EXECUTIVE SUMMARY

Introduction

This document, prepared by the Pacific Fishery Management Council (Council), provides background information about and analysis of changes to the Pacific Coast Groundfish Fishery Management Plan incorporated as Amendment 16-2. The Council is one of eight regional Fishery Management Councils providing management recommendations to the National Marine Fisheries Service (NMFS) and is responsible for managing fisheries occurring in federal waters off the U.S. West Coast. The proposals outlined here must be consistent with the Magnuson-Stevens Fishery Conservation and Management Act (MSA), the principal legislation governing fishery management in federal waters (between 3 and 200 nautical miles from shore). This document is also an environmental impact statement (EIS), pursuant to the National Environmental Policy Act (NEPA) of 1969, as amended. The EIS is a means of determining and disclosing whether the proposal could significantly affect the quality of the human environment. The document also contains information and analyses relevant to the Regulatory Flexibility Act (RFA) and Executive Order (EO) 12866 (Regulatory Impact Review or RIR). These mandates require agencies to evaluate the economic impact of regulatory actions, especially on small entities.

Amendment 16-2, the second in a series of amendments, adopts four rebuilding plans: darkblotched rockfish, Pacific ocean perch, lingcod, and canary rockfish. Adopted plans are implemented through the framework contained in Amendment 16-1, the first in this series. Subsequent amendments will adopt rebuilding plans for all of the remaining five overfished species.

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 eleven chapters in this document address these elements, along with the requirements of the MSA and other applicable law:

- Chapter 1, discusses the reasons for changing the FMP. This description of purpose and need defines the scope of the subsequent analysis.

- Chapter 2 outlines different alternatives that have been considered to address the purpose and need. One of these alternatives is the Council's preferred alternative, which is recommended to NMFS for adoption as a plan amendment.

- Chapter 3 describes the affected environment. This description of current conditions, or the environmental baseline, provides the basis for the analysis contained in Chapter 4.

- Chapter 4 assesses the direct and indirect impacts to the human environment of each alternative described in Chapter 2.

- Chapter 5 evaluates the cumulative impacts of the proposed action. Cumulative effects are the result of "the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions," including those of other agencies, organizations and individuals (40 CFR 1508.7). They are the total effect, or combination of direct and indirect impacts with external factors affecting components of the human environment.

- Chapter 6 addresses additional requirements of NEPA and implementing regulations, including the identification of any measures that will be implemented to mitigate significant impacts of the proposed action.

- Chapter 7 details how this amendment meets ten National Standards set forth in the MSA (§301(a)) and groundfish FMP goals and objectives.

- Chapter 8 provides information on those laws and Executive Orders, in addition to the MSA and NEPA, that an amendment must be consistent with, and how this amendment has satisfied those mandates.

- Chapters 9, 10, and 11 include required supporting information: the list of preparers, who received copies of the document, and the bibliography.

Rebuilding analyses, which provide background information used to structure the alternatives, and the amendatory language, are appended to the document.

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 canary rockfish (*Sebastes pinniger*), darkblotched rockfish (*S. crameri*), Pacific ocean perch (*S. alutus*), and lingcod (*Ophiodon elongatus*). These rebuilding parameters stem from the MSA and National Standard 1 guidelines (50 CFR 600.310). The most important strategic rebuilding parameters are the stock size, or target biomass, capable of supporting maximum sustainable yield (MSY) and a time period within which the stock must be rebuilt to this size. Amendment 16-1, addressing the process and standards for rebuilding plan adoption, states that new management measures intended to achieve these targets may be added to the FMP as part of rebuilding plans. However, no new management measures are proposed in Amendment 16-2 (evaluated in this EIS); instead, existing management measures implemented through the biennial management process will be used to constrain fishing to the targets identified in the rebuilding plans. Rebuilding plans for the remaining five overfished groundfish species will be implemented in subsequent amendments, as updated stock assessments and rebuilding analyses become available.

