UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
West Coast Region
1201 NE Lloyd Boulevard, Suite 1100
PORTLAND, OREGON 97232

July 24, 2019

Dear Recipient:

In accordance with provisions of the National Environmental Policy Act (NEPA), we announce the publication of the Final Environmental Impact Statement (FEIS) for Changes to Pacific Coast Groundfish Essential Fish Habitat Conservation Areas and Boundaries of the Trawl Gear Rockfish Conservation Areas.

The proposed action is intended to protect essential fish habitat (EFH) and other benthic habitats (including deep sea coral) by closing marine areas off the coasts of Washington, Oregon, and California to fishing with bottom trawl or bottom contacting gears. The proposed action is also intended to re-open historically productive fishing grounds to vessels fishing bottom trawl gear and participating in the Pacific Coast groundfish individual fishing quota (IFQ) program off Oregon and California. In concert, these changes are anticipated to minimize the effects of fishing on EFH to the extent practicable and increase management flexibility and fishing opportunities in the IFQ program.

NOAA has made available the Final Environmental Impact Statement electronically through the NOAA Fisheries publications website at https://www.fisheries.noaa.gov/resources/all-publications. The Record of Decision (ROD) will also be made available at this website.

Sincerely,

Nicolle Hill

FOR Barry A. Thom
Regional Administrator

Cover Sheet

Title of Environmental Review: Changes to Pacific Coast Groundfish Essential Fish Habitat Conservation Areas and Boundaries of the Trawl Gear Rockfish Conservation Area Final Environmental Impact Statement, Magnuson-Stevens Act Analysis, Regulatory Impact Review, and Regulatory Flexibility Analysis

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Location of Proposed Activities: The Exclusive Economic Zone (EEZ) of the United States (3 to 200 miles) off the coasts of Washington, Oregon and California

Proposed Action: NMFS will make a decision regarding an Amendment to the Pacific Coast Groundfish Fishery Management Plan (FMP), Amendment 28. This action was recommended by the Council and could change where bottom trawl fishing and bottom contact gear fishing is allowed off the coasts of Washington, Oregon, and California.

Abstract: The Council recommended changes to the essential fish habitat conservation areas, adjustments to the groundfish trawl rockfish conservation area, and use of MSA authorities to prohibit bottom contact fishing activities in waters deeper than 3,500 meters. NMFS' determination on whether these changes are consistent with applicable laws is the federal action requiring National Environmental Policy Act compliance. The analysis within the environmental impact statement informs NMFS, fishermen, and the public about the current and anticipated direct, indirect and cumulative environmental effects of Amendment 28 to the FMP.

CHANGES TO PACIFIC COAST GROUNDFISH ESSENTIAL FISH HABITAT CONSERVATION AREAS AND BOUNDARIES OF THE TRAWL GEAR ROCKFISH CONSERVATION AREA

Includes description of areas closed to groundfish bottom trawl fishing off the Pacific Coast and Amendment 28 to the Pacific Coast Groundfish Fishery Management Plan to refine and expand habitat conservation areas and change the trawl rockfish conservation area

Environmental Impact Statement, Magnuson-Stevens Act Analysis, Regulatory Impact Review, and Regulatory Flexibility Analysis

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ABC	Acceptable biological catch
ACL	Annual catch limit
ACT	Annual catch target
AOC	American Oceans Campaign
BAC	Block area closure
BOEM	Bureau of Energy Management
BRA	Bycatch reduction area
BTC	Bottom trawl closure
CBCM	Cape Blanco-Cape Mendocino
CBGCA	Cordell Banks Groundfish Conservation Area
CBNMS	Cordell Bank National Marine Sanctuary
CFPC	United States/Canada Border
CCA	Cowcod conservation area
CDFW	California Department of Fish and Wildlife
CEQ	Council for Environmental Quality
CFR	Code Federal Regulations
CMPC	Cape Mendocino-Point Conception
Coop	Group of fishermen
Council	Pacific Fishery Management Council
CPUE	Catch per unit of effort
CZMA	Coastal Zone Management Act
DAC	Discrete area closure
DBRK	Darkblotched rockfish
DEIS	Draft environmental impact statement
DPS	Distinct population segment
DSC	Deep-sea coral
DSC&S	Deep-sea coral and sponge
DSCRTP	Deep Sea Coral Research and Technology Program
EC	Economically important (species)
ECS	Ecosystem component species
EEZ	Exclusive Economic Zone
EFH	Essential fish habitat
EFHCA	EFH conservation area
EFP	Exempted fishing permit
EIS	Environmental impact statement
EM	Electronic monitoring
EO	Executive Order
ESA	Endangered Species Act
EPA	Environmental Protection Agency
ESU	Evolutionarily significant unit
fm	Fathom
FMA	Fishermen’s Marketing Association
FMP	Fishery management plan
FPA	Final preferred alternative
FR	Federal Register
ft	foot/feet
GAP	Groundfish Advisory Subpanel
GBGCA	Cordell Bank GCA
GCA	Groundfish conservation area
GDP	Gross Domestic Product
GFNMS	Greater Farallones National Marine Sanctuary
GIS	Geographic information system
GMT	Groundfish Management Team
GP	Greenpeace
HAPC	Habitat areas of particular concern
HCR	Harvest control rule
HFI	Habitat-forming invertebrates
HMS	Highly migratory species
HSP	Habitat suitability probability
IBQ	Individual bycatch quota
IFQ	Individual fishing quota
IO-PAC	Input-Output Model for Pacific Coast Fishery
IQA	Information Quality Act
ITS	Incidental take statement
kg	kilogram
km	kilometer
LME	Large marine ecosystem
LOF	List of fisheries
m	meter
m^2	miles squared
MBNMS	Monterey Bay National Marine Sanctuary
MBTA	Migratory Bird Treaty Act
MMPA	Marine Mammal Protection Act
MMS	Mineral Management Service
MPA	Marine protected area
MSA	Magnuson-Stevens Fishery Conservation and Management Act
MTC	Midwater Trawlers Cooperative
mt	metric ton
N	Need
NCCOS	National Center for Coastal and Ocean Science
NEPA	National Environmental Policy Act
nm	nautical miles
NMFS	National Marine Fisheries Service
NMS	National Marine Sanctuary
NOAA	National Oceanic and Atmospheric Administration
NOI	Notice of intent

NRDC	Natural Resources Defense Council
NWFSC	Northwest Fisheries Science Center
OA	Ocean acidification
OAH	Ocean acidification and hypoxia
Oceana, et al.	Oceana/Natural Resources Defense Council/Oceana/Ocean Conservancy
OFL	Overfishing limit
OFS	Overfished species
OMB	Office of Management and Budget
ONMS	Office of National Marine Sanctuaries
OSCZ	Ocean Salmon Conservation Zone
OSU	Oregon State University
OY	Optimum yield
P	Purpose
PacFIN	Pacific Fishery Information Network
Panel	West Coast Ocean Acidification and Hypoxia Science Panel
PBR	Potential biological removal
PCCB	Point Chehalis-Cape Blanco
PCUSMB	Point Conception-United States/Mexico Border
PDEIS	Preliminary draft environmental impact statement
POP	Pacific Ocean perch
PPA	Preliminary preferred alternative
Project Team	EFH/RCA Project Team
RCA	Rockfish conservation area
RIR	Regulatory impact review
ROA	Range of alternatives
SAFE	Stock assessment and fishery evaluation
SFFT	selective flatfish trawl
SIA	Social impact assessment
trawl RCA	Groundfish limited entry trawl RCA
U&A	Usual and accustomed
USCG	United States Coast Guard
USFWS	United States Fish and Wildlife Service
WCGOP	West Coast Groundfish Observer Program
YRF	Yelloweye rockfish

KEY TERMS AND CONCEPTS

Groundfish conservation areas (GCAs) are defined as follows: a geographic area defined by coordinates expressed in degrees latitude and longitude, wherein fishing by a particular gear type or types may be prohibited (50 Code of Federal Regulations [CFR] §660.11). GCAs include trawl rockfish conservation areas (RCAs), non-trawl RCAs, cowcod conservation areas (CCAs), and other spatial closures. Specific descriptions of the purposes and locations of GCAs are found at 50 CFR §660.60(c)(3), and regulations at 50 CFR §660.70 define coordinates for these polygonal GCAs: yelloweye rockfish RCAs, CCAs, waters encircling the Farallon Islands, and waters encircling the Cordell Banks. Essential fish habitat conservation areas (EFHCAs) may be present within the boundaries of a GCA.

The groundfish trawl RCA (trawl RCA) is defined as follows: a type of GCA closed to fishing with groundfish bottom trawl gear types, and designed to minimize catch of overfished and other groundfish species.[1] The trawl RCA is a large-scale area extending along the entire length of the West Coast of the United States. The trawl RCA boundaries are lines that connect a series of latitude and longitude coordinates that approximate particular depth contours of the continental shelf from approximately 30 to 700 fathoms (fm). The Pacific Fishery Management Council (Council) may and does change trawl RCA boundaries seasonally according to conservation needs. Trawl RCA is bounded by lines specifically defined by latitude and longitude coordinates established at 50 CFR §660.71 through §660.74. Although the boundary lines defined by the latitude and longitude coordinates are typically generalized approximations of depth, the trawl RCAs are not actually defined by depth contours, and the boundary lines that define the trawl RCA may close areas that are deeper or shallower than the actual depth contours. Vessels harvesting groundfishes using bottom trawl gear are subject to the trawl RCA restrictions all year round, and they may not fish in the trawl RCA or operate in the trawl RCA for any purpose other than transiting the area. Vessels harvesting groundfishes using midwater trawl gear are subject to trawl RCA restrictions from January 1 through May 15 and after, outside of the primary whiting season (approximately May until the sector allocation of Pacific whiting is harvested); they may not fish in the trawl RCA or operate in the trawl RCA for any purpose other than transiting the area during that time. Additionally, the trawl RCA serves as a management boundary, and certain bottom trawl gear configurations (e.g., selective flatfish trawl gear) are required for vessels fishing in the area shoreward of the trawl RCA. The trawl RCA partially overlaps with state waters of Washington and California. This document analyzes impacts relative to the 2015 trawl RCA that extends between the lines approximating the 100 fm and the 150 fm depth contours, including the “modified 200 fm line” between

[1] A type of groundfish conservation area, and part of the definition of “groundfish conservation area” at §660.11. Regulations at§660.112 prohibit certain types of activities for vessels with trawl gear on board.

40° 10’ N. latitude and 45° 46’ N. latitude. There is a similar trawl RCA that applies to ridgeback prawn, California halibut, and sea cucumber bottom trawl fisheries off California. Changes to the non-groundfish trawl RCA are not considered in this action.

EFHCAs are defined as follows: Under the EFH regulatory guidance at 50 CFR §600.815, regional fishery management councils and the National Marine Fisheries Service (NMFS) must minimize, to the extent practicable, the adverse effects of fishing on EFH. EFHCAs are spatially discrete areas closed to bottom trawling and, in some cases, other types of bottom contact gear, to protect the important habitat features found there (50 CFR 660.11). EFHCAs, established as part of Amendment 19 to the Pacific Coast Groundfish Fishery Management Plan (FMP), are one of the management measures developed by the Council and NMFS to protect habitat, especially those that are important, rare, or vulnerable, from the adverse effects of the groundfish fishery. EFHCAs may overlap with a GCA or with other EFHCAs.

Bottom contacting gear is defined as follows: Bottom contacting gear means fishing gear designed or modified to make contact with the bottom. This includes, but is not limited to, beam trawl, bottom trawl, dredge, fixed gear, set net, demersal seine, dinglebar gear, and other gear (including experimental gear) designed or modified to make contact with the bottom. Gear used to harvest bottom dwelling organisms (e.g., by hand, rakes, and knives) are also considered bottom contact gear (see Figure 2-3 “Umbrella figure”).

Bottom trawl gear is defined as follows: Bottom trawl gear means a trawl in which the otter boards or the footrope of the net are in contact with the seabed. It includes demersal seine gear and pair trawls fished on the bottom. Any trawl, except demersal seine/Scottish seine, not meeting the requirements for a midwater trawl, at 50 CFR 660.130(b), is considered a bottom trawl.

Polygon is defined as follows: Polygon means a spatially discrete area that is defined by latitude and longitude coordinates connected with straight lines. It may be a current EFHCA, a proposed area to designate as an EFHCA, or a portion of an existing EFHCA, depending on the alternative.

Priority habitat is defined as follows: Priority habitat means one of five types of habitats drawn, in modified form, from the “complex sensitive habitats” described in the environmental impact statement (EIS) for Amendment 19 to the groundfish FMP. These habitats are listed below:

- Hard substrate, including rocky ridges and rocky slopes
- Habitat-forming invertebrates (HFI), which covers deep-sea corals (Class Anthozoa), sponges (Phylum Porifera), and sea pens (Order Pennatulacea)
- Submarine canyons and gullies
- Seamounts

- Areas where the probability of occurrence of an overfished species was at least 80 percent of the maximum probability of occurrence predicted by models that were created during the Groundfish EFH Synthesis process (NMFS 2013)

See Section 4.1.1.2 for a description of the metrics used to summarize these priority habitats.

