Agenda Item F.2.a
Attachment 3
June 2006

DRAFT

Amendment 16-4
(Overfished Species Rebuilding Reprise)

PACIFIC COAST GROUNDFISH FISHERY MANAGEMENT PLAN

FOR THE CALIFORNIA, OREGON, AND WASHINGTON GROUNDFISH FISHERY

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JUNE 2006

This document is published by the Pacific Fishery Management Council pursuant to National Oceanic and Atmospheric Administration Award Number FNA03NMF4410067 and FNA17FC1641.

Changes to the FMP Since the Version Published in July 1993

The last generally available version of the Groundfish FMP was produced in July 1993 and incorporated changes made through Amendment 7. In addition to adding material required by the 1996 Sustainable Fisheries Act, Amendment 11 included a general editorial clean-up of Chapters 1–6. However, a revised version of the full document was never produced. Major changes to the content and organization of the FMP, since Amendment 7 and aside from the overall revisions of Chapters 1–6 made by Amendment 11, are summarized here to help clarify references to parts of the FMP in other Council documents.

Chapters in July 1993 FMP	Changes Made Through the Current Version of the FMP
Chapter 1 Introduction	No changes since Amendment 11
Chapter 2 Goals and Objectives	Amendments and additions, no substantial change in organization. (Amendments 12, 13, 16-1, and 17.)
Chapter 3 Areas and Stocks Involved	Amendments and additions, no substantial change in organization. (Amendment 16-1.)
Chapter 4 Optimum Yield	Substantially changed and expanded by Amendment 16-1, which moved and revised material on determining ABC, OY, precautionary thresholds, and rebuilding overfished species that was in Chapter 5 into this chapter. Amendments 16-2 and 16-3 add rebuilding plan summaries to section 4.5.4
Chapter 5 Specification and Apportionment of Harvest Levels	Substantially changed by Amendment 16-1, which moved material to Chapter 4, as noted above. Discussion of DAH, DAP, JVP, and TALFF deleted. (Also Amendments 12, 13, and 17.)
Chapter 6 Management Measures	Amendments and additions, no substantial change in organization. (Amendments 10, 11, 13, 16-1, 17.)
Chapter 7 Experimental Fisheries	No Changes
Chapter 8 Scientific Research	No Changes
Chapter 9 Restrictions on Other Fisheries	No Changes
Chapter 10 Procedures for Reviewing State Regulations	No Changes
Chapter 11 Appendices	This material is now produced under separate cover. An unnumbered section at the end of the FMP, “Appendices Contents,” summarizes the topic areas in the Appendices. It is intended that the unnumbered sections (also References, see below) will always appear at the end of the document. (Amendment 11 added material on essential fish habitat.)
Chapter 12 Management Measures that Continue	This chapter is renumbered Chapter 11. No other

in Effect With Implementation of Amendment 4	changes have been made.
Chapter 13 References	This chapter has been moved to an unnumbered section at the end of the document. (Amendment 16-1.)
Chapter 14 Groundfish Limited Entry	This chapter is renumbered Chapter 12. (Amendments 13 and 14.)

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LIST OF ACRONYMS AND ABBREVIATIONS

ABC	acceptable biological catch
DAH	domestic annual harvest
DAP	domestic annual processing
EEZ	exclusive economic zone
EFH	essential fish habitat
EFP	experimental fishing permit
ESA	Endangered Species Act
MARPOL	International Convention for the Prevention of Pollution from Ships
Magnuson-Stevens Act	Magnuson-Stevens Fishery Conservation and Management Act
FMP	fishery management plan
GAP	Groundfish Advisory Subpanel
GMT	Groundfish Management Team
HG	harvest guideline
IFQ	individual fishing quota
INPFC	International North Pacific Fisheries Commission
JV	joint-venture
JVP	joint-venture processing
LE	limited entry
MLR	minimum landing requirement
mt	metric ton
MSY	maximum sustainable yield
NMFS	National Marine Fisheries Service
OY	optimum yield
POP	Pacific ocean perch
PRA	Paperwork Reduction Act
PSMFC	Pacific States Marine Fisheries Commission
Regional Director	Regional Director, National Marine Fisheries Service
SAFE	Stock Assessment and Fishery Evaluation
Secretary	U.S. Secretary of Commerce
SPR	spawning biomass per recruit
SSC	Scientific and Statistical Committee
TALFF	total allowable level of foreign fishing

A note on annotations: Amended parts of the FMP are denoted at the end of chapters or second-level *sections by amendment number. If applicable, changes to lower-level subsections are also noted at the end of second-level sections. Amendments subsequent to Amendment 4, which substantially revised the original FMP are so noted.*

1.0 INTRODUCTION

1.1 Evolution of the Management Plan

The Pacific Coast Groundfish Fishery Management Plan (FMP) was approved by the U.S. Secretary of Commerce (Secretary) on January 4, 1982, and implemented on October 5, 1982. Prior to implementation of the FMP, management of domestic groundfish fisheries was under the jurisdiction of the states of Washington, Oregon, and California. State regulations have been in effect on the domestic fishery for more than 100 years with each state acting independently in both management and enforcement. Furthermore, many fisheries overlapped state boundaries and participants often operated in more than one state. Management and a lack of uniformity of regulations had become a difficult problem, which stimulated the formation of the Pacific States Marine Fisheries Commission (PSMFC) in 1947. PSMFC had no regulatory power but acted as a coordinating entity with authority to submit specific recommendations to states for their adoption. The 1977 Fishery Conservation and Management Act (later amended and renamed the Magnuson-Stevens Fishery Conservation and Management Act (or Magnuson-Stevens Act,) established eight regional fishery management Councils, including the Pacific Council. Between 1977 and the implementation of the groundfish FMP in 1982, state agencies worked with the Council to address conservation issues. Specifically, in 1981, managers proposed a rebuilding program for Pacific ocean perch. To implement this program, the states of Oregon and Washington established landing limits for Pacific ocean perch in the Vancouver and Columbia management areas.

Management of foreign fishing operations began in February 1967 when the U.S. and U.S.S.R. signed the first bilateral fishery agreement affecting trawl fisheries off Washington, Oregon, and California. The U.S. later signed bilateral agreements with Japan and Poland for fishing off the U.S. West Coast. Each of these agreements was renegotiated to reduce the impact of foreign fishing on important West Coast stocks, primarily rockfish, Pacific whiting, and sablefish. When the U.S. extended its jurisdiction to 200 miles (upon signing the Fishery Conservation and Management Act of 1976), the National Marine Fisheries Service (NMFS) developed and the Secretary implemented the preliminary management plan for the foreign trawl fishery off the Pacific Coast. From 1977 to 1982, the foreign fishery was managed under that plan. Many of these regulations were incorporated into the FMP, which provided for continued management of the foreign fishery.

Joint-venture fishing, where domestic vessels caught the fish to be processed aboard foreign vessels, began in 1979 and by 1989 had entirely supplanted directed foreign fishing. These joint ventures primarily targeted Pacific whiting. Joint-venture fisheries were then rapidly replaced by wholly domestic processing; by 1991 foreign participation had ended and U.S.-flagged motherships, catcher-processors, and shore-based vessels had taken over the Pacific whiting fishery. Since then U.S. fishing vessels and seafood processors have fully utilized Pacific Coast fishery resources. Although the Council may entertain applications for foreign or joint venture fishing or processing at any time, provisions for these activities have been removed from the FMP. Re-establishing such opportunities would require another FMP amendment.

Since it was first implemented in 1982, the Council has amended the groundfish FMP 20 times in response to changes in the fishery, reauthorizations of the Magnuson-Stevens Act, and litigation that invalidated provisions incorporated by earlier amendments. During the first ten years of plan implementation, up to 1992, the Secretary approved six amendments. Amendment 4, approved in 1990, was the most significant early amendment; in addition to a comprehensive update and reorganization of the FMP, it established additional framework procedures for establishing and modifying management measures. Another important change was implemented in 1992 with Amendment 6, which established a license limitation (limited entry) program intended to address overcapitalization by restricting further participation in groundfish trawl, longline, and trap fisheries.

The next decade, through 2002, saw the approval of another seven amendments. Amendment 9 modified the limited entry program by establishing a sablefish endorsement for longline and pot permits. Amendments 11, 12, 13 were responses to changes in the Magnuson-Stevens Act due to the 1996 Sustainable Fisheries Act. These changes required FMPs to identify essential fish habitat (EFH), more actively reduce bycatch and bycatch mortality, and strengthen conservation measures to both prevent fish stocks from becoming overfished, and promote rebuilding of any stocks that had become overfished. Amendment 14, implemented in 2001, built on Amendment 9 to further refine the limited entry permit system for the economically important fixed gear sablefish fishery. It allowed a vessel owner to "stack" up to three limited entry permits on one vessel along with associated sablefish catch limits. This in effect established a limited tradable quota system for participants in the primary sablefish fishery.

Most of the amendments adopted since 2001 deal with legal challenges to the three SFA-related amendments mentioned above, which were remanded in part by the Federal Court. These have required new amendments dealing with overfishing, bycatch monitoring and mitigation, and essential fish habitat. In relation to the first of these three issues, the Magnuson-Stevens Act now requires FMPs to identify thresholds for both the fishing mortality rate constituting overfishing and the stock size below which a stock is considered overfished. Once the Secretary determines a stock is overfished, the Council must develop and implement a plan to rebuild it to a healthy level. Since these thresholds were established for Pacific Coast groundfish, nine stocks have been declared overfished. The Court found that the rebuilding plan framework adopted by Amendment 12 did not comply with the Magnuson-Stevens Act. In response, Amendments 16-1, 16-2, and 16-3 established the current regime for managing these overfished species.[1] Amendment 16-1, approved in 2003, incorporated guidelines for developing and adopting rebuilding plans and substantially revised Chapters 4 and 5. Amendments 16-2 and 16-3, approved in 2004, incorporated key elements of rebuilding plans into Section 4.5.4. In 2005, a Court of Appeals ruling refined court interpretation of the Magnuson-Stevens Act rebuilding period requirements. Amendment 16-4, approved in [2006], revised the FMP to specify that rebuilding periods will be as short as possible, taking into account the status and biology of the stocks, the needs of fishing communities, and interactions of overfished stocks with the marine

[1] Although the Secretary declared Pacific whiting overfished in 2002, a 2004 stock assessment found that it had recovered to its rebuilt level. Thus, a rebuilding plan for this species was not adopted by these amendments.

ecosystem. As a result of this ruling, Amendment 16-4 also revised the rebuilding periods for [list stocks].

Amendment 17 modified the periodic process the Council uses to establish and modify harvest specifications and management measures for the groundfish fishery. Although not an SFA-related issue, this change did solve a procedural problem raised in litigation. The Council now establishes specifications and management measures every two years, allowing more time for them to be developed during the Council's public meetings.

Amendment 18, approved in 2006, addresses a remand of elements in Amendment 11 related to bycatch monitoring and mitigation. It incorporates a description of the Council's bycatch-related policies and programs into Chapter 6. It also effected a substantial reorganization and update of the FMP, so that it better reflects the Council's and the NMFS's evolving framework approach to management. Under this framework, the Council may recommend a range of broadly defined management measures for NMFS to implement. In addition to the range of measures, this FMP specifies the procedures the Council and NMFS must follow to establish and modify these measures. When first implemented, the FMP specified a relatively narrow range of measures, which were difficult to modify in response to changes in the fishery. The current framework allows the Council to effectively respond when faced with the dynamic challenges posed by the current groundfish fishery.

Amendment 19, also approved in 2006, revises the definition of groundfish EFH, identified habitat areas of particular concern, and describes management measures intended to mitigate the adverse effects of fishing on EFH. This amendment supplants the definition of EFH added to the FMP by Amendment 11.

1.2 How This Document is Organized

The groundfish FMP is organized into 11 chapters

Chapter 1 (this chapter) describes the development of the FMP and how it is organized.

Chapter 2 describes the goals and objectives of the plan and defines key terms and concepts.

Chapter 3 specifies the geographic area covered by this plan and lists the species managed by it, referred to as the fishery management unit, or FMU.

Chapter 4 describes how the Council determines harvest levels. These harvest limits are related to the maximum sustainable yield (MSY) and allowable biological catch (ABC) for FMU species. Precautionary reductions from these thresholds may be applied, depending on the management status of a given stock. If, according to these thresholds, a stock is determined to be overfished, the Council must recommend measures to end overfishing and develop a rebuilding plan, as specified in this chapter. Based on the thresholds, criteria and procedures described in this chapter, the Council specifies an optimum yield (OY), or harvest limit, for managed stocks or stock complexes.

Chapter 5 describes how the Council periodically specifies harvest levels and the management measures needed to prevent catches from exceeding those levels. Currently, the Council develops these specifications over the course of three meetings preceding the start of a two-year management period. (Separate OYs are specified for each of the two years in this period.) This chapter also describes how the stock assessment/fishery evaluation (SAFE) document, which provides information important to management, is developed.

Chapter 6 describes the management measures used by the Council to meet the objectives of the Magnuson-Stevens Act and this FMP. As noted above, this FMP is a framework plan; therefore, the range of management measures is described in general terms while the processes necessary to establish or modify different types of management measures are detailed. Included in the description of management measures is the Council's program for monitoring total catch (which includes bycatch) and minimizing bycatch.

Chapter 7 identifies EFH for groundfish FMU species and the types of measures that may be used to mitigate adverse impacts to essential fish habitat from fishing.

Chapter 8 describes procedures followed by the Council to evaluate and recommend issuing exempted fishing permits (EFPs). Permitted vessels are authorized, for limited experimental purposes, to harvest groundfish by means or in amounts that would otherwise be prohibited by this FMP and its implementing regulations. These permits allow experimentation in support of FMP goals and objectives. EFPs have been used, for example, to test gear types that result in less bycatch.

Chapter 9 provides criteria for determining what activities involving groundfish would qualify as scientific research and could therefore qualify for special treatment under the management program.

Chapter 10 describes the procedures used to review state regulations in order to ensure that they are consistent with this FMP and its implementing regulations.

Chapter 11 describes the groundfish limited entry program.

Appendix A contains descriptions of the biological, economic, social, and regulatory characteristics of the groundfish fishery.

Appendix B contains detailed information on groundfish EFH.

Appendix C describes the effects of fishing on groundfish EFH.

Appendix D describes the effects of activities other than fishing on groundfish EFH.

The appendices contain supporting information for the management program. Because these appendices do not describe the management framework or Council groundfish management policies and procedures, and only supplement the required and discretionary provisions of the FMP described in §303 of the Magnuson-Stevens Act, they may be periodically updated without being subjected to the Secretarial review and approval process described in §304(a) of the Magnuson-Stevens Act. These appendices are published under separate cover.

[Amended: 11, 16-4, 18,19]

2.0 GOALS AND OBJECTIVES

2.1 Goals and Objectives for Managing the Pacific Coast Groundfish Fishery

The Council is committed to developing long-range plans for managing the Washington, Oregon, and California groundfish fisheries that will promote a stable planning environment for the seafood industry, including marine recreation interests, and will maintain the health of the resource and environment. In developing allocation and harvesting systems, the Council will give consideration to maximizing economic benefits to the United States, consistent with resource stewardship responsibilities for the continuing welfare of the living marine resources. Thus, management must be flexible enough to meet changing social and economic needs of the fishery as well as to address fluctuations in the marine resources supporting the fishery. The following goals have been established in order of priority for managing the West Coast groundfish fisheries, to be considered in conjunction with the national standards of the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act).

