Amendment 16-3 to the Pacific Coast Groundfish Fishery Management Plan: Rebuilding Plans for Bocaccio, Cowcod, Widow Rockfish, and Yelloweye Rockfish

Scoping Information Document
Pacific Fishery Management Council
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Introduction

To date the U.S. Secretary of Commerce (Secretary) has declared nine groundfish stocks overfished. These stocks are bocaccio (*Sebastes paucispinis*), canary rockfish (*S. pinniger*), cowcod (*S. levis*), darkblotched rockfish (*S. crameri*), Pacific ocean perch (*S. alutus*), widow rockfish (*S. entomelas*), yelloweye rockfish (*S. ruberrimus*), lingcod (*Ophiodon elongatus*), and Pacific whiting (*Merluccius productus*). These declarations, stemming from Magnuson-Stevens Act (MSA) requirements, are based on overfishing criteria adopted by the Council under Amendment 11 to the Pacific Coast Groundfish FMP. The MSA (§304(e)(3)) also requires councils to "prepare a fishery management plan, plan amendment, or proposed regulations" in order to prevent overfishing and implement a plan to rebuild the overfished stocks. Existing provisions in the FMP did not meet this requirement and were struck down in Federal Court. Rebuilding parameters for the nine overfished West Coast groundfish stocks are shown in Tables 1 and 2.

In response, the Council is adopting a series of amendments under an umbrella title of Amendment 16. The first of these amendments, Amendment 16-1, establishes a legally-compliant framework for the adoption and implementation of rebuilding plans. It was submitted to NMFS on August 7, 2003, and is currently under review. Amendment 16-2, prepared as an environmental impact statement (EIS) adopts rebuilding plans for canary rockfish, darkblotched rockfish, Pacific ocean perch, and lingcod. According to the framework proposed in Amendment 16-1, adoption of a rebuilding plan includes amending the FMP to include crucial information about the stock and the rebuilding strategy, publishing the numerical values for two key rebuilding parameters in federal regulations, and publishing the rebuilding plan in the next Stock Assessment and Fishery Evaluation (SAFE) document distributed after approval of the FMP amendment. (Amendment 16-2 rebuilding plans will therefore be published in Volume I of the 2004 SAFE document, if they are approved by NMFS on behalf of the Secretary of Commerce.) The draft EIS (DEIS) for Amendment 16-2 was made available on September 19, 2003, commencing a 45-day public comment period. A parallel review process, required under the MSA, will begin at the end of October. The NEPA process, which includes the production of a final EIS incorporating any comments received on the DEIS, and the NMFS review process are timed to end at the same time, in late January. If approved, Amendment 16-2 will be implemented shortly thereafter.

Amendment 16-3 will follow a similar sequence to adopt rebuilding plans for bocaccio, cowcod, widow rockfish, and yelloweye rockfish. NMFS and the Council published a notice of intent to prepare an EIS for this action in the Federal Register on September 12, 2003 (68 FR 53712). This announced a public scoping period ending on November 10, 2003. During this period the Council is asking the public to identify issues of concern, either in relation to alternatives for implementing the proposed action, or potential impacts to the environment. The Council is scheduled to take preliminary action at their November 2003 meeting by approving a preliminary list of alternatives that will be evaluated in the subsequent EIS. Final Council action is scheduled for their April 2004 meeting when they will identify a preferred alternative. A DEIS will then be completed, with a scheduled release date in June 2004. Assuming no delays in the timeline, these

Table 1. Current rebuilding parameter/target estimates specified for overfished west coast groundfish: shelf species.

	Shelf rockfish & lingcod				
Rebuilding Parameter/Target	**Bocaccio[a/]**	**Canary[b/]**	**Cowcod[c/]**	**Lingcod[d/]**	**Yelloweye[e/]**
T_0 (year declared overfished)	1999	2000	2000	1999	2002
T_{MIN} (minimum time to achieve B_{MSY}; F = 0)	2018	2057	2062	2007	2027
Mean generation time	14 years	19 years	37 years	NA	44 years
T_{MAX} (maximum time to achieve B_{MSY})	2032	2076	2099	2009	2071
P_{MAX} (P to achieve B_{MSY} by T_{MAX})[f/]	$\geq$ 70%	60%	55%	60%	92%
Most recent stock assessment	MacCall 2003a	Methot and Piner 2002a	Butler et al. 1999	Jagielo et al. 2000	Methot et al. 2002
Most recent rebuilding analysis	MacCall 2003b	Methot and Piner 2002b	Butler and Barnes 2000	Jagielo and Hastie 2001	Methot and Piner 2002
B_0 (estimated unfished biomass)	13,387 B eggs in 2003	31,550 mt	3,367 mt	22,882 mt N 20,971 mt S	3,875 mt
$B_{CURRENT}$ (current estimated biomass)	984 B eggs in 2003	2,524 mt in 2002	238 mt in 1998	3,527 mt N 3,220 mt S in 2000	934 mt in 2002
$B_{CURRENT}$ % Unfished Biomass	7.4% in 2003	8% in 2002	7% in 1998	17% N 15% S in 2000	24% in 2002
MSST (minimum stock size threshold = 25% of B_0)	3,347 B eggs	7,888 mt	842 mt	5,720 mt N 5,243 mt S	969 mt
B_{MSY} (rebuilding biomass target = 40% of B_0)	5,355 B eggs	12,620 mt	1,350 mt	9,153 mt N 8,389 mt S	1,550 mt
MFMT (maximum fishing mortality threshold = F_{MSY})	$F_{50\%}$	$F_{73\%}$	$F_{50\%}$	$F_{45\%}$: F = 0.12 N F = 0.14 S	$F_{57\%}$
Harvest control rule[f/]	F $\approx$ 0.041	F = 0.0220	F = 0.0136	F = 0.053 N F = 0.061 S	F = 0.0139
T_{TARGET}[f/]	2021	2074	2095	2009	2052

