Chapter 4 Environmental Consequences

This chapter contains comparative analyses of the consequences of each alternative in the context of each component of the affected environment presented in Chapter 3.

4.1 Criteria for Evaluating the Consequences of the Alternatives

The consequences of the alternatives on marine habitat, the ecosystem, marine resources, the socioeconomic environment, and protected species are analyzed in the remainder of this chapter. The criteria for evaluating the consequences of the alternatives on marine habitat, the ecosystem, and marine resources are described in section 4.1.1. The criteria for evaluating the socioeconomic consequences of the alternatives are described in section 4.1.2. The criteria for evaluating the consequences of the alternatives on protected species are described in section 4.6.

4.1.1 Criteria for Evaluating the Consequences of the Alternatives on Marine Habitat, the Ecosystem, and Marine Resources

The following subsections, 4.1.1.1 through 4.1.1.7, describe the criteria used in the analyses of the consequences of the alternatives on marine habitat, the ecosystem, and marine resources.

4.1.1.1 Criteria for Evaluating the Consequences of the EFH and HAPC Designation Alternatives on Marine Habitat, the Ecosystem, and Marine Resources

The environmental consequences of the alternatives to identify and describe EFH are discussed in terms of: (1) the generic consequences common to all the alternatives; (2) risk aversion, scientific uncertainty, and geographic comparison of specific alternatives; and, (3) the implications of the EFH alternatives on the HAPC and Impacts Minimization alternatives. Section 4.2.1 discusses the generic consequences common to all the alternatives and is a qualitative analysis of indirect environmental and socioeconomic effects. Section 4.2.3 analyzes the implications of the EFH alternatives on the HAPC and Impacts Minimization alternatives.

The environmental consequences of the alternatives to designate HAPC are discussed in terms of: (1) the generic consequences common to all the alternatives; and, (2) geographic comparison of specific alternatives.

4.1.1.2 Criteria for Evaluating the Consequences of the Impacts Minimization Alternatives on Marine Habitat, the Ecosystem, and Marine Resources

Each of the alternatives is analyzed for its predicted effects on marine habitat, the ecosystem, and marine resources. The methodology for each is described in the remainder of this subsection.

4.1.1.3 Minimization of Adverse Effects

Each Alternative is analyzed for the extent to which it is may minimize adverse effects to EFH from fishing. Habitat effects research from throughout the world is focused on physical alteration to habitat and changes in biodiversity that result from effect. It is not possible to analyze the degree to which the function of habitat within the ecosystem or for groundfish will be affected by the alternatives. Another limitation is that the status of habitat in reference to a pristine condition is not knowable through assessment at this time. This means that the effect of an alternative on EFH, relative to the pristine condition of the habitat, cannot be assessed for this EIS. The Risk Assessment in Appendix A provides background on these limitations.

To analyze the expected performance of the alternative in minimizing adverse fishing effects, a GIS-based methodology is utilized for this EIS. The alternatives are overlaid with the sensitivity and recovery information developed through the Risk Assessment and the amount of habitat for each is calculated as a percentage of the whole. This provides a measure of the relative amount of habitat that is protected from fishing effects which is comparable among the alternatives.

Sensitivity values for each habitat type/fishing gear combination are resolved to a 4-point scale that represents direct change to habitat and biodiversity as a result of fishing. The sensitivity of habitat is indexed as follows:

0 = No detectable adverse effects on the seabed; i.e. no significant differences between effect and control areas in any metrics.

1 = Minor effects such as shallow furrows on bottom; small differences between effect and control sites, less than 25% in most measured metrics.

2 = Substantial changes such as deep furrows on bottom; differences between effect and control sites 25-50% in most metrics measured.

3 = Major changes in bottom structure such as re-arranged boulders; large losses of many organisms with differences between effect and control sites greater than 50% in most measured metrics.

Recovery time is indexed in years.

As a result of the focus of global literature on fishing effects, all of the sensitivity metrics rely on physical modification to the seabed and changes in biodiversity. It is not understood if these types of metrics necessarily equate to functional changes to habitat. That is, the results of the GIS analysis should not be strictly interpreted as an indication that limiting fishing effects in sensitive areas preserves the function of the habitat for groundfish and the ecosystem. Reducing physical modification and negative changes in biodiversity, given the limited data available and precautionary principals of resource management, is considered Environmentally Positive in scoring the alternatives and the alternatives are comparable by considering the relative amounts of habitat that is protected by their sensitivity and recovery values.

Habitat Table 4-22 compares the relative amount of habitat sensitivity and recovery. To simplify the large amount of information for the analyses of individual alternatives, dredge gear is not discussed, as it is not currently used off the West Coast. Pot, trap, and hook and line gear have maximum sensitivity and recovery values of 0.8, which are considered minimal, so are excluded from the discussion as well. The information for these gears is available in Habitat Table 4-22 and 4-23.

Nets are discussed in the analyses of individual alternatives for sensitivity values of 0.75 or larger, where recovery time is greater than 1.25 years. Bottom trawl is discussed for sensitivity values of 1.0 or larger, where recovery time is greater than or equal to 1 year. To further assist the reader to comprehend the large volume of information from the Habitat Tables, groupings are made at reasonable combinations of sensitivity and recovery levels.

To understand this analysis, one must view the sensitivity and recovery levels as a proxy for habitat type. That is, GIS technology allows the substrate types to be indexed and mapped by the sensitivity and recovery values described above. The polygons are defined by their assigned values and function in the analysis as discrete habitat types. The status or expected status due to the implementation of a particular alternative, of a particular habitat type is not knowable because of the scientific inability to factor in fishing intensity and the relationship of impact to recovery (k) at this time (see Risk Assessment Appendix A). It is a common pitfall of readers as they interpret this analysis, to be confused by the inclusion of sensitivity and recovery values for gear types that are not included in the relevant alternative. The information on all gear types is included because it displays a habitat type and is intended to fully disclose all relevant information so the reader can make an informed judgment on the performance of individual alternatives.

4.1.1.4 Habitat for Individual Species/Life Stages

Each alternative is analyzed for the extent to which it protects habitat for individual species/life stages of groundfish. This is accomplished through a GIS-based analysis in which the alternatives are overlaid with spatial profiles of suitable habitat for 168 individual species/life stages (out of 382 possible species life stage combinations, data is available for 168). A full discussion of how suitable was profiled is contained in the Risk Assessment (Appendix A).

Adverse effects to habitat can impair the ability of fish to carry out basic ecological functions such as spawning, feeding, breeding, and growth to maturity. These functions occur at discrete life stages and the habitat requirements of many fish change depending on the life stage. West Coast rockfish for example, spend their early life history as eggs and larvae floating in the water column before settling as juveniles on the substrate where they grow to maturity and reproduce. Although there is not a quantifiable measure of how much habitat is required for a population of fish to attain a stable, productive age structure, healthy functioning habitat is critical for populations of fish to sustain themselves and there is a level at which adverse effects to habitat will impair the ability of fish to do so.

In the event of catastrophic environmental conditions or management failure, a more even age structure can be expected to serve as insurance that fish (e.g. either many of a single age class or a few of many age classes) will persist to sustain the population. The scientific tools do not exist, or are unavailable for this EIS, to assess the effects of the alternatives on population dynamics. To assess the level of insurance for comparison among the alternatives, this analysis considers the relative amount of suitable habitat for a species/life stage that occurs within a closed area. Note that this is not an analysis of the abundance of species/life stage but rather quantifies suitable habitat. Although care should be taken in interpreting these results, the analysis concludes insurance for individual species/life stages accrues in proportion to the amount of suitable habitat that is protected. Insurance for a complete population accrues as habitat is protected for each life stage.

While efforts to identify suitable habitat for the Pacific Groundfish fishery have been encouraging, unfortunately the project team realized prior to publication of the DEIS that some of the maps generated from the information collected on the managed species were incorrect. Since publication of the DEIS the project team has continued to correct and update the underlying data sets used to generate HSP maps describing groundfish EFH. This FEIS contains updated maps and represent the best available science for spatial analyses of groundfish and habitat associations. The reader should still be cautioned that although the maps have undergone peer review, there is still uncertainty associated with the mapped representations of groundfish habitat. Caveats for understanding and utilizing the maps are contained in Appendix D.

4.1.1.5 Habitat Types

Each alternative is analyzed for the extent to which it protects individual habitat types. This is accomplished through a GIS-based analysis in which the alternatives are overlaid with maps of substrate and biogenic habitat. This is intended to provide a comparable measure of how habitat components of the ecosystem are protected. The substrate habitat types described in section 3.2.4 are carried forward for this analysis with the addition of estuaries as a unique habitat type (estuaries are described in section 3.2.2.1). Spatial data on biogenic habitats is limited to canopy kelp and seagrass which are described in section 3.2.2.1.2. Although spatial data sufficient for GIS analysis of corals, anemones, sea pens, and sea whips is not available for this EIS, a map of where these habitat-forming organisms have occurred in trawl surveys is provided as a means of visual comparison with the alternatives (Figure 3-1). Caveats on the use of this data is provided in Appendices A and B.

To foster the ecosystem approach, the analysis is stratified according to the major zoogeographic provinces (large areas which significant differences in biology) that are known to occur on the West Coast. The provinces are described in Chapter 3. In summary, they are the Oregonian Province north of Point Conception, California, and the San Diego Province to the south.

Considering the paucity of information on the ecosystem function of discrete habitat types and taking a precautionary approach to analyzing the alternatives, well-rounded protection of habitat is considered Environmentally Positive. That is, in the absence of definitive research, the analysis concludes that it is beneficial to protect some portion of each habitat type and that higher levels of protection (by relative area) is more beneficial than lower levels.

4.1.1.6 Additional Qualitative Analyses

Additional qualitative analyses are included for each alternative where appropriate.

4.1.1.7 Summary of Cumulative Effects on Habitat, the Ecosystem, and Marine Resources

Because we lack the ability to quantitatively predict how the alternatives compare to no action, a qualitative discussion is provided on the overall cumulative effects on habitat, the ecosystem, and marine resource. The information below forms the basis of our conclusions on cumulative impacts of each alternative.

<u>Closed Areas</u>

The various types of closed area alternatives include total prohibition of bottom-contacting activities (fishing and non-fishing), prohibition of fishing, prohibition of bottom fishing, and prohibition of bottom trawling. Closed areas reduce or eliminate effects to habitat and the marine resources therein. The size of the closed area may be important in terms of the functional contribution of habitat to the ecosystem and the production of marine resources. Closed areas may provide insurance to the persistence of marine resources and contribute to increased stock sizes outside the areas; however, these benefits are not quantifiable and may be significantly effected by the size of the area. Geographically larger closed areas are considered more beneficial than smaller ones.

For purposes of the analysis, a complete removal of anthropogenic effects is considered the most beneficial, followed by prohibition of fishing, prohibition of bottom fishing, and prohibition of bottom trawling. Completely removing effects over the long-term would allow habitat to maintain or return to a pristine condition. This benefit is scaled down as activities are added. A prohibition of fishing would remove all fishing effects but allow for non-fishing activities that may damage habitat. A prohibition of bottom fishing would protect habitat from direct effects however benefits to the insurance of marine resources may be limited if fish stocks are removed by pelagic gear types. A prohibition of bottom trawling would protect habitat from direct effects associated with trawling but leave the potential for effects from other bottom-tending gear types such as longline and pot gear. The function of prohibiting bottom trawling, while allowing harvest of fish by other gear types would potentially decrease the benefits of the closed area as a means of insurance to the persistence of marine resources.

Gear Restrictions

The various types of gear restrictions include complete prohibitions on particular gears, to gear modifications, to area-specific gear prohibitions. For purposes of the analyses, gear restrictions are considered to reduce, but not eliminate, direct effects to habitat. The analyses assume that direct effects to habitat will still occur although at reduced levels from the status quo.

Effort Reduction

Alternative C.10 includes an effort reduction component and is discussed in section 4.4.10.

Forage Habitat

Alternative C.5 includes a prohibition on harvesting forage habitat and is discussed in section 4.4.5.1.

Non-Fishing Effects

The habitat protection measures considered in this EIS do not protect against non-fishing threats such as pollutants, invasive species, diseases, and global warming. Such threats however, may be important factors in the health of groundfish populations and the ecosystem. To the extent that they would influence the environmental performance of the alternatives, the effects are assumed for purposes of analysis to be uniform throughout the project area and are not considered influential. This is due to an inability to predict more localized trends and is an inherent weakness in predicting cumulative effects of the alternatives.

Cumulative Effects

Cumulative effects are viewed as the sum of existing environmental trends, reasonably foreseeable environmental trends, and the effect of a particular alternative on the environment within the context of those trends. Each of the alternatives is considered for its potential to contribute to cumulative environmental effects and is given a positive, negative, zero, or unknown score. The final cumulative determination ultimately depends on how one weighs each portion of the effected environment, and the past, present, future, and alternative influence on that portion of the environment and is developed based on the preceding discussion for each general factor (i.e. closed areas, gear restrictions, effort reduction, forage habitat, and mobile threats). Additionally, the Council and NMFS have selected a combination of the alternatives for final action that would influence the final cumulative effect.

0 = No Change
E+ = Environmentally Positive
E- = Environmentally Negative
U = Unknown

4.1.2 Criteria for Evaluating the Socioeconomic Consequences of the Alternatives

This section describes the methodology used to assess the effect on the socioeconomic environment related to the alternatives in this EIS. The socioeconomic environment is delineated into West Coast fisheries, fish processors and buyers, consumers, management and enforcement, safety, communities, non-market values, and non-fishing values. Each of these delineations is addressed within the analysis of alternatives in order to enable the reader to compare and contrast the effects of each alternative on the socioeconomic environment in a consistent manner. Where data exists, the effect on each of these components is quantified. Where data does not exist, the effect on each alternative is discussed qualitatively. A summary of the criteria used to evaluate the socioeconomic consequences of the alternatives is presented in Socioeconomic Table 4-1.

4.1.2.1 Methodology for Assessing Effects on the Socioeconomic Environment

Analysis of alternatives and their relationship to the socioeconomic environment largely centers on the set of alternatives designed to minimize fishing effects to groundfish habitat. EFH and HAPC designation alternatives are expected to have similar effects to the socioeconomic environment in the form of consultation activities, and these effects are discussed in those sections. Alternatives designed to minimize fishing effects to habitat have a more dynamic effect on the socioeconomic environment, and as such, more analysis is provided on those alternatives. Quantitative measurements are provided for each impacts minimization alternative that has area closures impacting bottom trawl fisheries as part of that alternative. Where data exists other forms of quantitative analysis are provided for that alternative. In addition to quantitative measures, mapping was used to show revenue hotspots, effort hotspots, and trawl track information.

Quantitative measures provided for area closure analyses are in the form of limited entry groundfish bottom trawl revenues that are displaced or put “at risk” if those proposed area closures are put in place. Ideally, displaced revenues from all West Coast fisheries would be included in the analysis of displaced revenues and would act as a measure of aggregate effects to the fishery where effects to processors, communities, and the nation, for example, would be multiplicative of those fleet-wide displaced gross revenues. Unfortunately, spatial data for fisheries other than the limited entry groundfish trawl fleet are not available, or are not available on a temporally consistent and coastwide basis. Because of the lack of quantitative and spatial data available, NMFS solicited public comment following the release of the draft EIS, and public meetings were held in coastal communities likely to be impacted by management measures designed to protect essential fish habitat. Significant public comment was received through both mechanisms, and this comment has been used to the extent possible in analyzing the impact of alternatives.

Limited entry groundfish trawl revenues are used in each of these alternatives because they are the only consistent measure of fishing revenues that can be applied in an equal fashion across alternatives. Using limited entry groundfish bottom trawl revenues put at risk as a quantitative measure serves as an index of effects from each alternative. Although spatially-based revenues from the limited entry trawl sector are not necessarily indicative of spatially-based revenues from other sectors, the use of limited entry trawl data as an index is appropriate given that the trawl fleet is the largest source of groundfish landings, meaning the trawl fleet may have the largest effect on most communities and processors engaged in the groundfish industry, and a change in trawl activities may effect more entities than a change in other groundfish fishery sectors. Furthermore, although other spatial data exist (for example, Washington currently has electronic logbook data for open access trawls), using additional data that is not consistent between states and across the coast would tend to bias the analysis and make alternatives that influence that sector appear to have a larger effect than those that do not. (Open access trawling is defined as trawling that occurs by vessels that do not hold a federal groundfish trawl limited entry permit, but may catch groundfish incidentally while targeting another species.) For example, the use of Washington open access trawl data would make the effect of alternatives appear larger for alternatives that effect the Washington open access trawl fleet than for alternatives that do not effect that fleet. Without open access trawl data for other states, incorporating Washington open access trawl data into this analysis may be misleading to the reader. However, other spatial data that is available is used on a case by case basis where that information is appropriate. This information is used to describe impacts to those particular fisheries, but it should be noted that these impacts are not summed with the trawl revenues at risk analysis because it is likely that summing them would bias the analysis in the manner that was described previously.

Trawl revenues put at risk are quantified by using catch records and associated latitude and longitude coordinates for individual tows from trawl logbook data in the years 2000–2003 that are available in the PacFIN database. The West Coast EEZ was split into a grid of 10x10 minute block areas, and catch from trawl logbook records assigned to one of those areas, based on the latitude and longitude recorded for individual tows. Each of these 10x10 minute blocks were then assigned a value (in U.S. dollars) based on the amount of landed catch revenue that was attributed to all of the tows occurring within that block area, and the block areas were then matched to areas that would be closed under the various impacts minimization alternatives. This information is provided in the EIS in two ways. One approach assumes that the entire amount of revenue attributed to the 10x10 block area would be displaced if that block intersects (to any degree) with a potentially closed area. The second approach proportions the revenue within that block according to the portion of the block that would be closed under an alternative. The approach using the 10x10 block area likely represents a maximum amount of revenue that would be displaced from a closed area. The approach using the proportioned revenue from a 10x10 block area is likely to be near the actual amount of revenue that would be displaced if the actual closed area boundary represents the habitat area to be closed to fishing, but it is unknown whether it is an underestimate or an overestimate. Both methods are shown because for many alternatives the final boundaries for the closed areas were not developed.

Following the development of the revenues at risk analysis, trawl end points for the year 2003 were keyed into a database system and this information was used to show trawl track information for that year by combining trawl end points with start points. This information was mapped for the entire coast to show tracks where vessels had regularly trawled during the 2003 season (Figures 4-1 through 4-6). Although this trawl track information cannot specifically show where - during a particular tow - certain quantities of species were caught, this information was designed to compliment the trawl revenues at risk analysis by showing areas of high effort.

During the development of the trawl revenues at risk analysis, several discussions occurred on the appropriate resolution (size) of block areas that would be used. A resolution of 10x10 minute blocks– as opposed to 5x5–was used for several reasons, including;

- The available coordinates for trawl tows in the PacFIN database represent the start of tow location and tows may occur for several miles, so 10x10 blocks are more likely to cover the entire tow area,
- 10x10 minute block areas have been used in previous analyses and are already available in the PacFIN database,
- This resolution was agreed on (prior to the development of this EIS) by industry and agency representatives as being the most appropriate resolution, and

- The authors believe that potential variability between the estimated coordinate in logbook data and the actual coordinate of the tow–in combination with above factors–means that analysis using a finer resolution may be incorrect or misleading.

Trawl revenues that are put at risk should not be confused with revenues that are actually lost. Some portion of revenues put at risk may indeed be lost; however, revenues at risk are best described as revenues that will be displaced if that alternative is selected. Some of those revenues may be lost if–for example–the catch-per-unit effort and total catch in areas remaining open to fishing are substantially different from those closed, if the cost of traveling to areas remaining open is higher, or if the incidental take restrictions on prohibited or overfished species in areas remaining open limits the available catch of target species.[1] Unfortunately, a precise prediction of revenues that may be lost and the distribution of that loss are not possible due to data limitations. Factors that may cause substantial amounts of displaced revenues to be lost are discussed where the authors are able to reasonably identify those factors based on accepted theory and knowledge of the fishery.

Effects to processors, communities, and the region are generally multiplicative of effects to fishing vessels. If a change in landed catch or exvessel revenues occurs, processors may see a change in the amount of product flow to processing plants, which in turn may change revenues. A change in the mix of species can also have positive or negative effects on processors if a change in species mix results in a change in the amount of high or low valued species. For example, if processors retain some profit margin above the exvessel price of species, an increase in deliveries of high valued sablefish could positively effect processors even if there is an equivalent reduction in landings of some other, lower-valued species.

Community and regional economic effects can generally be described as being multiplicative of exvessel and processing revenues and labor. Revenues generated by fishing related activity have direct, indirect, and induced effects. Direct effects can be described as changes in the industries (e.g., changes in output, employment, or labor income in fishery industries) to which a final demand change was made. Indirect effects are changes in inter-industry purchases as they respond to the new demands of the directly effected industries–i.e., the purchases by fishery industries from other economic sectors. Induced effects reflect changes in household spending as income changes due to the changes in production. The total effects are the sum of direct, indirect, and induced effects.

The Fisheries Economic Assessment Model (FEAM) provides one means of calculating processing, community, and regional effects. This model is currently maintained and updated by The Research Group, Corvallis Oregon, and was adapted in 2004 to be more specific to changes in the limited entry trawl sector. A description of the FEAM is provided in Appendix E. Outputs from the FEAM are described here to provide information on processor, community, and regional effects resulting from possible changes in the limited entry trawl fishery. The outputs apply specifically to the limited entry trawl sector and are meant to compliment the trawl revenue at risk analysis provided in Chapter 4. Unfortunately, available resources make it infeasible to trace the trawl revenues-at-risk analysis to the community and state level; but the FEAM processor, community, and state outputs do not vary enough to substantially change the ranking–in terms of the amount of revenues at risk–for each alternative.

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[1] It should be noted that none of the alternatives change the total amount of harvest that can be taken by the fleet (i.e. OYs), but other factors could change cumulative limits.

Socioeconomic Tables 4-12 and 4-13 provide the factor or multiplier that would be applied to round pounds of landed catch from the limited entry trawl fleet. The factor represents the total effect. In the case of processors, this represents gross revenues. In the case of communities, states, or the West Coast region, this represents the sum of direct, indirect, and induced economic effects. Species-specific multipliers are provided so that the reader can draw inferences on effects that potential closures may have if those potential closures are relatively DTS or flatfish species intense for example. Although a multiplier for 'Groundfish' is provided, it is important to note that the multiplier in this case is based on the mix of species that have been landed by limited entry trawlers in the past. The more the species mix of landed catch changes from past landings, the less accurate that multiplier becomes.

The analysis of the effect of the alternatives on non-market values qualitatively assesses the potential for changes to non-market values based on principles of economic theory. In general, it is assumed that alternatives that have positive environmental effects will positively effect non-market values. A discussion of our capability to assess the influence of the alternatives on non-market values is contained in the analysis. One recognized constraint is the lack of available information on how the public values the Pacific ecosystem, groundfish and habitat. There is no known data on the extent to which the public values Pacific groundfish or habitat specifically. This imposes limits on the analysis of the effects. Therefore, it is not possible at this time to determine the extent to which an alternative effects non-market values. The likely direction and rate of change in non-market values, however, are assessed.

Effects to non-market values rely on the expected magnitude of potential changes to the ecosystem, groundfish and habitat. Other components of the socioeconomic environment rely on revenue changes and consultation costs, while non-market values rely on the potential effects to the ecosystem, groundfish and habitat. This is also true for the research and monitoring alternatives.

Quantifying the effect of alternatives on many portions of the socioeconomic environment is not possible due to data limitations. Where the authors are unable to quantify effects, a qualitative discussion of those effects is provided which is based on common theory, knowledge of the fishery, other NEPA and Council documents, and other applied and academic publications. Sections that are qualitative are structured in a manner that lays out the considerations of each alternative, discusses the possible effects to each environmental component of the social and economic environment, and identifies the most likely outcome from a socially beneficial or negative standpoint based on what is currently known about the relationship of habitat to the socioeconomic environment.

Analyses in this section are further divided into a short-run and long-run perspective where differences in time perspective are appropriate and where short and long-run outcomes can be identified. In general, short-run effects are easier to evaluate than long-run effects. Effects over the long-run may change as fishermen, processors, communities, and markets adapt to changing regulations. These adaptations may counter a short-run negative effect as business and community goals result in a reallocation of resources to capitalize on changing conditions and if habitat protection measures result in increased fishery yields. However, over the long-run an effect may grow if communities and businesses are unable to adapt to that change in the environment.

Much of this analysis focuses on the short and long-run cost effect to the socioeconomic environment. The ability to measure the potential benefits of short and long-term habitat protection on West Coast fisheries does not currently exist due to a lack of research and data pertaining to such protections. However, it is accepted that habitat is necessary for the survival of species, and that protecting habitat will foster the continued survival of existing species. Whether protecting habitat from damage will foster an increase in fish populations that will in turn translate into an increase in catch is unknown. In the case of groundfish, this theory is especially questionable since many groundfish species are sedentary, and an increase in a particular fish population may occur in areas inaccessible to fishing gear. For example, closing areas to types of fishing gear may increase the populations of fish species within those areas, but it is questionable whether spill-over effects will occur to areas outside those closed areas when species are sedentary in nature. Without spill-over effects, it is questionable whether increases in catch are likely to occur as a result of an increase in population, and this makes long term fishery benefits as a result of habitat protection debatable. Indeed, the SSC white paper on marine reserves (PFMC June 2004) concluded that perhaps one of the only certain benefits to closing areas to fishing (a tool analyzed in the impacts minimization alternatives) may be the reduction in stock uncertainty due to the existence of more robust stocks (various age groups) within those closed areas. Furthermore, although stock improvements may indeed occur as a result of closed areas, the evidence that a growth in stock would translate into additional fishing opportunities because of spillover from that closed area was still hypothetical and unproved.

Cumulative effects are viewed as the sum of existing trends, reasonably foreseeable trends, and the effect of a particular alternative. Cumulative effects are assessed in a qualitative fashion since at least one variable in the set of existing, future, and alternative variables is qualitative for each option and this makes a quantitative analysis unfeasible. Cumulative effects can be measured based on the sum of scores assigned to each past, present, and reasonably foreseeable trend, and each alternative. Each of these is given a positive, negative, zero, or unknown score; however, the final cumulative determination ultimately depends on how one weighs each portion of the effected environment, and the past, present, future, and alternative influence on that portion of the environment.

0 = No Change
E+ = Socially Positive
E- = Socially Negative
U = Unknown

4.2 Consequences of the Alternatives to Identify and Describe EFH (Alternatives A.1–A.6)

The following subsections, 4.2.1 through 4.2.3 describe the effects of Alternatives A.1 through A.6 on the effected environment. Subsection 4.2.4 describes the effects of the Final Preferred alternative to describe EFH on the effected environment.

4.2.1 Generic Consequences Common to all the EFH Identification and Description Alternatives

Designation of EFH, in accordance with section 303(a)(7) of the Magnuson-Stevens Act, does not in and of itself have any direct environmental or socioeconomic effects. However, EFH designation is likely to result in indirect environmental and socioeconomic effects because management measures are linked to adverse effects on EFH.

First, every FMP must minimize to the extent practicable adverse effects of fishing on EFH, pursuant to section 303(a)(7) of the Act. Under section 303(a)(7) of the Act and the associated provisions of the EFH regulations (50 CFR 600.815(a)(2)), each FMP must contain an evaluation of the potential adverse effects of fishing on EFH. Councils must act to prevent, mitigate, or minimize any adverse effects from fishing, to the extent practicable, if there is evidence that a fishing activity adversely effects EFH in a manner that is more than minimal and not temporary in nature. In determining whether it is practicable to minimize an adverse effect from fishing, Councils should consider the nature and extent of the adverse effect on EFH and the long-term and short-term costs and benefits of potential management measures to EFH, associated fisheries, and the nation. Subsequent amendments to the FMP or to its implementing regulations must ensure that the FMP continues to minimize to the extent practicable adverse effects on EFH caused by fishing.

Actions taken by a Council to minimize adverse effects of fishing on EFH may include fishing equipment restrictions, time or area closures, harvest limits, or other measures. Any such measures would be designed to reduce ongoing effects to fish habitats and/or promote recovery of disturbed habitats. These measures may result in socioeconomic effects for the effected sectors of the fishing industry, but would be designed to promote sustainable fisheries and long-term socioeconomic benefits. The environmental consequences of proposed actions would be evaluated in applicable NEPA documents before they are implemented. Section 4.4 of this EIS discusses the environmental consequences of the alternative measures to minimize effects of fishing on EFH, which are described in Chapter 2.

Second, Federal and state agency actions that may adversely effect EFH trigger consultation and/or recommendations under sections 305(b)(2)-(4) of the Act. Under section 305(b)(2) of the Magnuson-Stevens Act, each federal agency must consult with NMFS regarding any action authorized, funded, or undertaken by the agency that may adversely effect EFH. The EFH regulations require that federal agencies prepare EFH Assessments as part of the consultation process (50 CFR 600.920(e)). Under section 305(b)(4)(A) of the Act, NMFS must provide EFH Conservation Recommendations to federal and state agencies regarding any action that would adversely effect EFH. Under section 305(b)(3) of the Act, Councils may comment on and make recommendations to federal and state agencies regarding any action that may effect the habitat, including EFH, of a fishery resource under Council authority.

EFH recommendations from NMFS or a Council to federal or state agencies are non-binding. Nevertheless, as a result of EFH coordination, consultations, and recommendations, Federal or state agencies may decide to restrict various activities to avoid or minimize adverse effects to EFH. Such restrictions could result in project modifications that lead to higher costs for the applicants for federal or state permits, licenses, or funding. It would be speculative to predict the specific socioeconomic effects of future restrictions on development that may be imposed by agencies that authorize, fund, or undertake actions that may adversely effect EFH. Moreover, such agencies typically evaluate socioeconomic effects and other public interest factors under NEPA and other applicable laws before taking final action on any given activity. NMFS conducts approximately 6,000 EFH consultations and related EFH reviews nationwide every year, and is unaware of substantial project delays or significant increases in costs resulting from EFH consultations. Habitat conservation resulting from EFH consultations is expected to support healthier fish stocks and more productive fisheries over the long-term, with associated environmental and socioeconomic benefits. EFH consultations may also lead to indirect benefits for other species that use the same habitats as federally managed species of fish and shellfish.

Federal agencies will incur costs as a result of conducting EFH consultations, since time and resources will be required to develop EFH Assessments, exchange correspondence, and engage in other coordination activities required for effective interagency consultation. In some cases federal agencies might also request information from applicants for permits, licenses, or funding to assist the agency in completing EFH consultation. However, the EFH regulations encourage agencies to combine EFH consultations with existing environmental review procedures to promote efficiency and avoid duplication of effort. To further streamline EFH consultation, if more than one agency is responsible for a Federal action, the consultation requirements may be fulfilled by a single lead agency. State agencies and other non-federal entities are not required to consult with NMFS regarding the effects of their actions on EFH. If an entity participates in consultations with NMFS, then it is possible that costs associated with time and effort expended in consultation may be incurred, though most nearshore EFH consultations involving groundfish may be merged with ESA listed salmon consultations and any cost incurred may be borne through the ESA process.

Costs associated with consultations will likely vary depending on the number of species associated with an EFH designation, and the amount of habitat designated as EFH. If an entity chooses not to participate in consultations, then the EFH designation will ultimately have no effect on that entity. If consultations result in conservation recommendations, then there are likely to be increased costs in the short-term and possibly in the long-term depending on the amount of offsetting benefits realized from enhanced habitat productivity resulting from EFH designation. The designation process may negatively effect agencies if consultations use increased agency time and resources in addition to those currently required for the ESA process.

The EFH alternatives are not likely to have an effect on protected species; or, if the alternatives result in EFH conservation recommendations that improve habitat conditions the effect would be Environmentally Positive (E+).

4.2.2 Geographic Comparisons of the EFH Identification and Description Alternatives

The EFH alternatives, (A.1 through A.6), have been numbered in descending order of total area. The status quo alternative (A.1) encompasses the entire Exclusive Economic Zone (EEZ) of the West Coast, and all other areas are a subset of this area. Habitat Table 4-1 lists the areas included under each EFH identification alternative. To facilitate a more thorough comparison of all EFH alternatives to each other, we used GIS overlay analysis to merge all the areas together for visualization and quantification of the overlap between alternatives.

Figure 4-1 depicts the predominant spatial commonalities among the EFH alternatives. There is a core area that is common to all alternatives that includes the estuaries, the continental shelf, and most of the continental slope. Alternative A.6 is the most restrictive, delineating only the best 30% of the area for all species/life stage combinations with HSP values. As such, Alternative A.6 excludes some of the deeper areas in the Southern California Bight, as well as some deeper areas all along the western edge of the HSP data that are included in all of the other alternatives. Alternatives A.1 (EEZ), A.2 (depths < 3500 m), and A.3 (100% HSP) are the most inclusive alternatives and some of the deepest habitats in the HSP data are included only in these three alternatives. Finally, the large northwestern section of the EEZ is only included in alternatives A.1 and A.2, and the large southwestern section of the EEZ is only included alternative A.1. In addition, there is a small area within Puget Sound, due to disparate data sources, that is not included in the HSP data, and therefore this area is only included in alternatives A.1 and A.2.