<u>The Trawl Rationalization Program</u> (also called the Catch Share Program) is defined as follows: The Trawl Rationalization Program means an individual fishing quota (IFQ) program for the shorebased trawl fleet and harvester cooperatives for the at-sea mothership and catcher-processor fleets. The catch shares system divides the portion of the annual catch limit (ACL) allocated to the trawl fishery into shares controlled by individual fishermen or groups of fishermen (coops). Bottom trawl gear is not used in the coops that harvest Pacific whiting with midwater trawl gear. Bottom trawl gear can be used to target and harvest groundfishes in the Shorebased IFQ Program.[2]

<u>The Shorebased IFQ Program</u> is defined as follows: The Shorebased IFQ Program means vessels registered to a Federal limited entry permit with an endorsement for trawl gear and fishing for groundfishes under the terms of that permit. The number of limited entry permits is fixed, and additional permits cannot be developed; thus, the number of participating vessels has a maximum that cannot be exceeded. Harvest capacity of the existing fleet could expand if larger vessels were to replace smaller ones, but that would also be restricted by the vessel size limits associated with each limited entry permit. Harvest of groundfishes by participating vessels is limited by each individual's available IFQ (for IFQ species) and the vessel's trip limits for non-IFQ species.

[2] Other gear types are used in the Shorebased IFQ Program, including midwater gear to target Pacific whiting and midwater rockfish species and fixed gear under gear switching provisions.

EXECUTIVE SUMMARY

What proposed federal action does this EIS analyze?

The National Environmental Policy Act (NEPA) of 1969 requires that, before undertaking a major federal action, the agency analyze the short- and long-term effects on the human environment, including current biological and socioeconomic conditions. This Environmental Impact Statement (EIS) analyzes an Amendment to the Pacific Coast Groundfish Fishery Management Plan (FMP), Amendment 28, which considers changes to the essential fish habitat conservation areas (EFHCAs), adjustments to the groundfish trawl rockfish conservation area (RCA; trawl RCA), and use of MSA authorities to prohibit bottom contact fishing activities in waters deeper than 3,500 meters (m). These actions could change where bottom trawl fishing is allowed off the coasts of Washington, Oregon, and California, as well as the timing and location of bottom trawl closures. This Federal action has the potential to create significant effects on physical, biological, social, and economic resources of the human environment.

What is the history of Pacific Coast groundfish EFH?

EFH was first identified and described for Pacific Coast groundfish in 1998, in accordance with the Magnuson-Stevens Fishery Conservation and Management Act (MSA). EFH is defined as "waters and substrate necessary to fish for spawning, breeding, feeding or growth to maturity" (MSA sec. 3). Regulatory guidelines (50 CFR 600, Subpart J) 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." EFH was defined and incorporated into the FMP as part of Amendment 11. In 2006, Amendment 19 was approved, revising groundfish EFH. Amendment 19 took the following actions:

- Revised the 1998 designation of groundfish EFH.
- Established habitat areas of particular concern (HAPCs).
- Described adverse effects on EFH from fishing and non-fishing activities.
- Established EFHCAs that prohibit certain types of bottom-contact gear to minimize the adverse effects on EFH from fishing.
- Described the life history, habitat, and major prey items of groundfishes.
- Established a process for review and revision of EFH.

A periodic review of groundfish EFH provisions established by Amendment 19 was initiated in 2010 and concluded in 2014, at which time the Council determined that new information warranted consideration of changes to the existing components of groundfish EFH. In 2014, the Council also opted to combine the potential EFHCA revisions and trawl RCA modification into a single action. In 2015, the Council established the scope of the action and tasked staff with developing the FMP amendment and NEPA documents. In September 2015, the Council adopted a preliminary range of alternatives for revising groundfish EFHCAs, modifying the trawl RCA and closing waters deeper than 3,500 m to bottom contact gear. National Marine Fisheries Service (NMFS) and Council staff developed an evaluation of the environmental impacts of the preliminary range of alternatives from late 2015 through early 2018.

On February 1, 2016, NMFS published a Notice of Intent (NOI) to prepare EIS for Amendment 28 to the groundfish FMP (81 FR 5102). At its April 2016 meeting, the Council received a progress report and a preliminary analysis of the fishery management alternatives for consideration. At that meeting, the Council established a range of alternatives (ROA) that addressed potential changes to the current EFHCA configuration and trawl RCA, as well as the closure of waters deeper than 3,500 meters (m) to bottom contact gear.

In November 2016, the Council reviewed a draft analytical document that included analysis of habitat impacts, but did not yet include the economic, fishery resource, or protected species impacts analysis. At that meeting, alternatives were added, based on public comment. The Council adopted a preliminary preferred alternative in November 2016. In November 2017, NMFS and Council staff provided a progress update to the Council, and the Council took public comment. In April 2018, the Council adopted its final preferred alternative, presented as the “Preferred Alternative” in this EIS.

Who would be affected by these changes?

Those affected by proposed EFH and trawl RCA changes include participants in the non-tribal fisheries, shore-based processors, and fishing-related businesses in coastal communities. Participants in the non-tribal fisheries who harvest groundfish using bottom trawl gear would be directly affected by the changes to EFHCAs as well as changes to the trawl RCA. Groups affected by EFHCA changes would also include fishermen harvesting state-managed species such as pink shrimp, California halibut, sea cucumber, and ridgeback prawn. No one is anticipated to be impacted from the proposed deep-water closure because no bottom-contacting gear fishing occurs in that area currently.

What is the purpose and the need for this EIS?

There are multiple purposes and needs for the proposed action. Each purpose (P) is paired with its associated need (N):

P1: Minimize the adverse effects of fishing on EFH to the extent practicable.

N1: Consider new information on seafloor habitats, the distribution of fishing effort, the distribution of deep-sea corals, and new ecosystem-related products as they relate to protecting EFH from the adverse effects of fishing.

P2: Reconsider the purpose of RCAs as long-term closures to reduce catch of overfished species in the bottom trawl sector in light of the 2011 implementation of the Shorebased IFQ Program and the individual catch accountability that it provides.

N2: Consider transitioning from long-term RCA closures to the Shorebased IFQ Program as the primary catch control tool for IFQ species in the bottom trawl sector to provide the bottom trawl sector with increased flexibility to achieve optimum yield and economic efficiency.

P3: Protect benthic habitats, including deep-sea corals, from the adverse effects of fishing.

N3: Consider new discretionary MSA authorities under Section 303(b) that can be used to protect species and habitats, including deep-sea corals.

What is an EFHCA?

EFHCAs are spatially discrete areas closed to bottom trawling and, in some cases, other types of bottom contact gear, to protect the important habitat features found there. EFHCAs are one of the management measures the Council and NMFS developed to protect habitats, especially those that are important, rare, or vulnerable, from the adverse effects of bottom-contacting fishing gears. Some are small, closing only a few square miles; others are large, covering thousands of square miles. Generally, EFHCA boundaries are defined by lines that connect a series of latitude and longitude coordinates in a specific order. See Key Terms and Concepts for more information.

What is the trawl RCA?

The groundfish trawl RCA (trawl RCA) is a type of groundfish conservation area (GCA) closed to fishing with groundfish bottom trawl gear types and designed to minimize catch of overfished and other groundfish species.[3] The trawl RCA is a large-scale area extending along the entire length of the West Coast of the United States. The trawl RCA boundaries are defined by lines that connect a series of latitude and longitude coordinates that approximate particular depth contours of the continental shelf from approximately 30 fathoms (fm) to 700 fm. The Council may and does seasonally change trawl RCA boundaries within which particular regulations apply according to conservation needs. See Key Terms and Concepts for more information.

How are the alternatives structured?

The alternatives are divided into three subject areas, described below.

[3] This is a type of groundfish conservation area and part of the definition of "groundfish conservation area" at §660.11. Regulations at §660.112 prohibit certain types of activities for vessels with trawl gear on board.

Subject Area 1 alternatives consider revising the existing suite of EFHCAs by changing their boundaries, removing them entirely, or adding new ones. Each alternative presents different combinations of EFHCAs that consider changes in bottom trawl gear restrictions for a variety of areas and substrate types to conserve and protect groundfish EFH. All new EFHCAs would be closed to bottom trawl gear except for demersal seine gear, which would continue to be allowed in EFHCAs off California.

Subject Area 2 alternatives consider adjustments to the groundfish trawl RCA. The adjustments would include reopening this groundfish bottom trawl closure off varying parts of the coast and replacing it with an optional, smaller scale, depth-based, spatial fishery management tool called block area closures (BACs).

The Subject Area 3 alternative considers the use of MSA discretionary authorities to protect deep-water habitats. Protective closures would apply to bottom contact fishing gear in waters deeper than 3,500 meters (m).

What alternatives are considered in this EIS?

This EIS analyzes several alternatives. They are outlined in the paragraphs below and in a visual representation in Table 2-1, Chapter 2.

Subject Area 1, Alternative 1.a—the Collaborative Alternative—This alternative considers changes to the current suite of EFHCAs along the West Coast from the United States/Canada border south to Point Conception, California (excluding the tribal usual and accustomed areas [U&As] off Washington). Alternative 1.a would not propose any changes off the central Oregon coast or in the Southern California Bight area. It considers 59 areas: 43 closures and 16 reopenings (Figure 2-8., Chapter 2). Boundary adjustments are considered for multiple existing EFHCAs. Like all Subject Area 1 alternatives, closures would apply to bottom trawl gear, except for demersal seine (off California).

Subject Area 1, Alternative 1.b—the Oceana et al. Alternative—This alternative considers changes to the current suite of EFHCAs along the entire West Coast, from the United States/Canada border south to the United States/Mexico border (excluding the tribal U&As off Washington). It considers 68 areas: 61 closures and 7 reopenings (Figure 2-9, Chapter 2). Boundary adjustments are considered for multiple EFHCAs. Like all Subject Area 1 alternatives, closures would apply to bottom trawl gear, except for demersal seine (off California).

Subject Area 1, Alternative 1.h—the Preferred Alternative—This alternative considers changes to the current suite of EFHCAs along the West Coast from the central Washington coast south to the United States/Mexico Border (excluding the tribal U&As off Washington). This alternative is a collection of areas, many of which were considered under an initial range of alternatives in the Preliminary Draft EIS at the Council's April 2018 meeting. Alternative 1.h, the Preferred Alternative, contains 70 proposed areas: 53 closures and 17 reopenings (Figure 2-10.), most of which were incorporated from Alternative 1.a (38 closures and 16 reopenings) and Alternative 1.b (7 closures). The other eight areas (seven closures and one reopening) came from the other alternatives in the Preliminary Draft EIS (April 2018), as noted in Section 2.2.4. The boundaries of several areas in this alternative were modified from those described in the Preliminary Draft EIS (Council and NMFS 2018) to adjust them based on 2017 tribal U&A fishing area boundaries, to better protect priority habitats, or to reduce socioeconomic impacts. Some of the areas in this alternative would make boundary adjustments to some existing EFHCAs (No-action Alternative). For example, the Eel River Canyon has four associated areas: two would expand the closure into adjacent areas, and two would reduce the closure and reopen portions of the No-action Alternative EFHCA. Like all Subject Area 1 alternatives, closures would apply to bottom trawl gear, except for demersal seine (off California).

Subject Area 2, Alternative 2.c—Coastwide Removal with BACs—This alternative considers removing the trawl RCA coastwide, outside of the tribal U&As (south of Point Chehalis, Washington), thereby allowing access for vessels fishing with groundfish bottom trawl gear. It also considers the option of implementing depth/latitude-based closures, BACs, inseason or preseason available as a harvest management tool to prohibit fishing by vessels using groundfish bottom trawl gear at certain times across a variety of depths and latitudes. The waters off the West Coast, from the coastline (including state waters) out to the 700-fm contour line, would be divided into approximately 365 individual BACs that could be closed in any combination, based on fishery management needs. A combination of BACs could be implemented to meet a variety of management needs.

Subject Area 2, Alternative 2.d—Preferred Alternative—This alternative considers no changes to the trawl RCA off Washington, maintaining the trawl RCA management tool as described under the No-action Alternative. Off Oregon and California, the trawl RCA would be removed, and BACs would be available as a harvest management tool in the same way as Alternative 2.c. The waters off the West Coast, from the coastline (including state waters) out to the 700-fm contour line, would be divided into approximately 313 individual BACs that could be closed in any combination, based on fishery management needs.

Subject Area 3, Alternative 3—the Preferred Alternative—This alternative considers using authorities under MSA Sec. 303(b)(2)(A), 303(b)(2)(B), or 303(b)(12)[4] to close waters deeper than 3,500 m to bottom contact gear, consistent with September 2015 Agenda Item H.8.a, Supplemental NMFS Report.

[4] These discretionary authorities allow regional fishery management councils to designate zones where fishing is limited or not permitted.

These waters are seaward of groundfish EFH and shoreward of the Exclusive Economic Zone (EEZ) (Chapter 2, Figure 2-19).

What environmental resources are analyzed in this EIS?

Environmental resources analyzed include habitat, socioeconomic environment, fish, and protected resources. Specific metrics are used as proxies for each of these elements to assess likely impacts of the alternatives. For example, habitat metrics consist of hard, mixed, and soft substrate types, submarine canyons and gullies, overfished species habitats, and habitat-forming invertebrates (deep-sea corals, sponges, and sea pens). Socioeconomic effects are measured in terms of landings (round weight pounds), revenues (inflation-adjusted, 2015 United States dollars), effort (tow duration), and fishery dependency (proportion of community revenues). Economic impacts flow from the groundfish fishery in the form of personal income to vessel owners and their captains and crew, buyers and processors and their employees, and the communities (as these individuals make purchases and take part in the social lives of their local communities). The groundfish fishery also impacts suppliers, financers, and other related support industries. Fish resources include species harvested with bottom trawl gear, as well as other fish species occurring in the action area. Protected resources include protected species and critical habitat for salmon, green sturgeon, marine mammals, and seabirds occurring in the action area. Analysis was undertaken at various scales, including coastwide, state-by-state, by port group, etc. These analytical levels are discussed in Section 4.1.5, Analytical Levels.