Need (Problems for Resolution)

As of February 2002 the U.S. Secretary of Commerce (Secretary) had declared nine groundfish stocks overfished. These 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 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. Amendment 16-1 establishes a legally-compliant framework for the adoption and implementation of rebuilding plans. This amendment adopts rebuilding plans for four overfished groundfish species, consistent with the framework.

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 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 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

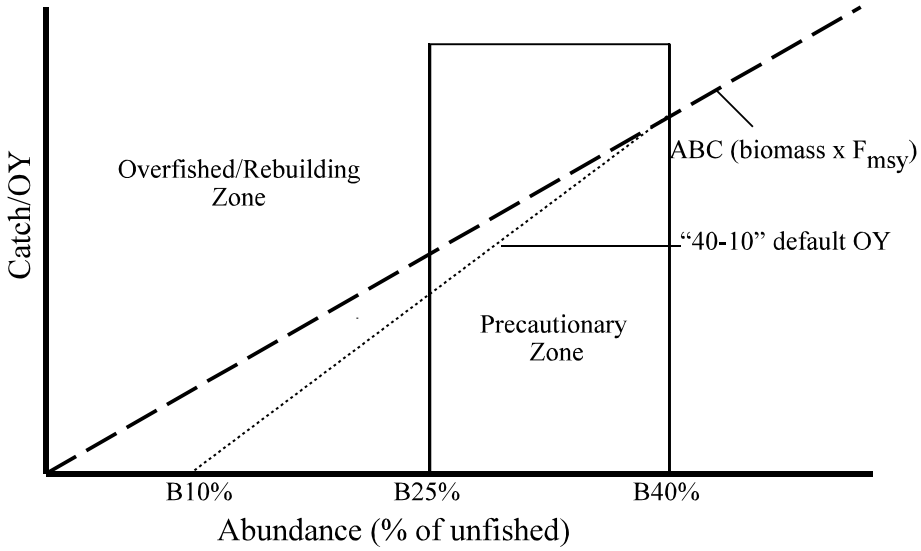
The purpose of the *Proposed Action* is to rebuild canary rockfish, darkblotched rockfish, lingcod, and Pacific ocean perch stocks managed under the Pacific Coast Groundfish FMP to a size capable of supporting MSY, or to a stock size less than this if such stock size results in long-term net benefit 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 are structured around management targets for each of the four overfished species considered in this EIS. 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 most of the groundfish stocks considered in this amendment, the biology of a particular species dictates a T_{MIN} of 10 years or greater, then the maximum allowable rebuilding time, T_{MAX}, is the rebuilding time in the absence of fishing (T_{MIN}) plus "one mean generation time." The MSA states that the rebuilding time should be as short as possible, taking into account the status and biology of the overfished stocks and the needs of fishing communities (Sec. 304(e)(A)(i)). In most cases, because of the biology of the stocks and the needs of fishing communities, the rebuilding time, or the target year, will be greater than the minimum rebuilding time (T_{MIN}).

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, denoted 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. The EIS evaluated five alternatives, described below.

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 $B_{40\%}$ (see Figure above). 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.

Stock	Strategic Rebuilding Parameters		
	F rate (2004 OY)	P_{MAX}	T_{TARGET}
Darkblotched Rockfish	Variable (62 mt)	74%	2029
Pacific Ocean Perch	Variable (1,045 mt)	<1%	>2124
Canary Rockfish	Variable (0 mt)	19%	2094
Lingcod	Variable (616 mt)	55% (northern stock) 68% (southern stock)	2009

These parameter values indicate that under the 40-10 adjustment policy, darkblotched rockfish and lingcod could rebuild within the maximum allowable time period with at least a 50% probability, the minimum permissible within the framework.

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—as long as 54 years for canary rockfish—many current participants in the commercial fishery would likely go out of business. Recreational fishing and related support businesses would be similarly affected. The rebuilding strategy is described by the following parameter values:

Stock	Strategic Rebuilding Parameters		
	F rate (2004 OY)	P_{MAX}	T_{TARGET}
Darkblotched Rockfish	0 (0 mt)	approaches 100%	2014
Pacific Ocean Perch	0 (0 mt)	100%	2012
Canary Rockfish	0 (0 mt)	approaches 100%	2057
Lingcod	0 (0 mt)	100%	2007

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. The relevant parameter values underlying the *Maximum Harvest* rebuilding strategy are shown below.

