GROUNDFISH BIENNIAL SPEX

CHAPTER 3.0 Affected Environment

3.3 Fishery Ecosystem

3.3.1 Protected Species

Four different laws designate a species or stock as "protected" within U.S. waters: the Endangered Species Act (ESA), the Marine Mammal Protection Act (MMPA), the Migratory Bird Treaty Act (MBTA), and Executive Order 13186. For the purposes of this section, a species is considered protected if it falls under the regulatory umbrella of one of these Federal laws.

In November, 2009, the Council and NMFS published the Draft Environmental Impact Statement on Rationalization of the Pacific Coast Groundfish Limited Entry Trawl Fishery. This document describes protected species found in the West Coast EEZ, and is summarized briefly below. The June 2008 Final EA on "A Limited Entry Program for the Non-Tribal Sectors of the Pacific Whiting Fishery" (FMP Amendment 15 EA) and the December 2005 Final EIS on "Pacific Coast Groundfish Fishery Management Plan Essential Fish Habitat Designation and Minimization of Adverse Impacts" (EFH EIS) (NMFS 2005) provided descriptions of West Coast EEZ species protected under the ESA, the MMPA, the MBTA and EO 13186 at Section 3.2 and 3.4, and Section 4.6, respectively, and provided information on fisheries interactions, where available and applicable. The December 2006 Final EIS on "Proposed Acceptable Biological Catch and Optimum Yield Specifications and Management Measures for the 2007-08 Pacific Coast Groundfish Fishery" (PFMC 2006) provided descriptions of West Coast EEZ species protected under these same laws at Chapter 6, and analyzed the effects of the groundfish fisheries on these species.

In March, 2010, the West Coast Groundfish Observer Program (WCGOP) published a report entitled "Bycatch of Marine Mammals, Sea Turtles, and Seabirds in the 2002-2008 U.S. West Coast Commercial Groundfish Fishery." The document includes information on one interaction with a leatherback sea turtle (*Dermochelys coriacea*), representing the first documented sea turtle interaction with this fishery in many years. (Heery et al 2010). Leatherback, green (*Chelonia mydas*), and olive ridley (*Lepidochelys olivacea*) turtles are listed as endangered under the ESA, while loggerhead (C*aretta caretta*) turtles are listed as threatened. Heery et al (2010) also documents interactions with other marine mammals and seabirds, and uses a ratio estimator to estimate bycatch rates (Cochran 1977).

Whales listed under the ESA or the MMPA, and known to be present in West Coast waters include humpback, fin, blue, sperm, gray, and orca. However, only the sperm whale (*physeter macrocephalus*) has been observed to have interacted with commercial groundfish vessels on the West Coast.

Other cetaceans with documented interactions with the West Coast groundfish fishery include the harbor porpoise (*Phocoena phocoena*), Pacific white-sided dolphin (*Lagenorynchus obliquidens*), and Risso's dolphin (*Grampus griseus*). These species are protected under the MMPA but not the ESA.

Other marine mammals with documented interactions with the West Coast groundfish fishery include the California sea lion (*Zalophus californianus*), harbor seal (*Phoca vitulina*), northern elephant seal (*Mirounga angustirostris*), and the steller sea lion (*Eumetopias jubatus*). These species are all protected under the MMPA, and the steller sea lion is also listed under the ESA.

The U.S. West Coast supports a diversity of seabird species, including several with documented interactions with the groundfish fishery. These species fall under a variety of protective statutes and are listed in Table 4.3-2).

Based on these NEPA implementing regulations, the relevant content of the aforementioned EAs, EISs, and data report are incorporated by reference.

Species Recently Listed Under the ESA

Lower Columbia River coho (70 FR 37160, June 28, 2005) the Southern Distinct Population (DPS) of green sturgeon (71 FR 17757, April 7, 2006), and the southern DPS of eulachon (75 FR 13012) on March 18, 2010) have been listed as threatened under the ESA. In addition, Oregon Coast coho was proposed on May 26, 2010, to remain listed as threatened (75 FR 9489). As a consequence, NMFS has reinitiated its Section 7 consultation on the Council's FMP.

3.3.2 Essential Fish Habitat

A description of West Coast marine ecosystems and the affected essential fish habitat are available in volume 1 of the Council's 2008 Stock Assessment and Fishery Evaluation (SAFE) document. Volume 1 of the 2008 SAFE document is available by request to the Council office or online at www.pcouncil.org/groundfish/gfsafe.html. That document is hereby incorporated by reference.

Essential Fish Habitat and Periodic Reviews

EFH has been described within the project area for highly migratory species, CPS, salmon, and groundfish. The MSA defines EFH to mean "those waters and substrate necessary to fish for spawning, breeding, feeding or growth to maturity" (16 U.S.C. 1802 sec. 3(10)). Regulatory guidelines elaborate that the words "essential" and "necessary" mean EFH should be sufficient to "support a population adequate to maintain a sustainable fishery and the managed species' contributions to a healthy ecosystem." The regulatory guidelines also establish authority for Councils to designate Habitat Areas of Particular Concern (HAPC) based on the vulnerability and ecological value of specific habitat types. Councils are required to minimize, to the extent practicable, the adverse effects of fishing on EFH. NMFS works through a consultation process to minimize adverse effects of non-fishing activities (50 CFR 600 subpart J). Refer to Volume 1 of the Council's 2008 groundfish SAFE document for more information. The Magnsuon Act requires councils and NMFS to periodically review EFH and make changes as warranted by newly available information. All four West Coast FMPs are either in the review process (salmon and CPS) or pending (HMS, groundfish).

3.3.3 Trophic Structure

West Coast Marine Ecosystems

The term ecosystem is generally defined as a "functional unit of the environment" within which the basic processes of energy flow and cycling are identifiable and can be (relatively) localized. In this sense, marine ecosystems are extremely difficult to identify, as most are relatively open systems, with poorly defined boundaries and strong interactions across broad spatial scales. The California Current ecosystem, like other Eastern boundary current ecosystems, are especially difficult to define, as they are characterized by tremendous fluctuations in physical conditions and productivity over multiple time scales (Parrish et al. 1981; Mann and Lazier 1996). To some degree, food webs are structured around coastal pelagic species (CPS) that exhibit boom-bust cycles over decadal time scales in response to low frequency climate variability (Bakun 1996; Schwartzlose et al. 1999). Similarly, the top trophic levels of such ecosystems are often dominated by highly migratory species such as salmon, albacore tuna, sooty shearwaters, fur seals and baleen whales, whose dynamics may be partially or wholly driven by processes in entirely different ecosystems, even different hemispheres. For this analysis, the ecosystem is considered in terms of physical and biological oceanography, climate, biogeography, essential fish habitat (EFH), marine protected areas, and the role of depleted species' rebuilding in the marine ecosystem.