Management Goals.

> Goal 1 - Conservation. Prevent overfishing and rebuild overfished stocks by managing for appropriate harvest levels and prevent, to the extent practicable, any net loss of the habitat of living marine resources.
>
> Goal 2 - Economics. Maximize the value of the groundfish resource as a whole
>
> Goal 3 - Utilization. Within the constraints of overfished species rebuilding requirements, achieve the maximum biological yield of the overall groundfish fishery, promote year-round availability of quality seafood to the consumer, and promote recreational fishing opportunities.

Objectives.

To accomplish these management goals, a number of objectives will be considered and followed as closely as practicable:

Conservation.

> Objective 1. Maintain an information flow on the status of the fishery and the fishery resource which allows for informed management decisions as the fishery occurs.
>
> Objective 2. Adopt harvest specifications and management measures consistent with resource stewardship responsibilities for each groundfish species or species group. Achieve a level of harvest capacity in the fishery that is appropriate for a sustainable harvest and low discard rates, and which results in a fishery that is diverse, stable, and profitable. This reduced capacity should lead to more effective management for many other fishery problems.
>
> Objective 3. For species or species groups that are overfished, develop a plan to rebuild the stock as soon as possible, taking into account the status and biology of the stock, the needs of fishing communities, recommendations by international organizations in which the United States participates, and the interaction of the overfished stock within the marine ecosystem. ~~required by the Magnuson-Stevens Act.~~

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.

Objective 5. Describe and identify essential fish habitat (EFH), adverse impacts on EFH, and other actions to conserve and enhance EFH, and adopt management measures that minimize, to the extent practicable, adverse impacts from fishing on EFH.

Economics.

Objective 6. Within the constraints of the conservation goals and objectives of the FMP, a~~A~~ttempt to achieve the greatest possible net economic benefit to the nation from the managed fisheries.

Objective 7. Identify those sectors of the groundfish fishery for which it is beneficial to promote year-round marketing opportunities and establish management policies that extend those sectors fishing and marketing opportunities as long as practicable during the fishing year.

Objective 8. Gear restrictions to minimize the necessity for other management measures will be used whenever practicable. Encourage development of practicable gear restrictions intended to reduce regulatory and/or economic discards through gear research regulated by exempted fishing permits.

Utilization.

Objective 9. Develop management measures and policies that foster and encourage full utilization (harvest and processing), in accordance with conservation goals, of the Pacific Coast groundfish resources by domestic fisheries.

Objective 10. Recognize~~ing~~ the multispecies nature of the fishery and establish a concept of managing by species and gear or by groups of interrelated species.

Objective 11. Develop management programs that reduce regulations-induced discard and/or which reduce economic incentives to discard fish. Develop management measures that minimize bycatch to the extent practicable and, to the extent that bycatch cannot be avoided, minimize the mortality of such bycatch. Promote and support monitoring programs to improve estimates of total fishing-related mortality and bycatch, as well as those to improve other information necessary to determine the extent to which it is practicable to reduce bycatch and bycatch mortality.

Social Factors.

Objective 12. When conservation actions are necessary to protect a stock or stock assemblage, attempt to develop management measures that will affect users equitably.

Objective 13. Minimize gear conflicts among resource users.

Objective 14. When considering alternative management measures to resolve an issue, choose the measure that best accomplishes the change with the least disruption of current domestic fishing practices, marketing procedures, and the environment.

Objective 15. Avoid unnecessary adverse impacts on small entities.

Objective 16. Consider the importance of groundfish resources to fishing communities, provide for the sustained participation of fishing communities, and minimize adverse economic impacts on fishing communities to the extent practicable.

Objective 17. Promote the safety of human life at sea.

[Amended; 7, 11, 13, 16-1, 16-4, 18]

2.2 Operational Definition of Terms

Acceptable Biological Catch (ABC) is a biologically based estimate of the amount of fish that may be harvested from the fishery each year without jeopardizing the resource. It is a seasonally determined catch that may differ from MSY for biological reasons. It may be lower or higher than MSY in some years for species with fluctuating recruitment. The ABC may be modified to incorporate biological safety factors and risk assessment due to uncertainty. Lacking other biological justification, the ABC is defined as the MSY exploitation rate multiplied by the exploitable biomass for the relevant time period.

Biennial fishing period is defined as a 24-month period beginning January 1 and ending December 31.

Bottom (or flatfish bottom) trawl is a trawl in which the otter boards or the footrope of the net are in contact with the seabed. It includes roller (or bobbin) trawls, Danish and Scottish seine gear, and pair trawls fished on the bottom.

Bottom-contact gear types by design and through normal use make contact with the sea floor. Such contact is more than intermittent in duration and areal extent.

Bycatch means fish which are harvested in a fishery, but which are not sold or kept for personal use and includes economic discards and regulatory discards. Such term does not include fish released alive under a recreational catch and release fishery management program.

Chafing gear is webbing or other material attached to the codend of a trawl net to protect the codend from wear.

Charter fishing means fishing from a vessel carrying a passenger for hire (as defined in section 2101(21a) of title 46, United States Code) who is engaged in recreational fishing.

Closure, when referring to closure of a fishery, means that taking and retaining, possessing or landing the particular species or species complex is prohibited.

Council means the Pacific Fishery Management Council, including its Groundfish Management Team (GMT), Scientific and Statistical Committee (SSC), Groundfish Advisory Subpanel (GAP), and any other committee established by the Council.

Commercial fishing is (1) fishing by a person who possesses a commercial fishing license or is required by law to possess such license issued by one of the states or the federal government as a prerequisite to taking, landing, and/or sale; or (2) fishing which results in or can be reasonably expected to result in sale, barter, trade, or other disposition of fish for other than personal consumption.

Density dependence is the degree to which recruitment declines as spawning biomass declines. Typically we assume that a Beverton-Holt form is appropriate and that the level of density-dependence is such that the recruitment only declines by ten percent when the spawning biomass declines by 50%.

Double-walled codend is a codend constructed of two walls of webbing.

$F_{x\%}$ is the rate of fishing mortality that will reduce female spawning biomass per recruit to x percent of its unfished level. $F_{100\%}$ is zero, and $F_{35\%}$ is a reasonable proxy for F_{MSY}.

Economic discards means fish which are the target of a fishery, but which are not retained because they are of an undesirable size, sex, quality, or for other economic reasons.

Essential fish habitat means those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity.

Exploitable biomass is the biomass that is available to a unit of fishing effort. Defined as the sum of the population biomass at age (calculated as the mean within the fishing year) multiplied by the age-specific availability to the fishery. Exploitable biomass is equivalent to the catch biomass divided by the instantaneous fishing mortality rate.

F is the instantaneous rate of fishing mortality. F typically varies with age, so the F values are presented for the age with maximum F. Fish of other ages have less availability to the fishery, so a unit of effort applies a lower relative level of fishing mortality to these fish.

F_{MSY} is the fishing mortality rate that maximizes catch biomass in the long term.

$F_{0.1}$ is the fishing mortality rate at which a change in fishing mortality rate will produce a change in yield per recruit that is ten percent of the slope of the yield curve at nil levels of fishing mortality.

F_{OF} is the rate of fishing mortality defined as overfishing.

Fishing means (1) the catching, taking, or harvesting of fish; (2) the attempted catching, taking, or harvesting of fish; (3) any other activity which can reasonably be expected to result in the catching, taking, or harvesting of fish; or (4) any operations at sea in support of, or in preparation for, any activity described above. This term does not include any activity by a vessel conducting authorized scientific research.

Fishing year is defined as January 1 through December 31.

Fishing community means a community which is substantially dependent on or substantially engaged in the harvest or processing of fishery resources to meet social and economy needs and includes fishing vessel owners, operators, crew, and recreational fishers and United States fish processors that are based in such community.

Fixed gear (anchored nontrawl gear) includes longline, trap or pot, set net, and stationary hook-and-line gear (including commercial vertical hook-and-line) gears.

Gillnet is a single-walled, rectangular net which is set upright in the water.

Harvest guideline (HG) is an specified numerical harvest objective which is not a quota. Attainment of a HG does not require closure of a fishery.

Hook-and-line means one or more hooks attached to one or more lines. Commercial hook-and-line fisheries may be mobile (troll) or stationary (anchored).

Incidental catch or incidental species means groundfish species caught when fishing for the primary purpose of catching a different species.

Individual fishing quota (IFQ) means a federal permit under a limited access system to harvest a quantity of fish expressed by a unit or units representing a percentage of the total allowable catch of a fishery that may be received or held for exclusive use by a person.

Longline is a stationary, buoyed, and anchored groundline with hooks attached, so as to fish along the seabed.

Maximum sustainable yield is an estimate of the largest average annual catch or yield that can be taken over a significant period of time from each stock under prevailing ecological and environmental conditions. It may be presented as a range of values. One MSY may be specified for a group of species in a mixed-species fishery. Since MSY is a long-term average, it need not be specified annually, but may be reassessed periodically based on the best scientific information available.

Midwater (pelagic or off-bottom) trawl is a trawl in which the otter boards may contact the seabed, but the footrope of the net remains above the seabed. It includes pair trawls if fished in midwater. A midwater trawl has no rollers or bobbins on the net.

MSY stock size means the largest long-term average size of the stock or stock complex, measured in terms of spawning biomass or other appropriate units, that would be achieved under an MSY control rule in which the fishing mortality rate is constant. The proxy typically used in this fishery management plan is 40% of the estimated unfished biomass, although other values based on the best scientific information are also authorized.

Nontrawl gear means all legal commercial gear other than trawl gear.

Optimum yield means the amount of fish which will provide the greatest overall benefit to the U.S., particularly with respect to food production and recreational opportunities, and taking into account the protection of marine ecosystems, is prescribed as such on the basis of the maximum sustainable yield from the fishery as reduced by any relevant economic, social, or ecological factor; and in the case of an overfished fishery, provides for rebuilding to a level consistent with producing the maximum sustainable yield in such fishery.

Overfished describes any stock or stock complex whose size is sufficiently small that a change in management practices is required to achieve an appropriate level and rate of rebuilding. The term generally describes any stock or stock complex determined to be below its overfished/rebuilding threshold. The default proxy is generally 25% of its estimated unfished biomass; however, other scientifically valid values are also authorized.

Overfishing means fishing at a rate or level that jeopardizes the capacity of a stock or stock complex to produce MSY on a continuing basis. More specifically, overfishing is defined as exceeding a maximum allowable fishing mortality rate. For any groundfish stock or stock complex, the maximum allowable mortality rate will be set at a level not to exceed the corresponding MSY rate (F_{MSY}) or its proxy (e.g., $F_{35\%}$).

Processing or to process means the preparation or packaging of groundfish to render it suitable for human consumption, retail sale, industrial uses, or long-term storage, including, but not limited to, cooking, canning, smoking, salting, drying, filleting, freezing, or rendering into meal or oil, but does not mean heading and gutting unless additional preparation is done.

Processor means a person, vessel, or facility that (1) engages in processing, or (2) receives live groundfish directly from a fishing vessel for sale without further processing.

Prohibited species are those species and species groups which must be returned to the sea as soon as is practicable with a minimum of injury when caught and brought aboard except when their retention is authorized by other applicable law. Exception may be made in the implementing regulations for tagged fish, which must be returned to the tagging agency, or for examination by an authorized observer.

Quota means a specified numerical harvest objective, the attainment (or expected attainment) of which causes closure of the fishery for that species or species group. Groundfish species or species groups under this FMP for which quotas have been achieved shall be treated in the same manner as prohibited species.

Recreational fishing means fishing for sport or pleasure, but not for sale.

Regulatory discards are fish harvested in a fishery which fishermen are required by regulation to discard whenever caught or are required by regulation to retain, but not sell.

Roller (or bobbin) trawl is a bottom trawl that has footropes equipped with rollers or bobbins made of wood, steel, rubber, plastic, or other hard material which keep the footrope above the seabed, thereby protecting the net.

Set net is a stationary, buoyed, and anchored gillnet or trammel net.

Stock Assessment and Fishery Evaluation (SAFE) document is a document prepared by the Council that provides a summary of the most recent biological condition of species in the fishery management unit, and the social and economic condition of the recreational and commercial fishing industries, and the fish processing industry. It summarizes, on a periodic basis, the best available information concerning the past, present, and possible future condition of the stocks and fisheries managed by the FMP.

Target fishing means fishing for the primary purpose of catching a particular species or species group (the target species).

A total catch limit is a portion of the OY for a groundfish FMU species, stock, or stock complex assigned to a defined fishery sector or to an individual vessel. Total catch is defined as landed catch plus bycatch (discard) mortality. The Council may specify total catch limits that are transferable or nontransferable among sectors or tradable or nontradable between vessels.

Trammel net is a gillnet made with two or more walls joined to a common float line.

Trap (or pot) is a portable, enclosed device with one or more gates or entrances and one or more lines attached to surface floats.

Spawning biomass is the biomass of mature female fish at the beginning of the year. If the production of eggs is not proportional to body weight, then this definition should be modified to be proportional to expected egg production.

Spawning biomass per recruit is the expected egg production of a female fish over its lifetime. Alternatively, this is the mature female biomass of an equilibrium stock divided by the mean level of recruitment that produced this stock.

Spear is a sharp, pointed, or barbed instrument on a shaft. Spears may be propelled by hand or by mechanical means.

Vertical hook-and-line gear (commercial) is hook-and-line gear that involves a single line anchored at the bottom and buoyed at the surface so as to fish vertically.

[Amended: 5, 11, 13, 17, 18, 19]

3.0 AREAS AND STOCKS INVOLVED

No changes in this chapter.

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 600.310(a))

"The determination of OY is a decisional mechanism for resolving the Magnuson-Stevens Act's multiple purposes and policies, implementing an FMP's objectives and balancing the various interests that comprise the national welfare. OY is based on MSY, or on MSY as it may be reduced ... [in consideration of social, economic or ecological factors].... The most important limitation on the specification of OY 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 600.310(c); Section 4.2 of this Chapter).
- Specifying stock status determination criteria (maximum fishing mortality threshold and minimum stock size threshold, or reasonable proxies thereof) (50 CFR 600.310(d); Section 4.4 of this Chapter).
- Actions for ending overfishing and rebuilding overfished stocks (including the development and adoption of rebuilding plans) (50 CFR 600.310(e); Section 4.5 of this Chapter).
- Setting OY and apportionment of harvest levels (50 CFR 600.310(f); Section 4.6 of this Chapter).

In establishing OYs for West Coast groundfish, this FMP uses 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. As provided by Section 303(b)(11) of the Magnuson-Stevens Fishery Conservation and Management Act, the Council may establish a research reserve for any stock, that is within the ABC but above and separate from the OY for that stock.

[Added: 16-1]

4.1 Species Categories

BMSY, ABC and the overfished/rebuilding stock size threshold cannot be precisely defined for all species, because of the absence of available information for many species managed under the FMP. For the purpose of setting MSY, ABC, the maximum fishing mortality threshold (MFMT), the minimum stock size threshold (MSST), OY and rebuilding standards, three categories of species are identified. 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

[Amended: 16-1]

4.2 Determination of MSY, or MSY Proxy, and B_{MSY}

Harvest policies are to be specified according to standard reference points such as MSY (MSY, interpreted as a maximum average achievable catch under prevailing ecological and environmental conditions over a prolonged period). The long-term average biomass associated with fishing at F_{MSY} is B_{MSY}. In this FMP, MSY generally refers to a constant F control rule that is assumed to produce the maximum average yield over time while protecting the spawning potential of the stock. Thus the constant F control rule is generally the proxy for the MSY control rule. Fishing rates above F_{MSY} eventually result in biomass smaller than B_{MSY} and produce less harvestable fish on a sustainable basis. The biomass level that produces MSY (i.e., B_{MSY}) is generally unknown and assumed to be variable over time due to long-term fluctuations in ocean conditions, so that no single value is appropriate. During periods of unfavorable environmental conditions it is important to account for reduced sustainable yield levels.