Stock	Strategic Rebuilding Parameters		
	F rate (2004 OY)	P_{MAX}	T_{TARGET}
Darkblotched Rockfish	0.033 (223 mt)	50%	2047
Pacific Ocean Perch	0.0109 (518 mt)	50%	2042
Canary Rockfish	0.0242 (46 mt)	50%	2076
Lingcod	0.0607 (northern stock) (815 mt, both stocks) 0.0667 (southern stock)	50%	2009

The *Council Preferred* Alternative–Adopt Interim Rebuilding Plan Targets

As noted, these four stocks have been managed under interim rebuilding plans since they were declared overfished. The Council chose as its preferred alternative to continue managing these overfished stocks using the targets they had identified in the interim plans. Therefore, from a practical perspective, stock management under this alternative and current management will not differ very much. For this reason the preferred alternative also could be considered a "no action" alternative. 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. 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 below, these values fall generally in the mid-range of permissible values.

Stock	Strategic Rebuilding Parameters		
	F rate (2004 OY)	P_{MAX}	T_{TARGET}
Darkblotched Rockfish	0.027 (186 mt)	80%	2030
Pacific Ocean Perch	0.0082 (396 mt)	70%	2027
Canary Rockfish	0.0220 (42 mt)	60%	2074
Lingcod	0.0531 (northern stock) 0.0610 (southern stock) (735 mt, both stocks)	60%	2009

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, only darkblotched and canary rockfish are constraining stocks to which the mixed stock exception might be applied. However, the Council has already indicated, as a matter of policy, that the mixed stock exception should not be applied to darkblotched rockfish. Thus, under this alternative the exception would only apply to canary rockfish, which would be managed at a constant harvest rate of F = 0.1178, resulting in an annual OY of 217 mt. This harvest rate is based on a 50% probability the stock would not decline over the next 100 years. This alternative is additive to the other alternatives: the canary rockfish harvest rate under this alternative could be substituted for the rate used in any of the other alternatives. Because canary rockfish management constrains harvests in a wide range of fisheries, application under any of the other alternatives would likely allow greater access to healthy stocks 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 80% for each stock, recognizing that the other alternatives incorporate 50% and 100% and various intermediate values in the *Council Preferred* alternative. The 90% P_{MAX} value was not evaluated because the effects are not significantly different from the *Maximum Conservation* alternative. Parameter values for the intermediate alternatives are displayed below.

Strategic Rebuilding Parameters

F rate	P_{MAX}	T_{TARGET}
	Darkblotched Rockfish	
0.031	60%	2040
0.029	70%	2034
	Pacific Ocean Perch	
0.0096	60%	2034
0.0068	80%	2022
	Canary Rockfish	
0.0193	70%	2071
0.0161	80%	2068
	Lingcod	
0.0510 (northern stock) 0.0533 (southern stock)	70%	2009
0.0474 (northern stock) 0.0472 (southern stock)	80%	2008

Impacts of the Alternatives

As noted above, Chapter 3 describes the human environment affected by the proposed action. It provides details about West Coast geography, bathymetry, ocean currents, and climate; the various stocks of groundfish and where they occur; and essential fish habitat. The chapter also describes the current status of the overfished stocks, as well as other stocks that are affected by actions contemplated for the West Coast groundfish fisheries. There is also a description of the affected socioeconomic environment, 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 are also described. This represents the baseline. The impacts of the alternatives, including the no action alternative, are evaluated in terms of this baseline.

