysis computer program, they are used here to illustrate concepts underlying the analyses. It cannot be assumed that these plots correspond to the actual rebuilding analysis results because more recent stock assessment data may be used in the published analyses.

simulations in the "program run." This gives an estimate of the probability that the target biomass will be met at any time before the specified year. This technique can be used first to calculate T_{MIN} in probabilistic terms, which is defined as the time needed to reach the target biomass in the absence of fishing with a 50% probability. Thus, if 1,000 simulations are run with F=0, the number of simulations reaching the target biomass in a given year can be progressively summed (or cumulated) starting with the first year set for the simulations and running out to some maximum number of years (which could be the simulation in which the population took the longest time to reach the target biomass or a predetermined maximum value). In this example T_{MIN} would be determined by finding the year in which this cumulative value equals 500. In other words, in half the simulations the target biomass was reached in some year up to and including the computed T_{MIN}. Given T_{MIN}, and assuming that it is greater than or equal to 10 years (as is the case with most of the overfished groundfish stocks), T_{MAX} is computed by adding the value of one mean generation time.

T_{TARGET} is determined in a similar way. It is defined as the amount of time needed to reach the target biomass—given some level of fishing mortality—with a 50% probability. (In the absence of fishing T_{TARGET} and T_{MIN} are thus the same value.) This can be considered the median year because half of all simulations reached the target biomass in the time period up to T_{TARGET} and half in the time period after.

Although the target year is identified in the MSA and national standards guidelines, the rebuilding analyses compare different harvest policies using a single standard: for a given level of fishing mortality, the probability of achieving the target biomass within the maximum allowed time period (T_{MAX}). The same type of Monte Carlo simulation can be used to determine this probability as was just described for determining T_{MIN} and T_{TARGET}. Figure 1-2 is a plot of the individual year and cumulative probability distributions for a given level of fishing mortality from the bocaccio analysis. The cumulative probability reaches 50% at T_{MAX}, which is 78 years from the start of rebuilding. This T_{MAX} probability means that 50% of the simulations reached the target biomass at some point in those 78 years. (In this case T_{TARGET} equals T_{MAX} because both are specified by the 50% probability. With an increased T_{MAX} probability, necessitating a reduction in fishing mortality, T_{TARGET} would occur earlier)

Figure 1-2 shows the percent of simulations reaching the target biomass in each year (represented by the bars) and two cumulative probabilities (lines). The solid line sums simulations that have reached the target biomass in any of the preceding years even if biomass declines below the target in subsequent years due to the kind of recruitment variability illustrated in Figure 1-1b. The dashed line cumulates only those trajectories that reach the target biomass and stay above it thereafter. This cumulative probability is comparatively lower, and for T_{MAX} is only 30% for the Monte Carlo simulation shown in Figure 1-2. It is important to appreciate this distinction and understand that the T_{MAX} probabilities used in rebuilding analyses are calculated the first way, expressing the likelihood of reaching the target biomass but not necessarily remaining above it.

The rebuilding analysis computer program is actually initialized with a given probability and iteratively searches for the level of fishing mortality that gives that probability. But from a policy-making standpoint the essential tradeoff is between a given level of fishing mortality and the probability that the stock will be rebuilt within the maximum permissible time period (T_{MAX}). Although computationally there is a prescribed relationship, with the T_{MAX} probability as an input value, policy makers may wish to base their decisions on T_{MAX}, T_{TARGET}, or the probability of reaching the target biomass. In doing so it is important to keep in mind the relationship between these parameters. Fundamentally, the policy maker only chooses the tradeoff between fishing mortality and the probability of rebuilding by T_{MAX}. Figure 1-3 illustrates this tradeoff in the widow rockfish rebuilding analysis. Note that the relationship is not linear and that incremental cost (in terms of catch reductions) increases rapidly at the low risk margin and that a 100% probability cannot be achieved even in the absence of fishing. Instead of choosing the fishing mortality level (or T_{MAX} probability) the policy maker could choose any year between T_{MIN} and T_{MAX} as the target year (as long as the resulting probability is equal to or greater than the default value of 50%); once fishing mortality has been fixed, the choice of T_{TARGET} simply determines the probability that it will be achieved. Note that choosing some T_{TARGET} other than the default does not influence the underlying policy variable, which is the level of fishing mortality. The default T_{TARGET} value is determined by its probability (50%). If the fishing mortality level has already been chosen, identifying some other T_{TARGET} value would only affect the probability of achieving target biomass by the year chosen, but does not change the rebuilding trajectory.

As the preceding discussion suggests, probability statements about T_{MAX} or T_{TARGET} tell us the likelihood of an outcome based on our understanding of a fish stock and our ability to model how that stock will grow over time. Since our understanding of these population characteristics is imperfect, some sources of uncertainty are not captured in the aforementioned probability statements. First, inputs to the rebuilding analysis are to a greater or lesser degree best estimates of true values. This applies to basic biological parameters, such as fecundity, that are used to model population growth. Population projections also depend on and estimate of the size and age structure of the modeled stock at the outset of the projected time period, derived from the most recent stock assessment. Similarly, the biomass target (B_{40}) requires an estimate of the equilibrium population size that would be reached in the absence of fishing (see Box). In all these cases the best estimate may not coincide with the true value. The Monte Carlo simulation used in the rebuilding analyses only considers uncertainty about future recruitment, so inaccuracy in the estimation of both species and stock-specific variables will not be captured in resulting probability statements. Finally, there is some uncertainty (or variability) inherent to the Monte Carlo simulation because any one "run" (set of projections) will not include all possible outcomes. This variability can be assessed by invoking several runs and measuring the variation in the output value (fishing mortality for a given T_{MAX} probability) among these runs (Punt 2002a). This type of assessment can be used to establish a range around a point estimate (the mean value) expressing the likelihood that the true value falls within that range.[5/]

New information may result in new estimates of biological and stock parameters, and assessed uncertainty in the Monte Carlo simulation tells us something about the range of possible outcomes. But rebuilding trajectories will also change over time with new stock assessments and as historical data (such as total catch estimates for past years) replaces projected values. Time targets—T_{MIN}, T_{MAX} and T_{TARGET}—fall along a time scale that begins when the stock is declared overfished (y_{decl}).[6/] Because the rebuilding analysis is usually conducted from one to several years after y_{decl}, a more recent stock assessment may allow population growth to be projected from the most recent year for which stock structure data (such as mortality, weight, and number of animals for each age class in the population) are available. In subsequent analyses (conducted as new stock assessment data become available) the pool of historical recruitment values will likely differ (with addition of the most recent years' data) and the there will be fewer years for which population growth is projected. (This assumes that T_{MAX} is not re-computed because, for example, changes in stock structure produce a different value for mean generation time.). It is highly likely that the new analysis will suggest a different level of fishing mortality to achieve the same T_{MAX} probability (and by extension T_{TARGET} value, or probability if the target year is fixed). Conversely, if the policy maker wishes to continue with the same harvest policy—a given fishing mortality rate for example—the T_{MAX} probability would likely be different in the new analysis.

5/ These assessments demonstrates three important points. First, different modeled species will produce different degrees of variability when comparing runs because of the underlying variability in the input recruitment data. Second, for a given species and T_{MAX} probability increasing the number of simulations in a run decreases uncertainty (or relative variability). But this decrease is not constant; above a certain run size there are diminishing returns for further increases in the number of simulations. Finally, for a given species and run size choosing a lower T_{MAX} probability increases certainty (by decreasing the range of possibly "correct" values for fishing mortality, or OY).

6/ National Standard guidelines identify the initial rebuilding year, for the purpose of calculating targets, as the year in which rebuilding measures were first implemented. For overfished Pacific groundfish this would be the year in which interim rebuilding plan measures were implemented as part of the annual management process. In most cases this was the either y_{decl} or the following year.

Estimation of Virgin Biomass

Target biomass is directly related to B_0, or "virgin (unfished) biomass." (It is expressed as a percentage of this value.) Target biomass in turn affects the rebuilding trajectory described by T_{MIN}, T_{MAX} and T_{TARGET}. B_0 is rarely known absolutely; instead it is calculated based on the relationship between the number of spawning fish and resulting recruits to the fishable population. Modelers choose a time period for which data are available and fishing effort has been at a stable and relatively moderate level. The choice of time period is complicated because biologists are unsure how important environmental conditions are to survival and growth versus spawning population size, which posits a "density dependent" spawner to recruitment relationship. (For groundfish this relationship is believed to be positive: a larger spawning population results in greater total recruitment.) For Pacific coast groundfish these two factors have historically had potentially confounding effects. A large-scale regime shift began in 1977; many scientists believe that generally warmer water produced less favorable conditions for groundfish. The period after 1977 also saw a decline in groundfish populations due to increased fishing effort. If an environmental explanation is favored, one would choose a long time series that encompassed recruitment both before and after 1977 in order to account for the impact of the environmental change. However, this will result in a relatively lower value for B_0 than only using recruitment values before 1977 when biomass and recruitment were closer to an unfished state. The SSC also discusses a third approach in its Terms of Reference, using spawner-recruit models instead of relying solely on empirical data. These models are problematic because they mathematically presuppose a certain spawner-recruit relationship. The overfished species being modeled may not exhibit this relationship because of its particular biology and ecology. The SSC recommends determining B_0 based on the density-dependent hypothesis and therefore using earlier data (resulting in relatively large values for B_0). It can be seen that uncertainty about stock dynamics requires scientific judgement. This is not a policy choice (which involve trade-offs between different social values). But these judgements do affect the variables that influence policy choices since other parameters, such as target biomass, are defined in relation to B_0.

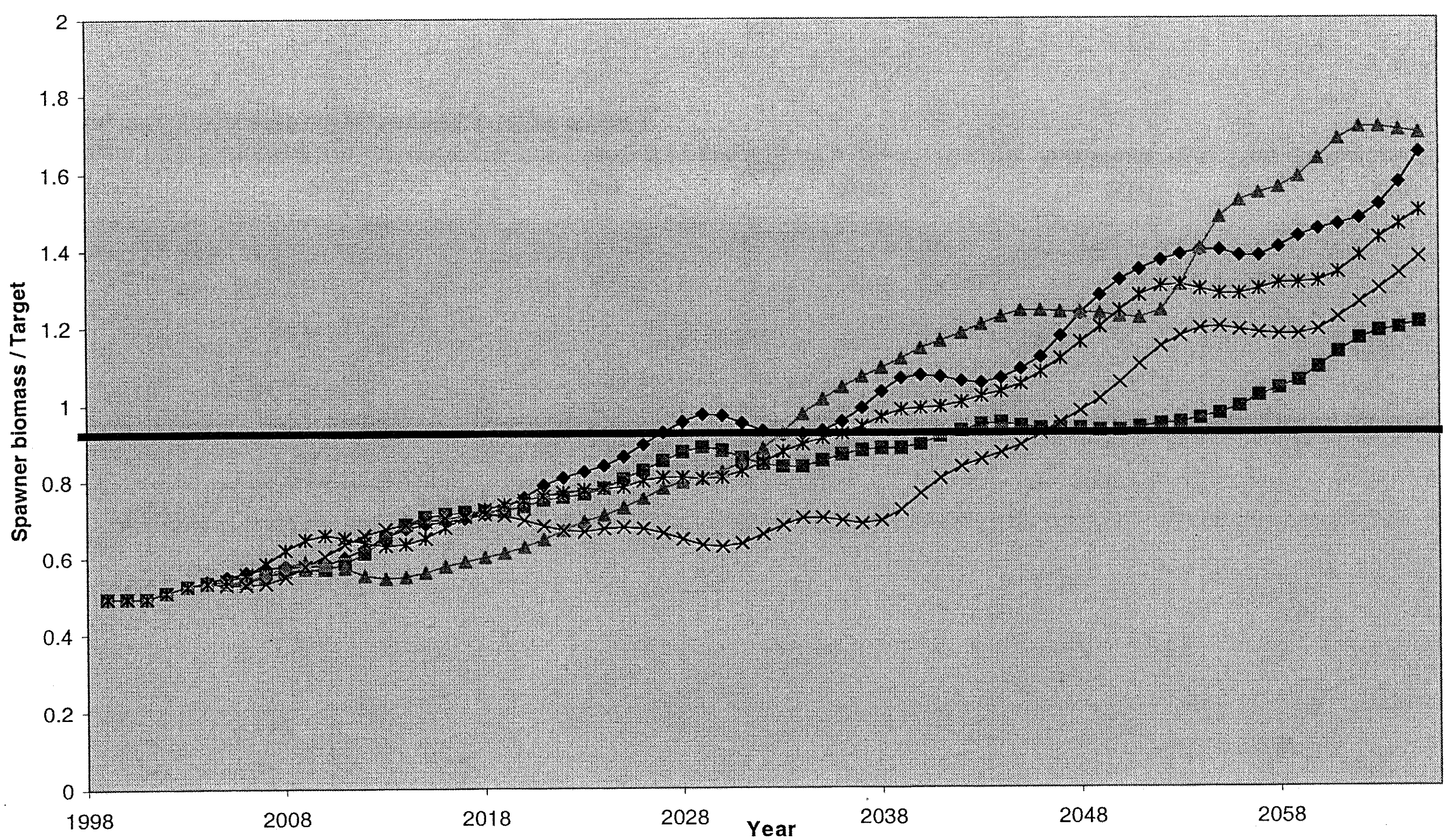

Figure 1-1a: Eample of five population growth simulations for widow rockfish for a given F. (Source: Andre Punt. Note: Plots are illustrative and may not correspond to actual rebuilding analysis results.)

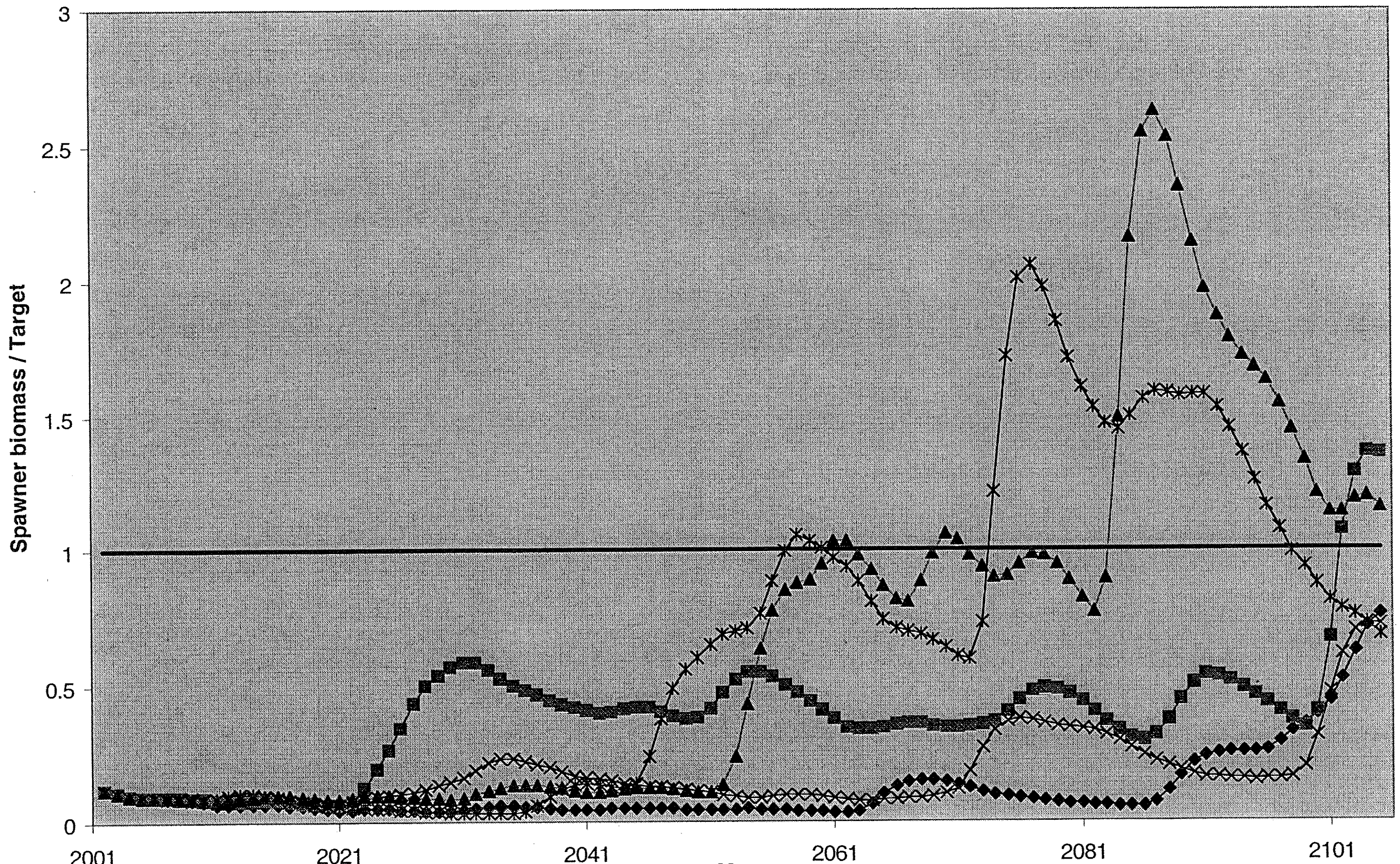

Figure 1-1b: Example of five population growth simulations for bocaccio for a given F. (Source: Andre Punt. Note: Plots are illustrative and may not correspond to actual rebuilding analysis results.)

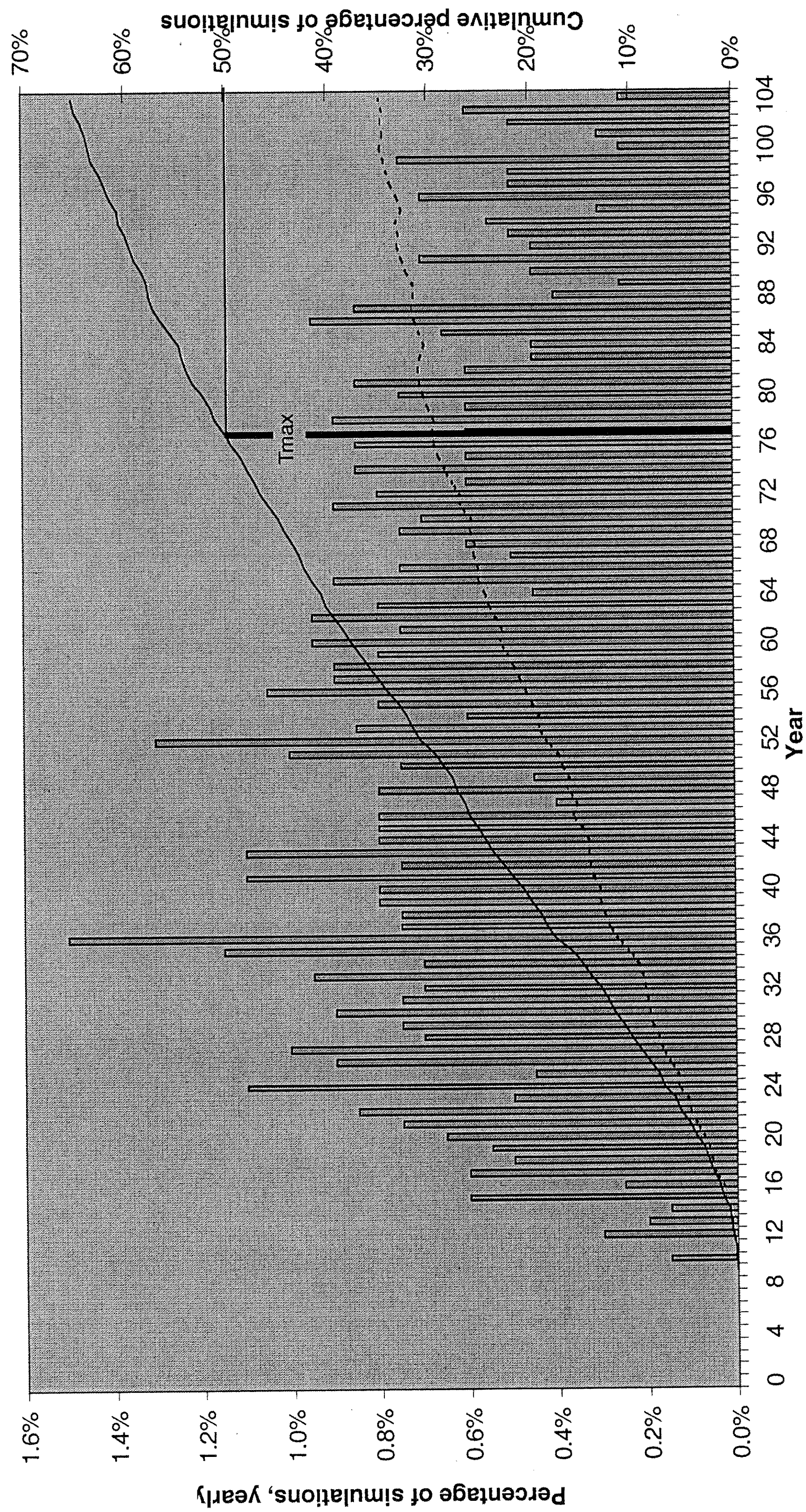

Figure 1-2: Rebuilding analysis for bocaccio at a given F and with a Tmax probability of 50%. (Source: Andre Punt. Note: Plots are illustrative and may not correspond to actual rebuilding analysis results.)

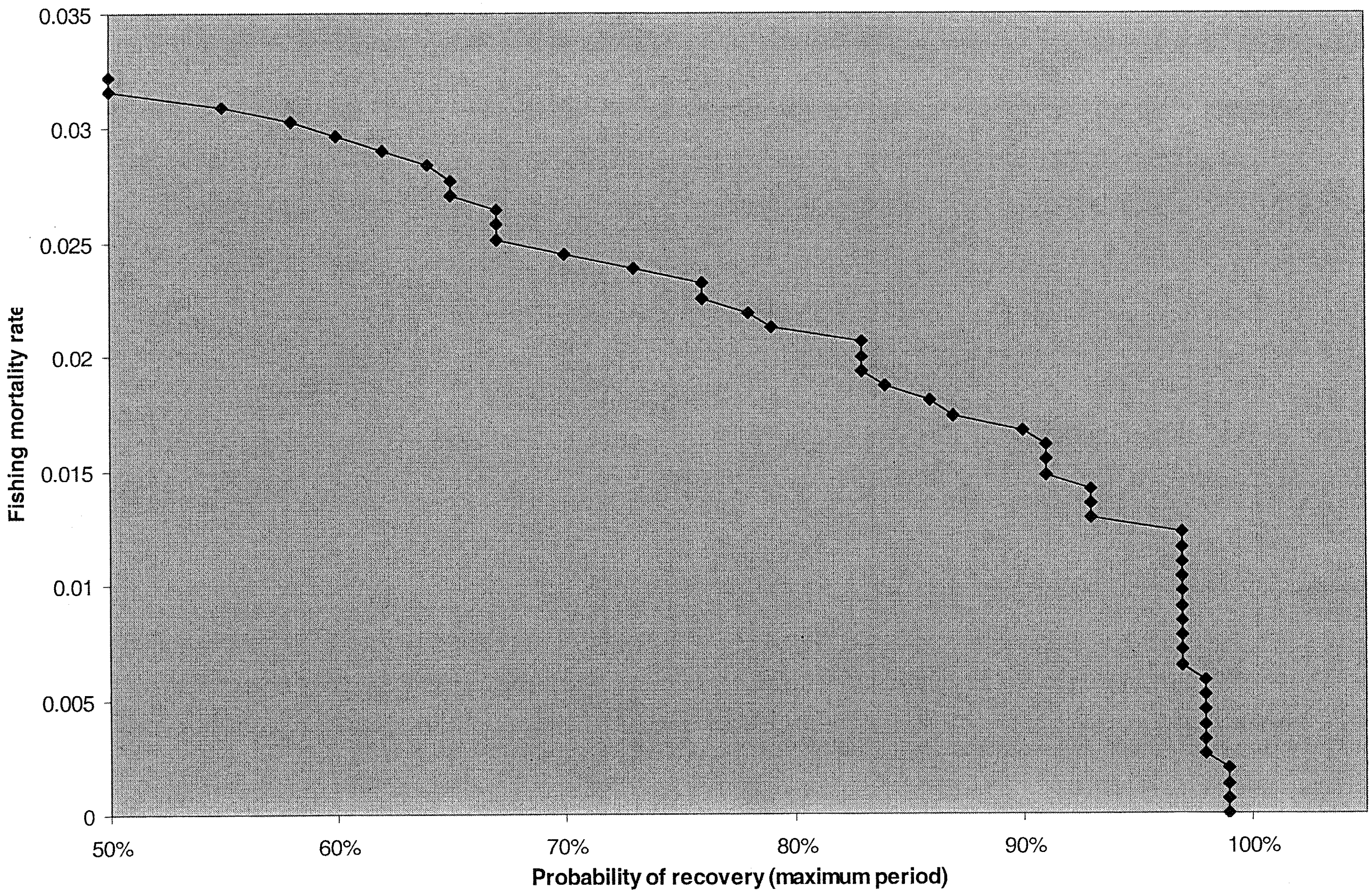

Figure 1-3: Example of F versus Tmax probability, widow rockfish rebuilding analysis. (Source: Andre Punt. Note: Plots are illustrative and may not correspond to actual rebuilding analysis results.)

1.3.3 Summary of the Current Management Regime

Draft rebuilding plans and rebuilding analyses have been used since 2000 to guide the Council in deciding management measures for overfished groundfish stocks. Provisions in Amendments 11 and 12 of the FMP established a framework for their development and implementation, in a way thought to be consistent with the Sustainable Fishing Act (or SFA, which re-authorized the MSA and added new provisions). As specified in these draft rebuilding plans, rebuilding management measures would be adopted through the Council's annual process of setting harvest specifications for the groundfish fishery. In addition to the draft rebuilding plans, rebuilding analyses (which are written by the stock assessment authors) and the Environmental Assessment for each year's harvest specifications (used in the Council/NMFS decision making process) take into account the scientific and legal constraints on harvests imposed by the need to rebuild overfished groundfish fisheries. Although the Council has respected these constraints in its decisions to date, NMFS has the authority to reject these decisions because in the regulatory context they only represent recommendations to the Secretary of Commerce.

The Council has typically chosen a risk-averse strategy when deciding on harvest levels for overfished stocks, based on recommendations contained in rebuilding analyses and given by the Council's advisory bodies. Total mortality has been controlled by reducing trip and landing limits for co-occurring species in select target fisheries, gear restrictions (i.e., the small footrope specification for landing shelf rockfish), seasonal closures (i.e., the recreational groundfish fishery seasons adopted in California), and area closures (i.e., the Cowcod Conservation Area closures in southern California).

The actual discard rate (or bycatch) of fish species that are overfished, which may differ among the various groundfish fishery sectors, is a critical uncertainty that must be addressed if effective measures to control total mortality and thus achieve rebuilding objectives are to be adopted. Limited data have been available to base these estimates. Therefore, bycatch and discard rate assumptions have been contentious and the focus of some recent legal challenges. However, NMFS implemented an observer program in August 2001, which allows direct observation of commercial bycatch and discard. Data from this program, available in the near future, will promote more informed management decisions and effectively control total mortality of overfished groundfish stocks.

1.3.2 Summary of Litigation over Amendment 12

In January 2000 the Natural Resources Defense Council along with other conservation organizations challenged the adequacy of Amendment 12 (*Natural Resources Defense Council v. Evans*) in Federal District Court. They claimed that rebuilding plans submitted pursuant to Amendment 12 were inadequate for two reasons. First, they did not take the form of fishery management plans, plan amendments, or regulations as required by the MSA. Second, rebuilding plans could allow overfishing under the "mixed-stock exception." The NRDC argued that the overfishing provisions in the SFA demonstrate Congress's intent to eliminate this exception so rebuilding plans should not entertain this exception. The Plaintiffs also argued that the Environmental Assessment accompanying Amendment 12 failed to consider a reasonable range of alternatives as required by NEPA. The Court found for the Plaintiffs on the claim that rebuilding measures must conform to the MSA-mandated format of a plan, amendment, or regulation and the NEPA-related claim of an inadequate range of alternatives. The Court decided that the second MSA-related claim, on the validity of the mixed-stock exception, was not ripe for judicial review because the exception had not yet been applied to Pacific groundfish management. In response to its findings, the Court ordered NMFS to revise Amendment 12 so that the rebuilding plan implementation process accords with MSA and NEPA requirements.

1.4 Scoping Summary

The Council process offers many opportunities to determine the scope of issues and effects relevant to an EIS. The scope includes the extent of the action, the range of alternatives considered and the types of impacts that are analyzed (40 CFR 1508.25). This work is carried out by NMFS and Council staff, advisory bodies and at Council meetings, which are open to the public.

Scoping began in early 1999 with the approval of Amendment 11 to the Groundfish FMP. This amendment established a new definition for what constituted an overfished stock and three groundfish stocks (lingcod, bocaccio rockfish and Pacific ocean perch) qualified under this definition. This meant that the Council had to begin developing rebuilding plans for these species. As an indication of the extent of scoping, discussion of rebuilding at Council meetings is summarized here.

April 1999. It was noted that the MSA required preparation of rebuilding plans within one year of an overfishing declaration, meaning that management measures would have to be in place before the March 2000 Council meeting. However, annual management measures (which determine harvest levels) are established during the fall Council meetings in the preceding year, meaning that analysis would have to be completed for the 1999 September and November meetings. It was recognized that allocation and bycatch were important rebuilding-related issues. The Council's Ad-Hoc Allocation Committee presented allocation options for lingcod and bocaccio under rebuilding scenarios. Since allowable harvest for these species was already low, allocation decisions were related to the effect of incidental catches on harvest opportunities for other species that are not overfished. Advisory bodies to the Council provided comments, mostly related to procedural issues. Among other things, the Council discussed how changes could be made to the rebuilding plan in the event that a stock recovered more quickly than anticipated.

June 1999. The Council considered procedures for rebuilding plan adoption. Staff recommended that adoption have three components: an FMP amendment that specifies the time period and anticipated allocation issues, a "source document" containing technical analyses, and an environmental assessment analyzing alternative rebuilding strategies. These procedures would apply to each overfished species, although the FMP could contain "generic" rebuilding goals and objectives. Preliminary analyses for lingcod, bocaccio and Pacific ocean perch were presented. Written comments from a fishermen's association and an environmental group focused on the appropriate amount of catch reduction, the problem of accounting for and reducing bycatch of overfished species, and allocation among fishery sectors. Scientific and industry advisory bodies commented on the draft rebuilding plans. Aside from technical comments, these groups recognized the high degree of uncertainty associated with predicting stock rebuilding because of limits on fishery and habitat information. The Council recognized the importance of public participation in formulating rebuilding plans. A representative of the Natural Resources Defense Council spoke during public comment.

September 1999. The Council reviewed the draft plan amendment (Amendment 12) for rebuilding overfished species. The draft amendment described how rebuilding plans would be developed and reviewed but would not include rebuilding measures. These would implemented through the annual management process that sets catch limits for groundfish fisheries. Rebuilding analyses showed that even at high levels of risk (low probability of stock recovery) annual catch levels would have to be substantially reduced. The draft amendment document contained two action alternatives: amending the FMP to adopt each rebuilding plan or creating a framework in the FMP that describes the process for developing and implementing rebuilding plans, but without incorporating the rebuilding plans into the FMP through the amendment process. Rebuilding analyses for overfished species were presented and reviewed. The Council moved to put the draft amendment out for public review, but recommended that the alternative requiring all rebuilding plans be plan amendments be dropped since this would be too burdensome a process. Public hearings were slated for the next Council meeting. Written comments from the Pacific Marine Conservation Council recommended balancing measures to prevent overfishing against impacts to fishing communities, adopting risk averse rebuilding targets, allocating cuts fairly, and using best available science. The California Department of Fish and Game submitted proposals for the management and allocation of depleted species, including the southern bocaccio stock. As part of this process it held two public scoping meetings. The Council also had to consider 2000 management measures that accounted for overfished species. This involved management strategies that would allow harvest of healthy stocks while minimizing impacts to those that were overfished. Public comments were received from six individuals representing environmental groups (Pacific Marine Conservation Council, Pacific Ocean Conservation Network, Natural Resources Defense Council), fishing interests and the Oregon Coastal Zone Management Association.

November 1999. The Council reviewed a revised draft of the amendment document (environmental assessment) containing two alternatives, no action and implementation of a framework amendment, but decided to defer adoption until its April 2000 meeting. Rebuilding measures for bocaccio, lingcod and Pacific ocean perch were adopted, however. The Environmental Defense Fund submitted written comments recommending that closed areas be considered for managing overfished stocks. The Habitat Steering Group, a Council advisory body, recommended that habitat information be included in the rebuilding plans and that plans should incorporate management tools based on the habitat requirements of overfished stocks. The Groundfish Advisory Subpanel (GAP) urged the adoption of better data collection and fishery monitoring. It also supported a "phase-in" rebuilding strategy for bocaccio with two dissents advocating lower initial harvest levels. Public comment was heard from nine individuals, including four representing conservation groups (Center for Marine Conservation, Pacific Marine Conservation Council, Natural Resources Defense Council, Environmental Defense Fund); the remainder were fishermen or representatives of fishing organizations.

April 2000. The Council did not take up rebuilding plan measures at its March meeting. The Council approved Amendment 12 (Option 2), which as described above established a process for adopting rebuilding measures as part of the annual management process. The amendment also declares groundfish to be fully utilized, meaning that foreign entities may not harvest or process these resources. The Council moved for modifications to the amendment with respect to the allocation of overfished stocks among fishery sectors. In January 2000 NMFS declared two additional groundfish species overfished (cowcod and canary rockfish). Rebuilding plans for these two species would have to be developed and submitted to NMFS by the end of 2000. The Council adopted a process for developing rebuilding plans for these species that would allow implementation through 2001 management measures. Public comment was taken from a representative of the Coos Bay Trawler's Association and a commercial fisherman.

June 2000. The Council was advised that the three submitted plans and two draft plans (for cowcod and canary rockfish) would have a substantial impact in terms of reductions in the allowable catch. They were asked to consider whether to incorporate review of rebuilding analyses into the current stock assessment review process or develop an alternative review process. It was noted that the MSA requires Secretarial review at least every two years. NMFS outlined a recommended process for technical review and monitoring of rebuilding plans. Advisory bodies made several recommendations for modification of the process and review schedule. The Council also discussed the two draft plans and recommended that the Ad-Hoc Allocation Subcommittee take up consideration of how to deal with the impact of very low allowable catches necessitated by the increased number of overfished species. Incidental catch in fisheries not managed by the Council would be an important consideration. Three individuals gave public testimony, two from environmental groups (Pacific Marine Conservation Council, Center for Marine Conservation) and one from the fishing industry (Oregon Trawl Commission).

September 2000. The Council considered rebuilding schedules and harvest levels for cowcod and canary rockfish. Staff noted that although only the cowcod stock in the Conception management area (Southern California) had been considered in the overfishing assessment, the Monterey portion (Central California) was almost certainly also overfished. The extremely low abundance and productivity of this stock restricts rebuilding options, but the limited distribution of the stock would confine impacts to a discrete geographic area. The California Department of Fish and Game proposed closing two areas in Southern California waters to bottom fishing to reduce cowcod fishing mortality. Canary rockfish are much more widely distributed and management measures would affect several fisheries, including pink shrimp and recreational fisheries. Choosing a rebuilding strategy was made difficult due to uncertainty about the maximum age and survival of female fish. Surveys show few older female fish, but this could be because they avoid capture. If they are indeed scarce (assuming the are not avoiding capture) allowable catches would have to be reduced more and rebuilding would take longer. The Ad-Hoc Allocation Committee met in advance of the September meeting to develop recommendations related to overfished species, which were presented at this Council meeting. Four individuals made public comments, two from environmental groups (Natural Resources Defense Council, Center for Marine Conservation) one from a recreational fishing group (United Anglers of California) and a private citizen.

November 2000. The Council adopted rebuilding plans for canary rockfish and cowcod. Written comment was received from the Natural Resources Defense Council (NRDC), the Center for Marine Conservation (CMC) and two commercial fishermen. The NRDC letter raised a range of concerns, arguing that Amendment 12 and subsequent rebuilding plans did not adequately comply with the MSA and NEPA. These issues also appear in the lawsuit brought against NMFS over Amendment 12 by NRDC in early 2000. The CMC letter argued that there was insufficient data on total fishing mortality and that the rebuilding plans did not specify management measures, as required by the MSA. The commercial fishermen argued that scientific assessments of cowcod were inaccurate and suggested various measures, including artificial propagation and the use of decommissioned structures to enhance habitat, to restore stocks. Designation of large closed areas was also suggested. Advisory bodies also commented on the rebuilding plans. Issues of concern included appropriate harvest levels to balance rebuilding against short-term economic losses, enforceability of management measures, allocation (especially between commercial and recreational sectors), and difficulties with monitoring, especially the recreational sector. Twenty-two people gave public comment; two represented conservation organizations (Center for Marine Conservation, Pacific Marine Conservation Council), the remainder were fishers or representatives of fishing organization.

NMFS announced the final rule approving Amendment 12 in the Federal Register on December, 29 2000 (65 FR 82947). In approving Amendment 12 NMFS revoked prior approval of the lingcod, bocaccio and Pacific ocean perch rebuilding plans because "they do not meet all of the rebuilding requirements described in Amendment 12, and [protection measures] are not adequately explained and analyzed." Groundfish fisheries would continue to operate under the terms of these rebuilding plans however. The Federal Register notice also contains responses to comments received from two parties. The main concern expressed in these comments was that Amendment 12 does not require rebuilding plans to be plan amendments or regulations, and that the plans do not meet all of the requirements of the MSA.

April 2001. Widow rockfish and darkblotched rockfish were declared overfished as a result of assessments completed before this meeting, bringing the total number of overfished species to seven. At this meeting the Council reviewed the form and content of rebuilding plans (or terms of reference for rebuilding plan authors), and procedures for preparation and adoption of plans in 2001. The schedule would allow 2002 management measures, which would be adopted at the November 2001 meeting, to incorporate rebuilding plan targets. Adoption of the canary rockfish cowcod rebuilding plans, revised in light of the issues that caused NMFS to revoke approval of the three already-adopted plans, was considered but deferred until the next meeting. The canary rockfish plan was seen as model for all other rebuilding plans and the Council wanted more time to review the plan and more opportunity for public comment. The Habitat Steering Group, among other things, recommended that rebuilding plans identify habitat and habitat impacts, and discuss the feasibility of creating marine reserves to manage the overfished species in question. Council members discussed and generally supported the recommendations without moving to make them a requirement of rebuilding plans. Public comment was heard from representatives of the CMC and the Pacific Marine Conservation Council.

June 2001. The Council again reviewed the seven rebuilding plans in various stages of preparation. Three (cowcod, bocaccio, and canary rockfish) were slated for adoption but the Council deferred and directed staff to further expand various elements in these plans, including bycatch accounting and habitat designation. New analyses were requested for Pacific ocean perch and lingcod, incorporating a new stock assessment for lingcod and using the standardized analytical procedures (terms of reference) approved at the last meeting. Rebuilding alternatives for widow rockfish management were adopted for consideration; these management measures would cut potential harvests by as much as two-thirds in comparison to the current year. The Groundfish Advisory Subpanel, representing fishers, expressed its frustration that inadequate funding resulted in inadequate monitoring and assessment, in turn necessitating substantial reductions to rebuild overfished species. NRDC and the CMC submitted written comments. The NRDC comments again covered the points under litigation, including the fact that rebuilding measures were not incorporated into the FMP; and that the draft plans do not meet the statutory requirements for rebuilding overfished stocks, and adequately account for bycatch or essential fish habitat. The CMC comments focused on the canary rockfish rebuilding plan, arguing the estimates of recruitment were too optimistic and bycatch estimates too low. Public comments came from representatives of the Pacific Marine Conservation Council, NRDC and the CMC.

September 2001. The Council deferred adoption of final rebuilding plans for canary rockfish, cowcod and bocaccio to allow staff to focus on developing 2002 management measures, which they would vote on at the November meeting. They also reviewed analyses for other overfished species. The complaint brought by NRDC in Federal District Court over Amendment 12 (consolidated with a subsequent complaint) was decided in August. The amendment was remanded. The Council briefly discussed the resulting need to develop a new amendment for rebuilding plans. There was no written or oral public comment.

November 2001. Declaration of an eighth overfished groundfish species, yelloweye rockfish, was anticipated at this meeting. This required developing management measures specifically for yelloweye stocks; in the past this species had been managed as part of a multi-species complex. The Council considered guidance on the completion of the rebuilding plans in light of the remand of Amendment 12. The Council also had to incorporate rebuilding plan measures into the 2002 management measures considered at this meeting. The Groundfish Advisory Subpanel recommended that rebuilding plans should consider the socioeconomic impacts of rebuilding measures and be flexible enough to accommodate new information as it become available. There was no written or oral public comment.

March/April 2002. During these two meetings the Council considered the schedule for completion of the revised rebuilding plan amendment (consequent of the Court's remand), numbered Amendment 16 and constituting the document before you. Although the Court directed speedy completion of the Amendment, the likelihood that new stock assessment information would become available in the first half of 2002, which would figure in the substance of the amendment, called for some delay. Ultimately, it was agreed that a draft of Amendment 16 would be brought before the Council in June. The Council was also advised that not all rebuilding plans would be included in the Amendment 16 package; remaining plans would be incorporated in a later amendment. In 2002 Pacific whiting became the ninth groundfish species to be declared overfished. This required a substantial reduction in harvests during 2002. (Whiting are harvested from April to November and the Council sets harvest limits for this species at its March meeting.) NMFS overruled the Council's recommendation, instituting a lower harvest level by emergency rule. NMFS and the Council published a notice of intent to prepare an EIS for Amendment 16 in the Federal Register on April 16 (67 FR 18576)

Relevant Issues

Scoping has two related purposes: to identify significant environmental issues that deserve study (40 CFR 1500.4(g)) and to eliminate from detailed study those issues that are not significant or have already been analyzed in other documents (40 CFR 1501.7(a)(3)). As the preceding summary reveals, rebuilding of overfished stocks has been on the Council's agenda for two and a half years. Council deliberations, advisory body discussion, and public comment—all of which are part of the Council process—have allowed considerable opportunity to scope rebuilding plan-related issues. NOAA Administrative Order (NAO) 216-6[7/] and Council on Environmental Quality (CEQ) regulations implementing NEPA provide a general framework for organizing issues that have been identified and ensuring that all relevant issues have been considered. Both these sources provide criteria for determining whether the environmental impacts of a proposed action (and its alternatives) are significant. They can thus be used to bound the "universe" of potential issues and actions.

First, NAO 216-6 (Section 6.02) lists guidelines for determining the significance of fishery management actions. The guidelines direct consideration of effects on: (1) target species, (2) non-target species, (3) habitat, (4) public health or safety, (5) protected species (e.g., listed under the ESA or MMPA) and their habitat, (6) biodiversity and ecosystem function, and (7) the socioeconomic environment as it relates the natural environment. There are two additional guidelines that do not fit readily into the preceding topic-

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7/ This document provides agency guidance on implementing NEPA.

specific list (8) cumulative effects on target and non-target species; and (9) the degree of controversy related to the effects of an action, although "no action should be deemed ti be significant based solely on its controversial nature."

Second, CEQ regulations define significance at an even more general level (40 CFR 1508.27) in terms of both context and intensity:

(a) Context. This means that the significance of an action must be analyzed in several contexts such as society as a whole (human, national), the affected region, the affected interests, and the locality. Significance varies with the setting of the proposed action. For instance, in the case of a site-specific action, significance would usually depend upon the effects in the locale rather than in the world as a whole. Both short- and long-term effects are relevant.

(b) Intensity. This refers to the severity of impact. Responsible officials must bear in mind that more than one agency may make decisions about partial aspects of a major action. The following should be considered in evaluating intensity:

(1) Impacts that may be both beneficial and adverse. A significant effect may exist even if the Federal agency believes that on balance the effect will be beneficial.

(2) The degree to which the proposed action affects public health or safety.

(3) Unique characteristics of the geographic area such as proximity to historic or cultural resources, park lands, prime farmlands, wetlands, wild and scenic rivers, or ecologically critical areas.

(4) The degree to which the effects on the quality of the human environment are likely to be highly controversial.

(5) The degree to which the possible effects on the human environment are highly uncertain or involve unique or unknown risks.

(6) The degree to which the action may establish a precedent for future actions with significant effects or represents a decision in principle about a future consideration.

(7) Whether the action is related to other actions with individually insignificant but cumulatively significant impacts. Significance exists if it is reasonable to anticipate a cumulatively significant impact on the environment. Significance cannot be avoided by terming an action temporary or by breaking it down into small component parts.

(8) The degree to which the action may adversely affect districts, sites, highways, structures, or objects listed in or eligible for listing in the National Register of Historic Places or may cause loss or destruction of significant scientific, cultural, or historical resources.

(9) The degree to which the action may adversely affect an endangered or threatened species or its habitat that has been determined to be critical under the Endangered Species Act of 1973.

(10) Whether the action threatens a violation of Federal, State, or local law or requirements imposed for the protection of the environment.

Finally, CEQ regulations (40 CFR 1502.16) list factors that shall be considered when assessing the environmental consequences of an action in an EIS. This list is somewhat duplicative, but salient elements include the need to consider "(c) Possible conflicts between the proposed action and the objectives of Federal, regional, State, and local (and in the case of a reservation, Indian tribe) land use plans, policies and controls for the area concerned....(e) Energy requirements and conservation potential of various alternatives and mitigation measures. (f) Natural or depletable resource requirements and conservation potential of various alternatives and mitigation measures. (g) Urban quality, historic and cultural resources, and the design of the built environment, including the reuse and conservation potential of various alternatives and mitigation measures. (h) Means to mitigate adverse environmental impacts..."

Table 1-1 incorporates the criteria described in these sources and gives a brief assessment of their likely significance. This screening process serves as the basis for the affected environment descriptions and environmental consequences analyses found in the procedural component (Part A) and rebuilding plans (Parts B and higher) that make up this amendment document.

Table 1-1: Potential effects of rebuilding procedural measures and rebuilding plans.

Affected Environment			Potential effects of the proposed action (and whether direct, indirect or cumulative) **Effect is primarily a consequence of: (1) Procedural measures, (2) Rebuilding plan implementation**
	1	2	
Biological			
Target species or stocks (overfished stocks)			
Abundance and present condition		✔	Rebuilding plans will have moderate to significant beneficial direct impact, because abundance will increase due to reducing fishing mortality; depending on rebuilding trajectory benefits may only emerge in the long-term. Complex cumulative impacts due to possible increases in regulatory discards of constraining stocks.
Population parameters (recruitment, age structure, spawning potential, etc.)		✔	Population structure, recruitment and other parameters will change over the long term as a direct impact of rebuilding plan implementation. Significant benefits likely.
Ecological relationships		✔	Complex indirect and cumulative effects due to changes in relative abundance of co-occurring species. Effects beneficial may be beneficial depending on changes to ecosystem structure.
Probable future condition		✔	Significant positive direct impact if proposed action restores overfished stocks.
Overfishing and rebuilding overfished stocks	✔	✔	Proposed action prevents overfishing (i.e., F > MFMT) on overfished stocks, although current policies intended to prevent overfishing on all stocks. Overfished stocks rebuilt if proposed action successful (i.e., stock biomass > MSST). Significant direct and indirect benefits impacts likely
Regulatory discards (target bycatch)		✔	Without discard caps or retention policies could increase regulatory discards if management is through landing limits. Without adequate monitoring total fishing mortality could be under-estimated. Potentially significant adverse impacts.
Other species occurring in the fishery (including management unit species)			
Abundance and present condition		✔	No direct effect. Could indirectly reduce fishing mortality if overfished species become constraining stocks and/or management measures also reduce fishing mortality to non-overfished stocks.
Ecological relationships		✔	Indirect and cumulative impacts due to changes in relative abundance of overfished species. Effect uncertain.
Probable future condition		✔	Negligible to moderate positive impact if fishing mortality on all MUS reduced as a consequence of restrictions on overfished species.
Discards (regulatory and/or economic bycatch)		✔	Unlikely to affect other MUS discards because overfished species act as constraining stocks.

Affected Environment	(1)	(2)	Potential effects of the proposed action (and whether direct, indirect or cumulative) Effect is primarily a consequence of: (1) Procedural measures, (2) Rebuilding plan implementation
Habitat (includes EFH)			
Type and extent			No effect
Condition		✔	Possible indirect effect if habitat-damaging fishing gear effort is reduced or closed areas implemented.
Non-fishing-related threats- activities that have potential adverse effects on EFH quantity and quality			No effect
Biodiversity and Ecosystem Function			
Trophic levels above and below species caught in the fishery		✔	Negligible to moderate positive indirect effect. Overfished species abundance increases, making them more available as predators and prey.
Distribution of species in marine ecosystem, local and regional biodiversity		✔	Moderate direct effect on biodiversity if extinctions (at whatever geographic scale) occur or are prevented.
Protected species			
Marine mammals		✔	
mortality/injury		✔	Negligible to moderate positive indirect effect correlated to change (reduction) in fishing effort.
ecosystem/habitat		✔	Negligible positive indirect effect due to increase in prey availability (if species consumes overfished species).
ESA-listed		✔	
mortality/injury		✔	Same as above.
ecosystem/habitat		✔	Same as above.
Seabirds		✔	
mortality/injury		✔	Negligible to moderate effect depending on reductions in fishing effort by longline vessels, which have some seabird bycatch.
ecosystem/habitat		✔	Negligible positive indirect effect due to increase in prey availability (if species consumes overfished species).

Affected Environment	Potential effects of the proposed action (and whether direct, indirect or cumulative) **Effect is primarily a consequence of: (1) Procedural measures, (2) Rebuilding plan implementation**		
Socioeconomic			
FMP fisheries overall		✔	Potentially significant direct and cumulative effects due to required reductions in catch.
Allocation between sectors			
Commercial catch and value, recreational catch and effort			
Capital and labor (number of vessels and firms, employment)			
Markets: sales, prices (exvessel, wholesale, retail, etc.), number and extent			
International trade (imports and exports)			
Energy requirements and energy conservation			
Resource seasonality and use			
Social and cultural importance of the resource			
Commercial Sector		✔	Potentially significant direct and cumulative effects due to required reductions in catch.
Allocation by region or gear groups			
Catch and value by gear/vessel type			
Capital and labor (number of vessels, employment) by gear/vessel type			
Investment, revenue, costs, effort, efficiency, productivity			
Markets: sales, exvessel prices, number and extent			
Resource seasonality and use			
Demographics, ethnic and social characteristics			
Dependence of groups on fishing for employment/income			

Affected Environment	Potential effects of the proposed action (and whether direct, indirect or cumulative) **Effect is primarily a consequence of: (1) Procedural measures, (2) Rebuilding plan implementation**		
	(1)	(2)	
S ocial and cultural importance of the resource			
Recreational fishery overall		✓	Moderate to significant direct and cumulative impacts due to loss of fishing opportunity.
Allocation by region or gear groups, charter and private recreational			
Catch and imputed value, charter and private recreational			
Non-market value, charter and private recreational			
Resource seasonality and use			
Private recreational			
Resource seasonality and use			
Support industries: investment and revenue			
Demographics, ethnic and social characteristics			
Social and cultural importance of the resource			
Charter industry			
Allocation by region or sub-sector			
Catch, effort and aggregate revenue			
Capital and labor (number of vessels, employment)			
Investment, revenue, costs, effort, efficiency, productivity			
Demographics, ethnic and social characteristics			
Dependence of employed groups on charter fishing for employment/income			
Social and cultural importance of the resource			

Affected Environment			Potential effects of the proposed action (and whether direct, indirect or cumulative) Effect is primarily a consequence of: (1) Procedural measures, (2) Rebuilding plan implementation
Buyers and Processors		✔	Moderate to large direct impact due to reduced availability of product.
Exvessel purchases by processor type			
Capital and labor (number of firms, employment)			
Investment, revenue, costs, effort, efficiency, productivity			
Markets: sales, wholesale and retail prices, number and extent, seasonality			
Demographics, ethnic and social characteristics			
Communities		✔	
Dependence on and engagement in fishing and fishing-related activities, past and present participation; aggregate of commercial, charter, private recreational and processing sectors			Moderate to significant indirect and cumulative impacts resulting from changes in employment, recreational participation. Could result in long-term reduction in engagement. Highly dependent communities severely affected in short-term but may transition to lower levels of dependence.
Demographics, ethnic and social characteristics			
Social structure: networks, values, identity			Moderate to significant indirect and cumulative effects due to loss of fisheries-related employment and participation opportunities.
Impact on the built environment in fishing communities (including coastal infrastructure, historic and culturally important areas/structures)			Cumulative impact of rebuilding restrictions results in decline in fishing industry, change in character of port areas and water-dependent business.
Health and Safety: weather-related vessel safety and regulation-related restrictions on access		✔	Possible moderate indirect effect. Closing or restricting access to nearshore and shelf areas could change fishing patterns, expose fishermen to inclement weather if effort moves farther offshore. However, substantial reduction in total effort could reduce total exposure to hazards.
Commercial vessels			
Charter vessels			
Private recreational vessels and participants			
Current Management Regime			

Affected Environment	(1)	(2)	Potential effects of the proposed action (and whether direct, indirect or cumulative) **Effect is primarily a consequence of: (1) Procedural measures, (2) Rebuilding plan implementation**
Management institutions	✔		Moderate direct effect if increase in management complexity, need for better monitoring, etc. Moderate to severe indirect and cumulative effects due to diversion of institutional resources to rebuilding-related activities.
Treaties and agreements	✔	✔	Negligible to moderate? If overfished stock is U.S.-Canada trans-boundary (e.g., whiting) could require more complex negotiations.
Federal laws, regulations and policies	✔	✔	Negligible direct impact. Cumulatively, a large number of overfishing declarations could lead to changes in federal fisheries law and policy.
State, local and Tribal laws, regulations and polices	✔	✔	State managed fisheries catch overfished species. To achieve rebuilding of severely depleted stocks states may need to implement new laws, policies or management measures.
Other Effects			
Precedent for future actions with significant effects	✔		Significant impact on the form and content of rebuilding plans, which may have cumulatively significant effects.
Degree of uncertainty, risk and likelihood of unknown risks	✔	✔	Procedural measures describe methods for review, revision and revocation of rebuilding plans. Costs and benefits of the tradeoff between procedurally simple methods and publicly demonstrable commitment is unknown. Unknown or unforseen events are likely in the case of species with very long rebuilding trajectories.
Degree to which the proposed action is controversial	✔	✔	These actions are very controversial.

2.0 PROCESS AND STANDARDS ALTERNATIVES

2.1 Description of the Alternatives

Primary purpose to set process and standards framework for rebuilding plans. There are four rebuilding issues and one housekeeping issue covered in this part (Part A) of Amendment 16:

Issue 1: Form and Required Elements of Species Rebuilding Plans
Issue 2: Periodic Review and Amendment of Rebuilding Plans
Issue 3: Mandated Revisions of Harvest Strategy
Issue 4: Rebuilding Plans for ESA Listed Species
Issue 5: Update Language of the FMP

The language updates are provided in Appendix A, have no environmental impact and are therefore exempt from NEPA analysis under the "categorical exclusion" criteria. There will be no analyses of these changes unless unanticipated effects are raised during the public comment periods on the plan amendment. While no NEPA analysis will be conducted, options for the language updates are provided here to identify changes to an FMP approved under the authority of the Magnuson-Stevens Act.

The direct effects of the alternatives considered in Part A to Amendment 16 are on the Council process and participation in that process. There are no direct effects on the fishery, the fishery resource or environment. Exact changes to the language of the FMP that would be required to implement the options under each of the issues is provided in Appendix A.

2.1.1 Issue 1- Form and Required Elements for the Species Rebuilding Plan

The MSA requires that Councils or the Secretary take action to end overfishing and rebuild any stock that is overfished or approaching an overfished condition. The standard convention for actions taken to rebuild a stock has been termed the "rebuilding plan."

Issue 1 of Part A to Amendment 16 covers the content that the Council will require and/or consider for inclusion in rebuilding plans. A central part of this issue is the question of what rebuilding parameters and other rebuilding plan elements will be set as part of an FMP or regulation and what related parameters and elements will be specified or explained in supporting policy documents. From the MSA and the NMFS 600 guidelines on the national standards it appears that the only specifically identified element of a rebuilding plan that must be set in the FMP or regulation is the rebuilding time (MSA 304(e)(4)(A)).[8/] However, when a stock has been overfished, FMP amendments or regulations must be established which "end overfishing and to rebuild affected stocks" (MSA Section 304(e)(3)(b)).[9/] Under the current FMP, actions required to "end overfishing and rebuild the affected stock" are generated as regulations under the annual management process, derived from the rules for specifying and managing for the OY. As specified in the National Standard Guidelines (600.310 (f)(1)), "in the case of an overfished fishery, [OY is constrained to an amount of harvest mortality] that provides for rebuilding to a level consistent with producing MSY in such fishery." The FMP also specifies that OYs will be constrained by rebuilding needs and fishery management regulations established to meet OY. These actions therefore appear to meet that standards

8/ While the specific element that must be placed in a fishery management plan or regulatory amendment is the target rebuilding time, there are two constraints placed on Council actions to rebuild overfished species. First remedial actions must fairly and equitable allocate restrictions and recovery benefits among the sectors (MSA 304(e)(4)(B)). This appears to be a more specific application of National Standard 6 and not a new requirement to which Councils or the Secretary must respond. Second, for fisheries governed under international agreements, the rebuilding action should reflect traditional participation by fishermen of the US relative to those of other countries (MSA 304(e)(4)(C)). None of the West Coast groundfish species are currently governed under international agreements. The groundfish species most likely to be the subject of a future international agreement is Pacific whiting. Halibut and salmon fisheries do come under international agreements and could be affected by severe needs to restrict groundfish mortality.

9/ CFR 50 Section 600.310 (e)(4)(ii) states that "in cases where overfishing is occurring Council action must be sufficient to end overfishing."

of Section 304(e)(3) for rebuilding actions (that actions be in FMPs or regulations). However, under Amendment 12 to the Council FMP, the Council set its rebuilding time targets during the annual specification process and did not place the time targets in the FMP or regulations. Thus the Council omitted from its FMP and regulations the single specifically identified element that is required to be part of a rebuilding action.

The issue of what a rebuilding plan must contain was not litigated with respect to West Coast rebuilding plans. However, the court has found that the Council's previous deliberations did not consider a reasonable range of alternatives for what should be included in the rebuilding plan. In this issue a broader range of alternatives is considered including the question of whether specific fishery management measures, habitat, and bycatch measures should be included as elements of rebuilding plans.

Option Overview

Details of the options are provided in Tables 2-1a and 2-1b. This overview provides a summary of how the options are organized and additional information about how they would be implemented. Corresponding revisions to FMP amendment language are provided in Appendix A.

Under the options, elements of rebuilding plans would take one of three forms (or a combination of these forms):

Rebuilding Plans Adopted as Policy Guidance Documents (Status Quo) The Council will prepare rebuilding plans as stated in section 5.3.6.2 (Contents of Rebuilding Plans) of the current FMP and submit them to NMFS concurrent with its recommendations for annual management measures. Rebuilding plans themselves are not specified as regulations or FMP amendments but as statements of principles and policies. Management measures described in section 6.2 of the FMP, including automatic actions, notices, abbreviated rulemaking actions, and full rulemaking actions would be used to implement rebuilding plans.

Rebuilding Plans Adopted as Fishery Management Plan Amendments Amend the FMP to require elements of individual rebuilding plans for overfished species be submitted as FMP amendments. Management measures described in section 6.2 of the FMP, including automatic actions, notices, abbreviated rulemaking actions, and full rulemaking actions would be used to implement rebuilding plans.

Rebuilding Plans Adopted as Regulatory Amendments Amend the FMP to require elements of individual rebuilding plans be submitted as regulatory amendments and published in the federal regulations at 50 CFR 660. Management measures described in section 6.2 of the FMP, including automatic actions, notices, abbreviated rulemaking actions, and full rulemaking actions would be used to implement rebuilding plans.

Options

The options are as follows.

Option 1a. **Status Quo -** Leave all elements currently listed in the FMP as part of the annual specification process--not part of an FMP or regulation. (The court found that status quo does not meet the requirements of the MSA.

Option 1b. **Complete Rebuilding Plan in Policy Document Accompanied by Plan Amendment to Specify T_{target} and Augment -** The rebuilding plan will be developed as a single policy document that will contain within it or be accompanied by an FMP amendment to (1) implement any rebuilding actions required under Section 304(e) of the MSA that are not already authorized under the existing FMP, (2) specify in the FMP the rebuilding period required under Section 304(e)(4)(A) of the MSA (T_{target}) and (3) specify B_{msy}. **Suboption (i):** Specify B_{msy} as an algorithm or formula. **Suboption (ii):** Specify B_{msy} as a hard number. Augment the list with additional elements (see list following and Tables 2.1-a and 2.1-b).

Option 1c. **Convert All Rebuilding Plan Elements into an FMP -** For each overfished species incorporate into an FMP amendment all elements that the current FMP specifies as part of a rebuilding plan.

Option 1d. **Convert All Rebuilding Plan Elements into a Regulatory Amendment -** For each overfished species incorporate into a regulatory amendment all elements the current FMP specifies as part of a rebuilding

Option 1e. **Convert All Rebuilding Plan Elements into an FMP and Augment -** For each overfished species incorporate into an FMP amendment all elements the current FMP specifies as part of a rebuilding **and augment the list with additional elements (see list following and Tables 2.1-a and 2.1-b).**

Option 1f. **Convert All Rebuilding Plan Elements into a Regulatory Amendment and Augment-** For each overfished species incorporate into a regulatory amendment **all** elements the current FMP specifies as elements for a rebuilding plan **and augment the list with additional elements (see following list and Tables 2.1-a and 2.1-b).**

Under Options 1b, 1e or 1f one or more elements would be added as required elements for rebuilding plans. The following are the categories of elements that might be added to the required list, augmenting the rebuilding plans. Specifics of the elements that might be required under each of these categories are provided in Tables 2.1-a and 2.1-b.

A. Harvest Regulation
B. Allocation Elements
C. Bycatch Elements
D. Habitat Elements
E. Marine Reserves
F. Rebuilding Parameters
   Biological Parameters T_{min}, Mean Generation Time, T_{max}, P_{max}[10/],
   Policy Parameters P_{target}, Rebuilding Harvest Strategy[11/]

(Note: At time of final adoptions, the Council may structure an alternative that would specify that some elements would be part of a policy document, some part of an FMP and some part of a regulations).

Discussion

Status quo (Option 1a) has been determined by the court to be inadequate because it does not meet the standards of the MSA, which requires certain rebuilding actions to be in the form of a plan or regulation. Under status quo, the rebuilding plan is a policy document with harvest control regulations implemented through the annual specification of regulations. The target rebuilding time is specified only in the policy document.

10/

B_0	The long-term average biomass that would be expected in the absence of fishing given prevailing ecological and environmental conditions.
T_{min}	The number of years required for a stock to rebuild to an MSY level in the absense of fishing with a probability of at least 50%
Mean Generation Time	A measure of the average time required for a female to produce a reproductively-active female offspring
T_{max}	10 years, or if T_{min} is greater than 10 years then T_{max} is T_{min} plus one mean generation time. T_{max} will not be known with certainty and will be specified as the median of a range of values such that a control rule designed to achieve T_{max} will have a 50% probability of reaching that objective, as determined using the best available information.

11/

P_{max}	The estimated probability of reaching T_{max}, may not be less than 50%.
P_{target}	The estimated probability of reaching B_{msy} on or before T_{target}
Rbldng Harvst Strategy	The harvest control rule that will be followed to rebuild a stock in T_{target} years with P_{target} probability. A harvest control rule associates a given stock size (or stock size proxy) with a given level of fishing mortality and a given level of potential harvest.

Option 1b maintains the bulk of the rebuilding plan and supporting rationale in the form of a policy document while implementing the target rebuilding time as a plan amendment and fishery management actions needed to achieve the rebuilding OY as regulations. The target rebuilding time is the provision of the rebuilding plan that the MSA specifically requires be established in the form of an FMP or regulation. Under Option 1b, the MSY biomass level would also be established as part of a rebuilding plan, it could be specified as a hard number or a formula or algorithm (e.g. 50% of the most recent estimate of the biomass that would be present if there were no fishing). The MSY biomass level is not a specifically named element of a rebuilding plan that the MSA requires be established in the form of an FMP or regulation. The range of options provided here is sufficiently broad to allow the Council to include the MSY biomass level in the policy document only (not as part of an FMP or regulation) if it is determined that such status for this rebuilding parameter is sufficiently consistent with the MSA.

Options 1c and 1e would establish the entire rebuilding plan as an FMP amendment including the explanation of how the rebuilding period was determined. Options 1d and 1f would establish the entire rebuilding plan as a regulation. Options 1e and 1f would consider adding to the list of elements that are required to be part of rebuilding plans. Candidates for addition come from lists of parameters recommended for inclusion by NMFS and measures for inclusion suggested in public comment.

This issue (Issue 1) specifies only the form in which elements of the rebuilding plan will be specified, what will be required for inclusion or consideration for inclusion in the individual rebuilding plans, and, for parameters, whether they are specified as hard numbers or formula, algorithms or relational tables. It does not specify the elements or values of parameters for the individual rebuilding plans.

The choice of the form in which the rebuilding plan is specified has its main impact on the administrative burden entailed in keeping the rebuilding plan updated and the speed with which the Council and NMFS can move to update a rebuilding plan. The initial specification of the rebuilding plan for a particular species will need to be accompanied by a NEPA analysis that also meets analytical requirements of the MSA and other applicable law. The process will also need to meet NEPA, APA, MSA and other legal requirements for public notice and comment. In the initial specification, certain elements of the rebuilding plan will be incorporated into the groundfish FMP or regulations. After the initial specification, any element of the rebuilding plan or supporting rationale that is not incorporated into an FMP or regulation could be updated by the Council with advance notice to the public and an opportunity for public comment. Most recent information from stock assessments, rebuilding analyses or other scientific sources would be used to update portions of the rebuilding plan that are not incorporated into an FMP or regulation. Such changes would not require amendment to the FMP or regulations but the scientific basis for new values would have to be documented.

Whether specific provisions are in the form of a policy document, FMP or regulation does not necessarily affect how those provisions will be implemented by the Council but it may affect public expectations about how closely the Council will adhere to the provisions. FMPs and regulations are more formal than Council policy documents. The more formal the establishment of the rebuilding provisions the more public notice and comment opportunity will need to be provided.

Rebuilding parameters that are set in and FMP or regulation and established as hard numbers will be more costly to update than similar rebuilding parameters established as formulas or algorithms. The primary costs for the update are administrative in nature. Administrative costs can be measured as the direct value of the time and various expenses associated with the management process. Where administrative resources are limited, the costs can also be evaluated in terms of the lost opportunity for addressing other policy problems in the fishery. For example, the time and resources needed to amend a rebuilding plan may detract from the management systems ability to improve capacity controls in the fishery. In such an instance, the opportunity costs of the administrative action may be viewed as the difference in net benefits between the status quo capacity controls and the improved capacity controls that are delayed because of the need to modify a rebuilding plan.

2.1.2 Issue 2- Periodic Review and Rebuilding Plan Amendment

Option 2a **Council Review Every 2 Years (Status Quo)** Rebuilding plans will be reviewed periodically, at least every 2 years and the Council may propose revisions to existing plans at any time in accordance with the amendment process appropriate for the form of the plan (see Issue 1). Rebuilding plans will be reviewed with respect goals 1-5 defined in Section 4.5.2.1 of the FMP.

Option 2b **Review Goals 2-5 Every 2 Years, Review Goal 1 Only With New Stock Assessments.** Rebuilding plans will be reviewed periodically, at least every 2 years and the Council may propose revisions to existing plans at any time in accordance with the amendment process appropriate for the form of the plan (see Issue 1). Rebuilding plans will be reviewed with respect to goal 1 Section 4.5.2.1[12/] of the rebuilding plan only when new stock assessment information is available. All other reviews will assess progress only with respect goals 2-5 defined in Section 4.5.2.1 of the FMP. Any revisions to the rebuilding plan must also be approved by NMFS.

Suboption (i) The rebuilding plan will be amended when information in the stock assessment or rebuilding analyses are updated or progress toward rebuilding has not been adequate (see Issue 3).

Suboption (ii) The rebuilding plan will be amended when new information indicates there has been a significant change in the rebuilding parameters specified in the plan or progress toward rebuilding has not been adequate (see Issue 3). The Council will consult with the SSC or GMT in determining whether a a change is significant.

Suboption (iii) The rebuilding plan will be amended when progress toward rebuilding has not been adequate (see Issue 3).

Option 2c **Council Reviews Goals 2-5 Every 2 years, Schedule for Stock Assessments and Review of Rebuilding Goal 1 Set in Rebuilding Plans.** Same as Option 2b except that a schedule for stock assessments will be specified in the rebuilding plan and driven by the stock dynamics (more frequent reviews and assessments will be conducted for more productive stocks). That schedule will specify an increase in the frequency of stock assessments and rebuilding plan reviews as T_{target} draws closer.

Option 2d **Council Review Goals 2-5 Every 2 years, Schedule for Stock Assessments Set As Follows.** Same as Option 4b except with the additional requirement that stock assessments be conducted once every 2 years when T_{max} is less than 20 years away and at least every 4 years when T_{max} is 20 years or more away.

Option 2e **No Formal Council Review** The Council will not conduct formal reviews. The Council may propose revisions to existing plans at any time. Any revisions to a rebuilding plan must be approved by NMFS. The Council will track harvest mortality in comparison to the harvest mortality goals under the rebuilding plan each year and will assess progress in rebuilding the stock biomass to the MSY level whenever new stock assessments are produced. Information in the Council SAFE document is expect to assist the Secretary in conducting the two year Secretarial reviews of progress under rebuilding plans. A draft of any Secretarial review will be provided to allow an opportunity for Council comment prior to the time the Secretarial review is finalized.

Suboption (i) The rebuilding plan will be amended when information in the stock assessment or rebuilding analyses are updated or progress toward rebuilding has not been adequate (see Issue 3).

12/ The goals of rebuilding programs are stated in Section 4.5.2.1 as follows: (1) achieve the population size and structure that will support the maximum sustainable yield within the specified time period; (2) minimize, to the extent practicable, the social and economic impacts associated with rebuilding, including adverse impacts on fishing communities; (3) fairly and equitably distribute both the conservation burdens (overfishing restrictions) and recovery benefits among commercial, recreational and charter fishing sectors; (4) protect the quantity and quality of habitat necessary to support the stock at healthy levels in the future; and (5) promote widespread public awareness, understanding and support for the rebuilding program.

Suboption (ii) The rebuilding plan will be amended when new information indicates there has been a significant change in the rebuilding parameters specified in the plan or progress toward rebuilding has not been adequate (see Issue 3). The Council will consult with the SSC or GMT in determining whether a a change is significant.

Suboption (iii) The rebuilding plan will be amended when progress toward rebuilding has not been adequate (see Issue 3).

Options 2b, 2c, 2d, and 2e: The Council's annual SAFE document will provide (1) the most recent information available on the best estimate of total fishing mortality as compared to target fishing mortality levels pursuant to the rebuilding plan; (2) the most recent assessment of stock size compared to the expected stock size for the rebuilding trajectory; (3) information on allocation and the social and economic status of the fishery.

Discussion

Under Option 2a (status quo) rebuilding plans would undergo complete review every two years. Under Optoins 2b, 2c and 2d, progress in rebuilding the stock biomass would be reviewed only when new stock assessments are available but performance of the rebuilding plans with respect to all other goals would be reviewed every two years. Under Option 2b, the frequency with which stock assessments are conducted is left open. Option 2c specifies that a schedule for conducting stock assessments would be included in each rebuilding plan and Option 2d specifies a minimum frequency for conducting stock assessments. Under Option 2e there would be no formal Council review of rebuilding plans. The Council would track progress of rebuilding stock biomass in its annual safe document and social and economic impacts of Council harvest policies would be evaluated in aggregate as part of the NEPA evaluation of the annual specification of harvest regulations. This information together with information on Council actions to protect habitat and promote public awareness of rebuilding programs would be available for incorporation into the two year review of rebuilding plans that the Secretary is required to conduct under the MSA.

Under each alternative to status quo, there are three suboptions that specify the standards for requiring an amendment to rebuilding plans. Each suboption requires amendment whenever progress is deemed in adequate, if such a standard is established under Issue 3. Additionally, under Suboption (i), an amendment to the rebuilding plan would be required with each update of rebuilding parameters in the stock assessment or rebuilding analysis. Under Suboption (ii) an amendment to the rebuilding plan would be required when there has been a significant change in the rebuilding parameters. The Council would determine significance in consultation with the GMT and SSC. Suboptions provide a minimum standard for when a plan would need to be amended and do not prevent the Council from recommending an amendment at any time.

More accurate estimates of parameters coming out of a new assessment and used in a new rebuilding analyses can dramatically change the expected probability that a stock can rebuild in the time specified in the previous rebuilding analyses. Example of the sorts of changes in rebuilding parameters that could drastically affect expected rebuilding includes both changes in biological parameters such as steepness and changes in fisheries descriptors such as selectivity. An example would include the most recent canary rockfish assessment (Methot and Piner 2002) where new information has led scientists to conclude that stock productivity (expected recruitment), as measured by the steepness parameter, was less productive than previously thought. This lowered view of productivity had the effect of increasing the time it would take to rebuild to a target even in the complete absence of removals. In addition, re-characterizing the sizes/ages typically removed by all fisheries with either new estimates of selectivity or by changing the proportion of removals allocated to different fisheries with different selectivity patterns can change the time to rebuild even though total catch remains the same. The most recent canary assessment indicates that the greater the percentage of the total catch taken by recreational fisheries relative to commercial fisheries will delay the time to rebuilt because of the generally smaller size and younger ages of the recreational removals.

The choice between these options on reviewing rebuilding plans will have its primary affect on administrative burden and to a certain degree, the distribution of that burden among agencies. Under Options 2a through 2d the Council would conduct a formal annual review that may fulfill a large portion of the information required by the Secretary to fulfill the MSA requirements for formal Secretarial review every two years. Under Option 2e, information similar to what would be generated in a formal review would be available to the Council in a format that would allow the Council and the Secretary to evaluate progress and performance under the rebuilding plan but the Council would not conduct a formal review.

The choice between the suboptions specifying when a rebuilding plan would need to be amended also has its primary affect on administrative burden. Suboption i would require the most frequent amendment of rebuilding plans and Suboption iii would require the least frequent amendment. Under Suboptions ii and iii, the rebuilding plan may tend to become more outdated than under Suboption i, however, the Council would still manage based on the most recent information from stock assessments and rebuilding analyses and under all three suboptions rebuilding would not be allowed to fall further behind than the standard specified under Issue 3.

The degree of the administrative burden will be lower if rebuilding plans are largely policy documents that accompany FMP or regulatory amendments than if they are largely in the form of FMPs or regulations.

2.1.3 Issue 3- Adequacy of Progress

Option 3a **No Standards for Progress (Status Quo)** The current FMP has no standard for the evaluation of whether progress toward rebuilding is adequate.

Option 3b **Standard Based on Negative Deviations.** If an updated stock projection indicates that the stock is below the rebuilding level projected under the original rebuilding plan then progress will be considered inadequate and an adjustment to the rebuilding plan must be made. (THIS OPTION SETS VERY RIGID STANDARD AND IS BEING INCLUDED IN THIS DRAFT TO ESTABLISH A RANGE FROM NO DEVIATION IN THIS OPTION TO MAXIMUM DEVIATION IN OPTION 3c).

Option 3c **Standard Based on T_{max}.** If an updated stock projection indicates that the stock does not have at least a 50% probability of rebuilding in the **maximum** time (T_{max}), then progress will be considered inadequate and an adjustment to the rebuilding plan must be made to increase the probability of rebuilding within the maximum time to at least 50%.

Option 3d **Establish a Specific Standard for Each Plan.** Each rebuilding plan will be required to include a specific standard for determining when progress has been adequate.

Discussion

Currently there is no standard for evaluating the adequacy of progress under a rebuilding plan. Under Option 3b or 3c, such a standard would be established. Under Option 3b, an amendment to the rebuilding plan would be required whenever the stock falls behind the rebuilding schedule. Under Option 3c, the Council would be required to amend its rebuilding plans when the probability of rebuilding in the maximum time allowed drops below 50%. Under Option 3a there is no guidance on when a rebuilding plan would need to be modified. There would be uncertainty about the amount of deviation from a rebuilding schedule that would be allowed before an amendment to the rebuilding plan would be required. Debate over when modification is required would likely consume the time and energy of fishery managers and the public. Under Option 3d, the standard for adequacy of rebuilding would be established for each plan at the time the rebuilding plan is developed.

Eventually a determination will be required on the amount of deviation from the rebuilding schedule that will be allowed without modification of the rebuilding plan. If no deviation were allowed, all rebuilding plans would likely need to be amended with each stock assessment. Rebuilding schedules for stock recovery are averages of a wide variety of outcomes from a stochastic rebuilding model (a model that takes into account uncertainties about stock recovery response to rebuilding policies). There is a substantially higher probability that stocks will rebuild faster or slower than expected than there is that they will rebuild exactly as projected by the rebuilding schedule. In fact the probability of rebuilding exactly on the rebuilding schedule is very low. Allowing no deviation from the rebuilding schedule is so impractical that an option that would specify a "no deviation" standard has not been included under this issue. Given that deviation from the rebuilding schedule is expected, a management system that is designed to anticipate such a contingency may be able to respond to such deviations at lower administrative costs.

Option 3b is similar to the no deviation option that was eliminated from consideration, except that it puts no limits on the degree to which rebuilding is ahead of schedule. Assuming normally distributed probabilities and unbiased stock assessments with normally distributed probabilities, rebuilding plans would likely need to be amended in half the years in which biomass is evaluated. Option 3c would allow rebuilding to fall behind schedule to the point that any further deterioration of progress would cause the rebuilding schedule to fall outside of the maximum rebuilding time allowed under the national standard guidelines. Options 3b and 3c bracket a range of other possible policies, for example, amendment of the rebuilding plan could be required when the probability of rebuilding in the maximum time falls to less than halfway between the probability of rebuilding in T_{max} under the adopted rebuilding plan and a 50% probability of rebuilding within T_{max} (for example, if the probability of rebuilding in T_{max} under the adopted plan is 70%, then a fall in the probability of rebuilding to below 60% would require an amendment to the rebuilding plan.

The choice of whether, and if so, how far to allow the rebuilding plan to fall behind schedule before amending it is a tradeoff between the rebuilding objectives, the social and economic needs of the fishing community, and benefits of the fishery to the nation. In establishing a rebuilding plan, the Council will select a harvest policy, or harvest control rule, that determines the amount of fish to be harvested presuming a given rebuilding schedule. A determination that the rebuilding plan can be allowed to fall behind schedule so long as the probability of rebuilding in T_{max} is more than 50%, says that administrative opportunity costs are sufficiently high and the short-term benefits to the community are likely to be sufficiently important that harvest levels specified in the control rule should be maintained as long as the minimum rebuilding standard is being met (the probability of rebuilding in T_{max} is more than 50%). A determination that the rebuilding plan cannot be allowed to fall behind schedule at all, without a rebuilding plan amendment, is a determination that the administrative opportunity costs of frequent rebuilding plan revision are sufficiently low and potential lost opportunity from not re-evaluating the rebuilding program are likely to be sufficiently high that the program should be re-evaluated whenever it falls behind schedule. As discussed in the previous paragraph, there are options that fall between these two extremes. Option 3d would determine the measure of adequacy of rebuilding in the context of the biology and economics of each overfished species.

2.1.4 Issue 4- ESA Listed Species

Option 4a **No Special Provisions (Status Quo)** There are no special provisions for rebuilding plans for species listed under the Endangered Species Act.

Option 4b **Incorporation of ESA Jeopardy Standards or Recovery Plans** A jeopardy standard or recovery plan for an overfished stock listed under the ESA will supercede the rebuilding plan for the overfished species until such time as the stock is no longer listed. If a stock is delisted, the rebuilding plan will come back into effect until such time as the stock is fully rebuilt. After delisting, an amendment to the rebuilding plan may be necessary to take into account the revised status and information on the overfished stock.

Discussion

Option 4b anticipates the possibility that a groundfish species could be listed under the ESA and establishes a contingency for dealing with such an event. If an overfished stock is listed, the jeopardy standard or recovery plan for the stock would replace the rebuilding plan until the stock is delisted. This is similar to a provision in the salmon FMP under which escapement goals for a particular stock are automatically replaced by the jeopardy standard or recovery plan when a stock is listed. By including a provision for an ESA listing in the groundfish plan at this time, the Council would avoid the need to amend the plan at a later time if a groundfish species is listed under the ESA. The main impact of Option 4b is to reduce future administrative costs that would be associated with a plan amendment on the issue at a later time provide for clear interpretation of the groundfish FMP plan in the event of a listing, and facilitate quicker reaction by the Council to any requirements of a jeopardy standard or recovery plan for an overfished stock. Under status quo, if a groundfish stock is listed, the Council may have to engage in another plan amendment process to address the listing and jeopardy standard or recovery plan, there may be some uncertainty in the management process prior to the time the plan is adjusted to address the listing.

2.1.5 Issue 5- Housekeeping Measures

The species list in section 3.1. of the FMP, Species Managed by this Fishery Management Plan, is not consistent with the groundfish species list in the annual specification and management measures (FR 67 10490; March 7, 2002) or the list at 50 CFR 660.302. The proposed measure would correct all misspellings and would specifically identify the following rockfish: chameleon (*Sebastes phillipsi*), dwarf-red (*Sebastes rufianus*), freckled rockfish (*Sebastes lentiginosus*), halfbanded (*Sebastes semicinctus*), pinkrose (*Sebastes simulator*), pygmy (*Sebastes wilsoni*), swordspine (*Sebastes ensifer*), widow (*Sebastes entomelas*), yelloweye (*Sebastes ruberrimus*) yellowmouth (*Sebastes reedi*), and yellowtail (*Sebastes flavidus*).

The terms "maximum fishing mortality threshold" (MFMT) and "minimum stock size threshold" (MSST) are used in the National Standard Guidelines and are intended for use as benchmarks to decide if a stock or stock complex is being overfished or is in an overfished state. The terms used to describe these same thresholds in the FMP are different from those used in the National Standard Guidelines (i.e. MFMT is the same as the F_{MSY} control rule described in the FMP and MSST is the same as the overfished/rebuilding threshold described in the FMP.) To address consistency in terminology, the equivalent terms should be defined in Sections 4.1and 4.4 of the FMP.

The National Standard Guidelines suggest that the annual SAFE document contain a description of each stock or stock complex (50 CFR 600.315 (e)(3). Because the MFMT and MSST are important benchmarks used to determine if overfishing has occurred or if a stock or stock complex is in an overfished state, Section 5.2 of the FMP, should call for the MFMT and MSST for stocks or stock complexes to be listed in SAFE documents. In addition, the last paragraph of Section 5.2 regarding the SAFE document availability and completion schedule is out of date and does not reflect the SAFE document schedule for 2002 and beyond.

Sections 4.2, 4.3.1, and 4.5.1 of the FMP list, summarize and/or reference the F_{MSY} proxies adopted in 1998. The 1998 values are used throughout these sections as examples in the describing F_{MSY} proxies. In spring 2000, the Council's Scientific and Statistical Committee sponsored a workshop to review the Council's groundfish exploitation rate policy. For 2001 and beyond, the Council adopted the SSC's new recommendations for harvest policies of: F40% for flatfish and whiting, F50% for rockfish (including thornyheads) and F45% for other groundfish such as sablefish and lingcod (66 FR 2338, January 11, 2001). The 1998 F_{MSY} proxy values used as examples in the FMP should be updated to reflect the Council's current policy.

References to an at-sea observer program in Sections 4.3.1.3, 4.4.2, and 4.6 indicate that no observer program exists from which data are available to upgrade stock assessments and evaluate overfishing. This text is outdated and should be updated to reflect the implementation of an at-sea observer program in 2001.

Chapter 4 contains several references to Council use of the mixed stock exception for setting OYs. These references do not comply or reference the current standards for invoking the mixed stock exception. The text needs to be updated to reflect the standards for invoking the mixed stock exception.

Chapter 5 is designated to cover the annual management process but includes numerous references to the development of rebuilding plans, which will not be on an annual cycle. Additionally, discussion of some topics is spread through numerous sections. The topic for Chapter 4 is OYs. Chapter 4 is a one page chapter in which OYs are discussed in general terms. The specific considerations and constraints that go into establishing OYs are specified in Chapter 5. A reorganization of Chapters 4 and 5 is proposed to: (1) place in Chapter 4 all considerations and constraints that go into establishing OYs, including the process and standards for establishing rebuilding plans; (2) place all provisions related to the annual management process in Chapter 5; and (3) reorganize the sections to construct a more concise document. The proposed reorganization is documented in Appendix A.

Option 5a **No Action Alternative** *(Do not amend FMP to include housekeeping measures).* Leave errors and outdated information in the FMP, including misspellings, an outdated species list, outdated information on default MSY proxies and outdated information on the need for an observer program. Leave an unclear linkage between provisions of the FMP and the national standards guidelines with respect to the terms MFMT and MSMT. Leave an inaccurate description of the process for developing the safe document in the FMP. Leave sections not related to the annual process in the annual process chapter. Leave the specification of OY spread across two chapters. Leave repetitive and fragmented discussions in place.

Option 5b **Amend FMP to include housekeeping measures** Amend FMP to include housekeeping measures to : 1) revise the list of species managed under the FMP; 2) address differences in the use of the terms maximum fishing mortality threshold (MFMT) and the minimum stock size threshold (MSST) and the National Standards Guidelines; 3) change Section 5.2 to include a description of the MFMT and MSST; 4) update last paragraph of Section 5.2 regarding the SAFE document availability and completion schedule; 5) update Sections 4.2, 4.3.1, and 4.5.1 of the FMP to include the Council adopted the SSC's new recommendations for harvest policies of: F40% for flatfish and whiting, F50% for rockfish (including thornyheads) and F45% for other groundfish such as sablefish and lingcod; 6) update the references to an at-sea observer program in sections 4.3.1.3, 4.4.2 and 4.6; and 7) reorganize Chaptes 4 and 5 to produce a more concise document.

2.2 Council-recommended Alternatives

Table 2.1-a. Issue 1, option details. [a/]

	Option 1a Status Quo	Option 1b Complete Rbld Pln in Policy Doc Accomp by FMP Amend for T_{target} & B_{msy}, & Augment	Option 1c Convert All Elements to FMP Amendmnt	Option 1d Convert All Elements to Regulatory Amendmnt	Option 1e Convert All Elements to Plan Amendmnt & Augment	Option 1f Convert All Elements to Regulatory Amendmnt & Augment
Elements in the Current FMP						
The second paragraph of Section 5.3.6.2 states that rebuilding plans ***will*** **specify** any individual goals and objectives including						
▸ a **time period** for ending the overfished condition and rebuilding the stock **[T_{target}]**[b/]	P	F	F	R	F	R
▸ and the **target biomass** to be achieved **[B_{msy}]**[c/] (biological parameter)	P	F	F	R	F	R
Suboption: specify as a formula or algorithm. Option i = Yes; Option ii = No (specify as a hard number)	N	Y/N	Y/N	Y/N	Y/N	Y/N
explain how the rebuilding period was determined, including any calculations that demonstrate the scientific validity of the rebuilding period	P	P	F	R	F	R
identify potential or likely **allocations** among sectors,	P	P	F	R	F	R
identify the types of **management measures** that will likely be imposed to ensure rebuilding in the specified period,	P	P	F	R	F	R
provide other information that may be useful to achieve the goals and objectives.	P	P	F	R	F	R

Table 2.1-a. Issue 1, option details. a/

	Option 1a Status Quo	Option 1b Complete Rbld Pln in Policy Doc Accomp by FMP Amend for T_{target} & B_{msy}, & Augment	Option 1c Convert All Elements to FMP Amendmnt	Option 1d Convert All Elements to Regulatory Amendmnt	Option 1e Convert All Elements to Plan Amendmnt & Augment	Option 1f Convert All Elements to Regulatory Amendmnt & Augment
Elements to Consider Adding to Rebuilding Plans	X	X	X	X	F	R
Harvest Regulations. Include specific harvest control measures (regulations) as part of the rebuilding plan (if in the form of an FMP amendment the rebuilding plan would also need to amend regulations). NOTE: Under other Options 1a-1d specific harvest regulations are established in conjunction with the annual process for setting OY.	X	X	X	X	F	R
Allocation. Include allocations or allocation priorities for overfished species where specific allocations or allocation priorities have not already been specified under the procedures of the FMP or in the FMP.NOTE: Under other Options 1a-1d specific allocations are specified under existing FMP provisions or the allocation framework and implemented in conjunction with the annual process for setting OY.	X	X	X	X	F	R
Bycatch. Suboption (i) **Include consideration** of the • the **adequacy of information** on bycatch and bycatch mortality. Measures needed to acquire the bycatch information necessary to adequately implement the harvest control rule may be considered as part of the rebuilding plan or in a separate plan pr regulatory amendment. Adopt risk averse harvest levels sufficient to account for uncertainty about bycatch. • the need for management measures to **minimize bycatch** and minimize the mortality of unavoidable bycatch as part of the rebuilding plans. Measures needed to minimize bycatch or the mortality of unavoidable bycatch may be considered as part of the rebuilding plan or in a separate plan or regulatory amendment. (NOTE: Bycatch measures will also be addressed as part of Amendment XX)	X	X	X	X	F	X
Suboption (ii) **Include** such **measures** as are needed • to **acquire the bycatch information** necessary to adequately implement the harvest control rule. • to **minimize bycatch** and minimize the mortality of unavoidable bycatch as part of the rebuilding plans. (NOTE: Bycatch measures will also be addressed as part of Amendment XX)	X	X	X	X	X	R
Habitat. Include specific habitat protection measures.	X	X	X	X	F	R
Close Areas. Include consideration of the contribution areas closed to groundfish fishing might make to rebuilding the stock (closed areas could range in extent to restricting all fishing, i.e. no-take marine reserves). Include such measures in the plan as appropriate.	X	X	X	X	F	R

Table 2.1-a. Issue 1, option details. [a/]

	Option 1a Status Quo	Option 1b Complete Rbld Pln in Policy Doc Accomp by FMP Amend for T_{target} & B_{msy}, & Augment	Option 1c Convert All Elements to FMP Amendmnt	Option 1d Convert All Elements to Regulatory Amendmnt	Option 1e Convert All Elements to Plan Amendmnt & Augment	Option 1f Convert All Elements to Regulatory Amendmnt & Augment
Parameters. The list of candidate parameters and the form in which they would be expressed "hard values" or "algorithms or formulae" is provided in Table 2.1-b. (NOTE: All parameters need not be added in the same form, i.e. some can be expressed as "hard values" others as "algorithms or formulae". Additionally, not all parameters may need be placed in the same type of document. It may be possible to specify that some will be placed in a policy document and others in the FMP or regulation.	X	P	X	X	F	R

Table 2.1-b. Issue 1 suboptions for adding to the list of required parameters.[d/]

Parameters to be Added As Part of the Rebuilding Action–(Suboptions)

For Option 1b the action is to add the element in a policy document
For Option 1e the action is to add the element in a n FMP amendment,
For Option 1f the action is to add the element in a a regulatory amendment

(NOTE: B_{msy} and T_{target} are included in Table 2-1 as elements required in the current FMP. They are included as part of the status quo and no proposal is being made to remove these values from the list of required parameters.)

		Suboptions		
		(i) **{Based on NMFS letter of 4/5/02}**	(ii) **{Based on SSC Comments, April 2002}**	(iii) **{Add all Parameters with Maximum Flexibility}**
Parameters Set As Part of the Rebuilding Action (included as part of the FMP or regulation)	Parameter Set as a "Hard Value"	T_{min} T_{max} Mean Generation Time		
	Parameters Set as a Formula, Algorithm, **or Table**	P_{target} [e/] Rebuilding Harvest Strategy e.g. Constant Catch [f/] Constant F [g/] Combination [h/]	T_{min} T_{max} Mean Gen Time P_{target} Rbldg Hrvst Strat	
	Form of Parameter Determined on Species by Species Basis			P_{target}[i/]
Parameters to be Discussed in Supporting Rationale for Rebuilding Action But Not Included as Part of the Rebuilding Action (not included as part of the FMP or regulation)	Parameter Identified as a "Hard Value"			
	Parameters Identified as a Formula, Algorithm or Table	Current forecast of the rebuilding trajectory. P_{max} [j/]	Current forecast of the rebuilding trajectory. B_0	
	Form of Parameter Determined on Species by Species Basis		MSY or proxy P_{max}	T_{min} T_{max} Mean Gen Time Rbldg Hrvst Strat Current forecast of the rebuilding trajectory. B_0 MSY or proxy P_{max}
Parameters not included		B_0 MSY or proxy		

3.0 AFFECTED ENVIRONMENT

3.1 Biological Environment

The process and standards measures considered in this Part are not anticipated to directly affect marine species or ecosystems. The rebuilding plans do have substantial direct and indirect effects, and taken together these actions may have significant cumulative impacts. This section provides a broad overview of the natural and socioeconomic environment. The management process is also described because the proposed action in this Part will more likely affect it. More detailed descriptions of overfished species may be found in the rebuilding plan sections of this amendment.

3.1.1 Overfished Groundfish Species or Stocks

Bocaccio (*Sebastes paucispinis*) was declared overfished in 1999. There are two separate West Coast populations, divided in the vicinity of Cape Mendocino, California. The southern bocaccio stock extends from about Cape Mendocino south as far as Sacramento Reef, Baja California. Bocaccio inhabit depths between 50 and 300 m but most commonly occur over the outer continental shelf at depths are 100 to 150 m. Larvae and small juveniles are pelagic and most often found in shallow coastal waters over rocky bottoms associated with algae. Large juveniles and adults are semi-demersal. Newly settled larvae in central California are first observed associated with the giant kelp canopy, but are also seen throughout the water column. Adults are commonly found in eelgrass beds, or congregated around floating kelp beds. Large adults disappear from traditional commercial fishing grounds during winter spawning and reappear in the spring. Parturition (birthing) occurs during November to March off northern and central California, and October to March off southern California. Male bocaccio mature at 3 to 7 years and females mature at 3 to 8 years. Adult bocaccio eat small fishes associated with kelp beds, including other species of rockfishes, and occasionally small amounts of shellfish. They are in turn prey for sharks, salmon, other rockfishes, lingcod and albacore; sea lions, porpoises, and whales also feed on them. This species directly competes with chilipepper, widow, yellowtail, and shortbelly rockfishes for both food and habitat resources.

Canary Rockfish (*Sebastes pinniger*) were declared overfished in 2000. They commonly inhabit oceanic waters in depths from 91 to 274 m. Historically, this species was fairly abundant throughout its range. Canary rockfish occur from northern Baja California (Mexico), to the western Gulf of Alaska. Adult canary rockfish are primarily restricted along the continental shelf from 457 m, inshore to 46 m. Adults feed on small crustaceans as well as anchovies, sand dabs, and other small fishes. The canary rockfish, like all members of the genus *Sebastes*, produces live young. Female canary rockfish reach sexual maturity at roughly 8 years of age. Canary rockfish off the Pacific Coast have a long spawning period from September through March, probably peaking in December and January off Washington and Oregon. Upon release from the female, larvae are planktonic in the upper 100 m of the water column. Although little is known about the early life history strategies of this rockfish, they are thought to migrate to demersal (bottom) waters during the summer of their first year, and develop into juveniles around nearshore rock reefs, where they may congregate for up to three years. They tend to move to deeper waters as they age. Females generally grow faster and reach slightly larger sizes than males, but it appears males generally live considerably longer than females. Both sexes are capable of reaching nearly 70 years of age, but very few females older than 30 years have been observed Washington and Oregon sample data.

Cowcod (*Sebastes levis*) was declared overfished in 2000. It is one of the largest West Coast rockfish and feeds mainly fishes, octopus, and squid. Juvenile cowcod eat small shrimp and crabs. New age and growth data reveal that cowcod are long-lived, slow growing, and become sexually mature at the relatively old age of 12 years. Their maximum age is estimated to be 75 years. Females give birth to planktonic larvae during the winter, which are free-floating and may be found in shallower water. However, as they grow larger they move to deep water rocky environment. Adults are usually associated with rocky bottoms, particularly where there are sharp, steep drop-offs. They typically inhabit the continental slope and upper continental shelf, from about 150 to 350 m. Larvae and juveniles are planktonic for up to 3 months and are likely to disperse long distances before settling to the bottom.

Darkblotched Rockfish (*Sebastes crameri*) were declared overfished in 2001. This species' range extends from the Bering Sea to near Santa Catalina Island, California, on soft bottom at 29 to 549 m, but usually deeper than 76 m. The population off Washington, Oregon and California is considered a single stock. Darkblotched rockfish migrate to deeper waters with increasing size and age, and males are generally smaller than females at age and in the fishery. Darkblotched rockfish are caught almost entirely with commercial trawl gear as part of a complex of slope rockfish that includes Pacific ocean perch, splitnose rockfish, yellowmouth rockfish, and sharpchin rockfish.

Lingcod (*Ophiodon elongatus*) were declared overfished in 1999. They are top-order predators of the family Hexagrammidae. The species ranges from Baja California to Kodiak Island in the Gulf of Alaska, and its center of abundance is near British Columbia and Washington. The West Coast portion of the species' range is considered to be one continuous population that extends into British Columbia. Lingcod are demersal on the continental shelf, most abundant in waters less than 200 meters deep, and distributed in patches among areas of hard bottom and rocky relief. This species generally does not migrate, although some tagged individuals have moved exceptional distances, and indirect evidence suggests a seasonal onshore movement associated with spawning. According to fishery and survey data males tend to be more abundant than females in shallow water, and the size of both sexes increases with depth. Females are usually larger than males, reaching a mature length of 76 cm at three years old or later. Males, in contrast, mature faster and at a smaller size: about two years and 50 cm. Maximum age is about 20 years.

Pacific Ocean Perch (POP) (*Sebastes alutus*) were declared overfished in 1999. They inhabit the continental slope from Japan and the Bering Sea to southern California. The West Coast stock extends from the U.S.-Canada border to northern California. POP primarily inhabit waters of the upper continental slope and are found along the edge of the continental shelf, ranging as deep as 825 m but usually found at 100 to 450 m. Throughout its range, the species is generally associated with gravel, rocky or boulder type substrate found in and along gullies, canyons, and submarine depressions of the upper continental slope. POP winter and spawn in deeper water (>275 m), then move to feeding grounds in shallower water (180 to 220 m) in the summer (June through August) to allow gonads to ripen. They release their larvae in depths of 360 to 400 m and juveniles stay in shallow water over rough or rocky bottoms, sometimes forming ball-shaped schools near the surface. Adults form large schools 30 m wide, to 80 m deep, and as much as 1,300 m long. Largest size is about 54 cm and 2 kg and their maximum age has been estimated at about 90 years.

Pacific whiting (*Merluccius productus*), also known as hake, were declared overfished in 2002. They are a semi-pelagic roundfish distributed from the Gulf of California to the Gulf of Alaska and east to Asia in depths from 0 to 1000 m (usually in depths <250 m). There are genetic differences between the West Coast whiting population and those found in the larger, semi-enclosed inlets of Puget Sound and the Strait of Georgia; the southern stock off Baja California also differs. The coastal Pacific whiting stock ranges from southern California to Queen Charlotte Sound but only the main coastal population off the Pacific Coast waters of WOC are within Council purview. Spawning occurs off southern California from January to March; the stock then migrates northward to feed in the waters off the continental slope and shelf from northern California to Vancouver Island.

Widow Rockfish (*Sebastes entomelas*) were declared overfished in 2001. These species ranges from southeastern Alaska to northern Baja California, where it frequents rocky banks at depths of 25 to 370 m. In those habitats it feeds on small pelagic crustaceans and fishes. There is no evidence that separate genetic stocks of widow rockfish occur along the Pacific Coast. Female widow rockfish attain a larger size compared to males, and fish in the northern part of the range tend to be larger at age compared to those in the south. Aggregations of this species form at night and disperse at dawn, an atypical pattern for rockfish. Widow rockfish is an important commercial groundfish species

Yelloweye Rockfish (*Sebastes ruberrimus*) were declared overfished in 2002. Yelloweye are distributed along the West Coast from Ensenada, Baja California to the Gulf of Alaska in high relief, rocky habitats at depths between 15 and 550 m. They are large-sized (up to 91 cm), long-lived (up to 118 years), late maturing, and relatively sedentary rockfish. These life history traits make yelloweye particularly susceptible to overfishing. Although they do tend to have a high fidelity to particular areas with little evidence of migration, there is no evidence of genetic stock structure throughout their range. Yelloweye have a varied diet of forage fish, other rockfishes, crustaceans, and have been known to eat lingcod spawn. This species is highly prized in both commercial and recreational fisheries due to their large size and fillet quality, and are readily taken with line gear. They are much less common in bottom trawl catches, which have been further reduced with the small footrope restrictions put in place on the shelf since 2000. Decompression and temperature shock account for high rates of yelloweye mortality.

3.1.2 Other Management Unit Species

The Pacific Coast Groundfish FMP manages over 80 species, including the overfished species described above. Although the majority of these species are rockfish (members of the genus *Sebastes*), flatfish and other roundfish are also part of the management unit. Information on the interactions between the various groundfish species and between groundfish and non-groundfish species varies. While a few species have been intensely studied, there is relatively little information on most. Fewer than 20 of the groundfish species have ever been comprehensively assessed. Only Pacific whiting has been assessed annually.

Since 2000, rockfish species managed under the FMP have been divided into six groups based on habitat (nearshore, shelf, and slope) and latitude (north or south of 40° 10' N latitude). The three northern groups encompass the preexisting U.S./Vancouver, Columbia, and Eureka management areas while the southern groups cover the Monterey and Conception management areas. Rockfish are further divided into those species or stocks that are individually and more rigorously assessed so that stock-specific ABCs and OYs can be developed and less rigorously assessed groups, which usually are also less commonly caught by managed fisheries. The Council employs a precautionary policy for the less rigorously assessed species, which are termed "minor rockfish." The policy assumes that fishing mortality accounts for 75% of total mortality (with natural causes accounting for the remaining quarter). As an added precaution, the OYs for these stocks are set at 75% of ABCs. For species with no stock assessments, where ABCs and OYs are based on historic fisheries landings levels, the Council is even more cautious, setting the OYs at 50% of ABCs.

Aside from rockfish and whiting, Dover sole and sablefish are important commercial species. Sole are mainly caught in a deepwater trawl fishery off of Oregon and Washington as part of the "DTS complex," a shorthand for the main constituents of the catch: Dover sole, thornyheads and sablefish. (Thornyheads are also considered rockfish, but in the genus *Sebastolabus*.) Arrowtooth flounder, English sole and petrale sole are other commercially important flatfish, caught mainly in this fishery, whose stocks have been assessed. In addition to their commercial importance, Dover sole, sablefish and shortspine thornyhead are considered in the "precautionary zone." This refers to the Council's management policy that sets a biomass target that is a proxy for MSY. If stock size is below this level, but not overfished, it is in the precautionary zone and the "40-10 harvest rate policy" adjustment is applied. These three species are briefly described below.

Dover sole (*Microstomus pacificus*) is a deep water flatfish that ranges from northern Baja California to the Bering Sea and inhabits depths up to 1500 m. Their extended pelagic larval phase can for more than a year. This results in extensive larval dispersal because of the influence of Pacific Coast currents during this period. Recruitment is probably correlated to variation in current patterns and ocean regime shifts. Adults are relatively sedentary with no evidence of extensive latitudinal movements. They do, however, make seasonal migrations from the continental slope to the shelf in the spring and back to the slope in the fall to spawn. Dover sole are only harvested by trawl gear.

Sablefish (*Anoplopoma fimbria*), also known as blackcod, are a deep water roundfish highly prized in commercial markets for their taste and oil content. They range from southern Baja California to the central Bering Sea, west to Kamchatka and south to Hokkaido, Japan in depths usually from 275 to 900 m, but they have been found deeper 2,000 m. Eggs and larvae are pelagic. They spawn in the winter months in deep water off the continental slope. Sablefish are highly migratory; tagging studies have documented migrations of up to 2,700 miles. There are at least three genetically distinct populations on the West Coast of North America: one south of Monterey characterized by slower growth rates and smaller average size, one that ranges from Monterey to the U.S.-Canada border that is characterized by moderate growth rates and size, and one ranging off British Columbia and Alaska characterized by fast growth rates and large size. The stock between California and Washington is actively assessed and managed through the Pacific Council.

Shortspine thornyhead (*Sebastolobus alascanus*) is a major component of the deepwater fishery on the continental slope, especially in the DTS trawl fishery. They are widely distributed from northern Baja California to the Bering Sea at depths of 100 to 1600 m. The status of this stock is subject to substantial public debate. Although it is one of the most numerous components of the slope ecosystem, because of its long life and slow growth it cannot sustain aggressive harvest rates. It is taken coincidentally with Dover sole, sablefish, and longspine thornyhead, especially in the upper slope and lower shelf; in deeper water, longspine thornyhead is a more predominate species. The two thornyhead species are often difficult to distinguish, and historical landings data combine the two into a single category. Shortspine thornyhead is a "constraining species" in the deepwater fishery; that is, coincidental catch of this species prevents full harvest of Dover sole and sablefish.

3.1.3 Incidentally Caught Species Outside the Management Unit

Groundfish fisheries catch a range of species not managed under the Groundfish FMP, although they may be managed under one of the Council's other three FMPs. Similarly, fisheries targeting species outside the management unit catch groundfish incidentally. The principal species in these categories are discussed briefly here.

Coastal pelagic species (CPS) are managed under the Council's CPS FMP. They are schooling fish, not associated with the ocean bottom, that migrate in coastal waters. These species include: northern anchovy (*Engraulis mordax*), Pacific sardine (*Sardinops sagax*), Pacific (chub) mackerel (*Scomber japonicus*), jack mackerel (*Trachurus symmetricus*) and market squid (*Decapoda*). CPS are taken incidentally in the at-sea and shore-based whiting fishery. There is little information on the incidental take of CPS by the other segments of the fishery. However, since CPS are not associated with the ocean bottom, the interaction is expected to be minimal.

Dungeness crab (*Cancer magister*)—typically harvested using traps (crab pots), ring nets, by hand (scuba divers) or dip nets—are incidentally taken or harmed unintentionally by groundfish gears. Distributed from the Aleutian Islands, Alaska, to Monterey Bay, California, this crab lives in bays, inlets, around estuaries, and on the continental shelf. They are managed by the states of Oregon and California, and by the State of Washington in cooperation with Washington Coast treaty tribes.

Pacific pink shrimp (*Pandalus jordani*) targeted by shrimp trawlers, commonly take associated groundfish. This species is found from Unalaska in the Aleutian Islands to San Diego, California, at depths of 46 to 366 m. However, the fishery is occurs along the U.S. West Coast from northern Washington to central California, and is concentrated off of Oregon. Shrimp trawl nets are usually constructed with net mesh sizes smaller than the net mesh sizes for legal groundfish trawl gear. Pacific shrimp fisheries are state-managed rather than by the Council.

Pacific halibut (*Hippoglossus stenolepis*) can be found along the continental shelf in the North Pacific and Bering Sea. They have flat, diamond-shaped bodies and are able to migrate long distances. Most adult fish tend to remain on the same grounds year after year, making only a seasonal migrations from the more shallow feeding grounds in summer to deeper spawning grounds in winter. Halibut are usually found in deep water (40 to 200 m). The International Pacific Halibut Commission (IPHC) estimates that the 2002 mortality level of legal-sized halibut incidentally taken in shrimp and groundfish trawl fisheries will be 254 mt (560,000 pounds). Pacific halibut are managed by the bilateral (U.S./Canada) IPHC, with Area 2A implementation of IPHC catch levels and regulations being the responsibility of the Council, the states of WOC, and the Pacific halibut treaty tribes.

Forage fish are small, schooling fish that serve as an important source of food for other fish species, birds and marine mammals. Examples of forage fish species are herring (*Clupea harengus pallasi*), smelt (*Osmeridae*), anchovies, and sardine. Many species of fish feed on forage fish. Major predators of herring include Pacific cod (42% of diet), whiting (32%), lingcod (71%), halibut (53%), coho (58%), and chinook salmon (58%) (Environment Canada 1994). Many species of seabirds depend heavily on forage fish for food as well. Marine mammals consuming forage fish include: harbor seals, California sea lions, Stellar sea lions, harbor porpoises, Dall's porpoises, and Minke whales (Calambokidis and Baird 1994). Forage fish are most commonly found in nearshore waters and within bays and estuaries, although some do spend of their lives in the open ocean where they may be incidentally taken by groundfish gears, particularly in trawls. Preliminary data from the 2001 at-sea whiting fishery indicates the fishery encounters very minor amounts of forage fish species. (Less than 5 mt Pacific herring and 1 mt of smelt and sardines combined were caught). There is little information on the incidental take of forage fish by the other segments of the fishery. However, given they are not associated with the ocean bottom, the interaction is expected to be minimal.

Little information is available on non-groundfish species incidentally captured in the groundfish fishery. In addition to those species mentioned above, known incidental catch in the whiting fishery includes American shad and walleye pollock. American shad, introduced in 1885, have flourished throughout the lower Columbia River, producing a record run of 2.2 million fish in 1988 (ODFW and WDFW 1989). Preliminary data indicate approximately 112 mt were taken as incidental catch in the at-sea sector of the Pacific whiting fishery in 2001, through October. American shad was also taken in the shore-based whiting fishery. Walleye pollock are found in the waters of the Northeastern Pacific Ocean from the Sea of Japan, north to the Sea of Okhotsk, east in the Bering Sea and Gulf of Alaska, and south in the Northwestern Pacific Ocean along the Canadian and U.S. West Coast to Carmel, California. Preliminary data indicates approximately 280 mt were taken as incidental catch in the at-sea sector of the Pacific Whiting fishery in 2001, through October.

3.1.3 Habitat Including Essential Fish Habitat (EFH)

3.1.3.1 Coast Wide Marine Habitat Characteristics

In the North Pacific Ocean, the large, clockwise-moving North Pacific Gyre circulates cold, sub-arctic surface water eastward splitting at the North American continent into the northward-moving Alaska Current and the southward-moving California Current. The California Current, a surface current, flows southward along the U.S. west coast and through the U.S. EEZ, the management area for the groundfish FMP. The California Current is known as an eastern boundary current, meaning that it draws ocean water along the eastern edge of an oceanic current gyre. Along the continental margin and beneath the California Current, waters off the U.S. West Coast are subject to major nutrient upwelling, particularly off Cape Mendocino (Bakun, 1996). Shoreline topographic features such as Cape Blanco, Point Conception and bathymetric features such as banks, canyons, and other submerged features, often create large-scale current patterns like eddies, jets, and squirts. Currents off Cape Blanco, for example, are known for a current "jet" that drives surface water offshore to be replaced by upwelling sub-surface water (Barth, et al, 2000). One of the better-known current eddies off the West Coast occurs in the Southern California Bight, between Point Conception and Baja California (Longhurst, 1998), wherein the current circles back on itself by moving in a northward and counterclockwise direction just within the Bight. The influence of these lesser current patterns and of the California Current on the physical and biological environment varies seasonally (Lynn, and Simpson 1987) and through larger-scale climate variation, such as El Niño-La Niña or Pacific Decadal Oscillation (Longhurst, 1998).

Physical topography off the U.S. West Coast is characterized by a relatively narrow continental shelf. The 200 m depth contour shows a shelf break closest to the shoreline off Cape Mendocino, Point Sur, and in the Southern California Bight and widest from central Oregon north to the Canadian border as well as off Monterey Bay. Deep submarine canyons pocket the EEZ, with depths greater than 4,000 m common south of Cape Mendocino..

3.1.3.2 Essential Fish Habitat.

The 80+ groundfish species managed by the FMP occur throughout the EEZ and occupy diverse habitats at all stages in their life histories. Some species are widely dispersed during certain life stages, particularly those with pelagic eggs and larvae; the essential fish habitat (EFH) for these species/stages is correspondingly large. On the other hand, the EFH of some species/stages may be comparatively small, such as that of adults of many nearshore rockfishes which show strong affinities to a particular location or type of substrate.

EFH for Pacific coast groundfish is defined as the aquatic habitat necessary to allow for groundfish production to support long-term sustainable fisheries for groundfish and for groundfish contributions to a healthy ecosystem. Descriptions of groundfish fishery EFH for each of the 80+ groundfish species and their life stages result in over 400 EFH identifications. When these EFHs are taken together, the groundfish fishery EFH includes all waters from the mean higher high water line, and the upriver extent of saltwater intrusion in river mouths, along the coasts of Washington, Oregon, and California seaward to the boundary of the U.S. EEZ.

The FMP groups the various EFH descriptions into seven major habitat types called "composite" EFHs. This approach focuses on ecological relationships among species and between the species and their habitat, reflecting an ecosystem approach in defining EFH. The seven "composite" EFH identifications are as follows.

1. Estuarine - Those waters, substrates and associated biological communities within bays and estuaries of the EEZ, from mean higher high water level (MHHW, which is the high tide line) or extent of upriver saltwater intrusion to the respective outer boundaries for each bay or estuary as defined in 33 CFR 80.1 (Coast Guard lines of demarcation).

2. Rocky Shelf - Those waters, substrates, and associated biological communities living on or within ten meters (5.5 fathoms) overlying rocky areas, including reefs, pinnacles, boulders and cobble, along the continental shelf, excluding canyons, from the high tide line MHHW to the shelf break (~200 meters or 109 fathoms).

3. Nonrocky Shelf - Those waters, substrates, and associated biological communities living on or within ten meters (5.5 fathoms) overlying the substrates of the continental shelf, excluding the rocky shelf and canyon composites, from the high tide line MHHW to the shelf break (~200 meters or 109 fathoms).

4. Canyon - Those waters, substrates, and associated biological communities living within submarine canyons, including the walls, beds, seafloor, and any outcrops or landslide morphology, such as slump scarps and debris fields.

5. Continental Slope/Basin - Those waters, substrates, and biological communities living on or within 20 meters (11 fathoms) overlying the substrates of the continental slope and basin below the shelf break (~200 meters or 109 fathoms) and extending to the westward boundary of the EEZ.

6. Neritic Zone - Those waters and biological communities living in the water column more than ten meters (5.5 fathoms) above the continental shelf.

7. Oceanic Zone - Those waters and biological communities living in the water column more than 20 meters (11 fathoms) above the continental slope and abyssal plain, extending to the westward boundary of the EEZ.

Life history and habitat needs for the species managed under the FMP are described in the EFH appendix to Amendment 11, which is available online at http://www.nwr.noaa.gov/1sustfsh/efhappendix/page1.html.

3.1.4 Biodiversity and Ecosystem Function

3.1.5 Protected Species

Protected species fall under three overlapping categories. First are marine mammals protected under the Marine Mammal Protection Act (MMPA) of 1972. The MMPA established a moratorium, with certain exceptions, on the taking of marine mammals in U.S. waters and by U.S. citizens on the high seas, and on the importing of marine mammals and marine mammal products into the United States. Under the MMPA NMFS manages West Coast cetaceans and pinnipeds, while the U.S. Fish and Wildlife Service (FWS) manages sea otters. Stock assessments report new information every year for strategic stocks and every three years for non-strategic stocks. Strategic stocks are defined as those whose human-caused mortality and injury exceeds the potential biological removal. Marine mammals whose abundance falls below the optimum sustainable population are listed as "depleted" according to the MMPA. Fisheries that interact with species listed as depleted, threatened, or endangered may be subject to management restrictions under the MMPA and ESA. NMFS publishes an annual list of fisheries in the Federal Register separating commercial fisheries into one of three categories, based on the level of serious injury and mortality of marine mammals occurring incidentally in that fishery. The categorization of a fishery in the list of fisheries determines whether participants in that fishery are subject to certain provisions of the MMPA, such as registration, observer coverage, and take reduction plan requirements. The WOC groundfish fisheries are in Category III, indicating a remote likelihood of, or no known serious injuries or mortalities, to marine mammals.

Second, species may be given protection under the Endangered Species Act (ESA) of 1973. The ESA protects species in danger of extinction throughout all or a significant part of their range and mandates the conservation of the ecosystems on which they depend. "Species" is defined by the Act to mean a species,

Marine Mammals	
Threatened:	Steller sea lion (*Eumetopias jubatus*) Eastern Stock, 1. Guadalupe fur seal (*Arctocephalus townsendi*), and
2.	Southern sea otter (*Enhydra lutris*) California Stock.
Seabirds	
Endangered:	Short-tail albatross (*Phoebastria (=Diomedea) albatrus*), 3. California brown pelican (*Pelecanus occidentalis*), and
4.	California least tern (*Sterna antillarum browni*).
Threatened:	Marbled murrelet (*Brachyramphs marmoratus*).
Sea Turtles	
Endangered:	Green turtle (*Chelonia mydas*) Leatherback turtle (*Dermochelys coriacea*) Olive ridely turtle (*Lepidochelys olivacea*)
Threatened:	Loggerhead turtle (*Caretta caretta*)
Salmon	
Endangered:	Chinook salmon (*Oncorhynchus tshawytscha)* Sacramento River Winter; Upper Columbia Spring Sockeye salmon (*Oncorhynchus nerka)* Snake River Steelhead trout (*Oncorhynchus mykiss)* Southern California; Upper Columbia
Threatened:	Coho salmon (*Oncorhynchus kisutch)* Central California, Southern Oregon, and Northern California Coasts Chinook salmon (*Oncorhynchus tshawytscha*) Snake River Fall, Spring, and Summer; Puget Sound; Lower Columbia; Upper Willamette; Central Valley Spring; California Coastal Chum salmon (*Oncorhynchus keta)* Hood Canal Summer; Columbia River Sockeye salmon (*Oncorhynchus nerka)* Ozette Lake Steelhead trout (*Oncorhynchus mykiss)* South-Central California, Central California Coast, Snake River Basin, Lower Columbia, California Central Valley, Upper Willamette, Middle Columbia, Northern California

Table 2-1: ESA-listed species occurring in West Coast waters.

a subspecies, or—for vertebrates only—a distinct population. Under the ESA, a species is listed as "endangered" if it is in danger of extinction throughout a significant portion of its range and "threatened" if it is likely to become an endangered species within the foreseeable future throughout all, or a significant part, of its range. (As noted in Table 2-1, three marine mammal stocks are also listed under the Endangered Species Act.)

Third, the Migratory Bird Treaty Act (MBTA) implements various treaties and conventions between the U.S. and Canada, Japan, Mexico and the former Soviet Union for the protection of migratory birds. Under the Act, taking, killing or possessing migratory birds is unlawful. In addition to the MBTA, an Executive Order, Responsibilities of Federal Agencies to Protect Migratory Birds, (E.O. 13186) directs federal agencies to negotiate Memoranda of Understanding with the U.S. Fish and Wildlife Service that would obligate agencies to evaluate the impact on migratory birds as part of any NEPA process. NOAA is also preparing an National Plan of Action to Reduce the Incidental Take of Seabirds in Longline Fisheries. This document contains guidelines that are applicable to relevant groundfish fisheries and would require seabird incidental catch mitigation if a significant problem is found to exist. The FWS is the primary federal agency responsible for seabird conservation and management. Under the MSA, NMFS must ensure fishery management actions comply with other laws designed to protect seabirds. NMFS is also required to consult with FWS if fishery management plan actions may affect seabird species listed as endangered or threatened. Taken together, these laws and directives underscore the need to consider impacts to seabirds in decision making and consider ways to reduce potential impacts of the proposed action. Four bird species are also ESA-listed, as noted in Table 2-1.

3.1.5.1 Marine Mammals

The waters off Washington, Oregon, and California (WOC) support a wide variety of marine mammals. Approximately thirty species, including seals and sea lions, sea otters, and whales, dolphins, and porpoise, occur within the EEZ. Many marine mammal species seasonally migrate through West Coast waters, while others are year round residents.

There is limited information documenting the interactions of groundfish fisheries and marine mammals, but marine mammals are probably affected by many aspects of groundfish fisheries. The incidental take of marine mammals, defined as any serious injury or mortality resulting from commercial fishing operations, is reported to NMFS by vessel operators. In the West Coast groundfish fisheries, incidental take is infrequent and primarily occurs in trawl fisheries (Forney *et al.* 2000). Indirect effects of groundfish fisheries on marine mammals are more difficult to quantify due to a lack of behavioral and ecological information about marine mammals. However, marine mammals may be affected by increased noise in the oceans, change in prey availability, habitat changes due to fishing gear, vessel traffic in and around important habitat (i.e., areas used for foraging, breeding, raising offspring, or hauling-out), at-sea garbage dumping, and diesel or oil discharged into the water associated with commercial fisheries.

Under the ESA, threatened species occurring off the West Coast include:

- Steller sea lion (*Eumetopias jubatus*) Eastern Stock,
- Guadalupe fur seal (*Arctocephalus townsendi*), and
- Southern sea otter (*Enhydra lutris*) California Stock.

Under the MMPA, depleted species occurring off the West Coast include:

- Sperm whale (*Physeter macrocephalus*) WOC Stock,
- Humpback whale (*Megaptera novaeangliae*) WOC - Mexico Stock,
- Blue whale (*Balaenoptera musculus*) Eastern North Pacific Stock, and
- Fin whale (*Balaenoptera physalus*) WOC Stock.

Of the marine mammal species incidentally caught in WOC groundfish fisheries, the Steller sea lion is listed as threatened under the ESA, the northern elephant seal may be within their optimum sustainable population range, and there is insufficient data to determine the status of the harbor seal, California sea lion, Dall's porpoise, and Pacific white-sided dolphin relative to their optimum sustainable population. None of these species are classified as strategic stocks under the MMPA. Based on its Category III status, the incidental take of marine mammals in the WOC groundfish fisheries does not significantly impact marine mammal stocks.

3.1.5.2 ESA-Listed Species

In addition to marine mammals (described above), a range of West Coast marine species are listed as endangered or threatened under the Endangered Species Act.

<u>Sea turtles</u> are highly migratory; four of the six species found in U.S. waters have been sighted off the West Coast. The green turtle (*Chelonia mydas*), the leatherback turtle (*Dermochelys coriacea*), and the olive ridely turtle (*Lepidochelys olivacea*) are listed as endangered, and the loggerhead turtle (*Caretta caretta*) is listed as threatened. The management and conservation of sea turtles is shared between NMFS and FWS. Little is known about the interactions between sea turtles and West Coast commercial fisheries. The directed fishing for sea turtles in WOC groundfish fisheries is prohibited, because of their

ESA listings, but the incidental take of sea turtles by longline or trawl gear may occur. Sea turtles are known to be taken incidentally by the California-based pelagic longline fleet and the California halibut gillnet fishery. Because of differences in gear and fishing strategies between those fisheries and the WOC groundfish fisheries, the expected take of sea turtles by groundfish gear is minimal. The management and conservation of sea turtles is shared between NMFS and FWS.

Sea turtles may be also indirectly affected by commercial fisheries. Sea turtles are vulnerable to collisions with vessels and can be killed or injured when struck, especially if struck with an engaged propeller. Entanglement in abandoned fishing gear can also cause death or injury to sea turtles by drowning or loss of a limb. The discard of garbage at sea can be harmful for sea turtles, because the ingestion of such garbage may choke or poison them. Sea turtles have ingested plastic bags, beverage six-pack rings, styrofoam, and other items commonly found aboard fishing vessels. The accidental discharge of diesel and oil from fishing vessels may also put sea turtles at risk, as they are sensitive to chemical contaminates in the water.

Salmon caught in the U.S. West Coast fishery have life cycle ranges that include coastal streams and river systems from central California to Alaska and oceanic waters along the U.S. and Canada seaward into the north central Pacific Ocean, including Canadian territorial waters and the high seas. Some of the more critical portions of these ranges are the freshwater spawning grounds and migration routes.

Chinook or king salmon (*Oncorhynchus tshawytscha*) and coho or silver salmon (*O. kisutch*) are the main species caught in Council-managed ocean salmon fisheries. In odd-numbered years, catches of pink salmon (*O. gorbuscha*) can also be significant, primarily off Washington and Oregon. Ocean salmon are caught with commercial and recreational troll gear. No other gears are allowed to take and retain salmon in the ocean fisheries. Small amounts of rockfish and other groundfish are taken as incidental catch in salmon troll fisheries.

NMFS issued Biological Opinions under the ESA on August 10, 1990, November 26, 1991, August 28, 1992, September 27, 1993, May 14, 1996, and December 15, 1999 pertaining to the effects of the groundfish fishery on chinook salmon (Puget Sound, Snake River spring/summer, Snake River fall, upper Columbia River spring, lower Columbia River, upper Willamette River, Sacramento River winter, Central Valley, California coastal), coho salmon (Central California coastal, southern Oregon/northern California coastal, Oregon coastal), chum salmon (Hood Canal, Columbia River), sockeye salmon (Snake River, Ozette Lake), and steelhead (upper, middle and lower Columbia River, Snake River Basin, upper Willamette River, central California coast, California Central Valley, south-central California, northern California, southern California).

3.1.5.2 Seabirds

Over sixty species of seabirds occur in waters off the coast of WOC within the EEZ. These species include: loons, grebes, albatross, fulmars, petrels, shearwaters, storm-petrels, pelicans, cormorants, frigate birds, phalaropes, skuas, jaegers, gulls, kittiwakes, skimmers, terns, guillemots, murrelets, auklets, and puffins. The migratory range of these species includes commercial fishing areas; fishing also occurs near the breeding colonies of many of these species.

Interactions between seabirds and fishing operations are wide-spread and have led to conservation concerns in many fisheries throughout the world. Abundant food in the form of offal (discarded fish and fish processing waste) and bait attract birds to fishing vessels. Of the gear used in the groundfish fisheries on the West Coast, seabirds are occasionally taken incidentally by trawl and pot gear, but they are most often taken by longline gear. Around longline vessels, seabirds forage for offal and bait that has fallen off hooks at or near the water's surface and are attracted to baited hooks near the water's surface during the setting of gear. If a bird becomes hooked while feeding on bait or offal, it can be dragged underwater and drowned. Of the incidental catch of seabirds by longline groundfish fisheries in Alaska, northern fulmars represented about 66% of the total estimated catch of all bird species, gulls contributed 18%, Laysan albatross 5%, and black-footed albatross about 4% (Stehn *et al.* 2001). Longline gear and fishing strategies in Alaska are similar to some, but not all, of those used in WOC longline fisheries.

Besides entanglement in fishing gear, seabirds may be indirectly affected by commercial fisheries in various ways. Change in prey availability may be linked to directed fishing and the discarding of fish and offal. Vessel traffic may affect seabirds when it occurs in and around important foraging and breeding habitat and increases the likelihood of bird storms. In addition, seabirds may be exposed to at-sea garbage dumping and the diesel and oil discharged into the water associated with commercial fisheries.

3.2 Socioeconomic Environment

3.2.1 FMP Fisheries Overall

The Pacific Coast commercial groundfish fishery is a year round, multi-species fishery that takes place off the coasts of WOC. Most of the commercial groundfish harvest is taken by trawl, longline, and trap (or pot) vessels operating in the limited entry segment of the groundfish fishery. The limited entry program was established in 1994. All vessels that land groundfish without groundfish limited entry permits are classified as open access vessels. Several open access fisheries take groundfish incidentally or in small amounts; participants in those fisheries may use, with some restrictions, longline, vertical hook-and-line, troll, pot, setnet, trammel net, shrimp and prawn trawl, California halibut trawl, sea cucumber trawl, and other gears.

In 1996 groundfish comprised over 20% of the exvessel value of all marine and anadromous fish landed on West Coast landings receipts. Exvessel value of groundfish landings in that year were up 17% as compared to 1986. By 2000, the exvessel value of groundfish landings had fallen 28% from the 1996 level (from $85.0 million to $61.3 million) and was 15% below the 1986 exvessel value. As a whole, exvessel value of West Coast landings dropped 24% between 1986 and 2000. (Note: these values are adjusted for inflation and do not include at-sea whiting deliveries.)

By value, West Coast landings tend to peak in the winter and late summer months. The height of the summer peak is largely influenced by the fixed gear sablefish fishery. In 1986 the groundfish fishery tended to occur at a more even rate on a year round basis. Landings by limited entry vessels comprise a large portion of the total groundfish landings.

Of the 231 vessels participating in the limited entry trawl fishery in 2000 all but nine earned more than 5% of their revenue from groundfish. In the same year most trawl vessels (85%) landed in excess of $100,000 (exvessel value) and about two-thirds depended on groundfish for at least 65% of their gross revenue.

There were 172 vessels that participated only in the limited entry fixed gear fishery in 2000 and all but 12 got more than 5% of their revenue from groundfish. But of those earning more than $100,000, less than a third (78%) depended on groundfish for more than 65% of their gross revenue. This suggests that larger producing non-trawl vessels tend to be less dependent on groundfish than trawl vessels.

The open access fishery is the largest sector, with 1,413 vessels in 2001, and as a group they are the least dependent on groundfish. Using the same measure, only 56% got more than 5% of their revenue from groundfish. The 141 larger vessels (more than $100,00 in exvessel revenue) in this sector were much less dependent on groundfish in comparison to the other two sectors: all but one of the vessels earned less than 35% of their gross revenue from groundfish.

Groundfish are taken as bycatch in several other fisheries, which are generally included in the groundfish open access sector for the purposes of management. The salmon and shrimp fisheries are the two most important. The commercial salmon fleet has been on a declining trend in recent years. However, since 1999 landings have improved because of greater salmon abundance, resulting in substantial increases in total and average revenue per vessel. The open access share of groundfish north of Cape Mendocino was based primarily on historical groundfish catch in the pink shrimp fishery. In 1981, the three coastal states established uniform coast wide regulations for the fishery, which all vessels must abide by regardless of their permit status. The season runs from April 1 through October 31 and commercial vessels may only use trawl nets or pots. Most of the pink shrimp catch is taken by trawl gear, which must have a minimum mesh size of 1-3/8 inches between knots.

3.2.2 Commercial Sector

3.2.3 Recreational Sector

Recreational fishing has been part of the culture and economy of West Coast fishing communities for more than 50 years. Along the northern coast, most recreational fishing targets salmon; in the past, abundant rockfish often provided a bonus to anglers. Recreational fisheries have contributed substantially to fishing communities, bringing in outside dollars and contributing to tourism in general.

Recreational fishing in the open ocean appears to have been on a downward trend for a number of years, but seems to have increased in the year 2000. Part of this decline is likely the result of shorter salmon seasons and smaller bag (retention) limits. Some effort shift from salmon to groundfish likely occurred. Groundfish are taken as target catch and as incidental catch in fisheries targeting other species. The degree to which the opportunity to harvest groundfish contributes to incentive for non-groundfish trips is uncertain. However, there is likely some relationship to the frequency of groundfish catch on the trip. More recreational trips are taken in southern California than in northern California, Oregon, or Washington. The distribution of recreational charter vessels coincides with the geographic distribution of trips.

3.2.4 Buyers and Processors

Several thousand entities have permits to buy fish on the West Coast. Of these 1,780[13/] purchased fish caught in the ocean area and landed on Washington, Oregon, or California state fish tickets in the year 2000 (excluding tribal catch) and 732 purchased groundfish.[14/] This group can be narrowed further because larger buyers (more than $20,000 in purchases) tend to handle groundfish more than smaller buyers. This group of 546 buyers bought 99% of all Council managed groundfish. But even this group can be narrowed since only 59% actually bought groundfish. Although a larger group, only a third of smaller buyers (less than $20,000 in purchases) bought groundfish.

Of the 732 buyers identified above, a small proportion (17%) purchased from trawl vessels. But this group is also important to non-trawl vessels, buying 60% (by value) of their landed catch. These buyers also tend to be the largest: 28 of 38 buyers with purchases over $1 million bought from trawl vessels and they made 78% of all groundfish purchases from trawl vessels. Mid-size buyers ($20,000-$1 million in purchases), on the other hand, are more important to non-trawl vessels, buying half of all fish off these vessels. However, the larger buyers tend to have more of a year round presence; four-fifths bought groundfish in every month in 2000 while slightly less than a third of those not purchasing groundfish bought in every month. If not active year round, buyers are most often inactive in the winter months (November to March).

In most port areas on the West Coast there are generally six or fewer buyers purchasing from limited entry vessels. In the north, the primary exception is Astoria, and in the south, the exceptions are San Francisco, Monterey, and San Luis Obispo. In San Francisco and south of San Luis Obispo more buyers purchase groundfish from non-trawl vessels (fixed gear catching rockfish and other groundfish) in comparison to buyers of trawl-caught species.

3.2.5 Communities

Fishing communities, as defined in the MSA, include not only the people who actually catch the fish, but also those involved in fisheries-dependent services and industries. In commercial fishing this may include boatyards, fish handlers, processors, and ice suppliers. In recreational fishing this may include tackle shops, small marinas, lodging facilities catering to out-of-town anglers, and tourism bureaus advertising charter fishing opportunities. People employed in fishery management and enforcement are also considered part of fishing communities.

13/ For this analysis a "buyer" was defined as a unique combination of PacFIN port code and state buyer code on the fish ticket. For California, a single company may have several buying codes that vary only by the last two digits. The last two digits on these codes were truncated and would appear as separate buying units only if they appear on fish tickets for different ports.

14/ Unless otherwise noted, this section provides quantitative information on nontribal landings or fish caught in the ocean area and landed on West Coast WOC fish tickets.

Fishing communities of the West Coast depend on commercial and/or recreational fisheries for many species. Participants in these fisheries employ a variety of fishing gears and combinations of gears. Naturally, community patterns of fishery participation vary coast wide and seasonally based on species availability, the regulatory environment, and oceanographic and weather conditions. Each community is characterized by its unique mix of fishery operations, fishing areas and habitat types, seasonal patterns, and target species. While each community is unique, there are many similarities. For example, all face danger, safety issues, dwindling resources, and a multitude of state and federal regulations.

Individuals make up unique communities with differing cultural heritages and economic characteristics. Examples include a Vietnamese fishing community of San Francisco Bay, an Italian fishing community of southern California and the Native American communities with an interest in the groundfish fisheries. In most areas, fishers with a variety of ethnic backgrounds come together to form the fishing communities within local areas, drawn together by their common interests in economic and physical survival in an uncertain and changing ocean and regulatory environment. Demographic information on geographic communities at the county level has been compiled for a general baseline description of West Coast fishing communities. This information may be downloaded from the Council web site (www.pcouncil.org).

In the year 2000, state level income impacts related to the commercial groundfish harvest and processing sector ($135 million) constituted 20% of a $675 million West Coast industry, excluding whiting delivered to at-sea processors, tribal commercial harvest, and harvest from inside marine fisheries (e.g., Puget Sound). Income impacts related to the groundfish fishery were the greatest in three Oregon port areas (Astoria/Tillamook, Newport, and Coos Bay), followed by Eureka, California, and Puget Sound ports in Washington.

Estimates of community income impacts for the recreational fishery are provided at a regional level. Precision of the MRFSS data, on which the trip estimates are based, do not allow estimates for substantially smaller geographic areas on an annual basis. The coastal community income associated with all ocean recreational fishing was estimated to be $245 million in 2000. The portion associated with groundfish was estimated at $44 million.

3.2.6 Health and Safety

3.3 Current Management Regime

The MSA describes Council membership and procedures at the most general level (Sec. 302). Regulations at 50 CFR 600 (Subpart B) add more detail and in particular require each council to prepare a statement of organization, practices, and procedures (SOPP). The Pacific Council SOPP specifies the membership and function of advisory bodies and annual management and activity cycles. Groundfish are managed through an annual process that establishes management measures for the fishing season, which corresponds to the calendar year. Ensuring a year round fishery, an FMP objective, has led to a complex regime of per-trip and cumulative monthly or bi-monthly landing limits. Further, from a management perspective the commercial fishery is divided into limited entry trawl, limited entry fixed gear, and open access sectors. In recent years management measures (primarily bag limits and seasons) have also been applied to recreational fisheries.

The Council's SOPP describes either a four or five meeting process for groundfish annual measures. But in practice Council decision making related to annual management occurs over the course of two meetings, which in the past have been in September and November. Coordinating the availability of stock assessment information, decision making and federally required public comment on rule making has emerged as a major issue in recent years. Broadly speaking, NMFS or state management agencies conduct fishery-independent surveys on a periodic basis that is rarely more frequent than every other year. The results of these surveys are combined with information gathered from fisheries to conduct a stock assessment. (As noted in Section 3.1.2, actual stock status is known for the relatively few management unit species that are of commercial importance. For other species harvest limits may be set based on past landings, assuming this represents a level of fishing mortality that is relatively stable and below MSY.) Before 1995 a fairly informal process was used to vet stock assessments in advance of the use of results in decision making. In that year NMFS commissioned a review and recommended a more structured process. Since then a set of goals and objectives has guided Stock Assessment Review

(STAR) Panels that peer review work done by Stock Assessment Teams (STAT) comprising state and federal fishery scientists. Based on these goals and objectives, a process has developed that specifies the required elements of stock assessments, features external anonymous reviewers, and sets a calendar for completing and reviewing stock assessments so they are available to the Council ahead of decision making. Overall, the process is intended to clearly distinguish scientific analysis from management decisions.

This process begins with trawl and/or hydroacoustic surveys. The resulting data are used in the stock assessments that analyze stock structure and estimate its size. The STAT/STAR process is laborious and time consuming, typically taking ten months to a year to complete. The length of time involved not only reflects the difficulty of the work but the rigorous review that ensues. Therefore, stock assessments are not usually conducted every year and the Council will identify candidate stocks for formal assessment at its June meeting. Stock assessments must be completed by May if they are to be used in that year's management cycle (which sets harvest levels and management measures for the next year).[15/] The Groundfish Management Team (GMT) then identifies alternative harvest levels.[16/] (These will become part of the range of management alternatives in the environmental assessment of annual management measures, known as the annual specifications.) The alternatives reflect the "acceptable biological catch" (ABC), a harvest level that is determined to be sustainable based on the scientific analysis in the stock assessment. The actual harvest level is expressed as an optimum yield (OY). The MSA defines OY as a yield that "will provide the greatest overall benefit to the Nation" and is less than MSY. More specifically, the Groundfish FMP describes the "40-10 default OY" policy that provides guidance for determining OY. When the stock size is less than that which can support MSY OY is reduced accordingly.[17/] At this point scientists have finished their work by specifying biologically acceptable levels of fishing mortality. It is now up to the Council to make policy decisions—within the constraints imposed by scientists—that balance competing sectoral interests and risks (due to uncertainty inherent in resource assessments) against potential costs (resulting from either under- or over-harvest).

As mentioned above, the Council reviews management alternatives and chooses its preferred alternative over the course of two meetings. The first meeting allows the Council to review and evaluate the alternatives sent up by the GMT. It may choose a preferred alternative at this point or wait until the next meeting to make its decision. In the interim the alternatives (possibly with a preferred alternative identified) are made available for public review. Council staff develop the environmental analysis that will become part of the environmental assessment guiding Council decisions. After the second Council meeting they complete the environmental analysis and the resulting document is submitted to NMFS so that they may begin the rule making process. Regulations for the ensuing year must be implemented before January 1. In the past the Council's September and November meetings have been devoted to the process just described. However, a federal court ruled that NMFS was not allowing sufficient time for public comment during the rule making process. This necessitated emergency action to allow the 2002 season to begin on time (by continuing management measures from the previous year into the first two months of the new year). In response, the management cycle to develop 2003 management measures has been shifted to the 2002 June and September meetings. Even with this change NMFS may not have sufficient time to complete rule making by the end of the year. Because the process for developing annual management measures has become more complex and time consuming, and has detracted from the Council's ability to conduct other business (not the least developing and implementing rebuilding plans), a multi-year management cycle is being discussed. Various scenarios are being considered, but all would

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15/ The whiting fishery usually begins in April and the Council has the option of choosing harvest levels in March of the same year, as was the case in 2002. Because this species has been declared overfished harvest levels will be tied to a rebuilding plan until the stock is recovered. This necessitates decision making in the preceding year as with other stocks.

16/ The GMT is one of several advisory panels that develop management recommendations for Council review. It comprises scientists from NMFS and state fishery management agencies.

17/ An ABC is established for every stock (a species or species group) where enough information is available. However, numerical OYs are not established for every stock, especially where harvest has been less than the ABC. Species and species groups with OYs include bocaccio, canary rockfish, chilipepper rockfish, cowcod, darkblotched rockfish, Dover sole, lingcod, longspine thornyhead, the minor rockfish complexes (northern and southern for nearshore, continental shelf, and continental slope species), Pacific cod, Pacific ocean perch (POP), Pacific whiting, sablefish, shortbelly rockfish, shortspine thornyhead, splitnose rockfish, widow rockfish, yelloweye rockfish and yellowtail rockfish.

extend management measures for more than one year (most likely to two years) so that they don't have to be specified every year. This would allow the Council to focus on strategic measures in the "off year."

4.0 ENVIRONMENTAL CONSEQUENCES

5.0 CONSISTENCY WITH FMP OBJECTIVES AND THE MAGNUSON-STEVENS ACT

5.1 FMP Goals and Objectives

The Groundfish FMP goals and objectives are listed below. They way in which this amendment addresses each objective is briefly described in italics below the relevant statement.

Management Goals.

> Goal 1 - Conservation. Prevent overfishing by managing for appropriate harvest levels and prevent any net loss of the habitat of living marine resources.
>
> Goal 2 - Economics. Maximize the value of the groundfish resource as a whole.
>
> Goal 3 - Utilization. Achieve the maximum biological yield of the overall groundfish fishery, promote year-round availability of quality seafood to the consumer, and promote recreational fishing opportunities.

Objectives. To accomplish these management goals, a number of objectives will be considered and followed as closely as practicable:

Conservation.

> Objective 1. Maintain an information flow on the status of the fishery and the fishery resource which allows for informed management decisions as the fishery occurs.

Measures in this amendment will not affect this objective. Procedures for periodically reviewing and changing rebuilding plans will depend on reliable information about resource status.

> Objective 2. Adopt harvest specifications and management measures consistent with resource stewardship responsibilities for each groundfish species or species group.

Measures in this amendment will not affect this objective. But specified procedures for the adoption and implementation of rebuilding plans will facilitate effective management of overfished species.

> Objective 3. For species or species groups which are below the level necessary to produce maximum sustainable yield (MSY), consider rebuilding the stock to the MSY level and, if necessary, develop a plan to rebuild the stock.

The standards and procedures in this amendment facilitate the adoption and implementation of rebuilding plans and therefore support this objective.

> Objective 4. Where conservation problems have been identified for nongroundfish species and the best scientific information shows that the groundfish fishery has a direct impact on the ability of that species to maintain its long-term reproductive health, the Council may consider establishing management measures to control the impacts of groundfish fishing on those species. Management measures may be imposed on the groundfish fishery to reduce fishing mortality of a nongroundfish species for documented conservation reasons. The action will be designed to minimize disruption of the groundfish fishery, in so far as consistent with the goal to minimize the bycatch of nongroundfish species, and will not preclude achievement of a quota, harvest guideline, or allocation of groundfish, if any, unless such action is required by other applicable law.

Measures in this amendment do not address this objective.

> Objective 5. Describe and identify essential fish habitat (EFH), adverse impacts on EFH, and other actions to conserve and enhance EFH, and adopt management measures that minimize, to the extent practicable, adverse impacts from fishing on EFH.

Measures in this amendment do not address this objective.

Economics.

> Objective 6. Attempt to achieve the greatest possible net economic benefit to the nation from the managed fisheries.

This amendment does not address this objective directly. Rebuilding plan implementation should increase net benefits in the long term.

> Objective 7. Identify those sectors of the groundfish fishery for which it is beneficial to promote year-round marketing opportunities and establish management policies that extend those sectors fishing and marketing opportunities as long as practicable during the fishing year.

Measures in this amendment do not address this objective.

> Objective 8. Gear restrictions to minimize the necessity for other management measures will be used whenever practicable.

Measures in this amendment do not address this objective.

Utilization.

> Objective 9. Develop management measures and policies that foster and encourage full utilization (harvesting and processing) of the Pacific coast groundfish resources by domestic fisheries.

Measures in this amendment do not address this objective.

> Objective 10. Recognizing the multispecies nature of the fishery and establish a concept of managing by species and gear or by groups of interrelated species.

Measures in this amendment do not address this objective. Rebuilding plans are species- or stock-specific.

> Objective 11. Strive to reduce the economic incentives and regulatory measures that lead to wastage of fish. Also, develop management measures that minimize bycatch to the extent practicable and, to the extent that bycatch cannot be avoided, minimize the mortality of such bycatch. In addition, promote and support monitoring programs to improve estimates of total fishing-related mortality and bycatch, as well as those to improve other information necessary to determine the extent to which it is practicable to reduce bycatch and bycatch mortality.

This amendment does not address this objective directly. The effect of harvest restrictions on bycatch rates could be addressed in rebuilding plans. Rebuilding plans must take into account total fishing mortality and rebuilding measures should also reduce bycatch.

> Objective 12. Provide for foreign participation in the fishery, consistent with the other goals to take that portion of the optimum yield (OY) not utilized by domestic fisheries while minimizing conflict with domestic fisheries.

This objective is no longer relevant because the fishery has been declared fully utilized.

Social Factors.

> Objective 13. When conservation actions are necessary to protect a stock or stock assemblage, attempt to develop management measures that will affect users equitably.

This amendment does not address this objective directly. Rebuilding plans may discuss allocation among sectors.

> Objective 14. Minimize gear conflicts among resource users.

Measures in this amendment do not address this objective.

> Objective 15. When considering alternative management measures to resolve an issue, choose the measure that best accomplishes the change with the least disruption of current domestic fishing practices, marketing procedures, and environment.

This amendment does not address this objective directly. The environmental impact analysis of rebuilding plan measures considers disruption of fishing, marketing and the environment. Some disruption is unavoidable.

> Objective 16. Avoid unnecessary adverse impacts on small entities.

This amendment does not address this objective directly. Rebuilding plan measures may entail adverse impacts, but these are necessary to rebuild overfished stocks.

> Objective 17. Consider the importance of groundfish resources to fishing communities, provide for the sustained participation of fishing communities, and minimize adverse economic impacts on fishing communities to the extent practicable.

This amendment does not address this objective directly. The environmental impact analysis of rebuilding plan measures considers impacts to communities.

> Objective 18. Promote the safety of human life at sea.

Measures in this amendment do not address this objective although the environmental impact analysis considers safety issues.

Although Amendment 12, the original document specifying rebuilding plan form and content, was remanded in part, the goals and objectives for rebuilding plans enumerated in that document are still relevant. The amendment described five goals, which can be re-cast as objectives falling under the three FMP goals:

Conservation

1. Achieve the population size and structure that will support the maximum sustainable yield within the specified time period.

2. Protect the quantity and quality of habitat necessary to support the stock at healthy levels in the future.

3. Promote widespread public awareness, understanding and support for the rebuilding program.

Economics

4. Minimize, to the extent practicable, the social and economic impacts associated with rebuilding, including adverse impacts on fishing communities.

Utilization

5. Fairly and equitably distribute both the conservation burdens (overfishing restrictions) and recovery benefits among commercial, recreational and charter fishing sectors.

This amendment adheres to these objectives in establishing rebuilding plan elements and plan implementation and review procedures.

5.2 National Standards

An FMP or plan amendment and any pursuant regulations must be consistent with ten national standards contained in the Magnuson-Stevens Act (§301). These are:

National Standard 1 states 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.

This amendment supports National Standard 1 by facilitating the adoption and implementation of rebuilding plans.

National Standard 2 states that conservation and management measures shall be based on the best scientific information available.

Rebuilding plans are based on rebuilding analyses that use the most recent stock assessment data and incorporate statistical measures of the likelihood that overfished stocks will recover within a mandated time period. These stock assessments and analyses are conducted by state and federal agency staff scientists with expertise in Pacific groundfish biology, ecology, and fishery science. They employ the best available data.

National Standard 3 states that, to the extent practicable, an individual stock of fish shall be managed as a unit throughout its range, and interrelated stocks of fish shall be managed as a unit or in close coordination.

Pacific groundfish are managed on the basis of known stocks when these can be differentiated from the total range of the species. Overfished species are managed individually in that harvest levels are determined for each stock. But managers recognize that many groundfish stocks share common habitats and ecosystems, and fishers may catch them as part of a multi-species complex. This allows unit management of interrelated stocks.

National Standard 4 states that conservation and management measures shall not discriminate between residents of different States. If it becomes necessary to allocate or assign fishing privileges among various United States fishermen, such allocation shall be (A) fair and equitable to all such fishermen; (B) reasonably calculated to promote conservation; and (C) carried out in such manner that no particular individual, corporation, or other entity acquires an excessive share of such privileges. The proposed measures will not discriminate between residents of different States.

This amendment and consequent rebuilding plans, to the degree that they specify allocation between sectors, will do so in a fair and equitable manner. Allocation decisions may be guided by rebuilding plan objectives and specific policies described in the plans. These decisions are made through the Council process and accordance with its established procedures and policies.

National Standard 5 states that conservation and management measures shall, where practicable, consider efficiency in the utilization of fishery resources; except that no such measure shall have economic allocation as its sole purpose.

This amendment and resulting rebuilding plans do not address this National Standard directly, except that no measures are intended to allocate groundfish resources solely for the purpose of economic efficiency.

National Standard 6 states that conservation and management measures shall take into account and allow for variations among, and contingencies in, fisheries, fishery resources and catches.

This amendment and resulting rebuilding plans recognize the differences between the various groundfish fishery sectors. Different sectors may have different catch levels for overfished species and capacity to avoid or minimize catch of overfished species. Although their primary purpose of measures described in this amendment is to allow overfished stocks to recover, differential impacts were considered when formulating them.

National Standard 7 states that conservation and management measures shall, where practicable, minimize costs and avoid unnecessary duplication.

Rebuilding plans will be implemented, reviewed and updated in a consistent and specific manner based on the measures in this amendment. Rebuilding plan measures are implemented through the annual *specification of management measures developed for the whole groundfish fishery. This approach is intended to minimize cost and duplication.*

National Standard 8 states that 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 in order to (A) provide for the sustained participation of such communities, and (B) to the extent practicable, minimize adverse economic impacts on such communities.

The analyses supporting this amendment and the individual rebuilding plans (organized around NEPA requirements) consider the socioeconomic impacts to fishing communities. Rebuilding plans generally do not employ a policy that would rebuild stocks in the minimum time period, which would very likely require a complete cessation of many fisheries. This is meant to minimize impacts to communities by allowing some level of fishing mortality on overfished stocks while identifying a trajectory that will lead to their eventual recovery.

National Standard 9 states that conservation and management measures shall, to the extent practicable, (A) minimize bycatch and (B) to the extent bycatch cannot be avoided, minimize the mortality of such bycatch.

Most overfished species are no longer targeted and in many cases only constitute bycatch due to regulatory discards. Because rebuilding plans must account for total fishing mortality, strategies must minimize bycatch. Rebuilding plan environmental impact analyses also evaluate the impact of the alternative management measures on bycatch.

National Standard 10 states that conservation and management measures shall, to the extent practicable, promote the safety of human life at sea.

This amendment does not directly affect safety. Indirect effects of rebuilding plan measures on safety are considered in the environmental analyses.

5.3 Other Applicable Magnuson-Stevens Act Provisions

This amendment and associated rebuilding plans conform to Section 304(e)–Rebuild Overfished Fisheries. The procedural measures described in Part A address the requirement that the Council "shall prepare a fishery management plan, plan amendment, or proposed regulations ... to end overfishing in the fishery and to rebuild affected stocks..." (§304(e)(3)). Pursuant rebuilding plans contain the elements required by Section 304(e)(4) and discussed in National Standard guidelines (50 CFR 600.310).

6.0 OTHER APPLICABLE LAW

6.1 National Environmental Policy Act

This document has been prepared in accordance with the requirements of the National Environmental Policy Act (NEPA) of 1969 to assess the impacts on the human environment that may result from the proposed action. It contains the elements consistent with an Environmental Impact Statement as described at 40 CFR Part 1502. The recommended format described at 40 CFR 1502.10 includes:

(a) Cover sheet.
(b) Summary.
(c) Table of contents.
(d) Purpose of and need for action. (Section 1 of the document.)
(e) Alternatives including proposed action (Section 2)
(f) Affected environment. (Section 3)
(g) Environmental consequences (Section 4)
(h) List of preparers. (Section 7.4)
(i) List of Agencies, Organizations, and persons to whom copies of the statement are sent. (Section 7.2)
(j) Index.
(k) Appendices (if any).

6.2 Regulatory Impact Review and Regulatory Flexibility Act Determination

In order to comply with Executive Order (EO) 12866 and the Regulatory Flexibility Act (RFA), this document also serves as a Regulatory Impact Review (RIR) and an Initial Regulatory Flexibility Analysis (IRFA).

6.2.1 Executive Order 12866 (Regulatory Impact Review)

EO 12866, Regulatory Planning and Review, was signed on September 30, 1993, and established guidelines for promulgating new regulations and reviewing existing regulations. The EO covers a variety of regulatory policy considerations and establishes procedural requirements for analysis of the benefits and costs of regulatory actions. Section 1 of the Order deals with the regulatory philosophy and principles that are to guide agency development of regulations. It stresses that in deciding whether and how to regulate, agencies should assess all of the costs and benefits across all regulatory alternatives. Based on this analysis, they should choose those approaches that maximize net benefits to society.

The regulatory principles in EO 12866 emphasize careful identification of the problem to be addressed. The agency is to identify and assess alternatives to direct regulation, including economic incentives such as user fees or marketable permits, to encourage the desired behavior. When an agency determines that a regulation is the best available method of achieving the regulatory objective, it must design its regulations in the most cost-effective manner to achieve the regulatory objective. Each agency is to assess both the costs and the benefits of the intended regulation and, recognizing that some costs and benefits are difficult to quantify, propose or adopt a regulation only after reasoned determination that the benefits of the intended regulation justify the costs. In reaching its decision agency must use the best reasonably obtainable information, including scientific, technical and economic data, about the need for and consequences of the intended regulation.

NMFS requires the preparation of an RIR for all regulatory actions of public interest, including those that either implement a new FMP or significantly amend an existing FMP or its implementing regulations. The RIR is part of the process of preparing and reviewing FMPs and provides a comprehensive review of the changes in net economic benefits to society associated with proposed regulatory actions. The analysis also provides a review of the problems and policy objectives prompting the regulatory proposals and an evaluation of the major alternatives that could be used to solve the problems. The purpose of the analysis is to ensure the regulatory agency systematically and comprehensively considers all available alternatives, so the public welfare can be enhanced in the most efficient and cost-effective way. The RIR addresses many of the items in the regulatory philosophy and principles of EO 12866.

The RIR analysis and an EIS required by NEPA have many common elements and they have been combined in this document. The following table shows where the elements of an RIR, as required by EO 12866, are located.

Required RIR Elements	Corresponding Sections
Description of management objectives	Sections 1 and 5
Description of the fishery[18/]	Section 3.2
Statement of the problem	Section 1.2
Description of each selected alternative	Section 2
An economic analysis of the expected effects of each selected alternative relative to status quo	Section 4.2

The RIR is designed to determine whether the proposed actions could be considered "significant regulatory actions" according to EO 12866. The following table identifies EO 12866 test requirements used to assess whether or not an action would be a "significant regulatory action," and identifies the expected outcomes of the proposed management alternatives. [For the purposes of the EO, none of the proposed alternatives would meet its criteria for a significant regulatory action.] A regulatory program is "economically significant" if it is likely to result in the effects described in item 1 in the table:

Summary of E.O. 12866 Test Requirements

EO 12866 Test of "Significant Regulatory Actions"	Status Quo	Preferred Alternative		
1) Have a annual effect on the economy of $100 million or more or adversely affect in a material way the economy, a sector of the economy, productivity, competition, jobs, the environment, public health or safety, or state, local, or tribal governments or communities				
2) Create a serious inconsistency or otherwise interfere with action taken or planned by another agency				
3) Materially alter the budgetary impact of entitlement, grants, user fees, or loan programs or the rights and obligations of recipients thereof				
4) Raise novel legal or policy issues arising out of legal mandates, the President's priorities, or the principles set forth in this Executive Order				

6.2.2 Impacts on Small Entities (Regulatory Flexibility Act, RFA)

18/ In addition to the information in this document, basic economic information is provided annually in the Council's SAFE document.

The RIR is also designed to determine whether the proposed rule has a "significant economic impact on a substantial number of small entities"[19] under the RFA. The purpose of the RFA is to relieve small businesses, small organizations, and small governmental entities of burdensome regulations and record-keeping requirements. Major goals of the RFA are: (1) to increase agency awareness and understanding of the impact of their regulations on small business, (2) to require that agencies communicate and explain their findings to the public, and (3) to encourage agencies to use flexibility and to provide regulatory relief to small entities. The RFA emphasizes predicting impacts on small entities as a group distinct from other entities and the consideration of alternatives that may minimize the impacts while still achieving the stated objective of the action. An initial regulatory flexibility analysis (IRFA) is conducted unless it is determined that an action will not have a "significant economic impact on a substantial number of small entities." The RFA requires that an initial regulatory flexibility analysis include elements that are similar to those required by EO 12866 and NEPA. Therefore, the IRFA has been combined with the RIR and NEPA analyses. The following table references the location of these RFA-required elements:

Required IRFA Elements	Corresponding Sections
A description of the reasons why action by the agency is being considered.	Section 1.2
A succinct statement of the objectives of, and the legal basis for, the proposed rule.	Sections 1 and 5
A description of and, where feasible, an estimate of the number of small entities to which the proposed rule will apply (including a profile of the industry divided into industry segments, if appropriate).	Section 3.2
A description of the projected reporting, record keeping and other compliance requirements of the proposed rule, including an estimate of the classes of small entities that will be subject to the requirement and the type of professional skills necessary for preparation of the report or record.	Section 6.5 and below
An identification to the extent practicable, of all relevant Federal rules that may duplicate, overlap or conflict with the proposed rule.	See below
A description of any significant alternatives to the proposed rule that accomplish the stated objectives that would minimize any significant economic impact of the proposed rule on small entities.	Section 2

[additional discussion and analysis of requirements referenced in above table.]

The actions considered in this document may have significant impacts on small entities. Public comment is invited on adjustments that would reduce the impacts on small entities while achieving the regulatory objectives and on whether the analysis adequately takes into account impacts on small entities.

6.3 Coastal Zone Management Act

Section 307(c)(1) of the Federal Coastal Zone Management Act (CZMA) of 1972 requires all federal activities which directly affect the coastal zone be consistent with approved, state coastal zone management programs to the maximum extent practicable. Section 11.7.3 of the Groundfish FMP discusses consistency with the coastal zone management programs of Washington, Oregon, and California. The measures proposed in this amendment are within the scope of that discussion and are consistent, to the maximum extent practicable, with these state programs.

In accordance with regulations at 15 CFR 930.54 (unlisted federal license or permit activities) a copy of the Draft EIS is transmitted to coastal zone management programs for review.

19/ The Small Business Administration defines a small business in commercial fishing "as a fish harvesting or hatchery business that is independently owned and operated and not dominant in its field of operation" with "annual receipts not in excess of $3,000,000."

6.4 Listed Species

Section 3.5 describes species listed under the Endangered Species Act and managed under the Marine Mammal Protection Act, and seabirds protected or given special consideration by law and NMFS policy that occur off the West Coast and may be affected by the groundfish fishery. Section 4.x considered potential effects of the alternatives on these species and found that they are not affected.

6.4.1 Endangered Species Act

6.4.2 Marine Mammal Protection Act

6.4.3 Seabirds

6.5 Paperwork Reduction Act

6.6 Executive Order 13132 (Federalism)

7.0 Reference Material

7.1 Bibliography

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7.2 Agencies, Organizations, and Persons Receiving a Copy of This EIS

7.3 List of Federal Register Notices Published in Connection With This Action

7.4 List of Preparers

Christopher Dahl, John DeVore, Jim Seger, Chuck Tracy
Pacific Fishery Management Council

Appendix A
Amendments to FMP Language

This appendix documents revisions to the language of the FMP which could result from Council action under each of the five issues presented in Chapter 2 of this document.

GUIDE TO SECTIONS AFFECTED BY ISSUES CONSIDERED IN THE FMP AMENDMENT

	Issue	Affected Sections
Issue 1	Form & Required Elements of Species Rebuilding Plans	4.5.2 4.5.2.2 4.5.2.3
Issue 2	Periodic Review and Rebuilding Plan Amendment	4.5.2.2 -Option 2c Only 4.5.2.4
Issue 3	Adequacy of Progress	4.5.2.1 4.5.2.2 -Option 3d Only 4.5.2.4
Issue 4	ESA Listed Species	4.5.2.5
Issue 5	Housekeeping Measures	All Sections of Chapters 4 and 5

The following is the table of contents for the affected sections.

TABLE OF CONTENTS FOR THE AFFECTED SECTIONS OF THE FMP

Page

AFFECTED FMP LANGUANGE

KEY:
<u>Bold italic underline = new text</u>
Strikeout or Bold Strikeout = old text that may be removed

3.0 AREAS AND STOCKS INVOLVED

* * *

<u>3.1 Species Managed by this Fishery Management Plan</u>

Table 3-1 is the listing of species managed under this FMP.

TABLE 3-1. Common and scientific names of species included in this FMP.

Common Name	Scientific Name
	SHARKS
Leopard shark	*Triakis semifasciata*
Soupfin shark	*Galeorhinus zyopterus*
Spiny dogfish	*Squalus acanthias*
Big skate	*Raja binoculata*
California skate	*R. inornata*
Longnose skate	*R. rhina*
	RATFISH
Ratfish	*Hydrolagus colliei*
	MORIDS
Finescale codling	*Antimora microlepis*
	GRENADIERS
Pacific rattail	*Coryphaenoides acrolepis*
	ROUNDFISH
Lingcod	*Ophiodon elongatus*
Cabezon	*Scorpaenichthys marmoratus*
Kelp greenling	*Hexagrammos decagrammus*
Pacific cod	*Gadus macrocephalus*
Pacific whiting (hake)	*Merluccius productus*
Sablefish	*Anoplopoma fimbria*
	ROCKFISH [a/]

TABLE 3-1. Common and scientific names of species included in this FMP.

Common Name	Scientific Name
Aurora rockfish	*Sebastes aurora*
Bank rockfish	*S. rufus*
Black rockfish	*S. melanops*
Black and yellow rockfish	*S. chrysomelas*
Blackgill rockfish	*S. melanostomus*
Blue rockfish	*S. mystinus*
Bocaccio	*S. paucispinis*
~~Bronze spotted~~ ***Bronzespotted*** rockfish	*S. gilli*
Brown rockfish	*S. auriculatus*
Calico rockfish	*S. dallii*
California scorpionfish	*Scorpaena gutatta*
Canary rockfish	*Sebastes pinniger*
Chameleon rockfish	***S. phillipsi***
Chilipepper	*S. goodei*
China rockfish	*S. nebulosus*
Copper rockfish	*S. caurinus*
Cowcod	*S. levis*
Darkblotched rockfish	*S. crameri*
Dusky rockfish	*S. ciliatus*
Dwarf-red rockfish	***S. rufianus***
Flag rockfish	*S. rubrivinctus*
Freckled rockfish	***S. lentiginosus***
Gopher rockfish	*S. carnatus*
Grass rockfish	*S. rastrelliger*
Greenblotched rockfish	*S. rosenblatti*
Greenspotted rockfish	*S. chlorostictus*
Greenstriped rockfish	*S. elongatus*
Halfbanded rockfish	***S. semicinctus***
Harlequin rockfish	*S. variegatus*
Honeycomb rockfish	*S. umbrosus*
Kelp rockfish	*S. atrovirens*
Longspine thornyhead	*Sebastolobus altivelis*
Mexican rockfish	*Sebastes macdonaldi*
Olive rockfish	*S. serranoides*
Pink rockfish	*S. eos*
Pinkrose rockfish	***S. simulator***
Pygmy rockfish	***S. wilsoni***
Pacific ocean perch	~~***Sebastes***~~ ***S.*** *alutus*
Quillback rockfish	*S. maliger*
Redbanded rockfish	*S. babcocki*
Redstripe rockfish	*S. proriger*
Rosethorn rockfish	*S. helvomaculatus*
Rosy rockfish	*S. rosaceus*
Rougheye rockfish	*S. aleutianus*
Sharpchin rockfish	*S. zacentrus*
Shortbelly rockfish	*S. jordani*
Shortraker rockfish	*S. borealis*
Shortspine thornyhead	*Sebastolobus alascanus*
Silvergray rockfish	*Sebastes brevispinis*
Speckled rockfish	*S. ovalis*
Splitnose rockfish	*S. diploproa*
Squarespot rockfish	*S. hopkinsi*
Starry rockfish	*S. constellatus*
Stripetail rockfish	*S. saxicola*
Swordspine rockfish	***S. ensifer***
Tiger rockfish	*S. nigrocinctus*
Treefish	*S. serriceps*
Vermilion rockfish	*S. miniatus*
Widow rockfish	***S. entomelas***
Yelloweye rockfish	***S. ruberrimus***
Yellowmouth rockfish	***S. reedi***
Yellowtail rockfish	***S. flavidus***

TABLE 3-1. Common and scientific names of species included in this FMP.