a/ Bocaccio were assessed by MacCall (2003a) in the Conception and Monterey INPFC areas combined. Biomass estimates are spawning output in billions of eggs. All rebuilding parameters based on model STATc in the most recent rebuilding analysis (MacCall 2003b). The strategic rebuilding parameters (T_{TARGET}, the harvest control rule (F), and P_{MAX}) are interpolated from model STATc results. A rebuilding plan for bocaccio south of 40°10' N. latitude will be analyzed in an EIS contemplated for groundfish FMP Amendment 16-3 scheduled for 2004.

b/ A canary rockfish rebuilding plan was adopted by the Council and submitted for incorporation in the groundfish FMP under Amendment 16-2.

c/ Cowcod were assessed in the Conception area. All parameters/targets are for the Conception area, although harvest specifications and management measures decided under the proposed action analyzed under the *Council Interim* alternative are for the Conception and Monterey INPFC areas combined. A rebuilding plan for cowcod will be analyzed in an EIS contemplated for groundfish FMP Amendment 16-3 scheduled for 2004.

d/ West coast lingcod were assessed as two stocks north (Columbia and U.S. Vancouver INPFC areas) and south (Eureka, Monterey, and Conception INPFC areas). The 2005-2006 specifications setting process contemplates changing the harvest control rule, and perhaps the target rebuilding year adopted for lingcod with Amendment 16-2.

e/ Yelloweye rockfish rebuilding parameters are from the most recent rebuilding analysis (Methot and Piner 2003). A rebuilding plan for yelloweye rockfish will be analyzed in an EIS contemplated for groundfish FMP Amendment 16-3 scheduled for submission in 2004.

f/ Under *Council Interim* alternative harvest specifications and/or rebuilding strategies.

Table 2. Current rebuilding parameter/target estimates specified for overfished west coast groundfish: slope and midwater species.

	Slope rockfish		Midwater species	
Rebuilding Parameter/Target	**Darkblotched[a/]**	**POP[b/]**	**Widow[c/]**	**Pacific whiting[d/]**
T_0 (year declared overfished)	2000	1999	2001	2002
T_{MIN} (minimum time to achieve B_{MSY} @ F = 0)	2011	2011	2026	2004
Mean generation time	33 years	28 years	16 years	8 years
T_{MAX} (maximum time to achieve B_{MSY})	2044	2042	2042	2012
P_{MAX} (P to achieve B_{MSY} by T_{MAX})[e/]	>90%	>70%	60%	NA
Most recent stock assessment	Rogers 2003	Hamel et al. 2003	He et al. 2003a	Helser et al. 2002
Most recent rebuilding analysis	Rogers 2003	Punt et al. 2003	He et al. 2003b	NA
B_0 (estimated unfished biomass)[e/]	30,775 mt	37,230 units of spawning output	43,580 M eggs	5.25 M mt
$B_{CURRENT}$ (current estimated biomass)	3,385 mt in 2003	10,313 units of spawning output in 2003	9,756 M eggs in 2002	1.26 M mt in 2002
% Unfished Biomass	11% in 2003	27.7% in 2003	22.4% in 2002	24% in 2002
MSST (minimum stock size threshold = 25% of B_0)	7,694 mt	9,308 units of spawning output	10,895 M eggs	1.31 M mt
B_{MSY} (rebuilding biomass target = 40% of B_0)	12,310 mt	14,892 units of spawning output	17,432 M eggs	2.1 M mt
MFMT (maximum fishing mortality threshold = F_{MSY})	$F_{50\%}$	$F_{50\%}$	$F_{50\%}$	$F_{40\%}$
Harvest control rule[e/]	F = 0.032	F = 0.0257	F = 0.0093	Decision deferred until adoption of groundfish FMP Amendment 16-4
T_{TARGET}[e/]	2030	2027	2037	

a/ A darkblotched rockfish rebuilding plan was adopted by the Council and submitted for incorporation in the groundfish FMP under Amendment 16-2. The proposed action in the 2004 specifications setting process was to raise the harvest control rule (F) from 0.027 estimated in the previous rebuilding analysis (Methot and Rogers 2001) and specified in FMP Amendment 16-2 to 0.032 estimated in the recent rebuilding analysis (Rogers 2003). However, the target rebuilding year of 2030 was not revised as part of the proposed action resulting in an increased probability of rebuilding by T_{MAX} (P_{MAX} increases from 80% to >90%). Rebuilding parameters are based on an intermediate model run and are consistent with the range of OYs adopted by the Council.

b/ A Pacific ocean perch rebuilding plan was adopted by the Council and submitted for incorporation in the groundfish FMP under Amendment 16-2. The proposed action in the 2004 specifications setting process was to change the harvest control rule (F) from 0.0082 estimated in the previous rebuilding analysis (Punt and Ianelli 2001) and specified in FMP Amendment 16-2 to 0.0257 estimated in the most recent rebuilding analysis (Punt et al. 2003). However, the target rebuilding year of 2027 was not revised as part of the proposed action resulting in an increased probability of rebuilding by T_{MAX} (P_{MAX} increases from 70% to >70%).