3.3.3.1 Physical and Biological Oceanography

The California Current is essentially the eastern limb of the Central Pacific Gyre, and begins where the west wind drift (or the North Pacific Current) reaches the North American Continent. This occurs near the northern end of Vancouver Island, roughly between 45° and 50° N latitude and 130° to 150° W longitude (Ware and McFarlane 1989). A divergence in the prevailing wind patterns causes the west wind drift to split into two broad coastal currents, the California Current to the south and the Alaska Current to the north. As there are really several dominant currents in the region, all of which vary in geographical location, intensity, and direction with the seasons, this region is often referred to as the California Current System (Hickey 1979). A more detailed description of the physical and biological oceanography of West Coast marine ecosystems can be found in Volume 1 of the 2008 SAFE document.

3.3.3.2 Interannual and Interdecadal Climate Forcing

The effects of climate on the biota of the California Current ecosystem have been recognized for some time. Many of these effects and research illuminating these processes can be found in Volume 1 of the 2008 SAFE document. Additional information regarding anthropogenic climate forcing follows.

Climate change and ocean acidification pose significant additional stresses to managed fisheries on top of fishing mortality (IPCC 1995;WBGU 2006;IPCC 2007). Heat stress from warming waters and changes in the timing and magnitude of upwelling and associated nutrients and prey are just two examples. As climate change proceeds, there will likely be greater departure from historic population trends and increased uncertainty and risk in fisheries management. In addition, the effects of fishing pressure may unexpectedly magnify the effects of climate change and vice versa (IPCC 2001;Harley and Rogers-Bennett 2004;Hsieh et al. 2008). For example, overfishing and climate interactions are believed to have facilitated the sustained collapse of the Atlantic cod (Rose and O'Driscoll 2002;Beaugrand et al. 2003).

Over the past decade, researchers have observed numerous oceanographic changes along the Pacific Coast which are consistent with anthropogenic climate forcing. They include: warmer surface waters in the California Current (Mendelssohn et al. 2003;Mendelssohn et al. 2005), increased stratification in the Southern region of the current (Roemmick and McGowan 1995), increased rate of eustatic sea level rise (IPCC 2007), declining pH with episodes of aragonite undersaturated waters occurring on the continental shelf (Feely et al. 2004;Orr et al. 2005;Caldeira and Wickett 2008), and phenology (changes in the timing and duration of upwelling) (Barth et al. 2007;Chan et al. 2008. Bograd et al. 2009). Ecological responses have also been observed, including shifts in planktonic community in the California Current from subtropical to tropical (Roemmick and McGowan 1995;Field et al. 2006), reproductive failures in seabird colonies (Sydeman et al. 2006; Peterson et al. 2006, Sydeman et al. 2009), numerous northward range extensions (Erickson et al. 1991;Carlton 2000;Hoff 2002;Walker et al. 2002;Tognazzini 2003;Field et al. 2007; Roberts et al. 2007;Rogers-Bennet 2007), shoaling of the oxygen minimum layer in deep water (Bograd et al. 2008), and reoccurring seasonal dead zones off the coast of Oregon (Chan et al. 2008).

Ludwig et al. (1993) argue the potential for adverse impacts on fish populations from the identified changes, individually and cumulatively and our inability to formulate precise predictions regarding fisheries' responses requires adoption of a more precautionary approach to exploitation than is the norm. As climate change imposes a variety of selective pressures, it will be critical for fish populations to maintain their connectivity and adaptability (IPCC 1995; IPCC 2001; FAO 2002;Arctic Council Arctic Climate Impact Assessment 2005; WBGU 2006). This will require preservation of large, genetically diverse populations which are broadly distributed, and maintenance of a more natural size distribution within populations, to promote productivity.

3.3.3.3 Biogeography

Biogeography describes spatial patterns of biological distribution. Along the U.S. west coast within the California Current system, such patterns have been observed to be influenced by various factors including depth, ocean conditions, and latitude. Each is discussed in volume 1 of the 2008 groundfish SAFE document.

3.3.3.4 Marine Protected Areas

In addition to the closed areas described above, there are marine protected areas distributed throughout the project area. The EIS for Pacific Coast Groundfish EFH contains a complete analysis of these sites and is incorporated here by reference. The following is a brief summary of these areas.

Federally Designated Marine Managed Areas

- Twenty-eight National Wildlife Refuges, covering approximately 89,000 ha. Regulations vary by refuge, but generally, commercial fishing is not allowed in most refuges.
- Seven National Parks, covering approximately 570,000 ha (although only a small fraction of this area is the marine portion of the parks). Regulations vary by park.
- Five National Marine Sanctuaries covering approximately 3,000,000 ha. Regulations vary by sanctuary, but in general, all types of fishing are allowed in Federal waters of the sanctuaries.
- Four National Estuarine Research Reserves (NERR), covering approximately 8,000 ha. All fishing and fishing gear are prohibited from the Tijuana River NERR and the Elkhorn Slough NERR (which doesn't include the Slough's main channel). All other NERR sites allow or do not address specific fishing regulations.

Other Federal Areas

These are some additional areas under Federal jurisdiction that may have restrictions to vessel access, rather than specific regulations having to do with fishing or fishing gear. These data were developed in 1998 by Al Didier for the Pacific States Marine Fisheries Commission (PSMFC), so the total number of areas may have changed since these data were compiled.

- Twenty-two Regulated Navigation Areas (33CFR165) cover approximately 17,000 ha, and are located generally in urban areas such as Puget Sound, Columbia River, San Francisco Bay, Los Angeles, and San Diego.
- Forty-nine Danger Zones and Restricted Areas (33CFR334) cover approximately 170,000 ha. These are located in Puget Sound, San Francisco Bay, Monterey Bay, between Morro Bay and Point Conception, off some of the Channel Islands, and a few additional southern California locations.
- Twenty-seven weather and scientific buoys. Two buoys are located off the Washington coast, one is located off the Oregon coast, and twenty buoys are located off the California coast, with six of these located off Monterey Bay. Four of these buoys are located outside the EEZ.

Fishing regulated areas established by the Council:

- Rockfish Conservation Areas (RCAs): These areas have changed over time, as well as having a seasonal component to their locations. In addition, there are specific areas for trawl gear and non-trawl gear.
- Cowcod Conservation Areas (CCAs): Sections of the CCA cover a total area of 1,372,447 ha.
- Darkblotched Conservation Area (DBCA): The Darkblotched Conservation Area covered 1,029,415 ha.
- Yelloweye Rockfish Conservation Area (YRCA): This area encompasses 59,285 ha.
- Two National Marine Fisheries sites (Pacific Whiting Salmon Conservation Zones), covering approximately 44,000 ha. These two sites, one off the Columbia River and one off the Klamath River, prohibit fishing for Pacific Whiting with commercial mid-water trawl gear.