Common Name	Scientific Name
	FLATFISH
Arrowtooth flounder (turbot)	*Atheresthes stomias*
Butter sole	*Isopsetta isolepis*
Curlfin sole	*Pleuronichthys decurrens*
Dover sole	*Microstomus pacificus*
English sole	*Parophrys vetulus*
	FLATFISH (continued)
Flathead sole	*Hippoglossoides elassodon*
Pacific sanddab	*Citharichthys sordidus*
Petrale sole	*Eopsetta jordani*
Rex sole	*Glyptocephalus zachirus*
Rock sole	*Lepidopsetta bilineata*
Sand sole	*Psettichthys melanostictus*
Starry flounder	*Platichthys stellatus*

a/ The category "rockfish includes all genera and species of the family ~~Scopaenidae~~ ***Scorpaenidae***, even if not listed, that occur in the Washington, Oregon, and California area. The ~~Scopaenidae~~ ***Scorpaenidae*** genera are *Sebastes*, ~~*Scorpana*~~ ***Scorpaena***, *Sebastolobus*, and ~~*Scorp*~~ ***Scorpaenodes***.

* * *

4.0 *PREVENTING OVERFISHING AND ACHIEVING* OPTIMUM YIELD

National Standard 1 requires that "Conservation and management measures shall prevent overfishing while achieving, on a continuing basis, the OY from each fishery for the U.S. fishing industry." (50 CFR Section 600.310(a))

"The determination of OY is a decisional mecahnism for resolving the MSA's multiple purposes and policies, implementing an FMP's objectives and balancing the various interests that comprise the national welfare. OY is based on MSY, or on MSY as it may be reduced . . . [in consideration of social, economic or ecological factors] . . . The most important limitation on the specification of OY is that the choice of OY and the conservation and management measures proposed to achieve it must prevent overfishing." (50 CFR Section 600.310(b))

This chapter addresses the essential considerations suggested for National Standard 1, as identified in the NMFS guidelines on the standard (600.310):

- *estimating MSY, estimated the MSY biomass and setting the MSY control rule (50 CFR Section 600.310(c)) [Section 4.2 of this Chapter]*
- *specifying stock status determination criteria (maximum fishing mortality threshold and minimum stock size threshold, or reasonable proxies thereof) (50 CFR Section 600.310(d)) [Section 4.4 of this Chapter]*
- *actions for ending overfishing and rebuilding overfished stocks (including the development and adoption of rebuilding plans) (50 CFR Section 600.310(e)) [Section 4.5 of this Chapter]*
- *setting OY and apportionment of harvest levels (50 CFR Section 600.310(f)) [Section 4.6 of this Chapter]*

In establishing OYs for West Coast groundfish, this FMP utilizes the interim step of calculating ABCs for major stocks or management units (groups of species). ABC is the MSY harvest level associated with the current stock abundance. Over the long term, if ABCs are fully harvested, the average of the ABCs would be MSY.

OY is set and apportioned under the procedures outlined in Chapter 5.

4.1 Species Categories (Previously portions of 5.3, as indicated)

~~ABC,~~ B_{msy}, ***ABC*** and overfished/rebuilding stock size threshold cannot be precisely defined for all species, because of the absence of available information for many species managed under the FMP. [PRECEDING

SENTENCE FROM SECTION 5.3, PARA 2, 1ST SENTENCE]. ***For the purpose of setting MSY, ABC, MFMT, MSST, OY and rebuilding standards,*** ~~T~~*t*hree categories of species are identified. [FOLLOWING WAS PREVIOUSLY SECTION 5.3, PARA 3] The first are the ***relatively*** few species for which a quantitative stock assessment can be conducted on the basis of catch-at-age or other data. ABCs and overfished/rebuilding thresholds can generally be calculated for these species. The second category includes a large number of species for which some biological indicators are available, but a quantitative analysis cannot be conducted. It is difficult to estimate overfished and overfishing thresholds for the second category of species *a priori*, but indicators of long term, potential overfishing can be identified. ABCs for species in this category are typically set at a constant level and some monitoring is necessary to determine if this level of catch is causing a slow decline in stock abundance. The third category includes minor species which are caught, but for which there is, at best, only information on landed biomass. For species in this category, it is impossible to determine MSY, ABC, or an overfished threshold.

4.2 Determination of MSY or MSY Proxy and B_{msy} (Previously 5.2)

Harvest policies are to be specified according to standard reference points such as MSY (MSY, interpreted as ~~an~~ ***a maximum*** average achievable catch ***under prevailing ecological and environmental conditions*** over a prolonged period), ***the long-term average biomass associated with fishing at Fmsy is Bmsy.*** ~~the biomass that produces MSY (B_{msy}) and the fishing rate (F_{msy}) that tends to hold biomass near B_{msy}.~~ In this FMP, MSY generally refers to a constant F control rule that is assumed to produce the maximum average yield over time while protecting the spawning potential of the stock. ***Thus the constant F control rule is genearlly the proxy for the MSY control rule.*** ~~. (Pacific whiting is generally based on a variable F control rule.)~~ Fishing rates above F_{msy} eventually result in biomass smaller than B_{msy} and produce less harvestable fish on a sustainable basis. Accordingly, management should avoid fishing rates that hold biomass below B_{msy} for long periods. ***The biomass level that produces MSY (i.e., B_{msy}) is generally unknown and assumed to be variable over time due to long-term fluctuations in ocean conditions, so that no single value is appropriate.*** [PREVIOUS SENTENCE MOVED FROM BELOW] ~~This is especially important during periods of unfavorable environment in which resources may be less productive than usual and the risk of stock depletion is greater.~~ ***During periods of unfavorable environment it is important to account for reduced sustainable yield levels.***

The problem with an F_{msy} control rule is that it is tightly linked to an assumed level of density-dependence in recruitment, and there is insufficient information to determine the level of density-dependence in recruitment for many West Coast groundfish stocks. Therefore, the use of approximations or proxies is necessary. Absent a more accurate determination of F_{msy}, the Council will apply default MSY proxies. The current (~~1998~~ ***2001) proxies are: $F_{40\%}$ for flatfish and whiting, $F_{50\%}$ for rockfish (including thornyheads) and $F_{45\%}$*** ~~$F_{35\%}$~~ for all species ***such as sablefish and lingcod*** ~~except rockfish and $F_{40\%}$ for rockfish[1/]~~. However, ~~these~~ values (~~$F_{35\%}$~~ *$F_{40\%}$, $F_{45\%}$* and ~~$F_{40\%}$~~ *$F_{50\%}$*) are provided here as examples only and are expected to be modified from time to time as scientific knowledge improves. If available information is sufficient, values of F_{msy}, B_{msy}, and more appropriate harvest control rules may be developed for any species or species group. ~~For example, the Council generally has applied a variable F control rule for management of Pacific whiting.~~

At this time, it is generally believed that, for many species, ~~$F_{35\%}$~~ *$F_{45\%}$* strikes a balance between obtaining a large fraction of the MSY if recruitment is highly insensitive to reductions in spawning biomass and preventing a rapid depletion in stock abundance if recruitment is found to be extremely sensitive to reductions in spawning biomass. The long-term expected yield under an ~~$F_{35\%}$~~ *$F_{45\%}$* policy depends upon the (unknown) level of density-dependence in recruitment. The recommended level of harvest will reduce the average lifetime egg production by each female entering the stock to ~~35%~~ *45%* of the lifetime egg production for females that are unfished.

Because the level of recruitment is expected to decline somewhat as a stock is fished at $F_{45\%}$, the expected Bmsy proxy is less than 45% of the unfished biomass. A biomass level of 40% is a reasonable proxy for B_{msy}. The short-term yield under an ~~$F_{35\%}$~~ *$F_{45\%}$* policy will vary as the abundance of the exploitable stock varies. This is true for any fishing policy that is based on a constant exploitation rate. The

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~~1/ In the rest of this document use of $F_{35\%}$ will be taken to mean $F_{40\%}$ in the case of rockfish, and the hybrid fishing mortality rate strategy for Pacific whiting.~~

abundance of the stock will vary, because of the effects of fishing, and because of natural variation in recruitment. When stock abundance is high (i.e., near its average unfished level), short-term annual yields can be approximately two to three times greater than the expected long-term average annual yield. For many of the long-lived groundfish species common on the West Coast, this "fishing down" transition can take decades. Many of the declines in ABC that occurred during the 1980s were the result of this transition from a lightly exploited, high abundance stock level to a fully exploited, moderately abundant stock level. <u>***Further declines below the overfished levels in the 1990s were due mostly to much lower than expected recruitment.***</u>

~~Recent work (Clark 1993, Mace 1994, and Ianelli 1995) indicates that $F_{35\%}$ may not be the best approximation of F_{msy}, given more realistic information about recruitment than was initially used by Clark in 1991. In his 1993 publication Clark extended his 1991 results by improving the realism of his simulations and analysis. In particular he (1) modeled stochasticity into the recruitment process, (2) introduced serial correlation into recruitment time series, and (3) performed separate analyses for the Ricker and Beverton-Holt spawner-recruit functions. For rockfish, these changes improved the realism of his spawning biomass per recruit (SPR) harvest policy calculations, because these species are known to have stochastic recruitment and they appear to display serial correlation in recruitments (especially on interdecadal time scales), and because the Beverton-Holt spawner-recruit curve may be biologically the most plausible recruitment model. The effect of each of these changes, in isolation and in aggregate, was to decrease F_{msy}. Consequently, the estimated SPR reduction needed to provide an optimal F_{msy} proxy (defined as that level of fishing which produces the largest assured proportion of MSY), must necessarily be increased. Clark concluded that $F_{40\%}$ is the optimal rate for fish stocks exhibiting recruitment variability similar to Alaska groundfish stocks. Likewise, Mace (1994) recommended the use of $F_{40\%}$ as the target mortality rate when the stock-recruitment relationship is unknown. Lastly, Ianelli (1995) determined that $F_{44\%}$ was a good F_{msy} proxy for Gulf of Alaska Pacific ocean perch, although he subsequently indicated that a recent recruitment to that stock was larger than expected and that $F_{44\%}$ may be too conservative in that case.~~

~~Based on this information and advice by its Groundfish Management Team, in 1997 the Council concluded that $F_{40\%}$ should be used as the proxy for F_{msy} for rockfish in the absence of specific knowledge of recruitment or life history characteristics which would allow a more accurate determination of F_{msy}. This and other proxies may be revised on the basis of further information and experience.~~

<u>*In spring 2000, the Council's Scientific and Statistical Committee (SSC) sponsored a workshop to review the Council's groundfish exploitation rate policy. The workshop explored the historic use of different fishing mortality (F) rates, and found that the Council's past practices have generally changed in response to new information from the scientific community. Starting in the early 1990s, the Council used a standard harvest rate of F35%. The SSC's workshop participants reported that new scientific studies in 1998 and 1999 had shown that the $F_{35\%}$ and F_{40}% rates used by the Council had been too aggressive for Pacific coast groundfish stocks, such that some groundfish stocks could not maintain a viable population over time. A 1999 study, "The Meta-Analysis of the Maximum Reproductive Rate for Fish Populations to Estimate Harvest Policy; a Review" (Myers, et al.) showed that Pacific coast groundfish stocks, particularly rockfish, have very low productivity compared to other, similar species worldwide. One prominent theory about the reason for this low productivity is the large-scale, North Pacific climate shifts that are thought to cycle Pacific coast waters through warm and cool phases of 20-30 years duration. Pacific coast waters shifted to a warm phase around 1977-78, with ocean conditions less favorable for Pacific coast groundfish and other fish stocks. Lower harvest rates are necessary to guard against steep declines in abundance during these periods of low productivity (low recruitment). After an intensive review of historic harvest rates, and current scientific literature on harvest rates and stock productivity, the SSC workshop concluded that F40% is too aggressive for many Pacific coast groundfish stocks, particularly for rockfish. For 2001 and beyond, the Council adopted the SSC's new recommendations for harvest policies of: F40% for flatfish and whiting, F50% for rockfish (including thornyheads) and F45% for other groundfish such as sablefish and lingcod.*</u>

In the past, ***F$_{msy}$*** ~~these~~ fishing rates were treated by the Council (as intended) as targets. Under the Magnuson-Stevens Act as amended in 1996, these fishing rates are more appropriately considered to be ~~**limits**~~ ***thresholds*** ~~which~~ ***that*** should not be exceeded (see Section 4.4).

The Council will consider any new scientific information relating to calculation of MSY or MSY proxies and may adopt new values based on improved understanding of the population dynamics and harvest of any species or group of species.

~~**The biomass level that produces MSY (i.e., B_{msy}) is also generally unknown and assumed to be variable over time due to long-term fluctuations in ocean conditions, so that no single value is appropriate. Current scientific thought is that B_{msy} (and/or the natural range of biomass under F_{msy}) usually falls somewhere between 0.3 to 0.5 of the average unfished abundance (mean $B_{unfished}$), and rarely falls below one quarter of that amount, (i.e., B_{msy} > 0.25 mean $B_{unfished}$). Rebuilding, or at least a reduced harvest rate, may be required if abundance falls below these levels.**~~

While B_{msy} may be set based on the averaged unfished abundance ($B_{unfished}$) ~~T~~***t***here are many possible approximations and estimates of mean $B_{unfished}$. If the necessary data exist, the following standard methodology is the preferred approach:

mean $B_{unfished}$ = mean R * SP**R**(F=0)

note: spawning biomass per recruit (SPR)

Where mean R is the average estimated recruitment ***expected under unfished conditions*** ~~**over all reliable years**~~, and SP***R***(F=0) is the spawning potential per recruit at zero fishing mortality rate. ~~**Alternative reference points based on mean R * SP($F_{35\%}$) or reconstruction of mean $B_{unfished}$ from stock-recruitment relationships may also be used.**~~ SP***R***(F=0) is normally available as part of the calculation leading to determination of ~~**$F_{35\%}$**~~ ***F45% and is equilavent to F100%.***

4.3 Determination of ABC ~~*OY, Precautionary Threshold, and (Overfished/Rebuilding Threshold)*~~ (Previously 5.3)

~~The Magnuson-Stevens Act as amended in 1996 defines OY as the amount of fish that is prescribed on the basis of MSY from the fishery as reduced by any relevant economic, social, or ecological factors. By this definition, overfishing occurs if a stock is harvested at a level in excess of F_{msy}. Moreover, overfished stocks (i.e., those that have declined to below a specified (overfished/rebuilding threshold)) are to be rebuilt to a level that is consistent with producing MSY.~~ In establishing OYs for West Coast groundfish, this FMP utilizes the interim step of calculating ABCs for major stocks or management units (groups of species). ***ABC is the MSY harvest level associated with the current stock abundance. Over the long term, if ABCs are fully harvested, the average of the ABCs would be MSY.***

~~ABC, B_{msy}, and overfished/rebuilding stock size threshold cannot be precisely defined for all species, because of the absence of available information for many species managed under the FMP.~~ PREVIOUS SENTENCE MOVED TO START OF 5.1. REMAINDER OF PARAGRAPH MOVED TO 4.4.2. ~~In this FMP, the term "overfishing" is used to denote situations where catch exceeds or is expected to exceed the established ABC or MSY proxy ($F_{x\%}$). The term "overfished" describes a stock who's abundance is below its overfished/rebuilding threshold). Overfished/rebuilding thresholds in general, are linked to the same productivity assumptions that determine the ABC levels. The default value of this threshold is 25% of the estimated unfished biomass level or 50% of B_{msy}, if known.~~

PARAGRAPH THREE OF 5.3, ON SPECIES CATEGORIES, HAS BEEN MOVED TO SECTION 4.1
PARAGRAPH FOUR OF 5.3, ON THE PRECAUTIONARY THRESHOLD, HAS BEEN MOVED TO SECTION 4.4.1

4.3.1 Determination of ABC (Previously 5.3.1)

4.3.1.1 Stocks with Quantitative Assessments, Category 1 (Previously 5.3.1.1)

The stocks with quantitative assessments are those that have recently been assessed by a catch-at-age analysis. Annual evaluation of the appropriate MSY proxy (e.g., ~~$F_{35\%}$~~ ***$F_{45\%}$***) for species in this category will require some specific information in the SAFE document. Estimated age-specific maturity, growth, and availability to the fishery (with evaluation of changes over time in these characteristics) are sufficient to determine the relationship between fishing mortality and yield-per-recruit and spawning biomass-per-recruit. The estimated time series of recruitment, spawning biomass, fishing mortality are also required to determine whether recent trends indicate a point of concern. In general, ABC will be calculated by applying ~~$F_{35\%}$~~ ***$F_{45\%}$*** (or $F_{40\%}$ ***or $F_{50\%}$*** or other established MSY proxy) to the best estimate of current biomass. This current biomass estimate may be for a single year or the average of the present and several future years. Thus, ABC may be intended to remain constant over a period of three or more years. ~~All ABCs will remain in effect until revised, and, whether revised or not, will be announced at the beginning of the year along with other specifications.~~ LAST SENTENCE MOVED BACK TO CHAPTER 5.

4.3.1.2 Stocks with ABC Set by Nonquantitative Assessment, Category 2 (Previously 5.3.1.2)

These stocks with ABC set by nonquantitative assessments typically do not have a recent, quantitative assessment, but there may be a previous assessment or some indicators of the status of the stock. Detailed biological information is not routinely available for these stocks, and ABC levels have typically been established on the basis of average historical landings. Typically, the spawning biomass, level of recruitment, or the current fishing mortality rate for Category 2 stocks are unknown. The Council places high priority on improving the information for managing these stocks so that they may be moved to Category 1 status.

4.3.1.3 Stocks Without ABC Values, Category 3 (Previously 5.3.1.3)

Of the 83 groundfish species managed under the FMP, ABC values have been established for only about 25. The remaining species are incidentally landed and usually are not listed separately on fish landing receipts. Information from fishery independent surveys are often lacking for these stocks, because of their low abundance or they are not vulnerable to survey sampling gear. ~~**Without an**~~ ***Until sufficient quantities of*** at-sea observer program ***data are available or surveys of other fish habitats are conducted,*** it is unlikely that ***there*** ~~**a data base**~~ will be ~~**developed in the future for these stocks to**~~ ***sufficient data to*** upgrade the assessment ~~**capability**~~ ***capabilities*** or ***to*** evaluate their overfishing potential. Interim ABC values may be established for these stocks based on qualitative information, including advice from the Council's advisory entities.

4.4 Precautionary Thresholds and Overfishing Status Determination Criteria (NEW SECTION TITLE)

The National Standard Guidelines define two thresholds that are necessary to maintain a stock at levels capable of producing MSY: the maximum fishing mortality threshold (MFMT) and a minimum stock size threshold (MSST). These two limits are intended for use as benchmarks to decide if a stock or stock complex is being overfished or is in an overfished state. The MFMT and MSST are intrinsically linked through the MSY Control Rule that specifies how fishing mortality or catches could vary as a function of stock biomass in order to achieve yields close to MSY. (PRECEDING WAS MOVED FROM SECTION 4.2)

4.4.1 Determination of Precautionary Thresholds (Previously 5.3.3)

The precautionary threshold is the biomass level at which point the harvest rate will be reduced to help the stock return to the MSY level ***(see Section 4.5.1 "Default Precautionary and Interim Rebuilding OY Calculation"). The precautionary biomass threshold is in addition to the overfishing and overfished/rebuilding thresholds required under ths MSA (MFMT and MSST). The precautionary biomass threshold is higher than the overfished biomass (MSST). Because B_{msy} is a longterm average, biomass will by definition be below B_{msy} in some years and above B_{msy} in other years. Thus,***

even in the absence of overfishing, biomass may decline to levels below B_{msy} due to natural fluctuation. By decreasing harvest rates when biomass is below B_{msy} but maintaining MSY control rule (or proxy control rule) harvest rates for biomass levels above MSY, the precautionary threshold and accompanying response effectively constitute a control rule that manages for harvests lower than MSY and an average biomass above MSY.

The precautionary threshold is established only for category 1 species. The precautionary threshold will be the B_{msy} level, if known. The default precautionary threshold will be 40% of the estimated unfished biomass level. The Council may recommend different precautionary thresholds for any species or species group based on the best scientific information about that species or group. It is expected the threshold will be between 25% and 50% of the estimated unfished biomass level.

~~For category 1 species, in addition to the overfished/rebuilding threshold, a precautionary threshold is established. The default value will be 40% of mean~~ $\cancel{B_{unfished}}$~~. This level of biomass is expected to be near~~ $\cancel{B_{msy}}$~~, and if abundance is between the overfished/rebuilding threshold and the precautionary threshold, a precautionary reduction in harvest will implemented to avoid further declines in abundance.~~ (PRECEDING PARAGRAPH MOVED FROM SECTION 5.3 THEN DELETED AS BEING REDUNDANT WITH EXISTING/NEW TEXT)

4.4.2 Determination of Overfishing Threshold (NEW SECTION)

In this FMP, ***for Category 1 species***, the term "overfishing" is used to denote situations where catch exceeds or is expected to exceed the established ABC or MSY proxy ($F_{x\%}$). ***This can also be expressed as where catch exceeds or is expected to exceed the MFMT.*** The term "overfished" describes a stock who's abundance is below its overfished/rebuilding threshold). Overfished/rebuilding thresholds in general, are linked to the same productivity assumptions that determine the ABC levels. The default value of this threshold is 25% of the estimated unfished biomass level or 50% of B_{msy}, if known. (PRECEDING WAS MOVED FROM SECTION 5.3) ***The MFMT is simply the value(s) of fishing mortality in the MSY control rule.*** **Technically, ~~e~~**Exceeding F_{msy} ~~**now**~~ constitutes overfishing. (PRECEDING WAS MOVED FROM SECTION 5.2)

THE FOLLOWING PARAGRAPHS ON CATEGORY 2 AND CATEGORY 3 SPECIES WERE MOVED FROM SECTION 5.3.6.2.

For Category 2 species, the following may be evaluated as potential indicators of overfishing:

- catch per effort from logbooks
- catch area from logbooks
- index of stock abundance from surveys
- stock distribution from surveys
- mean size of landed fish

If declining trends persist for more than three years, then a focused evaluation of the status of the stock, its ABC, and overfishing threshold will be quantified. If data are available, such an evaluation should be conducted at approximately five year intervals even when negative trends are not apparent. In fact, many stocks are in need of re-evaluation to establish a baseline for monitoring of future trends. Whenever an evaluation indicates the stock may be declining and approaching an overfished state, the Council should:

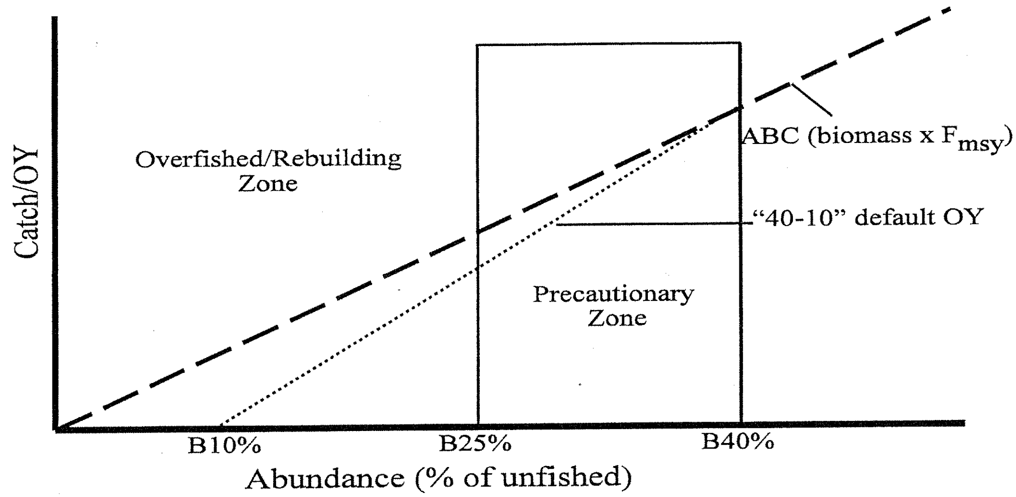
1. Improve data collection for this species so it can be moved to Category 1.

2. Determine the rebuilding rate that would allow the stock to return to MSY in no longer than ten years.

For Category 3 species, information from fishery independent surveys are often lacking for these species because of their low abundance or they are not vulnerable to survey sampling gear. Without an at-sea observer program, it is unlikely that a data base will be developed in the future for these species to evaluate the risk of overfishing.

4.4.3 Determination of Overfished/Rebuilding Thresholds (Previously 5.3.4)

The MSST (overfished/rebuilding threshold) is the default value of 25% of the estimated unfished biomass level or 50% of B_{msy}, if known. (PRECEDING WAS MOVED FROM SECTION 4.2) ~~As described in section 5.3,~~ The overfished/rebuilding threshold (***also refered to as $B_{rebuild}$*** ~~***MSST***), $B_{rebuild}$,~~ is generally in the range of 25% to 40% of $B_{unfished}$, and may also be written as



$B_{rebuild}$ = x% * mean R * SP***R***(F=0)

The default overfished/rebuilding threshold for category 1 groundfish is .25$B_{unfished}$. The Council may establish different thresholds for any species based on information provided in stock assessments, the SAFE document, or other scientific or groundfish management-related report. For example, if B_{msy} is known, the overfished threshold may be set equal to 50% of that amount. The Council may also specify a lower level of abundance where catch or fishing effort is reduced to zero. This minimum abundance threshold (B_{min}) would correspond to an abundance that severely jeopardizes the stock's ability to recover to B_{msy} in a reasonable length of time; ~~likely values fall between five percent and ten percent of the average unfished level.~~

4.5 Ending Overfishing and Rebuilding (New Section Title)

4.5.1 Default Precautionary and Interim Rebuilding OY Calculation (Previously 5.3.5)

The precautionary threshold, defined in Section 4.4.1, is used to trigger a precautionary management approach. If biomass declines to a level that requires rebuilding (below the MSST), the precautionary management approach also provides an interim rebuliding harvest control policy to guide the setting OY until the Council sets a new rebuilding policy specific to the conditions of the stock and fishery. The default OY/rebuilding ~~plan~~ ***policy*** can be described as an "ICES-type catch-based approach" that consists of a modification of the catch policy, where catch (C) declines from C(F_{msy}) at the precautionary threshold in a straight line to F=0 at the minimum abundance threshold of ten percent of the estimated mean unfished biomass (sometimes called pristine or virgin biomass or reproductive potential). This approach could also be described as an OY based on a variable F_{SPR} that is progressively more conservative at low biomass levels. The abbreviated name for this is the "40-10" default adjustment. In most cases, there is inadequate information to estimate F_{msy}; in such cases, the best proxy for F_{msy} will be used. The default proxy values will be $F_{40\%}$ for flatfish and whiting, $F_{\cancel{40\%}50\%}$ for rockfish in the *Sebastes* complex and $F_{\cancel{35\%}45\%}$ for other species ***such as sablefish and lingcod***. The Council anticipates scientific information about the population dynamics of the various stocks will improve over time and that this information will result in improved estimates of appropriate harvest rates and MSY proxies. Thus, these initial default proxy values will be replaced from time to time. Such changes will not require amendment to the FMP, but the scientific basis for new values must be documented.

The greater amount of catch reduction applied below the precautionary threshold will foster quicker return to the MSY level. If a stock falls below its overfished/rebuilding threshold, this line would be used as the interim rebuilding plan during the year until the Council develops a formal rebuilding plan. The point at which the line intersects the horizontal axis does not necessarily imply zero catch would be allowed, but rather is for determining the slope of the line.

In order to apply this default approach, a minimal amount of information is necessary; only stocks in Category 1 can be managed in this way. For stocks with inadequate information to apply this approach, the Council will consider other methods of ensuring that overfishing will be avoided. The Council will consider the approaches discussed in the National Standard Guidelines in developing such recommendations for stocks in Categories 2 and 3.

4.5.2 Stock Rebuilding ***Plan Elements and Processes***~~Requirements~~ (Previously 5.3.6)

As required by the Magnuson-Stevens Act within one year of being notified by the Secretary that a stock is overfished or approaching a condition of being overfished, the Council will prepare a recommendation to end the overfished condition and rebuild the stock(s) or to prevent the overfished condition from occurring.

A new rebuilding plan or revision to an existing rebuilding plan proposed by the Council will be submitted to the Secretary-

OPTION 1a-	***as a policy document to accompany the annual management recommendations developed as part of the regular annual management process (see Chapter 5).***
OPTION 1b-	***as a policy statement accompanying a groundfish FMP amendment specifying the target rebuilding time, best estimate of B_{msy} and other elements specifically required under the MSA; management regulations designed to achieve the harvest control rules developed as part of the regular annual management process (see Chapter 5)***
OPTION 1c OR 1e-	***an FMP amendment and management regulations designed to achieve the harvest control rules developed as part of the regular annual management process (see Chapter 5).***
OPTION 1d OR 1f-	***a regulatory amendment and management regulations designed to achieve the harvest control rules developed as part of the regular annual management process (see Chapter 5).***

~~**along with annual management recommendations as part of the regular annual management process.**~~ THE FOLLOWING SENTENCE IS INSECTION 4.5.2.3. ~~**Once approved by the Secretary, a rebuilding plan will remain in effect for the specified duration of the rebuilding program, or until modified.**~~ The Council will ***also*** make all approved rebuilding plans available in the annual SAFE document or by other means. The Council may recommend the Secretary implement interim measures to reduce overfishing until the Council's program has been developed and implemented.

The Council intends its stock rebuilding plans to provide targets, checkpoints and guidance for rebuilding overfished stocks to healthy and productive levels. ~~**The rebuilding plans themselves will not be**~~

~~regulations but principles and policies.~~ They are intended to provide a clear vision of the intended results and the means to achieve those results. They will provide the strategies and objectives that regulations are intended to achieve, and proposed regulations and results will be measured against the rebuilding plans. It is likely that rebuilding plans will be revised over time to respond to new information, changing conditions and success or lack of success in achieving the rebuilding schedule and other goals. As with all Council activities, public participation is critical to the development, implementation and success of management programs.

In order to facilitate implementation of rebuilding plans in a fair and equitable manner the Council made the following allocational decisions as part of Amendment 12 to the FMP:
THE FOLLOWING TWO PROVISIONS WERE PREVIOUSLY PART OF SECTION 4.6.

(1) For any stock that has been declared overfished, the open access/limited entry allocation shares may be temporarily revised for the duration of the rebuilding period by amendment to the regulations in accordance with the normal allocation process described in this FMP. However, the Council may at any time recommend the shares specified in chapter 12 of this FMP be reinstated without requiring further analysis. Once reinstated, any change may be made only through the allocation process.

(2) For any stock that has been declared overfished, any vessel with a limited entry permit may be prohibited from operating in the open access fishery when the limited entry fishery has been closed.

4.5.2.1 Goals and Objectives of Rebuilding Plans (Previously 5.3.6.1)

The ***overall*** goals of rebuilding programs are to (1) achieve the population size and structure that will support the maximum sustainable yield within the specified time period; (2) minimize, to the extent practicable, the social and economic impacts associated with rebuilding, including adverse impacts on fishing communities; (3) fairly and equitably distribute both the conservation burdens (overfishing restrictions) and recovery benefits among commercial, recreational and charter fishing sectors; (4) protect the quantity and quality of habitat necessary to support the stock at healthy levels in the future; and (5) promote widespread public awareness, understanding and support for the rebuilding program. ***More specifc goals and objectives may be developed in the rebuilding plan for each overfished species.***

To achieve the rebuilding goals, the Council will strive to (1) explain the status of the overfished stock, pointing out where lack of information and uncertainty may require that conservative assumptions be made in order to maintain a risk-averse management approach; (2) identify present and historical harvesters of the stock; (3) ***where adequate harvest sharing plans are not already in place*** develop harvest sharing plans for the rebuilding period and for when rebuilding is completed; (4) set harvest levels that will achieve the specified rebuilding schedule ; (5) implement any necessary measures to allocate the resource in accordance with harvest sharing plans; (6) promote innovative methods to reduce bycatch and bycatch mortality of the overfished stock; (7)

OPTIONS 2a, 2b, 2c, OR 2d: monitor fishing mortality and***, using available stock assessment information,*** the condition of the stock at least every two years to ensure the goals and objectives are being achieved ***(see Section 4.5.2.4 for additional details)***;

OPTION 2e: monitor fishing mortality ***annually*** ~~and the condition of the stock at least every two years~~ ***and compare stock biomass with respect to that expected under the rebuilding harvest control rule each time a new stock assessment is provided*** ~~to ensure the goals and objectives are being achieved;~~

(8) identify any critical or important habitat areas and implement measures to ensure their protection; and (9) promote public education regarding these goals, objectives and the measures intended to achieve them. (THIS PARAGRAPH WAS PREVIOUSLY THE FIRST PARAGRAPH OF 5.3.6.2)

4.5.2.2 Contents of Rebuilding Plans (Previously 5.3.6.2 (corrected from 5.6.3.2))

FIRST PARAGRAPH OF 5.6.3.2 MOVED TO 4.5.2.1 (PREVIOUSLY 5.3.6.1)

The rebuilding plan ***for overfished species*** will specify ~~any individual~~ ***rebuilding*** goals and objectives ***for that species*** including***:*** ~~**a time period for ending the overfished condition and rebuilding the stock and the target biomass to be achieved,**~~ INSERT LIST OF REQUIRED ELEMENTS BASED ON COUNCIL RECOMMENDATIONS FROM ISSUE 1, INCLUDING SPECIFICATION OF WHETHER THE ELEMENT IS TO BE PART OF A POLICY DOCUMENT, FMP, OR REGULATION, AND WHETER THE ELEMENT IS TO BE A FIXED VALUE OR A FORMULA/ALGORITHM/TABLE WHICH WILL WILL BE USED TO UPDATE THE VALUE AS NEW INFORMATION BECOMES AVAILABLE. **OPTION 2c*:*** ***A schedule for stock assessments will be specified in the rebuilding plan and driven by the stock dynamics (more frequent reviews and assessments will be conducted for more productive stocks). That schedule will specify an increase in the frequency of stock assessments and rebuilding plan reviews as Tmax draws closer.*** **OPTION 3d:** ***Each rebuilding plan will be required to include a specific standard for determining when progress has been adequate.*** BASED ON THE COUNCIL'S FINAL RECOMMENDATIONS ON ISSUE 1, ADJUST THE FOLLOWING TWO SENTENCES TO INDICATE WHICH, IF ANY, OF THE FOLLOWING WILL BE REQUIRED TO BE PART OF AN FMP AMENDMENT OR REGULATION. The ***rebuilding*** plan will explain how the rebuilding period was determined, including any calculations that demonstrate the scientific validity of the rebuilding period. The plan will identify potential or likely allocations among sectors, identify the types of management measures that will likely be imposed to ensure rebuilding in the specified period, and provide other information that may be useful to achieve the goals and objectives. THE FOLLOWING SENTENCE WAS MOVED FROM SECTION 4.6. ***For fisheries managed under an international agreement, Council rebuilding plans must reflect traditional participation in the fishery, relative to other nations, by fishermen of the United States.***

The Council may consider a number of factors in determining the time period for rebuilding, including:

1. The status and biology of the stock or stock complex.
2. Interactions between the stock or stock complex and other components of the marine ecosystem or environmental conditions.
3. The needs of fishing communities.
4. Recommendations by international organizations in which the United States participates.
5. Management measures under an international agreement in which the United States participates.

The lower limit of the specified time period for rebuilding will be determined by the status and biology of the stock or stock complex and its interactions with other components of the marine ecosystem or environmental conditions and is defined as the amount of time that would be required for rebuilding if fishing mortality were eliminated entirely.

If the lower limit is less than ten years, then the specified time period for rebuilding may be adjusted upward to the extent warranted by the needs of fishing communities and recommendations by international organizations in which the United States participates, except that no such upward adjustment may result in the specified time period exceeding ten years, unless management measures under an international agreement in which the United States participates dictate otherwise.

If the lower limit is ten years or greater, then the specified time period for rebuilding may be adjusted upward to the extent warranted by the needs of fishing communities and recommendations by international organizations in which the United States participates, except that no such upward adjustment can exceed the rebuilding period calculated in the absence of fishing mortality, plus one mean generation time or equivalent period based on the species' life-history characteristics. For example, if a stock could be rebuilt within 12 years in the absence of any fishing mortality, and has a mean generation time of eight years, the rebuilding period could be as long as 20 years.

THE FOLLOWING SENTENCE WAS MOVED FROM SECTION 4.6. ***Any new rebuilding program will commence as soon as the first measures to rebuild the stock or stock complex are implemented.***

Rebuilding target control rules for individual species may include: constant catch strategy - where catch is held constant over time unit the stock reaches B_{MSY}; a constant fishing mortality rate- where a constant proportion of the stock is removed annually until the stock reaches B_{MSY}, or a combination of these starategies.

The rebuilding plan will also consider the following possible measures to promote rebuiding: BASED ON COUNCIL FINAL RECOMMENDATIONS FROM ISSUE 1 INSERT LIST OF THE REBUILDING ACTIONS THAT REBUILDING PLANS ARE REQUIRED TO CONSIDER, IF ANY (AS OPPOSED TO REQUIRED TO INCLUDE).

~~In general, t~~*T*he Council will ~~*also*~~ consider the following questions in developing rebuilding plans.

1. What is the apparent cause of the current condition (historical fishing patterns, a declining abundance or recruitment trend, a change in assessment methodology, or other factors)?
2. Is there a downward trend in recruitment that may indicate insufficient compensation in the spawner-recruitment relationship?
3. Based on an comparison of historical harvest levels (including discards) relative to recommended ABC levels, has there been chronic over harvest?
4. Is human-induced environmental degradation implicated in the current stock condition? Have natural environmental changes been observed that may be affecting growth, reproduction, and/or survival?
5. Would reduction in fishing mortality be likely to improve the condition of the stock?
6. Is the particular species caught incidentally with other species? Is it a major or minor component in a mixed-stock complex?
7. What types of management measures are anticipated and/or appropriate to achieve the biological, social, economic and community goals and objectives of the rebuilding plan?

THE FOLLOWING SECTIONS ON CATEGORY 2 AND 3 WERE MOVED TO SECTION 4.4.2.

~~For Category 2 species, the following may be evaluated as potential indicators of overfishing:~~

~~catch per effort from logbooks~~
~~catch area from logbooks~~
~~index of stock abundance from surveys~~
~~stock distribution from surveys~~
~~mean size of landed fish~~

~~If declining trends persist for more than three years, then a focused evaluation of the status of the stock, its ABC, and overfishing threshold will be quantified. If data are available, such an evaluation should be conducted at approximately five year intervals even when negative trends are not apparent. In fact, many stocks are in need of re-evaluation to establish a baseline for monitoring of future trends. Whenever an evaluation indicates the stock may be declining and approaching an overfished state, the Council should:~~

~~1. Improve data collection for this species so it can be moved to Category 1.~~

~~2. Determine the rebuilding rate that would allow the stock to return to MSY in no longer than ten years.~~

~~For Category 3 species, information from fishery independent surveys are often lacking for these species because of their low abundance or they are not vulnerable to survey sampling gear. Without an at-sea observer program, it is unlikely that a data base will be developed in the future for these species to evaluate the risk of overfishing.~~

4.5.2.3. Process for Development and Approval of Rebuilding Plans (Previously 5.3.6.3, corrected from 5.6.3.3)

The Rebuilding Plan

Upon receiving notification that a stock is overfished, the Council will identify one or more individuals to draft the rebuilding plan. ~~If possible, the Council will schedule review and adoption of the proposed rebuilding plan to coincide with the annual management process.~~ **OPTION 1b:** ***The rebuilding plan will be developed as a single policy document that will contain within it or be accompanied by an FMP amendment to (1) implement any rebuilding actions required under Section 304(e) of the MSA that are not already authorized under the existing FMP, (2) specify in the FMP the rebuilding period required under Section 304(e)(4)(A) of the MSA, and (3) specify the following additional measures as part of the FMP*** (INSERT LIST OF ELEMENTS REQUIRED TO BE PART OF A REBUILDING FMP AMENDMENT AS SPECIFIED BY THE COUNCIL IN ITS FINAL DECISION ON ISSUE 1, SEE SECTION 2 OF THE MAIN TEXT OF THIS DOCUMENT). ***For portions of the rebuilding plan to be implented in the form of an FMP, the proposed actions will meet the standard procedural and analytical requirements for consideringa nd implementing and FMP amendment under the MSA and other applicable law.*** **OPTIONS 1a AND 1b:** A draft of the rebuilding plan will be reviewed and preliminary action taken (tentative adoption or identification of preferred alternatives), followed by final adoption at a subsequent meeting. The tentative plan or alternatives will be made available to the public and considered by the Council at a minimum of two meetings unless stock conditions suggest more immediate action is warranted. Upon completing it***s*** final recommendations, the Council will submit the proposed rebuilding plan or revision to an existing plan to NMFS for concurrence. ~~In most cases, this will be concurrent with its recommendations for annual management measures.~~ **OPTION 1c AND 1e (REPLACE PREVIOUS THREE SENTENCES WITH THE FOLLOWING):** ***A rebuilding plan will be developed following the standard procedures for considering and implementing an FMP amendment under the MSA and other applicable law.*** **OPTION 1d AND 1f (REPLACE PREVIOUS THREE SENTENCES WITH THE FOLLOWING):** ***A rebuilding plan will be developed following the standard procedures for implementing a regulatory amendment under the MSA and other applicable law.***

FOLLOWING PARAGRAPH WAS MOVED FROM THE END OF THE SECTION TO THIS POSITION. **OPTIONS 1a AND 1b:** NMFS will review the Council's recommendations and supporting information upon receipt and may approve, disapprove, or partially approve each rebuilding plan. The Council will be notified in writing of the NMFS decision. If NMFS does not concur with the Council's recommendation, reasons for the disapproval will be included in the notification. **FOR OPTIONS 1c, 1d, 1e, AND 1f, DELETE THE PREVIOUS THREE SENTENCES.** Once approved, a rebuilding plan will remain in effect for the length of the specified rebuilding period or until revised ***(i.e. stock reaches target biomass).***

Implementation of Actions Required Under the Rebuilding Plan

MOVED FROM MIDDLE OF FIRST PARAGRAPH OF THIS SECTION
Once a rebuilding plan is established, certain measures required in the rebuilding plan may need to be implemented through authorities and processes already established in the FMP. Management actions to achieve OY harvest and objectives related to rebuilding, requirements of the MSA and goals and objectives of the FMP (each of which may require a slightly different process) include: automatic actions, notices, abbreviated rulemaking actions, and full rulemaking actions (these actions are detailed ~~at~~ in Section 4.6, Chapter 5 and Section 6.2). Allocation proposals require consideration at a minimum of three Council meetings, as specified in the allocation framework. ~~In addition, a~~Any proposed regulations, to implement the ***rebuilding*** plan will be developed in accordance with the framework procedures of this FMP. (ORDER OF LAST TWO SENTENCES SWITCHED)

Any rebuilding management measures that are not already authorized under the framework of the existing FMP will be implemented through a plan amendment process. The plan amendment may

establish the needed measures or expand the framework to allow the implementation of the needed measures under framework procedures.

The Council may designate a state or states to take the lead in working with its citizens to develop management proposals to achieve the rebuilding. (MOVED FROM FIRST PARAGRAPH OF THIS SECTION ON "IMPLEMENTATION OF ACTIONS . . . ")

4.5.2.4 Process for Review and Update of Rebuilding Plans **OPTIONS 2c AND 2d:** ***and Schedule for Stock Assessments for Overfished Stocks*** (New section title inserted)

(FOLLOWING WAS PREVIOUSLY PART OF 5.3.6.3)

OPTION 2a (STATUS QUO): Rebuilding plans will be reviewed periodically, at least every 2 years and the Council may propose revisions to existing plans at any time ~~although in general this will occur only during the annual management process.~~ ***in accordance with the amendment process appropriate for the form of the plan*** **(DETERMINED UNDER ISSUE 1)*****. Rebuilding plans will be reviewed with respect goals 1-5 defined in Section 4.5.2.1 of the FMP.*** Any revisions to a rebuilding plan must ~~also~~ be approved by NMFS.

OPTION 2b, 2c, AND 2d: Rebuilding plans will be reviewed periodically, at least every 2 years and the Council may propose revisions to existing plans at any time ~~although in general this will occur only during the annual management process.~~ ***in accordance with the amendment process appropriate for the form of the rebuilding plan*** **(AS DETERMINED BY THE COUNCIL'S FINAL RECOMMENDATION WITH RESPECT TO ISSUE 1)*****. Rebuilding plans will be reviewed with respect to goal 1 Section 4.5.2.1 of the rebuilding plan only when new stock assessment information is available. All other reviews will assess progress only with respect goals 2-5 defined in Section 4.5.2.1 of the FMP. Any revisions to a rebuilding plan must also be approved by NMFS.*** **SUBOPTION** ***(i): The rebuilding plan will be amended when information in the stock assessment or rebuilding analyses are updated or progress toward rebuilding has not been adequate.*** **SUBOPTION** ***(ii) The rebuilding plan will be amended when new information indicates there has been a significant change in the rebuilding parameters specified in the plan or progress toward rebuilding has not been adequate The Council will consult with the SSC or GMT in determining whether a a change is significant.*****SUBOPTION** ***(iii) The rebuilding plan will be amended when progress toward rebuilding has not been adequate.***

OPTION 2c (ADD THE FOLLOWING TEXT TO THE PREVIOUS PARAGRAPH)***: A schedule for stock assessments will be specified in the rebuilding plan and driven by the stock dynamics (more frequent reviews and assessments will be conducted for more productive stocks). That schedule will specify an increase in the frequency of stock assessments and rebuilding plan reviews as T_{target} draws closer.***

OPTION 2d (ADD THE FOLLOWING TEXT TO THE PREVIOUS PARAGRAPH): ***Stock assessments will be conducted once every 2 years when T_{max} is less than 20 years away and at least every 4 years when Tmax is 20 or more years away.***

OPTION 2e: ~~Rebuilding plans will be reviewed periodically, at least every 2 years, and t~~*T*he Council may propose revisions to existing plans at any time~~, although in general this will be occur only during the annual management process~~. Any revisions to a rebuilding plan must ~~also~~ be approved by NMFS. ***The Council will track harvest mortality in comparison to the harvest mortality goals under the rebuilding plan each year and will assess progress in rebuilding the stock biomass to the MSY level whenever new stock assessments are produced. Information in the Council SAFE document is expect to assist the Secretary in conducting the two year Secretarial reviews of progress under rebuilding plans. A draft of any Secretarial review will be provided to allow an opportunity for Council comment prior to the time the Secretarial review is finalized.*** **SUBOPTION** ***(i): The rebuilding plan will be amended when information in the stock assessment or rebuilding analyses are updated or progress toward rebuilding***

has not been adequate. SUBOPTION *(ii) The rebuilding plan will be amended when new information indicates there has been a significant change in the rebuilding parameters specified in the plan or progress toward rebuilding has not been adequate The Council will consult with the SSC or GMT in determining whether a a change is significant.*SUBOPTION *(iii) The rebuilding plan will be amended when progress toward rebuilding has not been adequate.*

OPTIONS 2b, 2c, 2d, AND 2e: *The Council's annual SAFE document will provide (1) the most recent information available on the best estimate of total fishing mortality as compared to target fishing mortality levels pursuant to the rebuilding plan; (2) the most recent assessment of stock size compared to the expected stock size for the rebuilding trajectory; (3) information on allocation and the social and economic status of the fishery.*

OPTION 3b: *If an updated stock projection indicates that the stock is below the rebuilding level projected under the original rebuilding plan then progress will be considered inadequate and an adjustment to the rebuilding plan must be made.*

OPTION 3c: *Progress of rebuilding plans with respect to goal 1 of Section 4.5.2.1 will be deemed in adequate if an updated stock projection indicates that the stock does not have at least a 50% probability of rebuilding in the maximum time (T_{max}, then progress will be considered inadequate. In such a case, harvest strategy must be adjusted to increase the probability of rebuilding within the maximum time to at least 50%. Other needed adjustments to the rebuilding plan will also be considered.*

OPTION 4b: ADD THE FOLLOWING AS A NEW SECTION

Section 4.5.2.5 Incorporation of ESA Jeopardy Standards or Recovery Plans (New Section)

A jeopardy standard or recovery plan for an overfished stock listed under the ESA will supercede the rebuilding plan for the overfished species until such time as the stock is no longer listed. If a stock is delisted, the rebuilding plan will come back into effect until such time as the stock is fully rebuilt. After delisting, an amendment to the rebuilding plan may be necessary to take into account the revised status and information on the overfished stock.

4.6 Determination of OY (Previously 5.3.2)

THE FOLLOWING FIVE PARAGRAPHS PREVIOUSLY COMPRISED THE ENTIRETY OF CHAPTER 4
Optimum yield (OY) is defined in the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) as the amount of fish which will provide the greatest overall benefit to the Nation. The Magnuson-Stevens Act also specifies that OY is based on maximum sustainable yield (MSY), and may be equal to or less than MSY. The fishery management plan (FMP) authorizes establishment of a numerical or non-numerical OY for any groundfish species or species group and lays out the procedures the Council will follow in determining appropriate numerical OY values. An OY may be specified for the fishery management area as a whole or for specific subareas. Numerical OYs will be specified annually, based on acceptable biological catches (ABCs) for major species or species groups, which are in turn based on quantitative or qualitative stock assessments. "Control rules" for determining the numerical values of OYs ensure they will not exceed the ABCs except under tightly limited conditions.

Most of the 83 species managed by the FMP have never been assessed in either a quantitative or qualitative manner. In some cases even basic catch statistics are unavailable, because many species (rockfish, for example) are not sorted unless specifically required by regulation. Species of this type have generally not been subject to numerical harvest limits, but rather harvest is limited by gear restrictions and market demand. Other management measures which determine the total amount of harvest each year include trip landing and frequency limits. Those species without a specified OY and not included in a multi-species OY will be included in a non-numerical OY, which is defined as all the fish that can be taken under the regulations, specifications, and management measures authorized by the FMP and promulgated by the U.S. Secretary of Commerce. This non-numerical OY is not a predetermined numerical value, but rather the harvest that results from regulations, specifications, and management measures as they are changed in response to changes in the resource and the fishery. In many cases, the absence of a numerical specification reflects the absence of basic management information, such as abundance estimates and catch statistics. The non-numerical OY concept allows for a variable amount of groundfish to be harvested annually, limited by such constraints as gear restrictions, management measures for other species, and/or absence of consumer acceptance or demand.

The close spatial relationship of many groundfish species throughout the management area results in commercial and recreational catches often consisting of mixtures of several species. This is especially the case in the trawl fishery where fishermen may target on one species, but unavoidable harvest several other species. In such cases, the optimum harvest strategy often is to target on a group (complex or assemblage) of groundfish species. ~~The grouping of groundfish species into multispecies numerical and non-numerical OYs provides the flexibility to manage to obtain the optimum public benefit from the groundfish fishery as a whole rather than the maximum yield from each species. In other cases, single species management may be necessary to provide adequate resource protection, bycatch controls, or equitable allocation. In such cases, the Council may determine it more appropriate to use individual species management by means of quotas, harvest guidelines, allocations by gear type, and other management measures.~~

~~Managing multiple species complexes for OY from the complex as a whole necessarily may result in some degree of overfishing or failure to allow recovery to the MSY level for some individual stocks.~~ The Council will ~~strive, to the extent practicable, to~~ avoid overfishing individual stocks ***and control harvest mortality to allow overfished stocks to rebuild*** ~~or preventing a stock from recovering~~ to the MSY level. In the event the Council determines that greater long-term benefits will be gained from the groundfish fishery by overfishing individual stocks or by preventing a stock from recovering to its MSY level, it will justify the action in writing in accordance with the procedures ***and standards identified in this section and Section 600.310 of the National Standard Guidelines.*** ~~in Section 5.3.6 (Stock Rebuilding) or in Section 5.5 (Annual Implementation Procedures for Specifications and Apportionments).~~ Conversely, the Council may determine that greater benefits will accrue from protecting an individual stock by constraining the multiple species complex or specific components of that complex.

Prior to implementation of the FMP in 1982, the states of Washington, Oregon, and California managed the groundfish fishery without the use of quotas. State regulations since the mid-1940s took the form of area closures (such as San Francisco Bay), legal gear definitions, minimum codend mesh regulations, size limits, bag limits, and other nonquota management measures. Implementation of the FMP built upon those historical management practices by increasing the level of catch monitoring, improving the assessment of stock conditions, and establishing other mechanisms for responding to management needs. It provides for continuation of the historical fishery on traditionally harvested groundfish species while allowing for the development of new fisheries for underutilized species. The FMP, as amended, provides for the establishment of resource conservation measures such as harvest guidelines or quotas through the annual specification procedure and annual and inseason management measures through the "points of concern" and socioeconomic framework mechanisms.

THE REMAINDER OF THIS SECTION PREVIOUSLY COMPRISED THE ENTIRETY OF SECTION 5.3.2 EXCEPT AS NOTED.

Reduction in catches or fishing rates for either precautionary or rebuilding purposes is an important component of converting values of ABC to values of OY. This relationship is specified by the harvest control rule. All OYs will remain in effect until revised, and, whether revised or not, will be announced at the beginning of the year along with other specifications (see Chapter 5).

Groundfish stock assessments generally provide the following information to aid in determination of ABC and

OY.

1. Current biomass (~~or~~ ***and*** reproductive potential) estimate.

2. F_{msy} or proxy, translated into exploitation rate.

3. Estimate of MSY biomass (B_{msy}), ***or proxy,*** unfished biomass (based on average recruitment), precautionary threshold, and/or overfished/rebuilding threshold.

4. Precision estimate (e.g., confidence interval) for current biomass estimate.

Determination of Numerical OYs If Stock Assessment Information Is Available (Category 1)

The Council will follow these steps in determining numerical OYs. The recommended numerical OY values will include any ~~necessary~~ ***adjustments to harvest mortality needed*** ~~actions~~ to rebuild any stock determined to be below its overfished/rebuilding threshold and may include adjustments to address uncertainty in the status of the stock.

1. ABC: Multiply the current **fishable** biomass estimate times the F_{msy} exploitation rate or its proxy to get ABC.

2. Precautionary adjustment: If the abundance is above the specified precautionary threshold, OY may be equal to or less than ABC. If current biomass estimate is less than the precautionary threshold (Section 4.4.1), the harvest rate will be reduced according to the harvest control rule specified in Section 4.5.1 in order to accelerate a return of abundance to optimal levels. If the abundance falls below the overfished/rebuilding threshold (Section 4.4.2), the harvest control rule will generally specify a greater reduction in exploitation as an interim management response toward rebuilding the stock while a formal rebuilding plan is being developed. The rebuilding plan will include a specific harvest control rule designed to rebuild the stock, and that control rule will be used in this stage of the determination of OY.

3. Uncertainty adjustments: In cases where there is a high degree of uncertainty about the biomass estimate and other parameters, OY may be further reduced accordingly.

4. Other adjustments to OY: ***Adjustments to OY for*** ~~O~~***o***ther social, economic, or ecological considerations ***may be made. There will be*** ~~, including~~ reduction***s*** for anticipated bycatch ***mortality (i.e. mortality of discarded fish)***~~, may be made~~. Amounts of fish harvested as compensation for private vessels participating in NMFS resource survey activities will also be deducted from ABC prior to setting OY.

5. OY recommendations will be consistent with established rebuilding plans and achievement of their goals and objectives unless otherwise adjusted in accordance with section 6 below.
   (a) In cases where overfishing is occurring, Council action will be sufficient to end overfishing.
   (b) In cases where a stock or stock complex is overfished, Council action will specify ***OY in a manner that complies with rebuilding plans developed in accordance with Section 4.5.2.*** THE FOLLOWING IS ELIMINATED BECAUSE IT DUPLICATES PROVISIONS OF SECTION 4.5.2. ~~a time period for rebuilding the stock or stock complex that satisfies the requirements of section 304(e)(4)(A) of the Magnuson-Stevens Act.~~
   ~~(i) The Council will consider a number of factors in determining the time period for rebuilding:~~
   ~~(1) The status and biology of the stock or stock complex.~~
   ~~(2) Interactions between the stock or stock complex and other components of the marine ecosystem (also referred to as "other environmental conditions").~~
   ~~(3) The needs of fishing communities.~~
   ~~(4) Recommendations by international organizations in which the United States participates.~~
   ~~(5) Management measures under an international agreement in which the United States~~

~~participates.~~

~~(ii) These factors enter into the specification of the time period for rebuilding as follows:~~

~~(1) The lower limit of the specified time period for rebuilding is determined by the status and biology of the stock or stock complex and its interactions with other components of the marine ecosystem and is defined as the amount of time that would be required for rebuilding if fishing mortality were eliminated entirely.~~

~~(2) If the lower limit is less than ten years, then the specified time period for rebuilding may be adjusted upward to the extent warranted by the needs of fishing communities and recommendations by international organizations in which the United States participates, except that no such upward adjustment can result in the specified time period exceeding ten years, unless management measures under an international agreement in which the United States participates dictate otherwise.~~

~~(3) If the lower limit is ten years or greater, then the specified time period for rebuilding may be adjusted upward to the extent warranted by the needs of fishing communities and recommendations by international organizations in which the United States participates, except that no such upward adjustment can exceed the rebuilding period calculated in the absence of fishing mortality, plus one mean generation time or equivalent period based on the species' life-history characteristics. For example, suppose a stock could be rebuilt within twelve years in the absence of any fishing mortality, and has a mean generation time of eight years. The rebuilding period, in this case, could be as long as 20 years.~~

PARAGRAPH (iii) WAS MOVED TO SECTION 4.5.2.2.

~~(iii) Any new rebuilding program will commence as soon as the first measures to rebuild the stock or stock complex are implemented.~~

PARAGRAPH (iv) IS ELIMINATED BECAUSE THERE ARE NO PRE-EXISTING REBUILDING PLANS.

~~(iv) Any pre-existing rebuilding plans will be reviewed to determine whether they are in compliance with all requirements of the Magnuson-Stevens Act. (Note: Only Pacific ocean perch falls into this category.)~~

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

(d) For any stock that has been declared overfished, the open access/limited entry allocation shares may be temporarily revised for the duration of the rebuilding period by amendment to the regulations in accordance with the normal allocation process described in this FMP. However, the Council may at any time recommend the shares specified in chapter 12 of this FMP be reinstated without requiring further analysis. Once reinstated, any change may be made only through the allocation process.

(e) For any stock that has been declared overfished, any vessel with a limited entry permit may be prohibited from operating in the open access fishery when the limited entry fishery has been closed.

6. Adjustments to OY could include increasing OY above the default value up to the overfishing level as long as the management still allows achievement of established rebuilding goals and objectives. In limited circumstances, these adjustments could include increasing OY above the overfishing level as long as the harvest meets the standards of the mixed stock exception in the National Standard Guidelines:
   (a) The Council demonstrates by analysis that such action will result in long-term net benefits to the Nation.
   (b) The Council demonstrates by analysis that mitigating measures have been considered and that a similar level of long-term net benefits cannot be achieved by modifying fleet behavior, gear selection/configuration, or other technical characteristic in a manner such that no overfishing would occur.
   (c) The resulting rate or level of fishing mortality will not cause any species or evolutionarily significant unit thereof to require protection under the Endangered Species Act.

7. For species complexes (such as Sebastes complex), the OY will generally be set equal to the sum of the individual component ABCs, HGs, and/or OYs, as appropriate.

Determination of a Numerical OY If ABC Is Based on Nonquantitative Assessment (Category 2)

1. ABC may be based on average of past landings, previous nonquantitative assessment, or other qualitative information.

2. Precautionary adjustments, if any, would be based on relevant information. In general, the Council will follow a risk-averse approach and may recommend an OY below ABC if there is a perception the stock is below its MSY biomass level. If a declining trend persists for more than three years, then a focused evaluation of the status of the stock, its ABC, and the overfishing parameters will be quantified. If data are available, such an evaluation should be conducted at approximately five-year intervals even when negative trends are not apparent. In fact, many stocks are in need of re-evaluation to establish a baseline for monitoring of future trends. Whenever an evaluation indicates the stock may be declining and approaching an overfished state, then the Council should:
   a. Recommend improved data collection for this species.
   b. Determine the rebuilding rate that would increase the multispecies value of the fishery.

3. Uncertainty adjustment: In cases where there is a high degree of uncertainty about the condition of the stock or stocks, OY may be reduced accordingly.

4. Amounts of fish harvested as compensation for industry research activities will also be deducted.

5. These adjustments could include increasing OY above the default value as indicated for Category 1 stocks, items 5 and 6 above.

Non-numerical OY for Stocks with No ABC Values (Category 3)

Fish of these species are incidentally landed and usually are not listed separately in fish landing receipts. Information from fishery-independent surveys are often lacking for these stocks, because of their low abundance or they are not vulnerable to survey sampling gear. ***Until sufficient quantities of*** ~~**Without an**~~ at-sea observer program ***data are available or surveys of other fish habitats are conducted*** and/or requirements that landings of all species be recorded separately, it is unlikely that ***there*** ~~**a data base**~~ will be ~~**developed in the future for these stocks to**~~ ***sufficient data to*** upgrade the assessment ~~**capability**~~ ***capabilities*** or ***to*** evaluate their overfishing potential.

These species typically may be included in a non-numerical OY that is defined as all the fish that can be taken under the regulations, specifications, and management measures authorized by the FMP and promulgated by the Secretary. Such an OY may not be a predetermined numerical value, but rather that harvest that results from regulations, specifications, and management measures as they are changed in response to changes in the resource and the fishery. Nothing in this FMP prevents inclusion of these species in a numerical OY if the Council believes that is more appropriate.

5.0 ***ANNUAL*** SPECIFICATION AND APPORTIONMENT OF HARVEST LEVELS

The ability to establish and adjust harvest levels is the first major tool at the Council's disposal to exercise its resource stewardship responsibilities. Each fishing year, the Council will assess the biological, social, and economic condition of the Pacific coast groundfish fishery and update maximum sustainable yield (MSY) estimates or proxies for specific stocks (management units) where new information on the population dynamics is available. The Council will make this information available to the public in the form of the *Stock Assessment and Fishery Evaluation (SAFE)* document described in Section 5.1. Based upon the best scientific information available, the Council will evaluate the current level of fishing relative to the MSY level for stocks where sufficient data are available. Estimates of the acceptable biological catch (ABC) for major stocks will be developed, and the Council will identify those species or species groups which it proposes to be managed by the establishment of numerical harvest levels (optimum yields [OYs], harvest guidelines [HGs], or quotas). For those stocks judged to be below their overfished/rebuilding threshold, the Council will develop a stock rebuilding management strategy.

The process for specification of numerical harvest levels includes the estimation of ABC, the establishment of OYs for various stocks, calculation of specified allocations between harvest sectors, and the apportionment of numerical specifications to domestic annual processing (DAP), joint venture processing (JVP), total allowable level of foreign fishing (TALFF), and the reserve. The specification of numerical harvest levels described in this chapter is the process of designating and adjusting overall numerical limits for a stock either throughout the entire fishery management area or throughout specified subareas. The process normally occurs annually between September and November, but can occur, under specified circumstances at other times of the fishing year. The Council will identify those OYs which should be designated for allocation between limited entry and open access sectors of the commercial industry. Other numerical limits which allocate the resource or which apply to one segment of the fishery and not another are imposed through the socioeconomic framework process described in Chapter 6 rather than the specification process.

The National Marine Fisheries Service (NMFS) Regional Administrator will review the Council's recommendations, supporting rationale, public comments, and other relevant information; and, if it is approved, will undertake the appropriate method of implementation. Rejection of a recommendation will be explained in writing.

The procedures specified in this chapter do not affect the authority of the U.S. Secretary of Commerce (Secretary) to take emergency regulatory action as provided for in Section 305(c) of the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) if an emergency exists involving any groundfish resource or to take such other regulatory action as may be necessary to discharge the Secretary's responsibilities under Section 305(d) of the Magnuson-Stevens Act.

This chapter describes the steps in this process.

5.1 General Overview of Annual Specifications Process (New Section, text moved from introduction to Chapter 5)

The annual specification process, in general terms, occurs as follows:

1. The Council will determine the MSY or MSY proxy and ABC for each major stock. Typically, the MSY proxy will be in terms of a fishing mortality rate ($F_{x\%}$,) and ABC will be the $F_{x\%}$ applied to the current biomass estimate. ***The MSY is the maximum long-term average yield expected from annual application of the MSY (or proxy) harvest policy under prevailing ecological and environmental conditions.***

2. Every species will either have its own designated OY or be included in a multispecies OY. Species which are included in a multispecies OY may also have individual OYs, have individual HGs, or be included in

a HG for a subgroup of the multispecies OY. Stocks without quantitative or qualitative assessment information may be included in a numerical or non-numerical OY.

3. To determine the OY for each stock, the Council will determine the best estimate of current abundance and its relation to its precautionary and overfished thresholds. If the abundance is above the precautionary threshold, OY will be equal to or less than ABC. If abundance falls below the precautionary threshold, OY will be reduced according to the harvest control rule for that stock. If abundance falls below the overfished/rebuilding threshold, OY will be set according to the interim rebuilding rule until the Council develops a formal rebuilding plan for that species.

4. ***For any stock or stock complex where the Secretary identifies that overfishing is occuring the Council will take remedial action to end overfishing. For any stock or stock complex the Secretary has identified as approaching the overfished condition the Council will take remedial action to prevent the stock or stock complex from falling below the minimum stock size threshold or from fishing*** For any stock the Secretary has declared overfished ~~or approaching the overfished condition, or for any stock the Council determines is in need of rebuilding,~~ ***the Council will implement such annual management measures as are necessary to rebuild the stock through of control harvest mortality, habitat impacts or other effects of fishing activities that are subject to regulation under this annual process.*** ~~the Council will develop a rebuilding plan and submit it in the same manner as recommendations of the annual management process. Once approved, a rebuilding plan will remain in effect for the specified duration or until the Council recommends and the Secretary approves revision.~~

5. The Council may reserve and deduct a portion of the ABC of any stock to provide for compensation for vessels conducting scientific research authorized by NMFS. Prior to the research activities, the Council will authorize amounts to be made available to a research reserve. However, the deduction from the ABC will be made in the year after the "compensation fishing"; the amounts deducted from the ABC will reflect the actual catch during compensation fishing activities.

6. The Council will identify stocks which are likely to be fully harvested (i.e., the ABC, OY, or HG achieved) in the absence of specific management measures and for which allocation between limited entry and open access sectors of the fishery is appropriate.

7. The groundfish resource is fully utilized by U.S. fishing vessels and seafood processors. The Council may entertain applications for foreign or joint venture fishing or processing at any time, but fishing opportunities may be established only through amendment to this FMP. This section supercedes other provisions of this FMP relating to foreign and joint venture fishing.

5.2 SAFE Document (Previously 5.1)

For the purpose of providing the best available scientific information to the Council for evaluating the status of the fisheries relative to the MSY and overfishing definition, developing ABCs, determining the need for individual species or species group management, setting and adjusting numerical harvest levels, assessing social and economic conditions in the fishery, and updating the appendices of this fishery management plan (FMP); a SAFE document is prepared annually. Not all species and species groups can be reevaluated every year due to limited state and federal resources. However, the SAFE document will in general contain the following information:

1. A report on the current status of Washington, Oregon, and California groundfish resources by major species or species group.

2. Specify and update estimates of harvest control rule parameters for those species or species groups for which information is available. ***(The Council anticipates scientific information about the population dynamics of the various stocks will improve over time and that this information will result in***

improved estimates of appropriate harvest rates and MSY proxies. Thus, initial default proxy values will be replaced from time to time. Such changes will not require amendment to the FMP, but the scientific basis for new values must be documented.) COPIED FROM 4.5.

3. Estimates of MSY and ABC for major species or species groups.

4. Catch statistics (landings and value) for commercial, recreational, and charter sectors.

5. Recommendations of species or species groups for individual management by OYs.

6. A brief history of the harvesting sector of the fishery, including recreational sectors.

7. A brief history of regional groundfish management.

8. A summary of the most recent economic information available, including number of vessels and economic characteristics by gear type.

9. Other relevant biological, social, economic, ecological, and essential fish habitat information which may be useful to the Council.

10. ***A description of the maximum fishing mortality threshold (MFMT) and the minimum stock size threshold (MSST) for each stock or stock complex, along with other information the Council may use to determine whether overfishing is occurring or a stock or stock complex is overfished. (The default overfished/rebuilding threshold for category 1 groundfish is .25B$_{unfished}$. The Council may establish different thresholds for any species based on information provided in stock assessments, the SAFE document, or other scientific or groundfish management-related report.)*** PREVIOUS TWO SENTENCES COPIED FROM 4.4.2

11. A description of any rebuilding plans currently in effect, a summary of the information relevant to the rebuilding plans, and any management measures proposed or currently in effect to achieve the rebuilding plan goals and objectives.

12. A list of annual specifications and management measures that have been designated as routine under processes described in the FMP at Section 6.2.

The ~~**preliminary**~~ ***stock assessment section of the*** SAFE document is normally completed ~~late in the year, **generally late October**,~~ when the most current stock assessment and fisheries performance information is available and prior to the meeting at which the Council approves its final management recommendations for the upcoming year. The Council will make the ~~**preliminary**~~ ***stock assessment*** ~~***and fishery evaluation section***~~ of the SAFE document available to the public by such means as mailing lists or newsletters and will provide copies upon request. ~~**A final**~~ ***The fishery evaluation section of the*** SAFE may be prepared after the Council has made its final recommendations for the upcoming year and will include the final recommendations, ***an estimate of the previous year's catch, and*** ~~**including**~~ ***summaries of*** ~~**proposed and pre-existing**~~ ***rebuilding plans***~~. **The final SAFE document, if prepared, will also**~~ ***and*** be made available upon request.

5.3 Authorization and Accounting for Fish Taken as Compensation for Authorized Scientific Research Activities. (Previously 5.4)

At a Council meeting, NMFS will advise the Council of upcoming resource surveys that would be conducted using private vessels with groundfish as whole or partial compensation. For each proposal, NMFS will identify the maximum number of vessels expected or needed to conduct the survey, an estimate of the species and amounts of compensation fish likely to be needed to compensate vessels for conducting the survey, when the fish would be taken, and when the fish would be deducted from the ABC in determining the OY/harvest guideline. NMFS will initiate a competitive solicitation to select vessels to conduct resource surveys. NMFS will consult with the Council regarding the amounts and types of groundfish species to be used to support the surveys. If the Council approves NMFS' proposal, NMFS may proceed with awarding the contracts, taking into account any modifications requested by the Council. If the Council does not approve the proposal to use fish as compensation to pay for resource surveys, NMFS will not use fish as compensation.

Because the species and amounts of fish used as compensation will not be determined until the contract is awarded, it may not be possible to deduct the amount of compensation fish from the ABC or harvest guideline in the year that the fish are caught. Therefore, the compensation fish will be deducted from the ABC the year after the fish are harvested. During the annual specification process, NMFS will announce the total amount of fish caught during the year as compensation for conducting a resource survey, which then will be deducted from the following year's ABCs in setting the OYs.

5.4 Annual Implementation Procedures for Specifications and Apportionments (Previously 5.6)

Annually, the Council will develop recommendations for the specification of ABCs, OYs, any HGs or quotas, ~~and apportionments to DAH, DAP, JVP, and TALFF and the reserve over the span of two Council meetings.~~ In addition during this process, the Council may recommend establishment of HGs and quotas for species or species groups within an OY.

The Council will develop preliminary recommendations at the first of two meetings (usually in August or September) based upon the best stock assessment information available to the Council at the time and consideration of public comment. After the first meeting, the Council will provide a summary of its preliminary recommendations and their basis to the public through its mailing list as well as providing copies of the information at the Council office and to the public upon request. The Council will notify the public of its intent to develop final recommendations at its second meeting (usually October or November) and solicit public comment both before and at its second meeting.

At its second meeting, the Council will again consider the best available stock assessment information which should be contained in the recently completed SAFE report and consider public testimony before adopting final recommendations to the Secretary. Following the second meeting, the Council will submit its recommendations along with the rationale and supporting information to the Secretary for review and implementation.

Upon receipt of the Council's recommendations supporting rationale and information, the Secretary will review the submission, and, if approved, publish a notice in the *Federal Register* making the Council's recommendations effective January 1 of the upcoming fishing year. All ABCs, ***OYs, and any HGs or quotas*** will remain in effect until revised, and, whether revised or not, will be announced at the beginning of the year along with other specifications. PREVIOUS SENTENCE MOVED FROM 5.3.1.1.

In the event that the Secretary disapproves one or more of the Council's recommendations, he may implement those portions approved and notify the Council in writing of the disapproved portions along with the reasons for disapproval. The Council may either provide additional rationale or information to support its original recommendation, if required, or may submit alternative recommendations with supporting rationale. In the absence of an approved recommendation at the beginning of the fishing year, the current specifications in effect at the end of the previous fishing year will remain in effect until modified, superseded, or rescinded.

5.5 Inseason Procedures for Establishing or Adjusting Specifications and Apportionments (Previously 5.7)

5.5.1 Inseason Adjustments to ABCs

Occasionally, new stock assessment information may become available inseason that supports a determination that an ABC no longer accurately describes the status of a particular species or species group. However, adjustments will only be made during the annual specifications process and a revised ABC announced at the beginning of the next fishing year. The only exception is in the case where the ABC announced at the beginning of the fishing year is found to have resulted from incorrect data or from computational errors. If the Council finds that such an error has occurred, it may recommend the Secretary publish a notice in the *Federal Register* revising the ABC at the earliest possible date.

5.5.2 Inseason Establishment and Adjustment of OYs, HGs, and Quotas

OYs and HGs may be established and adjusted inseason (1) for resource conservation through the "points of concern" framework described in Chapter 6; (2) in response to a technical correction to ABC described above; or, (3) under the socioeconomic framework described in Chapter 6.

Quotas~~, except for apportionments to DAH, DAP, JVP, TALFF,~~ and reserve, may be established and adjusted inseason only for resource conservation or in response to a technical correction to ABC.

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REBUILDING PLANS FOR

A. DARKBLOTCHED ROCKFISH
B. PACIFIC OCEAN PERCH
C. COWCOD

VOLUME II

AMENDMENT 16 TO THE GROUNDFISH FISHERY MANAGEMENT PLAN

PACIFIC FISHERY MANAGEMENT COUNCIL
JUNE 2002

a. P = Policy Document. require as an element of a policy document
F = FMP Amendment, require as an element of an FMP
R = Regulatory Amendment, require as an element of a regulatory amendment.
X = Do not include as an element of a rebuilding document

b. T_{target}- The number of years in which fishery managers will try to rebuild the stock.

c. B_{MSY} or proxy - MSY stock size, the long-term average size of the sock or stock complex . . . that would be achieved under an MSY control rule (50 CFR Ch. VI, Section 600.310 paragraph (b)(1)(iii))

d. Status quo (no action) would maintain B_{msy} and T_{target} as the only required parameters for rebuilding plans (see Table 2.1-a).

e. Probability of achieving B_{msy} within T_{target} years

f. Where catch is held constant over time until the stock reaches B_{msy}.

g. Where a constant proportion of the stock is removed annually until the stock reaches B_{msy}.

h. A combination of the constant catch and constant F strategy.

i. P_{target} is the probability of acheiving T_{target}. If T_{target} is the median of the rebuilding times modeled for the F associated with the rebuilding harvest control rule, then P_{target} is 50%. Given that T_{target} is set less than or equal to T_{max}, a P_{target} of 50% implies a probability or rebuilding within T_{max} of greater than or equal to 50%. While P_{target} is not a required element under MSA, T_{target} is a required element and constraint on Council/Secretary action, however, T_{target} can act as an effective constraint only when a standard is set with respect to the probability of achieving T_{target}.

j. Probability of achieving B_{msy} within T_{max} years. If the estimate of P_{max} falls below 50% adjustment to the rebuilding plan may be required (see Issue 3).

DRAFT DARKBLOTCHED ROCKFISH REBUILDING PLAN

PART B TO AMENDMENT 16 OF THE PACIFIC COAST GROUNDFISH FISHERY MANAGEMENT PLAN

INCLUDING DRAFT ENVIRONMENTAL IMPACT STATEMENT AND REGULATORY ANALYSES

PREPARED BY THE PACIFIC FISHERY MANAGEMENT COUNCIL

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1.0 PURPOSE AND NEED FOR REBUILDING DARKBLOTCHED ROCKFISH

1.1 Purpose and Need

The darkblotched (*Sebastes crameri*) stock in the northeast Pacific was one of the principal north slope rockfish species caught in trawl fisheries operating on the continental slope within the PFMC management area of the west coast EEZ bounded by the international borders with Mexico and Canada (herein referred to as the "west coast"). The north-south management line for slope rockfish is currently in the vicinity of Cape Mendocino, California at 40°10' N. lat. Most darkblotched rockfish catch has occurred north of Cape Mendocino in the Eureka and Columbia INPFC areas (Figure 1-1) which is consistent with the estimated geographic center of biomass distribution occurring in slope areas off Oregon (Rogers *et al.* 2000). Darkblotched rockfish were often caught in association with Pacific ocean perch and likely experienced similar large removals by foreign trawlers during 1966-1975, although species composition of historical catches is uncertain (Part C: Draft Pacific Ocean Perch Rebuilding Plan). Continued exploitation by the domestic trawl fleet was probably over the maximum fishing mortality threshold now used as a proxy MSY harvest rate for darkblotched ($F_{50\%}$).

Adoption of Amendments 11 and 12 of the Pacific Coast Groundfish Fishery Management Plan (FMP) incorporated the legal rebuilding mandates of the Sustainable Fishery Act and established an overfishing threshold (Minimum Stock Size Threshold; MSST) of 25% of the estimated unfished spawning biomass for groundfish stocks. Rogers *et al.* (2000) estimated the 1999 abundance of the darkblotched rockfish stock in U.S. waters to be at 14% of its unfished biomass. Therefore, the National Marine Fisheries Service (NMFS) declared the stock overfished in January 2001.

Under the terms of the Magnuson-Stevens Fishery Conservation and Management Act (MSA) and the FMP, the Council must prepare a rebuilding plan to increase darkblotched rockfish stock abundance to a level that supports maximum sustainable yield (MSY; 40% of its unfished biomass). The purpose of this draft rebuilding plan and Environmental Impact Statement (EIS) is to evaluate alternative strategies designed to rebuild darkblotched rockfish in a time less than or equal to the maximum allowable (T_{MAX}) under the National Standard Guidelines interpreting the MSA.

1.2 Rebuilding Plan Overview

The Draft Darkblotched Rebuilding Plan (Part B, June 2002 draft) is organized to address the requirements of the MSA, National Environmental Policy Act, Executive Order 12866, and the Regulatory Flexibility Act. This document conforms to a National Environmental Policy Act (NEPA) structure and format with a purpose and need statement (section 1.1), a reasonable range of rebuilding alternatives presented in Chapter 2, a description of the affected environment (physical (habitat), biological (darkblotched and other affected species), and socioeconomic (affected fisheries, fishing industry, and fishing communities)) in Chapter 3, and an analysis of rebuilding consequences expected for affected environments in Chapter 4. Chapters 5-8 document how the rebuilding plan and alternatives conform to legal mandates, who contributed in preparation of the rebuilding plan, and the references used throughout this rebuilding plan document. Appendix B-1 is the rebuilding analysis prepared for this rebuilding plan (not included in this draft) and Appendix B-2, the FMP Amendment language for darkblotched rebuilding. The modular design of the rebuilding plan framework (each species rebuilding plan is stratified in Parts) is to allow it to stand alone as a decision-making document for rebuilding darkblotched rockfish on the slope within the Council's jurisdiction (Figure 1-1). This June 2002 draft adopts a ***bold italic font for items of particular emphasis (especially to the Council and other decision-makers)***, *highlight yellow italic font for noted gaps and questions to experts*, and *italic font for names of rebuilding alternatives and scientific species names.*

The overarching objective of this rebuilding plan is to increase darkblotched stock spawning biomass to a level that supports MSY within a target time set by the Council (T_{TARGET}). For darkblotched rockfish, the Council-approved proxy for this level of abundance is 40% of its estimated unfished biomass ($B_{40\%}$). Estimation of unfished biomass (B_0) is especially critical since it forms the basis for declaring a stock's biological and legal status. There is uncertainty about the estimate of B_0 and this value can be expected to change with improved understanding of the stock and when new stock assessments are conducted.

Rebuilding parameters specified in a rebuilding plan must include at least T_{TARGET} and may be required to include other parameters listed in Table 1-1 depending on decisions made in Part A of this amendment package. The values adopted for these parameters are determined by the best available science, Council/NMFS policies, and legal mandates (including the MSA and the National Standard Guidelines for interpreting the MSA). The time to rebuild is constrained on the high end ($T_{MAX} = T_{MIN} + 1$ mean generation; 1 mean generation = the mean time period for a spawning female to replace herself in the population; Restrepo *et al.* 1998) and on the low end (T_{MIN} = time to rebuild in the absence of fishing; F=0) by biological limits imposed by our understanding of the stock's potential productivity (50 CFR §600.310 (e)(4)(ii)(B)). The mean generation time for darkblotched is (age x survival x spawn) summed for all ages / (survival x spawn) summed for all ages (Methot and Rogers 2001). The National Standard Guidelines specify that the Council must manage to rebuild in no more than ten years if T_{MIN} is estimated to be less than or equal to ten years.

Scientific uncertainty exists for every aspect of rebuilding and thus influences success and failure of rebuilding. Uncertainty surrounds the estimation of parameters that define rebuilding targets and objectives, assessments of stock status and structure, projections of future recruitment and biomass, and evaluating how well management measures meet rebuilding objectives. All alternatives in this rebuilding plan (except *No Action*) assume the best available science. Ensuring the best available science is incorporated in Council decision-making is the role of the Council's Scientific and Statistical Committee (SSC) and therefore not analyzed specifically as a policy choice. However, recommendations for mitigating risk associated with scientific uncertainties are explored throughout this rebuilding plan.

This rebuilding plan generally analyzes alternative strategies and explores mitigating measures for achieving rebuilding targets and objectives. Specifically, this plan analyzes the tradeoffs (physical, biological, and socioeconomic) associated with alternative total fishing-related mortality limits (total catch OYs) and the management specifications (harvest controls and measures) to achieve these limits.

Area closures may be considered in this rebuilding plan. Currently such closures would be considered to move the fishery off darkblotched hotspots, and therefore reduce the total mortality of adult fish. The Council and NMFS are currently developing a policy for habitat based management that may result in modification to existing (or pending) closures, or other management measures intended to protect habitat deemed important to groundfish production. At issue in the development of this policy is the integration of habitat-based management with the harvest control management strategies that have historically been the foundation for Council actions. Alternative policies are being analyzed in a Programmatic EIS (contact Mr. Jim Glock, NMFS, (503) 231-2178). The policies adopted through the Programmatic EIS will be implemented through subsequent decisions such as implementation of the EFH provisions of the Magnuson-Stevens Act or the annual management process and may be utilized to achieve the mortality goals for darkblotched rockfish established in the rebuilding plan. Implementation of the EFH provisions is underway through another EIS that tiers off the Programmatic EIS. Publication of the draft action-specific EFH EIS is anticipated for August 2003 (contact Mr. Steve Copps, NMFS, (206) 526-6187).

TABLE 1-1. Current parameter/target estimates specified for rebuilding darkblotched rockfish. Data from Rogers *et al.* (2000) and Methot and Rogers (2001).

Rebuilding Parameter/Target	Estimate or proxy
T_0 (year declared overfished)	2000
T_{MIN} (minimum time to achieve B_{MSY} = mean time to rebuild at F = 0)	14 years
Mean generation time	33 years
T_{MAX} (maximum time to achieve $B_{MSY} = T_{MIN}$ + 1 mean generation time)	47 years

TABLE 1-1. Current parameter/target estimates specified for rebuilding darkblotched rockfish. Data from Rogers *et al.* (2000) and Methot and Rogers (2001).

Rebuilding Parameter/Target	Estimate or proxy
P_{MAX} (P to achieve B_{MSY} by T_{MAX}) [1/]	70%
Most recent stock assessment	Rogers *et al.* 2000
Most recent rebuilding analysis	Methot and Rogers 2001
B_0 (estimated unfished biomass)	29,044 mt
$B_{CURRENT}$ (current estimated biomass = X% of B_0)	4,067 mt in 2002
% Unfished Biomass	14% in 2002
MSST (minimum stock size threshold = 25% of B_0)	7,261 mt
B_{MSY} (rebuilding biomass target = 40% of B_0)	11,618 mt
MFMT (maximum fishing mortality threshold = F_{MSY})	$F_{50\%}$
Harvest Control [1/]	F = 0.029
T_{TARGET} [1/]	2034

[1/] Under *Council Interim Rebuilding.*

2.0 DARKBLOTCHED ROCKFISH REBUILDING PLAN ALTERNATIVES

Darkblotched rockfish rebuilding alternatives within MSA, FMP, and other legal constraints are analyzed in this rebuilding plan. The most risk-averse alternative (*Maximum Conservation*), most risk-prone alternatives (*Maximum Harvest* and *Mixed Stock Exception*), and alternatives with intermediate risk are compared with a *No Action* alternative. Probabilities of rebuilding within T_{MAX} vary between 60% and 80% in intermediate risk alternatives. All rebuilding alternatives except *No Action* consider the best available science for determining risk-neutral bycatch and discard rates. The best available science is anticipated to be direct observations of bycatch and discard in west coast groundfish fisheries. However, until these data are available to account for all sources of fishing-related mortality, the best available science is considered to be a bycatch/discard model developed by the Northwest Fisheries Science Center of the National Marine Fisheries Service (Hastie 2001). Assumed bycatch rates of darkblotched rockfish in trawl fisheries targeting other species would be at the mid-point of the range estimated from log books and EDCP data (Hastie 2001) for all alternatives except *No Action*. Rebuilding parameter estimates and probabilities for all alternatives (Table 2-1) are derived in the most recent stock assessment (Rogers *et al.* 2000) and rebuilding analysis by (Methot and Rogers 2001, Appendix B-1). The median year when darkblotched spawning biomass is projected to reach B_{MSY} under each alternative is noted in Table 2-1. This is not to be construed as the target year for rebuilding the stock to B_{MSY} (T_{TARGET}). T_{TARGET} is a legal construct/policy choice falling within the Council/NMFS decision-making nexus. The choice of T_{TARGET} is constrained to fall between T_{MIN} and T_{MAX}. Probabilities of rebuilding for these rebuilding alternatives summarized in Table 2-1 are relative to T_{MAX}., not T_{TARGET}. If it were assumed the median year of achieving B_{MSY} under the *Council Interim Rebuilding* alternative for darkblotched rockfish was the Council's choice for T_{TARGET}, the probability of achieving B_{MSY} in 2034 (T_{TARGET} in this case) is 50% (= median) and the probability of achieving B_{MSY} by 2047 (T_{MAX}) is 70% . The probability of achieving B_{MSY} within T_{TARGET} (P_{TARGET}) can be increased by lowering the harvest rate (F) and constraining fisheries further. Relative risk and probability of rebuilding alternatives meeting rebuilding objectives is sensitive to our current state of knowledge and the harvest control rule (i.e., harvest rate) adopted as a rebuilding target and strategy. The harvest control rule varies between rebuilding alternatives analyzed in this rebuilding plan, the best available science informing decisions and our current state of knowledge does not. ***Note that T_{TARGET} has not been explicitly noted in Table 2-1 and is a choice before the Council.***

2.1 The *No Action* Alternative

The choice of the *No Action* alternative for darkblotched rockfish was considered in terms of providing the most informative analysis of the consequences and tradeoffs of rebuilding the stock. Technically, a *No Action* alternative would be the action that would be taken in the absence of an approved rebuilding plan (or status quo). Under the strict context of that definition, *Council Interim Rebuilding* might be considered to represent status quo. For the purposes of this NEPA analysis *No Action* is considered to be the action prior to the Council approval of *Council Interim Rebuilding*, which is also analyzed.

Under the *No Action* alternative darkblotched would be managed with specified trip limits applied to the minor north slope rockfish complex (i.e., darkblotched would not be separated from the complex for management purposes). The harvest level (ABC) would be based on the Council's default $F_{50\%}$ MSY proxy and the total catch OY would be set equal to the ABC. The total catch OY would be calculated using a fishing mortality rate of 0.0*XXX*. A *16*% discard rate (of landed catch) would be assumed for controlling bycatch mortality. *[Rogers et al. (2000) assumed a 5% discard rate in the assessment?]* No special consideration would be given to MPAs.

2.2 The *Maximum Conservation* Alternative

Under the *Maximum Conservation* alternative rebuilding would occur in the shortest time possible by setting the fishing mortality rate to zero (F = 0) for those fisheries under Council control. The tradeoff is the greatest socioeconomic impact occurs to fisheries and fishing-dependent communities in the Monterey, Eureka, Columbia and U.S.-Vancouver INPFC areas during the course of rebuilding. Bottom trawl fisheries (and an other fisheries under Council control that demonstrate a bycatch of darkblotched rockfish) operating on the slope would be closed or modified to the point where targeted and incidental catch of darkblotched rockfish did not occur. The target rebuilding period (T_{TARGET}) would be the minimum rebuilding time (T_{MIN} = 14 years) with the median year of achieving BMSY estimated to be 2014. There would be no bycatch of darkblotched rockfish since there is no fishing-related mortality. Potential habitat impacts would be minimized by eliminating fishing effort. A subsequent decision-making process to implement the EFH provisions of the MSA would be utilized to determine if additional habitat based management measures were necessary to enhance productivity of the stock.

2.3 The *Maximum Harvest* Alternative

Under the *Maximum Harvest* alternative rebuilding would occur in the maximum allowable time (T_{MAX}), thereby allowing the maximum allowable harvest under rebuilding. A minimal impact would be expected on existing slope and shelf fisheries and dependent fishing communities, but at a cost of the slowest legal rebuilding schedule allowed by the FMP, MSA, and the National Standard Guidelines. The target rebuilding period (T_{TARGET}) would be the maximum rebuilding time (T_{MAX} = 47 years) with the median year of reaching B_{MSY} projected to be 2047. The *Maximum Harvest* alternative has a 50% probability of rebuilding within T_{MAX}. The total catch OY would be calculated using a fishing mortality rate of 0.033. No special consideration would be given to MPAs.

2.4 The *60%* Alternative

Under the *60%* alternative there would be a 60% probability of rebuilding within T_{MAX}. The target rebuilding time (T_{TARGET}) would be 40 years with the median year of reaching B_{MSY} projected to be 2040. The total catch OY would be calculated using a fishing mortality rate of 0.031. Consideration may be given to area closures that move the fishery off darkblotched hotspots and reduce total mortality.

2.5 The 70% or *Council Interim Rebuilding* Alternative

Under the *Council Interim Rebuilding* alternative there would be a 70% probability of rebuilding within T_{MAX}. This alternative was the one the Council selected in 2001 as its preferred alternative for rebuilding darkblotched rockfish. This analysis does not presume this is still the Council's preferred alternative. The target rebuilding time (T_{TARGET}) would be 34 years with the median year of reaching B_{MSY} projected to be 2034. The total catch OY would be calculated using a fishing mortality rate of 0.029. Consideration may be given to area closures that move the fishery off darkblotched hotspots and reduce total mortality.

2.6 The *80%* Alternative

Under the *80%* alternative there would be an 80% probability of rebuilding within T_{MAX}. The target rebuilding time (T_{TARGET}) would be 30 years with the median year of reaching B_{MSY} projected to be 2030. The total catch OY would be calculated using a fishing mortality rate of 0.027. Consideration may be given to area closures that move the fishery off darkblotched hotspots and reduce total mortality.

2.7 The *Mixed Stock Exception* Alternative

Under the *Mixed Stock Exception* alternative, rebuilding constraints would not be imposed thereby allowing overfishing of darkblotched rockfish. The mixed stock exception is a provision in National Standard Guideline 1 allowing an increased OY above the overfishing level as long as the harvest meets certain standards. Harvesting one species of a mixed-stock complex at its optimum level may result in the overfishing of another stock component in the complex. The Council may decide to permit this type of overfishing only if all of the following conditions are satisfied:

(a) The Council demonstrates by analysis that such action will result in long-term net benefits to the Nation.
(b) The Council demonstrates by analysis that mitigating measures have been considered and that a similar level of long-term net benefits cannot be achieved by modifying fleet behavior, gear

selection/ configuration, or other technical characteristic in a manner such that no overfishing would occur.

(c) The resulting rate or level of fishing mortality will not cause any species or evolutionarily significant unit thereof to require protection under the Endangered Species Act.

Since the west coast darkblotched rockfish stock is the most binding constraint to slope fisheries in the north, darkblotched may be considered to meet the standards of the *Mixed Stock Exception* provision. This alternative will be analyzed to determine whether potential management measures meet the mixed stock exception standards. If the Council demonstrates these standards are not met, the mixed stock exception alternative will be classified as "considered but rejected". ***If the Council demonstrates these standards are met, the Council will be asked to determine the management measures that would apply for darkblotched in order to do a comparative NEPA analysis before a final decision is made.***

2.8 Alternatives Considered But Rejected

Any alternatives with less than a 50% probability of rebuilding to B_{MSY} within the maximum allowable rebuilding time (T_{MAX}) are not compliant with the MSA as interpreted in a ***2000*** ruling in the ***X*** Circuit Federal Court (*American Oceans Campaign v. Daley*) *[proper case citation?]*. Such alternatives are not analyzed in this rebuilding plan. The *No Action* alternative has a probability of rebuilding to B_{MSY} of less than 50%, but is still analyzed as per NEPA requirements.

The *Mixed Stock Exception* may be considered for darkblotched. If the Council decides not to invoke the *Mixed Stock Exception*, this alternative will be rejected from final analysis.

TABLE 2-1. Rebuilding parameters associated with darkblotched rockfish rebuilding alternatives.

Alternative	F rate	Probability of rebuilding within T_{MAX}	Median year of reaching B_{MSY}	T_{TARGET} (year)
No Action	0.0*XX*	*X*%	20*XX*	NA
Maximum Conservation	0.000	approaches 100%	2014	20***XX***
Maximum Harvest	0.033	50%	2047	20***XX***
60%	0.031	60%	2040	20***XX***
Council Interim Rebuilding	0.029	70%	2034	20***XX***
80%	0.027	80%	2030	20***XX***
Mixed Stock Exception	0.***XXX***	*X*%	20***XX***	2***XXX***

[GMT/Methot: determine missing values for No Action in Table 2-1 after resolving the parameters used in No Action; Mixed Stock Exception parameters to be included if and when the Council decides to specify a Mixed Stock Exception alternative; all T_{TARGET}s to be determined by the Council]

3.0 AFFECTED ENVIRONMENT

3.1 Physical Environment

3.1.1 Darkblotched Rockfish Habitat

The distribution of darkblotched rockfish extends from the Bering Sea to Santa Catalina Island, California (Allen and Smith 1988). Based on the location of commercial landings and NMFS triennial survey data, darkblotched rockfish are frequently encountered along the central Pacific Coast (Oregon and northern California). They can be found at depths ranging from 29-549 m (Rogers *et al.* 2000), usually deeper than 76 m, and are classified as a middle shelf-mesobenthal species.

Darkblotched rockfish move into deeper water as they increase in size and age. Older larvae and pelagic juveniles are found closer to the surface than many other rockfish species (Love 2002). Off Oregon, benthic juveniles are taken at depths of 55-200 m. Adults have been found in water as shallow as 29 m, but are most abundant in the deeper portion of their range. In 1999, NMFS triennial survey data indicated that 91% of the estimated darkblotched rockfish biomass was found at depths between 180-360 m, with the remaining 9% found between 360-540 m (Rogers *et al.* 2000).

Darkblotched rockfish are associated with mud and rock habitats throughout their range (Eschemeyer *et al.* 1983). *[NOTE: Rogers et al. (2000) disputes a darkblotched association with soft slope substrates; cited submersible observations (W. Wakefield, NMFS, pers. comm.)]* The greatest numbers of darkblotched larvae and pelagic juveniles are found 83-93 km offshore; juvenile darkblotched can be taken as far offshore as 194 km. Off central California, young darkblotched rockfish recruit to soft substrate and low relief habitats. Demersal juveniles are often found perched on the highest structure in the benthic habitat (Love 2002). Adults are typically observed resting on mud, near cobble and boulders and do not often rise above the bottom (Love 2002). In Soquel Canyon, California, adults were most frequently associated with mud boulder, mud rock, rock mud, and mud cobble habitats (Yoklavich *et al.* 1999). Darkblotched rockfish make limited migrations once they recruit to the adult stock. *[Describe extent and pattern of migrations: offshore? latitudinal?]*

3.1.2 Human Effects on Rockfish Habitat

Potential fishing-related impacts to rockfish habitat are incurred from direct disturbance of the seafloor from contact by actively-fished, lost, or discarded fishing gear. The most common bottom fishing gears associated with seafloor disturbance on the west coast are trawl nets, longlines, and fish traps. Auster and Langton (1999) reviewed a variety of studies reporting habitat effects due to fishing for a wide range of habitats and gear types. Commonalities of all studies included immediate effects on species composition and diversity and a reduction of habitat complexity.

Bottom trawling gear is known to modify seafloor habitats by altering benthic habitat complexity and by removing or damaging infauna and sessile organisms (Freese *et al.* 1999, Friedlander *et al.* 1999). High resolution sidescan sonar images on the shelf and slope off Eureka, California, revealed deep gouges on the seafloor believed to be caused by trawl doors (Friedlander *et al.* 1999). The effects of bottom trawling on a "hard bottom" (pebble, cobble, and boulder) seafloor were also investigated in the Gulf of Alaska where a significant number of boulders were displaced and emergent epifauna were removed or damaged after a single pass with trawl gear. Casual observations during the Freese *et al.* (1999) study revealed that *Sebastes* species use cobble-boulder and epifaunal invertebrates for cover. When boulders are displaced they can still provide cover, but when piles of boulders are displace it reduces the number and complexity of crevices (Freese *et al.* 1999).

Limited qualitative observations of fish traps, longlines, and gill nets dragged across the seafloor during set and retrieval were similar to observations of bottom trawling gear, in that some types of organisms living on the seabed were dislodged. Quantitative studies of acute and chronic effects of fixed gear on habitat have not been conducted (Auster and Langton 1999).

In addition to fishing activities, humans have many other direct and indirect effects on fish habitat. While non-fishing human impacts have not been directly assessed on darkblotched rockfish habitat, a study of flatfish in Puget Sound, Washington indicated that anthropogenic stressors included chemical contaminant exposure and alteration of nearshore nursery habitats (Johnson *et al.* 1998). The New England Fishery Management Council compiled a list of human-induced threats to fish habitat that may be used as a guide to factors affecting groundfish species off the west coast. Oil, heavy metals, acid, chlorine, radioactive waste, herbicides and pesticides, sediments, greenhouse gases, and ozone loss are thought to be chemical factors that affect fish habitat. Biological threats can include the introduction of non-indigenous species, stimulation of nuisance and toxic algae, and the spread of disease. Human activities that may physically threaten fish habitat are dredging and disposal, mineral harvesting, vessel activity, shoreline alteration, and debris disposal (Wilbur and Pentony 1999).

Marine debris has also been recognized as posing a risk to marine organisms via entanglement and ingestion. Seafloor debris was surveyed from Point Conception, California to the U.S. - Mexico border at depths of 10 to 200 m and anthropogenic debris occurred on approximately 14 percent of the mainland shelf. Of the debris sampled, discarded fishing gear had the largest spatial coverage, followed by plastic, metal, and other debris (e.g., shoe soles and automobile parts) (Moore and Allen 1999). Less is known about the quantity of marine debris off Washington and Oregon, but it may be at levels that could negatively affect marine organisms.

As more information is gathered about the effects of fishing and non-fishing human activities on darkblotched rockfish habitat, additional management measures may be taken.

3.2 Biological Environment

TABLE 3-1. Biological reference points for darkblotched rockfish.

Biological Reference Point	Value
Maximum age	66 yrs
Maximum length	58 cm *[by gender?]*
Maximum weight	*X kg; [by gender?]*
Age at 50% maturity	8.4 yrs females; 5.1 yrs male
Length at 50% maturity	36.5 cm females; 29.6 cm males
Natural mortality rate (M)	0.05

[Should other biological reference points be included in Table 3-1?]

3.2.1 Darkblotched Rockfish Life History

Darkblotched have a low potential productivity and a long mean generation time of 33 years. There is no evidence of genetic stock structuring in the darkblotched population. Rogers *et al.* (2000) observed this was consistent with the smooth cline in age, size, and relative abundance indices of the coastwide population with no obvious breaks within the species range. Larger fish are generally found in deeper water (>200 fm; Nichol 1990). Lenarz (1993) reported evidence from the 1977-1992 NMFS triennial surveys of a higher proportion of larger fish in southern areas. The center of biomass distribution on the west coast is off Oregon (Rogers *et al.* 2000), which comports with the majority of landings in the Columbia INPFC area.

Darkblotched, like many *Sebastes* species, are long-lived, slow growing, and late to mature. Females grow faster than males and attain a larger mean size *[reference points?; ref?]*. The maximum reported age for darkblotched is 66 years.

The age at 50% maturity for males is estimated to be 5.1 years and 8.4 years for females (Nichol and Pikitch 1994). The estimated length at 50% maturity is 29.6 cm and 36.5 cm for males and females, respectively. Westrheim (1975) reported a smaller size at 50% maturity for darkblotched in Alaska and British Columbia waters than Nichol (1990) did for the stock off Oregon. Nichol and Pikitch (1994) report darkblotched fecundities ranging from 19,815 oocytes (565.0 g) for a 32.5 cm female to 489,064 oocytes (1,724.0 g) for a 47.0 cm female.

Darkblotched reproduce via internal fertilization and are viviparous (live-bearers). Spawning occurs from December through March off Oregon (Nichol and Pikitch 1994). Wourms (1991) describes one clear seasonal peak of spawning annually. Darkblotched larvae are planktonic and are distributed from southern California to the Bering Sea (Matarese *et al.* 1989). A long planktonic life stage would likely contribute to the apparent lack of genetic structuring in the west coast population.

3.2.2 Darkblotched Rockfish Stock Status

Darkblotched rockfish were managed as part of a coastwide *Sebastes* complex which was later segregated into north and south management units divided at 40°30' N. lat. The first assessment of darkblotched estimated the proxy MSY harvest rate and overfishing rate for the stock (Lenarz 1993). Lenarz (1993) estimated a range of likely natural mortalities (M = 0.025-0.05) for darkblotched based on a range of maximum ages (60-105 years). He also estimated fishery selectivity from length compositions from the California fishery which he converted to an age-based selectivity function. He then plotted the relative fecundity per recruit as a function of fishing-related and natural mortality to estimate $F_{35\%}$ (the target MSY proxy harvest rate at that time) and $F_{20\%}$ (the overfishing harvest rate) relative to fecundity per recruit. He estimated the range of likely harvest rates (F) at the MSY target ($F_{35\%}$) was 0.04-0.06 and the overfishing harvest rate ($F_{20\%}$) ranged between 0.07 and 0.11. While Lenarz did not calculate an ABC for darkblotched, he did note the estimated harvest rates at MSY and overfishing were lower than expected. He also noted a trend of decreasing size of darkblotched from the length composition data he evaluated.

The next assessment that was informative for darkblotched addressed all west coast *Sebastes* without individual ABCs (Rogers *et al.* 1996). Two methodologies were explored for estimating an ABC for darkblotched: 1) fishing-related mortality was assumed to equal natural mortality (F=M) to estimate an $F_{35\%}$ harvest rate, and 2) estimation of $F_{35\%}$ using a simple stock synthesis model. In the F=M approach, a proxy adjustment (Q) to triennial survey data was calculated to estimate relative biomass of generic *Sebastes*. It was determined that adjusting Q by 0.5 and then by M approximated $F_{35\%}$ estimates from stock synthesis models for most rockfish. A Q of 0.8 (instead of 0.5) was assumed for darkblotched since the survey swept most of the depth range of darkblotched and caught smaller fish than the fishery. The other factors that influenced the magnitude of Q was a noted decreasing trend in estimated survey biomass over time and the estimated size at 50% maturity was greater than estimated size at 50% selectivity (i.e., the survey caught darkblotched at sizes less than those estimated for most maturing and mature fish). The F=M method was compared to a stock synthesis modeling approach that incorporated triennial survey data and a Pacific ocean perch bycatch effort index.

Rogers *et al.* (2000) assessed stock's status in 2000 and determined the stock was at 14% of its unfished level ($B_{14\%}$). They incorporated five relative abundance indices in a length based stock synthesis model (Methot 1990) to derive current estimates of abundance and productivity. The five indices included three NMFS surveys with different latitudinal and depth coverages, the Pacific ocean perch effort index developed in the generic *Sebastes* assessment (Rogers *et al.* 1996), and a logbook index derived from California trawl logbook and species composition data stratified by major California port (Ralston 1999). Major uncertainties in the assessment model included the uncertain foreign catch composition, which had a significant effect on estimated unfished biomass (B_0), and assumptions regarding maturity, discard rates, and unchanging selectivity over time. Of these, the foreign catch of darkblotched influences our understanding of stock status the most; larger assumed historical catches increase estimates of B_0. Four accepted model runs varied the assumed foreign catch proportion from 0%-20%, which resulted in significant differences in B_0 and the spawning index. Only one of those model runs (assuming 0% foreign catch of darkblotched) estimated the stock was not overfished.

3.3 Socioeconomic Environment

3.3.1 Fisheries and Management History

[to be completed before public review]

Management of the foreign fishery. *Joint venture?*
Transition to domestic fishery and MSA

Darkblotched were managed as part of a coastwide *Sebastes* complex during 198X-1999. The fishing mortality rate target commonly accepted for shelf and slope rockfish was $F_{35\%}$, but changed on the advice of the SSC to an F50%.

Rogers *et al.* (1996) calculated a species-specific ABC for darkblotched and other rockfish in the *Sebastes* complex

Rogers *et al.* (2000) estimate abundance of darkblotched to be at 14% of its unfished biomass, below the minimum stock size threshold of $B_{25\%}$. In response, NMFS declared darkblotched overfished in January 2001. Individual total catch OY estimated for darkblotched; QSM management starting in 2001. The F50% MSY proxy for most west coast rockfish also adopted in 2001.

Total catch OY increased and rebuilding time extended starting in 2002 after new rebuilding analysis (Methot and Rogers 2001) suggests stock cannot be rebuilt within ten years. Council chooses *Council Interim Rebuilding* alternative which is estimated to achieve B_{MSY} by T_{MAX} with a 70% probability.

3.3.2 Fishing Communities

[to be completed before public review]

4.0 ENVIRONMENTAL CONSEQUENCES

This rebuilding plan EIS analyzes the effects of alternative strategies for rebuilding darkblotched rockfish on the probability of successful stock rebuilding, co-occurring species, affected habitat, and the socioeconomic environment (Table 4-1).

TABLE 4-1. Ranked relative effects of alternative darkblotched rockfish rebuilding strategies of potential negative habitat impacts, the probability of rebuilding by T_{MAX}, and short term economic costs (1 is highest rank, 7 is lowest rank).

Alternative	Potential Negative Habitat Effects	Probability of Rebuilding by T_{MAX}	Short Term Economic Costs
No Action	2	6	6
Maximum Conservation	7	1	1
Maximum Harvest	3	5	5
60%	4	4	4
Council Interim Rebuilding	5	3	3
80%	6	2	2
Mixed Stock Exception	1	7	7

4.1 Affected Darkblotched Rockfish Habitat Including Essential Fish Habitat

Alternative rebuilding strategies have varying effects on the rocky bottom habitats of the continental slope where darkblotched rockfish reside, primarily due to the extent fishing activities are affected but also to the degree MPAs are considered. The *Mixed Stock Exception* alternative might be expected to have the greatest potential impact on darkblotched rockfish habitats since a greater fishing intensity than *No Action* and rebuilding alternatives is likely (depending on Council specifications and mitigation measures under a *Mixed Stock Exception*). The *Maximum Conservation* alternative would have the least habitat impact since it eliminates fisheries that target or incidentally catch darkblotched and therefore eliminates potential fishing-related habitat impacts. Conversely, the *Maximum Harvest* alternative allows the maximum harvest under rebuilding constraints and therefore creates a greater potential disturbance to darkblotched rockfish habitat from a greater intensity of fishing effort relative to all rebuilding alternatives other than *No Action*. There would also be no special consideration given to MPAs to control total mortality and protect EFH. The intermediate risk alternatives (*60%*, *Council Interim*, and *80%*) would have intermediate effects relative to the maximum alternatives.

Darkblotched rockfish, as with many of the *Sebastes* species, have strong habitat affiliations with rocky habitats and other bottom structures. Depth-based restrictions or incentives may also be effective in displacing trawl effort away from darkblotched rockfish habitats.

Population productivity could be enhanced by protecting these habitats through the use of MPAs. This may be true globally for rockfish and other west coast groundfish species. Programmatic measures designed to identify, protect, and minimize potential fishing impacts on west coast rockfish EFH will be analyzed in the Supplemental EIS (EFH SEIS) in preparation by NMFS. Any habitat protection measures identified in the EFH SEIS that can be applied to encourage rebuilding darkblotched rockfish either through reducing total mortality or enhancing population productivity should be seriously considered as an adjunct to other harvest control measures analyzed in this plan. One consideration in whether MPAs should be incorporated in darkblotched rebuilding, is the relative productivity and extinction/depletion risk. If risks are high due to extremely low potential productivity, then MPAs should be considered more seriously as a mitigation of those risks.

Bottom trawl operations on the slope of the continental shelf would most affect darkblotched rockfish habitats. The relative effects of darkblotched rockfish rebuilding alternatives on these habitats resulting from the amount of physical contact with the bottom are assumed to be with duration of trawl gear bottom contact in sensitive rocky habitats and gear type. The relative fishing intensity of darkblotched rockfish rebuilding alternatives is assumed to be correlated with potential negative habitat effects. The ranking of darkblotched rockfish rebuilding alternatives by their assumed relative effect on these habitats (Table 4-1) is on this basis.

Since bottom trawl operations account for over 96% of recent darkblotched landings, associated trawl fishery impacts should be the focus of mitigating potentially negative habitat effects. Small footrope and chafing gear restrictions are believed to reduce potentially harmful effects of bottom trawls in rocky shelf habitat (National Academy Press 2002) and should be considered. To the extent that fixed gear and other potential fishery impacts to darkblotched rockfish habitat can be avoided or mitigated, a modest benefit could also be anticipated.

4.2 Affected Biological Environment

4.2.1 Controlling Fishing-Related Mortality of Darkblotched Rockfish

Successful stock rebuilding depends on the ability of management/rebuilding measures to effectively control all sources of fishing-related mortality, including landed catch and bycatch. All rebuilding alternatives analyzed in this EIS has a calculated total catch OY to accommodate landings of unavoidable incidental catch of darkblotched rockfish (except the *Maximum Conservation* alternative which has a total catch OY of 0 mt). The effectiveness of all rebuilding strategies (given the probabilistic trajectories of future increases in biomass relative to B_{MSY}) depends on managing darkblotched fishing-related mortality within prescribed total catch OYs. Landed catch allowances for all overfished species are designed to minimize target opportunities on these species while allowing landings of unavoidable bycatch that would otherwise be discarded dead at sea. Management measures consistent with rebuilding should have harvest control rules that are enforceable and effectively stay within total catch targets. Harvest control rules and management measures commensurate with alternative rebuilding strategies are analyzed qualitatively in this rebuilding plan EIS. Potential management measures that are likely to reduce sources of fishing-related mortality are also discussed.

Landed catch accounting and control

Landed catch accounting and control methods are considered relatively effective. Sorting requirements are now in place for darkblotched rockfish. This requires accounting for the weight of landed darkblotched rockfish when catches are hailed at sea or landed. Landings are recorded on state fish receiving tickets. Landings and state port sampling data are reported in-season to the PacFIN database managed by the Pacific States Marine Fisheries Commission (PSMFC; www.psmfc.org/pacfin/index.html). The Council's Groundfish Management Team (GMT) and PSMFC manage the Quota Species Monitoring (QSM) dataset reported in PacFIN. All landings of groundfish stocks of concern (overfished stocks and stocks below B_{MSY}) and target stocks and stock complexes in west coast fisheries are tracked in QSM reports of landed catch. The GMT recommends prescribed landing limits and other in-season management measures to the Council to attain, but not exceed total catch OYs of QSM species. Stock and complex landing limits are modified in-season to control total fishing-related mortality; QSM reports and landed catch forecasts are used to control the landed catch component. These landed catch accounting and control mechanisms are used for all rebuilding alternatives including *No Action*.

Bycatch accounting and control

Limiting bycatch (defined as dead discard) to the extent practicable is a MSA mandate. Effective bycatch accounting and control mechanisms are also critical for staying within target total catch OYs. The first element in limiting bycatch is accurately measuring bycatch rates by time and area. Bycatch rates of darkblotched rockfish in west coast trawl (and non-trawl) fisheries are uncertain. The NMFS first implemented a west coast Groundfish Fishery Observer Program in August 2001 to make direct observations of commercial groundfish targeting efforts. Observer coverage extends to about 10% of the west coast fleet currently, but should approach 20% by the summer of 2002 (E. Clarke, NMFS NWFSC, pers. comm.). Given the skewed distribution of bycatch in west coast groundfish fisheries, many observations in each sampling strata (i.e. target effort by gear type by area) will be needed to estimate representative rates of darkblotched rockfish bycatch. Therefore, NMFS has stated that Observer Program data probably won't be available for management use until the summer of 2003 at the earliest. There may be a period when a combination of Observer Program data and the best currently available methods for estimating bycatch are used to estimate bycatch.

Currently, the best available science that informs managers of bycatch and discard rates of darkblotched in the groundfish fishery is a model (Hastie model) that uses logbook and EDCP data to estimate coincident catch rates in target trawl efforts for other species (Hastie 2001). The Hastie model estimates bycatch rates (defined as coincident catch rates in this context) of darkblotched in two-month blocks. The seasonality of bycatch is an important management consideration. Target opportunities for healthy flatfish and DTS species vary seasonally and geographically. It is reasonable to expect bycatch rates of darkblotched to vary in accordance with the concurrence of target species and darkblotched. In November 2001, the Council adopted the Hastie model to use for bycatch accounting and control starting in 2002.

The Council selected and NMFS approved the use of the mid range of considered darkblotched rockfish bycatch rates to seasonally adjust landing limits to limit bycatch of darkblotched starting in 2002 (Table 4-2). The choice of bycatch rates to use for darkblotched bycatch control was uncertain at best given the lack of sorting requirements for darkblotched prior to 2001. The high range was not considered plausible because accepting it would assume that vessels discarded significant quantities of darkblotched before they reached their north slope rockfish trip limits (Hastie 2001). This was considered unlikely since darkblotched are generally larger and more valued than other species in the minor north slope rockfish complex. The low range was considered riskier than the mid range; therefore, the choice of the mid range was adopted. The extent that this bycatch rate is a reasonable proxy for darkblotched in lieu of direct (contemporary) observations of fishery interceptions is unknown. In this analysis, the mid range of bycatch rates is considered the most plausible and risk neutral. Bycatch rates from the Hastie model are applied to landed weight of the target species in the target fisheries depicted in Table 4-2 to estimate seasonal bycatch of darkblotched.

All rebuilding plan alternatives except *No Action* and *Maximum Conservation* use the mid range of bycatch rates estimated in the Hastie model to estimate darkblotched bycatch (Table 4-2). The *No Action* alternative assumes a 16% bycatch/discard rate for darkblotched. This is a proxy for darkblotched that was originally estimated for widow rockfish from trawl observations in the mid-1980s (Pikitch *et al.* 1988). The *Maximum Conservation* does not rely on modeled bycatch or any other bycatch accounting mechanism since all fishing-related mortality is eliminated. It is anticipated that all rebuilding alternatives will benefit from direct observations of bycatch. Rebuilding measures should always use the best available estimates of bycatch.

TABLE 4-2. Bycatch rates by target trawl fishery and two-month fishing period north and south of Cape Mendocino estimated for darkblotched rockfish. From the Hastie (2001) predictive model used to estimate bycatch starting in 2002. Council adopted rates are in the mid range.

Target fishery	2-mo. period	North of Cape Mendocino			South of Cape Mendocino		
		Low	Mid	High	Low	Mid	High
Arrowtooth	1	0.01%	0.18%	0.35%	NA		
	2	0.20%	0.50%	0.80%			
	3	0.60%	0.80%	1.00%			
	4	0.10%	0.20%	0.30%			
	5	0.50%	1.05%	1.60%			
	6	0.25%	0.50%	0.75%			
Petrale	1	2.00%	3.00%	4.00%	0.01%	0.02%	0.05%
	2	1.60%	3.30%	5.00%	0.56%	1.12%	1.68%
	3	0.30%	0.65%	1.00%	0.01%	0.00%	0.05%
	4	1.00%	1.65%	2.30%	0.74%	1.48%	2.22%

TABLE 4-2. Bycatch rates by target trawl fishery and two-month fishing period north and south of Cape Mendocino estimated for darkblotched rockfish. From the Hastie (2001) predictive model used to estimate bycatch starting in 2002. Council adopted rates are in the mid range.

Target fishery	2-mo. period	North of Cape Mendocino			South of Cape Mendocino		
		Low	Mid	High	Low	Mid	High
	5	0.75%	1.53%	2.30%	0.03%	0.05%	0.08%
	6	0.75%	1.88%	3.00%	0.01%	0.00%	0.05%
Flatfish	1	0.75%	2.38%	4.00%	0.15%	0.30%	0.45%
	2	0.80%	1.90%	3.00%	0.16%	0.33%	0.49%
	3	1.40%	1.70%	2.00%	0.28%	0.55%	0.83%
	4	0.80%	1.25%	1.70%	0.11%	0.23%	0.34%
	5	0.60%	1.50%	2.40%	0.14%	0.29%	0.43%
	6	0.40%	1.15%	1.90%	0.17%	0.35%	0.52%
Widow/Yellowtail	1	0.01%	0.03%	0.05%	0.01%	0.02%	0.05%
	6	0.01%	0.03%	0.05%	0.12%	0.24%	0.37%
DTS	1	0.30%	1.15%	2.00%	0.01%	0.00%	0.05%
	2	0.30%	1.15%	2.00%	0.01%	0.02%	0.05%
	3	1.20%	2.10%	3.00%	0.05%	0.09%	0.14%
	4	0.80%	1.65%	2.50%	0.02%	0.03%	0.05%
	5	0.40%	1.35%	2.30%	0.03%	0.06%	0.08%
	6	0.30%	2.65%	5.00%	0.01%	0.00%	0.05%
Chilipepper	1	NA			1.29%	2.58%	3.87%
	2				1.12%	2.24%	3.36%
	3				1.57%	3.15%	4.72%
	4				1.45%	2.89%	4.34%
	5				1.08%	2.15%	3.23%
	6				1.40%	2.80%	4.21%
Slope rockfish	1	50.00%	65.00%	80.00%	0.43%	0.87%	1.30%
	2	50.00%	65.00%	80.00%	0.76%	1.52%	2.28%
	3	50.00%	75.00%	100.00%	0.50%	1.00%	1.50%
	4	50.00%	75.00%	100.00%	0.36%	0.71%	1.07%
	5	50.00%	65.00%	80.00%	0.56%	1.12%	1.68%
	6	50.00%	65.00%	80.00%	0.07%	0.13%	0.20%
Leftover [1/]	1	2.50%	5.25%	8.00%	0.47%	0.93%	1.40%
	2	1.00%	3.50%	6.00%	0.01%	0.00%	0.05%
	3	1.00%	3.50%	6.00%	7.06%	14.13%	21.19%
	4	1.00%	3.00%	5.00%	0.01%	0.00%	0.05%
	5	0.50%	2.25%	4.00%	0.21%	0.41%	0.62%
	6	3.50%	4.25%	5.00%	0.05%	0.11%	0.16%

[1/] Leftover encompasses all bycatch not assigned to a target trawl fishing opportunity according to the criteria imposed by Hastie (2001).

Potential rebuilding measures to consider

Measures that would effectively displace fisheries with a relatively high incidence of darkblotched catch or other fishery/gear modifications should be considered to reduce fishing-related mortality. These measures would affect rebuilding through reducing risk of considered rebuilding alternatives in terms of achieving target fishing harvest rate (F) and the specified total catch OY. Avoidance measures through gear modification or fishing techniques should be investigated.

Management measures adopted for 2002 included a significantly higher slope rockfish cumulative landing limit south of the Cape Mendocino management line at 40°10' N. lat. Prior to the April meeting, review of DTS and flatfish landings north of Cape Mendocino revealed higher than projected effort during the first 2-month period. Additional modeling was also conducted to examine the potential effects of the lower whiting harvest guideline on DTS effort during the July-August period. These two sources of increased target species effort, along with expected research catch of 2 mt that had not been previously included, led to the conclusion that a reduction of roughly 5 mt of darkblotched bycatch would need to be achieved over the remainder of the year. During GMT discussion of this issue at the April Council meeting, data was presented indicating that landings of darkblotched in the Monterey area, which had been assumed to be zero, averaged about 40 mt during 2000 and 2001 (Figures 3-2 and 3.3) . If these landings represent catch coming from south of the Cape Mendocino management line, this would represent a source of bycatch mortality that was not included in the Hastie bycatch model. Of particular interest will be determination of whether landings into the Monterey INPFC area represent catch occurring in that area or in the Eureka INPFC area. Discussions with fishermen indicated increased effort occurred on the slope just north and south of 40°10' N. lat. It should be noted that because there was no sorting requirement for darkblotched prior to 2001, logbook data will be of very limited use in identifying darkblotched bycatch rates in the Monterey INPFC area, and the other two sources of observer-based estimates included in the 2001 bycatch modeling did not include fishing in this area. A precautionary consideration may be to move the slope rockfish management line further south to encompass at least the northern portion of the Monterey INPFC area (*Pt. Arena?*).

Depth-based restrictions and/or incentives to fish in deeper waters outside the depth range of greatest darkblotched density ***[GMT to evaluate logbooks to determine this depth range; Rogers et al. (2000) assumes ≤200 fm]*** would likely reduce risk in controlling fishing-related mortality through avoidance. Allowing fishing in waters deeper than most darkblotched are found could be done with a vessel monitoring system (VMS). A VMS tracks boats equipped with satellite transponders remotely from on-shore stations. A VMS may be feasible for managing west coast groundfish fisheries, given that VMS is already used in the management of some west coast marine fisheries such as the commercial albacore fishery. Some groundfish fisheries in the Aleutian Islands and Bering Sea currently use VMS to restrict the fishery to certain areas or depths. The cost of installing VMS to manage the deep-water trawl fleet needs to be considered. Such systems are expensive to set up, maintain, and operate. However, relative to the foregone benefits of prosecuting fisheries, this cost may be rationalized. To the extent that incentives to fish outside the depth range of darkblotched could be structured, some or all of the costs associated with implementing a VMS system for the west coast groundfish fishery could be born by the industry. For instance, higher landing limits for deeper water species that are considered healthy, such as longspine thornyhead (*Sebastolobus altivelis*) or any of the other DTS species could be considered with a depth-based restriction. Revenue from these higher landing limits could help offset the costs of implementing VMS.

Depth-based restrictions without safeguard controls like VMS raise enforcement concerns. An on the water presence is more difficult in the deeper offshore areas where the slope fishery would need to be displaced to effectively reduce darkblotched bycatch. Without remote tracking of distant water vessels or effective enforcement, depth-based restrictions would not reliably reduce potential fishing pressure on darkblotched rockfish. Displacement of vessels to deeper and more distant offshore locations also raises a general safety concern. If smaller vessels are displaced further offshore, there is a higher likelihood of accident and loss of life while conducting fishing operations. Such displacement also increases fuel and operating expenses which tend to decrease net economic benefits from the fishery.

Gear modifications should be considered that might be more effective in targeting healthy species while minimizing bycatch of overfished species such as darkblotched. The small footrope restriction (trawl footropes ≤ 8 inches in diameter; no anti-chafing gear) has been used on the west coast to minimize bycatch of overfished shelf rockfish species such as canary and yelloweye rockfish. Trawls under the small footrope restriction cannot effectively fish on the bottom in rocky habitats. Shelf rockfish landings by trawls under the small footrope restriction (adopted in 2000) have been significantly reduced. Some assurance is gained by the fact that landings of shelf rockfish on a per vessel basis have been generally less than allowable trip limits. A similar small footrope restriction in slope trawl fisheries to land any slope rockfish may reduce fishing-related mortality of darkblotched and other slope rockfish. However, some slope trawl fisheries would be compromised if small footrope restrictions were imposed to land all groundfish species. Larger footropes are required to effectively fish abundant flatfish species (i.e., Dover sole, petrale sole in the winter) on the silty mud bottoms of the abyssal plain on the outer slope. Small footropes dig into these soft substrates which are softer than the sandier, more compact depositional shelf bottoms outside rocky reefs. Larger footropes tend to "float" on the mud and more effectively catch target flatfish species. If these gears could be effectively restricted to softer mud bottom habitats on the slope, darkblotched and other slope rockfish could be avoided. Spatial mapping of these habitat types does not currently exist on any reasonable scale to consider such measures.

Other gear modifications that may more cleanly target harvestable shelf species include trawls with reduced mouths (smaller height and width dimensions) and cutback headropes. The ODFW has experimented with such trawls designed to target flatfish (M. Saelens, ODFW, pers. comm.). Initial results from comparative research tows with these experimental bottom trawls (29 paired tows with experimental and conventional trawls) on the shelf off Oregon were promising (+60% Dover sole in experimental nets, -76% canary rockfish in experimental nets, and -72% redstripe rockfish in experimental nets). These preliminary results suggest this gear more efficiently catches flatfish while reducing bycatch of shelf rockfish. Further evaluation of this gear is planned in deeper water during the summer of 2002. An additional 150 hours of effort on the slope is planned with an expected catch of 0.16 mt of darkblotched rockfish. Effectiveness of this gear in catching abundant flatfish on the slope while avoiding slope rockfish will clearly benefit darkblotched rebuilding.

Gear modifications designed to target harvestable groundfish and non-groundfish species and avoid slope rockfish should be investigated further. Exempted Fishing Permits (EFPs) could be used to investigate the efficiency of such gears as the experimental flatfish trawl being tested in waters off Oregon. Effective avoidance of overfished shelf and slope rockfish through the use of modified gears would reduce fishing-related mortality of darkblotched rockfish.

More accurate bycatch accounting coupled with such measures as discard caps could significantly reduce fishing-related mortality of darkblotched and other overfished groundfish species. The NMFS Observer Program could be linked with a program of mandatory full retention of rockfish during commercial fishing activities on the slope to increase accuracy in estimating total catch. This could ensure rebuilding total catch OYs are not exceeded while attempting to access harvestable groundfish species on the slope such as DTS and deep-water flatfish. Mandatory rockfish retention and observer coverage might allow greater flexibility for managers to consider fishing opportunities that might otherwise be considered risky. As long as total catch controls are reliable and responsive to rapid changes in the fishery, such explorations may be acceptably risk-averse.

Darkblotched rockfish on the west coast south of the U.S. - Canadian border are part of a larger stock assemblage, some of which is managed outside of Council jurisdiction. British Columbia annual darkblotched landings have averaged about ***X*** mt annually during 19***XX-XXXX***, or about ***X***% of average annual landings from U.S. waters for the same period. ***[table of Canadian db catch (foreign and domestic?; and exports to U.S.?)]*** It is unclear whether the cumulative fishing-related mortality across the stock's range is consistent with that mandated under MSA, FMP, NMFS National Guidelines, and U.S. legal authorities. The relative biomass of darkblotched across the multiple management jurisdictions in the northeast Pacific is also unknown. Coordinated and consistent assessment and management should be explored with the Canadian Department of Fisheries and Oceans. Cooperative management could benefit darkblotched rockfish rebuilding in waters off the west coast of the U.S. as well as in foreign waters.

4.2.2 Species Co-occurring With and Potentially Affected by Rebuilding Darkblotched Rockfish

Darkblotched rockfish are part of the northern slope rockfish complex (Table 4-3a) and are primarily associated with these rockfish species. The north-south slope rockfish management line near Cape Mendocino at 40°10' N. lat. does not conform perfectly with the estimated distribution of darkblotched biomass (Rogers *et al.* 2000); there are some landings in fisheries targeting the southern slope rockfish complex (Table 4-3b). The deep-water trawl fishery targeting Dover sole (*Microstomus pacificus*), shortspine and longspine thornyheads (*Sebastolobus alascanus* and *S. altivelis*, respectively), and sablefish (collectively referred to as the DTS complex) incidentally catch darkblotched. There are also strong seasonal associations with other deepwater flatfishes caught in bottom trawl fisheries that incidentally catch darkblotched, such as petrale sole (*Eopsetta jordani*) in the winter and rex sole (*Errex zachirus*), and, to a lesser extent, English sole (*Pleuronectes vetulus*).

TABLE 4-3a. Rockfish species found on the U.S. west coast continental slope north of Cape Mendocino, California.

Common name	Scientific name	Common name	Scientific name
Principal Species		Secondary Species	
Aurora rockfish	*Sebastes aurora*	Bank rockfish	*Sebastes rufus*
Darkblotched rockfish	*Sebastes crameri*	Blackgill rockfish	*Sebastes melanostomus*
Pacific ocean perch	*Sebastes alutus*		
Redbanded rockfish	*Sebastes babcocki*		
Rougheye rockfish	*Sebastes aleutianus*		
Sharpchin rockfish	*Sebastes zacentrus*		
Shortraker rockfish	*Sebastes borealis*		
Splitnose rockfish	*Sebastes diploproa*		
Yellowmouth rockfish	*Sebastes reedi*		

TABLE 4-3b. Rockfish species found on the U.S. west coast continental slope south of Cape Mendocino, California.

Common name	Scientific name	Common name	Scientific name
Principal Species		Secondary Species	
Aurora rockfish	*Sebastes aurora*	Darkblotched rockfish	*Sebastes crameri*
Bank rockfish	*Sebastes rufus*	Pacific ocean perch	*Sebastes alutus*
Blackgill rockfish	*Sebastes melanostomus*	Sharpchin rockfish	*Sebastes zacentrus*
Redbanded rockfish	*Sebastes babcocki*	Shortraker rockfish	*Sebastes borealis*
Rougheye rockfish	*Sebastes aleutianus*	Yellowmouth rockfish	*Sebastes reedi*
Splitnose rockfish	*Sebastes diploproa*		

[GMT: Are the species depicted correctly in Tables 4-3a and 4-3b? Note: the 2000 SAFE tables had some inconsistencies.]

4.3 Biodiversity and Ecosystem Function

[to be completed before public review]

Biodiversity and ecosystem functions of slope rockfish assemblages are poorly understood. Predator-prey, ecological niche, and competitive species interactions are ecosystem considerations. The potentially high biomass in a healthy darkblotched rockfish population can serve to increase productivity of important predators such as halibut and sablefish. Increased abundance of darkblotched could also displace other marine species by competing for space and forage. Other slope rockfish (Table 4-3) might be affected by variation in darkblotched abundance. Data informing the long term trends in relative biomass of rockfish and other species inhabiting the continental slope are not reliable.

Albacore tuna are known to prey on darkblotched.

4.4 Affected Socioeconomic Environment

The vast majority of the biomass and catch of darkblotched rockfish are located north of the Cape Mendocino management line for the minor slope rockfish complexes at 40°10' N. lat. Although fishing communities in this northern area are not heavily dependent on revenue from darkblotched rockfish directly, they have a strong dependence on revenue from species with which darkblotched co-occur.

4.4.1 Affected Fisheries

Groundfish trawl fisheries have accounted for 96.5% of darkblotched landings on the U.S. west coast from 1981 to 2001. Fixed gears (hook and line; no measurable catch of darkblotched in pots and traps) have accounted for 3.1% of darkblotched landings on the U.S. west coast with landings by other gear types (shrimp trawls, nets, troll) accounting for about 0.4% from 1981 to 2001. Some of the Washington coastal tribes (i.e., Makah, Quileuete, and Quinault tribes) pursue groundfish. The Makah Tribe has sampled tribal landings of north slope rockfish catches. Tribal landings of darkblotched rockfish have averaged *X* mt during *XXXX-XXXX*, about *X*% of total tribal *[groundfish, rockfish?]* landings. *[Joner/Jones/GMT?]* There is no recreational fishing effort on the continental slope in darkblotched habitats nor records of recreational harvest of darkblotched.

The DTS fishery, which targets Dover sole, two species of thornyhead rockfish, and sablefish comprises the major source of estimated darkblotched bycatch (Figure 4-*X*). *[provide figure of mean bycatch of db by target trawl fishery; use Hastie (2001) data]* Another source is the deep-water flatfish fishery, where Dover sole is also the major constituent species. In order to constrain the projected bycatch of darkblotched rockfish to remain within the adopted total catch OY of 168 mt for 2002 fisheries, trawl landing limits for these species have been shifted substantially to periods of the year in which bycatch of darkblotched was expected to be relatively low. Tables 4-4a and 4-4b summarize the range of likely financial impacts on the trawl fleet and these communities that would be associated with lowering the darkblotched OY from 168 mt to the 130 mt specified for 2001. This analysis serves to illustrate the likely principal economic effects of darkblotched rebuilding within the context of the specific affected fisheries. The range of likely economic effects among rebuilding alternatives analyzed in this rebuilding plan NEPA analysis are assumed to be relative to the projected yields in Table 4-5.

At the outset, it is crucial to emphasize the overall decline in groundfish revenues by trawlers and their communities over the past several years. As illustrated at the bottom of the table, nominal ex-vessel revenue in this region from groundfish other than whiting has fallen by over 40% since 1996; a decline of nearly 45% when adjusted for inflation. This loss of over $15 million in ex-vessel revenues does not include lost processor income, declines in tax bases from plant closures, nor the social and economic costs associated with increased unemployment. Throughout this period, the DTS species have comprised more than 50% of the non-whiting groundfish revenue in the northern area. Projected landings from the fall 2001 bycatch modeling of management measures for 2002 indicate that this percentage would be expected to remain above 55%, given the proposed management specifications. With the major reductions in trip limit opportunities for rockfish species, the DTS fishery is the glue that holds the remaining groundfish fishery together.

Darkblotched bycatch rates in the DTS fishery that were used in the bycatch modeling of the preferred suite of management alternatives range from 1.5% to 2.65%, depending on the season (Table 4-2). Using these endpoints to bound the effect on the DTS fishery, achieving a reduction of 38 mt of darkblotched would require foregoing between 1,400 mt (18%) and 2,500 mt (31%) of projected DTS landings (Table 4-4a). Since DTS targeting opportunities were already shifted substantially away from the highest bycatch periods, it is unlikely that impact on DTS landings would fall towards the low end of this range. This loss would amount to between $1.9 million and $3.3 million in ex-vessel revenues (Table 4.4-b). Because of the importance of these species to the processing sector, this loss could accelerate the rate of plant closures and unemployment in this region.

TABLE 4-4a. Evaluation of the economic consequences associated with management actions that would be necessary to reduce the 2002 OY for darkblotched rockfish (*Council Interim Rebuilding*) from the proposed amount of 168 mt to the 130 mt specified for 2001. (Increase in darkblotched total catch OY from 2001 to 2002 = 38 mt).

	High bycatch period	Low bycatch period
Range of seasonal darkblotched bycatch rates (mid values) for the DTS fishery	2.7%	1.5%
Estimated DTS tonnage that would be foregone to save 38 mt of darkblotched	1,434	2,533

TABLE 4-4b. Distribution and estimated economic effects of DTS landings foregone to lower darkblotched bycatch north of the Cape Mendocino management line (40°10' N. lat.).

Species	Percentage of projected 2002 DTS	Ranges of estimated foregone DTS species catch (mt)		2001 trawl prices	Ranges of estimated foregone ex-vessel revenue from DTS species	
		Low	High		Low	High
Sablefish	16%	230	406	$1.168	$592,482	$1,046,719
Longspines	11%	159	280	$0.900	$314,947	$556,406
Shortspines	7%	97	171	$1.000	$213,337	$376,895
Dover sole	66%	948	1,675	$0.362	$756,860	$1,337,119
DTS total		1,434	2,533		$1,877,626	$3,317,139
Projected 2002 DTS tonnage	8,151					
Reduction necessary for darkblotched savings		18%	31%			
Projected ex-vessel revenue from modeled target and bycatch species in 2002 (does not include whiting):					$18,859,657	
Projected ex-vessel revenue and percentage of total from combined DTS species					$10,672,387	56.6%
				Year	Nominal $s	Real (2001) $s
Ex-vessel value of non-whiting groundfish landed north of Cape Mendocino in:				1996	$38,842,600	$42,027,296
				2001	$23,172,100	$23,172,100
Reduction from 1996 to 2001					40.34%	44.86%

Projected yields, and therefore revenues, estimated for darkblotched rockfish under the *Maximum Conservation* alternative are zero since exploitation of darkblotched is eliminated. The alternatives with the greatest socioeconomic costs after *Maximum Conservation* are the intermediate alternatives (*80%*, *Council Interim Rebuilding*, and *60%*, respectively), *Maximum Harvest*, *No Action*, and *Mixed Stock Exception* in the order of increased negative socioeconomic impacts based on projected yields (Tables 4-1, 4-5, and 4-6).

Some mitigating measures to reduce the risk of exceeding rebuilding harvest rates have increased economic costs. Displacement of vessels to deeper, more distant waters may increase fuel and operating expenses of fishing operations. The costs of implementing VMS may also increase fishing overhead. Mandatory full retention of rockfish may increase costs for fish buyers and processors. Handling and disposition of retained rockfish that are unmarketable due to damage or size could potentially increase overhead and operating expenses. All overhead costs would likely be transferred to the consumer which could weaken demand. West coast groundfish market share could then be adversely impacted on the fiercely competitive world seafood market. Constraints imposed on north slope rockfish since 2000 due to darkblotched rockfish rebuilding needs and constraints imposed to protect Pacific ocean perch in prior years have probably dramatically reduced market share of slope rockfish and other slope groundfish species on the west coast and world fisheries (e.g., effects on DTS trawl landing opportunities: Tables 4-4a and 4-4b).

[check yield projections (Table 4-5) with Methot and Punt- confirm these are the "latest and greatest"]

TABLE 4-5. Projected total catch optimum yields (mt) for darkblotched rockfish under different rebuilding probabilities and the default "40-10" policy. Actual catches shown for 1999-2001.

Year	*No Action* "40-10"	*Maximum Harvest* 50%	60%	*Council Interim Rebuilding* 70%	80%	Year	*No Action* "40-10"	*Maximum Harvest* 50%	60%	*Council Interim Rebuilding* 70%	80%
1999	326	326	326	326	326	2025	339	332	321	306	292
2000	236	236	236	236	236	2026	340	333	322	307	293
2001	130	130	130	130	130	2027	340	335	324	309	295
2002	20	190	181	169	158	2028	341	335	324	310	296
2003	42	208	198	184	172	2029	342	337	326	311	297
2004	62	223	213	198	186	2030	344	338	327	312	299
2005	86	236	225	210	198	2031	344	339	329	314	300
2006	111	246	235	220	207	2032	345	340	330	315	302
2007	136	256	244	229	216	2033	343	341	330	316	302
2008	161	263	252	237	223	2034	345	342	331	317	303
2009	184	271	260	245	231	2035	345	343	332	318	304
2010	206	279	267	252	238	2036	345	343	332	318	305
2011	225	284	272	257	243	2037	344	343	333	318	305
2012	243	290	279	263	249	2038	344	344	333	319	305
2013	259	295	284	268	254	2039	345	345	334	320	306
2014	273	300	289	273	259	2040	345	344	334	320	307
2015	284	304	293	277	263	2041	344	345	334	320	307
2016	295	307	296	281	266	2042	344	345	335	321	307
2017	302	311	299	284	270	2043	344	345	335	320	307
2018	308	314	303	287	273	2044	343	343	333	320	307
2019	315	317	306	291	277	2045	343	345	335	320	307
2020	321	321	309	294	280	2046	344	345	335	321	308
2021	325	324	313	298	284	2047	343	346	336	322	308
2022	329	327	316	301	286	2028	344	348	337	323	310
2023	334	329	318	303	289	2049	345	348	338	323	310
2024	338	330	319	304	290						

TABLE 4-6. Projected gross revenue (thousands of dollars) on the west coast associated with potential future yields of darkblotched rockfish under rebuilding alternatives.

[Hastie/Harms to provide after resolution of Table 4-5 yield estimates]

4.4.2 Affected Markets for Fishery Products

[to be completed before public review]

Darkblotched rockfish are valued for high quality fillets, a feature common to many west coast rockfish. Their larger size and high quality made them one of the more sought after targets in the minor north slope rockfish complex. Market value in *XXXX* was $*X*/lb compared with a groundfish *[rockfish?]* average of $*X*/lb.

[Market value and share of DTS and deep-water flatfish by year and region on west coast?]

[Market share of total groundfish ex-vessel value and of total rockfish ex-vessel value by year and region on west coast?]

[Canadian and Alaskan market share?; Canadian exports of darkblotched to the U.S.?]

4.4.3 Affected Fishing Communities

[to be completed before public review]

Coastal communities north of Cape Mendocino, California *[Ft. Bragg and north?; include all Monterey area ports and north?; include U.S.-Vancouver area ports?]* would be most affected by darkblotched rebuilding. Those communities with a heavy dependence on commercial groundfish fishing in general or large trawl fleets would be most affected by limits placed on slope fisheries designed to rebuild darkblotched.

[Fishing communities north of Cape Mendocino with a dependence on groundfish? with a dependence on rockfish? with a dependence on DTS and deep-water flatfish?]

[Fishing communities north of Cape Mendocino with alternative viable fisheries? % of gross ex-vessel revenue associated with non-groundfish fishing by port north of Cape Mendocino?]

[Size of trawl fleet by port north of Cape Mendocino? Proportion of groundfish trawl to all commercial fishing vessels by port north of Cape Mendocino?]

[Anticipated economic effects of rebuilding darkblotched by port/coastal area?]

[Economic effects of anticipated effort shifts associated with rebuilding darkblotched and other overfished groundfish species]

[Anticipated economic effects of darkblotched rebuilding alternatives]

4.5 Cumulative Effects

[to be completed before public review]

[Anticipated relative cumulative impacts of each db rebuilding alternative]

Overfished shelf rockfish (i.e., bocaccio, canary rockfish, and yelloweye rockfish) rebuilding constraints are anticipated to shift some commercial groundfish fishing effort from shelf to slope areas. Such an effort shift could exacerbate efforts to control total fishing-related mortality of darkblotched rockfish. Rebuilding effectiveness may largely depend on the effectiveness of bycatch accounting and control mechanisms. The NMFS Observer Program is the anticipated remedy to the uncertainty associated with current bycatch accounting methods. Consideration should be given in the interim to depth-based restrictions and gear modifications to mitigate adverse effects of increased fishing pressure on the slope (section 4.2.1). Such restrictions will likely be needed to shift the majority of the on-bottom groundfish effort off the shelf given the dramatically low OYs considered to protect bocaccio in the south (Conception and Monterey INPFC areas) and yelloweye and canary rockfish in the north (Monterey. Eureka, Columbia, and U.S.-Vancouver INPFC areas). Extending depth-based restrictions deeper than the range of greatest darkblotched density could mitigate potentially adverse fishery effort shifts.

[Effect of moving the management line further south; effect of depth-based restrictions on other groundfish species]

[Effect of management error]

[Effect of environmental uncertainty; Regime shifts including those not represented in the recruitment series used to predict future recruitment*]*

If the *Mixed Stock Exception* was invoked for darkblotched rockfish, POP could be expected to become the groundfish stock most binding as a slope fishery constraint. The stock most constraining is also more likely to be overfished; realized yields might be expected to exceed prescribed total catch OYs more frequently. A *Mixed Stock Exception* for darkblotched rockfish would therefore be expected to increase the risk of not attaining POP rebuilding objectives without appropriate mitigation. Such mitigation may include the depth-based restrictions and gear modifications discussed above, as well as accurate bycatch accounting coupled with discard caps that ensure prescribed exploitation rates are not exceeded.

5.0 CONSISTENCY WITH FMP OBJECTIVES AND THE MAGNUSON-STEVENS ACT

[to be completed before public review]

5.1 FMP Objectives

5.2 National Standards

5.3 Other Applicable Magnuson-Stevens Act Provisions

6.0 OTHER APPLICABLE LAW

[to be completed before public review]

6.1 National Environmental Policy Act

6.2 Regulatory Impact Review and Regulatory Flexibility Act Determination

6.2.1 Executive Order 12866

6.2.2 Impacts on Small Entities

6.3 Coastal Zone Management Act

6.4 Listed Species

6.4.1 Endangered Species Act

Fisheries that interact with species listed as depleted, threatened, or endangered may be subject to management restrictions under the Endangered Species Act (ESA). West coast groundfish fisheries can potentially interact with species listed under the ESA.

Several species of salmon are found in the EEZ off the west coast during the ocean phase of their life cycle. Of these species, chinook salmon (two stocks), sockeye salmon (one stock), and steelhead (two stocks) are listed as endangered and coho salmon (three stocks), chinook salmon (six stocks), chum salmon (two stocks), sockeye salmon (one stock), and steelhead (eight stocks) are listed as threatened under the Endangered Species Act (ESA). Interactions between west coast groundfish fisheries and salmon occur, but based on Biological Opinions under the ESA (August 10, 1990, November 28, 1991, August 28, 1992, September 27, 1993, May 14, 1996, and December 15, 1999), implementation of the proposed alternatives for the groundfish fishery is not expected to jeopardize the existence of any threatened or endangered species or modification of critical habitat.

Over sixty species of seabirds are found in the EEZ off the west coast. Some of these species are listed as endangered (short-tail albatross, California brown pelican, California least tern) and threatened (marbled murrelet) under the ESA. In west coast groundfish fisheries, seabirds are occasionally taken by trawl and pot gear but they are most often taken with hook-and-line gear; a gear not known to catch darkblotched and other slope rockfish effectively. Measures designed to rebuild darkblotched will primarily affect bottom trawl fishing opportunities. Bottom trawl gears do not have significant direct seabird interactions. However, in addition to incidental take, seabirds may be indirectly affected by changes in prey availability, vessel traffic, garbage dumping, and diesel or oil discharge that can result from commercial fisheries. Reduced harvest opportunities due to darkblotched rebuilding constraints are expected to result in decreased fishing effort. Seabirds may indirectly benefit.

Sea turtles are highly migratory; four of the six species found in U.S. waters have been sighted off the West Coast. The green turtle (*Chelonia mydas*), the leatherback turtle (*Dermochelys coriacea*), and the olive ridley turtle (*Lepidochelys olivacea*) are listed as endangered, and the loggerhead turtle (*Caretta caretta*) is listed as threatened. The management and conservation of sea turtles is shared between NMFS and FWS. Little is known about the interactions between sea turtles and west coast commercial fisheries. The directed fishing for sea turtles in west coast groundfish fisheries is prohibited, because of their ESA listings, but the incidental take of sea turtles by longline or trawl gear may occur. Sea turtles are known to be taken incidentally by the California-based pelagic longline fleet and the California halibut gillnet fishery. Because of differences in gear and fishing strategies between those fisheries and the west coast groundfish fisheries, the expected take of sea turtles by groundfish gear is minimal.

Sea turtles may be also indirectly affected by commercial fisheries. Sea turtles are vulnerable to collisions with vessels and can be killed or injured when struck, especially if struck with an engaged propeller. Entanglement in abandoned fishing gear can also cause death or injury to sea turtles by drowning or loss of a limb. The discard of garbage at sea can be harmful for sea turtles, because the ingestion of such garbage may choke or poison them. Sea turtles have ingested plastic bags, beverage six-pack rings, styrofoam, and other items commonly found aboard fishing vessels. The accidental discharge of diesel and oil from fishing vessels may also put sea turtles at risk, as they are sensitive to chemical contaminates in the water.

The recently implemented west coast groundfish observer program should supply additional information about the incidental take of sea turtles in 2002 and beyond.

Three marine mammals species (Steller sea lion (*Eumetopias jubatus*) Eastern Stock, Guadalupe fur seal (*Arctocephalus townsendi*), and Southern sea otter (*Enhydra lutris*) California Stock) are found in the EEZ off the west coast and are listed as threatened under the ESA. Potential interactions of ESA-threatened marine mammals with groundfish fisheries are generally discussed in the following section.

6.4.2 Marine Mammal Protection Act

Fisheries that interact with species listed as depleted, threatened, or endangered may be subject to management restrictions under the Marine Mammal Protection Act (MMPA). NMFS publishes an annual list of fisheries in the *Federal Register* separating commercial fisheries into one of three categories, based on the level of serious injury and mortality of marine mammals occurring incidentally in that fishery. The categorization of a fishery in the list of fisheries determines whether participants in that fishery are subject to certain provisions of the MMPA, such as registration, observer coverage, and take reduction plan requirements. The west coast groundfish fisheries are in Category III, indicating a remote likelihood of, or no known serious injuries or mortalities, to marine mammals.

All marine mammals found in the EEZ off the west coast are protected by the Marine Mammal Protection Act (MMPA). Approximately thirty species, including seals and sea lions, sea otters, and whales, dolphins, and porpoise, occur within the EEZ. Many marine mammal species seasonally migrate through west coast waters, while others are year round residents.

There is limited information documenting the interactions of groundfish fisheries and marine mammals, but marine mammals are probably affected by many aspects of groundfish fisheries. The incidental take of marine mammals, defined as any serious injury or mortality resulting from commercial fishing operations, is reported to NMFS by vessel operators. In the west coast groundfish fisheries, incidental take is infrequent and primarily occurs in trawl fisheries (Forney *et al.* 2000). Indirect effects of groundfish fisheries on marine mammals are more difficult to quantify due to a lack of behavioral and ecological information regarding marine mammals. However, marine mammals may be affected by increased noise in the oceans, change in prey availability, habitat changes due to fishing gear, vessel traffic in and around important habitat (i.e., areas used for foraging, breeding, raising offspring, or hauling-out), at-sea garbage dumping, and diesel or oil discharged into the water associated with commercial fisheries.

Under the MMPA on the west coast, NMFS is responsible for the management of cetaceans and pinnipeds, while the U.S. Fish and Wildlife Service (FWS) manages sea otters. Stock assessment reports review new information every year for strategic stocks (those whose human-caused mortality and injury exceeds the potential biological removal (PBR)) and every three years for non-strategic stocks. Marine mammals whose abundance falls below the optimum sustainable population (OSP) are listed as "depleted" according to the MMPA. Under the ESA, a species is listed as "endangered" if it is in danger of extinction throughout a significant portion of its range and "threatened" if it is one likely to become an endangered species within the foreseeable future throughout all, or a significant portion, of its range.

Under the MMPA, depleted species occurring off the west coast include the sperm whale (*Physeter macrocephalus*) west coast stock, humpback whale (*Megaptera novaeangliae*) west coast - Mexico stock, blue whale (*Balaenoptera musculus*) eastern north Pacific stock, and fin whale (*Balaenoptera physalus*) west coast stock.

Of the marine mammal species incidentally caught in west coast groundfish fisheries, the Steller sea lion is listed as threatened under the ESA, the northern elephant seal may be within their OSP range, and there is insufficient data to determine the status of the harbor seal, California sea lion, Dall's porpoise, and Pacific white-sided dolphin relative to their OSP. None of these species are classified as strategic stocks under the MMPA. Based on its Category III status, the incidental take of marine mammals in the west coast groundfish fisheries does not significantly impact marine mammal stocks.

6.4.3 Migratory Bird Treaty Act

The Migratory Bird Treaty Act of 1918 was designed to end the commercial trade of migratory birds and their feathers that, by the early years of the 20th century, had diminished populations of many native bird species. The Act states that it is unlawful to take, kill, or possess migratory birds and their parts (including eggs, nests, and feathers) and is a shared agreement between the United States, Canada, Japan, Mexico, and Russia to protect a common migratory bird resource.

The Migratory Bird Treaty Act prohibits the directed take of seabirds, but the incidental take of seabirds does occur. Only limited information exists quantifying the incidental take of seabirds in west coast groundfish fisheries. However, none of the proposed management alternatives are likely to affect the incidental take of seabirds protected by the Migratory Bird Treaty Act. Implementation of the NMFS West Coast groundfish observer program should provide additional information about the incidental take of seabirds in groundfish fisheries.

6.5 Paperwork Reduction Act

6.6 Executive Order 13132 (Federalism)

7.0 LIST OF PREPARERS

Dr. Jean Rogers, NMFS NWFSC (and contributing stock assessment authors): stock assessment; rebuilding analysis
Dr. Richard Methot, NMFS NWFSC: stock synthesis model; rebuilding analysis; rebuilding yield projections
Dr. Jim Hastie, NMFS NWFSC; GMT: bycatch/discard; economic analysis and effects
GMT members: fishery effects; species interactions; management specifications
Ms. Carrie Nordeen, NMFS NWR: habitat description; habitat effects; listed species interactions
Mr. John DeVore, PFMC: lead author

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Appendix B-1 Darkblotched Rockfish Rebuilding Analysis

[to be included before public review]

Appendix B-2 FMP Amendment Language

[to be completed before public review]

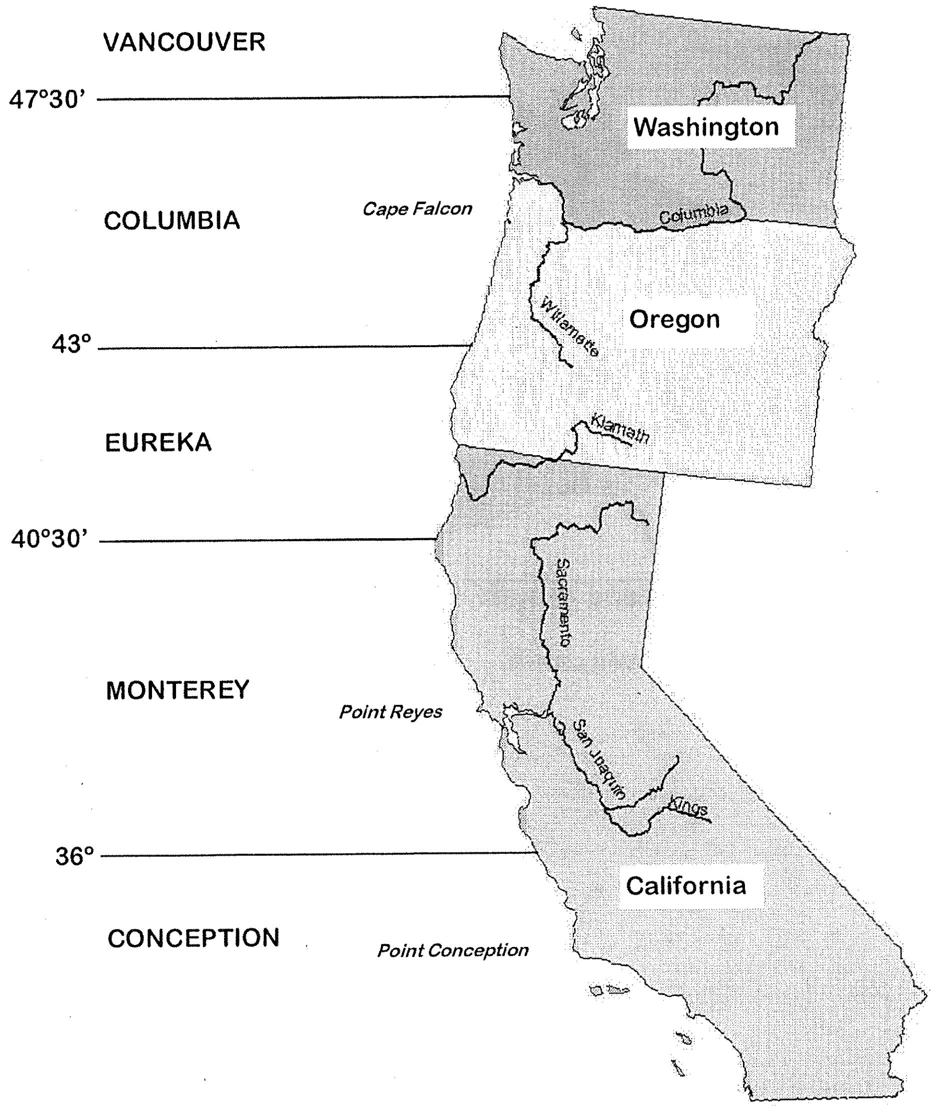

FIGURE 1-1. The Pacific Fishery Management Council management area (EEZ of the west coast of the United States) and INPFC management areas.

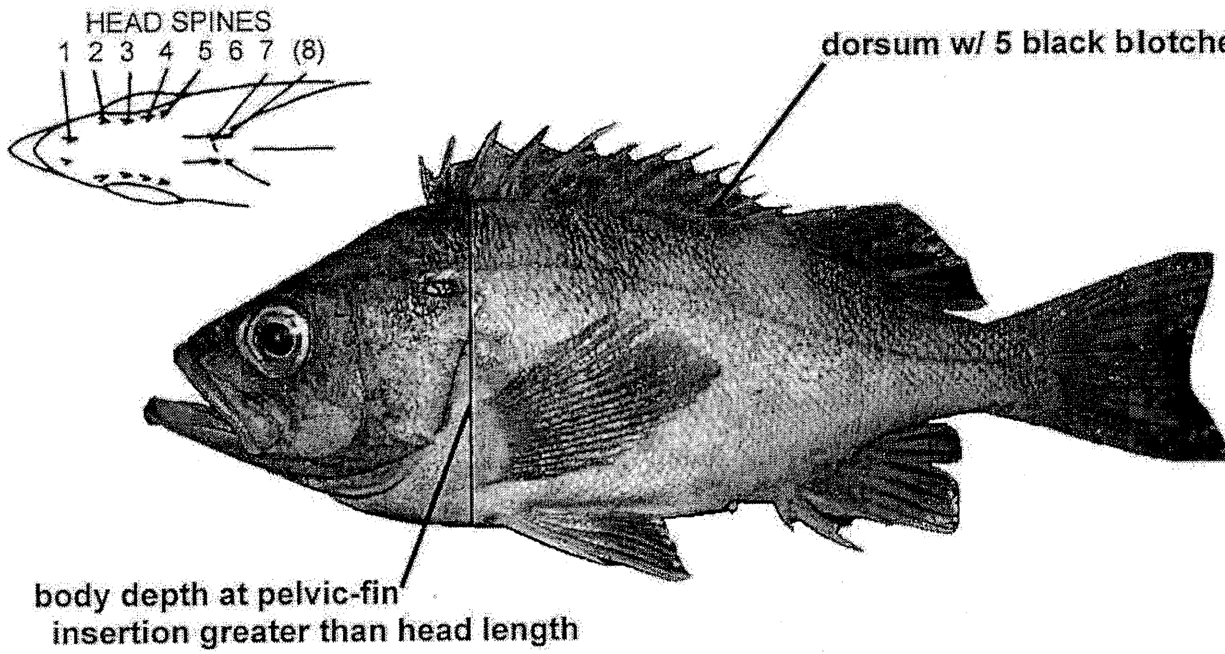

FIGURE 3-1. Darkblotched rockfish (*Sebastes crameri*).

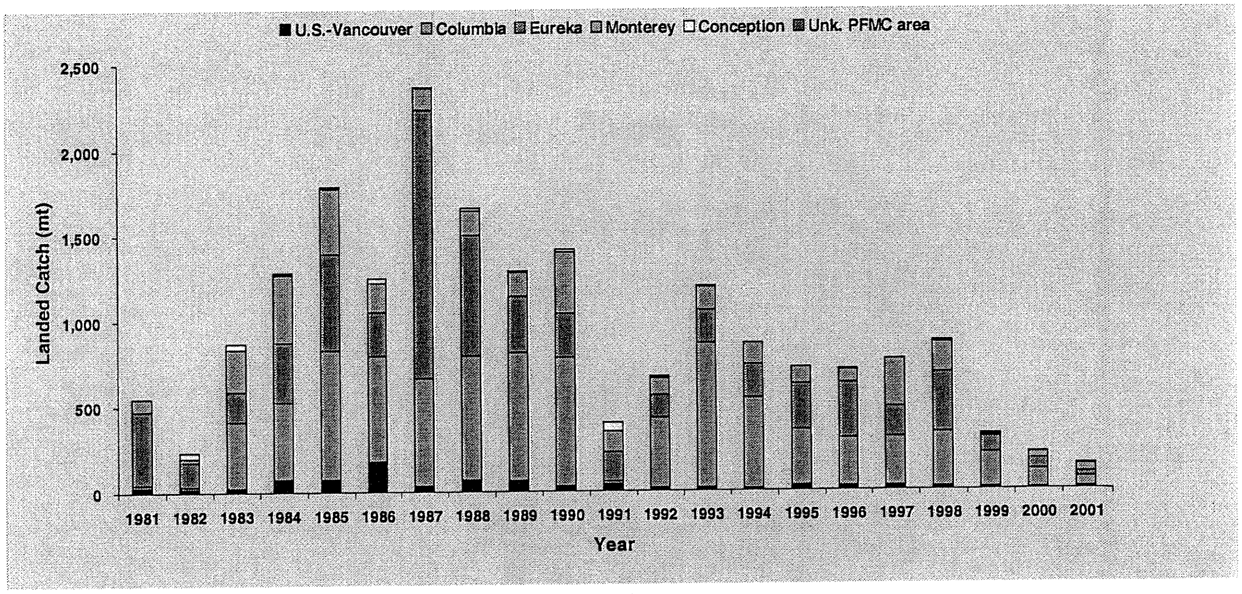

FIGURE 3-2. Landed catch (mt) of darkblotched rockfish by INPFC area on the U.S. west coast, 1981-2001. Data from PacFIN ("darkblotched rockfish" and "nominal darkblotched rockfish" categories).