The problem with an F_{MSY} control rule is that it is tightly linked to an assumed level of density-dependence in recruitment, and there is insufficient information to determine the level of density-dependence in recruitment for many West Coast groundfish stocks. Therefore, the use of approximations or proxies is necessary. Absent a more accurate determination of F_{MSY}, the Council will apply default MSY proxies. The current (2001) proxies are: F40% for flatfish and whiting, $F_{50\%}$ for rockfish (including thornyheads) and $F_{45\%}$ for all species such as sablefish and lingcod. However, values ($F_{40\%}$, $F_{45\%}$, and $F_{50\%}$) are provided here as examples only and are expected to be modified from time to time as scientific knowledge improves. If available information is sufficient, values of F_{MSY}, B_{MSY}, and more appropriate harvest control rules may be developed for any species or species group.

At this time, it is generally believed that, for many species, $F_{45\%}$ strikes a balance between obtaining a large fraction of the MSY if recruitment is highly insensitive to reductions in spawning biomass and preventing a rapid depletion in stock abundance if recruitment is found to be extremely sensitive to reductions in spawning biomass. The long-term expected yield under an $F_{45\%}$ policy depends upon the (unknown) level of density-dependence in recruitment. The recommended level of harvest will reduce the average lifetime egg production by each female entering the stock to 45% of the lifetime egg production for females that are unfished.

Because the level of recruitment is expected to decline somewhat as a stock is fished at $F_{45\%}$, the expected B_{MSY} proxy is less than 45% of the unfished biomass. A biomass level of 40% is a reasonable proxy for BMSY. The short-term yield under an $F_{45\%}$ policy will vary as the abundance of the exploitable stock varies. This is true for any fishing policy that is based on a constant exploitation rate. The abundance of the stock will vary, because of the effects of fishing, and because of natural variation in recruitment. When stock abundance is high (i.e., near its average unfished level), short-term annual yields can be approximately two to three times greater than the expected long-term average annual yield. For many of the long-lived groundfish species common on the West Coast, this "fishing down" transition can take decades. Many of the declines in ABC that occurred during the 1980s were the result of this transition from a lightly exploited, high abundance stock level to a fully exploited, moderately abundant stock level. Further declines below the overfished levels in the 1990s were due in large part to harvest rate policies that were later discovered to not be sustainable. More recent stock assessments indicate that West Coast groundfish stocks likely have lower levels of productivity than other similar species worldwide. Based on this retrospective information, harvest rate policies in the 1990s were too high to maintain stocks at B_{MSY}. The Council revised its harvest rate policies for lower levels of production, described below.

Scientific information as of 1997 (Clark 1993; Ianelli and Heifetz 1995; Mace 1994) indicated that $F_{35\%}$ may not be the best approximation of FMSY, 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 FMSY. 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 and Heifitz (1995) determined that F44% 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 FMSY for rockfish in the absence of specific knowledge of recruitment or life history characteristics which would allow a more accurate determination of FMSY. This proxy was later revised based on further Scientific and Statistical Committee (SSC) investigation into the appropriate FMSY proxies in 2000.

In the spring of 2000, the Council's SSC sponsored a workshop to review the Council's groundfish exploitation rate policy. The workshop explored the historic use of different fishing mortality (F) rates and found that the Council's past practices have generally changed in response to new information from the scientific community. Starting in the early 1990s, the Council used a standard harvest rate of F35%. The SSC's workshop participants reported that new scientific studies in 1998 and 1999 had shown that the $F_{35\%}$ and $F_{40\%}$ rates used by the Council had been too aggressive for Pacific Coast groundfish stocks, such that some groundfish stocks could not maintain a viable population over time. A 1999 study, The Meta-Analysis of the Maximum Reproductive Rate for Fish Populations to Estimate Harvest Policy; a Review (Myers, *et al.* 2000) showed that Pacific Coast groundfish stocks, particularly rockfish, have very low productivity compared to other, similar species worldwide. One prominent theory about the reason for this low productivity is the large-scale North Pacific climate shifts that are thought to cycle Pacific Coast waters through warm and cool phases of 20-30 years duration. Pacific Coast waters shifted to a warm phase around 1977-1978, with ocean conditions less favorable for Pacific Coast groundfish and other fish stocks. Lower harvest rates are necessary to guard against steep declines in abundance during these periods of low productivity (low recruitment). After an intensive review of historic harvest rates, and current scientific literature on harvest rates and stock productivity, the SSC workshop concluded that $F_{40\%}$ is too aggressive for many Pacific Coast groundfish stocks, particularly for rockfish. For 2001 and beyond, the Council adopted the SSC's new recommendations for harvest policies of: $F_{40\%}$ for flatfish and whiting, $F_{50\%}$ for rockfish (including thornyheads) and $F_{45\%}$ for other groundfish such as sablefish and lingcod.

In the past, F_{MSY} fishing rates were treated by the Council (as intended) as targets. Under the Magnuson-Stevens Act as amended in 1996, these fishing rates are more appropriately considered to be thresholds that should not be exceeded (see Section 4.4).

The Council will consider any new scientific information relating to calculation of MSY or MSY proxies and may adopt new values based on improved understanding of the population dynamics and harvest of any species or group of species.

While BMSY may be set based on the averaged unfished abundance ($B_{unfished}$) there are many possible approximations and estimates of mean $B_{unfished}$. If the necessary data exist, the following standard methodology is the preferred approach:

$$\text{mean } B_{unfished} = \text{mean } R * SPR(F=0)$$

Where mean R is the average estimated recruitment expected under unfished conditions, and SPR(F=0) is the spawning potential per recruit at zero fishing mortality rate. SPR(F=0) is normally available as part of the calculation leading to determination of $F_{45\%}$ and is equivalent to $F_{100\%}$.

[Amended: 5, 11, 16-1]

4.3 Determination of ABC

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.

4.3.1 Stocks with Quantitative Assessments, Category 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., F45%) 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, and fishing mortality are also required to determine whether recent trends indicate a point of concern. In general, ABC will be calculated by applying $F_{45\%}$ (or F40%, F50%, 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.

4.3.2 Stocks with ABC Set by Nonquantitative Assessment, Category 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.

4.3.3 Stocks Without ABC Values, Category 3

Of the 80-plus 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. Until sufficient quantities of at-sea observer program data are available or surveys of other fish habitats are conducted, it is unlikely that there will be sufficient data to upgrade the assessment capabilities or to evaluate the overfishing potential of these stocks. Interim ABC values may be established for these stocks based on qualitative information, including advice from the Council's advisory entities.

[Amended: 11, 12, 16-1]

4.4 Precautionary Thresholds and Overfishing Status Determination Criteria

The National Standard Guidelines define two thresholds that are necessary to maintain a stock at levels capable of producing MSY: the maximum fishing mortality threshold (MFMT) and a minimum stock size threshold (MSST). These two limits are intended for use as benchmarks to decide if a stock or stock complex is being overfished or is in an overfished state. The MFMT and MSST are intrinsically linked through the MSY control rule, which specifies how fishing mortality or catches could vary as a function of stock biomass in order to achieve yields close to MSY.

4.4.1 Determination of Precautionary Thresholds

The precautionary threshold is the biomass level at which point the harvest rate will be reduced to help the stock return to the MSY level (see Section 4.5.1 “Default Precautionary and Interim Rebuilding OY Calculation”). The precautionary biomass threshold is in addition to the overfishing and overfished/rebuilding thresholds required under ths Magnuson-Stevens Act (MFMT and MSST). The precautionary biomass threshold is higher than the overfished biomass (MSST). Because BMSY is a long term average, biomass will by definition be below BMSY in some years and above BMSY in other years. Thus, even in the absence of overfishing, biomass may decline to levels below BMSY due to natural fluctuation. By decreasing harvest rates when biomass is below BMSY 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 BMSY level, if known. The default precautionary threshold will be 40% of the estimated unfished biomass level. The Council may recommend different precautionary thresholds for any species or species group based on the best scientific information about that species or group. It is expected the threshold will be between 25% and 50% of the estimated unfished biomass level.

4.4.2 Determination of Overfishing Threshold

In this FMP, for Category 1 species, the term “overfishing” is used to denote situations where catch exceeds or is expected to exceed the established ABC or MSY proxy ($F_{x\%}$). This can also be expressed as where catch exceeds or is expected to exceed the MFMT. The term “overfished” describes a stock whose abundance is below its overfished/rebuilding threshold, or MSST. Overfished/rebuilding thresholds, in general, are linked to the same productivity assumptions that determine the ABC levels. The default value of this threshold is 25% of the estimated unfished biomass level or 50% of B_{MSY}, if known. The MFMT is simply the value(s) of fishing mortality in the MSY control rule. Technically, exceeding FMSY constitutes overfishing.

For Category 2 species, the following may be evaluated as potential indicators of overfishing:

- catch per effort from logbooks
- catch area from logbooks
- index of stock abundance from surveys
- stock distribution from surveys
- mean size of landed fish

If declining trends persist for more than three years, then a focused evaluation of the status of the stock, its ABC, and overfishing threshold will be quantified. If data are available, such an evaluation should be conducted at approximately five year intervals even when negative trends are not apparent. In fact, many stocks are in need of re-evaluation to establish a baseline for monitoring of future trends. Whenever an evaluation indicates the stock may be declining and approaching an overfished state, the Council should:

1. Improve data collection for this species so it can be moved to Category 1.

2. Determine the rebuilding rate that would allow the stock to return to MSY in no longer than ten years.

Information from fishery independent surveys is often lacking for Category 3 species because of their low abundance or because they are not vulnerable to survey sampling gear. Until sufficient data become available from the at-sea observer program, the risk of overfishing these species cannot be fully evaluated.

4.4.3 Determination of Overfished/Rebuilding Thresholds

The MSST (overfished/rebuilding threshold) is the default value of 25% of the estimated unfished biomass level or 50% of B_{MSY}, if known. The overfished/rebuilding threshold (also referred to as $B_{rebuild}$), is generally in the range of 25% to 40% of $B_{unfished}$, and may also be written as

$B_{rebuild}$ = x% * mean R * SPR(F=0)

The default overfished/rebuilding threshold for category 1 groundfish is $0.25B_{unfished}$. The Council may establish different thresholds for any species based on information provided in stock assessments, the SAFE document, or other scientific or groundfish management-related report. For example, if B_{MSY} is known, the overfished threshold may be set equal to 50% of that amount. The Council may also specify a lower level of abundance where catch or fishing effort is reduced to zero. This minimum abundance threshold (B_{MIN}) would correspond to an abundance that severely jeopardizes the stock's ability to recover to B_{MSY} in a reasonable length of time.

[Amended: 11, 12, 16-1]

4.5 Ending Overfishing and Rebuilding

4.5.1 Default Precautionary and Interim Rebuilding OY Calculation

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 rebuilding harvest control policy to guide ~~the~~ setting the OY until the Council sets a new rebuilding policy specific to the conditions of the stock and fishery. The default OY/rebuilding policy can be described as an "ICES-type catch-based approach" that consists of a modification of the catch policy, where catch (C) declines from $C(F_{MSY})$ at the precautionary threshold in a straight line to F=0 at the minimum abundance threshold of ten percent of the estimated mean unfished biomass (sometimes called pristine or virgin biomass or reproductive potential). This approach could also be described as an OY based on a variable FSPR 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 FMSY; in such cases, the best proxy for F_{MSY} will be used. The default proxy values will be $F_{40\%}$ for flatfish and whiting, $F_{50\%}$ for rockfish in the Sebastes complex and $F_{45\%}$ for other species such as sablefish and lingcod. The Council anticipates scientific information about the population dynamics of the various stocks will improve over time and that this information will result in improved estimates of appropriate harvest rates and MSY proxies. Thus, these initial default proxy values will be replaced from time to time. Such changes will not require amendment to the FMP, but the scientific basis for new values must be documented.

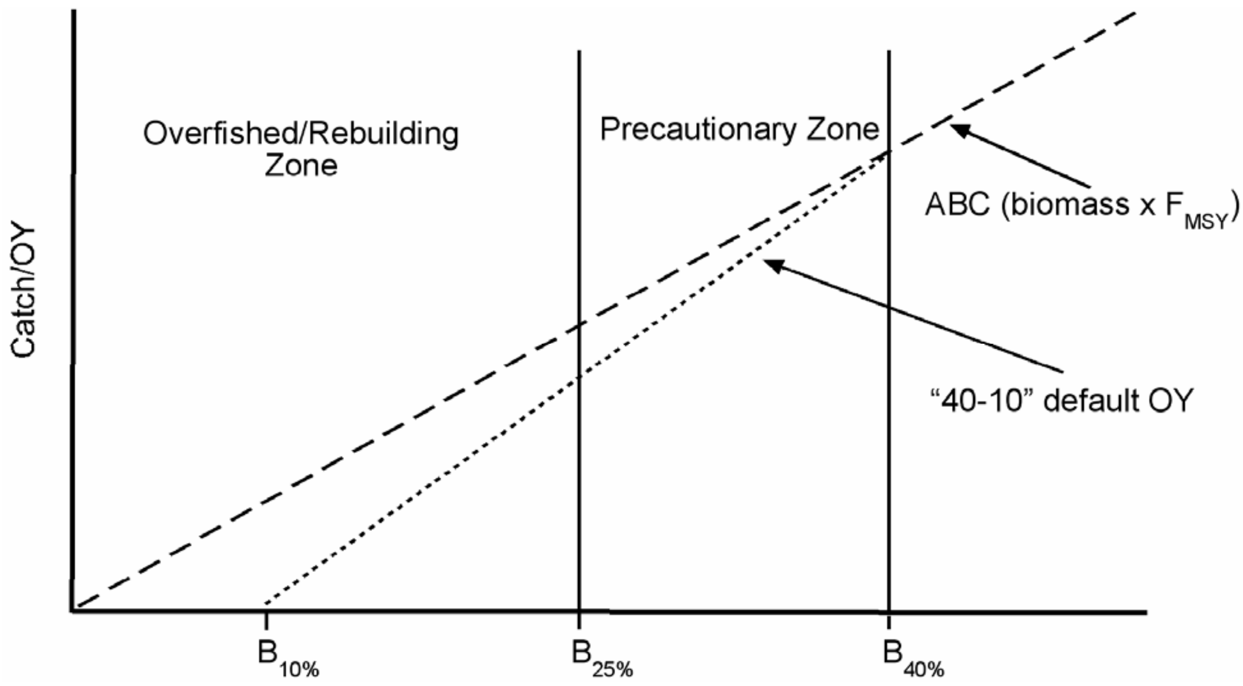

FIGURE 4-1. Illustration of default OY rule compared to ABC.

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 Procedures For Calculating Rebuilding Parameters

The Magnuson-Stevens Act and National Standard Guidelines provide a descriptive framework for developing strategies to rebuild overfished stocks. This framework identifies three parameters: a minimum time in which an overfished stock may can rebuild to its target biomass (denoted T_{MIN}), a maximum permissible time period for rebuilding the stock to its target biomass (T_{MAX}), and a target year, falling within the time period represented between T_{MIN} and T_{MAX} and representing the best of estimate of the year by which the stock will can be rebuilt, as soon possible, taking into account the status and biology of the stock, the needs of fishing communities, and the interaction of the stock of fish within the marine ecosystem (T_{TARGET}).