c/ The widow rockfish stock was assessed in 2003. All rebuilding parameters estimated in the most recent rebuilding analysis (He et al. 2003). Rebuilding spawning biomass parameters (i.e., B_0, B_{MSY}, $B_{CURRENT}$, MSST) are in millions of eggs. A rebuilding plan for coastwide widow rockfish will be analyzed in an EIS contemplated for groundfish FMP Amendment 16-3 scheduled for 2004.

d/ The Pacific whiting stock was assessed in 2002. Biomass estimates are in millions of mt of age 3+ fish. Some rebuilding parameters are unspecified since a rebuilding analysis has not been endorsed by the SSC. A new Pacific whiting assessment and rebuilding analysis is anticipated in March, 2004. A rebuilding plan for Pacific whiting based on a new assessment and rebuilding analysis will be analyzed in an EIS contemplated for groundfish FMP Amendment 16-4 scheduled for 2004.

e/ Under either a Council-adopted rebuilding plan (for those species' plans considered under FMP Amendment 16-2) or under the *Council Interim* alternative, except Pacific whiting.

rebuilding plans would be implemented in late 2004 or early 2005. A rebuilding plan for the ninth overfished species, Pacific whiting, is also scheduled to be developed in 2004 as Amendment 16-4. Before it can be developed an approved stock assessment and a rebuilding analysis have to be completed.

An EIS must include several elements specified in federal regulations. Four of these elements comprise the heart of an environmental impact analysis: a description of the purpose of and need for the proposed action, a reasonable range of alternatives for implementing the proposal, a description of the status of the environment before the proposal is implemented, and an analysis of the environmental effects of the proposed alternatives. The rest of this information document is a proposal for how these elements will be addressed in the Amendment 16-3 EIS. The alternatives and analyses proposed herein may be modified based on scoping and directions given by the Council.

Purpose of and Need for the Proposed Action

The Proposed Action

The proposed action is to implement legally-compliant rebuilding plans, consistent with the framework established in Amendment 16-1, that will set strategic rebuilding parameters to guide stock rebuilding for bocaccio (*Sebastes paucispinis*), cowcod (*S. levis*), widow rockfish (*S. entomelas*), and yelloweye rockfish (*S. ruberrimus*). These rebuilding parameters stem from the MSA and National Standard 1 guidelines (50 CFR 600.310). Three strategic rebuilding parameters guide the rebuilding process. These are: (1) the target year (T_{TARGET}) by which the stock is estimated to reach a biomass capable of supporting maximum sustainable yield (MSY); the harvest control rule needed to allow the stock to reach that biomass by T_{TARGET}; and (3) the probability of the stock rebuilding (P_{MAX}) in the maximum allowed time frame under National Standard Guidelines (T_{MAX}). Amendment 16-1 states that new management measures intended to achieve these targets may be added to the FMP as part of rebuilding plans. However, it is likely that existing management measures implemented through the biennial management process will be used to constrain fishing to the targets identified in the rebuilding plans.

Need (Problems for Resolution)

Rebuilding plans are mandated when the size of a stock or stock complex falls below a level described in the FMP as the minimum stock size threshold or MSST, which is 25% of unfished biomass ($B_{25\%}$) for stocks managed under the groundfish FMP. Diminished stock size may be caused or exacerbated by fishing. Regardless of the cause of the decline, fishing mortality needs to be controlled to prevent further deterioration in the condition of the stock, and if the stock has been overfished, to allow it to rebuild.

The proposed action is needed, because the four stocks in question are overfished. National Standard 1 in the MSA requires conservation and management measures that prevent overfishing. Preventing overfishing also means returning stocks to a size capable of achieving MSY, or to a stock size less than this if such stock size results in long-term net benefit to the nation. In order to rebuild overfished stocks and satisfy this mandate, legally compliant rebuilding plans must be adopted for stocks that have been declared overfished by the Secretary of Commerce.

Purpose of the Proposed Action

The purpose of the *Proposed Action* is to rebuild bocaccio, cowcod, widow rockfish, and yelloweye rockfish stocks managed under the Pacific Coast Groundfish FMP to a size capable of supporting MSY, or to a stock size less than this if such stock size results in long-term net benefit to the nation, and according to the requirements of the MSA. The MSA states: "For a fishery that is overfished, any fishery management plan, amendment, or proposed regulations... for such fishery shall... specify a time period for ending overfishing and rebuilding the fishery..." (Sec. 304(e)(4)). The MSA also states that this time period "shall be as short as possible," and usually may not exceed 10 years. However, in setting a time period for rebuilding the stock, fishery managers may take into account various mitigating factors, such as the biology of the stock and the needs of fishing communities, such that the time period may exceed 10 years. Rebuilding plans must

also take into account variations and contingencies in ecological and environmental conditions that cause MSY biomass to vary over time, which affects the practicable time period for rebuilding the stock.