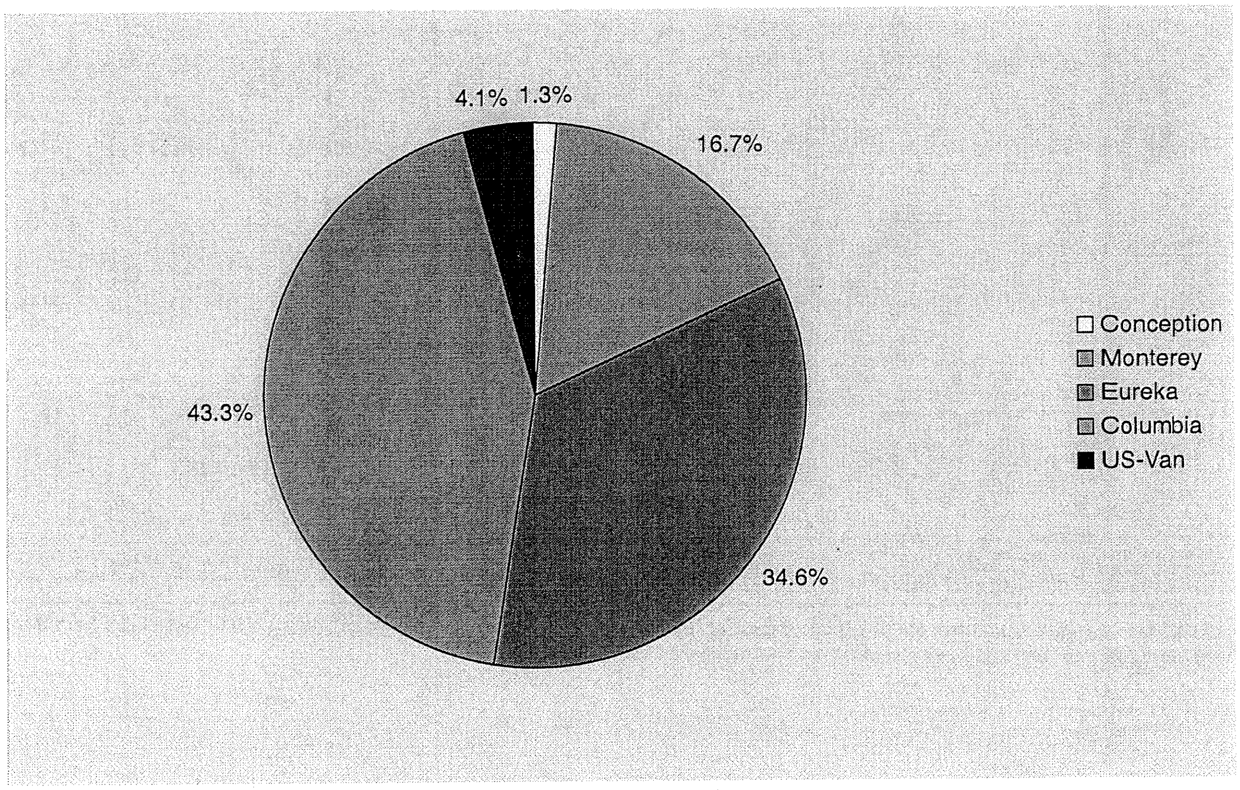

FIGURE 3-3. Average annual percent of landed darkblotched rockfish by INPFC area, 1981-2001.

Exhibit C.5
Attachment 4
June 2002

DRAFT PACIFIC OCEAN PERCH REBUILDING PLAN

PART C TO AMENDMENT 16 OF THE PACIFIC COAST GROUNDFISH FISHERY MANAGEMENT PLAN

INCLUDING DRAFT ENVIRONMENTAL IMPACT STATEMENT AND REGULATORY ANALYSES

PREPARED BY THE PACIFIC FISHERY MANAGEMENT COUNCIL

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TABLE OF CONTENTS

1.0 PURPOSE AND NEED FOR REBUILDING PACIFIC OCEAN PERCH

1.1 Purpose and Need

The Pacific ocean perch (*Sebastes alutus*, POP) stock in the northeast Pacific was the target of intense fishing pressure from 1965-1977, mostly by Soviet and Japanese trawlers. Large removals, followed by significant declines in catch and abundance led the Pacific Fishery Management Council (Council) to adopt a 20-year rebuilding plan for POP in 1981. Rebuilding under the original plan was largely influenced by a cohort analysis of 1966-76 catch and age composition data (Gunderson 1979), updated with 1977-1980 data (Gunderson 1981), and an evaluation of trip limits as a management tool (Tagart *et al.* 1980). Management under the original rebuilding strategy served to halt further declines in stock biomass. However, the stock has not recovered to an abundance that supports maximum sustainable yield (MSY).

Adoption of Amendments 11 and 12 of the Pacific Coast Groundfish Fishery Management Plan (FMP) incorporated the legal rebuilding mandates of the Sustainable Fishery Act and established an overfishing threshold of 25% of the estimated unfished spawning biomass for groundfish stocks. Ianelli and Zimmerman (1998) estimated the 1998 abundance of the POP stock in U.S. waters to be at 13% of its unfished biomass. Therefore, the National Marine Fisheries Service (NMFS) declared the stock overfished in March 1999.

Under the terms of the Magnuson-Stevens Fishery Conservation and Management Act (MSA) and the FMP, the Council must prepare a rebuilding plan to increase POP stock abundance to a level that supports MSY (40% of its unfished biomass). The purpose of this draft rebuilding plan and Environmental Impact Statement (EIS) is to evaluate alternative strategies designed to rebuild POP within the allowable time frame (T_{MAX}) mandated by the MSA and FMP.

1.2 Rebuilding Plan Overview

The Draft Pacific Ocean Perch Rebuilding Plan (Part C, June 2002 draft) is organized to address the requirements of the MSA, National Environmental Policy Act, Executive Order 12866, and the Regulatory Flexibility Act. This document conforms to a National Environmental Policy Act (NEPA) structure and format with a purpose and need statement (section 1.1), a reasonable range of rebuilding alternatives presented in Chapter 2, a description of the affected environment (physical (habitat), biological (POP and other affected species), and socioeconomic (affected fisheries, fishing industry, and fishing communities)) in Chapter 3, and an analysis of rebuilding consequences expected for affected environments in Chapter 4. Chapters 5-8 document how the rebuilding plan and alternatives conform to legal mandates, who contributed in preparation of the rebuilding plan, and the references used throughout this rebuilding plan document. Appendix C-1 is the rebuilding analysis prepared for this rebuilding plan (not included in this draft) and Appendix C-2, the FMP Amendment language for POP rebuilding. The modular design of the rebuilding plan framework (each species rebuilding plan is stratified in Parts) is to allow it to stand alone as a decision-making document for rebuilding POP on the slope within the Council's jurisdiction (Figure 1-1). This June 2002 draft adopts a ***bold italic font for items of particular emphasis (especially to the Council and other decision-makers)***, *highlight yellow italic font for noted gaps and questions to experts*, and *italic font for names of rebuilding alternatives and scientific species names.*

The overarching objective of this rebuilding plan is to increase Pacific ocean perch stock spawning biomass to a level that supports MSY within a target time set by the Council (T_{TARGET}). For POP, the Council-approved proxy for this level of abundance is 40% of its estimated unfished biomass ($B_{40\%}$). Estimation of unfished biomass (B_0) is especially critical since it forms the basis for declaring a stock's biological and legal status. There is uncertainty about the estimate of B_0 and this value can be expected to change with improved understanding of the stock and when new stock assessments are conducted.

Rebuilding parameters specified in a rebuilding plan must include at least T_{TARGET} and may be required to include other parameters listed in Table 1-1 depending on decisions made in Part A of this amendment package. The values adopted for these parameters are determined by the best available science, Council/NMFS policies, and legal mandates (including the MSA, National Standard Guidelines for interpreting the MSA, and legal precedent). The time to rebuild is constrained on the high end ($T_{MAX} = T_{MIN}$ + 1 mean generation; 1 mean generation = the mean time period for a spawning female to replace herself in the population; Restrepo *et al.* 1998) and on the low end (T_{MIN} = time to rebuild in the absence of fishing; F=0) by biological limits imposed by our understanding of the stock's potential productivity (50 CFR §600.310 (e)(4)(ii)(B)). The mean generation time for for POP is the mean age weighted by spawning output (Punt and Ianelli 2001). There is a legal mandate to rebuild within ten years if T_{MIN} is estimated to be less than or equal to ten years.

Scientific uncertainty exists for every aspect of rebuilding and thus influences success and failure of rebuilding. Uncertainty surrounds the estimation of parameters that define rebuilding targets and objectives, assessments of stock status and structure, projections of future recruitment and biomass, and evaluating how well management measures meet rebuilding objectives. All alternatives in this rebuilding plan (except *No Action*) assume the best available science. Ensuring the best available science is incorporated in Council decision-making is the role of the Council's Scientific and Statistical Committee (SSC) and therefore not analyzed specifically as a policy choice. However, recommendations for mitigating risk associated with scientific uncertainties are explored throughout this rebuilding plan.

This rebuilding plan generally analyzes alternative strategies and explores mitigating measures for achieving rebuilding targets and objectives. Specifically, this plan analyzes the tradeoffs (physical, biological, and socioeconomic) associated with alternative total fishing-related mortality limits (total catch OYs) and the management specifications (harvest controls and measures) to achieve these limits.

Area closures may be considered in this rebuilding plan. Currently such closures would be considered to move the fishery off POP hot-spots, and therefore reduce the total mortality of adult fish. The Council and NMFS are currently developing a policy for habitat based management that may result in modification to existing (or pending) closures, or other management measures intended to protect habitat deemed important to groundfish production. At issue in the development of this policy is the integration of habitat-based management with the harvest control management strategies that have historically been the foundation for Council actions. Alternative policies are being analyzed in a Programmatic EIS (contact Mr. Jim Glock, NMFS, (503) 231-2178). The policies adopted through the Programmatic EIS will be implemented through subsequent decisions such as implementation of the EFH provisions of the Magnuson-Stevens Act or the annual management process and may be utilized to acheive the mortality goals for Pacific ocean perch established in the rebuilding plan. Implementation of the EFH provisions is underway through another EIS that tiers off the Programmatic EIS. Publication of the draft action-specific EFH EIS is anticipated for August 2003 (contact Mr. Steve Copps, NMFS, (206) 526-6187).

TABLE 1-1. Estimated parameters/targets specified for rebuilding Pacific ocean perch. Data from Ianelli *et al.* (2000) and Punt and Ianelli (2001).

Rebuilding Parameter/Target	Estimate or proxy
T_0 (year declared overfished)	1999
T_{MIN} (minimum time to achieve B_{MSY} = mean time to rebuild at F = 0)	12 years
Mean generation time	30 years
T_{MAX} (maximum time to achieve $B_{MSY} = T_{MIN}$ + 1 mean generation time)	42 years
P_{MAX} (P to achieve B_{MSY} by T_{MAX}) 1/	70%
Most recent stock assessment	Ianelli *et al.* 2000
Most recent rebuilding analysis	Punt and Ianelli 2001
B_0 (estimated unfished biomass)	60,212 units of spawning output

TABLE 1-1. Estimated parameters/targets specified for rebuilding Pacific ocean perch. Data from Ianelli *et al.* (2000) and Punt and Ianelli (2001).

Rebuilding Parameter/Target	Estimate or proxy
$B_{CURRENT}$ (current estimated biomass)	13,066 units of spawning output in 1998
% Unfished Biomass	21.7% in 1998
MSST (minimum stock size threshold = 25% of B_0)	15,053 units of spawning output
B_{MSY} (rebuilding biomass target = 40% of B_0)	24,084 units of spawning output
MFMT (maximum fishing mortality threshold = F_{MSY})	$F_{50\%}$
Harvest control rule 1/	F = 0.0X
T_{TARGET} 1/	2027

1/ Under *Council Interim Rebuilding.*

2.0 PACIFIC OCEAN PERCH REBUILDING PLAN ALTERNATIVES

Pacific ocean perch rebuilding alternatives within MSA, FMP, and other legal constraints are analyzed in this rebuilding plan. The most risk-averse alternative (*Maximum Conservation*), most risk-prone alternative (*Maximum Harvest*), and alternatives with intermediate risk are compared with a *No Action* alternative. Probabilities of rebuilding within T_{MAX} vary between 60% and 80% in intermediate risk alternatives. All rebuilding alternatives except *No Action* consider the best available science for determining risk-neutral bycatch and discard rates. The best available science is anticipated to be direct observations of bycatch and discard in west coast groundfish fisheries. However, until these data are available to account for all sources of fishing-related mortality, the best available science is considered to be a bycatch/discard model developed by the Northwest Fisheries Science Center of the National Marine Fisheries Service (Hastie 2001). Assumed bycatch rates of POP in trawl fisheries targeting other species would be at the mid-point of the range estimated from log books and EDCP data (Hastie 2001) for all alternatives except *No Action.* Rebuilding parameter estimates and probabilities for all alternatives are derived in the most recent rebuilding analysis by Punt and Ianelli (2001, Appendix C-1) (Table 2-1). The median year when POP spawning biomass is projected to reach B_{MSY} under each alternative has been arbitrarily selected as the target rebuilding year (T_{TARGET}). Probabilities of rebuilding are relative to T_{MAX}, not T_{TARGET}. Rebuilding parameters estimated by Ianelli *et al.* (2000) and Punt and Ianelli (2001, Appendix C-1) are shown in Tables 1-1 and 2-1. The median year when POP spawning biomass is projected to reach B_{MSY} under each alternative is noted in Table 2-1. This is not to be construed as the target year for rebuilding the stock to B_{MSY} (T_{TARGET}). T_{TARGET} is a legal construct/policy choice falling within the Council/NMFS decision-making nexus. The choice of T_{TARGET} is constrained to fall between T_{MIN} and T_{MAX}. Probabilities of rebuilding for these rebuilding alternatives summarized in Table 2-1 are relative to, not T_{TARGET}. If it were assumed the median year of achieving B_{MSY} under the *Council Interim Rebuilding* alternative for POP was the Council's choice for T_{TARGET}, the probability of achieving B_{MSY} in 2027 (T_{TARGET} in this case) is 50% (= median) and the probability of achieving B_{MSY} by 2042 (T_{MAX}) is 70% . The probability of achieving B_{MSY} within T_{TARGET} (P_{TARGET}) can be increased by lowering the harvest rate (F) and constraining fisheries further. Relative risk and probability of rebuilding alternatives meeting rebuilding objectives is sensitive to our current state of knowledge and the harvest control rule (i.e., harvest rate) adopted as a rebuilding target and strategy. The harvest control rule varies between rebuilding alternatives analyzed in this rebuilding plan, the best available science informing decisions and our current state of knowledge does not. ***Note that T_{TARGET} has not been explicitly noted in Table 2-1 and is a choice before the Council.***

2.1 The *No Action* Alternative

The choice of the *No Action* alternative for POP was considered in terms of providing the most informative analysis of the consequences and tradeoffs of rebuilding the stock. Technically, a *No Action* alternative would be the action that would be taken in the absence of an approved rebuilding plan (or status quo). Under the strict context of that definition, *Council Interim Rebuilding* might be considered to represent status quo. For the purposes of this NEPA analysis *No Action* is considered to be the action prior to the Council approval of *Council Interim Rebuilding*, which is also analyzed.

Under the *No Action* alternative POP would be managed with specified trip limits and Council-adopted precautionary management measures. The harvest level would be based on the Council's default $F_{50\%}$ MSY proxy harvest rate and the precautionary "40-10" adjustment of the ABC to calculate a total catch OY. The total catch OY would be calculated using a fishing mortality rate of 0.0*XXX*. A *16*% discard rate (of landed catch) would be assumed for controlling bycatch mortality. The probability of achieving B_{MSY} by T_{MAX} is *X*%. The median year of reaching B_{MSY} is projected to be 20*XX*. No special consideration would be given to MPAs.

2.2 The *Maximum Conservation* Alternative

Under the *Maximum Conservation* alternative rebuilding would occur in the shortest time possible by setting the fishing mortality rate to zero for those fisheries under Council control. The tradeoff is the greatest socioeconomic impact occurs to fisheries and fishing-dependent communities in the Columbia and U.S.-

Vancouver INPFC areas (primarily in waters off Oregon and Washington) during the course of rebuilding. Bottom trawl fisheries (and any other fisheries under Council control that demonstrate a bycatch of POP) operating on the slope and edge of the continental shelf would be closed or modified to the point where targeted and incidental catch of POP did not occur. The target rebuilding period (T_{TARGET}) would be the minimum rebuilding time (T_{MIN} = 12 years) with the median year of reaching B_{MSY} projected to be 2012 (infers a 50% probability of the stock rebuilding by T_{MIN}). There would be no bycatch of POP since there is no fishing-related mortality. Potential habitat impacts would be minimized by eliminating fishing effort. A subsequent decision-making process to implement the EFH provisions of the MSA would be utilized to determine if additional habitat based management measures were necessary to enhance productivity of the stock.

2.3 The *Maximum Harvest* Alternative

Under the *Maximum Harvest* alternative rebuilding would occur in the maximum allowable time (T_{MAX}), thereby allowing the maximum allowable harvest under rebuilding. A minimal impact would be expected on existing slope and shelf fisheries and dependent fishing communities, but at a cost of the slowest legal rebuilding schedule allowed by the FMP, MSA, and the National Standard Guidelines. The target rebuilding period (T_{TARGET}) would be the maximum rebuilding time (T_{MAX} = 42 years) with the median year of reaching B_{MSY} projected to be 2042. The *Maximum Harvest* alternative has a 50% probability of rebuilding within T_{MAX}. The total catch OY would be calculated using a fishing mortality rate of 0.0109. No special consideration would be given to MPAs.

2.4 The *60%* Alternative

Under the *60%* alternative there would be a 60% probability of rebuilding within T_{MAX}. The target rebuilding time (T_{TARGET}) would be 34 years with the median year of reaching B_{MSY} projected to be 2034. The total catch OY would be calculated using a fishing mortality rate of 0.0096. Consideration may be given to area closures that move the fishery off POP hotspots and reduce total mortality.

2.5 The 70% or *Council Interim Rebuilding* Alternative

Under the *Council Interim Rebuilding* alternative there would be a 70% probability of rebuilding within T_{MAX}. This alternative was the one the Council selected in 2001 as its preferred alternative for rebuilding POP. This analysis does not presume this is still the Council's preferred alternative. The target rebuilding time (T_{TARGET}) would be 27 years with the median year of reaching B_{MSY} projected to be 2027. The total catch OY would be calculated using a fishing mortality rate of 0.0082. Consideration may be given to area closures that move the fishery off POP hotspots and reduce total mortality.

2.6 The *80%* Alternative

Under the *80%* alternative there would be an 80% probability of rebuilding within T_{MAX}. The target rebuilding time (T_{TARGET}) would be 22 years with the median year of reaching B_{MSY} projected to be 2022. The total catch OY would be calculated using a fishing mortality rate of 0.0068. Consideration may be given to area closures that move the fishery off POP hotspots and reduce total mortality.

2.7 The *Mixed Stock Exception* Alternative

Under the *Mixed Stock Exception* alternative, rebuilding constraints would not be imposed thereby allowing overfishing of POP. The mixed stock exception is a provision in National Standard Guideline 1 allowing an increased OY above the overfishing level as long as the harvest meets certain standards. Harvesting one species of a mixed-stock complex at its optimum level may result in the overfishing of another stock component in the complex. The Council may decide to permit this type of overfishing only if all of the following conditions are satisfied:

(a) The Council demonstrates by analysis that such action will result in long-term net benefits to the Nation.

(b) The Council demonstrates by analysis that mitigating measures have been considered and that a similar level of long-term net benefits cannot be achieved by modifying fleet behavior, gear selection/ configuration, or other technical characteristic in a manner such that no overfishing would occur.

(c) The resulting rate or level of fishing mortality will not cause any species or evolutionarily significant unit thereof to require protection under the Endangered Species Act.

Since this stock does not constrain fisheries to the extent that darkblotched rockfish constrain slope fisheries and yelloweye rockfish constrain fisheries on the edge of the shelf, POP are not considered to meet the standards of the *Mixed Stock Exception* provision.

2.8 Alternatives Considered But Rejected

Any alternatives with less than a 50% probability of rebuilding to B_{MSY} within the maximum allowable rebuilding time (T_{MAX}) are not compliant with the MSA as interpreted in a 2000 ruling in the X Circuit Federal Court (*American Oceans Campaign v. Daley*). Such alternatives are not analyzed in this rebuilding plan. The *No Action* alternative has a probability of rebuilding to B_{MSY} of less than 50%, but is still analyzed as per NEPA requirements. The *Mixed Stock Exception* was also considered but rejected since the POP stock does not currently constrain slope or shelf fisheries.

TABLE 2-1. Rebuilding parameters associated with Pacific ocean perch rebuilding alternatives.

Alternative	F rate	Probability of rebuilding within T_{MAX}	Mean year of reaching B_{MSY}	T_{TARGET}
No Action	0.0*XXX*	*X*%	20*XX*	20***XX***
Maximum Conservation	0.0000	approaches 100%	2012	20***XX***
Maximum Harvest	0.0109	50%	2042	20***XX***
60%	0.0096	60%	2034	20***XX***
Council Interim Rebuilding	0.0082	70%	2027	20***XX***
80%	0.0068	80%	2022	20***XX***

[GMT/Punt: determine missing values for No Action in Table 2-1 after resolving the parameters used in No Action; all T_{TARGET}s to be determined by the Council]

3.0 AFFECTED ENVIRONMENT

3.1 Physical Environment

3.1.1 Pacific Ocean Perch Habitat

Pacific ocean perch are distributed from Japan and the Bering Sea to La Jolla, California, although they are uncommon south of Oregon (Eschemeyer *et al.* 1983). The species is most abundant on the northern end of their range in northern British Columbia, Gulf of Alaska, and the Aleutian Islands (NMFS *et al.* 1998). They are abundant offshore in depths of 55-825 m with adults primarily found along the upper continental slope and shelf edge in depths of 100-450 m. They are classified as an outer shelf-mesobenthal species (Allen and Smith 1988).

Larvae and juveniles are pelagic (reside in the water column). Larvae are released at dusk, 20-30 m off the bottom in depths of 360-400 m, and rise to midwater depths of 215-275 m. Early POP studies suggest that after release, larvae immediately move to surface waters. However, recent research off British Columbia indicates that larvae remain at depth for extended periods and gradually move to shallower waters over several months (Leaman 2002). Juvenile POP are found in the shallow and intermediate portion of their bathymetric range until age ten. They tend to aggregate over rough or rocky bottoms.

Subadults and adults are benthopelagic (reside near the bottom and up in the water column). Adults are generally associated with gravel, rocky, or boulder substrates found in and along gullies, canyons, and submarine depressions; they may also occur on smooth substrates. Adults primarily inhabit waters 180-220 m in depth during summer months, but migrate to deeper waters (>275 m) in the fall and winter months to spawn and give birth. Research off British Columbia suggests that POP prefer a temperature range of 4-7°C (Scott 1995).

3.1.2 Human Effects on Rockfish Habitat

Potential fishing-related impacts to rockfish habitat are incurred from direct disturbance of the seafloor from contact by actively-fished, lost, or discarded fishing gear. The most common bottom fishing gears associated with seafloor disturbance on the west coast are trawl nets, longlines, and fish traps.

Auster and Langton (1999) reviewed a variety of studies reporting habitat effects due to fishing for a wide range of habitats and gear types. Commonalities of all studies included immediate effects on species composition and diversity and a reduction of habitat complexity.

Bottom trawling gear is known to modify seafloor habitats by altering benthic habitat complexity and by removing or damaging infauna and sessile organisms (Freese *et al.* 1999, Friedlander *et al.* 1999). In a study High-resolution sidescan sonar images on the shelf and slope off Eureka, California, revealed deep gouges on the seafloor believed to be caused by trawl doors (Friedlander *et al.* 1999). The effects of bottom trawling on a "hard bottom" (pebble, cobble, and boulder) seafloor were also investigated in the Gulf of Alaska where a significant number of boulders were displaced and emergent epifauna were removed or damaged after a single pass with trawl gear. Casual observations during the Freese *et al.* (1999) study revealed that *Sebastes* species use cobble-boulder and epifaunal invertebrates for cover. When boulders are displaced they can still provide cover, but when piles of boulders are displace it reduces the number and complexity of crevices (Freese *et al.* 1999).

Limited qualitative observations of fish traps, longlines, and gill nets dragged across the seafloor during set and retrieval were similar to observations of bottom trawling gear, in that some types of organisms living on the seabed were dislodged. Quantitative studies of acute and chronic effects of fixed gear on habitat have not been conducted (Auster and Langton 1999).

In addition to fishing activities, humans have many other direct and indirect effects on fish habitat. While non-fishing human impacts have not been directly assessed on POP habitat, a study of flatfish in Puget

Sound, Washington indicated that anthropogenic stressors included chemical contaminant exposure and alteration of nearshore nursery habitats (Johnson *et al.* 1998). The New England Fishery Management Council compiled a list of human-induced threats to fish habitat that may be used as a guide to factors affecting groundfish species off the west coast. Oil, heavy metals, acid, chlorine, radioactive waste, herbicides and pesticides, sediments, greenhouse gases, and ozone loss are thought to be chemical factors that affect fish habitat. Biological threats can include the introduction of non-indigenous species, stimulation of nuisance and toxic algae, and the spread of disease. Human activities that may physically threaten fish habitat are dredging and disposal, mineral harvesting, vessel activity, shoreline alteration, and debris disposal (Wilbur and Pentony 1999).

Marine debris has also been recognized as posing a risk to marine organisms via entanglement and ingestion. Seafloor debris was surveyed from Point Conception, California to the U.S. - Mexico border at depths of 10 to 200 m and anthropogenic debris occurred on approximately 14 percent of the mainland shelf. Of the debris sampled, discarded fishing gear had the largest spatial coverage, followed by plastic, metal, and other debris (e.g., shoe soles and automobile parts) (Moore and Allen 1999). Less is known about the quantity of marine debris off Washington and Oregon, but it may be at levels that could negatively affect marine organisms.

As more information is gathered about the effects of fishing and non-fishing human activities on POP habitat, additional management measures may be taken.

3.2 Biological Environment

TABLE 3-1. Biological reference points for Pacific Ocean Perch.

Biological Reference Point	Value
Maximum age	98 years
Maximum length	54 cm
Maximum weight	2 kg
Age at 50% maturity	8 yrs females
Length at 50% maturity	
Natural mortality rate (M)	

3.2.1 Pacific Ocean Perch Life History

Pacific ocean perch have a low potential productivity and a very low population resilience with a minimum population doubling time of more than 14 years (Musick *et al.* 2000). Genetic analyses suggest a significant mixing of the population across the species' range (Wishard *et al.* 1980; Seeb and Gunderson 1988). This could be explained by a widespread dispersal of larvae and juveniles transported to deeper waters in a prolonged pelagic phase. *[confirm mtDNA evidence of some genetic stock structuring in AK and BC?]*

Adult POP make seasonal onshore migrations to feeding grounds in shallower water (180-220 m) during June to August to allow gonads to ripen. They form large schools as much as 30 m wide, 80 m deep, and 1,300 m long. They then migrate offshore to spawn in deeper water (>275 m) in large spawning aggregations. Spawning occurs in September and October in Washington and British Columbia waters. Pacific ocean perch are viviparous (bear live young) and eggs are internally fertilized. Young are born in January and February off Oregon (Hitz 1962) and one to three months later in the season in more northern waters (Westrheim 1970). Larvae Juveniles remain pelagic for two or three years before becoming demersal (Alverson and Westrheim 1959). Juvenile POP form ball-shaped schools near the surface or hide in rocks. Pacific ocean perch migrate to deeper waters as they mature and attain adulthood on the continental slope.

Pacific ocean perch are carnivorous. Larvae eat small zooplankton. Small juveniles eat copepods and larger juveniles feed on euphausiids. Adults eat euphausiids, shrimps, squids, and small fishes. Adults occurring shallower than 150 m feed during the day; those at greater depths move toward the surface to feed at dawn and dusk. Immature fish feed throughout the year, but adults feed only seasonally, mostly April-August. Predators of POP include sablefish (*Anoplopoma fimbria),* Pacific halibut (*Hippoglossus stenolepis*), (*Physeter catodon*), and albacore tuna (*Thunnus alalunga*).

Pacific ocean perch are slow growing, long-lived, and late to mature. Larvae are 5-8 mm SL (standard length) at birth and the larval period lasts several weeks. Juveniles range up to 22-35 cm depending on sex and region *[larger fish further south?]*. Growth is slower for males. Largest size is about 54 cm and 2 kg. Maximum age of POP has been revised upwards with recent advances in ageing techniques. Gunderson (1977) originally estimated a maximum age of 30 years for POP. However, estimated longevity using the break and burn technique of ageing otoliths indicate POP can live up to 98 years (Heifetz *et al.* 2000). Estimated age at 50% maturity of POP is 10 years (Heifetz *et al.* 1997). *[Ianelli et al. 2000 indicate age at 50% mat. of 8 years; no ref?]* Relatively small numbers of young are produced during parturition with only about 300,000 for a female of 20 years of age (Frimodt 1995).

3.2.2 Pacific Ocean Perch Stock Status

The first POP stock assessments were done

Ianelli and Zimmerman (1998) estimated POP female spawning biomass in 1997 was 13% of it's unfished level, thereby confirming the stock was overfished. The NMFS formally declared POP overfished in March 1999 pursuant to the MSA, FMP, and National Standard Guidelines. The Council adopted and NMFS enacted more conservative management measures in 1999 as part of a redoubled rebuilding effort.

A new assessment for POP was done in 2000 which indicated the stock was more productive than originally thought (Ianelli *et al.* 2000).

A revised POP rebuilding analysis was completed and adopted by the Council in 2001 (Punt and Ianelli 2001, Appendix C-1). This analysis estimated a T_{MIN} of 12 years and a T_{MAX} of 42 years. It was noted in the rebuilding analysis the ongoing retrospective analysis of historic foreign fleet catches (Rogers In Prep.) is likely to change projections of POP rebuilding downward.

3.3 Socioeconomic Environment

[to be completed before public review]

3.3.1 Fisheries and Management History

Pacific ocean perch were harvested exclusively by U.S. and Canadian vessels in the Columbia and Vancouver INPFC areas prior to 1965. Large Soviet and Japanese factory trawlers began fishing for POP in 1965 in the Vancouver area and in the Columbia area a year later. Intense fishing pressure by these foreign fleets occurred during the 1966-1975 period (Figure 3-1). The foreign fishery ended in 1977 after passage of the MSA and the transition to a domestic fishery.

The POP resource off the west coast was overfished before implementation of the Pacific Coast Groundfish FMP. Large removals of POP in the foreign trawl fishery, followed by significant declines in catch and abundance led the Council to limit harvest beginning in 1979. A 20-year rebuilding plan for POP was adopted in 1981. Rebuilding under the original plan was largely influenced by a cohort analysis of 1966-1976 catch and age composition data (Gunderson 1979), updated with 1977-1980 data (Gunderson 1981), and an evaluation of trip limits as a management tool (Tagart *et al.* 1980). This was the first time trip limits were used by the Council to discourage targeting and overharvest of an overfished stock. This is a management strategy still in use today in the west coast groundfish fishery (Table 3-X). *[insert Table 3-X: trip limits for POP by year]* The allowable catch (optimum yield) for POP was also lowered significantly. After twenty years of rebuilding under the original plan, the stock was stabilized at a lower equilibrium than estimated in the pre-fishing condition. While continuing stock decline was abated, rebuilding was not achieved as the stock failed to increase in abundance to B_{MSY}.

3.3.2 Fishing Communities

[to be completed before public review]

4.0 ENVIRONMENTAL CONSEQUENCES

This rebuilding plan EIS analyzes the effects of alternative strategies for rebuilding Pacific ocean perch on the probability of successful stock rebuilding, co-occurring species, affected habitat, and the socioeconomic environment (Table 4-1).

TABLE 4-1. Ranked relative effects of alternative Pacific ocean perch rebuilding strategies of potential negative habitat impacts, the probability of rebuilding by T_{MAX}, and short term economic costs (1 is highest rank, 6 is lowest rank).

Alternative	Potential Negative Habitat Effects	Probability of Rebuilding by T_{MAX}	Short Term Economic Costs
No Action	1	6	6
Maximum Conservation	6	1	1
Maximum Harvest	2	5	5
60%	3	4	4
Council Interim Rebuilding	4	3	3
80%	5	2	2

4.1 Affected Pacific Ocean Perch Habitat Including Essential Fish Habitat

Alternative rebuilding strategies have varying effects on the rocky bottom habitats of the continental shelf and slope where POP reside, primarily due to the extent fishing activities are affected but also to the degree MPAs are considered. The *No Action* alternative would have the greatest potential impact on POP habitats since a greater fishing intensity would ensue and no consideration would be given to MPAs to aid in controlling fishing-related mortality or protect EFH. The *Maximum Conservation* alternative would have the least habitat impact since it eliminates fisheries that target or incidentally catch POP and therefore eliminates potential fishing-related habitat impacts. Conversely, the *Maximum Harvest* alternative allows the maximum harvest under rebuilding constraints and therefore creates a greater potential disturbance to POP habitat from a greater intensity of fishing effort relative to all rebuilding alternatives other than *No Action*. There would also be no special consideration given to MPAs to control total mortality and protect EFH. The intermediate risk alternatives (*60%*, *Council Interim*, and *80%*) would have intermediate effects relative to the "maximum" alternatives.

Pacific ocean perch, as with many of the *Sebastes* species, have strong habitat affiliations with rocky habitats and other bottom structures. Gunderson (*pers. comm.*) suggests that MPAs designed to protect submarine canyons and other high relief, rocky habitats on the edge of the continental slope could be effective measures for reducing fishing-related mortality and enhancing productivity of the stock. Depth-based restrictions or incentives may also be effective in displacing trawl effort away from POP habitats.

Population productivity could be enhanced by protecting these habitats through the use of MPAs. This may be true globally for rockfish and other west coast groundfish species. Programmatic measures designed to identify, protect, and minimize potential fishing impacts on west coast rockfish EFH will be analyzed in the Supplemental EIS in preparation by NMFS. Any habitat protection measures identified in the EFH Supplemental EIS that can be applied to encourage rebuilding POP either through reducing total mortality or enhancing population productivity should be seriously considered as an adjunct to other harvest control measures analyzed in this plan.

Bottom trawl operations on the slope and edge of the continental shelf would most affect POP habitats. The relative effects of POP rebuilding alternatives on these habitats resulting from the amount of physical contact with the bottom are assumed to be with duration of trawl gear bottom contact in sensitive rocky habitats and gear type. The relative fishing intensity of POP rebuilding alternatives is assumed to be correlated with potential negative habitat effects. The ranking of POP rebuilding alternatives by their assumed relative effect on these habitats (Table 4-1) is on this basis.

Since bottom trawl operations account for over 99% of recent POP catches, associated trawl fishery impacts should be the focus of mitigating potentially negative habitat effects. Small footrope and chafing gear restrictions are believed to reduce potentially harmful effects of bottom trawls in rocky shelf habitat (National Academy Press 2002) and should be considered. To the extent that fixed gear and other potential fishery impacts to POP habitat can be avoided or mitigated, a modest benefit could also be anticipated.

4.2 Affected Biological Environment

4.2.1 Controlling Fishing-Related Mortality of Pacific Ocean Perch

Successful stock rebuilding depends on the ability of management/rebuilding measures to effectively control all sources of fishing-related mortality, including landed catch and bycatch. All rebuilding alternatives analyzed in this EIS has a calculated total catch OY to accommodate landings of unavoidable incidental catch of POP (except the *Maximum Conservation* alternative which has a total catch OY of 0 mt). The effectiveness of all rebuilding strategies (given the probabilistic trajectories of future increases in biomass relative to B_{MSY}) depends on managing POP fishing-related mortality within prescribed total catch OYs. Landed catch allowances for all overfished species are designed to minimize target opportunities on these species while allowing landings of unavoidable bycatch that would otherwise be discarded dead at sea. Management measures consistent with rebuilding should have harvest control rules that are enforceable and effectively stay within total catch targets. Harvest control rules and management measures commensurate with alternative rebuilding strategies will be specifically analyzed in this rebuilding plan EIS. Potential management measures that are likely to reduce all sources fishing-related mortality are also discussed.

Landed catch accounting and control

Landed catch accounting and control methods are considered relatively effective. Sorting requirements are in place for POP. This requires accounting for the weight of landed POP when catches are hailed at sea or landed. Landings are recorded on state fish receiving tickets. Landings and state port sampling data are reported in-season to the PacFIN database managed by the Pacific States Marine Fisheries Commission (PSMFC; www.psmfc.org/pacfin/index.html). The Council's Groundfish Management Team (GMT) and PSMFC manage the Quota Species Monitoring (QSM) dataset reported in PacFIN. All landings of groundfish stocks of concern (overfished stocks and stocks below B_{MSY}) and target stocks and stock complexes in west coast fisheries are tracked in QSM reports of landed catch. The GMT recommends prescribed landing limits and other in-season management measures to the Council to attain, but not exceed total catch OYs of QSM species. Stock and complex landing limits are modified in-season to control total fishing-related mortality; QSM reports and landed catch forecasts are used to control the landed catch component. These landed catch accounting and control mechanisms are used for all rebuilding alternatives including *No Action.*

Bycatch accounting and control

Limiting bycatch (defined as dead discard) to the extent practicable is a MSA mandate. Effective bycatch accounting and control mechanisms are also critical for staying within target total catch OYs. The first element in limiting bycatch is accurately measuring bycatch rates by time and area. Bycatch rates of POP in west coast trawl (and non-trawl) fisheries are uncertain. The NMFS first implemented a west coast Groundfish Fishery Observer Program in August 2001 to make direct observations of commercial groundfish targeting efforts. Observer coverage extends to about 10% of the west coast fleet currently, but should approach 20% by the summer of 2002 (E. Clarke, NMFS NWFSC, pers. comm.). Given the skewed distribution of bycatch in west coast groundfish fisheries, many observations in each sampling strata (i.e. target effort by gear type by area) will be needed to estimate representative rates of POP bycatch. Therefore, NMFS has stated that Observer Program data probably won't be available for management use until the summer of 2003 at the earliest. There may be a period when a combination of Observer Program data and the best currently available methods for estimating bycatch are used to estimate bycatch.

Currently, the best available science that informs managers of bycatch and discard rates of POP in the groundfish fishery is a model (Hastie model) that uses logbook and EDCP data to estimate coincident catch rates in target trawl efforts for other species (Hastie 2001). The Hastie model estimates bycatch rates (defined as coincident catch rates in this context) of POP in two-month blocks. The seasonality of bycatch is an important management consideration. Target opportunities for healthy flatfish and DTS species vary seasonally and geographically. It is reasonable to expect bycatch rates of POP to vary in accordance with the concurrence of target species and POP. In November 2001, the Council adopted the Hastie model to use for bycatch accounting and control starting in 2002.

The Council selected and NMFS approved the use of the mid range of considered POP bycatch rates to seasonally adjust landing limits to limit bycatch of POP starting in 2002 (Table 4-2). The high range was not considered plausible because accepting it would assume that vessels discard significant quantities of POP before they reach their trip limits (Hastie 2001). The low range was considered less plausible than the mid range because that scenario implied a projected catch that is lower than actual recorded catch. The extent that this bycatch rate is a reasonable proxy for POP in lieu of direct (contemporary) observations of fishery interceptions is unknown. In this analysis, the mid range of bycatch rates is considered the most plausible and risk neutral. Bycatch rates from the Hastie model are applied to landed weight of the target species in the target fisheries depicted in Table 4-2 to estimate seasonal bycatch of POP. *[NOTE: check bycatch rates for South of Cape Mendocino in Table 4-2]*

All rebuilding plan alternatives except *No Action* and *Maximum Conservation* use the mid range of bycatch rates estimated in the Hastie model to estimate POP bycatch (Table 4-2). The *No Action* alternative assumes a 16% bycatch/discard rate for POP. This is a proxy for POP that was originally estimated for widow rockfish from trawl observations in the mid-1980s (Pikitch *et al.* 1988). The *Maximum Conservation* does not rely on modeled bycatch or any other bycatch accounting mechanism since all fishing-related mortality is eliminated. It is anticipated that all rebuilding alternatives will benefit from direct observations of bycatch. Rebuilding measures should always use the best available estimates of bycatch.

TABLE 4-2. Bycatch rates by target trawl fishery north and south of Cape Mendocino and two-month fishing period estimated for Pacific ocean perch (from the Hastie (2001) predictive model used to estimate bycatch starting in 2002). Council adopted rates are in the mid range.

Target fishery	2-mo. period	North of Cape Mendocino			South of Cape Mendocino		
		Low	Mid	High	Low	Mid	High
Arrowtooth	1	0.60%	2.30%	4.00%	NA		
	2	0.70%	2.85%	5.00%			
	3	2.00%	3.50%	5.00%			
	4	0.70%	1.35%	2.00%			
	5	1.00%	3.00%	5.00%			
	6	0.60%	2.30%	4.00%			
Petrale	1	0.70%	1.25%	1.80%	0.01%	0.00%	0.05%
	2	3.00%	5.00%	7.00%	0.01%	0.00%	0.05%
	3	0.15%	0.30%	0.45%	0.01%	0.00%	0.05%
	4	0.20%	0.45%	0.70%	0.01%	0.00%	0.05%
	5	0.90%	1.70%	2.50%	0.01%	0.00%	0.05%
	6	1.40%	3.20%	5.00%	0.01%	0.00%	0.05%
Flatfish	1	0.50%	1.75%	3.00%	0.01%	0.00%	0.05%
	2	2.40%	3.20%	4.00%	0.12%	0.23%	0.35%
	3	2.80%	4.40%	6.00%	0.01%	0.00%	0.05%
	4	1.00%	2.25%	3.50%	0.01%	0.00%	0.05%
	5	2.30%	3.40%	4.50%	0.01%	0.00%	0.05%
	6	1.20%	1.55%	1.90%	0.01%	0.00%	0.05%
Widow/Yellowtail	1	0.01%	0.03%	0.05%	0.01%	0.00%	0.05%

TABLE 4-2. Bycatch rates by target trawl fishery north and south of Cape Mendocino and two-month fishing period estimated for Pacific ocean perch (from the Hastie (2001) predictive model used to estimate bycatch starting in 2002). Council adopted rates are in the mid range.

Target fishery	2-mo. period	North of Cape Mendocino			South of Cape Mendocino		
		Low	Mid	High	Low	Mid	High
	6	0.01%	0.03%	0.05%	0.01%	0.00%	0.05%
DTS	1	0.05%	0.53%	1.00%	0.01%	0.00%	0.05%
	2	0.60%	1.30%	2.00%	0.01%	0.00%	0.05%
	3	1.40%	2.20%	3.00%	0.01%	0.00%	0.05%
	4	1.30%	1.90%	2.50%	0.01%	0.00%	0.05%
	5	0.40%	0.70%	1.00%	0.01%	0.00%	0.05%
	6	0.50%	1.00%	1.50%	0.01%	0.00%	0.05%
Chilipepper	1	NA			0.01%	0.00%	0.05%
	2				0.03%	0.06%	0.10%
	3				0.01%	0.00%	0.05%
	4				0.01%	0.00%	0.05%
	5				0.01%	0.00%	0.05%
	6				0.01%	0.00%	0.05%
Slope rockfish	1	5.00%	7.50%	10.00%	0.01%	0.00%	0.05%
	2	10.00%	17.50%	25.00%	0.01%	0.00%	0.05%
	3	10.00%	17.50%	25.00%	0.01%	0.00%	0.05%
	4	15.00%	27.50%	40.00%	0.01%	0.00%	0.05%
	5	15.00%	27.50%	40.00%	0.01%	0.00%	0.05%
	6	5.00%	7.50%	10.00%	0.01%	0.00%	0.05%
Leftover [1/]	1	3.00%	11.50%	20.00%	0.01%	0.00%	0.05%
	2	0.50%	2.75%	5.00%	0.01%	0.00%	0.05%
	3	3.00%	5.00%	7.00%	0.01%	0.00%	0.05%
	4	1.50%	10.75%	20.00%	0.01%	0.00%	0.05%
	5	2.50%	4.25%	6.00%	0.01%	0.00%	0.05%
	6	1.30%	5.65%	10.00%	0.01%	0.00%	0.05%

[1/] Leftover encompasses all bycatch not assigned to a target trawl fishing opportunity according to the criteria imposed by Hastie (2001).

Potential rebuilding measures to consider

Measures that would effectively displace fisheries with a relatively high incidence of POP catch or other fishery/gear modifications should be considered to reduce fishing-related mortality. These measures would affect rebuilding through reducing risk of considered rebuilding alternatives in terms of achieving target fishing harvest rate (F) and therefore, the specified total catch OY.

Depth-based restrictions and/or incentives to fish in deeper waters outside the depth range of greatest POP density *[GMT to evaluate logbooks to determine this depth range]* would likely reduce risk in controlling fishing-related mortality through avoidance. Allowing fishing in waters deeper than most POP are found could be done with a vessel monitoring system (VMS). A VMS tracks boats equipped with satellite transponders to be remotely tracked from on-shore stations. A VMS may be feasible for managing west coast groundfish fisheries, given that VMS is already used in the management of some west coast marine fisheries such as the commercial albacore fishery. Some groundfish fisheries in the Aleutian Islands and Bering Sea currently use VMS to restrict the fishery to certain areas or depths. The cost of installing VMS to manage the deep water trawl fleet needs to be considered. Such systems are expensive to set up, maintain, and operate. However, relative to the foregone benefits of prosecuting fisheries, this cost may be rationalized. To the extent that incentives to fish outside the depth range of POP could be structured, some or all of the costs associated with implementing a VMS system for the west coast groundfish fishery could be born by the industry. For instance, higher landing limits for deeper water species that are considered healthy, such as longspine thornyhead (*Sebastolobus altivelis*) or any of the other DTS species could be considered with a depth-based restriction. Revenue from these higher landing limits could help offset the costs of implementing VMS.

Depth-based restrictions without safeguard controls like VMS raise enforcement concerns. An on the water presence is more difficult in the deeper offshore areas where the slope fishery would need to be displaced to effectively reduce POP bycatch. Without remote tracking of distant water vessels or effective enforcement, depth-based restrictions would not reliably reduce potential fishing pressure on POP. Displacement of vessels to deeper and more distant offshore locations also raises a general safety concern. If smaller vessels are displaced further offshore, there is a higher likelihood of accident and loss of life while conducting fishing operations. Such displacement also increases fuel and operating expenses which tend to decrease net economic benefits from the fishery.

Gear modifications should be considered that might be more effective in targeting healthy species while minimizing bycatch of overfished species such as POP. The small footrope restriction (trawl footropes ≤ 8 inches in diameter; no anti-chafing gear) has been used on the west coast to minimize bycatch of overfished shelf rockfish species such as canary and yelloweye rockfish. Trawls under the small footrope restriction cannot effectively fish on the bottom in rocky habitats. Shelf rockfish landings by trawls under the small footrope restriction (adopted in 2000) have been significantly reduced. The fact that landings of shelf rockfish on a per vessel basis have been generally less than allowable trip limits validates the assumed effectiveness of this measure. A similar small footrope restriction in slope trawl fisheries to land any slope rockfish may reduce fishing-related mortality of POP and other slope rockfish. This measure could be specified north of Cape Mendocino only to be potentially effective for POP. However, some slope trawl fisheries would be compromised if small footrope restrictions were imposed to land all groundfish species. Larger footropes are required to effectively fish abundant flatfish species (i.e., Dover sole, petrale sole in the winter) on the silty mud bottoms of the abyssal plain on the outer slope. Small footropes dig into these soft substrates which are softer than the sandier, more compact depositional shelf bottoms outside rocky reefs. Larger footropes tend to "float" on the mud and more effectively catch target flatfish species. If these gears could be effectively restricted to softer mud bottom habitats on the slope, POP and other slope rockfish could be avoided. Spatial mapping of these habitat types does not currently exist on any reasonable scale to consider such measures.

Other gear modifications that may more cleanly target harvestable shelf species include trawls with reduced mouths (smaller height and width dimensions) and cutback headropes. The ODFW has experimented with such trawls designed to target flatfish (M. Saelens, ODFW, pers. comm.). Initial results from comparative research tows with these experimental bottom trawls (29 paired tows with experimental and conventional trawls) on the shelf off Oregon were promising (+60% Dover sole in experimental nets, -76% canary rockfish in experimental nets, and -72% redstripe rockfish in experimental nets). These preliminary results suggest this gear more efficiently catches flatfish while reducing bycatch of shelf rockfish. Further evaluation of this gear is planned in deeper water during the summer of 2002. An additional 150 hours of effort on the slope is planned with an expected catch of 0.16 mt of POP. Effectiveness of this gear in catching abundant flatfish on the slope while avoiding slope rockfish will clearly benefit POP rebuilding.

More accurate bycatch accounting coupled with such measures as discard caps could significantly reduce fishing-related mortality of POP and other overfished groundfish species. The NMFS Observer Program could be linked with a program of mandatory full retention of rockfish during commercial fishing activities on the slope to increase accuracy in estimating total catch. This could ensure rebuilding total catch OYs are not exceeded while attempting to access harvestable groundfish species on the slope such as DTS and deep water flatfish. Mandatory rockfish retention and observer coverage might allow greater flexibility for managers to consider fishing opportunities that might otherwise be considered risky. As long as total catch controls are reliable and responsive to rapid changes in the fishery, such explorations may be acceptably risk-averse.

Pacific ocean perch on the west coast south of the U.S. - Canadian border are part of a larger stock assemblage, most of which is managed outside of Council jurisdiction. British Columbia annual landings are over twenty times the magnitude of west coast landings. It is unclear whether the cumulative fishing-related mortality across the stock's range is consistent with that mandated under MSA, FMP, NMFS National Guidelines, and U.S. legal authorities. The relative biomass of POP across the multiple management jurisdictions in the northeast Pacific is also unknown. Coordinated and consistent assessment and management should be explored with the Canadian Department of Fisheries and Oceans.

Cooperative management could benefit POP rebuilding in waters off the west coast of the U.S. as well as in foreign waters. It is conceivable that POP rebuilding might not be attainable in west coast U.S. waters if harvest rates exceed biologically-sustainable rates in waters outside Council jurisdiction.

Risk and probability associated with effectiveness of rebuilding alternatives *[incorporate in above discussion]*

The relative probabilities of rebuilding alternatives achieving B_{MSY} by T_{MAX} (successful rebuilding) are ranked in Table 4-1. Associated probabilities of successful rebuilding and the mean year of achieving B_{MSY} are depicted in Table 2-2. The *Maximum Conservation* alternative has the greatest probability of successful rebuilding. In the absence of fishing, the mean year the stock is predicted to reach $B_{40\%}$ is 2012, well before the maximum time to rebuild of 2042. In contrast, the *Maximum Harvest* alternative extends rebuilding to T_{MAX} with a 50% probability of rebuilding within T_{MAX}. Rebuilding under this alternative is predicted to occur by 2042. The *Council Interim Rebuilding* alternative has a 70% probability of rebuilding within T_{MAX} and a median target year of achieving $B_{40\%}$ by 2027. The *No Action* alternative is not predicted to achieve rebuilding within T_{MAX}. The probability of achieving target biomass by T_{MAX} under *No Action* is X%, which is less than the legal mandate of 50%.

4.2.2 Species Co-occurring With and Potentially Affected by Rebuilding Pacific Ocean Perch

Pacific ocean perch are part of the northern slope rockfish complex (Table 4-3) and are primarily associated with these rockfish species. The deep water trawl fishery targeting Dover sole (*Microstomus pacificus*), shortspine and longspine thornyheads (*Sebastolobus alascanus* and *S. altivelis*, respectively), and sablefish (collectively referred to as the DTS complex) incidentally catch POP. There are also strong seasonal associations with other deepwater flatfishes caught in bottom trawl fisheries that incidentally catch POP, such as petrale sole (*Eopsetta jordani*) in the winter and rex sole (*Errex zachirus*), and, to a lesser extent, English sole (*Pleuronectes vetulus*).

TABLE 4-3. Rockfish species found on the U.S. west coast continental slope north of Cape Mendocino, California.

Common name	Scientific name	Common name	Scientific name
Principal Species		Secondary Species	
Aurora rockfish	*Sebastes aurora*	Bank rockfish	*Sebastes rufus*
Darkblotched rockfish	*Sebastes crameri*	Blackgill rockfish	*Sebastes melanostomus*
Pacific ocean perch	*Sebastes alutus*		
Redbanded rockfish	*Sebastes babcocki*		
Rougheye rockfish	*Sebastes aleutianus*		
Sharpchin rockfish	*Sebastes zacentrus*		
Shortraker rockfish	*Sebastes borealis*		
Splitnose rockfish	*Sebastes diploproa*		
Yellowmouth rockfish	*Sebastes reedi*		

4.3 Biodiversity and Ecosystem Function

Biodiversity and ecosystem functions of slope rockfish assemblages are poorly understood. Predator-prey, ecological niche, and competitive species interactions are ecosystem considerations. The potentially high biomass in a healthy POP population can serve to increase productivity of important predators such as halibut, sablefish, albacore tuna, and whales. Increased abundance of POP could also displace other marine species by competing for space and forage. Other slope rockfish (Table 4-3) might be affected by variation in POP abundance. Data informing the long term trends in relative biomass of rockfish and other species inhabiting the continental shelf and slope are not reliable.

Brodeur, R.D., and P.A. Livingston. 1988. Food habits and diet overlap of various eastern Bering Sea fishes. NOAA Tech. Memo NMFS F/NWC 127. 76 pp. *Addresses POP trophic interactions (from www.fishbase.org)?*

4.4 Affected Socioeconomic Environment

[to be included before public review]

A determination of potential socioeconomic consequences of rebuilding alternatives can be discerned by projecting future yields under alternative rebuilding probabilities (Table 4-4). Punt and Ianelli (2001, Appendix C-1) used the base-case model endorsed by the Stock Assessment Review (STAR) panel from the 2000 stock assessment and a random draw of POP recruits from 1965-1998 to generate future age 3 recruitment and project future yields under rebuilding. Probabilities of rebuilding were predicted by the proportion of simulations that achieved B_{MSY} within T_{MAX}.

Projected yields, and therefore revenues, estimated for POP under the *Maximum Conservation* alternative are zero since exploitation of POP is eliminated. The alternatives with the greatest socioeconomic costs after *Maximum Conservation* are the intermediate alternatives (*80%*, *Council Interim Rebuilding*, and *60%*, respectively), *Maximum Harvest*, and *No Action* in the order of increased negative socioeconomic impacts based on projected yields (Tables 4-1, 4-4, and 4-5). However, realized yields under rebuilding may not approach those projected in Table 4-4 since other stocks may constrain fisheries that harvest POP. The cumulative impacts analysis attempts to differentiate likely constraining stocks in affected fisheries and predict qualitatively how that might affect future yields of POP.

Some mitigating measures to reduce the risk of exceeding rebuilding harvest rates have increased economic costs. Displacement of vessels to deeper, more distant waters may increase fuel and operating expenses of fishing operations. The costs of implementing VMS may also increase fishing overhead. Mandatory full retention of rockfish may increase costs for fish buyers and processors as well. Handling and disposition of retained rockfish that are unmarketable due to damage or size could potentially increase overhead and operating expenses. All overhead costs would likely be transferred to the consumer which could weaken demand. West coast groundfish market share could then be adversely impacted on the fiercely competitive world seafood market.

TABLE 4-4. Projected total catch optimum yields (mt) for Pacific ocean perch under different rebuilding probabilities and the default "40-10" policy. Actual catches shown for 1999-2001.

Year	*No Action* "40-10"	*Maximum Harvest* 50%	60%	*Council Interim Rebuilding* 70%	80%	Year	*No Action* "40-10"	*Maximum Harvest* 50%	60%	*Council Interim Rebuilding* 70%	80%
1999	544	544	544	544	544	2021	1,155	599	538	473	398
2000	270	270	270	270	270	2022	1,137	599	539	474	400
2001	303	303	303	303	303	2023	1,133	599	539	474	400
2002	1,120	464	410	353	290	2024	1,116	599	539	475	401
2003	1,313	496	438	377	311	2025	1,108	598	539	475	401
2004	1,438	518	458	396	327	2026	1,100	599	540	475	402
2005	1,484	533	472	408	338	2027	1,090	600	541	477	403
2006	1,482	542	481	416	345	2028	1,091	602	543	478	404
2007	1,460	550	489	424	352	2029	1,097	602	543	479	405
2008	1,432	557	496	430	358	2030	1,097	602	543	479	406
2009	1,408	565	503	437	364	2031	1,100	602	544	479	406
2010	1,385	572	509	443	369	2032	1,098	601	543	480	406

TABLE 4-4. Projected total catch optimum yields (mt) for Pacific ocean perch under different rebuilding probabilities and the default "40-10" policy. Actual catches shown for 1999-2001.

Year	*No Action* "40-10"	*Maximum Harvest* 50%	60%	*Council Interim Rebuilding* 70%	80%	Year	*No Action* "40-10"	*Maximum Harvest* 50%	60%	*Council Interim Rebuilding* 70%	80%
2011	1,358	577	515	448	374	2033	1,094	601	543	480	407
2012	1,336	582	520	453	379	2034	1,094	603	545	481	408
2013	1,315	587	525	458	383	2035	1,096	605	547	483	409
2014	1,285	592	530	463	387	2036	1,094	605	547	483	410
2015	1,257	594	532	465	390	2037	1,092	605	547	483	410
2016	1,232	596	534	467	392	2038	1,088	606	548	484	411
2017	1,209	597	535	469	394	2039	1,097	606	548	484	411
2018	1,195	597	536	470	395	2040	1,099	605	548	485	412
2019	1,175	599	537	472	397	2041	1,097	608	551	487	414
2020	1,160	599	539	473	398	2042	1,091	607	550	487	413

TABLE 4-5. Projected gross revenue (thousands of dollars) on the west coast associated with potential future yields of Pacific ocean perch under rebuilding alternatives (assumes no constraints from other overfished stocks).

[to be included before public review]

4.4.1 Affected Fisheries

Groundfish trawl fisheries have accounted for 99.5% of POP landings on the U.S. west coast from 1981 to 2001. Fixed gears (hook and line, pots, and traps) have accounted for 0.2% of POP landings on the U.S. west coast with landings by other gear types (shrimp trawls, nets, troll) accounting for about 0.3% from 1981 to 2001. Tribal landings of POP have averaged *X* mt during *XXXX-XXXX*, about *X*% of total tribal *[groundfish, rockfish?]* landings. *[Joner/Jones/GMT?]* There is no recreational fishing effort on the continental slope in POP habitats nor records of recreational harvest of POP.

Bottom trawl fisheries targeting DTS species and deep water flatfish north of Cape Mendocino would be most affected by POP rebuilding (Table 4-2, Figure 4-1). The DTS trawl fishery has accounted for *X*% *[GMT?]* of total west coast trawl landings of POP. Although targeting slope rockfish in the north has been minimized in recent years by the need to rebuild POP and darkblotched rockfish, directed fisheries existed as recently as 1999. Petrale sole target opportunities in bottom trawl fisheries and, to a lesser extent, midwater trawl efforts directed at yellowtail rockfish and widow rockfish also accounted for measurable bycatch of POP.

4.4.2 Affected Markets for Fishery Products

[to be included before public review]

Pacific ocean perch are valued for high quality fillets, a feature common to many west coast rockfish. Market value in *XXXX* was $*X*/lb compared with a groundfish *[rockfish?]* average of $*X*/lb.

[Market value and share of DTS and deep water flatfish by year and region on west coast?]

[Market share of total groundfish ex-vessel value and of total rockfish ex-vessel value by year and region on west coast?]

[Canadian and Alaskan market share?; Canadian exports of POP to the U.S.?]

4.4.3 Affected Fishing Communities

[to be included before public review]

Coastal communities north of Cape Mendocino, California would be most affected by POP rebuilding. Those communities with a heavy dependence on commercial groundfish fishing in general or large trawl fleets would be most affected by limits placed on slope and shelf fisheries designed to rebuild POP.

[Fishing communities north of Cape Mendocino with a dependence on groundfish? with a dependence on rockfish? with a dependence on DTS and deep water flatfish?]

[Fishing communities north of Cape Mendocino with alternative viable fisheries? % of gross ex-vessel revenue associated with non-groundfish fishing by port north of Cape Mendocino?]

[Size of trawl fleet by port north of Cape Mendocino? Proportion of groundfish trawl to all commercial fishing vessels by port north of Cape Mendocino?]

[Anticipated economic effects of rebuilding POP by port/coastal area?]

[Economic effects of anticipated effort shifts associated with rebuilding POP and other overfished groundfish species]

[Anticipated economic effects of POP rebuilding alternatives]

4.5 Cumulative Effects

Pacific ocean perch rebuilding yields are unlikely to be attained due to the more binding constraints on slope fisheries imposed by the *Council Interim Rebuilding* alternative for darkblotched rockfish rebuilding (see Part B - Draft Darkblotched Rockfish Rebuilding Plan). Such constraints could be expected to accelerate POP rebuilding given projected future recruitments and the extent that realized total fishing-related mortality is less than anticipated.

[Anticipated relative cumulative impacts of each POP rebuilding alternative]

Overfished shelf rockfish (i.e., bocaccio, canary rockfish, and yelloweye rockfish) rebuilding constraints are anticipated to shift some commercial groundfish fishing effort from shelf to slope areas. Such an effort shift could exacerbate efforts to control total fishing-related mortality of POP. Rebuilding effectiveness may largely depend on the effectiveness of bycatch accounting and control mechanisms. The NMFS Observer Program is the anticipated remedy to the uncertainty associated with current bycatch accounting methods. Consideration should be given in the interim to depth-based restrictions and gear modifications to mitigate adverse effects of increased fishing pressure on the slope (section 4.2.1). Such restrictions will likely be needed to shift the majority of the on-bottom groundfish effort off the shelf given the dramatically low OYs considered to protect bocaccio in the south (Conception and Monterey INPFC areas) and yelloweye and canary rockfish in the north (Monterey. Eureka, Columbia, and U.S.-Vancouver INPFC areas). Displacement of on-bottom fishing effort from the edge of the shelf north of Cape Mendocino as a result of shelf rockfish protective measures could be expected to reduce potential fishing pressure during summer months when pre-spawning POP aggregate and feed there. However, this displacement could increase fishing-related mortality of POP with increased fishing pressure in slope areas where spawning and over-wintering occurs. Extending depth-based restrictions deeper than the range of greatest POP density *[could this be expected to vary seasonally given the offshore migration pattern?]* could mitigate potentially adverse fishery effort shifts.

Gear modifications designed to target harvestable groundfish and non-groundfish species and avoid slope rockfish should be investigated further. The use of Exempted Fishing Permits (EFPs) could investigate the efficiency of such gears as the experimental flatfish trawl being tested in waters off Oregon. Effective avoidance of overfished shelf and slope rockfish through the use of modified gears would reduce fishing-related mortality of POP.

If the *Mixed Stock Exception* was invoked for darkblotched rockfish, POP could be expected to become the groundfish stock most binding as a slope fishery constraint. The stock most constraining is also more likely to be overfished; realized yields might be expected to exceed prescribed total catch OYs more frequently. A *Mixed Stock Exception* for darkblotched rockfish would therefore be expected to increase the risk of not attaining POP rebuilding objectives without appropriate mitigation. Such mitigation may include the depth-based restrictions and gear modifications discussed above, as well as accurate bycatch accounting coupled with discard caps that ensure prescribed exploitation rates are not exceeded.

5.0 CONSISTENCY WITH FMP OBJECTIVES AND THE MAGNUSON-STEVENS ACT

[to be completed before public review]

5.1 FMP Objectives

5.2 National Standards

5.3 Other Applicable Magnuson-Stevens Act Provisions

6.0 OTHER APPLICABLE LAW

[to be completed before public review]

6.1 National Environmental Policy Act

6.2 Regulatory Impact Review and Regulatory Flexibility Act Determination

6.2.1 Executive Order 12866

6.2.2 Impacts on Small Entities

6.3 Coastal Zone Management Act

6.4 Listed Species

6.4.1 Endangered Species Act

Fisheries that interact with species listed as depleted, threatened, or endangered may be subject to management restrictions under the ESA. West coast groundfish fisheries can potentially interact with species listed under the ESA. Some salmon stocks, migratory bird species, sea turtles, and marine mammals found in the west coast EEZ are ESA-listed (section 4.4.1). None of the west coast groundfish fisheries are considered to have a significant take of these ESA-listed species.

Several species of salmon are found in the EEZ off the west coast during the ocean phase of their life cycle. Of these species, chinook salmon (two stocks), sockeye salmon (one stock), and steelhead (two stocks) are listed as endangered and coho salmon (three stocks), chinook salmon (six stocks), chum salmon (two stocks), sockeye salmon (one stock), and steelhead (eight stocks) are listed as threatened under the Endangered Species Act (ESA). Interactions between west coast groundfish fisheries and salmon occur, but based on Biological Opinions under the ESA (August 10, 1990, November 28, 1991, August 28, 1992, September 27, 1993, May 14, 1996, and December 15, 1999), implementation of the proposed alternatives for the groundfish fishery is not expected to jeopardize the existence of any threatened or endangered species or modification of critical habitat.

Over sixty species of seabirds are found in the EEZ off the west coast. Some of these species are listed as endangered (short-tail albatross, California brown pelican, California least tern) and threatened (marbled murrelet) under the ESA. In west coast groundfish fisheries, seabirds are occasionally taken by trawl and pot gear but they are most often taken with hook-and-line gear; a gear not known to catch POP and other slope rockfish effectively. Measures designed to rebuild POP will primarily affect bottom trawl fishing opportunities. Bottom trawl gears do not have significant direct seabird interactions. However, in addition to incidental take, seabirds may be indirectly affected by changes in prey availability, vessel traffic, garbage dumping, and diesel or oil discharge that can result from commercial fisheries. Reduced harvest opportunities due to POP rebuilding constraints are expected to result in decreased fishing effort. Seabirds may indirectly benefit.

Three marine mammals species (Steller sea lion (*Eumetopias jubatus*) Eastern Stock, Guadalupe fur seal (*Arctocephalus townsendi*), and Southern sea otter (*Enhydra lutris*) California Stock) are found in the EEZ off the west coast and are listed as threatened under the ESA. Potential interactions of ESA-threatened marine mammals with groundfish fisheries are generally discussed in the following section.

6.4.2 Marine Mammal Protection Act

Fisheries that interact with species listed as depleted, threatened, or endangered may be subject to management restrictions under the MMPA. NMFS publishes an annual list of fisheries in the *Federal Register* separating commercial fisheries into one of three categories, based on the level of serious injury and mortality of marine mammals occurring incidentally in that fishery. The categorization of a fishery in the list of fisheries determines whether participants in that fishery are subject to certain provisions of the MMPA, such as registration, observer coverage, and take reduction plan requirements. The west coast groundfish fisheries are in Category III, indicating a remote likelihood of, or no known serious injuries or mortalities, to marine mammals.

All marine mammals found in the EEZ off the west coast are protected by the Marine Mammal Protection Act (MMPA). Approximately thirty species, including seals and sea lions, sea otters, and whales, dolphins, and porpoise, occur within the EEZ. Many marine mammal species seasonally migrate through west coast waters, while others are year round residents.

There is limited information documenting the interactions of groundfish fisheries and marine mammals, but marine mammals are probably affected by many aspects of groundfish fisheries. The incidental take of marine mammals, defined as any serious injury or mortality resulting from commercial fishing operations, is reported to NMFS by vessel operators. In the west coast groundfish fisheries, incidental take is infrequent and primarily occurs in trawl fisheries (Forney *et al.* 2000). Indirect effects of groundfish fisheries on marine mammals are more difficult to quantify due to a lack of behavioral and ecological information regarding marine mammals. However, marine mammals may be affected by increased noise in the oceans, change in prey availability, habitat changes due to fishing gear, vessel traffic in and around important habitat (i.e., areas used for foraging, breeding, raising offspring, or hauling-out), at-sea garbage dumping, and diesel or oil discharged into the water associated with commercial fisheries.

Under the MMPA on the west coast, NMFS is responsible for the management of cetaceans and pinnipeds, while the U.S. Fish and Wildlife Service (FWS) manages sea otters. Stock assessment reports review new information every year for strategic stocks (those whose human-caused mortality and injury exceeds the potential biological removal (PBR)) and every three years for non-strategic stocks. Marine mammals whose abundance falls below the optimum sustainable population (OSP) are listed as "depleted" according to the MMPA. Under the ESA, a species is listed as "endangered" if it is in danger of extinction throughout a significant portion of its range and "threatened" if it is one likely to become an endangered species within the foreseeable future throughout all, or a significant portion, of its range.

Under the MMPA, depleted species occurring off the west coast include the sperm whale (*Physeter macrocephalus*) west coast stock, humpback whale (*Megaptera novaeangliae*) west coast - Mexico stock, blue whale (*Balaenoptera musculus*) eastern north Pacific stock, and fin whale (*Balaenoptera physalus*) west coast stock.

Fisheries that interact with species listed as depleted, threatened, or endangered may be subject to management restrictions under the MMPA and ESA. NMFS publishes an annual list of fisheries in the *Federal Register* separating commercial fisheries into one of three categories, based on the level of serious injury and mortality of marine mammals occurring incidentally in that fishery. The categorization of a fishery in the list of fisheries determines whether participants in that fishery are subject to certain provisions of the MMPA, such as registration, observer coverage, and take reduction plan requirements. The west coast groundfish fisheries are in Category III, indicating a remote likelihood of, or no known serious injuries or mortalities, to marine mammals.

Of the marine mammal species incidentally caught in west coast groundfish fisheries, the Steller sea lion is listed as threatened under the ESA, the northern elephant seal may be within their OSP range, and there is insufficient data to determine the status of the harbor seal, California sea lion, Dall's porpoise, and Pacific white-sided dolphin relative to their OSP. None of these species are classified as strategic stocks under the MMPA. Based on its Category III status, the incidental take of marine mammals in the west coast groundfish fisheries does not significantly impact marine mammal stocks.

Of the marine mammal species incidentally caught in west coast groundfish fisheries, the Steller sea lion is listed as threatened under the ESA, the northern elephant seal may be within their OSP range, and there is insufficient data to determine the status of the harbor seal, California sea lion, Dall's porpoise, and Pacific white-sided dolphin relative to their OSP. None of these species are classified as strategic stocks under the MMPA. Based on its Category III status, the incidental take of marine mammals in the west coast groundfish fisheries does not significantly impact marine mammal stocks.

6.4.3 Migratory Bird Treaty Act

The Migratory Bird Treaty Act of 1918 was designed to end the commercial trade of migratory birds and their feathers that, by the early years of the 20th century, had diminished populations of many native bird species. The Act states that it is unlawful to take, kill, or possess migratory birds and their parts (including eggs, nests, and feathers) and is a shared agreement between the United States, Canada, Japan, Mexico, and Russia to protect a common migratory bird resource.

The Migratory Bird Treaty Act prohibits the directed take of seabirds, but the incidental take of seabirds does occur. Only limited information exists quantifying the incidental take of seabirds in west coast groundfish fisheries. However, none of the proposed management alternatives are likely to affect the incidental take of seabirds protected by the Migratory Bird Treaty Act. Implementation of the NMFS west coast groundfish observer program should provide additional information about the incidental take of seabirds in groundfish fisheries.

6.5 Paperwork Reduction Act

6.6 Executive Order 13132 (Federalism)

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Appendix C-1. Pacific Ocean Perch Rebuilding Analysis

[to be included before public review]

Appendix C-2. FMP Amendment Language

[to be included before public review]

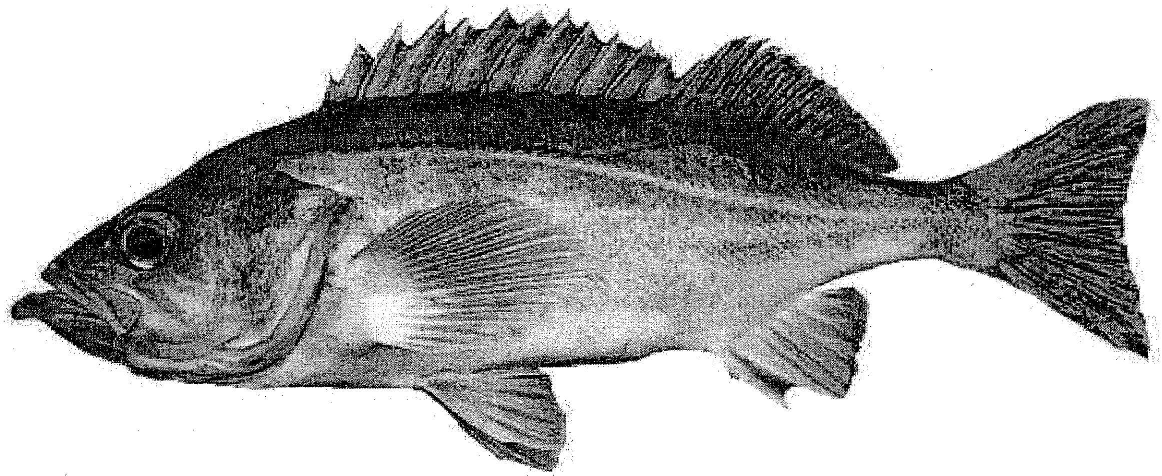

Figure 3-1. Pacific ocean perch (*Sebastes alutus*).

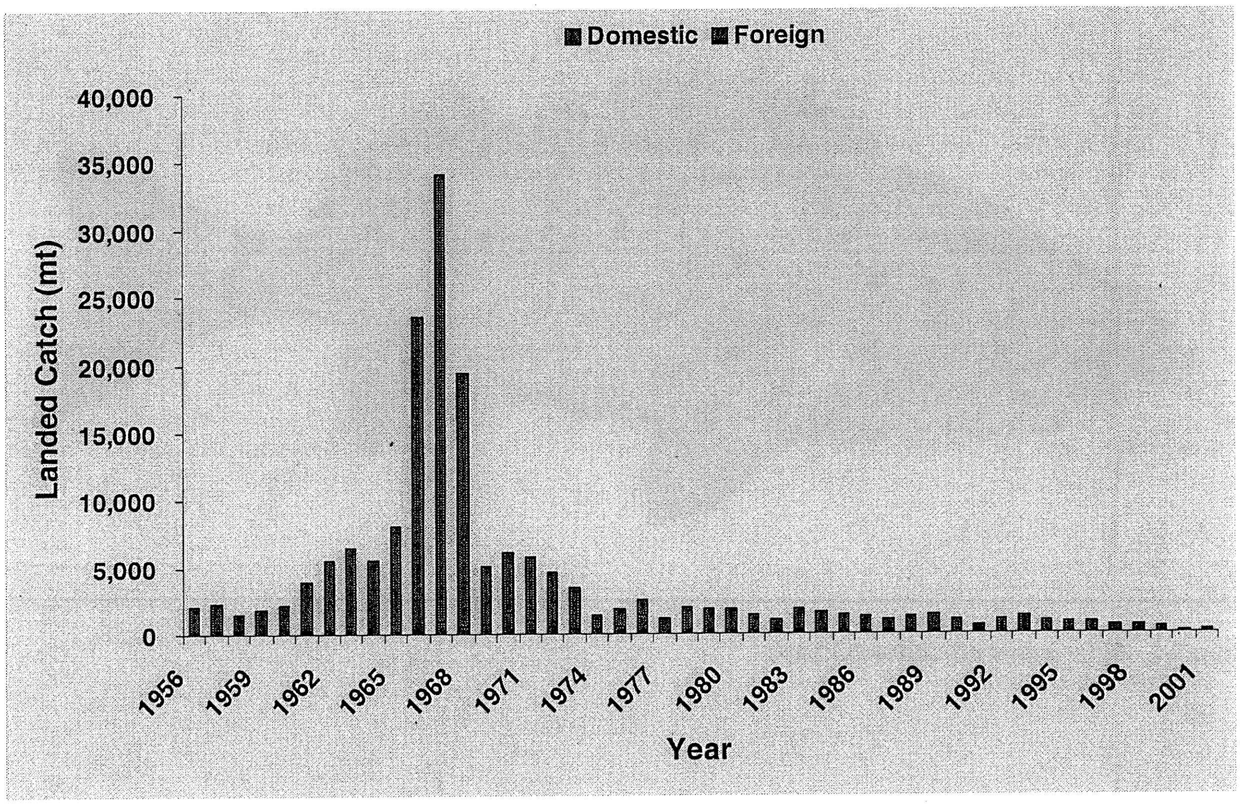

FIGURE 3-2. Landings (mt) of Pacific ocean perch on the U.S. west coast by domestic and foreign vessels, 1956-2001.

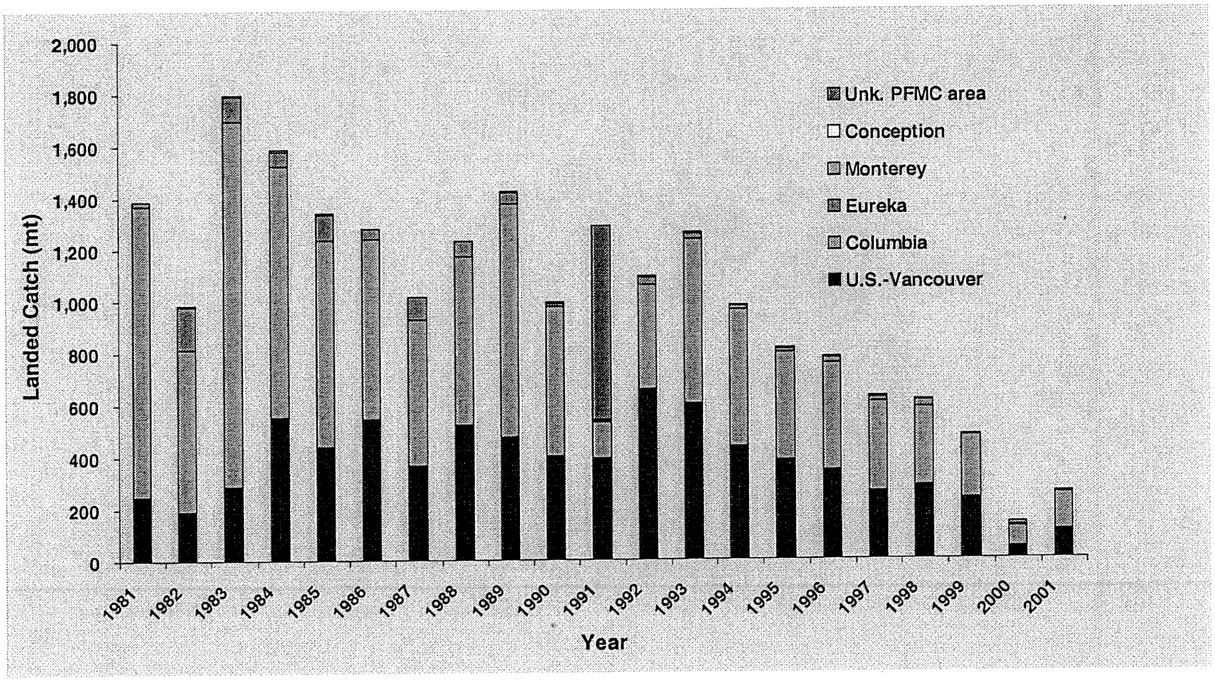

FIGURE 3-3. Landed catch (mt) of Pacific ocean perch by INPFC area, 1981-2001. Data from PacFIN ("Pacific ocean perch" and "nominal POP" categories only).

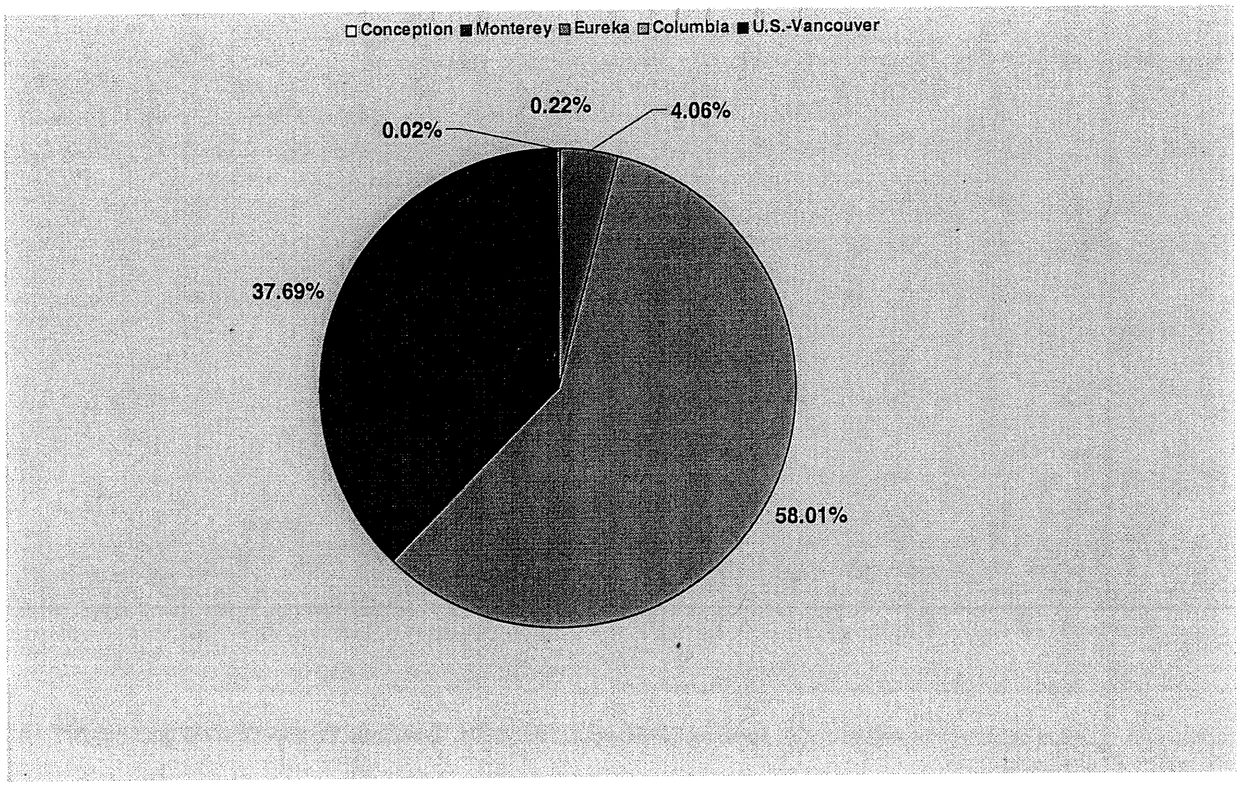

FIGURE 3-4. Average annual proportion of Pacific ocean perch landed catch by INPFC area, 1981-2001. Data from PacFIN ("Pacific ocean perch" and "nominal POP" categories only).

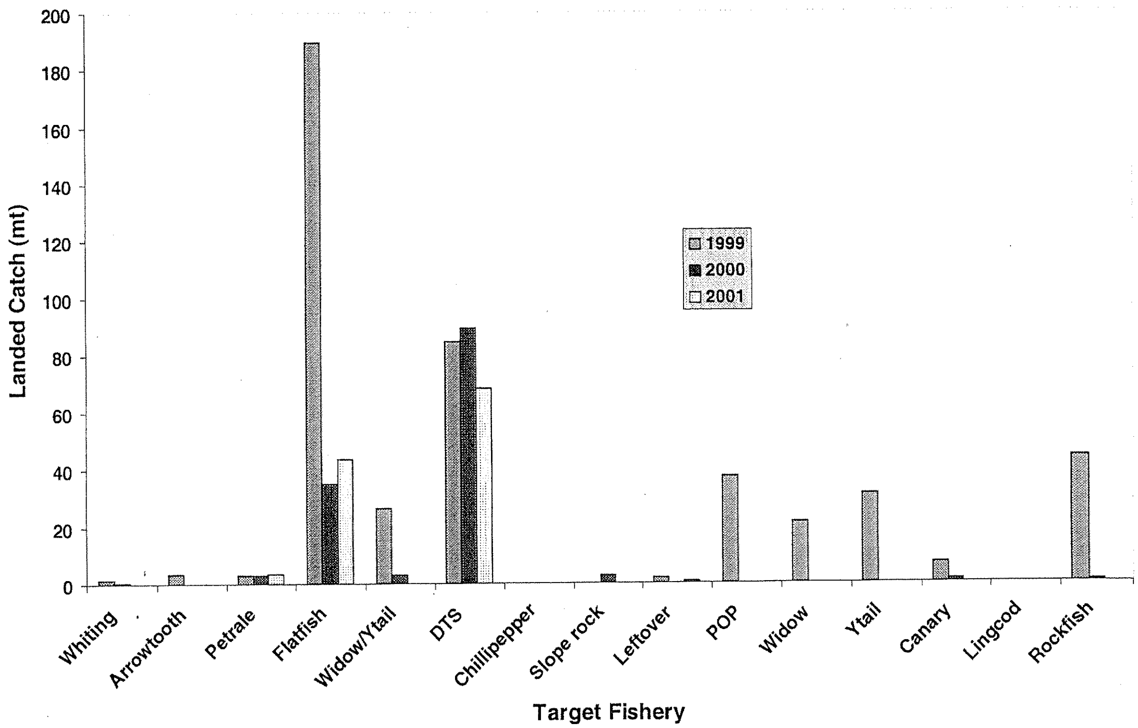

FIGURE 4-1. Landings of Pacific ocean perch in target trawl fisheries on the west coast in 1999, 2000, and 2001. Data from Hastie (2001).

Exhibit C.5
Attachment 5
June 2002

DRAFT COWCOD REBUILDING PLAN

PART D TO AMENDMENT 16
OF THE PACIFIC COAST GROUNDFISH FISHERY MANAGEMENT PLAN

INCLUDING DRAFT ENVIRONMENTAL IMPACT STATEMENT AND REGULATORY ANALYSES

PREPARED BY THE PACIFIC FISHERY MANAGEMENT COUNCIL

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JUNE 2002

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1.0 PURPOSE AND NEED FOR REBUILDING COWCOD

1.1 Purpose and Need

Cowcod (*Sebastes levis*) was a popular target in recreational and commercial fisheries in the Southern California Bight south of Point Conception. Because of its large size, cowcod were popular with recreational anglers, and commercial fishers received higher prices for cowcod than all other rockfish except those species caught and sold live to restaurants. Recreational angler success was high around islands and banks near the mainland during the 1960s, but by the 1990s catch rates were high only at remote offshore banks. The species productivity is relatively low due to exceptionally slow growth and late maturation. Because of this, the stock experienced a severe decline in response to an unsustainable exploitation rate.

Amendment 11 of the Pacific Coast Groundfish Fishery Management Plan (FMP) incorporated the legal rebuilding mandates of the Magnuson-Stevens Fishery Conservation and Management Act (MSA) for overfished species and established an overfishing threshold of 25% of the estimated virgin (unfished) spawning biomass for groundfish stocks. Butler et al. (1999) estimated the 1998 abundance of cowcod in the Southern California Bight south of Point Conception to be at 7% of its unfished biomass. Therefore, the National Marine Fisheries Service (NMFS) declared the stock overfished in January 2000 (65 FR 221). The Conception area cowcod stock represents only a portion of the historical range of the species, and cowcod in the Monterey area experienced similar declines in landings, indicating that the entire U.S. component of the cowcod population is overfished.

Under the terms of the MSA and the FMP, the Council must prepare a rebuilding plan for overfished stocks to increase stock abundance to a level that supports MSY (40% of its unfished biomass). The MSA requires that the objective for the rebuilding plan is to rebuild the stock within 10 years if possible, or if not possible because of life history characteristics, within the time required with no fishing related mortality plus one mean generation time. The purpose of this draft rebuilding plan is to evaluate alternative strategies designed to rebuild cowcod on the U.S. west coast within the allowable time frame mandated by the MSA and FMP.

1.2 Rebuilding Plan Overview

The Draft Cowcod Rebuilding Plan (Part D, June 2002 draft) conforms to a National Environmental Policy Act (NEPA) structure and format with a purpose and need statement (section 1.1), rebuilding alternatives presented in Chapter 2, a description of the affected environment (physical (habitat), biological (cowcod and other affected species), and socioeconomic (affected fisheries, fishing industry, and fishing communities)) in Chapter 3, and an analysis of rebuilding consequences expected for affected environments in Chapter 4. Chapters 5-8 document how the rebuilding plan and alternatives conform to legal mandates, who contributed in preparation of the rebuilding plan, and the references used throughout this rebuilding plan document. Chapter 9 incorporates cited figures and Appendix D-1 is the rebuilding analysis prepared for this rebuilding plan. The modular design of the rebuilding plan framework (each species rebuilding plan is stratified in Parts B,C,D, etc.) is to allow it to stand alone as a decision-making document for rebuilding cowcod within the Council's jurisdiction (the EEZ (3-200 nm)) on the continental west coast between the international borders with Mexico and Canada; Figure 1-1).

The overarching objective of this rebuilding plan is to increase cowcod stock spawning biomass to a level that supports MSY within the legally allowable time (T_{MAX}). For cowcod, the Council-approved proxy for this level of abundance is 40% of its estimated unfished biomass ($B_{40\%}$). Estimation of unfished biomass (B_0) is especially critical since it forms the basis for declaring a stock's biological and legal status.

Rebuilding parameters specified in a rebuilding plan must include at least T_{TARGET} and may be required to include other parameters listed in Table 1-1 depending on decisions made in Part A of this amendment package These parameters are determined by the best available science, Council/NMFS policies, and legal mandates (including the MSA, National Standard Guidelines for interpreting the MSA, and legal precedent). The time to rebuild is also constrained on the high end ($T_{MAX} = T_{MIN}$ + 1 mean generation; 1 mean generation equals the average time for a spawning female to replace herself in the population; Restrepo *et al.* 1998) and on the low end (T_{MIN} = time to rebuild in the absence of fishing; F=0) by biological limits imposed by the potential productivity of the stock.

Scientific uncertainty surrounds the estimation of parameters that define rebuilding targets and objectives, assessments of stock status and structure, projections of future recruitment and biomass, and evaluating how well management measures meet rebuilding objectives. All alternatives in this rebuilding plan except the *No Action* alternative assume the best available science. Ensuring the best available science is incorporated in Council decision-making is the role of the Council's Scientific and Statistical Committee (SSC) and therefore not analyzed specifically as a policy choice. However, recommendations for mitigating risk associated with scientific uncertainties are explored throughout this rebuilding plan.

This rebuilding plan generally analyzes alternative strategies for achieving rebuilding targets and objectives. Specifically, this plan analyzes the tradeoffs (physical, biological, and socioeconomic) associated with alternative total fishing-related mortality limits (total catch OYs) and the management specifications (harvest controls and measures) to achieve these limits.

Habitat-based rebuilding measures including area closures are specifically analyzed in this rebuilding plan because Marine Protected Areas (MPAs) may be a sound strategy as an alternative or contributing mechanism for controlling total fishing-related mortality of cowcod. Such closures would be considered to move the fishery off cowcod hot-spots, and therefore reduce the total mortality of adult fish. The Council and NMFS are currently developing a policy for habitat based management that may result in modification to existing (or pending) closures, or other management measures intended to protect habitat deemed important to groundfish production. At issue in the development of this policy is the integration of habitat-based management with the harvest control management strategies that have historically been the foundation for Council actions. Alternative policies are being analyzed in a Programmatic EIS (contact Mr. Jim Glock, NMFS, (503) 231-2178). The policies adopted through the Programmatic EIS will be implemented through subsequent decisions such as implementation of the EFH provisions of the Magnuson-Stevens Act or the annual management process and may be utilized to achieve the mortality goals for cowcod established in the rebuilding plan.

TABLE 1-1. Estimated parameters/targets specified for rebuilding cowcod rockfish. Data from Butler et al. (1999) and Appendix D-1.

Rebuilding Parameter/Target	Estimate or proxy
T_{MIN} (minimum time to achieve B_{MSY} = mean time to rebuild at F = 0)	62 years
Mean generation time	37 years
T_{MAX} (maximum time to achieve $B_{MSY} = T_{MIN}$ + 1 mean generation time)	98 years
B_0 (estimated unexploited (virgin or unfished) biomass)	3,367 mt
$B_{CURRENT}$ (current estimated biomass = X% of B_0; expressed as $B_{X\%}$)	238 in 1998 ($B_{7\%}$)
MSST (minimum stock size threshold = 25% of B_0; expressed as $B_{25\%}$)	842 mt
B_{MSY} (rebuilding biomass target = $B_{40\%}$)	1,350 mt
MFMT (maximum fishing mortality threshold = F_{MSY}; determines ABC)	$F_{40\%}$

2.0 COWCOD REBUILDING PLAN ALTERNATIVES

Rebuilding alternatives for cowcod analyzed in this rebuilding plan address harvest management alternatives and MPA alternatives. Harvest management measures control total fishing-related mortality, which determines the time required to rebuild the stock to B_{MSY}. MPA closures prohibit certain fishing and other activities in important habitat areas, and may be effective at reducing mortality and increasing stock productivity, particularly since adult cowcod have strong habitat affiliations (see sections 3.1.1, 3.2.1).

The cowcod stock is considered one continuous population and management alternatives are intended to rebuild the entire U.S. stock, although the Monterey and Conception management areas contain the majority of the current and historical U.S. abundance. Biological reference points are specific to the Conception management area since only that portion of the cowcod population has been assessed.

The median year when cowcod spawning biomass is projected to reach B_{MSY} under each alternative is noted in Table 2-1. This is not necessarily the target year for rebuilding the stock to B_{MSY} (T_{TARGET}). T_{TARGET} is a legal construct/policy choice falling within the Council/NMFS decision-making nexus. The choice of T_{TARGET} is constrained to fall between T_{MIN} and T_{MAX}. Probabilities of rebuilding for these alternatives are summarized in Table 2-1 relative to T_{MAX}.. If the median year of achieving B_{MSY} under the *Council Interim Rebuilding* alternative for cowcod was the Council's choice for T_{TARGET}, the probability of achieving B_{MSY} in 2095 (T_{TARGET} in this case) is 50% (= median) and the probability of achieving B_{MSY} by 2098 (T_{MAX}) is 55% . The probability of achieving B_{MSY} within T_{TARGET} can be increased by lowering the harvest rate (F) and constraining fisheries further. Relative risk and probability of rebuilding alternatives meeting objectives is sensitive to the current state of knowledge and the harvest control rule (i.e., harvest rate) adopted as a rebuilding target and strategy. The harvest control rule varies between rebuilding alternatives analyzed in this rebuilding plan, the best available science informing decisions and the current state of knowledge does not. ***Note that T_{TARGET} has not been explicitly noted in Table 2-1 and is a choice before the Council.***

2.1 The *No Action* Alternative

Under the *No Action* Harvest Alternative no rebuilding plan would be adopted. This alternative represents the baseline against which other alternatives will be compared.

Rebuilding parameters: The estimated catch under this alternative results in a median rebuilding period of greater than 300 years to reach B_{MSY} (1,350 MT for the Conception management area). The probability of rebuilding the stock within the maximum time allowed of 98 years (T_{MAX}) approaches 0% (Table 2.1).

Harvest Regulations: Commercial and recreational harvest of the Monterey and Conception management area cowcod resource would be managed within the southern minor shelf rockfish complex trip limits and recreational bag limits established in the Council's annual groundfish harvest specifications. Harvest would be based on the default $F_{50\%}$ MSY proxy harvest rate and the precautionary 40-10 adjustment of the allowable biological catch (ABC). A 16% bycatch rate (of landed catch) would be assumed for all fisheries. The ABC for 2002 would be 2,652 MT.

Marine Reserves: No MPAs to protect cowcod and cowcod habitat would be considered.

Allocation: This alternative would have neutral allocation impacts because no changes to the current allocation structure are specified or implied. This alternative provides minimal disruption to fisheries within the species range and therefore the least negative socioeconomic impact of the alternatives.

Essential Fish Habitat: This alternative would not significantly effect cowcod EFH or other EFH (PFMC 1998), although it would provide no additional protection or enhancement of cowcod EFH or EFH for other fish species.

2.2 The *Maximum Conservation* Alternative

Under the *Maximum Conservation* alternative, the fishing mortality rate (F) equals zero and rebuilding progresses at the fastest possible rate. This alternative would incur greater short term negative socioeconomic impacts than other alternatives considered.

Rebuilding parameters: The estimated catch (none) under this alternative results in a median rebuilding period of 62 years to reach B_{MSY} (1,350 MT for the Conception management area). The probability of rebuilding the stock within the maximum time allowed of 98 years (T_{MAX}) approaches100% (Table 2-1).

Harvest Regulations: All fishing activities, including incidental catch and discard mortality, that could potentially impact cowcod in the Conception and Monterey management areas would be prohibited. Some fisheries for pelagic and shallow water-nearshore species would be allowed (e.g. salmon, albacore, squid, etc.).

Marine Reserves: The entire coastal region south of Cape Mendocino, California to the U.S.-Mexico border would be an MPA closed to groundfish and prawn trawling activities. This alternative would provide the greatest protection for cowcod and their important habitat, as well other for many other groundfish species.

Allocation: This alternative would allocate impacts to all fishing sectors equally since landing prohibitions would be applied to all fishery sectors. The relative ability of various fishery sectors to accommodate regulations (e.g., relocation, effort shift to other species, etc.) is not known.

Essential Fish Habitat: This alternative would protect the and enhance EFH for cowcod and other species south of Cape Mendocino. Adult and juvenile cowcod EFH and other benthic EFH (canyon, continental slope/basin) would benefit from reduced fishing gear impacts. Larval cowcod EFH, other EFH associated with the water column (oceanic), and estuarine EFH would benefit from reduced pollution associated with fishing activities.

2.3 The *Maximum Harvest* Alternative

Under the *Maximum Harvest* Alternative a constant harvest rate would be allowed in the Monterey and Conception management areas. Rebuilding would proceed at the slowest rate allowed. This alternative would incur the least short term negative socioeconomic impacts of all alternatives except the *No Action* alternative.

Rebuilding Parameters: The optimum yield (OY) catch levels associated with $F_{0.014}$ under this alternative results in a median rebuilding period of 98 years to reach B_{MSY} (1,350 MT for the Conception management area). The probability of rebuilding the stock within the maximum time allowed of 98 years (T_{MAX}) is 50% (Table 2-1).

Harvest Regulations: No retention of cowcod would be allowed under this alternative; all harvest impacts would be allocated for bycatch mortality. For the first 10 years of the rebuilding period, the OY would be 2.5 MT in the Conception management area and 2.5 MT in the Monterey area.

Marine Reserves: Two MPAs would be established to protect cowcod south of Point Conception (Figure 2-1). The two areas combined in this MPA encompass about 3,200 nm^2, and would be closed to prawn trawling and groundfish fishing year round in areas deeper than 20 fathoms. No federally-managed groundfish species could be retained in these closed areas. The rectangular areas defining these MPAs are bounded by the following geographic coordinates:

33°50' N. lat., 119°20' W. long.;
33°50' N. lat., 119°00' W. long.;
33°40' N. lat., 119°00' W. long.;
33°40' N. lat., 118°50' W. long.;
33°20' N. lat., 118°50' W. long.;
33°20' N. lat., 119°10' W. long.;
32°50' N. lat., 119°10' W. long.;
32°50' N. lat., 119°00' W. long.;
32°00' N. lat., 119°00' W. long.;
32°30' N. lat., 118°50' W. long.;
32°20' N. lat., 118°50' W. long.;
32°20' N. lat., 119°20' W. long.;
32°50' N. lat., 119°20' W. long.;
32°50' N. lat., 119°30' W. long.;
33°00' N. lat., 119°30' W. long.;
33°00' N. lat., 119°50' W. long.;
33°30' N. lat., 119°50' W. long.;
33°30' N. lat., 119°20' W. long.;
33°50' N. lat., 119°20' W. long.

32°40' N. lat., 118°00' W. long.;
32°40' N. lat., 117°50' W. long.;
32°36'42" N. lat., 117°50' W. long.;
32°30' N. lat., 117°53'30" W. long.;
32°30' N. lat., 118°00' W. long.;
33°40' N. lat., 118°00' W. long.

The MPAs would protect cowcod and their habitat in the areas thought to encompass the majority of the remaining population centers. The MPA's would also do little to protect surrounding areas less important to cowcod, and result in numerous lines that would be difficult to enforce.

Allocation: The landing prohibition for this alternative would be applied to all fishery sectors, and would not represent any change in allocation. The MPA component would also apply to all fishery sectors, however, within the recreational sector, CPFV and large private vessels have easier access to the offshore areas than smaller private vessels, and may experience a greater negative impact. The relative ability of various fishery sectors to accommodate regulations (e.g., relocation, effort shift to other species, etc.) is not known.

Essential Fish Habitat: This alternative would protect the and enhance the most important adult and juvenile cowcod EFH by restricting groundfish fishing activities in the MPAs, which include the main cowcod population centers. EFH for other fish species would receive protection only insofar as it overlaps the MPAs established for cowcod. Fishing gear impacts to benthic environments and pollution associated with fishing activities would be reduced within the MPAs, although some of those impacts may be displaced and negatively impact EFH in those areas.

2.4 The *60% Intermediate Rebuilding* Alternative

Under the *60% Intermediate Rebuilding* Alternative a constant harvest rate would be allowed in the Monterey and Conception management areas. This alternative would have greater negative socioeconomic and positive biological impacts than the *No Action* alternative, and be intermediate between the *Maximum Harvest* alternative and the *Maximum Conservation* alternative.

Rebuilding Parameters: The optimum yield (OY) catch levels associated with F=1.2% under this alternative results in a median rebuilding period of 90 years to reach B_{MSY} (1,350 MT for the Conception management area). The probability of rebuilding the stock within the maximum time allowed of 98 years (T_{MAX}) is 60% (Table 2-1).

Harvest Regulations: No retention of cowcod would be allowed under this alternative; all harvest impacts would be allocated for bycatch mortality. For the first 10 years of the rebuilding period, the OY would be 2.1 MT in the Conception management area and 2.1 MT in the Monterey area.

Marine Reserves: Two MPAs would be established to protect cowcod south of Point Conception (Figure 2-2). The two areas combined in this MPA encompass about 5,600 nm^2, and would be closed to prawn trawling and groundfish fishing year round in areas deeper than 20 fathoms. No federally-managed groundfish species could be retained in these closed areas. The rectangular areas defining these MPAs are bounded by the following geographic coordinates:

33°50' N. lat., 118°50' W. long.;
33°50' N. lat., 120°00' W. long.;
32°20' N. lat., 120°00' W. long.;
32°20' N. lat., 118°50' W. long.;

32°50' N. lat., 117°50' W. long.;
32°50' N. lat., 118°00' W. long.;
32°30' N. lat., 118°00' W. long.;
32°30' N. lat., 117°50' W. long.;

The MPAs would protect cowcod and their habitat in the areas thought to encompass the majority of the remaining population centers. The MPA's would also include additional area that is not considered prime cowcod habitat, and consist of easily enforceable rectangular areas.

Allocation: The landing prohibition for this alternative would be applied to all fishery sectors, and would not represent any change in allocation. The MPA component would also apply to all fishery sectors, however, within the recreational sector, CPFV and large private vessels have easier access to the offshore areas than smaller private vessels, and may experience a greater negative impact. The relative ability of various fishery sectors to accommodate regulations (e.g., relocation, effort shift to other species, etc.) is not known.

Essential Fish Habitat: This alternative would protect the and enhance the most important adult and juvenile cowcod EFH by restricting groundfish fishing activities in the MPAs, which include the main cowcod population centers. EFH for other fish species would receive protection only insofar as it overlaps the MPAs established for cowcod, which under this option is less than the *Maximum Conservation* and *80% Intermediate* alternatives and greater than other alternatives. Fishing gear impacts to benthic environments and pollution associated with fishing activities would be reduced within the MPAs, although some of those impacts may be displaced and negatively impact EFH in those areas.

2.5 The *80% Intermediate Rebuilding* Alternative

Under the *80% Intermediate Rebuilding* alternative a constant harvest rate of would be allowed in the Monterey and Conception management areas. This alternative would have greater negative socioeconomic and positive biological impacts than all alternatives except the *Maximum Conservation* Alternative.

Rebuilding Parameters: The optimum yield (OY) catch levels associated with F = 0.9% under this alternative results in a median rebuilding period of 76 years to reach B_{MSY} (1,350 MT for the Conception management area). The probability of rebuilding the stock within the maximum time allowed of 98 years (T_{MAX}) is 80% (Table 2-1).

Harvest Regulations: No retention of cowcod would be allowed under this alternative; all harvest impacts would be allocated for bycatch mortality. Commercial groundfish fishing on the continental shelf (< 200 m) south of Cape Mendocino would be closed for 4-months per year. The recreational bag limit would be reduced to 5 fish per day. For the first 10 years of the rebuilding period, the OY would be 1.5 MT in the Conception management area and 1.5 MT in the Monterey area.

Marine Reserves: Two MPAs would be established to protect cowcod south of Point Conception (Figure 2-2). The two areas combined in this MPA encompass about 5,600 nm^2, and would be closed to prawn trawling and groundfish fishing year round in areas deeper than 20 fathoms. No federally-managed groundfish species could be retained in these closed areas. The rectangular areas defining these MPAs are bounded by the following geographic coordinates:

33°50' N. lat., 118°50' W. long.;
33°50' N. lat., 120°00' W. long.;
32°20' N. lat., 120°00' W. long.;
32°20' N. lat., 118°50' W. long.;

32°50' N. lat., 117°50' W. long.;
32°50' N. lat., 118°00' W. long.;
32°30' N. lat., 118°00' W. long.;
32°30' N. lat., 117°50' W. long.;

The MPAs would protect cowcod and their habitat in the areas thought to encompass the majority of the remaining population centers. The MPA's would also include additional area that is not considered prime cowcod habitat, and consist of easily enforceable rectangular areas.

Allocation: The landing prohibition for this alternative would be applied to all fishery sectors, and would not represent any change in allocation. The MPA component would also apply to all fishery sectors, however, within the recreational sector, CPFV and large private vessels have easier access to the offshore areas than smaller private vessels, and may experience a greater negative impact. The 4-month commercial closure and the 5-fish recreational bag limit are intended to reduce cowcod impacts in each fishery sector approximately 25%, and do not represent alterations in allocation. The 4-month closure would be allocated to the various commercial fishing sectors equally, but not necessarily at the same time of the year. Commercial closures associated with management objectives for other species could be considered as counting towards cowcod closure periods. The relative ability of various fishery sectors to accommodate regulations (e.g., relocation, effort shift to other species, etc.) is not known.

Essential Fish Habitat: This alternative would protect the and enhance the most important adult and juvenile cowcod EFH by restricting groundfish fishing activities in the MPAs, which include the main cowcod population centers. EFH for other fish species would receive protection insofar as it overlaps the MPAs established for cowcod, and additionally from the 4-month commercial closure and reduced effort associated with the 5 rockfish recreational bag limit. Fishing gear impacts to benthic environments and pollution associated with fishing activities would be reduced within the MPAs, although some of those impacts may be displaced and negatively impact EFH in those areas. This alternative provides more EFH protection and enhancement than all alternatives except the *Maximum Conservation* alternative.

2.6 The *Council Interim Rebuilding* Alternative

Under the *Council Interim Rebuilding* Alternative, a constant harvest rate would be allowed in the Monterey and Conception management areas. This alternative would have less negative socioeconomic and positive biological impacts than all alternatives except the *No Action* and *Maximum Fishing* alternatives. This alternative represents current Council management measures and is based on the cowcod rebuilding analysis (Appendix D-1).

Rebuilding Parameters: The optimum yield (OY) catch levels associated with F=1.0% under this alternative results in a median rebuilding period of 95 years to reach B_{MSY} (1,350 MT for the Conception management area). The probability of rebuilding the stock within the maximum time allowed of 98 years (T_{MAX}) is 55% (Table 2-1).

Harvest Regulations: No retention of cowcod would be allowed under this alternative; all harvest impacts would be allocated for bycatch mortality. For the first 10 years of the rebuilding period, the OY would be 2.4 MT in the Conception management area and 2.4 MT in the Monterey area.

Marine Reserves: Two MPAs would be established to protect cowcod south of Point Conception (Figure 2-3). The two areas combined in this MPA encompass about 4,300 nm^2, and would be closed to prawn trawling and groundfish fishing year round in areas deeper than 20 fathoms. No federally-managed groundfish species could be retained in these closed areas. The rectangular areas defining these MPAs are bounded by the following geographic coordinates:

33°50' N. lat., 119°30' W. long.;
33°50' N. lat., 118°50' W. long.;
32°20' N. lat., 118°50' W. long.;
32°20' N. lat., 119°30' W. long.;
33°00' N. lat., 119°30' W. long.;
33°00' N. lat., 119°50' W. long.;
33°30' N. lat., 119°50' W. long.;
33°30' N. lat., 119°30' W. long.;
33°50' N. lat., 119°30' W. long.;

32°40' N. lat., 118°00' W. long.;
32°40' N. lat., 117°50' W. long.;
32°30' N. lat., 117°50' W. long.;
32°30' N. lat., 118°00' W. long.;
32°40' N. lat., 118°00' W. long.;

The MPAs would protect cowcod and their habitat in the areas thought to encompass the majority of the remaining population centers. The MPA's would also include additional area that is not considered prime cowcod habitat, and consist of mostly rectangular areas that are reasonable to enforce.

Allocation: The landing prohibition for this alternative would be applied to all fishery sectors, and would not represent any change in allocation. The MPA component would also apply to all fishery sectors, however, within the recreational sector, CPFV and large private vessels have easier access to the offshore areas than smaller private vessels, and may experience a greater negative impact. The relative ability of various fishery sectors to accommodate regulations (e.g., relocation, effort shift to other species, etc.) is not known.

Essential Fish Habitat: This alternative would protect the and enhance the most important adult and juvenile cowcod EFH by restricting groundfish fishing activities in the MPAs, which include the main cowcod population centers. EFH for other fish species would receive protection only insofar as it overlaps the MPAs established for cowcod, which under this option is less than the *Maximum Conservation* , *80% Intermediate* and 60% alternatives and greater than the Maximum Fishing and *No Action* alternatives. Fishing gear impacts to benthic environments and pollution associated with fishing activities would be reduced within the MPAs, although some of those impacts may be displaced and negatively impact EFH in those areas.

2.7 Alternatives Considered But Rejected

Alternatives with less than a 50% probability of rebuilding to B_{MSY} within the maximum allowable rebuilding time (T_{MAX}) are not compliant with the MSA as interpreted in a 2000 ruling in the X Circuit Federal Court (*American Oceans Campaign v. Daley*). Such alternatives, except for the *No Action* alternative, are not analyzed in this rebuilding plan.

A 70% Intermediate alternative was not considered in detail because no measures different from the other alternatives other than the rebuilding parameters (F = 1.1%, Ttarget = 83 years, and Pmax = 70%) were proposed. The impacts from this alternative would be closely bracketed by the 60% and *80% Intermediate* alternatives.

Alternatives that affect cowcod management and habitat in waters outside U.S. jurisdiction (i.e. Mexico's EEZ) were not considered since the Council and NMFS has no regulatory authority in those waters, and no relevant treaties exist between the U.S. and Mexico.

TABLE 2-1. Rebuilding parameters associated with cowcod rebuilding alternatives.

Alternative	Probability of rebuilding within T_{MAX}	Median year of reaching B_{MSY}	F rate	T_{TARGET} (year)
No Action	approaches 0%	>2300	NA	NA
Maximum Conservation	approaches 100%	2062	0.0000	20***XX***
Maximum Harvest	50%	2098	0.0141	20***XX***
60% Intermediate Rebuilding	60%	2090	0.0121	20***XX***
80% Intermediate Rebuilding	80%	2076	0.0086	20***XX***
Council Interim Rebuilding	55%	2095	0.0136	*2**XXX***

3.0 AFFECTED ENVIRONMENT

The marine environment is connected by a number of common or shared physical, biological, ecological, economic, social, and regulatory characteristics that together define the West Coast. The following section describes the marine environment as it relates to cowcod.

3.1 Physical Environment

The California current is the eastward portion of the clockwise flowing Pacific Ocean Gyre which transports low salinity, cool water towards the equator. The California current is southward-flowing with associated northward counter-currents and sub-currents. Shoreline topographic features, such as Cape Blanco, Point Conception and other shoreline capes, as well as bathymetric features such as banks, canyons and other submerged features, often create large-scale current patterns such as eddies, jets, and squirts. These complex local currents subsequently can entrain and disperse water masses and marine organisms over the shelf (across and along the shelf). The California Current System and its associated marine ecosystem are affected on numerous time scales by significant changes in oceanic and atmospheric conditions including longer-scale basin-wide regime shifts, episodic phenomena such as *El Niño-La Niña* events, and seasonal upwelling and downwelling events. Rockfish have evolved life-history strategies that accommodate such environmental variability.

3.1.1 Cowcod Habitat

The distribution of cowcod extends from central Oregon to central Baja California and Guadalupe Island, but they are rare off Oregon and Northern California (Butler et al. 1999). Adults are usually associated with rocky bottoms, particularly where there are sharp, steep drop-offs. They typically inhabit the continental slope and upper continental shelf, from about 150 m to 250 m and are classified as a parademersal species). Commercial Passenger Fishing Vessel (CPFV) logbook data were used to identify areas of high CPUE for cowcod off central and southern California. These areas are considered to be important habitat areas for cowcod, and likely comprise significant remaining population centers (Figure 2-1).

Cowcod are found at varying depths depending on life stage. Larval cowcod have been found in northern California to northern Baja, California and between 13 km and 306 km offshore. Juveniles settle to the bottom and have been found as deep as 224 m (Love 2002). Adult cowcod are primarily found from 50 m to 303 m, with smaller fish generally found at the shallower end of the depth range (Barnes 2001).

Life stage also plays a role in cowcod habitat associations. Moser et al. (2000) found the highest number of larvae around the Channel Islands. From March to September, young settle into fine sand and clay sediments, as well as over oil platform shell mounds, oil pipelines, crinoid beds, and other complex strata. Adult cowcod occur on high-relief rock outcrops, particularly those with caves, crevices, and boulders, as well as the undercut bottom crossbeams of some oil platforms. Adult cowcod are reclusive fish and are often found with either their heads or bodies inside caves and crevices (Love 2002). Adults in Soquel Canyon are associated with rocky mud, ridge, and boulder habitats (Yoklavich et al. 2000). Information on habitat needs during mating is unavailable but parturition occurs from November through March, and presumed to occur around rocky ledges and steep slopes.

While the effects of fishing on cowcod habitat have not been directly investigated, there are several studies exploring how gear affects habitat. Auster and Langton (1999) reviewed a variety of research reporting habitat effects due to fishing for a wide range of habitats and gear types. Commonalities of all studies included immediate effects on species composition and diversity and a reduction of habitat complexity.

Bottom trawling gear is known to modify seafloor habitats by altering benthic habitat complexity and by removing or damaging infauna and sessile organisms (Friedlander et al. 1999; Freese et al. 1999). In a study on the shelf and slope off California, high-resolution sidescan-sonar images of the Eureka area revealed deep gouges on the seafloor believed to be caused by trawl doors (Friedlander et al. 1999). The effects of bottom trawling on a 'hard bottom' (pebble, cobble, and boulder) seafloor was also investigated in the Gulf of Alaska and results indicated that a significant number of boulders were displaced and emergent epifauna were removed or damaged after a single pass with trawl gear. Casual observations during the Freese et al. (1999) study revealed that Sebastes species use cobble-boulder and epifaunal invertebrates for cover. When boulders are displaced they can still provide cover, but when piles of boulders are displace it reduces the number and complexity of crevices (Freese et al. 1999).

There is less information available detailing the effects of fixed gear on habitat. Limited qualitative observations of fish traps, longlines, and gill nets dragged across the seafloor during set and retrieval showed results similar to mobile gear, such that some organisms living on the seabed were dislodged; however, quantitative studies of acute and chronic effects of fixed gear on habitat have not been conducted (Auster and Langton 1999). It should be noted that the extent of fixed gear dragging is much less than that of mobile gear.

In the last few decades, marine debris has also been recognized as posing a risk to marine organisms via entanglement and ingestion. Seafloor debris was surveyed from Point Conception, California south to the United States - Mexico international border at depths of 10 to 200 m and anthropogenic debris occurred on approximately 14 percent of the mainland shelf. Of the debris sampled, discarded fishing gear had the largest spatial coverage, followed by plastic, metal, and other debris (e.g., shoe soles and automobile parts) (Moore and Allen 1999).

3.1.2 Essential Fish Habitat

The Magnuson-Stevens Act defines EFH as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." EFH for Pacific coast groundfish is defined as the aquatic habitat necessary to allow for groundfish production to support long-term sustainable fisheries for groundfish and for groundfish contributions to a healthy ecosystem. The groundfish FMP groups the various EFH descriptions into units called "composite" EFHs. This approach focuses on ecological relationships among species and between the species and their habitat, reflecting an ecosystem approach in defining EFH. Seven major habitat types were adopted as the basis for such assemblages or "composites":

Cowcod composite EFH is classified as "Rocky Shelf" for adult stage:

> Those waters, substrates, and associated biological communities living on or within ten meters (5.5 fathoms) overlying rocky areas, including reefs, pinnacles, boulders and cobble, along the continental shelf, excluding canyons, from the high tide line MHHW to the shelf break (~200 meters or 109 fathoms);

"Neritic" for larval stage:

> Those waters and biological communities living in the water column more than ten meters (5.5 fathoms) above the continental shelf;

and "Rocky Shelf, Non-Rocky Shelf" for juvenile stage:

> Those waters, substrates, and associated biological communities living on or within ten meters (5.5 fathoms) overlying the substrates of the continental shelf, excluding canyon composites, from the high tide line MHHW to the shelf break (~200 meters or 109 fathoms).

There is inadequate information to define EFH for parturition and mating stage (PFMC 1998).

3.2 Biological Environment

3.2.1 Cowcod Stock Status

The cowcod stock of the U.S. west coast extends from the U.S.-Mexico border north to Oregon, although they are rare north of Cape Mendocino. The cowcod stock south of Cape Mendocino has experienced a long-term decline. Based on CPFV logs, abundance indices decreased approximately ten-fold between the 1960s and the 1990s (Butler *et al.* 1999). Recreational and commercial catch also declined substantially from peaks in the 1970s and 1980s, respectively (Figure 3-1).

The cowcod stock in the Conception management area (Point Conception to the U.S.-Mexico border) was assessed for the first time in 1998 (Butler *et al.* 1999). Initial (unfished) spawning biomass was estimated at 3,370 MT. The 1998 spawning biomass was estimated at 7% of its unfished biomass, with a 95% confidence interval of 4% to 11% of its unfished abundance, well below the 25% overfishing threshold (Figure 3-2). As a result, NMFS declared cowcod in the Conception and Monterey management areas overfished in January 2000.

The stock's low productivity and current spawning biomass necessitates an extended rebuilding period, estimated at 62 years (T_{MIN}) with no fishing related mortality, to achieve B_{MSY} (1,350 MT in the Conception management area) Appendix D-1).

3.2.2 Cowcod Life History

Cowcod (*Sebastes levis*) is one of the largest West Coast rockfish. The maximum recorded size is 37 inches (94 cm), but larger specimens have been reported (Eschemeyer *et al.* 1983). Adults are uniform pale pink to orange in color(Figure 3-3). Their heads are large and spined, the dorsal fins are deeply notched, and there is an unusually wide space between the eye and the upper jaw (Miller and Lea 1972). Young fish have four dark vertical bands on their sides which gradually fade into dusky blotches as they increase in size. Juvenile cowcod are distinguished by relatively large pectoral fins. Larval and juvenile cowcod are planktonic for up to three months and likely disperse long distances before settling to the bottom. This dispersal suggests cowcod represent a single biological population across the species' range.

Cowcod are long -lived, slow growing, and late to mature (median age of 50% maturity is 12 years). The maximum age for this species is estimated to be 75 years, which corresponds to an estimated mean generation time of 37 years. Cowcod continue to grow throughout their life, and therefore older and large females provide greater reproductive capacity than younger adults. As with other members of the genus *Sebastes*, fertilization is internal, and females give birth to planktonic larvae during the winter. The larvae are free floating and may be found in shallower water; however, as they grow larger they move to deep water rocky habitats and become relatively sedentary.

This species is generally solitary and does not migrate, however, they may occasionally aggregate or move in search of food.

3.2.3 Ecological Interactions

Cowcod are part of the southern shelf rockfish complex and are primarily associated with other rockfish of this complex (PFMC 2000). In mixed species commercial fisheries historically landing cowcod , species composition varies with gear type. In the trawl fishery, which is primarily in the Monterey management area, the main species taken with cowcod are chilipepper, bocaccio, and widow rockfish. In the hook and line and setnet fishery, which is primarily in the Conception management area, bronzespotted, bocaccio, and vermillion rockfish are most important (Butler et al. 1999).

Juveniles occur on similar strata where they are often accompanied by shrimp and other juvenile rockfish such as stripetail, splitnose, or swordspine. Larger immature fish are often found among anemones, sponges, crinoids and in association with bocaccio, greenspotted, greenblotched, and flag rockfish (Love 2002). Individual subadults have also been found in association with large white sea anemones on outfall pipes in Santa Monica Bay (Butler et al. 1999).

The diet of the cowcod includes mainly fishes, octopus, and squid. Juvenile cowcod eat small shrimp and crabs.

3.3 Socioeconomic Environment

Fishing communities, as defined in the Magnuson-Stevens Act, include not only the people who actually catch the fish, but also those who share a common dependency on directly related fisheries-dependent services and industries. In commercial fishing, this may include boatyards, fish handlers and processors, and ice suppliers. In recreational fishing, this may include tackle shops, small marinas, lodging facilities that cater to out-of-town anglers, and tourism bureaus that advertise charter fishing opportunities. Another component of fishing communities is the people employed in fishery management and enforcement.

Fishing communities of the West Coast depend on commercial and/or recreational fisheries for many species. Participants in these fisheries employ a variety of fishing gears and combinations of gears. Naturally, community patterns of fishery participation vary coastwide and seasonally based on species availability, the regulatory environment, and oceanographic and weather conditions. Each community is characterized by its unique mix of fishery operations, fishing areas and habitat types, seasonal patterns, and target species. While each community is unique, there are many similarities. For example, all face danger, safety issues, dwindling resources, and a multitude of state and federal regulations.

Individuals make up unique communities with differing cultural heritages and economic characteristics. Examples include a Vietnamese fishing community of San Francisco Bay, and an Italian fishing community of southern California. Also included in these considerations are the Native American communities with an interest in the groundfish fisheries (however, there are no coastal tribal communities in the area of concern). In most areas, fishers with a variety of ethnic backgrounds come together to form the fishing communities within local areas, drawn together by their common interests in economic and physical survival in an uncertain and changing ocean and regulatory environment.

Demographic information on geographic communities at the county level has been compiled for a general baseline description of West Coast fishing communities. This information may be downloaded from the Council web site (www.pcouncil.org).

People use fish in a variety of ways including as a food source, a resource base for businesses and jobs, recreation, and religious symbols. For some people, even the knowledge and certainty that a species or type of human community will continue to exist constitutes a valued part of their environment. Various types of values that humans place on fish and on human economic and social structures associated with fishing are affected by changes in fishing policy.

The primary form of information on the Socioeconomic environment is harvest related statistics. There is little information available about the characteristics of the individual participants and their social relationships other than harvest information. Information on the characteristics of the participants would allow us to look more at communities of association and how those communities fit within geographic communities. The following information on West Coast fisheries provides a simple look at the aggregated activities of individuals.

Cowcod have been harvested for nearly 100 years, with catch estimates back at least to 1915. The recreational fishery for cowcod developed after World War II off southern California. Recreational landings peaked in 1984 in the Conception area and declined rapidly to less than 2 mt in 1997. Commercial landings of cowcod peaked in 1984 at 141 mt and declined to low levels in the late 1990s. Most recreational catch of cowcod has been in the Conception area. Until recent years, most commercial cowcod catch was also in the Conception area, with smaller amounts taken in the Monterey area. Monterey area landings exceeded those in the Conception area in most years after 1989.

3.3.1 Commercial Fisheries

The commercial fishery took few cowcod prior to the early 1950s, and from about 1955 to 1980 took substantially less than the recreational sector. However, commercial fishing became the dominant harvest sector in the early 1980s. Trawls, set gillnets and hook-and-line were the primary commercial gear types used after about 1975. Nearly all the commercial cowcod landings during the 1980 to 1997 period occurred in the Monterey and Conception areas, with minor amounts landed in the Eureka management area. Landings in the Conception area peaked in 1984 and declined quickly after 1986. Landings in the Monterey area reached an initial peak in 1984, declined to low levels and peaked again in 1992; commercial landings in this area were consistently below the Conception area until 1990 (Figure 3-4).

Commercial landings of cowcod increased rapidly from 1982 to 1986, with setnets taking the largest share of the catch. Trawl landings plummeted from 1984 to 1985 and remained low until the early 1990s, when trawl gear became the primary commercial fishing mode for cowcod. Similarly, hook-and-line gear took the largest share of the cowcod catch in 1988, after which landings fell to low levels (Figure 3-5).

From 1981 to 1997, most of the trawl catch of cowcod was landed in the Monterey management area, mostly in the ports of San Francisco, Monterey, Bodega Bay, and Moro Bay, with a few landings in Conception area ports of Santa Barbara and Ventura. Most set net landings were made in Moro Bay and Santa Barbara, but substantial landings were made as far south as San Diego. Ventura was the primary port for hook-and-line landings.

3.3.2 Commercial Buyers and Processors

Groundfish buyers include processing plants, buying stations and vessels that hold buyers licenses and sell directly to wholesale markets. The total numbers of buyers active in the central and southern regions of California increased from 1998 to 1999. Most of the volatility in numbers of buyers occurs in the smaller size classes, those purchasing less than $10,000 exvessel value groundfish in a year (note: smaller groundfish buyers may include large seafood buyers that buy only small quantities of groundfish). The number of larger buyers (over $500,000 in exvessel purchases) in north-central California and south-Central California (Santa Cruz to Oxnard) declined from the range observed from 1994-1997.

3.3.3 Recreational Fisheries

Recreational fishing has been part of the culture and economy of West Coast fishing communities for more than 50 years. Along the northern coast, most recreational fishing targeted salmon, but the abundant rockfish often provided a bonus to anglers. Recreational fisheries have contributed substantially to fishing communities, bringing in outside dollars and contributing to tourism in general.

Recreational fishing in the open ocean appears to have been on a downward trend for a number of years. Part of this decline is likely the result of shorter salmon seasons and smaller bag (retention) limits. Some effort shift from salmon to groundfish likely occurred. Groundfish are taken as target catch and as incidental catch in fisheries targeting other species. The degree to which the opportunity to harvest groundfish contributes to incentive for non-groundfish trips is uncertain; however, there is likely some relationship to the frequency of groundfish catch on the trip. More recreational trips are taken in southern California than in northern California (Table 3-1), Oregon, or Washington.

TABLE 3.1. California recreational groundfish related trips and related income impacts, estimate for 2000, projections for 2001 and 2002 seasons.

		Trips (1,000's)			Local Income Impacts ($1,000's)			% Change from Previous Year
		Charter	Private	Total	Charter	Private	Total	
Northern California								
	2000	101	120	221	12,320	4,933	17,253	
Projected	2001	83	85	168	10,085	3,487	13,572	-21
Projected	2002	69	76	145	8,422	3,128	11,549	-15
Southern California								
	2000	57	28	85	6,971	1,236	8,207	
Projected	2001	50	18	68	6,147	785	6,931	-16
Projected	2002	42	15	58	5,194	679	5,873	-15

Recreational fishing activities follow a similar seasonal pattern along the entire coast, although there are regional variations. Summer is the most important time for recreational ocean fishing, with the peak occurring in July and August. The fewest trips are taken during November and December.

Cowcod reach the largest size of any rockfish in central and southern California, and are a highly prized trophy in the recreational fishery. Recreational fishers take cowcod with hook-and-line and in the past used as many as 10 baited hooks per rod. Jigs with treble hooks are also a popular method of catching cowcod. The California record for sport-caught cowcod is 21 lbs 14 oz, but the recreational fishery produced confirmed specimens as large as 34 lbs in the late 1990s.

Recreational effort was directed at cowcod from both private fishing boats and commercial passenger fishing vessels (CPFVs). Cowcod catch rates were low in the private boat fishery during 1975-1976, when they accounted for only 179 out of 140,296 fish sampled in a CDFG survey of private boats in the southern California sport fishery.

CPFVs include both charter boats (carrying a prearranged or closed group of anglers) and party boats (open to the general public, without prior reservation). The CPFV industry began in southern California around 1919, and by 1939 the fleet consisted of over 200 boats. CPFV operators targeted numerous species during the first half of the 20th century, such as tuna, giant sea bass, marlin, swordfish, mackerel, California halibut, kelp and sand bass, bonito, barracuda, and yellowtail. However, early reports do not list *Sebastes* (rockfish) as a CPFV target group during the first half century.

Following World War II, there was a notable expansion of the CPFV fleet, and by 1953 it totaled about 590 boats. By 1963, the statewide CPFV fleet had declined to 476 vessels, 450 of which operated out of central and southern California ports. The majority of the 1963 CPFV fleet (256 vessels) was based in the southern California bight. Species of preference for the southern California CPFV fleet did not include rockfish, although rockfish were listed as an important part of the catch. By 1974, attitudes of the typical CPFV fisher had changed, and there was increased effort directed towards rockfish. With the decline in availability of "traditional" sportfish in the 1960s and 1970s, less lively "food" fish such as *Sebastes* were sought in order to maintain angler satisfaction. In the 1980s and 1990s, cowcod seasonal catch tended to peak in late autumn through early spring, which is the time of year when southern California CPFVs normally target bottom fishes.

CPFVs in northern and central California typically have capacities of 6 to 50 anglers, and in southern California they may range up to about 60 anglers. State law has required logbooks for every CPFV trip since 1935, but compliance is not complete. From 1981 to 1986 in central and northern California, CPFV logbook data was found to account for 38% to 62% of total effort, and 49% to 84% of total catch. Prior to 1964, cowcod were not reported separately on logbooks, but instead were combined with all other *Sebastes* as part of a rockfish group. After 1964, it was common practice of CPFV skippers to itemize catches of large cowcod (>5 lbs), but they probably continued to lump small cowcod with other rockfish.

The Los Angeles Times reports catches from CPFVs between San Diego and Morro Bay. These reports are comparable to the logbook data for most common species, but give slightly higher numbers for the most desirable species (yellowtail and bonito). The Times reports many more cowcod than CPFV logbooks. Although highly sought in the later decades of the fishery, cowcod consistently composed less than 1% of the CPFV rockfish catch since the 1960s. Prior to 1981, the recreational fishery accounted for most of the annual catch of cowcod in the southern California bight. After 1981, the commercial fishery became dominant. Recreational catch increased substantially during the late 1960s and early 1970s, peaking at an estimated 140 mt in 1976. After that year, recreational catches fell rapidly to less than 20 mt in 1986.

The species is typically caught by targeting specific areas where cowcod are more abundant. Unintentional catch by recreational fishers is relatively rare outside those areas.

3.3.4 Fisheries Management

The primary management measures for controlling groundfish catches are the annual harvest levels, which include acceptable biological catch (ABC) and optimum yield (OY) specifications. The regulatory measures available to manage the West Coast groundfish fishery include, but are not limited to, harvest guidelines, quotas, landing limits, frequency limits, gear restrictions, time/area closures, prohibited species, bag and size limits, permits, other forms of effort control, allocation, reporting requirements, and on-board observers. The FMP provides framework procedures for implementing general management measures. The Framework provisions allow management measures to be adjusted as necessary, to prevent overfishing and adverse social and economic impacts For the commercial fishery prior to 2001, the primary cowcod management measure was landing limits. For the recreational fishery, the primary management measures have been bag limits and seasons.

Prior to 2000, cowcod were managed as part of the *Sebastes* complex and remaining rockfish and did not have a species specific ABC or OY. Commercial cowcod landings were restricted only by the generic *Sebastes* complex limits that included nearly all rockfish species. The recreational bag limit in Monterey and Conception management areas were 15 rockfish per day, and the season ran year round.

In 2000, species specific ABC and OYs were developed for cowcod and the *Sebastes* complex was restructured into nearshore, shelf and slope species groups. Cowcod was included in the minor shelf south category and a landing limit of one fish per landing was allowed most of the year, except for closures in January and February in the Conception area and in March and April in the Monterey area. In the California recreational fishery, cowcod was included in the daily bag limit of 10 rockfish, no more than one of which could be cowcod, and seasons were parallel with the commercial fishery. Gear restrictions in the commercial fishery were also instituted in 2000 that prohibited the use of trawl gear with a footrope diameter of greater than 8 inches, or the use of chafing gear, when landing certain rockfish species. This restriction was intended to eliminate the use of trawl gear in rocky habitats, including those frequented by adult cowcod.

Beginning in 2001, retention of cowcod was prohibited in both recreational and commercial fisheries and two MPAs were established to protect the remaining population centers. These actions were taken in response to the recent stock assessment indicating a severely depressed status and the subsequent declaration by NMFS that the stock was overfished.

Bycatch mortality for cowcod in the commercial fisheries assumed a 16% bycatch/discard rate for cowcod based on the landed catch. This is a proxy for cowcod originally estimated for widow rockfish from trawl observations in the mid-1980s (Pikitch *et al.* 1988). In recreational fisheries, bycatch rates were estimated from CPFV logbooks by 100 nm^2 strata in the Southern California Bight. The relative encounter rate of cowcod and other rockfish were used to determine the likely catch of cowcod within each stratum, then summed for the entire area. The areas of frequent occurrence of cowcod were used to establish the MPAs in 2001.

4.0 ENVIRONMENTAL CONSEQUENCES

This EIS/RIR analyzes the effects of alternative rebuilding strategies on cowcod, co-occurring species, affected habitat, and the socioeconomic environment for fisheries between Cape Mendocino, California and the U.S.-Mexico border. Fisheries north of this area do not significantly affect the cowcod population or important cowcod habitat.

TABLE 4-1. Ranked relative effects of alternative cowcod rebuilding strategies on the probability of timely rebuilding, potential negative habitat impacts, and short term economic costs (1 is highest rank, 5 is lowest rank).

Alternative	Probability of Timely Rebuilding	Potential Negative Habitat Effects	Socioeconomic Costs
No Action	6	1	5
Maximum Conservation	1	6	1
Maximum Harvest	5	2	4
60% Intermediate Rebuilding	3	4	3
80% Intermediate Rebuilding	2	5	2
Council Interim Rebuilding	4	3	4

4.1 Physical Environment

In general, potential fishing-related impacts on rockfish habitat could take the form of lost or discarded fishing gear, direct disturbance of the seafloor from contact by trawl nets, and direct disturbance of the seafloor contact by longlines and fish traps. Alternatives that include MPAs would provide areas where fishing gear impacts would be minimized. Bottom trawl operations would most affect adult cowcod habitat. Small footrope and chafing gear restrictions are believed to reduce potentially harmful effects of bottom trawls in rocky shelf habitat (National Academy Press 2002) and should be considered. To the extent that fixed gear and other potential fishery impacts to cowcod habitat can be avoided or mitigated, a modest benefit could also be anticipated.

4.1.1 Cowcod Habitat

As discussed in 3.1.1, cowcod are relatively sedentary rockfish that are typically associated with high-relief rocky outcrops, slopes, and ledges in central and southern California. The proposed alternatives are expected to affect cowcod habitat by varying the potential for interactions with fishing gear and the pollution associated with fishing vessels. Proposed alternatives will have a negligible effect on other anthropogenic stressors affecting cowcod habitat such as mineral harvesting, marine debris, urban run -off, and the introduction of non-indigenous species.

Alternative rebuilding strategies would have varying effects on rocky bottom habitats of the continental shelf and slope where cowcod reside, primarily associated with the degree to which MPAs are considered. The *No Action* alternative would have the greatest potential impact on cowcod habitats since a greater fishing intensity would ensue and no consideration would be given to MPAs to aid in controlling fishing-related mortality or to protect EFH.

The *Maximum Conservation* alternative would have the least habitat impact since it eliminates groundfish fisheries that target or incidentally catch cowcod and therefore eliminates potential fishing-related habitat impacts. The reduced impacts associated with this alternative would extend to all benthic habitats south of Cape Mendocino, since groundfish fishing activities would be prohibited in the entire area.

The *80% Intermediate Rebuilding* alternative would have greater habitat impacts than the *Maximum Conservation* alternative, but less than other alternatives because of the seasonal fishing closure, which would effect all habitat types south of Cape Mendocino. The seasonal closure, however, may result in displaced fishing effort into the open periods, and negate some of the benefits.

The *60% Intermediate, Council Interim Rebuilding* and *Maximum Fishing* alternatives would have impacts to Cowcod habitat intermediate between the *80% Intermediate* and the *No Action* alternatives. Impacts to adult cowcod habitat would be similar for all three since the proposed MPAs all contain similar amounts of adult habitat and differ primarily in dimension to facilitate enforcement. Some reduced impacts to larval and juvenile cowcod habitat may be associated with the larger MPAs, which include habitat for those life stages.

Programmatic measures designed to identify, protect, and minimize potential fishing impacts on West Coast rockfish EFH will be analyzed in the Supplemental EIS in preparation by NMFS. Any habitat protection measures identified in the EFH Supplemental EIS that can be applied to encourage rebuilding cowcod either through reducing total mortality or enhancing population productivity should be considered as an adjunct to other harvest control measures analyzed in this plan.

4.2 Biological Environment

4.2.1 Stock Status - Probability of Successful Stock Rebuilding

Cowcod stock rebuilding was modeled using a surplus production model because of the density dependent population growth inherent in the logistic equation (Appendix D-1). The analysts also tried the delay difference model used in the cowcod stock assessment (Butler et al. 1999), which yielded longer rebuilding times (average time = 145 years). Population simulations began with the 1998 cowcod biomass. Surplus production was modeled using a log-normal distribution fitted to recruitment (R) during 1951-1998 (Butler et al. 1999). Population trajectories with a fixed mean R indicated that minimum time to Bmsy in the absence of fishing was 62 years. All estimates of time to rebuild the cowcod to B_{MSY} assume mean values of unfished spawning biomass, current spawning biomass, maximum age, and generation time estimated in the rebuilding analysis for the Conception management area stock component (Appendix D-1). The probability of successfully rebuilding the cowcod stock is based on an analysis of the effects of fishing related mortality on a population model of the stock, and is expressed in terms of the probability of rebuilding the stock to B_{MSY} within T_{MAX} (Appendix D-1). The median rebuilding period is estimated by iteratively solving for the harvest rate(s) that produces a desired probability of rebuilding within T_{MAX}. This harvest rate corresponds to a 50% probability of achieving B_{MSY} within the median rebuilding period.

All alternatives except the *No Action* alternative assume a constant harvest rate is applied to the stock for the duration of the rebuilding period. Alternatives with higher harvest rates have a lower probability of rebuilding within T_{MAX} and a greater risk that rare events occurring in combination could cause the stock to become extinct. Alternatives with lower harvest rates and a higher probability of rebuilding within T_{MAX} will rebuild the stock quicker and achieve B_{MSY} sooner, at which time management could revert to an objective of F_{MSY}.

The harvest rates necessary to facilitate rebuilding of the cowcod stock are relatively low in comparison to historical harvest rates. To achieve such low harvest rates, all alternatives except the *No Action* alternative include MPAs. These MPAs would prohibit groundfish fishing activities in key habitat areas that could potentially impact cowcod. Since cowcod are generally sedentary and exhibit high site fidelity, MPAs are likely to protect a portion of the stock on a continuing basis.

To further reduce harvest rate, gear restrictions are also included in all alternatives except the *No Action* alternative. For the commercial trawl fishery several groundfish species found primarily on the continental shelf may not be landed by any vessel using trawls with footropes larger than eight inches in diameter. Also, the lower sections of the net may not have any material added to protect it from damage or snagging by rocks or other components of the ocean floor. These provisions are believed to have effectively eliminated trawling in rocky areas inhabited by cowcod, canary rockfish, lingcod, and associated species. An analysis by ODFW (Hannah and Freeman 2000) indicated that a significant decrease in trawl activities in rocky shelf areas off Washington and Oregon. Although updated trawl logbook information is not available for California, it is likely that similar changes in fishing areas have occurred.

The *No Action* alternative allows the harvest rate to increase as the stock rebuilds according to the precautionary 40-10 adjustment to the ABC, as specified in the FMP. The total catch OY for this alternative, however, exceeds the predicted capacity of the stock to rebuild from its currently depressed state, and would result in functional extinction of the U.S. portion of the cowcod population.

TABLE 4-2. Projected stock biomass (MT) for cowcod in the Conception management area under rebuilding alternatives.

Year	*No Action*	*No Harvest*	*Maximum Harvest*	*Intermediate Rebuilding*	*Council Interim Rebuilding*
2000					
2005					
2010					
2015					
2020					
2025					
2030					
2035					
2040					
2045					
2050					
2055					
2060					
2065					
2070					
2075					
2080					
2085					
2090					
2095					
2100					

All of the alternatives except the *No Action* alternative would prohibit retention of cowcod in both recreational and commercial fisheries, and in those alternatives allowing harvest impacts, bycatch mortality alone would use up the impacts. Therefore, effective bycatch control mechanisms are critical for successful rebuilding of the cowcod stock (see Section 4.3.4). All alternatives except the *No Action* alternative employ MPA's to reduce the likelihood that cowcod will be encountered by fishing activities, and therefore reduce potential bycatch. Effective implementation of MPAs will require on-water enforcement of boundaries and gear restrictions (see Section 4.3.4).

4.2.2 Cowcod Life History

Alternatives that include MPAs will provide refuges for adult cowcod, which are generally sedentary and have high site fidelity. MPA's for species with this behavior type may have a positive direct and indirect effects on rebuilding. Direct effects are protection of a portion of the stock since it is not likely to be intercepted by fishing activities outside the MPA. Indirect effects occur as a result of changes to the age structure of the population.

The fecundity of cowcod increases with age, and the greater the average age of the stock, the more productive the stock will be. By allowing the stock to increase and mature within the bounds of an MPA, the reproductive potential of the stock will increase. Since the larvae are planktonic, the increased abundance within the MPA will benefit the population at large.

Recent recruitment estimates used in the population simulation model were the product of spawning biomass levels that existed after the stock had been subjected to significant fishing pressure. Because the stock has continued to decrease, future recruitment will likely be even less. However, as the stock rebuilds and matures under alternatives with MPAs, the recruitment may increase quicker than under the *No Action* alternative, which would tend to keep the population age structure similar to current conditions. Alternative MPA designations likely do not have significantly different effects on cowcod because they all protect the same important habitat areas and differ primarily in dimension to facilitate ease of enforcement.

4.2.3 Ecological Interactions

Rockfish species that are associated with cowcod may experience direct positive effects from alternatives that include MPAs resulting from reduced fishing mortality and increased average age and associated reproductive potential. This potential benefit, however, is likely only for those species with similar behavior patterns. Transitory species such as bocaccio and widow rockfish, although apparently associated with cowcod, are probably migrating through cowcod habitat. Once outside of the protective MPA, they would be subject to fishing pressure, which may be intensified due to displacement of the fleet from MPA closures.

Alternative MPA designations may have significantly different effects on some species not associated with cowcod since the difference in dimensions results from including additional habitat not associated with cowcod. The benefits to other species of including different habitat types in an MPA would depend on the occupying species having similar residency behavior and life history characteristics as cowcod.

MPAs may have additional positive indirect effects on cowcod and related species. Fishing gear is thought to impact benthic habitats, including flora and fauna which provide food and cover for numerous species (see Section 4.2). By lessening fishing gear impacts, recruitment and growth of dependent species may increase.

4.3 Socioeconomic Environment

All alternatives except the *No Action* alternative prohibit retention of cowcod in both recreational and commercial fisheries, at least initially. Therefore, estimating potential revenue from cowcod OYs as rebuilding occurs is not meaningful since no capital will be generated. The realized value from rebuilding the cowcod stock will be in terms of constraints, or lack thereof, on other fisheries that have incidental impacts on cowcod.

Other groundfish trawl fisheries, for example, may be closed when the annual cowcod OY is reached (as bycatch mortality). Having a sufficiently large cowcod OY that incidental bycatch mortality will not exceed the OY will allow that fishery to proceed and continue to generate economic benefits. The *No Action* alternative would allow retention and sale of cowcod, but would result in rapid extension of the stock. This may relieve constraints on other fisheries, but would be contrary to the intent of the MSA and FMP.

A determination of potential socioeconomic consequences of rebuilding alternatives associated with cowcod harvest, independent of other fisheries and constraints, can be discerned by projecting future yields under alternative rebuilding probabilities (Table 4-3).

TABLE 4-3. Projected total catch optimum yields (MT) for cowcod in the Monterey and Conception management areas under rebuilding alternatives.

Year	*No Action*	*No Harvest*	*Maximum Harvest*	*Intermediate Rebuilding*	*Council Interim Rebuilding*
2000					
2005					
2010					
2015					
2020					
2025					
2030					
2035					
2040					
2045					
2050					
2055					
2060					
2065					
2070					
2075					
2080					
2085					
2090					
2095					
2100					

4.3.1 Commercial Fisheries

The ex-vessel value of commercial groundfish fisheries in the Monterey and Conception management areas was estimated at $12.7 million for 2000 (PFMC 2002). The majority of cowcod bycatch is associated with fisheries targeting other rockfish, lingcod, and sablefish. These fisheries were estimated to have an ex-vessel value of $8.6 million in 2000. All alternatives except the *Maximum Conservation* alternative establish an annual

OY for cowcod that could be reached before the end of the annual management cycle and result in early closure of some or all of these fisheries. The risk of that occurring relative to each alternative is proportional to the cowcod OY, which is based on the constant harvest rate (F) and stock abundance in a given year (Table 4-4). Alternatives with lower harvest rates will have lower OYs early in the rebuilding process, but because the stock rebuilds quicker, may have higher OYs later in the process. Other stocks, however, may constrain fisheries before cowcod OYs are reached.

Alternatives other than the *No Action* alternative could result in economic hardship within the California commercial groundfish industry. Some businesses could fail, although some could survive by converting to non-groundfish fisheries, or moving north of Cape Mendocino. The potential displacement of the fleet would be proportional to the allowable harvest rates for the alternatives, with The *Maximum Conservation* alternative resulting in the most displacement and the *Maximum Fishing* alternative resulting in the least.

Displaced vessels may seek to recover lost revenue by increasing their participation in other fisheries. The most likely fisheries to which they may turn first are those in which vessels already participate, increasing competition in those other fisheries (PFMC 2001). The larger producing groundfish trawl vessels also tend to participate in the Dungeness crab fishery, the shrimp/prawn fishery, and the troll albacore fishery. For groundfish hook-and-line vessels, the most frequent combination of strategies was groundfish hook-and-line and salmon, followed by groundfish hook-and-line and Dungeness crab. For groundfish pot vessels, the most frequent combination of strategies was groundfish pot and groundfish hook-and-line, followed by groundfish pot, groundfish hook-and-line, and salmon.

As mentioned in section 4.1.1, quantifying bycatch is critical to implementing an effective cowcod rebuilding plan since under all alternatives, except the *No Action* alternative, retention is prohibited and allowable impacts would be consumed by bycatch discard. NMFS is in the process of establishing an on-board observer program for West Coast commercial fisheries that will provide direct estimates of bycatch (see Section 4.3.4 for a full description of bycatch measures). This program will incur costs to the vessel owner though subsistence and insurance expenses for observers and additional safety equipment requirements.

Another option for bycatch accounting being considered is full retention requirements for all rockfish, which may prove effective in accounting for the total fishing-related mortality of cowcod with verification such as video and vessel transponder systems for monitoring full retention or observer data to compare to vessel collected data. Accountability of rockfish catch in excess of prescribed landing limits would enable accurate estimation of total mortality. If landings were allowed to be sold, targeting of depressed stocks may be encouraged. If landings were not allowed to be sold, vessels would use some of their capacity without compensation, reducing the profitability of their efforts.

4.3.2 Commercial Buyers and Processors

The effects on commercial buyers and processors of the alternatives is difficult to anticipate, since the specific management measures required to implement them are not known with much detail. It is not even known if cowcod will be a constraining stock for commercial fisheries. If not, the cowcod rebuilding plan would have much less impact than if cowcod were a constraining stock. In relative terms the impacts to commercial buyers and processors would be similar to those of the commercial fisheries.

Product output would be expected to decline roughly proportional to the reduced input; however, the effect on net revenue will depend on changes in cost associated with reduced output and any changes in the market prices for the purchasing of raw fish product or the resale of the product. Wholesale prices and processing/wholesaling costs are not available to assess the effects of the harvest reductions on gross or net revenue. In response to the reduced availability of raw product, buyers and processors may seek to increase revenue by bidding or finding other ways to acquire a larger portion of the available raw product (in the groundfish or other fisheries), reducing costs, or finding ways to add value to the products they sell.

4.3.3 Recreational Fisheries

The *No Action* alternative would continue the 2000 management regime, including a 15 rockfish bag limit in waters off southern and central California, a limit of two cowcod per boat, and hook limits. The recreational hook limit provision is intended to reduce the likelihood of catching cowcod.

Under the *Maximum Conservation* alternative, the recreational bottom fishery would close, and much of the fishing effort would be forgone. Because groundfish provide year-round opportunity, much of the current effort is focused on times when seasonally abundant species such as salmon and albacore are not available or when there are closures for those species.

The Maximum Fishing, *Council Interim Rebuilding*, and *60% Intermediate Rebuilding* alternatives rely primarily on establishing MPAs to reduce recreational cowcod harvest rates to target levels. The elimination of these areas from recreational groundfishing would affect primarily the CPFV sector since the proposed MPAs are well offshore, and out of easy range for most of the private fleet. Under these alternatives, effort in both private and CPFV sectors directed at the MPA areas would primarily be displaced into other areas.

The *80% Intermediate Rebuilding* alternative would require additional measures beyond the proposed MPA to maintain the target harvest rate. Measures could take the form of further reductions in individual or boat bag limits, additional seasonal groundfish closures, or gear restrictions. Seasonal closures could include entire management areas or only those portions deeper than some specified level (*e.g.* 20 fathoms). These measures would apply equally to private and CPFV sectors, although relatively greater impacts of depth specific closures would be felt by the CPFV sector because deeper areas off shore are more accessible to the larger vessels.

The effects of the alternatives on effort and associated income generated from recreational angling are difficult to anticipate, but in general, the *Maximum Conservation* alternative would have the greatest short term negative impacts, followed by the *80% Intermediate*, *60% Intermediate*, *Council Interim Rebuilding*, Maximum Fishing, and *No Action* alternatives.

4.3.4 Fisheries Management

One important element in limiting bycatch is accurately measuring bycatch rates by time and area. Bycatch rates of cowcod in West Coast trawl (and non-trawl) fisheries are uncertain. The NMFS began implementing a West Coast Groundfish Fishery Observer Program in August 2001 to make direct observations of commercial groundfish targeting efforts. Observer coverage extends to about 10% of the West Coast fleet currently, but should approach 20% by the summer of 2002 (E. Clarke, NMFS NWFSC, pers. comm.). Because of the rarity of cowcod encounters in West Coast groundfish fisheries, many observations in each sampling strata (i.e. target effort by gear type by area) will be needed to estimate representative rates of cowcod bycatch. This is particularly true for alternatives with MPAs. Therefore, NMFS has stated that Observer Program data probably won't be available for management use until the summer of 2003 at the earliest.

The *No Action* alternative assumes a *16%* bycatch/discard rate for cowcod based on the landed catch OY. The *Maximum Conservation* does not rely on modeled bycatch or any other bycatch accounting mechanism since all fishing-related mortality is eliminated. All other alternatives use the best currently available estimates of bycatch mortality. For recreational fisheries, the best currently available estimates are based on the CPFV logbook data and adjusted for MPAs closed to groundfish fishing. Initially, commercial fisheries will also use CPFV logbook data, to be replaced by Observer Program estimates as they becomes available. There may be a period when a combination of Observer Program data and the best currently available methods for estimating bycatch are used to estimate bycatch. It is anticipated that all rebuilding alternatives will benefit from direct observations of bycatch.

Effective implementation of MPAs under all alternatives except the *No Action* alternative will require enforcement efforts to ensure compliance with boundary and gear restrictions. Additional

4.4.3 Affected Fishing Communities

4.5 Cumulative Impacts

The establishment of additional MPAs that protect cowcod from fishing mortality (e.g. Channel Islands National Marine Sanctuary) would likely accelerate the rebuilding of cowcod.

Rebuilding measures implemented for lingcod, bocaccio, yelloweye, and canary rockfish are likely to effect cowcod rebuilding and vice versa. Nearshore, time/area closures to protect nest-guarding lingcod may reduce impacts of fishing gear and vessel traffic on juvenile and adult cowcod in those areas. Reductions in fishing effort in rocky habitat areas of the continental shelf from trawl gear footrope restriction to protect shelf rockfish may reduce the fishing effort in cowcod habitat, which should hasten cowcod rebuilding and increase protection of cowcod habitat. Landing limit restrictions for bocaccio, canary, and yelloweye rockfish may reduce effort in recreational and commercial fisheries that could accelerate cowcod rebuilding.

5.0 CONSISTENCY WITH FMP OBJECTIVES AND THE MAGNUSON-STEVENS ACT

[to be completed before public review]

5.1 FMP Objectives

5.2 National Standards

5.3 Other Applicable Magnuson-Stevens Act Provisions

6.0 OTHER APPLICABLE LAW

[to be completed before public review]

6.1 National Environmental Policy Act

6.2 Regulatory Impact Review and Regulatory Flexibility Act Determination

6.2.1 Executive Order 12866

6.2.2 Impacts on Small Entities

6.3 Coastal Zone Management Act

6.4 Listed Species

6.4.1 Endangered Species Act

Fisheries that interact with species listed as depleted, threatened, or endangered may be subject to management restrictions under the ESA. West coast groundfish fisheries can potentially interact with species listed under the ESA. Some salmon stocks, migratory bird species, sea turtles, and marine mammals found in the west coast EEZ are ESA-listed (section 4.4.1). None of the west coast groundfish fisheries are considered to have a significant take of these ESA-listed species.

6.4.2 Marine Mammal Protection Act

Fisheries that interact with species listed as depleted, threatened, or endangered may be subject to management restrictions under the MMPA. NMFS publishes an annual list of fisheries in the *Federal Register* separating commercial fisheries into one of three categories, based on the level of serious injury and mortality of marine mammals occurring incidentally in that fishery. The categorization of a fishery in the list of fisheries determines whether participants in that fishery are subject to certain provisions of the MMPA, such as registration, observer coverage, and take reduction plan requirements. The west coast groundfish fisheries are in Category III, indicating a remote likelihood of, or no known serious injuries or mortalities, to marine mammals.

Of the marine mammal species incidentally caught in west coast groundfish fisheries, the Steller sea lion is listed as threatened under the ESA, the northern elephant seal may be within their OSP range, and there is insufficient data to determine the status of the harbor seal, California sea lion, Dall's porpoise, and Pacific white-sided dolphin relative to their OSP. None of these species are classified as strategic stocks under the MMPA. Based on its Category III status, the incidental take of marine mammals in the west coast groundfish fisheries does not significantly impact marine mammal stocks.

6.4.3 Migratory Bird Treaty Act

The Migratory Bird Treaty Act of 1918 was designed to end the commercial trade of migratory birds and their feathers that, by the early years of the 20th century, had diminished populations of many native bird species. The Act states that it is unlawful to take, kill, or possess migratory birds and their parts (including eggs, nests, and feathers) and is a shared agreement between the United States, Canada, Japan, Mexico, and Russia to protect a common migratory bird resource.

The Migratory Bird Treaty Act prohibits the directed take of seabirds, but the incidental take of seabirds does occur. Only limited information exists quantifying the incidental take of seabirds in west coast groundfish fisheries. However, none of the proposed management alternatives are likely to affect the incidental take of seabirds protected by the Migratory Bird Treaty Act. Implementation of the NMFS west coast groundfish observer program should provide additional information about the incidental take of seabirds in groundfish fisheries.

6.5 Paperwork Reduction Act

6.6 Executive Order 13132 (Federalism)

7.0 LIST OF PREPARERS

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Mr. J. Thom Barnes, California Department of Fish and Game: rebuilding analysis and stock assessment co author
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Appendix D-1 Cowcod Rebuilding Analysis

[to be included before public review]

Appendix D-2 FMP Amendment Language

[to be completed before public review]

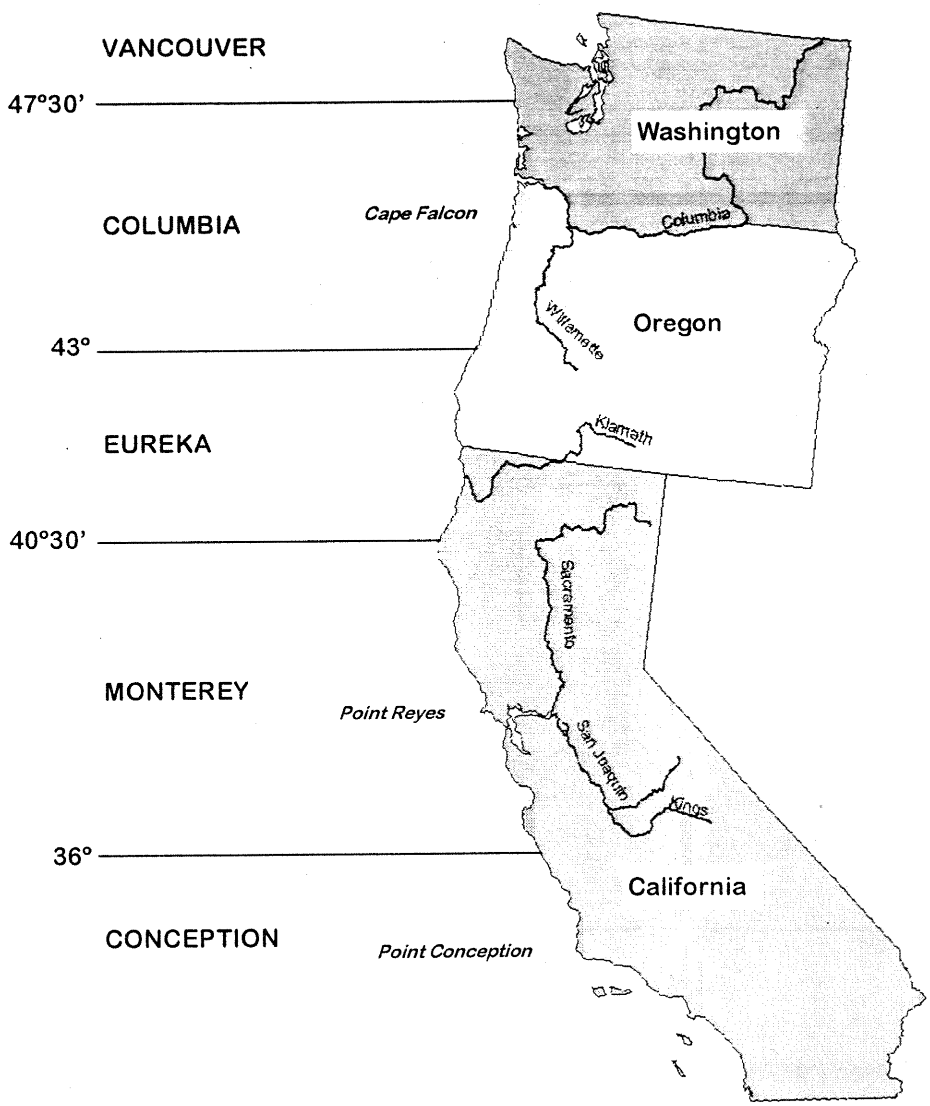

Figure 1-1. The Pacific Fishery Management Council management area (EEZ of the west coast of the United States) and INPFC management areas.

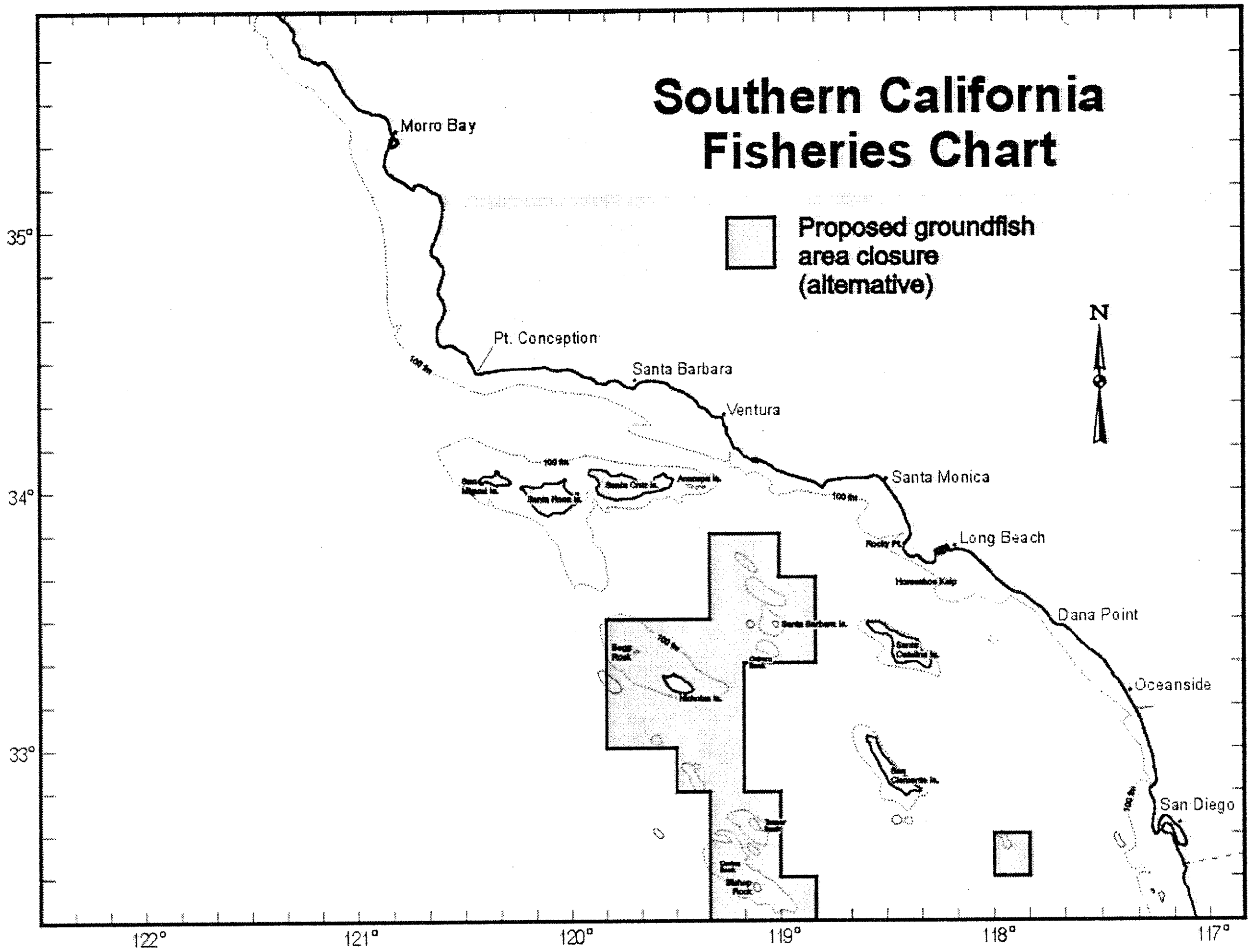

Figure 2-1. Marine Protected Area (MPA) for *Maximum Fishing* alternative. All groundfish fishing activities in water deeper than 20 fathoms would be prohibited.