Are there any environmental justice effects analyzed in this EIS?

Generally, the proposed action would not have disproportionately high adverse impacts on minority and low-income populations. The primary social and economic impacts would be on fishing communities, and, consistent with Executive Order (EO) 12898 and the MSA national standards, those impacts are carefully considered in the Council process to ensure fair and equitable management actions. Chapter 4 discusses socioeconomic impacts by port-group. Chapter 7 provides additional discussion of environmental justice.

What are the environmental consequences of each alternative?

Subject Area 1 EFHCA alternatives (Alternative 1.a, Alternative 1.b, and Alternative 1.h) would result in an increase in habitat and ecosystem protections over the amount currently being protected (No-action Alternative). However, each alternative would result in a loss of fishing area and may negatively impact the fishing industry. Reopening EFHCA areas would increase the square miles of available fishing area and would create positive benefits to the fishing industry; however, these actions may negatively affect benthic habitats due to bottom trawling in those areas.

Each alternative would close more areas than they would reopen. Alternative 1.b would close 19 times more area overall compared to Alternative 1.a., and it would close 1.2 times more area overall compared to Alternative 1.h. Alternative 1.a would have the smallest spatial extent. Alternative 1.h would close 16.4 times more area overall to bottom trawling than Alternative 1.a (Table 4-6, page 4-39), providing more benefit to benthic habitats and the fish resources that utilize them. Closures proposed under Alternative 1.b would contribute more landings than Alternative 1.a and Alternative 1.h closures, particularly in Eureka, meaning that Alternative 1.b would have a greater negative impact on the Eureka port group than other alternatives. Reopened areas under Alternative 1.a and Alternative 1.b would contribute more to Monterey landings than other ports, or to any ports under Alternative 1.h. Under all the Subject Area 1 alternatives, reopened areas would be smaller than closed areas, and they would generally result in lower biological or socioeconomic impacts, not taking habitat type or fishing grounds contribution into account. All the Subject Area 1 alternatives would likely pose negligible impacts or savings to fish and protected resources overall because they would not likely appreciably change effort in bottom trawl fisheries.

Subject Area 2 alternatives would reopen areas that have been closed to groundfish bottom trawling for over 15 years to protect overfished rockfish species in depths between approximately 100 fm to 150 fm. This area is predominantly soft-bottom habitats that recover quickly and provide habitat for a variety of species, in particular, overfished rockfish species. Since 2010, the fishery is managed with annual catch limits and individual fishing quotas; therefore, the Council recommended removal of trawl RCA with the goal of providing socioeconomic benefits. Reopening the trawl RCA would allow fishing in areas of habitat types that are associated with groundfish; this is unsurprising because past fishing activity indicates the presence in these areas of many marketable species with value. The reopened areas would reduce transit time/distance, resulting in higher efficiency in the groundfish bottom trawl fishery, lowering operational costs and increasing net revenue. Also, adopting a management strategy that relies less on pre-catch share regulations, like the time/area closures of the trawl RCA, would make good on some of the touted benefits of catch-share fishery management by increasing flexibility and efficiency. Both Subject Area 2 alternatives would negatively affect fish and protected resources; however, the magnitude is impossible to predict, and other measures are in place to mitigate the magnitude of negative impacts; therefore, it is unlikely to result in overfishing fish resources or jeopardy to protected species or their designated critical habitat.

Effects on biological resources would be similar for Alternative 2.c and Alternative 2.d, except off the Washington coast between Point Chehalis, Washington, and the Washington/Oregon border. Alternative 2.d would keep the trawl RCA in place off Washington, where it would continue to protect benthic habitats by nature of its closure. Retaining the trawl RCA off Washington would also lower the potential socioeconomic gains for ports that receive landings from groundfish bottom trawlers operating off Washington (Washington and northern Oregon ports), compared to than Alternative 2.c.

Alternative 3.a would close the portion of the EEZ deeper than 3,500 m to all bottom contact gear, including bottom trawl gear, bottom long line gear, and pot/trap gear. There would be negligible immediate impacts on habitats or fisheries due to this closure, as little to no bottom contact fishing occurs in these depths because it is impractical. However, Alternative 3.a would limit prospective fishing activities in the future, and it would reduce the potential damage by fishing activities on habitat features such as deep-sea corals.

What is the preferred alternative?

The preferred alternative for each of the three subject areas is shown in the table below.

Table ES-1. Preferred alternative by subject area.

Subject Area	Preferred Alternative
Subject Area 1	Alternative 1.h
Subject Area 2	Alternative 2.d
Subject Area 3	Alternative 3.a

The preferred alternatives are intended to conserve and protect EFH to the maximum extent practicable. The alternatives would have a net increase in habitat closed to bottom trawl activities. The preferred alternatives would add dozens of new and revised EFHCAs, including the large closure of the Southern California Bight (which would close most Federal waters in the area, except some areas closest to state waters where non-groundfish bottom trawling occurs). The preferred alternatives would also close waters deeper than 3,500 m to bottom contact gear. The preferred alternatives would also reopen the groundfish trawl RCA off Oregon and California, allowing access for groundfish bottom trawl fishermen to historically important fishing grounds, and they would provide the Council and NMFS the ability to manage the fishery using BACs. The preferred alternatives would likely increase efficiency and flexibility in management of the groundfish bottom trawl fishery.

Varying combinations of Subject Area 1 and Subject Area 2 alternatives are considered in Chapter 5. The impact metrics from Chapter 4 are not always additive (e.g., they cannot be summed to get net effects) because these combinations have spatial overlap. The preferred alternatives from each Subject Area are considered in “Combination 4” (see Chapter 5). Since the Subject Area 3 alternative would have no spatial overlap with the Subject Area 1 and Subject Area 2 alternatives, the impacts of Alternative 3 would be added to the combinations discussed in Chapter 5. See impact metrics and results for Alternative 3, which is described in Chapter 4.

What cumulative effects are analyzed in this EIS?

Chapter 6 considers and describes the cumulative effects of past, present, and reasonably foreseeable future actions on habitat, socioeconomics, socioeconomics, fish resources, and protected resources. Reasonably foreseeable future actions include the 2019-2020 groundfish biennial harvest specifications and management measures, trawl gear changes, and blackgill rockfish reallocation. The cumulative effects analysis also considers non-fishing activities that occur in the action area and may affect the same resources. Overall, when combined with the effects of past, present, and reasonably foreseeable future actions, the incremental effect of the range of alternatives would have between a neutral to medium positive influence on habitat, a neutral to medium positive influence on socioeconomics, a neutral to low positive influence on fish resources, and a neutral influence on protected resources.

What is the timeframe for NMFS' decision?

The Council considered public comment and adopted draft FMP Amendment 28 language for public review at its September 5 to 12, 2018 meeting. The Council adopted final FMP Amendment 28 language at its March, 2018 meeting. The Council deemed proposed regulations and transmitted FMP Amendment 28 to NMFS on June 3, 2018. NMFS anticipates publishing the proposed rule in summer 2019 and completing the final EIS and final rule by late 2019. With this timeframe, the, rule would be effective January 1, 2020.

1 INTRODUCTION

The groundfish fisheries in the exclusive economic zone (EEZ) off the West Coast of the United States are managed under the Pacific Coast Groundfish Fishery Management Plan (FMP). The FMP was prepared by the Pacific Fishery Management Council (Council) and approved and implemented by the National Marine Fishery Service (NMFS) under the Magnuson-Stevens Fishery (MSA) Conservation and Management Act (18 U.S.C. 1801 et seq.). The FMP includes more than 100 species of groundfishes that are harvested using both commercial and recreational gear off the Washington, Oregon, and California coasts. This document presents a description and analysis of the proposed fishery management alternatives for Amendment 28 to the FMP. The alternatives include changes to the essential fish habitat conservation areas (EFHCAs), adjustments to the groundfish trawl rockfish conservation area (RCA; trawl RCA), and use of MSA authorities to prohibit bottom contact fishing activities in waters deeper than 3,500 meters (m).

The MSA mandates that each regional FMP describe and identify essential fish habitat (EFH) for the fishery (16 U.S.C. 1853(7)). EFH is defined as ‘‘those waters and substrate necessary to fish for spawning, breeding, feeding or growth to maturity’’ (16 U.S.C. 1802(10)). Under this authority, NMFS and the Council have developed a comprehensive strategy to conserve EFH, including its identification and the implementation of measures to minimize adverse impacts on EFH from fishing, such as the establishment of EFHCAs, which are areas closed to certain types of bottom contact gear to protect the important habitat features found there.

The Council is considering revisions to the suite of EFHCAs established in Amendment 19, (completed in 2006) based on the periodic review of EFH that was completed in 2014. At that time, the Council concluded that there was enough new information to warrant consideration of modifying the existing suite of EFHCAs. This action does not consider changes to the criteria used to designate EFH; it only recommends changes to boundaries and regulations regarding certain EFHCAs. Some EFHCAs overlap with other bottom trawl closures (BTCs).

The trawl RCA, as described in Key Terms and Concepts, is an area extending along the entire length of the West Coast of the United States. It is closed to bottom trawling to protect overfished groundfish species. Fishing prohibitions associated with the trawl RCA are in addition to those associated with EFHCAs and other groundfish conservation areas (GCAs) such as the Cowcod Conservation Area (CCA) and the Cordell Bank GCA (CBGCA). The trawl RCA overlaps with some EFHCAs and the CBGCA. Management of the groundfish trawl fishery changed from cumulative landing limits and area closures (i.e., command and control measures to reduce catch) to individual fishing quotas (IFQ) (i.e., individual accountability under the Shorebased IFQ Program) in 2011. Given the new management regime, the Council received requests to reevaluate the purpose and utility of the trawl RCA (November 2011 Agenda Item E.7.b, Supplemental TRREC Report).

The alternatives described and analyzed in this document pertaining to the trawl RCA use the boundary lines that were in place in 2015. Although the trawl RCA boundaries can change annually and in season, the EFH/RCA Project Team (Project Team) had to define a stable configuration for analytical purposes. The 2015 groundfish trawl RCA configuration was in place when the Project Team began developing the suite of alternatives and the analytical approach. Hence, the Project Team uses the 2015 groundfish trawl RCA configuration described above in the definitions. Key Terms and Concepts includes a more detailed description of the groundfish trawl RCA. The Council is considering adjustments to the trawl RCA to provide greater access to target species while using the individual accountability of the trawl IFQ program to be the primary mechanism to minimize bycatch of overfished species.

In Amendment 19, the Council intended to close waters deeper than 3,500 m to bottom trawling to minimize the adverse effects of fishing on EFH. Because the Council limited groundfish EFH to waters less than 3,500 m deep, however, it was not an appropriate EFH action, and NMFS did not approve it. For Amendment 28, the Council and NMFS are now considering the discretionary authorities under MSA Section 303(b) to prohibit all bottom contact fishing activities deeper than 3,500 m. This action is being considered for the following reasons:

1) The species and their habitat needs are poorly understood at these depths.
2) The habitats at these depths, including deep-sea corals, have not yet been exposed to commercial bottom contact fishing gear, but they are likely to be sensitive to damage by bottom contact gear and slow to recover.
3) There is no current interest in using bottom contact gear at such depths due to gear limitations that make fishing there difficult, as well as the lack of a viable market for the benthic species found there.

Although no bottom fishing is currently occurring in these waters, this proposed closure is viewed as a precautionary measure to protect sensitive deep-sea habitats.

The National Environmental Policy Act (NEPA) of 1969 42 U.S.C. 4321 et seq.) requires that, prior to undertaking a major Federal action, the action agency conduct an analysis of the short- and long-term impacts on the human environment, which includes current biological, physical, social, and economic conditions. Given that Amendment 28 has the potential to affect physical, biological, social, and economic features of the human environment significantly, this Environmental Impact Statement (EIS) was prepared to inform the Council, NMFS, and the public of potential impacts of a range of alternatives.

1.1 Document Organization

Chapter 1 describes the purpose and need of the action. It identifies information generated during scoping following the issuance of the notice of intent (NOI).

Chapter 2 describes each alternative being considered, including a preferred alternative.

Chapter 3 describes the affected environment.

Chapter 4 describes the analytical approach, the metrics used to evaluate the direct and indirect effects of the alternatives on the environmental components of the action area, and the results of the analyses of the alternatives.

Chapter 5 analyzes the impacts of various combinations of the EFHCA and trawl RCA Alternatives and compares their impacts on each other, as well as to the No-action Alternative. Prior to Chapter 5, each alternative is evaluated as a stand-alone alternative, ignoring the potential interactions with the other alternatives.

Chapter 6 describes the cumulative effects of the proposed action with past, present, and reasonably foreseeable future actions.

Chapter 7 describes this action's consistency with other applicable laws, including the Groundfish FMP and National Standard guidelines. It contains a brief description of each law, its relevance to the proposed action, and how the proposed action is compliant.