Habitat Table 4-2 shows the total area of each EFH alternative and the total area that each alternative shares with the other alternatives. The diagonal values are blank because there is no need to compare the alternative to itself. The table is a mirror image along the diagonal. As mentioned above, alternatives A.2 through A.6 are completely within the EEZ, so the entire area of these alternatives is shared with A.1. In addition, alternative A.3 is a subset of Alternative A.2, so its entire area is in common with A.2. Alternative A.4 shares most of its area with Alternatives A.2 and A.3, although there are parts of some seamounts that either have no suitable habitat or are deeper than 3500 m. Alternative A.5 is a subset of alternatives A.1, A.2, and A.3. Nearly all the area of alternative A.5 is shared with alternative A.4, with the exception of some deeper areas in the Southern California Bight and along the western edge A.4. Alternative A.6 is a subset of Alternatives A.1, A.2, A.3, A.4, and A.5, so it's entire area is common to all alternatives.

Habitat Table 4-3 summarizes the information in Habitat Table 4-2 as percentages of total area. This table is not a mirror image along the diagonal because the percentage of area depends on whether you are asking the question “what percentage of X’s area is shared with Y?” or “what percentage of Y’s area is shared with X? For example, because A.3 is a subset of A.2, 100% of its area is shared with A.2. However, A.2 is larger than A.3, so only 46.4% of A.3’s area is shared with A.2. In order to answer the question, “what percentage of X’s area is shared with Y?” the table should be read from left to right, with alternative “X” being in the leftmost column and alternative “Y” being in the row along the top of the table.

4.2.3 The Implications of the EFH Identification and Description Alternatives on HAPC and Effects Minimization

Another important comparison for the analysis of all alternatives is to compare the spatial coverage of the HAPC alternatives (B.1 through B.9) and the impacts minimization alternatives (C.1 through C.14) to the EFH alternatives (A.1 through A.6). This analysis indicates the areas of HAPC and impacts minimization alternatives that may be excluded based on the selection of a particular EFH alternative. Habitat Tables 4-4 and 4-5 indicate which HAPC or impacts minimization alternatives would be limited by which EFH alternative. In other words, there is a portion of the HAPC or impacts minimization alternative that is outside of the area designated as EFH.

For a spatial perspective on the areas that may be excluded, standard GIS functions were used to overlay each HAPC and impacts minimization alternative with the EFH alternatives. There is a map for each HAPC alternative or impacts minimization alternative that may be limited by any EFH alternative. Figures 4-8 through 4-14 show the HAPC alternatives that may be limited in area by the EFH alternatives. Figures 4-15 through 4-28 show the impacts minimization alternatives that may be limited by the EFH alternatives. In order to synthesize the large number of combinations, (for each HAPC or impacts minimization alternative, there is a comparison with five EFH alternatives), we depicted each area that may be excluded with the combination of EFH alternatives that may exclude that particular area. Each unique combination uses a different color. The legend can then be interpreted as a matrix in the following ways: (a) for a particular color on the map, the EFH alternative(s) listed next to that color may exclude that area, or (b) for a particular EFH alternative, one may read down from the top and find all the colors depicting areas that may be excluded by that alternative. If, for example, one were considering EFH Alternative A.4, one would look for the areas on the map that are colored dark forest green, navy blue, peach, and aqua to see the areas that would be excluded from that HAPC or impacts minimization alternative if EFH alternative A.4 were chosen. The areas colored yellow are included in all EFH alternatives. EFH A.1 (status quo) is not depicted on the exclusion areas maps because all HAPC and impacts minimization alternatives are within the Exclusive Economic Zone, so there are no areas excluded.

Figure 4-29 shows the areas of the final preferred impacts minimization alternative may be excluded by the final preferred EFH alternative.

For more information on the environmental consequences of excluding some HAPC and effects minimization areas, see the environmental consequences section for those HAPC and impacts minimization alternatives.

4.2.4 Consequences of the Final Preferred Alternative to Identify and Describe EFH

The final preferred alternative for describing EFH represents a significant refinement over the status quo in that the entire EEZ would no longer be described as EFH. The final preferred alternative would describe 59.2% of the EEZ as EFH which equates to 48,719,109 ha (142,042 square miles) in addition to shoreward areas in state waters including bays and estuaries.

The final preferred alternative for describing EFH is presented in Chapter 2. The generic consequences of the final preferred alternative are described in 4.2.1. The specific data elements used to formulate the alternative are expected to be used during consultation activities and improve the quality of conservation recommendations. For instance, conservation recommendations for a project proposed in a specific area can now be based on analyses of HSP, habitat types, and other information sources available from the preferred alternative. In addition to supporting the delineation of suitable habitat for the individual species and life stages, these assessment-related techniques can be used as a basis for an ecosystem approach to management. For example, the HSP profiles for individual species/life stages can be combined by GIS analyses into ecosystem-level fish assemblages to investigate and predict environmental consequences of proposed projects. The specific conservation recommendations for non-fishing activities which may result from the implementation of the final preferred alternative are fully described in appendix 14 to the Risk Assessment. The consequences of the final preferred alternative to describe EFH are considered Environmentally Positive (E+).

The final preferred alternative for describing EFH does not encompass the entire project area and as such may limit the geographic extent of specific components of the final preferred alternative measures to minimize adverse impacts to EFH that would otherwise apply throughout the EEZ. Those specific components approved by the Council that could be interpreted to include areas seaward of EFH are: (1) footprint closure in which bottom trawling would be prohibited seaward of 700 fathoms; (2) ban of dredge gear; (3) ban of beam trawl gear; and, (4) ban of trawl roller gear greater than 19”. An analysis of the area that would be excluded from the implementation of these components is shown in Figure 4-29. NMFS has selected a preferred alternative that includes measures that, if implemented, would apply throughout the EEZ. Management measures to minimize adverse impacts on EFH could apply in the EEZ in areas not described as EFH, if there is a link between the fishing activity and adverse effects on EFH. Management measures could be based on the Council’s discretionary authority to protect habitat outside EFH that is based on section 303(b)(12) of the Magnuson-Stevens Act. NMFS will highlight this issue in the Notice of Availability for the FMP Amendment and Proposed Rule to implement the measures and request public comment and additional information that would support or not support including non-EFH areas in the management measures.

4.3 Consequences of the Alternatives to Designate HAPC (Alternatives (B.1-B.9)

The following subsections, 4.3.1 through 4.3.3 describe the effects of Alternatives B.1 through B.6 on the effected environment. Section 4.3.4 describes the effects of the final preferred alternative to designate HAPC on the effected environment.

4.3.1 Generic Consequences of the HAPC Designation Alternatives

Designation of HAPCs, like designation of EFH generally, does not have any direct environmental or socioeconomic effect, but may result in indirect effects greater than those associated with EFH because resource managers and regulators are likely to place a high priority on protecting areas that have been designated as HAPCs. HAPCs are used by NMFS and the Councils to focus conservation and management efforts on particularly valuable or vulnerable subsets of EFH. Although HAPC designation does not convey any higher regulatory standards for minimizing adverse effects of fishing or conducting EFH consultations, NMFS and the Councils may apply more scrutiny to fishing and non-fishing activities that adversely effect HAPCs as compared to EFH, and may be more risk averse when developing management measures to minimize adverse effects of fishing on HAPCs, and when recommending measures to federal and state agencies to minimize adverse effects of non-fishing activities on HAPCs. The potential environmental and socioeconomic effects from management measures to protect HAPCs would be comparable to those described in section 4.2.1 for EFH. As with EFH, conservation of HAPCs is expected in the long-term to support healthier fish stocks and more productive fisheries over the long-term, which, in turn, will provide added environmental and socioeconomic benefits. If an entity participates in consultations with NMFS, then it is possible that increased costs associated with time and effort expended in consultation may occur, though most nearshore consultations involving groundfish may be merged with ESA listed salmon consultations and any cost incurred may be borne through the ESA process.

The HAPC alternatives are not likely to have an effect on salmon; or, if the alternatives result in improved habitat conditions the effect would be Environmentally Positive (E+).

4.3.2 Geographic Comparison of the HAPC Designation Alternatives

The geographic area of the HAPC alternatives is shown in Habitat Table 4-6. Ranking from the greatest area to the least, the alternatives are in the following order: B.5, B.7, B.6, B.2, B.6, B.4, B.3, B.7, and B.8. B.9 is a process-based alternative and is not applicable to this analysis.

4.3.3 Alternative B.8

This alternative shares the generic consequences of HAPC described above but is considered separately due to the distinctive characteristics described in this section (See also Section 3.2.2.2.4). There are differing views regarding the ecological role of oil rig platforms.

Holbrook et al. (2000) stresses that current research is inconclusive with regard to whether the observed fish abundance and densities at platforms indicate increased fish productivity. There is concern that this increase is from attraction of fish populations away from natural reef systems (Chabot, personal communication; Charter, personal communication). When attempting to assess the productivity of an artificial reef, one must consider its location in relation to other reefs within the management area, size of the management area and patterns of larval recruitment (Carr and Hixon 1997). Artificial reefs only enhance production if production of organisms is greater on artificial reefs than on natural reefs within a defined management area (Carr and Hixon 1997).

Other noted concerns to oil platform HAPC designation include avoidance of returning the area under and around the oil platform to natural habitat, the potential for these sites to attract increased effort by fishermen and increased predators resulting in increased net mortality, and the potential for the oil platforms to be a hazard to navigation (Charter 2004, personal communication). According to Mr. Corrigan of the U.S. Coast Guard (2005, personal communication), both active and decommissioned platforms would only be considered a hazard to navigation if they are lacking appropriate marks on nautical charts and appropriate lighting. Gas and oil platforms are required to have these precautions in place according to regulation, making them an obstruction rather than a hazard to navigation.

Mercury contamination in fish that are long-lived and high order predators has caused the U.S. Food and Drug Administration (FDA) to issue advisories and ban certain fish from U.S. markets (EPA and FDA March 2004). Trefry et al (2002) found that the total mercury (Hg) near six drilling sites in the Gulf of Mexico were significantly higher than in areas well away from platforms. The disposal of drilling fluids containing mercury from operational oil rigs has resulted in concerns that mercury levels in fish caught near oil rigs, even years after the oil rig is no longer operational, may be substantially higher than those caught elsewhere and could be a health hazard to humans (Charter 2004, personal communication). It should be noted, however, that the Gulf of Mexico has a substantially higher number of rigs than the coast of California and that cumulative effects need to be thoroughly investigated in order to assess whether the risk associated with mercury levels in West Coast fish is significant.

The concerns shared above by environmental groups during public scoping have little or no supporting scientific research. However, the lack of scientific support does not make these concerns invalid. Therefore both positive and negative arguments for designation of oil platforms as HAPC are made available for full and fair consideration by decisionmakers.

Acknowledging these environmental concerns, there is recent scientific research indicating oil rig platforms off the Southern California Coast are a benefit to the ecosystem (See also Section 3.2.2.2.4).

Most platform studies have observed a species richness rivaling that of natural reefs, a vast majority being economically important rockfish species of all ages (Love 2005 in press, Love 2004 unpublished data, Love et al. 2003, Love et al. 2000a, Helvey 1999, Love et al. 1999a, Love et al. 1999b). Several studies have found higher densities of groundfish at platforms compared to natural outcroppings (Love et al. 1997, Love et al. 1999b, Love 2005b in review). This difference has been attributed to: reduced to nonexistent fishing pressure at platforms due to Coast Guard restrictions (Love et al. 1997, Love et al. 2003); high levels of recruitment for high relief platform structures (Love et al. 2003, Love 2005a in review); and reduced predation due to age-depth stratification (Love et al. 2003, Love et al. 2000a).

Further evidence that platforms provide habitat for increased fish productivity was found by Love (2005 unpublished data) when he compared growth rates, and found that in all instances fishes at platforms grew faster than fishes at paired reefs. Also, since many platforms have higher adult densities than natural reefs, they will produce a disproportionate amount of larvae in the region (Love et al. 2003). Research also demonstrates that a small amount of artificial nursery habitat may be valuable in rebuilding overfished species, as evidenced by findings that six platforms in Santa Barbara Channel produce about 20% of the juvenile bocaccio for the species' entire range (Love 2005 in press).

As the oil and gas industry ceases production on aging oil and gas platforms, oil and gas industry managers must decide what to do with the structure, a process called decommissioning. Federal regulations, under 30 CFR 250.1728, state that all platforms and other facilities must be completely removed to at least 15 feet below mudline. However, both lease provisions and the Minerals Management Service regulations governing disposition of offshore facilities are flexible enough to allow the federal government to contemplate and approve methods of jacket disposition other than complete removal, as we have seen in the Gulf States (CARE website, Love et al. 2003, Steinbach, personal communication). Further, the leases and regulations regarding platform disposition would be subject to conformance with state legislation, which (in the Gulf of Mexico) specifically established a policy for converting existing obsolete oil rigs to artificial reefs (Steinbach, personal communication). This platform reefing process allows for varying degrees of removal of the structure. If this trend of reefing platforms follows in Southern California, habitat under and around the platforms denied HAPC designation may or may not be returned to its natural state depending on the extent and process of decommissioning.

The U.S. Coast Guard restricts access of vessels over 100 feet long to the waters adjacent to platforms (Corrigan 2005, personal communication) and the physical structure of the platform restricts both commercial and recreational gear. These factors combined make it unlikely that large-scale fishing effort would increase if oil platforms are designated as HAPC.

It is up to the U.S. Coast Guard to provide necessary navigational aids in the event that a platform is reefed. However, HAPC designation does not create a reefing program for oil platforms. Therefore HAPC designation of oil platforms would not create additional hazards to navigation.

NMFS found no scientific research supporting concerns for human health due to platform associated mercury contamination of rockfish. Although Trefry et al. (2002) found higher total mercury near oil platforms in the Gulf of Mexico, methylmercury concentrations were not significantly different between near platform and far test sites. Methylmercury is the form of mercury that is synthesized and concentrated as it moves up through the food chain (EPA and FDA, 2004).

The overall effect of this alternative on fishing and non-fishing values is unclear in both the short-term and the long-term. Designation of the areas surrounding oil platforms would enhance NMFS' opportunity to fully consider a platforms potential contribution to the ecology of overfished species as part of the consultation process prior to decommissioning. The Environmental Consequences of designating oil production platforms as HAPC is considered unknown (U).

4.3.4 Consequences of the Final Preferred Alternative to Designate HAPC

The final preferred alternative to designate HAPC incorporates components of Alternatives B.2, B.3, B.4, B.6, B.7, B.8 and B.9. The generic consequences of the final preferred alternative to designate HAPC are described in Sections 4.3.1 and 4.3.3. The final preferred alternative to designate HAPC represents a significant change from the status quo under which there are no HAPC designations. Under the final preferred alternative, approximately 4.51% of the EEZ would be designated as HAPC which equates to 3,711,978 ha (10,822 square miles). Due to the generic consequences of designating HAPC, the final preferred alternative is considered Environmentally Positive (E+).

4.4 Consequences of the Alternatives to Minimize Adverse Fishing Effects to EFH (Alternatives C.1-C.14) on Marine Habitat, the Ecosystem, and Marine Resources

The following subsections, 4.4.1 through 4.4.14 describe the effects of alternatives C.1 through C.14 on marine habitat, the ecosystem, and marine resources. Section 4.4.15 describes the effects of the final preferred alternative on marine habitat, the ecosystem, and marine resources. For presentational purposes, socioeconomic effects are described in section 4.7.

4.4.1 Consequences of Alternative C.1: No Action

The current condition of habitat relative to a pristine state is unknown due to the scientific limitations described in Chapter Two and Appendix A. Similarly, it is not possible to predict changes to the condition of habitat as a result of reasonably foreseeable actions.

Chapter 3 describes the ecosystem and biological resources that occur in the EEZ and their relationship to habitat. Current habitat protections described in section 3.6 are presumed for purposes of this analysis to contribute to the no action alternative. That is, they contribute to the protection of habitat and are expected to persist. One notable exception is the RCA, which for purposes of this analysis is considered short-term. The area is defined during the biannual management process described in Chapter 1 and is therefore subject, by design of the groundfish management process, to negotiation and change. Additionally, the specific areas that define the RCA change considerably within a fishing year as bycatch quotas are monitored and adjusted. Chapter 3 describes the magnitude of these changes that are in some cases significant. Another issue that limits the effectiveness of the trawl RCA as a habitat protection measure is that non-groundfish trawl fisheries (i.e. State managed pink shrimp fisheries) are not excluded from the area. Therefore there are no measures to consider for a cumulative impacts analysis.

Alternative C.1 would not change the status quo (O).

4.4.2 Consequences of Alternative C.2: Depth-based Gear-specific Restrictions

The following subsections, 4.4.2.1 through 4.4.2.5 describe the effects of alternatives C.2 on marine habitat, the ecosystem, and marine resources.

4.4.2.1 Geographic Area

Habitat Table 4-9 compares the total geographic area of the impacts minimization alternatives.

Alternative C.2.1 for large footrope trawl gear encompasses 23,643 square nm and is equal to 10% of the EEZ. Alternative C.2.1 for fixed gear encompasses 20,287 square nm and is equal to 9% of the EEZ.

Alternative C.2.2 for large footrope trawl gear encompasses 239,892 square nm and is equal to 100% of the EEZ. Alternative C.2.2 for fixed gear encompasses 20,287 square nm and is equal to 8% of the EEZ.

Alternative C.2.3 for large footrope trawl gear encompasses 23,643 square nm and is equal to 10% of the EEZ. Alternative C.2.3 for fixed gear encompasses 13,471 square nm and is equal to 6% of the EEZ.

4.4.2.2 Minimization of Adverse Effects

Alternatives C.2.1, C.2.2, and C.2.3 have components that affect the large footrope trawl fishery however, due to data limitations, the sensitivity and recovery values do not differentiate between footrope sizes. It is not possible, given this limitation, to quantify the extent to which adverse effects would be minimized by this alternative.

4.4.2.3 Habitat for Individual Species/Life Stages

Habitat Table 4-15 shows the habitat of individual species/life stages that would be protected by this alternative. The information is presented for 168 separate species/life stage combinations. To simplify this information, we performed a frequency distribution. We chose four categories of amount of habitat protected; 1-25%, 26-50%, 51-75%, and 76-100%. We then determined how many species/life stage combinations fell into each category as presented below. This tells us how many species are affected by the alternative, and how much of their habitat would be protected.

For Alternative C.2.1 (large footrope trawl gear): 0 species/life stage combinations would have 0% of their habitat protected; 7 species/life stage combinations would have up to 25% of their habitat protected; 9 species/life stage combinations would have up to 50% of their habitat protected; 20 species/life stage combinations would have up to 75% of their habitat protected; and 132 species/life stage combinations would have up to 100% of their habitat protected.

For Alternative C.2.1 (fixed gear): 2 species/life stage combinations would have 0% of their habitat protected; 9 species/life stage combinations would have up to 25% of their habitat protected; 17 species/life stage combinations would have up to 50% of their habitat protected; 30 species/life stage combinations would have up to 75% of their habitat protected; and 110 species/life stage combinations would have up to 100% of their habitat protected.

For Alternative C.2.2 (large footrope trawl gear): 0 species/life stage combinations would have 0% of their habitat protected; 0 species/life stage combinations would have up to 25% of their habitat protected; 0 species/life stage combinations would have up to 50% of their habitat protected; 0 species/life stage combinations would have up to 75% of their habitat protected; and 168 species/life stage combinations would have up to 100% of their habitat protected.

For Alternative C.2.2 (fixed gear): 2 species/life stage combinations would have 0% of their habitat protected; 9 species/life stage combinations would have up to 25% of their habitat protected; 17 species/life stage combinations would have up to 50% of their habitat protected; 30 species/life stage combinations would have up to 75% of their habitat protected; and 110 species/life stage combinations would have up to 100% of their habitat protected.

For Alternative C.2.3 (large footrope trawl gear): 0 species/life stage combinations would have 0% of their habitat protected; 7 species/life stage combinations would have up to 25% of their habitat protected; 9 species/life stage combinations would have up to 50% of their habitat protected; 20 species/life stage combinations would have up to 75% of their habitat protected; and 132 species/life stage combinations would have up to 100% of their habitat protected.

For Alternative C.2.3 (fixed gear): 5 species/life stage combinations would have 0% of their habitat protected; 25 species/life stage combinations would have up to 25% of their habitat protected; 43 species/life stage combinations would have up to 50% of their habitat protected; 47 species/life stage combinations would have up to 75% of their habitat protected; and 48 species/life stage combinations would have up to 100% of their habitat protected.

4.4.2.4 Habitat Types

Habitat Table 4-16 compares the amount of substrate and biogenic habitat types that would be protected by the alternatives. To simplify this information, we performed a frequency distribution. We chose four categories of amounts of substrate or biogenic habitat that would be protected: 1-25%, 26-50%, 51-75%, and 76-100%. We then determined how many substrate types or biogenic habitat types fell into each category as presented below. This tells us how many substrate types or biogenic habitat types are affected by the alternative, and how much of each would be protected. For uncategorized amounts, see habitat table 4-16.

In the Oregonian zoogeographic province (north of Point Conception, California), alternative C.2.1 and C.2.3 for large footrope trawl gear protects:

- 9 substrate habitat types would have 0% of their area protected; 14 substrate types would have up to 25% of their area protected; 2 habitat types would have up to 50% of their area protected; 1 habitat type would have up to 75% of their area protected; and 3 habitat types would have up to 100% of their area protected; and,

- estuary, kelp, and seagrass would have 100% of their area protected.

In the Oregonian zoographic province (north of Point Conception, California), alternative C.2.1 and C.2.2 for fixed gear protects:

- 12 substrate habitat types would have 0% of their area protected; 13 substrate types would have up to 25% of their area protected; 1 habitat types would have up to 50% of their area protected; 1 habitat types would have up to 75% of their area protected; and 2 habitat types would have up to 100% of their area protected; and,

- estuary, kelp, and seagrass would have 100% of their area protected.

In the Oregonian zoogeographic province (north of Point Conception, California), alternative C.2.2 for large footrope trawl gear protects:

- 0 substrate habitat types would have 0% of their area protected; 0 substrate types would have up to 25% of their area protected; 0 habitat types would have up to 50% of their area protected; 0 habitat types would have up to 75% of their area protected; and 29 habitat types would have up to 100% of their area protected; and,

- estuary, kelp, and seagrass would have 100% of their area protected.

In the Oregonian zoogeographic province (north of Point Conception, California), alternative C.2.3 for fixed gear protects:

- 22 substrate habitat types would have 0% of their area protected; 5 substrate types would have up to 25% of their area protected; 0 habitat types would have up to 50% of their area protected; 2 habitat types would have up to 75% of their area protected; and 0 habitat types would have up to 100% of their area protected; and,

- estuary habitat would have 89% of its area protected, and kelp, and seagrass would have 100% of their area protected.

In the San Diego zoogeographic province (south of Point Conception, California), alternative C.2.1 and C.2.3 for large footrope trawl gear protects:

- 6 substrate habitat types would have 0% of their area protected; 17 substrate types would have up to 25% of their area protected; 2 habitat types would have up to 50% of their area protected; 1 habitat types would have up to 75% of their area protected; and 3 habitat types would have up to 100% of their area protected; and,

- estuary, kelp, and seagrass would have 100% of their area protected.

In the San Diego zoogeographic province (south of Point Conception, California), alternative C.2.1 and C.2.2 for fixed gear protects:

- 10 substrate habitat types would have 0% of their area protected; 15 substrate types would have up to 25% of their area protected; 1 habitat types would have up to 50% of their area protected; 1 habitat types would have up to 75% of their area protected; and 2 habitat types would have up to 100% of their area protected; and,

- estuary, kelp, and seagrass would have 100% of their area protected.

In the San Diego zoogeographic province (south of Point Conception, California), alternative C.2.2 for large footrope trawl gear protects:

- 0 substrate habitat types would have 0% of their area protected; 0 substrate types would have up to 25% of their area protected; 0 habitat types would have up to 50% of their area protected; 0 habitat types would have up to 75% of their area protected; and 29 habitat types would have up to 100% of their area protected; and,

- estuary, kelp, and seagrass would have 100% of their area protected.

In the San Diego zoogeographic province (south of Point Conception, California), alternative C.2.3 for fixed trawl gear protects:

- 21 substrate habitat types would have 0% of their area protected; 6 substrate types would have up to 25% of their area protected; 0 habitat types would have up to 50% of their area protected; 2 habitat types would have up to 75% of their area protected; and 0 habitat types would have up to 100% of their area protected; and,

- estuary, kelp, and seagrass would have 100% of their area protected.

4.4.2.5 Summary of Environmental Consequences and Cumulative Impacts

Alternative C.2 creates gear restrictions that would have an overall positive effect on habitat, the ecosystem, and marine resources (E+). Prohibitions on large footrope trawl gear under the relevant portions of the alternative would likely have the effect of removing trawl effects from rocky habitats (Bellman 2004). The positive effects of this may be masked somewhat where fixed gear is utilized. The components of the alternative that limit fixed gear would likewise remove effects associated with that gear type. The cumulative effects of this alternative, in addition to all the factors described in Section 4.1.1.7, is positive because it would reduce use of trawl gears that have the potential to adversely affect EFH.

4.4.3 Consequences of Alternative C.3: Close Sensitive Habitat

The following subsections, 4.4.3.1 through **Error! Reference source not found.**, describe the effects of alternatives C.3 on marine habitat, the ecosystem, and marine resources.

4.4.3.1 Geographic Area

Habitat Table 4-9 compares the total geographic area of the impacts minimization alternatives. Alternative C.3.1 encompasses 5,473 square nm and is equal to 2% of the EEZ. Alternative C.3.2 encompasses 40,202 square nm and is equal to 17% of the EEZ. C.3.3 encompasses 7,099 square nm and is equal to 3% of the EEZ. C.3.4 encompasses 55,516 square nm and is equal to 23% of the EEZ.

4.4.3.2 Minimization of Adverse Effects

Alternatives C.3.1 through C.3.4 would close areas to all types of fishing.

For nets, alternative C.3.1:

- the amount of habitat that would be protected where the sensitivity value is greater than 0.75 and recovery is in excess of 1.25 years is 36%.

- the amount of habitat that would be protected where the sensitivity value is greater than 1.2 and recovery is in excess of 1.0 years is 30%.

- the amount of habitat that would be protected where the sensitivity value is greater than 1.5 and recovery is in excess of 1.5 years is 74%.

For bottom trawls, alternative C.3.1:

- the amount of habitat that would be protected where the sensitivity value is greater than 1.0 and recovery is in excess of 1 year is 0%.
- the amount of habitat that would be protected where the sensitivity value is greater than 2.0 and recovery is in excess of 3.0 years is 80%.
- the amount of habitat that would be protected where the sensitivity value is greater than 2.75 and recovery is in excess of 2.75 years is 73%.

For nets, alternative C.3.2:

- the amount of habitat that would be protected where the sensitivity value is greater than 0.75 and recovery is in excess of 1.25 years is 36%.
- the amount of habitat that would be protected where the sensitivity value is greater than 1.2 and recovery is in excess of 1.0 years is 92%.
- the amount of habitat that would be protected where the sensitivity value is greater than 1.5 and recovery is in excess of 1.5 years is 74%.

For bottom trawls, alternative C.3.2:

- the amount of habitat that would be protected where the sensitivity value is greater than 1.0 and recovery is in excess of 1 year is 100%.
- the amount of habitat that would be protected where the sensitivity value is greater than 2.0 and recovery is in excess of 3.0 years is 80%.
- the amount of habitat that would be protected where the sensitivity value is greater than 2.75 and recovery is in excess of 2.75 years is 73%.

For nets, alternative C.3.3:

- the amount of habitat that would be protected where the sensitivity value is greater than 0.75 and recovery is in excess of 1.25 years is 100%.
- the amount of habitat that would be protected where the sensitivity value is greater than 1.2 and recovery is in excess of 1.0 years is 33%.
- the amount of habitat that would be protected where the sensitivity value is greater than 1.5 and recovery is in excess of 1.5 years is 100%.

For bottom trawls, alternative C.3.3:

- the amount of habitat that would be protected where the sensitivity value is greater than 1.0 and recovery is in excess of 1 year is 0%.
- the amount of habitat that would be protected where the sensitivity value is greater than 2.0 and recovery is in excess of 3.0 years is 100%.
- the amount of habitat that would be protected where the sensitivity value is greater than 2.75 and recovery is in excess of 2.75 years is 100%.

For nets, alternative C.3.4:

- the amount of habitat that would be protected where the sensitivity value is greater than 0.75 and recovery is in excess of 1.25 years is 100%.
- the amount of habitat that would be protected where the sensitivity value is greater than 1.2 and recovery is in excess of 1.0 years is 100%.
- the amount of habitat that would be protected where the sensitivity value is greater than 1.5 and recovery is in excess of 1.5 years is 100%.

For bottom trawls, alternative C.3.4:

- the amount of habitat that would be protected where the sensitivity value is greater than 1.0 and recovery is in excess of 1 year is 100%.
- the amount of habitat that would be protected where the sensitivity value is greater than 2.0 and recovery is in excess of 3.0 years is 100%.
- the amount of habitat that would be protected where the sensitivity value is greater than 2.75 and recovery is in excess of 2.75 years is 100%.

4.4.3.3 Habitat for Individual Species/Life Stages

Habitat Table 4-15 shows the habitat of individual species/life stages that would be protected by this alternative. The information is presented for 168 separate species/life stage combinations. To simplify this information, we performed a frequency distribution. We chose four categories of amount of habitat protected; 1-25%, 26-50%, 51-75%, and 76-100%. We then determined how many species/life stage combinations fell into each category as presented below. This tells us how many species are affected by the alternative, and how much of their habitat would be protected.

For Alternative C.3.1: 40 species/life stage combinations would have 0% of their habitat protected; 80 species/life stage combinations would have up to 25% of their habitat protected; 21 species/life stage combinations would have up to 50% of their habitat protected; 17 species/life stage combinations would have up to 75% of their habitat protected; and 10 species/life stage combinations would have up to 100% of their habitat protected.

For Alternative C.3.2: 5 species/life stage combinations would have 0% of their habitat protected; 100 species/life stage combinations would have up to 25% of their habitat protected; 33 species/life stage combinations would have up to 50% of their habitat protected; 20 species/life stage combinations would have up to 75% of their habitat protected; and 10 species/life stage combinations would have up to 100% of their habitat protected.

For Alternative C.3.3: 24 species/life stage combinations would have 0% of their habitat protected; 84 species/life stage combinations would have up to 25% of their habitat protected; 3 species/life stage combinations would have up to 50% of their habitat protected; 4 species/life stage combinations would have up to 75% of their habitat protected; and 53 species/life stage combinations would have up to 100% of their habitat protected.

For Alternative C.3.4: 5 species/life stage combinations would have 0% of their habitat protected; 48 species/life stage combinations would have up to 25% of their habitat protected; 32 species/life stage combinations would have up to 50% of their habitat protected; 19 species/life stage combinations would have up to 75% of their habitat protected; and 64 species/life stage combinations would have up to 100% of their habitat protected.

4.4.3.4 Habitat Types

Habitat Table 4-16 compares the amount of biogenic and substrate habitat types that would be protected by the alternatives. To simplify this information, we performed a frequency distribution. We chose four categories of amounts of substrate or biogenic habitat that would be protected: 1-25%, 26-50%, 51-75%, and 76-100%. We then determined how many substrate types or biogenic habitat types fell into each category as presented below. This tells us how many substrate types or biogenic habitat types are affected by the alternative, and how much of each would be protected. For uncategorized amounts, see habitat table 4-16.

In the Oregonian zoogeographic province (north of Point Conception, California), alternative C.3.1 protects:

- 19 substrate habitat types would have 0% of their area protected; 3 substrate types would have up to 25% of their area protected; 2 habitat types would have up to 50% of their area protected; 1 habitat types would have up to 75% of their area protected; and 4 habitat types would have up to 100% of their area protected; and,

- estuary habitat would have 1% of their area protected, kelp would have 83% of their area protected, and seagrass would have 14% of their area protected.

In the Oregonian zoogeographic province (north of Point Conception, California), alternative C.3.2 protects:

- 6 substrate habitat types would have 0% of their area protected; 3 substrate types would have up to 25% of their area protected; 4 habitat types would have up to 50% of their area protected; 5 habitat types would have up to 75% of their area protected; and 11 habitat types would have up to 100% of their area protected; and,

- estuary habitat would have 11% of their area protected, kelp would have 83% of their area protected, and seagrass would have 93% of their area protected.