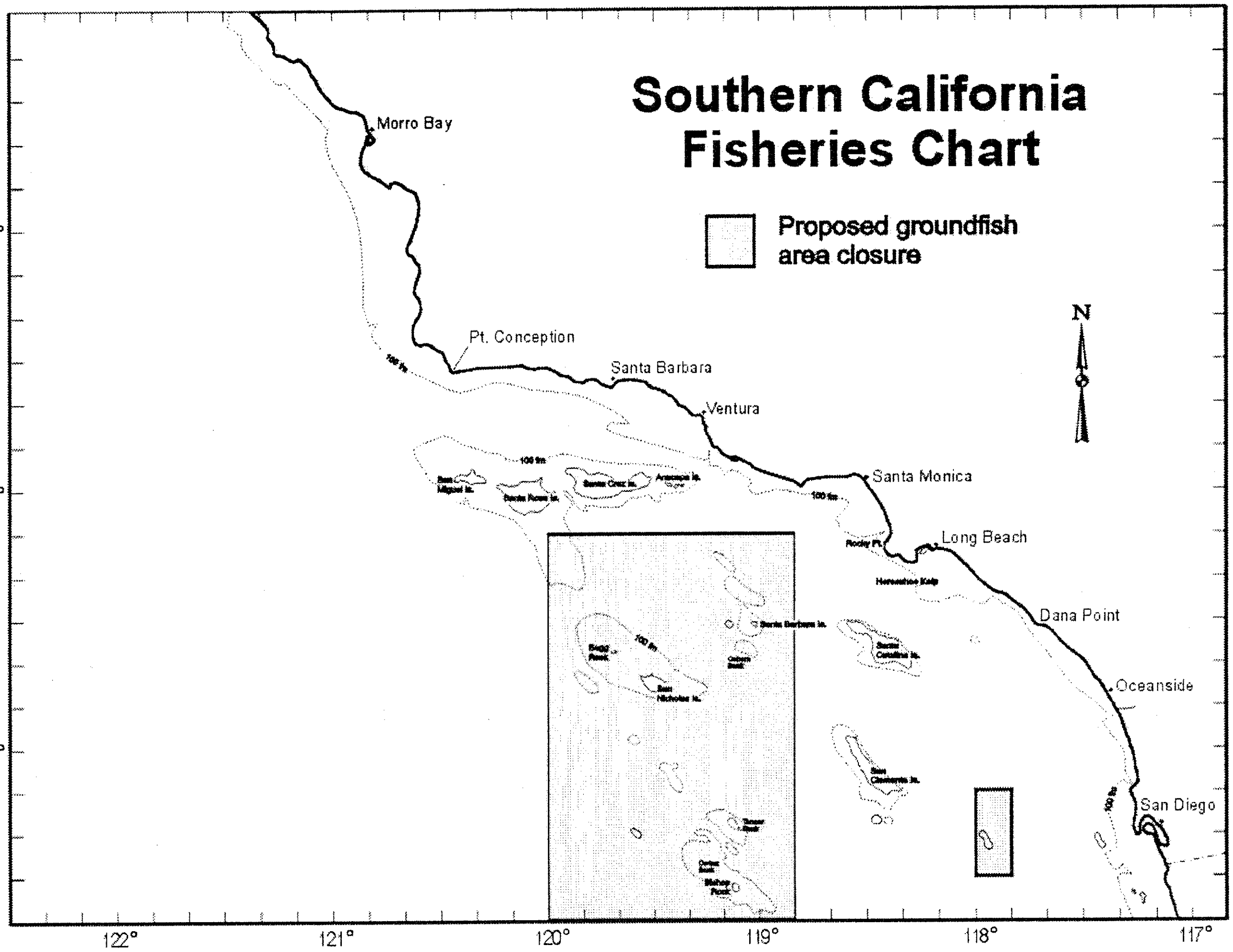

Figure 2-2. Marine Protected Area (MPA) for the *Interim Council Rebuilding* alternative. All groundfish fishing activities in water deeper than 20 fathoms would be prohibited.

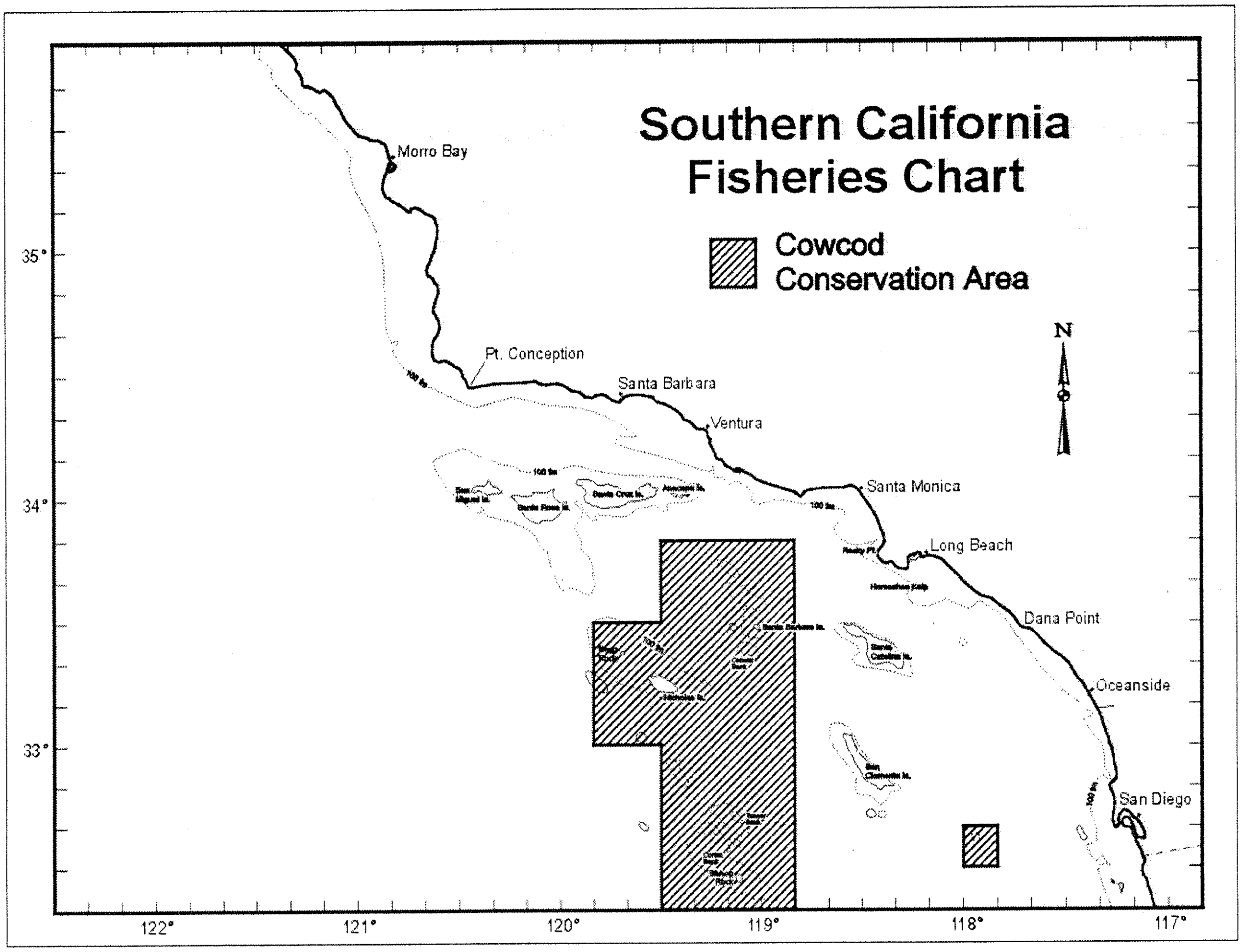

Figure 2-3. Marine Protected Area (MPA) for the *60% and 80% Intermediate Rebuilding* alternative. All groundfish fishing activities in water deeper than 20 fathoms would be prohibited.

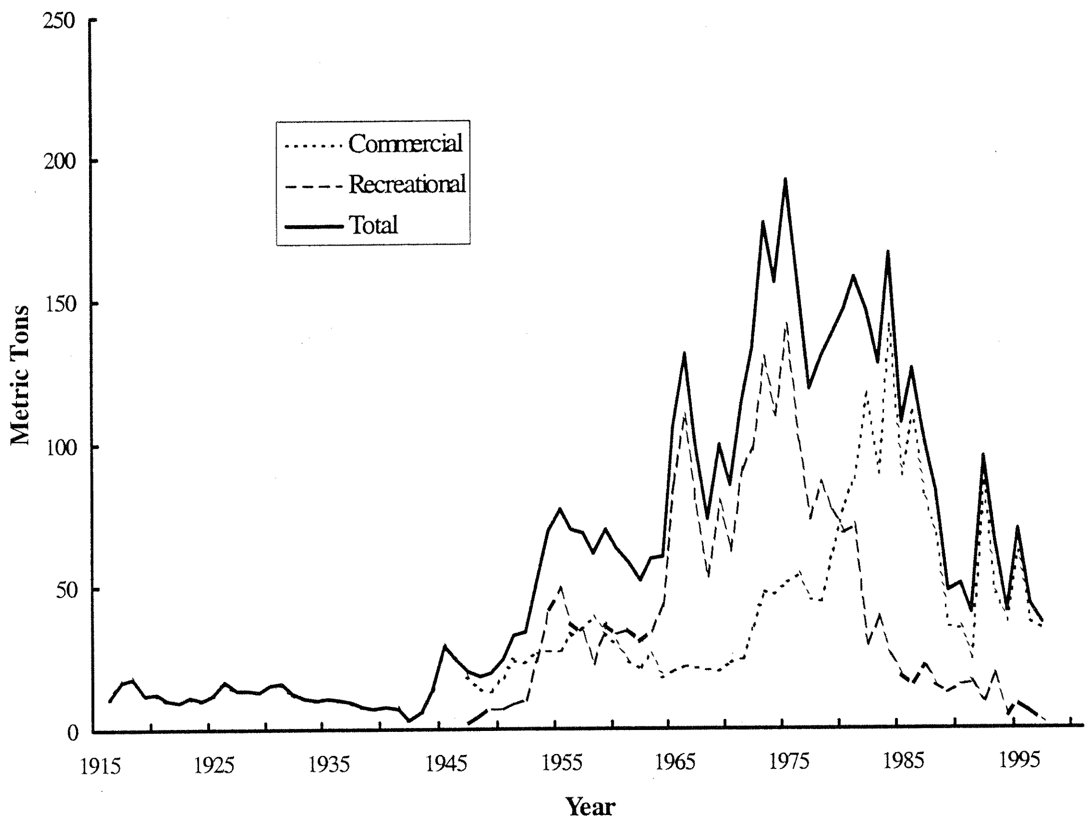

Figure 3-1 Commercial and recreational cowcod landings off the U.S. west coast.

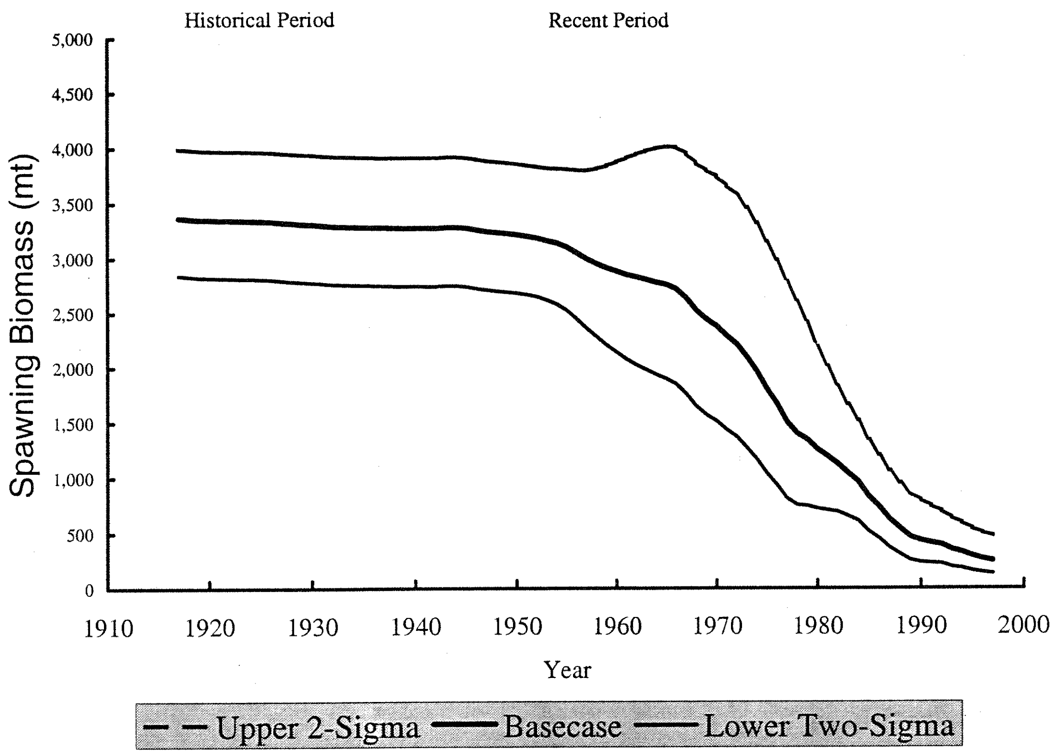

Figure 3-2. Cowcod spawning biomass trend for the Conception management area.

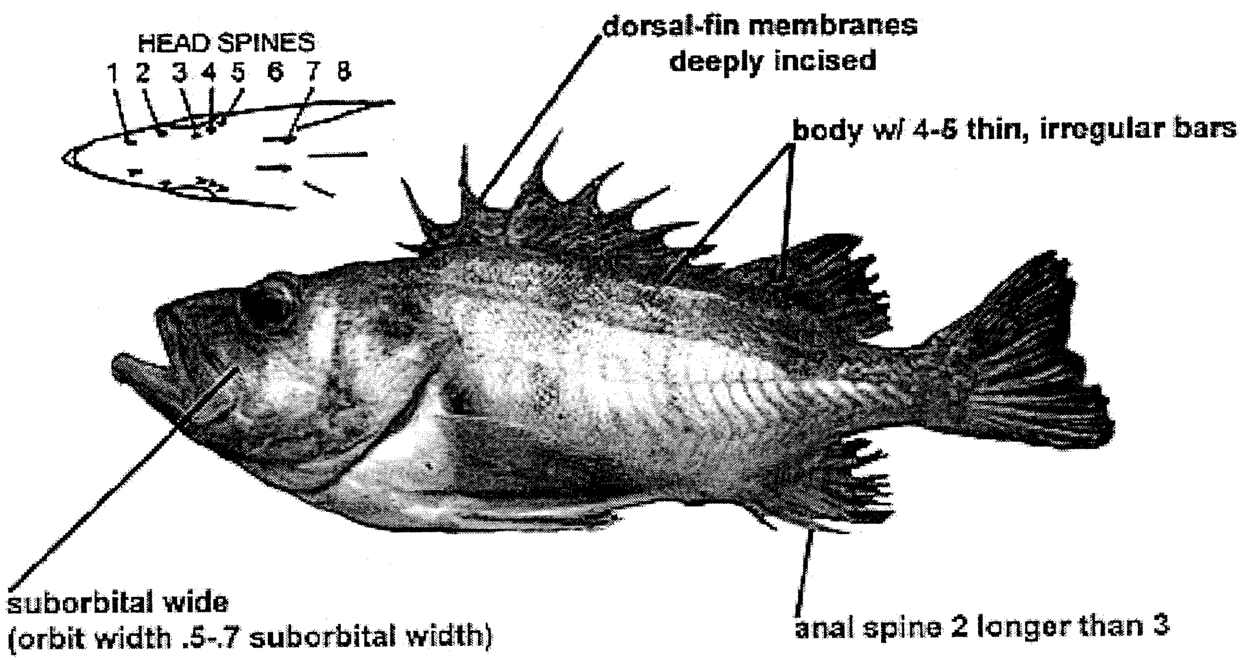

Figure 3-3. Cowcod (*Sebastes levis*).

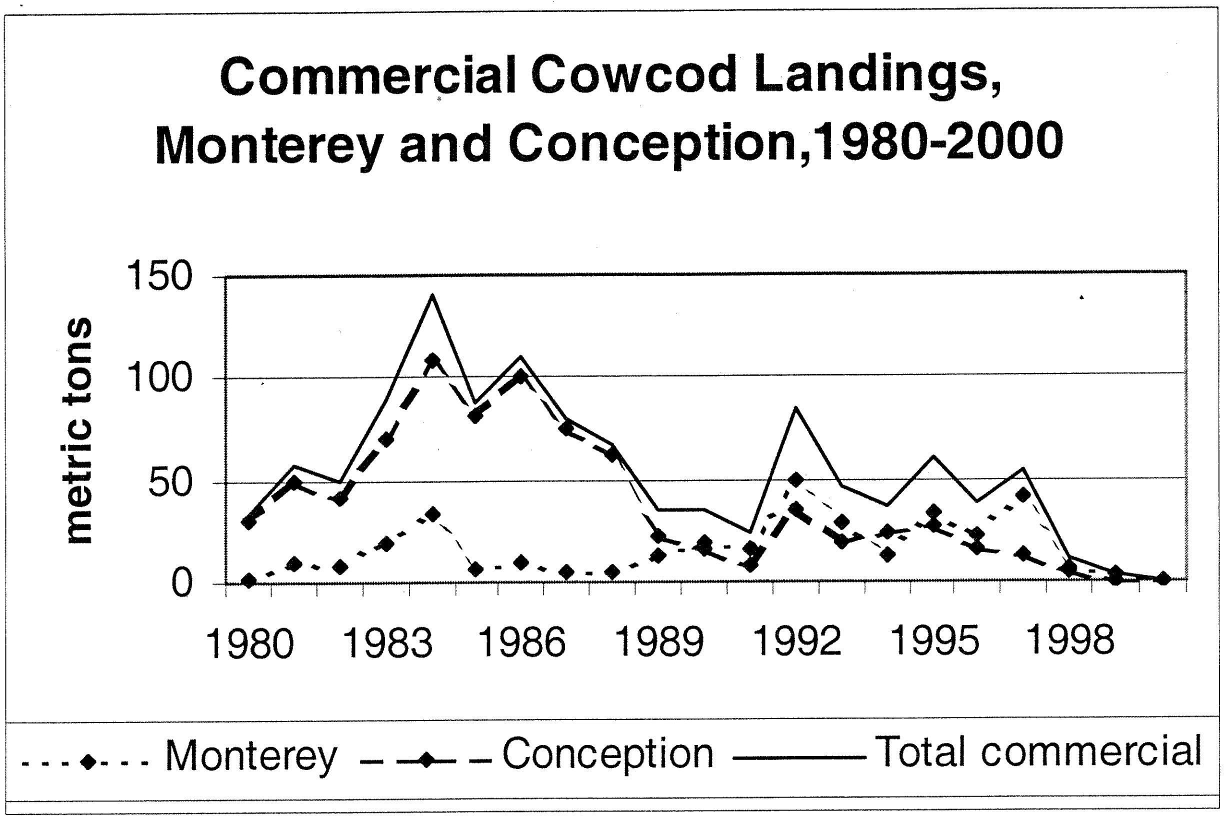

Figure 3-4. Commercial cowcod landings in the Monterey and Conception management areas, 1980-1999.

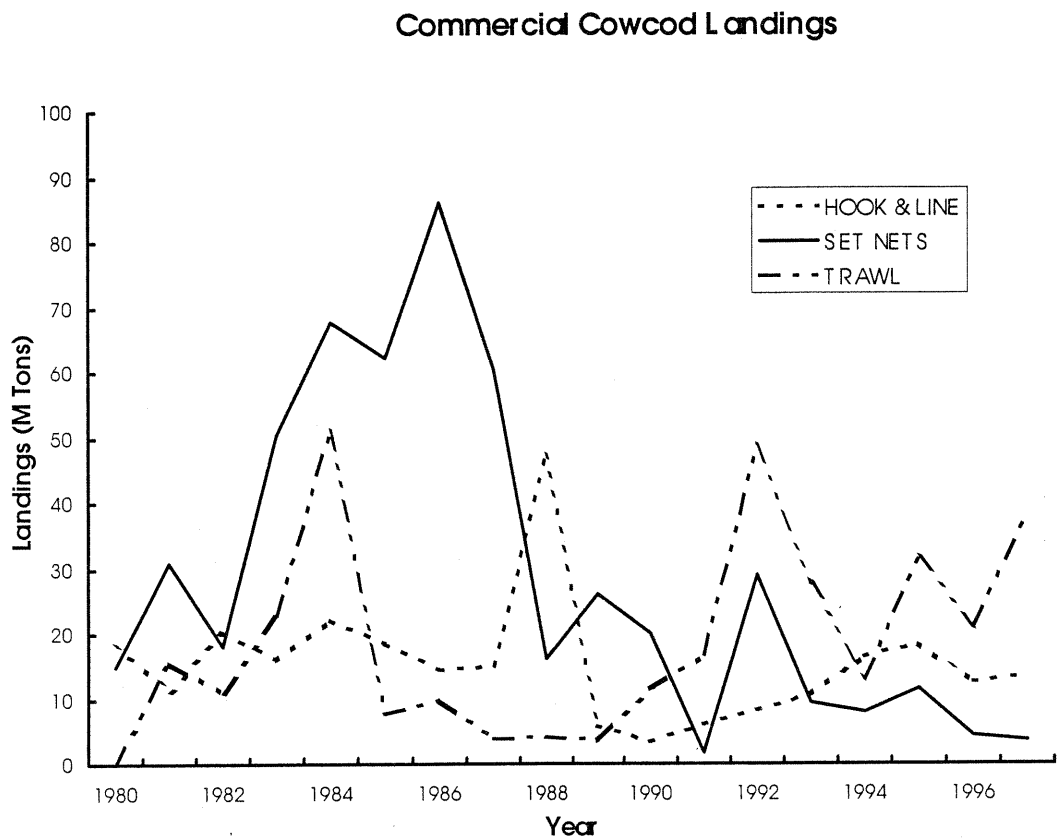

Figure 3-5. Commercial cowcod landings by gear type in the Monterey and Conception management areas, 1980-1997.

Exhibit C.5
Attachment 6
June 2002

DRAFT LINGCOD REBUILDING PLAN

PART E TO AMENDMENT 16 OF THE PACIFIC COAST GROUNDFISH FISHERY MANAGEMENT PLAN

INCLUDING DRAFT ENVIRONMENTAL IMPACT STATEMENT AND REGULATORY ANALYSES

PREPARED BY THE PACIFIC FISHERY MANAGEMENT COUNCIL

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1.0 PURPOSE AND NEED FOR REBUILDING LINGCOD

1.1 Purpose and Need

The lingcod (*Ophiodaon elongatus*) stock within the PFMC management area of the west coast EEZ (Figure 1-1; herein referred to as the "west coast") is a shelf roundfish species of the family *Hexigrammidae*. Most lingcod catch has occurred in the north in the Columbia and U.S.-Vancouver International North Pacific Fisheries Commission (INPFC) areas (Figure 1-1) which is consistent with the estimated geographic center of biomass distribution occurring water off Washington and British Columbia (Hart 1973). Lingcod were often caught in shelf trawl and recreational fisheries. Exploitation was estimated to be over the maximum fishing mortality threshold (MFMT) now used as a proxy MSY harvest rate for lingcod ($F_{45\%}$).

Adoption of Amendments 11 and 12 of the Pacific Coast Groundfish Fishery Management Plan (FMP) incorporated the legal rebuilding mandates of the Sustainable Fishery Act and established an overfishing threshold (Minimum Stock Size Threshold; MSST) of 25% of the estimated unfished spawning biomass or spawning potential (i.e., estimated number of eggs, recruits, or other spwaning units) for groundfish stocks. Jagielo *et al.* (1997) estimated the abundance of the northern lingcod stock in the Columbia and U.S.-Vancouver INPFC areas to be at 8.8% of its estimated unfished spawning potential. Therefore, the National Marine Fisheries Service (NMFS) declared the stock overfished in March 1999. Jagileo *et al.* 2000 estimated a coastwide biomass of lingcod to be at 15% of its unfished biomass, confirming the need to rebuild the stock coastwide.

Under the terms of the Magnuson-Stevens Fishery Conservation and Management Act (MSA) and the FMP, the Council must prepare a rebuilding plan to increase lingcod stock abundance to a level that supports maximum sustainable yield (MSY; 40% of its unfished biomass). The purpose of this draft rebuilding plan and Environmental Impact Statement (EIS) is to evaluate alternative strategies designed to rebuild lingcod in a time less than or equal to the maximum allowable (T_{MAX}) under the National Standard Guidelines interpreting the MSA.

1.2 Rebuilding Plan Overview

The Draft Lingcod Rebuilding Plan (Part E, June 2002 draft) is organized to address the requirements of the MSA, National Environmental Policy Act, Executive Order 12866, and the Regulatory Flexibility Act. This document conforms to a National Environmental Policy Act (NEPA) structure and format with a purpose and need statement (section 1.1), a reasonable range of rebuilding alternatives presented in Chapter 2, a description of the affected environment (physical (habitat), biological (lingcod and other affected species), and socioeconomic (affected fisheries, fishing industry, and fishing communities)) in Chapter 3, and an analysis of rebuilding consequences anticipated for affected environments in Chapter 4. Chapters 5-8 document how the rebuilding plan and alternatives conform to legal mandates, who contributed in preparation of the rebuilding plan, and the references used throughout this rebuilding plan document. Appendix E-1 is the rebuilding analysis prepared for this rebuilding plan (not included in this draft) and Appendix E-2, the FMP Amendment language for lingcod rebuilding. The modular design of the rebuilding plan framework (each species rebuilding plan is stratified in Parts) is to allow it to stand alone as a decision-making document for rebuilding lingcod in shelf areas within the Council's jurisdiction (Figure 1-1). This June 2002 draft adopts a ***bold italic font for items of particular emphasis (especially to the Council and other decision-makers)***, *highlight yellow italic font for noted gaps and questions to experts*, and *italic font for names of rebuilding alternatives and scientific species names.*

The overarching objective of this rebuilding plan is to increase lingcod stock spawning biomass to a level that supports MSY within a target time set by the Council (T_{TARGET}). For lingcod , the Council-approved proxy for this level of abundance is 40% of its estimated unfished biomass ($B_{40\%}$). Estimation of unfished biomass (B_0) is especially critical since it forms the basis for declaring a stock's biological and legal status. There is uncertainty about the estimate of B_0 and this value can be expected to change with improved understanding of the stock and when new stock assessments are conducted.

Rebuilding parameters specified in a rebuilding plan must include at least T_{TARGET} and may be required to include other parameters listed in Table 1-1 depending on decisions made in Part A of this amendment package. The values adopted for these parameters are determined by the best available science, Council/NMFS policies, and legal mandates (including the MSA and the National Standard Guidelines for interpreting the MSA). The time to rebuild is constrained on the high end ($T_{MAX} = T_{MIN}$ + 1 mean generation; 1 mean generation = the mean time period for a spawning female to replace herself in the population; Restrepo *et al.* 1998) and on the low end (T_{MIN} = time to rebuild in the absence of fishing; F=0) by biological limits imposed by our understanding of the stock's potential productivity (50 CFR §600.310 (e)(4)(ii)(B)). The mean generation time for lingcod is (age x survival x spawn) summed for all ages / (survival x spawn) summed for all ages (Methot and Rogers 2001). The National Standard Guidelines specify that the Council must manage to rebuild in no more than ten years if T_{MIN} is estimated to be less than or equal to ten years.

Scientific uncertainty exists for every aspect of rebuilding and thus influences success and failure of rebuilding. Uncertainty surrounds the estimation of parameters that define rebuilding targets and objectives, assessments of stock status and structure, projections of future recruitment and biomass, and evaluating how well management measures meet rebuilding objectives. All alternatives in this rebuilding plan (except *No Action*) assume the best available science. Ensuring the best available science is incorporated in Council decision-making is the role of the Council's Scientific and Statistical Committee (SSC) and therefore not analyzed specifically as a policy choice. However, recommendations for mitigating risk associated with scientific uncertainties are explored throughout this rebuilding plan.

This rebuilding plan generally analyzes alternative strategies and explores mitigating measures for achieving rebuilding targets and objectives. Specifically, this plan analyzes the tradeoffs (physical, biological, and socioeconomic) associated with alternative total fishing-related mortality limits (total catch OYs) and the management specifications (harvest controls and measures) to achieve these limits.

Area closures may be considered in this rebuilding plan. Currently such closures would be considered to move the fishery off lingcod hot-spots, and therefore reduce the total mortality of adult fish. The Council and NMFS are currently developing a policy for habitat based management that may result in modification to existing (or pending) closures, or other management measures intended to protect habitat deemed important to groundfish production. At issue in the development of this policy is the integration of habitat-based management with the harvest control management strategies that have historically been the foundation for Council actions. Alternative policies are being analyzed in a Programmatic EIS (contact Mr. Jim Glock, NMFS, (503) 231-2178). The policies adopted through the Programmatic EIS will be implemented through subsequent decisions such as implementation of the EFH provisions of the Magnuson-Stevens Act or the annual management process and may be utilized to acheive the mortality goals for lingcod established in the rebuilding plan. Implementation of the EFH provisions is underway through another EIS that tiers off the Programmatic EIS. Publication of the draft action-specific EFH EIS is anticipated for August 2003 (contact Mr. Steve Copps, NMFS, (206) 526-6187).

TABLE 1-1. Current parameter/target estimates specified for rebuilding lingcod . Data from Jagielo *et al.* (2000) and Jagielo and Hastie (2001).

Rebuilding Parameter/Target	Lingcod [1/]
T_0 (year declared overfished)	1999
T_{MIN} (minimum time to achieve B_{MSY} = mean time to rebuild at F = 0)	3.6 years N; 4.8 years S
Mean generation time	X years
T_{MAX} (maximum time to achieve B_{MSY})	10 years
P_{MAX} (P to achieve B_{MSY} by T_{MAX}) [2/]	60%
Most recent stock assessment	Jagielo *et al.* 2000

TABLE 1-1. Current parameter/target estimates specified for rebuilding lingcod . Data from Jagielo *et al.* (2000) and Jagielo and Hastie (2001).

Rebuilding Parameter/Target	Lingcod [1/]
Most recent rebuilding analysis	Jagielo and Hastie 2001
B_0 (estimated unfished biomass)	22,882 mt N; 20,971 mt S
$B_{CURRENT}$ (current estimated biomass = X% of B_0)	3,527 mt N; 3,220 mt S in 2000
% Unfished Biomass	15% N & S in 2000
MSST (minimum stock size threshold = 25% of B_0)	5,720 mt N; 5,243 mt S
B_{MSY} (rebuilding biomass target = 40% of B_0)	9,153 mt N; 8,389 mt S
MFMT (maximum fishing mortality threshold = F_{MSY})	$F_{45\%}$; F = 0.12 N; F = 0.14 S
Harvest control rule [2/]	F = 0.0531 N; F = 0.061 S
T_{TARGET} [2/]	2009

[1/] West coast lingcod were assessed as two stocks: north (Columbia and U.S.-Vancouver INPFC areas) and south (Eureka, Monterey, and Conception INPFC areas).
[2/] Under *Council Interim Rebuilding.*

2.0 LINGCOD REBUILDING PLAN ALTERNATIVES

Lingcod rebuilding alternatives within MSA, FMP, and other legal constraints are analyzed in this rebuilding plan. All alternatives specify north and south harvest control rules. These areas are the Columbia and U.S.-Vancouver INPFC areas in the north and the Conception, Monterey, and Eureka INPFC areas in the south (Figure 1-1). The Acceptable Biological Catch (ABC) and total catch optimum yields (OYs) are the sum of these management reference points calculated for these two management areas. The most risk-averse alternative (*Maximum Conservation*), most risk-prone alternative (*Maximum Harvest*), and alternatives with intermediate risk (*Council Interim Rebuilding*, *70%*, and *80%*) are compared with a *No Action* alternative. Probabilities of rebuilding within T_{MAX} vary between 60% and 80% in intermediate risk alternatives. The *Council Interim* alternative depicts the default rebuilding alternative originally adopted in 1999. All rebuilding alternatives except *No Action* consider the best available science for determining risk-neutral bycatch and discard rates. The best available science is anticipated to be direct observations of bycatch and discard in west coast groundfish fisheries. However, until these data are available to account for all sources of fishing-related mortality, the best available science is considered to be a bycatch/discard model developed by the Northwest Fisheries Science Center of the National Marine Fisheries Service (Hastie 2001). Assumed bycatch rates of lingcod in trawl fisheries targeting other species would be at the mid-point of the range estimated from log books and EDCP data (Hastie 2001) for all alternatives except *No Action*. It is likely that rebuilding measures for shelf rockfish (Parts D, *F, G, and H (in press)*) will control fishing effort and fishing-related mortality on rocky shelf areas where lingcod are most vulnerable. Bycatch control measures are still evaluated in this rebuilding plan. Rebuilding parameter estimates and probabilities for all alternatives (Table 2-1) are derived in the most recent stock assessment (Jagielo *et al.* 2000) and rebuilding analysis (Jagielo and Hastie 2001, Appendix E-1). The harvest control rule varies between rebuilding alternatives analyzed in this rebuilding plan, the best available science informing decisions and our current state of knowledge does not. Relative risk and probability of rebuilding alternatives meeting rebuilding objectives is sensitive to our current state of knowledge and the harvest control rule (i.e., harvest rate) adopted as a rebuilding target and strategy. The choice of T_{TARGET} is constrained to fall between T_{MIN} and and T_{MAX}. Lingcod, with a high reproductive and growth rate and short mean generation time, must be rebuilt within ten years. ***Note that T_{TARGET} has not been explicitly noted in Table 2-1 and is a choice before the Council.***

2.1 The *No Action* Alternative

The choice of the *No Action* alternative for lingcod was considered in terms of providing the most informative analysis of the consequences and tradeoffs of rebuilding the stock. Technically, a *No Action* alternative would be the action that would be taken in the absence of an approved rebuilding plan (or status quo). Under the strict context of that definition, *Council Interim Rebuilding* might be considered to represent status quo. For the purposes of this NEPA analysis *No Action* is considered to be the action prior to the Council approval of *Council Interim Rebuilding*, which is also analyzed.

Under the *No Action* alternative lingcod would be managed with specified trip limits applied. The harvest level (ABC) would be based on the Council's 1998 default $F_{35\%}$ MSY proxy and the total catch OY would be set equal to the ABC. The ABC and total catch OY would be calculated using a fishing mortality rate of 0.XXX. A 20% discard rate (of landed catch) would be assumed for controlling bycatch mortality. No special consideration would be given to MPAs.

2.2 The *Maximum Conservation* Alternative

Under the *Maximum Conservation* alternative rebuilding would occur in the shortest time possible by setting the fishing mortality rate to zero (F = 0) for those fisheries under Council control. The tradeoff is the greatest socioeconomic impact occurs to fisheries and fishing-dependent communities on the west coast (Conception, Monterey, Eureka, Columbia and U.S.-Vancouver INPFC areas) during the course of rebuilding. All fisheries operating on the shelf (bottom trawl fisheries, fixed gear, recreational fisheries, and tribal fisheries) under Council control that demonstrate a bycatch mortality of lingcod would be closed or modified to the point where targeted and incidental catch mortality of lingcod did not occur. The target rebuilding period (T_{TARGET}) would be the minimum rebuilding time (T_{MIN} = 4 years in the north and 5 years in the south) with the median year of achieving B_{MSY} estimated to be 2003 and 2004, respectively. There would be no bycatch of lingcod since there is no fishing-related mortality. Potential habitat impacts would be minimized by eliminating fishing effort. A subsequent decision-making process to implement the EFH provisions of the MSA would be utilized to determine if additional habitat based management measures were necessary to enhance productivity of the stock.

2.3 The *Maximum Harvest* Alternative

Under the *Maximum Harvest* alternative rebuilding would occur in the maximum allowable time (T_{MAX}), thereby allowing the maximum allowable harvest under rebuilding. A minimal impact would be expected on existing shelf fisheries and fishing-dependent communities, but at a cost of the slowest legal rebuilding schedule allowed by the FMP, MSA, and the National Standard Guidelines. The target rebuilding period (T_{TARGET}) would be the maximum rebuilding time (T_{MAX} = 10 years) with the median year of reaching B_{MSY} projected to be 2009. The *Maximum Harvest* alternative has a 50% probability of rebuilding within T_{MAX}. The total catch OY would be calculated using a fishing mortality rate of 0.0607 in the north (Columbia and U.S.-Vancouver INPFC areas) and 0.0667 in the south (Conception and Monterey INPFC areas. No special consideration would be given to MPAs.

2.4 The *60%* or *Council Interim Rebuilding* Alternative

Under the *Council Interim Rebuilding* alternative there would be a 60% probability of rebuilding within T_{MAX}. This alternative was the one the Council selected in 1999 as its preferred alternative for rebuilding lingcod. This analysis does not presume this is still the Council's preferred alternative. Under this alternative $T_{TARGET} = T_{MAX}$ which is 2009. The total catch OY would be calculated using a fishing mortality rate of 0.0531 in the north and 0.061 in the south. Consideration may be given to area closures that move the fishery off lingcod hotspots and reduce total mortality.

2.5 The 70% Alternative

Under the *70%* alternative there would be a 70% probability of rebuilding within T_{MAX}. The total catch OY would be calculated using a fishing mortality rate of 0.051 in the north and 0.0533 in the south. Consideration may be given to area closures that move the fishery off lingcod hotspots and reduce total mortality.

2.6 The *80%* Alternative

Under the *80%* alternative there would be an 80% probability of rebuilding within T_{MAX}. The total catch OY would be calculated using a fishing mortality rate of 0.0474 in the north and 0.0472 in the south. Consideration may be given to area closures that move the fishery off lingcod hotspots and reduce total mortality.

2.7 The *Mixed Stock Exception* Alternative

Under the *Mixed Stock Exception* alternative, rebuilding constraints would not be imposed thereby allowing overfishing of lingcod . The mixed stock exception is a provision in National Standard Guideline 1 allowing an increased OY above the overfishing level as long as the harvest meets certain standards. Harvesting one species of a mixed-stock complex at its optimum level may result in the overfishing of another stock component in the complex. The Council may decide to permit this type of overfishing only if all of the following conditions are satisfied:

(a) The Council demonstrates by analysis that such action will result in long-term net benefits to the Nation.
(b) The Council demonstrates by analysis that mitigating measures have been considered and that a similar level of long-term net benefits cannot be achieved by modifying fleet behavior, gear selection/ configuration, or other technical characteristic in a manner such that no overfishing would occur.

(c) The resulting rate or level of fishing mortality will not cause any species or evolutionarily significant unit thereof to require protection under the Endangered Species Act.

2.8 Alternatives Considered But Rejected

Any alternatives with less than a 50% probability of rebuilding to B_{MSY} within the maximum allowable rebuilding time (T_{MAX}) are not compliant with the MSA as interpreted in a *2000 ruling in the X Circuit Federal Court (American Oceans Campaign v. Daley) [proper case citation?]*. Such alternatives are not analyzed in this rebuilding plan. The *No Action* alternative has a probability of rebuilding to B_{MSY} of less than 50%, but is still analyzed as per NEPA requirements.

Since the west coast lingcod stock is the not the most binding constraint to shelf fisheries in the north or the south, lingcod are not considered to meet the standards of the *Mixed Stock Exception* provision. Therefore, this alternative will not be analyzed in this rebuilding plan.

TABLE 2-1. Rebuilding parameters associated with lingcod rebuilding alternatives.

Alternative	F rate	Probability of rebuilding within T_{MAX}	Median year of reaching B_{MSY}	T_{TARGET} (year)
No Action	0.0XX	X%	200X	NA
Maximum Conservation	0.000 N & S	approaches 100%	2004	20***XX***
Maximum Harvest	0.0607 N 0.0667 S	50%	2009	20***XX***
Council Interim Rebuilding	0.0531 N 0.0610 S	60%	2009	20***XX***
70%	0.0510 N 0.0533 S	70%	200X	20***XX***
80%	0.0474 N 0.0472 S	80%	200X	20***XX***

[determine missing values for No Action in Table 2-1 after resolving the parameters used in No Action]

3.0 AFFECTED ENVIRONMENT

3.1 Physical Environment

3.1.1 Lingcod Habitat

Lingcod occur from Kodiak Island, Gulf of Alaska to Baja, California with the highest densities from Point Conception, California to Cape Spenser, Alaska. They are classified as an estuarine-mesobenthal species (Allen and Smith 1988).

Young lingcod larvae are demersal. Older larvae and young juveniles are epipelagic and primarily found in the upper 3 m of the water column. Off California, young juveniles are pelagic and occur in the upper 35 m of the water column. Juveniles move to deeper water as they grow, but are still most common in waters less than 150 m. Adults are demersal along the continental shelf and most abundant in waters less than 200 m in depth. The catch of lingcod is generally highest in 70 - 150 m of water from Vancouver Island, British Columbia to the Columbia River estuary. Survey data indicates that male lingcod tend to be more abundant in shallower waters than females (Jagielo *et al.* 2000).

In general, lingcod are patchily distributed among areas of hard bottom and rocky relief. Larvae are typically found in nearshore waters. Small juveniles can be found on sandy substrate in estuaries and subtidal zones all along the coast, but are more common in the northern extent of their range. Large juveniles settle to the ocean floor on sand, often near eelgrass or kelpbeds. Adults prefer slopes of submerged banks with seaweed, kelp, and eelgrass beds 10 - 70 m below the surface and channels with swift currents flowing around rocky reefs. Adults are strongly residential, tending to remain near the reefs and rocky areas where they live (Adams and Starr 2001).

Spawning lingcod are generally associated with nearshore, rocky reef habitat. During spawning, male and female lingcod gather along rocky reefs affected by strong wave action or tidal currents (Vincent-Lang 1994). Egg masses are usually found in rock crevices or under over hanging boulders and have been found to depths of 97 m (Karpov et al. 1995). As current flow is necessary for gas exchange, eggs are usually laid in areas with currents 3.5 km/h or greater. Male lingcod guard egg masses from predators during incubation, removal of the male results in a high incidence of egg loss (Karpov et al. 1995). Spawning adults and eggs are common in Puget Sound, Hood Canal, and Skagit Bay, Washington and in Humboldt Bay, California.

3.1.2 Human Effects on Lingcod Habitat

In general, potential fishing-related impacts to fish habitat could take the form of lost or discarded fishing gear, direct disturbance of the seafloor from contact by trawl nets, and direct disturbance of the seafloor contact by longlines and fish traps.

While the effects of fishing on lingcod habitat have not been directly investigated, there is some research exploring how gear affects habitat. Auster and Langton (1999) reviewed a variety of studies reporting habitat effects due to fishing for a wide range of habitats and gear types. Commonalities of all studies included immediate effects on species composition and diversity and a reduction of habitat complexity.

Bottom trawling gear is known to modify seafloor habitats by altering benthic habitat complexity and by removing or damaging infauna and sessile organisms (Friedlander et al. 1999; Freese et al. 1999). In a study on the shelf and slope off California, high-resolution sidescan-sonar images of the Eureka area revealed deep gouges on the seafloor believed to be caused by trawl doors (Friedlander et al. 1999). The effects of bottom trawling on a 'hard bottom' (pebble, cobble, and boulder) seafloor was also investigated in the Gulf of Alaska and results indicated that a significant number of boulders were displaced and emergent epifauna were removed or damaged after a single pass with trawl gear. As adult lingcod are associated with hard bottom and rock relief, trawl gear may therefore affect the quality of lingcod habitat.

Limited qualitative observations of fish traps, longlines, and gill nets dragged across the seafloor during set and retrieval showed results similar to mobile gear, such that some organisms living on the seabed were dislodged. Quantitative studies of acute and chronic effects of fixed gear on habitat have not been conducted (Auster and Langton 1999).

In addition to fishing activities, anthropogenic influences on marine ecosystems is a growing area of interest and concern. The United States has doubled its population in the last five decades, and accompanying this growth, there has been a dramatic shift from inland rural areas to coastal urban areas. With over 50 percent of the country's population living within 50 miles of a coast, there have been major declines in the nation's coastal ecosystems (Sea Grant 2001). Because lingcod occupy coastal areas and are relatively sedentary, the species may be susceptible to habitat degradation due to urbanization. Research in California coastal areas indicates that contaminants of marine habitats stem from sewage discharges, aerial fallout, land runoff, industrial and munitions disposal, dredged material disposal, and thermal enrichment (Commission on Engineering and Technical Systems 1990). If lingcod habitat becomes contaminated, lingcod may be exposed to such things as petrochemical spills and can accumulate high concentrations of heavy metals. Human activities in and around estuaries, such as dredging for development, alteration of wetlands, and nutrient runoff, pose additional threats to lingcod (PSMFC 1996).

In the last few decades, marine debris has also been recognized as posing a risk to marine organisms via entanglement and ingestion. Seafloor debris was surveyed from Point Conception, California to the United States - Mexico international border at depths of 10 to 200 m and anthropogenic debris occurred on approximately 14 percent of the mainland shelf. Of the debris sampled, discarded fishing gear had the largest spatial coverage, followed by plastic, metal, and other debris (e.g., shoe soles and automobile parts) (Moore and Allen 1999). Less is known about the quantity of marine debris off Washington and Oregon, but it may be at levels that could negatively affect marine organisms.

As more information is gathered about the effects of fishing and non-fishing human activities on lingcod habitat, additional management measures may be taken for habitat protection.

3.2 Biological Environment

[to be completed before public review]

TABLE 3-1. Biological reference points for lingcod .

Biological Reference Point	Value
Maximum age	*X* yrs females; *X* yrs male
Maximum length	*X* cm females; *X* cm males
Maximum weight	3.1 kg females; 1.2 kg male
Age at 50% maturity	5 yrs females; 3 yrs male
Length at 50% maturity	69 cm females; 50 cm males
Natural mortality rate (M)	0.18 females; 0.32 males

[Should other biological reference points be included in Table 3-1?]

3.2.1 Lingcod Life History

3.2.2 Lingcod Stock Status

3.3 Socioeconomic Environment

[to be completed before public review]

3.3.1 Fisheries and Management History

[to be completed before public review]

TABLE 3-X. Specifications of Acceptable Biological Catch (ABC), Optimum Yields (OYs), and Limited Entry and Open Access Allocations

Year	ABC (mt)	Total catch OY (mt)	Commercial total catch OY (mt)	Limited Entry		Open Access	
				mt	%	mt	%
2002	745	577	251	203	81.0	48	19.0

3.3.2 Fishing Communities

[to be completed before public review]

4.0 ENVIRONMENTAL CONSEQUENCES

This rebuilding plan EIS analyzes the effects of alternative strategies for rebuilding lingcod on the probability of successful stock rebuilding, co-occurring species, affected habitat, and the socioeconomic environment (Table 4-1).

TABLE 4-1. Ranked relative effects of alternative lingcod rebuilding strategies of potential negative habitat impacts, the probability of rebuilding by T_{MAX}, and short term economic costs (1 is highest rank, 6 is lowest rank).

Alternative	Potential Negative Habitat Effects	Probability of Rebuilding by T_{MAX}	Short Term Economic Costs
No Action	1	6	6
Maximum Conservation	6	1	1
Maximum Harvest	2	5	5
Council Interim Rebuilding	3	4	4
70%	4	3	3
80%	5	2	2

4.1 Affected Lingcod Habitat Including Essential Fish Habitat

Alternative rebuilding strategies have varying effects on the rocky bottom habitats of the continental shelf where lingcod reside, primarily due to the extent fishing activities are affected but also to the degree MPAs are considered. The *No Action* alternative might be expected to have the greatest potential impact on lingcod habitats since a greater fishing intensity than the other rebuilding alternatives is likely. The *Maximum Conservation* alternative would have the least habitat impact since it eliminates fisheries that target or incidentally catch lingcod and therefore eliminates potential fishing-related habitat impacts. Conversely, the *Maximum Harvest* alternative allows the maximum harvest under rebuilding constraints and therefore creates a greater potential disturbance to lingcod habitat from a greater intensity of fishing effort relative to all rebuilding alternatives other than *No Action.* There would also be no special consideration given to MPAs to control total mortality and protect EFH. The intermediate risk alternatives (*Council Interim,70%*, and *80%*) would have intermediate effects relative to the maximum alternatives.

Lingcod have strong habitat affiliations with rocky habitats and other bottom structures. Bottom trawl operations on the continental shelf would most affect lingcod habitats. The relative effects of lingcod rebuilding alternatives on these habitats resulting from the amount of physical contact with the bottom are assumed to be with duration of trawl gear bottom contact in sensitive rocky habitats and gear type. The relative fishing intensity of lingcod rebuilding alternatives is assumed to be correlated with potential negative habitat effects. The ranking of lingcod rebuilding alternatives by their assumed relative effect on these habitats (Table 4-1) is on this basis. Small footrope and chafing gear restrictions are believed to have reduced potentially harmful effects of bottom trawls in rocky shelf habitat on the west coast (National Academy Press 2002). To the extent that fixed gear and other potential fishery impacts to lingcod habitat can be avoided or mitigated, a modest benefit could also be anticipated.

4.2 Affected Biological Environment

4.2.1 Controlling Fishing-Related Mortality of Lingcod

Successful stock rebuilding depends on the ability of management/rebuilding measures to effectively control all sources of fishing-related mortality, including landed catch and bycatch. All rebuilding alternatives analyzed in this EIS has a calculated total catch OY to accommodate landings of unavoidable incidental catch of lingcod (except the *Maximum Conservation* alternative which has a total catch OY of 0 mt). The effectiveness of all rebuilding strategies (given the probabilistic trajectories of future increases in biomass relative to B_{MSY}) depends on managing lingcod fishing-related mortality within prescribed total catch OYs. Landed catch allowances for all overfished species are designed to minimize target opportunities on these species while allowing landings of unavoidable bycatch that would otherwise be discarded dead at sea. Management measures consistent with rebuilding should have harvest control rules that are enforceable and effectively stay within total catch targets. Harvest control rules and management measures commensurate with alternative rebuilding strategies are analyzed qualitatively in this rebuilding plan EIS. Potential management measures that are likely to reduce sources of fishing-related mortality are also discussed.

Landed catch accounting and control

Landed catch accounting and control methods are considered relatively effective. Sorting requirements are in place for lingcod . This requires accounting for the weight of landed lingcod when catches are hailed at sea or landed. Landings are recorded on state fish receiving tickets. Landings and state port sampling data are reported in-season to the PacFIN database managed by the Pacific States Marine Fisheries Commission (PSMFC; www.psmfc.org/pacfin/index.html). The Council's Groundfish Management Team (GMT) and PSMFC manage the Quota Species Monitoring (QSM) dataset reported in PacFIN. All landings of groundfish stocks of concern (overfished stocks and stocks below B_{MSY}) and target stocks and stock complexes in west coast fisheries are tracked in QSM reports of landed catch. The GMT recommends prescribed landing limits and other in-season management measures to the Council to attain, but not exceed total catch OYs of QSM species. Stock and complex landing limits are modified in-season to control total fishing-related mortality; QSM reports and landed catch forecasts are used to control the landed catch component. These landed catch accounting and control mechanisms are used for all rebuilding alternatives including *No Action*.

Bycatch accounting and control

Limiting bycatch (defined as dead discard) to the extent practicable is a MSA mandate. Effective bycatch accounting and control mechanisms are also critical for staying within target total catch OYs. The first element in limiting bycatch is accurately measuring bycatch rates by time and area. Bycatch rates of lingcod in west coast trawl (and non-trawl) fisheries are uncertain. The NMFS first implemented a west coast Groundfish Fishery Observer Program in August 2001 to make direct observations of commercial groundfish targeting efforts. Observer coverage extends to about 10% of the west coast fleet currently, but should approach 20% by the summer of 2002 (E. Clarke, NMFS NWFSC, pers. comm.). Given the skewed distribution of bycatch in west coast groundfish fisheries, many observations in each sampling strata (i.e. target effort by gear type by area) will be needed to estimate representative rates of lingcod bycatch. Therefore, NMFS has stated that Observer Program data probably won't be available for management use until the summer of 2003 at the earliest. There may be a period when a combination of Observer Program data and the best currently available methods for estimating bycatch are used to estimate bycatch.

Currently, the best available science that informs managers of bycatch and discard rates of lingcod in the groundfish fishery is a model (Hastie model) that uses logbook and EDCP data to estimate coincident catch rates in target trawl efforts for other species (Hastie 2001). The Hastie model estimates bycatch rates (defined as coincident catch rates in this context) of lingcod in two-month blocks. The seasonality of bycatch is an important management consideration. Target opportunities for healthy flatfish, DTS, and rockfish species vary seasonally and geographically. It is reasonable to expect bycatch rates of lingcod to vary in accordance with the concurrence of target species and lingcod. In November 2001, the Council adopted the Hastie model to use for bycatch accounting and control starting in 2002.

The Council selected and NMFS approved the use of the mid range of considered lingcod bycatch rates to seasonally adjust landing limits to limit bycatch of lingcod starting in 2002 (Table 4-2). The Council did not consider the high range plausible due to the effect of the small footrope restriction not represented in input data (Hastie 2001). The low range was considered unlikely because implicit retained catch is smaller than actual landings in 2000 and 2001. The discard mortality deduction for lingcod assumes a discard mortality of 50% of estimated discard (Rickey 1997). The extent that these bycatch and discard rates are a reasonable proxy for lingcod in lieu of direct (contemporary) observations of fishery interceptions is unknown. In this analysis, the mid range of bycatch rates is considered the most plausible and risk neutral. Bycatch rates from the Hastie model are applied to landed weight of the target species in the target fisheries depicted in Table 4-2 to estimate seasonal bycatch of lingcod.

All rebuilding plan alternatives except *No Action* and *Maximum Conservation* use the mid range of bycatch rates estimated in the Hastie model to estimate lingcod bycatch (Table 4-2). The *No Action* alternative assumes a 20% bycatch/discard rate for lingcod. The *Maximum Conservation* does not rely on modeled bycatch or any other bycatch accounting mechanism since all fishing-related mortality is eliminated. It is anticipated that all rebuilding alternatives will benefit from direct observations of bycatch. Rebuilding measures should always use the best available estimates of bycatch.

TABLE 4-2. Bycatch rates by target trawl fishery and two-month fishing period north and south of Cape Mendocino estimated for lingcod . From the Hastie (2001) predictive model used to estimate bycatch starting in 2002. Council adopted rates are in the mid range.

Target fishery	2-mo. period	North of Cape Mendocino			South of Cape Mendocino		
		Low	Mid	High	Low	Mid	High
Arrowtooth	1	0.01%	0.03%	0.05%	NA		
	2	0.10%	0.20%	0.30%			
	3	0.25%	0.63%	1.00%			
	4	0.20%	0.65%	1.10%			
	5	0.05%	0.08%	0.10%			
	6	0.01%	0.03%	0.05%			
Petrale	1	0.50%	0.60%	0.70%	0.28%	0.55%	0.83%
	2	0.35%	0.68%	1.00%	0.99%	1.98%	2.96%
	3	1.20%	2.10%	3.00%	0.82%	1.63%	2.45%
	4	1.10%	1.50%	1.90%	5.84%	11.68%	17.52%
	5	0.50%	1.00%	1.50%	0.33%	0.66%	0.99%
	6	0.50%	0.60%	0.70%	0.37%	0.74%	1.10%
Flatfish	1	0.10%	0.35%	0.60%	0.10%	0.20%	0.30%
	2	0.50%	1.75%	3.00%	0.14%	0.27%	0.41%
	3	1.30%	1.75%	2.20%	0.41%	0.81%	1.22%
	4	1.00%	2.00%	3.00%	0.30%	0.60%	0.91%
	5	0.80%	2.40%	4.00%	0.31%	0.62%	0.93%
	6	0.40%	1.20%	2.00%	0.24%	0.49%	0.73%
Widow/Yellowtail	1	0.01%	0.06%	0.10%	0.05%	0.10%	0.15%
	6	0.01%	0.06%	0.10%	0.01%	0.00%	0.05%
DTS	1	0.01%	0.03%	0.05%	0.01%	0.01%	0.05%
	2	0.05%	0.28%	0.50%	0.01%	0.01%	0.05%
	3	0.30%	0.65%	1.00%	0.03%	0.06%	0.09%
	4	0.60%	0.80%	1.00%	0.03%	0.05%	0.08%
	5	0.30%	1.15%	2.00%	0.04%	0.08%	0.12%
	6	0.01%	0.06%	0.10%	0.02%	0.05%	0.07%
Chilipepper	1	NA			0.86%	1.72%	2.58%
	2				0.92%	1.85%	2.77%
	3				1.75%	3.50%	5.25%
	4				2.14%	4.28%	6.41%
	5				1.43%	2.85%	4.28%
	6				2.66%	5.32%	7.98%
Slope Rockfish	1	0.10%	0.55%	1.00%	1.15%	2.29%	3.44%
	2	0.10%	0.55%	1.00%	1.38%	2.75%	4.13%
	3	0.10%	0.55%	1.00%	0.45%	0.91%	1.36%
	4	0.10%	0.55%	1.00%	0.83%	1.65%	2.48%
	5	0.10%	0.55%	1.00%	0.24%	0.49%	0.73%
	6	0.10%	0.55%	1.00%	0.57%	1.15%	1.72%
Leftover [1/]	1	0.30%	1.65%	3.00%	0.18%	0.37%	0.55%
	2	0.30%	0.50%	0.70%	1.63%	3.27%	4.90%
	3	0.50%	0.85%	1.20%	3.05%	6.10%	9.15%
	4	0.80%	2.90%	5.00%	0.01%	0.00%	0.05%
	5	1.30%	3.15%	5.00%	0.42%	0.84%	1.26%
	6	1.50%	1.95%	2.40%	0.43%	0.86%	1.29%

[1/] Leftover encompasses all bycatch not assigned to a target trawl fishing opportunity according to the criteria imposed by Hastie

TABLE 4-2. Bycatch rates by target trawl fishery and two-month fishing period north and south of Cape Mendocino estimated for lingcod . From the Hastie (2001) predictive model used to estimate bycatch starting in 2002. Council adopted rates are in the mid range.

Target fishery	2-mo. period	North of Cape Mendocino			South of Cape Mendocino		
		Low	Mid	High	Low	Mid	High

(2001).

Potential rebuilding measures to consider

Measures that would effectively displace fisheries with a relatively high incidence of lingcod catch or other fishery/gear modifications could be considered to reduce fishing-related mortality. These measures would affect rebuilding through reducing risk of considered rebuilding alternatives in terms of achieving target fishing harvest rate (F) and the specified total catch OY. Avoidance measures through gear modification or fishing techniques should be investigated.

Depth-based restrictions and/or incentives to fish in deeper waters outside the depth range of greatest lingcod density *[GMT to evaluate logbooks to determine this depth range]* would likely reduce risk in controlling fishing-related mortality through avoidance. Allowing fishing in waters deeper than most lingcod are found could be done with a vessel monitoring system (VMS). A VMS tracks boats equipped with satellite transponders remotely from on-shore stations. A VMS may be feasible for managing west coast groundfish fisheries, given that VMS is already used in the management of some west coast marine fisheries such as the commercial albacore fishery. Some groundfish fisheries in the Aleutian Islands and Bering Sea currently use VMS to restrict the fishery to certain areas or depths. The cost of installing VMS to manage the deep-water trawl fleet needs to be considered. Such systems are expensive to set up, maintain, and operate. However, relative to the foregone benefits of prosecuting fisheries, this cost may be rationalized. To the extent that incentives to fish outside the depth range of lingcod could be structured, some or all of the costs associated with implementing a VMS system for the west coast groundfish fishery could be born by the industry.

Gear modifications should be considered that might be more effective in targeting healthy species while minimizing bycatch of overfished species such as lingcod. The small footrope restriction (trawl footropes ≤ 8 inches in diameter; no anti-chafing gear) has been used on the west coast to minimize bycatch of overfished shelf species such as canary and yelloweye . Trawls under the small footrope restriction cannot effectively fish on the bottom in rocky habitats. Shelf rockfish and lingcod landings by trawls under the small footrope restriction (adopted in 2000) have been significantly reduced.

Other gear modifications that may more cleanly target harvestable shelf species include trawls with reduced mouths (smaller height and width dimensions) and cutback headropes. The ODFW has experimented with such trawls designed to target flatfish (M. Saelens, ODFW, pers. comm.). Initial results from comparative research tows with these experimental bottom trawls (29 paired tows with experimental and conventional trawls) on the shelf off Oregon were promising (+60% Dover sole in experimental nets, -76% canary in experimental nets, and -72% redstripe in experimental nets). These preliminary results suggest this gear more efficiently catches flatfish while reducing bycatch of shelf.

Gear modifications designed to target harvestable groundfish and non-groundfish species and avoid shelf groundfish species should be investigated further. Exempted Fishing Permits (EFPs) could be used to investigate the efficiency of such gears as the experimental flatfish trawl being tested in waters off Oregon. Effective avoidance of overfished shelf rockfish and lingcod through the use of modified gears would reduce fishing-related mortality of lingcod .

More accurate bycatch accounting coupled with such measures as discard caps could significantly reduce fishing-related mortality of lingcod and other overfished groundfish species. The NMFS Observer Program is anticipated to increase accuracy in estimating total catch. The need to accurately account for shelf rockfish (cowcod, bocaccio, canary rocksfish, and yelloweye rockfish) bycatch in any west coast shelf fisheries is likely to significantly reduce bycatch of lingcod which are found in similar habitats.

Lingcod on the west coast south of the U.S. - Canadian border are part of a larger stock assemblage, some of which is managed outside of Council jurisdiction. British Columbia annual lingcod landings have averaged about *X* mt annually during 19*XX-XXXX*, or about *X*% of average annual landings from U.S. waters for the same period. It is unclear whether the cumulative fishing-related mortality across the stock's range is consistent with that mandated under MSA, FMP, NMFS National Guidelines, and U.S. legal authorities. The relative biomass of lingcod across the multiple management jurisdictions in the northeast Pacific is also unknown. Coordinated and consistent assessment and management should be explored with the Canadian Department of Fisheries and Oceans. Cooperative management could benefit lingcod rebuilding in waters off the west coast of the U.S. as well as in foreign waters.

4.2.2 Species Co-occurring With and Potentially Affected by Rebuilding Lingcod

4.3 Biodiversity and Ecosystem Function

[to be completed before public review]

4.4 Affected Socioeconomic Environment

[to be completed before public review]

4.4.1 Affected Fisheries

[check yield projections (Table 4-5) with Methot and Punt- confirm these are the "latest and greatest"]

TABLE 4-5. Projected total catch optimum yields (mt) for lingcod under different rebuilding probabilities and the default "40-10" policy. Actual catches shown for 1999-2001.

Year	*No Action* "40-10"	*Maximum Harvest* 50%	*Council Interim Rebuilding* 60%	70%	80%
1999	807	807	807	807	807
2000	508	508	508	508	508
2001	611	611	611	611	611
2002	280	646	577	535	489
2003	434	725	651	606	555
2004	616	815	735	685	629
2005	805	901	817	761	701
2006	987	979	891	831	766
2007	1,155	1,055	963	899	830
2008	1,309	1,117	1,022	954	882

TABLE 4-6. Projected gross revenue (thousands of dollars) on the west coast associated with potential future yields of lingcod under rebuilding alternatives.

[Hastie/Harms to provide after resolution of Table 4-5 yield estimates]

4.4.2 Affected Markets for Fishery Products

[to be completed before public review]

4.4.3 Affected Fishing Communities

[to be completed before public review]

[Anticipated economic effects of rebuilding lingcod by port/coastal area?]

[Economic effects of anticipated effort shifts associated with rebuilding lingcod and other overfished groundfish species]

[Anticipated economic effects of lingcod rebuilding alternatives]

4.5 Cumulative Effects

[to be completed before public review]

[Anticipated relative cumulative impacts of each db rebuilding alternative]

Lingcod biomass has increased significantly since the 1997 assessment. A preliminary update suggests that lingcod rebuilding appears to be progressing faster than the 2001 rebuilding analysis predicted and might reach B_{MSY} two years earlier than the *Council Interim Rebuilding* T_{TARGET} (B. Culver, WDFW, pers. comm.). Risks are further ameliorated by anticipated dispacement of shelf fisheries by the need to rebuild some depleted shelf rockfish species (Parts D, *F, G, and H (in press)*).

Overfished shelf rockfish (cowcod, bocaccio, canary rockfish, and yelloweye rockfish) rebuilding constraints are anticipated to shift groundfish fishing effort from shelf to nearshore and slope areas. Such restrictions will likely be needed to shift the majority of the on-bottom groundfish effort off the shelf given the dramatically low OYs considered to protect bocaccio in the south (Conception and Monterey INPFC areas) and yelloweye and canary in the north (Monterey. Eureka, Columbia, and U.S.-Vancouver INPFC areas). Although lingcod are known to migrate to nearshore and shelf areas, they primarily reside and spawn on shelf reefs. This anticipated effort shift will likely speed lingcod rebuilding and considerably reduce the risk of overfishing lingcod through management error or scientific uncertainty.

5.0 CONSISTENCY WITH FMP OBJECTIVES AND THE MAGNUSON-STEVENS ACT

[to be completed before public review]

5.1 FMP Objectives

5.2 National Standards

5.3 Other Applicable Magnuson-Stevens Act Provisions

6.0 OTHER APPLICABLE LAW

[to be completed before public review]

6.1 National Environmental Policy Act

6.2 Regulatory Impact Review and Regulatory Flexibility Act Determination

6.2.1 Executive Order 12866

6.2.2 Impacts on Small Entities

6.3 Coastal Zone Management Act

6.4 Listed Species

6.4.1 Endangered Species Act

Fisheries that interact with species listed as depleted, threatened, or endangered may be subject to management restrictions under the Endangered Species Act (ESA). West coast groundfish fisheries can potentially interact with species listed under the ESA.

Several species of salmon are found in the EEZ off the west coast during the ocean phase of their life cycle. Of these species, chinook salmon (two stocks), sockeye salmon (one stock), and steelhead (two stocks) are listed as endangered and coho salmon (three stocks), chinook salmon (six stocks), chum salmon (two stocks), sockeye salmon (one stock), and steelhead (eight stocks) are listed as threatened under the Endangered Species Act (ESA). Interactions between west coast groundfish fisheries and salmon occur, but based on Biological Opinions under the ESA (August 10, 1990, November 28, 1991, August 28, 1992, September 27, 1993, May 14, 1996, and December 15, 1999), implementation of the proposed alternatives for the groundfish fishery is not expected to jeopardize the existence of any threatened or endangered species or modification of critical habitat.

Over sixty species of seabirds are found in the EEZ off the west coast. Some of these species are listed as endangered (short-tail albatross, California brown pelican, California least tern) and threatened (marbled murrelet) under the ESA. In west coast groundfish fisheries, seabirds are occasionally taken by trawl and pot gear but they are most often taken with hook-and-line gear; a gear not known to catch lingcod and other slope effectively. Measures designed to rebuild lingcod will primarily affect bottom trawl fishing opportunities. Bottom trawl gears do not have significant direct seabird interactions. However, in addition to incidental take, seabirds may be indirectly affected by changes in prey availability, vessel traffic, garbage dumping, and diesel or oil discharge that can result from commercial fisheries. Reduced harvest opportunities due to lingcod rebuilding constraints are expected to result in decreased fishing effort. Seabirds may indirectly benefit.

Sea turtles are highly migratory; four of the six species found in U.S. waters have been sighted off the West Coast. The green turtle (*Chelonia mydas*), the leatherback turtle (*Dermochelys coriacea*), and the olive ridely turtle (*Lepidochelys olivacea*) are listed as endangered, and the loggerhead turtle (*Caretta caretta*) is listed as threatened. The management and conservation of sea turtles is shared between NMFS and FWS. Little is known about the interactions between sea turtles and west coast commercial fisheries. The directed fishing for sea turtles in west coast groundfish fisheries is prohibited, because of their ESA listings, but the incidental take of sea turtles by longline or trawl gear may occur. Sea turtles are known to be taken incidentally by the California-based pelagic longline fleet and the California halibut gillnet fishery. Because of differences in gear and fishing strategies between those fisheries and the west coast groundfish fisheries, the expected take of sea turtles by groundfish gear is minimal.

Sea turtles may be also indirectly affected by commercial fisheries. Sea turtles are vulnerable to collisions with vessels and can be killed or injured when struck, especially if struck with an engaged propeller. Entanglement in abandoned fishing gear can also cause death or injury to sea turtles by drowning or loss of a limb. The discard of garbage at sea can be harmful for sea turtles, because the ingestion of such garbage may choke or poison them. Sea turtles have ingested plastic bags, beverage six-pack rings, styrofoam, and other items commonly found aboard fishing vessels. The accidental discharge of diesel and oil from fishing vessels may also put sea turtles at risk, as they are sensitive to chemical contaminates in the water.

The recently implemented west coast groundfish observer program should supply additional information about the incidental take of sea turtles in 2002 and beyond.

Three marine mammals species (Steller sea lion (*Eumetopias jubatus*) Eastern Stock, Guadalupe fur seal (*Arctocephalus townsendi*), and Southern sea otter (*Enhydra lutris*) California Stock) are found in the EEZ off the west coast and are listed as threatened under the ESA. Potential interactions of ESA-threatened marine mammals with groundfish fisheries are generally discussed in the following section.

6.4.2 Marine Mammal Protection Act

Fisheries that interact with species listed as depleted, threatened, or endangered may be subject to management restrictions under the Marine Mammal Protection Act (MMPA). NMFS publishes an annual list of fisheries in the *Federal Register* separating commercial fisheries into one of three categories, based on the level of serious injury and mortality of marine mammals occurring incidentally in that fishery. The categorization of a fishery in the list of fisheries determines whether participants in that fishery are subject to certain provisions of the MMPA, such as registration, observer coverage, and take reduction plan requirements. The west coast groundfish fisheries are in Category III, indicating a remote likelihood of, or no known serious injuries or mortalities, to marine mammals.

All marine mammals found in the EEZ off the west coast are protected by the Marine Mammal Protection Act (MMPA). Approximately thirty species, including seals and sea lions, sea otters, and whales, dolphins, and porpoise, occur within the EEZ. Many marine mammal species seasonally migrate through west coast waters, while others are year round residents.

There is limited information documenting the interactions of groundfish fisheries and marine mammals, but marine mammals are probably affected by many aspects of groundfish fisheries. The incidental take of marine mammals, defined as any serious injury or mortality resulting from commercial fishing operations, is reported to NMFS by vessel operators. In the west coast groundfish fisheries, incidental take is infrequent and primarily occurs in trawl fisheries (Forney *et al.* 2000). Indirect effects of groundfish fisheries on marine mammals are more difficult to quantify due to a lack of behavioral and ecological information regarding marine mammals. However, marine mammals may be affected by increased noise in the oceans, change in prey availability, habitat changes due to fishing gear, vessel traffic in and around important habitat (i.e., areas used for foraging, breeding, raising offspring, or hauling-out), at-sea garbage dumping, and diesel or oil discharged into the water associated with commercial fisheries.

Under the MMPA on the west coast, NMFS is responsible for the management of cetaceans and pinnipeds, while the U.S. Fish and Wildlife Service (FWS) manages sea otters. Stock assessment reports review new information every year for strategic stocks (those whose human-caused mortality and injury exceeds the potential biological removal (PBR)) and every three years for non-strategic stocks. Marine mammals whose abundance falls below the optimum sustainable population (OSP) are listed as "depleted" according to the MMPA. Under the ESA, a species is listed as "endangered" if it is in danger of extinction throughout a significant portion of its range and "threatened" if it is one likely to become an endangered species within the foreseeable future throughout all, or a significant portion, of its range.

Under the MMPA, depleted species occurring off the west coast include the sperm whale (*Physeter macrocephalus*) west coast stock, humpback whale (*Megaptera novaeangliae*) west coast - Mexico stock, blue whale (*Balaenoptera musculus*) eastern north Pacific stock, and fin whale (*Balaenoptera physalus*) west coast stock.

Of the marine mammal species incidentally caught in west coast groundfish fisheries, the Steller sea lion is listed as threatened under the ESA, the northern elephant seal may be within their OSP range, and there is insufficient data to determine the status of the harbor seal, California sea lion, Dall's porpoise, and Pacific white-sided dolphin relative to their OSP. None of these species are classified as strategic stocks under the MMPA. Based on its Category III status, the incidental take of marine mammals in the west coast groundfish fisheries does not significantly impact marine mammal stocks.

6.4.3 Migratory Bird Treaty Act

The Migratory Bird Treaty Act of 1918 was designed to end the commercial trade of migratory birds and their feathers that, by the early years of the 20th century, had diminished populations of many native bird species. The Act states that it is unlawful to take, kill, or possess migratory birds and their parts (including eggs, nests, and feathers) and is a shared agreement between the United States, Canada, Japan, Mexico, and Russia to protect a common migratory bird resource.

The Migratory Bird Treaty Act prohibits the directed take of seabirds, but the incidental take of seabirds does occur. Only limited information exists quantifying the incidental take of seabirds in west coast groundfish fisheries. However, none of the proposed management alternatives are likely to affect the incidental take of seabirds protected by the Migratory Bird Treaty Act. Implementation of the NMFS West Coast groundfish observer program should provide additional information about the incidental take of seabirds in groundfish fisheries.

6.5 Paperwork Reduction Act

6.6 Executive Order 13132 (Federalism)

7.0 LIST OF PREPARERS

Mr. Tom Jagielo, WDFW; SSC (and contributing stock assessment authors): stock assessment; rebuilding analysis; rebuilding yield projections

Dr. Jim Hastie, NMFS NWFSC; GMT: bycatch/discard; economic analysis and effects; rebuilding analysis; rebuilding yield projections

GMT members: fishery effects; species interactions; management specifications

Ms. Carrie Nordeen, NMFS NWR: habitat description; habitat effects; listed species interactions

Mr. John DeVore, PFMC: contributing author

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Appendix E-1 Lingcod Rebuilding Analysis

[to be included before public review]

Appendix E-2 FMP Amendment Language

[to be completed before public review]

ADOPTION OF DRAFT REBUILDING PLANS FOR PUBLIC REVIEW FOR PACIFIC OCEAN PERCH, LINGCOD, COWCOD, WIDOW ROCKFISH, AND DARKBLOTCHED ROCKFISH

Situation: There are nine overfished groundfish species on the West Coast, eight of which have been managed under Council interim rebuilding measures adopted at previous meetings as either rebuilding plans or rebuilding strategies for yet-to-be completed rebuilding plans (Exhibit C.5, Attachment 1). As a result of litigation, the Federal District Court for the Northern District of California ruled in August 2001 that rebuilding plans for all nine species are required to be formally adopted as either fishery management plan (FMP) amendments or regulatory amendments, not as the policy documents the Council had adopted; additionally, the court ruled that the process of adopting the framework for rebuilding plans was inadequate under the National Environmental Policy Act (NEPA). This effectively means there are no approved rebuilding plans in place at this time.

At the April 2002 Council meeting, the Council indicated the intent to incorporate rebuilding plans for overfished groundfish species in at least two amendments, separated on the basis of availability of information. The expectation was that the first phase would include the process and standards for adopting rebuilding plans (dealing with such matters as status as either FMP amendments or regulatory amendments), as well as the species specific rebuilding plans for Pacific ocean perch (POP), lingcod, cowcod, and depending on staff workload capabilities, widow rockfish, and darkblotched rockfish. The proposed schedule was Council adoption of this first phase in a two meeting process, approval of a draft for public review in June, and final Council adoption in September as Amendment 16 to the Groundfish FMP. The second phase would include rebuilding plans for bocaccio, canary rockfish, yelloweye rockfish, and Pacific whiting, which would occur on a later schedule; the Council will consider rebuilding analyses and strategies for these species at this meeting (Exhibit C.3, Attachments 1-3 and 5, respectively).

The first phase (Amendment 16) will be analyzed in an Environmental Impact Statement (EIS). Part A of the amendment package analyzes alternative processes and standards for specifying rebuilding plans (Exhibit C.5, Attachment 2). The Council is asked at this time to provide guidance on the rebuilding process and standards alternatives. The Council may also want to identify preferred process and standards alternatives before released for public review. Pending Council guidance on element changes Part A of the amendment package, the process and standards analysis could be available for formal Council consideration and adoption at the September Council meeting.

Draft rebuilding plans for darkblotched rockfish, POP, cowcod, and lingcod are presented to the Council in Attachments 3-6 in this exhibit and would be considered Parts B, C, D, and E of Amendment 16. These draft rebuilding plans are not currently ready for formal public review since they have incomplete or missing elements (e.g., minimal or missing socioeconomic analyses). The Council is asked to consider whether the rebuilding plan analyses and other content are appropriate and provide guidance on when they should be completed and released for public review. The Council may also want to identify preferred rebuilding alternatives for these species.

The widow rockfish rebuilding plan was deferred from the Amendment 16 phase pending Council adoption of a revised rebuilding analysis for this species (Exhibit C.3, Attachment 4).

Council Action:

1. **Provide guidance on the structure and content of Part A: Draft Process and Standards for Rebuilding Plans.** done Motion 9
2. **Consider adopting preferred Process and Standards alternatives.**
3. **Provide guidance on the structure and content of the species specific draft rebuilding plans.**
4. **Consider adopting preferred rebuilding alternatives for POP, cowcod, darkblotched rockfish, and lingcod.**
5. **Determine the schedule for completion of Amendment 16.**

Reference Materials:

1. Current rebuilding parameter/target estimates specified for overfished west coast groundfish: shelf species (Table 1a); and slope and midwater species (Table 1b) (Exhibit C.5, Attachment 1).
2. Draft process and standards for rebuilding plans: Part A of the rebuilding plan EIS, Amendment 16 of the Pacific Coast Groundfish FMP (Exhibit C.5, Attachment 2).
3. Draft rebuilding plan for darkblotched rockfish: Part B of the rebuilding plan EIS, Amendment 16 of the Pacific Coast Groundfish FMP (Exhibit C.5, Attachment 3).
4. Draft rebuilding plan for POP: Part C of the rebuilding plan EIS, Amendment 16 of the Pacific Coast Groundfish FMP (Exhibit C.5, Attachment 4).
5. Draft rebuilding plan for cowcod: Part D of the rebuilding plan EIS, Amendment 16 of the Pacific Coast Groundfish FMP (Exhibit C.5, Attachment 5).
6. Draft rebuilding plan for lingcod: Part E of the rebuilding plan EIS, Amendment 16 of the Pacific Coast Groundfish FMP (Exhibit C.5, Attachment 6).
7. Public comment (Exhibit C.5.c).

Agenda Order:

a. Agendum Overview — John DeVore
b. Reports and Comments of Advisory Bodies
c. Public Comment
d. **Council Action:** Adopt Draft Rebuilding Plans for Public Review

Groundfish Fishery Strategic Plan (GFSP) Consistency Analysis

Rebuilding overfished species, as mandated by the Magnuson-Stevens Fishery Conservation and Management Act, was a primary motive for developing and implementing the GFSP. Many sections of the GFSP describe how rebuilding plans factor into short- and long-term Council priorities for conducting groundfish conservation and management. GFSP objectives such as developing sustainable and effective harvest policies (Sec. II.A.2), achieving fleet capacity reduction (Sec. II.A.3.(b)), allocating groundfish resources (Sec. II.A.4), developing an effective Observer Program (Sec. II.A.5), and development of marine reserves as a groundfish management tool (Sec. II.A.6) are grounded by the need to accomplish the goal of rebuilding overfished groundfish stocks.

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Supplemental Reference Materials

8. Exhibit C.5.b, Supplemental GAP Report.
9. Exhibit C.5, Supplemental Revised Attachment 1.
10. Exhibit C.5, Supplemental Attachment 2 (2).
11. Exhibit C.5.b, Supplemental SSC Report.
12. Exhibit C.5.b, Supplemental HC Report.
13. Exhibit C.5.c, Supplemental Public Comment 2.

PROCESS AND STANDARDS FOR REBUILDING PLAN

4.0 Environmental Consequences

The following terms are used in this document to describe various aspects of rebuilding plans (RELOCATE THE FOLLOWING TERMINOLOGY DISCUSSION TO SECTION 1 OR 2).

Rebuilding Plan Terminology

Rebuilding Plan:	The rebuilding plan is defined here as the composite of (1) the rebuilding actions, (2) the rebuilding policy and (3) the supporting explanatory information.
Rebuilding Actions:	The rebuilding actions are those actions required under the MSA for rebuilding a stock. Rebuilding actions include management measures to regulate fisheries (MSA Section 304(e)(3)) and the specification of required rebuilding parameters such as the target time for rebuilding (MSA Section 304(e)(4)(a)). Rebuilding actions must be specified an FMP or regulation.
Rebuilding Policy:	A rebuilding policy is any Council statement that guides the Council's future rebuilding actions but is not required to be incorporated in an FMP or regulation **and** that the Council chooses not to put in an FMP or regulation. Rebuilding policies are specified at the same time that rebuilding actions are specified and are detailed in the analytical documents accompanying the rebuilding actions. Rebuilding policies may be changed without a formal plan or regulatory amendment but the policy changes must be approved by NMFS. If such policy changes occur, it is likely that they will occur in the context of setting OYs and management regulations and will be accompanied by analyses and explanation of the reason for the proposed changes. **As part of the final action on the process and standards FMP amendment for rebuilding plans, the Council may decide that no part of the rebuilding plan will have the status of rebuilding "policy" (all policy elements of the rebuilding plan will be in an FMP or regulation).**
Rebuilding Explanatory Information:	Explanatory information provides the rationale for rebuilding actions and policies. Initial explanatory information will accompany or be provided as part of the rebuilding plan. Explanatory information may be updated without a plan or regulatory amendment. After updates to explanatory information, if there are significant mismatches between the explanatory information and the rebuilding rebuilding actions or policies, an amendment to the rebuilding plan will be needed. Any update to explanatory information should evaluate the significance of any such mismatch. **As part of the final action on the process and standards FMP amendment for rebuilding plans, the Council may decide that no part of the rebuilding plan will have the status of "rebuilding explanatory information" (i.e. all explanatory elements of the rebuilding plans will either be in an FMP or regulation.)**

Section 2 describes sets of options and sub-options under five issue areas, four of which are considered here.[1/] For the purposes of summarizing results of the analysis these options have been cast into six "scenarios" that suggest how they might be combined into an implemented package. These scenarios include the status quo and preferred alternative (the latter of which has not yet been specified by the Council). The analysis will go through each major category of impact, discussing each issue and the

1/ The fifth issue concerns several housekeeping measures, which are categorically excluded from the NEPA analysis because they will not have any direct, indirect or cumulative effects on the environment.

options under the issue. At the end of the major category, impacts will be summarized by scenario. Elements of the scenarios are summarized in Table 4-1 and described below:

Scenario 1: status quo. The first three rebuilding plans accompanying Amendment 12 were prepared in the form of environmental assessments with alternatives that described target biomass and rebuilding period as numeric values, a harvest rate policy, and bycatch control strategies. Draft rebuilding plans currently under consideration are similar in format and content. The FMP was not amended to incorporate rebuilding plan elements for specific species. All elements of the rebuilding plan are supposed to be reviewed every two years by the Council.

Scenario 2: Limited plan amendment. In this scenario rebuilding plans would be modified so that certain actions are in the FMP. All other actions in regulations governing fisheries would be derived from procedures under the existing FMP. Explanation of the derivation of elements of the rebuilding FMP amendment would be placed in the accompanying analytical documents that meet requireds fo NEPA and other applicable law. The FMP is not amended to require discussion of specific issues in the rebuilding plan. The FMP is amended to incorporate the rebuilding target, T_{TARGET} (specified in years), and the harvest control rule to be employed (described by type only or specified numerically). Since only these elements would become part of the FMP (in addition to existing FMP contents related to rebuilding plans) they could be described for all overfished species in tabular format. The Secretary, not the Council, would review the amended FMP as required in MSA §304(e)(7) (Option 2e in Section 2.1.2). The rebuilding plan could be revised and updated if new information results in significantly different values for any of the various rebuilding parameters, as determined by the SSC or GMT (sub-option ii in Section 2.1.2). A change in the target year or B_{MSY} (expressed as a percent of B_0) would require another FMP amendment. All the scenarios, aside from the status quo, would include amendment language to describe how an ESA listing would be handled.

Scenario 3: Implement targets as regulations. This scenario is similar to the previous one except that the target and harvest rate policy for each overfished species is specified in federal regulations instead of in the FMP. Regulations would continue to require fisheries to be managed so that targets are reached. The FMP would be amended to require these regulatory targets and harvest policies (but the targets would not be specified in the FMP) and to require that rebuilding plans be discuss certain issues (allocation and habitat protection measures for example). If rebuilding plans established management measures related to allocation and habitat protection these would be written into regulations along with targets and control rules. Rebuilding plans would be reviewed every two years except for targets, which would be reviewed after each stock assessment (Option 2b in Section 2.1.2). The standards for modifying targets and parameters would be the same as described for Scenario 2.

Scenario 4: Full plan amendment, limited specification. This scenario would require all of the description in each rebuilding plan be incorporated into the FMP as an amendment. It would also require rebuilding plans to consider a longer list of issues. The parameters specified in the FMP would be expanded to include the maximum rebuilding year (T_{MAX}) expressed as a date and associated probability. As with Scenarios 2 and 3, rebuilding plans would be revised when new information results in a significant change to parameters or targets; this would necessitate an FMP amendment if values specified in the FMP need to be changed. The Council reviews rebuilding plans every two years and reviews targets in relation to a fixed stock assessment schedule (Option 2c or 2d). Each rebuilding plan establishes intermediate targets, which could be biomass values, for assessing rebuilding progress. (Options 3b and 3c suggest the type of targets that might be established.)

Scenario 5: Full plan amendment, full specification. This scenario is similar to Scenario 4 except that many more parameters are numerically specified in the FMP (see Table 4-1). Also, in addition to required consideration of allocation, habitat and marine reserve issues, discussion and possible adoption of more detailed harvest regulations would be a required element of rebuilding plans (and incorporated into the FMP). Time and area closures, gear restrictions, or quotas are examples of such specific measures; these measures could also be aimed at reducing bycatch of overfished species. All elements of the rebuilding plans would be reviewed by the Council every two years (including targets). The amended FMP establishes a single method for calculating performance targets to assess rebuilding progress. (This method would be used to calculate numerical performance target values for each overfished species. Since all elements of the rebuilding plan preferred alternative would be incorporated into the FMP by subsequent amendment, these would also appear in the FMP.)

Preferred Alternative. Not identified in this draft. The Council can combine the options presented in Section 2 in any number of ways so that the preferred alternative will not necessarily correspond to any of the scenarios elucidated here for the purposes of analysis.

The options and sub-option described in Section 2 describe different ways in which rebuilding measures could be implemented by FMP amendment and/or regulations. **They will not directly affect the biological or socioeconomic environment because they do not contain specific measures that control fishing mortality or affect other aspects of the natural or social environment.** The specific measures with impacts on the natural environment will relate to decisions made with respect to each individual rebuilding plan. The direct, indirect, and cumulative effects of the process and standards for rebuilding plans due to the effects on administrative and public policy processes.

As indicated in Table 1-1, the process and standard options directly affect the management regime and have several other effects that should be considered in light of CEQ regulations (precedent-setting, risk and uncertainty, and controversy). These factors are organized into the following topic areas: (1) administrative capacity and other effects on the management regime; (2) capacity for adaptive management (which mitigates established precedents and addresses unknown risks); and (3) opportunity for public participation in decision making, specifically by commenting on proposed actions (which may mitigate controversy). The options described in Chapter 2 and the six scenarios described above (including the preferred alternative, although not in this draft) are analyzed comparatively under each of these topics.

4.1 Administrative Capacity and Costs

Administrative capacity is a measure of the time available to and productivity of the administrators of the management regime. This can be attributed to each element of the management system: Council members, advisory bodies, Council staff, NMFS staff and state agency staffs. Capacity is more or less a constant because the Council meets for defined periods of time and staffs have some total amount of work time. (This assumes no significant expansion in the number of staff.) Because capacity is fixed and administrative capacity fully utilized, the time cost of any management measure actually represents a tradeoff: time spent on one task means less time spent on another. Procedural measures can be assessed in terms of complexity; the more complex the task of implementing and "maintaining" the procedure the more organizational capacity will be required. This means that organizational attention and capacity is shifted away from other tasks that may be equally pressing or important. The allocation of resources among different tasks can have difficult-to-predict indirect effects on the environment if the implementation of management measures are delayed or organizations do not have the opportunity to address broad issues strategically.

Determining total capacity for each organizational component is not difficult. As noted above, this could be calculated based on the total number of staff person days (Council staff, NMFS) available annually (or any other defined time period).[2/] Capacity could also be subdivided roughly between task categories since tradeoffs are not absolute; some amount of time has to be devoted to certain tasks such as setting salmon seasons, groundfish annual specifications, administrative matters, etc. After deducting these

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2/ A more intangible element of capacity is that of the public and policy makers to absorb and understand the materials produced to support informed decision making. Increasing staff may not facilitate good decision making if it increases the volume of information produced without improving the summarizations and clarity with which the information is presented.

commitments, what remained would be some level of fungible time that could be rationed among tasks. It is more difficult to accurately anticipate the amount of time needed to complete different tasks because while the generic elements involved in developing and implementing management actions—such as scoping, organizing meetings, drafting documents, and rule making—can be identified, the actual amount of time needed for a given instance of one of these generic tasks can vary widely depending on how complex or controversial the task is. Because of these difficulties a quantitative assessment of the administrative costs implied by the different scenarios described above will not be attempted. Instead, a qualitative comparison is made. (Table 4-2 summarizes impacts for the three analytical criteria used here.) In this analysis, only actions that are consequent of this action—amending the FMP to establish the rebuilding plan implementation process—are considered. The administrative cost of developing and implementing these procedures is not relevant because the same " sunk cost" applies equally to all of the alternatives considered here.

Given that administrative capacity is a fixed quantity and increased resources devoted to rebuilding measures represents a tradeoff against other tasks, goals outlined in the Groundfish Fishery Strategic Plan (PFMC 2000) are briefly described to suggest potential tradeoffs. [describe]

4.1.1 Issue 1 - Form and Required Elements for the Species Rebuilding Plan

The following is a recapitulation of the options provided in Section 2.1.1.

Option 1a. **Status Quo -** Leave all elements currently listed in the FMP as part of the annual specification process--not part of an FMP or regulation. (The court found that status quo does not meet the requirements of the MSA.

Option 1b. **Complete Rebuilding Plan in Policy Document Accompanied by Plan Amendment to Specify T_{target} and Augment -** The rebuilding plan will be developed as a single policy document that will contain within it or be accompanied by an FMP amendment to (1) implement any rebuilding actions required under Section 304(e) of the MSA that are not already authorized under the existing FMP, (2) specify in the FMP the rebuilding period required under Section 304(e)(4)(A) of the MSA (T_{target}) and (3) specify B_{msy}. **Suboption (i):** Specify B_{msy} as an algorithm or formula. **Suboption (ii):** Specify B_{msy} as a hard number. Augment the list with additional elements (see list following and Tables 2.1-a and 2.1-b).

Option 1c. **Convert All Rebuilding Plan Elements into an FMP -** For each overfished species incorporate into an FMP amendment all elements that the current FMP specifies as part of a rebuilding plan.

Option 1d. **Convert All Rebuilding Plan Elements into a Regulatory Amendment -** For each overfished species incorporate into a regulatory amendment all elements the current FMP specifies as part of a rebuilding

Option 1e. **Convert All Rebuilding Plan Elements into an FMP and Augment -** For each overfished species incorporate into an FMP amendment all elements the current FMP specifies as part of a rebuilding **and augment the list with additional elements (see Tables 2.1-a and 2.1-b).**

Option 1f. **Convert All Rebuilding Plan Elements into a Regulatory Amendment and Augment -** For each overfished species incorporate into a regulatory amendment **all** elements the current FMP specifies as elements for a rebuilding plan **and augment the list with additional elements (see Tables 2.1-a and 2.1-b).**

Administrative costs associated with rebuilding plans will vary with

- the form in which each element of the rebuilding plan is set (policy document, FMP amendment, or regulatory amendment),

- the degree to which the specification of the element allows for variations and contingencies in the fishery resources (numerical values allow for less variation and contingency than formulas or algorithms),
- the elements that are included as part of the rebuilding plan.

Form

FMP amendments usually have the greatest administrative costs, taking the longest time to implement at the Secretarial level, and regulatory amendments have a somewhat lesser administrative cost, taking somewhat less time to implement at the Secretarial level. At the Council level, the administrative costs of FMP and regulatory amendments are comparable. Policy documents that are not in the form of an FMP or regulation may be modified with substantially less administrative cost than FMPs or regulations. In some cases, such as with the Council's groundfish strategic plan, a policy document may be developed without an accompanying NEPA analysis. In other cases, such as with the Council's initial rebuilding plans, policy documents may be accompanied by a NEPA analysis.

Under this issue, the Council determines elements that will be included in rebuilding plans. For each element included as part of a rebuilding plan, the administrative costs associated with including the element will be highest if it is specified as an element in an FMP, somewhat lower if it is specified as a regulation, and lowest if it is specified as a policy document. An important caveat in evaluating the tradeoff between form and administrative cost is that the form in which the element is specified must meet the requirements of the MSA. It may be possible to specify some rebuilding plan elements as regulations (for example constraints placed on fishing pursuant to the requirements of MSA, Sec 304(e)(3)) and other elements as FMP amendments (for example the time period for rebuilding required under MSA, Sec 304(e)(4)).

Numeric Value, Algorithm or Formula

To the degree to which it is allowed under the MSA and implementing regulations, the specification of elements of the rebuilding plan in a manner that allows the elements to vary based on new information (without requiring a plan amendment, regulatory amendment or an amendment to a policy document in order to implement the change) will result in lower administrative costs than if the same elements were specified as fixed values. One way to allow those elements to vary in such a manner is to specify them as algorithms, formulae or possibly as relational tables.

Elements to Be Included

The first section of the following table lists the elements required to be in rebuilding plans under status quo, Option 1a. The decision to be made is the form in which the elements in the current list will be specified (policy document, FMP or regulation). There is no option which would reduce the current list. Certain elements are required as rebuilding actions under the MSA. The required element specifically named in the MSA is the time period for rebuilding. This action must be put into an FMP or regulation. All options would maintain all of the current required elements; however, Option 1b would convert only T_{target} and B_{msy} into an FMP or regulatory amendment, all other elements would remain in the form of a policy document.

The second section of the table includes candidates for addition to the list of required elements. Options 1e and 1f would expand the Council's list of required the rebuilding plan elements. Subjects for the expanded list include harvest regulations, allocation, bycatch controls, habitat protection measures, closed areas, and additional rebuilding parameters. With the exception of the rebuilding parameters, actions on these subjects are considered and occur under the provisions of the current FMP as part of the specification of OYs and annual management measures or as regulatory amendments. The interaction between new rebuilding plans and each of these types of management measures will likely be covered in the analysis of any FMP or regulatory amendment to implement a rebuilding plan, including discussion of any need for adjustment to current practices.

Expansion of the list of elements for which options are developed as part of a rebuilding plan will increase the administrative cost and likely increase the amount of time required to develop and consider a rebuilding plan. Placing additional elements rebuilding plan elements in the FMP would increase the cost of their implementation or any future modification as compared to implementing the elements as part of the specifications of OYs and annual management measures, or implementing the measures as regulations under the framework of the current FMP or under any new frameworks created by this process and standards amendment.

With respect the additional parameters considered for inclusion in rebuilding plans, most of the parameters listed in the table will need to be considered in providing a rationale to support the selection of T_{target} and B_{msy}. The main administrative cost associated with inclusion of an item as an action of the rebuilding plan is the specification of that element as a part of an FMP or regulation and the need for amendments to the FMP or regulation if the value changes. Combining the results of the previous two sections, the administrative cost of including any of the additional parameters in a rebuilding plan might be minimized by either specifying the element as part of the explanatory text in a policy document (provided the element is not required to be in an FMP or regulation under the MSA) or—if incorporated into the FMP—specifying the elements as a algorithms, formula or procedure to be followed.

Rebuilding Plan Element	Impact on Administrative Costs
<u>Currently required elements</u> The second paragraph of Section 5.3.6.2 (renumbered as 4.5.2.2) states that rebuilding plans ***<u>will</u>***	Option 1a - Status Quo (baseline): Continue to require these elements as part of a policy document.
specify any individual goals and objectives including ▸ a **time period** for ending the overfished condition and rebuilding the stock [T_{target}] ▸ and the **target biomass** to be achieved [B_{msy}] (biological parameter)	Option 1b - Require that only the time period for rebuilding and B_{msy} be set as part of the rebuilding action (plan or regulatory amendment) drop all other elements. All other elements will still need to be addressed in providing a rationale to support the selection of these two parameters. Lower administrative costs than for options that include more elements in the FMP or regulation.
explain how the rebuilding period was determined, including any calculations that demonstrate the scientific validity of the rebuilding period	Option 1c - Convert all currently required elements into an FMP. Higher administrative costs than status quo, mainly associated with the need to amend the FMP in response to changing information.
identify potential or likely **allocations** among sectors,	Option 1d - Convert all currently required elements into a regulation. Higher administrative costs than status quo, mainly associated with the need to amend the regulations in response to changing information.
identify the types of **management measures** that will likely be imposed to ensure rebuilding in the specified period,	
provide other information that may be useful to achieve the goals and objectives.	

Rebuilding Plan Element	Impact on Administrative Costs
<u>Elements to Consider Adding to Rebuilding Plans</u> **Harvest Regulations.** Include specific harvest control measures (regulations) as part of the rebuilding plan (if in the form of an FMP amendment the rebuilding plan would also need to amend regulations). NOTE: Under other Options 1a-1d specific harvest regulations are established in conjunction with the annual process for setting OY.	Options 1e and 1f - Augment the list of required elements: These options increase administrative costs and lengthen time required for initial development of a rebuilding plan. If the plan (Option 1e) or regulatory amendments (Option 1f) would have been needed as adjustments to the rebuilding plan, this may represent a shift in when certain provisions are implemented rather than a change in total administrative costs. While lengthening the time required for development of a rebuilding plan, their may be some administrative efficiency gained by the inclusion of more actions as part of a single process. However, this also adds complexity to the process.
Allocation. Include allocations or allocation priorities for overfished species where specific allocations or allocation priorities have not already been specified under the procedures of the FMP or in the FMP.NOTE: Under other Options 1a-1d specific allocations are specified under existing FMP provisions or the allocation framework and implemented in conjunction with the annual process for setting OY. **Bycatch.** Suboption (i) **Include consideration** of the • the **adequacy of information** on bycatch and bycatch mortality. Measures needed to acquire the bycatch information necessary to adequately implement the harvest control rule may be considered as part of the rebuilding plan or in a separate plan pr regulatory amendment. Adopt risk averse harvest levels sufficient to account for uncertainty about bycatch. • the need for management measures to **minimize bycatch** and minimize the mortality of unavoidable bycatch as part of the rebuilding plans. Measures needed to minimize bycatch or the mortality of unavoidable bycatch may be considered as part of the rebuilding plan or in a separate plan or regulatory amendment. (NOTE: Bycatch measures will also be addressed as part of Amendment XX) Suboption (ii) **Include** such **measures** as are needed • to **acquire the bycatch information** necessary to adequately implement the harvest control rule. • to **minimize bycatch** and minimize the mortality of unavoidable bycatch as part of the rebuilding plans. (NOTE: Bycatch measures will also be addressed as part of Amendment XX) **Habitat.** Include specific habitat protection measures. **Close Areas.** Include consideration of the contribution areas closed to groundfish fishing might make to rebuilding the stock (closed areas could range in extent to restricting all fishing, i.e. no-take marine reserves). Include such measures in the plan as appropriate.	With the exception of the last element listed as candidates for an augmented list (additional rebuilding parameters), all elements listed here would need to include amendments to the regulations that restrict fishing activities. Under Option 1e, the actions would also be implemented as part of a plan amendment, a somewhat more administratively costly measure that takes longer to modify if adjustments are needed.

Rebuilding Plan Element	Impact on Administrative Costs
Parameters. The list of candidate parameters and the form in which they would be expressed "hard values" or "algorithms or formulae" is provided in Table 2.1-b. (NOTE: All parameters need not be added in the same form, i.e. some can be expressed as "hard values" others as "algorithms or formulae". Additionally, not all parameters may need be placed in the same type of document. It may be possible to specify that some will be placed in a policy document and others in the FMP or regulation.	Expanding the list of parameters in a FMP or regulation may increase the frequency with which FMP or regulations are amended. Regardless of whether or not they are included in an FMP or regulation, the parameters listed will need to be discussed in the explanation of the rebuilding plan. Specification of the parameters in FMPs or regulations as algorithms or formulas would likely result in less of a need for future amendments than if they are specified as numeric values.

4.1.2 Issue 2 - Periodic Review and Amendment of Rebuilding Plans

Under the main options, the conduct of formal rebuilding plan reviews by the Council vary from once every 2 years (Option 2a) to none (formal review only by the Secretary, Option 2e). Under Option 2e the Council would monitor progress as part of OY and management measure specification. Intermediate between the two extremes are three options which would require biannual reviews of the general rebuilding goals 2-5 every two years and review of goal 1 (achievement of B_{msy}) only when new stock assessments are conducted (for a list of the goals see footnote 12 on page 2-5). The intermediate options deviate from one another in the specification of a schedule for stock assessments. Option 2b provides no such schedule, Option 2c specifies that the rebuilding plan for individual species would include specification of a schedule for stock assessments and Option 2d specifies a common stock assessment schedule for all species managed under a rebuilding plans.

In general, if the Council conducts reviews, the more rigid the schedule for the review the greater the potential administrative opportunity costs, the greater the cost of deviating from the mandated schedule in order to address priorities developing out of future situations--the nature of which cannot be predicted at this time. Deviation from rigidities in the schedule would require the incursion of administrative costs and delay while a plan or regulatory amendment is developed to allow for the deviation. Absent an amendment to allow for the deviation, if the review schedule does not mesh with the priorities of future circumstances more beneficial tasks would have to be set aside in order to conduct reviews.

Option 2a Council Review Every 2 Years (Status Quo)	Option 2b Review Goals 2-5 Every 2 Years, Review Goal 1 Only With New Stock Assessments.	Option 2c Council Reviews Goals 2-5 Every 2 years; Review Goal 1 Only With New Stock Assessments; Schedule for Stock Assessments Set in Rebuilding Plans.	Option 2d Council Reviews Goals 2-5 Every 2 years; Review Goal 1 Only With Stock Assessments; Stock Assessments Every 5 Years or Every 2 Years if T_{max} is Less than 20 Years Off	Option 2e No Formal Council Review
Baseline	Impact	Impact	Impact	Impact
The Council conducts formal reviews on each rebuilding plan every two years. As of spring 2002 there are nine species for which rebuilding plans are needed. Secretary is required to conduct review every 2 years.	Some increased opportunity for the Council to address other management issues.	Some increased opportunity for the Council to address other management issues. Less of an increase than for Option 2b because of rigidity in schedule for stock assessments.	Some increased opportunity for the Council to address other management issues. Less of an increase than for Option 2b or 2c because of rigidity in schedule for stock assessments.	Greatest increased opportunity for the Council to address other fishery management issues.

Each alternative to status quo (Options 2b, 2c, 2d, and 2e) has three suboptions that define when a change in the rebuilding plans would be mandated. Under all the suboptions, the Council could recommend changes in rebuilding plans to NMFS at any time. Each suboption has different impact on administrative costs. There are administrative costs associated with uncertainty about when an action is required to amend a rebuilding plan. These costs are associated with the agency staff and Council time necessary to debate whether action is needed.

Conditions under which rebuilding plans will be amended.			
Status Quo: No Guidance	Suboption (i) - when progress toward rebuilding is inadequate; or when stock assessment or rebuilding analysis information is updated.	Suboption (ii) - when progress toward rebuilding is inadequate; or when new information indicates a significant change in rebuilding parameters	Suboption (iii) - when progress toward rebuilding is inadequate
Baseline	Impact	Impact	Impact
There is no standard for when a rebuilding plan would need to be amended.	Frequent amendments likely as each stock assessment is likely to entail the revisions of some rebuilding plan parameters. The degree of cost will depend on whether the parameters have been set as numeric values or some other type of algorithm and whether they are set in a plan amendment, regulation or policy document (see Issue 1).	Less frequent rebuilding plan amendments than Suboption(i), administrative costs associated with by case by case determination of "significance" until such time as a standard practice is developed.	Lower administrative costs than Suptions (i) or (ii)

4.1.3 Issue 3 - Adequacy of Progress

The following displays the effects of Issue 3 options on administrative costs.

<table>
<tr><td>Option 3a. No Standards for Progress (Status Quo)</td><td>Option 3b. Standards Based on Negative Deviations from Schedule</td><td>Option 3c. Standard Based on T_{max}</td><td>Option 3d. Standards Developed Under the Individual Rebuilding Plan</td></tr>
<tr><td>Baseline</td><td>Impact</td><td>Impact</td><td>Impact</td></tr>
<tr><td rowspan="2">Status Quo Baseline: Uncertainty about level of progress required before upward or downward adjustments should be made to harvest control rules. That uncertainty will need to resolved and will be an issue of controversy until standards are established either explicitly or through practice. Development analysis and consideration of alternative management policies in an environment where the standards for those policies has not been well specified generates process that are more difficult, complex and contentious.</td><td colspan="2">Impact: By establishing the standard for adequacy as part of the procedures and standards, the issue will not have to be deliberated in the individual rebuilding plans or during the administration of the individual rebuilding plans. On the other hand, if the standard of adequacy established here does not perform well in practice, the Council will need to revisit and revise the standards and procedures section of the FMP, expending administrative resources that may have otherwise been used to benefit the fishery in other ways.</td><td rowspan="2">Given the variety of ways in which rebuilding harvest control rules might be specified and that the appropriate way of specifying the control rule may vary between stocks, it is possible that establishment of a generic adequacy of progress standard for all rebuilding plans will lead to standards that do not match well with the rebuilding harvest control rule. In such an instance, an amendment to the process and standards portion of the FMP would be required, generating more administrative costs, or there would be inefficiencies resulting from the mismatch between the control rule and adequacy standard.

Requiring the specification of an adequacy standard to each rebuilding plan means that there will be some additional administrative costs associated with the development of the individual rebuilding plans, as compared to status quo (where no such standards are established) or as compared to options 3a and 3d (where the standards are established as part of the process and standards section of the amendment). Specification of an adequacy standard in the rebuilding plans, will likely result in lower administrative costs than under status quo.</td></tr>
<tr><td>This option resolves the question of whether Council action is required if rebuilding falls behind expected levels but leaves uncertainty about what happens if rebuilding exceeds expected levels. The zero tolerance approach to negative deviations is likely to lead to frequent plan amendments given the stochasticity in the resource and the measurement of the status of the resource. While administrative costs would be lessened by reduced uncertainty, there would be a 50% likelihood that each rebuilding plan would need to be amended. Therefore, administrative costs may be higher or lower than under status quo</td><td>This option resolves the question of whether Council action is required if rebuilding falls behind expected levels but leaves uncertainty about what happens if rebuilding exceeds expected levels. Harvest control rules would not need to be modified unless biomass rebuilding is not sufficient to, with a 50% probability, achieve rebuilding in the maximum time allowed under the MSA and National Standard Guidelines.</td></tr>
</table>

NOTE: The exact specification of the adequacy standard entailed in Option 3b depend on how the control rule is specified. For example a control rule set as “maintain a 50% probability of achieving rebuilding by the year 2030 starting using a harvest rate approach” contains implicit direction on how to proceed in the event the biomass does not increase at the expected rate (decrease F to maintain target rebuilding year at the specified probability given the information available in any future year).

4.1.4 Issue 4 - ESA Listed Species

The following displays the effects of the Issue 4 options on administrative costs.

Option 1 (Status Quo)	Option 2 If a stock is listed under the ESA, the rebuilding plan defaults to the jeopardy standard or recovery plan developed under the ESA .
Baseline	Impact
Baseline: The FMP and rebuilding plans will need to be amended if a rebuilding species is listed under the ESA.	Option 2 Impact: FMPs will not need to be amended if a rebuilding species is listed under the ESA. The administrative costs associated with such and FMP amendment would be directed to other management activities to benefit the fishery.

4.1.5 Summary of Administrative Cost by Scenario

Scenario 1, the status quo, entails the least administrative cost. Although the status quo entails the least administrative cost, it does not conform to MSA requirements, as found by the Court. It thus only has a relevance as a baseline for comparison. Under status quo, no future amendments are required because rebuilding plan elements are not incorporated into the FMP. Rebuilding plans have to be developed in a NEPA-compliant format and reviewed by the Council. The Council must select a preferred alternative and each rebuilding plan is distributed for public review at some point during this process. The SST, GMT and GAP would likely review each plan and transmit their comments to the Council before its review. Once the Council has approved a rebuilding plan NMFS must likewise determine whether or not to adopt the plan. There is an ongoing commitment in the biennial review of the rebuilding plans. Although these reviews involve less staff time than initial development, the advisory body and Council review burden would not necessarily be unsubstantial This depends to a large extent on whether new stock information and rebuilding analyses suggest that rebuilding trajectories are inaccurate or unrealistic. (Refer to the discussion in Section 1.3.2 on the uncertainties inherent in these analyses.)

Scenario 2 entails moderate increase in administrative burden in comparison to the status quo while meeting MSA requirements. As with the status quo and all other scenarios, rebuilding plans would be developed in a NEPA-compliant format. In addition, the FMP would be amended to incorporate the rebuilding year and harvest control rule for each overfished species. The control rule could be described (e.g., constant rate, constant harvest, or some mixed strategy) or specified numerically (as an F value and/or OY). If the control rule is specified in the FMP then it would have to be adhered to until the FMP was amended to change the specification. Future stock assessments and rebuilding analyses would likely show that the T_{MAX} probability had changed for a given harvest level. By the same token, if T_{TARGET} is defined as the median year for rebuilding, it would change (or a different probability would have to be chosen). (See Section 1.3.2 for a discussion of these tradeoffs.) In all cases the T_{MAX} probability could not fall below 50% for a given harvest rate. Thus specification of a portion of the rebuilding plan as an FMP would make the necessity of future FMP amendments more likely.

Under Scenario 2, a modest, single amendment to incorporate these specifications might suffice, depending on when rebuilding plans are completed. If all the plans are reviewed and approved in a relatively short time period then a single amendment could incorporate the targets and control rules for all of the current overfished species. The need to amend the rebuilding plans in future would be limited to changes in the targets and control rules; as noted above, changing the target to a later year would be very controversial. Alternatively, the mixed-stock exception might be invoked to allow fishing to continue without achieving targets. Because it would be controversial and National Standard guidelines (50 CFR 600.310(d)(6)) contain several analytical tests for applicability, using the exception would require substantial analysis and public debate. It would also likely require an FMP amendment to implement. Under the MSA the secretary is required to conduct review of rebuilding plans. Under Amendment 12, the Council also committed to conducting review rebuilding plans. Whether the Secretary would conduct its own review or review the adequacy of the Council review is unknown. Eliminating the formal Council review but assembling the basic information needed for a review would save administrative costs at the Council level and at best reduce duplication of effort between NMFS and the Council and at worst, shift the administrative costs of the review from the Council to NMFS. The Council would likely want the opportunity to comment on draft Secretarial reviews, so that there would not be complete relief of administrative costs for the Council.

All scenarios other than the status quo include provisions for managing stocks that are ESA-listed. The FMP is amended so that management measures consequent of the ESA process explicitly take precedence over FMP measures. (Some level of incidental take may be permitted under the ESA based on analysis in a biological opinion or similar document.) Specifying precedence in advance may obviate the need to amend the FMP in the event a species or stock were listed, reducing future administrative cost.

Scenario 3 would tend to shorten the implementation process as regulatory amendments can be implemented someone more quickly than plan amendments. The FMP would also require that rebuilding plans analyze allocation and habitat issues as part of a management strategies, requiring some additional staff and advisory body time to complete the requisite analyses. (The actual added cost is difficult to predict since these considerations could be discussed in rebuilding plans in Scenarios 1 and 2 even though not required.) The FMP would not be amended with rebuilding-plan-specific material (keeping in mind that this "process and standards" component would modify FMP language). As discussed above, a change to the targets and control rules contained in regulations would require substantial analysis and review so the administrative burden would be equivalent. The Council would review rebuilding plans with respect to goals contained in the FMP biennially, except for targets, which relate to the first of these goals. Reviewing goals two through five will require some analysis, but since they relate to issues that are a consequence of (or support) rebuilding, rebuilding plans would probably not require wholesale revision unless stock status had changed significantly. Information about stock status comes from assessments, and plans would be reviewed in light of the first goal only after these exercises. It is likely that many parameters would have to be respecified after stock assessments, particularly since the amended FMP would also require rebuilding plan review and revision when any parameter's value changes "significantly," as determined by the GMT and SSC (Sub-option ii under Option 2b). Taken together, these requirements imply that rebuilding plans would require substantial revision if an assessment indicates that stock status is significantly different than previously thought. This would incur a moderate administrative burden due to the need for careful review by the Council and advisory bodies, and Council and NMFS staff time needed to prepare and review documents. If stock assessments are biennial or annual then this workload would be no different than under the first two scenarios; if less frequent, administrative costs would be marginally less.

Scenario 4 adds more language to the FMP describing rebuilding measures for each overfished species. The preferred alternative in each rebuilding plan would be incorporated into the FMP. Note that in the current draft rebuilding plans the description of each alternative is relatively brief, although measures to address additional issues (allocation, habitat, bycatch) would have to be considered under this scenario; specificity is still contingent on the number and nature of parameters that are incorporated into the FMP. This scenario adds the target biomass and the maximum rebuilding time and associated probability. Since the target biomass is only expressed as a percent of unfished biomass, rather than as a quantity, it is unlikely that this parameter alone would trigger future amendments to change it. Maximum rebuilding time and its probability is a key analytical target and is causally linked to a specified harvest level. Thus, if the harvest control rule is also specified, it is very likely that the FMP would have to amended after each stock assessment because new rebuilding analyses, incorporating stock assessment data, would likely show that the T_{MAX} probability for a given harvest level had changed. A stock assessment schedule would be specified either in individual rebuilding plans or as part of this process and standards amendment. Council review would be essentially the same as in the previous scenario except that the stock assessment schedule could change their frequency. As already discussed, stock assessment frequency is the main determinant of significant rebuilding plan revision, resulting FMP amendments to change targets or parameters, and as a consequence, administrative cost. The FMP would also require that rebuilding plans include intermediate targets meant to assess performance of rebuilding measures (Section 2.1.3, adequacy of progress, Option 3d). Depending on the nature of these performance targets, they could trigger FMP amendments after every stock assessment (see below).

Scenario 5 would entail the incorporation of numerous numerically-specified parameters and targets into the FMP. The Council reviews all rebuilding plan elements biennially as under the status quo. This scenario also includes performance targets, but a generic standard is described in the FMP and applied to all overfished species (either Option 3b or 3c in Section 2.1.3). Under Option 3b a rebuilding plan would have to be revised if biomass (measured relative to target biomass), as estimated by a recent stock assessment, was below a projected level in the rebuilding analysis. As noted in Section 2, it would be very difficult to meet this performance standard.[3/] Instead, performance could be based on the"rebuilding envelope" described in rebuilding analyses. This accords to the 90% confidence interval for the relative biomass in each future year in the rebuilding period. (In other words, 90% of all simulations produced values that fell within this range in a given year.) If the measured value (from a stock assessment) falls outside this range then the rebuilding plan would have to be revised. (Note that any new rebuilding analysis made after subsequent stock assessments will almost certainly have different values for the "rebuilding envelope." Presumably, these new values would become the performance targets for subsequent years.) Option 3c is based on the T_{MAX} probability. As noted in Section 1.3.2, there is a tradeoff between this probability and the harvest level. If harvest policy is fixed (as a constant F for example) it is almost certain that the T_{MAX} probability will be different when the rebuilding analyses is redone with new stock assessment data. Alternatively, the decision maker could choose to fix the probability and vary the harvest rate.[4/] A fixed T_{MAX} probability management strategy would invalidate the type of performance target described under Option 3c because it uses the T_{MAX} probability as the measurement standard. This strategy would reduce the likelihood that rebuilding plan revision would be required due to a deviation from the performance target. Note that performance would be measured after a stock assessment provides new estimates of stock size. Performance targets would thus be set for some interval that corresponds to (or is a multiple of) assessment frequency.

The degree of detailed information incorporated into the FMP under this scenario pretty much ensures that the FMP will have to be amended after every stock assessment. As a result, the performance targets would not add substantially to administrative costs, even if measured biomass does not meet the target, because the rebuilding plan would have to be revised anyway. These revisions would have to be incorporated into the FMP by amendment. This scenario would entail the most administrative cost, although it is unclear that the biennial reviews would result in wholesale rebuilding plan revision and FMP amendment if stock assessments are less frequent.

4.2 Flexibility and Capacity for Adaptive Management

The concept of adaptive management was first developed in the 1970s (Holling 1973) and has been applied widely. Adaptive management assumes uncertainty, promotes "learning" strategies, and envisions a cyclical management process in which management measures are refined in response to new information and understanding of the managed system. A review of adaptive management of Columbia River salmon (Lee and Lawrence 1986) describes it as "a policy framework that recognizes biological uncertainty, while accepting the congressional mandate to proceed on the basis of the 'best available scientific knowledge.' An adaptive policy treats the program as a set of experiments designed to test and extend the scientific basis of fish and wildlife management." Gunderson (1999) argues that flexibility in management institutions and system resilience are key determinants of adaptive management success. Managing to rebuild overfished species populations is fraught with uncertainty because of the difficulty in predicting future performance. Stock performance depends on the nature of ecosystem resilience. As first described by Holling (1973), resilience may either be interpreted as a return to some "global" equilibrium following perturbation (such as fishing down one population in the system) or in terms of multiple equilibria where future states are unpredictable. Given that the role environmental regimes play in determining recruitment is at best poorly understood—and thus what is a reasonable estimate of potential unfished biomass—the ability to realistically plan for a future end state (stock recovery) may be limited. Policy makers may be tempted to replace ecosystem uncertainty with "spurious certitude": "Perhaps the

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3/ Although the concept of a "rebuilding schedule" is put forward in Section 2.1.3, rebuilding analyses express future values (such as biomass relative to the target) in probabilistic terms. A "schedule" could refer to the median value for all projections in the Monte Carlo simulation for a given year. There would be a 50% probability that the measured value would fall below the median.

4/ This strategy may be preferable because it would not require a sudden change in the harvest rate if the T_{MAX} probability progressively declined to the 50% "floor." Since the probability cannot fall below 50%, the harvest rate would have to be adjusted downward, probably by a substantial margin, when a future analysis generate some lower probability.

most common solution is to replace the uncertainty of resource issues with the certainty of a process, whether that process is a legal vehicle—such as a new policy, regulation, or lawsuit (Rodgers 1997)—or a new institution—such as a technical oversight committee or science advisory committee" (Gunderson 1999, p. 2). Given the long time horizons involved in rebuilding some overfished groundfish populations, uncertainty about future stock performance, and uncertainty about ecosystem performance, a flexible, or adaptive, management regime will be important.

Nyberg (1999) outlines six steps in the adaptive management cycle. (Other authors have posited similar steps; c.f. Olsen, 198x). Rebuilding mandates and the institutional structure of federal fisheries management (including the Council system) provide all the "pieces" to construct these steps: problem identification, program design, implementation, monitoring, evaluation, and adjustment of the management regime, which initiates a new round in the cycle of steps just described. Monitoring and evaluation are the key steps differentiating adaptive management; and flexibility—which makes the regime easier to change in response to new information—is a valuable attribute in these steps. The scenarios presented in this analysis all incorporate procedures to update rebuilding plans, and adjust management measures, in response to new information about overfished stocks. For all scenarios flexibility of response is constrained by the range of management tools that are both legal and practical. What varies is the procedural complexity entailed in adapting management measures in response to new data. This is a correlate of administrative cost discussed above. More complex procedures will require more administrative resources. (On the other hand, they may force better problem assessment and redesign as part of the adaptive cycle.) Generally, then, flexibility and administrative cost are inversely correlated. Recognizing this relationship, Issues and the six scenarios are briefly assessed here in terms of flexibility and opportunity for development of adaptive management approaches.

4.2.1 Issue 1 - Form and Required Elements for the Species Rebuilding Plan

Flexibility varies with the form in which the element of the rebuilding plan is established. A Council policy document is the most flexible form, because it is easiest to amend; a regulation is less flexible and an FMP the least. One type of element is a parameter, which may be expressed as a measurable value. Numeric values, are by nature an inflexible way of specifying a parameter. The numeric value of a parameter remains constant even when scientists' and managers' understanding of the status and characteristics of the stocks changes. Parameters specified by formulas or algorithms allow output values to vary in response to changing conditions; but they are rigid in that the relationships they specify may not be modified without an amendment to the rebuilding plan. While parameters will appear in all rebuilding plans, <u>requiring</u> other elements to be included in a rebuilding plan, beyond those required by law, results in less flexibility because rebuilding plan elements that are not especially relevant for a rebuilding plan for a particular species cannot be omitted.

4.2.2 Issue 2 - Periodic Review and Amendment of Rebuilding Plans

The following displays the effects of the Issue 2 options on flexibility.

Opion 2a Council Review Every 2 Years (Status Quo)	Option 2b Review Goals 2-5 Every 2 Years, Review Goal 1 Only With New Stock Assessments.	Option 2c Council Reviews Goals 2-5 Every 2 years; Review Goal 1 Only With New Stock Assessments; Schedule for Stock Assessments Set in Rebuilding Plans.	Option 2d Council Reviews Goals 2-5 Every 2 years; Review Goal 1 Only With Stock Assessments; Stock Assessments Every 5 Years or Every 2 Years if T_{max} is Less than 20 Years Off	Option 2e No Formal Council Review
Baseline	Impact	Impact	Impact	Impact
The Council conducts formal reviews on each rebuilding plan every two years. As of spring 2002 there are nine species for which rebuilding plans are needed. Secretary is required to conduct review every 2 years.	No increase in flexibility or opportunity for adaptive management as compared to status quo.	Less flexibility or opportunity for adaptive management as compared to status quo because stock assessment schedule would be predetermined. More flexibility that Option 2d because the stock assessment schedule would be set according to the situation and characteristics of the overfishes species.	Less flexibility or opportunity for adaptive management as compared to status quo because stock assessment schedule is predetermined.	Most flexibility and opportunity for adaptive management. The Council would monitor critical information needed to assess rebuilding progress on an information basis. Any more formal or detailed review would be conducted as needed based on management priorities arising out of future situations.

Each alternative to status quo (Options 2b, 2c, 2d, and 2e) has three suboptions that define when a change in the rebuilding plans would be mandated. Under all the suboptions, the Council could recommend changes in rebuilding plans to NMFS at any time. Each suboption has different impact on flexibility.

Conditions under which rebuilding plans will be amended.			
Status Quo: No Guidance	Suboption (i) - when progress toward rebuilding is inadequate; or when stock assessment or rebuilding analysis information is updated.	Suboption (ii) - when progress toward rebuilding is inadequate; or when new information indicates a significant change in rebuilding parameters	Suboption (iii) - when progress toward rebuilding is inadequate
Baseline	Impact	Impact	Impact
No standard is established for determining when a rebuilding plan would need to be amended therefore it appears that there is a great deal of flexibility.	Flexibility would be diminished in that any change in a parameter value would require a rebuilding plan amendment, unless the parameter has been specified as a formula or algorithm.	More flexibility than Suboption (i) in that a change in the rebuilding parameter would have to be "significant" before an amendment would be required.	More flexibility than Suboptions (i) or (ii) in that the only time an amendment to the rebuilding plan would be mandated is when progress toward rebuilding is inadequate. Less flexibility than status quo under which there is no standard for determining when an amendment to the rebuilding plan is needed.

4.2.3 Issue 3 - Adequacy of Progress

The following displays the effects of the Issue 3 options on flexibility.

<table>
<tr><td>Option 3a. No Standards for Progress (Status Quo)</td><td>Option 3b. Standards Based on Negative Deviations from Schedule</td><td>Option 3c. Standard Based on T_{max}</td><td>Option 3d. Standards Developed Under the Individual Rebuilding Plan</td></tr>
<tr><td>Baseline</td><td>Impact</td><td>Impact</td><td>Impact</td></tr>
<tr><td rowspan="2">Status Quo Baseline: No standard is established; therefore, the determination of adequacy of progress appears to be very flexible at present. However, because "adequate progress" is currently unspecified, standards could develop during the rebuilding plan review process. These ad hoc standards could be relatively inflexible in comparison to those deliberately planned in advance. Thus there is considerable uncertainty about the current baseline. This makes it difficult to use status quo as a baseline for comparison, therefore other options will be compared to Option 3d.</td><td colspan="2">Impact: Compared to Option 3d, there would be less flexibility for developing measures of adequacy that might be more tailored to the conditions and characteristics of a particular species.</td><td rowspan="2">On the surface, this option provides less flexibility than status quo. However, the degree of flexibility depends on (1) standards for the adequacy of progress that are developed through practice in the absence of a specified guideline for such determination (see discussion under baseline in this table); and (2) the standards that are developed as part of the consideration of the rebuilding plans for individual species.</td></tr>
<tr><td>This option resolves in the affirmative the question of whether Council action is required if rebuilding falls behind expected levels (provides no flexibility for negative deviation from the rebuilding schedule) but nominally provides maximum flexibility for dealing with rebuilding that exceeds expected levels.</td><td>This option provides some tolerance (flexibility) for a stock to fall behind on its rebuilding schedule (so long as T_{max} does not fall below 50%). but nominally provides maximum flexibility for dealing with rebuilding that exceeds expected levels.</td></tr>
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4.2.4 Issue 4 - ESA Listed Species

By addressing the effect of ESA listing on rebuilding plans, in advance of any such occurrence, if at some point a groundfish species is listed, there will be more administrative resources available for addressing other fishery management problems than if this contingency had not been anticipated. This would provide the Council with more flexibility to address other management issues.

4.2.5 Summary of Adaptive Management by Scenario

The status quo is arguably the most flexible scenario because adaptive response is largely incorporated into ongoing management. Changes to rebuilding plan elements can be handled in a fashion that is parallel to current procedures for vetting stock assessments and incorporating results into annual management (or, if implemented, biennial management). It is unclear whether rebuilding plan revisions implemented as policy documents would require a NEPA analysis; but if so, it might be possible to incorporate this in the analysis conducted for annual management measures. The frequency of rebuilding plan review is an issue in all scenarios because of the MSA requirement for two-year Secretarial review. The appropriateness of this mandated review cycle for species with long rebuilding periods is questionable. The "one size fits all" approach of a legal requirement assumes that most fish can rebuild their populations rapidly (as evidenced by the maximum rebuilding period of 10 years for populations that can reach target biomass in that time if there is no fishing). Scenarios 2 and 3 may be as flexible as the status quo since a minimum set of parameters is fixed in the FMP or regulations. Scenario 3 adds additional required rebuilding plan elements. It is unclear how this would affect flexibility; consideration of certain issues may be required, but the implementation of measures to address these issues may not be. Review of rebuilding plan measures facilitates adaptive management but, as implied above, too-frequent review (that is, not appropriately matched to the rebuilding period) may reduce flexibility by preempting administrative capacity better devoted to other managerial goals. Frequent reviews may also force response to "noise" rather than information in that changes to measured values (such as relative stock size) may not overcome measurement uncertainty (or not be significant in statistical terms). This is especially an issue with performance targets (adequacy of progress), which are incorporated in Scenarios 4 and 5. Establishing "scheduled" targets, based on discrete values for biomass (as in Option 3b as described) do not take into account the measured uncertainty that is part of rebuilding analyses. Although not explicit in the options or resulting scenarios, measures that pre-specify a management response would substantially reduce flexibility. Scenario 4, and especially Scenario 5, require additional parameters be specified in the FMP. This does not necessarily reduce flexibility, aside from reductions inherent in the demand on administrative capacity, as long as specific responses related to the parameters are not included in the FMP. Scenario 5 would add a requirement that rebuilding plans consider specific management measures to achieve rebuilding. "Preprogrammed" management measures, incorporated into the FMP along with other elements of rebuilding plan preferred alternatives, would be more difficult to modify in response to change in or new information about the resource. This would reduce flexibility and make the management regime less adaptive.

4.3 Opportunity for Public Participation in Decision Making

Public participation can help to reduce controversy if the full range of stake holders and interests feel that they had an equitable opportunity to air their concerns, and ultimately, influence decisions. Public participation in decision making can take a variety of forms, with varying levels of influence over the decisions themselves; this is reflected in the range of forums for public participation that the council process offers. Council members are the decision makers, of course, (recognizing NMFS's ultimate authority) and its membership is meant to represent a range of stakeholders (although some groups argue that representation is insufficiently diverse). The GAP reflects the perceptions and opinions of representatives of industry, recreationalists and other constituents on the committee; consensus statements from this body can directly influence Council members' decisions. (Technical bodies, such as the GMT and SSC similarly promote consensus on scientific issues.) Meetings of these bodies are open to the public, allowing limited participation by non-members and, at a minimum, public scrutiny of discussion and decisions. Comments from the public at large, through letters to the Council in advance of meetings and during comment periods at meetings can be collectively influential. The public also has the chance to lobby members of advisory bodies and the Council during meetings but outside established, formal public comment periods. Once the Council passes on its decisions to NMFS, as recommendations, there are opportunities for the submission of written comments during the rule making process. The most visible, and formalized, venues for public participation through commenting are associated with decision making (either by the Council or NMFS). Thus, the different scenarios can be evaluated by assessing the procedural complexity of future decision making. More complex decision processes (for example, involving multiple stages of review and revision by advisory bodies and the Council) generally afford more opportunity for public comment.

Trust is an important corollary of public participation that can play out in a variety of ways. Interest groups and stake holders who believe they have some influence over decisions are likely to put greater trust in the process. By reducing conflict, influence can stem controversy. (It should be emphasized that in the policy arena conflict and controversy are not necessarily bad things. They force more careful consideration of an issue from different perspectives. This may result in more equitable decisions.) On the other hand, those groups who believe themselves lacking in influence will seek greater transparency and certitude. Transparency allows the public to determine what factors (especially those that are explicitly "political") influence decision making. Certitude reassures those with less influence that decisions are constrained by explicit rules limiting their scope. Constraints may be external—imposed by legal requirements for example—or self-imposed so that a course of action is fully or permanently determined. As implied in the previous discussion of adaptive management, this type of certitude can be an institutional response to uncertainty, and one that runs counter to adaptive response. This is especially the case if interest groups see uncertainty as a means for specific groups with opposing interests to unduly influence decision making. This may be an important factor in relation to rebuilding measures because of the high degree of uncertainty about stock status in the future. Uncertainty could be seen to enlarge the range of potentially defensible decisions. Similarly, invoking adaptative strategies might be seen as an opportunity to accommodate a given set of interests. This aspect of participation, as it relates to controversy, is also evaluated by assessing "certitude," or the degree to which decisions are constrained by established policies. (These are constraints over and above those established by the MSA an National Standard Guidelines.) This characteristic will also tend to vary inversely with flexibility (adaptability).

4.3.1 Issue 1 - Form and Required Elements for the Species Rebuilding Plan

Whether or not a particular element of rebuilding plans is included as part of an FMP or regulation is the main determinant of the amount of opportunity for public comment. In general, the development of FMP amendments and regulations tend to be more protracted processes. However, the Council is not allowed to take any action without advance notice to the public in its agenda. Moreover, most action items require at least two Council meetings: one meeting to develop options, a period between meetings to develop an analysis, and a final meeting to take action. Non-routine management measures generally require three meetings under the procedures set out in the groundfish FMP. This is the same minimum number of meetings required for a plan or regulatory amendment. Any rebuilding plan element specified for inclusion as part of a policy document may or may not require an accompanying NEPA analysis. For the Council's groundfish strategic plan there was accompanying information, but not a full NEPA analysis. For the rebuilding plans the Council developed as policy documents under the Amendment 12 procedures for establishing rebuilding plans, a NEPA analysis was developed.

All rebuilding actions that are in the form of a regulation on the fishing industry will have to go through standard review and analysis processes specified in the current grounfish FMP, the MSA, NEPA and other legislation. Because rebuilding plans are mandated actions under the MSA, interested parties seeking more certitude that the Council will take action in certain areas potentially benefitting overfished species (for example protection of habitat) may be more assured by a requirement that such an action be part of a rebuilding plan. As a required part of the rebuilding plan, NMFS would evaluate the rebuilding plan for inclusion of the element before deciding whether to approve the plan. While it may be within Council authority to take action on a particular action (continuing the example, to protect habitat) consideration of the action may be deferred because of other pressing Council priorities. Inclusion of the element as a required part of the rebuilding plan provides certainty that the element will receive high priority.

4.3.2 Issue 2 - Periodic Review and Amendment of Rebuilding Plans

Opportunity for public comment on reviews of progress under rebuilding plans may be reduced if the Council forgoes doing its own periodic review, leaving the biannual review to the Secretary (Option 2e). The Council would request an opportunity to comment on the Secretarial review but would not be the author of the documents. Under all options except 2e, the Council would conduct a formal review every two years. Secretarial review is required regardless of whether the Council conducts a review, however, if the Council conducts a formal review the Secretary could review the Council's review and adopt it as the secretarial review, if the Council's review is deemed adequate.

4.3.3 Issue 3 - Adequacy of Progress

Currently there is no definition of adequacy of progress and the specification of such a definition in a public forum does not appear to be required under the MSA. The MSA leaves determination of adequacy of progress to the Secretary of Commerce. A Council definition of adequacy of progress may not constrain the Secretary; however, Secretarial approval of the Council definition may place some additional justification burden on the Secretary if at some future time the Secretary were to select some other measure of the adequacy of progress.

4.3.4 Issue 4 - ESA Listed Species

The amendment proposed here is similar to one developed for the salmon plan to address FMP species listed under the ESA. Under this amendment there would be opportunity for public comment as NMFS develops jeopardy standards and recovery plans. These ESA-related documents are developed outside the Council process. This process and standards amendment provides opportunity for public comment on the approach for handling ESA species. Without this provision, action would need to be taken at some future time if a groundfish species were listed under the ESA and there would likely be similar opportunity at that time for public comment on the proposed provision.

4.3.5 Summary of Opportunity for Public Participation in Decision Making Adaptive Management by Scenario

To assess public comment opportunities under the scenarios, a simple division may be made between activities that would afford comment as part of the Council process and those that add the more formal notice and comment procedures that are required of agency agencies. The first three scenarios, which place more emphasis on rebuilding policies as opposed to actions (as defined at the beginning of this chapter), would result in less opportunity for formal comment opportunities. In addition, less frequent FMP amendment (or regulatory changes), by reducing procedural complexity, would probably result in fewer opportunities overall. Under all of the scenarios rebuilding plan documents would be written and they take the form of a NEPA analysis. At least some of these plans are considered together as parts of an EIS. (Depending on scoping of potential effects, subsequent plans might be prepared as environmental assessments with analyses that are tiered of the EIS.) The EIS process accommodates substantial opportunity for public scrutiny and comment. Scenario 3, because it involves writing targets and control rules into regulations, would also entail formal comment opportunity as part of the rule making process. Scenarios 4 and 5, as already discussed, would result in frequent FMP amendments, allowing substantial comment opportunity during the Council process and formal commenting to NMFS as part of the approval process.

In all of the scenarios the need to amend the FMP (or regulations) would constrain the Council's (and NMFS's) ability to modify their course of action in the future. (The distinction between rebuilding policies and actions is instructive in this regard. Although policies are a commitment to a course of action, it is procedurally less difficult to modify them.) Clearly, the status quo has not generated a high degree of trust as reflected in the litigation over Amendment 12. Because all rebuilding measures are described as policies, future Council behavior is only self-constrained. Scenarios 2 and 3 would commit the Council to ensure rebuilding by the target year. As discussed above, it would be difficult and controversial to change the target. The limited FMP or regulatory amendment that is part of these scenarios might demonstrate sufficient constraint on future action, but only under Scenario 5 would the Council be obligated to describe specific management measures (including measures to minimize bycatch) in the FMP. It may require this high degree of specificity to satisfy those stakeholders with the lowest level of trust in the Council process.

4.4 Cumulative Impacts

The impact of the process and standards for rebuilding plans are on the governmental processes for managing the fisheries rather on the fishery itself. Therefore, effects of the proposed action must be evaluated in light of other reasonably anticipated actions that may have impacts in this same area. The current Council work priorities provide a list of projects the Council is currently working on and those that have been deferred due to the need to address higher priority issues (Table 4.4-a). These deferred items reflect the administrative opportunity cost of the items on which the Council is actively working. Other reasonably anticipated actions that will affect Council activities include any new mandates that may arise under the next reauthorization of the MSA.

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Northwest Region
7600 Sand Point Way N.E., Bldg. 1
Seattle, WA 98115

April 5, 2002

Dr. Hans Radtke, Chairman
Pacific Fishery Management Council
7700 NE Ambassador Place
Portland, OR 97220

Dear Dr. Radtke:

RE: Contents of Individual Rebuilding Plans

At its April 2002 meeting, the Council will be considering its process for developing fishery management plan (FMP) amendments to address the overfished species rebuilding requirements of the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act). There has been much discussion within the Council family, both formal and informal, about the structuring of individual rebuilding plans. One question we have all struggled with is exactly what parts of the rebuilding timeframe and strategy are locked into the rebuilding plan and can only be changed by plan amendment, and what might change with a new stock assessment. Based on the requirements of the Magnuson-Stevens Act, the National Standard Guidelines, and examples provided by rebuilding plans from other councils, I believe that rebuilding FMP amendments should contain the following parameters:

1. A best estimate of B_{MSY}, or its proxy, where B_{MSY} is the biomass target for achieving rebuilding. It would be helpful to the Council's plan development process if the Scientific and Statistical Committee and the Groundfish Management Team could discuss the trade-offs of expressing B_{MSY} as a formula (example: 40% of current best scientific estimate of B_{zero}) versus numeric quantification. The Plan should also state the conditions under which the B_{MSY} calculations will be updated. This would range from a technical update with each subsequent stock assessment to a FMP amendment.

2. A fixed rebuilding period, including the minimum possible time to rebuild to the B_{MSY} level in the absence of fishing with a 50% probability (T_{MIN}.) Rebuilding plans must also include the maximum allowable time to rebuild (T_{MAX}) and mean generation time if the rebuilding time exceeds 10 years, as well as the target time for rebuilding (T_{TARGET}.) These times should be expressed numerically and should be fixed within the FMP such that they are changeable only by FMP amendment. Whenever T_{TARGET} is set greater than T_{MIN}, the socioeconomic benefits from the extended rebuilding period should be greater than the benefits that would accrue from more rapid rebuilding.

3. The probability of achieving the rebuilding goal (B_{MSY}) within T_{TARGET} years.

4. The rebuilding harvest control rule that will annually set harvest rates for the species in question and will be applied to the most current stock assessment. Additionally, the current forecast for the rebuilding trajectory should, at a minimum, be analyzed in background documents for each rebuilding plan and be included within the FMP where appropriate for a given species. Harvest strategies may include: constant catch strategy – where catch is held constant over time until the stock reaches B_{MSY}; a constant fishing mortality rate – where a constant proportion of the stock is removed annually until the stock reaches B_{MSY}, or a combination of these strategies. Protocols for adjusting the harvest control rule should be detailed in the rebuilding plan FMP. Potential protocols range from a technical adjustment with each stock assessment to keep the probability of rebuilding from falling below 50%, to a full FMP amendment.

NMFS has provided guidance on other elements of the rebuilding plans at past Council meetings and that guidance has not changed. In this letter, we wished to highlight the above issues as an aid to your upcoming discussions. NMFS is looking forward to working with the Council in developing and implementing these rebuilding plans.

Sincerely,

William L. Robinson
Assistant Regional Administrator
for Sustainable Fisheries

104-297

(e) REBUILDING OVERFISHED FISHERIES.--

(1) The Secretary shall report annually to the Congress and the Councils on the status of fisheries within each Council's geographical area of authority and identify those fisheries that are overfished or are approaching a condition of being overfished. For those fisheries managed under a fishery management plan or international agreement, the status shall be determined using the criteria for overfishing specified in such plan or agreement. A fishery shall be classified as approaching a condition of being overfished if, based on trends in fishing effort, fishery resource size, and other appropriate factors, the Secretary estimates that the fishery will become overfished within two years.

(2) If the Secretary determines at any time that a fishery is overfished, the Secretary shall immediately notify the appropriate Council and request that action be taken to end overfishing in the fishery and to implement conservation and management measures to rebuild affected stocks of fish. The Secretary shall publish each notice under this paragraph in the Federal Register.

(3) Within one year of an identification under paragraph (1) or notification under paragraphs (2) or (7), the appropriate Council (or the Secretary, for fisheries under section 302(a)(3)) shall prepare a fishery management plan, plan amendment, or proposed regulations for the fishery to which the identification or notice applies--

(A) to end overfishing in the fishery and to rebuild affected stocks of fish; or

(B) to prevent overfishing from occurring in the fishery whenever such fishery is identified as approaching an overfished condition.

(4) For a fishery that is overfished, any fishery management plan, amendment, or proposed regulations prepared pursuant to paragraph (3) or paragraph (5) for such fishery shall--

(A) specify a time period for ending overfishing and rebuilding the fishery that shall--

(i) be as short as possible, taking into account the status and biology of any overfished stocks of fish, the needs of fishing communities, recommendations by international organizations in which the United States participates, and the interaction of the overfished stock of fish within the marine ecosystem; and

(ii) 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;

(B) allocate both overfishing restrictions and recovery benefits fairly and equitably among sectors of the fishery; and

(C) for fisheries managed under an international agreement, reflect traditional participation in the fishery, relative to other nations, by fishermen of the United States.

(5) If, within the one-year period beginning on the date of identification or notification that a fishery is overfished, the Council does not submit to the Secretary a fishery management plan, plan amendment, or proposed regulations required by paragraph (3)(A), the Secretary shall prepare a fishery management plan or plan amendment and any accompanying regulations to stop overfishing and rebuild affected stocks of fish within 9 months under subsection (c).

(6) During the development of a fishery management plan, a plan amendment, or proposed regulations required by this subsection, the Council may request the Secretary to implement interim measures to reduce overfishing under section 305(c) until such measures can be replaced by such plan, amendment, or regulations. Such measures, if otherwise in compliance with the provisions of this Act, may be implemented even though they are not sufficient by themselves to stop overfishing of a fishery.

(7) The Secretary shall review any fishery management plan, plan amendment, or regulations required by this subsection at routine intervals that may not exceed two years. If the Secretary finds as a result of the review that such plan, amendment, or regulations have not resulted in adequate progress toward ending overfishing and rebuilding affected fish stocks, the Secretary shall--

(A) in the case of a fishery to which section 302(a)(3) applies, immediately make revisions necessary to achieve adequate progress; or

(B) for all other fisheries, immediately notify the appropriate Council. Such notification shall recommend further conservation and management measures which the Council should consider under paragraph (3) to achieve adequate progress.

[3] Former paragraph (3) now appears at section 301(a)(3) and section 304(g).

Table 4-1: Summary of scenarios developed for environmental consequences analysis.

Element/Option	Scenario 1: Status Quo	Scenario 2: Limited plan Amendment	Scenario 3: Implement targets as regulations
Rebuilding plan elements	Target biomass and rebuilding period, specified as quantities (mt and years). Harvest rate policy, specified as a constant harvest in mt or unspecified F, or no fishing. Bycatch control strategies described. These plans are prepared in the form of an EA	Status quo elements. (Allows additional elements such as discussion of allocation, habitat, marine reserves to be included at the discretion of the author.)	Status quo elements and additional required elements (allocation, habitat).
FMP amendment elements and parameters specified in FMP amendment/regulation	None	T_{TARGET} as a date Harvest control rule (described or specified numerically) (FMP amended to include a table with these values for each species.)	FMP amendment requires that T_{TARGET} (as a date) and harvest control rule (described or specified numerically) be enumerated in federal regulations. (These values incorporated in regulations at 50 CFR Part 600 with regulatory language requiring that targets be met.)
Rebuilding plan review	Every two years	No formal review (Option 2e)	With new stock assessment (Option 2b)
Review Standards	None	Rebuilding plan revised if "significant" change in parameters. FMP amendment required for changes to T_{TARGET} or B_{MSY}. No standards (Issue 3) established to trigger required adjustment.	Same as scenario 2
ESA listing	No provisions	No jeopardy standards or recovery plan supercedes rebuilding plan.	No jeopardy standards or recovery plan supercedes rebuilding plan.

Table 4-1 (cont.)

Element/Option	Scenario 4: full plan amendment, limited specification	Scenario 5: full plan amendment, full specification	Preferred alternative
Rebuilding Plan elements	Status quo elements and additional required elements (allocation, habitat, bycatch).	Status quo elements and additional required elements (allocation, habitat, bycatch, specific management measures).	
FMP amendment elements and parameters specified in FMP amendment/regulation	Council's preferred alternative incorporated into FMP with the following specifications: T_{TARGET} in years B_{MSY} as percent T_{MAX} in years with probability P_{MAX} Harvest control rule	Council's preferred alternative incorporated into FMP with the following specifications: T_{MIN} in years T_{TARGET} in years Mean generation time in years T_{MAX} in years with probability P_{MAX} B_0 in mt MSST in mt MFMT as F_{MSY} (e.g., $F_{50\%}$) B_{MSY} in mt Harvest control specified numerically (F or OY in mt).	
Rebuilding plan review	Every two years and after scheduled stock assessment for rebuilding targets (Option 2c or 2d)	Every two years for all elements including targets (same as status quo).	
Review Standards	Rebuilding plan revised if "significant" change in parameters. FMP amendment required for changes to T_{TARGET} or B_{MSY}, T_{MAX}, or harvest control rule type. Performance standards incorporated into individual plans.	Rebuilding plan revised if "significant" change in parameters. FMP amendment required for changes to FMP-specified parameters (above). Generic performance standard for all overfished species in FMP and based on intermediate targets.	
ESA listing	No jeopardy standards or recovery plan supercedes rebuilding plan.	No jeopardy standards or recovery plan supercedes rebuilding plan.	

Table 4-2: Summary of effects of each scenario.

Impacts	Scenario 1: Status Quo	Scenario 2: Limited plan Amendment	Scenario 3: Implement targets as regulations
Administrative Capacity			
FMP amendments needed to incorporate rebuilding plan elements	None	One to several, depending on the number of rebuilding plan targets/control rules incorporated into each.	None, NMFS must amend regulations to incorporate targets/control rules.
Amendments required to update FMP in relation to rebuilding measures, and probable frequency	None	Subsequent amendments unlikely/infrequent but controversial because they would change target and/or control rule.	FMP amendments not necessary. Changes to regulations controversial because they would change target and/or control rule, but infrequent.
Impact on Adaptive Management			
Flexibility	Flexible. Changes in management accomplished through ongoing procedures; no changes to FMP required. Required biennial review could trigger non-adaptive responses.	Similar to status quo; limited need to amend FMP to implement new management measures. Secretarial review has unpredictable impacts on flexibility, could reduce.	Similar to status quo; limited need to amend FMP to implement new management measures. Matching review of rebuilding progress to stock assessments should improve adaptive response.
Impact on Public Participation			
Opportunity for public comment	Public comment during rebuilding plan adoption and biennial review	Public comment on rebuilding plan adoption, future FMP amendments to modify target/control rule. Formal comment provisions during Secretarial biennial review.	Public comment on rebuilding plan adoption and periodic review. Formal comment provisions during NMFS rule making to implement regulations.
Trust engendered by constraints imposed on future decisions	Few constraints, except changes to rebuilding plan only follow biennial review	Difficult to change target and harvest policy because they are incorporated into FMP. Change in parameters requires determination by GMT, SSC.	Difficult to change target and harvest policy because they are incorporated into regulations. Mandatory consideration of allocation and habitat issues could produce management measures incorporated into regulations. Change in parameters requires determination by GMT, SSC.

Table 4-2 (cont.)

Impacts	Scenario 4: full plan amendment, limited specification	Scenario 5: full plan amendment, full specification	Preferred alternative
Administrative Capacity			
FMP amendments needed to incorporate rebuilding plan elements	More likely that each rebuilding plan has to be incorporated in separate amendments because of the additional required elements	More likely that each rebuilding plan has to be incorporated in separate amendments because of the additional required elements	
Amendments required to update FMP in relation to rebuilding measures, and probable frequency	Somewhat likely after stock assessment; highly likely if harvest level numerically specified. The way in which performance targets specified in rebuilding plans also determines need to amend FMP. Scheduled stock assessments every two to four years.	Almost certain after every stock assessment. Scheduled stock assessments every two to four years.	
Impact on Adaptive Management			
Flexibility	Moderately flexible. Required rebuilding plan elements could reduce flexibility compared to status quo. Additional FMP-specified elements could entail more administrative burden, reducing flexibility. Review tied to scheduled stock assessments allows better match to stock characteristics, especially if schedule is species-specific.	Limited flexibility. Required rebuilding plan elements could reduce flexibility compared to status quo. Increased number of FMP-specified parameters further reduces flexibility. Required two-year review could affect flexibility, adaptive response as in status quo. Specification of management measures would make strategic changes difficult.	
Impact on Public Participation			
Opportunity for public comment	Public comment during biennial review and periodic review of targets. If FMP amendments more frequent this allows additional opportunity for public comment.	Public comment during biennial review. Likely that FMP amended after every stock assessment affords extended opportunity for public comment.	
Trust engendered by constraints imposed on future decisions	More parameters incorporated into FMP, with attendant difficulty in changing. Mandatory consideration of allocation, habitat issues and marine reserves could produce management measures incorporated into FMP. Change in parameters requires determination by GMT, SSC. Performance targets force response, although not necessarily pre-programmed.	Future action could be very constrained, pre-programmed because of the incorporation of most rebuilding plan elements into the FMP, including possible new measures due to required consideration of specific issues and especially specific management measures.	

TABLE 1a. rent rebuilding parameter/target estimates specified for overfished west c[illegible] groundfish: shelf species. May 30, 2002

Rebuilding Parameter/Target	Shelf rockfish & lingcod				
	Cowcod [1/]	Bocaccio [2/]	Canary [3/]	Yelloweye [4/]	Lingcod [5/]
T_0 (year declared overfished)	2000	1999	2000	2002	1999
T_{MIN} (minimum time to achieve B_{MSY}; F = 0)	62 years	97 years	57 years	***15-208 years N CA*** ***15-104 years OR-WA***	3.6 years N 4.8 years S
Mean generation time	37 years	12 years	19 years	***28 years N CA*** ***32 years OR-WA***	*X* years
T_{MAX} (maximum time to achieve B_{MSY})	98 years	109 years	76 years	***43-236 years N CA*** ***47-136 years OR-WA***	10 years
P_{MAX} (P to achieve B_{MSY} by T_{MAX}) [6/]	55%	*X*%	*X*%	*X*%	60%
Most recent stock assessment	Butler *et al.* 1999	MacCall 2002	Methot and Piner 2002	Wallace 2001	Jagielo *et al.* 2000
Most recent rebuilding analysis	Butler and Barnes 2000	MacCall 2002	Methot and Piner 2002	Wallace 2002	Jagielo and Hastie 2001
B_0 (estimated unfished biomass)	3,367 mt	*14,857 B eggs in 2002*	*31,550 mt*	*602-860 s.o. N CA* *1,440-1,596 s.o. OR-WA*	22,882 mt N 20,971 mt S
$B_{CURRENT}$ (current estimated biomass)	238 mt in 1998	*713 B eggs in 2002*	*2,524 mt in 2002*	*72.4 s.o. N CA* *236.1 s.o. OR-WA* *in 2001*	3,527 mt N 3,220 mt S in 2000
$B_{CURRENT}$ % Unfished Biomass	7% in 1998	*4.8% in 2002*	*8% in 2002*	*8%-12% N CA* *15%-16% OR-WA* *in 2001*	17% N 15% S in 2000
MSST (minimum stock size threshold = 25% of B_0)	842 mt	*3,714 B eggs*	*7,888 mt*	***602-860 s.o. N CA*** ***1,440-1,596 s.o. OR-WA***	5,720 mt N 5,243 mt S
B_{MSY} (rebuilding biomass target = 40% of B_0)	1,350 mt	*5,943 B eggs*	*12,713 mt*	***241-344 s.o. N CA*** ***576-638 s.o. OR-WA***	9,153 mt N 8,389 mt S
MFMT (maximum fishing mortality threshold = F_{MSY})	$F_{50\%}$	$F_{50\%}$	$F_{73\%}$	$F_{50\%}$: ***F = 0.042 in N CA*** ***F = 0.034 in OR-WA***	$F_{45\%}$: F = 0.12 N F = 0.14 S
Harvest control rule [6/]	F = 0.0136	*F = 0.0X*	*F = 0.0X*	*F = 0.0X*	F = 0.053 N F = 0.061 S
T_{TARGET} [6/]	2095	2*XXX*	20*XX*	2*XXX*	2009

[1/] Cowcod were assessed in the Conception area. All parameters/targets are for the Conception area, although cowcod retention is prohibited throughout its range.
[2/] Bocaccio were assessed in the Conception and Monterey INPFC areas combined in 2002. The assessment (MacCall 2002) has been approved by a STAR Panel but has not undergone full SSC review. Biomass estimates are in billions of eggs. A rebuilding analysis is still in development and awaits Council adoption. All data for 2002 still considered preliminary.
[3/] A coastwide canary rockfish assessment (Methot and Piner 2002) has been approved by a STAR Panel but has not undergone full SSC review. A rebuilding analysis is still in development and awaits Council adoption. All data for 2002 still considered preliminary.
[4/] Yelloweye rockfish were assessed as two stocks: northern California (N CA; Monterey INPFC area north to the California/Oregon border) and Oregon (OR; waters off Oregon) Assessment assumed a B_{MSY} target of 50% of B_o. Biomass estimates are in spawning output units (s.o.) calculated as the weighted age × the net maturity function. A rebuilding analysis is still in development. All data for 2002 still considered preliminary.
[5/] West coast lingcod were assessed as two stocks north (Columbia and U.S.-Vancouver INPFC areas) and south (Eureka, Monterey, and Conception INPFC areas).
[6/] Under *Council Interim Rebuilding* except bocaccio, canary rockfish, and yelloweye rockfish.

TABLE 1b. Current rebuilding parameter/target estimates specified for overfished west coast groundfish: slope and midwater species. **May 30, 2002**

Rebuilding Parameter/Target	**Slope rockfish**		**Midwater species**	
	Darkblotched	**POP**	**Widow** [1/]	**Pacific whiting** [2/]
T_0 (year declared overfished)	2000	1999	2001	2002
T_{MIN} (minimum time to achieve B_{MSY}; F = 0)	14 years	12 years	22 years	***2*** years
Mean generation time	33 years	30 years	16 years	***8*** years
T_{MAX} (maximum time to achieve B_{MSY})	47 years	42 years	38 years	***10*** years
P_{MAX} (P to achieve B_{MSY} by T_{MAX}) [3/]	70%	70%	60%	***X***%
Most recent stock assessment	Rogers *et al.* 2000	Ianelli *et al.* 2000	Williams *et al.* 2000	Helser *et al.* 2002
Most recent rebuilding analysis	Methot and Rogers 2001	Punt and Ianelli 2001	Punt and MacCall 2002	***Helser 2002***
B_0 (estimated unfished biomass)	29,044 mt	60,212 units of spawning output	34,900 mt in 2000	5.25 M mt
$B_{CURRENT}$ (current estimated biomass)	4,067 mt in 2002	13,066 units of spawning output in 1998	8,223 mt in 2000	1.26 M mt in 2002
% Unfished Biomass	14% in 2002	21.7% in 1998	23.6% in 2000	20% in 2001; 24% in 2002
MSST (minimum stock size threshold = 25% of B_0)	7,261 mt	15,053 units of spawning output	8,725 mt	1.31 M mt
B_{MSY} (rebuilding biomass target = 40% of B_0)	11,618 mt	24,084 units of spawning output	13,960 mt	2.1 M mt
MFMT (maximum fishing mortality threshold = F_{MSY})	$F_{50\%}$	$F_{50\%}$	$F_{50\%}$	$F_{40\%}$
Harvest control rule [3/]	F = 0.029	F = 0.0***X***	F = 0.0***X***	***F = 0.0X***
T_{TARGET} [3/]	2034	2027	20***39***	20***XX***

[1/] The widow rockfish stock was assessed in 2000. A revised rebuilding analysis (Punt and MacCall 2002) is awaiting Council adoption. Some data for 2002 still considered preliminary. *Council Interim Rebuilding* not specified or subject to change (highlighted specifications) pending adoption of the revised rebuilding analysis.
[2/] The Pacific whiting stock was assessed in 2002. Biomass estimates are in millions of mt of age 3+ fish. A rebuilding analysis (Helser 2002) is still in development and awaits Council adoption. Some data for 2002 still considered preliminary or unspecified.
[3] Under *Council Interim Rebuilding*.

SUMMARY MINUTES

Ad Hoc Groundfish Fishery Management Plan Environmental Impact Statement Oversight Committee

Pacific Fishery Management Council
West Conference Room
7700 NE Ambassador Place, Suite 200
Portland, OR 97220-1384
(503) 820-2280
May 8-9, 2002

A. Call to Order

Mr. Jim Glock called the Ad Hoc Groundfish Fishery Management Plan Environmental Impact Statement Oversight Committee meeting to order at 1 p.m. The agenda was approved.

Members in Attendance

Mr. Phil Anderson, Council member (WDFW), Olympia, WA
Mr. Ralph Brown, Council member, Brookings, OR
Mr. Tom Ghio, Groundfish Advisory Subpanel, Moss Landing, CA
Mr. Peter Huhtala, (for Mr. Bob Eaton) Pacific Marine Conservation Council, Astoria, OR
Mr. Jim Lone, Council member, Seattle, WA
Mr. Guy Norman, (for Mr. Burnie Bohn) ODFW, Portland, OR
Ms. Michele Robinson, (for Mr. Paul Hekkila, Habitat Committee) WDFW, Olympia, WA

Members Absent

Mr. LB Boydstun, Council member (CDFG), Sacramento, CA

Others in Attendance

Mr. Steve Copps, NMFS Northwest Region, Seattle, WA
Mr. Brian Culver, Groundfish Management Team (GMT) (WFDW), Olympia, WA
Dr. Christopher Dahl, Council staff, Portland, OR
Mr. Jim Glock, NMFS, Portland, OR
Dr. Don McIsaac, Council staff, Portland, OR
Dr. Hans Radtke, Council Chairman, Yachats, OR
Mr. Mark Saelens, GMT (ODFW), Newport, OR

B. Administrative Matters

It was agreed the chairperson and facilitator roles should be separated to minimize the perception that EIS development was solely in the hands of NMFS. Mr. Jim Lone was selected as meeting chair and rapporteur of the meeting results to the Council at its June meeting. Mr. Jim Glock was selected as facilitator for the meeting.

Mr. Glock discussed the meeting goals. These were to review the matrix of example draft alternatives already developed, elaborate on the alternatives therein, and change the number and structure of alternatives as needed. It was also noted that Mr. Peter Huhtala had an additional proposed alternative developed by the PMCC. Since this was the first formal meeting of the Committee, Mr. Glock pointed out that its role had not been precisely defined, and it was unclear whether it would also provide oversight for the essential fish habitat environmental impact statement (EFH-EIS) also in development. The alternative would be to task one of the existing advisory bodies. Currently, the Habitat Committee (HC) has agreed to some oversight responsibility for the EFH-EIS. The alternatives determined during the meeting would be brought before the Council in June for approval and/or modification. These alternatives will form the basis for subsequent analysis in the EIS. A draft of the EIS should be completed around November 2001, and the Council will review it for final approval at its April 2002 meeting. The Final EIS will be published in August 2002.

There was some discussion of the future role of the Committee. There will be some turnover in Committee membership in the coming year; Ms. Michele Robinson is representing Mr. Paul Heikkila. Mr. LB Boydstun or his designee was not in attendance. Mr. Lone will be leaving the Council by the end of the year. There will be additional personnel changes that affect the composition of the Committee.

There was additional discussion of the role of the Committee, and in response to a question Dr. Don McIsaac emphasized, the Committee should act as the interface between NMFS and the Council, work out issues in detail as cannot be done on the Council floor, and ensure the EIS provides some real benefits to the Council. Most important, the Committee should ensure the Council "buys in" to the EIS process. To ensure benefits and buy in, the Committee needs to discover opportunities in this programmatic EIS (PEIS) that can make it easier to develop and adopt "project" oriented management actions in the future.

C. Setting the Stage and Focus

Mr. Glock provided a brief overview of the requirements of National Environmental Policy Act (or NEPA, requiring EISs) and the NEPA process. Mr. Steve Copps discussed the relation between regulatory streamlining efforts initiated by NMFS headquarters, and the PEIS. Past EISs prepared for the groundfish FMP have been fairly cursory, so there is a need to more comprehensively analyze the many incremental changes in policy and management measures that have occurred. This can form the basis for strategic planning in the PEIS. Regulatory streamlining grew out of the events surrounding preparation of an EIS for the North Pacific Fishery Management Council (NPFMC) addressing fishery impacts to Stellar sea lions. The EIS development was not well-coordinated with the Endangered Species Act (ESA) process, so biological opinion findings nullified much of the work put into the EIS in development. NMFS recognizes that NEPA is the best umbrella process under which other mandates can be integrated during the fishery management process. If successful, this will ensure that Secretarial review of Council management actions is almost pro forma, since comprehensive analysis has gone into the decision process. However, institutionally NMFS is still unclear on what constitutes a programmatic EIS and this has lead to a very difficult process in the NPFMC in conjunction with SEIS development for their groundfish FMP. NMFS has had a series of workshops involving its personnel in order to determine how to best adapt the NEPA process to fishery management.

Mr. Ralph Brown noted that annual management requires frequent decision making such that it is very difficult to complete all of the paperwork, including NEPA documents. He was concerned the programmatic EIS would not help in this regard and might actually impose some additional burdens. For example, would the Council have to do a new EIS every time it wanted to make a change at the policy level? Mr. Copps discussed the concept of tiering and argued that through this technique the PEIS could be used to reduce future burdens. Mr. Glock argued that a new environmental analysis (not necessarily an EIS) would have to be done for a policy change, but many Council actions are not at the policy level. The PEIS would allow less complex analyses for individual actions through tiering. There was then discussion of how the analysis in the PEIS could be used in the future through tiering. It was unclear whether such analysis would be useful if the Council took action that was different than what will be in the PEIS. Discussion focused on the idea of "mixing and matching" elements from different alternatives in future actions. Would a new analysis be required in this case? It was suggested the PEIS separately analyze the impacts of program components in addition to the overall impact of the program, in order to make it easier to tier from in the future. In general, if the PEIS analyzes the impact, it does not have to be re-analyzed in the future.

Discussion continued on the nature of a programmatic EIS and what level of specificity is appropriate. Mr. Brown reemphasized his concern that an overly-specific document would make it less useful in the future. However, earlier discussion of the experience with the NPFMC PEIS demonstrated that it must have distinguishable alternatives, a reasonable range of alternatives, and measurable standards to assess the impacts of the alternatives. In the NPFMC, PEIS development is moving towards a model where each alternative is actually a complete and distinct FMP. This was seen as undesirable.

The groundfish strategic plan is structured around a contingent or "decision tree" framework: if one set of conditions is achieved (e.g., capacity reduction) this allows some types of action, but until that goal is achieved other measures have to be used. There was discussion of how a recognition of these types of contingencies can be incorporated into PEIS alternatives. This also relates to incorporating policies or measures that are currently not permitted (e.g., individual transferable quotas [ITQs]) but could in future. It was suggested that an "if–then" approach be used to handle these situations. Various ways of using this concept in formulating alternatives were discussed, including using the "mix and match" approach of individual program components and developing alternatives that would be different outcomes in a decision tree.

Mr. Glock pointed out that the PEIS is somewhat different from the actual action–one or more plan amendments–that would implement parts of the preferred alternative. To some degree the whole EIS does not stand or fall on whether every element gets implemented. In addition, the expectation is that a new supplemental PEIS will be drafted every 5-10 years.

The preceding discussion allowed the Committee to get a feel for the complexities of formulating alternatives and provoked a thoughtful discussion of how these alternatives could be structured and what policies and measures might constitute them.

D. Programmatic Supplemental Environmental Impact Statement (PSEIS) Timeline

This was discussed previously.

E. Presentation of Revised Alternatives Matrix

Mr. Glock briefly reviewed the set of draft alternatives that he had developed.

This was in the form of a matrix with major row headings corresponding to issue areas and the columns constituting the alternatives. It was agreed that one of the alternatives should represent elements of the strategic plan.