Chapter 8 contains a list of preparers and the distribution list for this document.

Chapter 9 contains references to the literature cited in the document.

Chapter 10 contains response to comments on the draft EIS.

Appendices:

A. Habitat metrics, by geographic breaks and polygon
B. Habitat Metrics – Habitat-forming Invertebrates
C. Landings and Revenues by Alternative and by Polygon
D. Additional Methodology Descriptions
    D-1 Data Source Selection Process for Catch, Revenue, and Protected Resources
    D-2 Discrete Area Closure (DAC) Methodology/Hotspot Analysis
E. History of Council Action
F. Public Comments on DEIS

1.1.1 Electronic Supporting Materials:

Information regarding this proposed action, including geo-spatial data, will be made available on the following websites after the action is approved by the Secretary of Commerce. https://www.nwfsc.noaa.gov/data/map, and https://www.fisheries.noaa.gov/

- Interactive, web-based mapping tool of the Alternatives described in Chapter 2, including the No-Action Alternative.
  http://www.soundgis.com/efh/efh2018eis-metrics/
- Latitude and longitude coordinates associated with Alternative 1.h, The Preferred Alternative for EFHCAs, in Appendix C-2 to the FMP:
  https://www.pcouncil.org/wp-content/uploads/2019/06/Appendix-C2-Coordinates-csv-FINAL.csv

1.1.2 Summary of Major Changes Made to the DEIS

Changes were editorial, clarifications, or correction of typographical errors, or to respond to comments received by providing additional information and/or references. The list of electronic supporting materials (above) is an example of the latter. The responses to public comments received (Chapter 10) identifies specific sections of the FEIS that NMFS has updated in response to questions asked.

1.2 Purpose and Need

The Council, in coordination with NMFS, has identified multiple purposes and needs for the proposed action. Each purpose (P) is paired with its associated need (N):

P1: Minimize the adverse effects of fishing on EFH to the extent practicable.

N1: Consider new information on seafloor habitats, the distribution of fishing effort, the distribution of deep-sea corals, and new ecosystem-related products as they relate to protecting EFH from the adverse effects of fishing.

P2:[5] Reconsider the purpose of RCAs as long-term closures to reduce catch of overfished species in the bottom trawl sector in light of the 2011 implementation of the Shorebased IFQ Program and the individual catch accountability that it provides.

N2: Consider transitioning from long-term RCA closures to the Shorebased IFQ Program as the primary catch control tool for IFQ species in the bottom trawl sector to provide the bottom trawl sector with increased flexibility to achieve optimum yield and economic efficiency.

[5] P2 and N2 reflect updated text by Council action at the November 2016 meeting.

P3: Protect benthic habitats, including deep-sea corals, from the adverse effects of fishing.

N3: Consider new discretionary MSA authorities under Section 303(b) that can be used to protect species and habitats, including deep-sea corals.

1.3 Action Area

Generally, the action area is the Pacific Coast of the United States EEZ, primarily seaward of Washington, Oregon, and California state territorial waters (3 nautical miles from shore; herein referred to as “state waters”), with some exceptions. The EEZ and state waters can be seen in Figure 2-13, page 2-29. Some areas within the EEZ are not considered part of the action area because direct and indirect impacts are not anticipated from any of the alternatives described in Chapter 2. Some areas of state waters would be impacted by some of the alternatives described in Chapter 2. Those areas of exception are further described below, and all remaining areas are considered to be part of the action area.

The Council and NMFS do not intend for any of the action alternatives described in Chapter 2 to revise state-issued regulations for state-managed species in state waters. Portions of state waters are included in the action area because the trawl RCA overlaps with state waters off Washington and California. However, areas of state waters that do not overlap any of the areas proposed for changes in Chapter 2 are not considered part of the action area.

The Council and NMFS do not intend for any of the action alternatives described in Chapter 2 to apply to tribal fisheries in usual and accustomed (U&A) fishing areas off Washington. Tribal U&A fishing areas for the Makah Tribe, the Quileute Tribe, the Hoh Tribe, and the Quinault Indian Nation are defined by latitude and longitude coordinates described in Federal Regulations at 50 CFR §660.4, and they can be seen depicted in maps throughout this EIS, including Figure 2-1, No-action Alternative.[6] However, fishing data from the tribal U&A fishing areas off Washington are used in the analysis, so this area is considered part of the action area. NMFS will continue to work with the tribes to ensure that adequate measures are in place to protect EFH within the U&A fishing area. If, in the future, additional measures are deemed necessary, NMFS would follow the procedures that are outlined in 50 CFR §660.50(d).

[6] The EFH/RCA analysis uses the tribal U&A fishing area boundaries set forth in *United States v. Washington*, 2:09-sp-00001-RSM, (W.D. Wash. Sept. 3, 2015) (Amended Order Regarding Boundaries of Quinault & Quileute U&As) and published in the FR on June 8, 2016 (81 FR 36807). On March 5, 2018, the U.S. District Court for the Western District of Washington issued an order revising the western U&A boundaries for the Quileute and Quinault Tribes, pursuant to a remand by the U.S. Court of Appeals for the Ninth Circuit in *Makah Indian Tribe v. Quileute Indian Tribe*, 873 F.3d 1157 (9th Cir. 2017). On May 1, 2018, the Quileute and Quinault Tribes appealed this order, and the appeal is currently pending before the U.S. Court of Appeals for the Ninth Circuit. NMFS published the March 5, 2018 boundaries in the FR on October 25, 2018 (83 FR 53827).

The action area does not include most of the “seaward of the 700 fm contour” EFHCA defined at 50 CFR §660.76. This EFHCA is a single, large, coastwide polygon (Figure 2-1, No-action Alternative Map), and it is closed to bottom trawling. However, several small areas of this polygon overlap with some of the proposed EFHCA reopenings, and they are, therefore, considered part of the action area. The action area includes all of the EEZ seaward of this “seaward of the 700 fm contour” EFHCA, which consists mostly of waters deeper than 3,500 meters (1,914 fm).

1.4 Scoping

On February 1, 2016, NMFS published an NOI to prepare an EIS for Amendment 28 to the groundfish FMP (81 Federal Register [FR] 5102). Through the NOI, NMFS sought comments from the public on the scope of issues to be addressed in this EIS, the range of alternatives to include, and the types of habitats to prioritize for protection from the adverse effects of fishing gear. The comment period closed on March 2, 2016. Further public participation occurred throughout the Council's decision-making process. The NOI identified the Council meeting in Vancouver, Washington, held from April 9 to April 14, 2016, as an opportunity for public involvement. NMFS provided the Council with a summary of the comments received during the NOI comment period (Agenda Item F.5.b, Supplemental NMFS Report). The comments received during scoping were considered, and they helped the Council and NMFS identify major issues and concerns.

2 DESCRIPTION OF ALTERNATIVES

This document contains analyses of a variety of alternatives intended to meet the purpose and need. The alternatives generally fall into one of three subject areas. Throughout the document, the alternatives are organized into the subject areas to which they pertain. The three subject areas are as follows: 1) EFHCA changes, 2) adjustments to the trawl RCA, and 3) use of MSA section 303(b) discretionary authorities.[7] The Project Team evaluated a combined No-action Alternative (that includes all three subject areas) and six individual action alternatives (Table 2-1). A preferred alternative is included from each of the three subject areas. Because Subject Area 1 and Subject Area 2 closures/reopeners have spatial overlap, NMFS also analyzed four ‘synthesis’ combinations in Chapter 5 (Table 5-1) and compared them to each other and to the No-action Alternative. The Subject Area 3 alternative does not have spatial overlap with the other subject area closures/reopeners; it is, therefore, considered as a stand-alone alternative, and it is not included in Chapter 5.

Figures in this chapter depict each of the alternatives on a coastwide scale. These are intended to provide information on the scale of each alternative for a gross comparison. Detailed views of any of the alternatives discussed in this chapter, and other related spatial references information (e.g. state water boundary, tribal U&A, etc.), can be viewed via a web-based, interactive mapping tool developed for this EIS. That tool is available at the following URL: http://www.soundgis.com/efh/efh2018eis-metrics/.

A single No-action Alternative is used to compare the action alternatives in all three subject areas. The No-action Alternative would 1) retain the current suite of EFHCAs intended to minimize the adverse effects of fishing on groundfish EFH (Subject Area 1), 2) retain the groundfish trawl RCA closures in place to control the catch of overfished species (Subject Area 2), and 3) continue to allow the use of bottom contact gear in waters deeper than 3,500 m (Subject Area 3). The No-action Alternative would also assume that harvest levels (e.g., annual catch limits), trawl gear restrictions, and the overall management scheme for the groundfish trawl fishery would remain similar to recent years. Discussion of other reasonably foreseeable future actions that may have cumulative effects with actions considered here can be found in Chapter 6.

While many areas off the West Coast are closed to groundfish bottom trawling, other maritime activities occur within bottom trawl closure areas. The types of activities allowed in some of these areas include

7 Previous reports from the Project Team placed the alternatives in one of four subject areas: 1) EFHCA changes contained in public proposals, 2) new EFHCAs within current RCAs, 3) adjustments to the trawl RCA, and 4) use of MSA section 303(b) discretionary authorities. However, the Project Team determined that it was more logical to reorganize them into the three subject areas, combining all EFHFCA alternatives into a single subject area.

fishing with non-groundfish trawl gear (e.g., pink shrimp trawl), midwater trawling, hook and line, and other non-trawl, groundfish fishing activities.

Table 2-1 Summary of the Alternatives Considered. Alternatives considered in the Preliminary Draft EIS but that are not analyzed further in this document are described in Section 2.2.4 and Section 2.3.3.

<table>
<tr><th>Subject Area</th><th>No-action Alternative</th><th colspan="6">Action Alternatives</th></tr>
<tr><td>1. EFHCA changes (re-openings and closures)</td><td rowspan="3">No-action Alternative
Retains current suite of EFHCAs.
Retains trawl RCA closures.
Continues to allow use of bottom contact gear in waters deeper than 3,500 m.</td><td colspan="2">Alternative 1.a, Collaborative Alternative</td><td colspan="2">Alternative 1.b, Oceana, et al. Alternative [1/]</td><td colspan="2">Alternative 1.h, Preferred Alternative</td></tr>
<tr><td>2. Adjustments to Trawl RCA</td><td colspan="3">Alternative 2.c, Remove trawl RCA and implement block area closures (BACs)[2/]</td><td colspan="3">Alternative 2.d, Preferred Alternative, Remove trawl RCA and implement BACs (Oregon and California)</td></tr>
<tr><td>3. Use of MSA Sec. 303(b) discretionary authorities</td><td colspan="6">Alternative 3, Preferred Alternative, Use MSA Sec. 303(b)(2)(A), Sec. 303(b)(2)(B), or Sec. 303(b)(12) to close waters deeper than 3,500 m to bottom contact gear, consistent with September 2015 Agenda Item H.8.a, Supplemental NMFS Report</td></tr>
</table>

[1/] Alternative 1.b, Oceana, et al., was modified per November 2016 Agenda item F.4.b CDFW report.
[2/] Alternative 2.c, would remove the trawl RCA coastwide outside the tribal U&A fishing area.

Off California, several non-groundfish trawl fisheries are subject to depth restrictions that are similar in time and place to the trawl RCA (the seaward boundary for these non-groundfish fisheries is a little deeper during winter months than it is for the groundfish fishery). These fisheries include the ridgeback prawn fishery and the California halibut (*Paralichthys californicus*) and sea cucumber trawl fisheries south of 38 degrees 57.50’ N. latitude.

Several marine sanctuaries, marine reserves, and marine conservation areas also occur within the action area. Generally, marine sanctuaries prohibit activities such as harassing, disturbing, or taking prohibited species (e.g., marine mammals, endangered species, etc.) and introducing invasive species.[8] Marine reserves and marine conservation areas may have restrictions more specific to fishing activities, including prohibiting commercial fishing or fishing for certain species entirely.[9] Without exception, all five west coast national marine sanctuaries prohibit exploring for, developing, or producing oil, gas, or minerals. With few exceptions, west coast national marine sanctuaries prohibit discharge from vessels and drilling into, dredging, and constructing, placing, or abandoning any structure on or in the submerged lands of each sanctuary. All national marine sanctuary program regulations would remain unchanged under any alternative.

2.1 No-action Alternative

A single No-action Alternative is considered in this EIS. Each of the three Subject Areas is clearly described for ease of comparison with the action alternatives.

Additional information regarding bottom trawl restrictions under the No-action Alternative in each of the three subject areas is provided in this section. Bottom trawl closures exist in the action area for a variety of reasons, and they have considerable spatial overlap (e.g., a single location may be closed to bottom trawling via multiple closures) (Figure 2-1). An example of the spatial overlap of bottom trawl closures is depicted in Figure 2-2. Where those BTCs overlap, the most stringent restrictions apply. For instance, pink shrimp trawling is allowed in the trawl RCA, but not the EFHCAs. It would, therefore, be prohibited in areas where they overlapped. Several fisheries may be affected by changes to bottom trawl closures under the action alternatives (Table 2-2).

[8] Olympic Coast National Marine Sanctuary (NMS) (Greater Farallones NMS (15 CFR 922.82), Monterey Bay NMS (15 CFR 922.@@), Channel Islands NMS (15 CFR 922.72), Cordell Bank NMS (15 CFR 922.112)

[9] Channel Islands Marine Reserve, within the NMS, regulations prohibit the use of fishing gear. Channel Islands Marine Conservation Area, within the NMS, regulations only allow certain types of fishing activities; otherwise, the use of fishing gear is prohibited (15 CFR 922.73).