In the Oregonian zoogeographic province (north of Point Conception, California), alternative C.3.3 protects:

- 17 substrate habitat types would have 0% of their area protected; 1 substrate types would have up to 25% of their area protected; 0 habitat types would have up to 50% of their area protected; 0 habitat types would have up to 75% of their area protected; and 11 habitat types would have up to 100% of their area protected; and,

- estuary habitat would have 1% of their area protected, kelp would have 100% of their area protected, and seagrass would have 19% of their area protected.

In the Oregonian zoogeographic province (north of Point Conception, California), alternative C.3.4 protects:

- 4 substrate habitat types would have 0% of their area protected; 1 substrate types would have up to 25% of their area protected; 0 habitat types would have up to 50% of their area protected; 0 habitat types would have up to 75% of their area protected; and 24 habitat types would have up to 100% of their area protected; and,

- estuary habitat would have 12% of their area protected, kelp and seagrass would have 100% of their area protected.

In the San Diego zoogeographic province (south of Point Conception, California), alternative C.3.1 protects:

- 21 substrate habitat types would have 0% of their area protected; 3 substrate types would have up to 25% of their area protected; 2 habitat types would have up to 50% of their area protected; 1 habitat types would have up to 75% of their area protected; and 2 habitat types would have up to 100% of their area protected; and,

- estuary habitat would have 0% of their area protected, kelp would have 93% of their area protected, and seagrass would have 5% of their area protected.

In the San Diego zoogeographic province (south of Point Conception, California), alternative C.3.2 protects:

- 5 substrate habitat types would have 0% of their area protected; 3 substrate types would have up to 25% of their area protected; 5 habitat types would have up to 50% of their area protected; 5 habitat types would have up to 75% of their area protected; and 11 habitat types would have up to 100% of their area protected; and,

- estuary habitat would have 40% of their area protected, kelp would have 93% of their area protected, and seagrass would have 72% of their area protected.

In the San Diego zoogeographic province (south of Point Conception, California), alternative C.3.3 protects:

- 19 substrate habitat types would have 0% of their area protected; 1 substrate types would have up to 25% of their area protected; 0 habitat types would have up to 50% of their area protected; 0 habitat types would have up to 75% of their area protected; and 9 habitat types would have up to 100% of their area protected; and,

- estuary habitat would have 0% of their area protected, kelp would have 100% of their area protected, and seagrass would have 30% of their area protected.

In the San Diego zoogeographic province (south of Point Conception, California), alternative C.3.4 protects:

- 3 substrate habitat types would have 0% of their area protected; 1 substrate types would have up to 25% of their area protected; 0 habitat types would have up to 50% of their area protected; 0 habitat types would have up to 75% of their area protected; and 25 habitat types would have up to 100% of their area protected; and,

- estuary habitat would have 43% of their area protected, kelp and seagrass would have 100% of their area protected.

4.4.3.5 Summary of Environmental Consequences and Cumulative Impacts

Alternative C.3 would prohibit all gear types in closed areas and would have overall positive effects on marine habitat, the ecosystem, and marine resources (E+). Habitat, and the ecosystem functions it provides, would be fully protected from fishing effects although the potential for effects from non-fishing activities exists. Because there would be no harvest of marine resources, the alternative has the potential to function as insurance from catastrophic environmental events and management failure. There is also the possibility that marine resources, such as groundfish, will attain a full age structure including highly productive older females, and will provide positive spill over effects to areas that are open to fishing. The cumulative effects of this alternative, in addition to all the factors described in Section 4.1.1.7, is positive because it would reduce use of trawl gears that have the potential to adversely affect EFH.

4.4.4 Consequences of Alternative C.4: Prohibit the Geographic Expansion of Fishing

The following subsections, 4.4.4.1 through 4.4.4.5, describe the effects of Alternative C.4 on marine habitat, the ecosystem, and marine resources.

4.4.4.1 Geographic Area

Habitat Table 4-9 compares the total geographic area of the impacts minimization alternatives. Alternative C.4.1 encompasses 214,149 square nm and is equal to 89.27% of the EEZ. Alternative C.4.2 encompasses 178,021 square nm and is equal to 74.21% of the EEZ.

4.4.4.2 Minimization of Adverse Effects

Alternative C.4.1 would be closed to bottom trawl only (e.g. no protection from other gears). Alternative C.4.2 would close areas to all bottom-tending fishing gear.

For bottom trawls, alternative C.4.1:

- the amount of habitat that would be protected where the sensitivity value is greater than 1.0 and recovery is in excess of 1 year is 89%.
- the amount of habitat that would be protected where the sensitivity value is greater than 2.0 and recovery is in excess of 3.0 years is 47%.
- the amount of habitat that would be protected where the sensitivity value is greater than 2.75 and recovery is in excess of 2.75 years is 45%.

For nets, alternative C.4.2:

- the amount of habitat that would be protected where the sensitivity value is greater than 0.75 and recovery is in excess of 1.25 years is 0%.
- the amount of habitat that would be protected where the sensitivity value is greater than 1.2 and recovery is in excess of 1.0 years is 0%.
- the amount of habitat that would be protected where the sensitivity value is greater than 1.5 and recovery is in excess of 1.5 years is 25%.

For bottom trawls, alternative C.4.2:

- the amount of habitat that would be protected where the sensitivity value is greater than 1.0 and recovery is in excess of 1 year is 100%.
- the amount of habitat that would be protected where the sensitivity value is greater than 2.0 and recovery is in excess of 3.0 years is 0%.
- the amount of habitat that would be protected where the sensitivity value is greater than 2.75 and recovery is in excess of 2.75 years is 28%.

4.4.4.3 Habitat for Individual Species/Life Stages

Habitat Table 4-15 shows the habitat of individual species/life stages that would be protected by this alternative. The information is presented for 168 separate species/life stage combinations. To simplify this information, we performed a frequency distribution. We chose four categories of amount of habitat protected; 1-25%, 26-50%, 51-75%, and 76-100%. We then determined how many species/life stage combinations fell into each category as presented below. This tells us how many species are affected by the alternative, and how much of their habitat would be protected.

For Alternative C.4.1: 0 species/life stage combinations would have 0% of their habitat protected; 102 species/life stage combinations would have up to 25% of their habitat protected; 47 species/life stage combinations would have up to 50% of their habitat protected; 14 species/life stage combinations would have up to 75% of their habitat protected; and 5 species/life stage combinations would have up to 100% of their habitat protected.

For Alternative C.4.2: 154 species/life stage combinations would have 0% of their habitat protected; 14 species/life stage combinations would have up to 25% of their habitat protected; 0 species/life stage combinations would have up to 50% of their habitat protected; 0 species/life stage combinations would have up to 75% of their habitat protected; and 0 species/life stage combinations would have up to 100% of their habitat protected.

4.4.4.4 Habitat Types

Habitat Table 4-16 compares the amount of biogenic and substrate habitat types that would be protected by the alternatives. To simplify this information, we performed a frequency distribution. We chose four categories of amounts of substrate or biogenic habitat that would be protected: 1-25%, 26-50%, 51-75%, and 76-100%. We then determined how many substrate types or biogenic habitat types fell into each category as presented below. This tells us how many substrate types or biogenic habitat types are affected by the alternative, and how much of each would be protected. For uncategorized amounts, see habitat table 4-16.

In the Oregonian zoogeographic province (north of Point Conception, California), alternative C.4.1 protects:

- 2 substrate habitat types would have 0% of their area protected; 9 substrate types would have up to 25% of their area protected; 8 habitat types would have up to 50% of their area protected; 3 habitat types would have up to 75% of their area protected; and 7 habitat types would have up to 100% of their area protected; and,
- estuary habitat would have 63% of their area protected, kelp would have 37% of their area protected, and 57% of seagrass would have 57% of their area protected.

In the Oregonian zoogeographic province (north of Point Conception, California), alternative C.4.2 protects:

- 7 substrate habitat types would have 0% of their area protected; 8 substrate types would have up to 25% of their area protected; 6 habitat types would have up to 50% of their area protected; 1 habitat types would have up to 75% of their area protected; and 7 habitat types would have up to 100% of their area protected; and,

- estuary, kelp, and seagrass would have 0% of their areas protected.

In the San Diego zoogeographic province (south of Point Conception, California), alternative C.4.1 protects:

- 5 substrate habitat types would have 0% of their area protected; 10 substrate types would have up to 25% of their area protected; 8 habitat types would have up to 50% of their area protected; 3 habitat types would have up to 75% of their area protected; and 3 habitat types would have up to 100% of their area protected;

- estuary habitat would have 69% of their area protected, kelp would have 77% of their area protected, and seagrass would have 68% of their area protected.

In the San Diego zoogeographic province (south of Point Conception, California), alternative C.4.2 protects:

- 12 substrate habitat types would have 0% of their area protected; 9 substrate types would have up to 25% of their area protected; 6 habitat types would have up to 50% of their area protected; 1 habitat types would have up to 75% of their area protected; and 1 habitat types would have up to 100% of their area protected; and,

- estuary, kelp, and seagrass would have 0% of their areas protected.

4.4.4.5 Summary of Environmental Consequences and Cumulative Impacts

Alternative C.4 would have overall positive effects on the ecosystem (E+). C.4.1 would fully protect habitat, and the ecosystem function it provides, from effects from bottom trawling but would allow effects from other bottom-tending gears. C.4.2 would prohibit effects from all bottom-tending gears. Both options are likely to have significant benefits although non-fishing activities may reduce their effectiveness. Benefits to marine resources, such as insurance and spill-over, may be masked somewhat due to the potential for harvest from other gear types. The alternative has the added benefit of addressing significant scientific uncertainty by prohibiting effects in areas that have not been fished recently. As such, it is likely to protect areas that are currently pristine. The cumulative effects of this alternative, in addition to all the factors described in Section 4.1.1.7, is positive because it would reduce use of trawl gears that have the potential to adversely affect EFH.

4.4.5 Consequences of Alternative C.5: Prohibit a Krill Fishery

The function of krill in the ecosystem is fully described in Chapter 3. At this point in time, a ban on krill harvest is considered Environmentally Positive (E+) if for no other reason than that we do not know how much krill biomass is available for harvest nor do we know how any given level of harvest will effect the amount of krill available to their fish, bird and mammal predators, or on the effect of bycatch. Thus a ban on potential krill harvest would be a precautionary ecosystem measure pending a formal krill stock assessment. Lacking an assessment, a “no harvest” policy provides assurance that negative environmental effects do not occur.

4.4.5.1 Consequences of Alternative C.5 on Protected Species

The consequences of banning krill harvest on protected are regarded as Environmentally Positive (E+) for the same reasons discussed in 4.1.1.

4.4.6 Consequences of Alternative C.6: Close Hotspots

The following subsections, 4.4.6.1 through 4.4.6.5, describe the effects of alternative C.6 on marine habitat, the ecosystem, and marine resources.

4.4.6.1 Geographic Area

Habitat Table 4-9 compares the total geographic area of the impacts minimization alternatives. Alternative C.6 encompasses 18,268 square nm and is equal to 7.77% of the EEZ.

4.4.6.2 Minimization of Adverse Effects

Alternatives C.6 would close areas to bottom trawling (e.g. no protection from other gear types).

For bottom trawls:

- the amount of habitat that would be protected where the sensitivity value is greater than 1.0 and recovery is in excess of 1 year is 0%.

- the amount of habitat that would be protected where the sensitivity value is greater than 2.0 and recovery is in excess of 3.0 years is 96%.

- the amount of habitat that would be protected where the sensitivity value is greater than 2.75 and recovery is in excess of 2.75 years is 0%.

4.4.6.3 Habitat for Individual Species/Life Stages

Habitat Table 4-15 shows the habitat of individual species/life stages that would be protected by this alternative. The information is presented for 168 separate species/life stage combinations. To simplify this information, we performed a frequency distribution. We chose four categories of amount of habitat protected; 1-25%, 26-50%, 51-75%, and 76-100%. We then determined how many species/life stage combinations fell into each category as presented below. This tells us how many species are affected by the alternative, and how much of their habitat would be protected.

For Alternative C.6: 3 species/life stage combinations would have 0% of their habitat protected; 11 species/life stage combinations would have up to 25% of their habitat protected; 20 species/life stage combinations would have up to 50% of their habitat protected; 39 species/life stage combinations would have up to 75% of their habitat protected; and 95 species/life stage combinations would have up to 100% of their habitat protected.

4.4.6.4 Habitat Types

Habitat Table 4-16 compares the amount of biogenic and substrate habitat types that would be protected by the alternatives. To simplify this information, we performed a frequency distribution. We chose four categories of amounts of substrate or biogenic habitat that would be protected: 1-25%, 26-50%, 51-75%, and 76-100%. We then determined how many substrate types or biogenic habitat types fell into each category as presented below. This tells us how many substrate types or biogenic habitat types are affected by the alternative, and how much of each would be protected. For uncategorized amounts, see habitat table 4-16.

In the Oregonian zoogeographic province (north of Point Conception, California), alternative C.6 protects:

- 17 substrate habitat types would have 0% of their area protected; 9 substrate types would have up to 25% of their area protected; 0 habitat types would have up to 50% of their area protected; 0 habitat types would have up to 75% of their area protected; and 3 habitat types would have up to 100% of their area protected; and,

- estuary habitat would have 24% of their area protected, kelp would have 100% of their area protected, and seagrass would have 24% of their area protected.

In the San Diego zoogeographic province (south of Point Conception, California), alternative C.6 protects:

- 17 substrate habitat types would have 0% of their area protected; of 9 substrate types would have up to 25% of their area protected; 0 habitat types would have up to 50% of their area protected; 0 habitat types would have up to 75% of their area protected; and 3 habitat types would have up to 100% of their area protected; and,

- estuary habit would have 63% of their area protected at would have 0% of their area protected, kelp would have 84% of their area protected, and seagrass would have 30% of their area protected.

4.4.6.5 Summary of Environmental Consequences and Cumulative Impacts

Alternative C.6 would have overall positive effects on the ecosystem (E+). The alternative would fully protect habitat, and the ecosystem function it provides, from effects from bottom trawling but would allow effects from other bottom-tending gears. It is likely to have significant benefits although non-fishing activities may reduce their effectiveness. Benefits to marine resources, such as insurance and spill-over, may be masked somewhat due to the potential for harvest from other gear types. However, because it is calculated to include only those areas where habitat is suitable for high numbers of groundfish, it protects habitat for a large diversity of species. The cumulative effects of this alternative, in addition to all the factors described in Section 4.1.1.7, is positive because it would reduce use of bottom trawl gear that has the potential to adversely affect EFH.

4.4.7 Consequences of Alternative C.7: Close Areas of Interest

The following subsections, 4.4.7.1 through 4.4.7.5, describe the effects of alternative C.7 on marine habitat, the ecosystem, and marine resources.

4.4.7.1 Geographic Area

Habitat Table 4-9 compares the total geographic area of the impacts minimization alternatives. Alternative C.7.1 and alternative C.7.2 are identical in area and encompass 8,796 square nm and are equal to 3.67% of the EEZ.

4.4.7.2 Minimization of Adverse Effects

Alternative C.7.1 would close areas to bottom trawl (e.g. not to other gear types). Alternative C.7.2 would close areas to all bottom-contacting activities.

For bottom trawls, alternative C.7.1:

- the amount of habitat that would be protected where the sensitivity value is greater than 1.0 and recovery is in excess of 1 year is 3%.
- the amount of habitat that would be protected where the sensitivity value is greater than 2.0 and recovery is in excess of 3.0 years is 3%.
- the amount of habitat that would be protected where the sensitivity value is greater than 2.75 and recovery is in excess of 2.75 years is 17%.

For nets, alternative C.7.2:

- the amount of habitat that would be protected where the sensitivity value is greater than 0.75 and recovery is in excess of 1.25 years is 0%.
- the amount of habitat that would be protected where the sensitivity value is greater than 1.2 and recovery is in excess of 1.0 years is 26%.
- the amount of habitat that would be protected where the sensitivity value is greater than 1.5 and recovery is in excess of 1.5 years is 15%.

For bottom trawls, alternative C.7.2:

- the amount of habitat that would be protected where the sensitivity value is greater than 1.0 and recovery is in excess of 1 year is 3%.
- the amount of habitat that would be protected where the sensitivity value is greater than 2.0 and recovery is in excess of 3.0 years is 3%.
- the amount of habitat that would be protected where the sensitivity value is greater than 2.75 and recovery is in excess of 2.75 years is 17%.

4.4.7.3 Habitat for Individual Species/Life Stages

Habitat Table 4-15 shows the habitat of individual species/life stages that would be protected by this alternative. The information is presented for 168 separate species/life stage combinations. To simplify this information, we performed a frequency distribution. We chose four categories of amount of habitat protected; 1-25%, 26-50%, 51-75%, and 76-100%. We then determined how many species/life stage combinations fell into each category as presented below. This tells us how many species are affected by the alternative, and how much of their habitat would be protected.

For Alternatives C.7.1 and C.7.2 (which are identical in area): 0 species/life stage combinations would have 0% of their habitat protected; 109 species/life stage combinations would have up to 25% of their habitat protected; 47 species/life stage combinations would have up to 50% of their habitat protected; 9 species/life stage combinations would have up to 75% of their habitat protected; and 3 species/life stage combinations would have up to 100% of their habitat protected.

4.4.7.4 Habitat Types

Habitat Table 4-16 compares the amount of biogenic substrate habitat types that would be protected by the alternatives. To simplify this information, we performed a frequency distribution. We chose four categories of amounts of substrate or biogenic habitat that would be protected: 1-25%, 26-50%, 51-75%, and 76-100%. We then determined how many substrate types or biogenic habitat types fell into each category as presented below. This tells us how many substrate types or biogenic habitat types are affected by the alternative, and how much of each would be protected. For uncategorized amounts, see habitat table 4-16.

In the Oregonian zoogeographic province (north of Point Conception, California), alternative C.7.1 or C.7.2 protects:

- 6 substrate habitat types would have 0% of their area protected; 8 substrate types would have up to 25% of their area protected; 7 habitat types would have up to 50% of their area protected; 2 habitat types would have up to 75% of their area protected; and 6 habitat types would have up to 100% of their area protected; and,

- estuary habitat would have 0% of their area protected, kelp would have 3% of their area protected, and seagrass would have 0% of their area protected.

In the San Diego zoogeographic province (south of Point Conception, California), alternative C.7.1 or C.7.2 protects:

- 11 substrate habitat types would have 0% of their area protected; 7 substrate types would have up to 25% of their area protected; 4 habitat types would have up to 50% of their area protected; 2 habitat types would have up to 75% of their area protected; and 5 habitat types would have up to 100% of their area protected; and,

- estuary habitat would have 0% of their area protected, kelp would have 7% of their area protected, and seagrass would have 0% of their area protected.

4.4.7.5 Summary of Environmental Consequences and Cumulative Impacts

Alternative C.7 would have overall positive effects on the ecosystem (E+). C.7.1 would fully protect habitat, and the ecosystem function it provides, from effects from bottom trawling but would allow effects from other bottom-tending gears. C.7.2 would prohibit effects from all bottom-tending gears. Both options are likely to have significant benefits although non-fishing activities may reduce their effectiveness. Benefits to marine resources, such as insurance and spill-over, may be masked somewhat due to the potential for harvest from other gear types. The alternative applies to areas of interest that were chosen for their unique habitat features and as such provides protection to unique habitat types. The cumulative effects of this alternative, in addition to all the factors described in Section 4.1.1.7, is positive because it would reduce use of bottom trawl gear that has the potential to adversely affect EFH.

4.4.8 Consequences of Alternative C.8: Zoning Fishing Activities

The following subsections, 4.4.8.1 through 4.4.8.5, describe the effects of alternative C.8 on marine habitat, the ecosystem, and marine resources.

4.4.8.1 Geographic Area

Habitat Table 4-9 compares the total geographic area of the impacts minimization alternatives. Alternative C.8.1 and alternative C.8.2 are identical in area and encompass 178,021 square nm and equal to 74.21% of the EEZ.

4.4.8.2 Minimization of Adverse Effects

Alternative C.8.1 would close areas to all mobile, bottom-contacting gear. Alternative C.8.2 would close areas to all bottom-tending gear.

For nets, alternatives C.8.1 and C.8.2:

- the amount of habitat that would be protected where the sensitivity value is greater than 0.75 and recovery is in excess of 1.25 years is 0%.
- the amount of habitat that would be protected where the sensitivity value is greater than 1.2 and recovery is in excess of 1.0 years is 0%.
- the amount of habitat that would be protected where the sensitivity value is greater than 1.5 and recovery is in excess of 1.5 years is 25%.

For bottom trawls, alternatives C.8.1 and C.8.2:

- the amount of habitat that would be protected where the sensitivity value is greater than 1.0 and recovery is in excess of 1 year is 100%.
- the amount of habitat that would be protected where the sensitivity value is greater than 2.0 and recovery is in excess of 3.0 years is 0%.
- the amount of habitat that would be protected where the sensitivity value is greater than 2.75 and recovery is in excess of 2.75 years is 28%.

4.4.8.3 Habitat for Individual Species/Life Stages

Habitat Table 4-15 shows the habitat of individual species/life stages that would be protected by this alternative. The information is presented for 168 separate species/life stage combinations. To simplify this information, we performed a frequency distribution. We chose four categories of amount of habitat protected; 1-25%, 26-50%, 51-75%, and 76-100%. We then determined how many species/life stage combinations fell into each category as presented below. This tells us how many species are affected by the alternative, and how much of their habitat would be protected.

For Alternatives C.8.1 and C.8.2 (which are identical in area): 154 species/life stage combinations would have 0% of their habitat protected; 14 species/life stage combinations would have up to 25% of their habitat protected; 0 species/life stage combinations would have up to 50% of their habitat protected; 0 species/life stage combinations would have up to 75% of their habitat protected; and 0 species/life stage combinations would have up to 100% of their habitat protected.

4.4.8.4 Habitat Types

Habitat Table 4-16 compares the amount of substrate habitat types that would be protected by the alternatives. To simplify this information, we performed a frequency distribution. We chose four categories of amounts of substrate or biogenic habitat that would be protected: 1-25%, 26-50%, 51-75%, and 76-100%. We then determined how many substrate types or biogenic habitat types fell into each category as presented below. This tells us how many substrate types or biogenic habitat types are affected by the alternative, and how much of each would be protected. For uncategorized amounts, see habitat table 4-16.

In the Oregonian zoogeographic province (north of Point Conception, California), alternative C.8.1 or C.8.2 protects:

- 7 substrate habitat types would have 0% of their area protected; 8 substrate types would have up to 25% of their area protected; 6 habitat types would have up to 50% of their area protected; 1 habitat types would have up to 75% of their area protected; and 7 habitat types would have up to 100% of their area protected; and,

- estuary habitat, kelp, and seagrass would have 0% of their areas protected.

In the San Diego zoogeographic province (south of Point Conception, California), alternative C.8.1 or C.8.2 protects:

- 12 substrate habitat types would have 0% of their area protected; 9 substrate types would have up to 25% of their area protected; 6 habitat types would have up to 50% of their area protected; 1 habitat types would have up to 75% of their area protected; and 1 habitat types would have up to 100% of their area protected; and,

- estuary habitat, kelp, and seagrass would have 0% of their areas protected.

4.4.8.5 Summary of Environmental Consequences and Cumulative Impacts

Alternative C.8 would have overall positive effects on the ecosystem (E+). C.8.1 would fully protect habitat, and the ecosystem function it provides, from effects from mobile bottom-tending gear, such as bottom trawling, but would allow effects from other bottom-tending gears. C.8.2 would prohibit effects from all bottom-tending gears. Both options are likely to have significant benefits, although non-fishing activities may reduce their effectiveness. Benefits to marine resources, such as insurance and spill-over, may be masked somewhat due to the potential for harvest from other gear types. The alternative has the added benefit of a long-term approach that would systematically prohibit effects in areas unless science develops sufficiently to demonstrate fishing would not create adverse habitat effects. The cumulative effects of this alternative, in addition to all the factors described in Section 4.1.1.7, is positive because it would reduce use of bottom trawl gear that has the potential to adversely affect EFH.

4.4.9 Consequences of Alternative C.9–Gear Restrictions

Alternative C.9 includes specific gear modifications and prohibitions that are designed to reduce adverse habitat effects. The alternative contains 8 separate options that are considered in turn for the remainder of this section.

4.4.9.1 Consequences of Prohibiting Roller Gear Larger than 15 Inches

Roller gear is used to allow trawls to be towed over rough bottom and is described fully in section 3.5. Roller gear larger than 8 inches is allowed seaward of the RCA; however, most vessels do not use roller gear in excess of 15 inches (Brown, McMullen, Pettinger 2004. personal communication). The benefits to habitat can only be qualitatively assessed due to a lack of experimental data. It is widely held however that large roller gear (e.g. 15 inches and greater) allow trawlers to access more sensitive habitats. This premise is upheld by an OSU study that showed a potential redistribution of the trawl fishery away from rocky areas after implementation of regulations that prohibited large footrope gear in certain portions of the EEZ (Bellman 2004). Prohibition of roller gear would likely protect such habitats by making them inaccessible to trawlers; however, it is not clear that 15-inch is an appropriate size cutoff versus 8 inches to achieve a redistribution of the trawl fishery away from sensitive habitat.

It is likely that no immediate benefit would result from this option because the gear is not widely used, if at all. The prohibition may however, prevent future access to sensitive habitats by trawlers with economic incentive to convert to larger footrope gear and for this reason is regarded as environmentally positive (E+). The cumulative effects of this alternative, in addition to all the factors described in Section 4.1.1.7, is positive because it would reduce use of trawl gears that have the potential to adversely affect EFH.

4.4.9.2 Consequences of Prohibiting Roller Gear Larger than 15 Inches on Protected Species

There are no foreseeable consequences of this alternative on protected species.

4.4.9.3 Consequences of Prohibiting Flat Trawl Doors

(i.e. requiring cambered doors) Trawl doors, including flat and cambered, are described in section 3.5. There is no experimental evidence to suggest that cambered doors have less effect on habitat than flat doors; however, fishermen on the West Coast are increasingly using cambered doors as they are more fuel efficient due to their increased hydrodynamic efficiency and reduced drag on the bottom (Brown, 2003). The reduction in bottom drag suggests that cambered doors can be fished with less direct habitat effects than flat doors. For this reason, the option is regarded as environmentally positive (E+). The cumulative effects of this alternative, in addition to all the factors described in Section 4.1.1.7, is positive because it would reduce use of trawl gears that have the potential to adversely affect EFH.

4.4.9.4 Consequences of Prohibiting Flat Trawl Doors (i.e. requiring cambered doors) on Protected Species

There are no foreseeable consequences of this alternative on protected species.

4.4.9.5 Consequences of Limiting Single Longline Groundline to 3 nm

Bottom longline gear is described fully in section 3.5. The principal components of the longline that can produce effects on the seabed are the anchors or weights, the hooks and the mainline. The key determinant of the effects of longlines is how far they travel over the seabed during setting or retrieval. Significant travel distance is more likely during retrieval. If the hauling vessel is not above the part of the line that is being lifted, the line, hooks and anchors can be pulled across the seabed before ascending. If the hooks and line snare exposed organisms, those organisms can be injured or detached. Lines may undercut emergent structures or roll over them. The relatively low breaking strength of the line may limit damage to more durable seafloor features (Rose et al. 2002). The mainline can also be moved numerous feet along the bottom and up into the water column by fish, particularly halibut during escape runs. Objects in the path of the groundline can be disturbed (Johnson 2002).

While there is no direct experimental evidence to suggest that habitat effects can be reduced by modifying the length of groundline; it may be inferred that shorter longlines would reduce the travel distance during retrieval and thereby reduce adverse effects to bottom habitat. Such a reduction (from current levels) may be minimal however and without further research it is inappropriate to make a conclusion in this EIS. Further, most longline fishing off the West Coast use groundlines less than 3 nm. As described in section 3.5.1.1, typical groundline lengths are: halibut fishery roughly 3 nm; the groundfish fishery roughly 1.0 nm; and, the blackcod fishery roughly 1.5 nm. For this reason, the environmental consequences of this alternative are regarded as having no change from current and reasonably foreseeable conditions (0). There are no foreseeable cumulative effects of this alternative because currently longlines over 3 nm long are not commonly used.

4.4.9.6 Consequences of Limiting Single Longline Groundline to 3 nm on Protected Species

There are no foreseeable consequences of this alternative on protected species.

4.4.9.7 Consequences of Employing Habitat-Friendly Anchoring Systems

Requiring fixed gear vessels to use habitat-friendly anchoring systems is likely to have Environmentally Positive effects on habitat; however, there is insufficient information available for this EIS to know specifically what types of anchors are available and predict the type of changes that may occur. A preliminary review of anchoring systems suggests that anchors resembling the "Bruce" anchor (an anchor design with a weak link which allows the anchor to be retrieved from the shovel instead of the shaft if it gets snagged) may be merit further consideration by the Council and NMFS.

4.4.9.8 Consequences of Employing Habitat-Friendly Anchoring Systems on Protected Species

There are no foreseeable consequences of this alternative on protected species.

4.4.9.9 Consequences of Prohibiting Dredge Gear

Dredge gear is described fully in section 3.5.7. The effects of dredge gear on habitat are described in section 3.2.5. Experimental data suggests that dredge gear modifies habitat more than any other gear type and can have similar effects on biodiversity (appendix 10 to the Risk Assessment). The effect of dredge gear on the seabed is dependent on the power and capability of the fishing vessel, the towing speed, the weight of the dredge and its size and design. The principal contact with the seabed is made by the shoes, tickler chains and footrope, with the lower edge of the frame only encountering higher sand waves and emergent structures. The chain bag also is pulled across the seabed. Hydraulic baffles may increase the suspension of sediment, while reducing the need for elements in direct contact with the bottom. Although dredge gear is not currently utilized on the West Coast, this alternative is regarded as environmentally positive in that it would eliminate the possibility of it happening in the future (E+). The cumulative effects of this alternative, in addition to all the factors described in Section 4.1.1.7, is positive because it would reduce use of fishing gears that have the potential to adversely affect EFH.

4.4.9.10 Consequences of Prohibiting Dredge Gear on Protected Species

There are no foreseeable consequences of this alternative on protected species.

4.4.9.11 Consequences of Prohibiting Beam-trawl Gear

Beam-trawl gear is described fully in section 3.5. During beam trawl fishing, the sole plates on the trawl head and the tickler chains are in direct contact with the seabed. The sole plates generally contact the seabed at a slight angle. The pressure exerted by the trawl head on the seabed is strongly related to the towing speed. As the speed is increased, the lift on the gear increases and the resultant pressure force decreases. A less firm bottom contact, e.g. on softer grounds, can also be obtained by shortening the warp length. A shrimp beam trawl weighs (in air) several hundred kilograms.

Tickler chains also contact the bottom. Generally only one tickler chain is used when fishing shrimp. The pressure exerted by the tickler chain is substantially lower than that exerted by the trawl heads, though the area covered is greater. When the tickler chain is towed over the seabed, sediments are transported. Smaller particles will go into suspension and may be transported away by currents or resettle in the track of the trawl. Local variations in morphology such as ripples may be flattened out.

The amount of penetration into the seabed depends on sediment type, with the greatest amount of penetration occurring on very fine to fine-muddy sand. If more than one chain is used on the beam trawl, the added weight increases contact with the seabed and increases fluidization of the sediment as each chain passes, allowing following chains to penetrate deeper (Jennings et al 2001).

Limitations in direct scientific observation of beam-trawl effects allows only for a qualitative analysis of the predicted effects of this alternative. For purposes of the analysis, beam trawl is assumed to have similar effects to standard bottom trawl gear that rates relatively high in potential effect among all the gear types. A prohibition on beam trawl gear would likely result in reduced physical modification to bottom habitat and associated loss in benthic biodiversity and is therefore regarded as environmentally positive (E+). The cumulative effects of this alternative, in addition to all the factors described in Section 4.1.1.7, is positive because it would reduce use of trawl gears that have the potential to adversely affect EFH.

4.4.9.12 Consequences of Prohibiting Beam-trawl Gear on Protected Species

There are no foreseeable consequences of this alternative on protected species.

4.4.9.13 Consequences of Prohibiting Set Gillnets in Waters Deeper than 60 fm

Gillnet gear is described fully in section 3.5. The benthic effects of a set gillnet fishing operation occurs during the retrieval of the gear. During retrieval, the nets and leadlines may snag bottom structures or the exposed sedentary benthos. The anchoring system can also affect bottom organisms and structure if they are dragged along the bottom before ascent. Lost nets can tear organisms from the seabed or overturn cobble and small boulders to which organisms may be attached if they are moved along the seabed by currents. Gillnets may be lost during bad weather or through interaction with mobile gears. Retrieval of gear lost to inclement weather is now high due to the increased use of GPS (global positioning systems), while gillnets lost to interactions with other gear is less likely to be retrieved. Once lost, gear may continue to fish. The extent of this 'ghost fishing' will be related to factors such as water depth, light levels, and water movements as well as vertical profile. A lost gillnet can provide a new surface for epibenthic organisms such as bryozoans to settle on and niches for fish and crabs. Although these organisms will help make the net visible to finfish, it can also provide a food source as certain organisms settle on the net or are caught in the net. This will commonly attract fish or other scavengers to eat those caught and the scavenger species can also get entangled. Overtime, especially in areas of high water flow, nets become bundled up, reducing their ability to entangle fish. In deep water, where fouling is very limited and currents slower, derelict nets may fish for longer periods.