F. Revise and Complete Alternatives Matrix and Descriptions

It was decided to begin working on the status quo or no action alternative and "Alternative 2" representing the strategic plan and finish these two alternatives by the end of the meeting on Wednesday. Remaining alternatives would be developed on Thursday. These minutes attempt to capture the discussion and points raised during development of the matrix, but do not describe the modified elements. Readers may wish to refer to the matrix while reading this.

Prevent overfishing (Alternatives 1 and 2)

The first issue discussed was "prevent overfishing." Here again there was some discussion of the specificity of the policy statement. Mr. Phil Anderson argued that Alternative 2 did not accurately reflect strategic plan goals and elements. It was also noted the status quo alternative will be similar to the strategic plan alternative, because elements of the strategic plan have been implemented since its publication.

Characterizing the status quo proved difficult. The FMP represents the status quo to some degree, and can act as a standard or benchmark, but it does not accurately reflect the status of ongoing management. For example, current harvest policy is more conservative than is reflected in the FMP. It was agreed that target fishing mortality levels from the harvest policy workshop should be added to both the status quo and strategic plan alternative. There was a discussion about the use of closed areas for harvest management and how they might be characterized in these two alternatives. It was agreed that different types of closed areas (e.g., cowcod closed areas versus marine protected areas [MPAs]) need to be distinguished for the purposes of analysis.

Mr. Mark Saelens argued that the status quo alternative should highlight efforts made by the Council to prevent overfishing; the "40-10" policy is one example. It would be unfortunate if the status quo was perceived as "all bad." He also suggested that additional measures be added related to healthy stocks. A discussion of the difference between "overfished" and "overfishing" ensued. How to incorporate policies for weak stock management within species assemblages into these two alternatives was then discussed.

Mr. Copps suggested the term "adaptive" could be added to the policy statements for prevent overfishing. The adaptive process can be "hard wired" into the policy alternative similar to how a harvest control rule establishes a procedure that has different results depending on current conditions. Amendment 12 on rebuilding plans was brought up as an example of this approach, which was invalidated by litigation, raising concerns about this approach.

Rebuild overfished stocks (Alternatives 1 and 2)

For rebuilding it was agreed that standards (stated as a probability of rebuilding within T_{MAX}) should be expressed as a range. After more discussion it was decided they should be stated only in terms of a minimum value so there would be no constraint on achieving a higher probability. These are $\geq$50% for the status quo and $\geq$60% for Alternative 2 (strategic plan). It was also agreed that the policy statements for this issue should recognize that consideration will be given to socioeconomic impacts in order to explain why T_{MIN} is not chosen for the standard.

Bycatch info system (Alternatives 1 and 2)

The "bycatch info system" discussion led to a more general discussion of the importance of catch accounting to achieving policy goals under other issue categories. It was decided that information system elements could appear under several different policies within an alternative. These could be different components of an overall information system. The following policy statement from the strategic plan was added to Alternative 2: "To quantify the amount and species of fish caught by the various gears in the groundfish fishery and account for total fishery-related removals."

The discussion of the appropriate standard for these two alternatives under the bycatch info system issue revolved around the use of the term "scientifically based" and whether the current observer system is scientifically based since it does not sample randomly across all gear types. There was also discussion of the difference between observer programs that have an enforcement component and ones that only monitor. It was recognized that the status quo observer program employs "stratified random sampling" by gear type, and this should be incorporated into the policy statement. Text from the strategic plan was incorporated into Alternative 2, referring to equal observer coverage among fleets and the possibility of industry funding for the program. In conclusion, the status quo policy focuses on "stratified random sampling based on funding" while Alternative 2 would advocate more coverage balanced equally across all fleets with industry funding if needed. The use of incentives for vessels to carry observers was discussed. Mr. Lone raised that concern about an unachievable requirement whereby vessels with very low catch levels have to carry observers, destroying the economic viability of their operation. The concept of an "insurance pool" based on industry funding was brought up. Such a fund could underwrite vessels with low catch levels that carry observers. It was noted the status quo tool box should include all state monitoring programs, including port samplers who ask recreational anglers about their discards.

Bycatch reduction (Alternatives 1 and 2)

The Committee found it difficult to identify a status quo policy for the next issue, bycatch reduction. Measures have been introduced, such as the small footrope requirement, but this does not constitute a policy. It was decided to use the relevant FMP objectives to craft the status quo policy statement. For Alternative 2, full retention was discussed, but it was recognized this is a standard, not a policy. More discussion on the appropriate standard ensued with agreement on a standard that incorporates language "minimize [bycatch] to the extent practicable" for both alternatives. Standards from the whiting fishery and the exempted fishing permits (EFPs) were also identified for the status quo alternative. Discussion of tools revolved around the use of observers and the Hastie bycatch model currently in use. It was agreed these should be incorporated into the status quo alternative.

Habitat (Alternatives 1 and 2)

Discussion of the "habitat" issue also revolved around the difficulty in distinguishing policies, standards, and tools. The concept of "no net loss" from the FMP was brought up for the status quo, and it was determined this is a standard. The policy for Alternative 2 was taken from the strategic plan: "To protect, maintain, and/or recover those habitats necessary for healthy fish populations and the productivity of those habitats." Standards for this alternative were drawn from the recommendations #1 and #2 in the strategic plan under this goal. Recommendation #3, promote scientific research..., was recognized as part of the goal for Alternative 2. A vigorous discussion ensued about whether any habitat protection is occurring under the status quo and how to characterize this component of the status quo alternative. EFH consultation and conservation recommendations were identified as tools, although it was argued that these tools have not been used to protect groundfish habitat in the Exclusive Economic Zone (EEZ). Further discussion centered on whether only measures specifically aimed at habitat protection should be identified. The consensus was that tools having another primary purpose (such as the small footrope requirement) should be identified.

Socioeconomics (Alternatives 1 and 2)

For the "socioeconomics" issue it was agreed that relevant objectives from the FMP be summarized for the status quo policy statement. Components of the strategic plan allocation goal and recommendations were adopted for Alternative 2. These included recommendations #5, #7, # 9, and #11, and possibly #1. However, it was unclear whether some of these might be standards rather than goals. Elements of the capacity reduction goal in the strategic plan were also recommended for Alternative 2. It was agreed the tribal allocations do not have to be part of the policy in alternatives since they are more or less a requirement that the Council does not have a choice over. Mr. Brown noted that allocation has been a major issue in the recent past and perhaps should be elaborated in more detail; but the Committee agreed it should not be separated into an new issue category.

The Committee adjourned for the day at approximately 6:45 p.m.

Thursday, May 9, 2002

F. Revise and Complete Alternaives Matrix and Descriptions (continued)

Having completed a review of Alternatives 1 and 2 on Wednesday, the Committee focused on the remaining alternatives when reconvening at 8 a.m. on Thursday. Mr. Glock briefly reviewed the previous day's meeting. He also emphasized that the number of alternatives could be changed by adding new ones or combining those in the draft matrix. The most important point is the alternatives should be distinguishable, and ideally would be the minimum number needed to represent a "reasonable range." In the draft matrix Alternatives 3 and 4 had a commercial and recreational focus respectively, while Alternatives 5 and 6 represented more conservation-oriented policies. Mr. Anderson pointed out that the strategic plan identified nearshore areas for preferential access by recreational fishers, allocation of shelf species on a case-by-case basis, and commercial preference for the slope area, which is farthest offshore and not exploited by recreational fishers. The main point is there is a spatial-species component to allocation, and a simple division of alternatives between a more commercial versus recreational orientation may not be appropriate. It was suggested draft matrix Alternatives 3 and 4 incorporate this concept.

At this point the Committee entered into a long discussion of how to generally structure the remaining alternatives. Mr. Lone asked if the Committee should consider alternatives that contradict the strategic plan and that the Council considered unreasonable. The Committee agreed the alternatives should represent what is considered reasonable by the broad range of interests and groups involved with groundfish issues, not just the Council perspective. Ms. Robinson suggested the alternatives be structured based on the particular issue highlighted within each (e.g., overfishing). It was decided alternatives that have a particular allocation policy (recreational versus commercial) should not have different harvest management or conservation policies, because this would create undue bias. This led to a discussion of how to restructure the alternatives in way that would represent different combinations of allocation policies with harvest management and conservation policies. One approach discussed was to develop four alternatives, two with harvest management policies from the strategic plan, but with different allocation policies; and two with a more precautionary harvest management and the different allocation policies as in the previous two alternatives. Another variation expanded the number of alternatives to eight, representing different combinations of allocation and harvest management policies. There was also continuing discussion of the precise meaning of phrases such as "risk neutral" and "risk averse."

Mr. Tom Ghio emphasized that the status quo situation from some period in the past, five years ago for example, should be described to demonstrate the progress represented by the current status quo. It was agreed this should not be an alternative, but can be part of the description of trends in the EIS.

Discussion continued on crafting the overall structure of the alternatives. Mr. Glock emphasized that any alternative should not contain a "poison pill" or element that makes it patently obvious it would not be chosen by the Council. At the same time the alternatives need to represent a diverse set of interests. Finally, three alternatives, in addition to the status quo and strategic plan (Alternative 2) alternatives, were agreed upon. These represented (1) a more "liberal" set of policies (generally favoring commercial fishing and socioeconomic benefits over conservation goals), (2) policies from the strategic plan, but with more "conservative" or risk-averse harvest and conservation policies, and (3) a very conservative or risk-averse set of policies.

Once the three alternatives were identified, the group discussed how best to handle the allocation issue within this suite of alternatives. Various possibilities were raised including incorporating variations in allocation within the alternatives (as "sub-options") or having alternatives that represent two extremes with respect to allocation (all recreational versus all commercial) and some intermediate policy. It was decided the allocation issue would be addressed within the agreed-upon set of alternatives in terms of nearshore species.

The Committee had one more set of "second thoughts" about these alternatives before proceeding. Mr. Brown pointed out that the five alternatives didn't differ in their basic assumptions about management or the basic elements they incorporated. For example, one possibility would be to have an alternative where stock assessments were not used at all, or one where very large marine protected areas substitute for most other forms of management. Other possibilities were raised, such as ITQs, "community-based" management and management of species assemblages rather than species. Mr. Copps suggested an alternative that would focus on scientific research and data gathering; in other words all authorized fishing would have as its primary purpose gathering information about the resource or it would use large closed areas in what would essentially be an experimental design. The bottom line was the existing alternatives are all based on the same paradigm. For example, Canada has a fundamentally different approach to management than the U.S.; an alternative could be developed that uses this "top down" very restrictive approach. This discussion did not reach any definitive conclusion. The unspoken consensus was that given time constraints the approach to framing alternatives that had been developed should be pursued. Elements of these alternative policies could be incorporated into the alternatives as framed.

Mr. Huhtala then presented an alternative developed by PMCC (see attached handout). The Committee discussed the various elements of this alternative and decided not to add it to the existing matrix "as is," but elements could be incorporated into the alternatives as they were fleshed out. Discussion touched on the need for a mechanism to incorporate new gear types into fisheries, cooperative research, the meaning of "community-based" management, and the utility of habitat areas of particular concern (HAPC) designations for habitat protection. The PMCC alternative most closely accorded to Alternative 4, the strategic plan policies with more risk-averse harvest policies. Mr. Anderson recommended Mr. Huhtala should suggest where elements of the PMCC alternative fit into existing alternatives as they worked through them.

Prevent overfishing (Alternatives 3 through 5)

Essentially the same process as was used for Alternatives 1 and 2, where comparisons and changes were made across alternatives under each issue heading, was used to develop Alternatives 3 through 5. Again the group started with the "prevent overfishing" alternative. Eventually the "burden of proof" concept emerged as a way of distinguishing between these alternatives. The more "liberal" Alternative 3 would focus on proving harm before prohibiting activities while Alternative 5 would require proof that an activity was not harmful before allowing it. Different policies for assessed versus un-assessed stocks under each alternative were developed. It was recognized the "conservative" alternative has a problem in that data for assessments usually comes from fisheries, which would likely be severely limited or prohibited under this alternative.

Rebuild overfished stocks (Alternatives 3 through 5)

Rebuilding policies were developed fairly quickly. It was noted that the "mixed stock exception" included under Alternative 3 allows the rebuilding period to be extended, but does not allow further declines in overfished stocks. (Continued declines would eventually result in an ESA designation in any case.)

Bycatch info system (Alternatives 3 through 5)

Turning to the "bycatch info system" policies (or more generally, fishery monitoring), Mr. Saelens pointed out that past recommendations from Council advisory bodies need to be recognized when policies are formulated. In summary, the policies were: relying mainly on reporting, with sampling and verification through limited observers (Alternative 3); extrapolate total catch from a large sample size due to high level of observer coverage (Alternative 4); and "count every fish," at least in the commercial fishery, through 100% observer coverage (Alternative 5).

Bycatch reduction (Alternatives 3 through 5)

For bycatch reduction the Committee agreed Alternative 3 should be close to the status quo with some modifications. Incentives would be used to encourage bycatch reduction. The limited entry program would be changed to allow gear modifications that reduce bycatch. This could eventually lead to adoption of an ITQ program where allocations are not made based on gear types. Alternative 4 would incorporate performance standards: procedures, which if adopted (and leading to bycatch reduction), allow fishermen to gain some payoff such as higher trip limits. There was also discussion of individual (per vessel) caps on bycatch, which could be applied under alternatives with adequate observer coverage. Without observers it would be difficult to determine compliance. Individual caps reward fishers who are more successful at reducing or eliminating bycatch, in contrast to fishery-wide caps where all participants would be affected by the behavior of those with higher bycatch rates; but Alternative 5 would require a retain-all fishery, so bycatch caps would not be applicable to this alternative. Fishery-wide standards, based on the amount of bycatch reduction for example, were also identified as a necessary component of the alternatives.

Habitat (Alternatives 3 through 5)

Turning to habitat policies, the Committee noted they could almost replicate overfishing policies on a conceptual level. Descriptive terms "no net loss" drawn from the FMP and "protect and recover" from the PMCC proposed alternative were used to generally characterize the alternatives. Two types of policies were discussed: those that reduce gear impacts and those that directly protect habitat through closed areas or MPAs. The "burden of proof" concept was also applied in this context. Under the "liberal" Alternative 3 the burden of proof would be to demonstrate that a gear type cause harm, while under "conservative" Alternative 5 the burden of proof would be to demonstrate that a gear type does not cause harm.

Turning to direct protection of habitat, it was recognized the percent values for areas completely protected under Alternatives 4 and 5 (10% and 25%) are somewhat arbitrary and at-the-moment "strawman" values. There was also discussion of how these protected areas might be distributed. For example, there could be many small areas or a few large ones, and the percent coverage could be divided equally between major habitat zones (slope, shelf and nearshore). Mr. Ghio raised the issue of what gear types habitat protection measures would apply to. For example, would all gear types, including those not regulated under the groundfish FMP, be excluded from closed areas? For Alternative 4 it was suggested gear restrictions be linked to the level of uncertainty about impacts; this could also apply to closing areas to fishing. It was suggested the Council Phase I marine reserves document could provide information to flesh out the standards and tools for Alternative 4.

Alternative 5 would focus on maintaining ecosystem function in addition to habitat. This would include designating "ocean wilderness areas" that would be protected for reasons beyond simply fishery management. It was recognized that for many marine species a "habitat" composed of a species assemblage may be more important than a particular biophysical environment and substrate. This is especially true when considering different life history stages. This means it can be difficult to separate habitat protection from "fish protection" (i.e., harvest management). At the same time it is important to protect substrate-related spawning habitat. The possibility of renaming this issue "habitat and ecosystem function" was raised for these reasons. The three alternatives could present a range in terms of the attention given to ecosystem management in addition to habitat protection.

The Committee raised the problems with enforcing closed areas or MPAs and the need for tools such as vessel monitoring systems (VMSs) for this purpose.

Standards were discussed in terms of achieving a higher level of protection outside of any MPAs designated under an alternative. (Only Alternatives 4 and 5 would have MPA designation as a policy.) Using the duration of bottom contact and how this would apply to different gear types was discussed. It was also recognized that some standards need to be identified to determine socioeconomic impacts. Without this it would be difficult to assess the pros and cons of different alternatives. (In other words, maximum protection would have the most benefits if socioeconomic impacts are not considered.) Some way to suggest the extent and siting of MPAs would need to be included in order to estimate socioeconomic impacts. After more discussion it was agreed this component of the alternatives would need more work after Mr. Glock had revised the alternatives matrix.

A discussion of habitat-related tools then ensued. Ms. Robinson suggested Alternative 3 employ status quo tools, Alternative 4 use tools identified in the strategic plan, and Alternative 5 focus on MPAs and gear standards and/or prohibitions. However, it was agreed gear standards/prohibitions should also be part of Alternative 4. Any gear standards and/or prohibitions (under Alternative 5 and/or 4) would be for areas outside of (that is, in addition to) those directly protected through closed areas/MPAs. Discussion returned to defining gear standards based on bottom contact. For Alternative 5 (and possibly Alternative 4) this might be "the gear can't touch the bottom unless it is already proved there is no impact." Some test methodology would have to be developed for this type of standard.

Socioeconomics (Alternatives 3 through 5)

Three subcategories were identified under ***Socioeconomics***: communities, capacity reduction, and allocation. Several characterizations of policy alternatives were discussed, which follow. However, during the discussion it became clear there were many ways to "mix and match" possible policies, that these could not be contained in the three remaining alternatives, and the choices that are made will have a fundamental effect on subsequent analysis. Alternative 3 would give the most weight to socioeconomic costs and benefits, while Alternative 5 would give essentially no weight to the socioeconomic component. Alternative 4, would adopt the same allocation and capacity reduction policies as are in the strategic plan. Alternative 3 would rely on market-based mechanisms and allow reductions in fleet size without too much concern for the impacts to communities. It would implement a property regime using ITQs for example. This would give the fishing industry the flexibility to survive and grow. Alternative 5, in contrast, would have a "command and control" orientation under which fishing is highly regulated. This would be very strict public ownership; individual quotas (IQs) could be implemented, but no permanent property right implied by tradeability would be invoked. The possibility Alternative 4 could involve some combination of these policies was raised, but it was recalled that this alternative was meant to represent strategic plan goals with more conservative harvest management, so those goals should be adopted as policies for this alternative.

The discussion of alternatives wrapped up at this point.

G. Next Steps

Mr. Copps raised the question of the Committee's involvement in developing alternatives for the EFH EIS and how the PEIS alternatives will relate to those alternatives. The problems of tasking advisory bodies and holding the kind of meeting just completed during the Council meeting week were discussed. Mr. Glock outlined the next steps in PEIS development. The alternatives developed during the meeting will be presented to the Council in June. They are expected to adopt them, possibly with some modifications. In addition, the EFH analysis that is ongoing may necessitate further modifications to the PEIS alternatives. It was tentatively agreed the Committee would meet again on July 10 and 11 at the Council offices in Portland, Oregon.

H. Miscellaneous Matters

No additional matters were discussed.

Adjourn

The meeting adjourned at approximately 2:30 p.m..

Committee Comment Draft Proposed PSEIS Alternatives, Developed by the ad hoc EIS Oversight Committee

	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
SUMMARY	Status quo: A process-oriented, adaptive management program to achieve broad goals, responsive to issues and emphasizing minimum disruption to historic use patterns	Modified status quo with a strategic focus emphasizing on capacity reduction, improved bycatch information collection, and resolution of allocation issues	Modified status quo with emphasis on obtaining greater social and economic benefits	Similar to Alt 2, but with increased emphasis on risk-averse management, and measuring and mitigating impacts on fish, other species, and habitat	A very risk-averse management program that emphasizes on measuring and mitigating impacts on fish, other species, and habitat
Prevent overfishing					
SUMMARY Policy/ Program Goals	A program that combines **risk-neutral and risk-averse harvest levels**, individual species and assemblage OYs, adjusting OYs to account for bycatch estimates, seasons and individual retention limits	Same as Alternative 1: A program that combines **risk-neutral and risk-averse harvest levels**, individual species and assemblage OYs, adjusting OYs to account for bycatch estimates, seasons and individual retention limits	A program that combines **risk-neutral harvest levels**, individual species and assemblage OYs, adjusting OYs to account for bycatch estimates, seasons and individual retention limits	A program that combines **risk-averse harvest levels**, individual species and assemblage OYs, adjusting OYs to account for bycatch estimates, seasons and individual retention limits	A **very risk-averse** program with a higher overfished threshold and lower harvest rates
Numerical Standards	ABC=Fmsy; OY≤ ABC with 40-10; adjusted 75:50; OFL=$B_{25\%}$; closure on reaching ABC/OY for any weak stock within an assemblage	ABC=Fmsy; OY≤ ABC with 40-10; adjusted 75:50; OFL=$B_{25\%}$; closure on reaching ABC/OY for any weak stock within an assemblage	ABC=Fmsy; OY≤ ABC with 40-10; unadjusted 75:50; OFL=$B_{25\%}$; closure on reaching ABC/OY for any weak stock within an assemblage	ABC=Fmsy; OY≤ ABC with 50-10; 50% reduction for all unassessed stocks; OFL=$B_{25\%}$; closure on reaching ABC/OY for any weak stock within an assemblage	ABC=Fmsy; OY≤ with 80-30; 75% reduction for all unassessed stocks; OFL=$B_{40\%}$; Bmsy=B50% or Bmsy=B60%
Toolbox	set ABC and OY; gear restrictions; trip limits; seasons; bag limits	set ABC and OY; gear restrictions; trip limits; area closures (e.g., MPAs); seasons; bag limits	set ABC and OY; gear restrictions; trip limits; seasons; bag limits	set ABC and OY; gear restrictions; catch limits; area closures (e.g., MPAs); seasons; bag limits	set ABC and OY; gear restrictions; area closures; catch limits with mandatory retention; seasons; bag limits

	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Rebuild Overfished Stocks					
SUMMARY	**Rebuilding periods set at or near maximum allowable**	**Rebuilding periods set at or near maximum allowable**	**Rebuilding periods may exceed maximum allowable** due to use of mixed-stock exception	**Rebuilding periods shorter** than maximum allowable	**Shortest possible rebuilding periods**
Policy/ Program Goals	Define overfishing by species; Consider socio-economic effects in rebuilding plans	Define overfishing by species; Consider socio-economic effects in rebuilding plans (See Strategic Plan for additional goals)	Define overfishing by species; Consider socio-economic effects in rebuilding plans; **utilize mixed-stock exception**	Define overfishing by species; shorter rebuilding periods, less consideration to socio-economic effects	Define overfishing by species; no consideration to socio-economic effects; area closures as a primary management tool
Numerical Standards	Tmax with >50% probability	Tmax with >60% probability	Tmax plus; do not reduce any overfished species abundance	Tmid with **>50%** probability	Tmin; F=near 0 for all overfished stocks
Toolbox	OY setting; gear restrictions; area closures; seasons; bag limits	OY setting; gear restrictions; area closures; seasons; bag limits	Mixed-stock exception; OY setting; gear restrictions; area closures; seasons; bag limits	OY setting; gear restrictions; area closures; seasons; bag limits	OY setting; gear restrictions; area closures (Reserves); seasons; bag limits

	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Bycatch Reporting					
SUMMARY Policy/ Program Goals	Bycatch estimated through a combination of logbooks, port sampling, observers	Bycatch estimated through a combination of logbooks, port sampling, observers (See Strategic Plan for additional goals/objectives)	Bycatch estimated through a combination of 100% reporting (commercial logbooks) with random observer verification, and increased port sampling of recreational catches	Total catch and bycatch estimated within +/-25% through large sample size, electronic catch and bycatch reporting by all commercial and CPFV vessels	Verified, total catch accounting through 100% observer coverage of all commercial groundfish and CPFV vessels and comprehensive port sampling of recreational catch
Numerical Standards	At-sea processing vessels: 100% observer coverage; other commercial vessels: stratified random monitoring based on available federal funding (about 10% observer coverage)	At-sea processing vessels: 100% observer coverage; other commercial vessels: stratified random monitoring to observe at least 10% of commercial groundfish vessels	100% commercial and CPFV logbook coverage including discards; observer coverage as needed to verify accuracy of total bycatch estimate	30% observer coverage of all commercial gear groups; 100% VMS coverage for unobserved vessels	Total accounting of all groundfish catch and bycatch; individual vessel limits for certain limiting species
Toolbox	federally funded (partial) observer program; state port sampling programs; EFPs	federally funded (partial) observer program; state port sampling programs; EFPs; may require vessels to provide observer	logbooks for all gear types; catch records for recreational fishers; fish tickets; observers (to verify)	observer program; VMS; cameras; logbooks; landings receipts	mandatory observer requirement; VMS; recreational catch reporting (records such as punch cards); port sampling of recreational catches

	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Bycatch reduction					
SUMMARY Policy/ Program Goals	Adjust trip limits to discourage fishing in certain areas and similar to expected species encounter rates; use gear restrictions where possible to reduce expected or assumed bycatch rates; area closures where appropriate	Reduce capacity, adjust trip limits to discourage fishing in certain areas and similar to expected species encounter rates; use gear restrictions where possible to reduce expected or assumed bycatch rates; area closures where appropriate	Reduce capacity; adjust trip limits to discourage fishing in certain areas and similar to expected species encounter rates; use gear restrictions where possible to reduce expected or assumed bycatch rates	Reduce bycatch by specific bycatch reduction measures; performance standards and incentive program; vessel and fleet bycatch caps based on application of observed bycatch rates	Prohibit discard of designated species in commercial fishery; monitoring system; performance standards and incentive program
Numerical Standards	none	none	none	reduce bycatch 50% in 5 years	near zero bycatch of groundfish
Toolbox	OY setting; gear restrictions, area closures; trip limits; seasons; bag limits	OY setting; gear restrictions, area closures (MPAs); trip limits; seasons; bag limits; full/increased retention requirements	OY setting; gear restrictions, trip limits; seasons; bag limits	OY setting; gear restrictions; area closures; bycatch caps; catch limits; discard monitoring system (e.g., camera) seasons; bag limits	OY setting; gear restrictions; area closures; bycatch caps; catch limits; seasons; bag limits

	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Habitat					
SUMMARY Policy/ Program Goals	no net loss of habitat	Protect, maintain and/or recover those habitats necessary for health fish populations and the productivity of those habitats; promote research on gear effects and gear modifications to reduce adverse impacts	no net loss of habitat: reduce gear/seafloor contact from pre-1996 levels; **current gears are assumed to have minimal impact on EFH until proven otherwise**	Protect and recover groundfish habitat: Eliminate fishing gear impacts in some EFH areas, reduce fishing impacts on bottom habitat in all other areas through a combination of gear restrictions and incentives to develop and use low impact methods	Protect and recover groundfish habitat; eliminate fishing gear impacts in a larger portion of EFH, reduce fishing impacts on bottom habitat in all other areas through a combination of gear restrictions and incentives to develop and use low impact methods; **current fishing gears/methods assumed to have negative impacts until proven otherwise**
Numerical Standards	none	none	none	Protect 10% of benthic EFH (equally spread over nearshore, shelf and slope seafloor) from all groundfish gear impacts; reduce hours of gear/seafloor contact by 25% from 2002 everywhere; establish gear performance standards	Protect 25% of benthic EFH (equally spread over nearshore, shelf and slope seafloor) from all groundfish gear impacts; reduce hours of gear/seafloor contact by 50% from 2002 everywhere; establish gear performance standards
Toolbox	EFH definition and identification; gear restrictions	EFH definition and identification; HAPCs, MPAs, gear restrictions; capacity reduction; performance standards	gear restrictions; capacity reduction	effort reduction; area closures; allocations for those meeting performance standards	area closures; allocations for those meeting performance standards

	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Socio-economics					
SUMMARY Policy/ Program Goals	Program focus is on social and economic stability, striving for equitable balance between commercial and recreational fishing through direct and indirect allocation (see FMP for specific goals and objectives)	Program focus on improving social and economic conditions by reducing commercial fleet capacity; stabilize social and economic conditions by resolving allocation issues (see Strategic Plan allocation goal and general allocation principles)	Program focus on maximizing socio-economic benefits, improving social and economic conditions by reducing commercial fleet capacity; maintain year-round fishing opportunities. Develop private ownership, rights-based measures (IFQs) to provide individual vessels flexibility to prosper.	Same as Alternative 2, plus emphasis on maintaining a diversity of harvesters, vessels, and communities.	Low priority to social and economic effects; no year round fishing goal; no IFQs; all vessels strictly regulated with equal opportunity, through individual caps.
Numerical Standards	none	at least 50% capacity reduction for commercial fleet	at least 50% capacity reduction for commercial fleet	at least 50% capacity reduction for commercial fleet	none
Toolbox	allocations; license limitation; species endorsements; trip limits; seasons; bag limits	allocations; license limitation; species endorsements; trip limits; permit stacking; seasons; bag limits	allocations; license limitation; trip limits; ITQs; seasons; bag limits	allocations; license limitation; trip limits; seasons; bag limits	individual catch limits; seasons; bag limits

Other Monitoring (habitat, ecosystem function, gear effectiveness, other)

Exhibit C.6.c
Supplemental HC Report
June 2002

HABITAT COMMITTEE REPORT ON FISHERY MANAGEMENT PLAN SUPPLEMENTAL ENVIRONMENTAL IMPACT STATEMENT

The Habitat Committee heard a report by Mr. Jim Glock on the activities of the Ad Hoc Groundfish Fishery Management Plan Environmental Impact Statement Oversight Committee. The HC will continue to be involved with the development of the Groundfish Programmatic Supplemental Environmental Impact Statement, which has been postponed due to recent developments.

PFMC
06/19/02

FISHERY MANAGEMENT PLAN PROGRAMMATIC ENVIRONMENTAL IMPACT STATEMENT

Situation: The Council has been briefed on the NMFS decision to develop a programmatic supplemental environmental impact statement (PSEIS) that will review the current status of the federal groundfish management program and offer a range of alternative management strategies at a broad programmatic or policy level. (A second SEIS is under preparation concurrently, addressing management alternatives for and environmental impacts to essential fish habitat, but it is not part of this agendum.)

The Ad Hoc Groundfish Fishery Management Plan (FMP) EIS Oversight Committee met May 8-9 to review progress on and further develop a range of programmatic alternatives that will be analyzed in the PSEIS. Five alternatives were identified, each focusing on different policy goals. (Refer to meeting minutes, Exhibit C.6.b.)

However, recent stock assessments have provided evidence that several overfished groundfish stocks are more depleted than originally thought, which may require curtailing and/or closing a large segment of the groundfish fishery. The PSEIS Project Leader believes the current suite of alternatives will need substantial revision to address this dynamic and consequential situation. In addition, scoping may be reinitiated in order to identify emerging issues and craft more relevant alternatives. For these reasons the Council should defer its review and approval of the alternatives that will be analyzed in the PSEIS. The Council could direct the EIS Oversight Committee to assist in scoping and the revision of the PSEIS alternatives.

Council Action:

1. Consider adoption of draft alternatives for the FMP PSEIS.

Reference Materials:

1. Summary Minutes, Ad Hoc Groundfish FMP EIS Oversight Committee, May 8-9, 2002 (Exhibit C.6.b).

Agenda Order:

a. Agendum Overview — Kit Dahl
b. Presentation of Draft Alternatives Developed by the Ad Hoc Groundfish FMP EIS Oversight Committee — Jim Lone
c. Reports and Comments of Advisory Bodies
d. Public Comment
e. **Council Action:** Consider adoption of draft alternatives for the FMP PSEIS.

Groundfish Fishery Strategic Plan (GFSP) Consistency Analysis

The GFSP broadly supports effective public involvement during and beyond the transition to sustainable groundfish fishery management. The GFSP also specifically seeks to update the goals and objectives in the current groundfish FMP to incorporate GFSP visions and goals (Sec. II.C.(d)3). The Programmatic SEIS will provide a public forum vehicle for assessing and incorporating GFSP visions and goals into the Groundfish FMP.

PFMC
06/03/02

Exhibit C.7.b
Supplemental GAP Report
June 2002

GROUNDFISH ADVISORY SUBPANEL STATEMENT ON AMENDMENT 17 (MULTI-YEAR) MANAGEMENT

The Groundfish Advisory Subpanel (GAP) received a presentation on the draft of Amendment 17 which would establish a multi-year management system. The GAP acknowledges the work done by Ms. Yvonne de Reynier of the Northwest Region on preparing the draft.

The GAP endorses the concept of multi-year management, as it will provide more time for Council consideration of important science and management matters that now often are put aside to accomplish the task of setting harvest levels and management measures every year. The reduction in Council family workload will benefit fisheries conservation and management by allowing more in-depth analysis of important issues.

In regard to the options presented, the GAP endorses Alternative 3, which provides for a 3-meeting groundfish management process, but continues the start date of the fishing season as January 1st. The GAP believes that a sub-option of the alternative should also be considered which would provide for an additional meeting date - perhaps in February - to prevent overlap between salmon and groundfish issues at the April meeting.

The primary reason for supporting Alternative 3 involves continuation of the January 1st start date. A May start date - as proposed in Alternative 4, would seriously disrupt fisheries that begin in April, such as the whiting fishery and the fixed gear tier sablefish fishery. A May date may also cause problems for tribal fisheries.

While March 1st might appear as a reasonable alternative and was supported by one member of the public testifying at the GAP, it was rejected for a variety of reasons. First, business planning is currently centered around the January 1st start date and has been for many years. There is enough instability in the fishery without creating further problems for business planning. Second, safety may be an important factor, especially as vessels attempt to finish up their available limits. January and February can be some of the worst weather months on the West Coast and having only these months available to finish fishing for the management cycle would pose a significant burden on vessels not capable of withstanding the weather.

Third, a March 1st start date could cause market disruptions for both processors and fishermen. Plants that process Dungeness crab see their heaviest activity in mid-December, January, and early February. Often, plants are forced to put groundfish vessels on limits simply in order to handle product flow. Again, if vessels are trying to finish out their management "year" in January and February, they may find themselves hampered by lack of markets.

Fourth, a March 1st start date could discriminate against vessels that have permits for both groundfish and crab. With a January start, such vessels can forgo groundfish in January to fish crab and make up their groundfish "loss" by fishing the rest of the year. With a March start, the time that losses are being made up coincides with the crab season when groundfish is usually foregone.

Finally, the GAP briefly examined the pros and cons of having an optimum yield that begins on January 1st of the first year and extends through December 31st of the second year, versus having identical optimum yields for each of the two years in the management cycle. The GAP was unable to reach consensus on this issue in the time available and recommends that both options be put forward for public review and analysis.

PFMC
06/18/02

Exhibit C.7.b
Supplemental SSC Report
June 2002

SCIENTIFIC AND STATISTICAL COMMITTEE REPORT ON DRAFT AMENDMENT 17 (MULTI-YEAR) MANAGEMENT

Ms. Yvonne de Reynier reviewed the five management alternatives included in draft Amendment 17 that is scheduled for adoption as a public review draft. Alternative 1 is the status quo and the other four options revise the groundfish specifications and management process. By September 2002, the Scientific and Statistical Committee (SSC) requested she include information for each alternative to determine if recreational and commercial fishery data will be available at the appropriate spatial and temporal resolution for the stock assessments. The SSC favors alternatives 4 and 5, because these use the most current data for management decisions.

The SSC re-emphasizes the issues it addressed in our April 2002 statement regarding multi-year groundfish management:

- Using standardized models would simplify the review of stock assessments.
- There is a need for standardized databases and contact between data support staff and assessment authors to ensure that assessments consider uncertainties related to the data.
- A two-year assessment cycle is consistent with the schedule for updating rebuilding analyses.
- There is a need to develop a process for selecting the assessments to be conducted during an "on" year and how each assessment will be reviewed.

PFMC
06/18/02

Tom Jagielo

Exhibit C.7
Attachment 1
June 2002

Amendment 17

The Pacific Coast Groundfish Fishery Management Plan

Environmental Assessment (EA) / Regulatory Impact Review (RIR) and Determination of the Impact on Small Businesses

June 2002

EXCERPTS FROM REVIEW DRAFT

1.0 PURPOSE AND NEED FOR ACTION

1.1 How this Document is Organized

1.2 Purpose and Need

The Pacific Coast Groundfish Fishery Management Plan (FMP) provides guidance for the Council's groundfish fishery management policies. This FMP covers over 80 species of groundfish (listed in Section 3.0 of the FMP) taken in multi-user fisheries occurring within the Exclusive Economic Zone (EEZ, 3-200 nautical miles offshore) off the coasts of Washington, Oregon, and California. Many of the FMP's guiding policies have been implemented through long-term federal regulations at 50 CFR 660.301-.360. These regulations cover issues ranging from allocations of particular species between different user groups to gear marking requirements to licensing and observer requirements.

In addition to deliberating on long-term groundfish fishery regulations, the Council sets groundfish harvest levels through an annual regulatory process. This annual process establishes harvest "specifications", which are harvest levels or limits such as acceptable biological catches (ABCs,) optimum yields (OYs,) or allocations for the different user groups. Management measures, such as trip limits, closed times and areas, and gear restrictions are also set in the annual regulatory process. Management measures are partnered with the specifications in the annual process because these measures are specifically designed to allow the fisheries to achieve, but not to exceed, the specifications harvest levels.

Annual development of specifications and management measures, with regulatory review and implementation by NMFS, is authorized in Section 5.6 of the FMP. Under this section of the FMP, certain management measures have been designated as routine for many of the groundfish species managed under the FMP. The Council annually publishes a list of those management measures designated as routine in its Stock Assessment and Fishery Evaluation (SAFE) Report.

Reconsidering the process by which new management measures are designated as routine is not part of the purpose of the actions analyzed in this document. Instead, the actions analyzed in this document will focus on the larger framework for developing and implementing specifications and management measures.

Since 1990, the Council has annually developed its recommendations for specifications and management measures in a two-meeting process (usually its September and November meetings) followed by a NMFS final action published in the *Federal Register* and made available for public comment and correction after the effective date of the action. In 2001, NMFS was challenged on this process in *Natural Resources Defense Council, Inc. v. Evans*, 2001 WL 1246622 (N.D.Cal. 2001) and the court ordered NMFS to provide prior public notice and allow public comment on the annual specifications. Because of this court order, the Council needs to amend the FMP's framework for developing annual specifications and management measures to incorporate NMFS publication of a proposed rule for the specifications and management measures, followed by a public comment period and final rule.

In addition to needing to revise the notice and comment procedure associated with the specifications and management measures, the Council wished to take a new look at efficiency in the annual management process. Groundfish management workload levels have increased in recent years, particularly those associated with setting annual harvest levels for both depleted and healthy stocks. Because of the increasing workload associated with developing specifications and management measures, the Council and NMFS have had less time for addressing many other important groundfish fishery management issues. NMFS has recently asked all of the fishery management councils to consider how they might streamline their processes for developing regulatory recommendations. To meet this NMFS request, the Council has decided that it needs to consider whether specifications and management measures could be published for multi-year, rather than single year, periods.

The Council's purposes in and needs for considering the actions analyzed in this document are to:

- Comply with a court order to provide more opportunity for public comment in the NMFS rule publication process.

- Streamline the process of and reduce the workload associated with developing specifications and management measures so that more Council and NMFS time may be devoted to issues other than specifications and management measures development.

1.3 Public Participation

The court's order in *Natural Resources Defense Council, Inc. v. Evans*, 2001 WL 1246622 (N.D.Cal. 2001) that NMFS provide prior public notice comment on the annual specifications was issued in August 2001. NMFS also began discussions about streamlining regulatory development and implementation processes with all of the fishery management councils in summer 2001. Because several NMFS Regions and councils use annual specifications and management measures development processes, the efficiency of those processes was an important part of the regulatory streamlining discussions. One suggestion to come out of those discussions was that some councils might consider whether their specifications and management measures could be developed for multi-year periods.

At its November 2001 meeting, the Council discussed the need to incorporate a NMFS public notice and comment period into the specifications and management measures process before implementation of the final rule. The Council decided that it could combine its investigations into how to modify the notice and comment period and into the applicability of multi-year management to groundfish fishery management. To initially scope out these issues, the Council created the Ad-Hoc Groundfish Multi-Year Management Committee (hereinafter, "Committee.") The Committee included representatives from the fishing industry, the conservation community, the three states and NMFS.

The Committee held public meetings in Portland, OR over December 13-14, 2001, and over January 31 - February 1, 2002. During those meetings, the Committee discussed a suite of issues associated with changing the specifications and management measures notice and comment process and with the possibility of making a transition to multi-year management (detailed in Section 2.3 of this document.) During these meetings, the Committee developed a suite of options to address the issues discussed in the Purpose and Need section of this document, above. In March 2002, the Council made these options available for more broad public comment. At its April 2002 meeting, the Council then chose five alternatives for analysis, with the expectation that a draft analysis of these options would be available for public consideration at its June 2002 meeting in Foster City, CA. These alternatives are presented in Section 2.0 of this document.

1.4 Related NEPA Analyses

1.4.1 Environmental Impact Statement (EIS) on Overfished Species Rebuilding Plans. (In development.)

The Council is preparing an EIS for what will become Amendment 16 to the FMP, which will set overall guidelines for the contents of overfished species rebuilding plans and which will incorporate rebuilding plans for several species in the FMP. The Amendment 16 EIS is scheduled for concurrent consideration with the specifications and management measures issues discussed in this EA. During discussions on each of these issues, the Council will need to ensure that processes analyzed herein for developing specifications and management measures are compatible with processes for developing and implementing overfished species rebuilding plans.

1.4.2 Environmental Assessment/Regulatory Impact Review/Initial Regulatory Flexibility Analysis (EA/RIR/IRFA) for Proposed Groundfish Acceptable Biological Catch and Optimum Yield Specifications and Management Measures for the 2002 Pacific Coast Groundfish Fishery. December 2001.

This EA/RIR/IRFA was prepared for the 2002 specifications and management measures and provides an example of the type of NEPA analysis for developing the annual specifications and management measures. The Council's annual SAFE document serves an appendix to this EA/RIR/IRFA, with information on the history of the fishery's management, stock status for recently assessed species, economic analyses, and other information. This EA/RIR/IRFA was intended to address the effects of the 2002 specifications and management measures on the environment, not the effects of the rulemaking development process on the environment.

1.4.3 EA/RIR for Amendment 13 to the Pacific Coast Groundfish FMP. December 2000.

Among other issues, Amendment 13 provided new flexibility in setting annual management measures, so that those measures could better address the rebuilding needs of overfished species. This NEPA analysis addressed the process by which new management measures are designated as routine. These routine management measures are the management measures developed in the annual specifications process. As mentioned above, the process by which new management measures are designated as routine is not part of the purpose of the Council's current discussions. Nonetheless, the Amendment 13 NEPA analysis may provide relevant additional background on the annual process of developing specifications and management measures.

2.0 ALTERNATIVES INCLUDING THE PROPOSED ACTION

2.1 Development of the Alternatives and How the Alternatives are Structured

As discussed above in Section 1.3, the alternatives for revising the specifications and management measures development process were initially discussed in December 2001 and January/February 2002 meetings of the Ad Hoc Groundfish Multi-Year Management Committee. The Committee developed six alternatives intended to represent a reasonable range of alternative management regimes for addressing the issues discussed under Section 1.0, Purpose and Need. At its April 2002 meeting, the Council eliminated one alternative from consideration and made the five remaining alternatives available for public review. That eliminated alternative and other alternatives not considered in this document are briefly detailed in Section 2.3 of this document.

Each of the five following alternatives provides the following components:

- Either an annual or biennial framework for setting specifications and management measures.
- The number of Council meetings used in developing specifications and management measures and the months in which those meetings would be held.
- The start date of the fishing year.
- A schedule for conducting new and updated groundfish stock assessments.

2.2 Description of the Alternatives

Alternative 1 (No Action)

The theme of Alternative 1 is to continue with the current annual management cycle, giving priority to the specifications and management measures process over other Council activities.

- Specifications and management measures set annually for a one-year period.
- Two Council meetings, with proposed specifications and management available at Meeting 1 and Council final action at Meeting 2.

  **This two-meeting process (usually September and November meetings) was standard for the 1990-2001 specifications and management measures. For the 2002 specifications, the Council adopted a three-meeting process, with proposed specifications available in June, proposed management measures available in September, and final Council action on all items in November. For 2003, the Council has had to revert to a two-meeting process (June, September) to allow a public notice and comment period prior to an expected March 1, 2003 finalization. For the purposes of this analysis, the two-meeting process will be considered the No Action alternative. **

- January 1 fishing year start date.
- Stock assessments for each assessed species are conducted once every three years. Assessed species divided into three stock groups (A, B, C) for year in which assessment occurs.

Years in which stock surveys are conducted	Year Stock Group A assessed, year harvest limits are based on that assessment	Year Stock Group B assessed, year harvest limits are based on that assessment	Year Stock Group C assessed, year harvest limits are based on that assessment
Year 1	Year 2, Year 3 harvest	Year 3, Year 4 harvest	Year 4, Year 5 harvest
Year 4	Year 5, Year 4 harvest	Year 6, Year 7 harvest	Year 7, Year 8 harvest
Year 7	Year 8, Year 9 harvest	Year 9, Year 10 harvest	Year 10, Year 11 harvest

Alternative 2 (biennial, three-meeting, March 1 start)

The theme of Alternative 2 is to maximize time for stock assessment scientists, Council staff, and NMFS staff to prepare documentation needed to implement specifications and management measures. Additionally, biennial management is intended to allow the Council time to focus its work in alternate years on issues other than specifications and management measures.

- Specifications and management measures set biennially for a two-year period.
- Three Council meetings, with proposed specifications available in April (Meeting 1,) proposed management measures available in June (Meeting 2,) and Council final action in September (Meeting 3.)
- March 1 fishing year start date.
- Stock assessments for each assessed species are conducted every year.

Years in which stock surveys are conducted	Year All Stocks Assessed	Years harvest limits are based on that assessment
Year 1	Year 3	Years 4-5
Year 2	Year 5	Years 6-7
Year 3	Year 5	Years 6-7
Year 4	Year 7	Years 8-9
Year 5	Year 7	Years 8-9

Alternative 3 (biennial, three-meeting, January 1 start)

The theme of Alternative 3 is to maximize time for stock assessment scientists, Council staff, and NMFS staff to prepare documentation needed to implement specifications and management measures ***without disrupting historic January 1 season start date.*** *Additionally, biennial management is intended to allow the Council time to focus its work in alternate years on issues other than specifications and management measures.*

- Specifications and management measures set biennially for a two-year period.
- Three Council meetings, with proposed specifications available in November (Meeting 1,) proposed management measures available in April (Meeting 2,) and Council final action in June (Meeting 3.)
- January 1 fishing year start date.
- Stock assessments for each assessed species are conducted every other year.

Years in which stock surveys are conducted	Year All Stocks Assessed	Years harvest limits are based on that assessment
Year 1	Year 3	Years 4-5
Year 2	Year 5	Years 6-7
Year 3	Year 5	Years 6-7
Year 4	Year 7	Years 8-9
Year 5	Year 7	Years 8-9

Alternative 4 (biennial, three-meeting, May 1 start)

The theme of Alternative 4 is to minimize the time between stock surveys and the years in which those surveys are used in setting harvest limits, ***while also maximizing time for Council staff and NMFS staff to prepare documentation*** *needed to implement specifications and management measures. Additionally, biennial management is intended to allow the Council time to focus its work in alternate years on issues other than specifications and management measures.*

- Specifications and management measures set biennially for a two-year period.
- Three Council meetings, with proposed specifications available in June (Meeting 1,) proposed management measures available in September (Meeting 2,) and Council final action in November (Meeting 3.)
- May 1 fishing year start date.
- Stock assessments for each assessed species are conducted every other year.

Years in which stock surveys are conducted	Year All Stocks Assessed	Years harvest limits are based on that assessment
Year 1	Year 2	Years 3-4
Year 2	Year 4	Years 5-6
Year 3	Year 4	Years 5-6
Year 4	Year 6	Years 7-8
Year 5	Year 6	Years 7-8

Alternative 5 (biennial, two-meeting, March 1 start)

The theme of Alternative 5 is to minimize the time between stock surveys and the years in which those surveys are used in setting harvest limits. Additionally, biennial management is intended to allow the Council time to focus its work in alternate years on issues other than specifications and management measures.

- Specifications and management measures set biennially for a two-year period.
- Two Council meetings, with proposed specifications and management measures available in June (Meeting 1) and Council final action in September (Meeting 2.)
- March 1 fishing year start date.
- Stock assessments for each assessed species are conducted every other year.

Years in which stock surveys are conducted	Year All Stocks Assessed	Years harvest limits are based on that assessment
Year 1	Year 2	Years 3-4
Year 2	Year 4	Years 5-6
Year 3	Year 4	Years 5-6
Year 4	Year 6	Years 7-8
Year 5	Year 6	Years 7-8

Groundfish Multi-Year Management Alternatives – Summary of Policy Considerations
("Y" = "Year")

Alternative	**Science Process** *Stock assessments occur Jan-May needed for all options. Different schedule indicated when more time available.*	**Data/Stock Assessment Use** *May not survey all stocks in all years. Y1 survey data used in Y2 assessment process.*	**Council Process** *Council process and workload more or less burdensome depending on whether 2- or 3-meeting process*	**NMFS Process** * 5 months minimum needed for proposed rule, comment period and response time*	**Industry Needs/Effects** *Where process is 2-years, discipline is needed in 1st fishing year to not push limits higher in Council process – otherwise fewer fish available for 2nd year, possible early closures
1. Status quo, 2-meeting annual process, 1/1 start. Annual process PFMC meets Sept. (proposed) and Nov. (final), Fishing Year starts Jan 1.	• 1/3 of stocks each year (labeled as groups A, B, and C in next box →) • STAR process for all assessed species, each year	• Year 1 survey info used in Y3 fishing for stock group A • Y1-2 survey info used in Y4 fishing for stock group B • Y1-3 survey info used in Y5 fishing for stock group C	• 7 months for Council staff and committees work on NEPA/RFA, SAFE documents • Less overall Council time for issues other than specifications	• 2 months for implementation, inadequate • Less overall NMFS time for issues other than specifications	• Start date the same, process same, so little/no industry adjustment • Less Council/NMFS time to work on other industry issues
2. 3-meeting, biennial process, 3/1 start. PFMC meets April (proposed ABC/OY), June (final ABC/OY, proposed management), and Sept (final management) Fishing year starts March 1	• Stock assessments could occur Jan- Mar of following Y • All stocks assessed every other year with STAR or STAR-lite review • Intervening years have STAR process for models, new overfished spp.	• Year 1 survey info used in Y4-5 fishing for all stocks • Y2 survey info used in Y6-7 fishing • Y3 survey info used in Y6-7 fishing	• 11-19 months for Council staff and committees work on NEPA/RFA, SAFE documents • More time for issues other than specifications • Inseason adjustments for last 3 months made at Nov meeting. • Conflict with salmon management schedule	• 5.5 months for implementation, adequate • More NMFS time for issues other than specifications	• Change in fishing year requires business planning changes for industry • 2-year process, possible early closures if limits not controlled • More Council/ NMFS time to work on other industry issues • Fishing based on older data than in options A, B, E, F

Alternative	Science Process *Stock assessments occur Jan-May needed for all options. Different schedule indicated when more time available.*	Data/Stock Assessment Use *May not survey all stocks in all years. Y1 survey data used in Y2 assessment process.*	Council Process *Council process and workload more or less burdensome depending on whether 2- or 3-meeting process*	NMFS Process * 5 months minimum needed for proposed rule, comment period and response time*	Industry Needs/Effects *Where process is 2-years, discipline is needed in 1st fishing year to not push limits higher in Council process – otherwise fewer fish available for 2nd year, possible early closures
3. 3-meeting, biennial process, 1/1 start. PFMC meets Nov (proposed ABC/OY), April (final ABC/OY, proposed management), and June (final management) Fishing year starts Jan 1	• Stock assessments occur Jan-Oct • All stocks assessed every other year with STAR or STAR-lite review • Intervening years have STAR process for models, new overfished spp.	• Year 1 survey info used in Y4-5 fishing for all stocks • Y2 survey info used in Y6-7 fishing • Y3 survey info used in Y6-7 fishing	• 14 months for Council staff and committees work on NEPA/RFA, SAFE documents • More time for issues other than specifications • Conflict with salmon management schedule	• 6.5 months for implementation, adequate time • More NMFS time for issues other than specifications	• Start date the same • 2-year process, possible early closures if limits not controlled • Fishing based on older data than in options A, B, E, F • More Council/ NMFS time to work on other industry issues
4. 3-meeting, biennial process, 5/1 start. PFMC meets June (proposed ABC/OY), Sept. (final ABC/OY, proposed management), and Nov. (final management) Fishing year starts May 1	• All stocks assessed every other year with STAR or STAR-lite review • Intervening years have STAR process for models, new overfished spp. • Database adjusting for change in fishing year	• Year 1 survey info used in Y3-4 fishing for all stocks • Y2 survey info used in Y5-6 fishing • Y3 survey info used in Y5-6 fishing	• 9 months for Council staff and committees work on NEPA/RFA, SAFE documents • More time for issues other than specifications • Inseason adjustments in Nov. and March possibly ill-timed for May 1 fishery start • Re-evaluation of whiting and fixed gear sablefish season management required	• 6 months for implementation, adequate • More NMFS time for issues other than specifications	• Change in fishing year requires business planning changes for industry • 2-year process, possible early closures if limits not controlled • 5/1 fishery start conflicts with current whiting and fixed gear sablefish seasons, interrupts Lenten marketing period. • More Council/ NMFS time to work on other industry issues
5. 2-meeting, biennial process, 3/1 start. PFMC meets June (proposed) and Sept (final), Fishing Year starts March 1	• All stocks assessed every other year with STAR-lite • Intervening years have STAR process for models, new overfished spp. • Database adjusting for change in fishing year	• Year 1 survey info used in Y3-4 fishing for all stocks • Y2 survey info used in Y5-6 fishing • Y3 survey info used in Y5-6 fishing	• 9 months for Council staff and committees work on NEPA/RFA, SAFE documents • More time for issues other than specifications • Inseason adjustments for last 2-3 months made at Nov meeting	• 5.5 months for implementation, adequate • More NMFS time for issues other than specifications	• Change in fishing year requires business planning changes for industry • 2-year process, possible early closures if limits not controlled • More Council/ NMFS time to work on other industry issues

2.3 Alternatives Eliminated from Detailed Study

During its initial meetings, the Multi-Year Management Committee discussed several variations on the options listed above:

Multi-Year Management for Periods Longer Than Two Years. Of the five options listed above, one would continue the annual management cycle and four would move the Council to biennial specifications and management measures. The Committee discussed management cycles ranging from one to five years in duration. These discussions revealed that setting the length of the management cycle would be a delicate balance between ensuring the use of the best and most recently available scientific information and allowing cycle participants adequate time to discuss and absorb this scientific information and its implications for management. Under the current annual cycle, processing and review of data must occur at a fairly swift pace, using scientific personnel time and resources that might otherwise be dedicated to stock assessments. Thus, the annual cycle tends to allow participating scientists to assess about one-third of all assessed stocks in any one year. As a result, each year's management cycle uses the most recently available information for one-third of assessed stocks. Discussions between the Committee and stock assessment scientists about timing of assessments and data availability led the Committee to conclude that a two-year management cycle would allow participating scientists more time to process and review data from the stock surveys and then more time to complete stock assessments for setting specifications and management measures. Three-year to five-year cycles would have lengthened the scientific process further, but the longer cycles would have also resulted in managers using "older" data in setting harvest levels. The Committee determined the benefits of a longer assessment and analysis period were outweighed by the need to use the best available scientific information in support of the management process.

Changing Council Meeting Dates. During its initial discussions, the Committee looked at different ways of addressing the scheduling needs of the scientific process (processing and reviewing data from resource surveys through to completed assessments) and the public notice and comment process (NMFS publication of proposed and final rules in the *Federal Register*). In addition to considering changing the duration of the management cycle, the fishing year start date, and the Council meetings at which discussion and decision occur, the Committee also looked at changing the dates of Council meetings to better incorporate the scientific process and the notice and comment process. For example, the Committee considered whether the process could be better served by moving the July Council meeting to June, or by moving the September and November meetings to early August and October. Ultimately, the Committee set aside these considerations for two logistical reasons. First, the current Council meeting schedule of five meetings per year held in March, April, June, September, and November is based on the management needs of a variety of fisheries (groundfish, salmon, coastal pelagic species, highly migratory species, halibut). Historically, the September and November meetings have been dominated by groundfish issues, thus the timing of those meetings could have been more flexible with changes to groundfish management needs. March and April meetings, however, are strictly timed with salmon season management and timing for those meetings could not be made flexible to accommodate groundfish management needs. The Committee was uncomfortable with the potential ripple effects of changing Council meeting dates on the management of species other groundfish. Second, Council meeting dates must be set several years in advance to ensure meeting location reservations adequate for the large number of Council meeting participants. Even if the Committee had wanted to forward an alternative meeting schedule for public consideration, the Council and NMFS would not have been able to fully implement such an alternative for three to four years. The Committee felt there were sufficient alternatives for addressing their goals in taking a new look at the management process without having to also address the complications of meeting logistics.

DRAFT AMENDATORY LANGUAGE FOR AMENDMENT 17 – MULTI-YEAR MANAGEMENT

This document presents draft amendatory language that would revise the FMP to allow multi-year management. Plain text shows status quo (Alternative 1) language. Bolded text shows where the FMP could be amended to allow a biennial specifications and management measures process under Alternatives 2-5. Some ~~strikeout~~ text is shown as editing text that is not relevant to any of the alternatives. There are numerous places in the FMP where the words "annual," "year," or "yearly" are used in descriptive paragraphs mentioning the Council's annual specifications and management measures process without affecting that process. To better focus attention on the FMP processes that would be affected by Amendment 17, these descriptive paragraphs have not been provided here. If the Council chooses any of the multi-year management alternatives (Alternatives 2-5,) permission from the Council to make minor edits to account for the change in management period would be helpful to the Council staff.

2.2 Operational Definition of Terms

Acceptable Biological Catch (ABC) is a biologically based estimate of the amount of fish that may be harvested from the fishery each year **or each biennial fishing period (Alternatives 2-5)** without jeopardizing the resource. It is a seasonally determined catch that may differ from maximum sustainable yield (MSY) for biological reasons. It may be lower or higher than MSY in some years **or two-year periods** for species with fluctuating recruitment. The ABC may be modified to incorporate biological safety factors and risk assessment due to uncertainty. Lacking other biological justification, the ABC is defined as the MSY exploitation rate multiplied by the exploitable biomass for the relevant time period.

* * *

Biennial fishing period is defined as a 24-month period beginning January 1 (Alternative 3) / March 1 (Alternatives 2 & 5) / May 1 (Alternative 4) and ending December 31 (Alternative 3) / February 28 [or 29 in leap years] (Alternatives 2 & 5) / April 30 (Alternative 4).

* * *

Fishing year is defined as January 1 through December 31 **(Alternatives 1& 3) / March 1 through February 28 [or 29 in leap years] (Alternatives 2 & 5) / May 1 through April 30 (Alternative 4).**

* * *

Maximum sustainable yield is an estimate of the largest average annual **or biennial** catch or yield that can be taken over a significant period of time from each stock under prevailing ecological and environmental conditions. It may be presented as a range of values. One MSY may be specified for a group of species in a mixed-species fishery. Since MSY is a long-term average, it need not be specified annually **or biennially**, but may be reassessed periodically based on the best scientific information available.

* * *

5.0 SPECIFICATION AND APPORTIONMENT OF HARVEST LEVELS

The ability to establish and adjust harvest levels is the first major tool at the Council's disposal to exercise its resource stewardship responsibilities. Each fishing year **(Alternative 1) biennial fishing period (Alternatives 2-5)**, the Council will assess the biological, social, and economic condition of the Pacific coast groundfish fishery and update maximum sustainable yield (MSY) estimates or proxies for specific stocks (management units) where new information on the population dynamics is available. The Council will make this information available to the public in the form of the *Stock Assessment and Fishery Evaluation (SAFE)* document described in Section 5.1. Based upon the best scientific information available, the Council will evaluate the current level of fishing relative to the MSY level for stocks where sufficient data are available. Estimates of the acceptable biological catch (ABC) for major stocks will be developed, and the Council will identify those species or species groups which it proposes to be managed by the establishment of numerical harvest levels (optimum yields [OYs], harvest guidelines [HGs], or quotas). For those stocks judged to be below their overfished/rebuilding threshold, the Council will develop a stock rebuilding management strategy.

The process for specification of numerical harvest levels includes the estimation of ABC, the establishment of OYs for various stocks, calculation of specified allocations between harvest sectors, and the apportionment of numerical specifications to domestic annual processing (DAP), joint venture processing (JVP), total allowable level of foreign fishing (TALFF), and the reserve. The specification of numerical harvest levels described in this chapter is the process of designating and adjusting overall numerical limits for a stock either throughout the entire fishery management area or throughout specified subareas. The process normally occurs annually between September and November **(Alternative 1) / biennially between April and September (Alternative 2) / between November and June (Alternative 3) / between June and November (Alternative 4) / between June and September (Alternative 5)** , but can occur, under specified circumstances at other times of the fishing year. The Council will identify those OYs which should be designated for allocation between limited entry and open access sectors of the commercial industry. Other numerical limits which allocate the resource or which apply to one segment of the fishery and not another are imposed through the socioeconomic framework process described in Chapter 6 rather than the specification process.

The National Marine Fisheries Service (NMFS) Regional Administrator will review the Council's recommendations, supporting rationale, public comments, and other relevant information; and, if it is approved, will undertake the appropriate method of implementation. Rejection of a recommendation will be explained in writing.

The procedures specified in this chapter do not affect the authority of the U.S. Secretary of Commerce (Secretary) to take emergency regulatory action as provided for in Section 305(c) of the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) if an emergency exists involving any groundfish resource or to take such other regulatory action as may be necessary to discharge the Secretary's responsibilities under Section 305(d) of the Magnuson-Stevens Act.

The ~~annual~~ specification**s and management measures** process, in general terms, occurs as follows:

1. The Council will determine the MSY or MSY proxy and ABC for each major stock. Typically, the MSY proxy will be in terms of a fishing mortality rate ($F_{x\%}$,) and ABC will be the $F_{x\%}$ applied to the current biomass estimate.

2. Every species will either have its own designated OY or be included in a multispecies OY. Species which are included in a multispecies OY may also have individual OYs, have individual HGs, or be included in a HG for a subgroup of the multispecies OY. Stocks without quantitative or qualitative assessment information may be included in a numerical or non-numerical OY.

3. To determine the OY for each stock, the Council will determine the best estimate of current abundance and its relation to its precautionary and overfished thresholds. If the abundance is above the precautionary threshold, OY will be equal to or less than ABC. If abundance falls below the precautionary threshold, OY will be reduced according to the harvest control rule for that stock. If abundance falls below the overfished/rebuilding threshold, OY will be set according to the interim rebuilding rule until the Council develops a formal rebuilding plan for that species.

4. ****Editorial changes for this paragraph would be addressed under Amendment 16 (overfished species rebuilding) to the FMP**** For any stock the Secretary has declared overfished or approaching the overfished condition, or for any stock the Council determines is in need of rebuilding, the Council will develop a rebuilding plan and submit it in the same manner as recommendations of the annual management process. Once approved, a rebuilding plan will remain in effect for the specified duration or until the Council recommends and the Secretary approves revision.

5. The Council may reserve and deduct a portion of the ABC of any stock to provide for compensation for vessels conducting scientific research authorized by NMFS. Prior to the research activities, the Council will authorize amounts to be made available to a research reserve. However, the deduction from the ABC will be made in the year after the "compensation fishing"; the amounts deducted from the ABC will reflect the actual catch during compensation fishing activities.

6. The Council will identify stocks which are likely to be fully harvested (i.e., the ABC, OY, or HG achieved) in the absence of specific management measures and for which allocation between limited entry and open access sectors of the fishery is appropriate.

7. The groundfish resource is fully utilized by U.S. fishing vessels and seafood processors. The Council may entertain applications for foreign or joint venture fishing or processing at any time, but fishing opportunities may be established only through amendment to this FMP. This section supercedes other provisions of this FMP relating to foreign and joint venture fishing.

This chapter describes the steps in this process.

5.1 SAFE Document

****Annual SAFE documents are required under Federal regulations implementing National Standard 2 of the Magnuson-Stevens Act (base conservation and management measures on the best available scientific information.) Under Amendment 16 to the FMP, the Council will consider revising the SAFE document production schedule (stock assessments available before final decision on specifications and management measures, evaluation of the fishery available after end of fishing year).**

Amendment 17 Alternatives 2-5 consider a biennial management process. Under a biennial management process, some elements of the SAFE document may not be necessary in years when the Council is not preparing specifications and management measures. For example, elements 2, 5, 6, 7, and 11 could be eliminated from "off year" SAFE documents without violating federal regulations or hampering the Council's ability to conduct inseason management.**

For the purpose of providing the best available scientific information to the Council for evaluating the status of the fisheries relative to the MSY and overfishing definition, developing ABCs, determining the need for individual species or species group management, setting and adjusting numerical harvest levels, assessing social and economic conditions in the fishery, and updating the appendices of this FMP; a SAFE document is prepared annually. Not all species and species groups can be reevaluated every year due to limited state and federal resources. However, the SAFE document will in general contain the following information:

1. A report on the current status of Washington, Oregon, and California groundfish resources by major species or species group.

2. Specify and update estimates of harvest control rule parameters for those species or species groups for which information is available.

3. Estimates of MSY and ABC for major species or species groups.

4. Catch statistics (landings and value) for commercial, recreational, and charter sectors.

5. Recommendations of species or species groups for individual management by OYs.

6. A brief history of the harvesting sector of the fishery, including recreational sectors.

7. A brief history of regional groundfish management.

8. A summary of the most recent economic information available, including number of vessels and economic characteristics by gear type.

9. Other relevant biological, social, economic, ecological, and essential fish habitat information which may be useful to the Council.

10. A description of any rebuilding plans currently in effect, a summary of the information relevant to the rebuilding plans, and any management measures proposed or currently in effect to achieve the rebuilding plan goals and objectives.

11. A list of annual specifications and management measures that have been designated as routine under processes described in the FMP at Section 6.2.

Under a biennial specifications and management measures process, elements 2, 5, 6, 7, and 11 would not need to be included in a SAFE document in years when the Council is not setting specifications and management measures for an upcoming biennial fishing period (Alternatives 2-5). The preliminary SAFE document is normally completed late in the year, generally late October, when the most current stock assessment and fisheries performance information is available and prior to the meeting at which the Council approves its final management recommendations for the upcoming year. The Council will make the preliminary SAFE document available to the public by such means as mailing lists or newsletters and will provide copies upon request. A final SAFE may be prepared after the Council has made its final recommendations for the upcoming year and will include the final recommendations, including summaries of proposed and pre-existing rebuilding plans. The final SAFE document, if prepared, will also be made available upon request.

* * *

5.4 Authorization and Accounting for Fish Taken as Compensation for Authorized Scientific Research Activities.

At a Council meeting, NMFS will advise the Council of upcoming resource surveys that would be conducted using private vessels with groundfish as whole or partial compensation. For each proposal, NMFS will identify the maximum number of vessels expected or needed to conduct the survey, an estimate of the species and amounts of compensation fish likely to be needed to compensate vessels for conducting the survey, when the fish would be taken, and when the fish would be deducted from the ABC in determining the OY/harvest guideline. NMFS will initiate a competitive solicitation to select vessels to conduct resource surveys. NMFS will consult with the Council regarding the amounts and types of groundfish species to be used to support the surveys. If the Council approves NMFS' proposal, NMFS may proceed with awarding the contracts, taking into account any modifications requested by the Council. If the Council does not approve the proposal to use fish as compensation to pay for resource surveys, NMFS will not use fish as compensation.

Because the species and amounts of fish used as compensation will not be determined until the contract is awarded, it may not be possible to deduct the amount of compensation fish from the ABC or harvest guideline in the year the fish are caught. Therefore, the compensation fish will be deducted from the ABC the year **(Alternative 1) / biennial fishing period (Alternatives 2-5)** after the fish are harvested. During the ~~annual~~ specification**s and management measures** process, NMFS will announce the total amount of fish caught during the year **(Alternative 1) / biennial fishing period (Alternatives 2-5)** as compensation for conducting a resource survey, which then will be deducted from the following year's ABCs in setting the OYs.

* * *

5.6 Annual **(Alternative 1) / Biennial (Alternatives 2-5)** Implementation Procedures for Specifications and ~~Apportionments~~ **Management measures**(previously section 5.8)

Annually/**Biennially**, the Council will develop recommendations for the specification of ABCs, OYs, any HGs or quotas, ~~and apportionments to DAH, DAP, JVP, and TALFF and the reserve~~ over the span of two **(Alternatives 1 & 5) / three (Alternatives 2, 3, 4)** Council meetings. In addition during this process, the Council may recommend establishment of HGs and quotas for species or species groups within an OY.

The Council will develop preliminary recommendations at the first of two **/ three** meetings (usually in August or September) **(Alternative 1) / in April (Alternative 2) / in November (Alternative 3) / in June (Alternatives 4 & 5)**, based upon the best stock assessment information available to the Council at the time and consideration of public comment. After the first meeting, the Council will provide a summary of its preliminary recommendations and their basis to the public through its mailing list as well as providing copies of the information at the Council office and to the public upon request. The Council will notify the public of its intent to develop final recommendations at its second **/third** meeting (usually October or November)

(Alternative 1) / in September (Alternatives 2 & 5) / in June (Alternative 3) / in November (Alternative 4), and solicit public comment both before and at its second meeting.

At its second **and/or third** meeting, the Council will again consider the best available stock assessment information which should be contained in the recently completed SAFE report and consider public testimony before adopting final recommendations to the Secretary. Following the second/**third** meeting, the Council will submit its recommendations along with the rationale and supporting information to the Secretary for review and implementation.

Upon receipt of the Council's recommendations supporting rationale and information, the Secretary will review the submission, and, if approved, publish a notice in the *Federal Register* making the Council's recommendations effective January 1 of the upcoming fishing year **(Alternative 1) / publish a proposed rule in the *Federal Register*, making the Council's recommendations available for public comment and agency review. Following the public comment period on the proposed rule, the Secretary will review the proposed rule, taking into account any comments or additional information received, and will publish a final rule in the *Federal Register*, possibly modified from the proposed rule in accordance with the Secretary's consideration of the proposed rule.**

In the event the Secretary disapproves one or more of the Council's recommendations, he may implement those portions approved and notify the Council in writing of the disapproved portions along with the reasons for disapproval. The Council may either provide additional rationale or information to support its original recommendation, if required, or may submit alternative recommendations with supporting rationale. In the absence of an approved recommendation at the beginning of the fishing year/**biennial fishing period**, the current specifications in effect at the end of the previous fishing year/**biennial fishing period** will remain in effect until modified, superseded, or rescinded.

5.7 Inseason Procedures for Establishing or Adjusting Specifications and ~~Apportionments~~ **Management Measures**(previously 5.9)

5.7.1 Inseason Adjustments to ABCs

Occasionally, new stock assessment information may become available inseason that supports a determination that an ABC no longer accurately describes the status of a particular species or species group. However, adjustments will only be made during the annual **/biennial** specifications process and a revised ABC announced at the beginning of the next fishing year **/ biennial fishing period**. The only exception is in the case where the ABC announced at the beginning of the fishing year **/ biennial fishing period** is found to have resulted from incorrect data or from computational errors. If the Council finds that such an error has occurred, it may recommend the Secretary publish a notice in the *Federal Register* revising the ABC at the earliest possible date.

* * *

6.0 MANAGEMENT MEASURES

* * *

6.2 General Procedures for Establishing and Adjusting Management Measures

Management measures are normally imposed, adjusted, or removed at the beginning of the fishing year / **biennial fishing period**, but may, if the Council determines it necessary, be imposed, adjusted, or removed at any time during the year. Management measures may be imposed for resource conservation, social or economic reasons consistent with the criteria, procedures, goals, and objectives set forth in the FMP.

Because the potential actions which may be taken under the two frameworks established by the FMP cover a wide range analyses of biological, social, and economic impacts will be considered at the time a particular change is proposed. As a result, the time required to take action under either framework will vary depending on the nature of the action, its impacts on the fishing industry, resource, environment, and review of these impacts by interested parties. Satisfaction of the legal requirements of other applicable law (e.g., the Administrative Procedure Act, Regulatory Flexibility Act, Executive Order 12291, etc.) for actions taken under this framework requires analysis and public comment before measures may be implemented by the Secretary.

Four different categories of management actions are authorized by this FMP, each of which requires a slightly different process. Management measures may be established, adjusted, or removed using any of the four procedures. The four basic categories of management actions are as follows:

A. Automatic Actions - Automatic management actions may be initiated by the NMFS Regional Administrator without prior public notice, opportunity to comment, or a Council meeting. These actions are nondiscretionary, and the impacts previously must have been taken into account. Examples include fishery, season, or gear type closures when a quota has been projected to have been attained. The Secretary will publish a single "notice" in the *Federal Register* making the action effective.

B. "Notice" Actions Requiring at Least One Council Meeting and One *Federal Register* Notice - These include all management actions other than "automatic" actions that are either nondiscretionary or for which the scope of probable impacts has been previously analyzed.

These actions are intended to have temporary effect, and the expectation is that they will need frequent adjustment. They may be recommended at a single Council meeting ~~(usually November)~~, although the Council will provide as much advance information to the public as possible concerning the issues it will be considering at its decision meeting. The primary examples are those **inseason** management actions defined as "routine" according to the criteria in Section 6.2.1. These include trip landing and frequency limits and size limits for all commercial gear types and closed seasons for any groundfish species in cases where protection of an overfished or depleted stock is required, and bag limits, size limits, time/area closures, boat limits, hook limits, and dressing requirements for all recreational fisheries. Previous analysis must have been specific as to species and gear type before a management measure can be defined as "routine" and acted upon at a single Council meeting. If the recommendations are approved, the Secretary will waive for good cause the requirement for prior notice and comment in the *Federal Register* and will publish a single "notice" in the *Federal Register* making the action effective. This category of actions presumes the Secretary will find the extensive notice and opportunity for comment on these types of measures along with the scope of their impacts already provided by the Council will serve as good cause to waive the need for additional prior notice and comment in the *Federal Register*.

C. Abbreviated Rulemaking Actions Normally Requiring at Least Two Council Meetings and One *Federal Register* "Rule" or "Notice" **(Alternative 1) C. Specifications and Management Measures Rulemaking Actions Requiring at Least Two (Alternative 5) / Three (Alternatives 2-4) Council Meetings and Two *Federal Register* Notices** - These include (1) management actions being classified as "routine", or (2) trip limits that vary by gear type, closed seasons or areas, and in the recreational fishery, bag limits, size limits, time/area closures, boat limits, hook limits, and dressing requirements the first time these measures are used or ~~(3) management measures that are intended to have permanent effect and are discretionary, and for which the impacts have not been previously analyzed~~ **(moved to Section D, below)**. Examples include changes to or imposition of gear regulations, or imposition of landings limits, frequency limits, or limits that are differential by gear type, or closed areas or seasons for the first time on any species or species group, or gear type. The Council will develop and analyze the proposed management actions over the span of at least two **/ three** Council meetings ~~(usually September and November)~~ and provide the public advance notice and opportunity to comment on both the proposals and the analysis prior to and at the second Council meeting. If the Regional Administrator approves the Council's recommendation, the Secretary will waive for good cause the requirement for prior notice and comment in the *Federal Register* and publish a "final rule" or "notice" in the *Federal Register* which will remain in effect until amended. **(Alternative 1 – sentence would be deleted under Alternatives 2-5)** If a management measure is designated as "routine" under this procedure, specific adjustments of that measure can subsequently be announced in the *Federal Register* by "notice" as described in the previous paragraphs. Nothing in this section prevents the Secretary from exercising the right not to waive the opportunity for prior notice and comment in the *Federal Register*, if appropriate, but presumes the Council process will adequately satisfy that requirement. **(Alternative 1 – sentence would be deleted under Alternatives 2-5) The Secretary will publish a "proposed rule" in the *Federal Register* with an appropriate period for public comment followed by publication of a "final rule" in the *Federal Register* (Alternatives 2-5).**

The primary purpose of the previous two categories of abbreviated notice and rulemaking procedures is to accommodate the Council's September-November meeting schedule for developing annual management recommendations, to satisfy the Secretary's responsibilities under the Administrative Procedures Act, and to address the need to implement management measures by January 1 of each fishing year.**(Alternative 1 – paragraph would be deleted under Alternatives 2-5)**

It should be noted the two **/three** Council meeting process refers to two decision meetings. The first **and second (Alternatives 2-4)** meeting to develop proposed management measures and their alternatives, the second **/third** meeting to make a final recommendation to the Secretary. For the Council to have adequate information to identify proposed management measures for public comment at the first meeting, the identification of issues and the development of proposals normally must begin at a prior Council meeting, ~~usually the June Council meeting~~.

D. Full Rulemaking Actions Normally Requiring at Least Two Council Meetings and Two *Federal Register* Rules (Regulatory Amendment) - These include any proposed management measure that is highly controversial or any measure which directly allocates the resource. **These also include management measures that are intended to have permanent effect and are discretionary, and for which the impacts have not been previously analyzed. (Alternative 2-5, moved from Section C, above)** The Council normally will follow the two meeting procedure described for the abbreviated**/ specifications and management measures** rulemaking category. The Secretary will publish a "proposed rule" in the *Federal Register* with an appropriate period for public comment followed by publication of a "final rule" in the *Federal Register*.

Management measures recommended to address a resource conservation issue must be based upon the establishment of a "point of concern" and consistent with the specific procedures and criteria listed in Section 6.2.2.

Management measures recommended to address social or economic issues must be consistent with the specific procedures and criteria described in Section 6.2.3.

PFMC
06/04/02

Exhibit C.7
Situation Summary
June 2002

DRAFT AMENDMENT 17 (MULTI-YEAR) MANAGEMENT

Situation: In April 2002, based on the advice of the Ad Hoc Groundfish Multi-Year Management Committee (GMMC) and other Pacific Fishery Management Council (Council) advisory bodies, the Council initiated development of an amendment to the groundfish fishery management plan (Amendment 17). The primary purpose of Amendment 17 is to reduce workload associated with developing specifications and management measures so that more Council and National Marine Fisheries Service (NMFS) time may be devoted to other issues (e.g., strategic plan implementation). Any change to the management schedule would need to be synchronized with stock assessment development and review, currently, also on an annual basis. Rebuilding plan review is another element that will need to be accounted for in the revised schedule. In addition, Amendment 17 addresses changes necessary to comply with a court order requiring opportunity for public comment on the NMFS rulemaking process after a Council decision.

The Council requested that Amendment 17 include and analyze five alternative management schedules. The five alternatives provide for:

- A status quo (annual) or biennial framework for setting specifications and management measures.
- Two or three Council meetings for developing specifications and management measures and the months in which those meetings would be held.
- Different fishing year start dates.
- Schedules for conducting new and updated groundfish stock assessments.

Amendment 17 authors will present the draft FMP amendment to the Council. This information will also be presented to the Council's other groundfish advisory committees, it is anticipated they will provide reports to the Council. Excerpts from Amendment 17 are contained in Attachment 1.

Scoping multi-year management approaches and other elements of Amendment 17 has occurred at two public meetings of the GMMC (December 13-14, 2001 and January 31-February 1, 2002). These topics have also been discussed at the March and April 2002 Council meetings.

The current schedule calls for adoption of a public review draft at the June 2002 Council meeting and final Council action in September 2002.

Council Action: Adopt Draft Amendment 17 for Public Review 6

Reference Materials:

1. Exhibit C.7, Attachment 1.
2. Exhibit C.7.b, Supplemental SSC Report. received 6-18-02
3. Exhibit C.7.b, Supplemental GMT Report.
4. Exhibit C.7.b, Supplemental GAP Report. received 6-18-02

Agenda Order:

a. Agendum Overview — Dan Waldeck
b. Reports and Comments of Advisory Bodies
c. Public Comment
d. **Council Action:** Adopt Draft Amendment 17 for Public Review

Supplemental Reference Materials

5. Exhibit C.7, Supplemental Attachment 2.

PFMC
06/04/02

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AMENDMENT 17

TO THE PACIFIC COAST GROUNDFISH FISHERY MANAGEMENT PLAN

(MULTI-YEAR MANAGEMENT AND THE SPECIFICATIONS AND MANAGEMENT MEASURES PROCESS)

DRAFT

INCLUDING DRAFT ENVIRONMENTAL ASSESSMENT

Prepared by the National Marine Fisheries Service for the Pacific Fishery Management Council

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JUNE 2002

TABLE OF CONTENTS

1.0 PURPOSE AND NEED FOR ACTION

1.1 How this Document is Organized

Note to Reader, June 11, 2002 – This document is in draft format. Several sections are incomplete and require further information, drafting, and analysis. In general, authors have marked areas where more information is needed with this symbol: ##. – Y. deReynier (NMFS/NWR – 206-526-6140)

1.2 Purpose and Need

The Pacific Coast Groundfish Fishery Management Plan (FMP) provides guidance for the Council's groundfish fishery management policies. This FMP covers over 80 species of groundfish (listed in Section 3.0 of the FMP) taken in multi-user fisheries occurring within the Exclusive Economic Zone (EEZ, 3-200 nautical miles offshore) off the coasts of Washington, Oregon, and California. Many of the FMP's guiding policies have been implemented through long-term federal regulations at 50 CFR 660.301-.360. These regulations cover issues ranging from allocations of particular species between different user groups to gear marking requirements to licensing and observer requirements.

In addition to deliberating on long-term groundfish fishery regulations, the Council sets groundfish harvest levels through an annual regulatory process. This annual process establishes harvest "specifications", which are harvest levels or limits such as Acceptable Biological Catches (ABCs,) optimum yields (OYs,) or allocations for different user groups. Management measures, such as trip limits, closed times and areas, and gear restrictions are also set in the annual regulatory process. Management measures are partnered with the specifications in the annual process because these measures are specifically designed to allow the fisheries to achieve, but not to exceed, the specifications harvest levels.

Annual development of specifications and management measures, with regulatory review and implementation by NMFS, is authorized in Section 5.6 of the FMP. Under this section of the FMP, certain management measures have been designated as routine for many of the groundfish species managed under the FMP. The Council annually publishes a list of those management measures designated as routine in its Stock Assessment and Fishery Evaluation (SAFE) Report.

Reconsidering the process by which new management measures are designated as routine is not part of the purpose of the actions analyzed in this document. Instead, the actions analyzed in this document will focus on the larger framework for developing and implementing specifications and management measures.

Since 1990, the Council has annually developed its recommendations for specifications and management measures in a two-meeting process (usually its September and November meetings) followed by a NMFS final action published in the Federal Register and made available for public comment and correction after the effective date of the action. In 2001, NMFS was challenged on this process in Natural Resources Defense Council, Inc. v. Evans, 2001 WL 1246622 (N.D.Cal. 2001) and the court ordered NMFS to provide prior public notice and allow public comment on the annual specifications. Because of this court order, the Council needs to amend the FMP's framework for developing annual specifications and management measures to incorporate NMFS publication of a proposed rule for the specifications and management measures, followed by a public comment period and final rule.

In addition to needing to revise the notice and comment procedure associated with the specifications and management measures, the Council wished to take a new look at efficiency in the annual management process. Groundfish management workload levels have increased in recent years, particularly those associated with setting annual harvest levels for both depleted and healthy stocks. Because of the increasing workload associated with developing specifications and management measures, the Council and NMFS have had less time for addressing many other important groundfish fishery management issues. NMFS has recently asked all of the fishery management councils to consider how they might streamline their processes for developing regulatory recommendations. To meet this NMFS request, the Council has decided that it needs to consider whether specifications and management measures could be published for multi-year, rather than single year, periods.

The Council's purposes in and needs for considering the actions analyzed in this document are to:

- Comply with a court order to provide more opportunity for public comment in the NMFS rule publication process;

- Streamline the process of and reduce the workload associated with developing specifications and management measures so that more Council and NMFS time may be devoted to issues other than specifications and management measures development.

1.3 Public Participation

The court's order in Natural Resources Defense Council, Inc. v. Evans, 2001 WL 1246622 (N.D.Cal. 2001) that NMFS to provide prior public notice comment on the annual specifications was issued in August 2001. NMFS also began discussions about streamlining regulatory development and implementation processes with all of the fishery management councils in summer 2001. Because several NMFS Regions and councils use annual specifications and management measures development processes, the efficiency of those processes was an important part of the regulatory streamlining discussions. One suggestion to come out of those discussions was that some councils might consider whether their specifications and management measures could be developed for multi-year periods.

At its November 2001 meeting, the Council discussed the need to incorporate a NMFS public notice and comment period into the specifications and management measures process before implementation of the final rule. The Council decided that it could combine its investigations into how to modify the notice and comment period and into the applicability of multi-year management to groundfish fishery management. To initially scope out these issues, the Council created the Ad-Hoc Groundfish Multi-Year Management Committee (hereinafter, "Committee.") The Committee included representatives from the fishing industry, the conservation community, the three states and NMFS.

The Committee held public meetings in Portland, OR over December 13-14, 2001, and over January 31 - February 1, 2002. During those meetings, the Committee discussed a suite of issues associated with changing the specifications and management measures notice and comment process and with the possibility of making a transition to multi-year management (detailed in Section 3.3.1 of this document.) During these meetings, the Committee developed a suite of options to address the issues discussed in the Purpose and Need section of this document, above. In March 2002, the Council made these options available for more broad public comment. At its April 2002 meeting, the Council then chose five alternatives for analysis, with the expectation that a draft analysis of these options would be available for public consideration at its June 2002 meeting in Foster City, CA. These alternatives are presented in Section 2.0 of this document.

1.4 Related NEPA Analyses

1.4.1 Environmental Impact Statement (EIS) on Overfished Species Rebuilding Plans. (In development.)

The Council is preparing an EIS for what will become Amendment 16 to the FMP, which will set overall guidelines for the contents of overfished species rebuilding plans and which will incorporate rebuilding plans for several species in the FMP. The Amendment 16 EIS is scheduled for concurrent consideration with the specifications and management measures issues discussed in this EA. During discussions on each of these issues, the Council will need to ensure that processes analyzed herein for developing specifications and management measures are compatible with processes for developing and implementing overfished species rebuilding plans.

1.4.2 Environmental Assessment/Regulatory Impact Review/Initial Regulatory Flexibility Analysis (EA/RIR/IRFA) for Proposed Groundfish Acceptable Biological Catch and Optimum Yield Specifications and Management Measures for the 2002 Pacific Coast Groundfish Fishery. December 2001.

This EA/RIR/IRFA was prepared for the 2002 specifications and management measures and provides an example of the type of NEPA analysis for developing the annual specifications and management measures. The Council's annual SAFE document serves as an appendix to this EA/RIR/IRFA, with information on the history of the fishery's management, stock status for recently assessed species, economic analyses, and other information. This EA/RIR/IRFA was intended to address the effects of the 2002 specifications and management measures on the environment, not the effects of the rulemaking development process on the environment.

1.4.3 EA/RIR for Amendment 13 to the Pacific Coast Groundfish FMP. December 2000.

Among other issues, Amendment 13 provided new flexibility in setting annual management measures, so that those measures could better address the rebuilding needs of overfished species. This NEPA analysis addressed the process by which new management measures are designated as routine. These routine management measures are the management measures developed in the annual specifications process. As mentioned above, the process by which new management measures are designated as routine is not part of the purpose of the Council's current discussions. Nonetheless, the Amendment 13 NEPA analysis may provide relevant additional background on the annual process of developing specifications and management measures.

2.0 ALTERNATIVES INCLUDING THE PROPOSED ACTION

2.1 Development of the Alternatives and How the Alternatives are Structured

As discussed above in Section 1.3, the alternatives for revising the specifications and management measures development process were initially discussed in December 2001 and January/February 2002 meetings of the Groundfish Multi-Year Management Committee. The Committee developed six alternatives intended to represent a reasonable range of alternative management regimes for addressing the issues discussed under Section 1.0, Purpose and Need. At its April 2002 meeting, the Council eliminated one alternative from consideration and made the five remaining alternatives available for public review. That eliminated alternative and other alternatives not considered in this document are briefly detailed in Section 2.3 of this document.

Each of the five following alternatives provides the following components:

- Either an annual or biennial framework for setting specifications and management measures.
- The number of Council meetings used in developing specifications and management measures and the months in which those meetings would be held.
- The start date of the fishing year.
- A schedule for conducting new and updated groundfish stock assessments.

2.2 Description of the Alternatives

Alternative 1 (No Action)

The theme of Alternative 1 is to continue with the current annual management cycle, giving priority to the specifications and management measures process over other Council activities.

- Specifications and management measures set annually for a one-year period.
- Two Council meetings, with proposed specifications and management available at Meeting 1 and Council final action at Meeting 2.

  **This two-meeting process (usually September and November meetings) was standard for the 1990-2001 specifications and management measures. For the 2002 specifications, the Council adopted a three-meeting process, with proposed specifications available in June, proposed management measures available in September, and final Council action on all items in November. For 2003, the Council has had to revert to a two-meeting process (June, September) to allow a public notice and comment period prior to an expected March 1, 2003 finalization. For the purposes of this analysis, the two-meeting process will be considered the No Action alternative. **
- January 1 fishing year start date.
- Stock assessments for each assessed species are conducted once every three years. Assessed species divided into three stock groups (A, B, C) for year in which assessment occurs.

Years in which stock surveys are conducted	Year Stock Group A assessed, Year harvest limits are based on that assessment	Year Stock Group B assessed, Year harvest limits are based on that assessment	Year Stock Group C assessed, Year harvest limits are based on that assessment
Year 1	Year 2, Year 3 harvest	Year 3, Year 4 harvest	Year 4, Year 5 harvest
Year 4	Year 5, Year 6 harvest	Year 6, Year 7 harvest	Year 7, Year 8 harvest
Year 7	Year 8, Year 9 harvest	Year 9, Year 10 harvest	Year 10, Year 11 harvest

Alternative 2 (biennial, three-meeting, March 1 start)

The theme of Alternative 2 is to maximize time for stock assessment scientists, Council staff, and NMFS staff to prepare documentation needed to implement specifications and management measures. Additionally, biennial management is intended to allow the Council time to focus its work in alternate years on issues other than specifications and management measures.

- Specifications and management measures set biennially for a two-year period.
- Three Council meetings, with proposed specifications available in April (Meeting 1,) proposed management measures available in June (Meeting 2,) and Council final action in September (Meeting 3.)
- March 1 fishing year start date.
- Stock assessments for each assessed species are conducted every year.

Years in which stock surveys are conducted	Year All Stocks Assessed	Years harvest limits are based on that assessment
Year 1	Year 2-3	Years 4-5
Year 2	Year 4-5	Years 6-7
Year 3	Year 4-5	Years 6-7
Year 4	Year 6-7	Years 8-9
Year 5	Year 6-7	Years 8-9

Alternative 3 (biennial, three-meeting, January 1 start)

The theme of Alternative 3 is to maximize time for stock assessment scientists, Council staff, and NMFS staff to prepare documentation needed to implement specifications and management measures ***without disrupting historic January 1 season start date.*** *Additionally, biennial management is intended to allow the Council time to focus its work in alternate years on issues other than specifications and management measures.*

- Specifications and management measures set biennially for a two-year period.
- Three Council meetings, with proposed specifications available in November (Meeting 1,) proposed management measures available in April (Meeting 2,) and Council final action in June (Meeting 3.)
- January 1 fishing year start date.
- Stock assessments for each assessed species are conducted every other year.

Years in which stock surveys are conducted	Year All Stocks Assessed	Years harvest limits are based on that assessment
Year 1	Year 2	Years 4-5
Year 2	Year 4	Years 6-7
Year 3	Year 4	Years 6-7
Year 4	Year 6	Years 8-9
Year 5	Year 6	Years 8-9

Alternative 4 (biennial, three-meeting, May 1 start)

The theme of Alternative 4 is to minimize the time between stock surveys and the years in which those surveys are used in setting harvest limits, ***while also maximizing time for Council staff and NMFS staff to prepare documentation*** *needed to implement specifications and management measures. Additionally, biennial management is intended to allow the Council time to focus its work in alternate years on issues other than specifications and management measures.*

- Specifications and management measures set biennially for a two-year period.
- Three Council meetings, with proposed specifications available in June (Meeting 1,) proposed management measures available in September (Meeting 2,) and Council final action in November (Meeting 3.)
- May 1 fishing year start date.
- Stock assessments for each assessed species are conducted every other year.

Years in which stock surveys are conducted	Year All Stocks Assessed	Years harvest limits are based on that assessment
Year 1	Year 2	Years 3-4
Year 2	Year 4	Years 5-6
Year 3	Year 4	Years 5-6
Year 4	Year 6	Years 7-8
Year 5	Year 6	Years 7-8

Alternative 5 (biennial, two-meeting, March 1 start)

The theme of Alternative 5 is to minimize the time between stock surveys and the years in which those surveys are used in setting harvest limits. Additionally, biennial management is intended to allow the Council time to focus its work in alternate years on issues other than specifications and management measures.

- Specifications and management measures set biennially for a two-year period.
- Two Council meetings, with proposed specifications and management measures available in June (Meeting 1) and Council final action in September (Meeting 2.)
- March 1 fishing year start date.
- Stock assessments for each assessed species are conducted every other year.

Years in which stock surveys are conducted	Year All Stocks Assessed	Years harvest limits are based on that assessment
Year 1	Year 2	Years 3-4
Year 2	Year 4	Years 5-6
Year 3	Year 4	Years 5-6
Year 4	Year 6	Years 7-8
Year 5	Year 6	Years 7-8

Groundfish Multi-Year Management Alternatives – Summary of Policy Considerations

Alternative	Science Process *Stock assessments occur Jan-May needed for all options. Different schedule indicated when more time available.*	Data/Stock Assessment Use *May not survey all stocks in all years. Y1 survey data used in Y2 assessment process.*	Council Process *Council process and workload more or less burdensome depending on whether 2- or 3-meeting process*	NMFS Process * 5 months minimum needed for proposed rule, comment period and response time*	Industry Needs/Effects *Where process is 2-years, discipline is needed in 1st fishing year to not push limits higher in Council process – otherwise fewer fish available for 2nd year, possible early closures
1. Status quo, 2-meeting annual process, 1/1 start. Annual process PFMC meets Sept. (proposed) and Nov. (final), Fishing Year starts Jan 1.	• 1/3 of stocks each year (labelled as groups A, B, and C in next box) • STAR process for all assessed species, each year	• Year 1 survey info used in Y3 fishing for stock group A • Y1-2 survey info used in Y4 fishing for stock group B • Y1-3 survey info used in Y5 fishing for stock group C	• 7 months for Council staff and committees work on NEPA/RFA, SAFE documents • Less overall Council time for issues other than specifications	• 2 months for implementation, inadequate • Less overall NMFS time for issues other than specifications	• Start date the same, process same, so little/no industry adjustment • Less Council/NMFS time to work on other industry issues
2. 3-meeting, biennial process, 3/1 start. PFMC meets April (proposed ABC/OY), June (final ABC/OY, proposed management), and Sept (final management) Fishing year starts March 1	• Stock assessments could occur Jan- Mar of following Y • All stocks assessed every other year with STAR or STAR-lite review • Intervening years have STAR process for models, new overfished spp.	• Year 1 survey info used in Y4-5 fishing for all stocks • Y2 survey info used in Y6-7 fishing • Y3 survey info used in Y6-7 fishing	• 11-19 months for Council staff and committees work on NEPA/RFA, SAFE documents • More time for issues other than specifications • Inseason adjustments for last 3 months made at Nov meeting. • Conflict with salmon management schedule	• 5.5 months for implementation, adequate • More NMFS time for issues other than specifications	• Change in fishing year requires business planning changes for industry • 2-year process, possible early closures if limits not controlled • More Council/ NMFS time to work on other industry issues • Fishing based on older data than in options A, B, E, F
3. 3-meeting, biennial process, 1/1 start. PFMC meets Nov (proposed ABC/OY), April (final ABC/OY, proposed management), and June (final management) Fishing year starts Jan 1	• Stock assessments occur Jan-Oct • All stocks assessed every other year with STAR or STAR-lite review • Intervening years have STAR process for models, new overfished spp.	• Year 1 survey info used in Y4-5 fishing for all stocks • Y2 survey info used in Y6-7 fishing • Y3 survey info used in Y6-7 fishing	• 14 months for Council staff and committees work on NEPA/RFA, SAFE documents • More time for issues other than specifications • Conflict with salmon management schedule	• 6.5 months for implementation, adequate time • More NMFS time for issues other than specifications	• Start date the same • 2-year process, possible early closures if limits not controlled • Fishing based on older data than in options A, B, E, F • More Council/ NMFS time to work on other industry issues

Alternative	Science Process *Stock assessments occur Jan-May needed for all options. Different schedule indicated when more time available.*	Data/Stock Assessment Use *May not survey all stocks in all years. Y1 survey data used in Y2 assessment process.*	Council Process *Council process and workload more or less burdensome depending on whether 2- or 3-meeting process*	NMFS Process * 5 months minimum needed for proposed rule, comment period and response time*	Industry Needs/Effects *Where process is 2-years, discipline is needed in 1st fishing year to not push limits higher in Council process – otherwise fewer fish available for 2nd year, possible early closures
4. 3-meeting, biennial process, 5/1 start. PFMC meets June (proposed ABC/OY), Sept. (final ABC/OY, proposed management), and Nov. (final management) Fishing year starts May 1	• All stocks assessed every other year with STAR or STAR-lite review • Intervening years have STAR process for models, new overfished spp. • Database adjusting for change in fishing year	• Year 1 survey info used in Y3-4 fishing for all stocks • Y2 survey info used in Y5-6 fishing • Y3 survey info used in Y5-6 fishing	• 9 months for Council staff and committees work on NEPA/RFA, SAFE documents • More time for issues other than specifications • Inseason adjustments in Nov. and March possibly ill-timed for May 1 fishery start • Re-evaluation of whiting and fixed gear sablefish season management required	• 6 months for implementation, adequate • More NMFS time for issues other than specifications	• Change in fishing year requires business planning changes for industry • 2-year process, possible early closures if limits not controlled • 5/1 fishery start conflicts with current whiting and fixed gear sablefish seasons, interrupts Lenten marketing period. • More Council/ NMFS time to work on other industry issues
5. 2-meeting, biennial process, 3/1 start. PFMC meets June (proposed) and Sept (final), Fishing Year starts March 1	• All stocks assessed every other year with STAR-lite • Intervening years have STAR process for models, new overfished spp. • Database adjusting for change in fishing year	• Year 1 survey info used in Y3-4 fishing for all stocks • Y2 survey info used in Y5-6 fishing • Y3 survey info used in Y5-6 fishing	• 9 months for Council staff and committees work on NEPA/RFA, SAFE documents • More time for issues other than specifications • Inseason adjustments for last 2-3 months made at Nov meeting	• 5.5 months for implementation, adequate • More NMFS time for issues other than specifications	• Change in fishing year requires business planning changes for industry • 2-year process, possible early closures if limits not controlled • More Council/ NMFS time to work on other industry issues

2.3 Alternatives Eliminated from Detailed Study

During its initial meetings, the Multi-Year Management Committee discussed several variations on the options listed above:

Multi-Year Management for Periods Longer Than Two Years. Of the five options listed above, one would continue the annual management cycle and four would move the Council to biennial specifications and management measures. The Committee discussed management cycles ranging from one to five years in duration. These discussions revealed that setting the length of the management cycle would be a delicate balance between ensuring the use of the best and most recently available scientific information and allowing cycle participants adequate time to discuss and absorb this scientific information and its implications for management. Under the current annual cycle, processing and review of data must occur at a fairly swift pace, using scientific personnel time and resources that might otherwise be dedicated to stock assessments and advanced modeling. Thus, the annual cycle tends to allow participating scientists to assess about one-third of all assessed stocks in any one year. As a result, each year's management cycle uses the most recently available information for one-third of assessed stocks. Discussions between the Committee and stock assessment scientists about timing of assessments and data availability led the Committee to conclude that a two-year management cycle would allow participating scientists more time to process and review data from the stock surveys and then more time to complete stock assessments for setting specifications and management measures. Three- to five- year cycles would have lengthened the scientific process further, but the longer cycles would have also resulted in managers using "older" data in setting harvest levels. The Committee determined that the benefits of a longer assessment and analysis period were outweighed by the need to use the best available scientific information in support of the management process.

Changing Council Meeting Dates. During its initial discussions, the Committee looked at different ways of addressing the scheduling needs of the scientific process (processing and reviewing data from resource surveys through to completed assessments) and the public notice and comment process (NMFS publication of proposed and final rules in the Federal Register). In addition to considering changing the duration of the management cycle, the fishing year start date, and the Council meetings at which discussion and decision occur, the Committee also looked at changing the dates of Council meetings to better incorporate the scientific process and the notice and comment process. For example, the Committee considered whether the process could be better served by moving the July Council meeting to June, or by moving the September and November meetings to early August and October. Ultimately, the Committee set aside these considerations for two logistical reasons. First, the current Council meeting schedule of five meetings per year held in March, April, June, September, and November is based on the management needs of a variety of fisheries (groundfish, salmon, coastal pelagic species, highly migratory species, halibut). Historically, the September and November meetings have been dominated by groundfish issues, thus the timing of those meetings could have been more flexible with changes to groundfish management needs. March and April meetings, however, are strictly timed with salmon season management and timing for those meetings could not be made flexible to accommodate groundfish management needs. The Committee was uncomfortable with the potential ripple effects of changing Council meeting dates on the management of species other than groundfish. Second, Council meeting dates must be set several years in advance to ensure meeting location reservations adequate for the large number of Council meeting participants. Even if the Committee had wanted to forward an alternative meeting schedule for public consideration, the Council and NMFS would not have been able to fully implement such an alternative for three to four years. The Committee felt that there were sufficient alternatives for addressing their goals in taking a new look at the management process without having to also address the complications of meeting logistics.

3.0 AFFECTED ENVIRONMENT

This section of the document describes the existing fishery and the resources that would be affected by this action. The physical environment is discussed in Section 3.1, the biological characteristics of the groundfish stocks and non-groundfish stocks interacting with the groundfish fishery are discussed in Section 3.2, and the socio-economic environment is discussed in Section 3.3.

3.1 PHYSICAL ENVIRONMENT

California Current System. In the North Pacific Ocean, the large, clockwise-moving North Pacific Gyre circulates cold, sub-arctic surface water eastward across the North Pacific, splitting at the North American continent into the northward-moving Alaska Current and the southward-moving California Current. Along the U.S. West Coast, the surface California Current flows southward through the U.S. West Coast EEZ, the management area for the groundfish FMP. The California Current is known as an eastern boundary current, meaning that it draws ocean water along the eastern edge of an oceanic current gyre. Along the continental margin and beneath the California Current flows the northward-moving California Undercurrent. Influenced by the California Current system and coastal winds, waters off the U.S. West Coast are subject to major nutrient upwelling, particularly off Cape Mendocino (Bakun, 1996). Shoreline topographic features such as Cape Blanco, Point Conception and bathymetric features such as banks, canyons, and other submerged features, often create large-scale current patterns like eddies, jets, and squirts. Currents off Cape Blanco, for example, are known for a current "jet" that drives surface water offshore to be replaced by upwelling sub-surface water (Barth, et al, 2000). One of the better-known current eddies off the West Coast occurs in the Southern California Bight, between Point Conception and Baja California (Longhurst, 1998), wherein the current circles back on itself by moving in a northward and counterclockwise direction just within the Bight. The influence of these lesser current patterns and of the California Current on the physical and biological environment varies seasonally (Lynn, 1987) and through larger-scale climate variation, such as El Niño-La Niña or Pacific Decadal Oscillation (Longhurst, 1998).

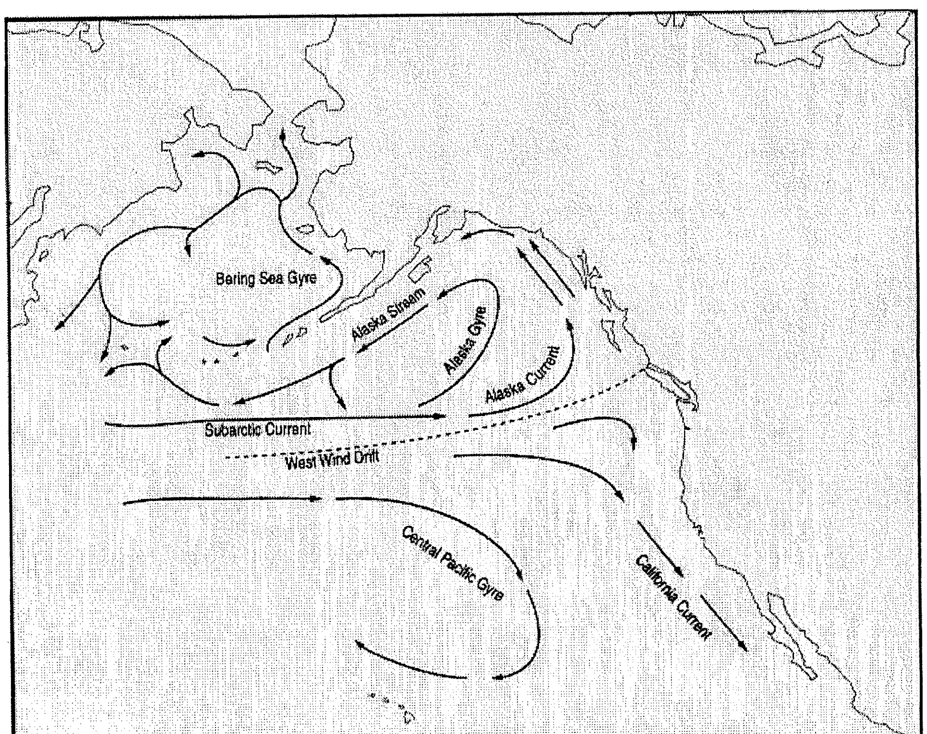


Figure 3.1.1 General circulation and major current systems of the North Pacific Ocean.
Source: NMFS

Topography. Physical topography off the U.S. West Coast is characterized by a relatively narrow continental shelf. The 200 m depth contour shows a shelf break closest to the shoreline off Cape Mendocino, Point Sur, and in the Southern California Bight and widest from central Oregon north to the Canadian border as well as off Monterey Bay. Deep submarine canyons pocket the EEZ, with depths greater than 4,000 m are common south of Cape Mendocino. See Figure 3.1.2.

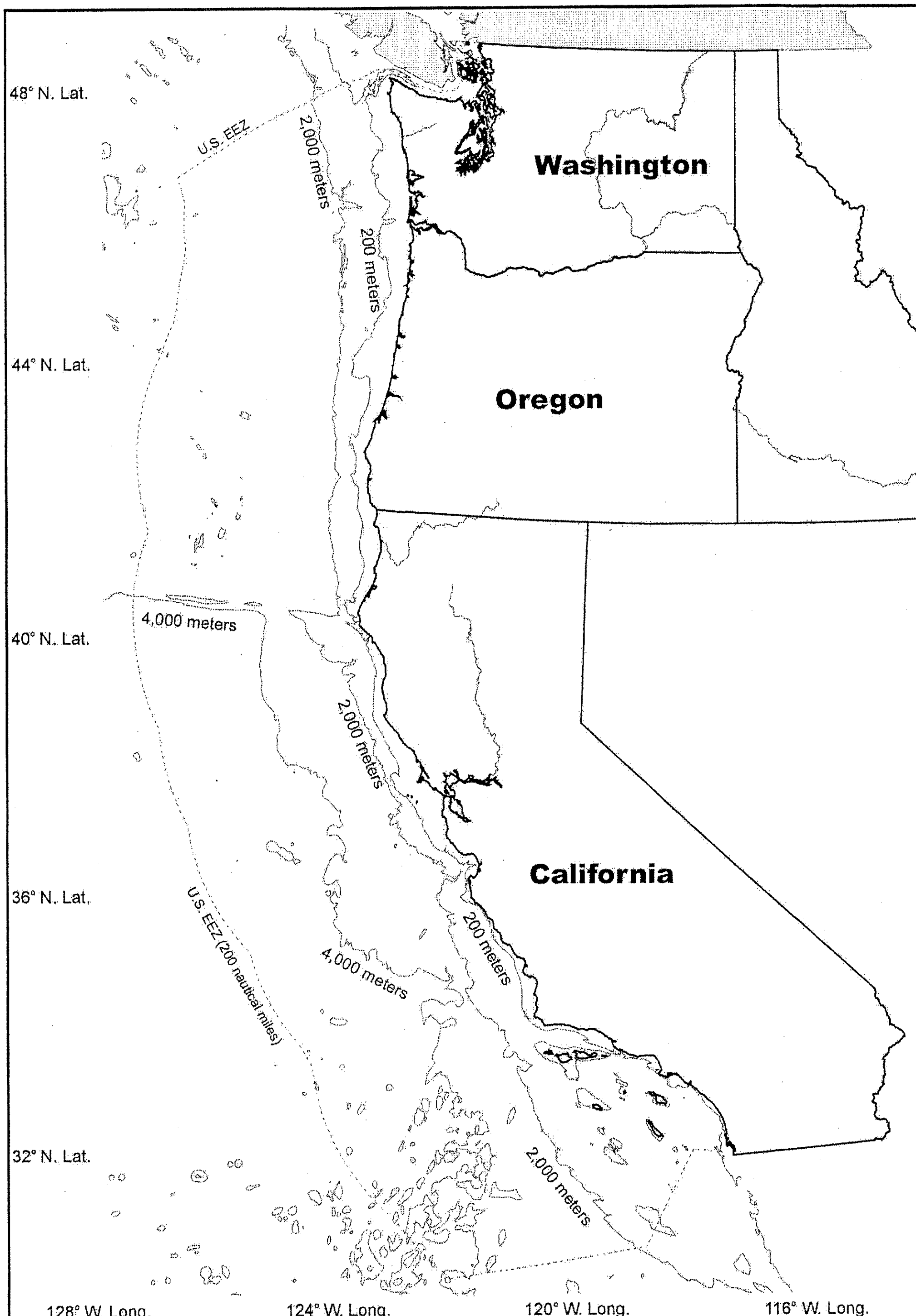


Figure 3.1.2 Bathymetric map of the U.S. West Coast EEZ; 200 m, 2000 m, and 4000 m contours shown.

Climate and Temperature Regime.

##Pacific Decadal Oscillation and El Niño/La Niña: Mantua et al (1997), Francis, et al (1998), 2002 Mantua & Hare article, Helser on whiting and El Niño? Evidence of effects of PDO on rockfish?##

Essential Fish Habitat. The 80+ groundfish species managed by the FMP occur throughout the EEZ and occupy diverse habitats at all stages in their life histories. Some species are widely dispersed during certain life stages, particularly those with pelagic eggs and larvae; the essential fish habitat (EFH) for these species/stages is correspondingly large. On the other hand, the EFH of some species/stages may be comparatively small, such as that of adults of many nearshore rockfishes which show strong affinities to a particular location or type of substrate.

EFH for Pacific coast groundfish is defined as the aquatic habitat necessary to allow for groundfish production to support long-term sustainable fisheries for groundfish and for groundfish contributions to a healthy ecosystem. Descriptions of groundfish fishery EFH for each of the 80+ groundfish species and their life stages result in over 400 EFH identifications. When these EFHs are taken together, the groundfish fishery EFH includes all waters from the mean higher high water line, and the upriver extent of saltwater intrusion in river mouths, along the coasts of Washington, Oregon, and California seaward to the boundary of the U.S. EEZ.

The FMP groups the various EFH descriptions into seven major habitat types called "composite" EFHs. This approach focuses on ecological relationships among species and between the species and their habitat, reflecting an ecosystem approach in defining EFH. The seven "composite" EFH identifications are as follows:

1. Estuarine - Those waters, substrates and associated biological communities within bays and estuaries of the EEZ, from mean higher high water level (MHHW, which is the high tide line) or extent of upriver saltwater intrusion to the respective outer boundaries for each bay or estuary as defined in 33 CFR 80.1 (Coast Guard lines of demarcation).

2. Rocky Shelf - Those waters, substrates, and associated biological communities living on or within ten meters (5.5 fathoms) overlying rocky areas, including reefs, pinnacles, boulders and cobble, along the continental shelf, excluding canyons, from the high tide line MHHW to the shelf break (~200 meters or 109 fathoms).

3. Nonrocky Shelf - Those waters, substrates, and associated biological communities living on or within ten meters (5.5 fathoms) overlying the substrates of the continental shelf, excluding the rocky shelf and canyon composites, from the high tide line MHHW to the shelf break (~200 meters or 109 fathoms).

4. Canyon - Those waters, substrates, and associated biological communities living within submarine canyons, including the walls, beds, seafloor, and any outcrops or landslide morphology, such as slump scarps and debris fields.

5. Continental Slope/Basin - Those waters, substrates, and biological communities living on or within 20 meters (11 fathoms) overlying the substrates of the continental slope and basin below the shelf break (~200 meters or 109 fathoms) and extending to the westward boundary of the EEZ.

6. Neritic Zone - Those waters and biological communities living in the water column more than ten meters (5.5 fathoms) above the continental shelf.

7. Oceanic Zone - Those waters and biological communities living in the water column more than 20 meters (11 fathoms) above the continental slope and abyssal plain, extending to the westward boundary of the EEZ.

Life history and habitat needs for the 82 species managed under the FMP are described in the EFH appendix to Amendment 11, which is available online at http://www.nwr.noaa.gov/1sustfsh/efhappendix/page1.html.

3.2 BIOLOGICAL ENVIRONMENT

3.2.1 Groundfish Stock Assessments; Resource Surveys and Biology of the stocks

Data from resource surveys are combined with information derived from life-history studies and commercial landing statistics to calibrate models of groundfish population dynamics. These models are used to generate estimates of current abundance and fishing mortality levels, identify trends in abundance, and predict sustainable annual harvest levels for groundfish populations (Figure 3.2.2). The Pacific Fishery Management Council considers output from the models when it establishing ABCs and setting annual harvest levels.

Stock Assessments
Stock assessments for Pacific Coast groundfish are generally conducted by staff scientists of the California Department of Fish and Game (CDFG), Oregon Department of fish and Wildlife (ODFW), Washington Department of Fish and Wildlife (WDFW), Oregon State University (OSU), University of Washington (UW) and the Southwest, Northwest, and Alaska Fisheries Science Centers of NMFS. The purpose of groundfish stock assessments is to describe the condition or status of a particular stock. The result of a stock assessment is typically a report on the health of the stock, a forecast of biologically sustainable harvest levels, and/or other recommendations that would maintain or restore the stock. If a stock is determined to be in an overfished condition (less than 25% of its unfished biomass), a rebuilding analysis and a rebuilding plan are developed.

Over the past 20+ years, groundfish assessments have primarily been concentrated on important commercial and recreational species. These species account for most of the historical catch and have been the targets of fishery monitoring and resource survey programs that provide basic information for quantitative stock assessments. However, not all groundfish assessments have the same level of information and precision.

Quantitative and non-quantitative assessments are used for groundfish stocks. The stocks with quantitative assessments are those for which there are sufficient data. These stock assessments are conducted by using the life history data to build a biologically realistic model of the fish stock, and calibrating this model so that it reproduces the observed fishery and survey data as closely as possible. During the 1990s, most West Coast groundfish assessments were conducted using the stock synthesis model. Recently there has been development of similar, but more powerful, models using state-of-the-art software tools. Assessment models and results are independently reviewed by the Council's Stock Assessment Review (STAR) panels. It is the responsibility of the STAR panels to review draft stock assessment documents and relevant information to determine if they use the available scientific data effectively to provide a good quality assessment of the condition of the stock. In addition, the STAR panels review the assessment documents to see that they are sufficiently complete and that the research needed to improve assessments in the future is identified. (Table 3.2.1) 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 that the assessment results are as accurate and error-free as possible.

Following review of assessment models by the STAR panels and subsequently the Groundfish Management Team (GMT) and Scientific and Statistical Committee (SSC), the GMT uses the reviewed assessments to recommend preliminary ABCs and OYs to the Council. The SSC comments on the STAR review results and the GMT recommendations. Biomass estimates from an assessment may be for a single year or they may be the average of the

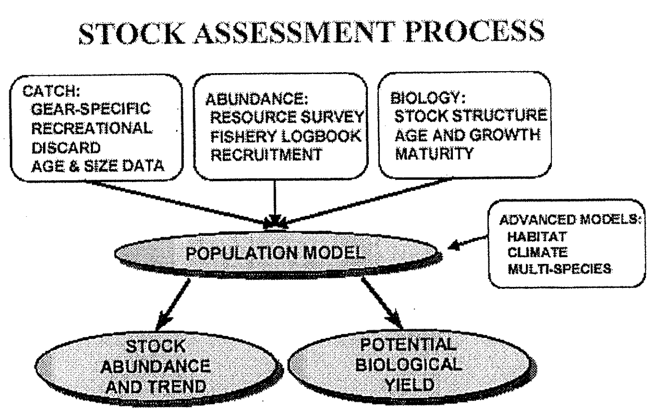


Figure 3.2.2 - Pacific Coast Groundfish Stock Assessment Process (NWFSC Research Plan)

present and several future years. In general, an ABC will be calculated by applying the appropriate harvest policy (MSY proxy) to the best estimate of current biomass. ABCs based on quantitative assessments remain in effect until revised by either a full or partial assessment.

Full assessments provide information on the abundance of the stock relative to historical and target levels, and provide information on current potential yield. Partial assessments do not have enough data to provide for a full assessment. Within the range of full assessments, there is a wide range of data availability and resulting assessment certainty. Approximately ## three to six full assessments ## are conducted each year; ##26## species have been assessed (with varying degrees of completeness and precision). Several species are assessed approximately every three to four years, however some have been assessed only once, and only Pacific whiting is examined annually (both partial and full assessments are used for whiting) .

Stocks with ABCs set by non-quantitative assessments typically do not have a recent, quantitative assessment, but there may be a previous assessment or some indicators of the status of the stock. Detailed biological information is not routinely available for these stocks, and ABC levels have typically been established on the basis of average historical landings. Typically, the spawning biomass, level of recruitment, or the current fishing mortality rates are unknown.

Many species have never been assessed and lack the data necessary to conduct even a qualitative assessment (i.e., is trend up, down or stable?). ABC values have been established for only about ##26 stocks##. The remaining species are incidentally landed and usually are not listed separately on fish landing receipts. Information from fishery independent surveys are often lacking for these stocks, because of their low abundance or they are not vulnerable to survey sampling gear. Precautionary measures continue to be taken when setting harvest levels (the OYs) for species that have no or only rudimentary assessments. Since implementation of the 2000 specifications, ABCs have been reduced by 25 percent to set OYs for species with less rigorous stock assessments, and by 50 percent to set OYs for those species with no stock assessment. At-sea observer data is expected to be available for use in the near future to upgrade the assessment capability or evaluate their overfishing potential for these stocks. Interim ABC values may be established for these stocks based on qualitative information.

The accuracy and reliability of various data used in assessments as well as on the scientific assumptions that the assessments are based on, need to be further analyzed to improve the quality of forecasts. Further analysis of issues such as uncertainty associated with fishery logbook data, calibration of surveys, and accuracy of aging techniques are also needed. In addition, information on ecosystem change and its influence on groundfish abundance is needed. Specific stock assessment areas that have been identified as needing improvement include: develop models to better quantify uncertainty and aid communication/ implementation of precautionary approach; develop models to specifically aid in the assessment of species with limited data; improve standardization of assessment methods and conduct a formal review of these methods so that the subsequent review of each species' assessment can be shortened, which could allow more assessments to be reviewed each year; develop models to better represent spatially-structured populations, e.g., populations with low rates of internal mixing or populations with ontogenetic patterns spanning a range of habitats. ##ecosystem modeling##

Table 3.2.1. Research Needs Identified by Pacific Coast Groundfish Assessments Scientists

Species	Assemeblage	Data needs Identified by Assessment Scientists
ROUNDFISH		
Lingcod	Shelf	* Improve age structure sample size in all areas * More frequent fishery independent surveys
Pacific Cod	Shelf	
Pacific Whiting	Mid-water	* Would benefit from increased survey observations
Sablefish	Deep Slope	* Would benefit from increased survey observations * Need understanding of survey gear selectivity & catchability * May benefit from ichthyoplankton surveys * Would benefit from additional tagging studies * Discard data needed * More biological samples from commercial catches
FLATFISH		

Dover sole	Deep Slope	* Additional research on age & growth to reduce variability * Need to examine depth strata data * Discard data needed
English sole	Nearshore	* Need more age, maturity & length data * Need recent fecundity data * Additional research on aging needed * More biological samples from commercial catches * Shelf survey designed for rockfish not flatfish
Petrale sole	Nearshore	* Genetic identity of stock * More biological samples from commercial catches * Need otoliths from juvenile fish taken in survey catches * Discard data needed * Need understanding of survey gear selectivity & catchability
Arrowtooth flounder	Shelf, Slope	* Discard data needed * Need reliable measure of abundance * Shelf survey designed for rockfish not flatfish * Need to validate aging methods
Other flatfish	Nearshore, Shelf, Slope	
ROCKFISH		
POP	Slope	* Further age analysis * Need further analysis of unfished biomass
Shortbelly	Shelf	* Further work on year class strength & life history needed
Widow	Shelf	* Need reliable measure of abundance * Discard data needed * Genetic idenity of stock needed * Need more age, maturity & length data
Canary	Shelf	* Determine why there is an absence of older females in survey data * Better understanding of survey gear selectivity & catchability * Evaluate spawner-recruit relationships * At-sea observer data needed * Identify habitat and distribution * Expand assessment area to include Canada * Need pre-recruit surveys
Chilipepper	Shelf	* Would benefit from increased survey observations
Bocaccio *	Shelf	* Review natural mortality assumptions * Examine geographic relationships
Splitnose	Slope	* Need more age, maturity & length data * Need at-sea discard data * Commercial fishery landings by species needed
Yellowtail	Shelf	* Age and maturity data needs to be updated * Better understanding of survey gear selectivity & catchability * Genetic identity of stocks needed
Shortspine thornyhead	Deep Slope	* XXXXXXXXXXXXXX
Longspine thornyhead	Deep Slope	* XXXXXXXXXXXXXX
Darkblotched	Slope	* Better commercial fishery landings by species * Discard data needed * Need more fishery and survey age, maturity & length data * Genetic identity of stocks needed * Better understanding of survey gear selectivity & catchability
Yelloweye	Shelf	* Need more age, maturity & length data * Identify habitat and distribution * Develop fishery independent indices * Need reliable method to measure of abundance
Cowcod	Shelf	* Need to validate aging methods * Identify habitat and distribution

Remaining Rockfish	All	* XXXXXXXXXXXXXX
bank	Slope (Mid-water)	* Commercial fishery landings by species needed * More commercial fishery age & length data * Need discard data * Better documentation of recreational catch * Need reliable index of recruitment
black	Nearshore	* XXXXXXXXXXXXXX
blackgill	Slope	* XXXXXXXXXXXXXX
OTHER FISH	All	

Resources Surveys
Normally a resource survey is implemented as a long-term, ongoing index to track natural and anthropogenic changes in fish abundance. In some cases, a single survey or a short time series can be directly calibrated to absolute abundance. An annual survey will most closely track natural biological fluctuations and smooth out apparent fluctuations caused by environmental effects on catchability.

For the purpose of conducting resource surveys, the groundfish species can be roughly broken into six assemblages based upon their adult habitat and co-occurrence in the fishery. _Midwater species_ are semipelagic schooling species such as Pacific whiting and shortbelly rockfish. These species can be surveyed with acoustic methods. _Deep slope species_ primarily includes sablefish, Dover sole, shortspine thornyhead, longspine thornyhead, and Pacific grenadier. They are found mostly on trawlable habitat on the shelf break and continental slope extending out to at least 1500m bottom depth. Most of these species recruit on the shelf and gradually move into deeper water as they age. _Shelf species_ include 30 rockfish species, lingcod, and Pacific cod. These species occur on the continental shelf. Many species are found over rocky habitat, and some species have significant off-bottom tendencies. _Slope rockfish species_ includes nine rockfish species found on the upper continental slope. _Nearshore rockfish species_ include 13 rockfish species and a few other species. They are found mostly in high relief habitat. _Nearshore flatfish species_ include 11 flatfish species that are found on trawlable, sand-mud habitat on the continental shelf.

Long term groundfish survey efforts include: 1) _Acoustic and midwater trawl survey_ - a coastwide survey that is conducted triennially (1977-2001) for Pacific whiting. Recent surveys have been coordinated with the Canadian acoustic survey to assure adequate coverage in northern areas. 2) _Shelf survey_ - a bottom trawl survey conducted triennially (1977-##1998 ##) in midsummer, sufficient coastwise coverage for most target species but did not cover south of Point Conception until ##2000##; survey covers the 30-275 fathoms range of bottom depths using two large (125 foot) chartered vessels. 3) _Slope survey_ - a bottom trawl survey conducted near annual in mid-autumn, covers 100-700 fathom range of bottom depth. Survey was started in 1998 and 1999. 4) _Nearshore survey_ - these are SCUBA and hook&line surveys for various nearshore rockfish off California and are conducted by California Department of Fish and Game (CDFG). 5) _mark-recapture survey_ for black rockfish and lingcod by Washington Department of Fish and Wildlife (WDFW). 6) _Shelf rockfish recruitment survey_ - midwater trawl survey off Central California by Southwest Fisheries Science Center (SWFSC) for age 0 rockfish. 7) _Multi-species - multi-disciplinary oceanographic and egg and larvae survey_ off southern California (California Cooperative Oceanographic Fisheries Investigation (CalCOFI)) which is currently conducted quarterly. NWFSC has indicated that further development of resource surveys is needed to provide an index of spawning biomass. Increasing the number of surveys and geographic scope would provide information about distribution, abundance, and age structure of many groundfish populations. ## identify more recent survey efforts ##

The West Coast Groundfish Research Plan identifies the following areas where further resources could be used to improve the accuracy and precision of stock assessments: development of survey methods for each of the groundfish assemblages and for each region of the coast; determine potential improvement in survey accuracy by stratifying survey effort on finer habitat features; evaluate alternative survey methodologies including egg and larval, mark recapture, hook and line, and visual; improve tracking of natural fluctuations in Pacific whiting abundance and US Canada distribution by increasing frequency of whiting acoustic survey (currently triennial); improve time series data on recruitment of groundfish species; determine relative value of alternative indexes of abundance, especially off southern California where sanitation district trawl surveys, power plant impingement data, and egg and larval surveys may have useful information for some groundfish; direct calibration of surveys; direct observation of fish density using visual & laser methods; investigate catchability characteristics of sampling methods, in particular fish behavior in response to sampling gear, and environmental effects on fish-gear interactions.

Life history and stock distribution
Biological data is necessary for accurate stock assessments and other fishery evaluations. This includes basic biological information such as stock structure, age composition, growth, and reproduction. Currently, stock distribution and movement information for egg, larval, juvenile, and adult life stages is determined from plankton surveys, fishery resource assessment surveys, fishery logbooks, and tagging studies. Genetic characteristics and species' population structure has been investigated for a few major groundfish species using mapping, genetics, morphology, parasites, microconstituents and other methods. "Production ageing" of fishery and survey specimens for major species is done to determine patterns in recruitment and enable age-based assessment methods. Validation of ageing methods via radiometric, tag-recapture, other techniques are used.

To further improve the base biological data used in assessments, scientists at the NWFSC have identified the following areas where resources are needed for improvement: age-specific growth and reproduction (maturity and fecundity) for more species; new methods to estimate natural mortality rates; genetic examination of stock structure for more species with high probabilities of having separate distinct populations; degree of mixing between and within populations; temporal and spatial trends in growth and maturation; life-history data on fish health and fitness (e.g., disease, parasite loads, bioenergetic indicators such as lipid and protein content).

Fishery mortality
Total fishery catch is needed so that stock assessment models can correctly separate fishing from natural causes of changes in fish abundance, and so that the effectiveness of current regulations can be determined. Data needed on an ongoing basis includes: timely estimates of total commercial and recreational catch for each species by each gear, location, and time stratum; information on bycatch, discards, and mortality of discarded bycatch; biological characteristics (age and size composition) of the catch; standardized measurement of fishing effort and catch-per-effort to complement; fishery-independent resource survey data; geographic distribution of catch and effort.

Currently landed commercial catch is monitored shoreside by the states and PSMFC with coastwide data access through PacFIN data system. The basic program is based upon comprehensive mandatory commercial landing receipts to determine landed catch, and biological samples by port biologists to determine species composition of each market category, and to collect size and age data. The growing nearshore commercial groundfish fisheries, including the live rockfish fishery, are monitored by state programs. Recreational fishery catch is estimated from interviews and other statistical sampling methods. There are state programs and the federal Marine Recreational Fisheries Statistics (MRFSS) program to estimate recreational catch. The catch made by or delivered to the at-sea whiting processors is monitored by voluntary observers trained by the West Coast observer program. In 2001, the NWFSC began placing at-sea observers on commercial vessels to monitor discarded catch, sample for catch composition, and collect biological data.

Trawl logbooks have been used to collect tow by tow data on trawl fishing effort and retained catch. Data from the three state programs are now mirrored in PacFIN. Statistical analyses to standardize fishing effort over time and between vessels have been conducted by NMFS and academic researchers. Commercial Passenger Fishing Vessels (head boats) have a logbook program in California that has been used in some stock assessments. Logbooks exist for some nontrawl commercial gears in some states, but no computerized database or concerted effort at standardization or compliance.

3.2.2 Stock Status For Pacific Coast Groundfish Species
Each fishing year, the Council uses the best available stock assessment data to evaluate the biological condition of the Pacific Coast groundfish fishery and to develop estimates of ABCs for major groundfish stocks. The ABCs are biologically based estimates of the amount of fish that may be harvested from the fishery each year without jeopardizing the resource. The ABC may be modified to incorporate biological safety factors and risk assessment due to uncertainty.

The ABC for a species or species group is generally derived by multiplying the harvest rate proxy (F_{MSY} proxy) by the exploitable biomass. When setting the 2002 ABCs, the Council maintained a policy of using a default harvest rate as a proxy for the fishing mortality rate (F_{MSY} proxy) that is expected to achieve the maximum sustainable yield. Harvest rate policies must account for several complicating factors, including the age and size at which individuals in a stock reach maturity, the relative fecundity of mature individuals over time, and the optimal stock size for the highest level of productivity within that stock. Default harvest rate proxies recommended by the Council's Scientific and Statistical Committee (SSC) in 2001 (66 FR 2338, January 11, 2001) continued to be used in 2002. These recommended harvest rate proxies are: F40% for flatfish and whiting, F50% for rockfish (including thornyheads), and F45% for other groundfish such as sablefish and lingcod.

Each year for the species or species groups that the Council proposes to manage, harvest levels or OYs are established. Groundfish species and species groups with OYs include bocaccio, canary rockfish, chilipepper rockfish, cowcod, darkblotched rockfish, Dover sole, lingcod, longspine thornyhead, the minor rockfish complexes (northern and southern for nearshore, continental shelf, and continental slope species), Pacific cod, Pacific ocean perch (POP), Pacific whiting, sablefish, shortbelly rockfish, shortspine thornyhead, splitnose rockfish, widow rockfish, yelloweye rockfish and yellowtail rockfish. Numerical OYs are not set for every stock, especially where harvest has been less than ABC.

The Magnuson-Stevens Act requires an FMP to prevent overfishing. Overfishing, is defined in the National Standards Guidelines (63 FR 24212, May 1, 1998) as exceeding the fishing mortality rate needed to produce the maximum sustainable yield. The OY harvest levels are set at levels that are expected to prevent overfishing, equal to or less than the ABCs. The term "overfished" describes a stock whose abundance is below its overfished/rebuilding threshold. Overfished/rebuilding thresholds in general, are linked to the same productivity assumptions that determine the ABC levels. The default value of this threshold is 25% of the estimated unfished biomass level or 50% of B_{msy}, if known. Nine groundfish species are below the overfishing threshold in 2002: bocaccio, canary rockfish, cowcod (south of Point Conception), lingcod, Pacific whiting, POP, widow rockfish, and yelloweye rockfish.

Table 3.2.1, Summary of Stock Status For Pacific Coast Groundfish Species, summarizes the biological condition of the Pacific Coast groundfish stocks. More detailed information on the status of each of these species or species groups is available in the stock assessments associated with the annul SAFE report, as well as in the Environmental Assessment/Regulatory Impact Review/Initial Regulatory Flexability for Proposed Groundfish ABC and OY specifications and management measures for the 2002 Pacific Coast Groundfish Fishery. These documents are available from the Council office.

Table 3.2.2. Summary of Stock Status For Pacific Coast Groundfish Species

Species	Year of Most Recent Stock Assessment	Biomass Estimate (Percent of unfished)	Did overfishing Occur in 2001? Was the fishing mortality above the MSST[1]?	Is the stock overfished in 2001? Was the Biomass below the MSST threshold?
ROUNDFISH				
Lingcod	2001 revision	15%	No	Yes
Pacific Cod			Unknown	Unknown
Pacific Whiting	2002	24%	Yes	Yes
Sablefish	2001	27%-38%	No	No
FLATFISH				
Dover sole	2001	29%	No	No
English sole	1993		Unknown	Unknown
Petrale sole	1999	42%	Unknown	Unknown
Arrowtooth	1993		No	No
Other flatfish			Unknown	Unknown
ROCKFISH				
Pacific Ocean	2000	XXX ? XXX	No	Yes
Shortbelly	1989	>40%	No	No
Widow	2000	24%	No	Yes

Canary	1999	22% North 8% South	No	Yes
Chilipepper	1998	46%-61%	No	No
Bocaccio *	1999	2% South	No	Yes
Splitnose	1994		Unknown	Unknown
Yellowtail	2000	63%	No	No
Shortspine	2001	25%-50%	No	No
Longspine	1998	>40%	No	No
Darkblotched	2000	12%	No	Yes
Yelloweye	2001	7%	No	Yes
Cowcod *	1999	4%-11%	No	Yes
bank	XXX ? XXX		No	No
black	1999 & 2001 [2]	35% [2]	No	No
blackgill	1998	51%	Unknown	Unknown
redstripe			Unknown	Unknown
sharpchin			Unknown	Unknown
silvergrey			No	Unknown
yellowmouth			Unknown	Unknown
Other rockfish			Unknown	Unknown
OTHER FISH			Unknown	Unknow

1) MSST-- The minimum stock size threshold (overfished/rebuilding threshold) is the default value of 25% of the estimated unfished biomass level or 50% of B_{msy}, if known.
2) 2001 update was completed for Oregon only

3.2.3 Groundfish Resources

The Pacific Coast groundfish FMP manages over 80 species which are divided by type as follows: roundfish, flatfish, rockfish, sharks, skates, ratfish, morids, and grenadiers. These species, occur throughout the EEZ and occupy diverse habitats at all stages in their life history. Information on the interactions between the various groundfish species and between groundfish and non-groundfish species varies in completeness. While a few species have been intensely studied, there is relatively little information on most groundfish species

Roundfish

Lingcod (*Ophiodon elongatus*), a top order predator of the family Hexagrammidae, ranges from Baja California to Kodiak Island in the Gulf of Alaska. Lingcod is demersal at all life stages (Allen & Smith 1988, NOAA 1990, Shaw & Hassler 1989). Adult lingcod prefer two main habitat types: slopes of submerged banks 10-70 m below the surface with seaweed, kelp and eelgrass beds and channels with swift currents that flow around rocky reefs (Emmett et al. 1991, Giorgi & Congleton 1984, NOAA 1990, Shaw & Hassler 1989). Juveniles prefer sandy substrates in estuaries and shallow subtidal zones (Emmett et al. 1991, Forrester 1969, Hart 1973, NOAA 1990, Shaw & Hassler 1989). As the juveniles grow they move to deeper waters. Adult lingcod are considered a relatively sedentary species, but there are reports of migrations of greater than 100 km by sexually immature fish (Jagielo 1990, Mathews & LaRiviere 1987, Mathews 1992, Smith et al. 1990).

Mature females live in deeper water than males and move from deep water to shallow water in the winter to spawn (Forrester 1969, Hart 1973, Jagielo 1990, LaRiviere et al. 1980, Mathews & LaRiviere 1987, Mathews 1992, Smith et al. 1990). Mature males may live their whole lives associated with a single rock reef, possibly out of fidelity to a prime spawning or feeding area (Allen & Smith 1988, 298, Shaw & Hassler 1989). Spawning generally occurs over rocky reefs in areas of swift current (Adams 1986, Adams & Hardwick 1992, Giorgi 1981, Giorgi & Congleton 1984, LaRiviere et al. 1980). After the females leave the spawning grounds, the males remain in nearshore areas to guard the nests until the eggs hatch. Hatching occurs in April off Washington but as early as January and as late as June at the geographic extremes of the lingcod range. Males begin maturing at about 2 years (50 cm), whereas females mature at 3+ years (76 cm). In the northern extent of their range, fish mature at an older age and larger size (Emmett et al. 1991, Hart 1973, Mathews & LaRiviere 1987, Miller & Geibel 1973, Shaw & Hassler 1989). The maximum age for lingcod is about 20 years (Adams & Hardwick 1992).

Lingcod are a visual predator, feeding primarily by day. Larvae are zooplanktivores (NOAA 1990). Small demersal juveniles prey upon copepods, shrimps and other small crustaceans. Larger juveniles shift to clupeids and other small fishes (Emmett et al. 1991, NOAA 1990). Adults feed primarily on demersal fishes (including smaller lingcod), squids, octopi and crabs (Hart 1973, Miller & Geibel 1973, Shaw & Hassler 1989). Lingcod eggs are eaten by gastropods, crabs, echinoderms, spiny dogfish, and cabezon. Juveniles and adults are eaten by marine mammals, sharks, and larger lingcod (Miller & Geibel 1973, NOAA 1990)

Pacific Cod (*Gadus macrocephalus*) are widely distributed in the coastal north Pacific, from the Bering Sea to southern California in the east, and to the Sea of Japan in the west. Adult Pacific cod occur as deep as 875 m (Allen & Smith 1988), but the vast majority occurs between 50 and 300 m (Allen & Smith 1988, Hart 1973, Love 1991, NOAA 1990). Along the West Coast, Pacific cod prefer shallow, soft-bottom habitats in marine and estuarine environments (Garrison & Miller 1982), although adults have been found associated with coarse sand and gravel substrates (Palsson 1990, Garrison & Miller 1982). Larvae and small juveniles are pelagic; large juveniles and adults are parademersal (Dunn & Matarese 1987, NOAA 1990). Adult Pacific cod are not considered to be a migratory species. There is however a seasonal bathymetric movement from deep spawning areas of the outer shelf and upper slope in fall and winter to shallow middle-upper shelf feeding grounds in the spring (Dunn & Matarese 1987, Hart 1973, NOAA 1990, Shimada & Kimura 1994).

Pacific cod have external fertilization (Hart 1973, NOAA 1990) and spawning from late fall to early spring. Their eggs are demersal. Larvae may be transported to nursery areas by tidal currents (Garrison & Miller 1982). Half of females are mature by 3 years (55 cm), and half of males are mature by 2 years (45 cm) (Dunn & Matarese 1987, Hart 1973). Juveniles and adults are carnivorous, and feed at night (Allen & Smith 1988, Palsson 1990) with the main part of the adult Pacific cod diet being whatever prey species is most abundant (Kihara & Shimada 1988,Klovach et al. 1995). Larval feeding is poorly understood. Pelagic fish and sea birds eat Pacific cod larvae, while juveniles are eaten by larger demersal fishes, including Pacific cod. Adults are preyed upon by toothed whales, Pacific halibut, salmon shark, and larger Pacific cod (Hart 1973, Love 1991, NOAA 1990, Palsson 1990). The closest competitor of the Pacific cod for resources is the sablefish (Allen 1982).

Pacific Whiting (*Merluccius productus*), also known as Pacific hake, is a semi-pelagic merlucciid (a cod-like fish species) that range from Sanak Island in the western Gulf of Alaska to Magdalena Bay, Baja California Sur. They are most abundant in the California Current System (Bailey 1982, Hart 1973, Love 1991, NOAA 1990). Smaller populations of Pacific whiting occur in several of the larger semi-enclosed inlets of the northeast Pacific Ocean, including the Strait of Georgia, Puget Sound, and the Gulf of California (Bailey et al. 1982, Stauffer 1985). The highest densities of Pacific hake are usually between 50 and 500 m, but adults occur as deep as 920 m and as far offshore as 400 km (Bailey 1982, Bailey et al. 1982, Dark & Wilkins 1994, Dorn 1995, Hart 1973, NOAA 1990, Stauffer 1985). Hake school at depth during the day, then move to the surface and disband at night for feeding (McFarlane & Beamish 1986, Sumida & Moser 1984, Tanasich et al. 1991). Coastal stocks spawn off Baja California in the winter, then the mature adults begin moving northward and inshore, following food supply and Davidson currents (NOAA 1990). Hake reach as far north as southern British Columbia by fall. They then begin the southern migration to spawning grounds and further offshore (Bailey et al. 1982, Dorn 1995, Smith 1995, Stauffer 1985).

Spawning occurs from December through March, peaking in late January (Smith 1995). Pacific hake are oviparous with external fertilization. Eggs of the Pacific hake are neritic and float to neutral buoyancy (Baily 1981, Bailey et al. 1982, NOAA 1990). Hatching occurs in 5-6 days and within 3-4 months juveniles are typically 35 mm (Hollowed 1992). Juveniles move to deeper water as they get older (NOAA 1990). Females off mature at 3-4 years (34-40 cm,) and nearly all males are mature by 3 years (28 cm). Females grow more rapidly than males after four years; growth ceases for both sexes at 10-13 years (Bailey et al. 1982).

All life stages feed near the surface late at night and early in the morning (Sumida & Moser 1984). Larvae eat calanoid copepods, as well as their eggs and nauplii (McFarlane & Beamish 1986, Sumida & Moser 1984). Juveniles and small adults feed chiefly on euphausiids (NOAA 1990). Large adults also eat amphipods, squid, herring, smelt, crabs, and sometimes juvenile hake (Bailey 1982, Dark & Wilkins 1994, McFarlane & Beamish 1986, NOAA 1990). Eggs and larvae of Pacific hake are eaten by pollock, herring, invertebrates, and sometimes hake. Juveniles are eaten by lingcod, Pacific cod and rockfish species. Adults are preyed on by sablefish, albacore, pollock, Pacific cod, marine mammals, soupfin sharks and spiny dogfish (Fiscus 1979, McFarlane & Beamish 1986, NOAA 1990).

Sablefish (*Anoplopoma fimbria*) are abundant in the north Pacific, from Honshu Island, Japan, north to the Bering Sea, and southeast to Cedros Island, Baja California. There are at least three genetically distinct populations off the West Coast of North America: one south of Monterey characterized by slower growth rates and smaller average size, one that ranges from Monterey to the U.S./Canada border that is characterized by moderate growth rates and size, and one ranging off British Columbia and Alaska characterized by fast growth rates and large size. Large adults are uncommon south of Point Conception (Hart 1973, Love 1991, McFarlane & Beamish 1983a, McFarlane & Beamish 1983b, NOAA 1990). Adults are found as deep as 1,900 m, but are most abundant between 200 and 1,000 m (Beamish & McFarlane 1988, Kendall & Matarese 1987, Mason et al. 1983). Off southern California, sablefish were abundant to depths of 1500 m (MBC 1987). Adults and large juveniles commonly occur over sand and mud (McFarlane & Beamish 1983a, NOAA 1990) in deep marine waters. They were also reported on hard-packed mud and clay bottoms in the vicinity of submarine canyons (MBC 1987).

Spawning occurs annually in the late fall through winter in waters greater than 300 m (Hart 1973, NOAA 1990). Sablefish are oviparous with external fertilization (NOAA 1990). Eggs hatch in about 15 days (Mason et al. 1983, NOAA 1990) and are demersal until the yolk sac is absorbed (Mason et al. 1983). After yolk sac is absorbed, the age-0 juveniles become pelagic. Older juveniles and adults are benthopelagic. Larvae and small juveniles move inshore after spawning and may rear for up to four years (Boehlert & Yoklavich 1985, Mason et al. 1983). Older juveniles and adults inhabit progressively deeper waters. The best estimates indicate that 50% of females are mature at 5-6 years (24 inches), and 50% of males are mature at 5 years (20 inches).

Sablefish larvae prey on copepods and copepod nauplii. Pelagic juveniles feed on small fishes and cephalopods, mainly squids (Hart 1973, Mason et al. 1983). Demersal juveniles eat small demersal fishes, amphipods and krill (NOAA 1990). Adult sablefish feed on fishes like rockfishes and octopus (Hart 1973, McFarlane & Beamish 1983a). Larvae and pelagic juvenile sablefish are heavily preyed upon by sea birds and pelagic fishes. Juveniles are eaten by Pacific cod, Pacific halibut, lingcod, spiny dogfish, and marine mammals, such as Orca whales (Cailliet et al. 1988, Hart 1973, Love 1991, Mason et al. 1983, NOAA 1990). Sablefish compete with many other co-occurring species for food, mainly Pacific cod and spiny dogfish (Allen 1982).

Flatfish

Dover Sole (*Microstomus pacificus*) are distributed from the Navarin Canyon in the northwest Bering Sea and westernmost Aleutian Islands to San Cristobal Bay, Baja California (Hagerman 1952, Hart 1973, NOAA 1990). Dover sole are a dominant flatfish on the continental shelf and slope from Washington to southern California. Adults are demersal and are found from 9-1,450 m, with highest abundance below 200-300 m (Allen & Smith 1988). Adults and juveniles, show a high affinity toward soft bottoms of fine sand and mud. Juveniles are often found in deep nearshore waters. Dover sole are considered to be a migratory species. In the summer and fall, mature adults and juveniles can be found in shallow feeding grounds, as shallow as 55 m off British Columbia (Westrheim & Morgan 1963). By late fall, the Dover sole begin moving offshore into deep waters (400 m or more) to spawn. Although there is an inshore-offshore seasonal migration, little north-south coastal migration occurs (Westrheim & Morgan 1963)

Spawning occurs from November-April off Oregon and California (Hart 1973, NOAA 1990, Pearcy et al. 1977) in waters 80-550 m depth at or near the bottom (Hagerman 1952, Hart 1973, Pearcy et al. 1977). Dover sole are oviparous; fertilization is external. Larvae are planktonic, being transported offshore and to nursery areas by ocean currents and winds for up to two years. Settlement to benthic living occurs mid-autumn to early spring off Oregon, and February-July off California (Markle et al 1992). Juvenile fish move into deeper water with age, and begin seasonal spawning-feeding migrations upon reaching maturity.

Dover sole larvae eat copepods, eggs and nauplii, as well as other plankton. Juveniles and adults eat polychaetes, bivalves, brittlestars and small benthic crustaceans. Dover sole feed diurnally by sight and smell (Dark & Wilkins 1994, Gabriel & Pearcy 1981, Hart 1973, NOAA 1990). Dover sole larvae are eaten by pelagic fishes like albacore, jack mackerel and tuna, as well as sea birds. Juveniles and adults are preyed upon by sharks, demersally feeding marine mammals, and to some extent by sablefish (NOAA 1990). Dover sole compete with various eelpout species, rex sole, English sole, and other fishes of the mixed species flatfish assemblage (NOAA 1990).

English Sole (*Parophrys vetulus*) are found from Nunivak Island in the southeast Bering Sea and Agattu Island in the Aleutian Islands, to San Cristobal Bay, Baja California Sur (Allen & Smith 1988). In research survey data, nearly all occurred at depths <250 m (Allen & Smith 1988). Adults and juveniles prefer soft bottoms composed of fine sands and mud (Ketchen 1956), but also occur in eelgrass habitats (Pearson & Owen 1992). English sole uses nearshore coastal and estuarine waters as nursery areas (Krygier & Pearcy 1986, Rogers et al. 1988). Adults make limited migrations. Those off Washington show a northward post-spawning migration in the spring on their way to summer feeding grounds, and a southerly movement in the fall (Garrison & Miller 1982). Tagging studies have identified separate stocks based on this species' limited movements and meristic characteristics (Jow 1969).

Spawning occurs over soft-bottom mud substrates (Ketchen 1956) from winter to early spring depending on the stock. Eggs are neritic and buoyant, but sink just before hatching (Hart 1973), juveniles and adults are demersal (Garrison & Miller 1982). Small juveniles settle in the estuarine and shallow nearshore areas all along the coast, but are less common in southerly areas, particularly south of Point Conception. Large juveniles commonly occur up to depths of 150 m. Although many postlarvae may settle outside of estuaries, most will enter estuaries during some part of their first year of life (Gunderson et al. 1990). Some females mature as 3-year-olds (26 cm), but all females over 35 cm long are mature. Males mature at 2 years (21 cm).

Larvae are planktivorous. Juveniles and adults are carnivorous, eating copepods, amphipods, cumaceans, mysids, polychaetes, small bivalves, clam siphons, and other benthic invertebrates (Allen 1982, Becker 1984, Hogue & Carey 1982, Simenstad et al. 1079) . English sole feed primarily by day, using sight and smell,and sometimes dig for prey (Allen 1982, Hulberg & Oliver 1979). A juvenile English sole's main predators are probably piscivorous birds such as great blue heron (Ardia herodias), larger fishes and marine mammals. Adults may be eaten by marine mammals, sharks, and other large fishes.

Petrale Sole (*Eopsetta jordani*) are found form Cape St. Elias, Alaska to Coronado Island, Baja California. The range may possibly extend into the Bering Sea, but the species is rare north and west of southeast Alaska and in the inside waters of British Columbia (Garrison & Miller 1982, Hart 1973). Nine separate breeding stocks have been identified, although stocks intermingle on summer feeding grounds (Hart 1973, NOAA 1990). Of these nine, one occurs off British Columbia, two off Washington, two off Oregon and four off California (NOAA 1990). Adults are found from the surf line to 550 m, but their highest abundance is <300 m (NOAA 1990). Adults migrate seasonally between deepwater, winter spawning areas to shallower, spring feeding grounds (NOAA 1990). They show an affinity to sand, sandy mud and occasionally muddy substrates (NOAA 1990).

Spawning occurs over the continental shelf and continental slope to as deep as 550 m. Eggs are pelagic and juveniles and adults are demersal (Garrison & Miller 1982). Eggs and larvae are transported from offshore spawning areas to nearshore nursery areas by oceanic currents and wind. Larvae metamorphose into juveniles at six months (22 cm) and settle to the bottom of the inner continental shelf (Pearcy et al. 1977). Petrale sole tend to move into deeper water with increased age and size. Petrale sole begin maturing at three years. Half of males mature by seven years (29-43 cm) and half of the females are mature by eight years (>44 cm) (Pedersen 1975a, Pedersen 1975b). Near the Columbia River, petrale sole mature one to two years earlier (Pedersen 1975a, Pedersen 1975b).

Larvae are planktivorous. Small juveniles eat mysids, sculpins and other juvenile flatfishes. Large juveniles and adults eat shrimps and other decapod crustaceans, as well as euphausiids, pelagic fishes, ophiuroids and juvenile petrale sole (Garrison & Miller 1982, Hart 1973, 162, NOAA 1990, Pearcy et al. 1977, Pedersen 1975a, Pedersen 1975b). Petrale sole eggs and larvae are eaten by planktivorous invertebrates and pelagic fishes. Juveniles are preyed upon (sometimes heavily) by adult petrale sole, as well as other large flatfishes. Adults are preyed upon by sharks, demersally feeding marine mammals, and larger flatfishes and pelagic fishes (NOAA 1990). Petrale sole competes with other large flatfishes. It has the same summer feeding grounds as lingcod, English sole, rex sole and Dover sole (NOAA 1990).

Arrowtooth Flounder (*Atheresthes stomias*) range from the southern coast of Kamchatka to the northwest Bering Sea and Aleutian Islands to San Simeon, California. Arrowtooth flounder is the dominant flounder species on the outer continental shelf from the western Gulf of Alaska to Oregon. Eggs and larvae are pelagic; juveniles and adults are demersal (Garrison & Miller 1982, NOAA 1990). Juveniles and adults are most commonly found on sand or sandy gravel substrates, but occasionally occur over low-relief rock-sponge bottoms Arrowtooth flounder exhibit a strong migration from shallow water summer feeding grounds on the continental shelf to deep water spawning grounds over the continental slope (NOAA 1990). Depth distribution may vary from as little as 50 m in summer to more than 500 m in the winter (NOAA 1990, Rickey 1995).

Arrowtooth flounder are oviparous with external fertilization (Barry 1996). Spawning may occur deeper than 500 m off Washington (Rickey 1995). Larvae eat copepods, their eggs and copepod nauplii (Yang 1995, Yang & Livingston 1985). Juveniles and adults feed on crustaceans (mainly ocean pink shrimp and krill) and fish (mainly gadids, herring and pollock) (Hart 1973, NOAA 1990). Arrowtooth flounder exhibit two feeding peaks, at noon and midnight

"Other Flatfish" are those species that do not have individual ABC/OYs and include butter sole, curlfin sole, flathead sole, Pacific sand dab, rex sole, rock sole, sand sole, and starry flounder. Life history descriptions of these species may be found in the Essential Fish Habitat West Coast Groundfish which was prepared for amendment 11 to the FMP. This document may be requested from the Council office and is available http://www.nwr.noaa.gov/1sustfsh/efhappendix/page1.html

Rockfish

Pacific ocean perch (*Sebastes alutus*) are found from La Jolla (southern California) to the western boundary of the Aleutian Archipelago (Eschmeyer et al 1983, Gunderson 1971, Ito 1986, Miller & Lea 1972), but are common from Oregon northward (Eschmeyer et al 1983). Pacific ocean perch primarily inhabit waters of the upper continental slope (Dark & Wilkins 1994) and are found along the edge of the continental shelf (Archibald et al. 1983). Pacific ocean perch occur as deep as 825 m, but usually are at 100-450 m and along submarine canyons and depressions (NOAA 1990). Larvae and juveniles are pelagic; subadults and adults are benthopelagic. Adults form large schools 30 m wide, to 80 m deep, and as much as 1,300 m long (NOAA 1990). They also form spawning schools (Gunderson 1971). Juvenile Pacific ocean perch form ball-shaped schools near the surface or hide in rocks (NOAA 1990). Throughout its range, Pacific ocean perch is generally associated with gravel, rocky or boulder type substrate found in and along gullies, canyons, and submarine depressions of the upper continental slope (Ito 1986).

Pacific ocean perch winter and spawn in deeper water (>275 m), then move to feeding grounds in shallower water (180-220 m) in the summer (June-August) to allow gonads to ripen (Archibald et al. 1983, Gunderson 1971, NOAA 1990). Pacific ocean perch are slow-growing and long-lived. The maximum age has been estimated at about 90 years (ODFW, personal communication). Largest size is about 54 cm and 2 kg (Archibald et al. 1983, Beamish 1979, Eschmeyer et al. 1983, Ito 1986, Mulligan & Leaman 1992, NOAA 1990, Richards 1994). Pacific ocean perch are carnivorous. Larvae eat small zooplankton. Small juveniles eat copepods, and larger juveniles feed on euphausiids. Adults eat euphausiids, shrimps, squids, and small fishes. Immature fish feed throughout the year, but adults feed only seasonally, mostly April-August (NOAA 1990). Predators of Pacific ocean perch include sablefish and Pacific halibut.

Shortbelly rockfish (*Sebastes jordani*) are found from San Benito Islands, Baja California, Mexico to La Perouse Bank, British Columbia (Eschmeyer et al 1983, Lenarz 1980). The habitat of the shortbelly rockfish is wide ranging (Eschmeyer et al 1983). Shortbelly rockfish inhabit waters from 50-350 m in depth (Allen & Smith 1988) on the continental shelf (Chess et al. 1988) and upper-slope (Stull & Tang 1996). Adults commonly form very large schools over smooth bottom near the shelf break (Lenarz 1992). Shortbelly rockfish have also been observed along the Monterey Canyon ledge (Sullivan 1995). During the day shortbelly rockfish are found near the bottom in dense aggregations. At night they are more dispersed. (Chess et al 1988). During the summer shortbelly rockfish tend to move into deeper waters and to the north as they grow, but they do not make long return migrations to the south in the winter to spawn (Lenarz

1980).

Shortbelly rockfish are viviparous, bearing advanced yolk-sac larvae (Ralston et al 1996). Shortbelly rockfish spawn off California during January through April (Lenarz 1992). Larvae metamorphose to juveniles at 27 mm and appear to begin forming schools at the surface at that time (Laidig et al. 1991, Lenarz 1980). A few shortbelly rockfish mature at age 2, while 50% are mature at age 3 and nearly all are mature by age 4 (Lenarz 1992). They live to be about 10 years old (Lenarz 1980, MacGregor 1986) with the maximum recorded age being 22 years (Lenarz 1992).

Shortbelly rockfish feed primarily on various life stages of euphausiids and calanoid copepods both during the day and night (Chess et al. 1988, Lenarz et al. 1991). Shortbelly rockfish play a key role in the food chain, as they are preyed upon by chinook and coho salmon, lingcod, black rockfish, hake, bocaccio, chilipepper, pigeon guillemots, western gull, marine mammals, and others (Chess et al. 1988, Eschmeyer et al. 1983, Hobson & Howard 1989, Lenarz 1980).

Widow rockfish (*Sebastes entomelas*) range from Albatross Bank of Kodiak Island to Todos Santos Bay, Baja California (Eschmeyer et al. 1983, 176, Miller & Lea 1972, NOAA 1990). Widow rockfish occur over hard bottoms along the continental shelf (NOAA 1990) Widow rockfish prefer rocky banks, seamounts, ridges near canyons, headlands, and muddy bottoms near rocks. Large widow rockfish concentrations occur off headlands such as Cape Blanco, Cape Mendocino, Pt. Reyes, and Pt. Sur. Adults form dense, irregular, midwater and semi-demersal schools deeper than 100 m at night and disperse during the day (Eschmeyer et al. 1983, NOAA 1990, Wilkins 1986). All life stages are pelagic, but older juveniles and adults are often associated with the bottom (NOAA 1990). All life stages are fairly common from Washington to California (NOAA 1990). Pelagic larvae and juveniles co-occur with yellowtail rockfish, chilipepper, shortbelly rockfish, and bocaccio larvae and juveniles off central California (Reilly et al 1992).

Widow rockfish are viviparous, have internal fertilization, and brood their eggs until released as larvae (NOAA 1990, Ralston et al 1996, Reilly et al 1992). Mating occurs from late fall-early winter. Larval release occurs from December-February off California, and from February-March off Oregon. Juveniles are 21-31 mm at metamorphosis, and they grow to 25-26 cm over 3 years. Age and size at sexual maturity varies by region and sex, generally increasing northward and at older ages and larger sizes for females. Some mature in 3 years (25-26 cm), 50% are mature by 4-5 years (25-35 cm), and most are mature in 8 years (39-40 cm) (28, NOAA 1990). The maximum age of widow rockfish is 28 years, but rarely over 20 years for females and 15 years for males (NOAA 1990). The largest size is 53 cm, about 2.1 kg (Eschmeyer et al. 1983, NOAA 1990).

Widow rockfish are carnivorous. Adults feed on small pelagic crustaceans, midwater fishes (such as age-1 or younger Pacific hake), salps, caridean shrimp, and small squids (Adams 1987, NOAA 1990). During spring, the most important prey item is salps, during the fall fish are more important, and during the winter widow rockfish primarily eat sergestid shrimp (Adams 1987). Feeding is most intense in the spring after spawning (NOAA 1990). Pelagic juveniles are opportunistic feeders and their prey consists of various life stages of calanoid copepods, and euphausiids (Reilly et al. 1992).

Canary Rockfish (*Sebastes pinniger*) are found between Cape Colnett, Baja California, and southeastern Alaska (Boehlert 1980, Boehlert & Kappenman 1980, Hart 1973, Love 1991,Miller & Lea 1972, Richardson & Laroche 1979). There is a major population concentration of canary rockfish off Oregon (Richardson & Laroche 1979). Canary primarily inhabit waters 91-183 m deep (Boehlert & Kappenman 1980). In general, canary rockfish inhabit shallow water when they are young and deep water as adults (Mason 1995). Adult canary rockfish are associated with pinnacles and sharp drop-offs (Love 1991). Canary rockfish are most abundant above hard bottoms (Boehlert & Kappenman 1980). In the southern part of its range, the canary rockfish appears to be a reef-associated species (Boehlert 1980). In central California, newly settled canary rockfish are first observed at the seaward, sand-rock interface and farther seaward in deeper water (18-24 m).

Canary rockfish are ovoviviparous and have internal fertilization (Boehlert & Kappenman 1980, Richardson & Laroche 1979). Off California, canary rockfish spawn from November-March and from January-March off Oregon and, Washington, (Hart 1973, Love 1991, Richardson & Laroche 1979). The age of 50% maturity of canary rockfish is 9 years; nearly all are mature by age 13 . The maximum length canary rockfish grow to is 76 cm (Boehlert & Kappenman 1980, Hart 1973, Love 1991). Canary rockfish primarily prey on planktonic creatures, such as krill, and occasionally on fish (Love 1991). Canary rockfish feeding increases during the spring-summer upwelling period when euphausiids are the dominant prey and the frequency of empty stomachs is lower (Boehlert et al. 1989).

Chilipepper rockfish (*Sebastes goodei*) are found from Magdalena Bay, Baja California, to as far north as the northwest coast of Vancouver Island, British Columbia (Allen & Smith 1988, Hart 1973, Miller & Lea 1972). Chilipepper have been taken as deep as 425 m, but nearly all in survey catches were taken between 50 and 350 m (Allen & Smith 1988). Adults and older juveniles usually occur over the shelf and slope; larvae and small juveniles are generally found near the surface. In California, chilipepper are most commonly found associated with deep, high relief rocky areas and along cliff drop-offs (Love et al. 1990), as well as on sand and mud bottoms (MBC 1987). They are occasionally found over flat, hard substrates (Love et al. 1990). Love (Love 1981) does not consider this to be a migratory species. Chilipepper may migrate as far as 45 m off the bottom during the day to feed (Love 1981).

Chilipeppers are ovoviviparous, and eggs are fertilized internally (Reilly et al. 1992). Chilipepper school by sex just prior to spawning (MBC 1987). In California, fertilization of eggs begins in October ands spawning occurs from September to April (Oda 1992) with the peak being December to January (Love et al. 1990). Chilipepper may spawn multiple broods in a single season (Love et al. 1990). Females of the species are significantly larger, reaching lengths of up to 56 cm (Hart 1973). Males are usually smaller than 40 cm (Dark & Wilkins 1994). Males mature at 2 to 6 years of age and 50% are mature at 3 to 4 years. Females mature at 2 to 5 years with 50% mature at 3 to 4 years (MBC 1987). Females may attain an age of about 27 years whereas the maximum age for males is about 12 years (MBC 1987).

Larval and juvenile chilipepper eat all life stages of copepods and euphausiids, and are considered to be somewhat opportunistic feeders (Reilly et al. 1992). In California, adults prey on large euphausiids, squid, and small fishes such as anchovies, lanternfish and young hake (Hart 1973, Love et al. 1990). Chilipepper are found with widow rockfish, greenspotted rockfish, and swordspine rockfish (Love et al. 1990). Juvenile chilipepper compete for food with bocaccio, yellowtail rockfish, and shortbelly rockfish (Reilly et al. 1992).

Bocaccio rockfish (*Sebastes paucispinis*) are found in the Gulf of Alaska off Krozoff and Kodiak Islands, south as far as Sacramento Reef, Baja California (Hart 1973, Miller & Lea 1972). In survey catches, Allen and Smith (1988) found bocaccio to be most common at 100-150 m over the outer continental shelf. Sakuma and Ralston (1995) categorized bocaccio as both a nearshore and offshore species. Larvae and small juveniles are pelagic (Garrison & Miller 1982) and are commonly found in the upper 100 m of the water column, often far from shore (MBC 1987). Large juveniles and adults are semi-demersal and are most often found in shallow coastal waters over rocky bottoms associated with algae (Sakuma & Ralston). Adults are commonly found in eelgrass beds, or congregated around floating kelp beds (Love et al. 1990, Sakuma & Ralston). Young and adult bocaccio also occur around artificial structures, such as piers and oil platforms (MBC 1987). Although juveniles and adults are usually found around vertical relief, adult aggregations also occur over firm sand-mud bottoms (MBC 1987). Bocaccio move into shallow waters during their first year of life (Hart 1973), then move into deeper water with increased size and age (Garrison & Miller 1982).