T_{MIN}, the lower limit of the specified time period for rebuilding, will be determined by the status and biology of the stock or stock complex and its interactions with other components of the marine ecosystem or environmental conditions, and is defined as the amount of time that would be required for rebuilding if fishing mortality were eliminated entirely.

If the lower limit T_{MIN} is less than ten years, then the specified time period for rebuilding may be adjusted upward so that the rebuilding period is as short as possible, taking into account the status and biology of the stock, the needs of fishing communities, and the interaction of the stock of fish within the marine ecosystem, 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 (which would then constitute T_{MAX}), unless management measures under an international agreement in which the United States participates dictate otherwise.

If the lower limit T_{MIN} is ten years or greater, then the specified time period for rebuilding may be adjusted upward so that the rebuilding period is as short as possible, taking into account the status and biology of the stock, the needs of fishing communities, and the interaction of the stock of fish within the marine ecosystem, 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 maximum allowable time to rebuild would be the rebuilding period could be as long as 20 years, which is T_{MAX}.

The Council may consider a number of factors in determining the time period for rebuilding, including:

1. The status and biology of the stock or stock complex.

2. Interactions between the stock or stock complex and other components of the marine ecosystem or environmental conditions.

3. The needs of fishing communities.

4. Recommendations by international organizations in which the United States participates.

5. Management measures under an international agreement in which the United States participates.

Calculating Rebuilding Probabilities

Stock assessment results form the basis of a rebuilding analysis, which in turn is used to develop rebuilding policies and choose the rebuilding parameters identified in each rebuilding plan. The elements of rebuilding analyses are described in the SSC Terms of Reference for Rebuilding Analyses (SSC 2001). This guidance has been incorporated into a computer program (Punt 2002). In the analysis the probability that the overfished stock will reach its target biomass is determined with respect to T_{MIN}, T_{MAX}, and T_{TARGET}. The methods for calculating the values of these parameters are described below. This is a simplified explanation of the current methodology; for example, equations and technical specifications are omitted. The SSC may revise their terms of reference in the future and the computer program undergoes continued refinement and elaboration.

The rebuilding analysis program uses "Monte Carlo simulation" to derive a probability estimate for a given rebuilding strategy. This method projects population growth many times in separate simulations. It accounts for possible variability by randomly choosing the value of a key variable─in this case total recruitment or recruits per spawner─from a range of values. These values can be specified empirically, by listing some set of historical values, or by a relationship based on a model. The SSC recommends that the rebuilding analyses use historical values. Because of this variability in a key input value, each simulation will show a different pattern of population growth. As a result, a modeled population may reach the target biomass that defines a rebuilt stock (B_{MSY}) in a different year in each of the simulations.

This technique ~~can be used~~ ~~is~~ first used to calculate T_{MIN} in probabilistic terms, which is defined as the time needed to reach the target biomass in the absence of fishing with a 50% probability. In other words, in half the simulations the target biomass was reached in some year up to and including the computed T_{MIN}. Given T_{MIN}, T_{MAX} is computed as 10 years or by adding the value of one mean generation time to T_{MIN}, if T_{MIN} is greater than or equal to 10 years.

~~After determining T_{MAX}, multiple Monte Carlo simulations are conducted, varying the fishing mortality rate. This determines the relationship between F and the probability of the stock being rebuilt by T_{MAX} (denoted P_{MAX}). Since a higher P_{MAX} probability must be achieved by lowering the fishing mortality rate (other things being equal) there is a tradeoff between fishery harvests and rebuilding speed in probabilistic terms. As fishing mortality is reduced, the likelihood that the stock will recover in this maximum time period increases.~~

A target year, T_{TARGET}, is ~~then computed as the median rebuilding year for each related F and P_{MAX}. The median year is simply the year by which half of all cases have already rebuilt, and is unique for a given F and P_{MAX}.~~ set as a year at T_{MIN} or greater, which does not exceed T_{MAX}, and which is as short as possible, taking into account the status and biology of the stock, the needs of fishing communities, and the interaction of the stock of fish within the marine ecosystem. Prior to Amendment 16-4, the Council set T_{TARGET} in part by considering the probability of rebuilding the stock by T_{MAX}. The Council may continue to review the probability of rebuilding the stock by T_{MAX} given differing F rates, a reference parameter known as "P_{MAX}." The Magnuson-Stevens Act, however, simply requires that rebuilding periods be as short as possible, taking into account:

- the status and biology of any overfished stocks of fish;
- the needs of fishing communities;
- recommendations by international organizations in which the United States participates;
- the interaction of the overfished stock of fish within the marine ecosystem. (§304(e)(4)(A)(i))

It is important to recognize that some of the terms introduced and described above represent policy decisions at the national level and the Council **does not have a choice** in setting their values. The dates for T_{MIN} and T_{MAX} are determined based on guidelines established at the national level. Mean generation time is a biological characteristic that cannot be chosen by policymakers. Thus, the Council cannot choose these values and then use them as a basis for management. Defined in national guidelines, T_{MIN} is a consequence of the productivity of the fish stock and is calculated by fishery biologists based on information they get from a particular stock. Similarly, T_{MAX}, which is calculated from T_{MIN}, does not represent a Council choice.

Policy flexibility comes into play in determining T_{TARGET}, or the time by which the stock is projected to rebuild. As explained earlier, the time to rebuild must be as short as possible, taking into account the status and biology of the stock, the needs of fishing communities, and the interaction of the stock of fish within the marine ecosystem. Fundamentally, Wwhen developing a management strategy, the Council **can** choose a fishing mortality rate and corresponding annual level of fishing. However, when rebuilding overfished species, the choice of F can be is based on either the value of T_{TARGET} or P_{MAX}, keeping in mind that these three values cannot be chosen independently of one another. In other words, the Council may choose one of these values and derive the other two from it, but they cannot choose these values for two of these terms independently of the third each other.

4.5.3 Stock Rebuilding Plans

As required by the Magnuson-Stevens Act, within one year of being notified by the Secretary that a stock is overfished or approaching a condition of being overfished, the Council will prepare a recommendation to end the overfished condition and rebuild the stock(s) or to prevent the overfished condition from occurring. For a stock that is overfished, the rebuilding plan will specify a time period for ending the overfished condition and rebuilding the stock. Overfishing restrictions and recovery benefits should be fairly and equitably allocated among sectors of the fishery.

Certain elements of a rebuilding plan developed by the Council, as specified in Section 4.5.3.2 (Contents of Rebuilding Plans), will be submitted to the Secretary as an FMP amendment and implementing regulations. Changes to key rebuilding plan elements will be accomplished through full (notice and comment) rulemaking. Once approved by the Secretary, a rebuilding plan will remain in effect for the specified duration of the rebuilding program, or until modified. The Council will make all approved rebuilding plans available in the annual SAFE document or by other means. The Council may recommend that the Secretary implement interim measures to reduce overfishing until the Council's program has been developed and implemented.

The Council intends its stock rebuilding plans to provide targets, checkpoints, and guidance for rebuilding overfished stocks to healthy and productive levels. They should provide a clear vision of the intended results and the means to achieve those results. They will provide the strategies and objectives that regulations are intended to achieve, and proposed regulations and results will be measured against the rebuilding plans. It is likely that rebuilding plans will be revised over time to respond to new information, changing conditions, and success or lack of success in achieving the rebuilding schedule and other goals. If, in response to these revisions, the Council recommends changes to the management target for a particular stock, such changes will be published through full (notice and comment) rulemaking as described in Section 6.2 of this FMP. As with all Council activities, public participation is critical to the development, implementation and success of management programs.

4.5.3.1 Goals and Objectives of Rebuilding Plans

The overall goals of rebuilding programs are to (1) achieve the population size and structure that will support the maximum sustainable yield within a ~~the~~ specified time period that is as short as possible, taking into account the status and biology of the stock, the needs of fishing communities, and the interaction of the stock of fish within the marine ecosystem; (2) minimize, to the extent practicable, the adverse social and economic impacts associated with rebuilding, including adverse impacts on fishing communities; (3) fairly and equitably distribute both the conservation burdens (overfishing restrictions) and recovery benefits among commercial, recreational, and charter fishing sectors; (4) protect the quantity and quality of habitat necessary to support the stock at healthy levels in the future; and (5) promote widespread public awareness, understanding and support for the rebuilding program. More specific goals and objectives may be developed in the rebuilding plan for each overfished species.

To achieve the rebuilding goals, the Council will strive to (1) explain the status of the overfished stock, pointing out where lack of information and uncertainty may require that conservative assumptions be made in order to maintain a risk-averse management approach; (2) identify present and historical harvesters of the stock; (3) where adequate harvest sharing plans are not already in place, develop harvest sharing plans for the rebuilding period and for when rebuilding is completed; (4) set harvest levels that will achieve the specified rebuilding schedule; (5) implement any necessary measures to allocate the resource in accordance with harvest sharing plans; (6) promote innovative methods to reduce bycatch and bycatch mortality of the overfished stock; (7) monitor fishing mortality and use available stock assessment information to evaluate the condition of the stock; (8) identify any critical or important habitat areas and implement measures to ensure their protection; and (9) promote public education regarding these goals, objectives, and the measures intended to achieve them.

4.5.3.2 Contents of Rebuilding Plans

Generally, rebuilding plans will contain:

1. A description of the biology and status of the overfished stock and fisheries affected by stock rebuilding measures.

2. A description of how rebuilding parameters for the overfished stock were determined (including any calculations that demonstrate the scientific validity of parameters).

3. Estimates of rebuilding parameters ($B_{UNFISHED}$, B_{MSY}, T_{MIN}, T_{MAX}, ~~and the probability of reaching target biomass by this date~~, and T_{TARGET}) at the time of rebuilding plan adoption.

4. A description of the fishing communities' needs that were considered at the time of adoption of the plan.

~~4.~~ 5. The process, and any applicable standards, that will be used during periodic review to evaluate progress in rebuilding the stock to the target biomass (see Section 4.5.3.5).

~~5.~~ 6. Any management measures the Council may wish to specifically describe in the FMP, which facilitate stock rebuilding in the specified period. (These measures would be in addition to any existing measures typically implemented through annual or biennial management. See Section 4.5.3.4 for more information.)

~~6.~~ 7. Any goals and objectives in addition to or different from those listed in the preceding section.

~~7.~~ 8. Potential or likely allocations among sectors.

~~8~~. 9. For fisheries managed under international agreement, a discussion of how the rebuilding plan will reflect traditional participation in the fishery, relative to other nations, by fishermen of the United States.

~~9~~. 10. Any other information that may be useful to achieve the rebuilding plan's goals and objectives.

The following questions also serve as a guide in developing rebuilding plans:

1. What is the apparent cause of the current condition (historical fishing patterns, a declining abundance or recruitment trend, a change in assessment methodology, or other factors)?

2. Is there a downward trend in recruitment that may indicate insufficient compensation in the spawner-recruitment relationship?

3. Based on ~~an~~ a 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. What types of fishing communities rely on catch of this particular stock, or on catch of stocks that co-occur with this stock?

~~6~~. 7. Is the particular species caught incidentally with other species? Is it a major or minor component in a mixed-stock complex?

~~7~~. 8. What types of management measures are anticipated and/or appropriate to achieve the biological, social, economic, and community goals and objectives of the rebuilding plan?

Rebuilding plan documents are distinct from the analytical documents required by the National Environmental Policy Act and other legal mandates, although they will reflect the contents of those analyses in a much briefer form. Rebuilding plan elements incorporated into the FMP (in Section 4.5.4) summarize the contents enumerated in this section. Rebuilding plans as a whole will be published in the next annual SAFE document after their approval.

Any new rebuilding program will commence as soon as the first measures to rebuild the stock or stock complex are implemented.

Fishing communities need a sustainable fishery that: is safe, well-managed, and profitable; provides jobs and incomes; contributes to the local social fabric, culture, and image of the community; and helps market the community and its services and products.

4.5.3.3 Process for Development and Approval of Rebuilding Plans

Upon receiving notification that a stock is overfished, the Council will identify one or more individuals to draft the rebuilding plan. A draft of the plan will be reviewed and preliminary action taken (tentative adoption or identification of preferred alternatives), followed by final adoption at a subsequent meeting. The tentative plan or alternatives will be made available to the public and considered by the Council at a minimum of two meetings, unless stock conditions suggest more immediate action is warranted. Upon completing its final recommendations, the Council will submit the proposed rebuilding plan or revision to an existing plan to NMFS for concurrence. A rebuilding plan will be developed following the standard procedures for considering and implementing an FMP amendment under the Magnuson-Stevens Act and other applicable law.

The following elements in each rebuilding plan will be incorporated into the FMP in Section 4.5.4:

1. A brief description of the status of the stock and fisheries affected by stock rebuilding measures at the time the rebuilding plan was prepared.

2. The methods used to calculate stock rebuilding parameters, if substantially different from those described in Section 4.5.2.

3. An estimate at the time the rebuilding plan was prepared of:
   - unfished biomass (Bunfished) and target biomass (BMSY);
   - the year the stock would be rebuilt in the absence of fishing (T_{MIN});
   - T_{MIN} plus one mean generation time (T_{MAX}); and
   - ~~the year the stock would be rebuilt if the maximum time period permissible under National Standard Guidelines were applied (T_{MAX}) and the estimated probability that the stock would be rebuilt by this date based on the application of stock rebuilding measures; and~~
   - the year in which the stock would be rebuilt based on the application of stock rebuilding measures that achieve rebuilding as soon as possible, taking into account the status and biology of the stock, the needs of fishing communities, and the interaction of the overfished stock within the marine ecosystem (T_{TARGET}).

4. A description of the harvest control rule (e.g., constant catch or harvest rate) and the specification of this parameter. The types of management measures that will be used to constrain harvests to the level required ~~implied~~ by the control rule will also be described (see also Section 4.5.3.4). These two elements, the harvest control rule and a description of management measures, represents the rebuilding strategy intended to rebuild the stock by the target year.

It is likely that over time the parameters listed above will change. It must be emphasized that the values enumerated in the FMP represent estimates at the time the rebuilding plan is prepared. Therefore, the FMP need not be amended if new estimates of these values are calculated. The values for these parameters found in the FMP are for reference, so that managers and the public may track changes in the strategy used to rebuild an overfished stock. However, any new estimates of the parameters listed above will be published in the SAFE documents as they become available.