Currently, these area-based spatial management measures, as well as depth-based gear restrictions, are key to achieving a range of management objectives, particularly those to reduce the bycatch of rebuilding species while maintaining fishing opportunities on healthy stocks. Latitudinal area management is outlined in the ABC and OY tables within the biennial specifications (e.g., North 40°10 N. latitude and South 40°10 N. latitude) and in the trip limit tables where, in some instances, limits differ from the ABC/OY delineations because of bycatch considerations.

Complex spatial management measures have become increasingly necessary within the existing management framework, for example, the RCA configuration adopted in March 2007 to minimize canary rockfish bycatch created a spatial management regime considerably more complex than past management measures. Yet the underlying causes and consequences for the spatially varying abundance and bycatch rates were unclear; the management regime was implemented without explicit knowledge of whether the differences in high versus low bycatch rates by area reflected habitat association and stock distribution, or historical patterns of depletion that leave depleted (low bycatch) regions more vulnerable to localized depletion. As trawl rationalization management alternatives are considered by the Council, there may be a further increased need for spatial management measures, possibly in a manner different than status quo. For example, some intersector allocation alternatives, as well as trawl rationalization alternatives, could result in effort and catch being concentrated in smaller areas than status quo, as some current alternatives allocate the IQ of groundfish stocks according to the Council's ABC/OY table rather than existing cumulative limits that separates the fishery into as many as three latitudinal areas (i.e., north and south of 40° 10' N latitude and between 38° and 40° 10' N latitude). There is also some potential for greater spatial resolution of nearshore resource management relative to that offshore. For example, there is some evidence that nearshore ecosystems exhibit marked regional differences in their species composition, dynamics and productivity, and the specialization of associated fishery, offshore ecosystems (particularly the slope ecosystem and species) tend to have more population connectivity and more homogenous distribution and life history characteristics (Pacific Marine Conservation Council 2006).

There is growing recognition of spatially complex stock structure for many west coast groundfish (e.g. (Miller et al. 2005;Gunderson and Vetter 2008), as well as increasing recognition for the need to characterize and maintain fish stocks at appropriate spatial scales (Berkeley et al. 2004b;Francis et al. 2007). New approaches for evaluating relative exploitation rates or size structure of exploited populations have also provided insights into the relative impacts of fisheries over finer spatial scales than traditional assessments (Harvey et al. 2006;O'Farrell and Botsford 2006). To accommodate and respond to such complexity appropriately, there is general agreement that additional research and analyses of current data sources will be needed, as spatial analysis in fisheries research and management have tended to lag behind more academic research in marine and terrestrial ecology (Pelletier and Mahevas 2005; Wilen 2006). A recent National Research Council report found that spatial analyses may be one of the greatest obstacles faced by fishery managers, and that advances in both assessment methods and simulation techniques should provide the means to better cope with the challenges of incorporating such complexity in the face of increasingly complex and spatially explicit management regimes (National Research Council 2006). Spatially-explicit management will continue to be critical to meeting conflicting management goals and objectives, such as maintaining fishing opportunities on healthy stocks while reducing incidental catches of rebuilding species, and meeting habitat protection requirements. Recent research by the NWFSC has examined some of the interactions between spatial management, and yield optimization, and protected species biomass (Horne et al. 2010). This recent research has not yet been fully analyzed in the context of this document.

State Marine Protected Areas. The California Marine Life Protection Act (MLPA) directs the state to reevaluate and redesign California's system of MPAs to: increase coherence and effectiveness in protecting the state's marine life and habitats, marine ecosystems, and marine natural heritage, as well as to improve recreational, educational and study opportunities provided by marine ecosystems subject to minimal human disturbance. The MLPA also requires that the best readily available science be used in the redesign process, as well as the advice and assistance of scientists, resource managers, experts, stakeholders and members of the public. This section's text and information is taken from the California Department of Fish and Game MSPA website (http://www.dfg.ca.gov/mlpa/).

A regional approach is being used to redesign MPAs along California's 1,100-mile coast. The state has been divided into five study regions:

- Central Coast (Pigeon Point to Point Conception)
- North Central Coast (Alder Creek near Point Arena to Pigeon Point)
- South Coast (Point Conception to the California/Mexico border)
- North Coast (California/Oregon border to Alder Creek near Point Arena)
- San Francisco Bay (waters within San Francisco Bay, from the Golden Gate Bridge northeast to Carquinez Bridge)

The North-Central Coast region and the Central region have MPAs already impletments, while the other three regions (South Coast, North Coast, and San Francisco Bay) are in process.

California's North-Central Coast Marine Protected Areas took effect May 1, 2010, from Alder Creek, near Point Arena (Mendocino County) to Pigeon Point (San Mateo County). The series of 21 marine protected areas (MPAs), three State Marine Recreational Management Areas, and six special closures, covers approximately 153 square miles (20.1%) of state waters in the north central coast study region. Approximately 86 square miles (11%) of the 153 square miles are designated as "no take" state marine reserves, while different take allowances providing varying levels of protection are designated for the rest.

North-Central Coast MPAs (the second of five study regions along the coast) include:

- 11 State Marine Conservation Areas (SMCA), which limit recreational and commercial fishing
- 10 "no-take" State Marine Reserves (SMR), which prohibit recreational and commercial fishing
- 3 State Marine Recreational Managed Area (SMRMA)
- 6 Special Closures

California's Central Coast Marine Protected Areas went into effect September 21, 2007. From Pigeon Point (San Mateo County) south to Point Conception (Santa Barbara County), the series of 29 marine protected areas represent approximately 204 square miles (or approximately 18 percent) of state waters in the Central Coast Study Region.

Central Coast MPAs (the first of five study regions along the coast) include:

- 15 State Marine Conservation Areas (SMCA), which limits recreational and commercial fishing.
- 13 "no-take" State Marine Reserves (SMR); a total of 85-square miles and;
- One State Marine Recreational Managed Area (SMRMA); Morro Bay State Marine Recreational Management Area, where recreational fishing is limited or restricted.

Oregon: MPA boundaries for three types of sites in Oregon were provided by ODFW. These are all small intertidal sites encompassing approximately 460 ha.

- Seven Marine Gardens: Generally, commercial and recreational pot gear is prohibited, other gear types not restricted.
- Six Research Reserves: Generally, commercial pot gear is prohibited.
- One Habitat Refuge: All commercial and recreational fishing activities are prohibited.
- Two no-take pilot marine reserves: Otter Rock off Depoe Bay and Redfish Rocks off Port Orford.