Because nets are expensive and can easily become torn if they are snagged on hard or rough bottoms, the goal of setnetters is to avoid these areas, while setting their nets just off to the side and parallel to these areas, on mud or sandy bottoms. Similarly for fear of snagging, efforts are also made to avoid dragging the anchor on retrieval (West 2003). A 1000 fathom long swordfish net, cut loose during a storm to avoid the sinking of a vessel, when retrieved 6 days later had already bunched up into a dense mass the size of a small house and was not catching fish (West 2003).

The set net is banned off Washington and Oregon except for small numbers of treaty set net fishermen on the Columbia River above Bonneville Dam and on certain smaller rivers of western Washington. This treaty fishery takes salmon, dogfish and true cod; lingcod and rockfish are caught as bycatch.

Off California, setnets are only allowed offshore of the three-mile state waters boundary and south of 38 degrees North latitude. Set nets can be fished at all water depths depending on the behavior of the fish being pursued. For example, white seabass can be targeted with set nets both when they reside near the bottom (during some parts of their life cycle) as well as when they are in the upper parts of the water column. There is a set net fishery for bonito, flying fish, and white croaker (mesh sizes of 2.75- 3 inches, 7.0 cm-7.6 cm), fishery for white seabass (using minimum mesh sizes of six inches, 15.2 cm), and a fishery for barracuda with a 3.5” (8.9 cm) mesh size. In California set nets are also used for angel shark, California halibut, lingcod, mullet, and perch. While trammel nets are also allowed in these fisheries, these nets are not currently known to be in use (West 2003).

Set gillnets are rated as having relatively low habitat effect when compared to other gear types and therefore this option is regarded as having only marginal environmental benefits (0). The cumulative effects of this alternative, in addition to all the factors described in Section 4.1.1.7, is positive because it would reduce use of fishing gears that have the potential to adversely affect EFH.

4.4.9.14 Consequences of Prohibiting Set Gillnets in Waters Deeper than 60 fm on Protected Species

There are no foreseeable consequences of this alternative on protected species.

4.4.9.15 Consequences of Prohibiting Dingle Bar Gear

Dingle bar and other troll gears are described fully in section 3.5. Dingle bars can contact the seafloor when deployed. The hooks and line can snag on rocks, corals, kelps and other objects during retrieval. This may upend smaller rocks and break hard corals, while leaving soft corals unaffected. Invertebrates and other lightweight objects can also be dislodged. While hook-and-line fishing rates as among the least destructive relative to other gear types, dingle bars are generally used to target lingcod in sensitive habitats that may be modified by the gear type. Therefore this alternative is regarded as environmentally positive (E+). The cumulative effects of this alternative, in addition to all the factors described in Section 4.1.1.7, is positive because it would reduce use of fishing gears that have the potential to adversely affect EFH.

4.4.9.16 Consequences of Prohibiting Dingle Bar Gear on Protected Species

There are no foreseeable consequences of this alternative on protected species.

4.4.10 Consequences of Alternative C.10: Central California No-trawl Zones

The following subsections, 4.4.10.1 through 4.4.10.5, describe the effects of alternative C.10 on marine habitat, the ecosystem, and marine resources.

4.4.10.1 Geographic Area

Habitat Table 4-9 compares the total geographic area of the impacts minimization alternatives. Alternative C.10 encompasses 8,345 square nm and is equal to 3.48% of the EEZ.

4.4.10.2 Minimization of Adverse Effects

Alternative C.10 would close areas to trawling (e.g. other gear types would be allowed).

For bottom trawls:

- the amount of habitat that would be protected where the sensitivity value is greater than 1.0 and recovery is in excess of 1 year is 1%.
- the amount of habitat that would be protected where the sensitivity value is greater than 2.0 and recovery is in excess of 3.0 years is 17%.

- the amount of habitat that would be protected where the sensitivity value is greater than 2.75 and recovery is in excess of 2.75 years is 6%.

4.4.10.3 Habitat for Individual Species/Life Stages

Habitat Table 4-15 shows the habitat of individual species/life stages that would be protected by this alternative. The information is presented for 168 separate species/life stage combinations. To simplify this information, we performed a frequency distribution. We chose four categories of amount of habitat protected; 1-25%, 26-50%, 51-75%, and 76-100%. We then determined how many species/life stage combinations fell into each category as presented below. This tells us how many species are affected by the alternative, and how much of their habitat would be protected.

For Alternative C.10: 11 species/life stage combinations would have 0% of their habitat protected; 148 species/life stage combinations would have up to 25% of their habitat protected; 9 species/life stage combinations would have up to 50% of their habitat protected; 0 species/life stage combinations would have up to 75% of their habitat protected; and 0 species/life stage combinations would have up to 100% of their habitat protected.

4.4.10.4 Habitat Types

Habitat Table 4-16 compares the amount of biogenic and substrate habitat types that would be protected by the alternatives. To simplify this information, we performed a frequency distribution. We chose four categories of amounts of substrate or biogenic habitat that would be protected: 1-25%, 26-50%, 51-75%, and 76-100%. We then determined how many substrate types or biogenic habitat types fell into each category as presented below. This tells us how many substrate types or biogenic habitat types are affected by the alternative, and how much of each would be protected. For uncategorized amounts, see habitat table 4-16.

In the Oregonian zoogeographic province (north of Point Conception, California), alternative C.10:

- 8 substrate habitat types would have 0% of their area protected; 15 substrate types would have up to 25% of their area protected; 3 habitat types would have up to 50% of their area protected; 0 habitat types would have up to 75% of their area protected; and 3 habitat types would have up to 100% of their area protected; and,

- estuary habitat, 34% of kelp, and 0% of seagrass would have 0% of their areas protected.

In the San Diego zoogeographic province (south of Point Conception, California), alternative C.10:

- 12 substrate habitat types would have 0% of their area protected; 11 substrate types would have up to 25% of their area protected; 3 habitat types would have up to 50% of their area protected; 0 habitat types would have up to 75% of their area protected; and 3 habitat types would have up to 100% of their area protected; and,

- estuary habitat, 1% of kelp, and 0% of seagrass would have 0% of their areas protected.

4.4.10.5 Summary of Environmental Consequences and Cumulative Impacts

Alternative C.10 would have overall positive effects on the ecosystem (E+). The alternative would fully protect habitat, and the ecosystem function it provides, from effects from bottom trawling but would allow effects from other bottom-tending gears. It is likely to have significant benefits, although non-fishing activities may reduce their effectiveness. Benefits to marine resources, such as insurance and spill-over, may be masked somewhat due to the potential for harvest from other gear types. It is also unclear at this time if permits that are purchased from active fishermen will be permanently retired or utilized by fishermen (i.e. by sale or lease of permit rights) who operate outside the closed area(s). If the permits are used, there may be some intensification of habitat effects to areas outside of the closed areas. If the permits are not used, the overall level of effect would be reduced. The cumulative effects of this alternative, in addition to all the factors described in Section 4.1.1.7, is positive because it would reduce use of bottom trawl gear that has the potential to adversely affect EFH.

4.4.11 Consequences of Alternative C.11: Relax Gear Endorsement Requirements

This alternative would allow fishers to choose gear types based on market conditions and may result in more "habitat-friendly" gears being chosen. Market conditions that may influence these decisions are described in section 4.7.3.11. Several changes in fleet structure are likely under this alternative. 1) DTS trawlers may switch to fixed gear during portions of the year to target sablefish, 2) shelf trawlers may switch to fixed gear during portions of the year to target sablefish, and 3) some fixed gear vessels may convert to trawling to target shelf flatfish.

Under this alternative, it is possible that total trawl effort would not change along the shelf. The catch per unit effort associated with fixed gear caught flatfish in combination with the price per pound for most flatfish species would tend to make it difficult for vessels to make a profit by using fixed gear to target flatfish along the shelf. Although total trawl effort may not change along the shelf (though the number of vessels may change), incentives may encourage fixed gear vessels to use trawl gear for targeting flatfish. This may not change total trawl effort since total effort on the shelf is constrained by rebuilding species and target species OYs, but the number of vessels trawling for flatfish may increase, thus reducing the pounds of flatfish harvest per vessel.

If DTS trawlers make more net revenue by using fixed gear, those vessels may use fixed gear during portions of the year. This would tend to reduce the amount of trawl effort along the slope. However, the inability of fixed gear to catch other DTS species relative to trawl gear may make it less profitable for some–or all–of these vessels to switch gear types if the reduction in catch of DTS species outweighs the benefits of the higher price for fixed gear sablefish.

Under this alternative, shelf flatfish trawlers may switch to fixed gear and target sablefish, thus increasing the number of vessels targeting sablefish and reducing available pounds per vessel. Depending on the opportunities afforded to fixed gear vessels that may switch to trawling during portions of the year. This alternative could have environmentally positive or negative effects because it is unpredictable if or how fishers will change gear types. The alternative is regarded as having Unknown effects (U).

4.4.12 Consequences of Alternative C.12: Close Ecologically Important Areas to Bottom Trawl

The following subsections, 4.4.12.1 through 4.4.12.5, describe the effects of alternative C.12 on marine habitat, the ecosystem, and marine resources.

4.4.12.1 Geographic Area

Habitat Table 4-9 compares the total geographic area of the impacts minimization alternatives. Alternative C.12 encompasses 235,115 square nm and is equal to 98.01% of the EEZ.

4.4.12.2 Minimization of Adverse Effects

Alternatives C.12 would close areas to bottom trawl (e.g. other gear types would be allowed).

For bottom trawls:

- the amount of habitat that would be protected where the sensitivity value is greater than 1.0 and recovery is in excess of 1 year is 100%.
- the amount of habitat that would be protected where the sensitivity value is greater than 2.0 and recovery is in excess of 3.0 years is 78%
- the amount of habitat that would be protected where the sensitivity value is greater than 2.75 and recovery is in excess of 2.75 years is 88%.

4.4.12.3 Habitat for Individual Species/Life Stages

Habitat Table 4-15 shows the habitat of individual species/life stages that would be protected by this alternative. The information is presented for 168 separate species/life stage combinations. To simplify this information, we performed a frequency distribution. We chose four categories of amount of habitat protected; 1-25%, 26-50%, 51-75%, and 76-100%. We then determined how many species/life stage combinations fell into each category as presented below. This tells us how many species are affected by the alternative, and how much of their habitat would be protected.

For Alternative C.12: 0 species/life stage combinations would have 0% of their habitat protected; 12 species/life stage combinations would have up to 25% of their habitat protected; 83 species/life stage combinations would have up to 50% of their habitat protected; 48 species/life stage combinations would have up to 75% of their habitat protected; and 25 species/life stage combinations would have up to 100% of their habitat protected.

4.4.12.4 Habitat Types

Habitat Table 4-16 compares the amount of substrate habitat types that would be protected by the alternatives. To simplify this information, we performed a frequency distribution. We chose four categories of amounts of substrate or biogenic habitat that would be protected: 1-25%, 26-50%, 51-75%, and 76-100%. We then determined how many substrate types or biogenic habitat types fell into each category as presented below. This tells us how many substrate types or biogenic habitat types are affected by the alternative, and how much of each would be protected. For uncategorized amounts, see habitat table 4-16.

In the Oregonian zoogeographic province (north of Point Conception, California), alternative C.12 protects:

- 0 substrate habitat types would have 0% of their area protected; 1-25% of 1 substrate types would have up to 25% of their area protected; 6 habitat types would have up to 50% of their area protected; 5 habitat types would have up to 75% of their area protected; and 17 habitat types would have up to 100% of their area protected; and,
- estuary habitat would have 87% of their area protected, kelp would have 69% of their area protected, and seagrass would have 87% of their area protected.

In the San Diego zoogeographic province (south of Point Conception, California), alternative C.12 protects:

- 0 substrate habitat types would have 0% of their area protected; 1 substrate type would have up to 25% of their area protected; 6 habitat types would have up to 50% of their area protected; 6 habitat types would have up to 75% of their area protected; and 16 habitat types would have up to 100% of their area protected; and,

- estuary habitat would have 69% of their area protected, kelp would have 92% of their area protected, and seagrass would have 96% of their area protected.

This alternative would also prohibit bottom trawling in the biogenic areas delineated by Oceana as described in Chapters 2 and 3. As of the publication of the DEIS, NMFS had not made a determination as to the reliability of scientific method used to calculate these areas. During the public comment period, the Council's Scientific and Statistical Committee reviewed the methodology and approved use of the information within this EIS (See Appendix D). The approved methodology indicates that alternative will provide significant protection of these organisms that are vulnerable to effect.

4.4.12.5 Summary of Environmental Consequences and Cumulative Impacts

Alternative C.12 would have overall positive effects on the ecosystem (E+). The alternative would fully protect habitat, and the ecosystem function it provides, from effects from bottom trawling but would allow effects from other bottom-tending gears. It is likely to have significant benefits although non-fishing activities may reduce their effectiveness. Benefits to marine resources, such as insurance and spill-over, may be masked somewhat due to the potential for harvest from other gear types. The alternative applies to areas that were chosen for their unique habitat features and as such provides protection to unique habitat types. The cumulative effects of this alternative, in addition to all the factors described in Section 4.1.1.7, is positive because it would reduce use of bottom trawl gear that has the potential to adversely affect EFH.

4.4.13 Consequences of Alternative C.13: Close Ecologically Important Areas to Bottom-contacting Gear

The following subsections, 4.4.13.1 through 0, describe the effects of alternatives C.13 on marine habitat, the ecosystem, and marine resources.

4.4.13.1 Geographic Area

Habitat Table 4-9 compares the total geographic area of the impacts minimization alternatives. Alternative C.13 encompasses 235,115 square nm and is equal to 98.01% of the EEZ.

4.4.13.2 Minimization of Adverse Effects

Alternatives C.13 would close areas to all bottom-contacting fishing gear.

For nets:

- the amount of habitat that would be protected where the sensitivity value is greater than 0.75 and recovery is in excess of 1.25 years is 90%.

- the amount of habitat that would be protected where the sensitivity value is greater than 1.2 and recovery is in excess of 1.0 years is 58%.

- the amount of habitat that would be protected where the sensitivity value is greater than 1.5 and recovery is in excess of 1.5 years is 87%.

For bottom trawls:

- the amount of habitat that would be protected where the sensitivity value is greater than 1.0 and recovery is in excess of 1 year is 100%.

- the amount of habitat that would be protected where the sensitivity value is greater than 2.0 and recovery is in excess of 3.0 years is 78%

- the amount of habitat that would be protected where the sensitivity value is greater than 2.75 and recovery is in excess of 2.75 years is 88%.

4.4.13.3 Habitat for Individual Species/Life Stages

Habitat Table 4-15 shows the habitat of individual species/life stages that would be protected by this alternative. The information is presented for 168 separate species/life stage combinations. To simplify this information, we performed a frequency distribution. We chose four categories of amount of habitat protected; 1-25%, 26-50%, 51-75%, and 76-100%. We then determined how many species/life stage combinations fell into each category as presented below. This tells us how many species are affected by the alternative, and how much of their habitat would be protected.

For Alternative C.13: 0 species/life stage combinations would have 0% of their habitat protected; 12 species/life stage combinations would have up to 25% of their habitat protected; 83 species/life stage combinations would have up to 50% of their habitat protected; 48 species/life stage combinations would have up to 75% of their habitat protected; and 25 species/life stage combinations would have up to 100% of their habitat protected.

4.4.13.4 Habitat Types

Habitat Table 4-16 compares the amount of biogenic and substrate habitat types that would be protected by the alternatives. To simplify this information, we performed a frequency distribution. We chose four categories of amounts of substrate or biogenic habitat that would be protected: 1-25%, 26-50%, 51-75%, and 76-100%. We then determined how many substrate types or biogenic habitat types fell into each category as presented below. This tells us how many substrate types or biogenic habitat types are affected by the alternative, and how much of each would be protected. For uncategorized amounts, see habitat table 4-16.

In the Oregonian zoogeographic province (north of Point Conception, California), alternative C.13 protects:

- 0 substrate habitat types would have 0% of their area protected; 1 substrate types would have up to 25% of their area protected; 6 habitat types would have up to 50% of their area protected; 5 habitat types would have up to 75% of their area protected; and 17 habitat types would have up to 100% of their area protected; and,

- estuary habitat would have 87% of their area protected, kelp would have 69% of their area protected, and seagrass would have 87% of their area protected.

In the San Diego zoogeographic province (south of Point Conception, California), alternative C.13 protects:

- 0 substrate habitat types would have 0% of their area protected; 1 substrate types would have up to 25% of their area protected; 6 habitat types would have up to 50% of their area protected; 6 habitat types would have up to 75% of their area protected; and 16 habitat types would have up to 100% of their area protected; and,

- estuary habitat would have 69% of their area protected, kelp would have 92% of their area protected, and seagrass would have 96% of their area protected.

This alternative would also prohibit bottom trawling in the biogenic areas delineated by Oceana as described in Chapters 2 and 3. As of the publication of the DEIS, NMFS had not made a determination as to the reliability of scientific method used to calculate these areas. During the public comment period, the Council's Scientific and Statistical Committee reviewed the methodology and approved use of the information within this EIS (See Appendix D). The approved methodology indicates that alternative will provide significant protection of these organisms that are vulnerable to effect.

4.4.13.5 Summary of Environmental Consequences and Cumulative Impacts

Alternative C.13 would have overall positive effects on the ecosystem (E+). The alternative would prohibit effects from all bottom-tending gears. It is likely to have significant benefits although non-fishing activities may reduce their effectiveness. Benefits to marine resources, such as insurance and spill-over, may be masked somewhat due to the potential for harvest from other gear types. The alternative has the added benefit of a long-term approach that would systematically prohibit effects in areas unless science develops sufficiently to demonstrate fishing would not create adverse habitat effects. The alternative applies to areas that were chosen for their unique habitat features and as such provides protection to unique habitat types. The cumulative effects of this alternative, in addition to all the factors described in Section 4.1.1.7, is positive because it would reduce use of trawl gears that have the potential to adversely affect EFH.

4.4.14 Consequences of Alternative C.14: Close Ecologically Important Areas to Fishing

The following subsections, 4.4.14.1 through 0, describe the effects of alternative C.14 through C.6 on marine habitat, the ecosystem, and marine resources.

4.4.14.1 Geographic Area

Habitat Table 4-9 compares the total geographic area of the impacts minimization alternatives. Alternative C.14 encompasses 235,115 square nm and is equal to 98.01% of the EEZ.

4.4.14.2 Minimization of Adverse Effects

Alternatives C.14 would close areas to all fishing.

For nets:

- the amount of habitat that would be protected where the sensitivity value is greater than 0.75 and recovery is in excess of 1.25 years is 90%.

- the amount of habitat that would be protected where the sensitivity value is greater than 1.2 and recovery is in excess of 1.0 years is 58%.

- the amount of habitat that would be protected where the sensitivity value is greater than 1.5 and recovery is in excess of 1.5 years is 87%.

For bottom trawls:

- the amount of habitat that would be protected where the sensitivity value is greater than 1.0 and recovery is in excess of 1 year is 100%.
- the amount of habitat that would be protected where the sensitivity value is greater than 2.0 and recovery is in excess of 3.0 years is 78%
- the amount of habitat that would be protected where the sensitivity value is greater than 2.75 and recovery is in excess of 2.75 years is 88%.

4.4.14.3 Habitat for Individual Species/Life Stages

Habitat Table 4-15 shows the habitat of individual species/life stages that would be protected by this alternative. The information is presented for 168 separate species/life stage combinations. To simplify this information, we performed a frequency distribution. We chose four categories of amount of habitat protected; 1-25%, 26-50%, 51-75%, and 76-100%. We then determined how many species/life stage combinations fell into each category as presented below. This tells us how many species are affected by the alternative, and how much of their habitat would be protected.

For Alternative C.14: 0 species/life stage combinations would have 0% of their habitat protected; 12 species/life stage combinations would have up to 25% of their habitat protected; 83 species/life stage combinations would have up to 50% of their habitat protected; 48 species/life stage combinations would have up to 75% of their habitat protected; and 25 species/life stage combinations would have up to 100% of their habitat protected.

4.4.14.4 Habitat Types

Habitat Table 4-16 compares the amount of biogenic and substrate habitat types that would be protected by the alternatives. To simplify this information, we performed a frequency distribution. We chose four categories of amounts of substrate or biogenic habitat that would be protected: 1-25%, 26-50%, 51-75%, and 76-100%. We then determined how many substrate types or biogenic habitat types fell into each category as presented below. This tells us how many substrate types or biogenic habitat types are affected by the alternative, and how much of each would be protected. For uncategorized amounts, see habitat table 4-16.

In the Oregonian zoogeographic province (north of Point Conception, California), alternative C.14 protects:

- 0 substrate habitat types would have 0% of their area protected; 1 substrate types would have up to 25% of their area protected; 6 habitat types would have up to 50% of their area protected; 5 habitat types would have up to 75% of their area protected; and 17 habitat types would have up to 100% of their area protected; and,
- estuary habitat would have 63% of their area protected, kelp would have 63% of their area protected, and seagrass would have 63% of their area protected.

In the San Diego zoogeographic province (south of Point Conception, California), alternative C.14 protects:

- 0 substrate habitat types would have 0% of their area protected; 1 substrate types would have up to 25% of their area protected; 6 habitat types would have up to 50% of their area protected; 6 habitat types would have up to 75% of their area protected; and 16 habitat types would have up to 100% of their area protected; and,

- estuary habitat would have 63% of their area protected, kelp would have 63% of their area protected, and seagrass would have 63% of their area protected.

This alternative would also prohibit bottom trawling in the biogenic areas delineated by Oceana as described in Chapters 2 and 3. As of the publication of the DEIS, NMFS had not made a determination as to the reliability of scientific method used to calculate these areas. During the public comment period, the Council's Scientific and Statistical Committee reviewed the methodology and approved use of the information within this EIS (See Appendix D). The approved methodology indicates that alternative will provide significant protection of these organisms that are vulnerable to effect.

4.4.14.5 Summary of Environmental Consequences and Cumulative Impacts

Alternative C.14 would prohibit all gear types in closed areas and would have overall positive effects on marine habitat, the ecosystem, and marine resources (E+). Habitat, and the ecosystem functions it provides, would be fully protected from fishing effects although the potential for effects from non-fishing activities exists. Because there would be no harvest of marine resources, the alternative has the potential to function as insurance from catastrophic environmental events and management failure. There is also the possibility that marine resources, such as groundfish, will attain a full age structure including highly productive older females, and will provide positive spill over effects to areas that are open to fishing. The alternative applies to areas that were chosen for their unique habitat features and as such provides protection to unique habitat types. The cumulative effects of this alternative, in addition to all the factors described in Section 4.1.1.7, is positive because it would reduce use of fishing gears that have the potential to adversely affect EFH.

4.4.15 Consequences of the Final Preferred Alternative to Minimize Adverse Fishing Effects to EFH on Marine Habitat, the Ecosystem, and Marine Resources

The final preferred alternative to minimize adverse fishing effects to EFH incorporates components of Alternatives C.2, C.4, C.7, C.9, C.10, C.12, and C.13. The final preferred alternative represents a significant change from the status quo under which there are no measures in place for the specific purpose of minimizing adverse fishing effects on EFH.

4.4.15.1 Geographic Area Protected by the Final Preferred Alternative

Habitat Table 4-9 compares the total geographic area of the impacts minimization alternatives. The final preferred alternative encompasses 196,032 square nm and is equal to 82% of the EEZ in addition to areas shoreward. The final preferred alternative includes 52 ecologically important areas as well as gear restrictions. Habitat Table 4-13 compares these ecologically important areas by area, including percent of the EEZ.

4.4.15.2 Minimization of Adverse Effects by the Final Preferred Alternative

The component of the final preferred alternative intended to minimize the adverse effects of fishing on groundfish EFH comprises management measures in three categories: (1) gear modifications, (2) closed areas, and (3) promotion of reductions in fishing effort.

Gear Modifications and Prohibitions

The preferred alternative includes the following gear modifications and prohibitions:

- Prohibit bottom trawl roller gear with a footrope diameter greater than 19 inches on bottom trawl gear throughout the EEZ and state waters seaward of the shoreline (modification of Alternative C.9.1).

- Prohibit bottom trawl roller gear with a footrope diameter greater than eight inches eastward of a line approximating the 100 fathom depth contour (modification of Alternative C.2.1).
- Prohibit dredge gear (Alternative C.9.5).
- Prohibit beam trawl gear throughout the EEZ and state waters seaward of the shoreline (Alternative C.9.6).

Habitat Table 4-14 lists the gear restrictions within the 52 ecologically important areas included in the final preferred alternative.

Restrictions in state waters may be implemented by state law, as appropriate. Although dependent on state regulation, the restrictions on dredge and beam trawl gear are not intended to apply in internal waters (Puget Sound, San Francisco Bay, etc.).

Closed Areas

The final preferred alternative contains two types of closed areas: a "trawl footprint" closure and ecologically important closed areas.

<u>Footprint Closure</u>: This component of the preferred alternative is a modification of the trawl footprint closure described under Alternatives C.4 and C.12. Under those alternatives, areas that were not trawled from 2000 to 2003 would be permanently closed to bottom trawl. The final preferred alternative closes depths greater than 700 fathoms to bottom trawl.

<u>Ecologically Important Closed Areas</u>: This component of the preferred alternative is a modification and combination of Alternative C.7, C.10, C.12, and C.13. Closure types within these ecologically important areas included under the preferred alternative are listed in Habitat Table 4-14. The preferred alternative also includes a new procedural element that was not described in the DEIS, applicable to areas closed to bottom trawl, which would allow reconsideration of these areas upon the receipt of new scientific information. Ecologically important closed areas are sited shoreward of 700 fathoms in the area not already closed to bottom trawl with the footprint closure and include areas closed to bottom trawl, all bottom-contacting gear types, or all fishing gear.

Effort Reduction

The final preferred alternative incorporates the element of Alternative C.10 involving public-private partnerships under which private funds are used to purchase groundfish limited entry trawl licensees by adding language to the FMP by amendment. The proposed language notes the Council will support such efforts, as feasible, through their consideration of actions upon which the execution of contracts may be contingent.

Minimization of Adverse Effects

To analyze the expected performance of the alternative in minimizing adverse fishing effects, a GIS-based methodology is utilized for this EIS. The alternatives, including the final preferred alternative, are overlaid with the sensitivity and recovery information developed through the Risk Assessment in Appendix A and the amount of habitat for each is calculated as a percentage of the whole. This provides a measure of the relative amount of habitat that is protected from fishing effects which is comparable among the alternatives.

Sensitivity values for each habitat type/fishing gear combination are resolved to a 4-point scale that represents direct change to habitat and biodiversity as a result of fishing. The sensitivity of habitat is indexed as follows:

0 = No detectable adverse effects on the seabed; i.e. no significant differences between effect and control areas in any metrics.

1 = Minor effects such as shallow furrows on bottom; small differences between effect and control sites, less than 25% in most measured metrics.

2 = Substantial changes such as deep furrows on bottom; differences between effect and control sites 25-50% in most metrics measured.

3 = Major changes in bottom structure such as re-arranged boulders; large losses of many organisms with differences between effect and control sites greater than 50% in most measured metrics.

Habitat Table 4-22 compares the relative amount of habitat sensitivity and recovery. To simplify the large amount of information for the analyses of individual alternatives, dredge gear is not discussed, as it is not currently used off the West Coast. Pot, trap, and hook and line gear have maximum sensitivity and recovery values of 0.8, which are considered minimal, so are excluded from the discussion as well. The information for these gears is available in Habitat Table 4-22 and 4-23.

Nets are discussed in the analyses of individual alternatives for sensitivity values of 0.75 or larger, where recovery time is greater than 1.25 years. Bottom trawl is discussed for sensitivity values of 1.0 or larger, where recovery time is greater than or equal to 1 year. To further assist the reader to comprehend the large volume of information from the Habitat Tables, groupings are made at reasonable combinations of sensitivity and recovery levels.

For dredge:

- the amount of habitat that would be protected where the sensitivity value is greater than 1.0 and recovery is in excess of 1 year is 45%.
- the amount of habitat that would be protected where the sensitivity value is greater than 2.0 and recovery is in excess of 2 years is 0%.
- the amount of habitat that would be protected where the sensitivity value is greater than 2.9 and recovery is in excess of 4.05 years is 0%.

For bottom trawls:

- the amount of habitat that would be protected where the sensitivity value is greater than 1.0 and recovery is in excess of 1 year is 100%.
- the amount of habitat that would be protected where the sensitivity value is greater than 2.0 and recovery is in excess of 3.0 years is 6%.
- the amount of habitat that would be protected where the sensitivity value is greater than 2.75 and recovery is in excess of 2.75 years is 58%.

For nets:

- the amount of habitat that would be protected where the sensitivity value is greater than 0.75 and recovery is in excess of 1.25 years is 0%.
- the amount of habitat that would be protected where the sensitivity value is greater than 1.2 and recovery is in excess of 1.0 years is 37%.
- the amount of habitat that would be protected where the sensitivity value is greater than 1.5 and recovery is in excess of 1.5 years is 53%.

For pot/trap:

- the amount of habitat that would be protected where the sensitivity value is greater than 0.3 and recovery is in excess of 0.05 years is 36%.
- the amount of habitat that would be protected where the sensitivity value is greater than 0.4 and recovery is in excess of 0.4 years is 51%.
- the amount of habitat that would be protected where the sensitivity value is greater than 0.8 and recovery is in excess of 0.8 years is 6%.

For hook and line:

- the amount of habitat that would be protected where the sensitivity value is greater than 0.2 and recovery is in excess of 0.2 year is 100%.
- the amount of habitat that would be protected where the sensitivity value is greater than 0.3 and recovery is in excess of 0.3 year is 57%.
- the amount of habitat that would be protected where the sensitivity value is greater than 0.8 and recovery is in excess of 0.8 year is 6%.

4.4.15.3 Habitat for Individual Species/Life Stages Protected by the Final Preferred Alternative

Each alternative is analyzed for the extent to which it protects habitat for individual species/life stages of groundfish. This is accomplished through a GIS-based analysis in which the alternatives are overlaid with spatial profiles of suitable habitat for 168 individual species/life stages (out of 382 possible species life stage combinations, data is available for 168). A full discussion of how suitable was profiled is contained in the Risk Assessment (Appendix A).

Habitat Table 4-15 shows the habitat of individual species/life stages that would be protected by the final preferred alternative. The information is presented for 168 separate species/life stage combinations. To simplify this information, we performed a frequency distribution. We chose four categories of amount of habitat protected; 1-25%, 26-50%, 51-75%, and 76-100%. We then determined how many species/life stage combinations fell into each category as presented below. This tells us how many species are affected by the alternative, and how much of their habitat would be protected.

The final preferred alternative would protect: 0 species/life stage combinations would have 0% of their habitat protected; 124 species/life stage combinations would have up to 25% of their habitat protected; 44 species/life stage combinations would have up to 50% of their habitat protected; 0

species/life stage combinations would have up to 75% of their habitat protected; and 0 species/life stage combinations would have up to 100% of their habitat protected.

4.4.15.4 Habitat Types Protected by the Final Preferred Alternative

Habitat Table 4-16 compares the amount of biogenic and substrate habitat types that would be protected by the final preferred alternative. To simplify this information, we performed a frequency distribution. We chose four categories of amounts of substrate or biogenic habitat that would be protected: 1-25%, 26-50%, 51-75%, and 76-100%. We then determined how many substrate types or biogenic habitat types fell into each category as presented below. This tells us how many substrate types or biogenic habitat types are affected by the alternative, and how much of each would be protected. For uncategorized amounts, see habitat table 4-16.

In the Oregonian zoogeographic province (north of Point Conception, California), the final preferred alternative to minimize adverse fishing effects to EFH protects:

- 1 substrate habitat types would have 0% of their area protected; 2 substrate types would have up to 25% of their area protected; 5 habitat types would have up to 50% of their area protected; 6 habitat types would have up to 75% of their area protected; and 15 habitat types would have up to 100% of their area protected; and,

- estuary habitat would have 0% of their area protected, kelp would have 4% of their area protected, and seagrass would have 0% of their area protected.