4.5.3.4 Updating Key Rebuilding Parameters

In addition to an initial specification in the FMP, the target year (T_{TARGET}) and the harvest control rule (type and numerical value) will also be specified in regulations. If new information indicates a need to change the value of either of these two parameters, such a change will be accomplished through full (notice and comment) rulemaking as described in Section 6.2 of this FMP. The target year is the year by which the stock would be rebuilt to its target biomass. Therefore, if a subsequent analysis identifies an earlier target year for the current fishing mortality rate (based on the harvest control rule), there is no obligation to change in regulations either the target year (to the computed earlier year) or the harvest control rule (to delay rebuilding to the original target year). Stock assessments for overfished species are typically conducted every two years. Stock assessments and rebuilding analyses use mathematical models to predict a stock's current abundance, as well as project future abundance and recruitment. In any mathematical model that uses a variety of data sources, as the stock assessments do, model results tend to vary from one assessment to the next within some range of values. This expected variation means that, when the Council and SSC review a new overfished species stock assessment and rebuilding model, they must also consider whether the result of that model or models show a rebuilding trajectory that varies from the previously-predicted trajectory to a significant degree. If the variation between the stock assessments and rebuilding analyses for a particular species do not show significant differences in the rebuilding trajectory for that species, they are mathematically considered to be essentially the same. In that circumstance, the Council will likely not need to revise the T_{TARGET} or harvest control rule for that species. Since the target year is ~~a~~ the key rebuilding parameter, it should only be changed after careful deliberation. For example, the Council might recommend that the target year be changed if, based on new information about the status and/or biology of the stock, they determine that the existing target year is later than the recomputed maximum rebuilding time (T_{MAX}) or if a recomputed harvest control rule would result in such a low optimum yield as to cause substantial socioeconomic impacts. These examples are not definitive: the Council may elect to change the target year because of other circumstances. However, any change to the target year or harvest control rule must be supported by commensurate analysis that demonstrates that the new target year is a target to rebuild the stock as soon as possible, taking into account the status and biology of the stock, the needs of fishing communities, and the interaction of the stock within the marine ecosystem.

4.5.3.5 Implementation of Actions Required Under the Rebuilding Plan

NMFS will implement or adjust, with the adoption of the rebuilding plan, any management measures not already in effect that are necessary to implement the rebuilding plan. Many necessary measures may already be in place through the standard management process. Because of the complex nature of the fishery and the interaction of various stocks, regulations will need to be adjusted over the periods of the rebuilding plans. Management measures will be adjusted, or new measures will be developed and implemented in the future, in order to best implement each rebuilding plan throughout the life of that plan.

Once a rebuilding plan is adopted, certain measures required in the rebuilding plan may need to be implemented through authorities and processes already described in the FMP. Management actions to achieve OY harvest, and objectives related to rebuilding requirements of the Magnuson-Stevens Act and goals and objectives of the FMP (each of which may require a slightly different process) include: automatic actions, notices, abbreviated rulemaking actions, and full rulemaking actions. (These actions are detailed in Section 4.6, Chapter 5, and Section 6.2.) Allocation proposals require consideration as specified in the allocation framework (see Section 6.2.3.1). Any proposed regulations to implement the rebuilding plan will be developed in accordance with the framework procedures of this FMP.

Any rebuilding management measures that are not already authorized under the framework of the existing FMP, or specified in the FMP consequent of rebuilding plan adoption, will be implemented by further FMP amendments. These plan amendments may establish the needed measures or expand the framework to allow the implementation of the needed measures under framework procedures.

The Council may designate a state or states to take the lead in working with its citizens to develop management proposals to achieve stock rebuilding.

4.5.3.6 Periodic Review of Rebuilding Plans

Rebuilding plans will be reviewed periodically, but at least every two years, although the Council may propose revisions to an adopted rebuilding plan at any time. These reviews will take into account the goals and objectives listed in Section 4.5.3.1, recognizing that progress towards the first goal, to achieve the population size and structure that will support MSY within the specified time period, will only be evaluated on receipt of new information from the most recent stock assessment. ~~In evaluating progress towards achieving target biomass, the Council will use the standard identified in the rebuilding plan. When drafting a rebuilding plan one of the following standards, or a standard similar in kind to the following, may be chosen:~~

- ~~If the probability of achieving the target biomass within the maximum permissible time period (T_{MAX}) falls below 50% (the required minimum value), then progress will be considered inadequate.~~

- ~~If the probability of achieving the target biomass within the maximum permissible time period (T_{MAX}) falls below the value identified in the rebuilding plan, then progress will be considered inadequate.~~

The Council, in consultation with the SSC and GMT, will determine on a case-by-case basis whether there has been a significant change in a parameter such that the chosen management target must be revised. If, based on this review, the Council decides that the harvest control rule or target year must be changed, the procedures outlined in Section 4.5.3.3 will be followed. Regardless of the Council's schedule for reviewing overfished species rebuilding plans, the Secretary of Commerce, through NMFS, is required to review the progress of overfished species rebuilding plans toward rebuilding goals every two years, per Magnuson-Stevens Act at 16 U.S.C. §304(e)(7).

4.5.3.7 Precedence of a Recovery Plan or "No Jeopardy" Standard Issued Pursuant to the Endangered Species Act

Like rebuilding plans pursuant to National Standard 1 in the Magnuson-Stevens Act, a recovery plan pursuant to the Endangered Species Act outlines measures for the conservation and survival of the designated species. Under Section 7 of the Endangered Species Act an agency must consult NMFS when any activity permitted, funded, or conducted by that agency may affect a listed marine species or its designated critical habitat. (In the case of fishery management actions, NMFS is both the action and consulting agency.) As part of these consultations, a biological opinion is produced describing standards that must be met when permitting or implementing the action to ensure that the action is not likely to jeopardize the continued existence of the listed species; these are referred to as "no jeopardy" standards.

Measures under a recovery plan or "no jeopardy" standards in a biological opinion will supercede rebuilding plan measures and targets if they will result in the stock rebuilding to its target biomass by an earlier date than the target year identified in the current rebuilding plan. (If expressed probabilistically, any ESA standard expressed as a combination of date and probability that constitutes a higher standard will take precedence over the equivalent target and probability in the rebuilding plan. For example, an ESA standard requiring recovery by the rebuilding plan target year, but with a higher probability, would take precedence over the rebuilding plan.) If a stock is de-listed before reaching its target biomass, the rebuilding plan will come back into effect until such time as the stock is fully rebuilt.

4.5.4 Summary of Rebuilding Plan Contents

As noted in Section 4.5.3.3, this section summarizes the contents of rebuilding plans, including the values for rebuilding parameters, at the time of their adoption. The specified numerical values for these parameters are likely to change over time. This section will not be amended to incorporate any revised values. As described in Section 4.5.3.4, if the numerical specification of the harvest control rule or target year for a given overfished species is changed, the new value will be published in federal groundfish regulations. In addition, subsequent SAFE documents may include updated values for the parameters listed in Section 4.5.3.3 and Table 4-1.

In 1999, NMFS notified the Council that the coastwide lingcod stock was considered overfished. Amendment 16-2 to the FMP included a rebuilding plan for lingcod that set a T_{TARGET} rebuilding date of 2009. However, the lingcod stock rebuilt faster than the Council had initially anticipated. The 2005 lingcod stock assessment showed that the coastwide stock had rebuilt to a level exceeding statutory requirements, B_{MSY} or B_{40}. Amendment 16-4, therefore, removed the lingcod rebuilding plan from the FMP.

4.5.4.1 Darkblotched Rockfish

Status of the Darkblotched Stock and Fisheries Affected by Stock Rebuilding Measures at the Time of the Council's Rebuilding Plan Adoption (June 2003)

Historically, darkblotched rockfish were managed as part of a coastwide Sebastes complex, which was later segregated into north and south management units divided at 40°30' N latitude. As a result, fishery-dependent data from this period are generally unavailable. The first darkblotched rockfish stock assessment estimated the proxy MSY harvest rate and overfishing rate for the stock (Lenarz 1993).

Rogers et al. (2000) assessed darkblotched stock status in 2000 and determined the stock was at 14% to 31% of its unfished level. This range in biomass estimates encompasses the MSST threshold of 25%; uncertainty in past catches by foreign vessels, which targeted Pacific ocean perch and also caught darkblotched rockfish, was the most important contributor to this wide range for the biomass estimate. A larger unfished biomass (B_0) is computed using larger historic catch estimates. Since the MSST is expressed as a percent of unfished biomass, a larger B_0 increases the absolute value of this threshold, making an overfished determination more likely. Without definitive information on foreign catches, managers assumed darkblotched comprised 10% of this catch, leading to the conclusion that the spawning stock biomass was 22% of its unfished level. Because this is below the MSST, the stock was declared overfished in 2000.

The Council adopted a rebuilding plan for darkblotched rockfish at its June 2003 meeting, as described by the parameter values listed in Table 4-1. These values are based on a rebuilding analysis conducted by Methot and Rogers (2001).

Darkblotched rockfish occur on the outer continental shelf and continental slope, mainly north of Point Reyes. Because of this distribution they are caught exclusively by commercial vessels. Most landings have been made by bottom trawl vessels targeting flatfish on the continental shelf, rockfish on the continental slope, and the Dover sole–thornyhead–sablefish complex, also on the slope.

Methods Used to Calculate Stock Rebuilding Parameters

The methods used by Methot and Rogers in their rebuilding analysis do not differ substantially from the approach described in Section 4.5.2.

Rebuilding Parameter Values at the Time of Rebuilding Plan Adoption

Table 4-1 lists the numerical values for B_0, B_{MSY}, T_{MIN}, T_{MAX}, P_{MAX}, T_{TARGET} and F. The values of B_0, B_{MSY}, T_{MIN}, and T_{MAX} are derived from the rebuilding analysis used in formulating the rebuilding plan (Methot and Rogers 2001). The Council chose a value of 80% for P_{MAX}, based on a harvest control rule of F = 0.027. This results in a target year of 2030.

Darkblotched Rockfish Rebuilding Strategy

As shown in Table 4-1, at the inception of the rebuilding plan the harvest control rule for darkblotched rockfish was a fishing mortality rate of 0.027. Based on the 2001 rebuilding analysis, this harvest rate is likely to rebuild the stock by the target year of 2030. This value is likely to change over time as stock size and structure changes. Any updated value will be published in federal groundfish regulations. The fishing mortality rate is applied to the exploitable biomass estimate to determine the OY for a given fishing period.

Management measures are implemented through the biennial harvest specification and management process described in Chapter 5. The types of management measures that may be implemented through this process are described in Chapter 6. In 2003, at the time of rebuilding plan adoption, measures intended to limit bycatch of overfished species included prohibiting retention of certain overfished species during some parts of the year, reducing landing limits (cumulative trip limits) on co-occurring species, establishing extensive time/area closures, and restricting the use of trawl nets equipped with large footropes. (By using large footropes with heavy roller gear, bottom trawlers can access rocky habitat on the continental shelf. This is the preferred habitat for some overfished species.)

Beginning in 2002 time/area closures, referred to as Groundfish Conservation Areas (GCAs), came into use as a way of decreasing bycatch of overfished species. GCAs enclose depth ranges where bycatch of overfished species is most likely to occur, based on information retrieved from log books and the at-sea observer program. The boundaries vary by season and fishery sector, and may be modified in response to new information about the geographic and seasonal distribution of bycatch.

To limit darkblotched rockfish bycatch, an outer boundary of the GCA was set to move fishing activity into deeper water, away from the depth range of higher abundance for this species. In 2003 this outer boundary was modified during the winter months to allow targeting of petrale sole and other flatfish in shallower depths while still minimizing bycatch. The cumulative trip limits for minor slope rockfish north of Cape Mendocino, the species complex that darkblotched rockfish are managed under, and for splitnose rockfish, a co-occurring target species, were also lowered. Trip limits for other target species also may be adjusted to reduce darkblotched rockfish bycatch.

4.5.4.2 Pacific Ocean Perch

Status of the Pacific Ocean Perch Stock and Fisheries Affected by Stock Rebuilding Measures at the Time of the Council's Rebuilding Plan Adoption (June 2003)

Pacific Ocean Perch (POP) were targeted by Soviet and Japanese factory trawlers between 1965 and 1975. Their large catches during this period substantially contributed to a decline in the West Coast stock. In 1981, just before this FMP was implemented, the Council declared the POP stock depleted and recommended conservative harvest policies. Although management measures discouraged targeting POP while allowing continued fishing on other species, the stock did not recover and the Council recommended still more restrictive measures. A 1998 stock assessment (Ianelli and Zimmerman 1998) estimated POP biomass was 13% of the unfished level, leading NMFS to declare the stock overfished in 1999.

The Council adopted a rebuilding plan for POP at its June 2003 meeting, as described by the parameter values listed in Table 4-1. These values are based on a 2000 stock assessment (Ianelli, *et al.* 2000) and subsequent rebuilding analysis (Punt and Ianelli 2001). A retrospective analysis of foreign fleet catches, underway at the time of rebuilding plan adoption, may change the rebuilding period estimates on which the rebuilding plan is based.

POP tend to occur at similar depths as darkblotched rockfish, although they have a more northerly geographic distribution. As a result, POP are caught in similar fisheries as darkblotched rockfish, but only north of Cape Mendocino. At the time the rebuilding plan was adopted, limited entry trawl vessels targeting flatfish, including petrale sole and arrowtooth flounder, accounted for more than 90% of all POP landings. POP are not an important component of the recreational fishery.

Methods Used to Calculate Stock Rebuilding Parameters

The methods used in the rebuilding analysis used to develop the rebuilding plan (Punt and Ianelli 2001) do not differ substantially from the approach described in Section 4.5.2.

Rebuilding Parameter Values at the Time of Rebuilding Plan Adoption

Table 4-1 lists the numerical values for B_0, B_{MSY}, T_{MIN}, T_{MAX}, P_{MAX}, T_{TARGET} and F. The values of B_0, B_{MSY}, T_{MIN}, and T_{MAX} are derived from the rebuilding analysis used in formulating the rebuilding plan (Punt and Ianelli 2001). The Council chose a value of 70% for P_{MAX}, based on a harvest control rule of F = 0.0082. This results in a target year of 2027.

Pacific Ocean Perch Rebuilding Strategy

As shown in Table 4-1, at the inception of the rebuilding plan the harvest control rule for POP was a fishing mortality rate of 0.0082. Based on the 2001 POP rebuilding analysis (Punt and Ianelli 2001), this harvest rate is likely to rebuild the stock by the target year of 2027. This value is likely to change over time as stock size and structure changes. Any updated value will be published in federal groundfish regulations. The fishing mortality rate is applied to the exploitable biomass estimate to determine the OY for a given fishing period.

Management measures are implemented through the biennial harvest specification and management process described in Chapter 5. The types of management measures that may be implemented through this process are described in Chapter 6. In 2003, at the time of rebuilding plan adoption, measures intended to limit bycatch of overfished species included prohibiting retention of certain overfished species during some parts of the year, reducing landing limits (cumulative trip limits) on co-occurring species, establishing extensive time/area closures, and restricting the use of trawl nets equipped with large footropes. (By using large footropes with heavy roller gear, bottom trawlers can access rocky habitat on the continental shelf. This is the preferred habitat for some overfished species.)

Beginning in 2002 time/area closures, referred to as Groundfish Conservation Areas (GCAs), came into use as a way of decreasing bycatch of overfished species. GCAs enclose depth ranges where bycatch of overfished species is most likely to occur, based on information retrieved from log books and the at-sea observer program. The boundaries vary by season and fishery sector, and may be modified in response to new information about the geographic and seasonal distribution of bycatch.

Because POP tend to co-occur with darkblotched rockfish, management measures applicable to that species also serve to constrain catches of POP. These measures include configuring the outer boundary of the GCA so that vessels fish in deeper water, where POP are less abundant. A cumulative trip limit, which represents the maximum amount of an identified species or species group that may be landed within the cumulative limit period (in 2003, two months) is also established for this species. Trip limits for overfished species are intended to discourage targeting on them while permitting any incidental catch to be landed. (Bycatch discarded at sea is more difficult to monitor.) As with darkblotched rockfish, trip limits for target species also may be adjusted in order to minimize bycatch of overfished species.