The Oregon Legislature also required state agencies to evaluate potential reserves at Cape Falcon south of Cannon Beach, Cascade Head near Lincoln City and Cape Perpetua near Yachats. It tells the agencies to support a reserve proposal for the Cape Arago-Seven Devils area, south of Coos Bay.

Washington: The Washington State GIS data for MPAs contain 68 individual sites covering approximately 28,000 ha. The areas are managed by one of the following organizations: Washington Department of Fish and Wildlife (WDFW), Washington Department of Natural Resources (WDNR), San Juan County Marine Resource Committee (MRC), Washington State Parks and Recreation Commission (WSPRC), or The Nature Conservancy (TNC). The total area figure is a bit of an overestimate because some of the areas, such as state parks and TNC areas include the upland portions of the sites as well as the marine portions.

- Nine WDFW Marine Preserves: generally prohibit most types of commercial fishing gear.
- Two WDFW Wildlife Refuges: generally closed to all access.
- Nine WDFW Conservation Areas: most restrictive of fishing—all fishing and gear are prohibited from nearly all of these sites.
- Two WDFW Sea Cucumber Closures: closed to commercial harvest of sea cucumbers and urchins.
- Six WDNR Aquatic Reserves: no restrictions on commercial or recreational fishing.
- Seven WDNR Natural Areas Preserves: highest level of restriction—only allowable activities are scientific or education functions. Therefore, no commercial or recreational fishing allowed.
- Two WDNR Natural Resource Conservation Areas: no specific prohibition of fishing activities.
- Eight San Juan County MRC Bottomfish Recovery Zones: these are voluntary bottomfish no-take zones—no specific prohibition of fishing activities.
- Seven State Parks: prohibited to take non-game invertebrates and seaweed. No specific prohibition of fishing activities.
- Two TNC Conservation Easements.
- Fourteen TNC Nature Preserves: limitation on public access and all fishing activities.

The Role of Rebuilding Species in the Marine Ecosystem

Under Section 304 of the MSA (104-297), fishery management plans, plan amendments, or proposed regulations for overfished species must take into account status and biology of any overfished stocks of fish as well as the interaction of overfished stocks within the marine ecosystem. This section was developed to consider the relevant aspects of these stocks with respect to their interaction with other biotic elements of the ecosystem.[1] The intent is not to replicate the evaluation of status, life history, and productivity of the stocks themselves, which is discussed in more detail in Chapters 2 and 4, but rather to focus on the role of these species in the environment, and to attempt to evaluate the relative impacts of

[1] Many marine organisms (such as many types of plankton, structure-forming invertebrates, and burrowing or bioturbating organisms) can and do interact with abiotic (physical and chemical) characteristics of an ecosystem that could have broader-scale impacts to marine communities and ecosystems. However, such interactions are neither known nor suspected for the rebuilding species evaluated in this section, and consequently are not explicitly considered here.

alternative management decisions analyzed in this document with respect to the long-term consequences on other elements of the ecosystem.

The general role of rebuilding species in the marine ecosystem is discussed in more detail in volume 1 of the 2008 groundfish SAFE document.

CHAPTER 4.3 The Fishery Ecosystem

4.3.1 Protected Species Impacts

This section addresses impacts of the considered alternatives on protected resources in the West Coast marine ecosystem. This includes migratory species that depend on the West Coast marine ecosystem as part of their life history. This section relies to some degree on the analysis presented in the 2009-2010 SPEX EIS. However, several protected species are included here that were not included previously. These include recent ESA listings and certain species of sea turtles and marine mammals.

4.3.1.1 Methods: Types of Impacts and Mechanisms, Metrics, and Indicators

The nature of impacts to protected species will vary depending on the nature of the fishery and the life history behavior of the particular species or population. Any changes in fishing location, effort, and gear switching will all likely result in changes to bycatch and other interactions with protected species. However, the impacts will not be uniform across the spectrum of protected species, due to the variability in the behavior and susceptibility to various fishing practices of each protected species. The conceptual matrix below provides a method for making general inferences regarding impacts, and is used as a basis for the qualitative statements about impacts. This matrix provides information on fishing opportunities in response to different management regimes on a relative basis. It does not attempt to provide quantitative information on the likely impacts to protected species.

Management Scenarios	**Change in Fishing Opportunities (Trawl and Fixed Gear)**
Higher ACLs for shelf spp.	Increased inshore opportunities
Lower ACLs for shelf spp.	Decreased inshore opportunities
Higher ACLs for slope spp.	Increased offshore opportunities
Lower ACLs for Slope spp.	Decreased offshore opportunities

Table 4.3-1. Conceptual matrix of impacts relative to fishing alternatives.

Table 4.3-2 below lists the protected species considered in the SPEX EIS, from Heery et al. 2010. As indicated above, the nature and magnitude of impacts of various fishing permutations depend on the nature of the species, migratory patterns, seasonality, etc. Note that extremely limited number of observations preclude developing statistically significant estimates of bycatch fishery-wide. Therefore, the WCGOP typically excludes single observations in the development of bycatch ratio estimates. For species with more bycatch data available, the WCGOP generated bycatch estimates, but only if the coefficient of variation (CV) for the observed number of bycatch observations was less than 80%. Observations with greater than 80% CV were excluded in bycatch estimates. Those species with bycatch estimates are indicated by an asterisk (*) in Table 4.3-2. Those bycatch estimates can be found in Heery et al. 2010.

Species	**Taxonomic Name**	**# of Observed bycatch, 2002-2008**	**Fishery**
Marine Mammals			
Steller sea lion*	*Eumetopias jubatus*	15	Trawl, non-NS

California sea lion*	*Zalophus californianus*	94	Trawl
Harbor seal*	*Phoca vitulina*	9	Mixed
Northern elephant seal*	*Mirounga angustirostris*	14	Trawl
Pacific white-sided dolphin	*Lagenorhynchus obliquidens*	1	N/A
Humpback whale			
Gray whale			
Sperm whale	*Physeter macrocephalus*	1	N/A
Harbor porpoise	*Phocoena phocoena*	1	N/A
Risso's dolphin	*Grampus griseus*	1	N/A
Finfish			
Green sturgeon	*Acipenser medirostrum*		
Eulachon			
Salmon spp.	*Oncorhynchus spp.*		
Sea turtles			
Green	*Chelonia mydas*		
Leatherback	*Dermochelys coriacea*	1	N/A
Olive ridley	*Lepidochelys olivacea*		
Loggerhead	*Caretta caretta*		
Sea Birds			
Black footed albatross	*Phoebastria nigripes*	132	Fixed gear
Brandt's cormorant*, and other non-specified cormorants	*Phalacrocorax penicillatus, etc*	10	Mostly trawl; some Fixed gear
Brown pelican	*Pelecanus occidentalis*	1	N/A
Common murre*	*Uria aalge*	50	Trawl
Leach's storm petrel*	*Oceanodroma leucorhoa, and unspecified petrels*	8	Trawl
Western gull* and other unspecified gulls	*Larus occidentalis, etc*	10	Fixed gear
Northern fulmar*	*Fulmarus glacialis*	79	Trawl, offshore
Sooty shearwater	*Puffinus griseus, and unspecified shearwaters*	30	Mostly offshore trawl; some offshore fixed gear

Table 4.3-2. Observed interactions of protected species. Primary fishery is indicated when the interactions occurred primarily in that fishery. (Adapted from Heery et al. 2010).