Chapters 4 and 5 evaluate the impacts of the alternatives. The discussion in these two chapters is summarized below according to the main human environment components 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. Direct and indirect effects are evaluated in Chapter 4. In this document the direct and indirect effects analysis evaluates stock rebuilding measures for each overfished species in isolation. Cumulative effects are evaluated in Chapter 5. The cumulative effect is the total effect, including other past, present, and reasonably foreseeable future actions. This analysis focuses on the combined effect of rebuilding measures for all nine overfished species: the four that are part of this amendment plus the

remaining five for which plans will be adopted at a later time. For purposes of the cumulative effects analysis, generally in each alternative the same harvest rate or P_{MAX} value is applied for each species. For example, to evaluate the cumulative impacts of the *Maximum Conservation* alternative, the analysis assumes a zero harvest rate for all nine overfished species. Likewise, under the *Maximum Harvest* alternative, a 50% P_{MAX} is used to determine harvest rates for all nine species. For the *Mixed Stock Exception* alternative the cumulative effects scenario assumes that in addition to canary rockfish, bocaccio, yelloweye rockfish, and widow rockfish would be managed according to the exception, with the remaining five species managed according to *Maximum Harvest* targets. The *Council Preferred* alternative uses targets from the interim rebuilding plans for all nine species.

Habitat and Ecosystem

Currently, the ability to assess impacts to habitat and ecosystem are 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.

Comparing the alternatives, the *Maximum Conservation* alternative would clearly result in the least impact to habitats resulting from fishing activities. Fishing would have to be extensively curtailed or eliminated in order to avoid impacts on overfished stocks, especially considering the cumulative effects of a zero harvest rate for all nine of the overfished species. In the short term, the *No Action* alternative requires comparatively low OYs for darkblotched and canary rockfish, the two constraining stocks considered in this document. A similar situation would apply among the other five overfished species considered for cumulative impacts, likely necessitating more restrictive management in the short term. Although, compared with the other alternatives, this could reduce habitat impacts, if higher harvest levels are allowed later on, this alternative could end up having greater impacts to habitat. Assuming this same general correlation, employing the targets from the *Maximum Harvest* alternative along with the mixed stock exception harvest rate for constraining stocks would allow the highest overall level of fishing activity. Although the extent and configuration of closed areas is not predicted, they would likely be smaller in extent or wholly unnecessary, increasing the area potentially disturbed by bottom-contacting fishing gear. The *Council Preferred* alternative has targets that are generally intermediate, and impacts—in the absence of other mitigating factors—are likely to be similar in intensity to those resulting from current management measures.

Managed Groundfish Stocks, Including Overfished Species

The *No Action* alternative would have significant impacts to two of the four overfished stocks considered here because they would not rebuild in the mandated time period. Access to non-overfished stocks would likely be constrained in the short term because of the OYs resulting from precautionary reduction. Over the long term harvest of these stocks would only be constrained by the need to manage them for MSY.

The *Maximum Conservation* alternative results in the fastest rebuilding for all overfished stocks. The harvest restrictions necessary under this alternative would also result in less impact to non-overfished groundfish since they would also be harvested at lower levels. If equivalent targets were adopted for all nine overfished species, all fisheries catching overfished groundfish species that operate inshore of about 250 fathoms (fm) north of 38° N latitude and inside 150 fm south of that latitude would be closed or modified to eliminate bycatch. These closed areas would substantially reduce impacts to all co-occurring species, both directly due to fishing mortality and indirectly because of reduced habitat disturbance. Future abundance and productivity of these co-occurring species would then be solely influenced by environmental, ecological, and trophic interactions. Depending on these trophic interactions, competitive species' stock sizes may decline due to increased predation by the recovering overfished species, or increase if the recovery of the overfished stock represents an increase in prey availability. All currently overfished groundfish species would be expected to rebuild at fast rates, perhaps even faster than predicted, because of the greater survival of juvenile fish and potentially greater productivity due to less fishing-related disturbance of habitats.