In the San Diego zoogeographic province (south of Point Conception, California), the final preferred alternative to minimize adverse fishing effects to EFH protects:

- 1 substrate habitat types would have 0% of their area protected; 5 substrate types would have up to 25% of their area protected; 6 habitat types would have up to 50% of their area protected; 6 habitat types would have up to 75% of their area protected; and 11 habitat types would have up to 100% of their area protected; and,

- estuary habitat would have 0% of their area protected, kelp would have 6% of their area protected, and seagrass would have 12% of their area protected.

4.4.15.5 Qualitative Assessment of Each Component of the Final Preferred Alternative for Impacts Minimization

Gear Modifications and Prohibitions

The preferred alternative includes the following gear modifications and prohibitions:

> **Prohibit bottom trawl roller gear with a footrope diameter greater than 19 inches on bottom trawl gear throughout the EEZ (modification of Alternative C.9.1).**
>
> The benefits to habitat from prohibition of bottom trawl roller gear with a footrope diameter greater than 19 inches on bottom trawl gear throughout the EEZ can only be qualitatively assessed due to a lack of experimental data. It is widely held however that large roller gear (e.g. 19 inches and greater) allow trawlers to access more sensitive habitats. This premise is upheld by an OSU study that showed a potential redistribution of the trawl fishery away from rocky areas after implementation of regulations that prohibited large footrope gear in certain portions of the EEZ (Bellman 2004). Prohibition of roller gear would likely protect such habitats by making them inaccessible to trawlers; however, the benefit of prohibiting 19” roller gear versus 8” is not clear. It is likely that no immediate benefit would result from this

option because the gear is not widely used, if at all. The prohibition may however, prevent future access to sensitive habitats by trawlers with economic incentive to convert to larger footrope gear and for this reason is regarded as environmentally positive (E+).

Prohibit bottom trawl roller gear with a footrope diameter greater than eight inches eastward of a line approximating the 100 fathom depth contour (modification of Alternative C.2.1).

Prohibition of bottom trawl roller gear with a footrope diameter greater than eight inches eastward of a line approximating the 100 fathom depth contour creates gear restrictions that would have an overall positive effect on habitat, the ecosystem, and marine resources (E+). Prohibitions on large footrope trawl gear included under the final preferred alternative would likely have the effect of removing trawl effects from rocky habitats (Bellman 2004).

Prohibit dredge gear (Alternative C.9.5).

Although dredge gear is not currently utilized on the West Coast, the prohibition of dredge gear under the final preferred alternative is regarded as environmentally positive in that it would eliminate the possibility of it happening in the future (E+). Additional information on the environmental consequences of prohibiting dredge gear can be found in Section 4.4.9.9.

Prohibit beam trawl gear (Alternative C.9.6).

Limitations in direct scientific observation of beam-trawl effects allows only for a qualitative analysis of the predicted effects of the prohibition of beam trawl gear within the final preferred alternative. For purposes of the analysis, beam trawl is assumed to have similar effects to standard bottom trawl gear that rates relatively high in potential effect among all the gear types. Additional information on the environmental consequences of prohibiting beam trawl gear can be found in Section 4.4.9.11. A prohibition on beam trawl gear would likely result in reduced physical modification to bottom habitat and associated loss in benthic biodiversity and is therefore regarded as environmentally positive (E+).

Closed Areas

The final preferred alternative contains two types of closed areas: a "trawl footprint" closure and ecologically important closed areas. Maps of these areas can be found at Figures 4-1 through 4-6

Ecologically Important Closed Areas:

This component of the preferred alternative is a modification of Alternative C.10, C.12, and C.13. It also includes a new procedural element that was not described in the DEIS. It is similar to Alternative B.9, but applicable to areas closed to bottom trawl. The selection of the specific areas included in the final preferred alternative occurred through a collaborative process involving Oceana; groundfish trawl fishermen, organized by the Fishermen's Marketing Association; the Fisheries Heritage Group, bringing together harbor managers, the Nature Conservancy, Environmental Defense, the Center for Future Oceans, and fisheries representatives; Council advisory bodies; and West Coast states. As noted above, Oceana developed Alternative C.12 and the Council incorporated it into the DEIS. During the public comment period Oceana worked to modify the proposal they had developed based on new information they had gathered. At the same time, the Fishermen's Marketing Association developed a proposal for areas to be closed to bottom trawl that represented areas similar to those identified by Oceana but excluding areas judged by fishermen to be important fishing grounds. The Fisheries Heritage Group engaged in a similar exercise on the Central

California coast, identifying three areas between Monterey and Point Conception. All three groups submitted their proposals as part of public comment on the DEIS. During the June 2005 Council meeting, when the Council identified their preferred alternative, these groups worked with the Council's Groundfish Management Team and other state and federal officials to craft a joint proposal that best met their differing objectives. By combining the perspectives of these groups, the final preferred alternative is intended to be a practicable measure that balances the mandate to conserve EFH while taking into account the effects on fishing communities (as required by MSA National Standard 8).

The final preferred alternative incorporates the element of Alternative C.10 involving public-private partnerships under which private funds are used to purchase groundfish limited entry trawl licensees by adding language to the FMP by amendment. The proposed language notes the Council will support such efforts, as feasible, through their consideration of actions upon which the execution of contracts may be contingent.

4.4.15.6 Summary of Cumulative Effects of the Final Preferred Alternative on Habitat, the Ecosystem, and Marine Resources

The final preferred alternative represents a significant change from the status quo under which there are no measures in place to minimize adverse fishing effects on EFH. Under the final preferred alternative, a combination of gear restrictions, effort reduction, and closed areas would be implemented to protect a broad range of habitat types, species, and provide protection over both the Oregonian and San Diego zoographic provinces and is considered Environmentally Positive (E+). The cumulative effects of this alternative, in addition to all the factors described in Section 4.1.1.7, is positive because it would reduce use of bottom trawl gear that has the potential to adversely affect EFH.

4.5 Consequences of the Alternatives for Research and Monitoring (Alternatives D.1-D.4)

Environmental consequences of the Alternatives for Research and Monitoring (Alternatives D.1-D.4) can be found in the following sections: Section 4.5.1 through 4.5.4. Section 4.5.5 provides analysis of the environmental consequences of the Final preferred alternative for research and monitoring.

4.5.1 Consequences of Alternative D.1 (No Action)

This section provides an overview of the status of habitat-related research and monitoring on the West Coast.

4.5.1.1 Habitat and Associated Biological Research

The Risk Assessment involved a data consolidation phase in which the best available ecological, environmental, and fisheries information was reviewed and incorporated into appropriate databases, in consultation with scientific advisory committees and agency scientists. Specific information assembled into a GIS and applied to the identification and description of EFH alternatives includes West-coastwide distributions of:

- Benthic substratum types (including maps on data quality in some areas)
- Estuaries
- Canopy kelp
- Seagrasses

- Bathymetry
- Latitude

Also considered in identifying and describing EFH alternatives were data on:

- Presence/absence distribution of some structure-forming invertebrates
- A general description of pelagic habitats
- Associations among groundfish and benthic substratum types

The ultimate goal is to delineate EFH in terms of its contribution to rates of growth, reproduction, survival, and production of the diverse group of groundfishes on the West coast. Currently, our understanding of EFH for many of these groundfish species is based on the distribution of presence/absence data on late-juvenile and adult stages of the fishes and their associated habitats; data on habitat-specific densities is available for only a few species, and there is fewer data to evaluate habitat-specific productivity. Until the late 1980s/early 1990s, surveys of benthic marine habitats and associated groundfishes largely were limited to subtidal (<30 m water depth) observations (primarily by SCUBA), while most of the West coast groundfish species and fisheries occur in deeper water. Assessing attributes and functions of EFH remains especially difficult in deep-water marine environments because of these assessments require advanced and expensive technology such as remotely operated vehicles, manned submersibles, and other types of remote sensing devices.

There is a critical need for comprehensive, detailed, and accurate information on benthic habitats and associated groundfish assemblages on spatial scales relevant to fishery management and habitat protection. Development of more efficient and effective visual and acoustic methods to survey deepwater benthic habitats and fishes is ongoing, especially in complex, diverse habitats that are difficult to assess with conventional survey tools. Additionally, core nursery grounds and spawning areas, both benthic and pelagic, need to be identified for fully-informed protection of these areas to be considered. There also is a critical need to understand the relationship between large climate events and abundance, growth, spawning success, and survival of groundfish species.

Currently there are several efforts underway to create maps of seafloor habitats on the West coast, including those used here to identify EFH alternatives. These efforts have been facilitated by the development of a unifying seafloor classification system for benthic habitats (Greene et al. 1999, 2003). While these efforts represent the first delineation of rocky and unconsolidated seafloor substrata, they are just the first step in describing, quantifying, and understanding benthic habitats throughout the entire range of groundfish species on the West coast. These databases and maps currently are considered preliminary because of varying levels of data quality and verification (ground-truthing), as well as the limited spatial coverage of some of the information. Detailed mapping of groundfish habitat has been accomplished in relatively few important areas, such as offshore banks of the Southern California Bight, Monterey Bay, California, and Heceta Bank, Oregon, and is slowly being extended to other areas of the Coast. It is absolutely imperative that the databases and maps be revised and improved on a regular schedule as new information is collected, and that these valuable baseline habitat maps be maintained and made easily accessible to the greater marine resources community. These data are critical not only in the identification of EFH but in comparative risk assessment of anthropogenic impacts (e.g., fishing gears; pollution; dredging; etc.) to these habitats.

From past research we know that settled juveniles and adults of many species of groundfishes, rockfishes in particular, are difficult (or impossible) to accurately appraise with traditional survey methodologies such as surface-based fishing and acoustic gear. This is due to the close association between many of these species and their rugged, rocky heterogeneous habitats. Consequently, alternative techniques, using laser line systems and direct observations along quantitative transects conducted from submersibles in various habitats, are being developed to improve assessments over untrawlable habitats, characterize and conserve deep-water habitats, assist in designing and evaluating Marine Protected Areas, and track the recovery for some groundfish species. This approach is especially critical when focusing on benthic habitats of extreme heterogeneity and biological assemblages of high diversity.

Identifying EFH for pelagic groundfish life history stages is a critical line of research that is largely absent in the EFH assessment of alternatives. New technologies, such as airborne LIDAR, are being developed to identify near-surface pelagic stages of some species. Coastwide collection and modeling of relevant information, such as the multi-decadal databases developed from CalCOFI surveys of fish eggs and larvae and from mid-water surveys of newly recruited groundfishes and associated physical oceanographic aspects of habitat (i.e. temperature and salinity from shipboard and satellite remote sensing), are ongoing efforts to better understand the relationship between the structure and function of pelagic habitats and the recruitment, survival, and productivity of managed fish species. Enhanced oceanographic monitoring systems are being developed to meet the need to understand species and climate/ocean interactions in modifying groundfish production.

Research on the distribution and function of structure-forming invertebrates, particularly as components of EFH for groundfish, is just beginning. Only since December 2003 did scientific and technical information on presence/absence distribution and habitat associations of some of these species become available for inclusion in this EIS. Ongoing research includes the systematics, distribution, and abundance of structure-forming invertebrates (particularly corals, sponges, anemones, sea pens, etc.) in deep water. A critical need is to understand the potential role of these species as groundfish EFH in continental shelf and slope ecosystems. Because these large invertebrates enhance the diversity and structural component of fish habitat and are vulnerable to impacts by at least some fisheries, they may signify HAPC.

4.5.1.2 Research on Anthropogenic Impacts to EFH

The evaluation of anthropogenic impacts to EFH in this EIS was based on sensitivity indices of various types of benthic habitats to disturbance or influence by various types of fishing gears, and on rates of recovery from such disturbances. These indices and rates were estimated from limited information, much of which derived from studies conducted outside our West coast region of interest.

Research on impacts of fishing to groundfish habitat should include objectives to improve our understanding of the ecological effects of fishing on the biodiversity and trophodynamics of ecosystems, the evaluation of gear impacts to marine benthic habitats on the shelf and slope, and the development of ways to reduce adverse impacts, including the use of marine protected areas, modified fishing gear, and bycatch information. To date, the best available science on fishing impacts to benthic habitats is limited to observations of modification to some physical components of habitats and associated changes in biodiversity. Understanding functional impacts (i.e. how physical modification of the ecosystem effects groundfish productivity) begins with the baseline characterization and cataloging of habitats that is described in this document.

Some critical research needs related to fishing impacts and groundfish populations include:

- estimating rates of impacts of specific fishing gears on the diverse habitat types found on the West coast;
- estimating the rates of habitat recovery from both chronic and acute disturbances;

- quantifying population and ecosystem effects resulting from fishing impacts;
- describing trophodynamic changes related to fishing impacts;
- evaluating the role of MPAs in management of fisheries and habitats; and
- evaluating the influence of MPAs on production, rebuilding, and long term sustainability of groundfish.

4.5.2 Consequences of Alternative D.2 (Expanded Logbook Program)

Currently, groundfish limited entry trawl vessels are required to record information on the time and location of fishing activities, along with estimates of catch composition, in a logbook. Some of these data are entered into the Pacific Fisheries Information Network (PacFIN) data system and may be accessed by managers. Information on fishing location, albeit limited because only tow set positions have been entered into the database, has proved invaluable to managers. Tow haul positions are now being incorporated into the database as well, to provide additional spatial information on fishing location. Knowing the spatial distribution of fishing effort is especially important to an evaluation of the effects of fishing on EFH. One of the most important data gaps hampering the full development of the fishing impacts model component of the comprehensive risk assessment has been the paucity of this kind of information. Under this alternative vessels in all commercial sectors, including recreational charter (for hire) boats, will participate in an expanded logbook program.

> **Option D.2.1**: All fishing vessels maintain a logbook, recording information on fishing time, location, and catch composition similar to the current trawl logbook program.
>
> **Option D.2.2**: A representative, random sample of all fishing vessels is required to maintain logbooks, gathering the information described above.

Both options are regarded as Environmentally Positive (E+) with D.2.1 being slightly more so due to the potential for it to reduce scientific uncertainty associated with random sampling.

4.5.3 Consequences of Alternative D.3 (Expanded VMS Program)

Combining VMS data with logbook and observer data would likely result in a more complete picture of fishing activities, although information contained in observer data is not currently used in regard to monitoring or reviewing fishing location or effort. The key piece of information provided by VMS would be a higher resolution track line of a trawl or fixed gear set. In the past, PacFIN records only included trawl set positions; this limits the ability to determine precisely where fishing impacts have occurred. For example, in the Risk Assessment, information on set positions from logbooks was generalized to ten-minute by ten-minute blocks because of uncertainty about the track line of the trawls. This was one of the considerations that led the SSC not to approve the fishing impact model component of the Risk Assessment. The Council and NMFS have also been considering expanding the VMS program to additional sectors to, among other uses, monitor and evaluate the effects of fishing on groundfish habitat. This alternative is regarded as Environmentally Positive (E+) as it would foster a more complete, and less uncertain, understanding of where habitat impacts are occurring.

4.5.4 Consequences of Alternative D.4 (Research Reserve System)

If fishing is restricted in specific areas to minimize fishing impacts on habitat, some of those areas could be used to measure the length of time needed for habitat features and function to recover. Over time these sites could also be compared with sites where fishing is ongoing in order to research the effects of fishing. This alternative will establish a system of research reserves within closed areas established as part of any of the fishing impacts minimization alternatives. These research reserves will help to focus research efforts. By encouraging research in a discrete set of reserve areas, results can be more easily compared. A reserve system could include a representative sample of habitat types in order to allow comparison of the effects of fishing across these different types. This alternative is regarded as Environmentally Positive (E+).

4.5.5 Consequences of the Final Preferred Alternative for Research and Monitoring

The final preferred alternative for research and monitoring incorporates components of D-2, D.3, and D.4. A complete analysis of the environmental consequences of these alternatives is included in Section 4.4.9 through 4.4.14. The final preferred alternative is considered Environmentally Positive (E+).

4.6 Consequences of the Alternatives on Protected Species

The following sub-section 4.6.1 through4.6.4, examines interactions between protected species and groundfish fisheries under the alternatives being considered in this EIS.

4.6.1 Effects on Pacific Salmon

NMFS prepared a Biological Opinion (BO) in 1992 that analyzed the effects of the West Coast groundfish fishery on salmon stocks listed under the ESA established limits to bycatch of chinook salmon. Currently the limit is set at 0.05 chinook salmon per metric ton of Pacific whiting, with an associated total catch of 11,000 chinook for the coastwide Pacific whiting fishery. This BO was subsequently reviewed and the allowable chinook catch level reaffirmed in 1993, 1996 and 1999 and is currently under review for 2005.

The BO also requires the Council to provide for monitoring of salmon bycatch in the midwater trawl fishery for whiting, but not in the bottom trawl fishery for groundfish. Currently, this monitoring requirement is based on not jeopardizing the existence of listed salmon species, including the Snake River fall chinook, lower Columbia River chinook, upper Willamette River chinook, and Puget Sound chinook. At present, the at-sea whiting fishery has 100% observer coverage. In recent years, a cooperative voluntary effort between the fishing industry and management agencies has been implemented to facilitate observer coverage and collect information on directed whiting landings at shoreside processing plants. Participating vessels are issued Exempted Fishing Permits (EFPs), which allow vessels to land unsorted catch at designated processing plants. Permitted vessels are not penalized for landing prohibited species, including Pacific salmon, nor are they held liable for overages of groundfish trip limits. In 2003, 99% of the whiting catch by the shoreside fishery was landed under an EFP.

The EFH and HAPC alternatives are not likely to adversely affect salmon or adversely modify critical habitat; or, if the alternatives result in improved habitat conditions the effect would be Environmentally Positive (E+). The impacts minimization alternatives may result in geographic redistribution of fisheries that could have positive, negative, or no effects on salmon. It is not possible to say how the fishery would redistribute under closed area or gear restriction alternatives and therefore the effects to salmon are considered Unknown (U).

The final preferred alternative incorporates components of the original alternatives. Therefore the effects on salmon for the final preferred EFH and HAPC alternative are Environmentally Positive (E+) and the effects to salmon from the preferred impacts minimization alternative are Unknown (U).

4.6.2 Effects on Seabirds

Interactions between seabirds and fishing operations are wide-spread and have led to conservation concerns in many fisheries throughout the world. Abundant food in the form of offal (discarded fish and fish processing waste) and bait attract birds to fishing vessels. Of the gear used in the groundfish fisheries in the North Pacific, seabirds are occasionally taken incidentally by trawl and pot gear, but they are most often taken by longline gear. Around longline vessels, seabirds forage for offal and bait that has fallen off hooks at or near the water’s surface, and are attracted to baited hooks near the water’s surface, during the setting of gear. If a bird becomes hooked while feeding on bait or offal, it can be dragged underwater and drowned.

Besides entanglement in fishing gear, seabirds may be indirectly affected by commercial fisheries in various ways. Change in prey availability may be linked to directed fishing and the discarding of fish and offal. Vessel traffic may effect seabirds when it occurs in and around important foraging and breeding habitat and increases the likelihood of bird strikes. In addition, seabirds may be exposed to at-sea garbage dumping and the diesel and other oil discharged into the water associated with commercial fisheries.

In the West Coast groundfish fisheries, groundfish observers collect information on interactions between seabirds and groundfish fisheries. Catcher-processors and motherships participating in the Pacific whiting fishery have had full observer coverage since the mid-1970s. The non-whiting portion of the groundfish fishery has had observer coverage only since the fall of 2001. Between September 2001 and October 2002, approximately 10% of the coastwide limited entry trawl landed weight and 30% of the limited entry fixed gear landed weight was observed.

The incidental take of seabirds by the at-sea whiting fleet is rare and infrequent. The species that have been taken by the at-sea whiting fleet include black-footed albatross, northern fulmar, and unidentified puffin. In the limited entry groundfish fisheries, very few interactions with seabirds have been observed.

In response to increased national concern about the incidental take of seabirds, NMFS, USFWS, and the Department of State collaborated in 2001 to develop the U.S. *National Plan of Action for Reducing the Incidental Catch of Seabirds in Longline Fisheries*. The purpose of this plan is to provide national-level policy guidance on reducing the incidental take of seabirds in U.S. longline fisheries and to require NMFS, in cooperation with USFWS, to conduct an assessment of all U.S. longline fisheries to determine whether an incidental take problem exists. Using the West Coast Groundfish Observer Program’s first year of data, NMFS drafted a preliminary assessment of seabird interactions with the groundfish longline fleet in 2003. There were no incidental takes of seabirds by longline vessels documented by NMFS groundfish observers during September 2001 to October 2002; however, a number of interactions between seabirds and longline vessels were observed (see Table 4.3.8). Additionally, this National Plan of Action further requires NMFS, in cooperation with USFWS, to work through the regional fishery management council process in partnership with longline fishery representatives to develop and implement mitigation measures in those fisheries where the incidental take of seabirds is a problem. Therefore, NMFS will continue to work with the

USFWS to better understand the interactions between seabirds and the groundfish fisheries and evaluate the need for seabird incidental take mitigation and management measures.

In order to predict the effects of the bycatch reduction alternatives on West Coast seabird populations, it is important to have knowledge of the distribution, intensity, and duration of fishing effort associated with the groundfish fisheries. This information is currently unavailable for the groundfish fleet.

NMFS prepared a Biological Opinion in 1990 that concluded the groundfish fisheries are not likely to jeopardize the continued existence of listed seabirds. The EFH and HAPC alternatives are not likely to have an effect on seabirds; or, if the alternatives result in improved habitat conditions the effect would be Environmentally Positive (E+). The effect of the impacts minimization alternatives on seabirds (listed and non-listed) may be negative if fishing effort intensifies in areas where seabirds congregate. However, the effects of the alternatives on effort displacement are not predictable and the effects of the alternatives are Unknown (U).

The final preferred alternative incorporates components of the original alternatives. Therefore the effects on seabirds for the final preferred EFH and HAPC alternative are Environmentally Positive (E+) and the effects to seabirds from the preferred impacts minimization alternative are Unknown (U).

4.6.3 Effects on Marine Mammals

NMFS prepared a Biological Opinion in 1990 that concluded the groundfish fisheries are not likely to jeopardize the continued existence of listed marine mammals. The EFH and HAPC alternatives are not likely to have an effect on marine mammals; or, if the alternatives result in improved habitat conditions the effect would be Environmentally Positive (E+). The effect of the alternatives on marine mammals may be negative if fishing effort intensifies in areas where the animals congregate. However, the effects of the alternatives on effort displacement are not predictable and the effects of the alternatives are Unknown (U).

The final preferred alternative incorporates components of the original alternatives. Therefore the effects on marine mammals for the final preferred EFH and HAPC alternative are Environmentally Positive (E+) and the effects to marine mammals from the preferred impacts minimization alternative are Unknown (U).

Species-specific concerns are addressed below.

California Sea Lion - Incidental mortalities of California sea lions have been documented in set and drift gillnet fisheries (Carretta et al. 2001; Hanan et al. 1993). Skippers logs and at-sea observations have shown that California sea lions have been incidentally killed in Washington, Oregon, and California groundfish trawls and during Washington, Oregon, and California commercial passenger fishing vessel fishing activities (Carretta et al. 2001). Total human-caused mortality (1,352 sea lions) is less than the 6,591 sea lions allowed under the Potential Biological Removal formula (Carretta et al. 2001).

Harbor Seal - Combining mortality estimates from California set net, northern Washington marine set gillnet, and groundfish trawl results in an estimated mean mortality rate in observed groundfish fisheries of 667 harbor seals per year along Washington, Oregon, and California (Carretta et al. 2001).

Northern Elephant Seal - There are no recent estimated incidental kills of Northern elephant seals in groundfish fisheries along Washington, Oregon, and California, however they have been caught in set net fisheries (Carretta et al. 2001).

Guadalupe Fur Seal - There have been no U.S. reports of mortalities or injuries for Guadalupe fur seals (Cameron and Forney 1999; Julian 1997; Julian and Beeson 1998), although there have been reports of stranded animals with net abrasions and imbedded fish hooks (Hanni et al. 1997).

Northern Fur Seal - There were no reported mortalities of northern fur seals in any observed fishery along the West Coast of the continental U.S. during the period 1994-1998 (Carretta et al. 2001), although there were incidental mortalities in trawl and gillnet fisheries off Alaska (Angliss and Lodge 2002).

Eastern Stock Steller Sea Lion - These have been observed taken incidentally in WA/OR/CA groundfish trawls and marine set gillnet fisheries (Angliss and Lodge 2002). Total estimated mortalities of this stock (44) is less than the 1,396 Steller sea lions allowed under the Potential Biological Removal formula (Angliss and Lodge 2002).

Southern Sea Otter - During the 1970s and 1980s considerable numbers of sea otters were observed caught in gill and trammel entangling nets in central California. During 1982 to 1984, an average of 80 sea otters were estimated to have drowned in gill and trammel nets (Wendell et al. 1986). This was projected as a significant source of mortality for the stock until gill nets were prohibited within their feeding range. More recent mortality data (Pattison et al. 1997) suggest similar patterns during a period of increasing trap and pot fishing for groundfish and crabs (Estes et al. In Press). This elevated mortality appears to be the main reason for both sluggish population growth and periods of decline in the California sea otter population (Estes et al. In Press).

Sea Otter (Washington Stock) - Gillnet and trammel net entanglements were a significant source of mortality for southern sea otters (Wendell et al. 1986) and some sea otters were taken incidentally in set nets off Washington (Kajimura 1990). Evidence from California and Alaska suggests that incidental take of sea otter in crab pots and tribal set-net fisheries may also occur. Sea otters are also quite vulnerable to oil spills due to oiled fur interfering with thermoregulation, ingested oil disintegrating the intestinal track, and inhaled fumes eroding the lungs (Richardson and Allen 2000).

Harbor porpoise - Harbor porpoise are very susceptible to incidental capture and mortalities in set net fisheries (Julian and Beeson 1998). Off Oregon and Washington, fishery mortalities of harbor porpoise have been recorded in the northern Washington marine set and drift gillnet fisheries (Carretta et al. 2001). However, these fisheries have largely been eliminated.

Dall's porpoise - Observers document that Dall's porpoise have been caught in the California, Oregon and Washington domestic groundfish trawl fisheries (Perez and Loughlin 1991) but the estimated annual take is less than two porpoise per year.

White-sided Dolphin - Observers have documented mortalities in the California, Oregon, and Washington groundfish trawl fisheries for whiting (Perez and Loughlin 1991). The total estimated kill of white-sided dolphins in these fisheries averages less than one dolphin per year (Carretta et al. 2001).

Risso's Dolphin - There have been no recent Risso's dolphin moralities in West Coast groundfish fisheries (Carretta et al. 2001), although Reeves et al. (2002) report that Risso's are a bycatch in some longline and trawl fisheries.

Common Dolphin - Common dolphin mortality has been estimated for set gillnets in California (Julian and Beeson 1998); however, the two species (short-beaked and long-beaked) were not reported separately. Reeves et al. (2002) relate that short-beaked common dolphins are also a bycatch in some trawl fisheries.

Short-finned Pilot Whale - Total human-caused mortality (3) of this species is less than the 6 short-finned pilot whales allowed under the Potential Biological Removal formula (Carretta et al. 2001).

Eastern Pacific Gray Whale - These have been an incidental catch in set net fisheries, but there have been no recent takes in groundfish fisheries (Angliss and Lodge 2002).

Minke Whale Minke whales have occasionally been caught in coastal gillnets off California (Hanan et al. 1993), in salmon drift gillnet in Puget Sound, Washington, and in drift gillnets off California and Oregon (Carretta et al. 2001). There have been no recent takes in groundfish fisheries off California , Oregon, or Washington (Carretta et al. 2001).

Sperm Whale - There are no recent observations of sperm whale incidental catches in West Coast groundfish fisheries.

Humpback, Blue, Fin, and Sei Whales - There are no recent observations of incidental catches of these species in West Coast groundfish fisheries.

Killer Whale - The only incidental take recorded by groundfish fishery observers was in the Bering Sea/Aleutian Islands (BSAI) groundfish trawl (Carretta et al. 2001). There are also reports of interactions between killer whales and longline vessels (Perez and Loughlin 1991). (Longline fishers in the Aleutian Islands reported several cases where orcas removed sablefish from longlines as the gear was retrieved.) There are no other reports of killer whale takes in West Coast groundfish fisheries (Carretta et al. 2001).

California Coastal Bottlenose Dolphin - Due to its exclusive use of coastal habitats, this bottlenose dolphin population is susceptible to fishery-related mortality in coastal set net fisheries. However, from 1991-94 observers saw no bottlenose dolphins taken in this fishery, and in 1994 the state of California banned coastal set gillnet fishing within 3 nm of the southern California coast. In central California, set gillnets have been restricted to waters deeper than 30 fathoms (56 m) since 1991 in all areas except between Point Sal and Point Arguello. These closures greatly reduced the potential for mortality of coastal bottlenose dolphins in the California set gillnet fishery.

4.6.4 Effects on Sea Turtles

Numerous human-induced factors have adversely effected sea turtle populations in the North Pacific and resulted in their threatened or endangered status (Eckert 1993; Wetherall et al. 1993). Documented incidental capture and mortality by purse seines, gillnets, trawls, longline fisheries, and other types of fishing gear adversely effect sea turtles, however the relative effect of each of these sources of effect on sea turtles is difficult to assess (NMFS and USFWS 1998a; 1998b; 1998c; 1998d). Each of the sea turtle species that might interact with groundfish fisheries is listed. Little data are available estimating total annual mortalities except in the drift gillnet fishery, which is not part of the groundfish FMP. None of the alternatives is expected to result in any effects on these species. NMFS prepared a Biological Opinion in 1990 that concluded the groundfish fisheries are not likely to jeopardize the continued existence of listed sea turtles. The EFH and HAPC alternatives are not likely to have an effect on sea turtles; or, if the alternatives result in improved habitat conditions the effect would be Environmentally Positive (E+). The effect of the impacts minimization alternatives may be negative if fishing effort intensifies in areas where the animals congregate. However, the effects of the alternatives on effort displacement are not predictable and the effects of the alternatives are Unknown (U).

The final preferred alternative incorporates components of the original alternatives. Therefore the effects on sea turtles for the final preferred EFH and HAPC alternative are Environmentally Positive (E+) and the effects to sea turtles from the preferred impacts minimization alternative are Unknown (U).

Species-specific information is discussed below.

Loggerhead - The primary fishery threats to the loggerheads in the Pacific are pelagic longline and gillnet fisheries (NMFS and USFWS 1998c). These gears are not used for taking groundfish.

Leatherback - Primary threats to leatherbacks in the Pacific are the killing of nesting females and eggs at nesting beaches and incidental take in coastal and high seas fisheries (NMFS and USFWS 1998b). Groundfish fishing operations are not known to effect this species.

Olive Ridley - Occasionally these turtles are found entangled in scraps of net or other floating debris. Although they are generally thought to be surface feeders, olive ridleys have been caught in trawls at depths of 80-110 meters (NMFS and USFWS 1998d).

4.7 Consequences of the Alternatives to Minimize Adverse Fishing Impacts to EFH (Alternatives C.1-C.14) on the Socioeconomic Environment

This section summarizes the effect of the alternatives on the socioeconomic environment. This section is divided into portions that address the alternatives associated with designating EFH and HAPC areas, alternatives to minimize adverse impacts from fishing, and alternatives for researching and monitoring. The designation of EFH and HAPC areas is largely analyzed from the standpoint of consultation activities on the part of appropriate agencies since designation in itself does not necessarily trigger an action.

Ideally, a summation of social, physical, and biological costs and benefits would allow for a comparison of the net effect of each alternative. Many factors would work to change the effects associated with habitat protection. For example, a protection measure may cause negative effects in the form of displaced or lost revenues associated with fishing activity in the short-run, but the protection of that habitat may result in increased production from ecosystem based services and/or an increase in stock productivity and fishery yields over the longer term. Estimating potential benefits that may be related to stock productivity ultimately depends on the relation between habitat protection, biological productivity, and the ability of fishers to successfully target and harvest stocks whose populations may increase. Unfortunately, research quantifying potential increases in the stocks of species resulting from habitat protection does not currently exist in a manner that can be used for this analysis.

Habitat protection may induce increases in non-fishing or non-use benefits, such as an increase in ecosystem-based services. An ecosystem-based service could be described as a natural benefit to society that the ecosystem provides. Some examples may include clean water, clean air, and–in the case of a marine environment–a kelp forest that reduces the impact of storm waves on coastal property. Several studies have been done attempting to value ecosystem based services for example, but such analysis is generally fraught with uncertainties and is extremely difficult to estimate. At this time, sufficient information does not exist on non-fishing and non-use values to draw quantitative conclusions regarding the outcomes of a change in such values related to habitat protection. Due to the lack of existing data on habitat management, its relationship to social and economic considerations, and available time and resources, an estimation of values attributed to habitat protection would be outside the scope of this EIS.