4.3.1.2 Direct and Indirect Impacts of the Alternatives

Chapter 2 describes four sets of harvest limit alternatives (including the No Action Alternative), with suboptions to be considered under Alternatives 1, 2, and 3. In general terms, fishing opportunities that would result in gear changes, geographic distribution, or timing of fishing effort are likely to have differential impacts to protected species. However, fishing behavior, and therefore impacts, is difficult to predict at this time. This section provides a discussion of possible scenarios, based on bycatch information from the WCGOP.

4.3.1.2.1 Salmon

Alternatives that would result in great slope opportunities would likely result in reduced incidental take of Chinook and coho salmon, as well as other shelf species, in comparison with the No Action Alternative. Quantitative models assessing bycatch of salmon species under various alternatives have not been developed, in part because factors external to the fishery are major drivers of bycatch rates. Oceanic conditions in particular affect migration patterns spatially and temporally, as does prey availability and other factors. A qualitative assessment of changes in bycatch is therefore presented in this document. For Chinook salmon, NMFS completed a supplemental biological opinion (NMFS 2006) which established incidental take limits established by the NMFS, which establishes take limits of 11,000 Chinook in the whiting fishery and 9,000 in the non-whiting groundfish bottom trawl fishery. For other salmonid species, incidental take limits have not yet been established.

There is considerable uncertainty about bycatch of salmon in the bottom trawl fishery. The magnitude and distribution of bycatch in the trawl fishery since 2002 has been affected by significant changes in management measures to protect overfished groundfish stocks, including: implementation of regulations for use of selective flatfish trawl gear; smaller scale spatial closed area management; and closing trawl fishing in some areas shoreward of the RCA. The uncertainty will remain until more years of observer data are available and changes in groundfish fishery management and effort distribution are analyzed in relation to the incidental take of salmon.

Few Chinook salmon are encountered south of Cape Mendocino, therefore changes in Chinook incidental take would likely be minimal in response to changes in bottom trawl effort in this area. Setting zero ACLs for all depleted species would likely require closure of most, if not all, groundfish fisheries (and other fisheries with groundfish incidental catch). In that case, incidental take of Chinook salmon, coho salmon, and other shelf species subject to trawl bycatch in West Coast groundfish fisheries would be effectively eliminated.

For 2011 and beyond, the Council is considering establishing automatic action authority under 50 CFR 660.370 (d) to implement depth based area closures in the non-tribal whiting fishery. These depth based area restrictions can be implemented to shift fishing effort to different depths based on catches and availability of depleted species managed with sector-specific bycatch limits, as well as catches of Chinook salmon, as discussed in section 4.5.3.2. Beginning in 2007, NMFS established automatic action authority to implement an Ocean Salmon Conservation zone in response to Chinook catches observed in 2005-06. When NMFS projects the catch of Chinook salmon in the Pacific whiting fishery will exceed the 11,000 fish threshold, the Ocean Salmon Conservation Area could be put in place for all sectors of the whiting fishery though a single Federal Register notice. Catches of Chinook salmon in the whiting fishery was below the 11,000 fish threshold in 2007-08 and the Ocean Salmon Conservation Zone mitigation measure was not implemented during this biennium. The Ocean Salmon Conservation Zone will still be available in 2011 and beyond, should the 11,000 fish threshold be reached.

Although the resulting incidental take of Chinook salmon cannot be predicted, in 2011-12 it is likely to be within the range of incidental take experienced in the recent past.

4.3.1.2.2 Marine Mammals. The West Coast Groundfish Observer Program (WCGOP) documents interactions with marine mammals. Several species are protected under the ESA and the MMPA. Again, a qualitative approach is used here to assess the significance of the impacts to marine mammal populations, based on reported interactions and, when available, the Potential Biological Removal (PBR) established for a species.

NMFS prepared a Biological Opinion in 1990 that concluded the groundfish fisheries are not likely to jeopardize the continued existence of listed marine mammals. Species specific discussions are available

in the EFH FEIS (section 4.6.3). The effects of the harvest limit alternatives on endangered and threatened marine mammal species are difficult to quantify, but recent WCGOP data (Heery et al. 2010) provides some ability to make inferences about potential relative impacts of various management scenarios. NMFS is currently in the process of analyzing available data on the interactions of the groundfish fishery with marine mammals.

The effect of the management measure alternatives on marine mammals may be negative if fishing effort intensifies in areas where they congregate. However, the effects of the alternatives on effort displacement are not predictable and the effects of the alternatives are unknown. NMFS is currently in the process of analyzing available data on the interactions of the groundfish fishery with marine mammals.

4.3.1.2.3 Sea Turtles

The WCGOP reported one documented interaction with a leatherback sea turtle, in 2008. The rarity of documented interactions precludes meaningful analysis of bycatch estimates. Therefore, the impacts analysis will be limited to a qualitative description of the past interaction, and the possibility of future interactions based on the alternatives presented.

Based on information available for the December 2005 EFH FEIS (section 4.6.4), trawl and longline fisheries, as occur in the West Coast groundfish fishery, could adversely affect sea turtles; however, the relative effects of fisheries occurring under the Groundfish FMP on sea turtles are difficult to assess. Species specific discussions are available in the EFH FEIS (section 4.6.4). There is very little information available to estimate total mortalities of sea turtles, with the exception of the drift gillnet fishery, which is not a part of the Groundfish FMP, therefore the effects of the harvest limit alternatives on endangered and threatened sea turtle species are unknown. NMFS prepared a Biological Opinion in 1990 that concluded fisheries conducted under the groundfish FMP are not likely to jeopardize the continued existence of listed sea turtles.