Description of the Alternatives

The alternatives will be structured around management targets for each of the four overfished species considered in the EIS (Table 3). These targets are derived from National Standards Guidelines, which specify how rebuilding should occur (50 CFR600.310(e)). Rebuilding should bring stocks back to a population size that can support MSY (B_{MSY}). A rebuilding plan must specify a target year (T_{TARGET}) based on the time required for the stock to reach B_{MSY}. This target is bounded by a lower limit (T_{MIN}) defined as the time needed for rebuilding in the absence of fishing (i.e., fishing mortality rate [F] = 0). Rebuilding plans for stocks with a T_{MIN} less than 10 years must have a target less than or equal to 10 years. If, as is the case with all of the groundfish stocks considered in this amendment, the biology of a particular species dictates a T_{MIN} of 10 years or greater, then the maximum allowable rebuilding time, T_{MAX}, is the rebuilding time in the absence of fishing (T_{MIN}) plus "one mean generation time."

Because of the uncertainty surrounding stock assessments and future population trends (due, for example, to variable recruitment), the rebuilding period limits and the target need to be expressed probabilistically. At the policy level this makes the tradeoff between long-term risk and short-term costs explicit. Long-term risk is expressed in terms of the probability that the stock will rebuild in the maximum time period (T_{MAX}), given a specified level of harvest during the rebuilding period. If harvest limits are lowered, representing greater short-term costs, this probability (P_{MAX}) increases. Conversely, if a higher harvest rate is chosen, P_{MAX} decreases, representing greater long-term risk that the stock will fail to rebuild. The target year is derived from the same computation. For a given harvest rate, T_{TARGET} is the year in which there is a 50% probability the stock will be rebuilt. (In other words, it is equally likely the stock will have already been rebuilt by this year as it is that the stock will not be rebuilt until a later year.) If catches of an overfished species are prohibited, then T_{TARGET} will be equal to T_{MIN}, the minimum possible rebuilding time. (T_{MIN} is also calculated in a similar way: it is the year with a 50% rebuilding probability, but with the harvest rate set to zero.) Choosing a target year equal to T_{MAX} results in a P_{MAX} equal to 50% since the T_{TARGET} and T_{MAX} are equal.

National Standards Guidelines identify a "mixed-stock complex" exception to the definition of overfishing (50 CFR 600.310(d)(6)), which is applicable to some overfished groundfish species. Different fish assemblages—some with healthy stocks and some with overfished stocks—can co-occur in a mixed-stock complex, and thus, both can be caught simultaneously. An optimum yield (OY) harvest for the healthy stock can result in overfishing the depleted stock. The guidelines allow councils to authorize this type of overfishing if three conditions are met (50 CFR 600.315(d)(6)). First, an FMP (or plan amendment) must assess the overall benefits of such a policy in comparison to other measures, such as reducing the OY for the healthy stock. Second, councils must consider mitigating measures that reduce overfishing by, for example, modifying fishing strategy or gear configuration. The benefits of mitigation must be compared to those determined in the preceding assessment; the measures would only be implemented if they will result in greater benefits. Finally, permitted overfishing cannot result in eventual listing of the species (or evolutionarily significant unit thereof) under the Endangered Species Act (ESA).

Given the framework described above, the alternatives represent different rebuilding strategies for each of the four overfished species and—with the exception of the use of the mixed stock exception—can be described in terms of a harvest rate and the associated P_{MAX} and T_{TARGET} values. Up to eight alternatives, including a No Action alternative, are proposed for evaluation in the Amendment 16-3 EIS; they are similar to the alternatives proposed for Amendment 16-2 and are described below.

Table 3. Harvest specifications (2004-2006 total catch OYs) and strategic rebuilding parameters associated with bocaccio, cowcod, widow rockfish, and yelloweye rockfish rebuilding alternatives.

Harvest Specifications and Strategic Rebuilding Parameters	Rebuilding Alternatives								
	No Action	***Mixed Stock Exception***	***Maximum Harvest***	***60%***	***70%***	***80%***	***90%***	***Maximum Conservation***	***Council Interim a/***
Bocaccio b/									
2004 OY (mt)	0	959	439.1	376.5	306.3	236.5	130.1	0	250.0
2005 OY (mt)	0	959	NA	NA	NA	NA	NA	0	TBD
2006 OY (mt)	0	959	NA	NA	NA	NA	NA	0	TBD
P_{MAX}	64.6%	NA	50%	60%	70%	80%	90%	100%	TBD
T_{TARGET}	2025	NA	2028	2025	2023	2020	2018	2016	TBD
F rate	NA	0.1700	0.0721	0.0615	0.0498	0.0383	0.0209	0.0000	TBD
Cowcod c/									
2004 OY (mt)	0	NA	NA	4.2	NA	NA	NA	0	4.8
2005 OY (mt)	0	NA	NA	4.2	NA	NA	NA	0	4.8
2006 OY (mt)	0	NA	NA	4.2	NA	NA	NA	0	4.8
P_{MAX}	NA	NA	50%	60%	70%	80%	90%	100%	55%
T_{TARGET}	NA	NA	2099	2089	NA	NA	NA	2061	2095
F rate	NA	NA	NA	0.0090	NA	NA	NA	0.0000	0.0100

Table 3. Harvest specifications (2004-2006 total catch OYs) and strategic rebuilding parameters associated with bocaccio, cowcod, widow rockfish, and yelloweye rockfish rebuilding alternatives.