Table 2-2. Commercial Fishing activities that are restricted in the each of the three subject areas under the No-action Alternative. Y = yes, fishing is restricted; N = no, fishing is not restricted.

	(Subject Area 1)	(Subject Area 1)	(Subject Area 1)	(Subject Area 2)	(Subject Area 3)
	EFHCAs	**Closed to bottom trawl**	**Closed to bottom contact gear**	**Trawl RCA**	**Waters deeper than 3,500 m**
Groundfish bottom trawl	N	Y	Y	Y	N
Footrope >19 inches	Y	Y	Y	Y	N
Groundfish/whiting midwater trawl	N	N	N	N[a/]	N
Groundfish non-trawl gears that do not contact the bottom	N	N	N	N	N
Groundfish non-trawl gears designed to contact the bottom (e.g., fish pot gear)	N	N	Y	N	N
Demersal seine	N	Sometimes[b/]	Y	Y	Y
Pink shrimp trawl	N	Y	Y	N	N
Ridgeback prawn trawl	N	Y	Y	Y[c/]	N
California halibut trawl	N	Y	Y	Y [c/]	N
Sea cucumber trawl	N	Y	Y	Y [c/]	N
Salmon troll (hook and line)	N	N	N	N	N

[a/] North of 40 10’ N. latitude, midwater trawling is prohibited everywhere, January through May (i.e., outside of the primary Pacific whiting season). South of 40 10’ N. latitude, midwater trawling is prohibited shoreward of the trawl RCA year-round. Midwater trawling is allowed inside the trawl RCA during the primary Pacific whiting fishing season (e.g., after May 1 or May 15, depending on the area of the coast).

[b/] Some EFHCAs that are closed to bottom trawl gear have an exception to allow fishing with demersal seine gear.

[c/] Ridgeback prawn, California halibut, and sea cucumber bottom trawl fisheries are prohibited from fishing in the non-groundfish trawl RCA, which functions like the groundfish trawl RCA and covers similar areas (mostly overlap each other), but has slightly different boundaries. The non-groundfish trawl RCA is not considered for revision in this action.

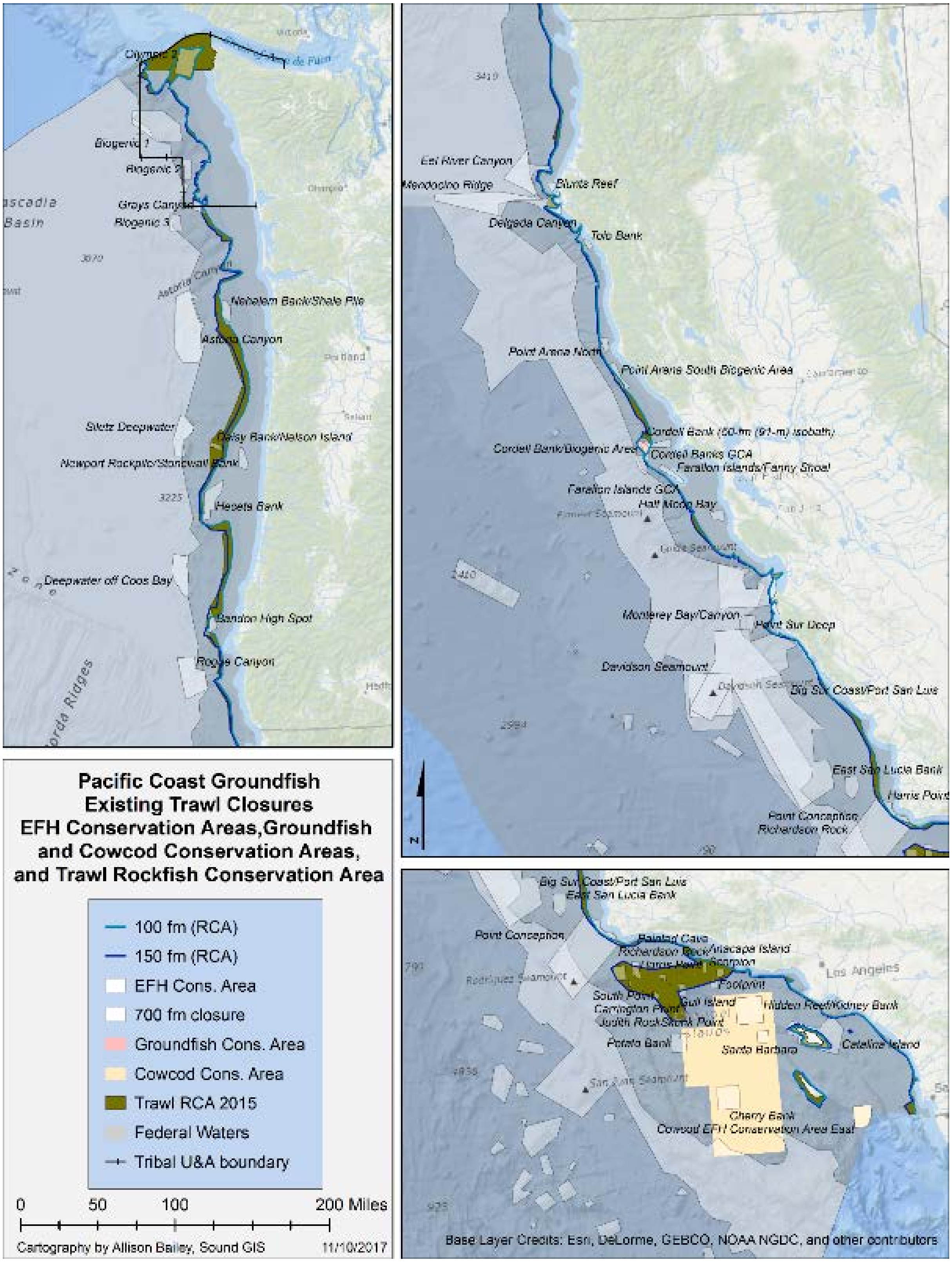

Figure 2-1. Existing Federal bottom trawl closures off the West Coast under the No-action Alternative.

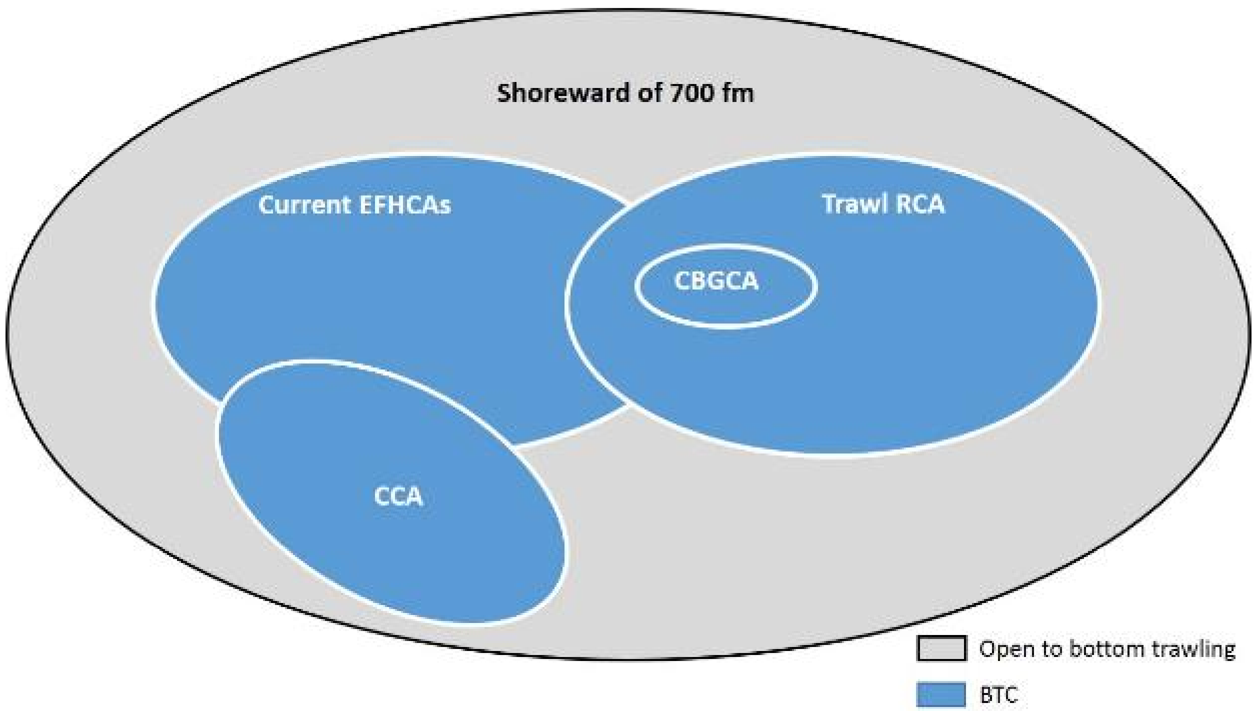

Figure 2-2. Conceptual Venn diagram showing overlap of bottom trawl closures. Note: The figure is not to scale, and it is not intended to evaluate relative impacts.

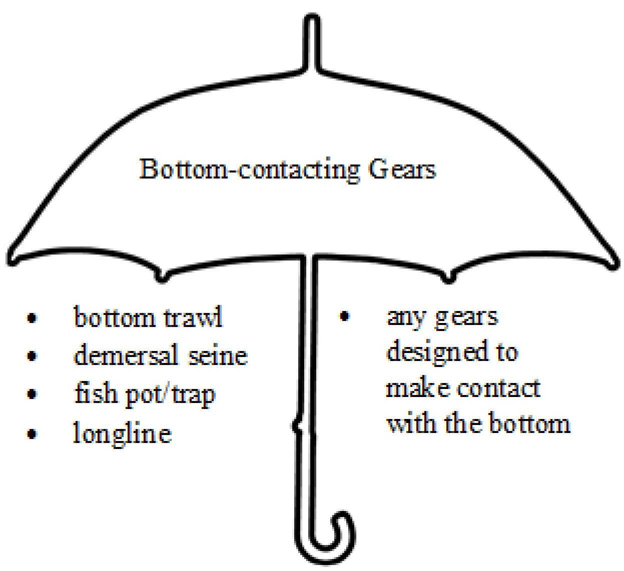

Figure 2-3. Examples of bottom contacting fishing gears.

2.1.1 No-action Alternative Subject Area 1

The No-action Alternative would retain the current suite of EFHCAs intended to minimize the adverse effects of fishing on groundfish EFH (Subject Area 1): These EFHCAs prohibit certain types of bottom contact gear, which is defined as any gear that is designed to make contact with the bottom (Table 2-3, Figure 2-3). Of the 52 EFHCAs along the West Coast, 17 prohibit all forms of bottom contact gear and the remaining 35, including the "seaward of the 700 fm contour" closure,[10] prohibit bottom trawl gear. Of the 35 EFHCAs closed to bottom trawl gear, the 19 that are off the coast of California allow the use of demersal seine gear (NMFS 2005).[11] The seaward of the 700 fm contour closure overlaps completely or partially with 16 EFHCAs. Under the No-action Alternative, there would be no change in the current configuration of EFHCAs (Figure 2-4) or their gear restrictions. Hence, bottom trawling (and in some cases, the use of any bottom contacting gear) would remain prohibited in those areas. Also, under the No-action Alternative, prohibitions would be maintained for the use of dredge gear, beam trawl gear, any bottom trawl gear with rollers greater than 19 inches (48 cm) within any area designated as groundfish EFH, and any bottom trawl gear with rollers larger than 8 inches (20 cm) in diameter shoreward of the 100 fm contour.

2.1.2 No-action Alternative Subject Area 2

The No-action Alternative would retain the trawl RCA closures to control the bycatch of overfished species and other groundfish species (Subject Area 2). Under the No-action Alternative, there would be no changes to the trawl RCA configuration that was in place at the start of this analysis, in 2015, (Figure 2-5), and the use of the trawl RCA for management purposes would remain similar to recent years. For analytical purposes, the Project Team used the 2015 trawl RCA configuration (see definitions in Chapter 1) for comparison to the action alternatives. Although trawl RCA boundaries can be modified routinely, as needed, via inseason action, the boundaries and management approach under the No-action Alternative would remain in place. The primary catch controls for vessels using bottom trawl gear within the Shorebased IFQ Program would include limited entry permits, IFQ, trip limits for non-IFQ species, and NMFS' authority to close the fishery to prevent the trawl sector in aggregate or the individual trawl sectors from exceeding an ACL, optimum yield (OY), annual catch target (ACT), or formal allocation specified in the FMP or regulation. Hence, groundfish bottom trawling would remain prohibited in the trawl RCA.

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10 In 2006, as part of Amendment 19, the Council and NMFS closed waters seaward of a boundary line approximating the 700 fm contour to bottom trawling to protect EFH. This is commonly referred to as the 'bottom trawl footprint closure' or the 'seaward of the 700 fm contour' EFHCA.

11 Demersal seine gear is described in Section 3.5.2 of the Amendment 19 EIS (NMFS 2005). It is considered a "small footrope trawl," but it is lighter in weight and has a small, light footrope.