4.5.4.3 Canary Rockfish

Status of the Canary Rockfish Stock and Fisheries Affected by Stock Rebuilding Measures at the Time of the Council's Rebuilding Plan Adoption (June 2003)

Canary rockfish exploitation began in the early 1940s when World War II increased demand for protein (Alverson, *et al.* 1964; Browning 1980). Through this decade the trawl fishery expanded in Oregon and Washington, accounting for most of the canary rockfish catch; in California longlines were mainly used to target rockfish during this period. Other gear historically used to catch canary rockfish include hook-and-line (primarily vertical longline), shrimp trawls, and pots and traps. From 1966 until 1976 foreign trawlers were responsible for most of the harvest. After passage of the Magnuson Act in 1977 domestic vessels became the dominant harvesters of this species. In recent years canary rockfish have become an important recreational target north of Cape Mendocino.

Overfishing, or exceeding the MFMT, was detected by a 1994 stock assessments and subsequent update (Sampson 1996; Sampson and Stewart 1994). In both cases the harvest rate exceeded the F20% threshold. In 1999 two age-based stock assessments showed that the stock was overfished in a northern area comprising the Columbia and U.S. Vancouver management zones (Crone, *et al.* 1999) and in a southern area comprising Conception, Monterey, and Eureka management zones (Williams, *et al.* 1999). Based on these assessments, the stock was declared overfished in January 2000.

The first rebuilding analysis (Methot 2000a) used results from the northern area assessment to project rates of potential stock recovery. The stock was found to have extremely low productivity, defined as production of recruits in excess of the level necessary to maintain the stock at its current low level. According to the anlaysis, rates of recovery are highly dependent on the level of recent recruitment, which could not be estimated with high certainty.

A subsequent assessment (Methot and Piner 2002c) treated the stock as a single coastwide unit (covering the area from the Monterey zone through the U.S. Vancouver zone). This differed from past assessments, where northern and southern areas were treated separately. The lack of older, mature females in surveys and other assessment indices was another consideration in this assessment. Older females may simply have a higher natural mortality rate, or survey and fishing gear may be less effective at catching them. If these fish are in fact un-sampled, productivity estimates should be higher because older, larger fish are more fecund. Methot and Piner (2002c) combined these two hypotheses in a single age-structured version of the SSC-endorsed stock synthesis assessment model (Methot 2000b). They estimated the 2002 abundance of canary rockfish coastwide was about 8% of B_0.

The Canary rockfish rebuilding plan was adopted by the Council at its June 2003 meeting and is based on a 2002 rebuilding analysis (Methot and Piner 2002a). The 2002 rebuilding analysis updated the first rebuilding analysis for canary rockfish, completed in 2000, using information from the aforementioned stock assessment. The Council's rebuilding strategy, when combined with the results of this rebuilding analysis, required a substantial reduction in the OY for 2003. As a result, fisheries must be managed for canary rockfish bycatch, often limiting the amount of target species that may be harvested.

Canary rockfish are encountered in a relatively wide variety of both commercial and recreational fisheries. However, limited entry trawlers targeting flatfish and arrowtooth flounder account for a large proportion of the landed catch, mainly north of Cape Mendocino. Much smaller amounts are caught in the whiting and DTS limited entry trawl fisheries, and by fixed gear vessels targeting groundfish on the continental shelf. Charter vessels account for most of recreationally-caught canary rockfish, mainly off of Northern California and Oregon.

Methods Used to Calculate Stock Rebuilding Parameters

The methods used in the rebuilding analysis used to develop the rebuilding plan (Methot and Piner 2002a) do not differ substantially from the approach described in Section 4.5.2.

Rebuilding Parameter Values at the Time of Rebuilding Plan Adoption

Table 4-1 lists the numerical values for B_0, B_{MSY}, T_{MIN}, T_{MAX}, P_{MAX}, T_{TARGET} and F. The values of B_0, B_{MSY}, T_{MIN}, and T_{MAX} are derived from the rebuilding analysis used in formulating the rebuilding plan (Methot and Piner 2002a). The Council chose a value of 60% for P_{MAX}, based on a harvest control rule of F = 0.022. This results in a target year of 2074.

Canary Rockfish Rebuilding Strategy

As shown in Table 4-1, at the inception of the rebuilding plan the harvest control rule for canary rockfish was a fishing mortality rate of 0.022. Based on the 2002 canary rockfish rebuilding analysis (Methot and Piner 2002a), this harvest rate is likely to rebuild the stock by the target year of 2074. This value is likely to change over time as stock size and structure changes. Any updated value will be published in federal groundfish regulations. The fishing mortality rate is applied to the exploitable biomass estimate to determine the OY for a given fishing period.

Management measures are implemented through the biennial harvest specification and management process described in Chapter 5. The types of management measures that may be implemented through this process are described in Chapter 6. In 2003, at the time of rebuilding plan adoption, measures intended to limit bycatch of overfished species included prohibiting retention of certain overfished species during some parts of the year, reducing landing limits (cumulative trip limits) on co-occurring species, establishing extensive time/area closures, and restricting the use of trawl nets equipped with large footropes. (By using large footropes with heavy roller gear, bottom trawlers can access rocky habitat on the continental shelf. This is the preferred habitat for some overfished species.)

Beginning in 2002 time/area closures, referred to as Groundfish Conservation Areas (GCAs), came into use as a way of decreasing bycatch of overfished species. GCAs enclose depth ranges where bycatch of overfished species is most likely to occur, based on information retrieved from log books and the at-sea observer program. The boundaries vary by season and fishery sector, and may be modified in response to new information about the geographic and seasonal distribution of bycatch.

Canary rockfish prefer rocky areas on the continental shelf so management measures in use at the time of rebuilding plan adoption were intended to discourage fishing in these areas. Under the regulations in place during 2003, bottom trawling is prohibited in the GCA, which encompasses depth ranges where canary rockfish are most frequently caught. In addition, the aforementioned restrictions on the use of trawl nets equipped with large footropes discourage fishing in the rocky habitat preferred by this species. In areas shoreward of the GCA large footrope gear is prohibited, preventing trawlers from assessing rocky habitat in these shallower depths. In areas deeper than the GCA, either small or large footrope gear may be used, although large footrope gear is the preferred type in these depths. In addition, cumulative trip limits are structured to encourage vessels to fish exclusively in deep water where canary rockfish (as well as some other overfished species) are not encountered. Vessels are allowed to use all gear configurations during any given cumulative limit period (currently two months). However, vessels which use the small footrope configuration are restricted to lower cumulative trip limits than vessels using large footrope configurations. Since the large footrope configuration may only be used offshore of the GCA, these measures encourage fishing exclusively in deeper water to take advantage of the higher limits afforded this gear type.

Recreational fisheries are managed mainly through bag limits, size limits, and fishing seasons established for each West Coast state. Bag and size limits have been established for canary rockfish. In addition, managers have the option of closing areas to recreational fishing if needed to prevent the canary rockfish OY from being exceeded.

~~4.5.4.4 Lingcod~~

~~Status of the Lingcod Stock and Fisheries Affected by Stock Rebuilding Measures at the Time of the Council's Rebuilding Plan Adoption (June 2003)~~

~~A 1997 stock assessment concluded that the lingcod stock in the Columbia and Vancouver zones (including the Canadian portion of the Vancouver management zone) was less than 10% of B_0, below the B25% MSST (Jagielo, *et al.* 1997). The Council responded by imposing substantial harvest reductions coastwide, reducing the harvest targets for the Eureka, Monterey, and Conception areas by the same percentage as in the north. In 1999, scientists assessed the southern portion of the stock and concluded the condition of the southern stock was similar to the northern stock, thus confirming the Council had taken appropriate action to reduce harvest coastwide (Adams, *et al.* 1999). Based on these assessments,~~

the lingcod stock was declared overfished in 1999.

Subsequently, Jagielo (2000) conducted a coastwide lingcod assessment, which showed substantial increase in stock size and suggested that the stock was younger and more productive than previously thought. A revised rebuilding analysis of coastwide lingcod (Jagielo and Hastie 2001) was adopted by the Council in September 2001. It confirmed the major conclusions of the 2000 assessment and rebuilding analysis, but slightly modified recruitment projections to stay on the rebuilding trajectory that reaches target biomass in 2009. The rebuilding plan adopted by the Council at is June 2003 meeting is based on this 2001 update of the original rebuilding analysis produced by the same author. Because the minimum time period within which lingcod could be rebuilt is less than 10 years, the maximum allowable rebuilding period (T_{MAX}) is 10 years. The Council chose a target year equal to T_{MAX}, with the stock expected to rebuild by 2009.

Lingcod are encountered in a diverse array of commercial fisheries. Historically, limited entry trawl and limited entry fixed gear vessels accounted for the majority of lingcod landings. The open access sector, comprising many different gear types and fishing strategies, also lands a significant amount coastwide in nearshore and continental shelf areas. Lingcod are an important species in recreational fisheries, which account for an increasing portion of overall lingcod mortality as commercial landings declined drammatically beginning in 1998. Although recreational lingcod catches are reported coastwide, most of the recreational catch occurs off central and Northern California, with private boats making most of this catch.

Methods Used to Calculate Stock Rebuilding Parameters

The methods used in the rebuilding analysis used to develop the rebuilding plan (Jagielo and Hastie 2001) do not differ substantially from the approach described in Section 4.5.2.

Rebuilding Parameter Values at the Time of Rebuilding Plan Adoption

Table 4-1 lists the numerical values for B_0, B_{MSY}, T_{MIN}, T_{MAX}, P_{MAX}, T_{TARGET} and F. The values of B_0, B_{MSY}, T_{MIN}, and T_{MAX} are derived from the rebuilding analysis used in formulating the rebuilding plan (Jagielo and Hastie 2001). The Council chose a value of 60% for P_{MAX}, based on a harvest control rule of F = 0.0531 for the northern portion of the stock and F = 0.061 for the southern portion of the stock. This results in a target year of 2009.

Lingcod Rebuilding Strategy

As shown in Table 4-1, at the inception of the rebuilding plan the harvest control rule for canary rockfish was a fishing mortality rate of 0.0531 for the northern portion of the stock and 0.061 for the southern portion of the stock. Based on the 2001 lingcod rebuilding analysis (Jagielo and Hastie 2001), this harvest rate is likely to rebuild the stock by the target year of 2009. This value is likely to change over time as stock size and structure changes. Any updated value will be published in federal groundfish regulations. The fishing mortality rate is applied to the exploitable biomass estimate to determine the OY for a given fishing period.

Management measures are implemented through the biennial harvest specification and management process described in Chapter 5. The types of management measures that may be implemented through this process are described in Chapter 6. In 2003, at the time of rebuilding plan adoption, measures

~~intended to limit bycatch of overfished species included prohibiting retention of certain overfished species during some parts of the year, reducing landing limits (cumulative trip limits) on co-occurring species, establishing extensive time/area closures, and restricting the use of trawl nets equipped with large footropes. (By using large footropes with heavy roller gear, bottom trawlers can access rocky habitat on the continental shelf. This is the preferred habitat for some overfished species.)~~

~~Beginning in 2002 time/area closures, referred to as Groundfish Conservation Areas (GCAs), came into use as a way of decreasing bycatch of overfished species. GCAs enclose depth ranges where bycatch of overfished species is most likely to occur, based on information retrieved from log books and the at-sea observer program. The boundaries vary by season and fishery sector, and may be modified in response to new information about the geographic and seasonal distribution of bycatch.~~

~~In addition to the more general measures described above, which are intended to reduce bycatch of all overfished species, lingcod landings by the limited entry fixed gear and open access sectors were prohibited during the winter months in 2003. Lingcod are more vulnerable in shallow depths (where vessels in these sectors are more likely to fish) during the winter because of their spawning behavior. For the same reason, retention of lingcod by recreational fishermen during winter months was prohibited in Washington and California during 2003. Recreational bag and size limits are also used to manage total lingcod fishing mortality.~~

4.5.4.~~5~~4 Bocaccio Rockfish

Status of the Bocaccio Stock and Fisheries Affected by Stock Rebuilding Measures at the Time of Rebuilding Plan Adoption (April 2004)

Assessment scientists and managers have treated West Coast bocaccio as independent stocks north and south of Cape Mendocino. The southern stock, which has been declared overfished, occurs south of Cape Mendocino and the northern stock north of 48° N latitude in northern Washington (off Cape Flattery). The overfished southern bocaccio rockfish stock occurs in Central and Southern California waters, on the continental shelf and in nearshore areas, often in rocky habitat. They are caught in both commercial and recreational fisheries in approximately equal amounts. Commercial catches mainly occur in limited entry trawl fisheries.

Bocaccio have long been an important component of California rockfish fisheries. Catches increased to high levels in the 1970s and early 1980s as relatively strong year-classes recruited to the stock. The Council began to recommend increasingly restrictive regulations after an assessment of the southern stock in 1990 (Bence and Hightower 1990) indicated that fishing rates were too high. The southern stock has been assessed six times (Bence and Hightower 1990; Bence and Rogers 1992; MacCall 2002; MacCall 2003b; MacCall, *et al.* 1999; Ralston, *et al.* 1996) and has suffered poor recruitment during the warm water conditions that have prevailed off Southern California since the late 1980s. The 1996 assessment (Ralston, *et al.* 1996) indicated the stock was in severe decline. NMFS formally declared the stock overfished in March 1999 after the groundfish FMP was amended to incorporate the tenets of the Sustainable Fisheries Act. MacCall et al. (1999) confirmed the overfished status of bocaccio and estimated spawning output of the southern stock to be 2.1% of its unfished biomass and 5.1% of the maximum sustainable yield (MSY) level. The northern stock of bocaccio has not been assessed.

While previous assessments only used data from Central and Northern California, an assessment in 2002 (MacCall and He 2002) also included data for southern California. While relative abundance increased slightly from the last assessment (4.8% of unfished biomass), potential productivity appears lower than previously thought, making for a more pessimistic outlook. The Council assumed a medium recruitment scenario for the 1999 year class, which was not assessed (MacCall, *et al.* 1999). The 2002 assessment revealed the 1999 year class experienced relatively lower recruitment. Therefore, although the 1999 year class contributed a substantial quantity of fish to the population, it did not contribute as much to rebuilding as was previously thought.

The 2003 bocaccio assessment differs greatly from the 2002 assessment. It is driven by the strength of the incoming 1999 year class that had not recruited into the indices used for the 2002 assessment and by a revised lower estimate of natural mortality (MacCall 2003b). In addition to the 2001 Triennial Survey data, the 2003 assessment used larval abundance data from recent CalCOFI surveys as well as length and catch per unit effort (CPUE) data from recreational fisheries. In calculating the recreational CPUE information, a new method was used that identifies relevant fishing trips by species composition and adjusts the catch history for regulatory changes that affect the level of discard and avoidance. The results of these calculations suggest that recreational CPUE has increased dramatically in recent years and is at a record high level in Central California north of Pt. Conception. The STAR Panel recommended the use of two assessment models as a means of bracketing uncertainty from the very different signals between the Triennial Survey and the recreational CPUE data. Following the Stock Assessment Review (STAR) Panel meeting, MacCall presented a third "hybrid" model that incorporated the data from all of the indices. The Scientific and Statistical Committee (SSC) recommended, and the Council approved, the use of this third modeling approach. This resulted in modest improvement in estimated stock size, but significantly affected the estimated productivity of the stock. These results had substantial effects on the rebuilding outlook for bocaccio which, under the 2002 assessment, was not expected to rebuild within T_{MAX} even with no fishing related mortality. Total mortality in 2003 fisheries was restricted to less than 20 mt as a means of conserving the stock while minimizing adverse socioeconomic impacts to communities. The current rebuilding analysis (MacCall 2003a), using the "hybrid" model, suggests the stock could rebuild to BMSY within 25 years while sustaining an optimum yield (OY) of approximately 300 mt in 2004.