Harvest Specifications and Strategic Rebuilding Parameters	Rebuilding Alternatives								
	No Action	***Mixed Stock Exception***	***Maximum Harvest***	***60%***	***70%***	***80%***	***90%***	***Maximum Conservation***	***Council Interim a/***
Widow Rockfish d/									
2004 OY (mt)	1,439	≥501	354	284	212	123	4	0	284
2005 OY (mt)	1,359	≥501	355	285	213	124	4	0	TBD
2006 OY (mt)	1,317	≥501	359	289	216	126	4	0	TBD
P_{MAX}	0%	≤30.9%	50%	60%	70%	80%	90%	100%	TBD
T_{TARGET}	NA	NA	2041	2037	2034	2030	2028	2028	TBD
F rate	NA	≥0.0165	0.0117	0.0093	0.0070	0.0040	0.0001	0.0000	TBD
Yelloweye Rockfish e/									
2004 OY (mt)	NA	55.6	NA	NA	NA	NA	NA	0	22
2005 OY (mt)	NA	55.6	NA	NA	NA	NA	NA	0	TBD
2006 OY (mt)	NA	55.6	NA	NA	NA	NA	NA	0	TBD
P_{MAX}	NA	NA	50%	60%	70%	80%	90%	100%	>80%
T_{TARGET}	NA	NA	2070	2067	2062	2058	NA	2026	<2058
F rate	NA	0.0355	0.0173	0.0167	0.0161	0.0153	NA	0.0000	<0.0153

a/ The Council Interim alternative represents interim rebuilding measures adopted during the process to set annual specifications for these species. Preferred alternatives to be determined (TBD) by Council action during either the November 2003 Council meeting in Del Mar, California or the April 2004 meeting in Sacramento, California; except for the 2004 OY which is the Council adopted total catch OY for 2004 fisheries.

b/ Bocaccio harvest specifications and strategic rebuilding parameters are based on the STATc base model in the most recent rebuilding analysis by MacCall (2003b).

c/ Cowcod harvest specifications and strategic rebuilding alternatives are based on the most recent rebuilding analysis by Butler and Barnes (2000). The OYs in the rebuilding analysis are only for the Conception INPFC area. The GMT recommended the same OY for the Monterey INPFC area; therefore, the OYs depicted in the table are double those presented in the rebuilding analysis.

d/ Widow rockfish harvest specifications and strategic rebuilding alternatives are based on Model 8, the base model in the most recent stock assessment (He et al. 2003a) and rebuilding analysis (He et al. 2003b).

e/ Yelloweye rockfish harvest specifications and strategic rebuilding alternatives are based on the most recent rebuilding analysis by Methot and Piner (2002b).

The No Action Alternative

An EIS must consider the alternative of no action. This represents the conditions that would apply if the proposed action or one of its alternatives is not implemented. Although the Council has been managing overfished groundfish species using interim rebuilding plans, comparing the rebuilding strategies to how overfished stocks would be managed according to the existing framework in the FMP is more informative. Under this framework a precautionary management strategy to rebuild stocks to B_{MSY} decreases the optimum yield (OY or target harvest level) from the ABC (acceptable biological catch) using the 40-10 adjustment. The 40-10 adjustment is a linear decrease in the OY from the ABC for spawning stock biomass levels between $B_{40\%}$ (40% of the unfished biomass, a proxy for B_{MSY}) and $B_{10\%}$, at which point the OY is adjusted to zero. This results in a straight line, representing the precautionary reduction, intersecting the x-axis at $B_{10\%}$ and the line representing the ABC-biomass relationship at $B_{40\%}$ (Figure 1). Conversely, when the stock is rebuilt, or at $B_{40\%}$, the OY would be set equal to the ABC. The harvest control rule is, therefore, a variable harvest rate based on the stock's biomass relative to its initial, unfished biomass. The parameters used to describe rebuilding strategies can be computed for the harvest rates resulting from application of the 40-10 precautionary reduction, as shown below. In comparison to the other alternatives, the precautionary strategy can result in much lower OYs in the short term, if the overfished stock is at a low biomass level, but allow greater harvests at higher biomass levels, making full recovery less likely.

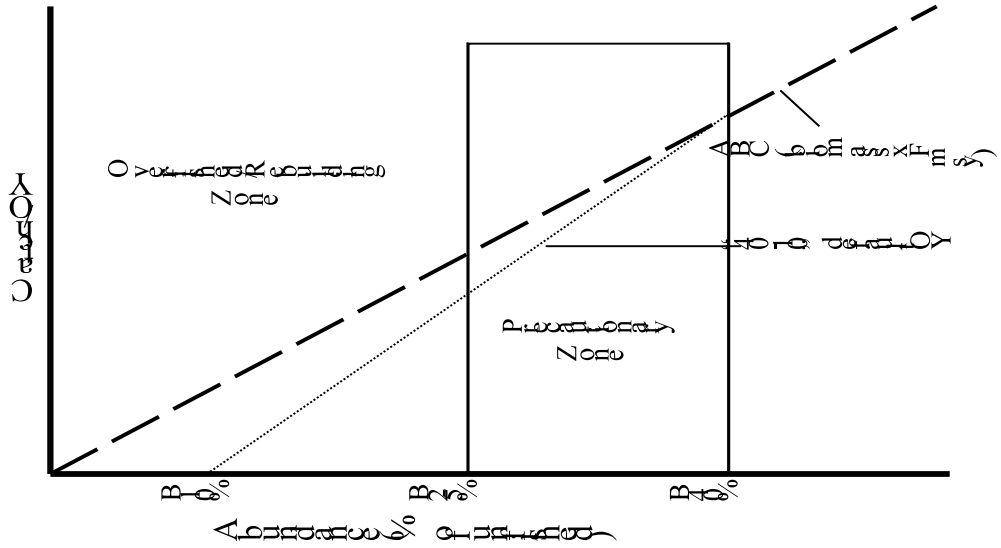

Figure 1. Graphic representation of the 40-10 rule to reduce OY from ABC for stocks below $B_{40\%}$ but above $B_{25\%}$.