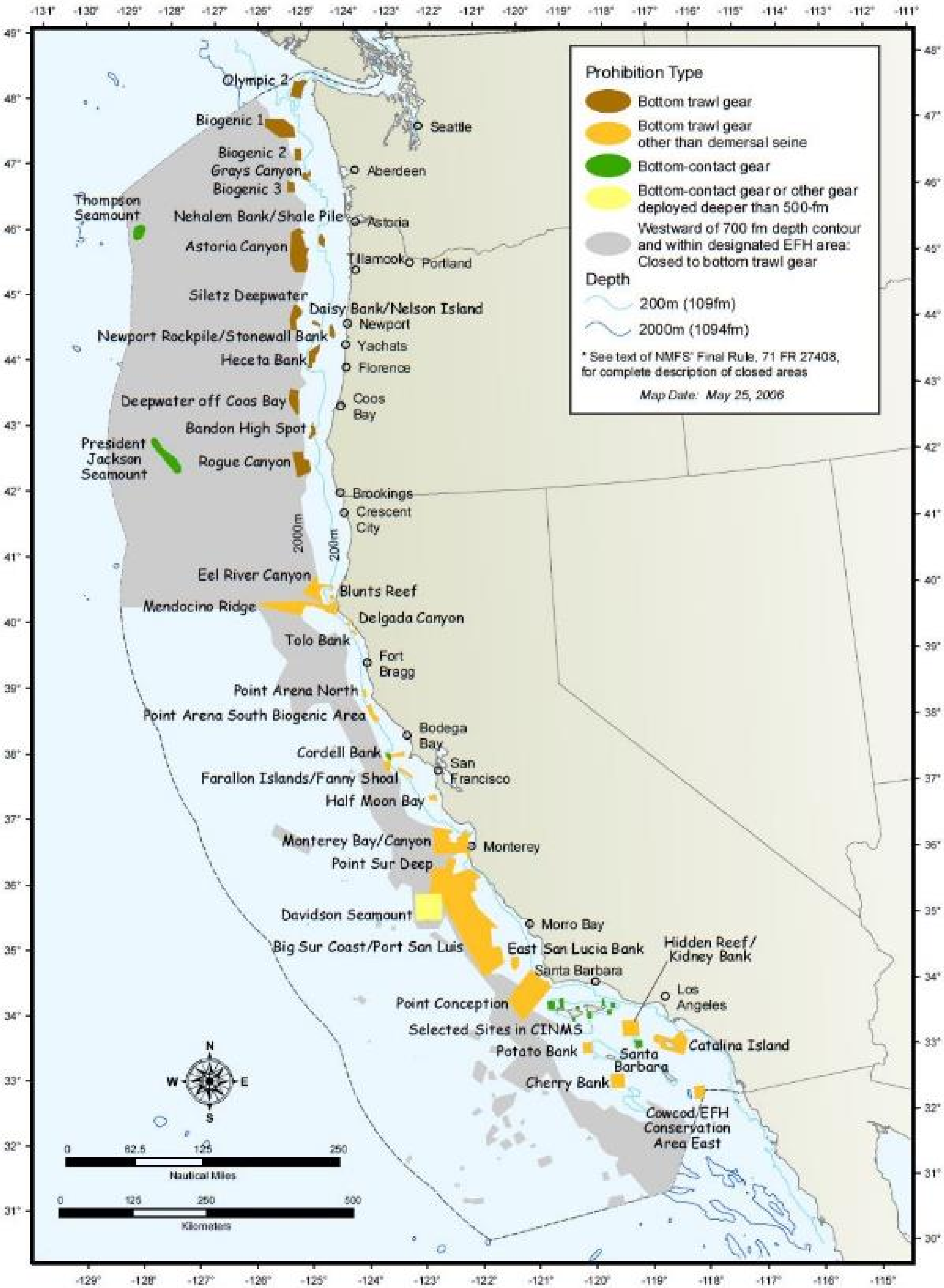

Figure 2-4. Existing EFHCAs under the No-action Alternative.

Table 2-3. No-action Alternative EFHCAs and the types of fishing restrictions within each area.

Name	Offshore of (state)	Closed to bottom trawl [d/]	Closed to demersal seine [d/]	Closed to bottom contacting gear (including longline/pot/trap gear) [d/]	Closed to midwater trawl gear	Closed to non-groundfish trawl	Closed to groundfish non-trawl (not bottom contacting)
EFH - Areas designated as EFH	Coastwide	X[c/]				X	
Seaward of the 700 fm contour [a/]	Coastwide	X	X			X	
Shoreward of the 100 fm contour [a/]	Coastwide	X[b/]				X	
Olympic 2	WA	X	X			X	
Biogenic 1	WA	X	X			X	
Biogenic 2	WA	X	X			X	
Grays Canyon	WA	X	X			X	
Biogenic 3	WA	X	X			X	
Thompson Seamount	OR	X		X		X	
Astoria Canyon	OR	X	X			X	
Nehalem Bank/Shale Pile	OR	X	X			X	
Siletz Deepwater	OR	X	X			X	
Daisy Bank/Nelson Island	OR	X	X			X	
Newport Rockpile/Stonewall Bank	OR	X	X			X	
Heceta Bank	OR	X	X			X	
Deepwater off Coos Bay	OR	X	X			X	
Bandon High Spot	OR	X	X			X	
President Jackson Seamount	OR	X		X		X	
Rogue Canyon	OR	X	X			X	
Eel River Canyon	CA	X				X	
Blunts Reef	CA	X				X	
Mendocino Ridge	CA	X				X	
Delgada Canyon	CA	X				X	
Tolo Bank	CA	X				X	
Point Arena North	CA	X				X	

Table 2-3. No-action Alternative EFHCAs and the types of fishing restrictions within each area (continued)

Name	Offshore of (state)	Closed to bottom trawl [d]	Closed to demersal seine [d]	Closed to bottom contacting gear (including longline/pot/trap gear) [d]	Closed to midwater trawl gear	Closed to non-groundfish trawl	Closed to groundfish non-trawl (not bottom contacting)
Point Arena South Biogenic Area	CA	X				X	
Cordell Bank/Biogenic Area	CA	X				X	
Cordell Bank (50 fm isobath) [a]	CA	X		X		X	
Farallon Islands/Fanny Shoal	CA	X				X	
Half Moon Bay	CA	X				X	
Monterey Bay/Canyon	CA	X				X	
Point Sur Deep	CA	X				X	
Big Sur Coast/Port San Luis	CA	X				X	
Davidson Seamount	CA	X		X		X	
East San Lucia Bank	CA	X				X	
Point Conception	CA	X				X	
Harris Point	CA	X		X		X	
Harris Point Exception	CA	X				X	
Richardson Rock	CA	X		X		X	
Scorpion	CA	X		X		X	
Painted Cave	CA	X		X		X	
Anacapa Island	CA	X		X		X	
Carrington Point	CA	X		X		X	
Judith Rock	CA	X		X		X	
Skunk Point	CA	X		X		X	
Footprint	CA	X		X		X	
Gull Island	CA	X		X		X	
South Point	CA	X		X		X	
Hidden Reef/Kidney Bank	CA	X				X	
Catalina Island	CA	X				X	
Potato Bank	CA	X				X	
Santa Barbara	CA	X		X		X	

Table 2-3. No-action Alternative EFHCAs and the types of fishing restrictions within each area (continued)

Name	Offshore of (state)	Closed to bottom trawl [d/]	Closed to demersal seine [d/]	Closed to bottom contacting gear (including longline/pot/trap gear) [d/]	Closed to midwater trawl gear	Closed to non-groundfish trawl	Closed to groundfish non-trawl (not bottom contacting)
Cherry Bank	CA	X				X	
Cowcod EFH Conservation Area, East	CA	X				X	

[a/] Boundary lines approximating depth contours for the 700 fm line are defined at §660.76 and for the 100 fm line are defined at §660.73.
[b/] Fishing bottom trawl gear in this area shoreward of the 100 fm line is prohibited with footrope gear greater than 8 inches in diameter. North of 40 10' N. latitude, the only small footrope trawl gear allowed is selective flatfish trawl gear.
[c/] Fishing bottom trawl gear in this area designated as EFH is prohibited with footrope greater than 19 inches in diameter (50 CFR 660.312).
d/ This is at trawl gear designed to make contact with the bottom.

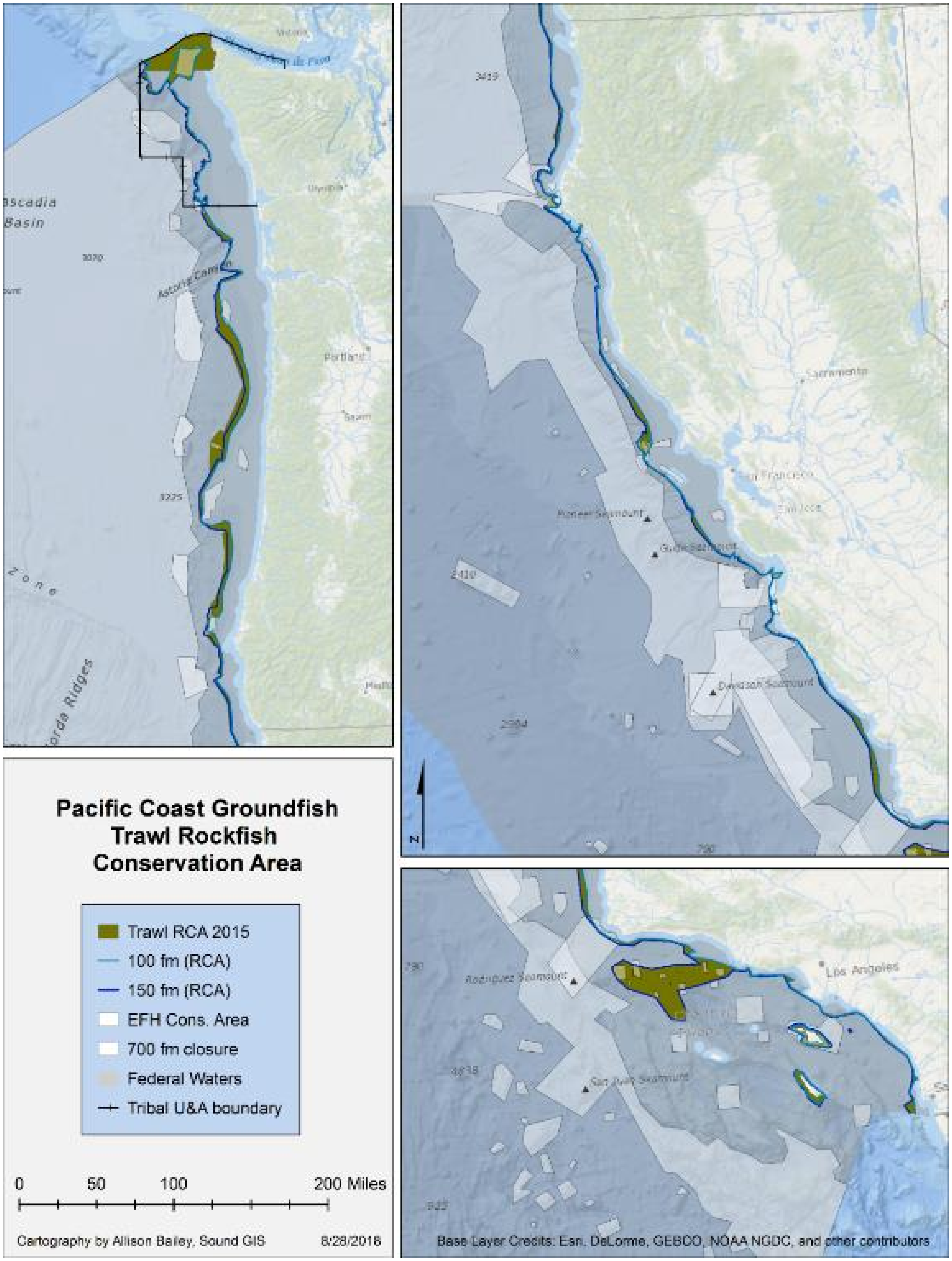

Figure 2-5. No-Action Alternative trawl RCA closure to groundfish bottom trawl fishing off Washington, Oregon and California in depths of approximately 100 fm to 150 fm.

2.1.3 No-action Alternative Subject Area 3

The No-action Alternative would continue to allow the use of bottom contact gear in waters deeper than 3,500 m (Subject Area 3). These waters are seaward of groundfish EFH and inside the United States EEZ (see Section 2.4.1 for more detail). These waters are found south of Cape Mendocino only (40°10’ N. latitude) because the continental shelf is much narrower than it is to the north; thus, the deep water areas off the California coast did not meet the criteria to be designated as EFH.