Due to data limitations, the ability to estimate net effects is restricted, and in many instances the analysis is reduced to one that is largely qualitative. However, qualitative information used in this document may still be considered scientific in nature, though an assessment of which alternatives are most or least beneficial may ultimately depend on how the reader weighs certain effects and the portion of the environment that effect is attributed to.

This section is organized in a manner that introduces the reader to the concepts that are used in the alternatives for designating, protecting, and researching EFH; describes the reasonably foreseeable effects on portions of the socioeconomic environment; analyzes the application of the described concepts in the context of each alternative; and provides a description of the cumulative effect of the alternatives. These sections are designed for comparison against the no action alternative.

4.7.1 Concepts Addressed in Analytical Sections

This section describes the concepts that are associated with the alternatives analyzed in this EIS and the general influence that they have on the socioeconomic environment. The alternatives analyzed in this EIS can be categorized as 1) EFH and HAPC designation, 2) minimizing fishing impacts on EFH, and 3) research and monitoring. Within each of these categories are concepts that are analyzed as common themes or management tools for use in addressing a topic. Concepts include consultation activities associated with the designation of EFH and HAPC; the use of area closures, gear modifications, gear restrictions, effort reduction, and zoning as tools for minimizing fishing effects to EFH; and the relationship of research reserves, logbooks, and vessel monitoring systems to research and monitoring alternatives.

The general themes in the impacts minimization alternatives include area closures; gear restrictions, modifications, and incentives; and fishing zones. This section briefly discusses the approach of those tools, their relationship to marine and fishery management, and their general effect on the socioeconomic environment.

4.7.1.1 Area Closures

The approach of an area closure would be to limit some or all gear types within that area in order to protect habitat. These areas may be discrete areas similar to the YRCA and CCA, or they may be large areas similar to the RCA. These areas would differ from current area closures, which are designed to minimize the incidental take of rebuilding species, because these habitat protection areas would have immobile boundaries and would apply more generally to gear types. For example, current regulations do not allow limited entry bottom trawl effort within the rockfish conservation areas, but shrimp trawling is allowed. An area proposed for closure for habitat purposes that excludes bottom trawling would presumably exclude both limited entry and shrimp trawl gear, along with any other type of trawl designed to touch ocean bottom.

An area closure would exclude all or certain types of gears that may potentially fish that area. In many instances, areas proposed for closure would displace vessels that currently fish those areas and–as a result–effort would likely increase in other portions of the West Coast EEZ. A shift in effort or fishing location may change the cost associated with fishing activity. In addition, catch and revenues that have historically occurred in habitat protection closed areas may be made up in other areas, or that catch may–all or in part–be lost. In this document, revenues that may be displaced are referred to as “displaced revenues” or revenues put “at risk”.

4.7.1.2 Gear Restrictions and Modifications

In general, gear restrictions are described as cases where certain gears are prohibited. A gear modification is where there are qualifications on the type of gear used. Gear incentives can be described as a case where there are incentives to encourage the use of certain gear types. The intention of gear requirements is to lessen the effect certain gears may have on habitat. A gear prohibition would eliminate that gear entirely, a gear modification may tend to make it more difficult for fishers to access certain areas, and gear incentives allow or encourage fishers to use gears that may cause less of an effect on groundfish habitat. For example, a qualification on the size of footrope used in bottom trawl gear would make it more difficult for trawlers to access areas with high relief substrate, thereby lessening the amount of fishing activity that occurs in more rocky areas.

Like an area closure, a gear requirement may also put revenues at risk. If a gear restriction is put in place, productive areas that have historically been fished may become inaccessible.

4.7.1.3 Effort Reduction

Effort reduction is designed to reduce the intensity of fishing effort; thereby lessening the amount of impact fishing has on habitat. Effort reduction can be accomplished through several means, including: limiting the number of hours vessels can fish, limiting the catch that vessels can retain, or reducing the number of vessels -- so long as there is no subsequent increase in effort from vessels remaining in that area. Effort reduction can have impacts in the form of reduced revenue on the part of vessels and fishing communities, and reductions in the amount of landings to processors.

4.7.1.4 Fishing Zones

Fishing zones establish areas where certain gears are allowed to fish and restrict those gears from other areas. Fishing zones behave similarly to area closures in that if gears were restricted from fishing areas where they have historically fished, revenues would be put at risk, and aggregate effort would increase in areas remaining open to certain gear types.

4.7.1.5 Prey Species

The NMFS final rule for implementing regulations to protect EFH specifies harvest limits for prey species as one potential means of protecting EFH. To the extent that prey is viewed as habitat, this EIS has analyzed the impact of prohibiting the take of krill which is a prey species for many marine species including groundfish. A fishery for prey species would reduce the amount of feed available for species that require that prey for sustenance, and a reduction in the population of available prey is therefore likely to reduce the survivability of organisms higher in the food chain.

4.7.2 Reasonably Foreseeable Effects on the Socioeconomic Environment

4.7.2.1 Reasonably Foreseeable Effects on West Coast Trawl Fisheries

Rebuilding overfished species are expected to continue to play a central role in the management of West Coast trawl fisheries. Although the manner in which overfished species are managed may presumably change, in the short-run, closed areas, constraining cumulative limits, and various gear requirements are expected to be central tools for management. However, limited entry trawl vessels are also expected to attain higher net revenues from groundfish. As a result of the trawl vessel buyback, there are fewer limited entry trawl vessels targeting groundfish, and bimonthly cumulative limits have increased as a result. In addition, new trawl technology that reduces the take of overfished species that co-occur with target species is expected to result in higher catch and revenue for vessels that target flatfish along the continental shelf.

In the long-run, different bycatch management tools may play a larger role. For example, as part of its preferred alternative for managing bycatch, the PFMC adopted a dedicated access privilege system as a long-term strategy for managing bycatch in the limited entry trawl fishery. In the long-run, a dedicated access privilege system may allow closed areas, gear requirements, and constraining cumulative limits to be of less importance as a management tool. Although there has been some discussion on imposing limited entry on the open access fleet, open access trawl fisheries are expected to remain in status quo for at least the short-term, meaning that rockfish excluder devices are expected to continue to be required for pink shrimp trawl vessels, and RCAs are expected to be applied to other exempted trawl gear.

4.7.2.2 Reasonably Foreseeable Effects on West Coast Fixed Gear Fisheries

Overfished species are expected to continue to play a central role in the management of West Coast fixed gear fisheries, though this is likely to affect the various fixed gear sectors differently. Although the way in which rebuilding species are managed may presumably change, in the short-run, closed areas and constraining cumulative limits are expected to be central tools for management of groundfish-based fixed gear fisheries. Non-groundfish fixed gear fisheries are largely expected to remain as status quo. Dedicated access privileges have not been considered for fixed gear fisheries.

4.7.2.3 Reasonably Foreseeable Effects on West Coast Recreational Fisheries

Restrictions on the recreational fishery due to overfished species concerns are expected to continue. Catch sharing agreements between states are also expected to continue, and both of these concerns mean that it is likely restrictions and current tools used to manage recreational groundfish fisheries will continue.

4.7.2.4 Reasonably Foreseeable Effects on Other Fisheries

Other fisheries of interest to groundfish EFH include any fishing activity occurring within the action area that may have an influence on EFH. Many of these fisheries are described in the effected environment (Chapter 3). Possible future effects on other fisheries are vast, and researching the many types of fishing activities along with foreseeable effects on those fisheries is not feasible given available resources, though some information is available for particular fisheries that qualify as other fisheries.

4.7.2.5 Reasonably Foreseeable Effects on Seafood Processors

The seafood processing industry has been consolidating, with the majority of processing capacity now located in a handful of ports and companies. Interest in relatively small value-added processing facilities has been growing, and some small processors have developed in recent years that specialize in certain species or product forms. The future of processing operations along the West Coast is largely conditional on available product quantity and the relationship between the harvester and buyer. Assuming that harvester-buyer relationships do not change, some processing consolidation may continue to occur in order to bring processing capacity in line with available landed catch quantities; but the degree of this consolidation is likely to be less than in the recent past since the decline in groundfish landings seems to have slowed or stopped in recent years. Notably, the Port of Astoria recently announced plans to develop processing and storage operations, largely in response to recent increases in Pacific sardine harvests. There continues to be interest in development of specialized processing activity by ports and community leaders, meaning some growth in small processing may occur in addition to Port of Astoria development.

4.7.2.6 Reasonably Foreseeable Effects on Fishing Communities

Many West Coast communities are expected to continue growing and expanding their economic base, especially in the areas of tourism and development of vacation and retirement homes. This should reduce the reliance those communities have on fishing. The portion of communities engaged in fishing will likely remain tied to the profitability and size of the fishing fleet, the quantity of fish being landed, and the profitability and number of shoreside processors.

4.7.2.7 Reasonably Foreseeable Effects on Non-Fishing Activities

Insufficient data and information is available about the numerous non-fishing activities discussed to adequately assess reasonably foreseeable trends in those industries. However population and income growth generally are expected to increase demand for recreational fishing as well as non-consumptive activities such as whale watching, kayaking and diving.

4.7.3 Consequences of the Impacts Minimization Alternatives on the Socioeconomic Environment

This section analyzes the effects of the impact minimization alternatives on the socioeconomic environment. Quantitative measures are provided where data is available to assist the reader in determining effects to the sectors of the socioeconomic environment outlined previously. Where data is not available, a qualitative discussion is provided.

The most consistent quantitative measure of alternative effects to fishing activity is displaced exvessel revenue to the limited entry trawl fleet. Socioeconomic Table 4-2 shows displaced trawl revenues for each alternative over a four-year period to illustrate the possible effects under alternatives on the trawl fleet. Impacts in Socioeconomic Table 4-2 are differentiated by the amount of revenues at risk if an entire 10x10 minute block were to be closed, and the amount of revenues at risk if revenues attributed to those 10x10 block areas are proportioned based on the criteria defining the area closure. The reader is also encouraged to read the discussion associated with each alternative as there are many other sectors and related impacts associated with those alternatives that are not captured in Socioeconomic Table 4-2. For example, although alternatives are likely have an effect on the cost of fishing, data does not exist to estimate those possible changes, so the description of alternative effects addresses potential changes in costs in a qualitative manner where possible changes can be identified.

Socioeconomic Table 4-3 summarizes the effect of each Council preferred impacts minimization alternative. These summary effects are compared against the no action alternative. Again, the reader is encouraged to read the discussion associated with each alternative as there are many factors associated with the summary determination described in the table

4.7.3.1 Alternative C.1

No action alternative (0)

4.7.3.1.1 Impact to the Socioeconomic Environment

In the short run, this alternative may have no impact on the socioeconomic environment, but if current practices harm the environment and if loss of habitat continues, then there will be negative effects in the long-run on fishermen, processors, communities, and non-market values.

4.7.3.2 Alternative C.2

Depth based gear restrictions

4.7.3.2.1 Option C.2.1

Prohibit the use of large footrope trawl gear shoreward of 200 fm and prohibit all fixed gear shoreward of 100 fm north of 40°10’ N latitude and 150 fm south of 40°10’ N latitude. (E-)

4.7.3.2.1.1 Impacts to Fisheries

This option is expected to behave in a manner similar to status quo for trawl vessels. Although large footrope trawl gear was permitted to depths as shallow as 150 fathoms during part of 2004, large amounts of trawl effort and catch have occurred at depths of 200 fathoms or more in recent years. If depths shallower than 200 fathoms are closed to large footrope gear, trawl vessels may be more constrained and incur higher costs than they are currently (E-).

Depth based fixed gear restrictions would tend to reduce the catch of shelf groundfish species and may eliminate some non-groundfish fixed gear fisheries, such as the Dungeness crab fishery for example–which is one of the largest fisheries on the West Coast. During the years 2001–2003, the exvessel value of Dungeness crab landings ranged from $52.3 million to $116.98 million (E-).

If VMS is required to monitor compliance with the closed areas, vessels that do not already carry VMS may be forced to incur costs on the order of $1,550 - $5,295 to purchase a unit; $120 of annual maintenance; and $1 - $5 per day for the cost of transmitting location (NMFS July 2003).

This alternative may create negative distributional and spillover effects. Vessels that obtain a large portion of their income from Dungeness crab fishing would see a larger reduction in revenues compared to vessels that do not participate in crab fisheries. Vessels that engage in the Dungeness crab fishery may switch to other fisheries in an attempt to make up lost revenues. If those vessels switch to other fisheries, vessels currently engaged in those other fisheries would be adversely affected through competition and a reduction in available fishery resource per vessel. Unfortunately, it is not possible to predict which fisheries those vessels may switch to.

4.7.3.2.1.2 Impacts on Management and Enforcement

Under option C.2.1, monitoring and enforcement would be required to verify that gear types were not being used within prohibited areas. Presumably this effort would be in addition to monitoring and enforcement of the existing RCAs (U).

4.7.3.2.1.3 Impacts to Consumers, Processors, and Communities

Under option C.2.1, the Dungeness crab fishery may be effectively closed. The West Coast Dungeness crab fishery provides a large source of Dungeness crab landings worldwide, so the elimination of this fishery would likely effect consumers in a negative fashion. Processors and communities that are directly engaged in activities related to the Dungeness crab fishery would also be adversely effected (E-).

4.7.3.2.1.4 Impacts on Safety

Effects to safety are likely to occur if there is a reduction in vessel net revenues, if vessels are forced to fish under more hazardous conditions, or if vessels are required to carry additional safety equipment. Under option C.2.1 vessels are not being forced to fish in more hazardous conditions, but it is likely some vessels will see a reduction in vessel net revenues. Vessels that are required to carry a VMS may see increases in safety since a vessel in distress may be more easily located if it has VMS; however if those vessels also see a reduction in net revenues, potential safety gains from carrying VMS may be negated if lower revenues result in less repair and maintenance. Therefore, the net Impacts to Safety are unknown (U).

4.7.3.2.2 Option C.2.2

Prohibit the use of large footrope trawl gear throughout the EEZ and prohibit all fixed gear shoreward of 100 fm north of 40°10' N latitude and 150 fm south of 40°10' N latitude. (E-)

4.7.3.2.2.1 Impacts to Fisheries

This option would put some trawl revenues at risk because large footrope trawl gear would be excluded. Depth-based fixed gear restrictions would tend to reduce the catch of shelf groundfish species and may completely eliminate some non-groundfish fixed gear fisheries such as the Dungeness crab fishery for example–which is one of the largest fisheries on the West Coast. During the years 2001–2003, the exvessel value of Dungeness crab landings alone ranged from $52.3 million to $116.98 million.

If VMS is required to monitor compliance with the closed areas, vessels that do not already carry VMS may incur costs on the order of $1,550 - $5,295 to purchase a unit; $120 of annual maintenance; and $1 - $5 per day for the cost of transmitting location (NMFS July 2003).

This alternative may create negative distributional and spillover effects. Vessels that obtain a large portion of their income from Dungeness crab or other fixed gear fishing would see a larger reduction in revenues compared to vessels that do not participate in crab fisheries. Vessels that engage in fixed gear fisheries may switch to other fisheries in an attempt to make up lost revenues. If those vessels switch to other fisheries, vessels currently engaged in those other fisheries would be adversely impacted through competition and a reduction in available fishery resource per vessel. Unfortunately, it is not possible to predict which fisheries those vessels may switch to.

4.7.3.2.2.2 Impacts on Management and Enforcement

Under option C.2.2, monitoring and enforcement would be required to verify that gear types were not being used within prohibited areas. This effort would probably be in addition to monitoring and enforcement of the existing RCAs.

4.7.3.2.2.3 Impacts to Consumers, Processors, and Communities

Under option C.2.2, economically important fixed gear fisheries such as the Dungeness crab fishery may be effectively closed. The West Coast Dungeness crab fishery provides a large source of Dungeness crab landings worldwide, so the elimination of this fishery would likely effect consumers in a negative fashion through higher prices at the consumer level. Processors and communities that are directly engaged in activities related to the Dungeness crab fishery (or other fixed gear fisheries) would also be adversely impacted as exvessel revenues are lost, demand for vessel services declines, and landed catch declines.

4.7.3.2.2.4 Impacts on Safety

Impacts to safety are likely to occur if there is a reduction in vessel net revenues, if vessels are forced to fish under more hazardous conditions, or if vessels are required to carry additional safety equipment. Under option C.2.2 vessels are not being forced to fish in more hazardous conditions, but it is likely some vessels will see a reduction in vessel net revenues. Vessels that are required to carry a VMS may see increases in safety since a vessel in distress may be more easily located if it has VMS, however if those vessels also see a reduction in net revenues, potential safety gains from carrying VMS may be negated if lower revenues result in less repair and maintenance. Therefore, the net Impacts to Safety are unknown (U).

4.7.3.2.3 Option C.2.3

Prohibit the use of large footrope trawl gear shoreward of 200 fm and prohibit all fixed gear shoreward of 60 fm coastwide. (E-)

4.7.3.2.3.1 Impacts to Fisheries

This option is expected to be similar to status quo for trawl vessels. Although large footrope trawl gear was permitted in depths as shallow as 150 fathoms in portions of 2004, large amounts of trawl effort–and catch - have occurred at depths of 200 fathoms or more in recent years. If the large footrope gear is prohibited in depths shallower than 200 fathoms, then trawl vessels may be more constrained and incur higher costs than they are currently.

Depth based fixed gear restrictions would tend to reduce the catch of shelf groundfish species and may eliminate large portions of some non-groundfish fixed gear fisheries such as the Dungeness crab fishery for example–which is one of the largest fisheries on the West Coast. However it is unknown how much of the Dungeness crab fishery would be effected under this option.

If VMS is required to monitor compliance with the closed areas, vessels that do not already carry VMS may incur costs on the order of $1,550 - $5,295 to purchase a unit; $120 of annual maintenance; and $1 - $5 per day for the cost of transmitting location (NMFS July 2003).

This alternative may create negative distributional and spillover effects if revenues are lost. For example, if a prohibition on fixed gear shoreward of 60 fathoms reduces the ability of vessels to catch Dungeness crab, vessels that actively engage in crab fishing may see a larger reduction in revenues compared to vessels that do not participate in crab fisheries. If vessels that engage in the Dungeness crab fishery experience reductions in revenues, they may switch to other fisheries in an attempt to make up those revenues. If those vessels switch to other fisheries, vessels currently engaged in those other fisheries would be adversely effected through competition and a reduction in available fishery resource per vessel. Unfortunately, it is not possible to predict which fisheries those vessels may switch to.

4.7.3.2.3.2 Impacts on Management and Enforcement

Under option C.2.3, monitoring and enforcement would be required to verify that gear types were not being used within prohibited areas. This effort would probably be in addition to monitoring and enforcement of the existing RCAs.

4.7.3.2.3.3 Impacts to Consumers, Processors, and Communities

Under option C.2.3, the Dungeness crab fishery may be effectively closed or limited. The West Coast Dungeness crab fishery provides a large source of Dungeness crab landings worldwide, so a large reduction in crab catch from this fishery would likely effect consumers in a negative fashion. Processors and communities that are directly engaged in activities related to the Dungeness crab fishery would also be adversely effected (E-).

4.7.3.2.3.4 Impacts on Safety

Impacts to safety are likely to occur if there is a reduction in vessel net revenues, if vessels are forced to fish under more hazardous conditions, or if vessels are required to carry additional safety equipment. Under option C.2.3 vessels are not being forced to fish in more hazardous conditions, but it is likely some vessels will see a reduction in vessel net revenues. Vessels that are required to carry a VMS may see increases in safety since a vessel in distress may be more easily located if it has VMS; however if those vessels also see a reduction in net revenues, potential safety gains from carrying

VMS may be negated if lower revenues result in less repair and maintenance. Therefore, the net impacts to safety are unknown (U).

4.7.3.3 Alternative C.3

Close sensitive habitat

4.7.3.3.1 Option C.3.1

Under this option, for each gear type those areas where the sensitivity index value is greater than or equal to two and the recovery index value is greater than one are identified. The combined area is then screened to include only the area where the cumulative number of hours trawled from 2000 through 2002 is less than 100 hours. The resulting areas are closed to all fishing (i.e., to all gear types). (E-)

4.7.3.3.1.1 Impacts to Fisheries

This option would put revenues at risk for all fisheries occurring within the U.S. EEZ off the West Coast. Estimated trawl revenues put at risk over a four year period range from $1,011,952 if the entire area were to be closed, or $181,973 if a portion of the area is closed. If VMS is required to monitor compliance with the closed areas, vessels that do not already carry VMS systems may incur costs on the order of $1,550 - $5,295 to purchase a unit; $120 of annual maintenance; and $1 - $5 per day for the cost of transmitting location (NMFS July 2003). Alternatives based on or adjusted for cumulative trawl hours or revenues would tend to effect vessels in the central and southern California region more than vessels in the north. This is because there are fewer trawl vessels in central and southern California, which tends to reduce trawl revenue and hours on an aggregate basis, but not necessarily on a per-vessel basis.

Depending on how various fisheries are effected, some fisheries may experience larger amounts of displaced effort than others. If displaced revenues result in lost revenue, vessels that are relatively more effected may participate more heavily in other fisheries and negatively effect vessels in those other fisheries through increased competition and reductions in available fishery resource per vessel (E-).

4.7.3.3.1.2 Impacts to Management and Enforcement

Under option C.3.1, enforcement would be required to monitor and verify compliance with new closed areas in addition to current enforcement of RCAs and existing closed areas.

4.7.3.3.1.3 Impacts to Processors and Communities

Impacts to processors and communities would occur if there is a reduction in revenues and landed catch associated with the closures occurring under this option. It is unknown if portions or all of the revenues and pounds put at risk will be lost. Therefore, the effect to communities and processors from this option is unknown, though any effect would be proportional to the effect on fishers in the short-run.

4.7.3.3.1.4 Impacts to Consumers

Impacts to consumers would result if there is a change in available product quantity or price. On the world market, West Coast groundfish make up a small proportion of total groundfish available to consumers. A potential change in product available to the market under this option is unlikely to have measurable effects on consumers.

4.7.3.3.1.5 Impacts on Safety

Impacts to safety are likely to occur if there is a reduction in vessel net revenues, if vessels are forced to fish under more hazardous conditions, or if vessels are required to carry additional safety equipment. Under this option, vessels are not being forced to fish in more hazardous conditions, but it is unknown whether there will be a reduction in vessel net revenues. Vessels that are required to carry a VMS may see increases in safety since a vessel in distress may be more easily located if it has VMS. Therefore, impacts to safety are generally positive.

4.7.3.3.2 Option C.3.2

For each gear type, those areas where both the sensitivity and recovery index values are greater than or equal to 0.5 are identified. The combined area is then screened to include only the area where the cumulative number of hours trawled from 2000 through 2002 is less than 100 hours. The resulting areas are closed to all fishing (i.e., to all gear types). (E-)

4.7.3.3.2.1 Impacts to Fisheries

This option would put revenues at risk for all fisheries occurring within the U.S. EEZ off the West Coast. Estimated trawl revenues put at risk over a four year period range from $1,531,975 if the entire area were to be closed, or $934,794 if only a portion of the area is closed. If VMS is required to monitor compliance with the closed areas, vessels that do not already carry VMS systems may incur costs on the order of $1,550 - $5,295 to purchase a unit; $120 of annual maintenance; and $1 - $5 per day for the cost of transmitting location (NMFS July 2003). Alternatives based on or adjusted for cumulative trawl hours or revenues would tend to effect vessels in the central and southern California region more than vessels in the north. This is because there are fewer trawl vessels in central and southern California, which tends to reduce trawl revenue and hours on an aggregate basis, but not necessarily on a per-vessel basis.

Depending on how various fisheries are effected, some may experience larger amounts of displaced effort than others. If displaced revenues result in lost revenue, vessels that are relatively more effected may participate more heavily in other fisheries and negatively effect vessels in those other fisheries through increased competition and reductions in available fishery resource per vessel.

4.7.3.3.2.2 Impacts to Management and Enforcement

Under this option, enforcement would be required to monitor and verify compliance with new closed areas in addition to current RCA enforcement and existing closed areas.

4.7.3.3.2.3 Impacts to Processors and Communities

Impacts to processors and communities would occur if there is a reduction in revenues and landed catch associated with the closures occurring under this option. It is unknown if portions or all of the revenues and pounds put at risk will be lost. Therefore, the effect to communities and processors from this option is unknown, though any effect would be proportional to the effect on fishers in the short-run (U).

4.7.3.3.2.4 Impacts to Consumers

Impacts to Consumers would occur if there is a change in available product quantity or price. On the world market, West Coast groundfish make up a small proportion of groundfish available to consumers. A potential change in product available to the market under this option is unlikely to have measurable effects on consumers.

4.7.3.3.2.5 Impacts on Safety

Impacts to safety are likely to occur if there is a reduction in vessel net revenues, if vessels are forced to fish under more hazardous conditions, or if vessels are required to carry additional safety equipment. Under this option, vessels are not being forced to fish in more hazardous conditions, but it is unknown whether there will be a reduction in vessel net revenues. Vessels that are required to carry a VMS may see increases in safety since a vessel in distress may be more easily located if it has VMS. Therefore, impacts to safety are generally positive (E+).

4.7.3.3.3 Option C.3.3

The same as Option C.3.1 except no adjustment is made for trawl effort. (E-)

4.7.3.3.3.1 Impacts to Fisheries

This option would put revenues at risk for all fisheries occurring within the U.S. EEZ off the West Coast. Estimated trawl revenues potentially at risk over a four year period range from $47,115,054 to $3,723,698, depending on the proportion of the 10x10 block area that is used. If VMS is required to monitor compliance with the closed areas, vessels that do not already carry VMS systems may incur costs on the order of $1,550 - $5,295 to purchase a unit; $120 of annual maintenance; and $1 - $5 per day for the cost of transmitting location (NMFS July 2003).

Depending on how various fisheries are effected, some may experience larger amounts of displaced effort than others. If displaced revenues result in lost revenue, vessels that are relatively more effected may participate more heavily in other fisheries and negatively effect vessels in those other fisheries through increased competition and reductions in available fishery resource per vessel.

4.7.3.3.3.2 Impacts to Management and Enforcement

Under this option, enforcement would be required to monitor and verify compliance with new closed areas in addition to current RCA enforcement and existing closed areas.

4.7.3.3.3.3 Impacts on Processors and Communities

Impacts to processors and communities would occur if there is a reduction in revenues and landed catch associated with the closures occurring under this option. It is unknown if portions or all of the revenues and pounds put at risk will be lost. Therefore, the effect to communities and processors from this option is unknown, though any effect would be proportional to the effect on fishers in the short-run.

4.7.3.3.3.4 Impacts to Consumers

Impacts to consumers would occur if there is a change in available product quantity or price. On the world market, West Coast groundfish make up a small proportion of groundfish available to consumers. A potential change in product available to the market under this option is unlikely to have measurable effects on consumers.

4.7.3.3.3.5 Impacts on Safety

Impacts to safety are likely to occur if there is a reduction in vessel net revenues, if vessels are forced to fish under more hazardous conditions, or if vessels are required to carry additional safety equipment. Under this option, vessels are not being forced to fish in more hazardous conditions, but it is unknown whether there will be a reduction in vessel net revenues. Vessels that are required to carry a VMS may see increases in safety since a vessel in distress may be more easily located if it has VMS. Therefore, impacts to safety are generally positive.

4.7.3.3.4 Option C.3.4

The same as Option C.3.2 except no adjustment is made for trawl effort. (E-)

4.7.3.3.4.1 Impacts to Fisheries

This option would put revenues at risk for all fisheries occurring within the U.S. EEZ off the West Coast. Estimated trawl revenues at risk over a four-year period range from $82,895,532 to $58,458,226 depending on what proportion of the 10x10 block area is used. If VMS is required to monitor compliance with the closed areas, vessels that do not already carry VMS systems may incur costs on the order of $1,550 - $5,295 to purchase a unit; $120 of annual maintenance; and $1 - $5 per day for the cost of transmitting location (NMFS July 2003).

Depending on how various fisheries are impacted, some may experience larger amounts of displaced effort than others. If displaced revenues result in lost revenue, vessels that are relatively more impacted may participate more heavily in other fisheries and negatively effect vessels in those other fisheries through increased competition and reductions in available fishery resource per vessel.

4.7.3.3.4.2 Impacts to Management and Enforcement

Under this option, enforcement would be required to monitor and verify compliance with new closed areas in addition to current RCA enforcement and existing closed areas.

4.7.3.3.4.3 Effects to Processors and Communities

Impacts to processors and communities would occur if there is a reduction in revenues and landed catch associated with the closures occurring under this option. It is unknown if portions or all of the revenues and pounds put at risk will be lost. Therefore, the effect to communities and processors from this option is unknown, though any effect would be proportional to the effect on fishers in the short-run.

4.7.3.3.4.4 Impacts to Consumers

Impacts to consumers would occur if there were changes in available product quantity or price. On the world market, West Coast groundfish make up a small proportion of groundfish available to consumers. A potential change in product available to the market under this option is unlikely to have any measurable effect to consumers.

4.7.3.3.4.5 Impacts on Safety

Impacts to safety are likely to occur if there is a reduction in vessel net revenues, if vessels are forced to fish under more hazardous conditions, or if vessels are required to carry additional safety equipment. Under this option, vessels are not being forced to fish in more hazardous conditions, but it is unknown whether there will be a reduction in vessel net revenues. Vessels that are required to carry a VMS may see increases in safety since a vessel in distress may be more easily located if it has VMS. Therefore, impacts to safety are generally positive.

4.7.3.4 Alternative C.4

Restrict the potential for commercial fisheries to expand into areas that are currently uneffected or have not been fished between 2000 and 2002.

4.7.3.4.1 Option C.4.1

This alternative and option would reduce opportunities for future expansion of the trawl fishery into areas that were not fished during the 2000–2002 period. In the short-run, this option would largely act as status quo from a cost and revenue perspective, though a small amount of trawl revenues may be displaced and some changes in cost may occur. (0)

4.7.3.4.1.1 Impacts to Fisheries

According to trawl logbook data, the trawl footprint expanded in 2003 to areas seaward of those areas that were trawled during the 2000–2002 period, and those revenues would be displaced under this alternative. These revenues are differentiated by species grouping and described in Socioeconomic Table 4-4.

Assuming that the areas fished in 2003 that would be closed in this alternative were not fished before 2003, it is unlikely that these revenues would be lost since catches in proposed closed areas would have been achieved in other areas in earlier years. A change in net revenues is unlikely for limited entry trawlers since these revenues are likely to be achieved in other portions of the EEZ off the West Coast, and costs are likely to be uneffected since limited entry trawl vessels are not being forced to travel longer distances or require additional equipment. Net revenues for other bottom trawl vessels (such as shrimp trawlers) may be reduced if those vessels are required to carry VMS to monitor compliance with the area closure. If VMS is required, vessels that do not already carry VMS systems may incur costs on the order of $1,550 - $5,295 to purchase a unit; $120 of annual maintenance; and $1 - $5 per day for the cost of transmitting location NMFS July 2003). This cost compares to approximately $69,000 of average annual gross revenue being made by vessels that made shrimp landings with shrimp trawl gear from 2000–2003 (PacFIN. July 2004)

Due to the minor effect to net revenues expected to be associated with this option, it is unlikely that this alternative would have any distributional effect (other than the possibility that additional vessels would be required to purchase VMS) on the fleet or any indirect effect to other fisheries resulting from trawl vessels shifting effort to other fishery sectors.

4.7.3.4.1.2 Impacts on Management and Enforcement

The effect of this alternative on management and enforcement would require establishing and monitoring an additional closed area. This option would essentially require that enforcement continue to monitor the shoreward RCA boundary, the seaward RCA boundary, other existing conservation areas/marine protected areas, in addition to a newly formed untrawled area boundary (E-).

4.7.3.4.1.3 Impacts on Consumers, Processors, Communities

Since there are no anticipated shifts in fishing effort, the manner in which the fishery is prosecuted is unlikely to change under this option. As this option would induce little or no change in the amount of seafood landed or associated revenues, there should be little or no effect to processors, communities, or consumers resulting from this option.

4.7.3.4.1.4 Impacts on Safety

Effects to safety are likely to occur if there is a reduction in vessel net revenues, if vessels are forced to fish under more hazardous conditions, or if vessels are required to carry additional safety equipment. Under this option, vessels are not being forced to fish in more hazardous conditions, and potential reduction in vessel net revenues is likely to be minimal. Vessels that are required to carry a VMS may see increases in safety since a vessel in distress may be more easily located if it has VMS. Therefore, impacts to safety are generally positive (E+).

4.7.3.4.2 Option C.4.2

This option would act similarly to option C.4.1, though all bottom tending gear types would be excluded from currently uneffected areas. This alternative is intended to freeze the footprint of bottom tending fishing gears. (0)

4.7.3.4.2.1 Impacts to Fisheries

In the long-term, this alternative would limit the opportunity for the fishery to expand into other areas and to target species residing in those areas. In the short-term this option would act like a status quo alternative and would displace minimal amounts of trawl revenues and little or no revenues from other bottom tending gear types. These revenues are differentiated by species grouping and described in Socioeconomic Table 4-5.