There is very little information available to estimate total mortalities of sea turtles, with the exception of the drift gillnet fishery, which is not a part of the Groundfish FMP, therefore the effects of the management measure alternatives on endangered and threatened sea turtle species are unknown. The effect of the management measure alternatives on sea turtles may be negative if fishing effort intensifies in areas where sea turtles congregate. However, the effects of the alternatives on effort displacement are not predictable and the effects of the alternatives are unknown.

4.3.1.2.4 Recently Listed Species

The Southern DPS of Eulachon (*Thaleichthys pacificus*), or Columbia River smelt, was listed as threatened under the ESA on May 17, 2010. NMFS has not yet developed an Incidental Take Statement. However, the Status Review (NMFS 2010) describes the most likely threats to eulachon recover, allowing for a qualitative assessment of the potential significance of impacts to eulachon from the U.S. West Coast commercial groundfish fishery.

The Southern DPS of the North American green sturgeon (*Acipenser medirostris*) was listed as threatened in April, 2006 (71 FR 17757, April 7, 2006), with Critical Habitat designated October 9, 2009. NMFS has not yet concluded ESA consultation and therefore has not yet established an Incidental Take Statement for the groundfish fishery. Documented interactions with the California halibut trawl fishery provide background for a qualitative assessment of the potential significance of impacts to green sturgeon. However, quantitative modeling or bycatch estimates have not yet been developed.

The effect of the management measure alternatives on the Southern DPS of green sturgeon may be negative if fishing effort intensifies in areas where they congregate. However, the effects of the

alternatives on effort displacement are not predictable and the effects of the alternatives are unknown. NMFS has reinitiated its Section 7 consultation on the Council's groundfish FMP.

4.3.1.2.5 Seabirds

Seabird species with documented interactions with the U.S. West Coast commercial groundfish fishery represent a diverse suite of life histories, migration patterns, and reproductive strategies. Three distinct spatial/temporal seasons have been identified for the West Coast: the Upwelling, Oceanic, and Davidson Current seasons (Ford et al. 2004). Distribution of seabird species also varies latitudinally. These seasons coincide with winter (January-April), summer (May-August) and fall (September-December).

Based on information available for the December 2005 EFH FEIS (section 4.6.2), seabird interactions in the West Coast groundfish fishery were described as "rare and infrequent." NMFS prepared a Biological Opinion in 1990 that concluded the groundfish fisheries are not likely to jeopardize the continued existence of listed seabirds. The effects of the harvest limit alternatives on endangered and threatened seabird species are unknown. NMFS is currently in the process of analyzing available data on the interactions of the groundfish fishery with seabirds.

However, the WCGOP provides information on the relative impacts of certain seabird species by fishing activity. The effect of the management measure alternatives on seabirds (listed and non-listed) may be negative if fishing effort intensifies in areas where seabirds congregate. Nonetheless, the effects of the alternatives on effort displacement are not predictable and the effects of the alternatives are unknown. NMFS is currently in the process of analyzing available data on the interactions of the groundfish fishery with seabirds.

4.3.1.3 Cumulative Impacts

This section briefly identifies two categories of actions that have effects that when combined with the effects of the proposed action, could result in significant impacts to ESA-listed Chinook and coho salmon, and impacts to marine mammals, seabirds, green sturgeon, and sea turtles. First are actions occurring in the past or the present that will have effects persisting into the period when the proposed action is implemented and possibly beyond. Second are reasonably foreseeable effects, which will be implemented on or after January 1, 2011 and combine with the direct and indirect effects of the proposed action to produce potentially significant cumulative effects. This section describes the cumulative effects on protected species resulting from the direct, indirect, and external effects on protected species.

Past and present actions with persistent effects:

Groundfish harvest specifications and management measures, 1998-2008: The 1998–08 period is identified for comparison because it marks a substantial reduction in groundfish harvest limits in comparison to earlier years. During this period rebuilding plans were developed and adopted for depleted groundfish species. Selection of a rebuilding strategy for each stock narrows the range of OYs that may be chosen for those stocks and has required the implementation of various constraining management measures to limit catches of these stocks. Past groundfish management measures authorized fishing, indirectly affecting the incidental take of Chinook salmon, as described in Section 5.1. The groundfish fishery, even with management measures in place to reduce impacts to Chinook salmon, has a persistent effect on stock productivity; however, given the life cycle of Chinook and coho salmon, fishing mortality in more recent years would have a much greater contributory effect on population status. NMFS in the process of analyzing available data on the interactions of fisheries conducted under the Pacific Coast groundfish FMP with marine mammals and seabirds. NMFS has reinitiated its Section 7 consultation on the Council's groundfish FMP for the Southern DPS of green sturgeon. There is very little information available to estimate total mortalities of sea turtles, with the exception of the drift gillnet fishery, which is

not a part of the Groundfish FMP, therefore the cumulative effects of fisheries conducted under the Pacific Coast groundfish FMP on endangered and threatened sea turtle species are unknown.

West Coast non-groundfish fisheries: Commercial and recreational salmon fisheries target nonlisted salmon but incidentally take listed Chinook and coho salmon. All fisheries have a similar persistent effect, contributing to total fishing mortality and attendant effects on stock productivity. Commercial and recreational salmon fisheries are managed to optimize harvest of hatchery-produced fish while keeping the take of wild, ESA-listed stocks within limits that will ensure their continued existence. Thus, in managing these stocks, all sources of fishing mortality are estimated or accounted for, including incidental take in groundfish fisheries. Humpback whale interactions have been documented in fisheries using pot and trap gear off the West Coast, including the West Coast crab fisheries. Additional species specific information on other fisheries is available in the EFH FEIS in Section 4.6.3. Green sturgeon are caught incidentally in estuaries by the white sturgeon fishery (NMFS 2002 - *NMFS 2002. Status Review for North American Green Sturgeon, Acipenser medirostris. National Marine Fisheries Service Southwest Fisheries Science Center. 110 Shaffer Road, Santa Cruz, California.*). Sea turtle capture has been documented in purse seines, gillnets, and other types of fishing gear that are not commonly used or are not authorized for use in fisheries conducted under the groundfish FMP.

Nonfishing actions: Salmon are vulnerable to human-caused degradation of freshwater habitat used for spawning. These effects are generally well known and diverse. They include physical barriers to migration (dams), changes in water flow and temperature (often a secondary effect of dams or water diversion projects), and degradation of spawning environments due to increased silt in the water due to adjacent land use. A very large proportion of the long-term, and often permanent, declines in salmon stocks are attributable to this class of impacts. For a detailed summary of nonfishing impacts to salmon habitat see Section 3.2.5 of the EFH Appendix in Amendment 14 to the Pacific Coast Salmon FMP. Besides entanglement in fishing gear, seabirds may be indirectly affected by commercial fisheries in various ways. Change in prey availability may be linked to directed fishing and the discarding of fish and offal. Vessel traffic may affect seabirds when it occurs in and around important foraging and breeding habitat and increases the likelihood of bird 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. As stated in Section 4.6.4 of the EFH FEIS, numerous human-induced factors have adversely affected sea turtle populations in the North Pacific.