2.2 Subject Area 1: Changes to EFHCAs

The changes to the existing suite of EFHCAs in Subject Area 1 would consist of revising the No-action Alternative (existing) EFHCAs to change their boundaries, remove them entirely, or add new EFHCAs. These areas are referred to throughout this document as “polygons.” See Key Definitions and Terms at the beginning of this document for a definition of “polygon.” Some polygons may be stand-alone areas; i.e., they would represent the creation of an entirely new EFHCA or the complete elimination of an existing EFHCA. Others may be adjacent to, overlap with, or occur within existing EFHCAs. For example, an existing EFHCA may be partially reopened in some of its bounded area by one polygon, and it may have contiguous areas closed by another polygon. The types of polygons would vary among and between alternatives. The best available scientific information was used in the design of polygons to be reopened or closed. For closures, this information includes research that has documented observations of priority habitats, including corals and sponges. Alternatives are described in more detail in this section. Seven alternatives were considered in the Preliminary Draft EIS (NMFS and Council 2018). Five of those alternatives, Alternative 1.c through Alternative 1.g, were considered but dismissed from further analysis as separate alternatives. They are discussed together below in Section 2.2.4: Other Alternatives Considered but Dismissed from Further Analysis–Subject Area 1. The remaining two alternatives (Collaborative Alternative, Oceana, et al. Alternative) and an additional alternative (Preferred Alternative) are discussed below in Sections 2.2.1, 2.2.2, and 2.2.3.

Generally, the existing EFHCAs having their boundaries modified would retain the same gear restrictions that are in place under the No-action Alternative. New stand-alone EFHCAs would prohibit fishing with bottom trawl gear, but demersal seines would be allowed in those polygons that are south of the Oregon-California state line. However, some bottom trawl activities may occur in these areas related to scientific research. With the applicable state and Federal permits and documentation, scientific research activities conducted on board a scientific research vessel (as described in 50 CFR 600.512(a)) may use gears that would be otherwise prohibited within EFHCAs. For example, the annual bottom trawl survey conducted by the Northwest Fisheries Science Center (NWFSC) may conduct transects that overlap EFHCAs to collect scientific information that supports groundfish stock assessments and fishery management. Areas that would be reopened by alternatives in this subject area would have EFHCA-related prohibitions on bottom trawling removed. All of the alternatives contemplate closures that would apply to all bottom trawl gear with the exceptions of: scientific research activities (coastwide), and demersal seine gear (off California). They are described in more detail in this section.

Most of the Subject Area 1 alternatives would include closures and reopenings that overlap with other bottom trawl closures (i.e., the trawl RCA, the CCA, and the CBGCA) (Figure 2-6). Unless and until these other BTCs are modified to allow bottom trawling, the overlapping EFHCA changes would have no practical effect on bottom trawl prohibitions except for where they overlap with the trawl RCA and affect pink shrimp trawling. Therefore, the analyses considered only those proposed closures and reopenings that would not overlap with other BTCs and compared them to the current BTCs. A second approach was used for the habitat analysis only. That approach considered all proposed closures and reopenings, regardless of whether they would overlap with another BTC, and compared them to the current suite of EFHCAs (Figure 2-7). A subset of the EFHCA alternatives was analyzed, combined with elimination of the trawl RCA (Subject Area 2), in Chapter 5, Synthesis Combinations.

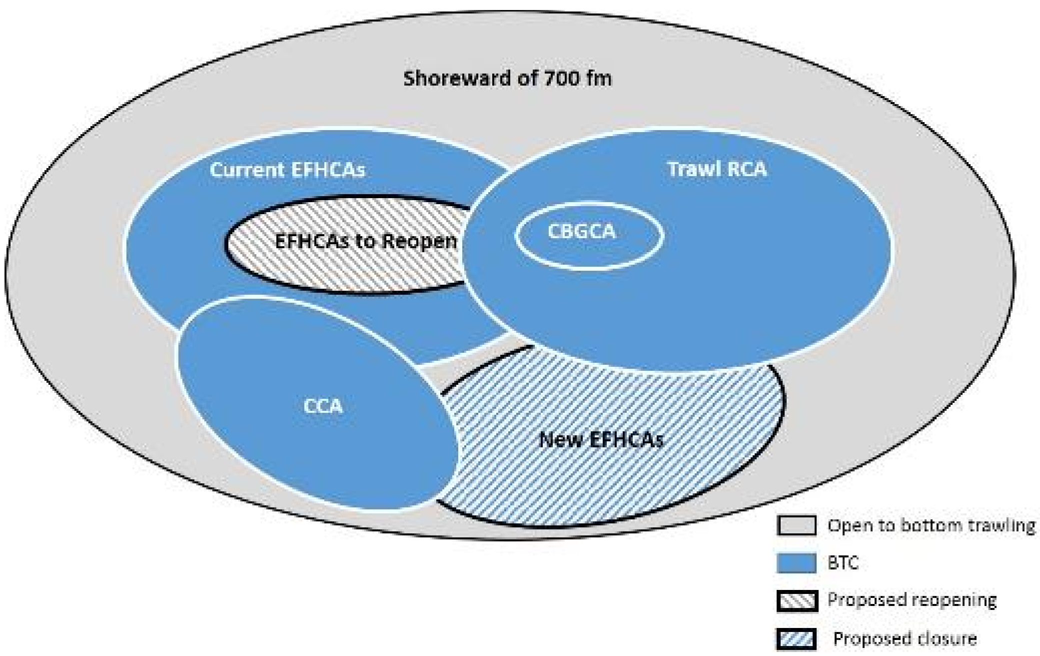

Figure 2-6. Conceptual Venn diagram showing overlap of proposed EFHCA closures and reopenings with other BTCs. Only the cross-hatched areas would be closed or reopened. Note: The figure is not to scale, and it is not intended to evaluate relative impacts.

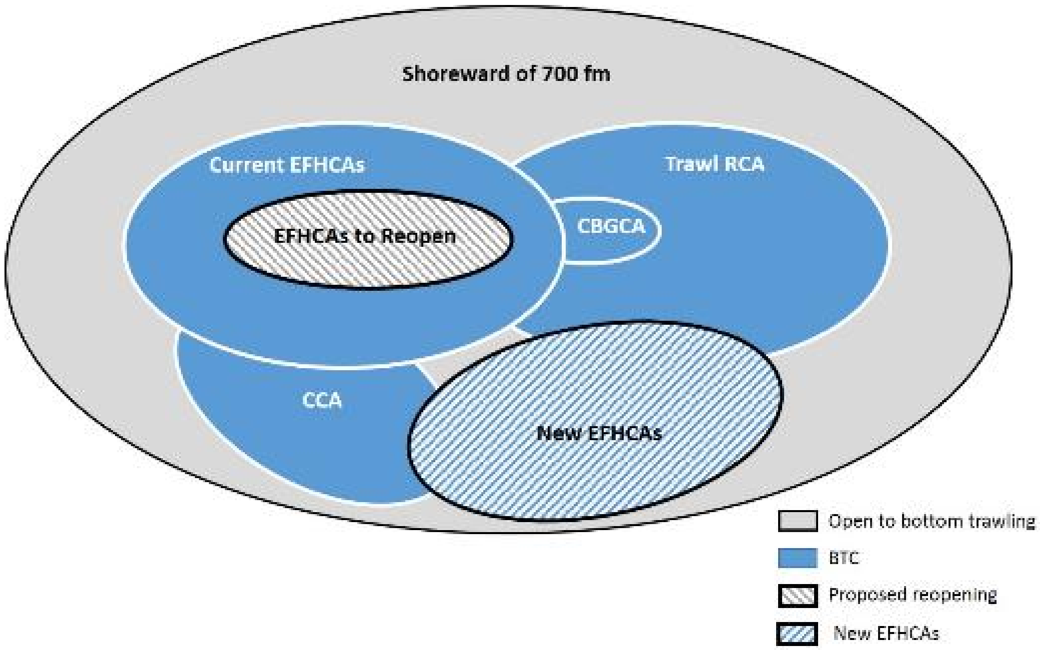

Figure 2-7. Conceptual Venn diagram showing extent of proposed closures and reopenings that would be included in calculating the extent of the changes to the No-action Alternative suite of EFHCAs. The cross-hatched areas represent the changes to the EFHCAs. Note: The figure is not to scale, and it is not intended to evaluate relative impacts.

2.2.1 Alternative 1.a: The Collaborative Alternative

This alternative would make a number of changes to the current suite of EFHCAs along the West Coast, from the United States/Canada Border south to Point Conception, California (excluding the tribal U&As off Washington). It would contain 59 polygons: 43 closures, and 16 reopenings (Figure 2-8). Multiple boundary adjustments would be made to some EFHCAs (e.g., the Eel River Canyon EFHCA has four associated polygons: two would expand the closure into adjacent areas, and two would reopen portions of the EFHCA). Alternative 1.a would not propose any changes off the central Oregon coast or in the Southern California Bight. Thirty-five of the closures are off the coast of California and would allow demersal seine gear.

2.2.2 Alternative 1.b: The Oceana, et al. Alternative

This alternative would make changes to the current suite of EFHCAs along the entire West Coast, from the United States/Canada Border south to the United States/Mexico Border (excluding the tribal U&As off Washington). It would contain 68 polygons: 61 closures and 7 reopenings (Figure 2-9). Multiple boundary adjustments would be made to some EFHCAs (e.g., the Heceta Ridge EFHCA would have two associated polygons, both of which would expand the closure into adjacent areas). Forty-five of the new closures are off the coast of California and would allow demersal seine gear. One area, the south Oregon footprint modification, extends north of Oregon-California Border. This polygon would be closed to bottom trawl gear with the exception of demersal seine gear.

2.2.3 Alternative 1.h: The Preferred Alternative

This alternative was selected as the Final Preferred Alternative (FPA) by the Council at its April 2018 meeting, and it is the NMFS Preferred Alternative. It would make changes to the current suite of EFHCAs [See the FMP, Appendix C3, for the EFHCA latitude and longitude coordinates.] along the West Coast from the central Washington coast south to the United States/Mexico Border (excluding the tribal U&As off Washington). This alternative is a collection of a variety of polygons, many of which were considered under an initial range of alternatives in the Preliminary Draft EIS at the Council's April 2018 meeting. Alternative 1.h, the Preferred Alternative, contains 70 proposed polygons: 53 closures and 17 reopenings (Figure 2-10), most of which were incorporated from Alternative 1.a, the Collaborative Alternative (38 closures and 16 reopenings), and Alternative 1.b, the Oceana, et al. Alternative (seven closures). The other eight polygons (seven closures and one reopening) came from an initial range of alternatives in the Preliminary Draft EIS (April 2018) and are not discussed as individual alternatives in this EIS for the reasons because they were "considered and rejected" (all, or in-part; see Section 2.2.4). The boundaries of several polygons in this alternative were modified from those described in the Preliminary Draft EIS (NMFS and Council 2018) to include areas outside the tribal U&A[12], to avoid the tribal U&A, to better protect priority habitats, or to reduce economic impacts.

Some of the polygons in this alternative would make boundary adjustments to some existing EFHCAs (No Action). For example the Eel River Canyon has four associated polygons: two would expand the closure into adjacent areas, and two would reduce the closure and reopen portions of the No-action Alternative EFHCA.

2.2.4 Other Alternatives Considered, but Dismissed from Further Analysis–Subject Area 1

The Council considered five alternatives in addition to 1.a, the Collaborative Alternative, 1.b, the Oceana, et al. Alternative, and Alternative 1.h, the Preferred Alternative. Those alternatives are described and discussed in the PDEIS (April 2018), but they were considered but dismissed from further analysis in this document. Two of those alternatives consisted of single polygons and were included in Alternative 1.h, the Preferred Alternative (Alternatives 1.e, Rittenburg Bank, and 1.f, Potato Bank). The remaining three alternatives from the PDEIS and included in this section are relatively small in scale, were not intended as stand-alone alternatives, and were solely proposed to inform the Council's selection of its FPA. Considered independently, these three alternatives do not meet the purpose and need, nor do they contribute to a reasonable range of alternatives.

[12] The Council's preferred alternative included the Grays Canyon northern modification polygon. The preferred alternative described the Grays Canyon northern modification EFHCA boundary using latitude and longitude coordinates that the Council considered to be consistent with the 2018 court order.