The minimal effect on fisheries would translate into little or no change in net revenues for vessels currently carrying VMS. If VMS is required for this option (in order to enforce the closed area), vessels that do not currently have VMS may incur costs on the order of $1,550 - $5,295 to purchase a unit; $120 of annual maintenance; and $1 - $5 per day for the cost of transmitting location NMFS July 2003). This cost compares to approximately $69,000 of average annual gross revenue being made by vessels that made shrimp landings with shrimp trawl gear over the 2000–2003 year period, the approximately $63,000 of average annual gross revenues made by vessels targeting spot prawns with pot gear, and the approximately $64,000 average annual gross revenues made by vessels landing Dungeness crab with pot gear over the 2001–2003 period (PacFIN. July 2004).

Due to the minor effect to net revenues expected to be associated with this option, it is unlikely that this alternative would have any distributional effect (other than the possibility that additional vessels would be required to purchase VMS) on the fleet or any indirect effect to other fisheries resulting from trawl vessels shifting effort to other fishery sectors.

4.7.3.4.2.2 Impacts on Management and Enforcement

The effect of this alternative on management and enforcement would require establishing and monitoring an additional closed area. This option would essentially require that enforcement continue to monitor the existing RCA, and other existing conservation areas/marine protected areas, in addition to a newly formed unfished area boundary.

4.7.3.4.2.3 Impacts to Consumers, Processors, and Communities

Like option C.4.1, this option is expected to have a minimal effect on net revenues and little or no effect on gross revenues and volume of groundfish landed. The fact that the volume of groundfish landed is not expected to change means that there are no expected effects to processors or consumers. Little or no effect to fishers or processors means that communities should not be effected under this alternative.

4.7.3.4.2.4 Impacts on Safety

Impacts to safety are likely to occur if there is a reduction in vessel net revenues, if vessels are forced to fish under more hazardous conditions, or if vessels are required to carry additional safety equipment. Under this option, vessels are not being forced to fish in more hazardous conditions, and potential reduction in vessel net revenues is likely to be minimal. Vessels that are required to carry a VMS may see increases in safety since a vessel in distress may be more easily located if it has VMS. Therefore, impacts to safety are generally positive.

4.7.3.5 Alternative C.5

Prohibit a Krill fishery (0)

4.7.3.5.1 Impacts on the socioeconomic environment

This alternative is not expected to have an effect on the socioeconomic environment, since there are no known fisheries for krill in the West Coast EEZ, and this alternative therefore establishes status quo regulations for current fisheries. This alternative may have negative effects on management and enforcement because agencies would need to establish and enforce a ban on krill harvests (E-).

4.7.3.6 Alternative C.6

Close Hotspots (E-)

4.7.3.6.1 Impacts on Fisheries

The closure of areas to fishing would tend to have negative consequences in the short term as revenue is displaced, and effort shifts to areas remaining open. The shift of effort to other areas may tend to increase competition in remaining open areas, which may result in lower catch per unit effort–as a result of localized depletion–and may result in higher costs if vessels fish more intensely or further from port to make up those revenues. Under this alternative, the amount of displaced bottom trawl revenue from the limited entry trawl fleet is estimated at $78,094,177 over a four year period if measured by revenue from the entire 10x10 block areas, or $41,622,276 if measured by a proportion of those areas. If VMS is required for this option (in order to enforce the closed area), vessels that do not currently have VMS may incur costs on the order of $1,550 - $5,295 to purchase a unit; $120 of annual maintenance; and $1 - $5 per day for the cost of transmitting location NMFS July 2003).

Depending on how various fisheries are impacted, some may experience larger amounts of displaced revenue than others in the short run. If displaced revenues result in lost revenue, vessels that are relatively more effected impacted may participate more heavily in other fisheries and negatively impact vessels in those other fisheries through increased competition and reductions in available fishery resource per vessel. If area closures result in higher stock productivity and higher fishery yields, then this alternative may have beneficial impacts in the long run, though this relationship is still hypothetical.

4.7.3.6.2 Impacts on Management and Enforcement

Closing additional areas would put burdens on enforcement agencies to monitor those areas in addition to monitoring existing closed areas (E-).

4.7.3.6.3 Impacts on Processors and Communities

Effects to processors and communities would occur if there is a reduction in revenues and landed catch associated with the closures occurring under this option. If area closures result in higher stock productivity which leads to increased fishery yields, this alternative may positively impact processors and communities in the long run. However, it is unknown if part or all of the revenues and pounds put at risk will be lost in the short run, and it is unknown whether habitat improvements will positively impact fishery yields in the long run. Therefore, the impact to communities and processors from this option is unknown, though any impact would be proportional to the impact on fishers in the short-run (U).

4.7.3.6.4 Impacts to Consumers

Impacts to consumers would occur if there is a change in available product quantity or price. On the world market, West Coast groundfish make up a small proportion of groundfish available to consumers. A potential change in product available to the market under this option is unlikely to have measurable effects on consumers (0).

4.7.3.6.5 Impacts on Safety

Impacts to safety are likely to occur if there is a reduction in vessel net revenues, if vessels are forced to fish under more hazardous conditions, or if vessels are required to carry additional safety equipment. Under this option, vessels are not being forced to fish in more hazardous conditions, but it is unknown whether there will be a reduction in vessel net revenues. Vessels that are required to carry a VMS may see increases in safety since a vessel in distress may be more easily located if it has VMS. Therefore, impacts to safety are generally positive (E+).

4.7.3.7 Alternative C.7

Close Areas of Interest

4.7.3.7.1 Option C.7.1

Close areas to bottom trawling (E-)

4.7.3.7.1.1 Impacts to Fisheries

Closing areas to trawling would tend to have negative consequences as revenue is displaced, and effort shifts to areas remaining open. The shift of effort to other areas may tend to increase competition in remaining open areas, which may result in lower catch per unit effort–as a result of localized depletion–and may result in higher costs if vessels fish more intensely to make up those revenues. Under this alternative, the amount of displaced bottom trawl revenue from the limited entry trawl fleet is estimated to be $29,471,349 over a four year period if measured by revenue from the entire 10x10 block areas, or $12,601,536 if measured by a proportion of those areas. If VMS is required for this option (in order to enforce the closed area), vessels that do not currently have VMS may be forced to incur costs on the order of $1,550 - $5,295 to purchase a unit; $120 of annual maintenance; and $1 - $5 per day for the cost of transmitting location (NMFS July 2003).

If displaced revenues result in lost revenue, trawl vessels may participate more heavily in non-trawl fisheries and negatively effect vessels in those other fisheries through increased competition and reductions in available fishery resource per vessel.

4.7.3.7.1.2 Impacts on Management and Enforcement

Closing additional areas would put burdens on enforcement agencies to monitor those areas in addition to monitoring existing closed areas (E-).

4.7.3.7.1.3 Impacts on Processors and Communities

Impacts to processors and communities would occur if there is a reduction in revenues and landed catch associated with the closures occurring under this option. It is unknown if part or all of the revenues and pounds put at risk will be lost. Therefore, the impact to communities and processors from this option is unknown, though any impact would be proportional to the effect on fishers in the short-run.

4.7.3.7.1.4 Impacts to Consumers

Impacts to consumers would occur if there is a change in available product quantity or price. On the world market, West Coast groundfish make up a small proportion of groundfish available to consumers. A potential change in product available to the market under this option is unlikely to have measurable effects on consumers (0).

4.7.3.7.1.5 Impacts on Safety

Impacts on safety are likely to occur if there is a reduction in vessel net revenues, if vessels are forced to fish under more hazardous conditions, or if vessels are required to carry additional safety equipment. Under this option, vessels are not being forced to fish in more hazardous conditions, but it is unknown whether there will be a reduction in vessel net revenues. Vessels that are required to carry a VMS may see increases in safety since a vessel in distress may be more easily located if it has VMS. Therefore, impacts to safety are generally positive (E+).

4.7.3.7.2 Option C.7.2:

Close areas to all bottom contact activities (E-)

4.7.3.7.2.1 Impacts on Fisheries

Closing areas to bottom tending fishing gear would tend to have negative consequences as revenue and effort is displaced, and effort shifts to areas remaining open. The shift of effort to other areas may tend to increase the amount of competition in remaining open areas, which may result in lower catch per unit effort–as a result of localized depletion–and may result in higher costs if vessels fish more intensely to make up those revenues. Under this alternative, the amount of displaced bottom trawl revenue from the limited entry trawl fleet is estimated to be $29,471,349 over a four year period if measured by revenue from the entire 10x10 block areas, or $12,601,536 if measured by a proportion of those areas. If VMS is required for this option (in order to enforce the closed area), vessels that do not currently have VMS may incur costs on the order of $1,550 - $5,295 to purchase a unit; $120 of annual maintenance; and $1 - $5 per day for the cost of transmitting location (NMFS July 2003).

Depending on how various fisheries are effected, some may experience larger amounts of displaced effort than others. If displaced revenues result in lost revenue, vessels that are relatively more effected may participate more heavily in other fisheries and negatively effect vessels in those other fisheries through increased competition and reductions in available fishery resource per vessel.

4.7.3.7.2.2 Impacts on Management and Enforcement

Closing additional areas would put burdens on enforcement agencies to monitor those areas in addition to monitoring existing closed areas (E-).

4.7.3.7.2.3 Impacts on Processors and Communities

Impacts to processors and communities would occur if there is a reduction in revenues and landed catch associated with the closures occurring under this option. It is unknown if portions or all of the revenues and pounds put at risk will be lost. Therefore, the effect to communities and processors from this option is unknown, though any effect would be proportional to the effect on fishers in the short-run (U).

4.7.3.7.2.4 Impacts to Consumers

Impacts to consumers would occur if there is a change in available product quantity or price. On the world market, West Coast groundfish make up a small proportion of groundfish available to consumers. A potential change in product available to the market under this option is unlikely to have measurable effects on consumers (0).

4.7.3.7.2.5 Impacts on Safety

Impacts to safety are likely to occur if there is a reduction in vessel net revenues, if vessels are forced to fish under more hazardous conditions, or if vessels are required to carry additional safety equipment. Under this option, vessels are not being forced to fish in more hazardous conditions, but it is unknown whether there will be a reduction in vessel net revenues. Vessels that are required to carry a VMS may see increases in safety since a vessel in distress may be more easily located if it has VMS. Therefore, impacts to safety are generally positive (E+).

4.7.3.8 Alternative C.8

Zoning fishing activities (E-)

4.7.3.8.1 Option C.8.1

Fishing zones are established for bottom-contact trawls, dredges, and similar bottom-tending mobile fishing gear. Other bottom-contacting gear types are unaffected by the zoning system, including the prohibition outside 2,000 m.

4.7.3.8.1.1 Impacts on Fisheries

Zoning fishing activities will act similarly to area closures by designating certain areas for certain gear types, and excluding those gears from other areas. The closure of areas to bottom tending fishing gear would tend to have negative consequences as revenue is displaced, and effort increases in zones designated for those gears. Increased effort in zoned areas may tend to increase competition in those areas, which may result in lower catch per unit effort–as a result of localized depletion–and may result in higher costs if vessels fish more intensely to make up those revenues. If VMS is required for this option (in order to enforce the closed area), vessels that do not currently have VMS may incur costs on the order of $1,550 - $5,295 to purchase a unit; $120 of annual maintenance; and $1 - $5 per day for the cost of transmitting location (NMFS July 2003).

Depending on how various fisheries are effected, some may experience larger amounts of displaced effort than others. If displaced revenues result in lost revenue, vessels that are relatively more effected may participate more heavily in other fisheries and negatively effect vessels in those other fisheries through increased competition and reductions in available fishery resource per vessel.

4.7.3.8.1.2 Impacts on Management and Enforcement

Additional area management would put burdens on enforcement to monitor those areas in addition to existing closed areas. Furthermore, this alternative would require more work on the part of administrative agencies in evaluating the impact of gear types and areas appropriate for zoning. (E-).

4.7.3.8.1.3 Impacts on Processors and Communities

Impacts to processors and communities would occur if there is a reduction in revenues and landed catch associated with the type of area management occurring under this option. It is unknown if part or all of the revenues and pounds put at risk will be lost. Therefore, the effect to communities and processors from this option is unknown, though any effect would be proportional to the effect on fishers in the short-run (U).

4.7.3.8.1.4 Impacts to Consumers

Impacts to consumers would occur if there is a change in available product quantity or price. On the world market, West Coast groundfish make up a small proportion of groundfish available to consumers. A potential change in product available to the market under this option is unlikely to have measurable effects on consumers (0).

4.7.3.8.1.5 Impacts on Safety

Impacts to safety are likely to occur if there is a reduction in vessel net revenues, or if vessels fish under more hazardous conditions. Under this option vessels are not being forced to fish in more hazardous conditions, but it is unknown whether there will be a reduction in vessel net revenues. Therefore, impacts to safety are unknown (U).

4.7.3.8.2 Option C.8.2

Fishing zones are established for all bottom-contacting gear types, including bottom longlines, traps, and pots. The immediate closure outside of 2,000 m applies to all bottom-contacting gear types. (E-)

4.7.3.8.2.1 Impacts on Fisheries

Zoning fishing activities will act similarly to area closures by designating certain areas for certain gear types, and excluding those gears from other areas. The closure of areas to bottom tending fishing gear would tend to have negative consequences as revenue is displaced, and effort increases in zones designated for those gears. Increased effort in zoned areas may tend to increase the amount of competition in those areas, which may result in lower catch per unit effort–as a result of localized depletion–and may result in higher costs if vessels fish more intensely to make up those revenues. If VMS is required for this option (in order to enforce the closed area), vessels that do not currently have VMS may incur costs on the order of $1,550 - $5,295 to purchase a unit; $120 of annual maintenance; and $1 - $5 per day for the cost of transmitting location (NMFS July 2003).

Depending on how various fisheries are effected, some may experience larger amounts of displaced effort than others. If displaced revenues result in lost revenue, vessels that are relatively more effected may participate more heavily in other fisheries and negatively effect vessels in those other fisheries through increased competition and reductions in available fishery resource per vessel.

4.7.3.8.2.2 Impacts on Management and Enforcement

Additional area management would put burdens on enforcement to monitor those areas in addition to existing closed areas (E-).

4.7.3.8.2.3 Impacts on Processors and Communities

Impacts to processors and communities would occur if there is a reduction in revenues and landed catch associated with the type of area management occurring under this option. It is unknown if portions or all of the revenues and pounds put at risk will be lost. Therefore, the impact to communities and processors from this option is unknown, though any impact would be proportional to the effect on fishers in the short-run (U).

4.7.3.8.2.4 Impacts to Consumers

Impacts to consumers would occur if there is a change in available product quantity or price. On the world market, West Coast groundfish make up a small proportion of groundfish available to consumers. A potential change in product available to the market under this option is unlikely to have measurable effects on consumers (0).

4.7.3.8.2.5 Impacts on Safety

Impacts to safety are likely to occur if there is a reduction in vessel net revenues, or if vessels are forced to fish under more hazardous conditions. Under this option, vessels are not being forced to fish in more hazardous conditions, but it is unknown whether there will be a reduction in vessel net revenues. Vessels that are required to carry a VMS may see increases in safety since a vessel in distress may be more easily located if it has VMS. Therefore, impacts to safety are generally positive (E+).

4.7.3.9 Alternative C.9

Establish effect-reducing fishing gear requirements: This alternative encompasses a suite of effect-reducing fishing gear options including: 1) prohibit roller gear larger than 15 inches; 3) prohibit flat trawl doors; 5) limit longline groundline to 3 nm; 6) employ habitat friendly anchoring systems for fixed gear; 7) prohibit dredge gear; 8) prohibit beam trawl gear; 9) prohibit set gillnets in waters deeper than 60 fathoms; and 11) prohibit dingle bar troll gear. (E-)

4.7.3.9.1 Impacts to Fisheries

In general, the sub options may decrease opportunities or catch per unit effort for some fishers, impose a cost in the form of additional/different equipment, and may–in whole or part–eliminate some fisheries.

4.7.3.9.1.1 Option 1

The prohibition of roller gear larger than 15 inches may reduce opportunities in areas with high relief substrate where roller gear larger than 15 inches is required to successfully access those areas. However, most vessels do not currently use roller gear in excess of 15 inches (Brown, McMullen, Pettinger 2004. personal communication), so additional costs may be minimal and effects may only come in the form of reduced future opportunities for fishing in areas that require roller gear larger than 15 inches to be accessed.

4.7.3.9.1.2 Option 2

The requirement to use weak links on tickler chains would likely be a minimal accounting cost. Depending on how the gear is set up, if a weak link were to break at sea, the vessel may incur opportunity costs in the form of time required to fix the chain.

4.7.3.9.1.3 Option 3

The prohibition of flat trawl doors would have a cost effect to fishers that currently use flat trawl doors. In the northern areas, this may be 40–60% of groundfish trawl vessels, and those vessels may incur a cost in the range of $3,000 - $8,000 apiece to replace trawl doors (Pettinger 2004, personal communication). Nearly all shrimp vessels use flat trawl doors due to the associated stability and height which is needed to bring the trawl net high enough to catch shrimp (6–8 feet off the bottom). There are no known cambered doors that would be effective for shrimp trawling at this time, and experimentation would be needed to develop a cambered shrimp door. This may effectively close the shrimp trawl fishery until such a door can be created (Pettinger 2004 and McMullen 2004, personal communications). Vessels that currently use flat trawl doors would see a reduction in net revenues under this option.

4.7.3.9.1.4 Option 4

Requiring aluminum trawl doors could effect all trawl vessels in the short-run since aluminum doors are typically not currently used and purchasing these doors would require vessels to incur additional cost. Aluminum trawl doors may not be heavy enough to remain in contact with the ocean bottom, which may reduce the catch-per-unit-effort of trawl vessels, or force trawlers to place weights on the trawl doors. In the long-run, aluminum trawl doors are likely to effect bottom trawl and shrimp trawl vessels since aluminum trawl doors are likely to be less durable than steel doors and may require additional maintenance, repair, and replacement due to the stress of bottom trawling.

4.7.3.9.1.5 Option 5

Limiting the length of longline is expected to have relatively slight effect on fishers. If vessels are forced to make more longline sets to achieve the same catch, vessels may be forced to purchase more groundline anchors, buoys, and poles to affix at each end. The cost of additional polyform buoys is approximately $20 - $40, the cost of additional anchors is on the order of $30, and the cost of pole weights is approximately $17 (Go2Marine, November 2004, personal communication). This additional cost would represent a decrease in net revenues to fixed gear fishers.

4.7.3.9.1.6 Option 6

Requiring fixed gear vessels to use habitat-friendly anchoring systems may require those vessels to replace their current fixed gear anchors, and this would impose an additional cost to those fishers. A review of anchors resembling the “Bruce” anchor (an anchor design with a weak link which allows the anchor to be retrieved from the shovel instead of the shaft if it gets snagged) suggests that the costs of an imitation “Bruce” may be $10 for a 2.2 pound anchor, while those produced by the original company may be on the order of $110 for a 11 pound anchor. Replacing anchors would reduce net revenues.

4.7.3.9.1.7 Option 7

The prohibition of dredge gear is not expected to have an effect since there are no dredge fisheries known to be currently operating.

4.7.3.9.1.8 Option 8

The prohibition of beam trawl gear would close the California beam trawl fishery. This is likely to have negative effects to those vessels that currently participate in the beam trawl fishery. According to CDFG data, shrimp landings caught with beam trawl gear have ranged from approximately 69,000 to 15,000 pounds annually from 1990–1999, and have generated approximately $87,000 to $219,000 in exvessel revenues over the same period. This catch would be put at risk under a beam trawl prohibition.

4.7.3.9.1.9 Option 9

The prohibition of set gillnets deeper than 60 fathoms may put some revenues at risk if set gillnets are currently being set at those depths. In September 2000, the California Department of Fish and Game (CDFG) issued emergency regulations that prohibited set gillnet fishing inshore of 110 m (60 fm) in central California from Point Reyes to Yankee Point in Monterey Bay and from Point Arguello to

Point Sal, citing concerns over the incidental take of common murre (*Uria aalge*) and California sea otters (*Enhydra lutris*). A permanent ban on gill and trammel nets inshore of 110 m (60 fm) from Point Reyes to Point Arguello became effective in September 2002 (SWFSC, November 2004). Closing waters deeper than 60 fathoms to set gillnet fishing would therefore eliminate set gillnet fishing in those portions of the California coast. Depending on the amount of set gillnet fishing occurring in that area now, set gillnet effort may switch to other areas, or set gillnet fishermen may participate in other fisheries using other gear.

4.7.3.9.1.10 Option 10

The prohibition of stick gear and weights with hooks on the bottom may displace some revenues and effort, though the effect of this alternative is largely unknown.

4.7.3.9.1.11 Option 11

The impact of a dingle bar troll gear prohibition would come in the form of reduced future opportunity. The prohibition of dingle-bar troll gear would make it more difficult to establish the directed lingcod fishery when the lingcod stock becomes rebuilt.

4.7.3.9.2 Impacts to Management and Enforcement

The sub options identified in this alternative may increase demands on enforcement because enforcement agencies would need to verify compliance with additional gear restrictions or modifications (E-).

4.7.3.9.3 Impacts on Processors, Communities, Consumers, and Safety

The options described under this alternative are not expected to have an effect on processors, communities, consumers, or safety. Each of the sub options individually has a relatively minor effect on vessel net revenues and/or landed pounds, and this minor effect is generally translated into negligible effects to processors, communities, or consumers. However adopting several of the sub options in combination may have negative effects, especially in certain geographic areas. Effects to safety are not expected to occur because changes in vessel net revenues are expected to be minor, and vessels are not being forced to fish in more hazardous conditions (0).

4.7.3.10 Alternative C.10

The Nature Conservancy/Environmental Defense Alternative: Vessel Buyback and Central California No Trawl Zones (U).

Appendix F gives the specifics of this proposals and TNC&EDF's evaluation of their proposal. Appendix G is a very preliminary draft EA on the proposal that will be updated as additional information is developed for the proposal and as the alternative becomes more specific as a result TNC&EDF's negotiations with the industry and the discussions with the Pacific Fishery Management Council. The discussion below contains excerpts from both documents. According to TNC&EDF:

> The project aims to protect biodiversity and promote recovery of groundfish stocks through the establishment of large no-trawl zones in federal waters between Point Conception and Davenport….
>
> Our project approach would be to purchase a significant majority of the bottom trawling permits and vessels and perhaps processors in the region in exchange for a significant portion of the project area designated as no-bottom trawl zones. The no-trawl zones would be sited using a participatory process with the goal of maximizing conservation gains while minimizing adverse socio-economic effects on processors and

> fishermen and their workforces. We intend to work closely with the residual fleet to identify key fishing grounds that would remain open for bottom trawling.

As stated by TNC&EDF, it is difficult to assess the financial costs and benefits to various users because of the buyback. Therefore, qualitative comments that provide a sense of the relative effects are provided.

> "Since the no-trawl zones would be sited through a participatory process aimed at minimizing socioeconomic costs and maximizing conservation benefits (and because we do not have access to confidential trawl track information), we cannot provide an accurate appraisal of these costs and benefits at this time."

4.7.3.10.1 Impacts on Fisheries

Project Area Groundfish Trawlers: The Buyback program would involve purchasing a majority of the approximately 23-26 vessels that regularly fish in the project area. They deliver collectively about $5-6 million annually in groundfish to about 7-8 major processors of seafood. Those participating in the buyback would obviously benefit from this alternative, as participants would not agree to leave the fishery unless financial remuneration was in their favor. The remaining project area buyback vessels would benefit from the revenues associated with larger trip limits and less competition on the fishing grounds, but would also see their costs rise as they are shifted from higher CPUE grounds to lower CPUE grounds, perhaps fishing grounds further from port. If the number of vessels and area fished effects the CPUE—it is unclear how CPUE will change because there will be fewer vessels (positive effect on CPUE) but a smaller amount of area to fish (negative effect on CPUE.)

Non-Project Area Groundfish Trawlers: Should any of the project area catches be transferred to outside the area through redesign of trip limits, non-project area groundfish trawlers may benefit. On the other hand, project area trawlers may transfer their effort to other ports causing more competition on non-Project area grounds.

Other fishing groups: Since these groups will be able to fish in the reserves, they will have less competition for the available species of fish found within the reserves. Other fishing groups may benefit from the availability of excess vessels and equipment should they not be scrapped. However, if the Buyback contract with TNC&EDF does not prevent re-entry into other fisheries, participants in the Buyback could take their payments and purchase state permits to fish other species of fish such as shrimp or crab. This was a common complaint with the 2003 Groundfish Buyback Program.

4.7.3.10.2 Impacts on Processors

There are approximately 6-8 processors associated with the project area. If total catch remains the same, the flow of product to the plants should remain the same. If the reserves cause harvesting costs to increase and if the Buyback reduces the amount of vessels that are able to supply the plants, ex-vessel prices may increase as a result. Scheduling of deliveries may be problematic with a reduced number of vessels. If the Buyback results in a significant number of vessels being purchased, the Processors will have to make the choice to continue processing, offering higher prices to bid trawlers from outside the project area to relocate into their port, or purchase limited entry trawler permits themselves to guarantee an adequate supply of fish.

4.7.3.10.3 Impacts on Communities and Ports

The primary California communities that may be effected by this alternative are: Avila, Watsonville, Del Mar, Moss Landing, Monterey, and Half Moon Bay. As indicated by TNC&EDF, communities may lose revenues from trawling and funding for harbor activities but potentially gain from increase activities by other gear groups and by the potential for ecotourism. There may be an increase in existence value, option value, and enhanced heritage value from the establishment of no-trawl zones.

4.7.3.10.3.1 Impacts on Processing labor and Fishing crew

With a reduction in the number of trawlers, fishing crew will become unemployed. Processing labor may be similarly effected if the total amount of fish landed is reduced or processors choose to close the plants. Any negative effects will be counterbalanced by TNC&EDF's willingness to offer some level of mitigation:

> Bearing in mind that the buyout that we are proposing would, in and of itself, greatly reduce economic effects arising from no-trawl zones in the project area, both TNC and Environmental Defense are committed to soften the effect of shifts and consolidations in the industry that may result from the implementation of our project. We will encourage companies and fisherman who may be the beneficiaries of the private buyback to give due financial consideration to employees who may be terminated; and likewise, we will do the same and consider some type of severance and/or training programs to assist in their transition to another job or career. Vessel crews, processing employees, skippers and other industry employees will be considered for assistance.

4.7.3.10.4 Impacts on Management and Enforcement

TNC&EDF state:

> Conceptually, large no trawl zones should present no significant new law enforcement or compliance challenges. They could be enforced in the same way as other closed areas. Compliance should increase as Vessel Monitoring Systems are introduced and finalized into the fleet as planned. Enforcement capacity has been enhanced in other National Marine Sanctuaries through the cross-deputization of agents from several enforcement bodies at the state, regional and federal levels.

While VMS is a good system, the costs of monitoring will go up because in addition to monitoring the rockfish conservation areas and existing marine reserves, enforcement officials will now have to monitor an additional set of marine reserves. It is presumed that fewer, larger, and more-straight lined the proposed closed areas are, the lower the enforcement costs will be (E-).

While the proposed set of marine reserves may add extra burden on fisheries management, they could also ease management burden if they reduce need for the rockfish conservation areas or adjustments in the rockfish conservation areas. Reducing the number of participants in the groundfish fishery may make allocation decisions and trip limit decision easier, while also reducing the need for area specific in-season adjustments.

4.7.3.11 Alternative C.11

Allow fish to be harvested by any legal gear without regard to gear endorsement

This alternative would allow fishers to harvest groundfish regardless of any gear endorsement that is currently tied to a permit. Under this alternative, fishers may be permitted to change gears mid-season. A possible scenario may be one where fixed gear vessels target flatfish with trawl gear, and DTS and shelf trawlers target sablefish with fixed gear. Indeed, market incentives may encourage trawl vessels to target sablefish with fixed gear due to the higher price per pound associated with sablefish caught with fixed gear (sablefish caught with fixed gear were worth over $1.00 per pound more than sablefish caught with trawl gear in 2003). This may create a case where there is a reduction of trawl effort in some areas and a switch to fixed gear to target sablefish. However, doing so may mean a reduction in the catch of other DTS species (Dover sole and thornyheads) due to the lower effectiveness of fixed gear in catching those other species, or lower cumulative limits for sablefish if additional vessels target them. The potential for trawlers to switch to fixed gear would depend on the amount of revenue foregone that is related to trawl caught non-sablefish species versus the amount of revenue they are gaining by catching higher priced sablefish with fixed gear. Analysis of revenue and rebuilding species effects is provided in Socioeconomic Table 4-6 and 4-7. A discussion of those effects is provided below.

4.7.3.11.1 Impacts to Fisheries

This alternative is expected to have a non-negative effect on aggregate fishing revenues since vessels would only switch gear types if there is an economic incentive in doing so. However, some vessels may be adversely effected, or see less positive effects than others. If vessels switch gear types, it is more likely that trawl vessels will shift to fixed gear due to the relative cost of purchasing and installing trawl gear versus fixed gear equipment, and the inability of most fixed gear vessels to accommodate trawl gear due to size and power limitations (E-/E+).

In a single species fishery, vessels may tend toward using a single gear type because of the lower marginal costs associated with doing so. In a multi-species fishery without gear restrictions, with trip limits, constraining species, or price differentiation, vessels are more likely to use several gears to target multiple species in order to cover their fixed costs. Based on this notion, several changes in fleet structure are likely under this alternative. 1) DTS trawlers may switch to fixed gear during parts of the year to target sablefish, 2) shelf trawlers may switch to fixed gear during portions of the year to target sablefish, and 3) some fixed gear vessels may convert to trawling to target shelf flatfish.

Under this alternative, it is possible that total trawl effort would not change along the shelf. The catch per unit effort associated with fixed gear caught flatfish in combination with the price per pound for most flatfish species would tend to make it difficult for vessels to make a profit by using fixed gear to target flatfish along the shelf. Although total trawl effort may not change along the shelf (though the number of vessels may change), incentives may encourage fixed gear vessels to use trawl gear for targeting flatfish. This may not change total trawl effort since total effort on the shelf is constrained by rebuilding species and target species OYs, but the number of vessels trawling for flatfish may increase, thus reducing the pounds of flatfish harvest per vessel.

If DTS trawlers make more net revenue by using fixed gear, those vessels may use fixed gear during portions of the year. This would tend to reduce the amount of trawl effort along the slope. However, the inability of fixed gear to catch other DTS species (Dover sole and thornyheads) relative to trawl gear may make it less profitable for some–or all–of these vessels to switch gear types if the reduction in catch of Dover sole and thornyheads outweighs the benefits of the higher price for fixed gear sablefish.

Under this alternative, shelf flatfish trawlers may switch to fixed gear and target sablefish, thus increasing the number of vessels targeting sablefish and reducing available pounds per vessel. This may increase revenues for those shelf trawlers that switch gear, but may reduce revenues for DTS trawlers depending on the number of shelf trawlers that switch gear types.

Depending on the opportunities afforded to fixed gear vessels that may switch to trawling during portions of the year, the relative cost of installing trawl gear on those vessels may not be a prohibitive factor. A review of trawl gear for sale in 2004 and 2003 suggests that the cost of hydraulic pumps, deep water winches, hook line, net reel, and windlass may range from $15,000 to $20,000 (Fishermen's News, October 2004, June 2004, and December 2003), the cost of trawl net and doors may be on the order of $5,000 (Fishermen's Marketing Association, November 2004, personal communication). Unfortunately, readily available information does not exist to estimate the cost of installing this equipment, but these costs amortized over multiple years may make it feasible for some fixed gear vessels to participate in trawl fisheries. If those vessels were to then target flatfish with trawl gear, trawl vessels that have historically targeted flatfish would be adversely effected since they do not have a formal allocation for flatfish species, and the OY for many flatfish species are currently being achieved, or are projected to be achieved beginning in 2005, because of new trawl technology (PFMC 2004). Additional vessels targeting flatfish would therefore reduce the catch available to existing flatfish trawl vessels.

Socioeconomic Table 4-6 looks at the revenues that may be gained or lost on a fleet wide basis if vessels change gear types. The upper bound range of revenues shows the revenue effect assuming there are no changes in the amount of Dover sole and thornyheads being landed, and that the price differential between fixed gear and trawl caught sablefish in 2003 is maintained (a difference of over $1.00 per pound). The lower bound revenue range assumes that Dover sole and thornyhead landings would decrease as the amount of sablefish caught with fixed gear increases. This is based on the relative ratios of sablefish to Dover sole and thornyheads caught with trawl gear and longline gear. The scenarios shown in the table are hypothetical, but encompass a range of possible effects based on the allocation of sablefish amongst sectors. The revenue columns show the change in the amount of revenue that would be achieved with the switch in gear type over what would be achieved without the change in gear type under the status quo. These columns should be viewed as a revenue change relative to status quo management rather than of a total amount. It is unknown whether the lower or upper range is more likely, but the most likely scenario is somewhere between the lower and upper bounds.