The *Maximum Harvest* alternative includes targets allowing the highest permissible harvests. Each stock has an even likelihood of rebuilding by T_{MAX}, or put another way, will rebuild slowest in comparison to the other alternatives (excepting canary rockfish under the *Mixed Stock Exception* alternative) because the target year is equal to the maximum permissible rebuilding time (T_{MAX}). This alternative would thus have the greatest environmental impact. Cumulatively, if all overfished species were managed according to a T_{MAX} target, there is a greater risk that stocks would not in fact recover within the rebuilding period due to unaccounted for fishing mortality and the indirect impacts of habitat disturbance.

The *Council Preferred* alternative adopts targets intermediate between the preceding two alternatives, with rebuilding probabilities in the 60% to 80% range. This represents a better than 50% likelihood the stocks will recover, while allowing sufficient access to overfished stocks, so fishermen can harvest healthy stocks at higher, sustainable levels. Cumulative impacts are considered based on the assumption the Council would adopt the interim values currently in place for all stocks. Depth-based restrictions would probably be needed in the 50 fm to 250 fm zone north of 38° N latitude and in the 20 fm to 150 fm zone south of 38° N latitude, but they may be relaxed in some areas and during some seasons, depending on bycatch rates. There is a chance that fishing mortality rates in general are too high for some of the co-occurring species, which might lead to overfishing. However, this alternative, especially with the implementation of depth-based restrictions and the advent of observer data, is precautionary and is expected to rebuild the overfished stocks, while maintaining co-occurring species at MSY levels over the long term.

The *Mixed Stock Exception* alternative would have a significant impact on canary rockfish, the only one of these four overfished species to which the exception would be applied, and variable impacts on other stocks depending on the targets that were chosen. The cumulative impacts analysis evaluated applying the exception to four additional overfished species for which rebuilding plans are not being adopted as part of this amendment, in addition to canary rockfish. These species would not rebuild. There is also a greater risk of continued overfishing of the other five overfished species. Some co-occurring species could be overfished as well, if currently available management measures failed to sufficiently constrain fishing mortality. Smaller rockfish and some of the other co-occurring species might thrive due to lesser competition and predation of exploited species.

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

The following table shows the sum of projected OYs in metric tons for the four overfished species over the course of the rebuilding period, and in parentheses, the exvessel present value of these OYs in thousands of dollars. These values help to illuminate the potential socioeconomic impacts of the alternatives. The cumulative OYs are used as proxies for the effect that harvest limits for overfished species have on the total fishery. (It is important to realize that these values do not account for the probabilistic nature of the underlying analysis. In other words, it is assumed the stocks have recovered to the MSY biomass level by the target year, while the underlying model expresses only a 50% likelihood of recovery by this date.) Overfished species' OYs act as de facto limits on harvesting healthy stocks, representing an important cumulative effect. An incremental increase in an overfished species' OY can allow proportionately much larger harvests of healthy groundfish stocks. In this way, an overfished species OY can act as an economic linchpin in the management system, disproportionately affecting the value of a fishery. The present value estimates (using a fixed discount rate and estimated price) give an idea of the stream of benefits over time: future economic benefits are less valuable in the present in comparison to short-term benefits. For example, the sum of the stream of OYs over the rebuilding period for canary rockfish is actually greater under the *Maximum Conservation* alternative than the *Maximum Harvest* alternative. However, since these benefits occur relatively far in the future, the present value of the Maximum Harvest alternative is greater. In contrast, for Pacific ocean perch even the present value of benefits under *Maximum Conservation* alternative is greater because of the magnitude of future benefits and relatively brief rebuilding time. (Its important to keep in mind that the interactions between co-occurring overfished species, darkblotched rockfish in this case, may mean that those benefits will not be realized. As with healthy stocks, darkblotched OYs likely would constrain these potential harvests.) Present exvessel value also gives a rough relative indication of the array of social benefits—like profits, personal income, and employment—that would derive from the fishery under the alternatives. These values have a further indirect impact in terms of the quality of life in coastal communities involved in or dependent on fishing.