Reasonably foreseeable future actions:

Groundfish harvest specifications and management measures, 2012-13 and beyond: As with past harvest specifications, future harvest specifications are likely to have an indirect effect on the incidental take of listed Chinook salmon and coho, which in combination with incidental take during 2011-12 will have cumulative effects on year classes intercepted by the fisheries during that time; however it is unlikely that impacts to listed Chinook salmon will exceed the 20,000 fish threshold for multiple years. (No incidental take threshold has been established for Oregon Coast coho). This cumulative effect will only persist as long as the affected year classes. For 2011-12 harvest specifications and management measures this is of relatively short duration. Projected rebuilding times for depleted species are much longer and rebuilding alternatives are thus likely to affect groundfish harvest levels, and thus indirectly effect interactions with Chinook salmon, seabirds, marine mammals, green sturgeon, and sea turtles for decades. However, it is likely that rebuilding strategies will continue to be modified in the future based on new information, so it is probably unrealistic to expect that any strategy adopted as part of this proposed action will remain unchanged for the duration of a given rebuilding period. Nonetheless, in very general terms groundfish fishing effort is likely to be constrained to mitigate depleted species catch for the foreseeable future.

Trawl Rationalization – Amendment 20 to the FMP: Rationalization of the trawl fishery is not expected to fundamentally change the mixed stock fishery structure where catch of healthy species will be constrained in order to meet rebuilding requirements for overfished groundfish species. It will increase flexibility of fishers to harvest their quotas, however, this increase in flexibility will also increase uncertainty in predicting Chinook and coho salmon, seabird, marine mammal, green sturgeon, and sea turtle interactions due to the changes that are likely to occur in fishing behavior due to changes in management measures that will regulate the trawl fishery under the new quota system.

West Coast non-groundfish fisheries: Similar to groundfish fisheries, future take in non-groundfish fisheries contributes to year-class-specific total fishing mortality of protected species, and will have persistent effects to other ESA listed species that are encountered incidentally.

Non-fishing actions: Adverse impacts to freshwater salmon habitat are likely to continue for the foreseeable future. Indirect effects to seabirds by commercial fisheries are likely to continue for the foreseeable future.

4.3.1.4 Summary of Impacts

Under a rationalized fishery, it is difficult to predict fishing behavior and resultant impacts to protected resources. It is likely that any Alternative resulting in a decreased overall effort would likewise result in decreased impacts to protected resources. However, there may be exceptions depending on a variety of factors discussed below. Further, it is possible that a rationalized fishery, assuming an increase targeting efficiency, would increase harvest of targeted species but would decrease bycatch. This circumstance would potentially happen with even less effort than currently used.

Gear Switching

Transition of effort from trawl gear (small footrope, large footrope) to fixed gear (longline, pots, etc.) under the Amendment 20 gear switching provision may change the nature of interactions with protected species. For example, California sea lion observed bycatch in the limited entry trawl fishery totaled 30 observations from 2002 to 2008, but only one observed bycatch in the nearshore fixed gear fishery during the same time period. As such, a shift of effort from trawl gear to fixed gear may result in a decrease in California Sea lion impacts.

If trawlers chose to harvest more of their quota pounds with fixed gear, increased impacts to protected resources might also occur. For example, black-footed albatross bycatch observations were limited almost entirely to the non-nearshore fixed gear fishery. If more vessels choose to harvest quota pounds with fixed gear in the non-nearshore (e.g., targeting sablefish) then bycatch of black footed albatross may increase.

It is not possible to further evaluate the potential for gear switching to change protected resources impacts because there is no qualitative method to predict the number of limited entry trawl permit holders who will chose to harvest their quota pounds with fixed gear. Further, we cannot predict which legal fixed gear they may use (e.g., pots, longline, rod and reel, trolled longline, etc.) and in what area (i.e., where a protected resource may occur).

Geographic Displacement

Increasing the extent of Rockfish Conservation Areas (RCA) would likely decrease bycatch pressure on those species subject to trawl bycatch as well as fixed gear. This would include all species in Table 4.3-2 that have any significant levels of bycatch.

Upshelf movement of effort, based on RCA increase in spatial extent, would disproportionally impact those species impacted by nearshore trawl or fixed gear fisheries. However, it is not clear that the Alternatives presented would result in a noticeable change in fishing distribution.

Targeted Effort

Even with a status quo overall effort, a rationalized fishery could result in decreased impacts to protected resources do to the increased flexibility afforded to participants in the fishery. This could be realized via the incentives to fish cleaner. Under this scenario, overfished stocks might not be limiting factors in closing fisheries. Rather, the fisheries would reach the maximum harvest allowable, ideally leaving overfished stocks below their bycatch thresholds.

4.3.2 Essential Fish Habitat

EFH descriptions have been developed for each of the four FMPs managed by the Council. These contain detailed descriptions of the habit requirements and associations, fishing and non-fishing impacts, and information on species biology and life histories. These include groundfish Amendment 19 ("Essential Fish Habitat Designation and Minimization of Adverse Impacts"), Appendix D or CPS Amendment 8 ("Description and Identification of Essential Fish Habitat for the Coastal Pelagic Species Fishery Management Plan); HMS Appendix F to the Fishery Management Plan for U.S. West Coast Fisheries for Highly Migratory Species; and Appendix D to Amendment 14 of the Pacific Salmon FMP. All are available on the Council's website (Http://www.pcouncil.org) and are are hereby incorporated by reference.

For reference information more directly relevant to groundfish EFH, a description of West Coast marine ecosystems and the affected essential fish habitat are available in volume 1 of the Council's 2008 Stock Assessment and Fishery Evaluation (SAFE) document. Volume 1 of the 2008 SAFE document is available by request to the Council office or online. That document is also hereby incorporated by reference.

4.3.2.1 Methods: Types of Impacts and Mechanisms, Metrics, and Indicators

The conceptual framework for analysis of EFH would include development of spatial and temporal geospatial information, overlaid with the expected geographic shifts in fishing opportunities resulting for the considered Alternatives. Because fishing behavior changes resulting from various management Alternatives, it is difficult to predict impacts to EFH. This precludes a quantitative assessment of impacts here. However, this document incorporates by reference the impacts assessment in the Draft EIS on Amendment 20, Rationalization of the Pacific Coast Groundfish Limited Entry Trawl Fishery.