4.7.3.11.2 Impacts to Management and Enforcement

Although this alternative may theoretically increase gross revenues and decrease trawl effects on slope habitat, this alternative may also have incidental catch implications that may limit the ability of this alternative to be successful with existing management tools. For example, the incidental take of Yelloweye rockfish is higher for fixed gear than for trawl gear. If trawl vessels were to switch to fixed gear, the incidental take of Yelloweye rockfish would likely increase and–depending on the take in other fishery sectors–that increase may be substantial enough to exceed the Yelloweye rockfish OY.

If existing predictive tools (e.g., the trawl bycatch model) continue to be the primary mechanism for structuring fishing regulations, these tools may be compromised because agencies may find it difficult to predict when vessels would shift gear types. The inability to predict when and to what degree vessels may shift effort between gear types would have implications for adequately predicting the catch of both target and non-target species. The inability to adequately predict catch is likely less of an issue for vessels that may switch to fixed gear from trawling, but the risk of exceeding groundfish species OYs increases if fixed gear vessels are allowed to switch to trawl gear because of the generally larger catch quantities associated with trawl gear. Furthermore, the likelihood of a disaster tow occurring increases if fixed gear vessels are allowed to use trawl gear because some of these vessels may not be familiar with locations that are commonly avoided by the existing trawl fleet due to bycatch implications.

Socioeconomic Table 4-7 shows possible implications on Yelloweye rockfish and Canary rockfish from allowing trawl vessels to switch to fixed gear. The first column represents a scenario where trawl vessels catch the listed metric tons of sablefish with fixed gear. The incidental catch columns represent the additional mortality of Yelloweye and Canary rockfish that would occur if trawl vessels were to catch that amount of sablefish with fixed gear. These estimates were generated using the NWFSC/GMT trawl and fixed gear bycatch models and assume the trawl and non-trawl RCA boundaries in effect for 2005 remain in effect under each scenario, and that the only change in trawl effort occurs seaward of the RCA. The columns referring to the remaining Canary and Yelloweye rockfish OY represent a "buffer" and are derived by using Canary and Yelloweye rockfish mortality estimates in the GMT bycatch scorecard[2] for 2005 management measures.

4.7.3.11.3 Impacts to Communities and Processors

Under this alternative, gross revenues may increase if trawl vessels switch to fixed gear to target sablefish, and the landed catch quantities of other species remain unchanged. Depending on the amount of trawl sablefish caught with fixed gear, and the change in the amount of other species previously caught by those vessels, exvessel revenues could increase by several million dollars. Communities would tend to be positively effected by an increase in exvessel revenues through additional expenditures in those communities. However while switching gear type may result in no change in vessel net revenue, it may result in a reduction in gross revenues, thereby also reducing the level of expenditures by those vessels in effected ports.

4.7.3.11.4 Impacts to Consumers

Consumers may be effected if there is a change in quantity or market price resulting from a change in West Coast fisheries. However it is unlikely that a change in the quantity and quality of groundfish caught along the West Coast under this alternative would have a noticeable effect on consumers due to the ease of product substitutability and the availability of other, similar species and products on the market.

4.7.3.11.5 Impacts to Safety

It is unlikely that safety concerns would increase under this alternative. If exvessel revenues increase, vessels may be able to afford additional safety equipment which would increase the level of safety. However, whether vessel revenues will ultimately increase is unknown. Therefore, the effect of this alternative on safety is unknown.

4.7.3.12 Alternative C.12

Comprehensive collaborative alternative (Oceana proposal): The fishing impact minimization tools of this alternative include area closures and gear restrictions. This alternative would close several areas to bottom trawling, prohibit the expansion of the trawl footprint, and set the maximum footrope size to 8 inches throughout the EEZ off the West Coast. In addition, catch reductions are mentioned as a potential tool to be used by the Council "as appropriate". (E-)

4.7.3.12.1 Impacts to Fisheries

In general, this alternative would put bottom trawl revenues at risk, and make it difficult for trawl vessels to access areas where large footrope trawl gear has been used in the past. Effects to trawl vessels would also come in the form of reduced future opportunities as trawl gear would not be allowed to fish in areas that were not trawled during the 2000–2003 period. Costs may change as vessels move to other locations. If those areas are further from port, and/or vessels are forced to fish more intensely to make up revenues, costs are likely to increase.

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[2] The GMT scorecard is a tool used for tracking and estimating the annual mortality of overfished species by fishery sector.

Socioeconomic Table 4-8 shows the estimated amount of displaced revenue over a four year period by species grouping. The sum of all areas proposed in this alternative displaces more revenue from the DTS complex than for other species groupings. The estimated proportioned block DTS revenues at risk are approximately 18% of DTS bottom trawl revenues generated by the fleet as a whole, while the estimated total block DTS revenues at risk are approximately 40% of DTS bottom trawl revenues generated by the fleet as a whole. Proportioned block Petrale revenues at risk represent slightly less than 20% of Petrale bottom trawl revenues, while total block Petrale revenues at risk represent approximately 40% of Petrale bottom trawl revenues generated by the fleet in total. Estimated proportioned rockfish revenues at risk represent approximately 25% of revenues generated by the fleet, while total block rockfish revenues at risk represent approximately 60% of revenues generated by the fleet in total.

Socioeconomic Table 4-9 shows the estimated amount of displaced revenue over a four year for individual proposed closure areas under alternative C.12. According to Socioeconomic Table 4-9, the 10 largest proposed closed areas in terms of total block revenues at risk are Olympic 1, Olympic 2, Eel River Canyon, Rogue Canyon, Astoria Canyon, Heceta Bank, Monterey Bay and Canyon, Ridges Biogenic Area 5, Mendocino Ridge, and Cordell Bank[3]. The 10 largest proposed closed areas in terms of revenues at risk for proportioned block areas are Olympic 1, Eel River Canyon, Olympic 2, Astoria Canyon, Monterey Bay and Canyon, Heceta Bank, Mendocino Ridge, Rogue Canyon, Ridges Biogenic Area 5, and Cordell Bank.

Net revenues in other bottom trawl vessels (such as shrimp trawlers) may be reduced if those vessels are required to carry VMS to monitor compliance with new area closures. If VMS is required, vessels that do not already carry VMS may be forced to incur costs on the order of $1,550 - $5,295 to purchase a unit; $120 of annual maintenance; and $1 - $5 per day for the cost of transmitting location (NMFS July 2003). This cost compares to approximately $69,000 of average annual gross revenue being made by vessels that made shrimp landings with shrimp trawl gear over the 2000–2003 year period (PacFIN July 2004).

The distribution of effects resulting from this alternative is largely unknown. Depending on the level of change in net revenues, some trawl vessels may choose to move into other fisheries–in whole or in part–thereby negatively effecting fishers in those other fisheries. Trawl vessels that fish in regions with relatively more closed areas may have a larger portion of their historic revenues put at risk than other vessels and this may translate into a larger amount of lost revenue when compared to vessels in other areas. If displaced revenues result in lost revenue, vessels may participate more heavily in other fisheries and negatively effect vessels in those other fisheries through increased competition and reductions in available fishery resource per vessel. Vessels that currently do not have VMS are likely to be more effected by alternatives that impose additional closed areas.

4.7.3.12.2 Impacts to Management and Enforcement

The effect of this alternative on management and enforcement would require establishing and monitoring additional closed areas. This option would require that enforcement agencies monitor new closed areas in addition to existing RCAs and other existing conservation areas/marine protected areas.

- [3] A groundfish closure is currently in place for both commercial and recreational fishing on the Bank.

4.7.3.12.3 Impacts on Processors and Communities

Effects to processors and communities are largely dependent on potential changes in landed catch volume, net revenues from fishing activity, and regional shifts in revenues and landed catch. A change in landed catch volume may translate into a change in processing labor and processing revenues, while a change in net revenues may translate into a change in expenditures made within those communities. Unfortunately, the ability to predict shifts or reductions in landed catch volume and revenues does not currently exist due to data limitations, so the aggregate effect to processors and communities is unknown. However, if some portion of revenues put at risk under this alternative are lost, then processors and communities near areas that have relatively more closures may be effected to a greater degree than processors and communities in other areas. In the long-run, processors may change location and move operations to communities with relatively few closures nearby.

4.7.3.12.4 Impacts to Consumers

Impacts to Consumers may occur if changes in the volume of fish landed along the West Coast translate into a change in market price or product availability. On a global scale, West Coast groundfish represent a small portion of groundfish species available to consumers, and groundfish landed along the West Coast are easily substituted by groundfish caught in other regions. It is therefore unlikely that this alternative would have any noticeable effect on consumers.

4.7.3.12.5 Impacts on Safety

Effects to safety are unknown under this alternative since there are some factors that may increase the level of safety, and some that may decrease safety. Soft sediment exists along the continental slope areas, and large footrope trawl gear is used there to keep the trawl from digging in. Small footrope trawl gear would be more prone to dig into soft sediment in these areas and cause safety hazards if trawl nets become stuck in the bottom. In addition, a reduction in net revenues at the vessel level may make it more difficult for fishers to afford safety equipment and perform routine maintenance, and this may create a more hazardous environment at sea. Vessels that are required to carry a VMS may see increases in safety since a vessel in distress may be more easily located if it has VMS.

4.7.3.13 Alternative C.13

Comprehensive collaborative alternative but areas would be closed to all fishing: This alternative is the same as alternative C.12, but areas would be closed to all fishing instead of only being closed to bottom trawling. (E-)

4.7.3.13.1 Impacts to Fisheries

This alternative essentially establishes a set of marine reserves that would close fishing within certain areas and displace revenues from all fisheries that are active in those areas. Unfortunately spatial data does not exist for non-trawl fisheries, so quantifying displaced revenues from those fisheries is not possible. Displaced revenues may result in lost net revenues to some fishers, and depending on the degree of loss, may provide incentives for some fishers to switch fisheries, thereby negatively effecting those other fisheries due to an increase in the number of participants. Net revenues may be reduced if vessels are required to carry VMS to monitor compliance with new area closures. If VMS is required, vessels that do not already carry VMS may be forced to incur costs on the order of $1,550 - $5,295 to purchase a unit; $120 of annual maintenance; and $1 - $5 per day for the cost of transmitting location (NMFS, July 2003). Due to the lack of data, it is uncertain whether fishers will change strategies and concentrate on other fisheries or species.

A potential benefit to this alternative is addressed in the SSC white paper on marine reserves which states:

> "*Reserves are uniquely qualified to provide a complete age structure for target species and thereby enhance persistence, i.e., the ability of fish stocks to withstand adverse effects associated with environmental variability and management uncertainty and error. In this sense, reserves have significant potential as a tool for mitigating uncertainty in stock assessments and managing unassessed stocks"* (PFMC–SSC. 2004).

This effect is likely more pronounced for this alternative than the others because the other alternatives do not exclude all gear. For example, some alternatives exclude bottom trawl gear but not bottom tending fixed gear. Proposed closed areas in alternatives that do not exclude all gears may not develop stocks with age structure required for enhanced persistence, since non-excluded gears would still induce mortality on groundfish species.

In an economic context, a decrease in future uncertainty (enhanced stock persistence) can be translated into an increase in capital wealth. That is, if fishers believe that the risk of future stock collapse has been reduced through the establishment of a system of marine reserves, the value of fishing capital (vessels and permits for example) will tend to increase assuming future net revenues do not decrease.

4.7.3.13.2 Impacts to Management and Enforcement

The effect of this alternative on management and enforcement would require establishing and monitoring additional closed areas. This option would require that enforcement agencies monitor new closed areas in addition to existing RCAs and other existing conservation areas/marine protected areas.

4.7.3.13.3 Impacts on Processors and Communities

Effects on processors and communities are largely dependent on potential changes in landed catch volume, net revenues from fishing activity, and regional shifts in revenues and landed catch. A change in landed catch volume may translate into a change in processing labor and processing revenues, while a change in net revenues may translate into a change in expenditures made within those communities. Unfortunately, the ability to predict shifts or reductions in landed catch volume and revenues does not currently exist due to data limitations, so the aggregate effect to processors and communities is unknown. However, if some portion of revenues put at risk is lost, then processors and communities near areas that have relatively more closures may be effected to a greater degree than processors and communities in other areas.

During the public comment period, comments were received stating the importance of the Bandon reef area to the communities of Bandon and Coos Bay. Although this area is not actively trawled, other gear types such as hook and line and troll fish the area routinely, and closing this area to all fishing would likely have a notable impact to the communities of Bandon and Coos Bay.

4.7.3.13.4 Impacts to Consumers

Impacts to consumers may occur if changes in the volume of fish landed along the West Coast translate into a change in market price or product availability. On a global scale, West Coast groundfish represent a small portion of groundfish species available to consumers, and groundfish landed along the West Coast are easily substituted by groundfish caught in other regions. Therefore it is unlikely that this alternative would have any noticeable effect on consumers.

4.7.3.13.5 Impacts on Safety

Effects to safety are unknown under this alternative since there are some factors that may increase the level of safety, and some that may decrease safety. Soft sediment exists along the continental slope areas, and large footrope trawl gear is used there to keep the trawl from digging in. Small footrope trawl gear would be more prone to dig into soft sediment in these areas and cause safety hazards if trawl nets become stuck in the bottom. In addition, a reduction in net revenues at the vessel level may make it more difficult for fishers to afford safety equipment and perform routine maintenance, and this may create a more hazardous environment at sea. Vessels that are required to carry a VMS may see increases in safety since a vessel in distress may be more easily located if it has a VMS.

4.7.3.14 Alternative C.14

Comprehensive collaborative alternative but areas would be closed to all bottom tending gear: This alternative is the same as alternative C.12, but excludes all bottom tending gear from proposed closed areas in addition to bottom trawling gear. (E-)

4.7.3.14.1 Impacts to Fisheries

In terms of impacts to fisheries, this alternative falls between alternatives C.13 and C.12. This alternative would displace more revenues than alternative C.12, but less than alternative C.13. Like alternative C.13, spatial information does not exist for non-trawl fisheries, so quantifying the effects to those other fisheries is not possible. Displaced revenues may result in lost net revenues to some fishers, and depending on the degree of loss, that may provide incentives for some fishers to switch fisheries, thereby negatively effecting those fisheries due to an increase in the number of participants. Net revenues may be reduced if vessels are required to carry VMS to monitor compliance with new area closures. If VMS is required, vessels that do not already carry VMS may be forced to incur costs on the order of $1,550 - $5,295 to purchase a unit; $120 of annual maintenance; and $1 - $5 per day for the cost of transmitting location (NMFS, July 2003). Due to the lack of data, it is uncertain whether fishers will change strategies and concentrate on other fisheries or species.

4.7.3.14.2 Impacts to Management and Enforcement

This alternative would require an additional management and enforcement commitment, including existing RCAs, other existing conservation areas/marine protected areas, and the new closed areas.

4.7.3.14.3 Impacts on Processors and Communities

Effects to processors and communities are largely dependent on potential changes in landed catch volume, net revenues from fishing activity, and regional shifts in revenues and landed catch. A change in landed catch volume may translate into a change in processing labor and processing revenues, while a change in net revenues may translate into a change in expenditures made within those communities. Unfortunately, the ability to predict shifts or reductions in landed catch volume and revenues does not currently exist due to data limitations, so the aggregate effect to processors and communities is unknown. However, if some portion of revenues put at risk is lost, then processors and communities near areas that have relatively more closures may be effected to a greater degree than processors and communities in other areas.

4.7.3.14.4 Impacts to Consumers

Impacts to consumers may occur if changes in the volume of fish landed along the West Coast translate into a change in market price or product availability. On a global scale, West Coast groundfish represent a small portion of groundfish species available to consumers, and groundfish landed along the West Coast are easily substituted by groundfish caught in other regions. Therefore, it is unlikely that this alternative would have any noticeable effect to consumers.

4.7.3.14.5 Impacts on Safety

Effects to safety are unknown under this alternative since there are some factors that may increase the level of safety, and some that may decrease safety. Soft sediment exists along the continental slope areas, and large footrope trawl gear is used there to keep the trawl from digging in. Small footrope trawl gear would be more prone to dig into soft sediment in these areas and cause safety hazards if trawl nets become stuck in the bottom. In addition, a reduction in net revenues at the vessel level may make it more difficult for fishers to afford safety equipment and perform routine maintenance, and this may create a more hazardous environment at sea. Vessels that are required to carry a VMS may see increases in safety since a vessel in distress may be more easily located if it has a VMS.

4.7.3.15 Impacts Minimization Alternatives and Non-Fishing Activities

It is not known what effect impact minimization requirements placed on commercial fishing operations will have on non-fishing activities in the short-term. In the long-term, benefits associated with a decrease in damage to habitat may create positive effects from possible increases in ecosystem services as a result of habitat protection. Costanza et al (1997) identify several ecosystem services including waste treatment, biological control, genetic resources, and storm protection. Some potential examples that apply to the marine environment include the effect kelp forests have in dampening the effect of storms on coastal areas, and the ability of the marine environment to assimilate output from waste water outfalls from coastal cities.

Impact minimization restrictions placed on commercial fishing operations will have an unknown effect on non-fishing values in the short-term. Positive effects are anticipated if impact minimization options are perceived as permanent, beneficial management actions that will improve habitat quality and productivity. In the long-term, benefits associated with a decrease in damage to habitat are expected to have a positive overall effect on non-fishing values. A positive value may result due to enhanced habitat productivity. For example, if impact minimization options lead to increased habitat productivity, dive trip operators will likely benefit due to their ability to offer an enhanced experience. Passive use values are also expected to increase due to a potential increase in biodiversity, existence value and bequest value. However, it should be noted that some negative effects to social and cultural value may result due to loss of certain gear groups or fishing industry in coastal communities (U).

4.7.4 Research and Monitoring Alternatives

4.7.4.1 Alternative D.1

No Action

4.7.4.1.1 Impacts on the Socioeconomic Environment

By definition, this alternative is not expected to have an effect on the socioeconomic environment

4.7.4.2 Alternative D.2

Expanded Logbook Program

4.7.4.2.1 Option D.2.1

All vessels

4.7.4.2.2 Impacts to Fisheries

An expanded logbook program would require additional vessels to maintain spatial fishing information. This alternative would result in more time spent filling out logbooks by vessel operators. Effects to net revenues are not expected under this option.

4.7.4.2.3 Impacts to Management and Enforcement

An expanded logbook program would place additional burdens on agencies to enter logbook data into an electronic format for use in management activities. The existence of additional logbook data in a format that can be readily used by management would increase the information available for spatial management and would improve the ability of managers to model fishing activities accordingly.

4.7.4.2.4 Impacts on Processors, Communities, Consumers, and Safety

It is unlikely that an expanded logbook program would influence processors, communities, consumers, or safety. An expanded logbook program is not expected to change the manner in which fisheries occur.

4.7.4.2.5 Option D.2.2

Sample of vessels

4.7.4.2.6 Impacts to Fisheries

An expanded logbook program would require additional vessels to maintain spatial fishing information. This alternative would result in more time spent filling out logbooks by vessel operators. Effects to net revenues are not expected under this option.

4.7.4.2.7 Impacts to Management and Enforcement

An expanded logbook program would place additional burdens on agencies to enter logbook data into an electronic format for use in management activities. The existence of additional logbook data in a format that can be readily used by management would increase the information available for spatial management and would improve the ability of managers to model fishing activities accordingly.

A sample of logbooks would reduce the cost of entering and maintaining that data compared with option D.2.1, though a sample would also reduce the amount of spatial fishery information available, and reduce the level of certainty agencies have in estimating spatial effort and catch on a fleet-wide basis.

4.7.4.2.8 Impacts on Processors, Communities, Consumers, and Safety

It is unlikely that an expanded logbook program would influence processors, communities, consumers, or safety. An expanded logbook program is not expected to change the manner in which fisheries occur.

4.7.4.3 Alternative D.3

Expanded Vessel Monitoring System

4.7.4.3.1 Impacts to Fisheries

An expanded vessel monitoring system program would require additional vessels to incur the cost of installing and maintaining VMS equipment, thus reducing net revenues. Vessels that do not already carry VMS may be forced to incur costs on the order of $1,550 - $5,295 to purchase a unit; $120 of annual maintenance; and $1 - $5 per day for the cost of transmitting location (NMFS, July 2003).

4.7.4.3.2 Impacts to Management and Enforcement

An expanded VMS program would place additional burdens on agencies to monitor and record data transmitted via additional vessel monitoring systems. If this data is made available to both management and enforcement agencies, it would improve the amount of spatial fishery information available, and would enable managers to model fisheries more effectively.

4.7.4.3.3 Impacts on Processors, Communities, Consumers, and Safety

It is unlikely that an expanded VMS program would influence processors, communities, or consumers. Safety may be enhanced of additional vessels carry VMS as those vessels may be easier to locate. An expanded VMS program is not expected to change the manner in which fisheries occur on an aggregate basis.

4.7.4.4 Alternative D.4

Research Reserves

4.7.4.4.1 Impacts to Fisheries

A system of research reserves may put fishery revenues at risk in those areas that are closed to fishing, and increase effort in areas remaining open to fishing. If revenues at risk result in lost revenue, vessels that are relatively more effected may participate more heavily in other fisheries and negatively effect vessels in those other fisheries through increased competition and reductions in available fishery resource per vessel. If vessels are required to carry a vessel monitoring system to verify compliance with the reserve system, vessels that do not already carry VMS may be forced to incur costs on the order of $1,550 - $5,295 to purchase a unit; $120 of annual maintenance; and $1 - $5 per day for the cost of transmitting location (NMFS, July 2003).

4.7.4.4.2 Impacts to Management and Enforcement

If a research reserve system closes areas to fishing, agencies would be required to monitor new closed areas in addition to areas currently closed in order to minimize bycatch. In addition, the amount of fisheries-independent research being conducted would presumably need to increase, thereby placing additional burdens on agencies.

4.7.4.4.3 Impacts on Processors, Communities, Consumers, and Safety

Effects to processors, communities, consumers, and safety may occur if there are changes in the distribution of landed catch, if there are reductions in the amount of landed catch, if there are changes in vessel revenues, or if vessels are required to carry additional safety equipment or fish in more hazardous conditions. Changes in these factors are largely unknown, and therefore the effect to processors, communities, consumers, and safety are unknown.

4.7.4.5 Research and Monitoring Alternatives and Non-Fishing Values

In the short-term, the research and monitoring options are anticipated to have an unknown effect on non-fishing activities. In the long-term, benefits associated with a decrease in damage to habitat, resulting from better management enabled by enhanced biological data collection, may increase non-consumptive use value and passive use values due to enhanced habitat productivity.

In the longer term, the improved knowledge base that would result from increased research and monitoring may allow managers to provide for enhanced fishery production that would benefit other fisheries. Additionally, ecosystem concerns that are currently difficult or impossible to factor in to management may be more easily addressed with additional research and information. Costanza et al.

(1997) identify several ecosystem services including waste treatment, biological control, genetic resources, and storm protection. Some potential examples that apply to the marine environment include the effect kelp forests have in dampening the effect of storms on coastal areas, and the ability of the marine environment to assimilate output from waste water outfalls from coastal cities.

4.7.5 Cumulative Effects of the Alternatives on the Socioeconomic Environment

Cumulative effects must be considered when evaluating the alternatives to the issues considered in this EIS. Cumulative effects are those combined effects of an action on the quality of human environment that result from the incremental effect of the action when added to other past, present, and reasonably foreseeable future actions, regardless of whether a federal or non-federal agency undertake such actions (40 CFR 1508.7). The area that would be effected by actions discussed in this document is from the mean high tide mark to the seaward boundary of the West Coast EEZ (0 to 200 nautical miles offshore).

Unfortunately, data does not exist to quantify most potential benefits that have accrued within the recent past, though it is likely that the costs of recent management actions have outweighed the monetary benefits based on empirical evidence of recent industry consolidation. The net effects of the alternatives in this EIS are even more uncertain, but possible benefits and costs can be described from a short-term and long-term perspective. If habitat protection results in increased stock productivity and revenues to the fishing industry, it is likely that these benefits would accrue over the long-term since many groundfish species are relatively slow growing. Protecting habitat is likely to have a cost in the short-term if fishing revenues are displaced, but it may also have an effect in the long-term if habitat protection results in an opportunity cost (e.g., foregone revenues) in perpetuity.

Although potential benefits are unknown, recent management actions have been increasingly restrictive on fishing (commercial and recreational) in general. The commercial catch of groundfish (excluding Pacific whiting) had been declining for many years (though this decline may have slowed or stopped), and as a result revenues for many vessels were also declining. The implementation of the rockfish conservation areas–combined with differential catch limits designed to minimize the mortality of rockfish–displaced revenues from areas that had historically been productive for much of the commercial fishing fleet.

Several actions have worked to counter the decline in vessel revenues. In 2003, the limited entry trawl fleet participated in a vessel buyback program that reduced the number of groundfish vessels on the West Coast. Analysis before the buyback program showed that net revenues per vessel should increase post buyback as a result of lower aggregate fixed cost, and available data shows that exvessel revenues per vessel increased in 2004 over 2003 on an average vessel basis. Unfortunately, the effect of this buyback had negative consequences on some communities and processors as certain ports lost a disproportionate share of their trawl fleet and the associated landings. In 2001, NMFS implemented a permit stacking program for the limited entry fixed gear vessels, reducing the number of vessels participating in the primary sablefish fishery. As part of this permit stacking program, the Council recommended lengthening the primary sablefish season from 5-10 days to 7 months. Season participants may now choose their time and pace of fishing, affording them improved safety and product marketing flexibility. The Council is also in the process of considering a dedicated access privilege program for the limited entry trawl fishery. Vessel owners with dedicated access privileges are better able to plan for and invest in their future, including optimizing their product marketing opportunities. Implementing a dedicated access privilege program in the trawl fishery would likely improve the financial standing of the fishery's participants, making monitoring devices and personnel costs more easily borne by vessels.

In response for the need to enforce and verify compliance with RCA boundaries, limited entry vessels are now required to carry VMS, and in the near future, open access vessels may be required to carry VMS as well. Beginning in 2005, trawlers fishing shoreward of the RCA will be required to fish with a selective flatfish trawl–a gear designed to avoid rockfish while retaining more abundant flatfish. This will require vessels to incur costs of modifying their current trawl gear, but will allow those vessels to fish bimonthly cumulative limits that are larger than limits specified for the 2004 season. This is likely to increase the amount of total trawl effort occurring on the continental shelf, in areas shoreward of the trawl RCA.

The cost of many of the impact minimization and research and monitoring alternatives proposed in this EIS may include both gear and equipment modifications and requirements, and possible loss in net revenue as a result of closed areas. Some benefits may include increases in safety for alternatives that require VMS on additional vessels, since VMS would make it easier to locate vessels in distress. Other potential benefits may include increases in stock productivity and fishery yields due to habitat protection, though such benefits are still hypothetical. Unfortunately, quantifying all of the costs and benefits associated with each alternative is not possible because it is unknown how much revenue is likely to be lost (if any) as a result of an area closure and whether habitat protection will ultimately result in increased fishery yields. In the same sense, the costs and benefits of past and existing regulatory actions are largely unknown, though it can be reasonably stated that the net monetary effect of many past management measures has generally been negative based on industry consolidation and increasing demands on management agencies.

Socioeconomic Table 4-10 describes the effect of past and present factors on portions of the socioeconomic environment along with the likely effect each impact minimization and research and monitoring alternative will have on identified portions of the socioeconomic environment. The cumulative effect can be described as the sum of all of those influences, although the collective sum also depends on the weight given to each portion of the environment.

4.8 Consequences of the Final Preferred Alternative on the Socioeconomic Environment

The preferred alternative to minimize adverse impacts to EFH from fishing does so through a suite of area closures and by limiting large footrope trawl gear shoreward of 150 fathoms. Some closures are specific to trawl gear, others include all bottom contact gear or specific gear types, and others are closed to all fishing.

4.8.1 Impacts to Fisheries

All fisheries may be positively influenced over the long term due to the potential for enhanced ecosystem conditions (E+). Under this alternative, limited entry bottom trawl revenues at risk may equal to $8.4 million if proportioned block data is used or $36.3 million if entire block revenues are used. The majority of revenues put at risk are expected to be comprised of DTS species, primarily because closed areas tend toward deeper depths where these species are found (Socioeconomic Table 4-15). This alternative eliminates future opportunities for bottom trawl expansion by freezing the trawl footprint. This is expected to act as status quo since it is not believed bottom trawl vessels fish outside the area designated as the trawl footprint. Impacts to other fisheries may occur if trawl fisheries are impacted to a degree that makes other fisheries appear relatively more profitable. This alternative does not include any reductions in the amount of catch that trawl vessels are allowed to retain, but it may make it more difficult for trawl vessels to attain historic catch levels in the short run, thus making other fisheries appear more attractive. In the long run, habitat protection measures may result in greater stock productivity and actually enhance the amount of trawl catch. Unfortunately, both of these short run and long run impacts are hypothetical due to lack of information. The short and long run impacts to trawl fisheries and the potential for trawl vessels to participate in non-trawl fisheries is unknown (U) however may be consistent with the status quo (O).

Vessels using bottom tending gear may experience displaced revenues as several areas are also closed to bottom tending gear. Some areas are expected to result in little or no displaced revenues such as Thompson seamount and President Jackson seamount because it is not believed that vessels actively fish these areas with bottom tending gear to any large degree. Vessels traditionally fishing the Cordell bank area with bottom tending gear may experience some displacement of revenues, though the amount is expected to be minor because this area is relatively small and the Cordell bank area is regularly closed to groundfish fishing under status quo management because of the rockfish conservation area boundaries. Since areas closed to bottom tending gear are few and relatively small, it is expected that few, if any, vessels will participate in other fisheries. The consequences of the final preferred alternative on fixed gear fisheries is likely to be no significant change or unknown (O/U).

For recreational fisheries, on a fishery-wide basis the preferred alternative is not expected to result in a change in the aggregate level of catch. Recreational fishing may be curtailed at areas where bottom contact gear would be prohibited in the Channel Island areas and Cordell bank. It is unlikely that such restrictions are significant however the lack of spatial information for recreational fisheries limit the prediction of consequences to unknown with the potential for positive consequences due to enhanced ecosystem conditions (U/E+).

This alternative is likely to require additional vessels to carry VMS so that enforcement can adequately monitor the closed areas. This may include non-limited entry trawlers such as shrimp, sea cucumber, and California halibut trawl vessels. It may also include vessels using bottom tending gear such as open access groundfish vessels using longline, vertical hook and line, or pots; crab pot vessels; and shrimp pot vessels. In order to enforce gear restrictions around the Channel Islands, additional types of vessels in the southern California area may be required to carry VMS. If VMS is required to monitor compliance with the closed areas, vessels that do not already carry VMS may be forced to incur costs on the order of $1,550 - $5,295 to purchase a unit; $120 of annual maintenance; and $1 - $5 per day for the cost of transmitting location (NMFS July 2003)

4.8.2 Impacts on Management and Enforcement

This alternative will impact management and enforcement agencies by requiring closed areas to be enforced and to verify that certain gear types are not being used in restricted areas. Of particular note, some closed areas were drawn with highly detailed boundaries in an attempt to minimize the impact to fishers while protecting sensitive habitat. These detailed boundaries are more difficult to enforce than boundaries drawn with straight lines and few corners. Detailed trawl closure areas tend to be more focused in areas off the California coast where there are also fewer enforcement officers. However, requiring VMS of vessels subject to trawl closed areas would ease the burden of enforcing these closures (E-).

4.8.3 Impacts to Consumers, Processors, and Communities

Under this alternative, some amount of catch and revenue is likely to be displaced, and this may effect other entities reliant on that catch. It is unlikely that consumers will be impacted since any change in catch volumes potentially occurring under this alternative are likely to be made up by catch occurring in other regions or internationally, or will constitute a small portion of global groundfish catch. Processors may be affected if there is a reduction in landed catch volume or a change in the mix of species being landed. Communities may be affected if changes in exvessel revenue occur or if landings to those communities change. It is generally unknown if catch volumes will change, and therefore impacts to processors, communities, and consumers is unknown (U).

4.8.4 Impacts on Safety

Impacts to safety are likely to occur if there is a reduction in vessel net revenues, if vessels are forced to fish under more hazardous conditions, or if vessels are required to carry additional safety equipment. Under this alternative vessels are not being forced to fish in more hazardous conditions, but some vessels may see a reduction in vessel net revenues. Vessels that are required to carry a VMS may see increases in safety since a vessel in distress may be more easily located if it has VMS; however if those vessels also see a reduction in net revenues, potential safety gains from carrying VMS may be negated if lower revenues result in less repair and maintenance. Therefore, the net impacts to safety are unknown (U).