	No Action	*Maximum Conservation*	*Maximum Harvest*	*Council Preferred*
Darkblotched Rockfish	13,362 ($4,687)	12,240 ($3,646)	14,386 ($5,481)	13,565 ($5,229)
Pacific Ocean Perch	41,694 ($20,406)	36,084 ($12,559)	24,525 ($11,264)	29,791 ($11,162)
Canary Rockfish	14,012 (1,425)	13,062 (568)	10,288 (1,777)	10,505 (1,673)
Lingcod	6,959 ($6,154)	4,119 ($3,363)	7,611 ($6,902)	7,029 ($6,353)

Cell entries are: cumulative OYs in metric tons, and exvessel present value in thousands of dollars (in parentheses).

Applying the 40-10 precautionary adjustment under the *No Action* alternative would result in lower harvest levels in the short term compared with the *Council Preferred* and *Maximum Harvest* alternatives, except for Pacific ocean perch. In the short term, substantially higher harvests of that stock could occur, under the precautionary adjustment, contributing to the higher cumulative OYs over the rebuilding period and greater present value. However, because the stock would not recover, in later years the potential harvest would actually be lower than under the other alternatives. Even short-term harvest levels are unlikely to reach annual OYs because of the constraint on actual catches imposed by limits on co-occurring darkblotched rockfish harvests. Over the long term, darkblotched rockfish are predicted to recover with application of the precautionary adjustment. Pacific ocean perch could then become a constraining species as long as application of the precautionary adjustment prevented recovery of this stock. Because lingcod is a relatively productive stock, it is also expected to recover if the precautionary adjustment were applied, with OYs similar to those that result under the other alternatives. Like Pacific ocean perch, canary rockfish would not be expected to recover in the foreseeable future, with similar implications for long-term benefits. This alternative would require substantial short-term reductions (depending on stock biomass), which could result in reduced profits, income, and employment lasting beyond the time when higher harvests would again be possible. (This would be due to a more-or-less permanent shift of human and financial capital out of fisheries. This is even more likely under the *Maximum Conservation* alternative, since fishing would be essentially prohibited in the short-term.)

The *Maximum Conservation* alternative would have the greatest socioeconomic impact because all bycatch of these overfished species would have to be eliminated. (If the other five overfished species were similarly managed, a much wider range of fisheries would be cumulatively affected.) Any fishery in which bycatch occurs would have to be curtailed or eliminated to completely prevent bycatch of these species. This is likely to result in a significant socioeconomic impact due to the reduction in profits, personal income, and employment. However, stocks would recover to their target biomass faster, allowing fishing to resume at higher levels. (Although, as mentioned, the social capital necessary to harvest the resource would probably have to be reconstituted.)

The *Maximum Harvest* alternative would delay rebuilding for the longest period of time with the intent of keeping harvests at their highest permissible levels for the duration of rebuilding. As a result, this alternative would have the least socioeconomic impact, at least in the short term. The delayed rebuilding period can also be expressed as the level of risk that overfished stocks do not rebuild. Further delay in rebuilding, and resulting restrictions—even if less than what would be needed to achieve faster rebuilding—could reduce the present socioeconomic value of this strategy in comparison to other alternatives. The overall higher harvests that would be possible could also increase the risk that a currently healthy stock would be inadvertently overfished, engendering further socioeconomic costs.

The *Council Preferred* alternative includes a range of targets, reflecting occurrence of stocks in different fisheries and the productivity of the stock. Canary rockfish, for example, are relatively unproductive but occur in a wide range of fisheries. The Council chose a more distant target (reflected in the relatively lower 60% rebuilding probability) in order to allow a moderate level of bycatch. Even modest bycatch could be sufficient to allow greater fishing opportunity on healthy stocks. A target based on the 60% rebuilding probability was also chosen for lingcod. This slightly greater risk was assumed because the stock is predicted to recover rapidly. Even if the stock recovered after T_{MAX} (recognizing the increasingly higher probability of recovery in each subsequent year), the delay in recovery would not be great. As would be expected, the overall intensity of socioeconomic impacts under this alternative is intermediate to the preceding two.