The Maximum Conservation Alternative

Under this alternative no catches of the four stocks considered here would be allowed until the stocks are rebuilt. In other words, the harvest rate (F) would be set at zero, and T_{TARGET} would equal T_{MIN}. By definition, the stocks would rebuild fastest under this alternative, but at considerable socioeconomic cost. A zero harvest policy for these stocks, which together are caught in a wide range of fisheries, would likely result in the effective closure of many fisheries. On the other hand, stocks would rebuild more quickly, allowing higher, sustainable harvests at MSY once the target biomass was reached. However, given the long time periods involved to rebuild these stocks, even if fishing completely stopped—until 2027 for yelloweye rockfish, a species caught in many different fisheries—many current participants in the commercial fishery would likely go out of business. Recreational fishing and related support businesses would be similarly affected.

This alternative entails the lowest long-term risk: all four stocks are certain to rebuild within the maximum time period and are likely to rebuild in the shortest possible amount of time. It is judged the most environmentally beneficial in terms of the biological benefit of rapidly rebuilding stocks to a higher, target biomass level.

The Maximum Harvest Alternative

This alternative represents the other end of the range of possible rebuilding strategies from the *Maximum Conservation* alternative. The target year would equal T_{MAX} and P_{MAX} and would, thereby, equal 50% for each stock. As denoted by its name, the highest permissible harvest level would be allowed during the rebuilding period. This socioeconomic benefit represents a tradeoff against the time it would take for the stocks to rebuild.

Adopt Council Interim Rebuilding Plan Targets

These four stocks have been managed under interim rebuilding plans since they were declared overfished.[1] Under this alternative the targets they had identified in the interim plans would be used to continue managing these overfished stocks. Therefore, from a practical perspective, stock management under this alternative and current management would not differ very much.[2] In choosing targets for the interim plans, the Council evaluated the risk-benefit tradeoff for each stock. Unlike the previous two alternatives, the P_{MAX} values differ among the stocks. As shown in Table 3, these values fall generally in the mid-range of permissible values.

The Mixed Stock Exception Alternative

Many groundfish stocks co-occur, and it may be difficult or impossible for a fisherman to catch one species while avoiding others. Management measures must be structured to limit catches within OYs. Species with low OYs then become "constraining stocks" because they act to limit fishermen's ability to catch otherwise healthy target species. As discussed above, NMFS policymakers anticipated this situation and, as part of National Standard Guidelines, identified a mixed stock exception, which may be used if the three conditions (described above) are met. Of the four overfished stocks considered in this amendment, bocaccio, widow rockfish, and yelloweye rockfish are constraining stocks to which the mixed stock exception could be applied. This alternative is additive to the other alternatives: the harvest rates computed under this alternative could be substituted for the rate used for any one of these three species in any of the other alternatives. Application of the mixed stock exception for a given species under any of the other alternatives would likely allow greater access to healthy stocks in those fisheries where that species co-occurs than would otherwise be possible.

Other Intermediate Alternatives

In formulating the preferred alternative, the Council could have chosen targets intermediate to those identified in the preceding alternatives, representing a very large number of potential combinations. In support of decision making—while keeping the number of alternatives manageable (recognizing that the alternatives encompass the full range of reasonable alternatives)—these intermediate values are incorporated into the analysis, although socioeconomic impacts are not predicted. They are structured around 10% increments in P_{MAX} between 60% and 90% for each stock, recognizing that the other alternatives incorporate 50% and 100% and various intermediate values.

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[1]Bocaccio was declared overfished in 1999, cowcod in 2000, widow rockfish in 2001, and yelloweye rockfish in 2002.

[2]This alternative also could be considered a "no action" alternative because it reflects management prior to implementation of the proposed action. There is an important difference between the interim plans and the choice of the targets from those plans as a preferred alternative, which is represented by the framework implemented by Amendment 16-1. The framework and subsequent adoption of rebuilding plans obligates the Council to manage to targets that cannot be as easily changed.

Impacts of the Alternatives

In the EIS, Chapter 3 will describe the human environment affected by the proposed action. West Coast geography, bathymetry, ocean currents, and climate; the various stocks of groundfish and where they occur; and essential fish habitat will be described. The chapter will also describe the current status of the overfished stocks, as well as other stocks that are affected by actions contemplated for the West Coast groundfish fisheries. The affected socioeconomic environment will also be described, including all the affected fisheries and fishing communities. Groundfish fisheries include limited entry trawl, limited entry fixed gear, directed open access, incidental open access, charter, recreational, and tribal fisheries. Potentially affected markets and the structure and values of fishing communities also will be described. This represents the baseline. The impacts of the alternatives, including the no action alternative, will be evaluated in terms of this baseline.