Bocaccio are ovoviviparous (Garrison & Miller 1982, Hart 1973). Love et al. (1990) reported the spawning season to be protracted and last almost year-round (>10 months). Parturition occurs during January to April off Washington, November to March off northern and central California, and October to March off southern California (MBC 1987). Two or more broods may be born in a year in California (Love et al. 1990). The spawning season is not well known in northern waters. Males mature at 3 to 7 years with 50% mature in 4 to 5 years. Females mature at 3 to 8 years with 50% mature in 4 to 6 years(MBC 1987).

Larval bocaccio often eat diatoms, dinoflagellates, tintinnids, and cladocerans (Sumida & Moser 1984). Copepods and euphausiids of all life stages (adults, nauplii and egg masses) are common prey for juveniles (Sumida & Moser 1984). Adults eat small fishes associated with kelp beds, including other species of rockfishes, and occasionally small amounts of shellfish (Sumida & Moser 1984). Bocaccio are eaten by sharks, salmon, other rockfishes, lingcod and albacore, as well as sea lions, porpoises, and whales (MBC 1987). Bocaccio directly compete with chilipepper and widow, yellowtail, and shortbelly rockfishes for both food and habitat resources (Reilly et al. 1992).

Splitnose rockfish (*Sebastes diploproa*) occur from Prince William Sound, Alaska to San Martin Island, Baja

California (Miller & Lea 1972). Splitnose rockfish occur from 0-800 m, with most of survey catches occurring in depths of 100-450 m (Allen & Smith 1988). The relative abundance of juveniles (<21 cm) is quite high in the 91-272 m depth zone and then decreases sharply in the 274-475 m depth zone (Boehlert 1980). Splitnose rockfish have a pelagic larval stage and prejuvenile stage, and a benthic juvenile stage (Boehlert 1977). Benthic splitnose rockfish associate with mud habitats (Boehlert 1980). Young occur in shallow water, often at the surface under drifting kelp (Eschmeyer et al. 1983). The major types of vegetation juveniles are found under are Fucus sp. (dominant), eelgrass, and bull kelp (Schaffer et al 1995). Juvenile splitnose rockfish off southern California are the dominant rockfish species found under drifting kelp (Boehlert 1977).

Splitnose are ovoviviparous and release yolk sac larvae (Boehlert 1977). They may have two parturition seasons, or may possibly release larvae throughout the year (Boehlert 1977). In general, the main parturition season get progressively shorter and later toward the north (Boehlert 1977). Splitnose rockfish growth rates vary with latitude, being generally faster in the north. Splitnose mean sizes increase with depth in a given latitudinal area. Mean lengths of females are generally greater than males (Boehlert 1980). Off California, 50% maturity occurs at 21 cm, or 5 years of age, whereas off British Columbia 50% of males and females are mature at 27 cm (Hart 1973). Adults can achieve a maximum size of 46 cm (Boehlert 1980, Eschmeyer et al. 1983, Hart 1973). Females have surface ages to 55 years and section ages to 81 years.

Adult splitnose rockfish off southern California feed on midwater plankton, primarily euphausiids (Allen 1982). Juveniles feed mainly on planktonic organisms, including copepods and cladocerans during June and August. In October, their diets shift to larger epiphytic prey and are dominated by a single amphipod species. Juvenile splitnose rockfish actively select prey (Schaffer et al. 1995) and are probably diurnally active (Allen 1982). Adults are probably nocturnally active, at least in part (Allen 1982).

Yellowtail rockfish (*Sebastes flavidus*) range from San Diego, California, to Kodiak Island, Alaska (Fraidenburg 1980, Gotshall 1981, Lorz et al. 1983, Love 1991, Miller & Lea 1972, Norton & MacFarlane 1995). The center of yellowtail rockfish abundance is from Oregon to British Columbia (Fraidenburg 1980). Yellowtail rockfish are a common, demersal species abundant over the middle shelf (Carlson 1972, Fraidenburg 1980, Tagert 1991, Weinberg 1994). Yellowtail rockfish are most common near the bottom, but not on the bottom (Love 1991, Stanely et al. 1994). Yellowtail adults are considered semi-pelagic (Stanely et al. 1994, Stein et al. 1992) or pelagic which allows them to range over wider areas than benthic rockfish (Pearcy 1992). Adult yellowtail rockfish occur along steeply sloping shores or above rocky reefs (Hart 1973). They can be found above mud with cobble, boulder and rock ridges, and sand habitats; they are not, however, found on mud, mud with boulder, or flat rock (Love 1991, Stein et al. 1992). Yellowtail rockfish form large (sometimes greater than 1,000 fish) schools and can be found alone or in association with other rockfishes (Love 1991, Pearcy 1992, Rosenthal et al. 1982, Stein et al. 1992, Tagert 1991). These schools may persist at the same location for many years (Pearcy 1992).

Yellowtail rockfish are viviparous (Norton & MacFarlane 1995) and mate from October to December. Parturition peaks in February and March and from November-March off California (Westrheim 1975). Young-of-the-year pelagic juveniles often appear in kelp beds beginning in April and live in and around kelp, in midwater during the day, descending to the bottom at night (Love 1991, Tagert 1991). Male yellowtail rockfish are 34-41 cm in length (5-9 years) at 50% maturity, females are 37-45 cm (6-10 years) (Tagert 1991). Yellowtail rockfish are long-lived and slow-growing; the oldest recorded was 64 years old (Fraidenburg 1981, Tagert 1991). Even though they are slow growing, like other rockfish, they have a high growth rate when compared to other rockfish (Tagert 1991). They reach a maximum size of about 55 cm in approximately 15 years (Tagert 1991). Yellowtail rockfish feed mainly on pelagic animals, but are opportunistic, occasionally eating benthic animals as well (Lorz et al. 1983). Large juveniles and adults eat fish (small hake, Pacific herring, smelt, anchovies, lanternfishes, and others), along with squid, krill, and other planktonic organisms (euphausiids, salps, and pyrosomes) (Love 1991, Phillips 1964, Rosenthal et al. 1982, Tagert 1991).

Shortspine Thornyhead (*Sebastolobus alascanus*) are found from northern Baja California to the Bering Sea and occasionally to the Commander Islands north of Japan (Jacobson & Vetter 1996). They are common from southern California northward (Love 1991). Shortspine thornyhead inhabit areas over the continental shelf and slope (Erickson & Pikitch 1993, Wakefield & Smith 1990). Although they can occur as shallow as 26 m (Eschmeyer et al. 1983), shortspine thornyhead mainly occur between 100 and 1400 m off

Oregon and California, most commonly between 100-1000 m (Jacobson & Vetter 1996).

Spawning occurs in February and March off California (Wakefield & Smith 1990). Shortspine thornyhead are thought to be oviparous (Wakefield & Smith 1990), although there is no clear evidence to substantiate this (Erickson & Pikitch 1993). Eggs rise to the surface to develop and hatch. Larvae are pelagic for about 12-15 months. During January to June, juveniles settle onto the continental shelf and then move into deeper water as they become adults (Jacobson & Hunter 1993). Off California, they begin to mature at 5 years; 50% are mature by 12-13 years; and all are mature by 28 years (Owen & Jacobson 1992). Although it is difficult to determine the age of older individuals, Owen and Jacobson (Owen & Jacobson 1992) report that off California, they may live to over 100 years of age. The mean size of shortspine thornyhead increases with depth and is greatest at 1000-1400 m (Jacobson & Vetter 1996).

Benthic individuals are sit-and-wait predators that rest on the bottom and remain motionless for extended periods of time (Jacobson & Vetter 1996). Off Alaska, shortspine thornyhead eat a variety of invertebrates such as shrimps, crabs, and amphipods, as well as fishes and worms (Owen & Jacobson 1992). Longspine thornyhead are a common item found in the stomachs of shortspine thornyhead. Cannibalism of newly settled juveniles is important in the life history of thornyheads (Jacobson & Vetter 1996).

Longspine Thornyhead (*Sebastolobus altivelis*) are found from the southern tip of Baja California to the Aleutian Islands (Eschmeyer et al. 1983, Jacobson & Vetter 1996, Love 1991, Miller & Lea 1972, Smith & Brown 1983) but are abundant from southern California northward (Love 1991). Juvenile and adult longspine thornyhead are demersal and occupy the sediment surface (Smith & Brown 1983). Off Oregon and California, longspine thornyhead mainly occur at depths of 400-1400+ m, most between 600 and 1000 m in the oxygen minimum zone (Jacobson & Vetter 1996). Thornyhead larvae (Sebastolobus spp.) have been taken in research surveys up to 560 km off the California coast (Cross 1987, Moser et al. 1993). Juveniles settle on the continental slope at about 600-1200 m (Jacobson & Vetter 1996). Longspine thornyhead live on soft bottoms, preferably sand or mud (Eschmeyer et al. 1983, Jacobson & Vetter 1996, Love 1991). Longspine thornyheads neither school nor aggregate (Jacobson & Vetter 1996).

Spawning occurs spawn in February and March at 600-1000 m (Jacobson & Vetter 1996, Wakefield & Smith 1990). Longspine thornyhead are oviparous and are multiple spawners, spawning 2-4 batches per season (Love 1991, Wakefield & Smith 1990). Eggs rise to the surface to develop and hatch. Floating egg masses can be seen at the surface in March, April, and May (Wakefield & Smith 1990). Juveniles (<5.1 cm long) occur in midwater (Eschmeyer et al. 1983). After settling, longspine thornyhead are completely benthic (Jacobson & Vetter 1996). Longspine thornyhead can grow to 38 cm (Eschmeyer et al. 1983, Jacobson & Vetter 1996, Miller & Lea 1972) and live more than 40 years (Jacobson & Vetter 1996). Longspine thornyhead reach the onset of sexual maturity at 17-19 cm TL (10% of females mature) and 90% are mature by 25-27 cm (Jacobson & Vetter 1996).

Longspine thornyhead are sit-and-wait predators (Jacobson & Vetter 1996). They consume fish fragments, crustaceans, bivalves, and polychaetes and occupy a tertiary consumer level in the food web. Pelagic juveniles prey largely on herbivorous euphausiids and occupy a secondary consumer level in the food web (Love 1991, Smith & Brown 1983). Longspine thornyhead are commonly seen in shortspine thornyhead stomachs. Cannibalism in newly settled longspine thornyhead may occur because juveniles settle directly onto adult habitat (Jacobson & Vetter 1996). Sablefish commonly prey on longspine thornyhead.

Darkblotched rockfish (*Sebastes crameri*) are found from Santa Catalina Island off southern California to the Bering Sea (Miller & Lea 1972, Richardson & Laroche 1979). Off Oregon, Washington, and British Columbia it is primarily an outer shelf/upper slope species (Richardson & Laroche 1979). Distinct population groups have been found off the Oregon coast between lat. 44 30' and 45 20'N (Richardson & Laroche 1979). Adults occur in depths of 25-600 m and 95% are between 50 and 400 m (Allen & Smith 1988). Off central California, young darkblotched rockfish recruit to soft substrate and low (<1 m) relief reefs (Love et al. 1991). Darkblotched rockfish make limited migrations after they have recruited to the adult stock (Gunderson 1997).

Darkblotched rockfish are viviparous (Nichol & Pickitch 1994). Insemination of female darkblotched rockfish occurs from August to December, fertilization and parturition occurs from December to March off Oregon and California, primarily in February off Oregon and Washington (Hart 1973, Nichol & Pickitch 1994, Richardson & Laroche 1979). Females attain 50% maturity at a greater size (36.5 cm) and age (8.4

years) than males (29.6 cm and 5.1 years) (Nichol & Pickitch 1994). Adults can grow to 57 cm (Hart 1973). Pelagic young are food for albacore (Hart 1973).

Yelloweye rockfish (*Sebastes ruberrimus*) range from the Aleutian Islands, Alaska to northern Baja California; they are common from central California northward to the Gulf of Alaska (Eschmeyer et al. 1983, Hart 1973, Love 1991, Miller & Lea 1972, O'Connell & Funk 1986). Yelloweye rockfish occur in water 25-550 m deep; 95% of survey catches occurred from 50 to 400 m (Allen & Smith 1988). Yelloweye rockfish are bottom dwelling, generally solitary, rocky reef fish, found either on or just over reefs (Eschmeyer et al. 1983, Love 1991, O'Connell & Funk 1986). Boulder areas in deep water (>180 m) are the most densely-populated habitat type and juveniles prefer shallow-zone broken-rock habitat (O'Connell & Carlile 1993). They also reportedly occur around steep cliffs and offshore pinnacles (Rosenthal et al. 1982). The presence of refuge spaces is an important factor affecting their occurrence (O'Connell & Carlile 1993).

Yelloweye rockfish are ovoviviparous and give birth to live young in June off Washington (Hart 1973). The age of first maturity is estimated at 6 years and all are estimated to be mature by 8 years (Echeverria 1987). Yelloweye rockfish can grow to 91 cm (Eschmeyer et al. 1983, Hart 1973). Males and females probably grow at the same rates (Love 1991, O'Connell & Funk 1986). The growth rate of yelloweye rockfish levels off at approximately 30 years of age (O'Connell & Funk 1986). Yelloweye rockfish can live to be 114 years old (Love 1991, O'Connell & Funk 1986). Yelloweye rockfish are a large predatory reef fish that usually feeds close to the bottom (Rosenthal et al. 1988). They have a widely varied diet, including fish, crabs, shrimps and snails, rockfish, cods, sand lances and herring (Love 1991). Yelloweyes have been observed underwater capturing smaller rockfish with rapid bursts of speed and agility. Off Oregon the major food items of the yelloweye rockfish include cancroid crabs, cottids, righteye flounders, adult rockfishes, and pandalid shrimps (Steiner 1978). Quillback and yelloweye rockfish have many trophic features in common (Rosenthal et al. 1988).

Cowcod (*Sebastes levis*) occur from Ranger Bank and Guadalupe Island, Baja California to Usal, Mendocino County, California (Miller & Lea 1972). Cowcod range from 21 to 366 m (Miller & Lea 1972) and is considered to be parademersal (transitional between a midwater pelagic and benthic species). Adults are commonly found at depths of 180-235 m and juveniles are most often found in 30-149 m of water (Love et al. 1990). MacGregor (MacGregor 1986) found that larval cowcod are almost exclusively found in southern California and may occur many miles offshore. Adult cowcod are primarily found over high relief rocky areas (Allen 1982); they are generally solitary, but occasionally aggregate (Love et al. 1990). Solitary subadult cowcod have been found in association with large white sea anemones on outfall pipes in Santa Monica Bay (Allen 1982). Juveniles occur over sandy bottom and solitary ones have been observed resting within a few centimeters of soft-bottom areas where gravel or other low relief was found (Allen 1982). Although the cowcod is generally not migratory; it may move to some extent to follow food (Love 1980). Cowcod are ovoviviparous, and large females may produce up to three broods per season (Love et al. 1990). Spawning peaks in January in the Southern California Bight (MacGregor 1986). Cowcod grow to 94 cm (Allen 1982). Larvae are extruded at about 5.0 mm (MacGregor 1986). Juveniles eat shrimp and crabs and adults eat fish, octopus, and squid (Allen 1982).

Bank rockfish (*Sebastes rufus*) are found from Newport, Oregon, to central Baja California, most commonly from Fort Bragg southward (Love 1992). Bank rockfish occur offshore (Eschmeyer et al. 1983) from depths of 31 to 247 m (Love 1992), although adults prefer depths over 210 m (Love et al. 1990). Observations of commercial catches indicate juveniles occupy the shallower part of the species range (Love et al. 1990). Bank rockfish are a midwater, aggregating species that is found over hard bottom (Love 1992), over high relief or on bank edges (Love et al. 1990), and along the ledge of Monterey Canyon (Sullivan 1995). It also frequents deep water over muddy or sandy bottom (Miller & Lea 1972). Spawning ranges from December to May (Love et al. 1990). Peak spawning in the Southern California Bight is January, in central and northern California it is February. Off California, bank rockfish are multiple brooders (Love et al. 1990). Females grow to a larger maximum size (50 cm) than males (44 cm), but grow at a slightly slower rate (Cailliet et al. 1996). Males reach first maturity at 28 cm, 50% maturity at 31 cm, and 100% at 38 cm. Females reach first maturity at 31 cm, 50% at 36 cm, and 100% maturity at 39 cm (Love et al. 1990). Bank rockfish are midwater feeders, eating mostly gelatinous planktonic organisms such as tunicates, but also preying on small fishes and krill (Love 1992).

Black rockfish (*Sebastes melanops*) are found from southern California (San Miguel Island) to the Aleutian

Islands (Amchitka Island), and they occur most commonly from San Francisco northward (Hart 1973, Miller & Lea 1972, Phillips 1957, Stein & Hassler 1989). Black rockfish occur from the surface to greater than 366 m, however they are most abundant at depths less than 54 m (Stein & Hassler 1989). Off California, black rockfish are found along with the blue, olive, kelp, black-and-yellow, and gopher rockfishes (Hallacher & Roberts 1985) Adults are usually observed well up in the water column (Hallacher & Roberts 1985). The abundance of black rockfish in shallow water declines in the winter and increases in the summer (Stein & Hassler 1989). Densities of black rockfish decrease with depth during both the upwelling and non-upwelling seasons (Hallacher & Roberts 1985, PFMC 1996). Off Oregon larger fish seem to be found in deeper water (20-50 m) (Stein & Hassler 1989). Black rockfish off the northern Washington coast and outer Strait of Juan de Fuca exhibit no significant movement. However, fish appear to move from the central Washington coast southward to the Columbia River, but not into waters off Oregon. Movement displayed by black rockfish off the northern Oregon coast is primarily northward to the Columbia River (Culver 1986). Black rockfish form mixed sex, midwater schools, especially in shallow water (Hart 1973, Stein & Hassler 1989). Black rockfish larvae and young juveniles (<40-50 mm) are pelagic but are benthic at larger sizes (Laroche & Richardson 1980).

Black rockfish have internal fertilization and annual spawning (Stein & Hassler 1989). Parturition occurs from February-April off British Columbia, January-March off Oregon, and January-May off California (Stein & Hassler 1989). Spawning areas are unknown, but spawning may occur in offshore waters because gravid females have been caught well offshore (Dunn & Hitz 1969, Hart 1973, Stein & Hassler 1989). Black rockfish can live to be more than 20 years in age. The maximum length attained by the black rockfish is 60 cm (Hart 1973, Stein & Hassler 1989). Off Oregon, black rockfish primarily prey on pelagic nekton (anchovies and smelt) and zooplankton such as salps, mysids, and crab megalops. Off central California, juveniles eat copepods and zoea, while adults prey on juvenile rockfish, euphausiids, and amphipods during upwelling periods; during periods without upwelling they primarily consume invertebrates. Black rockfish feed almost exclusively in the water column (Culver 1986). Black rockfish are known to be eaten by lingcod and yelloweye rockfish (Stein & Hassler 1989).

<u>Blackgill rockfish</u> *(Sebastes melanostomus)* are distributed from Washington to Punta Abreojos (Love 1991, Moser & Ahlstom 1978). Adult blackgill rockfish are found offshore at depths of 219-768 m (Eschmeyer et al. 1983). Blackgill rockfish usually inhabit rocky or hard bottom habitats, along steep drop-offs, such as the edges of submarine canyons and over seamounts (Love 1991). However, they may also occur over soft-bottoms (Eschmeyer et al. 1983). Blackgill rockfish are a transitional species, occupying both midwater and benthic habitats (Love et al. 1990), although they are rarely taken at more than 9 m above the bottom (Love 1991). Blackgill are considered an aggregating species (Love 1991).

Blackgill rockfish spawn from January-June (peaking in February) off southern California, and in February off central and northern California (Love 1991, Love et al. 1990, Moser & Ahlstom 1978). The largest blackgill rockfish on record is 61 cm (Eschmeyer et al. 1983, Love 1991, Love et al. 1990). Blackgill rockfish primarily prey on such planktonic prey as euphausids and pelagic tunicates, as well as small fishes (e.g., juvenile rockfishes and hake, anchovies and lantern fishes) and squid (Love et al. 1990).

<u>Redstripe rockfish</u> *(Sebastes proriger)* occur from San Diego, California to the Bering Sea (Allen & Smith 1988, Hart 1973, Miller & Lea 1972). Redstripe rockfish inhabits the outer shelf and upper slope and are most common between 100 and 350 m (Allen & Smith 1988). Adults are semi-demersal, while larvae and juveniles are pelagic to semi-demersal (Garrison & Miller 1982). Young redstripe rockfish can occur in estuaries (Kendall & Lenarz 1986). Redstripe rockfish are generally found slightly off the bottom over both high and low relief rocky areas (Starr et al. 1996). Redstripe rockfish are very sedentary, exhibiting little or no movement from a home habitat or range (Matthes et al. 1986).

Redstripe rockfish are ovoviviparous (Garrison & Miller 1982). Off Oregon, larvae are released between April and July, but later off northern and central California, during July through September (Kendall & Lenarz 1986). Redstripe rockfish may grow to reach 61 cm (Hart 1973). Larvae and juveniles of this species were found to feed primarily on copepods, their eggs, and copepod nauplii, as well as all stages of euphausiids (Kendall & Lenarz 1986). Food of adult redstripe rockfish consists of small fish such as anchovies, herring and early stages of other groundfish, as well as squid (Starr et al. 1996). Redstripe rockfish may compete for food and habitat resources with widow, squarespot , shortbelly, and canary rockfishes, as well as lingcod and spiny dogfish (Erickson et al. 1991).

Sharpchin rockfish (Sebastes zacentrus) occur from San Diego, California, to the Aleutian Islands, Alaska (Allen & Smith 1988). Sharpchin rockfish occur from 25 to 475 m, but about 96% occur from 100 to 350 m (Allen & Smith 1988). Sharpchin rockfish can occur over soft bottoms (Eschmeyer et al. 1983), but they apparently prefer mud and cobble substrate and are associated with boulder and cobble fields (Stein et al. 1992)._ Parturition occurs from March through July off Oregon and from May through June off northern and central California (Echeverria 1987). Shortratker rockfish can grow to 33 cm (Miller & Lea 1972).

Silvergrey Rockfish (Sebastes brevispinis) are found from Santa Barbara Island, southern California, to the Bering Sea (Allen & Smith 1988, Hart 1973). Silvergray rockfish are included in the shelf rockfish assemblage (Hart 1973, Nagtegaal 1983) and inhabit the outer shelf-mesobenthal zone (Allen & Smith 1988)._ They occur in depths from 0 to 375 m with 95% of survey catches taken in depths of 100 to 300 m (Allen & Smith 1988)._ Off Oregon young are probably released in late spring or summer (Hart 1973, Allen & Smith 1988)._ Off Washington young are released in June (Hart 1973). They achieve a maximum size of 71 cm (Hart 1973).

Yellowmouth rockfish (Sebastes reedi) occur from Sitka, Alaska to Point Arena, California. Yellowmouth rockfish occupy a depth range from 137-366 m (Miller & Lea 1972)) usually 275-366 m over rough bottom (Kramer et al. 1995). Off Oregon, yellowmouth rockfish release their young from February through June (150). Yellowmouth females mature at 33 cm or larger (9 years old), and males mature at lengths greater than 31 cm (9 years old). They grow to 54 cm and can live to 34 years of age (Hart 1973).

"Other Rockfish" are those rockfish species that do not have individual ABC/OYs. Life history descriptions of these species may be found in the Essential Fish Habitat West Coast Groundfish which was prepared for amendment 11 to the FMP. This document may be requested from the Council office and is available http://www.nwr.noaa.gov/1sustfsh/efhappendix/page1.html

"OTHER FISH" are those groundfish species that do not have individual ABC/OYs. Life history descriptions of these species may be found in the Essential Fish Habitat West Coast Groundfish which was prepared for amendment 11 to the FMP. This document may be requested from the Council office and is available http://www.nwr.noaa.gov/1sustfsh/efhappendix/page1.html

3.2.4 Endangered Species

West Coast marine species listed as endangered or threatened under the Endangered Species Act (ESA) are discussed below in sections 3.2.5 (Marine Mammals,) 3.2.6 (Seabirds,) 3.2.7 (Sea Turtles,) and 3.2.8 (Salmon). Under the ESA, a species is listed as "endangered" if it is in danger of extinction throughout a significant portion of its range and "threatened" if it is likely to become an endangered species within the foreseeable future throughout all, or a significant portion, of its range. The following species are subject to the conservation and management requirements of the ESA:

Marine Mammals	
Threatened:	Steller sea lion (*Eumetopias jubatus*) Eastern Stock, • Guadalupe fur seal (*Arctocephalus townsendi*), and • Southern sea otter (*Enhydra lutris*) California Stock.
Seabirds	
Endangered:	Short-tail albatross (*Phoebastria (=Diomedea) albatrus*), • California brown pelican (*Pelecanus occidentalis*), and • California least tern (*Sterna antillarum browni*).
Threatened:	Marbled murrelet (*Brachyramphs marmoratus*).
Sea Turtles	
Endangered:	Green turtle (*Chelonia mydas*) Leatherback turtle (*Dermochelys coriacea*) Olive ridely turtle (*Lepidochelys olivacea*)
Threatened:	Loggerhead turtle (*Caretta caretta*)
Salmon	

Endangered:	Chinook salmon (*Oncorhynchus tshawytscha)*	Sacramento River Winter; Upper Columbia Spring
	Sockeye salmon (*Oncorhynchus nerka)*	Snake River
	Steelhead trout (*Oncorhynchus mykiss)*	Southern California; Upper Columbia
Threatened:	Coho salmon (*Oncorhynchus kisutch)*	Central California, Southern Oregon, and Northern California Coasts
	Chinook salmon (*Oncorhynchus tshawytscha*)	Snake River Fall, Spring, and Summer; Puget Sound; Lower Columbia; Upper Willamette; Central Valley Spring; California Coastal
	Chum salmon (*Oncorhynchus keta)*	Hood Canal Summer; Columbia River
	Sockeye salmon (*Oncorhynchus nerka)*	Ozette Lake
	Steelhead trout (*Oncorhynchus mykiss)*	South-Central California, Central California Coast, Snake River Basin, Lower Columbia, California Central Valley, Upper Willamette, Middle Columbia, Northern California

3.2.5 Marine Mammals

The waters off Washington, Oregon, and California (WOC) support a wide variety of marine mammals. Approximately thirty species, including seals and sea lions, sea otters, and whales, dolphins, and porpoise, occur within the EEZ. Many marine mammal species seasonally migrate through West Coast waters, while others are year round residents.

There is limited information documenting the interactions of groundfish fisheries and marine mammals, but marine mammals are probably affected by many aspects of groundfish fisheries. The incidental take of marine mammals, defined as any serious injury or mortality resulting from commercial fishing operations, is reported to NMFS by vessel operators. In the West Coast groundfish fisheries, incidental take is infrequent and primarily occurs in trawl fisheries (Forney *et al.* 2000). Indirect effects of groundfish fisheries on marine mammals are more difficult to quantify due to a lack of behavioral and ecological information about marine mammals. However, marine mammals may be affected by increased noise in the oceans, change in prey availability, habitat changes due to fishing gear, vessel traffic in and around important habitat (i.e., areas used for foraging, breeding, raising offspring, or hauling-out), at-sea garbage dumping, and diesel or oil discharged into the water associated with commercial fisheries.

The Marine Mammal Protection Act (MMPA) and the ESA are the federal legislation that guide marine mammal species protection and conservation policy. Under the MMPA on the West Coast, NMFS is responsible for the management of cetaceans and pinnipeds, while the U.S. Fish and Wildlife Service (FWS) manages sea otters. Stock assessment reports review new information every year for strategic stocks (those whose human-caused mortality and injury exceeds the potential biological removal [PBR]) and every three years for non-strategic stocks. Marine mammals whose abundance falls below the optimum sustainable population (OSP) are listed as "depleted" according to the MMPA.

Fisheries that interact with species listed as depleted, threatened, or endangered may be subject to management restrictions under the MMPA and ESA. NMFS publishes an annual list of fisheries in the Federal Register separating commercial fisheries into one of three categories, based on the level of serious injury and mortality of marine mammals occurring incidentally in that fishery. The categorization of a fishery in the list of fisheries determines whether participants in that fishery are subject to certain provisions of the MMPA, such as registration, observer coverage, and take reduction plan requirements. The WOC groundfish fisheries are in Category III, indicating a remote likelihood of, or no known serious injuries or mortalities, to marine mammals.

Of the marine mammal species incidentally caught in WOC groundfish fisheries, the Steller sea lion is listed as threatened under the ESA, the northern elephant seal may be within their OSP range, and there is insufficient data to determine the status of the harbor seal, California sea lion, Dall's porpoise, and Pacific white-sided dolphin relative to their OSP. None of these species are classified as strategic stocks under the MMPA. Based on its Category III status, the incidental take of marine mammals in the WOC groundfish fisheries does not significantly impact marine mammal stocks.

3.2.6 Seabirds

Over sixty species of seabirds occur in waters off the coast of WOC within the EEZ. These species include: loons, grebes, albatross, fulmars, petrels, shearwaters, storm-petrels, pelicans, cormorants, frigate birds, phalaropes, skuas, jaegers, gulls, kittiwakes, skimmers, terns, guillemots, murrelets, auklets, and puffins. The migratory range of these species includes commercial fishing areas; fishing also occurs near the breeding colonies of many of these species.

Interactions between seabirds and fishing operations are wide-spread and have led to conservation concerns in many fisheries throughout the world. Abundant food in the form of offal (discarded fish and fish processing waste) and bait attract birds to fishing vessels. Of the gear used in the groundfish fisheries on the West Coast, seabirds are occasionally taken incidentally by trawl and pot gear, but they are most often taken by longline gear. Around longline vessels, seabirds forage for offal and bait that has fallen off hooks at or near the water's surface and are attracted to baited hooks near the water's surface during the setting of gear. If a bird becomes hooked while feeding on bait or offal, it can be dragged underwater and drowned. Of the incidental catch of seabirds by longline groundfish fisheries in Alaska, northern fulmars represented about 66% of the total estimated catch of all bird species, gulls contributed 18%, Laysan albatross 5%, and black-footed albatross about 4% (Stehn *et al.* 2001). Longline gear and fishing strategies in Alaska are similar to some, but not all, of those used in WOC longline fisheries.

Besides entanglement in fishing gear, seabirds may be indirectly affected by commercial fisheries in various ways. Change in prey availability may be linked to directed fishing and the discarding of fish and offal. Vessel traffic may affect seabirds when it occurs in and around important foraging and breeding habitat and increases the likelihood of bird storms. In addition, seabirds may be exposed to at-sea garbage dumping and the diesel and oil discharged into the water associated with commercial fisheries.
The FWS is the primary federal agency responsible for seabird conservation and management. Under the Magnuson-Stevens Act, NMFS is required to ensure fishery management actions comply with other laws designed to protect seabirds. NMFS is also required to consult with FWS if fishery management plan actions may affect seabird species listed as endangered or threatened.

3.2.7 Sea Turtles

Sea turtles are highly migratory; four of the six species found in U.S. waters have been sighted off the West Coast. Little is known about the interactions between sea turtles and West Coast commercial fisheries. The directed fishing for sea turtles in WOC groundfish fisheries is prohibited, because of their ESA listings, but the incidental take of sea turtles by longline or trawl gear may occur. Sea turtles are known to be taken incidentally by the California-based pelagic longline fleet and the California halibut gillnet fishery. Because of differences in gear and fishing strategies between those fisheries and the WOC groundfish fisheries, the expected take of sea turtles by groundfish gear is minimal. The management and conservation of sea turtles is shared between NMFS and FWS.

Sea turtles may be also indirectly affected by commercial fisheries. Sea turtles are vulnerable to collisions with vessels and can be killed or injured when struck, especially if struck with an engaged propeller. Entanglement in abandoned fishing gear can also cause death or injury to sea turtles by drowning or loss of a limb. The discard of garbage at sea can be harmful for sea turtles, because the ingestion of such garbage may choke or poison them. Sea turtles have ingested plastic bags, beverage six-pack rings, styrofoam, and other items commonly found aboard fishing vessels. The accidental discharge of diesel and oil from fishing vessels may also put sea turtles at risk, as they are sensitive to chemical contaminates in the water.

3.2.8 Salmon

Salmon caught in the U.S. West Coast fishery have life cycle ranges that include coastal streams and river systems from central California to Alaska and oceanic waters along the U.S. and Canada seaward into the north central Pacific Ocean, including Canadian territorial waters and the high seas. Some of the more critical portions of these ranges are the freshwater spawning grounds and migration routes.

Chinook or king salmon (*Oncorhynchus tshawytscha*) and coho or silver salmon (*O. kisutch*) are the main species caught in Council-managed ocean salmon fisheries. In odd-numbered years, catches of pink salmon (*O. gorbuscha*) can also be significant, primarily off Washington and Oregon. Ocean salmon are caught with commercial and recreational troll gear. No other gears are allowed to take and retain salmon in the ocean fisheries. Small amounts of rockfish and other groundfish are taken as incidental catch in salmon troll fisheries.

NMFS issued Biological Opinions under the ESA on August 10, 1990, November 26, 1991, August 28, 1992, September 27, 1993, May 14, 1996, and December 15, 1999 pertaining to the effects of the groundfish fishery on chinook salmon (Puget Sound, Snake River spring/summer, Snake River fall, upper Columbia River spring, lower Columbia River, upper Willamette River, Sacramento River winter, Central Valley, California coastal), coho salmon (Central California coastal, southern Oregon/northern California coastal, Oregon coastal), chum salmon (Hood Canal, Columbia River), sockeye salmon (Snake River, Ozette Lake), and steelhead (upper, middle and lower Columbia River, Snake River Basin, upper Willamette River, central California coast, California Central Valley, south-central California, northern California, southern California).

3.2.9 Nongroundfish Species Interactions

Coastal Pelagic Species (CPS) CPS are schooling fish, not associated with the ocean bottom, that migrate in coastal waters. These species include: northern anchovy (*Engraulis mordax*), Pacific sardine (*Sardinops sagax*), Pacific (chub) mackerel (*Scomber japonicus*), jack mackerel (*Trachurus symmetricus*) and market squid (*Decapoda*). These species are managed under the Coastal Pelagic Species Fishery Management Plan.

Sardines inhabit coastal subtropical and temperate waters and at times have been the most abundant fish species in the California current. During times of high abundance, Pacific sardine range from the tip of Baja California to southeastern Alaska. When abundance is low, Pacific sardine do not occur in large quantities north of Point Conception, California. Pacific (chub) mackerel in the northeastern Pacific range from Banderas Bay, Mexico to southeastern Alaska. They are common from Monterey Bay, California to Cabo San Lucas, Baja California, and most abundant south of Point Conception, California. The central subpopulation of northern anchovy ranges from San Francisco, California to Punta Baja, Mexico. Jack mackerel are a pelagic schooling fish that range widely throughout the northeastern Pacific, however much of their range lies outside the U.S. EEZ. Adult and juvenile market squid are distributed throughout the Alaska and California current systems, but are most abundant between Punta Eugenio, Baja California and Monterey Bay, Central California.

CPS are taken incidentally in the groundfish fishery. Incidental take is well documented in the at-sea and shore-based whiting fishery. Preliminary data for 2001 indicates approximately 321mt of jack mackerel, 469 mt of Pacific mackerel, and 55 mt of squid was incidentally taken in the at-sea whiting fishery. There is little information on the incidental take of CPS by the other segments of the fishery, however given CPS are not associated with the ocean bottom, the interaction is expected to be minimal.

Dungeness Crab The Dungeness crab (*Cancer magister*) is distributed from the Aleutian Islands, Alaska, to Monterey Bay, California. They live in bays, inlets, around estuaries, and on the continental shelf. Dungeness crab are found to a depth of about 180 m. Although it is found at times on mud and gravel, this crab is most abundant on sand bottoms; frequently it occurs among eelgrass. The Dungeness crab, which are typically harvested using traps (crab pots), ring nets, by hand (scuba divers) or dip nets, are incidentally taken or harmed unintentionally by groundfish gears.

Pacific Pink Shrimp Pacific pink shrimp (*Pandalus jordani*) are found from Unalaska in the Aleutian Islands to San Diego, California, at depths of 25 to 200 fm (46 to 366 m). Off the U.S. West Coast these shrimp are harvested with trawl gear from northern Washington to central California between 60 and 100 fm (110 to 180 m). The majority of the catch is taken off the coast of Oregon. Concentrations of pink shrimp are associated with well-defined areas of green mud and muddy-sand bottom. Shrimp trawl nets are usually constructed with net mesh sizes smaller than the net mesh sizes for legal groundfish trawl gear. Thus, it is shrimp trawlers that commonly take groundfish in association with shrimp, rather than the reverse.

Pacific Halibut Halibut (*Hippoglossus stenolepis*) belong to a family of flounders called Pleuronectidae. Halibut are usually found in deep water (40 to 200 m). The International Pacific Halibut Commission (IPHC) report, "Incidental Catch and Mortality of Pacific Halibut, 1962-2000" contains estimates of the incidental catches of halibut in the coastal trawl fisheries (groundfish and shrimp trawls). Estimates of incidental catches of halibut, based on the at-sea observer data collected in the Enhanced Data Collection Program conducted from 1995 through 1998, results in an estimated mortality level of legal-sized halibut incidentally taken in shrimp and groundfish trawl fisheries will be 254 mt (560,000 pounds) in 2002.

Forage Fish Forage fish are small, schooling fish which serve as an important source of food for other fish species, birds and marine mammals. Examples of forage fish species are herring (*Clupea harengus pallasi*), smelt (*Osmeridae*), anchovies, and sardine. Many species of fish feed on forage fish. Major predators of herring include Pacific cod (42% of diet), whiting (32%), lingcod (71%), halibut (53%), coho (58%), and chinook salmon (58%) (Environment Canada 1994). Many species of seabirds depend heavily on forage fish for food as well. Marine mammals consuming forage fish include: harbor seals, California sea lions, Stellar sea lions, harbor porpoises, Dall's porpoises, and Minke whales (Calambokidis and Baird 1994). Forage fish are most commonly found in nearshore waters and within bays and estuaries, although some do spend of their lives in the open ocean where they may be incidentally taken by groundfish gears, particularly in trawls. Preliminary data from the 2001 at-sea whiting fishery indicates the fishery encounters very minor amounts of forage fish species (Pacific herring less than 5 mt and less than 1 mt of smelt and sardines combined). There is little information on the incidental take of forage fish by the other segments of the fishery, however given they are not associated with the ocean bottom, the interaction is expected to be minimal.

Miscellaneous Species Little information is available on nongroundfish species incidentally captured in the groundfish fishery. Other than those species mentioned above, documentation from the whiting fishery indicates species such as American shad and walleye pollock are taken incidentally. American shad, introduced in 1885, have flourished throughout the lower Columbia River, producing a record run of 2.2 million fish in 1988 (ODFW and WDFW 1989). American shad was also taken in the shore-based whiting fishery. Walleye pollock are found in the waters of the Northeastern Pacific Ocean from the Sea of Japan, north to the Sea of Okhotsk, east in the Bering Sea and Gulf of Alaska, and south in the Northwestern Pacific Ocean along the Canadian and U.S. West Coast to Carmel, California.

3.3 HUMAN ENVIRONMENT

3.3.1 History of Management Via Annual Specifications and Management Measures

Washington, Oregon, and California have been managing groundfish fisheries off of their coasts since the early 20th century. Then, as now, many fisheries straddled state borders, with vessels operating offshore of their home states and offshore of neighboring states. Congress recognized the West Coast need for a coordinating body that would ensure compatible management and regulation between states in 1947 by forming the Pacific States Marine Fisheries Commission (PSMFC). Since then, PSMFC has served in a coordinating role for fisheries management issues in common between the three West Coast states, Alaska, and Idaho. The Fishery Conservation and Management Act (now amended and renamed as the Magnuson-Stevens Fishery Conservation and Management Act) went into effect in 1977, extending exclusive economic zones (EEZs) out to 200 nautical miles offshore and forming fishery management councils to manage the fisheries occurring within EEZ waters. From 1977 through 1982, the three states coordinated groundfish management through the Pacific Fishery Management Council (Council,) during which time the Council also developed its initial FMP for groundfish. (Council, March 1998)

In September 1982, the groundfish FMP went into effect. Under the FMP, the Council was authorized to set annual optimum yields (OYs) for Pacific whiting, Pacific ocean perch (POP,) shortbelly rockfish, widow rockfish, and sablefish. These particular species were the first chosen for OY harvest limitations due to their contributions to foreign catch (Pacific whiting and shortbelly rockfish) or to their importance to domestic harvest (sablefish and widow rockfish.) In the case of POP, which had been overfished by the foreign fisheries in the 1960s and 1970s, an OY was needed to set the species on a rebuilding schedule. Federal groundfish fishery regulations intended to keep the harvest of these species within their OYs and of other groundfish within their Acceptable Biological Catches (ABCs) were relatively brief and simple. These regulations were published in the *Federal Register*, to be modified if and when the fisheries approached an ABC or OY for a managed species.

By 1987, the Council had realized that its relatively simple and straightforward FMP was too inflexible to allow regular adjustments to harvest levels and regulatory restrictions. For example, the FMP had to be amended each time the Council wished to set an OY for a species that had not previously been managed with OYs. Amendment 4 to the FMP was intended to address some of the inefficiencies of the initial FMP by creating processes by which the Council would discuss and make decisions on long-term permanent changes to regulations, on annual specifications of ABCs and OYs and management measures to implement those specifications, and on inseason actions to change the annual management measures. Amendment 4 gave the FMP a new procedure for developing and implementing annual specifications and their allocations between different fishery sectors:

> "The Council will develop preliminary recommendations at the first of two meetings (usually in September) based upon the best stock assessment information available to the Council at the time and consideration of public comment. After the first meeting, the Council will provide a summary of its preliminary recommendations and their basis to the public through its mailing list as well as providing copies of the information at the Council office and to the public upon request. The Council will notify the public of its intent to develop final recommendations at its second meeting (usually November) and solicit public comment both before and at its second meeting.
>
> At its second meeting, the Council will again consider the best available stock assessment information which should be contained in the recently completed SAFE (Stock Assessment and Fishery Evaluation) report and consider public testimony before adopting final recommendations to the Secretary (of Commerce.) Following the second meeting, the Council will submit its recommendations along with the rationale and supporting information to the Secretary for review and implementation.
>
> Upon receipt of the Council's recommendations, supporting rationale and information, the Secretary will review the submission and, if approved, publish a notice in the *Federal Register* making the Council's recommendations effective January 1 of the upcoming fishing year." (Council, August 1990)

The Council used this "two-meeting process" followed by the publication of a single *Federal Register* notice to implement the Council's recommendations from 1991-2001. Through that process, the Council could set harvest levels (such as ABCs and OYs) for managed species and management measures intended to allow the fisheries to achieve those harvest levels (trip limits or bag limits, size limits, etc.) Overall federal regulations were amended to include a list of species that could be managed via the annual process and the particular management measures that could be used with those species, called the "routine" management measures. Over time, the Council added new species and new management measures to this list by amending federal regulations when new routine measures were needed.

For both commercial and recreational fisheries, routine management measures have been intended to keep groundfish landings within annual harvest levels. In the commercial fisheries, trip landing and frequency limits were applied as routine management measures for the following reasons: to extend the fishing season; to minimize disruption of traditional fishing and marketing patterns; to reduce discards; to discourage target fishing while allowing small incidental catches to be landed; to allow small fisheries to operate outside the normal season; and, for the open access fishery only, to keep landings at the historical proportions of the 1984-88 window period. Size limits could also be applied as routine management measures in the commercial fisheries, either to protect juvenile fish or to extend the fishing season. For the recreational fisheries, bag limits have been applied as routine management measures to spread the available catch over a large number of anglers, to avoid waste, or for consistency with state regulations. Size limits could also be applied as routine management measures in the recreational fisheries, either to protect juvenile fish, to enhance the quality of the recreational fishing experience, or for consistency with state regulations. (FMP at 6.2.1)

With Amendment 13 to the FMP, the Council set up a two-meeting process for designating new routine management measures that set publication of the routine management measures in its annual SAFE document, rather than in federal regulations. The Council built this additional flexibility into the FMP so that it could act more swiftly on new information about management changes needed to protect overfished species. Under the Amendment 13 revisions to the FMP, routine management measures could be added or changed, "in cases where protection of an overfished or depleted stock is required..." (FMP at 6.2) Amendment 13 also added to the types of routine management measures available to the Council, "In cases where protection of an overfished or depleted stock is required, the Council may impose limits that differ by gear type, or establish closed areas or seasons."

As of 2002, the following measures have been classified as routine:

Commercial fisheries:	Recreational fisheries:
• Differential limits by gear type may be set for overfished species or for fisheries in which overfished species are caught incidentally. • For all FMP-managed rockfish species, whether individually or within a species group/complex, trip landing and frequency limits may be set. Off California, time/area closures may be set. • For all FMP-managed flatfish species, whether individually or within a species group/complex, trip landing and frequency limits may be set. • For cowcod, time/area closures may be set. • For sablefish and lingcod, trip landing and and frequency limits and size limits may be set. And, for lingcod, time/area closures may be set. • For whiting, trip landing and frequency limits may be set for the offseason. Directed whiting season start dates may be set. • For all groundfish species, separately or in any combination, trip landing and frequency limits may be set for any open access fishery, including exempted trawl fisheries.	• For lingcod off Washington, and Oregon, bag limits, size limits, and closed seasons may be set. For lingcod, cabezon, and kelp greenling off California, bag limits, size limits, boat limits, hook limits, closed areas, and dressing/fileting requirements may be set. • For rockfish off Washington and Oregon, bag limits and size limits may be set. For rockfish off California, bag limits, size limits, boat limits, hook limits, closed areas, and dressing/fileting requirements may be set.

In 2001, NMFS was challenged on the two-meeting annual specifications and management measures process in Natural Resources Defense Council, Inc. v. Evans, 2001 WL 1246622 (N.D.Cal. 2001.) Part of the court's ruling in that case required NMFS to provide a *Federal Register* notice-and-comment period as part of the annual specifications and management measures process. To meet the court's requirement for the 2002 specifications and management measures, NMFS published a proposed (67 FR 1555, January 11, 2002) and final rule (67 FR 10490, March 7, 2001) for the overall 2002 specifications and management measures, and an emergency rule to implement management measures for January-February 2002 (67 FR 1540, January 11, 2002). If the agency had not published January-February management measures for 2002, the management measures from January-February 2001 would have remained in effect for that period. NMFS published the emergency rule for the first two months of 2002 because some of the management measures from January-February 2001 were not conservative enough to adequately address rebuilding needs of overfished species. For the 2003 specifications and management measures, the Council will develop its initial specifications and management measures recommendations at its June 2002 meeting, with final recommendations at its September 2002 meeting, to be followed by a NMFS proposed and final rule for the 2003 season.

Protecting Overfished Species Within the Specifications and Management Measures Process

The major goal of management of the groundfish fishery throughout the 1990's was to prevent overfishing while achieving the OYs and providing year-round fisheries for the major species or species groups. One of the primary goals of the Pacific coast groundfish FMP is to keep the fishery open throughout the entire year for most segments of the fishery (See FMP goals and objectives at section 2.0). Harvest rates are constrained by annual harvest guidelines, two-month or one-month cumulative period landings limits, individual trip limits, size limits, species-to-species ratio restrictions, bag limits in the recreational fisheries and other measures, all designed to control effort so that the allowable catch is taken at a slow rate that will stretch the season out to a full year. Cumulative period catch limits are set by comparing current or previous landings rates with the year's total available catch. Landings limits have been used to slow the pace of the fishery and stretch the fishing season out over as many months as possible, so that the overall harvest target is not reached until the end of the year.

By 2000, lower OYs and growing awareness of reduced productivity of the groundfish resource had made it apparent that the goal of a year-round fishery was no longer achievable for a number of species. In addition, new legislative mandates under the Magnuson-Stevens Act gave highest priority to preventing overfishing and rebuilding overfished stocks to their MSY levels. The National Standard Guidelines at 50 CFR 600.310 interpreted this as "weak stock management," which means that harvest of healthier stocks must be curtailed to prevent overfishing or to rebuild overfished stocks. To meet initial rebuilding requirements for the three species declared overfished in 1999, bocaccio, lingcod, POP, the Council developed a new management strategy that diverts effort off the sea floor of the continental shelf, where many of the overfished species are found. Overfished species protection measures initially applied in 2000 included more restrictive trip limits for continental shelf species, reduced seasons for commercial hook-and-line gear and recreational fisheries off central and southern California, and trawl gear restrictions limiting the species and quantities of groundfish that could be taken with trawl nets using footropes of greater than 8 inches in diameter.

These 2000 restrictions were relatively severe when compared against allowable landings limits in the 1990s. At the urging of their coastal communities, the governors of the three West Coast states asked the Secretary of Commerce, through NMFS, to declare the West Coast groundfish fishery a commercial fishery failure. At the time, NMFS estimated that allowable landings limits in 2000 would reduce the commercial harvest value of West Coast groundfish by 25% from 1999 harvest levels. NMFS did declare the groundfish fisheries to be a commercial fishery failure in January 2000 (Dalton, 2000). In its declaration, NMFS cited the potential causes of the fishery resource disaster to be declining productivity in groundfish stocks associated with recently discovered oceanic regime shifts (See Section 2.##, above), advancements in scientific information about West Coast rockfish productivity that showed West Coast rockfish stocks to be generally less productive than many similar rockfish species worldwide.

Since 2000, management measures intended to eliminate directed catch and minimize incidental catch of overfished species have increased in number and in restrictiveness. Although year-round groundfish landings opportunities continue to be available to some gears in some areas, fishing opportunities have been eliminated for many vessels.

Table 3.3.1: Timetable of management measures implemented to protect overfished species through the annual specifications and management measures process

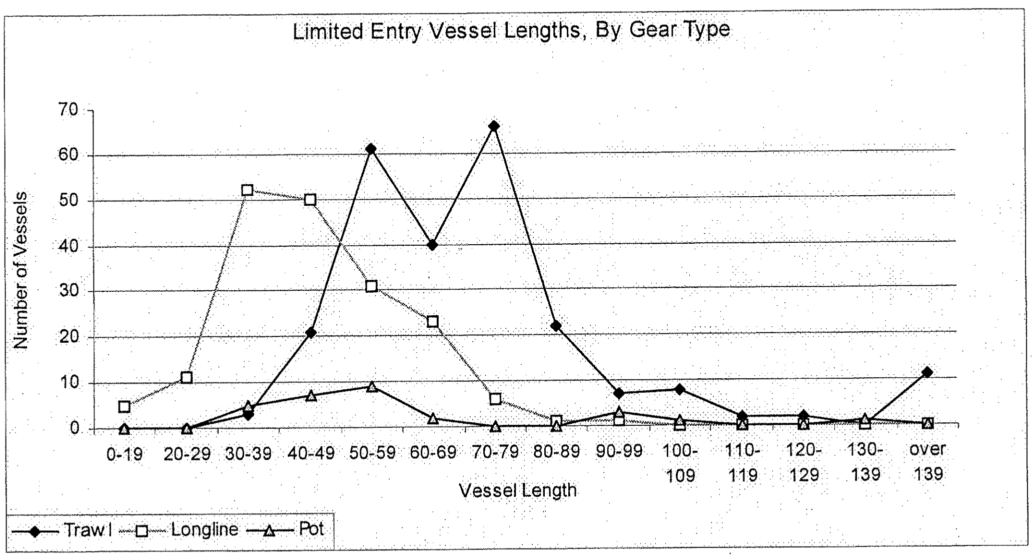
Year	Species Declared Overfished	Management Measures to Protect Overfished Species
1999	lingcod, bocaccio, POP	• These three species were declared overfished in March 1999, after the specifications and management measures had been set for that year.
2000	canary rockfish, cowcod (Management measures to protect lingcod, bocaccio, POP continue.)	• Targeting opportunities for overfished stocks eliminated • Shelf rockfish targeting reduced for hook-and-line gear and for large and small footrope trawl, particularly for healthy stocks closely associated with overfished species (e.g. chilipepper rockfish with bocaccio) • Commercial hook-and-line and recreational fisheries off central and southern California closed 4 months for nearshore and shelf rockfish with rockfish recreational bag limits also reduced • All commercial fisheries closed 6 months coastwide for lingcod with recreational season closures and reduced bag limits for lingcod varying by state.
2001	widow rockfish, darkblotched rockfish (Management measures to protect lingcod, bocaccio, POP, canary rockfish, cowcod continue.)	• Targeting opportunities for overfished stocks eliminated • Shelf rockfish targeting further reduced for hook-and-line gear and for large and small footrope trawl with minimal targeting allowed for midwater trawl gear • Flatfish landings restricted to reduce incidental catch of protected rockfish • Commercial hook-and-line and fisheries off California closed or depth restricted 7 months (central CA) or 5 months (southern CA) for nearshore and shelf rockfish • Recreational fisheries off California closed or depth restricted 6 months (central CA) or 4 months (southern CA) for nearshore and shelf rockfish with overall rockfish recreational bag limits same as in 2000 but species-specific limits reduced for overfished species • All commercial fisheries closed 6 months, except that central CA hook-and-line closed 8 months, for lingcod • Recreational season closures and continued reduced bag limits for lingcod varying by state • Cowcod Conservation Areas introduced to Southern California Bight waters, closed to all fishing for groundfish • Cowcod retention prohibited in all fisheries • Pink shrimp trawlers using fish excluder devices (state-managed fishery)
2002	yelloweye rockfish, whiting (Management measures to protect lingcod, bocaccio, POP, canary rockfish, cowcod, widow rockfish, darkblotched rockfish continue.)	• Targeting opportunities for all overfished stocks except whiting eliminated. Whiting OY reduced by 20% from 2001 • New bycatch analysis used to determine co-occurrence ratios between healthy species and overfished species, allowing more precise setting of healthy species limits to better reduce incidental catch of overfished species • Shelf rockfish targeting further reduced for hook-and-line gear and for all trawl gears • Flatfish landings further restricted to reduce incidental catch of protected rockfish • Commercial hook-and-line and recreational fisheries off California closed or depth restricted10 months (central CA) or 4 months (southern CA) for nearshore and shelf rockfish Commercial hook-and-line and recreational fisheries off central and southern California closed 4 months for nearshore and shelf rockfish with rockfish recreational bag limits also reduced • Commercial hook-and-line fisheries closed 6 months, except that central CA hook-and-line closed or depth restricted 8 months, for lingcod • Recreational season closures and continued reduced bag limits for lingcod varying by state • Cowcod Conservation Areas continue, cowcod retention continues to be prohibited • Yelloweye rockfish and canary rockfish retention prohibited in commercial hook-and-line fisheries, reduced or prohibited in recreational fisheries, reduced in trawl fisheries. • Pink shrimp trawlers using fish excluder devices (state-managed fishery) • Pacific halibut sport fishery closed area expanded to protect co-occurring yelloweye rockfish (state-managed fishery)

3.3.2 Profile of the Commercial Limited Entry (Non-Tribal) Groundfish Fisheries

The Pacific coast groundfish fishery is a year-round, multi-species fishery that takes place off the coasts of Washington, Oregon, and California. Most of the Pacific coast non-tribal, commercial groundfish harvest is taken by the limited entry fleet. The groundfish limited entry program was established in 1994 for trawl, longline, and trap (or pot) gears. There are also several open access fisheries that take groundfish incidentally or in small amounts; participants in those fisheries may use, but are not limited to longline, vertical hook-and-line, troll, pot, setnet, trammel net, shrimp and prawn trawl, California halibut trawl, and sea cucumber trawl. Open access fisheries are described below at Section 3.3.3. In addition to these non-tribal commercial fisheries, members of the Makah, Quileute, Hoh, and Quinault tribes participate in commercial, and ceremonial and subsistence fisheries for groundfish off the Washington coast. Tribal groundfish fisheries are described below at Section 3.3.4.

##Limited entry section out of date, June 2002 draft section placeholder only.## In 1999, excluding the at-sea processing vessels, there were 490 vessels with Pacific coast groundfish limited entry permits, of which approximately 53 percent were trawl vessels, 40 percent were longline vessels, 6 percent were trap vessels, and 2 percent were vessels that combine more than one gear type. Each permit is endorsed for a particular gear type and that gear endorsement cannot be changed, so the distribution of permits between gear types is fairly stable. The number of total permits will only change if multiple permits are combined to create a new permit with a longer length endorsement, or if a permit is not renewed. Limited entry permits may be sold and leased out by their owners, so the distribution of permits between the three states often shifts. In 1999, roughly 41 percent of the limited entry permits were assigned to vessels making landings in California, 37 percent to vessels making landings in Oregon, and 21 percent to vessels making landings in Washington. In 1998, 1,626 vessels participated in the open access groundfish fishery. Of these vessels, 1,077 landed their catch catch in California, 427 landed their catch in Oregon, and 122 landed their catch in Washington (PACFIN, October 1999).

Limited entry fishers focus their efforts on many different species, with the largest landings by volume (other than Pacific whiting) from the following species: Dover sole, sablefish, thornyheads, widow rockfish, and yellowtail rockfish. There are 55+ rockfish species managed by the Pacific coast groundfish FMP and, taken as a whole, rockfish landings represent the highest volume of non-whiting landings in the Pacific coast commercial groundfish fishery. In addition to these mixed-species fisheries, there is a distinct mid-water trawl fishery that targets Pacific whiting (*Merluccius productus*). Pacific whiting landings are substantially higher in volume than any other Pacific coast groundfish species. In 1998, by weight, whiting accounted for approximately 85 percent of all commercial shore-based groundfish landings.



With the exception of that portion of Pacific whiting catch that is processed at sea, virtually all other Pacific coast groundfish catch is processed at shore-based processing plants along the Pacific coast. The groundfish processing sector is described below in Section 3.3.##. By weight, 1998 commercial groundfish landings were distributed among the three states as follows: Washington, 13 percent; Oregon, 69 percent; California, 13 percent. By value, 1998 commercial groundfish landings were distributed among the three states as follows: Washington, 15 percent; Oregon, 43 percent; California, 42 percent. The discrepancies between the Oregon and California portions of the landings are expected because Oregon processors handle a relatively high percent of the shore-based whiting landings, a high volume, low value fishery. Conversely, California fishers land more of the low volume, high value species as a proportion of the total state-wide catch than Oregon fishers. Vessel owners and captains employ a variety of strategies to fill out a year of fishing. Fishers from the northern ports may fish in waters off of Alaska, as well as in the west coast groundfish fishery. Others may change their operations throughout the year, targeting on salmon, shrimp, crab, or albacore.

In addition to these mixed-species fisheries, there is a distinct mid-water trawl fishery that targets Pacific whiting (*Merluccius productus*). Pacific whiting landings are significantly higher in volume than any other Pacific coast groundfish species. In 1998, whiting accounted for approximately 66% of all Pacific coast commercial groundfish shoreside landings by weight. The Pacific whiting fleet includes catcher boats that deliver to shore-based processing plants and to at-sea processor ships, as well as catcher-processor ships. Whiting is a high volume species, but it commands a relatively low price per pound, so it accounts for only about 9% of all Pacific coast commercial groundfish shoreside landings by value. [For more specific information on distribution of groundfish catch by volume and by value see the 1999 SAFE (PFMC, October 1999.)

With the exception of the portion of Pacific whiting catch that is processed at sea, all other Pacific coast groundfish catch is processed in shore-based processing plants along the Pacific coast. By weight, 1998 commercial groundfish landings were distributed among the three states as follows: Washington, 13%; Oregon, 69%; California, 18%. By value, commercial groundfish landings are distributed among the three states as follows: Washington, 15%; Oregon, 43%; California, 41% (PFMC, October 1999.) The discrepancies between the Oregon and California portions of the landings are expected because Oregon processors handle a relatively high percent of the shore-based whiting landings, a high volume, low value fishery. Conversely, California fishers land more of the low volume, high value species as a proportion of the total state-wide catch than Oregon fishers.

Catcher vessel owners and captains employ a variety of strategies to fill out a year of fishing. Fishers from the northern ports may fish in waters off of Alaska, as well as in the West Coast groundfish fishery. Others may change their operations throughout the year, targeting on salmon, shrimp, crab, or albacore, in addition to various high-value groundfish species, so as to spend more time in waters close to their communities. Factory trawlers and motherships fishing for or processing Pacific whiting off of the West Coast usually also participate in the Alaska pollock seasons, allowing the vessels and crews to spend a greater percentage of the year at work on the ocean. Commercial fisheries landings for species other than groundfish vary along the length of the coast. Dungeness crab landings are particularly high in Washington state, squid, anchovies, and other coastal pelagics figure heavily in California commercial landings, with salmon, shrimp, and highly migratory species like albacore more widely distributed, and varying from year to year.

Whiting has been processed into surimi, sold in headed and gutted form, filleted, and converted to meal and oil. Other, higher quality fish like Petrale sole are dressed and rushed to fresh, local markets as quickly as possible, while most sablefish is frozen and sent to foreign markets. The quantity of groundfish caught off of the West Coast is just a small percent of the amount of groundfish caught in federal waters off Alaska, so West Coast groundfish moves through many of the same markets as Alaska groundfish, taking prices set by the northern fleet.

3.3.3 Profile of the Commercial Open Access (Non-Tribal) Groundfish Fisheries, Directed and Incidental

Unlike the limited entry sector, the open access fishery has unrestricted participation and is comprised of vessels targeting or incidentally catching groundfish with a variety of gears, excluding groundfish trawl gear. While the open access groundfish fishery is under federal management and does not have participation restrictions, some state and federally managed fisheries that land groundfish in the open access fishery have implemented their own limited entry (restricted access) fisheries or enacted management provisions that have affected participation in groundfish fisheries.

The commercial open access groundfish fishery consists of vessels that do not necessarily depend on revenue from the fishery as a major source of income. Many vessels that predominately fish for other species inadvertently catch and land groundfish. Or, in times and areas when fisheries for other species are not profitable, some vessels will transition into the groundfish open access fishery for short periods. The commercial open access fishery for groundfish is split between vessels targeting groundfish (*directed fishery*) and vessels targeting other species (*incidental fishery*). The number of unique vessels targeting groundfish in the open access fishery between 1995-1998 coastwide was 2,723, while 2,024 unique vessels landed groundfish as incidental catch (1,231 of these vessels participated in both) (SSC's Economic Subcommittee, 2000).

In the directed open access fishery, fishers target groundfish in the "dead" and/or "live" fish fishery using a variety of gears. The terms dead and live fish fisheries refers to the state of the fish when they are landed. The dead fish fishery has historically been the most common way to land fish. The dead fish fishery made up 80% of the directed open access landings by weight coastwide in 2001. More recently, the market value for live fish has increased landings of live groundfish. The other component of the open access fishery is the incidental catch of groundfish in fisheries targeting other species (e.g., shrimp, salmon, highly migratory species, squid). Combining both the directed and incidental fisheries, the commercial groundfish open access fishery is potentially very large and includes a variety of gear types.

Landings, Revenue, and Participation by State Fisheries are generally distributed along the coast in patterns governed by factors such as location of target species, location of ports with supporting marine supplies and services, and restrictions/regulations of various state and federal governments. For the open access directed groundfish fishery, the majority of landings by weight that target groundfish occur off California. Oregon's directed groundfish open access fishery has the next highest landings, followed by Washington's. In the incidental groundfish fisheries, Oregon and California both have similar landings in their open access fisheries. Washington again has the lowest landings by weight of incidental groundfish (PFMC 2001e). Participation in "both directed and bycatch components of the open access fishery is much greater in California than in Oregon and Washington combined. For instance, in 1998, 779 California boats, 232 Oregon boats and 50 Washington boats participated in the directed fishery. In that same year, 520 California boats, 305 Oregon boats and 40 Washington boats participated in the bycatch fishery" (SSC's Economic Subcommittee, 2000).

Open access fisheries have been examined for their landings in the years 1996 and 2001, two randomly chosen years following the implementation of the limited entry program. Overall and in each individual state, open access landings decreased between 1996 and 2001. Federally, open access landings limits were sharply reduced between 1996 and 2001. Ex-vessel value for open access groundfish fisheries also decreased coastwide between 1996 and 2001. The directed fishery decreased from over $7 million in 1996 to under $5 million in 2001 and the incidental fishery decreased by half, from roughly $800,000 in 1996 to roughly $400,000 in 2001. (##Hastie 2001 tables, cite somehow)

Table 3.3.2: Estimated Open Access Fishery Landings in 1996 and 2001, by state, weight and value

Open Access Sector	*1996 landings by weight*	*2001 landings by weight*
Coastwide Directed	3,291 mt	1,086 mt
Coastwide Incidental	802 mt	197 mt
Washington Directed	225 mt	66 mt
Washington Incidental	296 mt	28 mt
Oregon Directed	458 mt	237 mt
Oregon Incidental	384 mt	98 mt
California Directed	2,608 mt	776 mt
California Incidental	122 mt	70 mt

Directed Fishery The directed open access fishery for groundfish primarily targets rockfish, sablefish, lingcod, cabezon and flatfish. A vessel is considered to target groundfish in the open access fishery during a fishing trip if it is fishing with any gear other than groundfish trawl and if over 50% of the revenue from landings in that trip were from groundfish species. Participation in the directed fishery has decreased from 1,357 vessels in 1994 to 1,032 in 1999 (##PFMC 2001d). Reasons for this trend could include movement from the groundfish open access sector into other more profitable fisheries, or movement out of fishing all together.

As previously mentioned, the open access directed groundfish fishery consists of landings in both the dead and live fish categories. In the directed fishery, gears used to target and land dead groundfish include: vertical hook and line, rod/reel, pot, longline, troll/dinglebar, jig, sculpin trawl, setnet, and drifted (fly gear). Essentially all of the groundfish species managed under the FMP are targeted by various gears in the directed open access dead fishery. Increasingly, the live fish trade is gaining landings, due to a growing market value for live fish. In 2001, the live fish directed open access fishery accounted for 20% of the coastwide directed open access landings by weight, compared to only 6% in 1996. Gear used to target live groundfish include: pot, stick, and rod/reel. While Washington has prohibited live fish landings since 1999, both Oregon and California have live fish fisheries targeting groundfish. Currently, Oregon and California are drafting nearshore fishery management plans (FMPs) that would transition some species of groundfish landed in the live fish fishery from federal to state management.

In the directed open access fishery, certain gears are used to target specific species. Hook-and-line gear, the most common gear type, is generally used to target sablefish, rockfish and lingcod, while pot gear generally targets sablefish and some thornyheads and rockfish. In southern and central California, setnet gear targets rockfish, including chilipepper, widow, bocaccio, yellowtail and olive rockfish, and to a lesser extent vermillion rockfish.

Incidental Fisheries Fisheries that catch and land groundfish incidentally include: pink shrimp, spot prawn, ridgeback prawn, California and Pacific halibut, Dungeness crab, salmon, sea cucumber, coastal pelagic species, California sheephead, highly migratory species and the gillnet complex. Some of the gears in the incidental groundfish fishery include: non-groundfish trawl, pot, pole/line, longline, round haul, setnet, driftnet, purse seine, harpoon, gillnet, and troll. Not all of these fisheries have significant incidental groundfish catch. Open access fisheries with greater incidental groundfish catch are reviewed herein. For further information see ##Goen.##

Pink Shrimp Pink shrimp, also known as ocean shrimp, range from the Aleutian Islands in Alaska to San Diego, California, at depths from 150 to 1200 feet. They are targeted with shrimp trawl gear off Washington, Oregon, and California. The pink shrimp fishery is managed by the states, with incidental catch limits imposed as trip limits in the federal open access groundfish fishery under "exempted trawl." Vessels targeting pink shrimp also land groundfish species, including rockfish, lingcod, sablefish, thornyheads, and flatfish. Between 1990 and 2001, coastwide landings of groundfish in the pink shrimp fishery reached a high in 1993 of 896 metric tons, 8 % of the total landing with shrimp (Hastie, Table NGF1). Many groundfish species are caught incidentally in the pink shrimp fishery due in part to the indiscriminate nature of trawl gear. Efforts are underway to reduce the incidence of groundfish bycatch, by requiring bycatch reduction devices (BRDs) and no-fishing buffer zones above the seafloor. In 2001, Washington and Oregon instituted mandatory BRDs in pink shrimp trawl nets, effective August 1, 2001, to reduce finfish take, including canary rockfish, an overfished species. Historically, about 71% of the canary rockfish landed annually by Pacific Coast shrimpers was landed in Oregon (ODFW 2002). For 2002, Washington and Oregon are not requiring BRDs unless implemented through temporary emergency rule if canary rockfish landings reach a certain level, similar to 2001. California requires BRDs for all vessels landing shrimp in California ports.

In Washington, 15 vessels participated in the pink shrimp fishery in 1998 and 14 on a regular basis in 1999. In Oregon, only 84 vessels landed shrimp in 2001 (74 double-rig; 10 single-rig) compared to 108 in 2000, 121 in 1999 and 109 vessels in 1998 (ODFW 2002, PSMFC 1997). Despite lower landings in recent years, Oregon generally has the largest volume by weight of landings. In 1999, Oregon landed more pink shrimp than California, Washington, British Columbia and Alaska combined. In California, an average of 88 vessels participated per season from 1983 through 1999 (Collier and Hannah 2001).

Pacific Halibut Pacific halibut range from the Hokkaido, Japan to the Gulf of Anadyr, Russia on the Asiatic Coast and from Nome, Alaska to Santa Barbara, California on the North American (Pacific) Coast. The Pacific halibut fishery is managed by the International Pacific Halibut Commission (IPHC) with implementing regulations set by the federal governments of Canada and the United States (US) in their respective waters. A license from the IPHC is required to participate in the non-treaty commercial Pacific halibut fishery. The commercial sector off the Pacific Coast, IPHC Area 2A, has both a treaty and non-treaty sector. For the non-treaty commercial sector, harvest is divided between the directed halibut fishery and the incidental catch of halibut in the salmon troll fishery. When the Area 2A total allowable catch is above 900,000 lbs, as it has been in recent years, halibut may be retained in the limited entry primary sablefish fishery north of Point Chehalis, Washington (46°53'18" N. lat.).

The non-treaty directed commercial fishery in Area 2A is confined to south of Point Chehalis, Washington, Oregon, and California. Area 2A licenses, issued for the directed commercial fishery, have decreased from 428 in 1997 to 320 in 2001. For 2001, the directed commercial licenses also allow longline vessels to retain halibut caught incidentally north of Point Chehalis during the primary sablefish season. Area 2A licenses issued for the incidental salmon troll fishery increased from 275 in 1997 to 345 in 2001. In Area 2A, the incidental salmon troll fishery was allowed to retain 1 halibut per 5 chinook, plus 1 extra halibut, with a maximum of 35 incidental halibut landed. Groundfish are caught in the Pacific halibut fishery coastwide. Rockfish and sablefish are commonly intercepted, as they are found in similar habitat to Pacific halibut and are easily caught with longline gear. The recent overfished species designation of yelloweye rockfish, which is commonly caught with Pacific halibut, has caused the Council some concern about the effects of Pacific halibut fisheries on overfished rockfish species.

Salmon Salmon are targeted with troll gear off all three West Coast states. The ocean commercial salmon fishery, both non-treaty and treaty, is under federal management with a suite of seasons and total allowable harvest. The Council manages commercial fisheries in the Exclusive Economic Zone (3-200 miles offshore), while the states manage commercial fisheries in state waters (0-3 miles). Beside troll gear, salmon are also targeted with gillnets and/or tanglenets in the mouths of rivers. Although the gillnet/tanglenet fishery does not technically occur in Council-managed waters, it may have some impact on groundfish that migrate through that area during part of their life cycle.

The majority of chinook and coho were landed in California in 1999 with Washington and Oregon both having significantly fewer landings. The salmon troll fishery does have an incidental catch of Pacific halibut and groundfish, including yellowtail rockfish. Halibut are caught incidentally off Washington and Oregon, while groundfish are caught off all three states. The California salmon fisheries primarily harvest chinook or king salmon. Coho or silver salmon are observed in small numbers but are presently under a no-retention catch policy. Occasionally in odd-numbered years, pink salmon are landed. In 1983, California implemented a limited entry program that capped the fishery at just over 4,600 commercial salmon vessels. ##need info on gf inc. catch##

Gillnet Complex ##more from CDFG?## The gillnet or driftnet complex is managed by the state of California and made up of California halibut, white seabass, white croaker and sharks. These species are targeted solely with driftnet gear off California, since the setnet fishery for white seabass was prohibited in 1994. White seabass may also be caught with commercial hook-and-line gear in the early spring, when large seabass are available. White croaker, an abundant nearshore species, is predominately caught off central California in the driftnet fishery, although they range from Vancouver Island, British Columbia to Magdalena Bay, Baja California (but are not abundant north of Point Reyes, California). The entrance of Southeast Asian refugees (mainly Vietnamese) into this fishery, in part caused a shift in fishing effort from southern to central California (Moore and Wild 2001, p.234).

3.3.3 Profile of the Tribal Groundfish Fisheries, Directed and Incidental

##Need to discuss groundfish, halibut, D. crab, maybe salmon? for directed and incidental groundfish fisheries? Certainly March/April halibut and sablefish fisheries. Ceremonial and subsistence for halibut, other spp.?##

3.3.4 Profile of the Recreational Fisheries

##RecFIN data issue. Data on where seasons strongest and when for effects on recreational fisheries of closures at different times of years? Participation in salmon charter industry as indicator of potential groundfish participants, possibly more data on salmon sector? Discuss halibut recreational fishery, particularly as it affects yelloweye rockfish?##

3.3.5 Profile of the Processing Sector

##Estimates of # of processors (shorebased and at-sea,) where located. Processors that have closed in recent years? What spp. (groundfish and non-groundfish) processed at what times of year? Davis & Radtke on OR, sources for CA and WA? Connections with processors off AK and BC?##

4.0 ENVIRONMENTAL CONSEQUENCES OF THE ALTERNATIVES

How This Section is Organized

This Section examines the environmental consequences that could be expected to result from adoption of each of the alternatives. As discussed in Section 1.0, Purpose and Need for Action, the purposes in and needs for considering these alternatives are to:

- Comply with a court order to provide more opportunity for public comment in the NMFS rule publication process
- Streamline the process of and reduce the workload associated with developing specifications and management measures so that more Council and NMFS time may be devoted to issues other than specifications and management measures development.

Therefore, this section will consider the environmental effects of the specifications and management measures process and of the potential alternatives to that process. The specific effects of the specifications and management measures adopted for 2002 were analyzed in the EA/RIR/IRFA for the 2002 ABC and OY specifications and management measures (Council 2001.) Concurrent to this FMP amendment, the Council is also considering Amendment 16, an FMP amendment on rebuilding overfished species. The NEPA analysis for Amendment 16 and for the overfished species rebuilding plans associated with Amendment 16 will evaluate the alternatives for rebuilding overfished species and how rebuilding measures that are part of the specifications and management measures process affect the human environment.

This section forms the analytic basis for the comparison of issues across alternative specifications and management measures processes. The potential of each alternative to affect one or more components of the human environment is discussed in this section; direct and indirect effects of the alternatives are discussed in this analysis. Direct effects are caused by an action and occur at the same time and place as the action, while indirect effects occur later in time and/or further removed in distance from the direct effects (40 CFR 1508.27). Direct effects of some of the alternatives include the effects of a potential change in the start date of the fishery management period on the Council's management process. Indirect effects from a change in fishery start date could include increased or decreased fishing pressure on particular groundfish stocks at different times of the year.

4.1 Physical Impacts of the Alternatives

Physical impacts generally associated with fishery management actions are effects resulting from changes in the physical structure of the benthic environment as a result of fishing practices (e.g. gear effects and fish processing discards). Although groundfish fishing activity affects the physical environment, the process of implementing specifications and management measures does not have an effect on the physical environment. Discussions of the effects on the physical environment of the specifications and management measures for a particular year are found within the appropriate NEPA analyses for that year's specifications and management measures. Concurrent to this Amendment 17, NMFS is also drafting an Environmental Impact Statement on the effects of groundfish fishing on EFH. The effects on the physical environment of the full suite of groundfish management measures and policies will be considered within that EIS.

4.2 Biological Impacts of the Alternatives

The biological impacts generally associated with fishery management actions are effects resulting from: 1) harvest of fish stocks that may result in changes in food availability to predators, changes in population structure of target fish stocks, and changes in community structure; 2) entanglement and/or entrapment of non-target organisms in active or inactive fishing gear; 3) major shifts in the abundance and composition of the marine community as a result of fishing pressure.

In this section, alternative specifications and management measures processes are examined for their potential effects on the biological environment. The primary areas where the process itself could affect the environment are: 1) the effect of potential fishing effort shifts caused by changes to the fishing season start date on target and non-target species; 2) the effect of the management process on the age of the resource surveys and assessments used in setting harvest specifications; and 3) the effect of the management process on the ability of the scientific process to describe and analyze the status of groundfish stocks and to estimate the harvestable surpluses of those stocks. Although the management and scientific processes do not affect the biological environment in a direct fashion like the harvest of a particular quantity of a species each year, these processes have notable indirect effects on the timing of fishing pressure on groundfish stocks and on the quality of data and scientific analyses used in setting specifications and management measures. Table 4.2 provides these effects in a matrix format.

Table 4.2.1 Summary of the Potential Biological Impacts of Alternative Specifications and Management Measures Processes

BIOLOGICAL ISSUES	Effects on marine communities from fishing effort shifts due to season changes	Effects on the age of the resource surveys and assessments used in setting harvest specifications	Effects on data availability (Fishery and mortality data, age, size, growth & recruitment data, resource surveys)	Effects on advanced models (Stock assessments, multi-species interactions, habitat, climate)
Threshold	If this specifications and management measures process results in a time-shift in fishing effort, how might it affect when specific stocks and stock mixes are taken?	"Best available data" and "most recently available data" are two different concepts. How would this specifications and management measures process affect the use of the most recently available data?	Could this specifications and management measures process result in more and better catch, abundance, and biological data being available to stock assessment modelers and the public?	Could this specifications and management measures process provide more opportunities to develop, review and refine scientific models to improve the "best available science?"
Alternative 1, status quo, no action: 2-meeting annual process (Sept & Nov,) Jan 1 start date	Status quo/no action alternative tends to result in early attainment of harvest allocations and fishing closures during Oct-Dec. Although this schedule decreases fishing pressure during early winter flatfish spawning aggregation months of Nov-Dec, fishing pressure is heavy again during later flatfish spawning aggregation months of Jan-March. Bycatch of protected rockfish species in flatfish fisheries tends to be lower during winter flatfish spawning aggregation periods. This schedule also leaves open fishing opportunities during summer months, when flatfish tend to move to more shallow depths and when bycatch of protected slope rockfish species is higher in fisheries targeting healthier slope rockfish and DTS stocks.	Under status quo/no action, resource surveys are conducted triennially (see Section 3.#). Stock assessments are also conducted triennially, with one-third of all assessed stocks receiving assessment updates each year. For some species, data from a resource survey in Year 1 is assessed in Year 2 and fishing occurs on that assessment in Year 3. At the other extreme, data from a resource survey in Year 1 is not assessed until Year 4, with fishing occurring on that assessment in Year 5. For all alternatives, resource surveys occur in summer/autumn months. Assessments based on those surveys are generally not available until May 1 of the following year.	No measurable effect on data gathering and availability. Availability of data used to assess stock status and potential biological yields tends to be most dependent on financial commitments that agencies & other interested parties make to data gathering. Catch data needed for inseason monitoring least available/ reliable early in fishing year. Jan 1 fishing year start could result in more in-year management fluctuations for species with heavier fishing pressure during Jan-Apr (DTS complex, flatfish.)	Status quo/no action alternative uses annual updates of one-third of all assessed stocks, with STAR processes that review both models used and data sources that contribute to models. Status quo STAR process increases workload for stock assessment authors who are annually preparing both models and data sources used in models for STAR review.
Alternative 2: 3-meeting biennial process (April, June & Sept,) Mar 1start date	Given closure trends under status quo, March 1 start date would likely result in early allocation attainment and closures during Dec-Feb. Alternative 2 could thus reduce fishing pressure on flatfish during winter spawning aggregation months, but could also result in greater fishing pressure on healthy flatfish stocks in periods when bycatch of protected rockfish stocks is higher. Like Alternative 1, summer fishing months would continue open. If this alternative is implemented with two-year harvest allocations, as opposed to two-year *harvestable* specifications with annual allocations, early attainment and closure period could lengthen, possibly to Oct-Feb of second year in two-year fishing period.	Biennial management process would allow a biennial scientific process. Additional financial resources devoted to groundfish resource surveys should allow for biennial or annual surveys. Under this 3-meeting process, a resource survey would occur in Year 1, stock assessments in Year 2, management deliberations in Year 3, and fishing based on the Year 2 stock assessments would occur in Years 4 and 5. This alternative allows roughly the same newness of data use as the status quo alternative for two-thirds of assessed stocks, with *later* data use for one-third of assessed stocks.	No measurable change in data gathering and availability over Alternative 1. Alternative 2 has March 1 start date, which could result in more in-year management fluctuations for species with heavier fishing pressure during Mar-Jun (DTS complex & flatfish for Mar/ Apr; widow & yellowtail rockfish taken in pelagic trawls, all species taken in small boat hook-and-line fisheries during warmer May/June period.)	Improvement in model development and data use over Alternative 1. Biennial management process would allow biennial scientific process, with model development and review occurring in one year, then stock assessments that plug data into developed models occurring in alternate years. Biennial process could be expected to improve quality & variety of models used, to improve use of already-collected data on unassessed stocks, and to allow more time for exploring habitat and ecosystem modeling.
Alternative 3: 3-meeting, biennial process (Nov, April & June,) Jan 1 start date	If biennial process sets annual harvest allocations against biennial *harvestable* specifications, this alternative should have no measurable changes over Alternative 1. If, however, this alternative is implemented with two-year harvest allocations, early attainment and closure period could lengthen over Alternative 1, possibly to Aug-Dec of second year in two-year fishing period.	Same as Alternative 2.	No measurable change over Alternative 1.	Same as Alternative 2.

BIOLOGICAL ISSUES	Effects on marine communities from fishing effort shifts due to season changes	Effects on the age of the resource surveys and assessments used in setting harvest specifications	Effects on data availability (Fishery and mortality data, age, size, growth & recruitment data, resource surveys)	Effects on advanced models (Stock assessments, multi-species interactions, habitat, climate)
Alternative 4: 3-meeting, biennial process (June, Sept & Nov,) May 1 start date	Given closure trends under status quo, May 1 start date would likely result in early allocation attainment and closures during Feb-Apr period. Alternative 4 would thus allow fishing pressure on flatfish during winter spawning aggregation months, when bycatch of protected rockfish stocks is lower. The major biological disadvantage of this alternative is that fishery data availability would be lowest during summer months of first year of the two-year fishing period. Pleasant weather summer months tend to have greater vessel participation and tend to show higher bycatch of protected rockfish stocks in fisheries targeting healthier stocks. If this alternative is implemented with two-year harvest allocations, as opposed to two-year *harvestable* specifications with annual allocations, early attainment and closure period could lengthen, possibly to Dec-Apr of second year in two-year fishing period.	Biennial management process would allow a biennial scientific process. Additional financial resources devoted to groundfish resource surveys should allow for biennial or annual surveys. Under this 3-meeting process, a resource survey would occur in Year 1, stock assessments and management deliberations in Year 2, and fishing based on those assessments would occur in Years 3 and 4. This combination of a 3-meeting process with Years 3 and 4 use of data is possible because of the May 1 fishing period start date. This alternative allows roughly the same newness of data use as the status quo alternative for two-thirds of assessed stocks, with *earlier* data use for one-third of assessed stocks.	No measurable change in data gathering and availability over Alternative 1. Alternative 4 has May 1 start date, which could result in more in-year management fluctuations for species with heavier fishing pressure during May-Aug (widow & yellowtail rockfish taken in pelagic trawls; all species taken in small boat hook-and-line fisheries in warm months.)	Same as Alternative 2.
Alternative 5: 2-meeting, biennial process (June & Sept,) March 1 start date	Same as Alternative 2.	Same as Alternative 4, except that earlier use of data is possible with this alternative because it is a 2-meeting process. Of the four biennial alternatives, this alternative provides the shortest time between resource survey and fishing activity.	Same as Alternative 2.	Same as Alternative 2.

4.2.1 Biological Effects of Changing the Fishing Season Start Date

With the specifications and management measures process, fishery managers set annual harvestable amounts for each groundfish species or species group and try to construct trip limits for those species that will allow the harvest of the OYs of healthy stocks without allowing total catch of overfished and depleted stocks to exceed their OYs. Setting a year of trip limits is a delicate balancing act that requires consideration of when groundfish stocks and non-groundfish stocks are most available, when healthy and depleted stocks mix in a way that makes clean harvesting of healthy stocks more likely, and when different sectors of the fishing fleet are most likely to fish with which type of gear and in what waters. Ideally, managers would like to set a trip limit structure at the beginning of the fishing year that perfectly predicts all of these variables. In reality, however, fish stocks and the fishing fleet often behave in ways that are not predicted by the harvest models used in setting the year's management measures. As fishery scientists and managers track the fishery through the year, landings levels may be higher or lower than predicted at the beginning of the year. At a mid-year analysis of landings levels, usually at the Council's April, June, and September meetings, managers will make inseason adjustments to trip limit levels to either accelerate or decelerate landings rates. Under the current management structure (status quo/no action alternative,) managers have historically allowed more fishing during the warm weather months, with the expectation that landings of some species may be restricted or shut down toward the end of the calendar/fishing year.

##For all alternatives, ask for SSC opinion about ovoviviparous rockfish parturition – seem to be several species bearing live young in December-March period. ##

Under Alternative 1 (status quo/no action,) harvest allocations tend to be attained by late fall, with restrictions or closures occurring in the October through December period. This schedule tends to reduce pressure on flatfish stocks during the early part of their spawning season; however, spawning is usually still occurring when the fishery re-opens January 1. The advantage of allowing heavier fishing pressure on flatfish stocks during their spawning season is that they tend to be most aggregated then, less mixed with other groundfish stocks like rockfish. The disadvantage of allowing fishing on spawning aggregations that occur during the early part of the management period is that the fish are so readily available for harvest that a significant proportion of the year's harvestable surplus for a particular species may be taken in the first few months of the fishery. In a fishery managed by an FMP that puts a priority on year-round harvest availability, a significant harvest of healthy flatfish stocks early in the year could jeopardize the availability of flatfish or co-occurring protected stocks later in the year. A January 1 fishing period start date also usually ensures that the fishery will be open during the summer months. Hook-and-line fisheries do not tend to target flatfish stocks... ## rockfish availability in summer?## Sablefish are also a valuable hook-and-line and pot gear species. Status quo fixed gear sablefish management allows a small daily or weekly trip limit fishery for the limited entry and open access fisheries throughout the year and the larger limited entry tiered sablefish fishery described in Section 3.##. Sablefish stock health is more likely affected by possible discard in the daily/weekly trip limit fisheries and possible highgrading discard in the tiered fisheries than by any particular overall fishing period start date. ##Rockfish stocks commonly caught with sablefish – minor slope issues?##

Like the status quo alternative, Alternative 3 also has a January 1 fishing period start date. Alternative 3, however, is a biennial process. If the Council considers biennial management processes, it will have to decide whether to set one-year or two-year harvest allocations. Specifications, such as ABCs, could be set for two years without affecting fishery participation. If harvest allocations are set in two-year increments, fishing pressure could be fairly consistent for the first 18 months of the two-year period, with significant restrictions and closures in the final six months of the period.

Alternatives 2 and 5 are biennial processes with March 1 fishing period start dates. A March 1 start date, with a corresponding February 28/29 ending date could push the restriction and closure period from the status quo October-December to a new December-February. For flatfish fishing on spawning aggregations, this change in slow periods may or may not affect incidental catch rates of overfished species. Vessels that have traditionally targeted flatfish during the January-February period could instead target flatfish during November-December, although that strategy change could mean forgoing Dungeness crab fishing opportunities (See Section 4.##.) Similar to Alternatives 1 and 3, Alternatives 2 and 5 would ensure open fisheries during the summer months, which have traditionally been stronger for hook-and-line fisheries. Also like Alternative 3, these two biennial processes would have the management challenge of possibly stronger effort in the first year and a half of the two-year management period with restrictions and closures for possibly 4-6 months of the second year. The potential socio-economic effects of biennial management are discussed in Section 4.##, biological effects would depend upon the species likely to be taken directly or incidentally during the months of October-February. For the trawl fisheries at least, these months tend to have lower incidental catch rates of overfished species, which makes them more attractive months for stronger fishing effort rather than catch restrictions.

Alternative 4 is a biennial process with a May 1 start date. A May 1 start date, with a corresponding April 30 ending date could push the restriction and closure period from the status quo October-December to a new February-April. The advantage of this start date is that it would leave open some of the stronger months for targeting healthy stocks with lower incidental catch of overfished species. Unfortunately, the notable biological disadvantage of a May 1 start date is that fishery data availability would be lowest during the summer months of the first year of the two-year fishing period. Summer weather tends to allow greater fishery participation and the summer months tend to show higher incidental catch rates for overfished stocks taken in fisheries targeting healthy stocks. In order to protect against unpredictable harvest spikes, managers would have to severely restrict early summer fishing in at least the first year of the two-year fishing period. Without those restrictions, landings in those early months could quickly eat up allocations of both healthy and protected stocks.

Many of the potential biological effects of shifting the fishing year start date should more properly be considered effects of the Council's year-round fishery policy, rather than effects of the start date of a management period. If, for example, the trawl flatfish fisheries were managed with a four month season of November through February, allocations of those flatfish stocks could be taken entirely during periods when bycatch of overfished stocks is relatively low.

4.2.2 Biological Effects of Changing to the Management Process on "Best Available Science" and "Most Recently Available Science"

At National Standard 2, the Magnuson-Stevens Act requires that conservation and management measures be based on the best available scientific information (16 U.S.C. 1826). Table 4.2, above, briefly analyzes the effects of changing the specifications and management measures process on the:

- Age of the resource survey and stock assessments used in setting harvest specifications
- Availability and quality of more and better catch, abundance, and biological data
- Availability and quality of advanced scientific models used to assess stock and ecosystem health

Section 3.2.1 discusses the scientific process and the types of information and tools needed for that process. In considering the biological effects of the management process on the environment, we must look at the quality of the scientific information that we use in that management process. The Magnuson-Stevens Act and other legislation commonly call for the use of the "best available science," but that concept is often confused with "most recently available science." For example, data from a resource survey conducted in 2002 may be the most recently available data for informing the harvestable surplus of a particular species in 2003, but without a stock assessment for that species, using that data for the 2003 fishing season could not be considered using the best available science.

Data availability from resource surveys and other sources is generally dependent upon the financial resources that scientific agencies devote to gathering data. For many years, NMFS has conducted triennial West Coast groundfish resource surveys. A recent strengthening of Congressional interest in scientific information about West Coast groundfish has provided the agency with the resources to conduct biennial or annual resource surveys. These increased data gathering resources would be available under any of the alternatives. Therefore, this document discusses the effect of all of the alternatives on best available science with the assumption that all alternatives, including status quo, include annual or biennial resource surveys. While the specifications and management measures process should not affect the availability and quality of data used as the basis for stock assessments and other scientific analyses, that process can affect when the data is used and the scientific process by which it is used. Resource survey timing and use of data from those surveys would be affected by the alternatives as follows:

Table 4.2.2 Data Availability and Use in the Management Process

	Alternative 1			Alternative 2	Alternative 3	Alternative 4	Alternative 5
Resource Survey Conducted	Year 1			Year 1	Year 1	Year 1	Year 1
Stock Assessment Conducted	1st/3rd stocks, Year 2	2nd/3rd stocks, Year 3	3rd/3rd stocks, Year 4	Year 2	Year 2	Year 2	Year 2
Management Process Occurs	1st/3rd stocks, Year 2	2nd/3rd stocks, Year 3	3rd/3rd stocks, Year 4	Year 3	Year 3	Year 2	Year 2
Fishing on Year 1 Resource Survey Occurs	1st/3rd stocks, Year 3	2nd/3rd stocks, Year 4	3rd/3rd stocks, Year 5	Years 4/ 5*	Years 4/ 5	Years 3/4*	Years 3/4*
Time Gain/Loss of "Most Recently Available Data" Over Other Alternatives	For 1st group of assessed stocks, data is used sooner than all other alternatives. For 2nd and 3rd groups, data is used as soon as or later than all other alternatives.			Data use oldest in this alt., as fishing occurs in Years 4/5 and fishing year begins March 1.	Data use older than Alts. 4 and 5, but slightly more recent than Alt. 2 due to January 1 start.	Data use newer than Alt. 2 by 10 months and newer than Alt. 3 by 8 months.	Data use newest in this alt. Newer than Alt. 2 by a year, than Alt. 3 by 10 months, and than Alt. 4 by 2 months.

*For Alternatives 2 and 5, the "year" in which fishing would occur would be March 1 through February 28/29. For Alternative 4, the "year" would be May 1 through April 30.

In addition to affecting the timing of resource survey data use, the management process can also affect the quality and type of scientific analysis conducted on that data. An annual specifications and management measures process does not allow contributing scientific agencies enough time to conduct stock assessments on all assessed species each year. As a result, the status quo stock assessment process is to update stock assessments for one-third of all assessed species each year. Stock assessment authors will also try to add new stocks to the list of assessed species every year, although the addition of new species sometimes results in the delay of stock assessments for other species (See Section 3.2.1). Under a biennial management process (Alternatives 2-5,) the scientific process would also become biennial, with one year spent on developing and evaluating stock assessment models and the second year spent on analyzing resource survey and other data. The major benefits of allowing more time for model exploration and development would be more rigorously analyzed stock assessment and overfished species rebuilding models for currently assessed stocks, new assessment models for unassessed stocks for which data already exists, and new modeling efforts on multi-species interactions, habitat use, or ecosystem/climate models.

As shown in Table 4.2.2, the status quo/no action alternative tends to allow the use of the most recently available data for at least one-third of all assessed stocks. This use of most recently available data, however, should not be confused with the use of the best available science. Alternatives 2-5 would tend to provide the management process with better science than the annual stock assessment and management process of Alternative 1. In terms of considering which of the biennial alternatives is most desirable for most recent use of data, the "time gain/loss" row in Table 4.2.2 shows that the biennial alternatives vary in recentness of data use by between two months and a full year.

4.3 Socio-Economic Impacts of the Alternatives

The socio-economic impacts generally associated with fishery management actions are effects resulting from: 1) changes in harvest (whether directed commercial or indirected as recreational charter) availability and processing opportunities that may result in unstable income opportunities; 2) changes to access privileges associated with license limitation and individual quota systems; 3) fishing season timing or structure restrictions that may improve or reduce the safety of fishing activity; 4) fishing season timing or structure restrictions that may or may not take into account the social and cultural needs of fishery participants. Of these elements, the specifications and management measures process would not affect access privileges. The Council is currently discussing license limitation in the open access fisheries and trawl permit stacking. If the Council decides to move forward with either of these programs, the effects of changing fishery access privileges would be analyzed in the appropriate NEPA documents for those programs.

In this section, alternative specifications and management measures processes are examined for their potential socio-economic effects. The primary areas where the process itself could affect fishing industries and communities: 1) the effect of changes to the fishing season start date on harvest availability and processing opportunity; 2) the effect of changes to the fishing season start date on fishery structure and safety; 3) the effect of changes to the fishing season start date on social and cultural needs of fishery participants. In addition to these direct effects on fishery management actions on fishing industries and communities, changing the specifications and management measures process may affect the fishing public, general public, and participants in the fishery management process in: 1) the amount of management and science time devoted to developing annual specifications and management measures and the resultant staff resources for actions outside of that process; 2) the number and timing of Council meetings used to develop specifications and management measures; 3) the time available for public participation in the NMFS publication and evaluation of Council specifications and management measures recommendations. Table 4.3.1 provides these effects in a matrix format.##SSC/GAP/GMT on socio-economic analysis points?##

Table 4.3.1Summary of Potential Socio-Economic Impacts of Alternative Specifications and Management Measures Processes

SOCIO-ECONOMIC ISSUES	Effects of changing season start date on harvest availability and processing opportunity	Effects of changing season start date on safety and social/cultural needs of fishing communities	Effects of management time and public review and analysis devoted to specifications and management measures process
Threshold	How would this specifications and management measures process affect harvest availability and processing opportunity for fishery participants? Would participation in fisheries other than groundfish fisheries be affected by a change in season start date?	How would this specifications and management measures process affect the safety of fishery participants? Would changing the start of the fishing season affect the social/cultural needs of fishing communities?	Does this specifications and management measures process allow more or less management time for other, non-specifications activities? How does this particular process affect public review and comment opportunities?
Alternative 1, status quo, no action: 2-meeting annual process (Sept & Nov,) Jan 1 start date	Status quo/no action alternative tends to result in early attainment of harvest allocations and fishing closures during Oct-Dec. For fishers wishing to operate during winter months and for processing plants, this slow groundfish period coincides with the Dungeness crab fishing and processing season. Just as Dungeness crab opportunities are decreasing in January-February, groundfish are again available for harvesting and processing. Recreational fishing tends to be slow during this period for most of the West Coast, except perhaps south of Point Conception, CA.	The specifications and management measures process itself does not tend to affect the safety of fishery participants, although the fishing period start date could have some effect on safety. Under status quo, fishing opportunities tend to slow down or close entirely during early winter months when offshore conditions are less navigable (Oct-Dec.) Cultural groups that might be most affected by an Oct-Dec decrease in fresh fish availability could include persons celebrating Euro-American end-of-year holidays or individual fishers wanting to increase their pre-holiday incomes.	Status quo/no action alternative tends to devote the most management time to specifications and management measures because it is an annual process. The status quo schedule has a 2-meeting (Sept/Nov) process of Council proposals and final recommendations, followed by a Jan 1 publication of NMFS final rule implementing those regulations. In this process, public comment is received by the Council during the Sept/Nov period and by NMFS following publication of the final rule. Of the five alternatives, this schedule is the most compressed for management staff. For 2002, the Council held a 3-meeting process (June/Sept/Nov) followed by a Jan 1 NMFS proposed and emergency rule publication and public comment period and a Mar 1 final rule publication. While this 2002 variation lengthened staff time for the Council process, it increased staff workload for the NMFS process without increasing available work time.
Alternative 2: 3-meeting biennial process (April, June & Sept,) Mar 1start date	Given closure trends under status quo, March 1 start date would likely result in early allocation attainment and closures during Dec-Feb. Similar to Alternative 1, this alternative would result in slower groundfish landings or closures during a period of higher Dungeness crab landings. With this potential closure period, however, fishers and processors might have less access to the stronger flatfish spawning aggregations of the mid-winter period. As with Alternative 1, recreational fishing tends to be slow during the winter months.	This alternative would tend to result in declining landings and closures during the Dec-Feb period, which like the slow months of Alternative 1 include rougher winter weather months. Cultural groups that might be most affected by a Dec-Feb decrease in fresh fish availability could again include persons celebrating the Euro-American end-of-year holidays of December and individual fishers wanting to increase their pre-holiday incomes. Additionally, Asian-American lunar New Year's holiday celebrants could be affected by closures during this period.	Like all of the biennial alternatives, Alternative 2 would decrease overall time spent on developing specifications and management measures because the process would take place every two years instead of every year. Public review and comment would occur in Apr/Sept period for the Council process and following a Jan 1 publication of a NMFS proposed rule. Of the five alternatives, this schedule allows the most lengthy for Council staff work time (11-19 months,) as it relies on stock assessments conducted in the prior year. NMFS staff work time = 5.5 months. This alternative relies on an April meeting for proposing specifications, which have historically been final meetings for salmon management process, leaving little Council time and energy for groundfish issues. March 1 start date would mean that inseason adjustments for final 3 months of year (Dec-Feb) would be made at a Nov meeting.
Alternative 3: 3-meeting, biennial process (Nov, April & June,) Jan 1 start date	Same as Alternative 1.	Same as Alternative 1.	Alternative 3 would be similar to Alternative 2 in benefits derived from Council time devoted to issues other than the groundfish specifications and management measures. Depending on when stock assessments are complete, this alternative could provide Council staff 14 months work time and NMFS staff 6.5 months work time. This alternative includes an April (salmon) meeting. Jan 1 start date would mean that inseason adjustments for final 3 months of year (Oct-Dec) would be made at Sept meeting, with final check for Dec at the Nov meeting.

SOCIO-ECONOMIC ISSUES	Effects of changing season start date on harvest availability and processing opportunity	Effects of changing season start date on safety and social/cultural needs of fishing communities	Effects of management time and public review and analysis devoted to specifications and management measures process
Alternative 4: 3-meeting, biennial process (June, Sept & Nov,) May 1 start date	Given closure trends under status quo, May 1 start date would likely result in early allocation attainment and closures during Feb-Apr period. This schedule would keep the fisheries open through stronger flatfish months and allow participants to switch between flatfish and Dungeness crab at will. A Feb-Apr groundfish closure could also have the negative effect of a very lean 3-month period between Dungeness crab fishing/processing season and the shrimp, salmon and albacore seasons. For some of the small boat fishers, this alternative could also mean a lack of fishing opportunity in their traditional start-up fishing months. Early spring recreational fishing opportunities would also be curtailed under this schedule.	This alternative would tend to result in declining landings and closures during the Feb-Apr period, which could mean increased fishing during the preceding rough winter weather months. Cultural groups that might be most affected by a Feb-Apr decrease in fresh fish availability could include persons celebrating Asian-American lunar New Year's holidays and Christian followers of Church proscriptions on consuming animal meat during Lent. Groundfish treaty tribe subsistence fishing for groundfish could be most affected by May 1 start date, as a notable proportion of tribal groundfish landings occur in March-April, concurrent with the tribal halibut season start. Although tribal groundfish landings opportunities could not be restricted based on non-tribal use of all available resources, management between tribal and non-tribal fishing opportunities would have to be monitored more closely to ensure groundfish availability for tribal fishing seasons.	Alternative 4 would be similar to Alternative 2 in benefits derived from Council time devoted to issues other than the groundfish specifications and management measures. This alternative could provide Council staff 9 months work time and NMFS staff 6 months work time. May 1 start date would mean that inseason adjustments for final 5 months of year (Dec-Apr) would be made at a Nov meeting, with final check for Apr at the March meeting. May 1 fishing period start date would require restructuring of the non-tribal whiting and fixed gear primary sablefish season management processes, as both seasons currently begin in April. May 1 fishing period start date could also require change to tribal sablefish management process, as treaty tribes' sablefish season currently begins in March. This alternative would not interfere with a salmon-focused Council meeting.
Alternative 5: 2-meeting, biennial process (June & Sept,) March 1 start date	Same as Alternative 3.	Same as Alternative 3.	Alternative 5 would be similar to Alternative 2 in benefits derived from Council time devoted to issues other than the groundfish specifications and management measures. This alternative could provide Council staff 9 months work time and NMFS staff 5.5 months work time. Like Alternative 2, March 1 start date would mean that inseason adjustments for final 3 months of year (Dec-Feb) would be made at a Nov meeting. Unlike Alternatives 2-4, this alternative would be a 2-meeting Council process, leaving less Council meeting time for discussing specifications and management measures. This alternative would not interfere with a salmon-focused Council meeting.

4.3.1 Socio-Economic Effects of Changing Season Start Date

As detailed above in Table 4.3.1, the five alternatives consider a range of fishing season start dates: January 1 (Alternatives 1 and 2,) March 1 (Alternatives 2 and 5,) and May 1 (Alternative 4.) In crafting these alternatives, the Multi-Year Management Committee considered only fishing year start dates that would coincide with both the start of a traditional "major" commercial cumulative limit period and with the start of a Recreational Fisheries Information Network (RecFIN) two-month recreational fishing "wave." Using these criteria was intended to allow a smooth transition of catch and landings data analysis from the current specifications and management measures process to any of the alternative processes. Based on these criteria, potential start dates could have been January 1, March 1, May 1, July 1, September 1, and November 1.

##Table/Figure of groundfish and non-groundfish species processed throughout year? Possibly need to differentiate between species that are caught and species that are processed, as some may be self-processed by vessel operators##

Section 4.2.1 discusses the potential biological effects on the marine environment of changing the fishing season start date. As discussed in that section, the status quo alternative's January 1 fishing period start date, has historically tended to result in more intense fishing pressure at the beginning of the year, followed by increased overall participation and reduced per vessel participation mid-year, with any necessary landings slow downs or closure occurring around October-December. This type of fishing pressure scenario would apply to Alternative 3 (January 1 start date) as well as to the status quo/no action alternative. Under these alternatives, harvest allocations would tend to be attained by late fall, with restrictions or closures occurring in the October-December period. In terms of safety, fishery restrictions and closures toward the end of the year may be more acceptable. Small vessel operators who might want to have access to groundfish allocations during better weather months might be more economically affected by summer closures than by winter closures. For small vessels operating off Southern California, however, winter weather restrictions may be less important than a consistent fishing opportunity. ##Recreational fishing off SoCal in winter?##

From a processing perspective, the January 1 start date with early winter restrictions may be economically acceptable because the Dungeness crab fishing season tends to be strong in the November through January period. That fishery may allow fish processing plants to stay open during an otherwise slow groundfish period. There are disadvantages, however to a January 1 start date with early winter restrictions and closures for both fish marketers and the fish consuming public. Americans spend a great deal of money during the November-December period, buying gifts and entertaining friends and family either at home or at restaurants. Although fish marketers would have difficulty convincing Americans to eat cod for Thanksgiving, December holidays and New Year's Eve/Day tend to be celebrated with a wide range of luxury foods. Exporting opportunities, particularly to cultures with more fish-oriented diets, are also lost during a potentially lucrative time of year. In addition to the overall disadvantage of lost marketing opportunities during the year end period of high holiday spending, these closures affect the ability of fishery participants to manage the financial challenges of the holiday season. Like most Americans, groundfish fishery participants could probably better meet those challenges if they were able to increase their incomes during that November-December period. Alternatives 1 and 3 have the disadvantage of a fishing period start date that tends to result in fewer fishing opportunities at a time of year when fishery participants may have a greater need for income opportunities..

Alternatives 2 and 5 are biennial processes with March 1 fishing period start dates. A March 1 start date, with a corresponding February 28/29 ending date could push the restriction and closure period from the status quo October-December to a new December-February period. For processors that focus on Dungeness crab, a slow period in December-February might be more advantageous in northern ports, where crab tends to enter its hardshell phase later than in the south. Processors at the southern end of the Dungeness crab range (central-northern California) would be at a disadvantage because the hardshell phase for crab in their area tends to come in November-December, a time when they might want to continue to accept groundfish landings. In terms of safety, a December-February closure probably has no measurable change in effects over an October-December closure. Additionally, a slow December-February period would tend to have positive year end holiday marketing benefits over an October-December closure. In the early part of the calendar year, however, several different Asian-American cultures are celebrating New Years tied to the lunar calendar. Asian-Americans tend to consume fish more regularly than other American culture groups, making Asian holiday celebrations important fish-consumption periods. ##Statistics on fish consumption across culture groups and over time?##

Alternative 4 is a biennial process with a May 1 start date. A May 1 start date, with a corresponding April 30 ending date could push the restriction and closure period from the status quo October-December to a new February-April. This start date could ensure open groundfish fisheries throughout the Dungeness crab season, allowing vessels and processing plants to switch between crab and groundfish at will. Having a slow groundfish period of February-April, however, might be difficult for West Coast fishery participants trying to fill out their incomes between the Dungeness crab season and the shrimp, salmon and albacore seasons of spring and summer. For vessel safety and small vessel income, Alternative 4 is the least advantageous. February-April is the period when small vessels that do not fish during winter are just starting to get back on the water. Many fishers would not want to see a period of management-constrained fishing opportunities following immediately on the heels of a period of weather-constrained income. Conversely, the knowledge that the fisheries would likely close during the February-April period would give vessel operators greater incentives to fish during winter weather that they might otherwise avoid. Like the potential December-February slow period associated with a March 1 start date, a February-April slow period could also negatively affect consumers interested in purchasing fish for Asian-American New Years celebrations. Fishery restrictions or closures during this period would have the added disadvantage of occurring within Lent, a period in the Christian calendar when many persons refrain from eating animal meat and increase their fish consumption. ##Lenten proscriptions primarily for Catholic communities?## In addition to these holiday-related cultural needs for increased fish consumption, a May 1 start date could require reorganization of tribal/nontribal fishing opportunities for groundfish. Tribal commercial fishery management issues will be addressed in the next section, along with nontribal commercial fishery management concerns. For most tribal fisheries, however, there are subsistence and ceremonial uses of different fish species. Much of the subsistence fishing by the four groundfish treaty tribes occurs during the March-April tribal commercial halibut and sablefish fisheries. Nontribal groundfish fisheries would need to be managed in a way that would ensure groundfish availability for tribal commercial, subsistence and ceremonial fisheries during the February-April period.

As with biological effects, many of the potential socio-economic effects of shifting the fishing year start date should more properly be considered effects of the Council's year-round fishery policy, rather than effects of the start date of a management period. Socio-economic effects of the start date of the fishery management period could also be linked to a lack of allocation of many species between user groups and to the lack of management tools that would allow fishery participants to fish during periods most advantageous to their particular business needs. Vessel operators and processors should be able to take advantage of whichever holiday markets best fit the needs of their coastal communities and their extra-community marketing goals. Small vessel operators should not be forced to fish during inclement weather because of concerns about fishery closures during spring and summer months. Vessel operators afforded the privilege of fishing for both Dungeness crab and groundfish, or groundfish and shrimp, should be able to time their fishing trips based on the migratory patterns of their target species and their own marketing strategies and those of their associated processors.

4.3.2 Socio-Economic Effects of the Council and NMFS Public Review Processes

##Expand from table##

5.0 CONSISTENCY WITH FMP OBJECTIVES AND THE MAGNUSON-STEVENS ACT

5.1 FMP Objectives

5.2 National Standards

6.0 OTHER APPLICABLE LAW

6.1 National Environmental Policy Act

6.2 Regulatory Impact Review and Regulatory Flexibility Act Determination

6.3 Coastal Zone Management Act

6.4 Endangered Species Act

6.5 Marine Mammal Protection Act and Seabird Conservation

6.6 Paperwork Reduction Act

6.7 Executive Order 13132 (Federalism)

6.8, etc. ##Executive Orders on Tribal interactions, environmental justice, recreational fisheries?

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7.2 Data Sources and Methodologies Necessary for this EA##??

7.3 List of Public Meetings, Agencies and Persons Consulted

7.4 List of Federal Register Notices Published in Connection with this Action

66FR52114-52115 – 10/12/01 – Announcing November 2001 Council meeting where Council requested formation of GMMC based on recommendations of Groundfish Management Process Committee

66FR59575 – 11/29/01 – Announcing first GMMC meeting for December 13-14, 2001

> SUPPLEMENTARY INFORMATION: The formation of this ad hoc committee is in response to the Council's request for a committee to scope multi-year management approaches for the West Coast groundfish fishery. Multi-year management of the groundfish fishery would be synchronized with a multi-year groundfish stock assessment schedule. Full accommodation of federal notice and comment requirements would also be incorporated into the multi-year cycle. This is the first meeting of the committee, and the primary purpose of the meeting is to refine the purpose and objectives of multi-year management, as well as initiate scoping of alternative approaches.

67FR569 – 01/04/02 – Announcing second GMMC meeting for January 31-February 2, 2002

67FR7358-7360 – 02/19/02 – Announcing March 2002 Council meeting where initial review of GMMC recommendations occurred.

67FR13317-13318 – 03/22/02 – Announcing April 2002 Council meeting where Council initiated FMP amendment.

7.5 List of Preparers

This document was prepared by the Northwest Regional Office of the National Marine Fisheries Service. Contributors: Yvonne deReynier, Jamie Goen, Becky Renko, Carrie Nordeen. Preparers also appreciate the organizational aid of Daniel Waldeck of the Pacific Fishery Management Council, who staffed GMMT meetings and Amendment 17 discussion items for the Council.

Appendix A

DRAFT AMENDATORY LANGUAGE FOR AMENDMENT 17 – MULTI-YEAR MANAGEMENT

This document presents draft amendatory language that would revise the FMP to allow multi-year management. Plain text shows status quo (Alternative 1) language. Bolded text shows where the FMP could be amended to allow a biennial specifications and management measures process under Alternatives 2-5. Some ~~strikeout~~ text is shown as editing text that is not relevant to any of the alternatives. There are numerous places in the FMP where the words "annual," "year," or "yearly" are used in descriptive paragraphs mentioning the Council's annual specifications and management measures process without affecting that process. To better focus attention on the FMP processes that would be affected by Amendment 17, these descriptive paragraphs have not been provided here. If the Council chooses any of the multi-year management alternatives (Alternatives 2-5,) permission from the Council to make minor edits to account for the change in management period would be helpful to the Council staff.

2.2 Operational Definition of Terms

Acceptable Biological Catch (ABC) is a biologically based estimate of the amount of fish that may be harvested from the fishery each year **or each biennial fishing period (Alternatives 2-5)** without jeopardizing the resource. It is a seasonally determined catch that may differ from MSY for biological reasons. It may be lower or higher than MSY in some years **or two-year periods** for species with fluctuating recruitment. The ABC may be modified to incorporate biological safety factors and risk assessment due to uncertainty. Lacking other biological justification, the ABC is defined as the MSY exploitation rate multiplied by the exploitable biomass for the relevant time period.

* * *

Biennial fishing period is defined as a 24-month period beginning January 1 (Alternative 3) / March 1 (Alternatives 2 & 5) / May 1 (Alternative 4) and ending December 31 (Alternative 3) / February 28 [or 29 in leap years] (Alternatives 2 & 5) / April 30 (Alternative 4).

* * *

Fishing year is defined as January 1 through December 31 **(Alternatives 1& 3) / March 1 through February 28 [or 29 in leap years] (Alternatives 2 & 5) / May 1 through April 30 (Alternative 4).**

* * *

Maximum sustainable yield (MSY) is an estimate of the largest average annual **or biennial** catch or yield that can be taken over a significant period of time from each stock under prevailing ecological and environmental conditions. It may be presented as a range of values. One MSY may be specified for a group of species in a mixed-species fishery. Since MSY is a long-term average, it need not be specified annually **or biennially**, but may be reassessed periodically based on the best scientific information available.

* * *

5.0 SPECIFICATION AND APPORTIONMENT OF HARVEST LEVELS

The ability to establish and adjust harvest levels is the first major tool at the Council's disposal to exercise its resource stewardship responsibilities. Each fishing year **(Alternative 1) biennial fishing period (Alternatives 2-5)**, the Council will assess the biological, social, and economic condition of the Pacific coast groundfish fishery and update maximum sustainable yield (MSY) estimates or proxies for specific stocks (management units) where new information on the population dynamics is available. The Council will make this information available to the public in the form of the *Stock Assessment and Fishery Evaluation (SAFE)* document described in Section 5.1. Based upon the best scientific information available, the Council will evaluate the current level of fishing relative to the MSY level for stocks where sufficient data are available. Estimates of the acceptable biological catch (ABC) for major stocks will be developed, and the Council will identify those species or species groups which it proposes to be managed by the establishment of numerical harvest levels (optimum yields [OYs], harvest guidelines [HGs], or quotas). For those stocks judged to be below their overfished/rebuilding threshold, the Council will develop a stock rebuilding management strategy.

The process for specification of numerical harvest levels includes the estimation of ABC, the establishment of OYs for various stocks, calculation of specified allocations between harvest sectors, and the apportionment of numerical specifications to domestic annual processing (DAP), joint venture processing (JVP), total allowable level of foreign fishing (TALFF), and the reserve. The specification of numerical harvest levels described in this chapter is the process of designating and adjusting overall numerical limits for a stock either throughout the entire fishery management area or throughout specified subareas. The process normally occurs annually between September and November **(Alternative 1) / biennially between April and September (Alternative 2) / between November and June (Alternative 3) / between June and November (Alternative 4) / between June and September (Alternative 5)** , but can occur, under specified circumstances at other times of the fishing year. The Council will identify those OYs which should be designated for allocation between limited entry and open access sectors of the commercial industry. Other numerical limits which allocate the resource or which apply to one segment of the fishery and not another are imposed through the socioeconomic framework process described in Chapter 6 rather than the specification process.

The National Marine Fisheries Service (NMFS) Regional Administrator will review the Council's recommendations, supporting rationale, public comments, and other relevant information; and, if it is approved, will undertake the appropriate method of implementation. Rejection of a recommendation will be explained in writing.

The procedures specified in this chapter do not affect the authority of the U.S. Secretary of Commerce (Secretary) to take emergency regulatory action as provided for in Section 305(c) of the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) if an emergency exists involving any groundfish resource or to take such other regulatory action as may be necessary to discharge the Secretary's responsibilities under Section 305(d) of the Magnuson-Stevens Act.

The ~~annual~~ specification**s and management measures** process, in general terms, occurs as follows:

1. The Council will determine the MSY or MSY proxy and ABC for each major stock. Typically, the MSY proxy will be in terms of a fishing mortality rate ($F_{x\%}$,) and ABC will be the $F_{x\%}$ applied to the current biomass estimate.

2. Every species will either have its own designated OY or be included in a multispecies OY. Species which are included in a multispecies OY may also have individual OYs, have individual HGs, or be included in a HG for a subgroup of the multispecies OY. Stocks without quantitative or qualitative assessment information may be included in a numerical or non-numerical OY.

3. To determine the OY for each stock, the Council will determine the best estimate of current abundance and its relation to its precautionary and overfished thresholds. If the abundance is above the precautionary threshold, OY will be equal to or less than ABC. If abundance falls below the precautionary threshold, OY will be reduced according to the harvest control rule for that stock. If abundance falls below the overfished/rebuilding threshold, OY will be set according to the interim rebuilding rule until the Council develops a formal rebuilding plan for that species.

4. ****Editorial changes for this paragraph would be addressed under Amendment 16**

(overfished species rebuilding) to the FMP** For any stock the Secretary has declared overfished or approaching the overfished condition, or for any stock the Council determines is in need of rebuilding, the Council will develop a rebuilding plan and submit it in the same manner as recommendations of the annual management process. Once approved, a rebuilding plan will remain in effect for the specified duration or until the Council recommends and the Secretary approves revision.

5. The Council may reserve and deduct a portion of the ABC of any stock to provide for compensation for vessels conducting scientific research authorized by NMFS. Prior to the research activities, the Council will authorize amounts to be made available to a research reserve. However, the deduction from the ABC will be made in the year after the "compensation fishing"; the amounts deducted from the ABC will reflect the actual catch during compensation fishing activities.

6. The Council will identify stocks which are likely to be fully harvested (i.e., the ABC, OY, or HG achieved) in the absence of specific management measures and for which allocation between limited entry and open access sectors of the fishery is appropriate.

7. The groundfish resource is fully utilized by U.S. fishing vessels and seafood processors. The Council may entertain applications for foreign or joint venture fishing or processing at any time, but fishing opportunities may be established only through amendment to this FMP. This section supercedes other provisions of this FMP relating to foreign and joint venture fishing.

This chapter describes the steps in this process.

<u>5.1 SAFE Document</u>

****Annual SAFE documents are required under Federal regulations implementing National Standard 2 of the Magnuson-Stevens Act (base conservation and management measures on the best available scientific information.) Under Amendment 16 to the FMP, the Council will consider revising the SAFE document production schedule (stock assessments available before final decision on specifications and management measures, evaluation of the fishery available after end of fishing year).**

Amendment 17 Alternatives 2-5 consider a biennial management process. Under a biennial management process, some elements of the SAFE document may not be necessary in years when the Council is not preparing specifications and management measures. For example, elements 2, 5, 6, 7, and 11 could be eliminated from "off year" SAFE documents without violating Federal regulations or hampering the Council's ability to conduct inseason management.**

For the purpose of providing the best available scientific information to the Council for evaluating the status of the fisheries relative to the MSY and overfishing definition, developing ABCs, determining the need for individual species or species group management, setting and adjusting numerical harvest levels, assessing social and economic conditions in the fishery, and updating the appendices of this fishery management plan (FMP); a SAFE document is prepared annually. Not all species and species groups can be reevaluated every year due to limited state and federal resources. However, the SAFE document will in general contain the following information:

1. A report on the current status of Washington, Oregon, and California groundfish resources by major species or species group.

2. Specify and update estimates of harvest control rule parameters for those species or species groups for which information is available.

3. Estimates of MSY and ABC for major species or species groups.

4. Catch statistics (landings and value) for commercial, recreational, and charter sectors.

5. Recommendations of species or species groups for individual management by OYs.

6. A brief history of the harvesting sector of the fishery, including recreational sectors.

7. A brief history of regional groundfish management.

8. A summary of the most recent economic information available, including number of vessels and economic characteristics by gear type.

9. Other relevant biological, social, economic, ecological, and essential fish habitat information which may be useful to the Council.

10. A description of any rebuilding plans currently in effect, a summary of the information relevant to the rebuilding plans, and any management measures proposed or currently in effect to achieve the rebuilding plan goals and objectives.

11. A list of annual specifications and management measures that have been designated as routine under processes described in the FMP at Section 6.2.

Under a biennial specifications and management measures process, elements 2, 5, 6, 7, and 11 would not need to be included in a SAFE document in years when the Council is not setting specifications and management measures for an upcoming biennial fishing period (Alternatives 2-5). The preliminary SAFE document is normally completed late in the year, generally late October, when the most current stock assessment and fisheries performance information is available and prior to the meeting at which the Council approves its final management recommendations for the upcoming year. The Council will make the preliminary SAFE document available to the public by such means as mailing lists or newsletters and will provide copies upon request. A final SAFE may be prepared after the Council has made its final recommendations for the upcoming year and will include the final recommendations, including summaries of proposed and pre-existing rebuilding plans. The final SAFE document, if prepared, will also be made available upon request.

* * *

5.4 Authorization and Accounting for Fish Taken as Compensation for Authorized Scientific Research Activities.

At a Council meeting, NMFS will advise the Council of upcoming resource surveys that would be conducted using private vessels with groundfish as whole or partial compensation. For each proposal, NMFS will identify the maximum number of vessels expected or needed to conduct the survey, an estimate of the species and amounts of compensation fish likely to be needed to compensate vessels for conducting the survey, when the fish would be taken, and when the fish would be deducted from the ABC in determining the OY/harvest guideline. NMFS will initiate a competitive solicitation to select vessels to conduct resource surveys. NMFS will consult with the Council regarding the amounts and types of groundfish species to be used to support the surveys. If the Council approves NMFS' proposal, NMFS may proceed with awarding the contracts, taking into account any modifications requested by the Council. If the Council does not approve the proposal to use fish as compensation to pay for resource surveys, NMFS will not use fish as compensation.

Because the species and amounts of fish used as compensation will not be determined until the contract is awarded, it may not be possible to deduct the amount of compensation fish from the ABC or harvest guideline in the year that the fish are caught. Therefore, the compensation fish will be deducted from the

ABC the year **(Alternative 1) / biennial fishing period (Alternatives 2-5)** after the fish are harvested. During the ~~annual~~ specification**s and management measures** process, NMFS will announce the total amount of fish caught during the year **(Alternative 1) / biennial fishing period (Alternatives 2-5)** as compensation for conducting a resource survey, which then will be deducted from the following year's ABCs in setting the OYs.

* * *

5.6 Annual **(Alternative 1) / Biennial (Alternatives 2-5)** Implementation Procedures for Specifications and ~~Apportionments~~ **Management measures**(previously section 5.8)

Annually/**Biennially**, the Council will develop recommendations for the specification of ABCs, OYs, any HGs or quotas, ~~and apportionments to DAH, DAP, JVP, and TALFF and the reserve~~ over the span of two **(Alternatives 1 & 5) / three (Alternatives 2, 3, 4)** Council meetings. In addition during this process, the Council may recommend establishment of HGs and quotas for species or species groups within an OY.

The Council will develop preliminary recommendations at the first of two **/ three** meetings (usually in August or September) **(Alternative 1) / in April (Alternative 2) / in November (Alternative 3) / in June (Alternatives 4 & 5)** , based upon the best stock assessment information available to the Council at the time and consideration of public comment. After the first meeting, the Council will provide a summary of its preliminary recommendations and their basis to the public through its mailing list as well as providing copies of the information at the Council office and to the public upon request. The Council will notify the public of its intent to develop final recommendations at its second **/third** meeting (usually October or November) **(Alternative 1) / in September (Alternatives 2 & 5) / in June (Alternative 3) / in November (Alternative 4)**, and solicit public comment both before and at its second meeting.

At its second **and/or third** meeting, the Council will again consider the best available stock assessment information which should be contained in the recently completed SAFE report and consider public testimony before adopting final recommendations to the Secretary. Following the second/**third** meeting, the Council will submit its recommendations along with the rationale and supporting information to the Secretary for review and implementation.

Upon receipt of the Council's recommendations supporting rationale and information, the Secretary will review the submission, and, if approved, publish a notice in the *Federal Register* making the Council's recommendations effective January 1 of the upcoming fishing year **(Alternative 1) / publish a proposed rule in the *Federal Register*, making the Council's recommendations available for public comment and agency review. Following the public comment period on the proposed rule, the Secretary will review the proposed rule, taking into account any comments or additional information received, and will publish a final rule in the *Federal Register*, possibly modified from the proposed rule in accordance with the Secretary's consideration of the proposed rule.**

In the event that the Secretary disapproves one or more of the Council's recommendations, he may implement those portions approved and notify the Council in writing of the disapproved portions along with the reasons for disapproval. The Council may either provide additional rationale or information to support its original recommendation, if required, or may submit alternative recommendations with supporting rationale. In the absence of an approved recommendation at the beginning of the fishing year/**biennial fishing period**, the current specifications in effect at the end of the previous fishing year/**biennial fishing period** will remain in effect until modified, superseded, or rescinded.

5.7 Inseason Procedures for Establishing or Adjusting Specifications and ~~Apportionments~~ **Management Measures**(previously 5.9)

5.7.1 Inseason Adjustments to ABCs

Occasionally, new stock assessment information may become available inseason that supports a determination that an ABC no longer accurately describes the status of a particular species or species group. However, adjustments will only be made during the annual **/biennial** specifications process and a revised ABC announced at the beginning of the next fishing year **/ biennial fishing period**. The only exception is in the case where the ABC announced at the beginning of the fishing year **/ biennial fishing period** is found to have resulted from incorrect data or from computational errors. If the Council finds that such an error has occurred, it may recommend the Secretary publish a notice in the *Federal Register* revising the ABC at the earliest possible date.

* * *

6.0 MANAGEMENT MEASURES

* * *

6.2 General Procedures for Establishing and Adjusting Management Measures

Management measures are normally imposed, adjusted, or removed at the beginning of the fishing year / **biennial fishing period**, but may, if the Council determines it necessary, be imposed, adjusted, or removed at any time during the year. Management measures may be imposed for resource conservation, social or economic reasons consistent with the criteria, procedures, goals, and objectives set forth in the FMP.

Because the potential actions which may be taken under the two frameworks established by the FMP cover a wide range analyses of biological, social, and economic impacts will be considered at the time a particular change is proposed. As a result, the time required to take action under either framework will vary depending on the nature of the action, its impacts on the fishing industry, resource, environment, and review of these impacts by interested parties. Satisfaction of the legal requirements of other applicable law (e.g., the Administrative Procedure Act, Regulatory Flexibility Act, Executive Order 12291, etc.) for actions taken under this framework requires analysis and public comment before measures may be implemented by the Secretary.

Four different categories of management actions are authorized by this FMP, each of which requires a slightly different process. Management measures may be established, adjusted, or removed using any of the four procedures. The four basic categories of management actions are as follows:

A. Automatic Actions - Automatic management actions may be initiated by the NMFS Regional Administrator without prior public notice, opportunity to comment, or a Council meeting. These actions are nondiscretionary, and the impacts previously must have been taken into account. Examples include fishery, season, or gear type closures when a quota has been projected to have been attained. The Secretary will publish a single "notice" in the *Federal Register* making the action effective.

B. "Notice" Actions Requiring at Least One Council Meeting and One *Federal Register* Notice - These include all management actions other than "automatic" actions that are either nondiscretionary or for which the scope of probable impacts has been previously analyzed.

These actions are intended to have temporary effect, and the expectation is that they will need frequent adjustment. They may be recommended at a single Council meeting (~~usually November~~), although the Council will provide as much advance information to the public as possible concerning the issues it will be considering at its decision meeting. The primary examples are those **inseason** management actions defined as "routine" according to the criteria in Section 6.2.1. These include trip landing and frequency limits and size limits for all commercial gear types and closed seasons for any groundfish species in cases where protection of an overfished or depleted stock is required, and bag limits, size limits, time/area closures, boat limits, hook limits, and dressing requirements for all recreational fisheries. Previous analysis must have been specific as to species and gear type before a management measure can be defined as "routine" and acted upon at a single Council meeting. If the recommendations are approved, the Secretary will waive for good cause the requirement for prior notice and comment in the *Federal Register* and will publish a single "notice" in the *Federal Register* making the action effective. This category of actions presumes the Secretary will find that the extensive notice and opportunity for comment on these types of measures along with the scope of their impacts already provided by the Council will serve as good cause to waive the need for additional prior notice and comment in the *Federal Register*.

C. Abbreviated Rulemaking Actions Normally Requiring at Least Two Council Meetings and One *Federal Register* "Rule" or "Notice" **(Alternative 1) C. Specifications and Management Measures Rulemaking Actions Requiring at Least Two (Alternative 5) / Three (Alternatives 2-4) Council Meetings and Two *Federal Register* Notices** - These include (1) management actions being classified as "routine", or (2) trip limits that vary by gear type, closed seasons or areas, and in the recreational fishery, bag limits, size limits, time/area closures, boat limits, hook limits, and dressing requirements the first time these measures are used or ~~(3) management measures that are intended to have permanent effect and are discretionary, and for which the impacts have not been previously analyzed~~ **(moved to Section D, below)**. Examples include changes to or imposition of gear regulations, or imposition of landings limits, frequency limits, or limits that are differential by gear type, or closed areas or seasons for the first time on any species or species group, or gear type. The Council will develop and analyze the proposed management actions over the span of at least two / **three** Council meetings ~~(usually September and November)~~ and provide the public advance notice and opportunity to comment on both the proposals and the analysis prior to and at the second Council meeting. If the Regional Administrator approves the Council's recommendation, the Secretary will waive for good cause the requirement for prior notice and comment in the *Federal Register* and publish a "final rule" or "notice" in the *Federal Register* which will remain in effect until amended. **(Alternative 1 – sentence would be deleted under Alternatives 2-5)** If a management measure is designated as "routine" under this procedure, specific adjustments of that measure can subsequently be announced in the *Federal Register* by "notice" as described in the previous paragraphs. Nothing in this section prevents the Secretary from exercising the right not to waive the opportunity for prior notice and comment in the *Federal Register*, if appropriate, but presumes the Council process will adequately satisfy that requirement. **(Alternative 1 – sentence would be deleted under Alternatives 2-5) The Secretary will publish a "proposed rule" in the *Federal Register* with an appropriate period for public comment followed by publication of a "final rule" in the *Federal Register* (Alternatives 2-5).**

The primary purpose of the previous two categories of abbreviated notice and rulemaking procedures is to accommodate the Council's September-November meeting schedule for developing annual management recommendations, to satisfy the Secretary's responsibilities under the Administrative Procedures Act, and to address the need to implement management measures by January 1 of each fishing year. **(Alternative 1 – paragraph would be deleted under Alternatives 2-5)**

It should be noted the two **/three** Council meeting process refers to two decision meetings. The first **and second (Alternatives 2-4)** meeting to develop proposed management measures and their alternatives, the second **/third** meeting to make a final recommendation to the Secretary. For the Council to have adequate information to identify proposed management measures for public comment at the first meeting, the identification of issues and the development of proposals normally must begin at a prior Council meeting, ~~usually the June Council meeting~~.

D. Full Rulemaking Actions Normally Requiring at Least Two Council Meetings and Two *Federal Register* Rules (Regulatory Amendment) - These include any proposed management measure that is highly controversial or any measure which directly allocates the resource. **These also include management measures that are intended to have permanent effect and are discretionary, and for which the impacts have not been previously analyzed. (Alternative 2-5, moved from Section C, above)** The

Council normally will follow the two meeting procedure described for the abbreviated/ **specifications and management measures** rulemaking category. The Secretary will publish a "proposed rule" in the *Federal Register* with an appropriate period for public comment followed by publication of a "final rule" in the *Federal Register*.

Management measures recommended to address a resource conservation issue must be based upon the establishment of a "point of concern" and consistent with the specific procedures and criteria listed in Section 6.2.2.

Management measures recommended to address social or economic issues must be consistent with the specific procedures and criteria described in Section 6.2.3.

Exhibit C.8.e
Public Comment
June 2002

Subject: Fwd: Cutbacks
Date: Thu, 30 May 2002 09:38:05 -0700
From: "PFMC Comments" <pfmc.comments@noaa.gov>
To: chuck.tracy@noaa.gov

Pacific Fishery Management Council
7700 NE Ambassador Place, Suite 200
Portland, Oregon 97220-1384
Phone: 503-820-2280
Fax: 503-820-2299
Toll-Free: 1-866-806-7204
On the web at: http://www.pcouncil.org

Subject: Cutbacks
Date: Wed, 29 May 2002 19:40:19 EDT
From: <llahodges@aol.com>
To: pfmc.comments@noaa.gov

We are in the commercial fishing industry and in the paper we read that we could face worse cutbacks next year that we already have. There is a statement that says if a survey on Halibut is done it could catch all of the yearly quota on boccacio and yellow eye. If these fish are so endangered how can a survey catch the whole west coast allowance . If they are so scarce no one should be able to catch them. Someone needs to get thier head out of the sand and really see what is happening. The fishermen are seeing these fish which are suppose to live in the rocks out in the flat lands of the ocean. Does this make any sence? We are all having to be put out of business because of someones asumptions. Why not let the fishermen show what is out there? We all have to sit back and wait while you drive us into bankruptcy when we see the stocks are there. We don't know where the information is coming from but it is so wrong. UN REAL. All the fishermen have told you people what is out there but we are thought to all be liars. Don't you think it's time for someone to wake up and listen to the people who depend on the resource for thier lives? There is something seriously wrong with your data. It's time to check it or give us a way out without going totally broke!!!!!!!!

PFMC Comments <pfmc.comments@noaa.gov>

Subject: Fwd: Bottom Fish
From: "PFMC Comments" <pfmc.comments@noaa.gov>
Date: Mon, 03 Jun 2002 09:17:22 -0700
To: john.devore@noaa.gov

X-Mozilla-Status: 0001
X-Mozilla-Status2: 00000000
Return-Path: <pfmc.comments@noaa.gov>
Received: from mercury.akctr.noaa.gov ([127.0.0.1]) by mercury.akctr.noaa.gov (Netscape Messaging Server 4.15 mercury Jun 21 2001 23:53:48) with ESMTP id GX518Y00.TUG for <john.devore@noaa.gov>; Mon, 3 Jun 2002 09:17:22 -0700
Message-ID: <32b87532b52d.32b52d32b875@mercury.akctr.noaa.gov>
X-Mailer: Netscape Webmail
MIME-Version: 1.0
Content-Language: en
X-Accept-Language: en
Content-Type: multipart/mixed; boundary="--5639709f20f718a9"

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Portland, Oregon 97220-1384
Phone: 503-820-2280
Fax: 503-820-2299
Toll-Free: 1-866-806-7204
On the web at: http://www.pcouncil.org

Subject: Bottom Fish
From: Paul Fako <prfako@worldnet.att.net>
Date: Mon, 03 Jun 2002 08:29:00 -0700
To: <pfmc.comments@noaa.gov>

X-Mozilla-Status: 0001
X-Mozilla-Status2: 00000000
Return-Path: <pfmc.comments@noaa.gov>
Received: from mercury.akctr.noaa.gov ([127.0.0.1]) by mercury.akctr.noaa.gov (Netscape Messaging Server 4.15 mercury Jun 21 2001 23:53:48) with ESMTP id GX518Y00.TUG for <john.devore@noaa.gov>; Mon, 3 Jun 2002 09:17:22 -0700
Message-ID: <32b87532b52d.32b52d32b875@mercury.akctr.noaa.gov>
X-Mailer: Netscape Webmail
MIME-Version: 1.0
Content-Language: en
X-Accept-Language: en
Content-Type: multipart/mixed; boundary="--5639709f20f718a9"

Greetings:

I was pleased to read the article concerning your proposed action to ban bottom fishing in US Pacific Waters to increase depleted stock. This is a few years late as far as I am concerned. Although I am an avid fish eater and one-time ocean fisherman, It is very noticeable to even the least active of us that we are losing our fish. I only hope that the order is strong enough to enable us to prevent other countries from continuing to fish our water out to at least 100 miles. they wil be angry, but it happens. the entire world should take a hint and eat cerial for a few years to allow us to regain a hold on our fish stocks and STOP using this valuable for FERTILIZER and cat food and other unnecessary, profit/gain oriented enterpeises that are really of no benefit to me as a common man.

Thanks again. Vote YES to ban for 10 years!!!

Paul Fako, Pacifica, CA

PFMC Comments
<pfmc.comments@noaa.gov>

Subject: Fwd: Rockfish populations
From: "PFMC Comments" <pfmc.comments@noaa.gov>
Date: Thu, 30 May 2002 09:37:45 -0700
To: john.devore@noaa.gov
CC: chuck.tracy@noaa.gov

X-Mozilla-Status: 0001
X-Mozilla-Status2: 00000000
Return-Path: <pfmc.comments@noaa.gov>
Received: from mercury.akctr.noaa.gov ([127.0.0.1]) by mercury.akctr.noaa.gov (Netscape Messaging Server 4.15 mercury Jun 21 2001 23:53:48) with ESMTP id GWXNIX00.B29; Thu, 30 May 2002 09:37:45 -0700
Message-ID: <305cd230754a.30754a305cd2@mercury.akctr.noaa.gov>
X-Mailer: Netscape Webmail
MIME-Version: 1.0
Content-Language: en
X-Accept-Language: en
Content-Type: multipart/mixed; boundary="--237267a27f085ab0"

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Fax: 503-820-2299
Toll-Free: 1-866-806-7204
On the web at: http://www.pcouncil.org

Subject: Rockfish populations
From: Kimball Marlow <kmarlow@earthlink.net>
Date: Thu, 30 May 2002 08:53:14 -0700
To: pfmc.comments@noaa.gov

X-Mozilla-Status: 0001
X-Mozilla-Status2: 00000000
Return-Path: <pfmc.comments@noaa.gov>
Received: from mercury.akctr.noaa.gov ([127.0.0.1]) by mercury.akctr.noaa.gov (Netscape Messaging Server 4.15 mercury Jun 21 2001 23:53:48) with ESMTP id GWXNIX00.B29; Thu, 30 May 2002 09:37:45 -0700
Message-ID: <305cd230754a.30754a305cd2@mercury.akctr.noaa.gov>
X-Mailer: Netscape Webmail
MIME-Version: 1.0
Content-Language: en
X-Accept-Language: en
Content-Type: multipart/mixed; boundary="--237267a27f085ab0"

To: Policy Makers

I read a article in the Oregonian this morning on 3 rockfish that have very low populations with a projected recovery time of 60 plus years. I have a few ideas that might help, both the fish, and the commercial fisherman. I agree that the populations need recovery time, and the only way to do this is to stop fishing where they breed and mature. It is to bad that the other fisheries will have to pay the price for the recovery of this group, but it seems the only clear path to recovery. I would like to see this problem approached in a manor that works for everyone, but I think that is not practical, some commercial fishing will have to be redefined such as the bottom drag net group that destroy a wide range of habitat and captures juvenile fish. Here is what I have come up with for a few solutions.

1. That recreational angling say unchanged from the shore, and within the mouth of the bay.

2. That recreational angling outside the bay be confined to 2 mile north or south of the bay, and up to 4 miles out. (This will leave a very large area for natural habitat that can offer plenty of space to young fish, and will also reduce the take of young Salmon.)

3. Halibut fishing and Crab trapping stay unchanged.

4. All drag nets, gill nets, and long lines be terminated for a number of years, and then only allow them to work small strips of ocean bottom. Kind of like strip logging in the mountains, but 95% of the ocean bottom is untouched forever to keep fishery levels in good condition.

5. Institute a massive artificial reef/habitat project up and down the coast to provide work for the displaced commercial fisherman, and speed the recovery of the rockfish populations. I'm not sure what you would use for this, but I think I remember old tires being put to good use this way. This will keep their boats operating and the bills paid, so their families don't end up on the welfare line. (get congress to recognize this as a disaster area that requires help)

6. Keep foreign fishing boats a long way of our continental shelf.

This is just some brain storming and you can take it or leave it, but I had to put in my 2 cents.
Sincerely: Kim Marlow

PFMC Comments
<pfmc.comments@noaa.gov>

Subject: Fwd: Don't Stop Sportsman from Bottom Fishing!
From: "PFMC Comments" <pfmc.comments@noaa.gov>
Date: Fri, 31 May 2002 13:35:17 -0700
To: john.devore@noaa.gov

X-Mozilla-Status: 0001
X-Mozilla-Status2: 00000000
Return-Path: <pfmc.comments@noaa.gov>
Received: from mercury.akctr.noaa.gov ([127.0.0.1]) by mercury.akctr.noaa.gov (Netscape Messaging Server 4.15 mercury Jun 21 2001 23:53:48) with ESMTP id GWZT6T00.LII for <john.devore@noaa.gov>; Fri, 31 May 2002 13:35:17 -0700
Message-ID: <319e3d314239.314239319e3d@mercury.akctr.noaa.gov>
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MIME-Version: 1.0
Content-Language: en
X-Accept-Language: en
Content-Type: multipart/mixed; boundary="--3ad61d78575c7aa"

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Toll-Free: 1-866-806-7204
On the web at: http://www.pcouncil.org

Subject: Don't Stop Sportsman from Bottom Fishing!
From: "Wilsonville Dental Group" <wdgweb@wilsonvilledental.com>
Date: Thu, 30 May 2002 21:48:02 -0700
To: <pfmc.comments@noaa.gov>

X-Mozilla-Status: 0001
X-Mozilla-Status2: 00000000
Return-Path: <pfmc.comments@noaa.gov>
Received: from mercury.akctr.noaa.gov ([127.0.0.1]) by mercury.akctr.noaa.gov (Netscape Messaging Server 4.15 mercury Jun 21 2001 23:53:48) with ESMTP id GWZT6T00.LII for <john.devore@noaa.gov>; Fri, 31 May 2002 13:35:17 -0700
Message-ID: <319e3d314239.314239319e3d@mercury.akctr.noaa.gov>
X-Mailer: Netscape Webmail
MIME-Version: 1.0
Content-Language: en
X-Accept-Language: en
Content-Type: multipart/mixed; boundary="--3ad61d78575c7aa"

Wilsonville Dental Group, P.C.

29292 Town Center Loop E.
Wilsonville, OR 97070
503-682-3873 fax
503-682-0431
drclark@wilsonvilledental.com

May 30, 2002

Pacific Fisheries Management Council

Re: Commission to stop all bottom fishing for sportsman

Dear Sirs:

I am a concerned citizen and sportsman in Oregon worried about the pending rule changes that would eliminate all fishing in the Pacific Ocean for all bottom fish, including halibut, ling cod, sea bass, etc. As I am sure you are aware, the Pacific Fisheries Management Council is recommending eliminating all bottom fishing by January 2003. If this passes through the council and is adopted, it will be a disaster for Oregon's coastal economy, as well as a huge disappointment for all sports fishermen.

Specifically, I feel sport fishing should be considered separately from commercial fishing, and like all the other fishing regulations, be regulated separately. I think the economic impact of this decision must be balanced with any concern for the fish. There must be better science behind such a decision, one that has such sweeping results. This should be better thought out and more gradually implemented. I have outlined below the reasons for this important point. If there is anything you can do to help keep the sport fishing open, it will keep the charter boats, the guides and the private fisherman on the water. If bottom fishing is eliminated for sportsmen, all the ocean charters will cease to exist. Please have one of your staff call and interview some of them and you will be shocked at how catastrophic this will be to them personally and as an industry. Here are two names you can call:

Jeurgen Turner, Captain of the Tacklebuster, Tradewinds Charters, Depoe Bay, Oregon 1-541-765-2949, 1-800-445-8730

Wayne Butler, Captain of the MisChief, Bandon, Oregon
1-541-347-9126

Outlined below are the main points to consider:

1. Sportsmen make a huge contribution to the local economy. Depending on the area, we are talking about millions and millions of dollars, from gas stations, to shopping malls, to hotels and restaurants, etc.
2. Sportsmen catch only 3-4% of the total catch, statistically insignificant. This is way less than the margin of error that the researchers use for guessing the numbers of total fish and their alleged decline. In other words, the impact of sport fishing could not even be measured! They are swatting a fly with a sledgehammer, and then want to measure the impact of the fly on reducing the speed of the sledgehammer as it comes to a stop. Whether there was inshore sport fishing or not would have no statistical impact on the total population of bottom fish, either up or down.
3. Sportsmen generate 40 times as much money per pound of fish caught than commercially caught fish for the economy. Thus it would be fiscally irresponsibly to eliminate millions of dollars from the economy without any proven benefit. The commercial boats catch 97% of the fish but contribute only 2.5%, per pound of fish caught, as much to the economy as the sport fisherman. Wouldn't it make a lot more sense to have your cake and eat it too, i.e. cut the commercial fisherman, thus reducing fish catch by 97%, and retain the sport fishing with it's millions and millions of dollars in the economy.
4. Sportsman practice targeted fishing techniques, not indiscriminate, non-selective methods, like the commercial fisherman. Sport fishing uses simple hooks and bait targeted toward a specific species. If the wrong fish is caught it can generally be released unharmed. Generally fish are caught one at a time, therefore reducing to total damage, worst-case scenario, to one fish! Commercial fisherman's techniques will kill all the fish caught, regardless of their species or desirability, and this may be thousands of fish by a single boat. The by catch/incidental catch of non-target fish can sometimes be greater than the targeted species. The incidental catch fish are generally not allowed to be kept, thus a double problem; not only were they needlessly killed, they will not even be eaten. Generally the unwanted fish are simply pitch forked over the side. To put this into perspective, every year the incidental catch of halibut by commercial fisherman fishing for other species, is greater than the total amount of halibut caught by sport fishermen! This can also be true for salmon and other fish depending on the commercial fishery and location.
5. Sportsman's fishing techniques do not harm the fish's habitat, like can happen with some commercial harvesting. There is no impact to the fish habitat by sport fishing. Some types of commercial fishing can cause irreparable damage to the bottom structure that can totally wreck the habitat and seriously disrupt the food chain. The indiscriminant harvesting of "everything" on the bottom can totally devastate the populations of some species to the point of complete extinction in that location.
6. Sportsmen have proven they will follow conservationist regulations. These regulations do not need to be all or none. If there are target fish needing help with survival, let the sportsman be an educated conservationist and make those species catch and release only. Sportsmen have been doing this successfully for many years with numerous other species.
7. Sportsmen are willing to team-up with the Fish and Wildlife agencies to help with the rehabilitation of bottom fish habitat and populations. They are willing to contribute time and money to help. This new regulation will not make them a team member but will make them an enemy. There will be no money, time or cooperation when such fact less and groundless regulations are put into effect.
8. The continued sport fishing for bottom fish enhances public awareness of the problem. As long as people are still fishing for bottom fish, even with catch and release regulations, there will be an increased public awareness of the problem. Out of sight and out of mind will take place if there is no bottom fishing.
9. The government should not have a "knee jerk" reaction to limited and potentially flawed science.
   a. Perhaps the same El Nino climatic changes, which produced a huge reduction in the salmon populations for a decade, may be responsible for a similar cyclic low in the bottom fish population. (El Nino's change in winds and currents reduced the near shore upwelling of nutrient rich deep water. This in turn diminished the food for plankton, which diminished the food for herring and other baitfish, which diminished the food for salmon.) Since it is known that bottom fish, in general, mature slower and live longer than salmon, and since they are effected by the very same food chain changes, perhaps it is simply the same cyclic change in their population that was observed for salmon, but delayed in observance because of their slower growth and reproduction. This would be a naturally occurring cycle, not one completely caused by over fishing. Likewise, it will self-resolve with the return of normal ocean conditions more conducive to providing the necessary food chain for all the bottom fish involved; and until the ocean conditions favor the reproduction of bottom fish populations, sport fishing restrictions will have zero positive effect.
   b. Perhaps, since the only real research on bottom fishing populations is on fish inside 250 fathoms, the cause of a decline in fish populations is related to chemical pollutants and other toxins. If we focus on fishing as the only cause of the decline, more time and money will be senselessly lost. The focus of regulations should be as specific as possible to target and control the most likely causes of the bottom fish decline. Sport fishing is not one of the principle causes and restricting it will cause more harm than good. The money generated by the sport fisherman can be used to fund more research and find effective solutions to the fisheries problems. Eliminating the sportsmen's revenues will reduce the amount of funding to find the true causes and solutions.
10. The regulations should relate to actual local conditions, not global, sweeping regulations that treat every area with the same restrictions, regardless of the local fish populations and conditions. They should have accurate estimates of past fish populations and be able to show conclusively there is a decline, (not a natural cyclic adjustment to fish populations) and then do this for each area they wish to regulate. Since the fish are not migratory, it is not acceptable to generalize conditions and populations and assume that in area X it is the same as in area Y. It would be criminal to damage people and economies in areas where it is not needed; where restricting fishing in healthy areas would have no positive benefit for the areas where the problems exist, and would cause great harm to the people and economy where there isn't even a problem.
11. The Federal Government has no constitutional right to regulate Oregon State waters, i.e. inside three miles of our coast. It regulates salmon because the fish are migratory and extend their range beyond state boundaries; halibut because it is impacted by commercial fisherman from all west coast states in waters generally outside the state's three mile boundary, and other fisheries that are primarily outside the state's boundary, i.e. shrimp, haddock, cod, etc. However, bottom fish are not migratory and the part of this new regulation that would impact inside the three-mile state's constitutional boundary is outside the federal government's jurisdiction. It would be tantamount to the federal government regulating crappie fishing. It is the states sovereign right to control it's own boundary waters. The state of Oregon should vigorously oppose any federal regulations inside it's own boundaries.

As I began, I am a concerned citizen and sportsman. Professionally I am a dentist, not a charter boat operator or guide. I am very interested in seeing sound science behind any decision and believe we have not been given any. Nor has the Commission considered the State's rights and ability to handle much of this on a state level.

Please balance your considerations and do all you can to help protect not only the fish, but the fishermen as well.

Sincerely,

Terrence A. Clark, DMD

PFMC Comments
<pfmc.comments@noaa.gov>

WASHINGTON DEPARTMENT OF FISH AND WILDLIFE
PROPOSED COMMERCIAL FISHERY OPTIONS FOR 2003

The Washington Department of Fish and Wildlife (WDFW) is proposing the following commercial fishery options to be considered for public review. All fathom lines will be defined by latitude/longitude waypoints.

Commercial Groundfish (LE & OA)

Option 1
Close fixed gear and/or trawl fisheries inside a line approximating 150 fathoms to provide protection for canary and yelloweye rockfish.

Option 2
Close fixed gear fishery inside a line approximating 100 fathoms to provide protection for yelloweye rockfish.

Option 3
Close trawl fishery inside a line approximating 250 fathoms to provide protection for darkblotched rockfish.

Option 4
Close trawl flatfish fishery outside a line approximating either 50, 75,100, or 125 fathoms to provide protection for darkblotched, canary and yelloweye rockfish (closure areas would apply as needed to conserve rockfish).

Option 5
Allow midwater trawl fishery for yellowtail and widow rockfish subject to time/area restrictions.

Option 6
Allow midwater trawl fishery for whiting subject to time/area restrictions.

Halibut Retention in Sablefish Fishery North of Pt. Chehalis

Option 1
No halibut retention allowed in sablefish fishery North of Pt. Chehalis.

Halibut South of Pt. Chehalis

Option 1
Close directed halibut fishery in the area outside 25 fathoms and inside 150 fathoms.

Option 2
Allow directed halibut fishery subject to time/area/observer restrictions/requirements.

Pink Shrimp Fishery

Option 1
Require excluders in the pink shrimp fishery.

Option 2
Mandatory retention of marketable groundfish in the pink shrimp fishery.

Salmon Troll

Option 1
No halibut retention in salmon troll fishery; no yelloweye and canary rockfish retention.

Option 2
Close salmon troll fishery in Marine Catch Areas 3 and 4 outside 25 fathoms.

Option 3
Gear modifications (e.g., prohibit placement of any hook within 4 fathoms (24') of the weight used on each mainline deployed).

WASHINGTON DEPARTMENT OF FISH AND WILDLIFE
PROPOSED RECREATIONAL GROUNDFISH SEASON OPTIONS FOR 2003

The Washington Department of Fish and Wildlife (WDFW) is proposing the following recreational groundfish season options to be considered for public review:

Bottomfish

Option 1
A recreational groundfish bag limit of 10 groundfish, including rockfish (and excluding lingcod), sublimit of 1 canary rockfish and no retention of yelloweye rockfish, open year-round. An additional bag limit of 2 lingcod, 24-inch minimum size limit, open Mar 16-Oct 15.

Option 2
A recreational groundfish bag limit of 10 groundfish, including rockfish (and excluding lingcod), and no retention of canary or yelloweye rockfish, open year-round. An additional bag limit of 2 lingcod, 24-inch minimum size limit, open Mar 16-Oct 15.

Option 3
Option 1 or 2 with closure outside of a line approximating 25 fathoms–latitude/longitude waypoints to be defined.

Halibut

Option 1
Allow recreational halibut fishing inside one-square-mile halibut “hotspot” areas–latitude/longitude points to be defined; subarea seasons described in Catch Sharing Plan.

Option 2
Close recreational halibut fishery outside of a line approximating 25 fathoms–latitude/longitude waypoints to be defined; subarea seasons described in Catch Sharing Plan.

Salmon

Option 1
Close recreational salmon fishery outside of a line approximating 25 fathoms in Marine Catch Areas 3 and 4--latitude/longitude waypoints to be defined.

Option 2
No retention of canary rockfish with a salmon onboard.

Option 3
Option 2 with additional restriction of no halibut retention with a salmon onboard.

-DRAFT-

California Recreational and Commercial Fixed Gear Rockfish and Lingcod Management Recommendations for 2003

(All 2002 regulations remain in effect for 2003 unless modified for 2003)

I. Northern Area (40° 10' to Oregon border)

(Same as Oregon)

II. Southern Area (South of 40° 10')

1. Optimum Yields (South of 40° 10')

- Bocaccio – 0 to 6 metric ton range
- Nearshore rockfish sort group
  - Option one: partition minor nearshore into components. Shallow Group (B&Y, China, gopher, grass, kelp) 80 to 160 mt. CA scorpionfish (sculpin) 50 to 100 mt. Deeper group 402 to 532 mt. The total would not exceed the current 662 mt.
  - Option two: manage minor near shore as we do now but reduce it to the historic catch in the minor nearshore (shallow group: 80 to 160 mt, scorpionfish: 50 to 100 mt).
  - Option three: provide for the shallow group and scorpionfish in accordance with "Option one" estimates (80 to 160 mt, 50 to 100 mt) and then adjust (increase) the overall shallow OY to account for expected catch of the deeper nearshore group in shallow water (<20fm; <10 fm).
    - Fishing allowed within 20 fathoms: increase OY by 20-150 mt (see tasks, below)
    - Fishing allowed within 10 fathoms: increase OY by 10-100 mt (see tasks, below)

2. Nearshore rockfish set-aside for recreational fishery

- Option one: maintain a 16% commercial / 84% recreational apportionment of overall OY for minor nearshore group
- Option two: 50% commercial / 50% recreational apportionment

3. Depth restrictions

- Option one: no rockfish, lingcod, (or ocean whitefish)[1] may be taken in waters between 10 fathoms and 150 fathoms
- Option two: no rockfish, lingcod (or ocean whitefish)[1] may be taken in waters between 20 fathoms and 150 fathoms

4. Rockfish and lingcod fishing seasons

- Match commercial fixed gear season with recreational
  - Option one: year-round fishery
  - Option two: maintain 2002 season structure for nearshore rockfish
    - 40° 10' to Pt. Conception: Jan-Feb, May-Oct, Nov-Dec (maybe)
    - Pt. Conception to Mexico border: Mar-Oct

5. Rockfish and lingcod bag limits

- Rockfish
  - Option one: 5 rockfish; no more than 1 shelf rockfish; 0 overfished rockfish
  - Option two: 7 rockfish; no more than 2 shelf rockfish; 0 overfished rockfish
  - Option three: 10 rockfish; no more than 2 shelf rockfish; 0 overfished rockfish
- Lingcod
  - Option one: 2 lingcod with 24 inch size limit
  - Option two: 2 lingcod with 22 inch size limit
  - Option three: 3 lingcod with 22 inch size limit

- CA Scorpionfish (sculpin)
    - 5-10 fish scorpionfish bag limit separate from rockfish bag limit

6. Rockfish size limits

- Option 1: status quo; no recreational size limits for Shallow Group (B&Y, China, gopher, grass, kelp)
- Option 2: match recreational size limits to commercial size limits

Black and yellow	10 in.
China	12 in.
Gopher	10 in.
Grass	12 in.
Kelp	10 in.

7. Other Management Issues/Options

- Commercial
    - Gear restrictions – no stick gear
    - Gear closely attended
    - Limit hooks
    - Barbless hooks
    - Circle hooks
- Recreational
    - Barbless hooks
    - Circle hooks

Tasks to be completed prior to September meeting: Look at the proportion of blues/blacks, etc (the crossover species) that were caught in less than 10-20 fathoms. Look at ratio of the eight deeper species to the shallow five in less than 10-20 fathoms. This will help decide the reduction of OY in the minor nearshore.

Note: 1. Does not apply to commercial.

6/20/2002 4:43 AM

ELTON GALLEGLY
23D DISTRICT, CALIFORNIA

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Congress of the United States
House of Representatives
Washington, DC 20515–0523

COMMITTEES:
INTERNATIONAL RELATIONS
SUBCOMMITTEES:
EUROPE, CHAIRMAN
WESTERN HEMISPHERE
JUDICIARY
SUBCOMMITTEES:
IMMIGRATION AND CLAIMS
COURTS, THE INTERNET AND INTELLECTUAL PROPERTY
RESOURCES
SUBCOMMITTEE:
NATIONAL PARKS, RECREATION AND PUBLIC LANDS

June 10, 2002

RECEIVED
JUN 14 2002
PFMC

The Honorable Donald Evans
Secretary
Department of Commerce
14th Street and Constitution Ave. N.W.
Washington, D.C. 20230

Dear Secretary Evans:

Enclosed, please find a letter from Bob Fletcher, President of the Sportfishing Association of California expressing his concern over a proposal to close or severely reduce the take of the bocaccio or salmon grouper off the coast of California.

Along with Mr. Fletcher, several of my constituents in the sportfishing industry have come to my office expressing their concerns regarding the latest "scientific" stock assessment of the bocaccio rockfish that will be discussed at the June 17th meeting of the Pacific Fishery Management Council. It is my understanding that no independent adult groundfish surveys have been conducted south of Point Conception in 25 years. In addition, the sport fisherman and commercial fisherman who have come to my office have indicated they are seeing more rockfish, including bocaccio, than they have seen in many years. Furthermore, the economic impact of the elimination of the rockfish fishery off the California coast will be devastating, and will surely lead to bankruptcy for many and to major dislocation for others.

Please review the concerns outlined in Mr. Fletcher's letter and provide a response. Thank you for your attention to this matter. Please forward your reply to my Oxnard district office.

Sincerely,

ELTON GALLEGLY
Member of Congress

cc: Chairman Radtke, PFMC

SPORTFISHING ASSOCIATION OF CALIFORNIA

1084 BANGOR STREET
SAN DIEGO, CALIFORNIA 92106
(619) 226-6455 FAX (619) 226-0175

ROBERT C. FLETCHER
PRESIDENT

W. A. NOTT
PRESIDENT-EMERITUS

June 8, 2002

The Honorable Elton Gallegly
U. S. House of Representatives
2427 Russell House Office Building
Independence Ave. & S. Capitol ST., SW
Washington, DC 20515

Subject: Pacific Fishery Management Council (PFMC) Assessment of Bocaccio.

Dear Representative Gallegly:

The Sportfishing Association of California (SAC) has since 1972 represented the legitimate interests of the southern California commercial passenger fishing vessel (CPFV) fleet. Many of our members fish out of the ports of Oxnard, Ventura, Port Hueneme and Santa Barbara, and rely heavily on access to the rockfish complex; a large mixed stock assemblage of bottom fish. In its meeting during the week of June 17th, the PFMC will be receiving a 'stock assessment' report from one of its scientific advisory bodies showing that the bocaccio, or salmon grouper, populations are in need of much more protection, and the probable result of such protection will be a total closure of all shelf rockfishing in 2003, and perhaps even additional closures in 2002.

Congressman Gallegly, the closure, if it comes, will have a devastating effect on the small businesses operating charter and open party sportfishing boats in your district, and appears to be in direct conflict with the overwhelming view of the fishermen that the stocks are, in fact, in better shape than just three years ago! In addition ~~to~~ this unanimous opinion of skippers that the bocaccio are in better shape than they have been in decades, there has not been an fishery-independent adult bottomfish survey south of Point Conception in 25 years! Finally, the bocaccio stock distribution continues south into the waters off Baja California for 250 miles, and there is no indication that that portion of the population is in any trouble.

SAC requests that you contact the appropriate person in the Federal government, perhaps the Secretary of Commerce, and express your concern over the probable elimination of sportfishing opportunity for rockfishing in southern California, based on science that directly flies in the face of the fishermen's opinion of the bocaccio's status, and has no groundfish surveys from the area where the fish lives!

Sincerely,

Bob Fletcher

Bob Fletcher, President

Exhibit C.8.c
Supplemental ODFW Report
June 2002

MEMORANDUM

OREGON DEPARTMENT OF FISH AND WILDLIFE

DATE: June 5, 2002

TO: Mark Saelens

FROM: Bob Hannah

SUBJ: Projected Canary Rockfish Catch With Various BRD Rules

As per your request, here are my estimates of the amount of canary rockfish needed by the regional pink shrimp fishery to get through the season under various BRD (Bycatch Reduction Device) scenarios.

Status Quo - BRDs required mid summer, using current rules	5.5 t
BRDs required April 1, under current rules	1.0 t
BRDs required April 1, No Fisheyes allowed	0.5 t
BRDs required April 1, No Fisheyes, No daily testing period	0.1 t

These numbers are pretty soft, with the exception of the 5.5 and1.0 ton figures which are based on landings in 2001, and inseason progress to date in 2002.

2003 Oregon Marine Recreational Fishery Options

Option 1. Most Liberal –overall status quo with adjustments to lingcod bag limit and cabezon length limit (alt. 3)

Bottomfish – 10 rockfish bag limit with sub-limits of 1 canary and 1 yelloweye rockfish. Two lingcod at 24-inch minimum length. Minimum length limit of 16 inches for cabezon. Fishery open year round at all-depths.

P. Halibut – Yelloweye rockfish retention prohibited if Pacific halibut is on-board vessel during all-depth fishery. See catch sharing plan.

Option 2 Medium Conservative (alt. 2)

Bottomfish – 10 rockfish bag limit with sub-limits of 1 canary and 1 yelloweye rockfish. Two lingcod at 24-inch minimum length. Fishery open year round, but restricted to 0 to 27 fathoms from June through October. Minimum length limit of 16 inches for cabezon. Oregon nearshore landing restrictions (commercial and recreational) capped at 2000 levels for the following species categories:

Black and blue rockfish combined
Other nearshore rockfish combined
Cabezon (16" inch minimum length)
Greenling spp.

Note:
(1) Council preference for recreational fisheries is continued. Total expected recreational catch deducted from total OY, remainder available to commercial fisheries.
(2) Commercial hook-and-line fisheries to be closed if rockfish limit of any category reached.