4.3.2.2 Direct and Indirect Impacts of the Alternatives

To the extent that management alternatives will alter geographic area or gear type, there could be impacts to EFH. Increased RCA spatial extent could result in a decreased impact to EFH. However if fishing effort is re-located to other areas of EFH, this positive effect may be nullified. However, the Alternatives considered in Chapter 2 would likely result in geographic impacts at too fine a scale to make significant changes to EFH.

4.3.2.3 Cumulative Impacts

Protected species are subject to various sources of human-induced and natural mortality, and other factors affecting population viability. These external factors include:

- Take of marine mammals and seabirds in other fisheries
- Nonfishing sources of direct mortality (e.g., ship strikes, oil spills)
- Degradation of nesting habitat for seabirds and disturbance of haul out areas for marine mammals
- Climate forcing affecting food chain dynamics, producing more or less prey

4.3.2.4 Summary of Impacts of the Alternatives

With regard to EFH, NMFS recently completed an EIS to comprehensively evaluate groundfish habitat and the effects of groundfish fishing on that habitat, in response to litigation (*American Oceans Campaign v. Daley et al.*, Civil Action No 99-982[GK]). Amendment 19 of the Groundfish FMP, approved on March 8, 2006, provides for a comprehensive strategy to conserve EFH, including its identification, designation of HAPC, and the implementation of measures to minimize to the extent practicable adverse impacts to EFH from fishing. The final rule implementing Amendment 19 provides measures necessary to conserve EFH and no additional EFH recommendations are necessary for this proposed action.

The general effects of fishing on habitat and the marine ecosystem are further described in volume 1 of the 2008 groundfish SAFE document.

Impacts to EFH are difficult to predict under a rationalized fishery. However, inferences can be made based on likely scenarios.

In general, there is no empirical or theoretical evidence that declines in these stocks of west coast rockfish have had impacts on predators or higher trophic level species, particularly impacts above and beyond those which might be expected by reduction of biomass to their target levels. However, there is potential evidence, largely theoretical, that among those rebuilding species that are higher trophic level predators, there could be cascading ecological consequences to some benthic communities resulting from severe depletion and potential replacement by more opportunistic species. Again, the extent to which such impacts (if real) might be of a greater magnitude than those that would be expected under scenarios in which biomass declined to target levels is currently impractical to quantify. Recent research by the NWFSC attempts to measure the effects of fishing on seabird productivity. However, the research is pending publication and therefore is not included in this analysis.

Management Measure Alternatives

The management measure alternative's principal function is to constrain short-term fishing mortality to levels consistent with the rebuilding targets established in rebuilding plans, or other stock management goals for precautionary zone and healthy stocks. In this respect the management measures that have been implemented by the Council in recent years appear to have contributed to increasing abundance and productivity levels for rebuilding depleted (and other) species, although such improvement may be as much a result of factors outside the control of the management regime, such as changes in climate. Components of the management measure alternatives, and the management framework generally, that employ spatial closures, which effectively eliminate fishing mortality from broad areas of habitat that are optimal for both the rebuilding species and other, healthier groundfish stocks in the California Current, likely have an ancillary mitigating effect with respect to the ecosystem impacts of fishing. The protection of intact functional patches of habitat was identified by Baskett, et al. (2006) as one of the management measures that had the greatest potential to avoid or reverse changes in species composition on small rocky reef habitats. These area closures, intended to reduce bycatch of depleted species, are sited in those depth zones and habitats in which these species are most frequently encountered. As such, they tend to represent the optimal habitat for these species, and are either known or suspected (from catch rate data, trawl surveys, ROV surveys, and other means) to sustain the highest densities of depleted species. Consequently, this approach would be expected to effectively maintain functioning habitat areas and/or metapopulations of rebuilding species with an extremely high degree of protection.

Management measures' effects on the ecosystem operate in two ways: by affecting fish populations directly through measures to reduce fishing mortality and the protection of intact patches of habitat.

Thus, management measure alternative 1, intended to constrain total catch to the low end of the range, is likely to have the least adverse impacts with respect to the ecosystem because of the extent of area closures and reductions in fishing mortality for rebuilding species. The Council-preferred alternative implements area closures generally similar to those currently in place (no action) except for the addition of a new YRCA off Westport, Washington and the potential implementation of YRCAs off northern California. In particular, the configuration and extent of the area closures within this alternative represents a short-term effect over the next biennium, which may be less relevant, in terms of the ecosystem, than how these types of management measures will be applied over the long term. In summary, it is intuitive that the lower the fishing mortality rate, and the greater the extent of spatial closures over the long term, the greater the potential for rebuilding species to fill their niche or role in the ecosystem relative to the risk of changes or shifts in equilibrium or ecosystem states. But both the precision of multispecies or ecosystem models and their ability to accurately reflect the potential cumulative impacts to the ecosystem that result in slightly differing rebuilding trajectories are extremely low, particularly with respect to any ability to detect thresholds that may exist with respect to alternative stable states within either small or broad-scale habitats and ecosystems.

In comparing the preferred alternative to no action, the cumulative effect of recent action taken to mitigate the adverse effects of fishing to EFH through the implementation of Groundfish FMP Amendment 19 needs to be taken into account. That action not only protects additional habitat areas from trawl fishing impacts into the foreseeable future, but also prohibits the use of large-footrope gear shoreward of the 100 fm depth contour, mitigating impacts to remaining nearshore high-relief reef communities. These measures became effective in June 2006 and will likely further mitigate the effects of fishing in the next biennium.

4.3.3 Trophic and other ecosystem impacts

The California Current large marine ecosystem is not predicted to be substantially impacted by rationalization, although it is difficult to make predictions about a complicated system that has many inputs to productivity. Changes in catch, induced by moving from status quo management to share-based management, may result in changes to the ecosystem's food web that are perceptible. Changes in location of catch and changes in the type of gear utilized may result in changes to the amount and kind of essential fish habitat impacted. Such changes in habitat impacts may have an effect on the ecosystem. However, that link, while logical, is difficult to demonstrate, as noted in the EFH EIS (PFMC 2004).

4.3.3.4 Summary of Impacts of the Alternatives

Several fishery-related factors could affect incidental take of marine mammals: geographic redistribution of effort and opportunities; gear switching; and changes to harvest guidelines. This provides good general indications of the relative threats faced by protected species. However, it is unlikely that the 2011-2012 Groundfish SPEX will result in a significant impact to the ecosystem, especially when considered in the context of the No Action Alternative. A summary of ecosystem impacts is found in the EIS on Groundfish Amendment 20, and is hereby incorporated by reference.

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