The *Mixed Stock Exception* alternative would allow higher harvests of canary rockfish and could be combined with any of the preceding alternatives (except for the *No Action* alternative). Since the demands of rebuilding canary rockfish will affect a range of fisheries, relaxing this constraint under any of the alternatives would allow a higher harvest level in some fisheries. However, fisheries with little or no canary rockfish bycatch, but with bycatch of other overfished species, would not necessarily benefit. (Considering cumulative impacts, there are several other overfished stocks outside of those whose rebuilding plans are adopted in this amendment for which the Council has left open the possibility of invoking the mixed stock exception. If it were used for all these species few fisheries might be constrained.)

This summary has not considered non-market values that are difficult to quantify (leaving aside non-monetary use benefits derived from recreational fishing, for example). Such benefits—option or existence values associated with recovered stocks—are to some degree implicit in the proposed action. The MSA requires overfished stocks to be rebuilt even if the monetary cost-benefit calculation is negative, as long as the overall benefit is positive. There is thus an implied social benefit, over and above any quantifiable use benefit, that is represented by the net monetary cost incurred in rebuilding overfished stocks.

Meeting the rebuilding targets in the alternatives will affect a range of socioeconomic sectors, including commercial and recreational fishing, fisheries prosecuted by Indian tribes under treaty, and the coastal communities where these activities are based. Although the absolute effect on each of these sectors cannot be forecast, for a given alternative the relative intensity of the socioeconomic impacts is similar across sectors. Effects of the proposed action on fisheries, fishing-related activities, and fishing communities are described below.

Commercial Fisheries

Darkblotched rockfish and Pacific ocean perch are co-occurring species in deepwater on the continental slope. Pacific ocean perch have a somewhat more northerly distribution, with commercial catches north of Mendocino, while darkblotched rockfish are caught as far south as Point Reyes. Because of their depth distribution, these two species are caught exclusively by commercial vessels, primarily bottom trawlers targeting various flatfish species on the outer continental shelf and on the continental slope. An important trawl fishery targeting the Dover sole/thornyhead/sablefish species complex (DTS) would also be affected by rebuilding-related restrictions. Canary rockfish and lingcod are caught in a wider range of fisheries, including recreational fisheries both on the continental shelf and nearshore areas. Canary rockfish are commonly associated with rocky outcrops; they are, therefore, often caught by longline fishermen, who they can set their gear in these areas.

Recreational Fisheries

As mentioned above, recreational fishermen do not catch darkblotched rockfish and Pacific ocean perch because of the distribution of these species. In contrast, recreational catches account for a large proportion of the total lingcod and canary rockfish fishing mortality. Charter vessels more commonly catch canary rockfish, while lingcod are mostly caught by private vessels. This difference is likely due to the occurrence of these two species, with lingcod more common in shallower nearshore areas. 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, Quilieute, Hoh, and Quinalt 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. The midwater trawls used in this fishery also catch relatively small amounts of canary and darkblotched rockfish. More limited bottom trawl fishing by these tribes, and ocean salmon fishing, also catch overfished species, including canary rockfish and lingcod. In terms of the four species considered in this amendment, the catch is modest and rebuilding measures—aside from the zero mortality target under the *Maximum Conservation* alternative—would have little effect. Cumulatively, management of all nine overfished species is likely to have a greater effect, since other overfished species, and widow rockfish in particular, are frequent bycatch in the whiting fishery.

Fishing Communities

Because of the distribution of the overfished species considered in this amendment, and the fishing fleets most commonly catching them, ports on the Oregon and Washington coasts would be most affected by rebuilding measures. Groundfish vessels in these ports would find it difficult to shift to other fisheries or locations in response to stock rebuilding-related fishing restrictions. In addition, many of the buyers and processors along the Oregon/Washington coast are relatively small. Because of their size, they have limited scope for reducing operations and remaining financially solvent. Small size also limits their ability to change the kinds of fish they process and sell. 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. Nonetheless, while not quantified, restrictions could devalue the ocean recreational experience in this region and indirectly affect demand for recreational products and services.