The Council adopted a rebuilding plan for bocaccio rockfish at its April 2004 meeting, as described by the parameter values listed in Table 4-1. These values are based on a rebuilding analysis conducted by MacCall (2003b).

Fisheries in central and southern California are affected by the bocaccio rebuilding plan because the overfished population occurs in these waters. Recreational and limited entry trawl fisheries in this region have accounted for the bulk of landings in recent years.

Methods Used to Calculate Stock Rebuilding Parameters

The methods used by MacCall in his rebuilding analysis (MacCall 2003a) do not differ substantially from the approach described in Section 4.5.2.

Rebuilding Parameter Values at the Time of Rebuilding Plan Adoption

Table 4-1 lists the numerical values for B_0, B_{MSY}, T_{MIN}, T_{MAX}, P_{MAX}, T_{TARGET} and F. The values of B_0, B_{MSY}, T_{MIN}, and T_{MAX} are derived from the rebuilding analysis used in formulating the rebuilding plan (MacCall 2003a). Using the STATc base model from the most recent stock assessment (MacCall 2003b), the Council chose a value of 70% for P_{MAX}, based on a harvest control rule of F = 0.0498. This results in a target year of 2023.

Bocaccio Rockfish Rebuilding Strategy

As shown in Table 4-1, at the inception of the rebuilding plan the harvest control rule for bocaccio rockfish was a fishing mortality rate of 0.0498. Based on the 2003 rebuilding analysis, this harvest rate is likely to rebuild the stock by the target year of 2023. This value is likely to change over time as stock size and structure changes. Any updated value will be published in federal groundfish regulations. The fishing mortality rate is applied to the exploitable biomass estimate to determine the OY for a given fishing period.

Management measures are implemented through the biennial harvest specification and management process described in Chapter 5. The types of management measures that may be implemented through this process are described in Chapter 6. In 2004, at the time of rebuilding plan adoption, measures intended to limit bycatch of overfished species included prohibiting retention of certain overfished species during some parts of the year, reducing landing limits (cumulative trip limits) on co-occurring species, establishing extensive time/area closures, and restricting the use of trawl nets equipped with large footropes. (By using large footropes with heavy roller gear, bottom trawlers can access rocky habitat on the continental shelf. This is the preferred habitat for some overfished species.)

Beginning in 2002, time/area closures known as GCAs came into use as a way of decreasing bycatch of overfished species. GCAs enclose depth ranges where bycatch of overfished species is most likely to occur, based on information retrieved from logbooks and the at-sea observer program. The boundaries vary by season and fishery sector, and may be modified in response to new information about the geographic and seasonal distribution of bycatch.

As noted, a large proportion of bocaccio catch occurs in recreational fisheries in Central and Southern California. Recreational depth closures, restricting fishing to shallow waters, bag limits, and seasonal closures have been used to reduce recreational bocaccio catches.

4.5.4.~~6~~5 Cowcod

Status of the Cowcod and Fisheries Affected by Stock Rebuilding Measures at the Time of Rebuilding Plan Adoption (April 2004)

Relatively little is known about cowcod, a species of large rockfish that ranges from Ranger Bank and Guadalupe Island in central Baja California to Usal, Mendocino County, California (Miller and Lea 1972), and may infrequently occur as far north as Newport, Oregon. Cowcod have been assessed only once (Butler, *et al.* 1999). Adult cowcod are primarily found over high relief rocky areas (Allen 1982). They are generally solitary, but occasionally aggregate (Love, *et al.* 1990).

While cowcod are not a major component of the groundfish fishery, they are highly desired by both recreational and commercial fishers because of their bright color and large size. In recent years small amounts have been caught by limited entry trawl vessels and recreational anglers in Southern California. The cowcod stock south of Cape Mendocino has experienced a long-term decline. The cowcod stock in the Conception area was assessed in 1998 (Butler, *et al.* 1999). Abundance indices decreased approximately tenfold between the 1960s and the 1990s, based on commercial passenger fishing vessel (CPFV) logs (Butler, *et al.* 1999). Recreational and commercial catch also declined substantially from peaks in the 1970s and 1980s, respectively.

B_0 was estimated to be 3,370 mt, and 1998 spawning biomass was estimated at 7% of B_0, well below the

25% overfishing threshold. As a result, NMFS declared cowcod in the Conception and Monterey management areas overfished in January 2000. Large areas off Southern California (the Cowcod Conservation Areas [CCAs]) have been closed to fishing for cowcod. The stock's low productivity and declined spawning biomass also necessitates an extended rebuilding period, estimated at 62 years with no fishing-related mortality (T_{MIN}), to achieve a 1,350 mt BMSY for the Conception management area.

There is relatively little information about the cowcod stock, and there are major uncertainties in the one assessment that has been conducted. The assessment authors needed to make estimates of early landings based on more recent data and reported total landings of rockfish. Age and size composition of catches are poorly sampled, population structure is unknown, and the assessment was restricted to Southern California waters.

A cowcod rebuilding review was completed in 2003, which validated the assumption that non-retention regulations and area closures have been effective in constraining cowcod fishing mortality (Butler, *et al.* 2003). These results, although encouraging, are based on cowcod fishery-related removals from CPFV observations and angler reported discards. Non-retention regulations and limited observation data have increased the need for fishery independent population indices.

The Council adopted a rebuilding plan for cowcod at its April 2004 meeting, as described by the parameter values listed in Table 4-1. These values are based on a rebuilding analysis conducted by Butler and Barnes (2000).

Methods Used to Calculate Stock Rebuilding Parameters

The Cowcod rebuilding analysis (Butler and Barnes 2000) was completed before the SSC default rebuilding analysis methodology (Punt 2002), described in Section 4.5.2 , had been developed. Instead, it uses a surplus production model using a log-normal distribution fitted to recruitment during 1951-1998. At the time of rebuilding plan adoption (2004) a new cowcod stock assessment and rebuilding analysis had not been completed. In April 2004 the SSC recommended that future cowcod stock assessments use a model whose output can be used in the default rebuilding analysis methodology.

Rebuilding Parameter Values at the Time of Rebuilding Plan Adoption

Table 4-1 lists the numerical values for B_0, B_{MSY}, T_{MIN}, T_{MAX}, P_{MAX}, T_{TARGET} and F. The values of B_0, B_{MSY}, T_{MIN}, and T_{MAX} are derived from the rebuilding analysis (Butler and Barnes 2000) used in formulating the rebuilding plan. The Council chose a value of 60% for P_{MAX}, based on a harvest control rule of F = 0.009. This results in a target year of 2090.

Cowcod Rebuilding Strategy

As shown in Table 4-1, at the inception of the rebuilding plan the harvest control rule for cowcod was a fishing mortality rate of 0.009. Based on the 2000 cowcod rebuilding analysis (Butler and Barnes 2000), this harvest rate is likely to rebuild the stock by the target year of 2090. This value is likely to change over time as stock size and structure changes. Any updated value will be published in federal groundfish regulations. The fishing mortality rate is applied to the exploitable biomass estimate to determine the OY for a given fishing period.

Management measures are implemented through the biennial harvest specification and management process described in Chapter 5. The types of management measures that may be implemented through this process are described in Chapter 6. In 2004, at the time of rebuilding plan adoption, measures intended to limit bycatch of overfished species included prohibiting retention of certain overfished species during some parts of the year, reducing landing limits (cumulative trip limits) on co-occurring species, establishing extensive time/area closures, and restricting the use of trawl nets equipped with large footropes. (By using large footropes with heavy roller gear, bottom trawlers can access rocky habitat on the continental shelf. This is the preferred habitat for some overfished species.)

Beginning in 2002, time/area closures known as GCAs came into use as a way of decreasing bycatch of overfished species. GCAs enclose depth ranges where bycatch of overfished species is most likely to occur, based on information retrieved from logbooks and the at-sea observer program. The boundaries vary by season and fishery sector, and may be modified in response to new information about the geographic and seasonal distribution of bycatch.

Because cowcod is a fairly sedentary species, establishment of a marine protected area, considered one of the GCAs, is the key strategy for limiting cowcod fishing mortality. The CCAs in the Southern California Bight encompasses two areas of greatest cowcod density, as estimated in 2000, based on historical cowcod catch and catch rates in commercial and recreational fisheries. To aid in enforcement, the CCAs are bounded by straight lines enclosing simple polygons. Butler, et al. (2003) concluded that the CCAs have been effective in reducing bycatch to levels projected to allow stock rebuilding. Estimated fishery removals have been at levels sufficient to rebuild the stock, since the CCAs were implemented, except in 2001 when 5.6 mt was caught in the Conception management area. Most of this catch occurred in the spot prawn trawl fishery, which subsequently has been phased out.

Given the particular life history characteristics of cowcod, the Council will continue to use species-specific area closures to protect cowcod. As new information becomes available on cowcod behavior and fisheries interactions with cowcod, the boundaries or related regulations concerning the current CCAs may change, and additional CCAs may be established by regulation.

4.5.4.~~7~~ 6 Widow Rockfish

Status of the Widow Rockfish Stock and Fisheries Affected by Stock Rebuilding Measures at the Time of Rebuilding Plan Adoption (April 2004)

Widow rockfish are an important commercial species from British Columbia to central California, particularly since 1979, when an Oregon trawl fisherman demonstrated the ability to make large catches at night using midwater trawl gear. Since that time, many more participants entered the fishery and landings of widow rockfish increased rapidly (Love, *et al.* 2002). Because widow rockfish are commonly distributed in the mesopelagic (midwater) zone they are most commonly caught in with midwater trawl gear, which sweeps this zone (in contrast to bottom trawl gear used to target most groundfish species). Historically, widow rockfish were a major target species. Landings peaked at 12,473 mt in 1989 and as recently as 2000 stood at 3,866 mt (PFMC 2002). Target fisheries were eliminated after widow rockfish were declared overfished in 2001. Currently, the Pacific whiting fishery accounts for about three-quarters of widow rockfish catches; a small directed fishery for yellowtail rockfish, prosecuted by Washington treaty Indian Tribes, and the limited entry fixed gear sector account for almost all of the remaining incidental catches. Most catches occur in the U.S.-Vancouver, Columbia, and Eureka management areas.

Williams, et al. (2000) assessed the widow rockfish in 2000. The spawning output level (8,223 mt), based on that assessment and a revised rebuilding analysis (Punt and MacCall 2002) adopted by the Council in June 2001, was at 23.6% of the unfished level (33,490 mt) in 1999. This result was computed using the average recruitment from 1968 to 1979 multiplied by the spawning output-per-recruit at F = 0. The analysis concluded the rebuilding period in the absence of fishing is 22 years, and with a mean generation time of 16 years, the maximum allowable time to rebuild (T_{MAX}) is 38 years. Widow rockfish were declared overfished in 2001 based on these analyses.

The most recent assessment (He, *et al.* 2003b) concluded that the widow rockfish stock size is 22.4% of the unfished biomass, but indicates stock productivity is considerably lower than previously thought. Data sparseness was a significant problem in this widow rockfish assessment (Conser, *et al.* 2003; He, *et al.* 2003b). Limited logbook data prior to 1990 is available from bottom trawl fisheries, a questionable data source for a midwater species. The NMFS laboratory at Santa Cruz conducts a midwater trawl survey from which a juvenile index is derived. This index has been highly variable in its ability to predict recruitment, in part, due to the survey's limited geographical area relative to the overall distribution of widow rockfish. The widow rockfish rebuilding analysis considered a wide range of model formulations that investigated different hypothesis on natural mortality, stock-recruitment variability, and the use of a power coefficient to reduce variability of the Santa Cruz midwater juvenile survey. The SSC recommended model formulations that pre-specify the recruitment for 2003-2005, do not use a stock-recruitment relationship (recruits per spawner ratios were used instead to project future recruitment), and vary the power coefficient between two and four in the Santa Cruz midwater juvenile survey. The SSC did not recommend a power coefficient higher than four because the relationship between the Santa Cruz midwater survey recruitment index and other recruitment indices changed dramatically with higher powers. The previous rebuilding analysis (Punt and MacCall 2002) had used a power coefficient of 10 that dampened the estimate of recruitment variability and suggested much higher stock productivity.

Many of the rebuilding parameters for widow rockfish did not change dramatically with the new rebuilding analysis. The rebuilding period in the absence of fishing increased to 25 years and, with a mean generation time of 16 years; the maximum allowable time to rebuild (T_{MAX}) is 41 years. However, the harvest rate associated with different rebuilding strategies dropped significantly in response to the new understanding of decreased stock productivity. Thus, the interim rebuilding OY for 2003 using the 2000 rebuilding analysis was 832 mt, while in 2004, using the 2003 rebuilding analysis (He, *et al.* 2003a), the OY was 284 mt (using the base model, Model 8, which uses a power coefficient of three).

The Council adopted a rebuilding plan for widow rockfish at its April 2004 meeting, as described by the parameter values listed in Table 4-1. These values are based on a rebuilding analysis conducted by He, et al. (He, *et al.* 2003a).

Methods Used to Calculate Stock Rebuilding Parameters

The methods used in the rebuilding analysis He, et al. (He, *et al.* 2003a) used to develop the rebuilding plan do not differ substantially from the approach described in Section 4.5.2.

Rebuilding Parameter Values at the Time of Rebuilding Plan Adoption

Table 4-1 lists the numerical values for B_0, B_{MSY}, T_{MIN}, T_{MAX}, P_{MAX}, T_{TARGET}, and F. The values of B_0, B_{MSY}, T_{MIN}, and T_{MAX} are derived from the rebuilding analysis used in formulating the rebuilding plan (He, *et al.* 2003a). Using Model 8, the base model from the 2003 stock assessment (He, *et al.* 2003b), the Council chose a value of 60% for P_{MAX}, based on a harvest control rule of F = 0.0093. This results in a target year of 2038.

Widow Rockfish Rebuilding Strategy

As shown in Table 4-1, at the inception of the rebuilding plan the harvest control rule for canary rockfish was a fishing mortality rate of 0.0093. Based on the 2003 widow rockfish rebuilding analysis (He, et al. 2003a), this harvest rate is likely to rebuild the stock by the target year of 2038. This value is likely to change over time as stock size and structure changes. Any updated value will be published in federal groundfish regulations. The fishing mortality rate is applied to the exploitable biomass estimate to determine the OY for a given fishing period.

Management measures are implemented through the biennial harvest specification and management process described in Chapter 5. The types of management measures that may be implemented through this process are described in Chapter 6. In 2004, at the time of rebuilding plan adoption, measures intended to limit bycatch of overfished species included prohibiting retention of certain overfished species during some parts of the year, reducing landing limits (cumulative trip limits) on co-occurring species, establishing extensive time/area closures, and restricting the use of trawl nets equipped with large footropes. Because widow rockfish are mainly caught in the water column, bottom trawl gear restrictions have little effect on widow rockfish catch rates.

Beginning in 2002, time/area closures known as GCAs came into use as a way of decreasing bycatch of overfished species. GCAs enclose depth ranges where bycatch of overfished species is most likely to occur, based on information retrieved from logbooks and the at-sea observer program. The boundaries vary by season and fishery sector, and may be modified in response to new information about the geographic and seasonal distribution of bycatch.