This EIS will also evaluate the impacts of the alternatives. Potential impacts are summarized below according to the main human environment components that may be evaluated in the EIS. Impacts can be direct, occurring at the same time and in the same place as the proposed action; indirect, occurring at a different time or place; or cumulative. The cumulative effect is the total effect, including other past, present, and reasonably foreseeable future actions, even those not carried out by NMFS. Uncertainty makes predicting long-term effects very difficult. It is true that the rebuilding framework does include a measurement of risk (P_{MAX}, or the likelihood of stock rebuilding for a given rebuilding strategy), but there are other sources of uncertainty—such as measurement error and mis-specification of models. As a result, when new stock assessments are conducted the relationship between strategic rebuilding parameters can change such that, for example, the harvest control rule (expressed as a fishing mortality rate) takes on a new value for a given T_{TARGET}. For this reason evaluation of impacts over the long term (which realistically means more than two to five years) will likely be treated qualitatively.

Habitat and Ecosystem

Currently, the ability to assess impacts to habitat and ecosystem is limited. Fishing gear affects habitat when it contacts the bottom. For this reason, bottom trawl gear is presumed to have the greatest effect, while fixed gear, such as bottom longlines and traps are thought to have a more moderate effect. Fishing gear can disturb bottom substrate and uproot or break apart benthic macro fauna like corals and sea anemones. However, the degree to which these impacts affect ecosystem structure or stock productivity is not well understood. Cumulative effects also result from an array of non-fishing activities that contaminate marine waters and alter ecosystems, primarily in nearshore areas.

Climate change and climate cycles can affect ecological conditions; this in turn affects productivity, influencing the likelihood that a stock will rebuild. Changes in trophic structure, caused by fishery removal or other human activities, can also influence rebuilding prospects. For example, the disappearance of larger adult fish due to overfishing can have a depensatory effect whereby other, smaller species—normally prey of the adult fish—feed on juveniles of the overfished stock, slowing recovery of the overfished population.

The effects of the alternatives will depend on the types of management measures that are implemented to meet rebuilding targets and, in turn, how this affects the intensity and distribution of fishing effort. Extensive closed areas, based on the depth distribution of overfished species, have become a feature of groundfish management. Most commercial fishing, including bottom trawling, is prohibited in these areas. Fishing impacts are, therefore, minimized within these areas, and if they are kept in place over the duration of the longest rebuilding periods, could offer long-term habitat protection. However, because habitat protection is not the primary purpose of these areas, their duration and configuration cannot be guaranteed. For example, fishery managers could conceivably implement other measures that more effectively control bycatch, thereby eliminating the need for the closed areas.

Managed Groundfish Stocks, Including Overfished Species

Impacts to managed stocks will be mainly evaluated in terms of the effect on overfished groundfish species. Establishing rebuilding targets indirectly affects harvest levels through the harvest specification process. The relative effect of the alternatives on the four overfished species considered in this amendment can be evaluated in terms of the targets identified under the alternatives. OYs for the species considered in this amendment, determined from the targets chosen under a given alternative, will also affect other overfished

and target groundfish species through any constraints on harvest over and above the OYs that might be chosen for those species. (For example, choosing the *Maximum Conservation Alternative*, which requires no harvests of the four species considered here, would require management measures which would also substantially constrain—or totally prevent—harvests of other overfished and target groundfish species, even if the OYs chosen for these species were greater than zero.) Essentially, the management framework can be used as an evaluation tool. Alternatives that rebuild stocks more slowly would thus be considered to have a greater impact on the stocks in question. Allowing overfishing (which would likely be the case under the *Mixed Stock Exception Alternative*) would be considered a significant impact. To the degree that effects to other stocks can be predicted, a similar set of criteria would be applied. Alternatives that are more likely to quickly return depressed non-overfished stocks to B_{MSY}, for example, would have a greater beneficial effect. (Taking the *Maximum Conservation Alternative* as an example again, depressed non-overfished stocks would likely benefit from reduced fishing mortality under this alternative, returning to the target biomass more rapidly than would otherwise be the case.)

The Management Regime

Adoption of any alternative would require implementation of management measures to keep harvests to the levels needed to meet the adopted rebuilding targets in each rebuilding plan. Management measures are implemented as part of the biennial harvest levels and management measures specifications process. Through this process harvest limits are periodically respecified as new stock assessments and rebuilding analyses become available. As part of the same process, management measures can be adjusted to meet any of these re-specified OYs. In addition, the FMP may be amended to improve the management regime and increase the number of available management measures. The kinds of management measures currently available include depth-based restrictions, used to prohibit fishing in areas where there is a high bycatch of overfished species; seasonal restrictions, intended to restrict fishing during those times of year when bycatch is higher; trip limit management; and requiring gear modifications to limit bycatch.

Socioeconomic Impacts

Socioeconomic impacts are closely related to biological impacts, although in the short term an adverse biological impact may translate into a beneficial socioeconomic impact. This is because socioeconomic impacts are related to the revenue generated from the sale of commercially landed groundfish and the direct non-monetary and indirect monetary benefits derived from recreational fishing. Alternatives that constrain fishing mortality more—while having a biological benefit—would likely reduce overall revenues. Of course, over the long term returning stocks to a size capable of supporting MSY should increase potential socioeconomic benefits. Socioeconomic impacts will be evaluated, first, in terms of the effect on different fishery sectors. These sectors can be defined very broadly in terms of commercial and recreational sectors. Further subdivision is possible within these sectors based on regulatory categories and geographic location.