P. Halibut – Yelloweye rockfish retention prohibited if Pacific halibut is on-board vessel during all-depth fishery. Nearshore fishery open in < or = to 27-fathom curve during June through September. See catch sharing plan.

Option 3. Most Conservation (alt. 1)

Bottomfish - 10 groundfish bag limit (including lingcod) with sub-limits of 1 canary and 2 lingcod (24-inch minimum length). Yelloweye rockfish retention prohibited. Minimum length limit of 16 inches for cabezon. Open 0 to 20 fathoms year round. Oregon landings of nearshore fish capped at 2000 levels (see option 2).

Pacific Halibut – all-depth fishery closed on Stonewall Banks; description area to be identified. Nearshore open to < or = 20 fathom curve. See catch sharing plan for sub-area seasons.

Salmon – mooching may be prohibited.

2003 Oregon Commercial Groundfish Management Options
(Range of options for discussion June-September, 2002

Option 1 (Most Conservative)

- Open 0-20 fathoms for hook and line fishing of black rockfish and blue rockfish.
- Open 0-50 fathoms for nearshore flatfish.
- Closed 20-150 fathoms to all commercial fishing except:
  - Nearshore flatfish fishery allowed out to 50 fm.
  - Shrimp fishery allowed with mandatory excluder devices.
  - Pacific whiting fishery (midwater gear) allowed.
  - Other state fisheries (e.g. crab) allowed.
  - Oregon Developing Fisheries allowed, but no groundfish retention.
- If darkblotched rockfish OY is reduced significantly extend closure to 250 fathoms.
- Nearshore catch capped at the level of 2000 catch, 16"minimum size for cabezon.
- Restrict halibut fishing to outside 150 fathoms.
- For salmon troll fishery new requirements for distance between cannonball and first spread may be increased. Other options may also be considered.

Option 2 (Medium Conservation)

- Open 0-27 fathoms for hook and line fishing of black rockfish and blue rockfish.
- Open 0-50, or perhaps 75, fathoms for nearshore flatfish.
- Closed 20-150 fathoms to all commercial fishing except:
  - Nearshore flatfish fishery allowed out to 50 or 75 fm (to be determined).
  - Shrimp fishery allowed with mandatory excluder devices.
  - Pacific whiting fishery (midwater gear) allowed.
  - Other state fisheries (e.g. crab) allowed.
  - Oregon Developing Fisheries allowed, but no groundfish retention.
  - EFP fishery for yellowtail rockfish and widow rockfish allowed.
  - EFP fishery for flatfish using selective flatfish trawl allowed.
- If darkblotched rockfish OY is reduced significantly extend closure to 250 fathoms.
- Nearshore catch capped at the level of 2000 catch, 16"minimum size for cabezon.
- Restrict halibut fishing to outside 100 fathoms.
- For salmon troll fishery new requirements for distance between cannonball and first spread may be increased. Other options may also be considered.

Option 3 (Most Liberal)

- Open 0-27 fathoms for hook and line fishing of black rockfish and blue rockfish.
- Open 0-75, fathoms for nearshore flatfish.
- Closed 20-150 fathoms to all commercial fishing except:
  - Nearshore flatfish fishery allowed out to 75 fm.
  - Shrimp fishery with mandatory excluder devices allowed.

- Pacific whiting fishery (midwater gear) allowed.
- Other state fisheries (e.g. crab) allowed.
- Oregon Developing Fisheries allowed, but no groundfish retention.
- EFP fishery for yellowtail rockfish and widow rockfish allowed.
- EFP fishery for flatfish using selective flatfish trawl allowed.

- If darkblotched rockfish total is reduced significantly extend closure to 250 fathoms.
- Nearshore catch capped at the level of 2000 catch, 16"minimum size for cabezon.

Quileute Natural Resources
QUILEUTE INDIAN TRIBE

401 Main Street • Post Office Box 187
LaPush, Washington 98350
Phone: (360) 374-5695 • Fax: (360) 374-9250

TESTIMONY OF THE QUILEUTE TRIBE TO PFMC
FOSTER CITY, CALIFORNIA
June 20, 2002

My name is Mel Moon. I am the Director of Natural Resources for the Quileute tribe. I am giving testimony for the Quileute Tribe on the groundfish proposed management measure for 2003 (table 2-1 revised) options listed in the ABC OY chart. After review it is apparent that for this meeting the most pressing issue is the setting of 2003 yelloweye harvest levels. For the Pacific Coast Treaty Tribes in Washington State that fish for halibut, the critical issue is how to continue the halibut fishery in light of the incidental catch of yelloweye.

For these tribes, last year we estimated 1.5 metric tons of incidental catch of yelloweye were needed to conduct all fisheries. The actual catch during all fisheries for the Pacific Ocean Washington treaty tribes was approx. 2.25 metric tons (halibut, sablefish, salmon, Ceremonial & Subsistence). Consultation with the other tribes indicated that of the 2.25 mt, the Makah landed .75 mt, the Quinault landed less than 100 lbs and the Quileute landed 1.5 mt of the total. In comparison to all other non-tribal fisheries, the tribal catch has been consistently low. In light of the recent developments in the PFMC process, incidental encounter of yelloweye is of the highest concern for the coastal Tribes in '03, especially during the halibut fishery.

We are currently exploring alternative means to reduce potential impacts to yelloweye during this halibut fishery. Minimizing impacts may include regulations that consider the use of alternative baits, times, and depths of fishing.

We have a unique legal standing that presents a challenge to achieving or designing a lower catch plan on yelloweye. In March of 2001, Judge Rothstein of the U.S. District court, Western District of Washington, signed a court order directing the 12 Treaty Halibut Tribes to follow a detailed management plan. The plan requires fixed start dates (mid- March) with successive dates and set percentage amounts for restricted and unrestricted fisheries in the 12 treaty halibut Tribes' usual and accustomed fishing grounds.

Under this prescribed, court-ordered structure, the 2003 Treaty Halibut fishery for the four Pacific coastal tribes would likely result in another 2.25 metric tons landed of incidental yelloweye. Of the same total the Quileute Tribe would likely catch 1.5 metric tons. We are currently exploring alternatives with all other halibut tribes to discuss possible new plans for 03 which could reduce this amount.

This alternative would involve an agreed-to intertribal allocation of halibut between all 12 treaty halibut Tribes. This new management plan would have to be submitted to and approved by the court. Individual allocation would allow tribes more flexibility in structuring their fisheries to reduce the impacts of incidental yelloweye during halibut fisheries. In addition to exploring these alternatives with other treaty halibut Tribes, we are working closely with the other co-managers to explain how to address these challenges.

Quileute Natural Resources actively manages its halibut fishery, which includes closely monitoring and recording yelloweye encounter. Our efforts include acquiring tribal and state funding to initiate a port sampling program in Neah Bay, LaPush and Westport. We are also engaged with the National Marine Fisheries Service to develop a near-term and long-term program to assess and monitor the stocks on a regional basis.

In regard to other groundfish species, we would support the '02 harvest and allocation principles and have them forwarded for '03.

COASTAL PELAGIC SPECIES ADVISORY SUBPANEL COMMENTS ON PROPOSED MANAGEMENT MEASURES FOR 2003

The Coastal Pelagic Species Advisory Subpanel reviewed the proposed management recommendations for market squid in 2003, including a prohibition on day-time fishing and no purse seining for squid within 10 fathoms anywhere in the state of California. The HMSAS also reviewed the background paper submitted by Ms. Heather Munro on behalf of the West Coast Seafood Processors's Association that investigates the alleged incidents of bocaccio interaction within the market squid fishery.

The CPSAS does not believe eliminating day-time fishing is a rational recommendation. Currently, 100% of the squid fishing in the Monterey/Moss Landing area occurs during daylight hours - the only time squid are available to the fishery. Eliminating daytime fishing would result in an immediate halt of landings into Monterey causing negative economic and social impacts. Furthermore, there is no economic incentive to land bocaccio, only a disincentive as it renders the squid catch worthless. The percentage of daytime squid fishing in southern California is less, but still a significant amount. There have been no allegations of bocaccio interaction with squid catches in southern California.

The reality of the fishing practice is that fishermen can and want to avoid bocaccio during their fishing trips. Experienced fisherman can identify bocaccio on their echo sounder and avoid them. If a fishermen has not identified the fish and makes a set, he still has the opportunity to let the fish escape once he realizes that the fish are not squid.

The CPSAS is concerned there is no evidence to suggest the recent allegation of interaction with bocaccio is more then a rare occurrence, and the proposed management measures are not based on the best available science.

The information provided by California Department of Fish and Game (CDFG) port sampling data demonstrates there has been only one incidence of bocaccio observed in the market squid catch prior to 2002. It occurred on July 9, 2001 in Moss Landing. There were a total of 1,481 landings between October 1998 and September 2001. After that time, CDFG has observed and recorded another 559 landings, of which one incident of bocaccio (a handful) was recorded in Moss Landing as incidental catch. The total number of landings that have been observed is 2,040.

This works out to less then 0.1% occurrence. The CPSAS finds that further restricting the market squid fishery based on the existing data is unjustified. There are already management measures in place that prohibit weekend fishing.

The CPSAS recommends the Council consider the most recent quantitative data that demonstrates the lack of interaction between bocaccio and market squid prior to implementing any further restrictions. The CPSAS believes the data demonstrates that no further restrictions on market squid fishing at this time are warranted. Ongoing monitoring of potential bocaccio interactions should continue through the current port sampling program.

PFMC
06/20/02

Exhibit C.8.d
Supplemental EC Report
June 2002

ENFORCEMENT CONSULTANTS REPORT ON
PROPOSED MANAGEMENT MEASURES FOR 2003

The conservation measures under consideration for 2003 represent an unprecedented shift in emphasis from dockside to at-sea enforcement. Over the course of time, dockside trip limit management has been the mainstay of groundfish enforcement on the West Coast. This enforcement responsibility has been shouldered almost exclusively by the state officers in many coastal ports. It is inappropriate and an unfair expectation that state agencies should now be expected to shoulder a major at-sea enforcement regime. An increased responsibility now falls on the federal agencies jointly responsible for management and enforcement in the federal exclusive economic zone (EEZ).

NOAA Fisheries Office of Law Enforcement, the U.S. Coast Guard, fisheries managers, and many agencies with audit and oversight responsibilities such as the Office of Inspector General and General Accounting Office have provided guidance and direction to our Fisheries Management Councils encouraging them to adopt conservation and management measures that are cost effective and enforceable. Where dockside measures alone will not achieve the desired conservation goals for a co-managed resource, the Councils, states, and NOAA Fisheries increasingly rely on Vessel Monitoring System (VMS) technology.

The bathymetric restrictions proposed for a majority of the West Coast fisheries extending from Canada to Mexico mark a transition to major dependence on costly at-sea enforcement. The low optinum yields (OYs) for the most stressed stocks of groundfish can be easily exceeded by only a few unlawful incursions by vessels with gear capable of catching relatively large quantities of these prohibited species. This represents a daunting challenge for the Coast Guard, states, NOAA Fisheries, and the Council to deter those few unlawful incursions which could compromise the management goals.

At their present capabilities, Enforcement Consultant (EC) agency patrol vessels and aircraft are unable to provide year-long, coast-wide coverage of the EEZ out to the seaward bathymetric restricted area, to the degree required to meet the management goals. As a result, the Council will need to embrace new enforcement capabilities (VMS, expanded observer coverage, procurement of new, long-range patrol vessel platforms, etc.) or rely almost exclusively on the multi-mission Coast Guard, recently overburdened with Homeland defense responsibilities, to provide this extensive coverage.

The EC sees major challenges in the proposed 2003 fishing regimes. We suggest creating a subgroup from the EC, Groundfish Management Team, Groundfish Advisory Subpanel, and others to begin work immediately on identifying fisheries and specific requirements where implementation of a VMS will assist in achieving our management goals. We remain committed to seeking resolution to these challenges while ensuring viable fisheries for coastal communities and protection of our nations valued marine resources.

PFMC
06/21/02

Exhibit C.8.d
Supplemental GAP Report
June 2002

GROUNDFISH ADVISORY SUBPANEL STATEMENT ON PROPOSED MANAGEMENT MEASURES FOR 2003

The Groundfish Advisory Subpanel (GAP) met jointly with the Groundfish Management Team (GMT) to discuss proposed groundfish management measures for 2003. The attached sheets represent the range of management options proposed by the GAP.

PFMC
06/21/02

Rod Moore

LIMITED ENTRY TRAWL

	OPTION 1	OPTION ~~2~~ 1	OPTION 3	OPTION ~~4~~ 2	OPTION ~~5~~ 3
N of 40°10'	No trawling	Closure from 50 to 250 fm; small footrope required shallower than 50 fm	Closure from 100 - 200 fm; small footrope required shallower than 100 fm	Seasonal closures between 100 and 200 fm; small footrope required shallower than 100 fm	Small footrope required shallower than 125 fathoms; allow retention of halibut bycatch
40°10' to 36°	No trawling	Closure from 50 to 250 fm; small footrope required shallower than 50 fm	Closures from 55 to 200 fms; small footrope required shallower than 55 fm	Seasonal closures between 150 and 200 fms; permanent closure from 60 - 150 fms; small footrope required inside 60 fm	Permanent closure from 65 to 125 fms; small footrope required shallower than 65 fm
South of 36°	No trawling	Closure from 50 to 150 fm; small footrope required shallower than 50 fm	Closures from 55 to 150 fms; small footrope required shallower than 55 fm	Seasonal closures between 150 and 200 fms; permanent closure from 60 - 150 fms; small footrope required inside 60 fm	Closure from 65 to 125 fms; small footrope required shallower than 65 fm

All closures are designed to protect significant species such as darkblotched, canary, and bocaccio.

"Closure" means that the taking of finfish is prohibited in the area using a small or large footrope trawl

**** The trawl fishery requests that the Council initiate a plan amendment that will allow use of all legal gear to take the unharvested portion of the trawl allocation of sablefish**

LIMITED ENTRY FIXED GEAR

OPTION 1

Fishery closed 20-150 fms

Sablefish DTL:
800 lbs /week [N. 40°10']

300 lbs/day; 800 lbs/wk [40°10' to 36°]

300 lbs/day; 900 lbs/wk [S. 36°]

Slope Rockfish:
10,000 lbs/2 mos [N. 40°10']

15,000 lbs/2 mos [40°10' to 36°]

15,000 lbs/2 mos [S. 36°]

Halibut:
No fishery inside 150 fm in Area 2A
Retention of halibut bycatch in sablefish fishery allowed

Thornyheads:
Limits same as trawl, all areas

Nearshore, S.40°10' :
Open 0 to 20 fm

200 lbs vermillion/mo

No retention shelf rock

800 lbs / 2 mos nearshore rockfish

Closed: Mar/Apr & Nov/Dec

Lingcod: 24" minimum size

Unless otherwise specified, cumulative limits same as 2002 minus 100 pounds / period

Gear to be closely monitored, no gear allowed > 1/4 mile from vessel

On stick gear, use biodegradable cotton of size 60 or less between the hook and line/rod

OPTION 2

Fishery closed 20-150 fms

Sablefish DTL:
300 lbs/day; 800 lbs /week [N. 40°10']

300 lbs/day; 800 lbs/wk [40°10' to 36°]

300 lbs/day; 900 lbs/wk [S. 36°]

Slope Rockfish:
20,000 lbs/2 mos [N. 40°10']

20,000 lbs/2 mos [40°10' to 36°]

25,000 lbs/2 mos [S. 36°]

Halibut:
No fishery inside 125 fm in Area 2A

Thornyheads:
Limits same as trawl, all areas

Nearshore, S.40°10' :
Open 0 to 20 fm

200 lbs vermillion/mo

No retention shelf rock

1200 lbs / 2 mos nearshore rockfish

Closed: Mar/Apr
possible Nov/Dec

Lingcod: 24" minimum size

Unless otherwise specified, cumulative limits same as 2002

Gear to be closely monitored, no gear allowed > 1/4 mile from vessel

On stick gear, use biodegradable cotton of size 60 or less between the hook and line/rod

OPTION 3

Fishery closed 20-150 fms

Sablefish DTL:
300 lbs/day; 800 lbs /week [N. 40°10']

300 lbs/day; 800 lbs/wk [40°10' to 36°]

350 lbs/day; 1050 lbs/wk [S. 36°]

Slope Rockfish:
30,000 lbs/2 mos [N. 40°10']

25,000 lbs/2 mos [40°10' to 36°]

30,000 lbs/2 mos [S. 36°]

Halibut:
No fishery inside 100 fm in Area 2A

Thornyheads:
Limits same as trawl, all areas

Nearshore, S.40°10' :
Open 0 to 20 fm

200 lbs ~~vermillion~~ shelf/mo

~~No retention shelf rock~~

1000 lbs / 2 mos nearshore rockfish

No Closed period

Lingcod: 24" minimum size

Unless otherwise specified, cumulative limits same as 2002

On stick gear, use biodegradable cotton of size 60 or less between the hook and line/rod

The limited entry fixed gear fishery is willing to serve as the "pilot" fishery for using VMS for depth-based enforcement

OPEN ACCESS

North of 40°10'		
OPTION 1	**OPTION 2**	**OPTION 3**
For hook and line and pot fishing for nearshore rockfish, restricted to same depths as recreational fishery	For hook and line and pot fishing for nearshore rockfish, restricted to same depths as recreational fishery	For hook and line and pot fishing for nearshore rockfish, restricted to same depths as recreational fishery
Closed between 150 fm and deepest point for recreational fishery	Closed between 150 fm and deepest point for recreational fishery	Closed between 150 fm and deepest point for recreational fishery
Nearshore limits capped at level of 2002 catch	Nearshore limits capped at level of 2002 catch	Nearshore limits capped at level of 2002 catch
Up to 200 lbs/2 mos Yellowtail, widow, vermillion in any combination	Up to 200 lbs/2 mos Yellowtail, widow, vermillion in any combination	Up to 200 lbs/2 mos Yellowtail, widow, vermillion in any combination
16" minimum size for cabezon [OR & WA], state minimum size [CA]	16" minimum size for cabezon [OR & WA], state minimum size [CA]	16" minimum size for cabezon [OR & WA], state minimum size [CA]
Halibut and dogfish fishing outside 150 fm only	Halibut and dogfish fishing outside 100 fm only	

NEARSHORE S. 40°10'		
OPTION 1	**OPTION 2**	**OPTION 3**
Open 0 to 20 fm	Open 0 to 20 fm	Open 0 to 20 fm
200 lbs vermillion/mo	200 lbs vermillion/mo	200 lbs vermillion/mo
No retention shelf rock	No retention shelf rock	No retention shelf rock
800 lbs / 2 mos nearshore rockfish	1200 lbs / 2 mos nearshore rockfish	1000 lbs / 2 mos nearshore rockfish
Closed: Mar/Apr AND Nov/Dec	Closed: Mar/Apr possible Nov/Dec	No Closed period
Lingcod: 24" minimum size	Lingcod: 24" minimum size	Lingcod: 24" minimum size
Unless otherwise specified, cumulative limits same as 2002 minus 100 pounds / period	Unless otherwise specified, cumulative limits same as 2002	Unless otherwise specified, cumulative limits same as 2002
Gear to be closely monitored, no gear allowed > 1/4 mile from vessel	Gear to be closely monitored, no gear allowed > 1/4 mile from vessel	
On stick gear, use biodegradable cotton of size 60 or less between the hook and line/rod	On stick gear, use biodegradable cotton of size 60 or less between the hook and line/rod	On stick gear, use biodegradable cotton of size 60 or less between the hook and line/rod

SOUTH OF 36°		
OPTION 1	**OPTION 2**	**OPTION 3**
Closed 20 to 150 fm	Closed 20 to 150 fm	Closed 20 to 150 fm
Sablefish: 300 lbs/day; 900 lbs/wk	Sablefish: 300 lbs/day; 900 lbs/wk	Sablefish: 350 lbs/day; 1050 lbs/wk
Thornyheads: 50 lbs/day S. Pt. Conception	Thornyheads: 50 lbs/day S. Pt. Conception	Thornyheads: 50 lbs/day S. Pt. Conception
Slope Rockfish: 5,000 lbs / 2 mos	Slope Rockfish: 10,000 lbs / 2 mos	Slope Rockfish: 12,500 lbs / 2 mos

OTHER COMMERCIAL FISHERIES

Salmon troll: The GAP recommends that new requirements be established to increase the distance between the cannonball and the first spread. However, this recommendation should be reviewed by the Salmon Advisory Subpanel

CPS in OR & WA: The GAP recommends no change in current regulations as there is no evidence of rockfish bycatch

CPS in CA: For wetfish, the GAP recommends no change in current regulations as there is no evidence of rockfish bycatch. For squid, the GAP recommends the following options:

Option 1: N. of Pt. Conception, no squid fishery inside of 10 fm
S. of Pt. Conception, no change in current regulations

Option 2: No change in current regulations

Shrimp: The GAP recommends the following options

Option 1: Require excluders, eliminate fish-eye as an approved device
Maintain the current groundfish catch limit

Option 2: Require excluders, eliminate fish-eye as an approved device
Allow experimental testing of additional devices

Exempted Trawl, N.: Require excluders, establish an incidental groundfish limit between 0 & 2002 limit

Exempted Trawl, S.: Except for CA halibut trawl, require excluders, establish an incidental groundfish limit between 0 & 2002 limit

CA Halibut Trawl: Maintain the 7 ½" between knot measure mesh size; establish an incidental groundfish limit between 0 & 2002 limit

RECREATIONAL FISHERY

WASHINGTON					
	OPTION 1	OPTION 2	OPTION 3	OPTION 4	OPTION 5
Bottomfish	Closed outside 25 fm except for yellowtail hotspot outside Gray's Harbor Bag limit 10 all species except lingcod, canary, and yelloweye 2 lingcod, min. Size 24", allowed 3/16 - 10/15	Closed outside 25 fm except for yellowtail hotspot outside Gray's Harbor; July 1, areas 1 & 2 open outside 25 fm Bag limit 10 all species except lingcod, canary, and yelloweye 1 canary allowed 2 lingcod, min. Size 24", allowed 3/16 - 10/15	No depth closure Bag limit 10 all species except lingcod, canary, and yelloweye 1 canary allowed 2 lingcod, min. Size 24", allowed 3/16 - 10/15		
Halibut	Allow halibut only inside bottomfish areas; catch sharing plan open in these areas	Open inside small hotspot areas; subarea seasons in catch sharing plan open inside bottomfish areas			

WASHINGTON					
Salmon	Closed outside 25 fm, areas 3 & 4 Max. 6 oz sinker outside 25 fm, areas 1 & 2. No downriggers No retention of canary with salmon No retention of halibut with salmon	Closed outside 25 fm, areas 3 & 4 Max. 6 oz sinker outside 25 fm, areas 1 & 2. No downriggers No retention of canary with salmon	Closed outside 25 fm, areas 3 & 4 Max. 6 oz sinker outside 25 fm, areas 1 & 2. No downriggers	Closed outside 25 fm in areas 3 & 4; open all other areas	Status quo for gear and areas

OREGON & CA N. 40°10'			
	OPTION 1	OPTION 2	OPTION 3
Bottomfish	Open 0 to 20 fm year round 10 groundfish bag limit wi sublimit of 2 lingcod, 24" minimum length Yelloweye & canary prohibited 16" min length cabezon Landings of: black & blue rock combined; other nearshore rock; cabezon; greenling; capped at 2000 levels	Open year round, closed outside 27 fm June 1 - Oct 31 10 rockfish bag limit wi sublimits of 1 canary; 1 yelloweye; 2 lingcod, 24" minimum length 16" min length cabezon Landings of: black & blue rock combined; other nearshore rock; cabezon; greenling; capped at 2000 levels	Open year round, all depths 10 rockfish bag limit wi sublimits of 1 canary; 1 yelloweye; 2 lingcod, 24" minimum length 16" min length cabezon
Halibut	Nearshore open to 20 fm All depth fishery closed on Stonewall Banks Sub-area seasons per catch sharing plan No yelloweye retention if halibut on board vessel	Nearshore open to 27 fm, June - Sept All depth fishery open Sub-area seasons per catch sharing plan No yelloweye retention if halibut on board vessel	Sub-area seasons per catch sharing plan No yelloweye retention if halibut on board vessel
Salmon	Mooching prohibited		

CALIFORNIA S. 40°10'		
OPTION 1	**OPTION 2**	**OPTION 3**
Open Inside ~~20~~ 10 fm	Open Inside 20 fm	Open Inside 20 fm
~~10~~ 5 fish bag limit including ~~2~~ 0 shelf species	~~10~~ 7 fish bag limit including ~~2~~ 1 shelf species	10 fish bag limit including 2 shelf species
No retention bocaccio, yelloweye, canary, cowcod	No retention bocaccio, yelloweye, canary, cowcod	No retention bocaccio, yelloweye, canary, cowcod
	16" cabezon	10" min size on black & yellow; ~~China~~, gopher, grassy, kelp rockfish China 12"
Lingcod: 2 fish, 24" minimum	Lingcod: 2 fish, 24" minimum	Lingcod: 3 fish, 22" minimum
Closed Nov, Dec, Mar, Apr	Closed Mar, Apr; possibly Nov, Dec	~~12 month season~~ Closed NOV-April
5 sculpin max	7 sculpin max	10 sculpin max
Apply %'s to GMT	GMT	GMT Report
50:50 HG Shore	com/rec 30:70	com/rec 16:84

~~[illegible]~~ com/rec for minor nearshore rockf...

Jim Hastie

GROUNDFISH MANAGEMENT TEAM (GMT) RECOMMENDATIONS FOR MANAGEMENT MEASURES TO BE CONSIDERED FOR THE 2003 GROUNDFISH FISHERY

In the limited time available, the GMT has attempted to integrate the commercial and recreational options provided to us by the states into a single package of options (attached) with four tables addressing commercial and recreational fisheries in the areas north and south of 40°10'. In general, the GMT believes that the state proposals provide a reasonable framework for evaluating management measures for the 2003 fishery. In some instances, however, the GMT is recommending expansion or slight modification of the options originally provided to us. In the northern area commercial fishery, the GMT has identified more potential depth-based lines than identified by the states. While we recognize that this will increase workload in terms of specifying line coordinates analyzing alternatives, we believe that the increased flexibility provided by more lines is important for addressing the OY ranges under consideration for canary, yelloweye, and darkblotched rockfish. In addition to consideration of fixing lines for each fleet at specific locations for the entire year, it is the GMT's intention to consider analysis of seasonally varying depth restrictions in order to address conservation issues in ways that provide the greatest access of the fleet to stocks that are not overfished. In the area south of 40°10', the GMT has supplemented the CDFG proposal with commercial trawl options that reflect the approach recommended for 2002 inseason changes to protect bocaccio. Our analysis of the distribution of darkblotched rockfish has led us to propose dividing management of southern slope rockfish at 38° in 2003, rather than the 36° line implemented inseason this year. We would anticipate offering a larger slope rockfish limits south of 38°, with limits between 40°10' and 38° set at similar levels to those north of 40°10', in order to control bycatch of darkblotched rockfish.

For the recreational fisheries, the GMT believes that the Oregon and Washington recreational fisheries proposals represent reasonably conservative management options for analysis, although the team believes that a less than year-round fishery option should be added for Oregon and Washington. Accordingly, in our summary of the most conservative state options (Option 1 for Oregon and Option 3 for Washington) we have modified the proposals to allow for a less-than-year-round fishery. The GMT notes that the California recreational season length options are year-round and the status quo season structure applied to shelf rockfish. California recreational season lengths have not proven sustainable in 2001 or 2002 and in both years California recreational catches have led to early closure of groundfish fisheries. Given the reductions in OYs that have been proposed for access to nearshore species within the 20-fathom area, the GMT believes that the options available for analysis of the recreational groundfish fisheries south of 40°10' need to include season lengths that are more restrictive than prescribed in the California proposal. Accordingly, we have included in Option 1 reference to the possibility of shorter seasons.

2001 Research Catches

In response to a Council request earlier this week, the GMT has identified the following research catches for 2001 that were reported to the NMFS NW Region.

Bocaccio:	0.25 mt
Canary :	1.6 mt
Darkblotched:	1.9 mt
Widow:	0.3 mt
POP:	2.3 mt
Yelloweye:	0.09 mt
"Other" rockfish	17 mt

Table 1. Commercial Fishery Options NORTH of 40°10' N. lat.

	All Three States Commercial Groundfish (Limited Entry and Open Access) ***Pacific whiting mid-water allowed under all options, with possible depth restrictions***			
Option 1	Close fixed gear and/or bottom trawl fisheries inside a line approximating 150 fm to provide protection for canary and yelloweye rockfish.			
Option 2	Close fixed gear fishery inside a line approximating 100 fm to provide protection for yelloweye rockfish.			
Option 3	Close trawl fishery inside a line approximating 250 fm to provide protection for darkblotched rockfish.			
Option 4	Close trawl flatfish fishery outside a line approximating either 50, 75, 100, 125 fm to provide protection for darkblotched rockfish, canary rockfish, and/or yelloweye rockfish.			
Option 5	Allow midwater trawl fishery for yellowtail and widow rockfish subject to time/area restrictions.			
Option 6	[Except Washington] Nearshore landings capped at 2002 level for black and blue rockfish combined, other nearshore rockfish combined, cabezon (15" min. length), greenling spp.			
	Washington only Commercial Non-Groundfish Fisheries (Options Interchangeable, Waypoints for Fm Contours Options to be Defined)			
	Halibut in Sablefish Fishery North of Point Chehalis	*Directed Halibut Fishery South of Point Chehalis*	*Pink Shrimp Fishery*	*Salmon Troll Fishery*
Option 1	Status quo	Close directed halibut fishery between 25 fm and 150 fm	Require excluders	No halibut retention in salmon troll fishery; no yelloweye and canary rockfish retention
Option 2	No halibut retention with sablefish North of Pt. Chehalis	Allow directed halibut fishery subject to time/area/observer restrictions/requirements	Mandatory retention of marketable groundfish	Close in Marine Catch Areas 3 and 4 outside of a line approximating 25 fm
Option 3				Gear modifications (e.g., prohibit placement of any hook within 4 fm (24') of the weight used on each mainline)

	Oregon only Commercial Fisheries (Options Interchangeable, Waypoints for Fathom Contours Options to be Defined); OR Developing Fisheries allowed with no groundfish retention; EFP fishery for flatfish using selective flatfish trawl allowed				
	Hook-and-Line for Black, Blue and/or Other Nearshore Rockfish	*Nearshore Flatfish Trawl*	*Directed Halibut Fishery*	*Pink Shrimp Fishery*	*Salmon Troll*
Option 1	Open 0-20 fm	Open 0-50 fm	Close directed halibut fishery inside 150 fm	Require excluders	No halibut retention in salmon troll fishery; no yelloweye and canary rockfish retention; Increase distance between cannonball and first spread
Option 2	Open 0-27 fm	Open 0- 75 fm	Close directed halibut fishery inside 100 fm	Mandatory retention of marketable groundfish	
Commercial Fishery Options SOUTH of 40°10' N. lat					
	Limited Entry Trawl			*Limited Entry Fixed Gear and Open Access*	*CA Exempted Trawl Fisheries (subject to CA-defined depth restriction options)*
	• New management line at 38° N. lat., no line at 36° with higher slope rockfish limits to the south • DTS, slope rockfish, splitnose allowed outside of 150 fm • flatfish restricted to between 3 nm and 50-70 fm • no groundfish retention 50-150 or 70-150 fm			Same as recreational fisheries, except for bag limits	No groundfish retention
				Sablefish, slope rockfish, splitnose, and thornyheads N of 36° allowed outside of 150 fm	Minimal bycatch level groundfish retention, but no retention of overfished species

Table 2. Washington State Recreational Options to be Analyzed in Addition to Status Quo

	Bottomfish	Halibut	Salmon
Option 1	A recreational groundfish bag limit of 10 groundfish, including rockfish (and excluding lingcod), sublimit of 1 canary rockfish and no retention of yelloweye rockfish, open year-round. An additional bag limit of 2 lingcod, 24-inch minimum size limit, open Mar 16-Oct 15.	Allow recreational halibut fishing inside one-square-mile halibut "hotspot" areas–latitude/longitude points to be defined; subarea seasons described in Catch Sharing Plan.	Close recreational salmon fishery outside of a line approximating 25 fathoms in Marine Catch Areas 3 and 4--latitude/longitude waypoints to be defined.
Option 2	A recreational groundfish bag limit of 10 groundfish, including rockfish (and excluding lingcod), and no retention of canary or yelloweye rockfish, open year-round. An additional bag limit of 2 lingcod, 24-inch minimum size limit, open Mar 16-Oct 15.	Close recreational halibut fishery outside of a line approximating 25 fathoms–latitude/longitude waypoints to be defined; subarea seasons described in Catch Sharing Plan.	No retention of canary rockfish with a salmon onboard.
Option 3	Option 1 or 2 with closure outside of a line approximating 25 fathoms–latitude/longitude waypoints to be defined--and a season less than year round.		Option 2 with additional restriction of no halibut retention with a salmon onboard.

Oregon State Recreational Options to be Analyzed in Addition to Status Quo

	Bottomfish	Halibut	Salmon
Option 1	10 groundfish bag limit (including lingcod) with sub-limits of 1 canary and 2 lingcod (24" min. length). Yelloweye rockfish retention prohibited. Min. length limit of 16" for cabezon. Open 0 to 20 fathoms, during a season less than year round. Oregon landings of nearshore fish capped at 2000 levels (see Op. 2).	All-depth fishery closed on Stonewall Banks; description area to be identified. Nearshore open to < or = 20 fathom curve. See catch sharing plan for sub-area seasons.	Mooching may be prohibited; other options may be considered.
Option 2	10 rockfish bag limit with sub-limits of 1 canary and 1 yelloweye rockfish. Two lingcod at 24" min. length. Fishery open year round, but restricted to 0-27 fm June-Oct. Min. length limit of 16" for cabezon. OR nearshore landing restrictions (commercial & recreational) capped at 2000 levels for the following species categories: Black and blue rockfish combined, Other nearshore rockfish combined, Cabezon (16" min. length,) Greenling spp.	Yelloweye rockfish retention prohibited if Pacific halibut is on-board vessel during all-depth fishery. Nearshore fishery open in < or = to 27-fathom curve during June through September. See catch sharing plan.	
Option 3	10 rockfish bag limit with sub-limits of 1 canary and 1 yelloweye rockfish. Two lingcod at 24" min. length. Min. length limit of 16" for cabezon. Fishery open year round at all-depths. Inseason closure outside 27 fms if necessary.	Yelloweye rockfish retention prohibited if Pacific halibut is on-board vessel during all-depth fishery. See catch sharing plan.	

<table>
<tr><th colspan="2">California State Recreational Options to be Analyzed in Addition to Status Quo (North of 40°10' N. lat. same as OR)</th></tr>
<tr><th colspan="2">**Elements within each option interchangeable</th></tr>
<tr><td>Option 1</td><td>
• No rockfish, lingcod (or ocean whitefish) may be taken in waters 10-150 fm
• Partition minor nearshore rockfish into components: shallow group (black&yellow, china, gopher, grass, kelp) 80-160 mt; med group (CA scorpionfish) 50-100 mt; deeper group 402-532 mt. Total would not exceed the current 662 mt.
• Maintain a 16% commercial: 84% recreational apportionment of overall OY for minor nearshore group
• Apply 2002 shelf season structure for nearshore rockfish (or shorter season)
  • 40°10' to Pt. Conception (34°27'): Jan-Feb, May-Oct, Nov-Dec
  • Pt. Conception to Mexico: Mar-Oct
• 5 rockfish, no more than one of which may be shelf rockfish, no retention of overfished rockfish species; CA scorpionfish 5-10 fish bag limit separate from rockfish bag limit
• 2 lingcod with 24" min. size limit
• status quo size limits for rockfish, with no recreational size limits for shallow water group (black&yellow, china, gopher, grass, kelp)
</td></tr>
<tr><td>Option 2</td><td>
• No rockfish, lingcod, or ocean whitefish may be taken in waters 20-150 fm
• Status quo minor nearshore rockfish management, but reduce to historic catch levels: shallow group 80-160 mt, scorpionfish 50-100 mt
• 50% commercial: 50% recreational apportionment of overall OY for minor nearshore group
• Year-round fishery
• 7 rockfish, no more than two of which may be shelf rockfish, no retention of overfished rockfish species; CA scorpionfish 5-10 fish bag limit separate from rockfish bag limit
• 2 lingcod with 22" min. size limit
• status quo size limits for all currently limited rockfish, with additional limits for: black&yellow = 10", china = 12", gopher = 10", grass = 12", kelp = 10"
</td></tr>
<tr><td>Option 3</td><td>
• No additional prohibition options beyond Options 1 & 2, above, for rockfish, lingcod, and ocean whitefish take
• Provide for the shallow group and CA scorpionfish in accordance with Option 1 estimates (80-160 mt, 50-100 mt) and then adjust (increase) the overall OY to account for expected catch of the deeper nearshore group in shallow water (<20 fm; <10 fm)
  • Fishing allowed within 20 fm, increase OY by 20-150 mt
  • Fishing allowed within 10 fm, increase OY by 10-100 mt
• No additional allocation options for minor nearshore rockfish apportionment beyond Options 1 & 2, above
• No additional season length options beyond Options 1 & 2, above
• 10 rockfish, no more than two of which may be shelf rockfish, no retention of overfished rockfish species; CA scorpionfish 5-10 fish bag limit separate from rockfish bag limit
• 3 lingcod with 22" min. size limit
• No additional rockfish size limit options beyond Options 1 & 2 above
</td></tr>
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Coastwide annual and bi-monthly commercial landings of overfished species, by fleet, 1999-2001

	1999	2000	2001	1999						2000						2001					
	All	All	All	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6
Pacific Ocean Perch																					
LE Trawl	481.4	139.7	187.5	28.3	75.9	122.6	138.6	88.0	28.0	6.9	6.5	38.8	40.1	35.5	11.9	24.3	22.7	45.5	54.5	40.6	
LE Fixed-gear	0.1	0.7	0.0			0.1						0.5	0.1	0.0				0.0	0.0	0.0	0.0
LE Shrimp-trawl	0.0	0.2	0.0			0.0	0.0	0.0				0.2	0.0	0.0				0.0			
OA Non-shrimp	0.2	0.0	0.0		0.0	0.1	0.0	0.1			0.0		0.0	0.0					0.0		0.0
OA Shrimp-trawl	0.1	0.1	0.0		0.0	0.0	0.0	0.0	0.0			0.0	0.0	0.0			0.0	0.0			
Total	481.8	140.6	187.6	28.3	75.9	122.8	138.6	88.2	28.0	6.9	6.6	39.5	40.3	35.5	11.9	24.3	22.7	45.5	54.5	40.6	0.0
Widow RF																					
LE Trawl	3,836.3	3,761.8	1,750.4	882.0	843.6	309.0	345.6	694.7	761.5	374.0	487.1	404.6	601.1	1,069.0	826.1	387.9	456.1	189.6	53.6	15.5	647.7
LE Fixed gear	16.1	5.3	0.5	1.7	1.9	2.4	3.9	5.7	0.4	0.1	0.7	1.8	0.9	1.5	0.3	0.1	0.1	0.0	0.1	0.2	
LE Shrimp-trawl	5.2	1.0	0.5		0.7	1.6	2.3	0.5			0.0	0.2	0.5	0.2			0.0	0.4	0.0	0.0	
OA Non-shrimp	41.4	17.7	13.0	4.5	4.9	2.8	8.4	14.9	5.8	2.0	0.1	1.6	2.7	6.4	4.9	5.1	1.2	1.9	3.1	1.6	0.1
OA Shrimp-trawl	4.6	1.7	0.6		0.5	1.6	1.5	0.9	0.0		0.1	0.7	0.7	0.2			0.2	0.3	0.0		
Total	3,903.5	3,787.5	1,765.0	888.2	851.6	317.6	361.6	716.7	767.7	376.2	487.9	408.9	605.9	1,077.4	831.3	393.2	457.7	192.2	56.8	17.3	647.8
Canary RF																					
LE Trawl	494.6	33.4	25.6	25.5	67.8	179.0	153.0	66.9	2.4	0.2	2.1	10.3	10.3	8.9	1.6	0.9	1.8	8.2	11.1	3.5	0.1
LE Fixed-gear	55.4	5.9	5.1	2.0	8.0	24.2	15.4	5.8	0.0	0.2	0.5	2.2	1.3	1.2	0.4	0.6	0.7	1.5	1.3	1.0	
LE Shrimp-trawl	14.2	4.3	0.7		0.9	5.3	4.8	3.3			0.0	0.9	2.7	0.7		0.0	0.0	0.5	0.2	0.0	
OA Non-shrimp	56.6	5.0	2.8	0.4	11.1	19.8	19.0	5.8	0.4	0.3	0.4	1.8	1.2	1.0	0.3	0.2	0.5	1.1	0.7	0.3	
OA Shrimp-trawl	21.3	7.2	2.0		1.2	9.2	7.0	4.0	0.0		0.0	1.6	3.9	1.6			0.1	0.8	1.0	0.0	
Total	642.2	55.8	36.2	28.0	88.9	237.5	199.2	85.8	2.8	0.6	3.0	16.9	19.5	13.5	2.3	1.7	3.1	12.2	14.3	4.8	0.1
Bocaccio																					
LE Trawl	30.3	16.1	13.9	5.5	5.1	5.8	6.3	5.6	2.0	0.8	2.3	3.3	2.7	3.8	3.2	2.0	2.2	3.1	3.8	2.7	0.0
LE Fixed-gear	5.0	2.4	2.4	0.5	1.0	1.0	0.7	1.6	0.1	0.0	0.1	0.8	0.6	0.6	0.3	0.3	0.1	0.4	1.2	0.5	
LE Shrimp-trawl	0.3	0.1	0.0	0.3	0.0			0.0		0.0	0.1		0.0	0.0					0.0		
OA Non-shrimp	22.8	5.9	6.4	3.7	5.1	3.4	4.7	4.0	1.9	0.8	0.1	1.4	0.8	1.3	1.6	1.8	0.3	0.5	2.0	2.0	
OA Shrimp-trawl	0.2	0.0	0.1	0.0	0.0	0.1	0.1	0.0			0.0	0.0			0.0		0.0	0.1			
Total	58.5	24.6	22.8	10.0	11.2	10.2	11.8	11.4	4.0	1.6	2.6	5.4	4.1	5.8	5.2	3.9	2.7	4.1	6.9	5.2	0.0

Coastwide annual and bi-monthly commercial landings of overfished species, by fleet, 1999-2001 (cont.)

	1999	2000	2001	1999						2000						2001					
	All	All	All	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6
Cowcod RF																					
LE Trawl	3.8	1.4	0.8	0.5	1.2	0.1	0.8	1.2	0.0	0.1	0.2	0.1	0.3	0.3	0.3	0.4	0.2	0.0	0.1	0.1	0.1
LE Fixed-gear	0.3	0.5		0.1	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.3	0.1	0.0						
LE Shrimp-trawl		0.0									0.0	0.0	0.0	0.0							
OA Non-shrimp	2.2	0.4	0.0	0.4	0.8	0.3	0.4	0.0	0.2	0.0	0.0	0.1	0.1	0.1	0.1			0.0			
OA Shrimp-trawl	0.2	0.1		0.0	0.0	0.0	0.1	0.0			0.0	0.0	0.0								
Total	6.5	2.4	0.8	1.0	2.1	0.5	1.4	1.2	0.2	0.2	0.3	0.2	0.8	0.6	0.4	0.4	0.2	0.0	0.1	0.1	0.1
Darkblotched RF																					
LE Trawl	280.2	216.5	141.0	34.1	56.8	96.1	64.1	26.8	2.3	28.7	25.3	52.5	42.7	41.7	25.7	22.2	24.9	33.8	31.5	26.4	2.4
LE Fixed-gear		1.7	1.8							0.0	0.7	0.3	0.4	0.3	0.0	0.0	0.1	0.0	0.6	1.0	
LE Shrimp-trawl	2.0		0.0		0.0	0.0	1.5	0.4										0.0	0.0		
OA Non-shrimp	0.1	0.5	0.2		0.0		0.0	0.1		0.0	0.1	0.1	0.2	0.0	0.0	0.0	0.1	0.0	0.0		0.1
OA Shrimp-trawl	2.0	0.0	0.0		0.0	0.3	1.3	0.4				0.0						0.0	0.0	0.0	
Total	284.3	218.8	143.1	34.1	56.8	96.5	67.0	27.6	2.3	28.7	26.2	52.9	43.3	42.0	25.8	22.2	25.1	33.8	32.1	27.4	2.4
Yelloweye RF																					
LE Trawl	20.5	1.0	2.2	0.4	1.6	4.3	9.7	4.5	0.0	0.0	0.0	0.2	0.5	0.2	0.0	0.0	0.1	0.5	1.2	0.5	
LE Fixed-gear	47.7	5.0	6.9	0.5	2.5	5.1	34.5	5.1		0.0	0.4	1.3	1.5	1.6	0.1	0.7	1.0	2.0	1.7	1.4	
OA Non-shrimp	15.4	2.9	2.9	0.1	0.6	1.8	10.1	2.6	0.1	0.2	0.1	0.6	1.1	0.6	0.2	0.2	0.5	0.7	1.1	0.5	0.0
Total	83.5	8.9	12.0	1.0	4.7	11.3	54.3	12.2	0.1	0.3	0.6	2.1	3.1	2.5	0.4	0.9	1.6	3.2	4.0	2.3	0.0
Lingcod																					
LE Trawl	204.3	61.8	58.5	12.1	30.9	59.2	59.8	32.4	9.9	0.0	0.1	18.3	24.8	18.1	0.5	0.2	0.0	21.1	18.8	18.3	0.1
LE Fixed-gear	33.1	17.2	18.8	2.1	4.4	7.3	12.2	6.6	0.5			4.8	6.4	5.8	0.1		0.0	5.1	7.8	5.8	0.1
LE Shrimp-trawl	14.9	6.4	1.6		1.0	5.8	5.9	2.2				3.6	2.5	0.3				0.9	0.4	0.2	
OA Non-shrimp	84.7	49.0	63.5	0.6	11.7	25.3	34.0	12.7	0.4	0.1	1.1	26.9	20.2	0.6	0.1	0.0	0.0	19.3	25.0	19.0	0.1
OA Shrimp-trawl	17.5	9.1	5.5		0.5	6.1	7.2	3.8				4.8	4.4				0.0	3.2	2.2	0.0	
Total	354.5	143.5	147.8	14.9	48.5	103.6	119.1	57.7	10.8	0.1	1.2	58.3	58.4	24.8	0.7	0.2	0.1	49.6	54.2	43.5	0.2

Annual and bi-monthly summary of commercial and recreational landings of overfished species, by area and fleet, 1999-2001.

	1999	2000	2001	1999						2000						2001					
	All	All	All	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6
Pacific Ocean Perch																					
WA																					
LE Trawl	144.8	34.9	50.6	9.1	17.4	40.5	33.5	33.6	10.7	1.3	1.9	11.3	10.7	7.6	2.2	6.4	5.2	10.0	16.2	12.7	
LE Fixed-gear		0.5	0.0									0.5						0.0		0.0	
LE Shrimp-trawl		0.0										0.0									
OA Non-shrimp	0.1	0.0	0.0					0.1					0.0						0.0		
OA Shrimp-trawl	0.0	0.0	0.0				0.0					0.0	0.0				0.0				
Comm. total	144.9	35.5	50.6	9.1	17.4	40.5	33.6	33.7	10.7	1.3	1.9	11.8	10.7	7.6	2.2	6.4	5.2	10.0	16.2	12.7	
Rec. Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	144.9	35.5	50.6	9.1	17.4	40.5	33.6	33.7	10.7	1.3	1.9	11.8	10.7	7.6	2.2	6.4	5.2	10.0	16.2	12.7	0.0
OR																					
LE Trawl	325.0	101.6	136.3	18.8	52.9	78.1	103.5	54.4	17.4	5.5	4.1	26.8	28.2	27.3	9.8	17.8	17.3	35.2	38.2	27.9	
LE Fixed-gear	0.1	0.0	0.0			0.1							0.0	0.0					0.0	0.0	0.0
LE Shrimp-trawl	0.0	0.2	0.0			0.0	0.0	0.0				0.2	0.0	0.0				0.0			
OA Non-shrimp	0.1	0.0			0.0	0.1	0.0				0.0			0.0							
OA Shrimp-trawl	0.1	0.1	0.0		0.0	0.0	0.0	0.0	0.0			0.0	0.0	0.0				0.0			
Comm. total	325.3	101.9	136.3	18.8	52.9	78.3	103.5	54.4	17.4	5.5	4.1	27.0	28.2	27.3	9.8	17.8	17.3	35.2	38.2	27.9	0.0
Rec. Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	325.3	101.9	136.3	18.8	52.9	78.3	103.5	54.4	17.4	5.5	4.1	27.0	28.2	27.3	9.8	17.8	17.3	35.2	38.2	27.9	0.0
CA: N. of Avila																					
LE Trawl	11.5	3.1	0.7	0.4	5.5	4.0	1.5	0.1		0.1	0.5	0.7	1.2	0.6		0.1	0.2	0.3	0.1	0.0	
LE Fixed-gear		0.1											0.1								
OA Non-shrimp			0.0																0.0		0.0
Comm. total	11.5	3.2	0.7	0.4	5.5	4.0	1.5	0.1		0.1	0.5	0.7	1.4	0.6		0.1	0.2	0.3	0.1	0.0	0.0
Rec. Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	11.5	3.2	0.7	0.4	5.5	4.0	1.5	0.1	0.0	0.1	0.5	0.7	1.4	0.6	0.0	0.1	0.2	0.3	0.1	0.0	0.0

Annual and bi-monthly summary of commercial and recreational landings of overfished species, by area and fleet, 1999-2001 (cont).

	1999	2000	2001	1999						2000						2001					
	All	All	All	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6
Widow RF																					
WA																					
LE Trawl	513.4	373.0	289.8	146.0	137.9	29.2	43.1	93.9	63.3	30.6	26.6	13.7	36.6	143.0	122.4	67.7	75.6	17.5	16.5	9.1	103.4
LE Fixed-gear	0.0		0.0				0.0	0.0											0.0		
LE Shrimp-trawl		0.0	0.0										0.0							0.0	
OA Non-shrimp	0.5	0.9	0.0			0.0	0.0	0.2	0.3		0.0	0.4	0.4	0.1				0.0	0.0		
OA Shrimp-trawl	0.0		0.1					0.0									0.1	0.1			
Comm. total	514.0	373.9	289.9	146.0	137.9	29.2	43.2	94.1	63.6	30.6	26.6	14.1	37.1	143.1	122.4	67.7	75.6	17.6	16.5	9.2	103.4
Rec. Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	514.0	373.9	289.9	146.0	137.9	29.2	43.2	94.1	63.6	30.6	26.6	14.1	37.1	143.1	122.4	67.7	75.6	17.6	16.5	9.2	103.4
OR																					
LE Trawl	2,740.5	2,706.1	1,142.6	598.7	559.0	215.4	241.6	515.1	610.9	288.4	337.1	317.4	448.6	706.5	608.1	265.2	301.1	113.9	32.5	1.6	428.4
LE Fixed-gear	9.2	1.0	0.3	1.1	0.7	2.1	3.4	1.9		0.1	0.7	0.2	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.1	
LE Shrimp-trawl	2.3	0.8	0.2		0.3	0.8	0.8	0.5				0.2	0.4	0.2			0.0	0.1	0.0		
OA Non-shrimp	5.6	1.5	0.5		2.6	0.9	1.2	0.8			0.1	0.5	0.3	0.6	0.0	0.2	0.2	0.0	0.0	0.0	
OA Shrimp-trawl	3.2	1.4	0.4		0.5	0.6	1.2	0.9			0.0	0.6	0.5	0.2			0.2	0.2	0.0		
Comm. total	2,760.7	2,710.8	1,144.0	599.7	563.1	219.8	248.1	519.2	610.9	288.5	337.8	318.8	449.8	707.6	608.2	265.5	301.6	114.3	32.6	1.6	428.4
Rec. Total	2	15	1		0	0	1	0			0	6	7	2			0		1		
Total	2,762.7	2,725.8	1,145.0	599.7	563.1	219.8	249.1	519.2	610.9	288.5	337.8	324.8	456.8	709.6	608.2	265.5	301.6	114.3	33.6	1.6	428.4
CA: N. of Avila																					
LE Trawl	582.4	682.8	318.1	137.4	146.8	64.5	60.8	85.7	87.3	55.0	123.4	73.4	115.9	219.4	95.6	55.1	79.4	58.2	4.6	4.8	116.0
LE Fixed-gear	6.9	4.3	0.2	0.6	1.2	0.3	0.5	3.8	0.4	0.0		1.6	0.9	1.5	0.3	0.0			0.1	0.2	
LE Shrimp-trawl	2.9	0.2	0.3		0.4	0.9	1.5	0.0			0.0	0.0	0.1	0.0				0.3			
OA Non-shrimp	35.3	15.3	12.6	4.5	2.3	1.9	7.1	13.9	5.5	2.0	0.0	0.7	2.0	5.7	4.9	4.9	1.1	1.8	3.1	1.5	0.1
OA Shrimp-trawl	1.4	0.3	0.0		0.0	1.0	0.3	0.0	0.0		0.0	0.1	0.2					0.0			
Comm. total	628.8	702.8	331.1	142.5	150.7	68.6	70.3	103.4	93.2	57.1	123.5	75.9	119.1	226.6	100.7	60.0	80.5	60.3	7.7	6.5	116.1
Rec. Total	30	12	9	14	2	0	3	8	2	8		0		0	2	9			0	0	
Total	658.8	714.8	340.1	156.5	152.7	68.6	73.3	111.4	95.2	65.1	123.5	75.9	119.1	226.6	102.7	69.0	80.5	60.3	7.7	6.5	116.1

Annual and bi-monthly summary of commercial and recreational landings of overfished species, by area and fleet, 1999-2001 (cont).

	1999	2000	2001	1999						2000						2001					
	All	All	All	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6
Canary RF																					
WA																					
LE Trawl	116.2	6.5	6.1	1.3	6.6	49.0	42.3	16.8	0.2		0.3	1.4	2.0	2.2	0.5	0.3	0.3	1.4	3.1	1.1	
LE Fixed-gear	3.0	1.6	1.2		0.0	0.6	1.4	1.0		0.1	0.2	0.9	0.3	0.1	0.1	0.0	0.1	0.6	0.5	0.1	
LE Shrimp-trawl	0.4	0.4			0.0	0.2	0.2	0.1				0.2	0.1	0.2							
OA Non-shrimp	2.6	0.9	0.3	0.0	0.5	1.6	0.3	0.2			0.0	0.6	0.1	0.1	0.0		0.0	0.3	0.0	0.0	
OA Shrimp-trawl	0.8	0.9	0.3		0.1	0.2	0.4	0.2				0.1	0.2	0.6			0.0	0.2	0.1		
Comm. total	123.1	10.2	7.9	1.3	7.2	51.7	44.5	18.2	0.2	0.1	0.5	3.1	2.7	3.2	0.6	0.3	0.4	2.4	3.6	1.2	
Rec. Total	5	3	2		0	3	1	0			0	1	1	0			0	1	1		
Total	128	13.2	9.9	1.3	7.2	54.7	45.5	18.2	0.2	0.1	0.5	4.1	3.7	3.2	0.6	0.3	0.4	3.4	4.6	1.2	0.0
OR																					
LE Trawl	292.4	16.4	11.4	12.2	53.2	113.5	71.9	41.2	0.4	0.0	0.4	7.3	4.0	4.2	0.5	0.4	0.8	4.0	4.7	1.5	0.0
LE Fixed-gear	48.8	3.7	3.8	2.0	7.0	22.7	13.9	3.2	0.0	0.1	0.3	1.2	0.9	1.0	0.2	0.6	0.5	1.0	0.9	0.8	
LE Shrimp-trawl	12.0	3.8	0.6		0.3	4.7	3.9	3.1				0.7	2.6	0.5			0.0	0.5	0.1		
OA Non-shrimp	51.3	2.6	1.9	0.2	10.4	18.0	17.3	5.2	0.3	0.0	0.3	1.1	0.7	0.4	0.1	0.2	0.4	0.8	0.4	0.1	
OA Shrimp-trawl	19.9	6.0	1.5		1.0	8.9	6.4	3.6	0.0		0.0	1.5	3.4	1.1			0.1	0.7	0.8	0.0	
Comm. total	424.5	32.5	19.3	14.4	71.9	167.8	113.4	56.3	0.7	0.2	1.1	11.7	11.6	7.2	0.8	1.1	1.9	6.9	7.0	2.4	0.0
Rec. Total	43	31	16	1	1	9	25	5	1	1	0	7	16	6	1	1	2	6	4	2	0
Total	467.5	63.5	35.3	15.4	72.9	176.8	138.4	61.3	1.7	1.2	1.1	18.7	27.6	13.2	1.8	2.1	3.9	12.9	11.0	4.4	0.0
CA: N. of Avila																					
LE Trawl	86.0	10.6	8.1	12.1	8.0	16.5	38.8	8.9	1.7	0.1	1.4	1.6	4.4	2.6	0.5	0.2	0.7	2.8	3.3	1.0	0.0
LE Fixed-gear	3.6	0.6	0.1		1.0	0.8	0.1	1.7		0.0	0.0	0.2	0.2	0.1	0.1	0.0	0.1	0.0			
LE Shrimp-trawl	1.7	0.1	0.1		0.5	0.4	0.7	0.1			0.0	0.0	0.0	0.0		0.0		0.0	0.0	0.0	
OA Non-shrimp	2.6	1.5	0.6	0.2	0.2	0.2	1.5	0.4	0.2	0.3	0.0	0.2	0.3	0.4	0.2	0.1	0.1	0.1	0.2	0.1	
OA Shrimp-trawl	0.6	0.4	0.2		0.1	0.1	0.2	0.2				0.0	0.3	0.0					0.2		
Comm. total	94.6	13.1	9.0	12.3	9.8	18.0	41.3	11.3	1.9	0.4	1.4	2.0	5.2	3.1	0.9	0.3	0.9	2.9	3.7	1.2	0.0
Rec. Total	62	76	32	15	5	4	10	15	14	16	0	10	11	21	18	15		1	10	7	1
Total	156.6	89.1	41.0	27.3	14.8	22.0	51.3	26.3	15.9	16.4	1.4	12.0	16.2	24.1	18.9	15.3	0.9	3.9	13.7	8.2	1.0

Annual and bi-monthly summary of commercial and recreational landings of overfished species, by area and fleet, 1999-2001 (cont).

	1999	2000	2001	1999						2000						2001					
	All	All	All	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6
Bocaccio																					
CA: N. of Avila																					
LE Trawl	30.3	16.1	13.9	5.5	5.1	5.8	6.3	5.6	2.0	0.8	2.3	3.3	2.7	3.8	3.2	2.0	2.2	3.1	3.8	2.7	0.0
LE Fixed-gear	3.6	1.6	1.5	0.3	0.8	0.5	0.6	1.4	0.1	0.0	0.0	0.5	0.5	0.5	0.1	0.3			0.9	0.4	
LE Shrimp-trawl	0.1	0.1	0.0	0.1	0.0			0.0		0.0	0.1		0.0	0.0					0.0		
OA Non-shrimp	19.4	4.9	4.2	2.8	3.9	2.6	4.6	3.7	1.8	0.7	0.0	1.1	0.7	1.2	1.1	1.6	0.0	0.0	1.6	1.0	
OA Shrimp-trawl	0.2	0.0		0.0	0.0	0.1	0.1	0.0				0.0									
Comm. total	53.6	22.8	19.7	8.6	9.8	8.9	11.6	10.8	3.9	1.6	2.4	4.9	3.9	5.6	4.4	3.9	2.2	3.1	6.3	4.1	0.0
Rec. Total	52	59	49	12	10	6	8	14	3	14		6	4	25	10	17		2	8	22	
Total	105.6	81.8	68.7	20.6	19.8	14.9	19.6	24.8	6.9	15.6	2.4	10.9	7.9	30.6	14.4	20.9	2.2	5.1	14.3	26.1	0.0
CA: S. of Avila																					
LE Fixed-gear	1.3	0.8	0.8	0.3	0.2	0.5	0.1	0.3	0.0		0.1	0.3	0.1	0.1	0.2	0.0	0.1	0.4	0.3	0.1	
LE Shrimp-trawl	0.1			0.1																	
OA Non-shrimp	3.4	1.0	2.2	0.9	1.2	0.8	0.1	0.3	0.1	0.0	0.1	0.2	0.1	0.1	0.5		0.3	0.5	0.3	1.0	
OA Shrimp-trawl	0.0	0.0	0.1	0.0	0.0			0.0			0.0	0.0			0.0		0.0	0.1			
Comm. total	4.9	1.9	3.1	1.3	1.4	1.3	0.2	0.6	0.1	0.0	0.1	0.5	0.2	0.2	0.8	0.0	0.5	0.9	0.7	1.1	
Rec. Total	67	43	54	23	19	4	1	13	6		10	2	2	20	10		7	20	14	14	
Total	71.9	44.9	57.1	24.3	20.4	5.3	1.2	13.6	6.1	0.0	10.1	2.5	2.2	20.2	10.8	0.0	7.5	20.9	14.7	15.1	0.0

Annual and bi-monthly summary of commercial and recreational landings of overfished species, by area and fleet, 1999-2001 (cont).

	1999	2000	2001	1999						2000						2001					
	All	All	All	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6
Cowcod RF																					
CA: N. of Avila																					
LE Trawl	3.8	1.4	0.8	0.5	1.2	0.1	0.8	1.2	0.0	0.1	0.2	0.1	0.3	0.3	0.3	0.4	0.2	0.0	0.1	0.1	0.1
LE Fixed-gear	0.0	0.5					0.0			0.0	0.0	0.0	0.3	0.1	0.0						
LE Shrimp-trawl		0.0									0.0	0.0	0.0	0.0							
OA Non-shrimp	0.4	0.2	0.0	0.0	0.0	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1			0.0			
OA Shrimp-trawl	0.1	0.1		0.0	0.0	0.0	0.1	0.0			0.0	0.0	0.0								
Comm. total	4.3	2.1	0.8	0.5	1.2	0.3	1.0	1.2	0.1	0.2	0.3	0.2	0.7	0.5	0.4	0.4	0.2	0.0	0.1	0.1	0.1
Rec. Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	4.3	2.1	0.8	0.5	1.2	0.3	1.0	1.2	0.1	0.2	0.3	0.2	0.7	0.5	0.4	0.4	0.2	0.0	0.1	0.1	0.1
CA: S. of Avila																					
LE Fixed-gear	0.3	0.0		0.1	0.0	0.1	0.1	0.0	0.0		0.0	0.0	0.0	0.0							
OA Non-shrimp	1.8	0.3		0.4	0.8	0.2	0.3	0.0	0.2		0.0	0.1	0.1	0.1	0.0						
OA Shrimp-trawl	0.1						0.1														
Comm. total	2.2	0.3		0.4	0.9	0.2	0.5	0.1	0.2		0.0	0.1	0.1	0.1	0.0						
Rec. Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	2.2	0.3	0.0	0.4	0.9	0.2	0.5	0.1	0.2	0.0	0.0	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Annual and bi-monthly summary of commercial and recreational landings of overfished species, by area and fleet, 1999-2001 (cont).

	1999	2000	2001	1999						2000						2001					
	All	All	All	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6
Darkblotched RF																					
WA																					
LE Trawl	10.3	8.6	8.2	1.5	2.6	2.9	2.2	1.0	0.1	0.5	0.7	1.0	3.1	1.8	1.5	0.8	1.2	1.2	1.6	3.3	
LE Fixed-gear			0.0																0.0	0.0	
OA Non-shrimp	0.0	0.0	0.0					0.0					0.0						0.0		
Comm. total	10.3	8.7	8.2	1.5	2.6	2.9	2.2	1.1	0.1	0.5	0.7	1.0	3.2	1.8	1.5	0.8	1.2	1.2	1.6	3.3	
Rec. Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	10.3	8.7	8.2	1.5	2.6	2.9	2.2	1.1	0.1	0.5	0.7	1.0	3.2	1.8	1.5	0.8	1.2	1.2	1.6	3.3	0.0
OR																					
LE Trawl	189.2	110.8	63.7	29.2	37.1	63.6	43.1	14.5	1.6	19.4	14.3	28.8	14.4	21.9	12.0	12.0	9.9	14.6	16.5	10.6	0.1
LE Fixed-gear		0.1	0.2										0.1	0.0		0.0		0.0		0.2	
LE Shrimp-trawl	2.0		0.0		0.0	0.0	1.5	0.4										0.0			
OA Non-shrimp	0.0	0.0	0.1		0.0		0.0							0.0			0.1	0.0			
OA Shrimp-trawl	2.0	0.0	0.0		0.0	0.3	1.3	0.4				0.0						0.0	0.0	0.0	
Comm. total	193.2	110.9	64.1	29.2	37.1	64.0	45.9	15.3	1.6	19.4	14.3	28.8	14.5	21.9	12.0	12.0	10.0	14.7	16.5	10.8	0.1
Rec. Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	193.2	110.9	64.1	29.2	37.1	64.0	45.9	15.3	1.6	19.4	14.3	28.8	14.5	21.9	12.0	12.0	10.0	14.7	16.5	10.8	0.1
CA: N. of Avila																					
LE Trawl	80.7	97.2	69.1	3.4	17.1	29.6	18.8	11.2	0.6	8.8	10.3	22.7	25.2	18.0	12.2	9.4	13.8	17.9	13.4	12.4	2.2
LE Fixed-gear		1.6	1.6							0.0	0.7	0.3	0.3	0.3	0.0		0.1	0.0	0.6	0.8	
LE Shrimp-trawl			0.0																0.0		
OA Non-shrimp	0.1	0.5	0.1				0.0	0.0		0.0	0.1	0.1	0.2	0.0	0.0	0.0	0.0		0.0		0.1
OA Shrimp-trawl			0.0															0.0			
Comm. total	80.8	99.3	70.8	3.4	17.1	29.6	18.8	11.3	0.6	8.8	11.2	23.1	25.7	18.3	12.2	9.4	13.9	17.9	14.0	13.3	2.3
Rec Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	80.8	99.3	70.8	3.4	17.1	29.6	18.8	11.3	0.6	8.8	11.2	23.1	25.7	18.3	12.2	9.4	13.9	17.9	14.0	13.3	2.3

Annual and bi-monthly summary of commercial and recreational landings of overfished species, by area and fleet, 1999-2001 (cont).

	1999	2000	2001	1999						2000						2001					
	All	All	All	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6
Yelloweye RF																					
WA																					
LE Trawl	9.9	0.2	0.8	0.3	0.3	0.9	4.7	3.8			0.0	0.1	0.0	0.0			0.0	0.0	0.5	0.3	
OA Non-shrimp	0.0	0.0						0.0					0.0								
Comm. total	9.9	0.2	0.8	0.3	0.3	0.9	4.7	3.8			0.0	0.1	0.0	0.0			0.0	0.0	0.5	0.3	
Rec. Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	9.9	0.2	0.8	0.3	0.3	0.9	4.7	3.8	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.5	0.3	0.0
OR																					
LE Trawl	2.7	0.1	0.5	0.0	0.4	1.6	0.5	0.3	0.0		0.0	0.0	0.0	0.0	0.0		0.1	0.2	0.2	0.1	
LE Fixed-gear	43.6	3.3	5.2	0.2	2.2	4.7	33.5	3.0			0.3	0.9	1.2	0.9		0.6	0.7	1.4	1.2	1.3	
OA Non-shrimp	10.0	0.9	1.1		0.5	1.1	6.8	1.6	0.1		0.0	0.2	0.4	0.2		0.1	0.2	0.2	0.3	0.2	
Comm. total	56.4	4.3	6.8	0.2	3.0	7.4	40.8	4.9	0.1		0.4	1.2	1.7	1.1	0.0	0.8	0.9	1.8	1.8	1.6	
Rec. Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	56.4	4.3	6.8	0.2	3.0	7.4	40.8	4.9	0.1	0.0	0.4	1.2	1.7	1.1	0.0	0.8	0.9	1.8	1.8	1.6	0.0
CA: N. of Avila																					
LE Trawl	7.9	0.8	0.8	0.0	0.9	1.9	4.5	0.5	0.0	0.0	0.0	0.0	0.5	0.2	0.0	0.0	0.0	0.3	0.4	0.1	
LE Fixed-gear	4.1	1.6	1.7	0.4	0.3	0.4	1.0	2.0		0.0	0.1	0.4	0.3	0.8	0.1	0.1	0.4	0.6	0.5	0.1	
OA Non-shrimp	5.3	2.0	1.9	0.1	0.2	0.7	3.3	1.0	0.1	0.2	0.1	0.4	0.6	0.5	0.2	0.1	0.3	0.5	0.7	0.2	0.0
Comm. total	17.3	4.4	4.4	0.5	1.4	3.0	8.8	3.5	0.1	0.3	0.2	0.8	1.4	1.4	0.4	0.2	0.7	1.4	1.7	0.4	0.0
Rec. Total	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	17.3	4.4	4.4	0.5	1.4	3.0	8.8	3.5	0.1	0.3	0.2	0.8	1.4	1.4	0.4	0.2	0.7	1.4	1.7	0.4	0.0

9

Annual and bi-monthly summary of commercial and recreational landings of overfished species, by area and fleet, 1999-2001 (cont).

	1999	2000	2001	1999						2000						2001					
	All	All	All	1	2	3	4	5	6	1	2	3	4	5	6	1	2	3	4	5	6
Lingcod																					
WA																					
LE Trawl	21.9	9.1	8.9	1.0	2.7	7.5	8.3	1.6	0.9			3.2	3.2	2.7				3.2	3.1	2.6	
LE Fixed-gear	8.2	4.5	6.1		0.1	2.1	4.8	1.2				1.5	2.1	0.8	0.1			1.6	3.1	1.4	
LE Shrimp-trawl	0.5	0.5	0.0			0.3	0.2	0.0				0.4	0.1					0.0	0.0		
OA Non-shrimp	9.2	10.0	5.0		2.9	3.5	2.0	0.8			1.1	5.9	2.6	0.4	0.0			2.5	1.7	0.8	
OA Shrimp-trawl	1.8	1.8	1.0		0.1	0.3	1.1	0.4				0.9	0.9					0.6	0.5		
Comm. total	41.7	25.9	21.2	1.0	5.8	13.7	16.3	4.1	0.9		1.1	11.8	9.0	3.9	0.1			7.9	8.4	4.8	
Rec. Total	36	28	32		3	23	8	1			2	12	11	2			3	21	8		
Total	77.7	53.9	53.2	1.0	8.8	36.7	24.3	5.1	0.9	0.0	3.1	23.8	20.0	5.9	0.1	0.0	3.0	28.9	16.4	4.8	0.0
OR																					
LE Trawl	96.9	24.9	22.6	4.8	18.2	29.4	25.8	15.7	3.1		0.1	7.1	11.3	6.1	0.3	0.0		8.2	7.6	6.8	
LE Fixed-gear	15.0	7.8	9.1	1.5	3.2	3.5	4.9	1.8	0.1			2.1	2.9	2.8	0.0			2.6	3.3	3.2	
LE Shrimp-trawl	13.4	5.5	1.1		0.9	5.3	5.1	2.1				3.1	2.2	0.3				0.5	0.4	0.2	
OA Non-shrimp	34.0	19.0	29.5		4.7	9.9	15.8	3.7	0.0			12.1	6.8	0.0	0.0			13.9	9.1	6.6	0.0
OA Shrimp-trawl	14.5	7.1	4.4		0.4	5.4	5.7	3.1				3.8	3.3				0.0	2.6	1.7	0.0	
Comm. total	173.8	64.3	66.8	6.3	27.4	53.4	57.2	26.2	3.2		0.1	28.2	26.5	9.2	0.4	0.0	0.0	27.9	22.0	16.8	0.0
Rec. Total	113	124	111	5	6	25	48	28	2	5	2	34	44	32	8	8	22	47	20	7	8
Total	286.8	188.3	177.8	11.3	33.4	78.4	105.2	54.2	5.2	5.0	2.1	62.2	70.5	41.2	8.4	8.0	22.0	74.9	42.0	23.8	8.0
CA: N. of Avila																					
LE Trawl	85.5	27.8	26.9	6.4	10.0	22.4	25.7	15.0	6.0	0.0	0.0	8.0	10.3	9.3	0.1	0.2	0.0	9.7	8.1	8.9	0.1
LE Fixed-gear	9.9	4.9	3.6	0.6	1.1	1.7	2.5	3.7	0.3			1.2	1.5	2.2	0.0		0.0	0.8	1.5	1.2	0.1
LE Shrimp-trawl	1.0	0.4	0.4		0.1	0.1	0.6	0.1				0.1	0.2	0.0				0.3		0.0	
OA Non-shrimp	41.6	20.0	28.9	0.6	4.1	11.9	16.3	8.2	0.4	0.1	0.0	8.9	10.8	0.1	0.1	0.0	0.0	2.9	14.2	11.7	0.0
OA Shrimp-trawl	1.2	0.2	0.0		0.0	0.4	0.5	0.3				0.1	0.1							0.0	
Comm. total	139.0	53.2	59.8	7.6	15.2	36.5	45.6	27.4	6.8	0.1	0.0	18.3	22.9	11.7	0.2	0.2	0.1	13.8	23.7	21.9	0.2
Rec. Total	290	171	119	20	30	22	92	66	60	37	3	33	61	37	0	12	4	3	67	32	
Total	429.0	224.2	178.8	27.6	45.2	58.5	137.6	93.4	66.8	37.1	3.0	51.3	83.9	48.7	0.2	12.2	4.1	16.8	90.7	53.9	0.2

Exhibit C.8.d
Supplemental SAS Report
June 2002

SALMON ADVISORY SUBPANEL REPORT ON PROPOSED MANAGEMENT MEASURES FOR 2003

The Salmon Advisory Subpanel (SAS) was not invited to this meeting and hasn't met to discuss potential regulatory implications with respect to salmon fisheries that may occur as a result of restrictions on the take of bocaccio and yelloweye rockfish. We formally request that we be included in the process from this time forward, including a SAS conference call as soon as practicable after this meeting and formal participation in the September meeting.

We also request that the Council make sure at least one option put out for public review include "status quo" for salmon fisheries coastwide.

PFMC
06/20/02

Subject: Fwd: A charter Captain's experience
From: "PFMC Comments" <pfmc.comments@noaa.gov>
Date: Fri, 07 Jun 2002 08:11:08 -0700
To: john.devore@noaa.gov

X-Mozilla-Status: 0001
X-Mozilla-Status2: 00000000
Return-Path: <pfmc.comments@noaa.gov>
Received: from mercury.akctr.noaa.gov ([127.0.0.1]) by mercury.akctr.noaa.gov (Netscape Messaging Server 4.15 mercury Jun 21 2001 23:53:48) with ESMTP id GXCCUK00.7X2 for <john.devore@noaa.gov>; Fri, 7 Jun 2002 08:11:08 -0700
Message-ID: <363de2361089.361089363de2@mercury.akctr.noaa.gov>
X-Mailer: Netscape Webmail
MIME-Version: 1.0
Content-Language: en
X-Accept-Language: en
Content-Type: multipart/mixed; boundary="--45ec3da151d65fd2"

Pacific Fishery Management Council
7700 NE Ambassador Place, Suite 200
Portland, Oregon 97220-1384
Phone: 503-820-2280
Fax: 503-820-2299
Toll-Free: 1-866-806-7204
On the web at: http://www.pcouncil.org

Subject: A charter Captain's experience
From: "Capt. David Bacon" <captain@wavewalker.com>
Date: Wed, 05 Jun 2002 20:15:23 -0700
To: pfmc.comments@noaa.gov

X-Mozilla-Status: 0001
X-Mozilla-Status2: 00000000
Return-Path: <pfmc.comments@noaa.gov>
Received: from mercury.akctr.noaa.gov ([127.0.0.1]) by mercury.akctr.noaa.gov (Netscape Messaging Server 4.15 mercury Jun 21 2001 23:53:48) with ESMTP id GXCCUK00.7X2 for <john.devore@noaa.gov>; Fri, 7 Jun 2002 08:11:08 -0700
Message-ID: <363de2361089.361089363de2@mercury.akctr.noaa.gov>
X-Mailer: Netscape Webmail
MIME-Version: 1.0
Content-Language: en
X-Accept-Language: en
Content-Type: multipart/mixed; boundary="--45ec3da151d65fd2"

Hello,

This letter is to advise you that I find bocaccio (salmon grouper) rockfish to be abundant in the waters of the Santa Barbara Channel and surrounding the Channel islands. I commonly have to keep careful count on them to avoid going over limits, and we often change locations in an attempt to reduce our catch of bocaccio rockfish. They are not high on the list of favorite fish for my anglers, so we try to limit our take.

I am a fishing charter captain, and I can guarantee you that NO ONE is more in tune with the relative populations of the various species of fish in our local waters. I understand that "science" is being quoted to lead you to believe that the overall bocaccio population is depressed and should be protected by closure on rockfish fishing. This is NOT true. Bocaccio population levels are higher than I have seen them in years, and we are catching large specimens as well as little guys.

I implore you NOT to implement closures. Closures are unwarranted. closures are not needed to help the fish populations Closures destroy industries.

I have tried repeatedly to volunteer on panels, such as the California DF&G's working groups to discuss proposed closures, and before that, I applied to be on the Channel Islands Marine Sanctuary Advisory Council. I have not been selected. Selected members always seem to be those who are not against closures. That convinces me that what you are told is the will and thinking of my industry is severely and purposely distorted by excluding those who are opposed to closures. Those of us who spend time on the water constantly, are opposed to closures, because we know they are not needed for the fish, and because we know the impact on our industry and related industries will be totally devastating. The UASC and SAC do NOT represent our knowledge and beliefs. they mistakenly back small closures simply because they believe closures will happen anyway and their intent is to limit them. If closures are imposed, I certainly want them to be small, however closures are NOT needed. Just say NO to closures. I make this statement based upon my own experience and observations on the water year-round.

Sincerely,

Capt. David Bacon
WaveWalker Charters, Santa Barbara

PFMC Comments
<pfmc.comments@noaa.gov>

Subject: Fwd: Rockfish closure
From: "PFMC Comments" <pfmc.comments@noaa.gov>
Date: Fri, 07 Jun 2002 08:10:52 -0700
To: john.devore@noaa.gov

X-Mozilla-Status: 0001
X-Mozilla-Status2: 00000000
Return-Path: <pfmc.comments@noaa.gov>
Received: from mercury.akctr.noaa.gov ([127.0.0.1]) by mercury.akctr.noaa.gov (Netscape Messaging Server 4.15 mercury Jun 21 2001 23:53:48) with ESMTP id GXCCU500.K42 for <john.devore@noaa.gov>; Fri, 7 Jun 2002 08:10:53 -0700
Message-ID: <362a5e361244.361244362a5e@mercury.akctr.noaa.gov>
X-Mailer: Netscape Webmail
MIME-Version: 1.0
Content-Language: en
X-Accept-Language: en
Content-Type: multipart/mixed; boundary="--68a846d36b971de5"

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Phone: 503-820-2280
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Toll-Free: 1-866-806-7204
On the web at: http://www.pcouncil.org

Subject: Rockfish closure
From: <SErick5620@aol.com>
Date: Fri, 7 Jun 2002 01:13:43 EDT
To: pfmc.comments@noaa.gov

X-Mozilla-Status: 0001
X-Mozilla-Status2: 00000000
Return-Path: <pfmc.comments@noaa.gov>
Received: from mercury.akctr.noaa.gov ([127.0.0.1]) by mercury.akctr.noaa.gov (Netscape Messaging Server 4.15 mercury Jun 21 2001 23:53:48) with ESMTP id GXCCU500.K42 for <john.devore@noaa.gov>; Fri, 7 Jun 2002 08:10:53 -0700
Message-ID: <362a5e361244.361244362a5e@mercury.akctr.noaa.gov>
X-Mailer: Netscape Webmail
MIME-Version: 1.0
Content-Language: en
X-Accept-Language: en
Content-Type: multipart/mixed; boundary="--68a846d36b971de5"

Gentlemen:I am recreational angler who has been fishing the Southern California Bight for more than 42 years. During this time I have spent a good deal of time fishing for rockfish (Sebastes). I understand that you are considering blanket closures that would include recreational fishing for these fish. Some of the studies that you have been presented indicate that bocaccio are on the verge of extinction. It is my experience, at least in the areas that I fish, that nothing could be farther from the truth. Down here, sportfishermen and sportboat captains regard bocaccio as over-abundant pests, and because of our lack of interest in this undesirable species, we go out of our way to avoid them. They are more abundant down here, in all sizes, than they have been for more than twenty years.Obviously, something is wrong with your studies, your data and your assumptions about bocaccio. I'm certain that oth er Sebastes species have been wrongly placed on the "overfished" list because of bad data.I urge you to make a thorough study of the anecdotal experiences of long time recreational anglers and sportboat captains on a regional basis. In California, we are talking about a constituency of nearly 1 million anglers that pay to use and conserve the resource, not exploit and profit from it.You will find that our reality, times several hundred million dollars of economic impact, differs widely from those who craft research to gain grants, and those who fish for profit alone.
Sincerely,
Fred Erickson..........member, High Desert Saltwater Anglers

PFMC Comments
<pfmc.comments@noaa.gov>

Subject: Fwd: Bottom Fish
From: "PFMC Comments" <pfmc.comments@noaa.gov>
Date: Mon, 03 Jun 2002 09:17:22 -0700
To: john.devore@noaa.gov
X-Mozilla-Status: 0001
X-Mozilla-Status2: 00000000
Return-Path: <pfmc.comments@noaa.gov>
Received: from mercury.akctr.noaa.gov ([127.0.0.1]) by mercury.akctr.noaa.gov (Netscape Messaging Server 4.15 mercury Jun 21 2001 23:53:48) with ESMTP id GX518Y00.TUG for <john.devore@noaa.gov>; Mon, 3 Jun 2002 09:17:22 -0700
Message-ID: <32b87532b52d.32b52d32b875@mercury.akctr.noaa.gov>
X-Mailer: Netscape Webmail
MIME-Version: 1.0
Content-Language: en
X-Accept-Language: en
Content-Type: multipart/mixed; boundary="--5639709f20f718a9"

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Phone: 503-820-2280
Fax: 503-820-2299
Toll-Free: 1-866-806-7204
On the web at: http://www.pcouncil.org

Subject: Bottom Fish
From: Paul Fako <prfako@worldnet.att.net>
Date: Mon, 03 Jun 2002 08:29:00 -0700
To: <pfmc.comments@noaa.gov>
X-Mozilla-Status: 0001
X-Mozilla-Status2: 00000000
Return-Path: <pfmc.comments@noaa.gov>
Received: from mercury.akctr.noaa.gov ([127.0.0.1]) by mercury.akctr.noaa.gov (Netscape Messaging Server 4.15 mercury Jun 21 2001 23:53:48) with ESMTP id GX518Y00.TUG for <john.devore@noaa.gov>; Mon, 3 Jun 2002 09:17:22 -0700
Message-ID: <32b87532b52d.32b52d32b875@mercury.akctr.noaa.gov>
X-Mailer: Netscape Webmail
MIME-Version: 1.0
Content-Language: en
X-Accept-Language: en
Content-Type: multipart/mixed; boundary="--5639709f20f718a9"

Greetings:

I was pleased to read the article concerning your proposed action to ban bottom fishing in US Pacific Waters to increase depleted stock. This is a few years late as far as I am concerned. Although I am an avid fish eater and one-time ocean fisherman, It is very noticeable to even the least active of us that we are losing our fish. I only hope that the order is strong enough to enable us to prevent other countries from continuing to fish our water out to at least 100 miles. they wil be angry, but it happens. the entire world should take a hint and eat cerial for a few years to allow us to regain a hold on our fish stocks and STOP using this valuable for FERTILIZER and cat food and other unnecessary, profit/gain oriented enterpeises that are really of no benefit to me as a common man.

Thanks again. Vote YES to ban for 10 years!!!

Paul Fako, Pacifica, CA

PFMC Comments
<pfmc.comments@noaa.gov>

Subject: Fwd: June Council meeting
From: "PFMC Comments" <pfmc.comments@noaa.gov>
Date: Wed, 05 Jun 2002 10:26:05 -0700
To: john.devore@noaa.gov
CC: john.coon@noaa.gov

X-Mozilla-Status: 0001
X-Mozilla-Status2: 00000000
Return-Path: <pfmc.comments@noaa.gov>
Received: from mercury.akctr.noaa.gov ([127.0.0.1]) by mercury.akctr.noaa.gov (Netscape Messaging Server 4.15 mercury Jun 21 2001 23:53:48) with ESMTP id GX8TRH00.7DZ; Wed, 5 Jun 2002 10:26:05 -0700
Message-ID: <3473d1348bd6.348bd63473d1@mercury.akctr.noaa.gov>
X-Mailer: Netscape Webmail
MIME-Version: 1.0
Content-Language: en
X-Accept-Language: en
Content-Type: multipart/mixed; boundary="--278c435c445b21fd"

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Phone: 503-820-2280
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Toll-Free: 1-866-806-7204
On the web at: http://www.pcouncil.org

Subject: June Council meeting
From: Joel Greenberg <rfacer@ix.netcom.com>
Date: Wed, 05 Jun 2002 10:23:35 -0700
To: pfmc.comments@noaa.gov

X-Mozilla-Status: 0001
X-Mozilla-Status2: 00000000
Return-Path: <pfmc.comments@noaa.gov>
Received: from mercury.akctr.noaa.gov ([127.0.0.1]) by mercury.akctr.noaa.gov (Netscape Messaging Server 4.15 mercury Jun 21 2001 23:53:48) with ESMTP id GX8TRH00.7DZ; Wed, 5 Jun 2002 10:26:05 -0700
Message-ID: <3473d1348bd6.348bd63473d1@mercury.akctr.noaa.gov>
X-Mailer: Netscape Webmail
MIME-Version: 1.0
Content-Language: en
X-Accept-Language: en
Content-Type: multipart/mixed; boundary="--278c435c445b21fd"

Pacific Fisheries Management Council
7700 NE Ambassador Place, Suite 200
Portland, Oregon 97220-1384

Gentlemen:

I am recreational angler who has been fishing the Southern California Bight for more than 35 years. During this time I have spent a good deal of time fishing for rockfish (Sebastes). I understand that you are considering blanket closures that would include recreational fishing for these fish. Some of the studies that you have been presented indicate that bocaccio are on the verge of extinction. It is my experience, at least in the areas that I fish, that nothing could be farther from the truth. Down here, sportfishermen and sportboat captains regard bocaccio as over-abundant pests, and because of our lack of interest in this undesirable species, we go out of our way to avoid them. They are more abundant down here, in all sizes, than they have been for more than twenty years.

Obviously, something is wrong with your studies, your data and your assumptions about bocaccio. I'm certain that other Sebastes species have been wrongly placed on the "overfished" list because of bad data.

I urge you to make a thorough study of the anecdotal experiences of long time recreational anglers and sportboat captains on a regional basis. In California, we are talking about a constituency of nearly 1 million anglers that pay to use and conserve the resource not exploit and profit from it.

You will find that our reality, times several hundred million dollars of economic impact, differs widely from those who craft research to gain grants, and those who fish for profit alone.

Sincerely,

Joel Greenberg
Member:
United Anglers of Southern California
Los Angeles Rod & Reel Club

Subject: Fwd: Boccacio Stocks
From: "PFMC Comments" <pfmc.comments@noaa.gov>
Date: Wed, 05 Jun 2002 10:27:58 -0700
To: john.devore@noaa.gov
CC: john.coon@noaa.gov

X-Mozilla-Status: 0001
X-Mozilla-Status2: 00000000
Return-Path: <pfmc.comments@noaa.gov>
Received: from mercury.akctr.noaa.gov ([127.0.0.1]) by mercury.akctr.noaa.gov (Netscape Messaging Server 4.15 mercury Jun 21 2001 23:53:48) with ESMTP id GX8TUM00.LH1; Wed, 5 Jun 2002 10:27:58 -0700
Message-ID: <34a05934499d.34499d34a059@mercury.akctr.noaa.gov>
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MIME-Version: 1.0
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Phone: 503-820-2280
Fax: 503-820-2299
Toll-Free: 1-866-806-7204
On the web at: http://www.pcouncil.org

Subject: Boccacio Stocks
From: <Fishnmg@cs.com>
Date: Wed, 5 Jun 2002 13:25:20 EDT
To: pfmc.comments@noaa.gov

X-Mozilla-Status: 0001
X-Mozilla-Status2: 00000000
Return-Path: <pfmc.comments@noaa.gov>
Received: from mercury.akctr.noaa.gov ([127.0.0.1]) by mercury.akctr.noaa.gov (Netscape Messaging Server 4.15 mercury Jun 21 2001 23:53:48) with ESMTP id GX8TUM00.LH1; Wed, 5 Jun 2002 10:27:58 -0700
Message-ID: <34a05934499d.34499d34a059@mercury.akctr.noaa.gov>
X-Mailer: Netscape Webmail
MIME-Version: 1.0
Content-Language: en
X-Accept-Language: en
Content-Type: multipart/mixed; boundary="--1279610489e179d"

MIKE GEORGE
4951 Corbina Way
Oxnard, Ca.
93035-2812
Phone 805-984-6509
fishnmg@cs.com

Mr Hans RadtkeChairman, Pacific Fisheries Management Council7700 NE Ambassador Place, Suite 200Portland, Oregon 97220-1384

Gentlemen:

I am recreational angler who has been fishing the Southern California Bight for more than 45 years. During this time I have spent a good deal of time fishing for rockfish (Sebastes). I understand that you are considering blanket closures that would include recreational fishing for these fish. Some of the studies that you have been presented indicate that bocaccio are on the verge of extinction. It is my experience, at least in the areas that I fish, that nothing could be farther from the truth. Down here, sportfishermen and sportboat captains regard bocaccio as overabundant pests, and because of our lack of interest in this undesirable species, we go out of our way to avoid them. They are more abundant down here, in all sizes, than they have been for more than twenty years.
Obviously, something is wrong with your studies, your data and your assumptions about bocaccio. I'm certain that other Sebastes species have been wrongly placed on the "overfished" list because of bad data.
I urge you to make a thorough study of the anecdotal experiences of long time recreational anglers and sportboat captains on a regional basis. In California, we are talking about a constituency of nearly 1 million anglers that pay to use and conserve the resource, not exploit and profit from it.
You will find that our reality, times several hundred million dollars of economic impact, differs widely from those who craft research to gain grants, and those who fish for profit alone.
Sincerely,

Mike George

PFMC Comments
<pfmc.comments@noaa.gov>

Subject: Fwd: Rockfish closure
From: "PFMC Comments" <pfmc.comments@noaa.gov>
Date: Wed, 05 Jun 2002 10:26:36 -0700
To: john.devore@noaa.gov
CC: john.coon@noaa.gov

X-Mozilla-Status: 0001
X-Mozilla-Status2: 00000000
Return-Path: <pfmc.comments@noaa.gov>
Received: from mercury.akctr.noaa.gov ([127.0.0.1]) by mercury.akctr.noaa.gov (Netscape Messaging Server 4.15 mercury Jun 21 2001 23:53:48) with ESMTP id GX8TSC00.KJM; Wed, 5 Jun 2002 10:26:36 -0700
Message-ID: <3464383461f2.3461f2346438@mercury.akctr.noaa.gov>
X-Mailer: Netscape Webmail
MIME-Version: 1.0
Content-Language: en
X-Accept-Language: en
Content-Type: multipart/mixed; boundary="--989584f1ff42b53"

Pacific Fishery Management Council
7700 NE Ambassador Place, Suite 200
Portland, Oregon 97220-1384
Phone: 503-820-2280
Fax: 503-820-2299
Toll-Free: 1-866-806-7204
On the web at: http://www.pcouncil.org

Subject: Rockfish closure
From: Pat Ross <patr@saket.com>
Date: Wed, 05 Jun 2002 09:26:45 -0700
To: pfmc.comments@noaa.gov

X-Mozilla-Status: 0001
X-Mozilla-Status2: 00000000
Return-Path: <pfmc.comments@noaa.gov>
Received: from mercury.akctr.noaa.gov ([127.0.0.1]) by mercury.akctr.noaa.gov (Netscape Messaging Server 4.15 mercury Jun 21 2001 23:53:48) with ESMTP id GX8TSC00.KJM; Wed, 5 Jun 2002 10:26:36 -0700
Message-ID: <3464383461f2.3461f2346438@mercury.akctr.noaa.gov>
X-Mailer: Netscape Webmail
MIME-Version: 1.0
Content-Language: en
X-Accept-Language: en
Content-Type: multipart/mixed; boundary="--989584f1ff42b53"

Why should sport fishermen pay for the last 50 years of bottom raping by commercial fishermen. You guys are shooting yourself in the foot by closing rock fishing to the public. Think about what I'm saying CLOSING FISHING TO THE PUBLIC who are voters and taxpayers and #1 we didn't put us in this mess to begin with. PLEASE do not close us out, you will be awakening a sleeping GIANT. Thanks
Pat Ross 1440 Cossacks pl, Glendora Ca. 91741, Working man, Taxpayer, Voter and sport fisherman.

PFMC Comments
<pfmc.comments@noaa.gov>

Subject: Fwd: comment
From: "PFMC Comments" <pfmc.comments@noaa.gov>
Date: Wed, 05 Jun 2002 13:49:05 -0700
To: john.devore@noaa.gov
X-Mozilla-Status: 0001
X-Mozilla-Status2: 00000000
Return-Path: <pfmc.comments@noaa.gov>
Received: from mercury.akctr.noaa.gov ([127.0.0.1]) by mercury.akctr.noaa.gov (Netscape Messaging Server 4.15 mercury Jun 21 2001 23:53:48) with ESMTP id GX935T00.CIV for <john.devore@noaa.gov>; Wed, 5 Jun 2002 13:49:05 -0700
Message-ID: <346b4f34c9d7.34c9d7346b4f@mercury.akctr.noaa.gov>
X-Mailer: Netscape Webmail
MIME-Version: 1.0
Content-Language: en
X-Accept-Language: en
Content-Type: multipart/mixed; boundary="--7aa39986e7447c"

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Phone: 503-820-2280
Fax: 503-820-2299
Toll-Free: 1-866-806-7204
On the web at: http://www.pcouncil.org

Subject: comment
From: "Jeff I SAVAGE" <Jeff.Savage@EWEB.Eugene.OR.US>
Date: Wed, 05 Jun 2002 12:38:23 -0700
To: <pfmc.comments@noaa.gov>
X-Mozilla-Status: 0001
X-Mozilla-Status2: 00000000
Return-Path: <pfmc.comments@noaa.gov>
Received: from mercury.akctr.noaa.gov ([127.0.0.1]) by mercury.akctr.noaa.gov (Netscape Messaging Server 4.15 mercury Jun 21 2001 23:53:48) with ESMTP id GX935T00.CIV for <john.devore@noaa.gov>; Wed, 5 Jun 2002 13:49:05 -0700
Message-ID: <346b4f34c9d7.34c9d7346b4f@mercury.akctr.noaa.gov>
X-Mailer: Netscape Webmail
MIME-Version: 1.0
Content-Language: en
X-Accept-Language: en
Content-Type: multipart/mixed; boundary="--7aa39986e7447c"

Dear sirs; I read with disbelief about the restrictions to the sport fisherman, before any restrictions are made to the sport fisherman every commercial fishing boat should be used for and artificial reef. lets look at some facts.

The sport fleet catches 5% of the bottom fish.

The commercial fisherman are the reason for over fishing NOT the sports fisherman. they have been allowed to kill and throw over the side juvenile fish for years.

you are the agency that is in control of the health of the fishery. by the simple fact that you are dominated by the commercial fisherman you have allowed over fishing to continue until it is now a crises.

If you people are in charge of the health of the Pacific fishery.
YOU HAVE FAILED MEASURABLY.

WHY ARE WE BEING PUNISHED FOR THE SINS OF THE COMMERCIAL FLEET?

HOW COULD THIS HAPPEN WITH GREAT PEOPLE LIKE YOU RUNNING THINGS?

I WOULD LOVE TO TALK TO YOU FACE TO FACE BUT OF COURSE THE MEETINGS ARE MILES AWAY FROM THE SPORT FISHERMEN.

PLEASE GIVE UP,CALL GOERGE W BUSH AND TELL HIM THIS AGENCY IS THE WORST IN THE GOVERNMENT AND ARE GOING TO CLOSE THE DOORS AND GO HOME, PLEASE GO HOME, GET THE COMMERCIAL FISHERMEN OUT OF YOU AGENCY.

JEFF SAVAGE
541-933-2854

PFMC Comments <pfmc.comments@noaa.gov>

Subject: Fwd:
From: "PFMC Comments" <pfmc.comments@noaa.gov>
Date: Wed, 05 Jun 2002 13:49:26 -0700
To: john.devore@noaa.gov
X-Mozilla-Status: 0001
X-Mozilla-Status2: 00000000
Return-Path: <pfmc.comments@noaa.gov>
Received: from mercury.akctr.noaa.gov ([127.0.0.1]) by mercury.akctr.noaa.gov (Netscape Messaging Server 4.15 mercury Jun 21 2001 23:53:48) with ESMTP id GX936F00.LJT for <john.devore@noaa.gov>; Wed, 5 Jun 2002 13:49:27 -0700
Message-ID: <34776b34ce62.34ce6234776b@mercury.akctr.noaa.gov>
X-Mailer: Netscape Webmail
MIME-Version: 1.0
Content-Language: en
X-Accept-Language: en
Content-Type: multipart/mixed; boundary="--202f8134ee56dae"

Pacific Fishery Management Council
7700 NE Ambassador Place, Suite 200
Portland, Oregon 97220-1384
Phone: 503-820-2280
Fax: 503-820-2299
Toll-Free: 1-866-806-7204
On the web at: http://www.pcouncil.org

From: STEVE <soats_o@yahoo.com>
Date: Wed, 5 Jun 2002 11:33:44 -0700 (PDT)
To: pmfc <pfmc.comments@noaa.gov>
X-Mozilla-Status: 0001
X-Mozilla-Status2: 00000000
Return-Path: <pfmc.comments@noaa.gov>
Received: from mercury.akctr.noaa.gov ([127.0.0.1]) by mercury.akctr.noaa.gov (Netscape Messaging Server 4.15 mercury Jun 21 2001 23:53:48) with ESMTP id GX936F00.LJT for <john.devore@noaa.gov>; Wed, 5 Jun 2002 13:49:27 -0700
Message-ID: <34776b34ce62.34ce6234776b@mercury.akctr.noaa.gov>
X-Mailer: Netscape Webmail
MIME-Version: 1.0
Content-Language: en
X-Accept-Language: en
Content-Type: multipart/mixed; boundary="--202f8134ee56dae"

Mr Hans Radtke
Chairman, Pacific Fisheries Management Council
7700 NE Ambassador Place, Suite 200
Portland, Oregon 97220-1384

I am recreational angler who has been fishing the Southern California Bight since the 80's. During this time I have spent a good deal of time fishing for rockfish (Sebastes) and understand that you are considering blanket closures that would include recreational fishing for these fish. Some of the studies that you have been presented indicate that bocaccio are on the verge of extinction. It is my experience, at least in the areas that I fish, that nothing could be farther from the truth. Down here, sportfishermen and sportboat captains regard bocaccio as over-abundant pests, and because of our lack of interest in this undesirable species, we go out of our way to avoid them. They are more abundant down here, in all sizes, than they have been for more than twenty years.

Obviously, something is wrong with your studies, your data and your assumptions about bocaccio. I'm certain that other Sebastes species have been wrongly placed on the "overfished" list because of bad data.

I urge you to make a thorough study of the anecdotal experiences of long time recreational anglers and sportboat captains on a regional basis. In California, we are talking about a constituency of nearly 1 million anglers that pay to use and conserve the resource, not exploit and profit from it.

You will find that our reality, times several hundred million dollars of economic impact, differs widely from those who craft research to gain grants, and those who fish for profit alone.

Sincerely,

Steven Ota

PFMC Comments
<pfmc.comments@noaa.gov>

Subject: Fwd: Pacific Fisheries Management Council
From: "PFMC Comments" <pfmc.comments@noaa.gov>
Date: Wed, 05 Jun 2002 15:29:36 -0700
To: john.devore@noaa.gov

X-Mozilla-Status: 0001
X-Mozilla-Status2: 00000000
Return-Path: <pfmc.comments@noaa.gov>
Received: from mercury.akctr.noaa.gov ([127.0.0.1]) by mercury.akctr.noaa.gov (Netscape Messaging Server 4.15 mercury Jun 21 2001 23:53:48) with ESMTP id GX97TC00.RM4 for <john.devore@noaa.gov>; Wed, 5 Jun 2002 15:29:36 -0700
Message-ID: <34d99b34c5ef.34c5ef34d99b@mercury.akctr.noaa.gov>
X-Mailer: Netscape Webmail
MIME-Version: 1.0
Content-Language: en
X-Accept-Language: en
Content-Type: multipart/mixed; boundary="--695c39483fbf400a"

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7700 NE Ambassador Place, Suite 200
Portland, Oregon 97220-1384
Phone: 503-820-2280
Fax: 503-820-2299
Toll-Free: 1-866-806-7204
On the web at: http://www.pcouncil.org

Subject: Pacific Fisheries Management Council
From: David Dwiers <ded04747@pomona.edu>
Date: Wed, 5 Jun 2002 13:57:44 -0700
To: "'pfmc.comments@noaa.gov'" <pfmc.comments@noaa.gov>

X-Mozilla-Status: 0001
X-Mozilla-Status2: 00000000
Return-Path: <pfmc.comments@noaa.gov>
Received: from mercury.akctr.noaa.gov ([127.0.0.1]) by mercury.akctr.noaa.gov (Netscape Messaging Server 4.15 mercury Jun 21 2001 23:53:48) with ESMTP id GX97TC00.RM4 for <john.devore@noaa.gov>; Wed, 5 Jun 2002 15:29:36 -0700
Message-ID: <34d99b34c5ef.34c5ef34d99b@mercury.akctr.noaa.gov>
X-Mailer: Netscape Webmail
MIME-Version: 1.0
Content-Language: en
X-Accept-Language: en
Content-Type: multipart/mixed; boundary="--695c39483fbf400a"

Mr. Radke,

As a long distance recreational angler, meaning, I live a ways from the ocean, I am very concerned about the so-called science behind the "necessity" to halt ALL rockfish angling. I have been fishing the Pacific Ocean for a good long time and only in the last few years have noticed a large increase in the number of Salmon Grouper being caught (and for the most part, released) in our local waters. Also, the Ling Cod population has really been on the upswing.

It seems every time some Environmental, Save the Animals or any number of sob story groups, needs a sponser, the celebrities are lined up to head to Washington or wherever to get the Media exposure, while us everyday folks sit back and cringe.

Please try to see all sides of the story before making any decisions. The angling community is a large one that contributes much to our economy as well as the well being of our oceans.

Thank You,
David Dwiers

PFMC Comments
<pfmc.comments@noaa.gov>

Subject: Fwd: Bocaccio
From: "PFMC Comments" <pfmc.comments@noaa.gov>
Date: Wed, 05 Jun 2002 15:28:35 -0700
To: john.devore@noaa.gov

X-Mozilla-Status: 0001
X-Mozilla-Status2: 00000000
Return-Path: <pfmc.comments@noaa.gov>
Received: from mercury.akctr.noaa.gov ([127.0.0.1]) by mercury.akctr.noaa.gov (Netscape Messaging Server 4.15 mercury Jun 21 2001 23:53:48) with ESMTP id GX97RN00.QLK for <john.devore@noaa.gov>; Wed, 5 Jun 2002 15:28:35 -0700
Message-ID: <34fbf034ed50.34ed5034fbf0@mercury.akctr.noaa.gov>
X-Mailer: Netscape Webmail
MIME-Version: 1.0
Content-Language: en
X-Accept-Language: en
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Portland, Oregon 97220-1384
Phone: 503-820-2280
Fax: 503-820-2299
Toll-Free: 1-866-806-7204
On the web at: http://www.pcouncil.org

Subject: Bocaccio
From: fredhollander@webtv.net (Freddie)
Date: Wed, 5 Jun 2002 14:27:01 -0700 (PDT)
To: pfmc.comments@noaa.gov

X-Mozilla-Status: 0001
X-Mozilla-Status2: 00000000
Return-Path: <pfmc.comments@noaa.gov>
Received: from mercury.akctr.noaa.gov ([127.0.0.1]) by mercury.akctr.noaa.gov (Netscape Messaging Server 4.15 mercury Jun 21 2001 23:53:48) with ESMTP id GX97RN00.QLK for <john.devore@noaa.gov>; Wed, 5 Jun 2002 15:28:35 -0700
Message-ID: <34fbf034ed50.34ed5034fbf0@mercury.akctr.noaa.gov>
X-Mailer: Netscape Webmail
MIME-Version: 1.0
Content-Language: en
X-Accept-Language: en
Content-Type: multipart/mixed; boundary="--1f64424a5eae3e0d"

Dear Chairman Radtke,

I have become aware that PFMC will be meeting shortly to discuss closing shelf rockfishing to include Southern California (SoCal, below Pt. Concepcion) for the purpose of protecting bocaccio. I cannot empirically address the health of bocaccio north of Pt. Concepcion because I lack experience, but below the stocks are not in immanent danger, and there is adequate mitigation in place already:

1. They are the most ubiquitous sebastes everywhere in SoCal. The cowcod closure of 4300 square miles protects huge numbers of bocaccio.

2. Following several cold water years, their numbers make fishing for other sebastes almost impossible outside the Cowcod closure areas due the California Fish and Game Commission limit of two (2). As a recreational angler, I have tried to use heavier lures to get past them (they are generally higher in the water column) to the vermilion below them. It is not possible because they are so thick. And for reasons I don't understand, in the summer months the bocaccio schools are composed of larger fish, 3 to 6 lbs in the Santa Monica Bay, where I do my rockfishing. Once a limit of two is made, I leave the grounds because I refuse to release dead bocaccio in the attempt to catch other sebastes.

3. Further mitigation comes from the current four consecutive month sebastes closure imposed by the Cal. F&G Commission, Nov - February.

I invite any PFMC member to be a guest on my boat for a short trip from Marina del Rey, my home port, to the Santa Monica Bay "Short Banks" to demonstrate that a limit of bocaccio can be caught within 10 - 15 minutes of fishing.

Thank you for your attention,

Frederick Hollander, Ph.D
P.O. Box 651
Santa Monica, CA 90406
Tel: 310-396-0720

thank you,
frederick hollander, ph.d.

RECEIVED
JUN 7 2002
PFMC

June 3, 2002

Pacific Fisheries Management Council & Members
7700 NE Ambassador Place, Suite #200
Portland OR 97220-1384

RE: Stock of Boccacio and other rock fish in our region

Dear Council:

Let it be known that the stock of these fish in our area, south-southeast (Santa Barbara Channel), of Point Conception, are sufficient in numbers and on the increase to sustain sportfishing of these species for an indefinite period of time. The Pacific Fisheries Management Council should be made aware that the real detriment to the population of Boccacio and rock fish is the over-population of the harbor seal and sea lion. The control of this nuisance marine animal should be referred to the proper organization. Additionally, another impending detriment is the unauthorized and illegal dumping from oceanliners and cruise ships in the shipping lane, which I first-hand have witnessed on numerous occasions. The undeniable amount of bait in these waters is in such large numbers that we can expect the rockfish population to continue to grow in the years to come. However, the biologists that study our region should realize that sportfishermen take the least amount of these fish compared to other types of commercial fishing. I would strongly suggest that the Pacific Fisheries Management Council and its members concentrate their efforts to pollution control and refer these hazards to the proper agency and the non-lethal control of the sea lion and the harbor seal population in our area.

Sincerely,

Captain Robert Stone
Roy Stone
Owner/operator motor vessel "Breakwater"
Channel Islands Harbor
Oxnard CA

805-701-9937

6-5-02

RECEIVED
JUN 5 2002
PFMC

TO: PACIFIC FISHERY MANAGEMENT COUNCIL

RE: NEW GROUNDFISH RULES

DEAR COUNCIL:

I HAVE LIVED IN GRAYLAND WASHINGTON FOR 27 YEARS AND FISHED THE SOUTH JETTY AT WESTPORT FOR AS LONG, I AM 53 YEARS OLD.

THE LOCAL STOCKS OF SHALLOW WATER LING COD, BLACK BASS AND GREEN LING HAVE NEVER BEEN BETTER.

THIS ENTIRE FISHERY IS INSIDE OF 10 FATHOMS (60').

THE LIMIT OF 10 ROCKFISH AND TWO LING COD IN THIS SHALLOW WATER FISHERS SHOULD BE LEFT ALONE.

WEATHER AND SEA CONDITIONS LIMIT THROUGH NATURAL MEANS THE IMPACT THAT SPORT FISHERMEN & WOMEN CAN IMPACT THIS FISHERY.

THIS FISHERY IS NOT ACCESSABLE TO COMMERCIAL & CHARTER INTEREST DUE TO THE SHALLOW ROCKY APPROACH. ONLY TO SOME SMALL BOATS AND PEOPLE WHO ARE WILLING TO HIKE AND FISH FROM JETTY'S.

RESPECTFULLY

NICHOLAS P. ADSKIM
PO BOX 383
GRAYLAND, WASH. 98547
360-267-2119

6/5/02

Feinberg, Mike

to: PFMC

Gentlemen:

I am recreational angler who has been fishing the Southern California Bight for more than 10 years. During this time I have spent a good deal of time fishing for rockfish (Sebastes). I understand that you are considering blanket closures that would include recreational fishing for these fish. Some of the studies that you have been presented indicate that bocaccio are on the verge of extinction. It is my experience, at least in the areas that I fish, that nothing could be farther from the truth. Down here, sportfishermen and sportboat captains regard bocaccio as over-abundant pests, and because of our lack of interest in this undesirable species, we go out of our way to avoid them. They are more abundant down here, in all sizes, than they have been for more than twenty years.

Obviously, something is wrong with your studies, your data and your assumptions about bocaccio. I'm certain that other Sebastes species have been wrongly placed on the "overfished" list because of bad data.

I urge you to make a thorough study of the anecdotal experiences of long time recreational anglers and sportboat captains on a regional basis. In California, we are talking about a constituency of nearly 1 million anglers that pay to use and conserve the resource, not exploit and profit from it.

You will find that our reality, times several hundred million dollars of economic impact, differs widely from those who craft research to gain grants, and those who fish for profit alone.

Sincerely,

Mike F

MIKE GEORGE

4951 Corbina Way
Oxnard. Ca.
93035-2812
Phone 805-984-6509
fishnmg@cs.com

Mr Hans Radtke
Chairman, Pacific Fisheries Management Council
7700 NE Ambassador Place, Suite 200
Portland, Oregon 97220-1384

Gentlemen:

I am recreational angler who has been fishing the Southern California Bight for more than 45 years. During this time I have spent a good deal of time fishing for rockfish (Sebastes). I understand that you are considering blanket closures that would include recreational fishing for these fish. Some of the studies that you have been presented indicate that bocaccio are on the verge of extinction. It is my experience, at least in the areas that I fish, that nothing could be farther from the truth. Down here, sportfishermen and sportboat captains regard bocaccio as over-abundant pests, and because of our lack of interest in this undesirable species, we go out of our way to avoid them. They are more abundant down here, in all sizes, than they have been for more than twenty years.

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Sincerely,

Mike George

Mike George

Pacific Fisheries Management Council
7700 NE Ambassador Place, Suite 200
Portland, Oregon 97220-1384

Gentlemen:

I am recreational angler who has been fishing the Southern California Bight for more than 35 years. During this time I have spent a good deal of time fishing for rockfish (Sebastes). I understand that you are considering blanket closures that would include recreational fishing for these fish. Some of the studies that you have been presented indicate that bocaccio are on the verge of extinction. It is my experience, at least in the areas that I fish, that nothing could be farther from the truth. Down here, sportfishermen and sportboat captains regard bocaccio as over-abundant pests, and because of our lack of interest in this undesirable species, we go out of our way to avoid them. They are more abundant down here, in all sizes, than they have been for more than twenty years.

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Sincerely,

Joel Greenberg
Member:
United Anglers of Southern California
Los Angeles Rod & Reel Club
Moderator on www.internetfishing.com (Allcoast Sportfishing Association)

Subject: Fwd: closures
From: "PFMC Comments" <pfmc.comments@noaa.gov>
Date: Mon, 10 Jun 2002 08:08:14 -0700
To: john.devore@noaa.gov

X-Mozilla-Status: 0001
X-Mozilla-Status2: 00000000
Return-Path: <pfmc.comments@noaa.gov>
Received: from mercury.akctr.noaa.gov ([127.0.0.1]) by mercury.akctr.noaa.gov (Netscape Messaging Server 4.15 mercury Jun 21 2001 23:53:48) with ESMTP id GXHWPQ00.4EQ for <john.devore@noaa.gov>; Mon, 10 Jun 2002 08:08:14 -0700
Message-ID: <3789b0376945.3769453789b0@mercury.akctr.noaa.gov>
X-Mailer: Netscape Webmail
MIME-Version: 1.0
Content-Language: en
X-Accept-Language: en
Content-Type: multipart/mixed; boundary="--67902c7039c31e0d"

Pacific Fishery Management Council
7700 NE Ambassador Place, Suite 200
Portland, Oregon 97220-1384
Phone: 503-820-2280
Fax: 503-820-2299
Toll-Free: 1-866-806-7204
On the web at: http://www.pcouncil.org

Subject: closures
From: RCFrank@webtv.net (Ray Frank)
Date: Fri, 7 Jun 2002 12:20:12 -0700 (PDT)
To: pfmc.comments@noaa.gov

X-Mozilla-Status: 0001
X-Mozilla-Status2: 00000000
Return-Path: <pfmc.comments@noaa.gov>
Received: from mercury.akctr.noaa.gov ([127.0.0.1]) by mercury.akctr.noaa.gov (Netscape Messaging Server 4.15 mercury Jun 21 2001 23:53:48) with ESMTP id GXHWPQ00.4EQ for <john.devore@noaa.gov>; Mon, 10 Jun 2002 08:08:14 -0700
Message-ID: <3789b0376945.3769453789b0@mercury.akctr.noaa.gov>
X-Mailer: Netscape Webmail
MIME-Version: 1.0
Content-Language: en
X-Accept-Language: en
Content-Type: multipart/mixed; boundary="--67902c7039c31e0d"

The fact is I can't drop a line without finding baccacio some one has to take a look at the numbers as there are the most plentiful species in the rockcod grounds. The real problem I see is the 2 fish limit is wasteful as you have to throw them back and they don't and can't live once you bring them up there swim bladders are extruding out of there mouths and it won't allow them to return to the bottom. Thanks

Ray Frank. VOTE FOR ANYONE BUT DAVIS FOR GOV <(*(((>< FISHING CHARTERS info hit the link below
http://community.webtv.net/RCFrank/ORANGECOUNTY

PFMC Comments
<pfmc.comments@noaa.gov>

Subject: Fwd: Proposed Bocaccio Closure
From: "PFMC Comments" <pfmc.comments@noaa.gov>
Date: Mon, 10 Jun 2002 10:45:34 -0700
To: john.devore@noaa.gov

X-Mozilla-Status: 0001
X-Mozilla-Status2: 00000000
Return-Path: <pfmc.comments@noaa.gov>
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Message-ID: <377fb537c7c7.37c7c7377fb5@mercury.akctr.noaa.gov>
X-Mailer: Netscape Webmail
MIME-Version: 1.0
Content-Language: en
X-Accept-Language: en
Content-Type: multipart/mixed; boundary="--21b8565e3c943eae"

Pacific Fishery Management Council
7700 NE Ambassador Place, Suite 200
Portland, Oregon 97220-1384
Phone: 503-820-2280
Fax: 503-820-2299
Toll-Free: 1-866-806-7204
On the web at: http://www.pcouncil.org

Subject: Proposed Bocaccio Closure
From: David Lee <dddwmlee@pacbell.net>
Date: Mon, 10 Jun 2002 10:07:54 -0700
To: pfmc.comments@noaa.gov

X-Mozilla-Status: 0001
X-Mozilla-Status2: 00000000
Return-Path: <pfmc.comments@noaa.gov>
Received: from mercury.akctr.noaa.gov ([127.0.0.1]) by mercury.akctr.noaa.gov (Netscape Messaging Server 4.15 mercury Jun 21 2001 23:53:48) with ESMTP id GXI3ZY00.VNH for <john.devore@noaa.gov>; Mon, 10 Jun 2002 10:45:34 -0700
Message-ID: <377fb537c7c7.37c7c7377fb5@mercury.akctr.noaa.gov>
X-Mailer: Netscape Webmail
MIME-Version: 1.0
Content-Language: en
X-Accept-Language: en
Content-Type: multipart/mixed; boundary="--21b8565e3c943eae"

I oppose any closure of the recreational fishing seasons. I believe the current strategy of limit restrictions and commercial shutdowns is and will be effective. I have seen immediate improvements in fish quality and quantity following commercial fishing restrictions. The scientific opinion relies in part on commercial landings for fish stock evaluations, I believe this leads to unreliable conclusions. While it appears to be true that commercial take methods do deplete large numbers of fish stocks there also appears to be enough fish to repopulate soon after commercial take is stopped. The sport take of these fish is minute by comparison and seems to have little impact on total fish stock.
In conclusion, These observations are my own and are based on my own observations of water fished before and after commercial long line restrictions were in place. I also add observations I have made on the inshore live fish fishery as a SCUBA diver to say that commercial targeting of specific groundfish fisheries cane take too many fish too quickly but rod and real fishing (sport) does not take enough to limit recovery. Please allow sport fishing to continue while the recovery is in progress.
David Lee
dddwmlee@pacbell.net

PFMC Comments
<pfmc.comments@noaa.gov>

Subject: [Fwd: Fwd: Please don't be deterred!]
From: "John Coon" <John.Coon@noaa.gov>
Date: Mon, 10 Jun 2002 13:20:21 -0700
To: John DeVore <John.DeVore@noaa.gov>
X-Mozilla-Status: 0001
X-Mozilla-Status2: 00000000
Return-Path: <john.coon@noaa.gov>
Received: from noaa.gov ([65.215.224.18]) by mercury.akctr.noaa.gov (Netscape Messaging Server 4.15 mercury Jun 21 2001 23:53:48) with ESMTP id GXIAXY00.0HL for <John.DeVore@noaa.gov>; Mon, 10 Jun 2002 13:15:34 -0700
Message-ID: <3D050A05.988A2956@noaa.gov>
Organization: PFMC
X-Mailer: Mozilla 4.7 [en] (WinNT; U)
X-Accept-Language: en
MIME-Version: 1.0
Content-Type: multipart/mixed; boundary="------------48A5E1C668927CC6DE5F2DEC"

Part of supplemental GF public comment.
-------- Original Message --------
Subject: Fwd: Please don't be deterred!
Date: Fri, 07 Jun 2002 08:12:02 -0700
From: "PFMC Comments" <pfmc.comments@noaa.gov>
To: john.coon@noaa.gov

Please distribute to the appropriate staff officer.

Pacific Fishery Management Council
7700 NE Ambassador Place, Suite 200
Portland, Oregon 97220-1384
Phone: 503-820-2280
Fax: 503-820-2299
Toll-Free: 1-866-806-7204
On the web at: http://www.pcouncil.org

Subject: Please don't be deterred!
From: <BOSENN@aol.com>
Date: Wed, 5 Jun 2002 22:53:06 EDT
To: pfmc.comments@noaa.gov
X-Mozilla-Status: 0001
X-Mozilla-Status2: 00000000
Return-Path: <john.coon@noaa.gov>
Received: from noaa.gov ([65.215.224.18]) by mercury.akctr.noaa.gov (Netscape Messaging Server 4.15 mercury Jun 21 2001 23:53:48) with ESMTP id GXIAXY00.0HL for <John.DeVore@noaa.gov>; Mon, 10 Jun 2002 13:15:34 -0700
Message-ID: <3D050A05.988A2956@noaa.gov>
Organization: PFMC
X-Mailer: Mozilla 4.7 [en] (WinNT; U)
X-Accept-Language: en
MIME-Version: 1.0
Content-Type: multipart/mixed; boundary="------------48A5E1C668927CC6DE5F2DEC"

I had been an avid sportfisherman since 84.' During those years i have traveled over 75,000 miles of open seas in the Southern California waters. I have witnessed first hand, the steady decline of virtually every resident specie of fish. The oldest 2 and 3 generations of every resident fish are nonexistent!

When the sportfishing community declared 'war' against the reserves, i gave away all of my fishing equipment! I removed all vestiges of fishing equipment from my boat! I now do underwater photography and it has opened up a whole new world. I have a 19ft wooden skiff that i designed and built back in 91.' I make regular trips to San Clemente Island, San Nicolas Island and the Cortes Bank. Since i spend a great deal of time underwater, i have been able to witness the changes that are occurring right before our open eyes.

I implore you to stay the course and to implement the conservation measures that will protect OUR precious waters. Please don't ever loose sight of the fact that those who declared war against conservation are the very same people who drove the need for the proposed measures in the first place....

I take underwater pictures so that i may share the beauty with others, that they will want to protect the sea and the life it holds. I do not sell my pictures and i have never derived a cent of income from all of my time on the water. Non-consumptive interaction is the way of the future and i offer my experience as an example of how rewarding that philosophy can be. I have a web page dedicated to the life in our waters. There are no ads, and i have no ambitions other than to promote the value of non-consumptive interaction with the ocean environment.

http://www.loveofsea.com

When the next generation reviews this era of 'discussion,' they will inevitably come to the conclusion that you people had the momentum to take some serious measures on behalf of THEIR best interest. When the fish are gone, we all share the loss, but we never share the profit....

Fish in abundance will never be disparaged!

I hope you folks will understand the magnitude of the opportunity before you and give the gift of an abundant sea to those who don't yet have a voice.

It is not about now...

it's about 20 years from now!

Brad Mongeau

(loves the sea)

Subject: Fwd: Rockfish Closures
From: "PFMC Comments" <pfmc.comments@noaa.gov>
Date: Mon, 10 Jun 2002 14:02:48 -0700
To: john.devore@noaa.gov

X-Mozilla-Status: 0001
X-Mozilla-Status2: 00000000
Return-Path: <pfmc.comments@noaa.gov>
Received: from mercury.akctr.noaa.gov ([127.0.0.1]) by mercury.akctr.noaa.gov (Netscape Messaging Server 4.15 mercury Jun 21 2001 23:53:48) with ESMTP id GXID4O00.MPB for <john.devore@noaa.gov>; Mon, 10 Jun 2002 14:02:48 -0700
Message-ID: <37c31637f9f2.37f9f237c316@mercury.akctr.noaa.gov>
X-Mailer: Netscape Webmail
MIME-Version: 1.0
Content-Language: en
X-Accept-Language: en
Content-Type: multipart/mixed; boundary="--178858517551c81"

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7700 NE Ambassador Place, Suite 200
Portland, Oregon 97220-1384
Phone: 503-820-2280
Fax: 503-820-2299
Toll-Free: 1-866-806-7204
On the web at: http://www.pcouncil.org

Subject: Rockfish Closures
From: "Harvey Begnoche" <begnoche@cox.net>
Date: Mon, 10 Jun 2002 13:46:19 -0700
To: <pfmc.comments@noaa.gov>

X-Mozilla-Status: 0001
X-Mozilla-Status2: 00000000
Return-Path: <pfmc.comments@noaa.gov>
Received: from mercury.akctr.noaa.gov ([127.0.0.1]) by mercury.akctr.noaa.gov (Netscape Messaging Server 4.15 mercury Jun 21 2001 23:53:48) with ESMTP id GXID4O00.MPB for <john.devore@noaa.gov>; Mon, 10 Jun 2002 14:02:48 -0700
Message-ID: <37c31637f9f2.37f9f237c316@mercury.akctr.noaa.gov>
X-Mailer: Netscape Webmail
MIME-Version: 1.0
Content-Language: en
X-Accept-Language: en
Content-Type: multipart/mixed; boundary="--178858517551c81"

Harvey E. Begnoche
3725 Via Cabrillo
Oceanside, Ca. 92056
Email: begnoche@cox.net

To whom it may concern:
I am a recreational angler who has been fishing the Southern California Bight for about 15 years. I understand that you are considering blanket closures that would include recreational fishing, as well as commercial hook and line for certain rockfish (Sebastes species). Some of the research studies brought before you indicate Bocaccio are on the verge of extinction. It is my experience, at least in the areas that I fish, that nothing could be farther from the truth. In these Southern locales, sport anglers and sport-boat captains regard Bocaccio as over-abundant, and because of our lack of interest in this species, we go out of our way to avoid them.

They are more abundant down here, in all sizes, than they have been since I started fishing. Take the 9 mile bank off of San Diego for example. The Salmon Grouper are very large and extremely abundant. More so than I have ever seen. Obviously, something is wrong with the research, the data analyzed as a result of this research, and your assumptions in general about Bocaccio. I'm certain that other Sebastes species have been wrongly placed on the "overfished" list because of incomplete and erroneous data as well.

I urge you to make a thorough study of the anecdotal experiences of long time recreational anglers, sportboat captains, and commercial hook and line fishers on a regional basis. In California, we are talking about a constituency of nearly 1 million anglers, commercial hook and line fishers, that pay to use and conserve the resource, not exploit it. You will find that our reality, times several hundred million dollars of economic impact, differs widely from those who craft research to gain grants, and those who fish with destructive gear methods.

Sincerely,
Harvey E. Begnoche

PFMC Comments
<pfmc.comments@noaa.gov>

Subject: Fwd: My 2 cents worth regarding the impending closure. Please read.
From: "PFMC Comments" <pfmc.comments@noaa.gov>
Date: Mon, 10 Jun 2002 14:16:43 -0700
To: john.devore@noaa.gov

X-Mozilla-Status: 0001
X-Mozilla-Status2: 00000000
Return-Path: <pfmc.comments@noaa.gov>
Received: from mercury.akctr.noaa.gov ([127.0.0.1]) by mercury.akctr.noaa.gov (Netscape Messaging Server 4.15 mercury Jun 21 2001 23:53:48) with ESMTP id GXIDRV00.FNA for <john.devore@noaa.gov>; Mon, 10 Jun 2002 14:16:43 -0700
Message-ID: <3805f137a323.37a3233805f1@mercury.akctr.noaa.gov>
X-Mailer: Netscape Webmail
MIME-Version: 1.0
Content-Language: en
X-Accept-Language: en
Content-Type: multipart/mixed; boundary="--71b05a445d3133a0"

Pacific Fishery Management Council
7700 NE Ambassador Place, Suite 200
Portland, Oregon 97220-1384
Phone: 503-820-2280
Fax: 503-820-2299
Toll-Free: 1-866-806-7204
On the web at: http://www.pcouncil.org

Subject: My 2 cents worth regarding the impending closure. Please read.
From: "Roger" <rogerf@vcnet.com>
Date: Mon, 10 Jun 2002 14:12:11 -0700
To: <pfmc.comments@noaa.gov>

X-Mozilla-Status: 0001
X-Mozilla-Status2: 00000000
Return-Path: <pfmc.comments@noaa.gov>
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Message-ID: <3805f137a323.37a3233805f1@mercury.akctr.noaa.gov>
X-Mailer: Netscape Webmail
MIME-Version: 1.0
Content-Language: en
X-Accept-Language: en
Content-Type: multipart/mixed; boundary="--71b05a445d3133a0"

Gentlemen/Ladies:

I am recreational angler who has been fishing the Southern California Bight for more than 25 years. During this time I have spent a good deal of time fishing for rockfish (Sebastes). I understand that you are considering blanket closures that would include recreational fishing for these fish. Some of the studies that you have been presented indicate that bocaccio are on the verge of extinction. It is my experience, at least in the areas that I fish, that nothing could be farther from the truth. Down here, sportfishermen and sportboat captains regard bocaccio as over-abundant pests, and because of our lack of interest in this undesirable species, we go out of our way to avoid them. They are more abundant down here, in all sizes, than they have been for more than twenty years.

Obviously, something is wrong with your studies, your data and your assumptions about bocaccio. I'm certain that other Sebastes species have been wrongly placed on the "overfished" list because of bad data.

I urge you to make a thorough study of the anecdotal experiences of long time recreational anglers and sportboat captains on a regional basis. In California, we are talking about a constituency of nearly 1 million anglers that pay to use and conserve the resource, not exploit and profit from it.

You will find that our reality, times several hundred million dollars of economic impact, differs widely from those who craft research to gain grants, and those who fish for profit alone.

Sincerely,

Roger Fort

PFMC Comments
<pfmc.comments@noaa.gov>

RECEIVED
JUNE 1 1 2002
PFMC

Oneita J. Turner
4995 Sunnyside Rd SE #18
Salem, Oregon 97302
503-371-5319
o.turner@worldnet.att.net

June 8, 2002

I would like to express my deep concern about any proposal that would close sport fishing in off shore waters, in particular Charter Fishing.

You are certain to hear the many economic reasons of how the closure of the sport fishing industry would impact our already failing economy. The closure would not only impact the owners of the boats, as they lose their business, but it would also affect from one degree to another all business that are touched by Charter Fishing. Any business that benefits from the tourism generated by the fishing fleet to the marine supply, to fuel docks, restaurants, and motels, just to name a few. The loss in dollars to the oil companies who supply the fuel and oil for the fleets will not be insignificant, and will certainly spell doom for many of their business.

However, I would like to address a more finite aspect of a possible loss of the Charter Fishing Fleet. Memorial Day; for the past fifty-seven years the small community of Depoe Bay, Oregon has paid tribute to those lost at sea, those who have served our Nation, and those who ashes are scattered at sea. Without a Charter Fleet there will be no Memorial Day Fleet of Flowers. For those of us who have someone "at sea," who have no grave to go, to this one day has deep meaning for us. And, I am certain their are other communities who so honor those at sea.

The loss of the Charter Fleet spells other things as well. It will mean that no longer will the handicapped, the blind, the deaf, the mentally challenged be able to go ocean fishing. It will mean that many of elderly will not be able to continue with the pleasure of ocean fishing, because there will be no one to take them. The joys of this experience will be denied to several segments of our society that have depended on services of the charter fishing industry.

The Charter Fishing industry is unique; it is not something that can be shut down with the expectation that we can import it from another country. It will be the loss of an important part of a special way of life, of private enterprise; and, more to the point the loss of large part of the coastal economy.

I would like to suggest a more positive approach. While extreme measures maybe needed to protect a few species of fish let us look at what can be done to promote the growth of the faster growing species. Let us start creating new reefs to attract and promote bottom fish grown. It is well known that this being done on the eastern coastline, and has been done in other areas of the world. But, more importantly work with and listen to the men and women of the charter industry on their ideas. They are the people who are on the ocean, who have a lifetime of knowledge stored in their memories. They are a valuable resource.

Please consider wisely before closing the sport fishing (Charter Fishing) for one coastline of our nation.

Sincerely,

Oneita Turner

Oneita Turner

Subject: Fwd: "Catch and release"
From: "PFMC Comments" <pfmc.comments@noaa.gov>
Date: Tue, 11 Jun 2002 09:07:04 -0700
To: john.devore@noaa.gov

X-Mozilla-Status: 0001
X-Mozilla-Status2: 00000000
Return-Path: <pfmc.comments@noaa.gov>
Received: from mercury.akctr.noaa.gov ([127.0.0.1]) by mercury.akctr.noaa.gov (Netscape Messaging Server 4.15 mercury Jun 21 2001 23:53:48) with ESMTP id GXJU3S00.QR6 for <john.devore@noaa.gov>; Tue, 11 Jun 2002 09:07:04 -0700
Message-ID: <388a043857c6.3857c6388a04@mercury.akctr.noaa.gov>
X-Mailer: Netscape Webmail
MIME-Version: 1.0
Content-Language: en
X-Accept-Language: en
Content-Type: multipart/mixed; boundary="--106b35787b615e4c"

Pacific Fishery Management Council
7700 NE Ambassador Place, Suite 200
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Phone: 503-820-2280
Fax: 503-820-2299
Toll-Free: 1-866-806-7204
On the web at: http://www.pcouncil.org

Subject: "Catch and release"
From: <CFHunters@aol.com>
Date: Mon, 10 Jun 2002 21:20:01 EDT
To: pfmc.comments@noaa.gov

X-Mozilla-Status: 0001
X-Mozilla-Status2: 00000000
Return-Path: <pfmc.comments@noaa.gov>
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X-Mailer: Netscape Webmail
MIME-Version: 1.0
Content-Language: en
X-Accept-Language: en
Content-Type: multipart/mixed; boundary="--106b35787b615e4c"

Dear Chairman Radkte:
Please make decision based on facts and not guesses. I am totally for programs that manage our fish stocks. Howevwer, if someone is saying that the Bocaccio stock is dwindling; the person is definitely wrong. It is quite obvious to anyone who fishes regularly to observe that the stocks of Bocaccio, halibut, calico bass, black sea bass, white sea bass have come back. The conservation programs that we have are working. Why mess with them? Perhaps, what we should do is to encourage anglers to practice "catch and release." I don't feel the government and the fishing tour operators are doing enough to preach that. Please consider that as an alternative to closing off fishing as a sport to all.
Y. Lee
Concerned citizen and angler

PFMC Comments <pfmc.comments@noaa.gov>

Netscape Messenger Express for PFMC Comments

Folders Inbox **Message** Options Help Logout

Compose Reply Reply All Forward Move message to folder: Delete Prev Next

From All Aboard Adventures <aboard@mcn.org>

Date Tuesday, June 11, 2002 9:13 am

To pfmc.comments@noaa.gov

Subject Groundfish management

Dear Council Members:

We operate a charter boat business in Fort Bragg, California. Our community has been hit with several extreme newspaper articles (taken from the Oakland Tribune) claiming that all fishing...sport and commercial will be prohibited as of Jan 03 from Mexico to Canada.

Our entire community is up in arms. For several years, we have asked for biologists to board our vessels and actually document what fish we are catching. How on earth can this council claim the stocks of these fish are threatened, when no-one from your council has been out of our harbor to document?

Our suggestions to the council are:

1) To very carefully distinguish individual areas that you have *documented* data from and start with any restrictions based on *accurate* information.

2) Before any restrictions are applied out of the Noyo Harbor on the Mendocino Coast, we highly recommend the council come out on our ocean and document. Our charter boat fleets have asked for this to be done, and to date, we have not had any representatives participate in accurate documenting on our charter boats.

3) Give the new restrictions, just applied, a chance.

Sincerely,

Captain Tim Gillespie & First Mate Cindy!
All Aboard Adventures on The Sea Hawk!
Noyo Harbor
Fort Bragg, CA 95437
(707) 964-1881
Visit our Website! http://www.allaboardadventures.com/

PACIFIC TRAWL CO, INC.
Trawls and Trawl Supplies

P.O. Box 6353. Eureka Cal. 95501
707-444-0431
Fax 707-444-2751

LIAM N. MASSEY
President

JUN 11 2002

Dear Council Members:

June 11, 2002

I would like to take this opportunity to comment on the proposed Closure to Trawling of the West Coast Continental Shelf.

My business has been supplying trawl gear to the groundfish fleet on this coast since 1979. In the past five years, we have seen our business cut in half as a result of the starvation policy you have carried out in an attempt to manage the fisheries on this coast. I feel that a closure of the shelf would mean we could no longer remain in business.

The Council's policy of ever-decreasing trip limits has reached its' final conclusion; the resource has been wasted, the processing and supply infrastructure has contracted, the fishing vessels have become unsafe and in some cases, completely unseaworthy. These vessels are now faced with fishing for less fish and less money, while paying more for the necessary supplies with which to do so. In my opinion, a closure of the shelf is an admission of the failure of this management policy, and a golden opportunity for more lawsuits against N.M.F.S.

Let me list the fisheries which my business supplies and which will be impacted by this closure: the multi-species fishery for petrale and English sole, sand dabs, pink shrimp, California halibut, and cucumber: the midwater fisheries for hake and chilipepper; the California and Washington fisheries for prawns. A blanket closure would mean the loss to the nation of these fisheries and the loss of the participants' livelihoods.

I will follow this letter with two more describing the difficulties I face as, firstly, a gear supplier and secondly, as a frustrated gear design technician.

I would ask you to consider very carefully this proposed closure and its' impact on the United States fishing industry which is composed of many hard working American men and women. In conclusion, please step back and try to figure out some other plan to manage our national seafood resource: Systematically destroying the economic viability of commercial fishing and thus precipitating a Final Full Closure is not a management method.

Sincerely,

Liam N. Massey

Liam N. Massey, President
Pacific Trawl Co. Inc.

PACIFIC TRAWL CO, INC.
Trawls and Trawl Supplies

P.O. Box 6353. Eureka Cal. 95501
707-444-0431
Fax 707-444-2751

LIAM N. MASSEY
President

Dear Council Members:

June 11, 2002

I have been in the business of supplying trawl gear to the West Coast commercial fleet since 1979. Prior to that, I was a trawler owner and operator. Gear changes and trawl selectivity have been both a career and a hobby all my life. All of my spare resources of time and money have gone to support this interest. I consider myself an expert in this field.

As such, I am dismayed and confounded with your decision to close the U.S. Western Continental Shelf to groundfishing because of the need to rebuild a few species of rockfish, without first looking into methods of excluding them from trawls.

To the best of my knowledge, the only attempt initiated by the Council to deal with this problem was the 8" footrope modification to trawls a couple of years ago. That *solution* was an ill-conceived reaction by the industry under pressure from the Council to avoid full closure. It did not take into account the damage it would to the ocean bottom, and consequent vulnerability to future lawsuits which could ensue against the industry. It was an indirect and inappropriate attempt to deal with a problem and its' limited success is hardly a surprise.

I am a firm proponent of trawling as the only method of catching many species of fish in an economical and responsible manner. Numerous research papers and books have been written on exclusion methods for trawls and none have been looked into for use on this coast. Apparently, the Council finds it easier to close down a fishery and jeopardize the livelihoods dependent upon it rather than deal with the problems associated with it.

I respectfully ask that you pursue all alternatives to a full closure. There would be little benefit to the nation, and the cost would be loss of livelihood for the many American taxpaying individuals, families and businesses who depend on the ocean for a living.

Sincerely,

Liam N. Massey, Gear Engineer
Pacific Trawl Co. Inc.

PACIFIC TRAWL CO, INC.
Trawls and Trawl Supplies

P.O. Box 6353, Eureka Cal. 95501
707-444-0431
Fax 707-444-2751

LIAM N. MASSEY
President

Dear Council Members: June 11, 2002

I have been in the business of supplying trawl gear to fishing vessels on the West Coast of the U.S. since 1979. I would like to take this opportunity to acquaint you with some of the difficulties I encounter while attempting to do this.

In the past five years, I have seen my own business drop by half, two other netmakers go out of business, and the only two manufacturers of P.E. netting in the U.S. quit the business.

Everything we use in this industry is imported. This includes: netting, wire rope, floats, chain, shackles, rope and trawl links. In order to obtain reasonable pricing, we have to order by container lots, 10-20 ton at a time. With netting for example, we must purchase a minimum of ten ton per order, and minimum of 600 lb. per twine/mesh size. In order to cover all the requirements in the various fisheries we supply, we carry 24 mesh/twine size combinations. All of these sizes are not manufactured by the same netting factory, some come from Asia and some from Europe. From the time we place the order, we expect to receive the material in three to six months, depending on the supplier.

With this timetable, we have been forced to second guess what fishery management **might** do a year in advance. If mesh sizes, or method of measuring mesh is changed, we are faced with a loss of the inventory we carry for that fishery and the necessity of placing an order for the new size, assuming we can come up with the volume and money to do so. At best, we might have the new material in six months.

Please take this situation into account when contemplating gear changes. To the best of my knowledge no gear supplier on this coast has been consulted about the impacts of regulation change. We must have at least six months advance notice of the changes in order to, hopefully, sell off some old inventory and be able to order new.

Thank you for your time.

Sincerely,

Liam N. Massey

Liam N. Massey, Fishing Gear Supplier
Pacific Trawl Co. Inc.

Public Comment C.8.E
Management Measures for 200_

June 12, 2002

Chris Fryer
2132 Oregon Street
Berkeley, CA 94705

Dr. Donald McIsaac
Executive Director,
Pacific Fishery Management Council
7700 NE Ambassador Place, Suite 200
Portland, OR 97220

Dear Dr. McIsaac,

As a diver, I am very concerned about recent scientific reports noting the declining and serious nature of the rockfish fishery in the Pacific. I understand that the Pacific Fishery Management Council will be discussing these reports at their June meeting. Due to the dire nature of these reports, I urge you to close the rockfish (also known as groundfish) fishery until good science notes that it can again be sustainably fished. I know that there are a number of fishing techniques and other fisheries, including squid and shrimp fishing, that also affect rockfish population through bycatch. I urge you to restrict these destructive fishing practices and reduce fishing levels on other fisheries to allow the rockfish stocks to replenish.

Older scientific reports underestimated the dire state of rockfish populations. It is time for the PFMC to act now to restrict fishing that affects rockfish populations. I am a California scuba diver and have seen a steady decline in large rockfish over many years.

Again, this trend must be reversed and the rockfish populations allowed to replenish. Close areas where overfishing has occurred and keep them closed until depleted rockfish stocks have been rebuilt.

I understand that closures related to rebuilding the rockfish populations will have a profound affect on the commercial fishing industry. Please know that I will also contact my state and federal representatives and urge them to assist financially to minimize the impact on working people.

Thank you for your time.

Sincerely,

Chris Fryer

To: Pacific Fishery Management Council

From: Tracy Grogan

Date: June 13, 2002

I am writing because I am concerned about recent scientific reports that some of our rockfish populations are seriously depleted and continue to decline at increasing rates. As a diver, consumer and conservationist, I have seen become acutely aware of the growing impact we have on that decline. I have taken it upon myself to alter my dining habits and to educate others about depleted fish stocks such as swordfish, "sea bass", bluefin tuna, orange roughy, and sharks, among others. But this grassroots activity can never grow beyond low levels of adherence unless organizations and governing bodies take up the cause.

I urge the PFMC to use its position and standing to act immediately to reduce fishing levels in order to rebuild our depleted fish stocks. Without intervention, the commercial viability of this fish can be measured in single-digit years. I urge you to close areas where overfishing has been occurring, and keep them closed until the depleted stocks have been rebuilt.

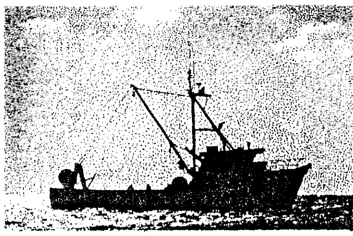
Even as efforts, such as aquaculture, are introduced as long-term solutions to the conflict between the need to feed this planet and the need to create sustainable practices, we are challenged to make sacrifices in the short term. You have an opportunity to serve your constituents (all those who make a living or put food on the table from our troubled fisheries) in both the long and short term. One need look no further than the east coast fisheries to see that short term greed will ultimately lead to depleted stocks and bankrupt fishermen. It is in the best interest of each of us to limit fishing in such a way as to create a sustainable stock.

You are in a unique position to bring this to reality. I urge you to support limitations and even bans on the commercial harvesting of rockfish in a manner that is first consistent with sustainability and, only when the first goal is achieved, the healthy continuation of commercial fishing in this region. If you do not achieve the first, the second will soon collapse.

Thank you for the opportunity to comment,

Tracy Grogan

Agenda Item # C-8
Proposed Management Measures for 200.
June 2002



HUNTER ENTERPRISES

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June 12, 2002

Dear Council Members:

We would like to comment on the proposed Closure to Trawling of West Coast Continental Shelf.

Our family has been in the fishing industry four generations on the Pacific Coast and we had one of the largest processing plants on the West Coast (Eureka Fisheries Inc) which has recently closed it's doors after 50 years of business. This closure was strictly due to the ever decreasing amount of fish allowed by the Council and the National Marine Fisheries to be landed. Our Pacific Coast communities have been hard hit economically by the decisions being made by the Council and the NMFS.

We are in complete agreement with the statements issued recently by a number of Congressmen on our behalf regarding the Magnuson Act and the PFMC and NMF's many Management Plans. They clearly understand the needless and "scientifically unjustified assault" by the NMFS, PFMC, and the various environmental groups to use the Magnuson Act against the fishing industry. These members of Congress are committed to a reasonable approach to protecting both the fishery and the fishing industry. They know that the Magnuson Act must be amended immediately.

The Amendment to the Magnuson Act is only one step that must be taken to insure that the industry remains viable. The PFMC's management plans the last five years have drastically reduced the fishing industry, putting many processors, vessels, and people out of business while attempting to manage the fisheries. We feel these policies and decisions have been made using poor science and have ignored the industry's experience and knowledge when compiling the data. Decisions have been made solely on the side of caution and fear of law suits being filed by environmental groups.

The closure of the shelf is an admission of failure of the management policy. There are many other methods including gear changes and trawl selectivity that could be used to protect certain fish species. These alternate methods would be a better solution for fisheries management than Closure to Trawling of the West Coast Continental Shelf.

We urge you to carefully consider the effects your decisions will have on the fishing industry and the communities of the entire West Coast, as well as the seafood resource.

Sincerely,

G.A. (Gib) Hunter
Bill C Hunter

ALLEN CODY • DENNIS GAYLE • EL CERRITO • FISHWISH
OREGON FLYER • TRAVIS WM. • WARRIOR II • WINGA

Exhibit C.8
Attachment 1
June 2002

Table 1a. 2002 Specifications of Acceptable Biological Catch (ABC), Optimum Yields (OYs), and Limited Entry and Open Access Allocations, by International North Pacific Fisheries Commission (INPFC) Areas (weights in metric tons).

Species	ACCEPTABLE BIOLOGICAL CATCH (ABC)						OY (Total catch)	Commercial OY (Total catch)	Allocations (Total catch)			
	Vancouver a/	Columbia	Eureka	Monterey	Conception	Total Catch			Limited Entry		Open Access	
									Mt	%	Mt	%
ROUNDFISH												
Lingcod b/	745					745	577	251	203	81.0	48	19.0
Pacific Cod	3,200		c/			3,200	na	3,200	--	--	--	--
Pacific Whiting d/									--	--	--	--
Sablefish e/ (north of 36^{O})	4,644				--	4,644	4,367	3,906	3,539	90.6	367	9.4
Sablefish f/ (south of 36^{O})	--				333	333	229	229	--	--	--	--
FLATFISH												
Dover sole g/	8,510					8,510	7,440	7,368	--	--	--	--
English sole	2,000		1,100			3,100	na	–	–	–	–	–
Petrale sole h/	1,262		500	800	200	2,762	na	–	–	–	–	–
Arrowtooth flounder	5,800					5,800	na	–	–	–	–	–
Other flatfish i/	700	3,000	1,700	1,800	500	7,700	na	–	–	–	–	–
ROCKFISH:												
Pacific Ocean Perch j/	640			--		640	350	350	--	--	--	--
Shortbelly k/	13,900					13,900	13,900	13,900	--	--	--	--
Widow l/	3,727					3,727	856	853	827	97.0	26	3.0

Table 1a. 2002 Specifications of Acceptable Biological Catch (ABC), Optimum Yields (OYs), and Limited Entry and Open Access Allocations, by International North Pacific Fisheries Commission (INPFC) Areas (weights in metric tons).

	ACCEPTABLE BIOLOGICAL CATCH (ABC)								Allocations (Total catch)			
							OY	Commer-cial OY	Limited Entry		Open Access	
Species	Vancou-ver a/	Colum-bia	Eureka	Monte-rey	Concep-tion	Total Catch	(Total catch)	(Total catch)	Mt	%	Mt	%
Canary m/	228					228	93	44	39	87.7	5	12.3
Chilipepper n/	c/			2,700		2,700	2,000	1,985	1,106	55.7	879	44.3
Bocaccio o/	c/			122		122	100	44	25	55.7	19	44.3
Splitnose p/	c/			615		615	461	461	--	--	--	--
Yellowtail q/	3,146			c/		3,146	3,146	3,131	2,871	91.7	260	8.3
Shortspine thornyhead r/ (north of $34^{O}27'$)	1,004					1,004	955	948	945	99.73	3	0.27
Longspine thornyhead s/ (north of 36^{O})	2,461				--	2,461	2,461	2,455	--	--	--	--
Longspine thornyhead s/ (south of 36^{O} t/)	--				390	390	195	195	--	--	--	--
	c/			19	--	19	2.4	0	--	--	--	--
Cowcod u/	c/			--	5	5	2.4	0	--	--	--	--
Darkblotched v/	187					187	168	168	163	--	5	–
Yelloweye w/	22			5	--	27	13.5	3.69	--	--	--	--
Minor Rockfish North x/	4,795			--		4,795	3,115	2,442	2,239	91.7	203	8.3
Minor Rockfish South y/	--			3,506		3,506	2,015	1,283	714	55.7	569	44.3
Remaining Rockfish	2,727			854		--	--	--	--	--	--	--
bank z/	c/			350		350	--	--	--	--	--	--
black aa/	615		500			1,115	--	--	--	--	--	--

Table 1a. 2002 Specifications of Acceptable Biological Catch (ABC), Optimum Yields (OYs), and Limited Entry and Open Access Allocations, by International North Pacific Fisheries Commission (INPFC) Areas (weights in metric tons).

	ACCEPTABLE BIOLOGICAL CATCH (ABC)								Allocations (Total catch)			
							OY	Commer-cial OY	Limited Entry		Open Access	
Species	Vancou-ver a/	Colum-bia	Eureka	Monte-rey	Concep-tion	Total Catch	(Total catch)	(Total catch)	Mt	%	Mt	%
blackgill bb/	c/			75	268	343	--	--	--	--	--	--
bocaccio (north)	318					318	--	--	--	--	--	--
chilipepper (north)	32					32	--	--	--	--	--	--
redstripe	576			c/		576	--	--	--	--	--	–
sharpchin	307			45		352	--	--	--	--	--	--
silvergrey	38			c/		38	--	--	--	--	--	–
splitnose	242			c/		242	--	--	--	--	--	--
yellowmouth	99			c/		99						
yellowtail (south)				116		116						
Other rockfish cc/	2,068			2,652		--	--	--	--	--	--	--
OTHER FISH dd/	2,500	7,000	1,200	2,000	2,000	14,700	na	–	–	–	–	–

Table 1b. 2002 OYs for minor rockfish by depth sub-groups (weights in metric tons).

Species	Total Catch ABC	OY (Total catch)			Harvest Guidelines (Total catch)			
					Limited Entry		Open Access	
		Total Catch OY	Recrea-tional Estimate	Commercial OY	Mt	Percent	Mt	Percent
Minor Rockfish North x/	4,795	3,115	673	2,442	2,239	91.7	203	8.3
Nearshore		987	663	324	161	na	163	na
Shelf		968	10	958	928	na	30	na
Slope		1,160	0	1,160	1,150	na	10	na
Minor Rockfish South y/	3,506	2,015	732	1,283	714	55.7	569	44.3
Nearshore		662	532	130	23	na	107	na
Shelf		714	200	514	194	na	320	na
Slope		639		639	497	na	142	na

a/ ABC applies to the U.S. portion of the Vancouver area, except as noted under individual species.

b/ Lingcod was designated as overfished in 1999. Coastwide, lingcod is believed to be at 15 percent of its unfished biomass. An assessment was conducted in 2000 and updated for 2001. The stock assessment included parts of Canadian waters, therefore the U.S. portion of the ABC for the Vancouver area was set at 44 percent of the total. for that area. The ABC of 745 mt was calculated using an Fmsy proxy of F45%. The total catch OY of 577 mt is based on a 60 percent probability of rebuilding the stock to Bmsy by the year 2009. The total catch OY is reduced by 326 mt, the amount that is estimated to be taken by the recreational fishery, resulting in a commercial OY of 251 mt. The open access total catch allocation is 48 mt (19 percent of the commercial OY) and the open access landed catch value is 38 mt. The limited entry total catch allocation is 203 mt and the landed catch value is 163 mt. The landed catch values are based on a new discard analysis which correlates coincidental catch rates of lingcod with the expected catch of specific target species. A “mid” level bycatch range (13%-20%) was selected for estimating discard mortality. The landed catch values will be evaluated inseason and adjusted as necessary. Tribal vessels are expected to land a small amount of lingcod (4-5 mt), but do not have a specific allocation at this time.

c/ “Other species” - These species are neither common nor important to the commercial and recreational fisheries in the areas footnoted. Accordingly, Pacific cod is included in the non-commercial OY of “other fish” and rockfish species are included in either “other rockfish” or “remaining rockfish” for the areas footnoted only.

d/ A new assessment is expected in early 2002. Therefore, final adoption of the ABC and OY have been deferred until early 2002, when the results of the new assessment become available.

e/ Sablefish north of 36° N lat. - A new sablefish assessment was done in 2001 for the area north of Point Conception (34°27'N lat.). Sablefish north of 34°27'N lat. is believed to be between 27 percent and 38 percent of its unfished biomass. The ABC for the surveyed area (4,786 mt) is based on an environmentally driven model with an Fmsy proxy of F45%. The ABC for the management area north of 36° N lat. is 4,644 mt (97.04 percent of the ABC from the surveyed area). The total catch OY for the area north of 36° N lat is 4,367 mt which is based on the application of the 40-10 harvest rate policy and is 97.04 percent of the OY from the surveyed area. The total catch OY is reduced by 10 percent for the tribal set aside (437 mt) and by 24.7 mt for compensation to vessels that conducted resource surveys. The remainder (3,906 mt) is the commercial total catch OY. The open access allocation of 9.4 percent of the commercial OY, resulting in an open access total catch OY of 367 mt. The limited entry total catch OY is 3,539 mt, 90.6 percent of the commercial OY. The limited entry total catch OY is further divided with 58 percent (2,052 mt) allocated to the trawl fishery and 42 percent (1,486 mt) allocated to the non-trawl fishery. Discard rates will be applied as follows: 21 percent for limited entry trawl, 8 percent for limited entry fixed gear and open access, and 3 percent for the tribal fisheries. The resulting landed catch values are: 1,601 mt for limited entry trawl, 1,442 mt for limited entry fixed gear, 338 mt for open access, and 424 mt for the tribal fisheries.

f/ Sablefish south of 36° N lat. - The ABC of 333 mt is the sum of 142 mt (2.96 percent of the ABC from the new 2001 survey based assessment) and 191 mt (based on historical landings). The total catch OY (229 mt) is the sum of 133 mt (2.96 percent of the OY from the new 2001 survey based assessment with the application of the 40-10 harvest rate policy) and 96 mt (that portion of the ABC based on historical landings which was reduced by 50 percent to address uncertainty due to limited information). There are no limited entry or open access allocations in the Conception area at this time. The assumed discard value is 8 percent, resulting in a landed catch value of 211 mt.

g/ Dover sole north of 34°27'N lat. was assessed as a unit in 2001 and is believed to be at 29% of its unfished biomass. The ABC (8,510 mt) is based on an Fmsy proxy of F40%. Because the biomass is estimated to be in the precautionary zone, the total catch OY of 7,440 mt is based on the application of the 40-10 harvest rate policy. The OY is reduced by 71.6 mt for compensation to vessels that conducted resource surveys, resulting in a commercial OY of 7,368 mt. Discards are assumed to be 5 percent, resulting in a landed catch value of 7,000 mt.

h/ Petrale sole was believed to be at 42 percent of its unfished biomass following a 1999 assessment. For 2002, the final ABC for the Vancouver-Columbia area (1,262 mt) is based on an F40% Fmsy proxy. The ABCs for the Eureka, Monterey, and Conception areas (1,500 mt) continue at the same level as 2001.

i/ "Other flatfish" are those species that do not have individual ABC/OYs and include butter sole, curlfin sole, flathead sole, Pacific sand dab, rex sole, rock sole, sand sole, and starry flounder. The ABC is based on historical catch levels.

j/ Pacific ocean perch (POP) was designated as overfished in 1999. The ABC (640 mt) is based on the 2000 assessment which was updated for 2001. The total catch OY (350 mt) is based on a 70 percent probability of rebuilding the stock to Bmsy by the year 2042. The landed catch value is 294 mt. The landed catch value is based on a new discard analysis which correlates coincidental catch rates of POP with the expected catch of specific target species. A “mid” level bycatch range (approximately 16%) was selected for estimating discard mortality. The landed catch value will be evaluated inseason and adjusted as necessary. Tribal vessels are expected to land only trace amounts of POP in 2002 and do not have a specific allocation at this time.

k/ Shortbelly rockfish remains an unexploited stock and is difficult to assess quantitatively. The 1989 assessment provided 2 alternative yield calculations of 13,900 mt and 47,000 mt. NMFS surveys have shown poor recruitment in most years since 1989, indicating low recent productivity and a naturally declining population in spite of low fishing pressure. The ABC and OY therefore are set at 13,900 mt, the low end of the range in the assessment.

l/ Widow rockfish was assessed in 2000 and is believed to be at 24 percent of its unfished biomass. Therefore, it was declared overfished in 2001. The ABC (3,727 mt) is based on an F50% Fmsy proxy. The OY (856 mt) is based on a 60 percent probability of rebuilding the stock to Bmsy within 37 years. The OY is reduced by 3 mt for the amount estimated to be taken as recreational catch, resulting in a commercial OY of 853 mt. The commercial OY is divided with open access receiving 3 percent (26 mt) and limited entry receiving 97 percent (827 mt). The landed catch equivalent for the open access fishery is 21 mt. The limited entry allocation is reduced by 150 mt for anticipated bycatch in the at-sea whiting fishery and an additional 40 mt for anticipated bycatch in the shore-based sector of the whiting fishery. The remainder of the limited entry allocation is reduced by 16 percent to account for discards in the trip limit fisheries. The landed catch equivalent, excluding the at-sea whiting fishery, is 575 mt. Tribal vessels are expected to land about 27 mt of widow rockfish in 2002, but do not have a specific allocation at this time.

m/ Canary rockfish is believed to be at 22 percent of its unfished biomass in the north (north of Cape Blanco) and 8 percent of its unfished biomass in the south (south of Cape Blanco). Canary rockfish was declared overfished in 2000. The coastwide ABC (228 mt) is based on an Fmsy proxy of F50%. The coastwide OY of 93 mt (the sum of 73 mt for the northern area, plus 20 mt for the southern area) is based on a 52 percent probability of rebuilding the stock to Bmsy by the year 2056. The OY is reduced by 5 mt for research surveys and 44 mt for the estimated recreational catch, resulting in a commercial OY of 44 mt. The commercial OY is divided with open access receiving 12.3 percent (5 mt) and limited entry receiving 87.7 percent (39 mt). The landed catch value for the open access fishery is 4.5 mt. The 39 mt limited entry allocation is further reduced by 3 mt for anticipated bycatch in the offshore whiting fishery. The limited entry landed catch value is 30 mt. The landed catch value is based on a new discard analysis which correlates coincidental catch rates of canary rockfish with the expected catch of specific target species. A “low” level bycatch range (approximately 16%) was selected for estimating discard mortality. The landed catch value will be evaluated inseason and adjusted as necessary. However, the specific open access/limited entry allocation has been suspended during the rebuilding period as necessary to meet the overall rebuilding target while allowing harvest of healthy stocks. Tribal vessels are expected to land about 2.5 mt of canary rockfish in 2002, but do not have a specific allocation at this time.

n/ Chilipepper rockfish - The ABC (2,700 mt) for the Monterey-Conception area is based on the 1998 stock assessment with the application of an F50% Fmsy proxy. Because the unfished biomass is believed to be above 40 percent, the default OY could be set equal to the ABC. However, the OY is set at 2,000 mt, near the recent average landed catch, to discourage effort on chilipepper, which is known to have bycatch of overfished bocaccio rockfish. The OY is reduced by 15 mt for the amount estimated to be taken in the recreational fishery, resulting in a commercial OY of 1,985 mt. Of the commercial OY, open access is allocated 44.3 percent (879 mt) and limited entry is allocated 55.7 percent (1,106 mt). The assumed discard is 16 percent, resulting in a open access landed catch value of 739 mt and a limited entry landed catch value of 929 mt.

o/ Bocaccio rockfish is believed to be at 2 percent of its unfished biomass and was designated as overfished in 1999. The ABC of 122 mt is based on an F50% Fmsy proxy. The OY (100 mt) is based on the rebuilding plan, which has a 67% probability of rebuilding the stock to Bmsy by the year 2033. The OY is reduced by 56 mt for the amount estimated to be taken as recreational harvest, resulting in a 44 mt commercial OY. Open access is allocated 44.3 percent (19 mt) of the commercial OY and limited entry is allocated 55.7 percent (25 mt) of the commercial OY. The open access landed catch value is 16 mt and the limited entry landed catch value is 21 mt. The landed catch values are based on a new discard analysis which correlates coincidental catch rates of bocaccio with the expected catch of specific target species. A “high” level bycatch range (approximately 16%) was selected for estimating discard mortality. The landed catch values will be evaluated inseason and adjusted as necessary.

p/ Splitnose rockfish - The 2001 ABC is 615 mt in the southern area (Monterey-Conception). The 461 mt total catch OY for the southern area reflects a 25 percent precautionary adjustment because of the less rigorous assessment for this stock. In the north, splitnose is included in the minor slope rockfish OY. The assumed discard is 16 percent for a landed catch value of 387 mt.

q/ Yellowtail rockfish is believed to be at 63 percent of its unfished biomass. The ABC of 3,146 mt is based on a 2000 stock assessment for the Vancouver-Columbia-Eureka areas with an Fmsy proxy of F50%. The OY (3,146 mt) was set equal to the ABC. To derive the commercial OY (3,131 mt) the total catch OY is reduced by 15 mt, the amount estimated to be taken in the recreational fishery. The open access allocation (260 mt) is 8.3 percent of the commercial OY. The limited entry allocation (2,871 mt) is 91.7 percent the commercial OY. For anticipated bycatch in the at-sea whiting fishery, 400 mt is subtracted from the limited entry allocation. An additional 150 mt is deducted for the shore-based whiting fishery. The remainder (2,471 mt) is further reduced by 20 percent for assumed discard. The limited entry landed catch equivalent, excluding the at-sea whiting fishery, is 2,007 mt. The open access landed catch equivalent is 218 mt, given the assumed discard of 16 percent. Tribal vessels are expected to land about 300 mt of yellowtail rockfish outside their directed whiting fishery in 2002, but do not have a specific allocation at this time.

r/ Shortspine thornyhead - A new assessment was done for shortspine thornyhead in 2001 and the stock is believed to be between 25 and 50 percent of its unfished biomass. The ABC (1,004 mt) for the area north of Pt. Conception (34^{O}27'N lat.) is based on a F50% Fmsy proxy. The OY of 955 mt is based on the new survey with the application the 40-10 harvest policy, resulting in a commercial OY of 948 mt. Open access is allocated 0.27 percent (3 mt) of the commercial OY and limited entry is allocated 99.73 percent (945 mt) of the commercial OY. A 20 percent rate of discard is applied to obtain a limited entry landed catch value of 757 mt. There is no ABC or OY for the southern Conception area. It is estimated that the treaty tribes will take 1 mt of shortspine thornyheads in 2002**.** This small amount is not subtracted from the OYs at this time.

s/ Longspine thornyhead is believed to be above 40 percent of its unfished biomass. The ABC (2,461 mt) in the north (Vancouver-Columbia-Eureka-Monterey) is based on the average of the 3-year individual ABCs at an F50% Fmsy proxy. The total catch OY (2,461 mt) is set equal to the ABC. The OY is further reduced by 6 mt for compensation to vessels that conducted resource surveys, resulting in a commercial OY of 2,455 mt. To derive the landed catch equivalent of 2,037 mt, the limited entry allocation is reduced by 17 percent for estimated discards.

t/ Longspine thornyhead - A separate ABC (390 mt) is established for the Conception area and is based on historical catch for the portion of the Conception area north of 34^{O}27' N. lat. (Point Conception). The ABC was reduced by 50 percent to obtain the OY (195 mt), this reduction addresses uncertainty in the stock assessment due to limited information. There is no ABC or OY for the southern Conception Area.

u/ Cowcod in the Conception area was assessed in 1999 and is believed to be at less than 10 percent of its unfished biomass. Therefore cowcod was declared overfished in 2000. The ABC in the Conception area (5 mt) is based on the 1999 assessment, while the ABC for the Monterey area (19 mt) is based on average landings from 1993-1997. An OY of 4.8 mt (2.4 mt in each area) is based on a 55 percent probability of rebuilding the stock to Bmsy by the year 2094. Cowcod retention will not be permitted in 2002.

v/ Darkblotched rockfish was assessed in 2000 and is believed to be at 22 percent of its unfished biomass. The stock was declared overfished in 2001. The ABC of 187 mt is based on an Fmsy proxy of F50%. The OY of 168 mt is based on a 70% probability of rebuilding the stock to Bmsy by 2034. For anticipated bycatch in the at-sea whiting fishery, 5 mt is subtracted from the limited entry allocation. The landed catch value for the remaining limited entry fisheries is 130 mt. The landed catch values are based on a new discard analysis which correlates coincidental catch rates of darkblotched rockfish with the expected catch of specific target species. A “mid” level bycatch range (approximately 20%) was selected for estimating discard mortality. The landed catch values will be evaluated inseason and adjusted as necessary. Specific open access/limited entry allocation has been suspended during the rebuilding period as necessary to meet the overall rebuilding target while allowing harvest of healthy stocks. Tribal vessels are expected to land minimal amounts of darkblotched rockfish in 2002, but do not have a specific allocation at this time.

w/ Yelloweye rockfish was assessed in 2001 and is believed to be at 7 percent of its unfished biomass off northern California and at 13 percent of its unfished biomass off Oregon, indicating that it is overfished at this time. The 27 mt coastwide ABC (5 mt for the Monterey area and 22 mt for the areas north of 40^{O}10'N lat.) is based on an Fmsy proxy of F50%. As a precautionary measure, until rebuilding measures can be adopted, the coastwide ABC has been reduced by 50 percent to obtain the OY of 13.5 mt (2.5 mt for the Monterey area and 11 mt for the areas north of 40^{O}10'N lat.) The OY is reduced by 8.81 mt for the amount estimated to be taken as recreational harvest, and 1 mt for the amount expected to be taken in the tribal fishery, resulting in a commercial OY of 3.69 mt. Specific open access/limited entry allocation has been suspended during the rebuilding period as necessary to meet the overall rebuilding target while allowing harvest of healthy stocks.

x/ Minor rockfish north includes the "remaining rockfish" and "other rockfish"' categories in the Vancouver, Columbia, and Eureka areas combined. These species include ``remaining rockfish'' which generally includes species that have been assessed by less rigorous methods than stock assessment, and "other rockfish" which includes species that do not have quantifiable assessments. The ABC (4,795 mt) is the sum of the individual "remaining rockfish" ABCs (2,727 mt) plus the "other rockfish" ABCs (2,068 mt). The remaining rockfish ABCs continue to be reduced by 25 percent (F=0.75M) as a precautionary adjustment. To obtain the total catch OY (3,115 mt) the remaining rockfish ABCs are further reduced by 25 percent with the exception of black rockfish, and other rockfish ABCs are reduced by 50 percent**.** This was a precautionary measure due to limited stock assessment information. The OY is reduced by 673 mt for the amount estimated to be taken in the recreational fishery, resulting in a commercial OY of 2,442 mt. Open access is allocated 8.3 percent (203 mt) of the commercial OY and limited entry is allocated 91.7 percent (2,239 mt) of the commercial OY. The discard is assumed to be 5 percent for nearshore rockfish, 16 percent for shelf rockfish, and 20 percent for slope rockfish, resulting in a an open access landed catch value of 188 mt and a limited entry landed catch value of 1,852 mt. Tribal vessels are expected to land about 10 mt of minor rockfish (2 mt of minor nearshore rockfish, 4 mt of shelf rockfish, and 4 mt of slope rockfish) in 2002, but do not have a specific allocation at this time.

y/ Minor rockfish south includes the ``remaining rockfish'' and ``other rockfish'' categories in the Monterey and Conception areas combined. These species include ``remaining rockfish'' which generally includes species that have been assessed by less rigorous methods than stock assessment, and ``other rockfish'' which includes species that do not have quantifiable assessments. The ABC (3,506 mt) is the sum of the individual "remaining rockfish" ABCs (854 mt) plus the "other rockfish" ABCs (2,652). The remaining rockfish ABCs continue to be reduced by 25 percent (F=0.75M) as a precautionary adjustment. To obtain total catch OY (2,015 mt), the remaining rockfish ABCs are further reduced by 25 percent, with the exception of blackgill rockfish, and the other rockfish ABCs were reduced by 50 percent. This was a precautionary measure due to limited stock assessment information. The OY is reduced by 732 mt for the amount estimated to be taken in the recreational fishery, resulting in a commercial OY of 1,283 mt. Open access is allocated 44.3 percent (569 mt) of the commercial OY and limited entry is allocated 55.7 percent (714 mt) of the commercial OY. The discard is assumed to be 5 percent for nearshore rockfish, 16 percent for shelf rockfish, and 20 percent for slope rockfish, resulting in an open access landed catch value of 484 mt and a limited entry landed catch value of 582 mt.

z/ Bank rockfish - The ABC of 350 mt is based on a 2000 assessment for the Monterey and Conception areas. This stock contributes 263 mt towards the minor rockfish OY in the south.

aa/ Black rockfish - The ABC (1,115 mt) which is based on a 2000 assessment, is the sum of the assessment area (615 mt) plus the average catch in the unassessed area (500 mt). To obtain the OY for the southern portion of this area, the ABC has been reduced by 50 percent as a precautionary measures due to limited information. For the assessed area the OY was set equal to the ABC. This stock contributes 865 mt towards the minor rockfish OY in the north.

bb/ Blackgill rockfish is believed to be at 51 percent of its unfished biomass. The ABC (343 mt) is the sum of the Conception area ABC of 268 mt, based on the 1998 assessment with an Fmsy proxy of F50%, and the Monterey area ABC of 75 mt. This stock contributes 306 mt towards minor rockfish south (268 mt for the Conception area ABC and 38 mt for the Monterey area). The OY for the Monterey area is the ABC reduced by 50 percent for precautionary measures because of lack of information.

cc/ ”Other rockfish” includes rockfish species listed in 50 CFR 660.302 and California scorpionfish. The ABC is based on the 1996 review of commercial Sebastes landings and includes an estimate of recreational landings. These species have never been quantifiably assessed. Beginning in 2002, yelloweye rockfish, in the Monterey and Conception areas, has been removed from the “other rockfish” category.

dd/ ”Other fish” includes sharks, skates, rays, ratfish, morids, grenadiers, and other groundfish species noted above in footnote c/.