Because widow rockfish occur in midwater and aggregate at night, elimination of target fishery opportunities is a relatively easy way of reducing widow rockfish bycatch. The Council has taken a policy approach of establishing management measures to reduce incidental catch in the Pacific whiting fishery sufficient to constrain total mortality below harvest levels (OYs) needed to rebuild the stock. At the time of rebuilding plan adoption, catch in other fisheries is sufficiently small so that rebuilding targets can be met without applying any special measures, beyond those needed to discourage targeting, to reduce widow rockfish fishing mortality in these fishery sectors.

Widow rockfish catches in recreational fisheries are relatively modest. Catches in this sector are managed mainly through bag limits, size limits, and fishing seasons established for each West Coast state. No recreational bag and size limits have been established for widow rockfish. However, general bag limits for rockfish may have some constraining effect on widow recreational catches.

4.5.4.~~8~~ 7 Yelloweye Rockfish

Status of the Yelloweye Rockfish Stock and Fisheries Affected by Stock Rebuilding Measures at the Time of Rebuilding Plan Adoption (April 2004)

Yelloweye rockfish are common from Central California northward to the Gulf of Alaska. They are bottom-dwelling, generally solitary, rocky reef fish, found either on or just over reefs (Eschmeyer, *et al.* 1983; Love 1991; Miller and Lea 1972; O'Connell and Funk 1986). Boulder areas in deep water (>180 m) are the most densely populated habitat type, and juveniles prefer shallow-zone broken-rock habitat

(O'Connell and Carlile 1993). They also reportedly occur around steep cliffs and offshore pinnacles (Rosenthal, *et al.* 1982). The presence of refuge spaces is an important factor affecting their occurrence (O'Connell and Carlile 1993). Yelloweye rockfish are potentially caught in a range of both commercial and recreational fisheries. Because of their preference for rocky habitat, they are more vulnerable to hook and line gear.

The first ever yelloweye rockfish stock assessment was conducted in 2001 (Wallace 2002). This assessment incorporated two area assessments: one from Northern California using CPUE indices constructed from Marine Recreational Fisheries Statistical Survey (MRFSS) sample data and California Department of Fish and Game (CDFG) data collected on board commercial passenger fishing vessels, and the other from Oregon using Oregon Department of Fish and Wildlife (ODFW) sampling data. The assessment concluded current yelloweye rockfish stock biomass is about 7% of unexploited biomass in Northern California and 13% of unexploited biomass in Oregon. The assessment revealed a thirty-year declining biomass trend in both areas with the last above average recruitment occurring in the late 1980s. The assessment's conclusion that yelloweye rockfish biomass was well below the 25% of unexploited biomass threshold for overfished stocks led to this stock being separated from the rockfish complexes in which it was previously listed. Until 2002, when yelloweye rockfish were declared overfished, they were listed in the "remaining rockfish" complex on the shelf in the Vancouver, Columbia, and Eureka management areas and the "other rockfish" complex on the shelf in the Monterey and Conception areas. As with the other overfished stocks, yelloweye rockfish harvest is now tracked separately.

In June 2002 the SSC recommended that managers should conduct a new assessment incorporating Washington catch and age data. This recommendation was based on evidence that the biomass distribution of yelloweye rockfish on the West Coast was centered in waters off Washington and that useable data from Washington were available. Based on that testimony, the Council recommended completing a new assessment in the summer of 2002, before a final decision was made on 2003 management measures. Methot et al. (2002b) did the assessment, which was reviewed by a STAR Panel in August 2002. The assessment result was much more optimistic than the one prepared by Wallace (2002), largely due to the incorporation of Washington fishery data. While the overfished status of the stock was confirmed (24% of unfished biomass), Methot et al. (2002b) provided evidence of higher stock productivity than originally assumed. The assessment also treated the stock as a coastwide assemblage. This assessment was reviewed and approved by the SSC and the Council at the September 2002 Council meeting. Methot and Piner (2002) prepared a rebuilding analysis based on this assessment.

The Council adopted a rebuilding plan for yelloweye rockfish at its April 2004 meeting, as described by the parameter values listed in Table 4-1. These values are based on a rebuilding analysis conducted by Methot and Piner (2002a).

Because yelloweye rockfish prefer rocky reef habitat on the continental shelf, they are most vulnerable to recreational and commercial fixed gear fisheries. In the past, the groundfish trawl sector has accounted for a large proportion of the catch: from 1990 to 1997 trawlers took an average of 46% of the catch coastwide (although most catches occur in Washington and Oregon waters). (This discussion is based on data in the table on page 3 of Methot, *et al.* 2003.) Trip limit reductions after 1997 and the imposition of restrictions on large footrope trawl gear in 2000 have substantially diminished the amount of yelloweye rockfish caught by the trawl sector. (Large footrope gear had made it possible for trawlers to access the rocky habitat where yelloweye live.) Trawl vessels accounted for only 14% of the catch on average from 1998 to 2001. Commercial fixed gear catches have also taken a significant share of the catch, 38% in the years 1990-1997. However, the implementation of the nontrawl RCA, which encloses much yelloweye habitat, has resulted in their share falling also. Open access directed groundfish fisheries and the Pacific halibut longline fleet also catch small amounts of yelloweye rockfish. Recreational catches have become more significant with the reduction in commercial catches. Comparing the 1990-1997 and 1998-2001 periods, their share of the total coastwide catch almost doubled to 30%, although actual average catches declined slightly. Most recreational catches occur in Washington State waters.

Methods Used to Calculate Stock Rebuilding Parameters

The methods used in the rebuilding analysis (Methot and Piner 2002a) used to develop the rebuilding plan do not differ substantially from the approach described in Section 4.5.2.

Rebuilding Parameter Values at the Time of Rebuilding Plan Adoption

Table 4-1 lists the numerical values for B_0, B_{MSY}, T_{MIN}, T_{MAX}, P_{MAX}, T_{TARGET}, and F. The values of B_0, B_{MSY}, T_{MIN}, and T_{MAX} are derived from the rebuilding analysis used in formulating the rebuilding plan (Methot and Piner 2002a). The Council chose a value of 80% for P_{MAX}, based on a harvest control rule of F = 0.0153. This results in a target year of 2058.

Yelloweye Rockfish Rebuilding Strategy

As shown in Table 4-1, at the inception of the rebuilding plan the harvest control rule for canary rockfish was a fishing mortality rate of 0.0153. Based on the 2002 rebuilding analysis (Methot and Piner 2002), this harvest rate is likely to rebuild the stock by the target year of 2058. This value is likely to change over time as stock size and structure changes. Any updated value will be published in federal groundfish regulations. The fishing mortality rate is applied to the exploitable biomass estimate to determine the OY for a given fishing period.

Management measures are implemented through the biennial harvest specification and management process described in Chapter 5. The types of management measures that may be implemented through this process are described in Chapter 6. In 2004, at the time of rebuilding plan adoption, measures intended to limit bycatch of overfished species included prohibiting retention of certain overfished species during some parts of the year, reducing landing limits (cumulative trip limits) on co-occurring species, establishing extensive time/area closures, and restricting the use of trawl nets equipped with large footropes. (By using large footropes with heavy roller gear, bottom trawlers can access rocky habitat on the continental shelf. This is the preferred habitat for some overfished species.)

Beginning in 2002, time/area closures known as GCAs came into use as a way of decreasing bycatch of overfished species. GCAs enclose depth ranges where bycatch of overfished species is most likely to occur, based on information retrieved from logbooks and the at-sea observer program. The boundaries vary by season and fishery sector, and may be modified in response to new information about the geographic and seasonal distribution of bycatch.

In addition to the more general measures described above, which are intended to reduce bycatch of all overfished species, the Yelloweye Rockfish Conservation Area (YRCA), a C-shaped closed area off the Washington coast, near Cape Flattery, prevents recreational groundfish and halibut anglers from targeting this species in an area where they are concentrated. Recreational bag and size limits are also used to manage total yelloweye rockfish fishing mortality.

Given the particular life history characteristics of yelloweye rockfish, the Council will continue to use a species-specific area closure or closures to protect yelloweye rockfish. As new information becomes available on yelloweye rockfish behavior and fisheries interactions with yelloweye rockfish, the boundaries or related regulations concerning the current YRCA may change, and additional YRCAs may be established by regulation.

TABLE 4-1. Specified rebuilding plan parameters at the time of plan adoption. (Page 1 of 1).

Species	Year Stock Declared Overfished	Year Rebuilding Plan Adopted	B_0	B_{MSY}	T_{MIN}	T_{MAX}	P_{MAX}	T_{TARGET}	Harvest Control Rule
Darkblotched Rockfish	2000	2003	29,044 mt	11,618 mt	2014	2047	80%	2030	F = 0.027
Pacific Ocean Perch	1999	2003	60,212 units of spawning output	24,084 units of spawning output	2012	2042	70%	2027	F = 0.0082
Canary Rockfish	2000	2003	31,550 mt	12,620 mt	2057	2076	60%	2074	F = 0.022
~~**Lingcod**~~	~~1999~~	~~2003~~	~~28,882 mt N;~~ ~~20,971 mt S~~	~~9,153 mt N;~~ ~~8,389 mt S~~	~~2007~~	~~2009~~	~~60%~~	~~2009~~	~~F = 0.0531 N;~~ ~~F = 0.061 S~~
Bocaccio*	1999	2004	13,387 B eggs in 2003	5,355 B eggs	2018	2032	70%	2023	F = 0.0498
Cowcod	2000	2004	3,367 mt	1,350 mt	2062	2099	60%	2090	F = 0.009
Widow Rockfish**	2001	2004	43,580 M eggs	17,432 M eggs	2026	2042	60%	2038	F= 0.0093
Yelloweye Rockfish	2002	2004	3,875 mt	1,550 mt	2027	2071	80%	2058	F= 0.0153

***Based on the STATc base model in MacCall (2003b).**

****Based on the Model 8 base model in He, *et al.* (He, *et al.* 2003b).**

[Amended: 11, 12, 16-1, 16-2, 16-3]

4.6 Determination of OY

Optimum yield (OY) is defined in the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) as the amount of fish which will provide the greatest overall benefit to the Nation. The Magnuson-Stevens Act also specifies that OY is based on maximum sustainable yield (MSY), and may be equal to or less than MSY. The fishery management plan (FMP) authorizes establishment of a numerical or non-numerical OY for any groundfish species or species group and lays out the procedures the Council will follow in determining appropriate numerical OY values. An OY may be specified for the fishery management area as a whole or for specific subareas. Numerical one-year OYs will be specified biennially, based on acceptable biological 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 80-plus species managed by the FMP have never been assessed in either a quantitative or qualitative manner. In some cases even basic catch statistics are unavailable, because many species (rockfish, for example) are not sorted unless specifically required by regulation. Species of this type have generally not been subject to numerical harvest limits, but rather harvest is limited by gear restrictions and market demand. Other management measures which determine the total amount of harvest each year include trip landing and frequency limits. Those species without a specified 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 unavoidably harvest several other species. In such cases, the optimum harvest strategy often is to target on a group (complex or assemblage) of groundfish species.

The Council will avoid allowing overfishing individual stocks and control harvest mortality to allow overfished stocks to rebuild to the MSY level. In the event the Council determines that greater long-term benefits will be gained from the groundfish fishery by overfishing individual stocks or by preventing a stock from recovering to its MSY level, it will justify the action in writing in accordance with the procedures and standards identified in this section and the National Standard Guidelines (50 CFR 600.310(d)). Conversely, the Council may determine that greater benefits will accrue from protecting an individual stock by constraining the multiple species complex or specific components of that complex.

Prior to implementation of the FMP in 1982, the states of Washington, Oregon, and California managed the groundfish fishery without the use of quotas. State regulations since the mid-1940s took the form of area closures (such as San Francisco Bay), legal gear definitions, minimum codend mesh regulations, size limits, bag limits, and other 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.

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 fishing period 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 (and reproductive potential) estimate.

2. FMSY or proxy, translated into exploitation rate.

3. Estimate of MSY biomass (BMSY), or proxy, unfished biomass (based on average recruitment), precautionary threshold, and/or overfished/rebuilding threshold.

4. Precision estimate (e.g., confidence interval) for current biomass estimate.

4.6.1 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 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 FMSY 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 other social, economic, or ecological

considerations may be made. OY will be reduced for anticipated bycatch mortality (i.e. mortality of discarded fish). 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.
   (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.
   (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.

4.6.2 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.

4.6.3 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 at-sea observer program data are available or surveys of other fish habitats are conducted and/or requirements that landings of all species be recorded separately, it is unlikely that there will be to sufficient data to upgrade the assessment capabilities or to evaluate the overfishing potential of these stocks.

These species typically may be included in a non-numerical OY that is defined as all the fish that can be taken under the regulations, specifications, and management measures authorized by the FMP and promulgated by the Secretary. Such an OY may not be a predetermined numerical value, but rather that harvest that results from regulations, specifications, and management measures as they are changed in response to changes in the resource and the fishery. Nothing in this FMP prevents inclusion of these species in a numerical OY if the Council believes that is more appropriate.

[Amended: 11, 16-1, 17]

5.0 PERIODIC SPECIFICATION AND APPORTIONMENT OF HARVEST LEVELS
6.0 MANAGEMENT MEASURES
7.0 ESSENTIAL FISH HABITAT
8.0 EXPERIMENTAL FISHERIES
9.0 SCIENTIFIC RESEARCH
10.0 PROCEDURE FOR REVIEWING STATE REGULATIONS
11.0 GROUNDFISH LIMITED ENTRY

Draft Amendment 16-4 proposes no changes to the remaining chapters of the FMP (Chapters 5-11,) except, when referring to the number of overfished species, to refer to there being seven, not eight, overfished groundfish species. For example, a sentence that reads "Six of the eight overfished species are continental shelf species…," would be revised to read "Five of the seven overfished species are continental shelf species…" This change is proposed in light of the 2005 recovery of the coastwide lingcod stock to above B_{40}.

REFERENCES

[**N.B. In the last published version of the FMP Chapter 13.0 was originally identified as References.** Chapter 11.0 was originally identified as Appendices. This material has been moved to two un-numbered sections at the end of the document and the remaining chapters after Chapter 10.0 have been re-numbered. Works cited in the Appendices are listed there.]

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APPENDICES CONTENTS

N.B. In the last published version of the FMP (July 1993) the Appendices appeared as Chapter 11.0, and have not been revised or updated since that time. This original material provides descriptive information on the following topics:

- Biological and Environmental Characteristics of the Resource
- Description of the Fishery
- Social and Economic Characteristics of the Fishery
- History of Management
- History of Research
- Weather-Related Vessel Safety
- Relationship of this FMP to Existing Laws and Policies
- Management and Enforcement Costs
- Groundfish Landings Data, 1981 - 1988 from PacFIN

References cited in the July 1993 version of Chapter 11.0 appear in Chapter 13.0 of that version of the FMP, which is entitled "References" and has not been revised or updated since that time.

A portion of Amendment 11 (1998) addressing Essential Fish Habitat added numbered Section 11.10 to the Appendices chapter of the FMP.

More detailed species accounts of groundfish EFH are compiled in the West Coast Groundfish Essential Fish Habitat Appendix, which is available on the NMFS Northwest Region website.1/

In summary, the FMP Appendices consist of the following material: Chapter 11.0 of the July 1993 version of the FMP, Section 11.10 added by FMP Amendment 11, the West Coast Essential Fish Habitat Appendix, and Chapter 13.0 of the July 1993 version. These materials are available under separate cover.

[1/]http://www.nwr.noaa.gov/1sustfsh/efhappendix/page1.html