Commercial Fisheries

Commercial fisheries are divided into limited entry trawl, limited entry fixed gear, and the so-called open access sector. Open access fisheries include fishers targeting groundfish with legal gear (excluding those gear types for which a groundfish limited entry permit is required—trawl, longline, and fish pots) and vessels catching groundfish incidentally while targeting other species. This second category of fishers are for the most part also managed under plans, policies, or regulations related to the species they are targeting. Table 4 shows 1998 landings by commercial vessels in these three categories (the limited entry trawl sector is further subdivided between the target whiting fishery and other groundfish trawl fisheries). (No groundfish species had yet been declared overfished in 1998. Since the information represents landed catch, using this earlier data should give a better picture of the distribution of overfished species catch among sectors. Subsequently, regulatory discards have increased, making the data less representative. At the same time, the absolute amounts given in Table 4 are not comparable to the current situation for this reason.) Table 4 also divides these categories between landings north of 40º 10' N latitude and south of that line. This line, near Cape Mendocino, California, represents a major geographic boundary in terms of management measures applied to commercial fisheries.

It can be seen that yelloweye rockfish landings are distributed across these regulatory/geographic categories, with no one category dominating. Management measures intended to rebuild this stock are likely to have

wide-ranging socioeconomic impacts as a result. Widow rockfish landings, in contrast, were mainly landed by trawl fisheries in the northern area. It is also the only one of these four overfished species caught in appreciable quantities by the targeting whiting trawl fishery. Bocaccio is more common in the southern area, and in 1998 a large proportion was caught in the open access sector (representing a diverse array of fisheries), with the limited southern area entry trawl sector posting the bulk of the remaining share. Cowcod was caught in relatively small quantities, almost exclusively in the southern area, with open access fisheries dominating. Currently, this species is managed under a very low OY, primarily by closing areas of higher abundance.

Recreational Fisheries

All of these species have been caught in Rebuilding these two stocks will require recreational catch restrictions, with bag and size limits the most common measures to date. California has also limited the recreational fishing season, mainly in response to the need to rebuild overfished groundfish species. Lingcod are predicted to recover quickly, so limits could be relaxed after a relatively short period of time. But the need to limit recreational catches of other overfished species is likely to require restrictive measures—such as bag limits on total recreational catch or closed seasons—even after the lingcod stock recovers. Canary rockfish are a case in point; their projected recovery time is more than 70 years under the *Council Preferred* alternative.

The Tribal Fishery

The Makah, Quileute, Hoh, and Quinault Indian tribes, which are located in Washington state, have treaty rights to catch up to half of the harvest in their "usual and accustomed" (U and A) fishing areas. These tribes participate in the Pacific whiting fishery, which accounts for most of their groundfish landings. As shown in Table 4, widow rockfish is the only one of these four species caught in appreciable quantities in this fishery. The midwater trawls used in this fishery also catch relatively small amounts of canary and darkblotched rockfish. In 2004 the Makah tribe is planning to prosecute a midwater trawl fishery for yellowtail rockfish. Yelloweye rockfish bycatch will monitored and will be a management concern. More limited bottom trawl fishing by these tribes, and ocean salmon fishing, also catch overfished species, including yelloweye and widow rockfish. Generally, managing for bycatch of the four species considered in this amendment will have a modest effect on tribal fisheries, unless the zero mortality target under the *Maximum Conservation* alternative is chosen.

Fishing Communities

Because of the distribution of the overfished species considered in this amendment, and the fishing fleets most commonly catching them, ports coastwide are likely to be affected by rebuilding measures for one species or another. As noted above, widow rockfish are primarily caught in northern areas, with a center of distribution off of Oregon. Yelloweye rockfish is caught in fisheries on the continental shelf in Washington, Oregon, and Northern California. Limiting bocaccio and cowcod catches will primarily affect fisheries off of Central and Southern California. Recreational fishing is also an important part of the local economy in many of these ports. In addition to the income and employment generated by charter boats, allied support businesses (like bait and tackle shops) also depend on recreational fishing. Harvest restrictions aimed at rebuilding overfished groundfish will by no means eliminate marine recreational fishing opportunities. Salmon, for example, are more important recreational target species, but from Monterey northwards. Limiting recreational catches of bocaccio and cowcod would have relatively large impact on recreational fisheries in Southern California. While difficult to quantify, restrictions could devalue the ocean recreational experience in this region and indirectly affect demand for recreational products and services.

Table 4. 1998 commercial landings of overfished species considered under Amendment 16-3, in metric tons and by major fishery sectors.

	Limited Entry Trawl- Whiting	Limited Entry Trawl		Limited Entry Fixed Gear		Open Access		Total
	North	North	South	North	South	North	South	
Bocaccio	0	36.1 (11.82%)	105.1 (34.4%)	1.7 (0.6%)	14.9 (4.9%)	4.2 (1.4%)	143.4 (47.0%)	305.4 (100%)
Cowcod	0	0.1 (0.2%)	2.6 (10.0%)	0	3.3 (12.7%)	0	19.9 (77.1%)	25.8 (100%)
Widow	811.6 (8.8%)	6,802.1 (74.0%)	980.4 (10.7%)	10.6 (0.1%)	13.4 (0.2%)	292.2 (3.2%)	275.9 (3.0%)	9,186.1 (100%)
Yelloweye	0	1.3 (3.3%)	3.1 (8.2%)	4.9 (12.8%)	9.1 (23.6%)	5.8 (15.1%)	14.2 (37.0%)	38.4 (100%)