Exhibit C.8
Attachment 2
June 2002

DRAFT Minutes

Ad Hoc Allocation Committee Teleconference

May 21, 2002

Members Present:
Dr. Hans Radtke, Chairman, Pacific Fishery Management Council
Mr. LB Boydstun, California Department of Fish and Game
Mr. Mark Saelens, Oregon Department of Fish and Wildlife (acting member)
Mr. Phil Anderson, Washington Department of Fish and Wildlife
Mr. Bill Robinson, Northwest Region National Marine Fisheries Service

Others Present:
Ms. Eileen Cooney, General Counsel, National Oceanic and Atmospheric Administration
Dr. Jim Hastie, Northwest Fisheries Science Center National Marine Fisheries Service
Mr. Rod Moore, West Coast Seafood Processors Association
Dr. Steve Freese, National Marine Fisheries Service
Mr. Steve Copps, National Marine Fisheries Service
Ms. Yvonne deReynier, Northwest Region National Marine Fisheries Service
Ms. Becky Renko, Northwest Region National Marine Fisheries Service
Mr. Jim Glock, National Marine Fisheries Service
Mr. Jim Morgan, Southwest Region National Marine Fisheries Service
Ms. Marija Vojkovich, California Department of Fish and Game
Mr. Dave Thomas, California Department of Fish and Game
Ms. Marci Yaremko, California Department of Fish and Game
Mr. Guy Norman, Oregon Department of Fish and Wildlife
Mr. Burnie Bohn, concerned Oregon citizen
Mr. Brian Culver, Washington Department of Fish and Wildlife
Ms. Michele Robinson, Washington Department of Fish and Wildlife
Mr. Bob Strickland, United Anglers of California
Mr. Randy Fry, United Anglers of California
Ms. Karen Garrison, Natural Resources Defense Council
Mr. Bob Eaton, Pacific Marine Conservation Council
Mr. Peter Huhtula, Pacific Marine Conservation Council
Mr. Bob Osborn, United Anglers of California
Mr. Tom Raftican, United Anglers of California
Mr. Brian Peterson, Shrimp Producers Marketing Association
Dr. Donald McIsaac, Executive Director, Pacific Fishery Management Council
Mr. Ed Waters, Pacific Fishery Management Council staff
Mr. Dan Waldeck, Pacific Fishery Management Council
Mr. Jim Seger, Pacific Fishery Management Council staff
Mr. John DeVore, Pacific Fishery Management Council staff

A. Call to Order

Dr. McIsaac was asked to chair the meeting. Allocation Committee members, agency personnel, and public participants at the five listening stations were introduced.

B. Review and Approve Agenda

The agenda was approved after the addition of a new item: D.4 Other Management Alternatives.

C. Stock Assessment Update and Recommended Optimum Yields for 2003

1. GMT-recommended harvest level alternatives

Dr. Hastie reviewed the GMT-recommended harvest level alternatives for 2003 west coast groundfish fisheries (Table 2-1). He explained that harvest levels for all overfished species were ranged (low, medium, and high) from 50%-80% probabilities of rebuilding within the maximum allowable time. A sablefish harvest range was also provided since the stock assessment addressed two different states of nature hypotheses. The low range was provided by Dr. Schirripa at the request of the GMT to indicate a harvest control that projected spawning biomass increases in the next ten years (all other specifications showed slight declines over time as the 1999 and 2000 year classes became less prominent in the population). The medium and high sablefish harvest levels assumed an $F_{45\%}$ harvest rate under a density-dependent and regime shift hypothesis, respectively. The low harvest alternative assumed density dependence with an $F_{60\%}$ harvest. The GMT recommended the same 2002 harvest levels for all other species that were not assessed this year. The cowcod projections were expected later this week from Mr. Tom Barnes, CDFG. Canary rockfish projections were also not detailed pending a rebuilding analysis. The GMT was told the 2003 harvest projections for canary would range from about 20-50 mt.

Dr. Hastie was asked about the new yelloweye rebuilding projections- why did the numbers change so dramatically? He answered that the assessment author could not get the rebuilding program developed by Dr. Punt to work correctly using data from the northern areas in the assessment. Therefore, he used the "40-10" adjustment as a proxy in the north last year. The model was modified by Dr. Punt over the winter and used to project yelloweye rebuilding. Hence, the significant changes in OYs. Different projections in the Monterey area were the result of correcting length data used in model inputs.

Dr. Punt's rebuilding program was discussed in more detail. The Committee learned that all rebuilding analyses, except the one developed for cowcod, used Dr. Punt's program. Dr. Hastie thought the new cowcod projections were going to be generated from the program. The Committee also learned the SSC reviewed and endorsed the rebuilding program, although it was not clear that new versions of the program were subsequently reviewed. Does the model estimate future recruitments using density-dependence? Dr. Hastie explained how the program randomly draws either recruits or recruits per spawners. Density-dependence can be interjected by the choice of the recruitment time series (recent recruits or R/S). The SSC developed a Terms of Reference for how to do rebuilding analyses and project future recruitment. Therefore, the model inputs are not entirely ad hoc. The Committee wanted the SSC to review and comment on the new version of Dr. Punt's program at the June Council meeting.

Dr. Hastie was asked whether the GMT-recommended OYs in Table 2-1 were fixed (staged) harvest levels or based on fixed harvest rates? The Committee also wanted to know whether a fixed or staged constant harvest strategy would work for the most constraining species. Dr. Hastie responded that yelloweye, bocaccio, and canary are so unproductive, there is little benefit in a fixed or staged constant harvest strategy. For canary and bocaccio, the difference in the outlook from the last assessment and that of the recent assessment was the assumed performance of recent year classes. Not only were those past assumptions overly optimistic, the recruitment profile was so much more pessimistic (in hindsight using the new assessments), that the conclusion is these stocks are less productive than originally thought. Given the low stock productivity, it might take a decade or more to see any appreciable increase in spawning stock biomass. Therefore, a constant harvest rebuilding strategy is riskier than a constant harvest rate strategy.

The darkblotched harvest range was deliberated. Was the Council interim rebuilding probability trajectory used? Dr. Hastie stated the medium harvest level was a 2003 projection of the 70% probability trajectory and consistent with the interim rebuilding specifications adopted by the Council last year. There was some discussion about probability of achieving B_{MSY} by T_{MAX} or T_{TARGET}. Rebuilding probabilities (the probability of achieving B_{MSY} within the legally allowable time) are always expressed relative to T_{MAX}, not T_{TARGET}. The median year when spawning biomass is projected to reach B_{MSY} under each rebuilding probability trajectory is often confused with T_{TARGET}. This is not to be construed as the target year for rebuilding the stock to B_{MSY} (T_{TARGET}). T_{TARGET} is a legal construct/policy choice falling within the Council/NMFS decision-making nexus. The choice of T_{TARGET} is constrained to fall between T_{MIN} and T_{MAX}. If it were assumed the median year of achieving B_{MSY} under any rebuilding probability trajectory was the Council's choice for T_{TARGET}, the probability of achieving B_{MSY} by the T_{TARGET} year is 50% (= median) and less than the probability of achieving B_{MSY} by T_{MAX} (unless $T_{TARGET} = T_{MAX}$). The probability of achieving B_{MSY} within T_{TARGET} (P_{TARGET}) can be increased from 50% by lowering the harvest rate (F) and constraining fisheries further.

Dr. McIsaac asked how the bocaccio ABC could increase from 122 mt this year to 198 mt next year while there is an 85% decrease in the total catch OY? The ABC increased because the ratio of current estimated biomass ($B_{CURRENT}$) to estimated unfished biomass (B_0) increased. However, recruitment was shown to be much poorer than that assumed from the last assessment and would therefore require less catch to stay on the same rebuilding trajectory. The new analysis draws upon lower recruitments to predict future recruitment resulting in more pessimistic projections and a lower OY. In essence, the assumed stock productivity is much less than assumed in the last assessment. The Committee wanted to know whether the model inputs changed? Dr. Hastie replied there were more abundance indices used in the new assessment. The stock synthesis model had to be adapted to accommodate the increased inputs. In questioning whether a thorough review of the assessment occurred, the Committee was apprized of the STAR Panel process that occurred in April and was referred to the bocaccio STAR Panel report for details. Mr. Boydstun asked if the Council were bound by these OY constraints? Mr. Robinson said the Council was bound by the best available science. The addition of the Monterey area to the assessment was also considered as an influencing factor. The Committee was assured that the SSC would review the assessment and rebuilding analysis at the June Council meeting.

Mr. Anderson mentioned the Council was facing the same situation in the north with yelloweye and canary as was being faced in the south with bocaccio. Yelloweye and canary rebuilding could constrain salmon, halibut, and other non-groundfish fisheries on the north shelf. Using canary rebuilding as an example, Dr. McIsaac asked if abundance decreases, wouldn't the bycatch also decrease? Dr. Hastie mentioned this has occurred in past cases. However, in this case, the new assessment did not indicate a dramatic change in abundance. Recruitment and potential stock productivity assumptions are now more pessimistic. Mr. Robinson said the new assessment suggests less surplus production, not necessarily a less abundant stock. Therefore, the bycatch rate (coincident catch rate) might not change. Dr. Hastie observed that the abundance decreased dramatically since the late 80s/early 90s. Bycatch rates should now be lower than those years. Canary biomass trajectories are flat.

2. Accounting for all sources of fishing-related mortality

Sources of uncertainty in accounting for all sources of mortality include research catches and bycatch in non-groundfish fisheries. The GMT reviewed the issue of catch accountability in research fisheries and is close to finalizing a statement. The Northwest Region summarized 2001 research fishery catches. There is a concern that all catches are not fully accounted at the species level. Anecdotal evidence from the IPHC Halibut Longline Survey suggest a yelloweye bycatch of about 1 mt last year. Research catches alone, particularly in a year when there are halibut and shelf trawl surveys, could take the entire yelloweye OY. We need to account for this before setting harvest levels.

Bycatch in non-groundfish fisheries could also threaten to take all the most constraining species' OYs. For bocaccio, these fisheries include squid, prawn, and California halibut fisheries. California gillnet, California halibut and other fisheries may have a bycatch of bocaccio and yelloweye. The GMT recommends, for species that are not overfished, to continue to subtract expected research catches from the ABC. However, for overfished species, expected research harvest should be subtracted from the OY.

Mr. Anderson asked when the halibut survey is done and whether one is scheduled for this year? The answer was July and August every year including this year. Mr. Strickland expressed concern with bocaccio bycatch. Why would the fishery persist if there is a bycatch problem? Many of these fisheries are outside of Council control. Some, like the shrimp fishery, are state managed. The Council and states tend to coordinate and cooperate; however, the regulatory framework occurs at the state level. Other fisheries outside of Council control with a bocaccio bycatch include the prawn, shrimp, and California Halibut fisheries. Ms. Garrison asked if the GMT will recommend what to do about bycatch in non-groundfish fisheries? The Council can allocate groundfish to these fisheries. Dr. Hastie explained that, while the Council can allocate groundfish, they cannot dictate management measures to the states. The GMT will attempt to identify which fisheries are a problem, but lack of observer data in these fisheries makes that difficult. In many cases, groundfish may not be a desirable bycatch. If those catches become market discards, then an analysis of fish tickets will not provide accountability. There is also the problem with species identification. Yelloweye sorting requirements were mandated for the first time last year. Therefore, fish tickets will not be informative for that species. Ms. Garrison mentioned the first year and a half of California observer data from the California prawn fishery will be available in June. Dr. Hastie thanked her for the heads up and said he would look at the data.

Ms. Garrison asked why there are minor shelf rockfish OYs given rebuilding species' constraints? Dr. Hastie explained these are potential harvest levels that are not attained due to bycatch constraints. The GMT will explain how we can manage these species within the constraints imposed by rebuilding. The question was raised whether adopting this range of OYs would prompt a change in 2002 specifications? Mr. Robinson said they were only contemplating changes for 2003.

D. *Specifications and Management Options for 2003*

1. Is the Mixed Stock Exception a viable alternative for 2003?

Mr. Robinson addressed this question. He said it is an option available in the Magnuson-Stevens Act. He needs to contact headquarters and have the agency explore this option. Critical questions include which species the mixed stock exception (MSE) would be applied?; would that include bocaccio, bocaccio and yelloweye, or bocaccio, yelloweye, and canary?; what would be the specified OYs? There would have to be a comprehensive biological and economic analysis. Economic benefits need to be analyzed relative to the risk to the stock. Is the stock in strong decline? How low would stock biomass be predicted to go? The Council would need a specific MSE proposal analyzed along with an alternative analyzed without the MSE.

Mr. Anderson questioned the relief we'd get with MSE. He stated the stock biomass can't be driven below the minimum stock size threshold (MSST). Average landings of yelloweye in Washington in the last ten years has been 175 mt. The rebuilding analysis predicts an equilibrium yield at $B_{40\%}$ of only about 12 mt. Therefore, rebuilding yelloweye doesn't help recover the overall fishery level.

Dr, McIsaac asked if the MSE is a viable option for NMFS approval in 2003 if all requisite analyses are done and the Council pulls the trigger? Mr. Robinson said it is viable if the analysis is satisfactory. Ms. Cooney said this would trigger an automatic law suit. NMFS would need to discuss the ramifications of the MSE for 2003 management. Mr. Boydstun stated he would like to see an MSE alternative analyzed. Ms. Cooney said there would have to be non-MSE alternatives analyzed as well.

Mr. Anderson asked if a harvest level below MSST can be selected? Mr. Boydstun asked what standards are applied for crafting an MSE alternative? Dr. McIsaac asked for clarification of MSST- an ESA threshold? - $B_{25\%}$? Mr. Robinson explained all the candidate stocks are below the MSST. The MSE infers rebuilding would be extended beyond T_{MAX}. Dr. Hastie thought the MSE analysis could move forward by delineating other thresholds such as different F rates, etc. These choices require added analyses both in the annual specifications EA and rebuilding plans. However, everyone is working at or above capacity and therefore represents a time/workload issue as well. The GMT would need specification from the Council and/or SSC on a MSE alternative to do the analysis. Mr. Bohn mentioned these are the kinds of issues that might get you through one year, but, to be effective, the MSE would have to be in place for much longer and is therefore a problematic route. Mr. Robinson did not advise using the MSE to limp along from one year to the next. He advised making the hard choices to modify fisheries instead.

Dr. Hastie elected to address D.2-D.4 together.

2. Effort shifts from the shelf in response to rebuilding needs
    a. Expected consequences for slope rockfish and fisheries
    b. Expected consequences for nearshore species and fisheries

3. Exploring increased depth stratification in groundfish management
    a. Incentives (i.e., higher landing limits for longspine?) to fish out of the depth range of overfished species

b. Verification of fishing location
   i. Can a VMS system be implemented for 2003?
   ii. Mandatory observer coverage for certain types of trips
c. Enforcement concerns

4. Other Management Alternatives

Dr. Hastie referred to the coastal map graphic he provided (attached). Using trip limit management on the shelf for bottom trawl fisheries is probably not feasible. There could be some consideration for limited midwater trawl opportunity targeting widow and yellowtail, as well as a whiting fishery. At-sea whiting observer results indicate no yelloweye bycatch. However, the shoreside whiting fishery took 0.33 mt of yelloweye last year. This bycatch occurred in about 10 landings out of 6,000 total. This bycatch might be mitigated for avoidance.

There are slope constraints with some shelf rockfish species. Opportunities could be shaped with depth restrictions although some enforcement concerns have been raised in the past. DTS/petrale opportunities could be shaped without depth restrictions, but with depth restrictions, there could be increased opportunities. Fixed gear sablefish fishing could be done with depth restrictions for line gear. Pot gear would not need depth restrictions since shelf rockfish are not caught in pot gear. There cannot be line gear fisheries on the shelf or anywhere within the depth range of yelloweye. The DTS/petrale trawl fishery would need to move away from the shelf and the depth range of darkblotched.

The GMT addressed the southern catches of darkblotched in 2001 by analyzing logbook data and determined that most of those catches (40 mt total) occurred just south of the 40°10' management line. Therefore, the GMT will review and recommend a new management line further south for slope fisheries to protect darkblotched. The Council could consider larger landing limits for slope rockfish south of a new line, although limits as large as originally adopted for 2002 are not recommended. The new line might be Pt. Arena or a point somewhere south of San Francisco.

Nearshore flatfish and rockfish opportunities cannot be had within the shallow depth range of yelloweye or bocaccio. Juvenile bocaccio and yelloweye show up in shallow waters. Need to consider a depth restriction for nearshore fisheries or a species restriction (focus fisheries on species with shallow ranges). The alternative is no fishing for nearshore rockfish. Can look at depth restrictions for nearshore flatfish as well.

Experimental gears hold promise for fishing opportunities. ODFW is experimenting with trawl nets designed to target flatfish. Initial results using trawls with the headrope cut back and smaller openings indicate increased flatfish catch efficiency with less rockfish bycatch. Could structure EFPs to test these types of gears to target flatfish on the shelf.

What about nearshore sport gear restrictions? There is a noted bocaccio bycatch of juveniles in southern nearshore sport fisheries. There is the potential of changing hook size to avoid juvenile bocaccio. For example, hook size in the slope fixed gear sablefish line fishery is believed responsible for the lack of darkblotched bycatch. Detailed bathymetric charts depicting where bycatch problems occur and fishing opportunities might exist would be useful for the next Council meeting.

Addressing a potential vessel monitoring system (VMS) solution, Mr. Robinson mentioned NMFS has VMS experts that could come to the next (June 3) Allocation Committee meeting. Requiring VMS may run into some procedural problems for 2003 implementation including conflicts with the Paperwork Reduction Act. Mr. Moore mentioned that industry has talked with the Northwest Fisheries Science Center about using research funding to pay for VMS. He thought it could be deployed for 2003 since the system is set up for the albacore fishery.

Mandating observers in order to prosecute fisheries is problematic. There are cost issues, observer availability issues, equity issues, etc. Ms. Cooney asked if the GMT had a specific proposal? Dr. Hastie stated no, but without depth restrictions, we cannot prosecute fisheries and stay within rebuilding OYs. Current resources won't cover mandatory observer coverage.

Anticipated effort shifts from the shelf to slope and nearshore areas is a big problem. Fisheries in these areas are already over capacity and effort shifts would exacerbate the problem. Shifts to nearshore fisheries would be greatest. The Council would need to reduce OYs for minor nearshore rockfish. For some species, such as black rockfish in the north, OYs would have to be dramatically reduced since their range overlaps with yelloweye. Mr. Robinson asked if there were many unassessed nearshore species that we are concerned about? Dr. Hastie said none of the nearshore species have been assessed except black rockfish where problems in the assessment forced it being pulled back. Nearshore rockfish ABCs are based on average catches. Many species in the nearshore catch data cannot be specified. Therefore, need to reduce the OYs of the entire complex. Mr. Boydstun agreed with the recommendation of further depth partitioning of minor nearshore rockfish into a shallow water group and those within the range of constraining species. This process should start in June and management measures crafted accordingly. Other nearshore species may need additional protection. The Allocation Committee should take this up on June 3. Mr. Saelens thought it important to also consider the canary OY and depth range.

Washington has addressed some of the non-groundfish bycatch issues in their shrimp and prawn fisheries. For instance, starting in 2003, prawn fisheries can only use pot gear to avoid shelf rockfish bycatch. Other states should consider this option. The WA halibut fishery has been managed for a 3 mt yelloweye bycatch. Given the low OY, this will need attention. Closed areas to protect yelloweye won't be enough to preserve the sport halibut fishery. Fixed gear halibut fisheries north of Pt. Chehalis are also a problem. Any bottom trawling on the shelf can't be considered. There may be some shelf opportunities with EFPs. There should be federal observers available with many fisheries closing. Could consider some arrowtooth and midwater trawl opportunities. Mr. Anderson wanted to look at VMS and other strategies for increased depth stratification. These are huge challenges with major economic impacts. Mr. Anderson suggested adding another day to the June 3 meeting. Mr. Robinson agreed and urged that management measures need to be defensible. Need to look at permanent gear modifications and use EFPs in 2003.

Public comment was solicited.

Mr. Moore stated all sectors of the groundfish fishery would be affected. Everyone will have to work cooperatively. As GAP chair, he will not tolerate people playing the blame game. Mr. Robinson said the Allocation Committee will need to discuss the recreational fishery. The state representatives need to bring recreational management options to the next Allocation Committee meeting.

Ms. Garrison said Congress needs to consider a "Farm Bill" for fishermen.

Mr. Peterson asked if the alternative harvest levels were developed using Dr. Punt's rebuilding program? Dr. Hastie replied they were. Mr. Peterson asked if new rebuilding analyses were done consistently? Dr. Hastie said yes. Were new survey indices added? Dr. Hastie said no- that would require a new assessment.

Mr. Glock asked if the shelf is closed, what is done with sablefish? Would the entire OY move to the slope? Dr. Hastie replied the GMT would need to work with Dr. Schirripa, the assessment author. He thought sablefish movements were extensive enough that the OY could be shifted to the slope. Shifting OYs would only be a problem with sedentary species.

Mr. Fry stated central California sport fishers are feeling pain from the 2002 management specifications with only 4 months of opportunity while trawlers fish for 12 months. The Council needs to stop the bleeding in the sport sector.

Mr. Raftican stated the pain stretches south of Pt. Conception in state-managed fisheries as well. A handful of trawlers can shut down the entire sport fishery.

E. *Provide Direction to Council Staff, Groundfish Management Team, Groundfish Advisory Subpanel, and Other Council Entities*

Mr. Boydstun requested an accountability of commercial and recreational catches by time and area for overfished species. We have RecFIN Wave 1 estimates in hand for 2002. He will direct his staff to estimate Wave 2 using sport sampling data. He would like catch accountability for the last 4-5 years. The Allocation

Committee also needs to understand tradeoffs in different fisheries. Some coastal areas are more dependent on rockfish than others. What non-rockfish opportunities exist where? This is not an assignment, but a proposed agenda item. The Allocation Committee also needs an economic analysis of options. Can we use PFMC staff economists for the June 3 meeting? Dr. McIsaac said it is not possible to do anything of significance by June 3. Mr. Robinson said no economic analysis is needed for the June 3 meeting; this is needed after June 3. Dr. Radtke agreed. We need to know what alternatives are on the table. Mr. Boydstun said California will consider specifying pot gear in their prawn fisheries. He recommended the state and Council consider partitioning nearshore rockfish south of Cape Mendocino.

Mr. Saelens said some of the assignments on his list were already covered. ODFW staff is looking at yelloweye bycatch in the shoreside whiting fishery. All Oregon sport sampling data has been transferred to RecFIN. ODFW will also consider pot gear for their prawn fishery.

Mr. Anderson said his list of assignments was covered. WDFW will look at WA catches, recreational halibut observer data, and yelloweye catches from the WA sampling program data. Outreach to WA stakeholders will be a high priority. WDFW will continue to shape management alternatives between June 3 and the June Council meeting.

Dr. McIsaac noted the earlier requests to provide bathymetric charts and catch tables for bocaccio, canary, and yelloweye stratified by time, area, and fishery sectors (including non-groundfish, Council fisheries, state-managed fisheries, and research fisheries). He tasked Mr. DeVore with coordinating this.

Dr. Hastie asked if the catch tables should focus on overfished species? Mr. Boydstun said yes but should include other species such as sablefish. Dr. Hastie asked if the analysis could be limited to overfished and targeted species? Mr. Boydstun agreed. Dr. Hastie stated these tables can be expanded later. He is concerned with deliverables by June 3. Dr. McIsaac asked if the analysis could be limited to 2000 and more recent years? Mr. Boydstun wants the last three years of estimates. He recommended using the canary catch accounting format from the June 2000 Council meeting. Mr. DeVore will email that attachment to Dr. Hastie. Dr. Hastie stated that, although state data has been transferred to RecFIN, it has not been incorporated yet.

Ms. Garrison asked about alternatives such as depth restrictions and no trawling on the shelf. Does it make sense to consider MPAs? Do we have data? Dr. Hastie said the GMT is considering recommending a complete shelf closure. Specifying MPAs would therefore be moot.

G. Topics for the June 3 Allocation Committee meeting

1. Draft agenda?
2. Assignments?

Adding another day to the June 3 meeting was considered. Ms. Cooney said that could be done with a new (revised) meeting notice posted on the web and sent to the groundfish mailing list. Consensus was to add June 4. The Committee members also wanted to start at 10 a.m. on June 3 rather than 8 a.m. These changes were made.

The draft agenda for the next Allocation Committee meeting:

Review catch tables
Management tradeoffs (expand "D" agenda items)
State-managed fishery effects
Economic analysis: a report of what should be analyzed
State-sponsored outreach
Other management alternatives?

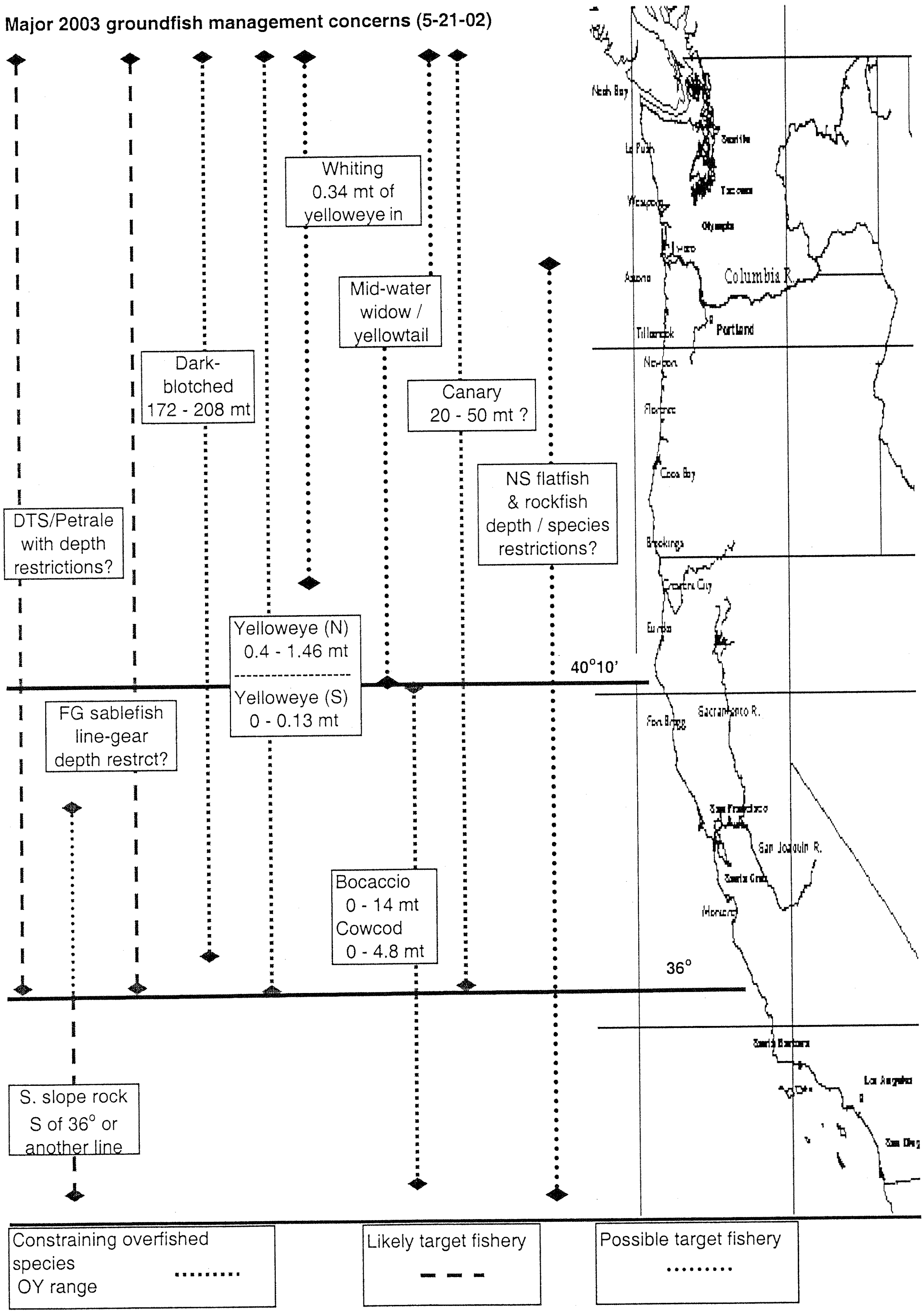
ADJOURN 11:35

PFMC
05/21/02

TABLE 2-1. Acceptable biological catch (ABC) and total catch optimum yield (OY) alternatives for 2003 for the Washington, Oregon, and California region (metric tons) under the GMT-proposed alternatives. (Overfished stocks in CAPS).

	Status Quo Alternative 2002 ABCs/OYs		**Alternative 1** 2003 Low ABCs/OYs		**Alternative 2** 2003 Medium ABCs/OYs		**Alternative 3** 2003 High ABCs/OYs	
	ABC	OY	ABC	OY	ABC	OY	ABC	OY
LINGCOD	745	577		555		651		725
Pacific Cod	3,200	3,200			3,200	3,200		
PACIFIC WHITING	166,000	129,600						
Sablefish	4,644	4,367		4,381		7,359		8,091
Conception INPFC area	333	229		233		323		346
PACIFIC OCEAN PERCH	640	350	640	311	640	377	640	496
Shortbelly Rockfish	13,900	13,900			13,900	13,900		
WIDOW ROCKFISH	3,727	856	3,871	656	3,871	832	3,871	916
CANARY ROCKFISH	228	93		>20 ?				<50 ?
Chilipepper Rockfish	2,700	2,000			2,700	2,000		
BOCACCIO	122	100	198	0	198		198	14
Splitnose Rockfish	615	461			615	461		
Yellowtail Rockfish	3,146	3,146			3,146	3,146		
Shortspine Thornyhead	1,004	955			1,004	955		
Longspine Thornyhead	2,461	2,461			2,461	2,461		
S. of Pt. Conception	390	195			390	195		
COWCOD (S. Concep)	5	2.4			5	2.4		
N. Concep & Monterey	19	2.4			19	2.4		
DARKBLOTCHED	187	168		172		184		208
YELLOWEYE - Coastwide	27	13.5						
N of 40°10' latitude	22	11	22	0.400	22	1.033	22	1.460
Monterey	5	2.5	5	0.000	5	0.067	5	0.133
Minor Rockfish North	4,795	3,115			4,795	3,115		
Minor Rockfish South	3,506	2,015			3,506	2,015		
Remaining Rockfish North	2,755				2,755			
Black	1,115				1,115			
Bocaccio	318				318			
Chilipepper - Eureka	32				32			
Redstripe	576				576			
Sharpchin	307				307			
Silvergrey	38				38			
Splitnose	242				242			
Yellowmouth	99				99			
Remaining Rockfish South	854				854			
Bank	350				350			
Blackgill	343				343			
Sharpchin	45				45			
Yellowtail	116				116			
Other Rockfish North	2,068				2,068			
South	2,652				2,652			
Dover Sole	8,510	7,440			8,510	7,440		
English Sole	3,100				3,100			
Petrale Sole	2,762				2,762			
Arrowtooth Flounder	5,800				5,800			
Other Flatfish	7,700				7,700			
Other Fish	14,700				14,700			

Major 2003 groundfish management concerns (5-21-02)



DRAFT MINUTES
Ad Hoc Allocation Committee Meeting

Holiday Inn Portland Airport
8439 NE Columbia Boulevard
Portland, OR 97220
(503) 256-5000
June 3-4, 2002

Note: In these draft minutes the Ad Hoc Allocation Committee will be referred to as the Committee.

MONDAY, JUNE 3, 2002 10 A.M.

Members Present:
Mr. Jim Lone, Washington Recreational Fishing Industry Association
Dr. Hans Radtke, Chairman, Pacific Fishery Management Council
Mr. LB Boydstun, California Department of Fish and Game
Mr. Burnie Bohn, Oregon Department of Fish and Wildlife
Mr. Phil Anderson, Washington Department of Fish and Wildlife
Mr. Bill Robinson, Northwest Region National Marine Fisheries Service

Others Present:
Ms. Eileen Cooney, General Counsel, National Oceanic and Atmospheric Administration
Dr. Jim Hastie, Northwest Fisheries Science Center National Marine Fisheries Service, GMT
Mr. Steve Springer, National Marine Fisheries Service Enforcement
Mr. Mike Gonzales, National Marine Fisheries Service Enforcement
Ms. Vicki Nomura, National Marine Fisheries Service
Mr. Otha Easley, National Marine Fisheries Service
Mr. Rod Moore, West Coast Seafood Processors Association, GAP
Mr. Steve Copps, National Marine Fisheries Service
Ms. Yvonne de Reynier, Northwest Region National Marine Fisheries Service
Mr. Jim Glock, National Marine Fisheries Service
Ms. Marija Vojkovich, California Department of Fish and Game
Mr. Dave Cleary, Oregon State Police, EC
Mr. Dave Thomas, California Department of Fish and Game, GMT
Dr. Patty Burke, Oregon Department of Fish and Wildlife
Mr. Guy Norman, Oregon Department of Fish and Wildlife
Mr. Mark Saelens, Oregon Department of Fish and Wildlife, GMT
Mr. Don Bodenmiller, Oregon Department of Fish and Wildlife
Mr. Rod Kaiser, Oregon Department of Fish and Wildlife
Mr. Brian Culver, Washington Department of Fish and Wildlife, GMT
Ms. Michele Robinson, Washington Department of Fish and Wildlife, GMT
Mr. Tom Ghio, LE fixed gear fisherman, F/V Miss Allison, GAP
Mr. Kelly Smotherman, LE trawl fisherman, GAP
Mr. Dale Myer, Arctic Storm, Inc., GAP
Mr. Steve Bodnar, Coos Bay Trawlers Association
Mr. Joe Easley, Oregon Trawlers Association
Ms. Laura Deach, LE fixed gear fisherman
Mr. Joe Bersch, Supreme Alaska Seafoods
Mr. Terry Thompson, LE trawl fisherman, F/V Olympic
Mr. Michael Pettis, LE fixed gear fisherman, F/V Challenger
Mr. Brian Peterson, shrimp fisherman, Shrimp Producers Marketing Association
Mr. Chris Olson, Newport Marina Charters
Mr. Mark Cedergreen, Westport Charterboat Association, SAS
Mr. Don Stevens, Oregon Salmon Commission, SAS
Mr. Steve Joner, Makah Indian Tribe

Mr. Rob Jones, Northwest Indian Fisheries Commission
Dr. Vidar Wespestad, Pacific Whiting Conservation Cooperative
Dr. Peter Leipzig, Fishermen's Marketing Association
Mr. Robert Alverson, Fishing Vessels Owner's Association
Mr. Jeff Barnard, The Associated Press
Dr. Donald McIsaac, Executive Director, Pacific Fishery Management Council
Mr. Ed Waters, Pacific Fishery Management Council staff
Mr. Dan Waldeck, Pacific Fishery Management Council staff
Mr. Jim Seger, Pacific Fishery Management Council staff
Mr. John DeVore, Pacific Fishery Management Council staff

A. Call to Order

Mr. Jim Lone called the meeting to order and a round of introductions was made.

B. Review and Approve Agenda

The agenda was modified to discuss "Management Tradeoffs" and "Management Options and Recommendations" in sequence. The agenda was approved with that modification.

C. Stock Assessment/Rebuilding Analysis Update and Recommended Optimum Yields for 2003

Updated rebuilding yields recommended for 2003 management from the draft bocaccio and yelloweye rebuilding analyses were presented to the Committee. The bocaccio yields were still being developed, but a preliminary range of 0 to 0.6 mt of bocaccio in 2003 was verbalized to the committee. The yelloweye rebuilding yields were presented in a draft rebuilding analysis with two different rebuilding scenarios. The first scenario assumes a density-dependent recruitment mechanism for yelloweye and estimates a 2003 rebuilding OY range of 0-1.4 mt. Scenario 2 for yelloweye assumes recruitment is dependent on environmental conditions, as opposed to stock size or density, and is much more optimistic. The 2003 rebuilding yields under scenario 2 range from 0 to 38.2 mt.

The Committee wondered how the bocaccio outlook could change so dramatically since the last assessment in 1999? Dr. Hastie explained the assessment indicated there was very little harvestable surplus in the stock. The flat selectivity curve and recruitment profile (low, sporadic recruitment history) indicates the stock has a very low potential productivity. In fact, there is a significant chance, given the new assessment and pessimistic outlook, that the stock cannot rebuild at all, even under a zero fishing scenario.

When asked whether the bocaccio rebuilding analysis took into account potential regime shifts and other environmental drivers for future recruitment, Dr. Hastie replied it depended on the past recruitment series used to predict future recruitment. If the past recruitment profile represents future conditions, then predictions should be reasonable. It was acknowledged that, unlike yelloweye, the bocaccio analysis did not advance separate density-dependence and regime shift scenarios. The Committee wanted to know where the bocaccio science was in the scientific review process? The STAR Panel reviewed the stock assessment in April. However, the rebuilding analysis is still in development and has not been formally reviewed. The SSC is expected to review the rebuilding analysis at the June Council meeting.

It was recognized there would be difficulty convincing folks there are not much bocaccio out there. Doesn't the new assessment indicate bocaccio biomass increased since the last assessment? Dr. Hastie explained that estimates of current biomass <u>and</u> unfished, virgin biomass went up since the last assessment. During the last assessment the Council and its advisors assumed a medium level of recruitment for the 1999 year-class. The current assessment indicates the 1999 year-class recruited at levels less than the low recruitment scenario presented in the 1999 assessment. Not only does this reduce the estimated current biomass, it adds to a series of low recruitments used to predict future recruitment. This indicates the stock is less productive than originally thought. The point was raised that current levels of recruitment may not exceed natural mortality. If this is truly the case, fishing would drive the stock down farther.

The draft yelloweye rebuilding analysis was briefly discussed. Two scenarios are presented in the analysis. Scenario 1 has the same result as for bocaccio rebuilding- no fishing. Scenario 2 presents an environmental regime shift hypothesis as a driver for yelloweye recruitment. Scenario 2 implies high recruitment at low stock sizes and is therefore much more optimistic than Scenario 1.

Dr. Hastie translated the yelloweye Scenario 2 2003 rebuilding OYs from the areas assessed to the current management areas. This was needed since the assessment was stratified in two areas (northern California and Oregon) while management is stratified north and south of Cape Mendocino at 40°10' N. lat. Relative to the currently used management areas, the Scenario 2 2003 OYs would be 28 mt north and 6.3 mt in the Monterey INPFC under a low OY option. The high OY option for yelloweye under Scenario 2 would allow 31.23 mt of harvest in the north and 6.97 mt in Monterey.

The Committee questioned whether modeling density-dependence is an ad hoc decision by assessment authors. There are varied analyses that assume regime shift and density-dependence influences on stock recruitment. Dr. Hastie ventured that the SSC should weigh in on this for specific assessments. The rebuilding model developed by Dr. Punt does allow the choice of recruits or recruits/spawner, but not a blend of both data inputs. However, the choice of the past recruitment time series (when predicting future recruitment) can influence the degree of density-dependence assumed for future recruitment.

Mr. Lone then invited public comments.

Mr. Moore: Estimated unfished, virgin biomass (B_0) varies with each new assessment. The Council needs to convene an SSC workshop on calculating B_0 and MSY. He suggested the Council needs guidance from NMFS headquarters before the June Council meeting on this issue.

Mr. Ghio: The 1999 bocaccio year class that fishermen are encountering hasn't shown up in assessments yet. The outlook should change after these fish start showing up.

Mr. Thompson: He volunteered that he has done a lot of research fishing and therefore has much first-hand experience. How can juvenile recruitment be assessed? While there is some work in the south (i.e., CalCOFI), no indices of juvenile recruitment exist in the north.

Dr. Leipzig: The new bocaccio assessment presented a new index of recruitment (Power Plant Index) that was not reviewed by the STAR Panel. The Power Plant Index used in the previous assessment counted the number of positive days when impingement occurred; the new index counts the number of fish by volume of entrained water. He also pointed out that the estimated unfished biomass (B_0) for bocaccio is higher than biomasses estimated in the 1950s when there was little fishing.

Mr. Pettis: He started to address sablefish permit stacking issues. Mr. Lone stated a preference to stay on topic and Mr. Pettis acceded.

Ms. Deach: She asked the question to what degree has management contributed to the current decline in groundfish? If managers can't admit to being part of the problem, then they can't begin to address how to fix these problems.

Mr. Alverson: Mr. Alverson suggested that the Council could consider VMS as an experimental option next year. He addressed recent fluctuations in the allowed annual harvest of sablefish. He recommended a gradual increase in annual harvests. Sablefish recruit to the spawning biomass as 6 year olds. Don't set the harvest too high; allow recent recruits to survive and contribute to spawning and future production. A high harvest rate on young fish also compromises gross revenues since smaller fish would be sold.

D. VMS and Enforcement Issues

Mr. Springer gave a PowerPoint presentation on Vessel Monitoring Systems (VMS). The main use of VMS is to enforce time/area fishery restrictions. It allows satellite tracking of vessels equipped with VMS from remote base stations. VMS works well to document violations and compliance. It adds surveillance patrol flexibility and increases search and rescue capabilities. Vessel locations can be tracked with GPS accuracy. Typically, these locations are verified at regular intervals (i.e., hourly) with these intervals determined by the needs of the fishery manager and/or enforcement personnel.

Each VMS is carefully tailored to the fishery in which it is used. Given the variety of features that can be added to a VMS, it is critical to carefully define the requirements of the fishery. VMS can be set up with one or two-way transmission. For instance, VMS can transmit catch data or physical data (water temperatures, depth, etc.) along with the time and area information. A VMS can meet the needs of multiple fisheries simultaneously, but these needs must be clearly specified before the system is designed and set up.

There is National VMS Program support (financial, logistic, and technical). Policies and standards of the National VMS Program include 1) confidentiality of fishing positions, 2) secure data, 3) controlled access to data, 4) type approvals, and 5) periodic performance standards. The National NOAA Fisheries Law Enforcement Program currently has jurisdiction of over 3.4 million square miles of area with global enforcement authority, monitors about 1,400 miles of coastline, staffs 162 personnel, and has some responsibility for 35 statutes.

Mr. Otha Easley discussed the different VMS systems and components. The primary VMS components include 1) mobile transceiver units, 2) mobile communications service providers, 3) vessel monitoring database and base stations, and 4) NMFS systems architecture. Different VMS systems include Inmarsat C with global coverage and 2-way transmission capabilities, Boatracs with limited regional coverage and 2-way transmission, and Argos with global coverage and 1-way transmission. Inmarsat C uses four geostationary satellites allowing global coverage except at the north and south poles. There is a 5-10 minute delay on reporting with GPS accuracy (20 m). There is 2-way transmission capability with distress button features available. The on-board components cost about $2,500 with a $1/day communications cost. Inmarsat C has been approved for HMS longline fisheries on the east coast. Boatrac also uses geostationary satellites with near real-time reporting. There is 2-way transmission capability and location accuracy of about 300 m using triangulation. The on-board Boatrac components cost about $5,800 with communications costing about $2/day. Boatracs systems are in use in the New England groundfish, herring, and scallop fisheries. They track location and days-at-sea for vessels in these fisheries. The Argos systems use polar orbiting satellites and can therefore provide the polar coverage lacking with the other systems. Argos systems are lightweight and can be outfitted for smaller boats using battery packs and other simpler configurations. There is only 1-way transmission; however, a distress button feature is available to alert the Coast Guard when trouble arises. Costs are about $1,800 for the on-board components and $5/day communications costs. Argos has been approved for HMS longline and is in use in the Alaska cod/pollock and Alaska Atka mackerel fisheries. The Argos Mar-YX system can be equipped with a 100 day internal battery and has been tested in a small-vessel fishery in American Samoa.

The choice of VMS systems and the specific design features need to take into account various aspects of the fishery and the management needs. Considerations include the importance of real-time vs. delayed reporting. Circumstances of the fishery including vessel size (power supply?), geographical area of operation, reporting interval in relation to nature of fishery, duration of the fishing event, and closed area size. The value of other features include: 1) accuracy of the device, 2) 1-way vs. 2-way communications, 3) at-sea catch reporting capabilities, 4) internal data log, 5) ease of installation, 6) internal programmable parameters, and 7) distress signal capability.

The issue of who pays for VMS systems was discussed. Each fishery has a different payment structure ranging from the industry bearing all the costs (i.e., New England scallop fishery) to NMFS Enforcement bearing all the costs (i.e., the Western Pacific pelagic longline fishery). It was noted that NMFS was requesting a large appropriation for VMS. Could that be used to subsidize VMS in the West Coast groundfish fishery? Mr. Springer answered the West Coast groundfish fishery may be a high priority. The appropriation request is for $5.4 million, of which $3.2 million is needed for building the national VMS infrastructure (e.g., training, maintenance, operations, etc.).

The NMFS Enforcement personnel present were asked whether any fisheries in the U.S. use depth-based restrictions? Mr. Mike Gonzales, from the Southwest Region, replied that fisheries operating near the Northwest Hawaiian Islands Coral Reef Ecosystems Reserve (NWHICRER) are prohibited from fishing in waters 20-50 fm in depth. He stated that enforcement folks prefer enforcing area closures with straight lines defined by lat./long. coordinates. In fact, the depth-based restrictions noted for the NWHICRER are expected to be defined by straight lat./long. line boundaries. Mr. Gonzales was asked how VMS can distinguish vessels fishing in closed areas from vessels transiting closed areas? He replied the transiting vs. fishing track signatures are different.

The Committee and public in attendance discussed the VMS needs of the West Coast groundfish fishery. Considerations include the need for real-time vs. delayed reporting, vessel size (hard-wired units for large vessels vs. battery operated units for small vessels), size of the footprint (large area closures require the Argos or Inmarsat system), the need for 1-way vs. 2-way transmission, and safety concerns (set up with a distress signal feature?). Transiting or fishing near closed areas can be accommodated by increasing the reporting frequency when near closed areas. The Committee considered the capacity of the West Coast fleets and whether the NMFS VMS program could accommodate the large number of vessels on the West Coast. Including the limited entry groundfish fleet of about 500 vessels, there are 2,500 vessels currently using or considering use of VMS nationwide. The National VMS Program can accommodate 10,000 VMS units per Enforcement Division. With 5 divisions nationwide, this allows a capacity of 50,000 vessels in the National VMS Program.

The Committee asked how quickly a West Coast groundfish VMS program could be set up and was told it would take about 6 months after a system is designed. A longer delay may occur if funding issues are unresolved and an appropriation/federal subsidy is requested. The question was asked how we could adopt and regulate VMS. The same federal rulemaking process used to adopt management measures and other regulations would be followed.

E. Catch Accountability of Overfished and Targeted Groundfish Species

Dr. Hastie reviewed a draft GMT statement on groundfish catch accountability in research fisheries which will appear in the June briefing book (therefore not included in these draft minutes). The need for full accountability of research catches by species is critical given the low OYs recommended for some of the overfished rockfish stocks. Last year, there were 17 mt of unspecified rockfish caught in research fisheries which is unacceptable. The GMT is recommending a process of mandating species catch accountability in research fisheries with the Northwest Region of NMFS in charge of approving research fisheries and receiving/disseminating research fishery catch data. The GMT is also recommending a review and prioritization of all research fisheries contemplated in the future.

Dr. Hastie also explained that none of the bycatch rates used in his model are depth-based. He expects to restructure the model with a depth stratification this summer to better account for bycatch in 2003 fisheries which are likely to have depth-based restrictions.

F. Management Tradeoffs

The Mixed Stock Exception (MSE) was discussed by the Committee. Mr. Robinson said the Northwest Region is in consultation with NMFS Headquarters on the MSE. If the Council was interested in triggering the MSE, they would need to propose specific measures. The MSE analysis needs to address costs and benefits to the fishery, the overfished stock, other co-occurring stocks, etc. There is a significant difference in using the MSE to avoid full fishery closure and getting more yield. If rebuilding is suspended (i.e., if target rebuilding times are estimated to exceed the maximum allowable rebuilding time (T_{MAX})) to avoid a dire situation, then the MSE might be considered.

The Committee asked Mr. Robinson whether the bocaccio situation might qualify for the MSE since it potentially affects all California fisheries? Mr. Robinson replied he would need to consult with NMFS Headquarters with this case. Ms. Cooney explained there are two parts to the MSE: 1) what benefits do you get in fishing under a specific MSE proposal? and 2) what does it do to the stock? The MSE cannot be used if it drives the stock to extinction or causes it to be listed as a threatened or endangered species according to the Endangered Species Act (ESA). The Committee suggested that doubling the bocaccio OY in 2003 would still not accommodate a fishery. The Council must consider a zero-sum exercise for bocaccio, but how to get to zero? The first step is to determine where bocaccio bycatch occurs to do a zero-based bycatch budgeting. The Committee decided to attempt to structure a management option that zeroes out bycatch on the shelf and then determine what bycatch occurs on the fringe.

G. Management Options and Recommendations

The Committee discussed management options for 2003 West Coast fisheries and started developing a management option that minimizes impacts to overfished shelf rockfish species (Table 1). The conceptual framework for Table 1 and the "minimal impact" alternative was the need to shift fisheries with a bycatch of shelf rockfish out of the depth range of overfished shelf rockfish species, coupled with risk-averse management measures such as mandating VMS or requiring observers and bycatch caps in fisheries that might still have a risk of incidentally catching bocaccio, yelloweye, and canary. The fisheries listed in Table 1 were judged by the Committee to be the most at risk of incurring a bycatch of overfished shelf rockfish.

The following conversation threads and questions were part of the deliberations that went into developing Table 1 (the topic was further discussed and the "minimal impact" alternative further developed on Tuesday morning). The Committee/GMT should consider recommending a nearshore rockfish OY south of Cape Mendocino with the anticipated increased fishing pressure in nearshore areas next year.

Mr. Joner addressed tribal fishery options for 2003 (at least as considered by the Makah Tribe). The Makahs project a catch of 1,000 pounds of yelloweye this year with the restrictions in place. The Makahs will consider area and depth restrictions in their 2003 fisheries to avoid yelloweye. They are also considering bait restrictions in their halibut fishery based on evidence of reduced yelloweye bycatch with some baits.

The Committee adjourned for the day.

<u>TUESDAY, JUNE 4, 2002 8:30 A.M.</u>

Members Present:
Mr. Jim Lone, Washington Recreational Fishing Industry Association
Dr. Hans Radtke, Chairman, Pacific Fishery Management Council
Mr. LB Boydstun, California Department of Fish and Game
Mr. Burnie Bohn, Oregon Department of Fish and Wildlife
Mr. Phil Anderson, Washington Department of Fish and Wildlife
Mr. Bill Robinson, Northwest Region National Marine Fisheries Service

Others Present:
Ms. Eileen Cooney, General Counsel, National Oceanic and Atmospheric Administration
Dr. Jim Hastie, Northwest Fisheries Science Center National Marine Fisheries Service, GMT
Mr. Steve Springer, National Marine Fisheries Service Enforcement
Mr. Mike Gonzales, National Marine Fisheries Service Enforcement
Ms. Vicki Nomura, National Marine Fisheries Service
Mr. Otha Easley, National Marine Fisheries Service
Mr. Rod Moore, West Coast Seafood Processors Association, GAP
Ms. Yvonne de Reynier, Northwest Region National Marine Fisheries Service
Mr. Jim Glock, National Marine Fisheries Service
Ms. Marija Vojkovich, California Department of Fish and Game
Mr. Dave Cleary, Oregon State Police, EC
Mr. Dave Thomas, California Department of Fish and Game, GMT
Dr. Patty Burke, Oregon Department of Fish and Wildlife
Mr. Guy Norman, Oregon Department of Fish and Wildlife
Mr. Mark Saelens, Oregon Department of Fish and Wildlife, GMT
Mr. Don Bodenmiller, Oregon Department of Fish and Wildlife
Mr. Rod Kaiser, Oregon Department of Fish and Wildlife
Mr. Brian Culver, Washington Department of Fish and Wildlife, GMT
Ms. Michele Robinson, Washington Department of Fish and Wildlife, GMT
Mr. Tom Ghio, LE fixed gear fisherman, F/V Miss Allison, GAP
Ms. Janice Green, GAP

Mr. Steve Bodnar, Coos Bay Trawlers Association
Ms. Laura Deach, LE fixed gear fisherman
Mr. Joe Bersch, Supreme Alaska Seafoods
Mr. Terry Thompson, LE trawl fisherman, F/V Olympic
Mr. Brian Peterson, shrimp fisherman, Shrimp Producers Marketing Association
Mr. Chris Olson, Newport Marina Charters
Mr. Mark Cedergreen, Westport Charterboat Association, SAS
Mr. Don Stevens, Oregon Salmon Commission, SAS
Mr. Steve Joner, Makah Indian Tribe
Mr. Rob Jones, Northwest Indian Fisheries Commission
Dr. Peter Leipzig, Fishermen's Marketing Association
Mr. Robert Alverson, Fishing Vessels Owner's Association
Mr. Jeff Barnard, The Associated Press
Mr. Jonathan Brinckman, The Oregonian Newspaper
Mr. Kit Dahl, Pacific Fishery Management Council staff
Mr. Ed Waters, Pacific Fishery Management Council staff
Mr. Dan Waldeck, Pacific Fishery Management Council staff
Mr. Jim Seger, Pacific Fishery Management Council staff
Mr. John DeVore, Pacific Fishery Management Council staff

G. Management Options and Recommendations (continued)

H. State-managed Fisheries

These two agendums were combined in Committee deliberations.

Table 1 was further developed. The Committee was interested in the status of the canary rebuilding analysis and learned it was still in development. Mr. DeVore was asked to distribute this as soon as it was available. Mr. Boydstun wanted to consider VMS for fisheries south of Cape Mendocino and Mr. Bohn wanted to consider establishing a precautionary nearshore rockfish OY for inshore fisheries north of Cape Mendocino.

Potential gear modifications designed to avoid shelf rockfish was discussed. Mr. Saelens reviewed field trials of experimental flatfish trawls in Oregon waters. Reducing the dimensions of the mouth of trawl nets and cutting back the headrope appears to increase catch efficiency for flatfish while significantly reducing rockfish bycatch. Mr. Robinson mentioned that the Northwest Fisheries Science Center is interested in aiding this research effort. Further trials are expected later this summer. Mr. Anderson mentioned experimental gear modifications are being researched by WDFW this year as part of their arrowtooth and midwater yellowtail EFPs.

The Committee briefly discussed survey improvements contemplated for future shelf rockfish assessments. There is a need to better survey the rocky reef habitats where overfished shelf rockfish species reside. The low OYs recommended to rebuild bocaccio, canary, and yelloweye also obviate the need to consider non-extractive survey technologies. Mr. Anderson explained the effort to investigate yelloweye habitats in waters off Washington using submersible video technology. They will be implementing a 10 day investigation in August this year. This may be prove to be a promising technology for future rockfish surveys.

Concerns regarding yelloweye bycatch in recreational and commercial halibut fisheries were raised. The Committee deliberated how best to coordinate halibut management with the IPHC. It was decided that the Council can effect halibut management changes by amending the Halibut Catch Sharing Plan. The plan can be amended in time for 2003 by proposing changes at the September Council meeting with final adoption at the November Council meeting. Mr. Anderson explained WDFW initiatives being considered for their recreational halibut fishery. Further area restrictions to shift recreational halibut pressure away from yelloweye areas are being considered. Meetings with Washington stakeholders will occur during the week of June 10 after which WDFW will propose restricted area boundaries defined by lat./long. coordinates. The WDFW will also define a 150 fm line (see Table 1) using lat./long. coordinates.

Tribal management options were further discussed. Mr. Joner mentioned the Makah Tribe was planning on meeting with WDFW the week of June 10. They will consider how to reduce yelloweye bycatch in the competitive halibut fishery. The Makahs are also planning a side-by-side longline survey for yelloweye with the WDFW submersible survey this summer. The Makahs will also consider depth restrictions in their halibut fishery as well as time and area restrictions in their midwater trawl fisheries to reduce shelf rockfish bycatch. There was also a concern regarding yelloweye and canary bycatch in tribal salmon troll fisheries. The Makahs are planning on contributing funds for a dedicated state/tribal port sampler in Neah Bay (after July?). Port sampling and a tribal full retention program should help in accounting for tribal bycatch.

Mr. Anderson explained WDFW efforts to manage yelloweye bycatch this year. They are putting observers on halibut charter boats this year to get a better idea of yelloweye bycatch. The yelloweye harvest guideline in Washington this year is 3 mt. They have accounted for 1.6 mt in all Washington fisheries combined. Given that 70%-80% of yelloweye bycatch in Washington occurs in the recreational halibut fishery and the fishery is almost finished for the year, they are projecting a final total catch well under 3 mt.

Dr. Hastie further reviewed research catch accountability. The Northwest Region of NMFS is attempting to catalogue all research fisheries on the West Coast. The GMT is encouraging all researchers to account for their catches down to the species level and to diligently report those catches to the Northwest Region. Research fisheries also need to provide an accounting of all expected rockfish catches prior to implementing fishing. The GMT also strongly recommends all overfished shelf rockfish caught in research fisheries need to be provided for biological sampling. This may be the only way to obtain critical age/length data with the low OYs and non-retention regulations anticipated for future fisheries. Mr. Culver mentioned a letter was sent to the IPHC regarding the halibut survey and the need to account for shelf rockfish bycatch.

Mr. Saelens reviewed logbook and fish ticket data to inform the Committee on estimated bycatch in the shoreside whiting fishery. The point was made that rockfish bycatch should be reduced in 2002 with the reduced whiting OY adopted. The following table summarizes these results:

Bycatch of overfished rockfish species in the shoreside whiting fishery.

Species	Year	Estimated Bycatch (lbs)	Estimated Bycatch (mt)
Yelloweye	1998	100	0.045
	1999	46	0.021
	2000	3	0.001
	2001	0	0.000
Canary	1998	837	0.380
	1999	1,347	0.612
	2000	1,148	0.522
	2001	987	0.449
Darkblotched	1998	8,723	3.965
	1999	913	0.415
	2000	2,658	1.208
	2001	1,790	0.814

Mr. Lone invited public comment.

Mr. Stevens: Is the Committee recommending VMS for all West Coast commercial fisheries? Mr. Boydstun suggested the Committee/Council needs to work out these details. He was certain there would be a recommendation to mandate VMS for all limited entry groundfish fisheries, but was less certain that would be feasible for open access fisheries. Mr. Stevens stated that commercial salmon trollers would be willing to take on-board observers.

Mr. Moore: Regarding the option to recommend a recreational bag limit of 5 rockfish in waters shallower than 10 fm (Table 1), what about a consideration for the same allowance in the squid fishery? That fishery tends to release bocaccio alive. Regarding research fisheries, deducting the expected overfished species catch from the OY is a de facto allocation to research. Research fisheries would then get priority over recreational and commercial fisheries.

Mr. Ghio: He mentioned that he has a scientific permit and conducts cooperative research fishing. He stated that in California they are not allowed to land fish in numbers exceeding the recreational bag limits. Mr. Saelens stated that all research fisheries need to be critically evaluated and prioritized. Some ongoing research fisheries may need to be eliminated.

Ms. Deach: Why wouldn't nearshore fisheries require VMS? They could cross into deeper water and fish illegally (given depth-based restrictions) without a VMS. Mr. Boydstun thought shore-based patrols could enforce nearshore fishery restrictions. Mr. Anderson volunteered that they may need to monitor nearshore vessels that are out of visual range. Mr. Gonzales stated that there was a lot of complexity in considered management options. The simpler the management action, the easier it is to enforce.

Dr. Leipzig: If, after the SSC review, the OYs are larger than now indicated, can we liberalize these options? Mr. Boydstun replied we could then add fish back into the zero-based bycatch "budget" and re-address the options outlines in Table 1. Mr. Robinson stated that it would first need to be proved that Table 1 options are indeed zero-based. Mr. Anderson stated they probably are not since some fisheries with an expected bycatch are not included (i.e., the recreational halibut fishery is not eliminated). He suggested calling the suite of options in Table 1 a "low impact" alternative rather than a "minimal impact" alternative.

I. State/Federal Outreach

Mr. DeVore mentioned the Council initiative to develop fact sheets regarding the current science and 2003 management challenges (one such fact sheet was passed out to the Committee members and other attendees). He stated these factorials are posted on the Council web site.

Mr. Alverson recommended an outreach to NRDC and other litigants to consider a respite from their legal challenges to allow the Council time and resources to address groundfish management challenges. Ms. Cooney suggested litigants will continue to comment on the process and there was no guarantee the plaintiffs will back off. Mr. Robinson suggested there was nothing to prevent Council members and others from talking with plaintiffs. Those folks directly involved in settlement negotiations have a more structured arrangement where such outreach and dissemination of negotiation details are not allowed.

Mr. Anderson suggested the Committee could have a public outreach recommendation. Mr. DeVore mentioned the "media loop" concept where key media contacts from state and federal agencies are given timely information and details so they can keep their public and stakeholders well informed. He explained that Ms. Jennifer Gilden was the Council staff media contact. Mr. Robinson asked that Mr. Brian Gorman be included in the media loop.

The Committee suggested that we need a better public review structure for proposed management measures. Could the Council sponsor 5 hearings this summer with the state agencies adding additional meetings to accomplish public outreach? Dr. Hastie cautioned that Council and other support staff will be fully subscribed this summer modeling complex management scenarios for the 2003 annual specifications Environmental Assessment (EA). The EA probably won't be available for public review until late August at the earliest. The Northwest Region needs to review a draft EA prior to public review. Mr. Boydstun suggested Council staff and other support staff would not be needed to staff public hearings; state personnel could do that job. Mr. Ghio said public hearings would be important for the public to vent. Five hearings would not be enough for California. All user groups need to get together to develop options that provide the best economic return with the low OYs being considered for 2003.

J. Needed Economic Analyses

Mr. Seger suggested that needed economic analyses should follow a logical two-step process. The first step is to analyze logbook data from inside and outside potential closed areas considered for next year. The second step is to use that data to analyze the economic effect of anticipated effort shifts. He pointed out that the final version of the 2002 annual specifications EA contained lots of solid economic data such as the gross values of different West Coast fisheries stratified by year and area. He was concerned with the complex economic analysis associated with the MSE. He was not sure there were enough resources available for a full evaluation of the MSE.

Dr. Radtke suggested we should look at the 2002 annual specifications EA and use that information to analyze effects in the 2003 annual specifications EA. Getting the most market value in 2003 may depend on ITQs. Magnuson-Stevens Act reauthorization discussions are currently focusing on the ITQ moratorium.

Mr. Seger introduced the newest Council staffer, Mr. Ed Waters, who will be assisting in developing needed economic analyses.

K. Conclusions and Final Public Comment

Mr. Robinson cautioned against defining a MSE alternative generically. There has to be a specific proposal to exceed rebuilding OYs to do a MSE analysis. Other alternatives need to be analyzed as well. Dr. Hastie stated we need to know equilibrium harvest levels for rebuilding species. What level of harvest will keep overfished stocks from declining further?

Mr. Stevens recommended fish tickets need to be standardized. He suggested a federal fish ticket for landing catch from federal waters and a state fish ticket for landing catch in fisheries operating inside 3 nm.

Mr. Culver expressed a concern with the uncertain science currently discussed, The SSC needs to firm up this science. How can we get the SSC to review the new science now?

Mr. Anderson stated EFPs could provide future opportunities for access to harvestable stocks while avoiding impacts to overfished stocks. The Council, states, and NMFS need to develop an EFP funding mechanism. Mr. Saelens stated that the ODFW will try to implement a midwater trawl EFP for 2003.

There was general agreement that public hearings should occur. It is not clear that the "minimal impact" alternative is the worst case scenario. There could be further cuts or fishery modifications if bycatch rates are shown to be excessive in fisheries not addressed in Table 1. Conversely, some liberalization of fishery cuts could be warranted once the science is firmed up. It was clear that the depth-based restrictions inherent in the "minimal impact" alternative depend on implementation of VMS. Management lines that are easier to enforce than fathom curves still need to be specified. There was general debate on whether 2003 management is dependent on VMS. All state representatives of the Committee pledged to consider specifying management lines by conferring with staff and fishery stakeholders. However, there was some disagreement that VMS would be critical to implement depth-based restrictions in 2003. Dr. Hastie thought if we could not adopt a depth-based management scheme for 2003 without a reasonable assurance of compliance, then seasonal management may be an appropriate strategy. The Committee was also reminded that commercial effort may need to be shifted deeper than 150 fm to protect darkblotched rockfish. There also needs to be consideration of moving the slope management line further south of 40°10' N. lat. to reduce darkblotched bycatch. The Council might consider higher landing limits for fisheries that are shifted into deeper water as an added incentive to fish outside the darkblotched depth range.

Consideration should be given to a mandatory observer program and bycatch triggers (a threshold of observed bycatch would close the fishery in that area). WDFW is currently rotating 2 observers for 9 vessels in their midwater yellowtail EFP this year and are able to cover this fishery efficiently this way. A mandatory 100% observer program coupled with depth restrictions is a reasonable alternative to VMS and drawing management lines. However, there may be a disruption of the current NMFS Observer Program if 100% observer coverage is mandated. This tradeoff needs to be considered. With enough time for research, development, and testing, VMS systems may be able to automatically send fathometer readings along with position information. This capability may take a year or more to develop and implement.

The Committee wondered how rulemaking was anticipated to occur next year? NMFS has said they need 5 months for public notice and comment after final Council adoption of management measures. There is not enough time between mid-September and January 1 to do this. The Council also believed they could not afford to roll over the specifications from this year and wondered if specifications for the first two months next year would occur with emergency rulemaking?. Mr. Robinson agreed that a roll over of specifications could not occur with such low OYs contemplated. He explained that NMFS was not likely to pursue emergency regulations either. He expected an interim rule would be adopted for the first two months next year with the rest of the annual specifications adopted under final rulemaking. An interim rule is a final rule adopted without the full public notice and comment period.

PFMC
06/13/02

Table 1. The minimal impact alternative for 2003 West Coast fisheries considered by the Ad Hoc Allocation Committee in June 2002.

Fishery	2003 Fishery Description
	Fisheries south of Cape Mendocino
Recreational	
CA sport (including Ocean whitefish)	0 rockfish > 10 fm [1/] [2/]; 5 rockfish <10 fm [1/] (no more than 2 shelf rockfish); 0 overfished rockfish
Trawl	
Shrimp	Excluders
Whiting	
Slope LS Thornyhead	>150 fm; VMS
Slope Sablefish	>150 fm; VMS
Slope Dover	>150 fm; VMS
Slope Petrale	>150 fm; VMS
Midwater Widow/Chilipepper	Observer req./bycatch trigger
Nearshore Flatfish	<45 fm + > 3 nm; Use flatfish trawls
Fixed Gear	
LE/OA line	<10 fm 2/; >150 fm; Daily Trip Limit to Weekly Trip Limit; VMS
LE/OA pot/trap	<10 fm 2/; >150 fm; Daily Trip Limit to Weekly Trip Limit; VMS
LE 3-T Sablefish	>150 fm; VMS
salmon troll	area/gear restrictions
CPS purse seine	>10 fm; no daylight fishing
setnet	<10 fm; >150 fm; VMS
Exempted Trawl	
CA halibut	<45 fm
sea cucumber	<45 fm
spot prawn	>150 fm; VMS
ridgeback prawn	>150 fm; VMS
Research and Stock Assessment	Coordinate and enumerate Deduct rebuilding species catch from OY not ABC
	Fisheries north of Cape Mendocino
Recreational	
WA sport	0 RF (0 canary, yelloweye all depths) > 25 fm; halibut area restrictions
OR/CA sport	0 RF > 20-27 fm [3/]; season restrictions
Trawl	
Shrimp	Excluders
Shoreside Whiting	?
At-sea Whiting	?
Slope LS Thornyhead	>150 fm; VMS
Slope Sablefish	>150 fm; VMS
Slope Dover	>150 fm; VMS
Slope Petrale	>150 fm; VMS
Midwater Widow/Yellowtail	Observer req./bycatch trigger
Nearshore Flatfish	<45 fm + > 3 nm (WA only); Use flatfish trawls?
Fixed Gear	
LE/OA line	<10 fm [3/]; >150 fm; Daily Trip Limit to Weekly Trip Limit; >3 nm (WA only)
LE/OA pot/trap	<10 fm [3/]; >150 fm; Daily Trip Limit to Weekly Trip Limit; >3 nm (WA only)
LE 3-Tier Sablefish	>150 fm; VMS
Directed halibut [4/]	>150 fm; Observer required/bycatch trigger (<150 fm?)
Dogfish	>150 fm; Observer required/bycatch trigger (<150 fm?)
salmon troll	area/gear restrictions
CPS purse seine	>3 nm (WA only)
Exempted Trawl	

Table 1. The minimal impact alternative for 2003 West Coast fisheries considered by the Ad Hoc Allocation Committee in June 2002.

Fishery	2003 Fishery Description
spot prawn	Pot only in WA (+OR?)
Tribal	Depth restrictions in halibut fishery;
	Time/area restrictions in MW trawl
Research and Stock Assessment	Coordinate and enumerate
	Deduct rebuilding species catch from OY not ABC

1/ Consider a 20 fm break.

2/ OYs for nearshore rockfish and CA scorpionfish.

3/ Consider nearshore rockfish OYs, cap nearshore rockfish OY at 2002 level?

4/ Coordinate with IPHC. Change Halibut Catch Sharing Plan.

PROPOSED MANAGEMENT MEASURES FOR 2003

Situation: Management measures adopted during the Council process are designed to implement new and existing rebuilding programs, achieve bycatch reduction mandates, keep total catch within the proposed harvest levels, and achieve optimum benefits to the various user groups and fishing communities. The harvest levels and allocations adopted for 2002 are attached to provide a reference when the Council deliberates management alternatives for 2003 (Exhibit C.8, Attachment 1).

In the last three years the Council has implemented a substantial restructuring of the groundfish fishery that includes gear restrictions, seasons, and dramatically lower harvest levels consistent with previously-approved rebuilding programs for overfished species. However, new assessments and rebuilding analyses for bocaccio, canary rockfish, and yelloweye rockfish indicate a worsening crisis in West Coast groundfish management for 2003. Rebuilding these species could require a cessation of most, if not all, on-bottom fishing on the continental shelf. Rebuilding will be protracted and costly. Allowing access to species in shallower or deeper zones may require new approaches, such as depth-based trip limits. Effort shifts to nearshore and slope areas are likely to exacerbate overcapacity problems in these fisheries, creating greater challenges for successful rebuilding of darkblotched rockfish and Pacific ocean perch on the slope. The inevitable economic consequences will be severe for all segments of the commercial and recreational fishing and support industries.

The Ad Hoc Allocation Committee (Committee) met by teleconference on May 21 (Exhibit C.8, Attachment 2) and in a two day meeting on June 3 and 4 (Exhibit C.8, Supplemental Attachment 3) to address the challenges posed by the need to rebuild these shelf rockfish species. The Committee is expected to propose a range of management alternatives including allocation alternatives for 2003. Additionally, the Groundfish Management Team, Groundfish Advisory Subpanel, and interested public are expected to provide recommendations and alternatives for 2003 management.

The Council should develop specific management options at this meeting to help focus public attention on the extent of changes that may be necessary and to provide the basis for adopting final management measures at the September Council meeting. The severity of the situation for shelf rockfish and the expected effort shifts from the shelf to nearshore and slope fisheries necessitates consideration of major adjustments to all sectors of the groundfish fishery. Allocation alternatives or specifications consistent with proposed management measures should also be considered and adopted by the Council at this time. A draft 2003 Annual Specifications Environmental Assessment will be prepared for Council consideration at the September Council meeting. The outline of the draft 2003 Annual Specifications Environmental Assessment is provided as Exhibit C.8, Supplemental Attachment 4.

Council Action:

1. Adopt proposed 2003 management measures for public review.

Reference Materials:

1. 2002 Specifications of Acceptable Biological Catch (ABC), Optimum Yields (OYs), and Limited Entry and Open Access Allocations, by International North Pacific Fisheries Commission (INPFC) Areas (weights in metric tons) (Exhibit C.8, Attachment 1).
2. Draft minutes of the May 21 Ad Hoc Allocation Committee teleconference (Exhibit C.8, Attachment 2).
3. ✓ Draft minutes of the June 3-4 Ad Hoc Allocation Committee meeting (Exhibit C.8, Supplemental Attachment 3). received 6-17-02
4. ~~Draft 2003 annual specifications Environmental Assessment outline (Exhibit C.8, Supplemental Attachment 4).~~ none
5. Public comment (Exhibit C.8.e).

Supplemental Reference Materials

6. Exhibit C.8.d, Supplemental Ad Hoc Allocation Committee Data Report.
7. Exhibit C.8.e, Supplemental Public Comment 2

over →

Agenda Order:

a. Agendum Overview — John DeVore
b. Ad Hoc Allocation Committee Report — Phil Anderson
c. Recommendations of the States, Tribes, and Federal Agencies
d. Reports and Comments of Advisory Bodies
e. Public Comment
f. **Council Action:** Adopt Proposed Measures for Public Review

Groundfish Fishery Strategic Plan (GFSP) Consistency Analysis

The GFSP supports making the necessary allocation decisions, so fishery participants can plan on a specific share of future OYs (Sec. II.A.1(3)) and establishing an allowable level of catch that prevents overfishing while achieving OY based on best available science (Sec. II.A.2). The GFSP envisions choices made by the Council on 2003 management measures at this stage in the process would be consistent with these criteria.

The GFSP also supports establishing and maintaining a management process that is transparent, participatory, understandable, accessible, consistent, effective, and adaptable (Sec. II.C). The Council process of adopting specific proposed management measures at this September meeting would be consistent with these GFSP principles.

PFMC
06/05/02

8. Exhibit C.8.c, Supplemental ODFW Report.
9. Exhibit C.8.c, Supplemental Congressional Report.
10. Public Comment C.8.e, Management Measures for 2002, from Chris Fryer
11. Item C.8.e, Public Comment, Proposed Management Measures for 2003. from Tracy Grogan.
12. Agenda Item # C-8, Proposed Management Measures for 2003; <Hunter Enterprises>.
13. Exhibit C.8.e, Supplemental Public Comment 3.
14. Exhibit C.8.c, Proposed Treaty Indian Harvest Levels.
15. Exhibit C.8.d, Supplemental SAS Report.
16. Exhibit C.8, supplemental 2002 Canadian Rockfish Management Measures.

Supplemental Reference mtls. Continued.

17. Exhibit C.8, Revised supplemental Attachment 3
18. Exhibit C.8.c, Supplemental Quileute Tribe Comments
19. Exhibit C.8.c, Supplemental ODFW Report 2
20. Exhibit C.8.c, Supplemental ODFW Report 3
21. Exhibit C.8.c, Revised Supplemental WDFW Report 1
22. " " Supplemental WDFW Report 1.
23. Exhibit C.8.c, Supplemental WDFW Report 2.
24. Exhibit C.8.c, Revised Supplemental WDFW Report 2
25. Exhibit C.8.d, Supplemental Revised Ad Hoc Allocation Committee Data Report.
26. Exhibit C.8.d, Supplemental CPSAS Report.
27. Exhibit C.8.d, Supplemental GMT Report.
28. Exhibit C.8.c, Supplemental CDFG Report.
29. Exhibit C.8.d, Supplemental GAP Report.
30. Exhibit C.8.d, Supplemental EC Report.

Fisheries and Oceans Canada

Backgrounder

BG-PR-02-006E

May 27, 2002

INSHORE ROCKFISH HARVEST REDUCTION MEASURES

Conservation measures for inshore rockfish will include a reduction of inshore rockfish harvest levels. Harvest reduction, together with the other elements of the inshore rockfish conservation strategy, will meet conservation goals and permit fisheries to continue.

Recreational Fishery

In 2002, daily limits will be reduced in the inside waters (Areas 12 to 20, 28 and 29) from five to one and seasonal closures in some areas will also be implemented. In the outside waters along the West Coast of Vancouver Island (Areas 21 to 27), daily limits will be reduced from eight to three, and in the North Coast (Areas 1 to 11), from eight to five. Anglers are advised to keep what they catch and to avoid rockfish by changing fishing locations if the daily limit is attained.

Commercial Fisheries

For the 2002 directed inshore rockfish commercial fishery, the total allowable catch (TAC) will be reduced to align the harvest levels with a fishing mortality rate of 1.5 per cent. The Inside Category ZN inshore rockfish quota has been reduced from 2001 levels by 75 per cent (from 125 tonnes to 32 tonnes) and the Outside Category ZN inshore rockfish quota has been reduced from 2001 levels by approximately 50 per cent (from 538 tonnes to 282 tonnes).

For the 2002 commercial halibut fishery, the inshore rockfish quota has been reduced from 2001 levels by approximately 50 per cent (from 210 tonnes to 110 tonnes).

For the groundfish trawl fishery, the inshore rockfish quota has been reduced from 2001 levels by approximately 50 per cent (from 23 tonnes to 12 tonnes).

Other commercial fisheries that encounter inshore rockfish as by-catch will continue to harvest their target species in 2002; however, efforts to avoid inshore rockfish will be increased. The Department is continuing to work with industry to address by-catch issues in each fishery.

First Nations

Fisheries and Oceans Canada will continue to work with First Nations to incorporate inshore rockfish harvest rate reductions measures into their fisheries.

BACKGROUNDERS

Inshore Rockfish Management Goals
Inshore Rockfish Biology

Fisheries and Oceans Canada

Backgrounder

BG-PR-02-005E **May 27, 2002**

INSHORE ROCKFISH MANAGEMENT GOALS

Outlined below are the components of the inshore rockfish conservation strategy that are being implemented in 2002.

1. Rockfish conservation areas will be expanded to protect rockfish habitat. They will provide a buffer against scientific uncertainty, and for the essential protection and rebuilding of rockfish stocks. Rockfish conservation areas will be most extensive in the inside waters (Strait of Georgia and Johnstone Strait) where science indicates that stock declines have been most precipitous. A first set of expanded conservation areas will take effect in mid to late June, and following consultations, a full slate of rockfish conservation areas will be established for the 2003 fishing season. Details about these conservation areas will be released shortly.
2. Fishing mortality will be substantially reduced. Current estimates of harvest rates are six per cent for the inside waters and four per cent for the outside waters. To reduce harvest rates to the precautionary sustainable harvest rate of less than 1.5 per cent requires drastic reduction of directed rockfish harvest and of rockfish by-catch levels in the inside waters and significant reductions in the outside waters.

   On December 14, 2001, Fisheries and Oceans Canada stated that a harvest rate of less than two per cent was necessary to reverse declines and ensure stock rebuilding of inshore rockfish stocks. A recent Pacific Scientific Advice Review Committee report recommends that a sustainable fishing mortality rate for inshore rockfish species must be less than 0.75 of the natural mortality rate. Natural mortality rate has been conservatively estimated to be two per cent. A sustainable fishing rate for inshore rockfish must therefore be 1.5 per cent or less.

3. Comprehensive catch monitoring programs will be established that will allow for an accounting of all significant inshore rockfish catch (retained and released). In 2002, significant increases in catch monitoring levels are being implemented in many fisheries.

   Commercial fishery monitoring tools will include increased number of fishery observers, use of experimental camera technology, dockside monitoring, logbook data and biological sampling at landing sites. Improvements to the coverage of recreational creel surveys are being developed, and consultations are currently on-going with First Nations to develop or improve catch monitoring programs. Catch monitoring standards as outlined in Fisheries and Oceans Canada's framework entitled *Pacific Region Fishery Monitoring and Reporting Framework* will be developed for the 2003 fishing season and may be fully implemented by the following year.

4. A stock assessment framework for inshore rockfish will be developed by December 2002. Complementary stock monitoring programs, which will include the collection of abundance and biological data, will be developed in consultation with and participation of commercial and recreational harvesters and First Nations. This framework will enable the Department to more accurately assess rockfish abundance and evaluate the progress toward rebuilding objectives.

OTHER BACKGROUNDERS

Inshore Rockfish Harvest Reduction Measures
Inshore Rockfish Biology

Fisheries and Oceans Canada

Backgrounder

BG-PR-02-007E May 27, 2002

INSHORE ROCKFISH BIOLOGY

Thirty-four different species of rockfish live in B.C. coastal waters. Inshore rockfish include quillback, copper, china, tiger, black, and yelloweye (sometimes called Red Snapper) rockfish. B.C. rockfish come in many different shapes, sizes and colours, but they have certain characteristics in common. They are long-lived, have low productivity, mature slowly, are mainly sedentary in nature and rarely survive after being caught. These characteristics make inshore rockfish particularly vulnerable to over harvest and local area depletion.

Yelloweye rockfish, for example, can reach 90 centimetres in length and live over 100 years. After these rockfish reach sexual maturity, at about 20 years of age, they produce larvae annually. The survival of the young rockfish is subject to ocean conditions and years of good survival occur every 15 to 20 years. These life history characteristics of inshore rockfish result in low stock productivity.

Because inshore rockfish rarely survive after being caught, catch and release is not an effective management tool in protecting inshore rockfish stocks. Rockfish possess closed swim bladders, which cause gases in their body cavity to expand when they are brought to the surface. The decompression effects, ruptured swim bladders, damaged sinuses and eyes, are irreversible and fatal and can occur when bringing fish to the surface, from depths as shallow as 10 metres (30 feet).

Conservation concerns are most apparent for the quillback and yelloweye rockfish species where there is specific evidence of unsustainable harvest levels (there is little information to directly assess harvest impacts on the other species). Quillback and yelloweye rockfish are frequently harvested as target species, but all inshore rockfish species intermingle and are impacted in the directed and by-catch fisheries. Since all inshore rockfish species are vulnerable to over harvest and they are caught together, conservation measures will encompass all these inshore rockfish species.

OTHER BACKGROUNDERS

Inshore Rockfish Management Goals
Inshore Rockfish Harvest Reduction Measures

ENFORCEMENT CONSULTANTS STATEMENT ON STATUS OF FISHERIES AND INSEASON ADJUSTMENTS

- Employing a boundary fathom curve restriction running the length of the West Coast represents a significant change from past Council management measures and will mark the transition to a much greater dependence upon at-sea enforcement. Previous conservation measures were largely enforced by the comparatively inexpensive method of dockside enforcement. The Council should give careful consideration to the costs associated with at-sea enforcement during their decision making process; to include vessels, aircraft, observers, and vessel monitoring systems (VMSs).

- Off Oregon and Washington, the proposed Dover sole/thornyhead/trawl-caught sablefish complex opening will require vessels to fish over 40 miles offshore. Weather conditions during the period of the opening – October through December – will require the Coast Guard to provide a major cutter (210' or greater) for effective enforcement. The major cutter scheduling conference for fiscal year 2003 will be held in August; as of today, the Coast Guard cannot confidently state that a major cutter will be available to patrol off Washington and Oregon during this opening.

- State agency patrol vessels in Oregon and Washington will not routinely be capable of patrolling this opening, so enforcement will rely heavily – possibly exclusively – on Coast Guard surface and air assets. As always, operational requirements may force these assets to shift to other missions for part or all of the opening period. For this reason, the Council should view this complete reliance on Coast Guard assets as a temporary, transitional need while alternative enforcement methodologies such as VMS are investigated.

- The Coast Guard would also like to state their concern with the safety of this proposed fishery. Some participating vessels will require deck gear modifications (e.g., adding additional cable to fish greater depths). Adding weight above a vessel's center of gravity and fishing further offshore in late fall/winter weather conditions may reduce the safety margins available to fishermen, observers, and enforcement officials.

PFMC
06/20/02

Dave Cleary

GROUNDFISH ADVISORY SUBPANEL STATEMENT ON STATUS OF FISHERIES AND INSEASON ADJUSTMENTS

The Groundfish Advisory Subpanel (GAP) met jointly with the Groundfish Management Team (GMT) to discuss inseason adjustments to the groundfish fishery. In spite of extensive discussions to reach a consensus, the GAP and the GMT found themselves in fundamental disagreement on how best to continue viable fisheries while ensuring conservation of certain key fish stocks, especially darkblotched and bocaccio rockfish. The GAP thus submits the following recommendations which - while diverging from those made by the GMT - still - in our view, meet the Council's conservation goals. These comments are based on Table 1 which is included as part of Exhibit C.9.d - Supplemental GMT Report.

NORTH OF 40° 10'

The GAP agrees with the GMT Option 1, with the following changes:
Rather than closing all groundfish bottom trawling, beginning September 1, 2002, allow a DTS fishery outside of 250 fathoms and a shelf flatfish fishery inside of 125 fathoms. The shelf flatfish fishery would be restricted to small footrope gear only.

The GAP recognizes that implementing a depth-based change will require an emergency rule and requests that the Council ask that one be implemented.
In addition, the GAP recommends the following cumulative limit changes:

a) reduce the cumulative limit of slope rockfish to 500 pounds / 2 month period for the remainder of the year
b) reduce the cumulative limit of Pacific Ocean perch to 4,000 pounds / 2 month period for the remainder of the year.

These changes will ensure the continued conservation of canary and darkblotched rockfish, as well as those few yelloweye rockfish that may be incidentally taken in trawl gear. The recommended regulations will ensure that trawlers avoid the depths where these species are commonly taken.

SOUTH OF 40° 10'

The GAP agrees with the items listed under "Immediate Action" with one change:
In item #1, add a provision that nearshore flatfish may be retained by a vessel which has an observer on board.

The GAP disagrees with the options listed under "Further Action"

Where fathom limits are indicated, the GAP intends that they be identified as way points using latitude / longitude locations connected by straight lines sufficient in length to facilitate adequate enforcement. The GAP recommends that the state and federal enforcement agencies convene a panel of knowledgeable fishermen to help identify the points and draw the lines.

In the areas where trawling is restricted, only one type of net may be on board the vessel when fishing in the area.

PFMC
06/20/02

Jim Hastie

Exhibit C.9.d
Supplemental GMT Report
June 2002

GROUNDFISH MANAGEMENT TEAM (GMT) REPORT ON INSEASON STATUS OF THE GROUNDFISH FISHERY AND RECOMMENDATIONS FOR MANAGEMENT CHANGES

The GMT has reviewed the inseason status of fisheries landings and identified two areas of major concern: bocaccio and darkblotched rockfish. As of June 8, commercial landings of bocaccio reported to PacFIN total 21 mt. Although this is slightly ahead of a pace for year-end attainment of the commercial harvest guideline, the greater problem is presented by estimated recreational landings. Through the first two 2-month waves of 2002, RecFIN estimates that about 60 mt have been taken. This amount is higher than the harvest guideline set aside for recreational for the entire year. It also reflects only two months of opportunity for fishing outside of 20 fm in each of the areas north and south of Pt. Conception. The accuracy of the RecFIN estimates for the charter boat sector were evaluated by California Department of Fish and Game (CDFG) staff, using state charter boat logbook submissions. The review concluded that, at this time, the RecFIN estimate could not be rejected. As a consequence, the GMT anticipates that by the end of June not only will the OY have been exceeded, but landings will have approached, if not exceeded, the ABC. Since removals in excess of the ABC constitute "overfishing", the GMT believes it is critical to address all sources of bocaccio fishing mortality as quickly as possible.

As a result, for the area south of 40o10', the GMT has several recommendations for actions beginning July1, and we have attempted to identify other depth-based alternatives that we would support implementing as soon as practicable. From the advice we have received, implementing a depth-based approach would require a 2-meeting process, which would imply the earliest implementation date would be October 1. With the exception of the DTS and slope rockfish species, the GMT recommends that retention of groundfish species be prohibited for all trawl gear (including exempted trawl). Trawl survey depth distributions for sablefish Dover sole and bocaccio are provided in Figure 1. Discussions with the GAP also indicated that these fisheries occur in depths where bocaccio are not encountered. Additionally, we recommend re-instituting the 22" size limit for trawl sablefish that has been used in previous years, to provide further encouragement for the fishery to occur at depths beyond the bocaccio range. Limits for slope would be reduced beginning September 1 to 1,800 lb per 2-months between 40°10' and 36°rockfish for all gears, and to 15,000 lb per 2-months south of 36° for trawl and fixed gear, with equivalent limits for splitnose. Additionally, we support restricting the DTS and slope rockfish fisheries to areas outside of 150 fm as soon as possible. For all fixed-gears, we recommend closing all limits outside 20 fm except for primary sablefish, Daily/weekly-Trip-Limit sablefish, slope rockfish, and limited-entry shortspine north of 36°. Until a fathom curve can be implemented, we recommend implementing a 22" minimum size limit for the fixed-gear Daily/weekly-Trip-Limit sablefish fishery. Because California sport regulations revert to open inside 20 fm only when shelf rockfish is closed, the GMT supports taking this action July 1. We would also urge that the recreational groundfish fishery be closed outside of 10 fm as soon as possible. The GMT would also support Council consideration in September of re-opening the trawl flatfish fishery inside of some fathom line.

Our best estimate of darkblotched rockfish landings through June 8 is 78 mt, which represents about 55% of the landed catch OY. As the GMT informed the Council in April, significant landings of darkblotched occurred south of 40°10' during the first months of 2002. Further review of available data indicates that as of June 8, roughly 30 mt were landed south of 40°10', and review of 2001 logbooks suggests that these fish were caught south of that line. These south-of-40°10' fish represent catch not accounted for in last fall's modeling of expected darkblotched bycatch. In response to this situation, the Council lowered the southern slope rockfish limit from 50,000 lb to 5,000 lb per 2-months from May-August. This appears to have reduced darkblotched landings to less than 1 mt during May. However, the magnitude of earlier catches means that the projected bycatch from the north, plus a measure of landings and estimated discards from south of 40°10', for the remainder of the year would be 35-40 mt above the total catch OY.

The GMT has crafted two options for achieving the needed reduction in projected bycatch. Under the first option, currently scheduled trawl limits would remain in place during July-August, but with a requirement that only small footrope be used. All limits for bottom groundfish fishing would be closed beginning September 1, with the intent of crafting a DTS limit outside of 250-300 fm and a flatfish limit inside 100 fm at the September meeting, for implementation October 1. Trawl survey distributions for sablefish, Dover sole, and darkblotched are provided in Figure 2. Under this option, the Council may wish to initiate a mechanism by which the GMT could recommend closure of the bottom trawl fishery to the NW Regional Administrator before September 1. The second option would involve closing bottom trawling beginning July 1, with the intention of re-opening the DTS fishery outside of 250-300 fm and a flatfish limit inside 150 fm beginning October 1.

Table 1. Proposed GMT recommendations for inseason adjustments to the 2002 groundfish fishery.

Fishery Status

Bocaccio: By the end of June, projected catch will exceed OY and approach or exceed ABC

Darkblotched: Model-projected northern bycatch plus southern (landings + assumed discard) with current limits will be 201 mt through year end (relative to a 163 mt target)

Under Option 1 (North of 40°10'), this would be reduced to 157 mt
Under Option 2 (North of 40°10'), this would be reduced to 153 mt

Inseason Options (* Indicates GMT-preferred)

North of 40°10'

Possible 2-month midwater trawl opening for widow/yellowtail, after whiting *

Option 1
- Leave trawl limits as specified for July and August (small footrope required)
- Close all groundfish bottom trawling (small and large footrope) September 1
- Consider re-opening the following fisheries at the September Council meeting:
  1. DTS fishery October 1 outside of 250-300 fm
  2. Flatfish fishery inside 100 fm

  NOTE: With Council approval, the Team could review the darkblotched status at the July GMT meeting, and implement a closure before September 1 if the OY is projected to be reached sooner

Option 2
- Close all groundfish bottom trawling (small and large footrope) July 1
- Consider re-opening the following fisheries at the September Council meeting:
  1. DTS fishery October 1 outside of 250-300 fm
  2. Flatfish fishery October 1 inside 150 fm

South of 40°10'

Immediate Action

1. No groundfish trawling except DTS and slope rockfish beginning July 1; minimum size limit of 22" for sablefish with a trip limit of 500 lbs/trip of sablefish less than 22"
2. No groundfish retention with exempted trawl gear beginning July 1
3. Close all fixed gear fisheries outside 20 fm July 1, except: primary sablefish; slope rockfish; DTL with 22" minimum size for sablefish
4. Allow limited entry fixed gear shortspine thornyhead fishery between 40°10' and 36°
5. Close recreational fishery outside 20 fm July 1
6. Beginning September 1, reduce slope rockfish trip limit to 1,800 lbs/2 months and splitnose to 1,800 lbs/2 months for all gears in the area between 40°10' and 36°
7. South of 36°, reduce trawl and limited entry fixed gear slope rockfish trip limit to 15,000 lbs/2 months and splitnose to 15,000 lbs/2 months September 1

Further Action

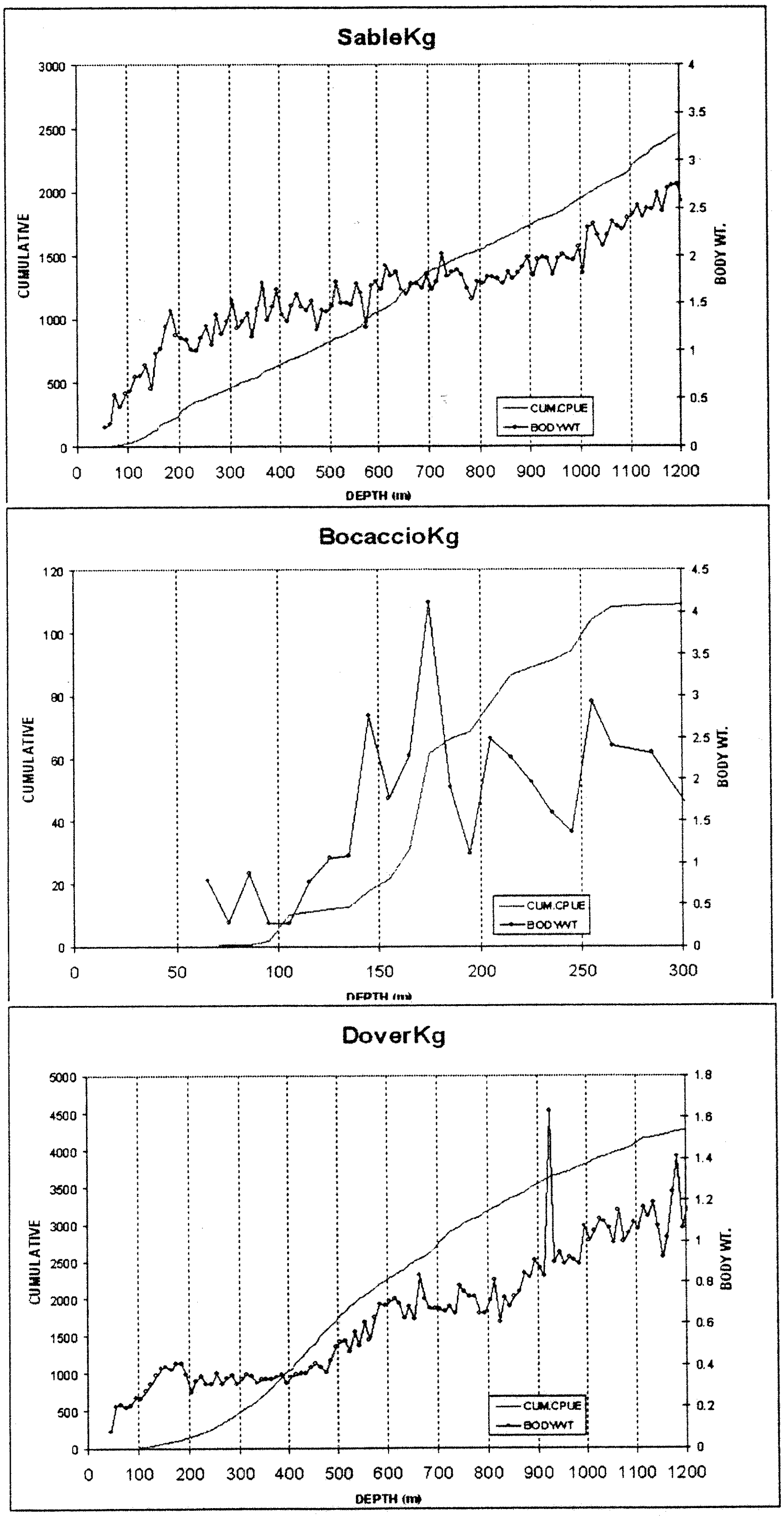
Option 1 - Recreational *
- Close recreational fishery outside 10 fm as soon as possible

Option 1 - Commercial *
- South of 40°10', close slope rockfish and DTS fishery for all gears inside of 150 fm; drop 22" minimum size limit

Option 2 - Commercial *
- Close fixed gear fishery outside 10 fm as soon as possible

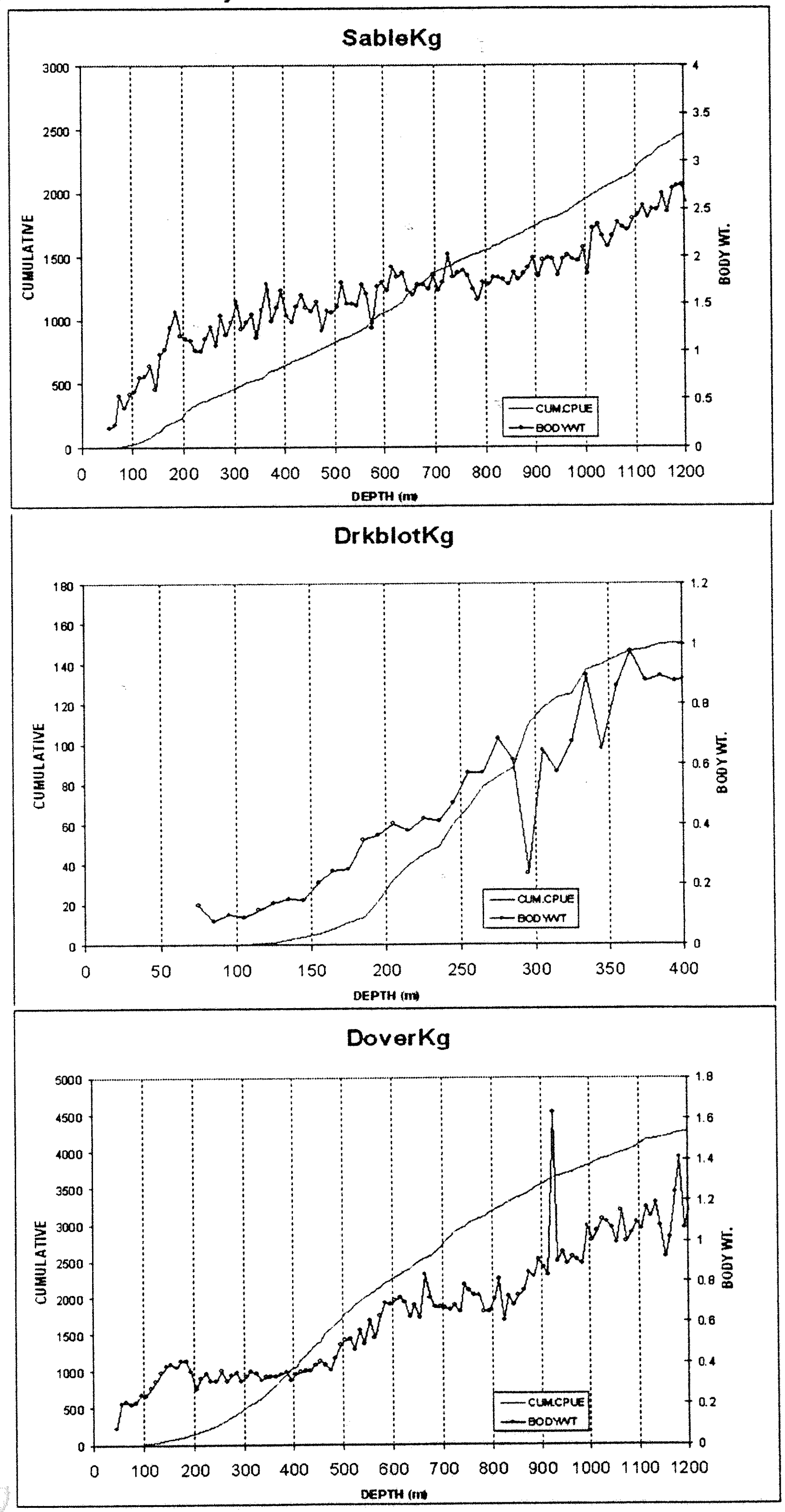
Option 3 - Commercial *
- Consider reopening the following fishery at the September Council meeting:
  1. Trawl nearshore flatfish fishery inside 40-45 fm beginning October 1

Figure 1.--Overview of depth distribution of sablefish, Dover sole, and bocaccio in slope and shelf surveys, coastwide for all years.



Conversion	
Meters	Fathoms
100	56
180	100
200	111
270	150
300	167
400	222
450	250
500	278
540	300

Figure 2.--Overview of depth distribution of sablefish, Dover sole, and darkblotched in slope and shelf surveys, coastwide for all years.



Conversion	
Meters	Fathoms
100	56
180	100
200	111
270	150
300	167
400	222
450	250
500	278
540	300

STATUS OF FISHERIES AND INSEASON ADJUSTMENTS

Situation: In the current groundfish management program, the Council sets annual harvest targets (optimum yield [OY] levels) and individual vessel landing limits for specified periods, with the understanding these vessel landing limits will likely need to be adjusted periodically through the year in order to attain, but not exceed, the OYs. The initial vessel landing limits are based on predicted participation rates, estimates of how successful participants will be at attaining their limits for each period, and comparisons with previous years. The Groundfish Management Team (GMT) tracks landings data throughout the year and periodically makes projections based on all the information available. The GMT presents these landings data and projections to the Groundfish Advisory Subpanel (GAP), and they discuss adjustments that may be necessary and beneficial.

The Council is to consider advice from the GMT, the GAP, and the public on recommended inseason adjustments to the groundfish fishery and adopt changes as necessary.

Council Action: Consider and adopt inseason adjustments if necessary.

Reference Materials: All reference materials will be supplemental attachments.

Agenda Order:

a. Agendum Overview — John DeVore
b. Quota/Species Monitoring Update — Jim Hastie
c. State Regulations in the Pink Shrimp Fisheries — P. Anderson/G. Norman/LB Boydstun
d. Reports and Comments of Advisory Bodies
e. Public Comment
f. **Council Action:** Consider Inseason Adjustments

Groundfish Fishery Strategic Plan (GFSP) Consistency Analysis

The GFSP supports establishing an allowable level of catch that prevents overfishing while achieving OY based on best available science (Sec. II.A.2). The GFSP also supports establishing and maintaining a management process that is transparent, participatory, understandable, accessible, consistent, effective, and adaptable (Sec. II.C). The Council process of adopting inseason adjustments to landing limits is consistent with these GFSP principles.

PFMC
06/04/02

Supplemental Reference Materials

1. Exhibit C.9.d, Supplemental GMT Report.
2. Exhibit C.9.d, Supplemental EC Report.
3. Exhibit C.9.d, Supplemental GAP Report

Exhibit C.10.b
Supplemental GAP Report
June 2002

GROUNDFISH ADVISORY SUBPANEL STATEMENT ON
GROUNDFISH STOCK ASSESSMENT PRIORITIES FOR 2003

The Groundfish Advisory Subpanel (GAP) reviewed the list of stock assessment priorities submitted by NMFS and provides the following comments.

The GAP agrees that Pacific whiting, lingcod, Pacific ocean perch, darkblotched rockfish, and widow rockfish should be subjected to assessment and Stock Assessment Review (STAR) Panel review as proposed.

The GAP also agrees that bocaccio rockfish should be subject to an assessment, but disagrees the assessment should be simply an update or go through a STAR-light process. The implications for management of a bocaccio assessment are significant and there are additional data sources that might be used which have not been previously reviewed by a STAR Panel. In the view of the GAP, this disqualifies bocaccio from the STAR-light process.

The GAP does agree the yellowtail rockfish assessment is a reasonable candidate for a STAR-light process and recommends that this assessment be reviewed in that manner.

The majority of the GAP recommends that an assessment for cabezon be deleted from the list. Given the fact the State of California is directing its efforts and resources towards near-shore management, including potentially management of cabezon, the GAP believes that effort not be expended on cabezon at this time.

Finally, the GAP recommends that a high priority be given to a full assessment of yelloweye rockfish. Given the data sources used - and not used - and the critical status of this species, it is important that a full assessment be undertaken as soon as possible. The GAP understands that a further review of the yelloweye rebuilding analysis might be completed prior to final Council action on harvest specifications in September. The GAP strongly supports such further review so that appropriate data can be included.

PFMC
06/20/02

SCIENTIFIC AND STATISTICAL COMMITTEE REPORT ON
GROUNDFISH STOCK ASSESSMENT PRIORITIES FOR 2003

Dr. Elizabeth Clarke of the National Marine Fisheries Services presented a prioritized list to the Scientific and Statistical Committee (SSC) of species that are proposed for stock assessments in 2003 (Exhibit C.10, Supplemental Attachment 1). Because of workload concerns, the SSC recommends conducting expedited assessments when possible for species on the draft list:

1. Pacific whiting will require a full assessment.
2. Lingcod may be eligible for an expedited assessment.
3. Pacific ocean perch may be eligible for an expedited assessment.
4. Darkblotched rockfish may be eligible for an expedited assessment.
5. Bocaccio would likely require a full assessment to include discard information that will become available this year.
6. Widow rockfish may be eligible for an expedited assessment.
7. Cabezon would be a new assessment.
8. Yellowtail rockfish may be eligible for an expedited assessment.
9. Yelloweye rockfish will have new data, from submersibles and other sources, available in 2003 with a full assessment planned for 2004.

In addition, the SSC recommends that cowcod rockfish be considered for an assessment in 2003. The SSC suggests that as soon as possible:

- the most recent assessments for the stocks listed above be reviewed,
- stock assessment authors for 2003 be identified,
- decisions be made whether each stock is eligible for an expedited or full review,
- the number of stock assessment review (STAR) Panels required during 2003 be determined.

The SSC notes that groundfish STAR Panels will need to be coordinated with those for coastal pelagics. The SSC also notes a review of the 2002 STAR process has not been conducted, but anticipates there may be an opportunity for this review in November 2002.

PFMC

06/20/02

Exhibit C.10
Situation Summary
June 2002

GROUNDFISH STOCK ASSESSMENT PRIORITIES FOR 2003

Situation: As per the Council's stock assessment and review procedures, stock assessment priorities are to be set in June to allow sufficient time for assessment authors to obtain relevant data for next year's assessments. Dr. Elizabeth Clarke will present a list of proposed species for assessment in 2003 and issues to consider in setting assessment priorities for 2003.

Council Task: Discussion and guidance.

Reference Materials:

1. STAR Process Update and Draft Stock Assessment List for 2003 (Exhibit C.10, Supplemental Attachment 1).

Agenda Order:

a. Agendum Overview — John DeVore
b. Reports and Comments of Advisory Bodies
c. Public Comment
d. Council Discussion and Guidance

Groundfish Fishery Strategic Plan (GFSP) Consistency Analysis

This agenda item is consistent with GFSP goals for science, data collection, monitoring, and analysis (Sec. II.B).

PFMC
06/05/02

STOCK ASSESSMENT PRIORITIES FOR 2003

DRAFT

WHITING (NWC)

LINGCOD (WDFW & NWC)

POP (NWC)

DARKBLOTCHED (NWC)

BOCACCIO (SWC) update

WIDOW (SWC)

CABEZON (CDFG & SWC) new assessment

YELLOWTAIL (NWC & WDFW) update

YELLOWEYE (WDFW & NWC) prep for 2004

Summer Stock Assessment Schedule 1

June Council meeting	June 17-21
Stock Assessment/STAR (yelloweye and bocaccio)	Week of July 29
Groundfish Management Team (GMT) meeting	Week of August 5
Allocation Committee meeting	Week of August 12
Briefing Book Deadline	August 21
September Council meeting	September 9-13

Summer Stock Assessment Schedule 2

June Council Meeting	June 17-21
Groundfish Management Team (GMT) meeting	As scheduled (week of July 29)
STAR Panel meeting	August 11-14 (Sun-Wed), Seattle
SSC & GMT meetings	August 15-16 (Thurs-Fri), Portland
Allocation Committee meeting	August 19-20 (Mon-Tues), Portland
Briefing Book Deadline	August 21 (Wed)
September Council Meeting	September 9-13

Exhibit C.10
Supplemental NMFS Attachment
June 2002

STOCK ASSESSMENT PRIORITIES FOR 2003

This table lists species that have one or more reasons to be on a priority list for assessment in 2003. This number of assessments exceeds the rate of approximately six per year that has occurred in recent years, and would strain the system's capacity to conduct and review assessments. It is likely that some will have to be delayed or conducted as a minimal update. For any that are delayed, an effort will be made to produce a brief status report and determine if trends from the previous assessment would indicate a risk of drifting into overfishing.

SPECIES	AGENCIES	LAST ASSESSMENT	USES 2001 SURVEY	2 YR REBUILD UPDATE	FULL OR UPDATE ASMT.
WHITING	NW	2002	YES		FULL
LINGCOD	WA & NW	2000	YES	YES	FULL
YELLOWEYE	WA & NW	2001			FULL
BOCACCIO	SW	2002	YES	YES	FULL
P.O.P.	NW	2000	YES	YES	
DARKBLOTCHED	NW	2000-2001	YES	YES	
WIDOW	SW	2000		YES	
CABEZON	CA & SW	NEW			FULL
COWCOD	SW & CA	1999		YES	
BLACK	CA, OR, WA	1999			FULL
YELLOWTAIL	WA & NW	2000	YES		

Liz Clarke
Rick Methot

GROUNDFISH ADVISORY SUBPANEL STATEMENT ON SCOPING FOR DELEGATION OF NEARSHORE MANAGEMENT AUTHORITY

The Groundfish Advisory Subpanel (GAP) received a presentation from the California Department of Fish and Game (CDFG) on the question of delegation of nearshore management authority. Although somewhat hampered by the fact that the voluminous background material on this subject was not received by GAP members until the afternoon prior to the presentation, the GAP, nevertheless, provides the following comments.

While a minority of the GAP believes the Council should adopt some of the conservative management approaches to rockfish embodied in the California plan, the GAP still unanimously opposed delegation of nearshore management authority, and recommends the Council give this issue a low priority in light of the many more crucial issues facing the Council.

The GAP believes the types of authority transfer being contemplated will cause additional confusion to resource users, an added cost, and could actually increase discards. Vessels legally fishing in the Exclusive Economic Zone (EEZ) off California and either not registered in California or landing in Oregon could be forced to discard species on the delegated list which could otherwise be legally taken.

The GAP notes there is no provision for full participation in California management decisions by non-residents who are affected by the law. In the similar case of deferred management in the Alaskan crab fisheries, there are avenues of non-resident participation and checks and balances to ensure the rights of non-residents are accommodated.

Even residents can be adversely affected by the management process, as they now will be forced to attend California Fish and Game Commission meetings as well as Council meetings to keep abreast of nearshore rockfish science and management. Several GAP members noted that these meetings are often scheduled concurrently.

Questions were also raised as to how science would be coordinated between the Council and California, given that some of these species exist inside and outside California waters and off the shores of more than one state.

Finally, it is unclear to the GAP whether sufficient resources will be available to the CDFG to conduct the necessary level of research, management, and enforcement if nearshore species are transferred. If these fiscal and personnel resources are not available, then there is a question of whether the fish stocks and the users will be better off with transfer of management.

While the GAP is sympathetic to the fact CDFG faces difficult legislative mandates, it is not a problem the Council or resource users should have to address.

PFMC
06/20/02

Exhibit C.11.b
Supplemental NMFS Response Letter
June 2002

RECEIVED

JUN 11 2002

PFMC

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
1315 East-West Highway
Silver Spring, Maryland 20910

THE DIRECTOR

JUN - 3 2002

Mr. Tom Hafer
10400 Santa Ana Road
Atascadero, California 93422

Dear Mr. Hafer:

Thank you for your letter to President Bush regarding the management of the West Coast nearshore groundfish fishery off California.

Many species in the groundfish fishery are in severe decline. As you know, nearshore fisheries off California are currently managed under both state (California Department of Fish and Game (CDFG)) and Federal (National Marine Fisheries Service (NMFS)) regulations. These regulations apply to the commercial, recreational, and tribal sectors. NMFS has declared nine groundfish species as overfished (bocaccio, lingcod, Pacific Ocean perch, canary rockfish, cowcod, darkblotched rockfish, widow rockfish, yelloweye rockfish, and Pacific whiting). While these overfished species are not generally found in the nearshore waters as adults, some of them, including bocaccio and canary rockfish, enter nearshore waters during early life stages. While in nearshore waters, young overfished species are caught by both nearshore commercial and recreational fishermen. As groundfish species decline, additional management measures, such as area closures, may be necessary to protect groundfish stocks.

In response to your concern about CDFG's proposal to close the commercial nearshore fishery off California, NMFS is considering implementing area closures not only for commercial nearshore fisheries, but also for recreational groundfish fisheries and commercial shelf fisheries as well. NMFS is considering taking such action to protect declining West Coast groundfish stocks. However, NMFS is also considering other management measures that will protect declining groundfish stocks and will cause less economic harm to West Coast communities.

I hope you will continue to make your comments available to NMFS and the Pacific Fishery Management Council (Council). I encourage you to remain involved in the management process by attending meetings and writing letters to your state and Federal representatives. Please contact the Council toll free at 1-866-806-7204 for information on upcoming meetings. Management decisions for the 2003 groundfish fishery will next be discussed at the June 17-21, 2002, Council meeting in San Francisco, California.

I appreciate your interest in this matter.

Sincerely,

John Oliver

for William T. Hogarth, Ph.D.

State of California - The Resources Agency
GRAY DAVIS, *Governor*

DEPARTMENT OF FISH AND GAME
http://www.dfg.ca.gov
1416 Ninth Street
Sacramento, CA 95814

(562) 342-7108

RECEIVED
MAY 13 2002
PFMC

May 9, 2002

Dr. Donald O. McIsaac, Executive Director
Pacific Fishery Management Council
7700 NE Ambassador Place, Suite 200
Portland, Oregon 97220-1384

Re: Nearshore Fishery Management Plan

Dear Dr. McIsaac:

Enclosed is a draft copy of the Nearshore Fishery Management Plan (Nearshore FMP) recently completed by the Department of Fish and Game (Department) for California's nearshore finfish fishery. The plan has been revised by comments received through peer review and preliminary public review. It was submitted to the Fish and Game Commission (Commission) on May 9, 2002, for the formal public review process. The Commission will take public comments during several meetings and could adopt the plan in late August, and implementing regulations by November 2002.

In order to make the Nearshore FMP more readable, it has been organized into three sections:

- Section 1 presents the Department's proposed management strategy.
- Section 2 includes the environmental analysis required under the California Environmental Quality Act.
- Section 3 includes draft regulations that would implement the Department's proposed management strategy. The Nearshore FMP provides a framework in which the Commission can build specific management strategies that respond to management needs on a regional as well as ecological basis. Adaptability and flexibility are hallmarks of the plan.

All but four species included for management through the Nearshore FMP are currently covered by the federal Groundfish Fishery Management Plan (Groundfish FMP). Many of those species occur exclusively in California, and several range as far north as Oregon. Although the Groundfish FMP was constructed to manage on a

All but four species included for management through the Nearshore FMP are currently covered by the federal Groundfish Fishery Management Plan (Groundfish FMP). Many of those species occur exclusively in California, and several range as far north as Oregon. Although the Groundfish FMP was constructed to manage on a coastwide basis, effective implementation of the Nearshore FMP may best be accomplished by a transfer of authority for several or all of the groundfish species included in the Nearshore FMP. Therefore the plan explains the need for the transfer of authority for certain nearshore groundfish to California.

We know that the Pacific Fishery Management Council and scientific and advisory bodies will want to thoroughly consider this subject and we will be submitting a more specific Transfer Of Authority (TOA) document for discussion. However, the nearshore FMP provides the background, management approach, and analysis of alternatives that will allow the discussion of TOA to be comprehensive.

If you have any questions please do not hesitate to contact me at the above numbers or Mr. LB Boydstun, Intergovernmental Affairs Office at (916) 651-6281.

Sincerely,

Patricia Wolf

Patricia Wolf, Regional Manager

Enclosures

EXECUTIVE SUMMARY

This Nearshore Fishery Management Plan (NFMP) is presented in three sections. Section 1 presents the background to the NFMP as well as the Department's proposed management strategy. Section 2 includes the environmental analysis (Fish and Game Code Section 781.5), including a review of alternatives and options, some of which were recommended by constituents in the review of the initial draft NFMP. Section 3 includes regulations that would implement the Department's proposed management strategy.

Below is a brief summary of each of the chapters in Section 1.

Chapter 1: Introduction

Chapter 1 begins by placing the NFMP within the context of the Marine Life Management Act (MLMA's) goals, objectives, policies, and mandates. Applying the MLMA to the nearshore fishery begins with a definition of problems in the fishery that require management attention. Chapter 1 includes a consensus problem statement developed by the NFMP Advisory Committee, which is composed of constituents with diverse interests in the nearshore fishery.

The Department applied the MLMA to problems identified in the statement in developing a set of goals and objectives for management of the nearshore fishery through the NFMP. The five goals are:

- Insure long-term resource conservation and sustainability,
- Employ science-based decision-making,
- Increase constituent involvement in management,
- Balance and enhance socio-economic benefits, and
- Identify implementation costs and sources of funding.

Each goal is accompanied by objectives, all of which are based directly upon the MLMA. Some objectives include more detailed guidance recommended by the Department.

To meet the MLMA mandate for adaptive management, the NFMP establishes a hierarchical framework within which adjustments to the management of the nearshore fishery can be made in a responsible and timely manner. This framework structure begins with regular review of the management of the fishery. The NFMP provides examples of the types of the biological and socio-economic issues that may trigger a change in management.

In response to this review, the Department may recommend that the Commission take one of four types of action:

- Amendment of the FMP, in order to change species covered by the NFMP, for instance;

- Full Rulemaking Action, in order to adopt management measures that will have a long-term effect, grant discretion in their application, and may have impacts that have not been analyzed previously;
- Notice Action, in order to alter a management measure, such as an annual quota, that has been classified as routine through full rulemaking; and
- Prescribed Action for management actions that are non-discretionary such as closure of a fishery when a quota has been reached.

Each of these actions represents a different degree of change in management and requires a different level of analysis and regulatory process. Amendment of the FMP requires the most analysis and process, including an environmental analysis, while the Department may carry out a Prescribed Action without prior public notice.

Chapter 2: Background

Chapter 2 begins with a description of the process that the Department used in selecting the 19 species of nearshore finfish proposed for management under the NFMP. This process relied upon such criteria as changes in catch levels, special biological characteristics, and special habitat needs. The 19 species are as follows:

Black rockfish	*Sebastes melanops*
Black-and-yellow rockfish	*Sebastes chrysomelas*
Blue rockfish	*Sebastes mystinus*
Brown rockfish	*Sebastes auriculatus*
Cabezon	*Scorpaenichthys marmoratus*
Calico rockfish	*Sebastes dallii*
China rockfish	*Sebastes nebulosus*
Copper rockfish	*Sebastes caurinus*
Gopher rockfish	*Sebastes carnatus*
Grass rockfish	*Sebastes rastrelliger*
Kelp greenling	*Hexagrammos decagrammus*
Rock greenling	*Hexagrammos lagocephalus*
Kelp rockfish	*Sebastes atrovirens*
Monkeyface prickleback	*Cebidichthys violaceus*
Olive rockfish	*Sebastes serranoides*
Quillback rockfish	*Sebastes maliger*
California scorpionfish	*Scorpaena guttata*
California sheephead	*Semicossyphus pulcher*
Treefish	*Sebastes serriceps*

Chapter 2 then describes the history and socio-economics of the fishery. The chapter and NFMP focuses upon extractive uses, that is, commercial and recreational fishing. It begins this discussion with a description of the types of statistical information on commercial and recreational fishing that are available, together with their strengths and weaknesses. The chapter then describes general trends in the nearshore commercial and recreational fisheries in the 1980s and 1990s. The chapter presents statistics on trends in the commercial fishery by gear (chiefly, hook-and-line gear, traps, and gill and trammel nets), and discusses reasons for increased landings in the 1990s, including the growth of the live-fish market. The chapter presents trends in recreational fishing for the same periods.

The chapter then analyzes the socio-economic dimensions of the nearshore fishery. It presents general estimates of the economic activity generated by both commercial and recreational fishing. The chapter also analyzes economic values associated with non-extractive uses.

Both state and federal management authorities are then described, including recent federal and state management actions regarding nearshore fish. The state has active management jurisdiction over four of the 19 species: California sheephead, cabezon, rock greenling, and kelp greenling.

Chapter 3: Management Measures for Sustainable Nearshore Fisheries

The core of the NFMP is the recommended management strategy, which aims at meeting the MLMA's primary goal of sustainability by meeting several objectives:

- preventing overfishing,
- rebuilding depressed stocks,
- ensuring conservation, and
- promoting habitat protection and restoration.

The Department proposes to meet these requirements and the goals and objectives of the NFMP by employing five general measures. Each of these measures addresses an aspect of fishery management; together they form an integrated approach to meeting the MLMA guidelines.

1. Fishery Control Rule: The NFMP describes a Fishery Control Rule that includes three stages, recognizing the practical level of knowledge and understanding of the fishery. As knowledge increases, management can become less precautionary. The Fishery Control Rule provides a protocol for determining sustainable levels of fishing that then are enforced through the adoption of specific management tools such as size limits, time/area closures, or gear restrictions.

2. Regional Management: The NFMP recognizes the significant geographical differences in the nearshore fishery and proposes developing management tailored to conditions specific to each of three regions.

3. Marine Protected Areas: The NFMP uses marine protected areas (MPAs) to ensure that the MLMA's objectives for protection of habitat and ecosystem integrity as well as sustainable fisheries are met. The NFMP recognizes the authority of the Marine Life Protection Act (MLPA) to design a Master Plan for MPAs in California. The Master Plan will make recommendations on specific

sites for MPAs, implementation and phasing, funding, monitoring, enforcement, and management. The NFMP includes a recommended approach to MPAs, which should be referenced when citing MPAs to benefit nearshore finfish.

4. Restricted Access: The NFMP bases its approach to restricted access upon the Fish and Game Commission's restricted access policy, and presents four initial options for regional restricted access programs in the commercial fishery.

5. Allocation: The NFMP builds upon the allocation policy adopted by the Commission in December 2000. Total allowable catch (TAC) will be allocated between commercial and recreational fisheries based on historical catches, on a regional level.

Finally, effective implementation of the NFMP's measures will benefit from transfer of management authority to the State for some or all of the nearshore species currently managed under the federal groundfish fishery management plan.

Chapter 4: Research to Support the Nearshore Fishery Management Plan

The NFMP continues with a proposed research plan that aims to support effective and adaptive management of the nearshore fishery by acquiring and applying essential fishery information (EFI), as required by the MLMA. The chapter begins with a discussion of the relevance of specific types of EFI to the management tools described in the previous chapter on the proposed management strategy. The chapter then describes past and current fishery-dependent monitoring of commercial and recreational fisheries and identifies weaknesses in this monitoring. The limited past and current fishery-independent assessment activities of the Department are reviewed together with their shortcomings.

The chapter then describes eight types of EFI, in order of priority:

- spatial and temporal estimates of abundance,
- total mortality by species, as well as temporally and spatially,
- age and growth characteristics,
- recruitment,
- ecological interactions,
- reproductive characteristics,
- distribution of stocks, and
- movement patterns.

The chapter then sets forth a research protocol that aims to fill gaps in EFI, as required by the MLMA. The research plan rests on two bases: improvement of existing fishery-dependent and fishery-independent monitoring and assessment, and a systematic program of research and monitoring in a discrete set of reference sites.

The chapter also describes EFI for the socio-economic dimensions of the fishery, including employment, expenditures and fishery costs, resource demand and net economic value, and revenue. The chapter also describes a research plan for filling gaps in information.

The chapter closes with a review of past and current collaborative research and commits the Department to encourage similar collaboration in designing and implementing the research plan.

Chapter 5: Implementation and Costs

Implementing the broad agenda of the NFMP will focus the Department's energy and budget on management, enforcement and research. Management will focus on the continuous need to collect and analyze reliable data, adapt management to new circumstances and information, and to convene meetings for the public and special interest groups. Enforcement ensures compliance with NFMP regulations and collaborates with scientific staff in conducting research from enforcement vessels. Research will move marine management from a species-based focus to an ecosystem-based, broad scale understanding of environmental events. It will move fishery management from a precautionary estimate of allowable catch to a scientific understanding for fishery facilitation.

Funding for the NFMP implementation will be spread between management, enforcement and research.

STATE OF CALIFORNIA-THE RESOURCES AGENCY GRAY DAVIS, *Governor*

DEPARTMENT OF FISH AND GAME
Marine Region-Southern Operations
4665 Lampson Avenue, Suite C
Los Alamitos, CA 90720
(562) 342-7108

May 24, 2002

Dr. Donald O. McIsaac, Executive Director
Pacific Fishery Management Council
7700 NE Ambassador Place, Suite 200
Portland, Oregon 97220-1384

Re: Transfer of Management Authority Scoping Document

Dear Dr. McIsaac:

Enclosed is a copy of the transfer of management authority (TOA) scoping document drafted by the Department of Fish and Game (DFG) for the Council's June briefing book. Four different management strategies are identified for TOA with an intermediate and long term approach to management. The document also includes a planning and procedure for a federal groundfish plan amendment and an amendment schedule. In addition, the document contains responses to questions and comments received by DFG staff from members of the Council's Groundfish Management Team and Groundfish Advisory Panel regarding TOA.

We know that the Council's scientific and advisory bodies will want to thoroughly review this document and the State's Nearshore Fishery Management Plan (NFMP) that was sent to the Council office May 9, 2002, for discussion at the upcoming June and September Council meetings. The NFMP also contains additional information regarding TOA on pages 78-84 of section 1, chapter 2. The DFG will have staff at the June Council meeting to answer any questions from the Council or its advisory bodies regarding California's request for TOA. Our request is strictly a California initiative, although we have heard that Oregon and Washington may also be interested in TOA for some or all of the nearshore groundfish stocks defined in the Groundfish Plan.

If you have any questions please do not hesitate to contact me at (562) 342-7108 or Mr. LB Boydstun, Intergovernmental Affairs Office, (916) 651-6281.

Sincerely,

Patricia Wolf

Patricia Wolf
Regional Manager
Marine Region

SCOPING DOCUMENT

A REQUEST TO THE PACIFIC FISHERY MANAGEMENT COUNCIL
FOR
AN AMENDMENT TO THE PACIFIC COAST GROUNDFISH PLAN
FOR
THE TRANSFER OF MANAGEMENT AUTHORITY
OF
16 NEARSHORE GROUNDFISH STOCKS
FROM
THE COUNCIL TO CALIFORNIA

Prepared By
Marine Region
California Department of Fish and Game
May 24, 2002

Pacific Coast Groundfish Plan Amendment
Request for Management Authority of 16 Nearshore Groundfish Stocks

Agencies: Pacific Fishery Management Council (Council) and National Marine Fisheries Service (NMFS)

Proposed Action

The State of California is requesting the transfer of management authority for cabezon, kelp greenling, and all minor nearshore rockfish stocks (Table 1) harvested within California's geographic boundaries from the Council. This action may require an amendment to the Pacific Coast Groundfish Plan (Federal Groundfish Plan). If a plan amendment is required to accomplish the transfer of management authority, the amendment must comply with the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA), National Environmental Policy Act (NEPA) and other applicable law. Under NEPA, an environmental assessment (EA) or environmental impact statement (EIS) must be prepared.

Purpose and Need of Proposed Action

The State's request for management authority comes after a decade of increased fishing pressure on certain nearshore groundfish stocks, aggravated relations between recreational and commercial fishermen, gear conflicts between different components of the commercial fishery and with recreational fishermen in some areas, and a change in oceanographic conditions that has reduced productivity and recruitment of nearshore groundfish stocks. The current management approach under the guidance of the Council is not designed to address these nearshore management issues. To address some of these issues, the California Legislature passed the Marine Life Management Act (MLMA) in 1998, which was modeled partly on the MSFCMA. The MLMA provides that fishery management plans (FMP) will form the basis for managing California's recreational and commercial marine fisheries and requires the California Fish and Game Commission (Commission) to adopt an FMP for the nearshore fishery (Nearshore Plan). The MLMA also gave the Commission authority to regulate the commercial fishery for nearshore fish stocks as defined in the Fish and Game Code. This, in addition to its authority to regulate the recreational fishery, gave the Commission regulatory authority over all aspects of the fishery for nearshore fish stocks. This new paradigm will result in the consolidation of both the commercial and recreational regulations in Title 14, California Code of Regulations, which will ultimately simplify regulations for the State's law enforcement officers and constituents.

In order to fully implement the goals and objectives of the Nearshore Plan, a number of key management measures are proposed which go well beyond the current management approach employed by the Council for nearshore groundfish. The draft nearshore plan provides the framework from which the Commission can enact specific localized, management measures that respond to changes in knowledge about the nearshore ecosystem and the nearshore fisheries without the need to amend the plan. The fisheries will be regulated to meet total allowable catches (TAC) using a variety of management measures to affect the catch including time and area closures, gear restrictions, and minimum size limits. Fishery closures to directed harvest will be implemented to stay within allocations and TACs. The Nearshore Plan was released on May 9, 2002, for a formal 45 day comment period, and the Commission is scheduled to adopt the plan at its August 30th, 2002, meeting in Oakland. A total of 19 species has been identified in the State's plan. Sixteen of these stocks are managed by the Council under the guidance of the Federal Groundfish Plan (Table 1). Currently, fourteen of the sixteen stocks are actively managed by the Council (minor nearshore rockfish group), while only two are monitored (cabezon and kelp greenling). Consequently, the State believes it cannot fully satisfy the mandates of the MLMA, implement its Nearshore Plan, and address the concerns of its constituents without the management authority for those nearshore groundfish stocks listed in the Federal Groundfish Plan. The goals and objectives of the Nearshore Plan include the following concepts:

Conservation

- The Nearshore Plan's harvest control rule is adaptive and precautionary and aims ultimately to manage individual species in the context of the overall nearshore ecosystem;

- The Nearshore Plan identifies the need to gather information on bycatch and to reduce it as much as possible;

- The Nearshore Plan calls for identifying key habitat for nearshore fishes and for means of reducing the potential impacts of fishing on these habitats;

- The Nearshore Plan calls for the establishment of a network of marine protected areas to protect and restore marine ecosystems, and to provide for non-consumptive uses;

Economics

- The Nearshore Plan aims to manage commercial and recreational fisheries "to assure the long-term economic, recreational, cultural and social benefits of the fisheries and the marine habitats upon which they depend";

Utilization

- The Nearshore Plan calls for reducing the discard rate associated with bycatch and for developing incentives for efficient use of capital, labor, and fishery resources through restricted access;

Social Factors

- The Nearshore Plan requires increases or decreases in allowable catches be accomplished in a fair and equitable manner;

- The Nearshore Plan calls for minimizing the impacts of fishery management on small-scale fisheries and coastal communities.

The Nearshore Plan's management approach is an integration of five management measures that together, over time, meet the goals and objectives of the MLMA and provide sustainability for the nearshore fisheries and ecosystem. Some of these measures go beyond the current measures employed by the Council for groundfish management. These five measures are:

Fishery Control Rule (FCR)

- The primary mechanism for achieving sustainable use and preventing overfishing. The FCR formula sets the TAC for each species or species group under various stages of fishery information;

Regional Management

- The establishment of three management zones along the California coast is initially recommended to allow for localized fishery planning and policy development;

Resource Allocation

- The fair and equitable distribution of resources between recreational and commercial fishing sectors is called for within each of the management zones;

Marine Protected Areas

- The inclusion of reserves, parks and conservation areas within the nearshore ecosystem will be accomplished under the process of the State's Marine Life Protection Act (MLPA);

Restricted Access

- The reduction of the commercial fishery fleet will be matched with resource availability.

Management Background

West Coast groundfish management evolved in the late 1970s with the formation of the Council and the development of the Federal Groundfish Plan, which identifies more than 80 species of groundfish for management. Since then, groundfish management has been focused primarily on those stocks harvested within the exclusive economic zone (EEZ, 3-200 nautical miles), while less attention has been focused on those nearshore stocks harvested primarily within the jurisdictional waters (0-3 nautical mile) of the west coast states.

During the late 1980s, and continuing into the 1990s, landings of many nearshore groundfish stocks began to increase in the commercial fishery. This was in response to increasing demand for high value live-fish to supply restaurants, mostly in the Los Angeles and San Francisco areas. In addition, increasing human population size and shifting patterns of the commercial and recreational fisheries have altered the nearshore fishery off California. For example, the commercial nearshore fishery has converted primarily from a set gill net fishery in the 1970s to a trap and hook-and-line fishery for live-fish in the 1990s. As a result, the commercial fishery has expanded into new species, new geographic areas, and into new habitats, such as kelp beds, which were previously not economical for the lower value dead-fish harvest. Likewise, recreational fishing in the nearshore has expanded geographically since the 1970s as more central and northern California commercial passenger fishing vessels (CPFV) have focused on nearshore fishing, in addition to an increase in the number of private recreational boats also fishing in the nearshore. These factors, combined with recent environmental changes (such as an oceanographic shift to warmer water from the 1970s through the 1990s) have led to localized and larger-scale reductions in nearshore groundfish stocks. As the nearshore fisheries have expanded geographically, areas that are distant from ports, which may have acted as refugia (areas where fish are not taken) in the past, have come under exploitation, further affecting the ability of nearshore stocks to sustain exploitation. Increases in the ex-vessel value paid to commercial fishermen for many of the nearshore stocks has also been important in stimulating increased fishing effort. Some nearshore stocks have gone from less than $1.00 per pound for dead-fish to more than $6.00 per pound for live-fish over the past decade. These trends have developed in the absence of a comprehensive management strategy for nearshore stocks.

The expansion of the nearshore fishery has taken place in the absence of key information that would allow for the assessment of the status of nearshore groundfish populations. Essential fishery information can only be obtained gradually and over a period of several years, resulting in a continually changing base of knowledge upon which to base management decisions. This information flow often lags behind the development of the fishery. As a result, it is hard to determine if current fishing levels are sustainable. Population size is not known for any species in the nearshore fishery, with the exception of some assessment work on black rockfish. In addition, inconsistency in species identification and other factors have made it difficult to determine catch trends for many species of nearshore fishes. Also the recreational small boat and the commercial live-fish fishery are highly mobile and are not dependent on established landing points or fish processing facilities, which makes it difficult to estimate the catch of independent recreational anglers, to track landings, and to enforce reporting requirements for commercial fisheries. Managing this coastwide nearshore fishery is hindered by significant regional differences in biological and socioeconomic factors, and is further complicated by overlapping Federal and State jurisdictions.

Potential Management Strategies and Options
There are four potential management strategies the State can pursue through the Council process to achieve management authority for some or all of the nearshore groundfish stocks listed in table 1. These strategies include: (A) Status Quo; (B) Deletion of Species; (C) Deferral of Management Authority; and (D) Delegation of Management Authority.

Strategy (A) - Status Quo
The Council would continue to manage nearshore groundfish stocks as it has in the past. This would involve the establishment of annual specifications and commercial vessel trip limits for the minor nearshore rockfish complex. There would continue to be two broad management areas off California, separated at Cape Mendocino. The northern area would be managed in concert with Oregon and Washington fisheries. There would be no active management of cabezon or kelp greenling on the Federal level. California would continue to manage cabezon and kelp greenling under annual catch limits and leave the management of minor nearshore rockfish up to the Council process. If this strategy is adopted, the State would not be able to fully

implement key features of its Nearshore Plan, including a fishery control rule, regional management, resource allocation, restricted access, and marine protected areas.

Strategy (B) - Deletion of Species
This action would delete defined nearshore stocks from the Federal Groundfish Plan. Stocks deleted from the Federal Groundfish Plan will no longer be under the management authority of the Council. For example, the harvest control rules outlined in the Federal Groundfish Plan for minor nearshore rockfish and other minor nearshore fishes would not apply to those stocks deleted from the plan. This action will require a plan amendment and could result in a loss of Federal funding and/or logistical support for those stocks removed from the Federal Groundfish Plan.

Options for Strategy (B)
B.1. Delete reference to cabezon, kelp greenling, and all 14 minor nearshore rockfish stocks from the Federal Groundfish Plan (Table 1). Under this option, a portion of the harvest guideline (HG) for minor nearshore rockfish north of Cape Mendocino would need to be allocated to California.

B.2. Delete reference to the nine minor nearshore rockfish stocks that are harvested almost exclusively within California's jurisdictional waters and adjacent EEZ waters from the Federal Groundfish Plan (Figure 1, Tables 1 and 2). Here again, a portion of the HG for minor nearshore rockfish north of Cape Mendocino would need to be assigned to California.

Strategy (C) - Deferral of Management Authority (interim approach)
This action would give California jurisdiction over vessels registered under State law while fishing anywhere in the EEZ for defined nearshore groundfish stocks provided the State's regulations are consistent with the Federal Groundfish Plan and applicable Federal fishing regulations (MSFCMA section 306 (a)(3)(A)). This action would require a majority vote of the Council members to make a consistency determination, but it might also require an amendment to the Federal Groundfish Plan, depending upon the planned degree of deviation in the State's regulations. California's laws would apply to California registered vessels while fishing for nearshore groundfish in the EEZ off Oregon and Washington, but would not apply to Oregon and Washington vessels fishing for nearshore groundfish in EEZ waters adjacent to California, if they are not registered in California and do not land their catches in California. Under this Strategy, the State would request the Council to forego or alter its annual specifications and/or defer all management measures affecting minor nearshore rockfish (and cabezon and kelp greenling) in California waters to the State. It could also request to continue the current optimum yields (OY) for nearshore rockfish, or the State could propose new OYs based on the more conservative harvest formulae in the Nearshore Plan. The State would determine allocations or fishery set-asides, subregion catch limits, and all other management measures affecting the catch of nearshore rockfish, kelp greenling and cabezon in State waters, and by State registered vessels. The State would be responsible for closing the fisheries upon attainment of individual or total area catch limits and allocations. Regulations of fisheries in Federal waters would be accomplished by either: 1) continuing to set vessel trip limits that only apply to Federal waters (fish must be landed outside of California) or 2) asking NMFS to harmonize its regulations with the State. Under both of the following options, it is understood that a portion of the OY for minor nearshore rockfish north of Cape Mendocino would be assigned to the State.

Options for strategy (C)
C.1. Defer management authority for cabezon, kelp greenling, and all 14 minor nearshore rockfish stocks listed in the Federal Groundfish Plan from the Council to California (Table 1).

C.2. Defer management authority for only those nine minor nearshore rockfish stocks harvested almost exclusively within California's jurisdictional waters and adjacent EEZ waters from the Council to California (Figure 1, Tables 1 and 2).

Strategy (D) - Delegation of Management Authority (long term approach)
This strategy is similar to strategy (C)-Deferral of Management Authority. The major difference is that California would be able to enforce its regulations on all U.S. fishing vessels while fishing in the EEZ adjacent

to State waters. This action would require a three-quarters majority vote by the Council members for approval and an amendment to the Federal Groundfish Plan (MSFCMA section 306 (a)(3)(B)). The amendment could also specify a process whereby the State reports the consistency of its regulations to the Council relative to the Federal Groundfish Plan. Under both of the following options, a portion of the OY for minor nearshore rockfish north of Cape Mendocino would be assigned to California.

Options for Strategy (D)
D.1. Delegate management authority for cabezon, kelp greenling, and all 14 minor nearshore rockfish stocks listed in the Federal Groundfish Plan from the Council to California (Table 1).

D.2. Delegate management authority for only those nine minor nearshore rockfish stocks harvested almost exclusively within California's jurisdictional waters and adjacent EEZ waters from the Council to California (Figure 1, Tables 1 and 2).

Planning and Procedure Needs for a Federal Groundfish Amendment

Composition of Proposed Plan Development Team:
To be determined.

Proposed Advisory Panel Composition (5 members):
GAP (2): one California LE commercial member and one California recreational member (CPFV).

California Nearshore Advisory Panel (3): one OA member, one recreational (non-CPFV) member, and one at-large member.

Plan Amendment Support:
CDFG: preparation of all Council and Federal documents including meeting records, meeting room arrangements in California, and per diem and travel support for CDFG Team members.

NMFS: per diem and travel support for NMFS staff.

PFMC: technical staff assistance including meeting notices, per diem and travel support for GAP and staff members, and document copying and distribution.

Federal Groundfish Plan Amendment Schedule

June 2002: the Council will hold a scoping session to receive input on the Transfer of Authority Amendment from advisory panels and public.

September 2002: the Council will finalize the scoping session, followed by a decision to proceed with amendment to Federal Groundfish Plan.

November 2002: working on draft Federal Groundfish Plan amendment.

March 2003: Council receives input from the advisory groups and schedules public hearings.

May 2003: public hearings on draft plan amendment.

June 2003: the Council will take final action on transfer of authority amendment.

July 2003: adopted plan amendment is sent to the NMFS for review and adoption by the Secretary of Commerce.

January 2004: plan amendment is completed and State takes over management of target species.

Responses to Questions Received from the Groundfish Advisory Panel on April 9, 2002

Question (Q)1. Will the Council retain control over setting the OYs for the nearshore fishery if the State receives management authority for some or all the stocks? If so, what method will the Council use to determine the OY for each management region within the Councils jurisdiction?

Response (R)1. In general, no matter what course of action is adopted, a transition period will be necessary before the adopted action is fully implemented. If deletion is selected as the preferred option, all or some of the stocks under consideration for management authority would be removed from the Federal Groundfish Plan, which would mean no Council or Federal government involvement. However, if deferral or delegation is adopted, the Council could continue to set the OYs, and the State could assume the responsibility for fishery allocations, subregion catch limits and management measures needed to stay within those limits. During the transition period, the State and the Council would work together to equitably solve the issue of transboundary stocks in the area north of Cape Mendocino.

Q2. What if a species of fish is deleted from the Federal Groundfish Plan and added to the State's Nearshore Plan, will the Council review the States management goals and objectives to ensure the State is adhering to its management plan?

R2. If a species were deleted from the Federal Groundfish Plan there would no longer be any Council or Federal government involvement in the management of that species. However, if an FMP defers or delegates management authority to the State for some or all of the 16 nearshore groundfish stocks, it would have to adopt some form of review process to ensure State regulations are consistent with the Federal Groundfish Plan, the MSFCMA, and other applicable Federal laws. Additionally, there could be a process by which constituents may appeal a State regulation they feel is incompatible with the FMP through the Council.

Q3. What if the Council closes the open access (OA) fishery and issues a permit based on participation since 1994, and the State also issues a nearshore permit but with different requirements, what will the State do with those fishermen who might fit one requirement but not another?

R3. Both California and the Council are considering limited entry (LE) programs affecting OA groundfish fisheries. The scope and extent of the two programs, as currently being discussed, are expected to overlap with regard to some or all minor nearshore rockfish. Discussions have begun with regard to the need to coordinate the two programs to avoid conflicting qualification criteria and permit application process for species of mutual concern. This potential conflict could be avoided by assigning, through the Plan Amendment process, specific nearshore fish stocks in specific areas off California to the State management process, inlcuding the State's LE program.

Q4. Will those fishermen with an A-permit, and who currently have an allocation of the minor nearshore groundfish under the Council management scheme but have not made landings of nearshore groundfish receive a California restricted access permit?

R4. Most of the fish in question occur in State waters and the State retains management authority in those waters. If the Commission opts to disregard A-permit status as a sole qualification criterion for a State program, the permit holder will have the option of appealing the decision to the Commission or the NMFS. This is a matter should be taken up early in the Commission process. Currently, a restricted access Nearshore Finfish Permit is required by the State for landing six species of shallow-dwelling nearshore rockfish, which effectively limits participation by any A-permit holders who did not already qualify for the existing State Nearshore Finfish Permit. A legal opinion from the NMFS might be helpful in this regard.

Q5. Will California submit its Nearshore Plan to the Council for approval? If so, will the Council be able to change it in part, or will the Council have only a yes or no option?

R5. As part of the scoping process, the State will submit its Nearshore Plan to the Council and the NMFS for review and comment. The State will review any comments received from the Council and NMFS. Also, a formal 45-day comment period for the draft Nearshore Plan began May 9, 2002, and any suggestions for revision by the Council or NMFS could be made as part of that California Environmental Quality Act process. However, the Commission will continue to receive comments up to the Nearshore Plan's adoption hearing set for August 30th, 2002, in Oakland.

Q6. What will happen to the LE OY for nearshore groundfish stocks if California receives management for them?

R6. See Answer R4. State management is expected to provide for nearshore rockfish harvest guidelines off California that are the same or similar to current levels. The Nearshore Plan does not currently recognize a distinct set-aside (allocation) of fish for A-permit holders. This is a matter that should be taken up during the comment period on the draft Nearshore Plan.

Q7. Who will conduct stock assessments for nearshore groundfish stocks, if NMFS is not involved in the management of these fish?

R7. Under deferral and delegation, the species would continue to appear in the Council Groundfish Plan; hence, the NMFS would presumably have a justification to work on them. In addition, the CDFG has taken the lead in organizing a cooperative sampling program for the nearshore called CRANE - Cooperative Research and Assessment of Nearshore Ecosystems. The CRANE program will eventually provide important information for assessment and management of nearshore finfish, including rockfish.

Q8. How will the Council handle the commercial OY and the recreational set aside for those seven transboundary stocks?

R8. If the State receives management authority for those seven transboundary stocks, it will develop total allowable catch limits and allocations within subregions of the State based on those guidelines described in the Nearshore Plan. South of Cape Mendocino, *Sebastes* have traditionally been managed separately by the Council, and State management in that area would not affect transboundary stocks. North of Cape Mendocino, it would be necessary for the State to coordinate with the Council to ensure that an equitable portion of the northern nearshore rockfish OY was made available for California fisheries.

Q9. What are the preferred management action(s) and preferred option(s) of the State?

R9. The preferred approach to transfer of authority would involve two distinct steps. Initially (as an interim approach) the State would seek deferral of management authority for all sixteen nearshore groundfish stocks listed in the Nearshore Plan. Eventually, it would be appropriate for the State to seek delegation of authority, but only after the process of implementing the Nearshore Plan has progressed and framework provisions in the Nearshore Plan have been used to develop a comprehensive management program. Delegation would be contingent upon the State establishing autonomous geographic management regions. For each region, it will be necessary to determine a TAC for each species or species group, and specific allocation of those TACs between recreational and commercial sectors. At that time, delegation would become the preferred option. As part of the preferred option, the State would like to keep the NMFS actively involved with ongoing research, stock assessments, and data collection of nearshore groundfish.

Comments Expressed by the Groundfish Advisory Panel on April 9, 2002

Comment (C)1. California's request for transfer of management authority for nearshore groundfish stocks is moving too quickly through the Council. The GAP does not have the time to review this issue and all the other management issues before it including: a review of the Nearshore Plan, restricted access, and marine protected areas.

Response (R)1. We appreciate these concerns. California has major challenges with regard to nearshore fish stocks and the State is in a much better position than the Council to deal with them. The Council amendment process can take a year or longer to complete: thus time is critical in terms of relieving the Council of California's issues with regard to management of its nearshore fish stocks.

C2. The GAP would like to review the final adopted version of the Nearshore Plan before they make any statements regarding the transfer of management authority to California.

R2. The Nearshore Plan is expected to be finalized well before the Transfer of Authority issue has been decided.

C3. Some GAP members expressed concern that the Nearshore Plan would not protect their current rights under the Council system to fish those nearshore groundfish stocks currently listed in the Federal Groundfish Plan.

R3.This should be taken up during the public comment period on the draft Nearshore Plan.

C4. The Fish and Game Commission has no vested interest in protecting California's nearshore commercial fishery.

R4. Not true. Half of the Commission members are business people dependent upon private enterprise for a living. The Commission has been charged by the Legislature under the MLMA to equitable manage the nearshore fishery, which included the commercial fishery. We expect the Final Nearshore Plan and Implementing Regulations to reflect a balance in fishing opportunity for the two sectors.

C5. A concern was expressed that the Commission is leaning toward a specific management option in the Nearshore Plan that would eliminate all commercial fishing within the nearshore management zone, also known as the Washington State option.

R5. Not true. There is a "Washington State" option, which bans nearshore commercial fishing. However, it is still an option and we are not aware of a preference for that or any other option. A final decision on the options is expected at the Commission's adoption hearing set for August 30th, 2002, in Oakland.

C6. Some individuals expressed no support for the delegation of management authority.

C7. Some individuals would like to see the State manage only kelp greenling and cabezon.

R7. This is status quo.

Table 1. Nearshore groundfish stocks that are currently managed by the Council which are also listed in California's Nearshore Plan.

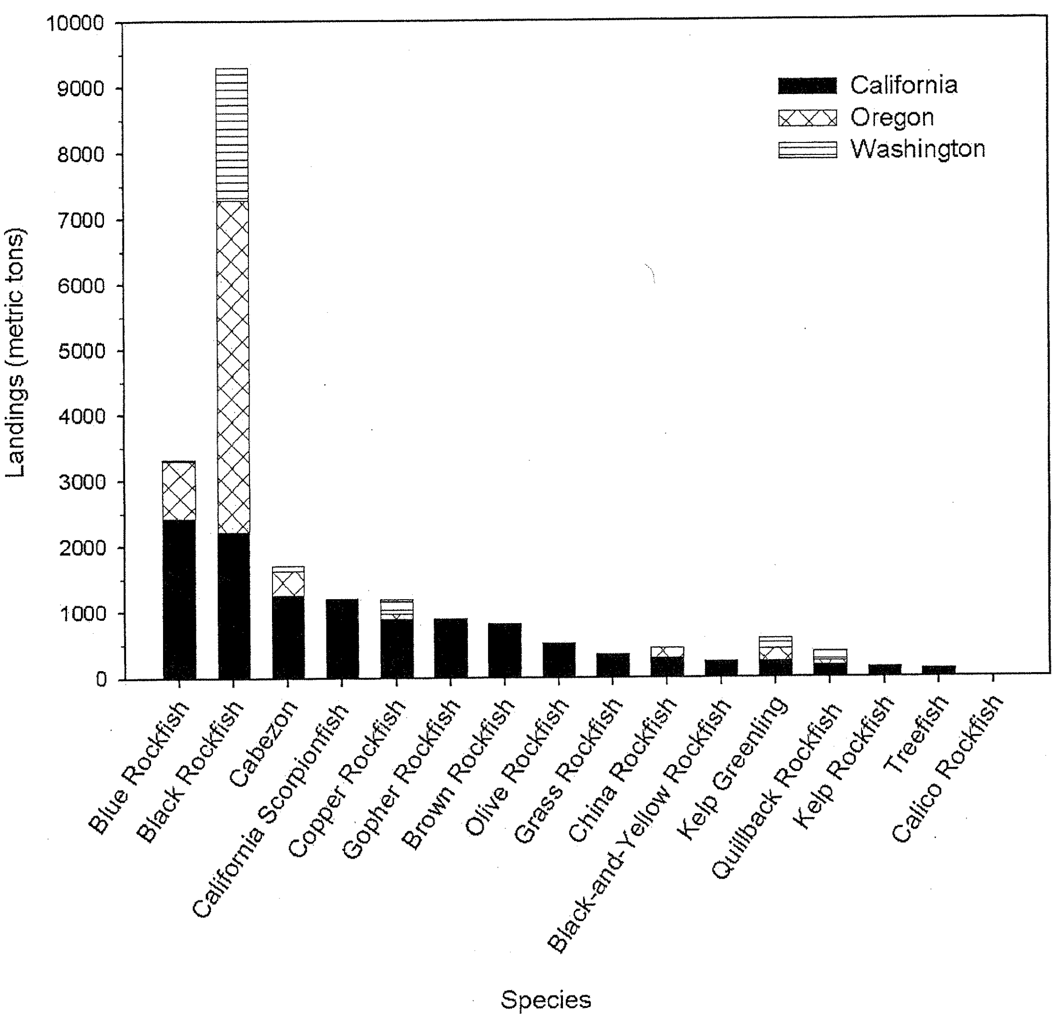
Minor Nearshore Rockfish (Actively Managed)		Other Nearshore Groundfish (Monitored)
Black Rockfish, *Sebastes melanops*	Copper Rockfish, *Sebastes caurinus*	Cabezon, *Scorpaenichthys marmoratus*
Black-and-Yellow Rockfish, *Sebastes chrysomelas*	Grass Rockfish, *Sebastes rastrelliger*	Kelp Greenling, *Hexagrammos decagrammus*
Blue Rockfish, *Sebastes mystinus*	Gopher Rockfish, *Sebastes carnatus*	
Brown Rockfish, *Sebastes auriculatus*	Kelp Rockfish, *Sebastes atrovirens*	
Calico Rockfish, *Sebastes dallii*	Olive Rockfish, *Sebastes serranoides*	
California Scorpionfish, *Scorpaena guttata*	Treefish, *Sebastes serriceps*	
China Rockfish, *Sebastes nebulosus*	Quillback Rockfish, *Sebastes maliger*	

Table 2. Combined commercial and recreational landings (metric tons) for 16 nearshore groundfish stocks for California, Oregon, and Washington, 1993-2000.

Minor Nearshore	California	Oregon	Washington	Total
Black Rockfish	2,220	5,062	2,009	9,291
Black-and-Yellow Rockfish	238	0	0	238
Blue Rockfish	2,426	878	17	3,320
Brown Rockfish	814	1	6	820
Calico Rockfish	4	0	0	4
California Scorpionfish	1,205	0	0	1,205
China Rockfish	286	151	11	448
Copper Rockfish	899	78	218	1,194
Gopher Rockfish	894	0	0	894
Grass Rockfish	353	4	0	358
Kelp Rockfish	150	0	0	150
Olive Rockfish	523	0	0	523
Quillback Rockfish	183	62	130	375
Treefish	113	0	0	113
Other Minor Nearshore				
Cabezon	1,261	632	82	1,705
Kelp Greenling	235	194	162	592
Total	11,804	6,792	2,635	21,230

Data sources: PacFin and RecFin (all modes)
Generic PacFin landing groups were not computed to include the designations other rockfish and nearshore rockfish.

Figure 1. Combined commercial and recreational landings (metric tons) for 16 nearshore groundfish stocks for California, Oregon, and Washington, 1993-2000.



note: four metric tons of calico rockfish was landed in California.

Exhibit C.11
Situation Summary
June 2002

SCOPING FOR DELEGATION OF NEARSHORE MANAGEMENT AUTHORITY

Situation: The Groundfish Strategic Plan contemplates delegation or deferral of management authority for certain nearshore species to the states, particularly species that reside in and are harvested primarily within state waters. The Strategic Plan notes "the Council and NMFS are not well suited to assess the biological requirements of many of these local populations, to assess the social and economic issues associated with them, or to monitor localized fisheries." Therefore, the Strategic Plan recommends the Council "[c]onsider delegating or deferring nearshore rockfish and other groundfish species, such as scorpionfish, greenling, and cabezon, to the States." (Groundfish Strategic Plan, Management Policies Recommendation, page 13).

California Department of Fish and Game (CDFG) is developing a fishery management plan (FMP) for California's nearshore finfish fishery. The California Fish and Game Commission (CFGC) could take final action on the nearshore FMP as early as August 2002. For Council information and discussion, CDFG will present a brief overview of their draft nearshore FMP. The Exclusive Summary from this document is included as Attachment 1.

CDFG is also scoping transfer of management authority for several groundfish species that would be managed under their nearshore FMP. Approximately 16 of the species included in the draft state FMP are currently managed under the federal Pacific Coast Groundfish FMP. CDFG notes that effective implementation of their nearshore FMP depends on transfer of management authority from the federal FMP to the state FMP. To provide information to the Council and scope public comment on the issue of transferring management authority, CDFG will present a brief review of their *Transfer of Management Authority Scoping Document* (Attachment 2).

Information about California's nearshore FMP and transfer of management authority scoping will also be provided to the Council Scientific and Statistical Committee (SSC), Groundfish Advisory Subpanel (GAP), and Groundfish Management Team (GMT). It is anticipated each of these advisory committees will provide reports to the Council.

Per Council request at the April 2002 meeting, the discussion of nearshore management authority will include opportunity for the states of Oregon and Washington to comment on their interest in seeking transfer of management authority in their respective states.

During the discussion of the transfer of authority issue, the Council may want to consider how it intends to formally review and comment on both CDFG's nearshore FMP and transfer of management authority request. That is, what sort of process might be necessary to review the voluminous information and formally comment on this topic to the CDFG and CFGC?

Council Task: Discussion

Reference Materials:

1. Exhibit C.11, Attachment 1, CDFG draft Nearshore FMP – Executive Summary.
2. Exhibit C.11, Attachment 2, CDFG Transfer of Management Authority Scoping Document.
3. Exhibit C.11.b, Supplemental SSC Report.
4. Exhibit C.11.b, Supplemental GMT Report.
5. Exhibit C.11.b, Supplemental GAP Report. Received 6/21/02

Agenda Order:

a. Agendum Overview — Dan Waldeck
b. Reports and Comments of Advisory Bodies
c. Public Comment
d. Council Discussion

more Supplemental Reference materials
6. Exhibit C.11.b, Supplemental NMFS Response Letter.

PFMC
06/04/02

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GMT C.4.b overhead

<Supplemental Presentation by Dr. Hastie>

Overview of relationships between rebuilding times and likelihoods of success