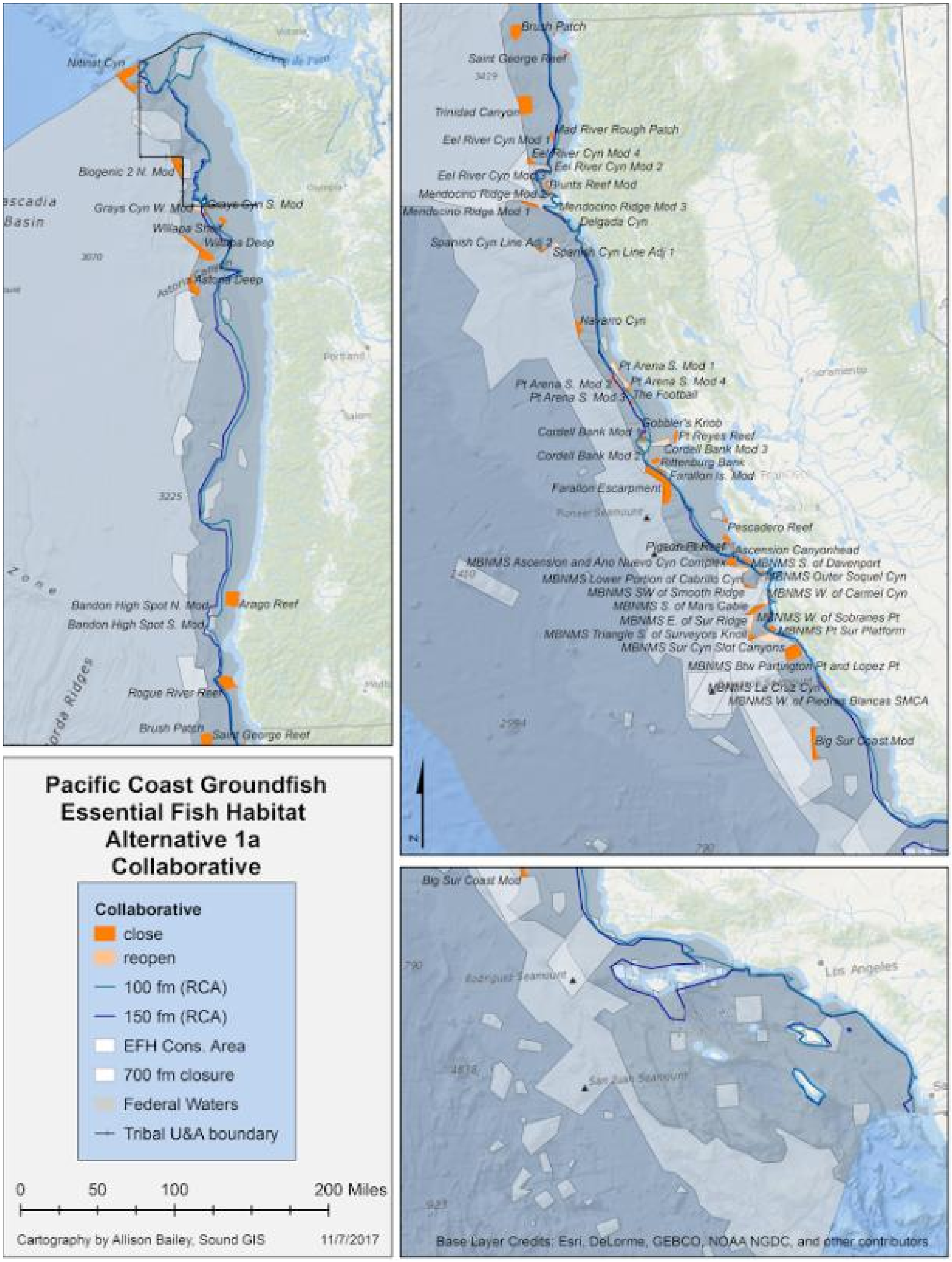

Figure 2-8. Alternative 1.a., the Collaborative Alternative. Map depicting coastwide EFHCA areas to be closed or reopened.

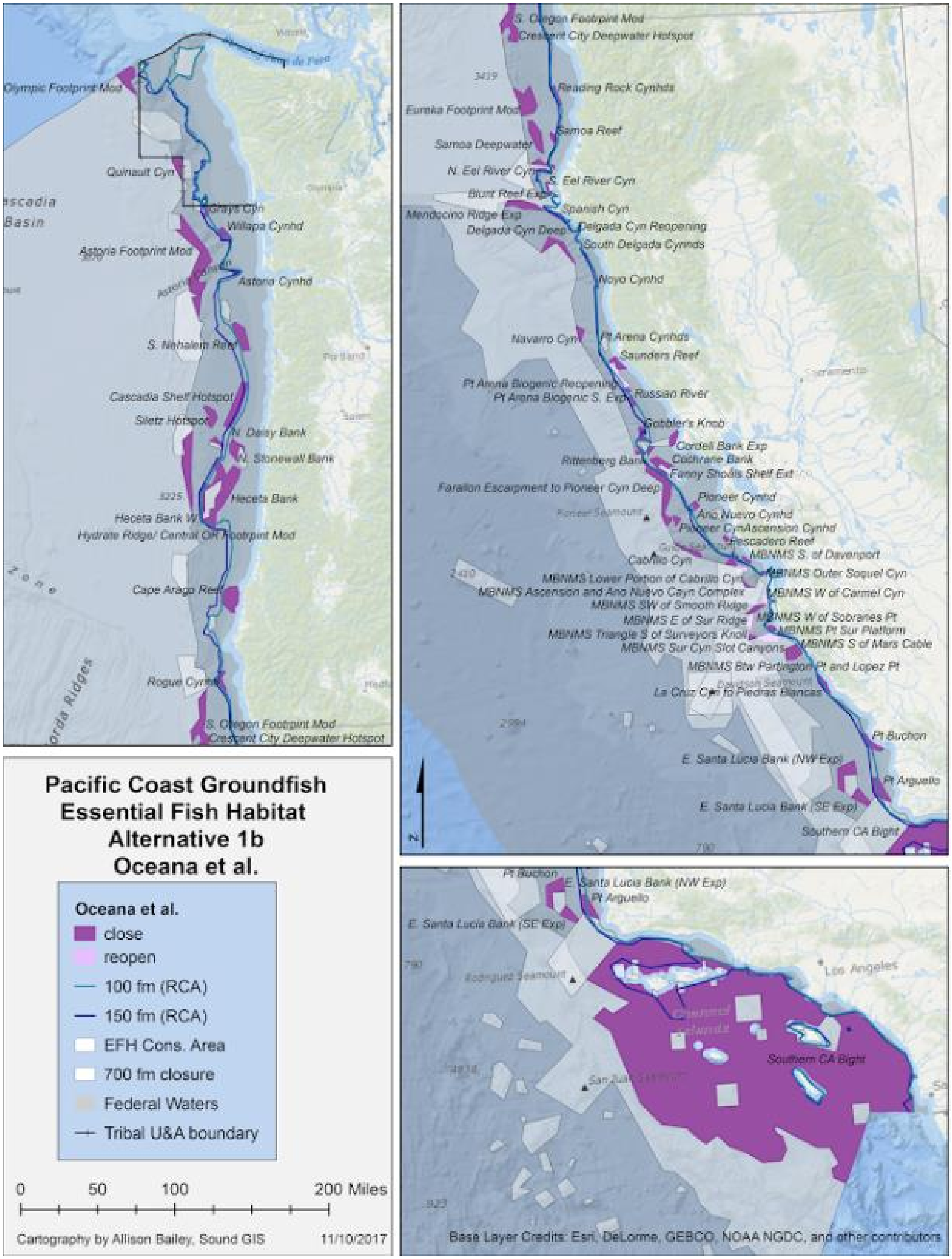

Figure 2-9. Alternative 1.b., the Oceana, et al. Alternative. Map depicting coastwide EFHCA areas to be closed or reopened.

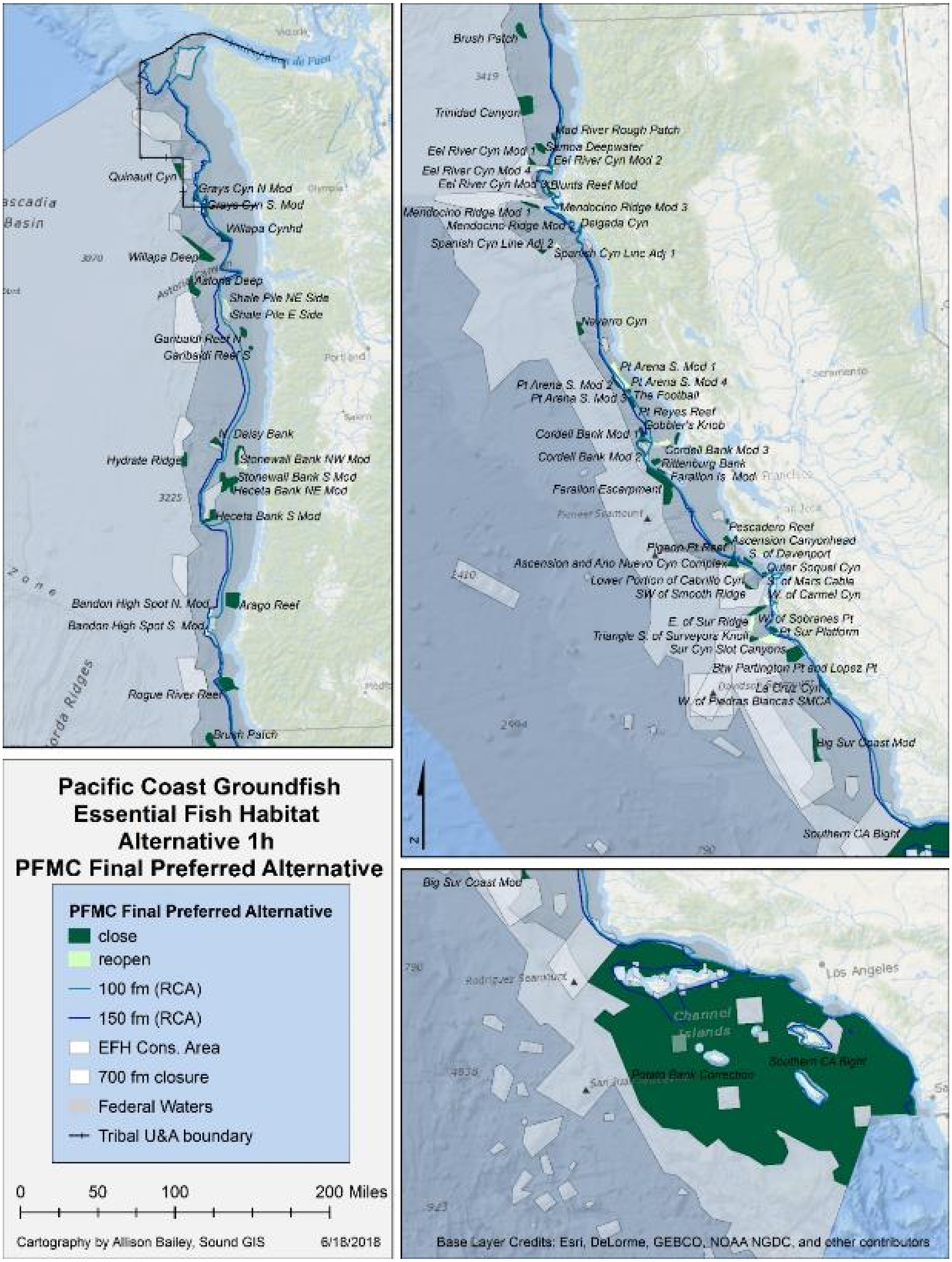

Figure 2-10. Alternative 1.h., the Preferred Alternative. Map depicting coastwide EFHCA areas to be closed or reopened.

Alternative 1.c, The Midwater Trawlers Cooperative (MTC) Alternative, considered making changes to the current suite of EFHCAs off the coast of Oregon, between the Columbia River to the north and Coos Bay to the south. It would contain 13 polygons: 9 closures and 4 reopenings. Multiple boundary adjustments would be made to some EFHCAs (e.g., Daisy Bank would have four associated polygons: two would expand the closure into adjacent areas, and two would reopen portions). Six closures and one reopening were incorporated into Alternative 1.h, the Preferred Alternative.

Alternative 1.d, Garibaldi Reef South, considered adding one new EFHCA off the north coast of Oregon. It would consist of a single polygon, approximately 8 square miles, which would create a new EFHCA off Cape Meares. This EFHCA would protect rocky reef habitat. This new EFHCA would prohibit bottom trawling in that area.

Portions of Alternative 1.c, the MTC Alternative, and Alternative 1.d, the Garibaldi Reef South Alternative, were considered but rejected. They were rejected because the combination of existing habitat protections under the No-action Alternative and changes considered under Alternative 1.h, the Preferred Alternative, would provide habitat protections that would minimize impacts on EFH and protect priority habitats, while balancing economic impacts on fishing communities by allowing access to productive fishing grounds.

Alternative 1.g, the New EFHCAs in Washington Alternative, considered creating new EFHCAs that are closed to bottom trawling off the coast of Washington in areas that lie within the No-action Alternative trawl RCA. The new EFHCAs would have been based on the presence of priority habitats within the No-action Alternative trawl RCA from Point Chehalis to the Washington-Oregon state line. This alternative was considered but rejected because there are limited amounts of priority habitats in the area, and the trawl RCA protects the area from the adverse impacts of groundfish bottom trawling.

2.3 Subject Area 2: Adjustments to the Groundfish Trawl RCA

The adjustments to the groundfish trawl RCA would remove the trawl RCA and would include flexible and responsive management tools to replace it. Three alternatives were considered in the PDEIS, and a fourth alternative (Alternative 2.d, the Preferred Alternative) was added at the April 2018 Council meeting. The alternatives vary, depending on whether they would cover all (Alternative 2.c) or part of the coast (Alternative 2.d). Two alternatives, Alternatives 2.a and 2.b., are discussed together in Section 2.3.3 below.

Some portions of the trawl RCA have remained closed since it was implemented in 2002. While depths and latitudes can change through time to meet fishery management needs, some depths have never been opened. Areas that were closed to groundfish bottom trawling for three or more years have provided habitat protections; however, the groundfish trawl RCA was designed to reduce and manage catch of overfished species. These alternatives would include reconsidering the purpose of RCAs as long-term closures to reduce catch of overfished species in the bottom trawl sector considering the 2011 implementation of the Shorebased IFQ Program and the individual catch accountability that it provides.

The trawl RCA overlaps with other bottom trawl closures (i.e., the EFHCAs, the CCA, and the CBGCA) (Figure 2-11). Unless and until these other BTCs are modified to allow bottom trawling, removing the trawl RCA would have no practical effect on bottom trawl prohibitions in those overlapping areas. Therefore, the analyses considered only the area of the trawl RCA that does not overlap with other BTCs. Removal of the trawl RCA was analyzed combined with the Subject Area 1 alternatives in Chapter 5, Synthesis Combinations.

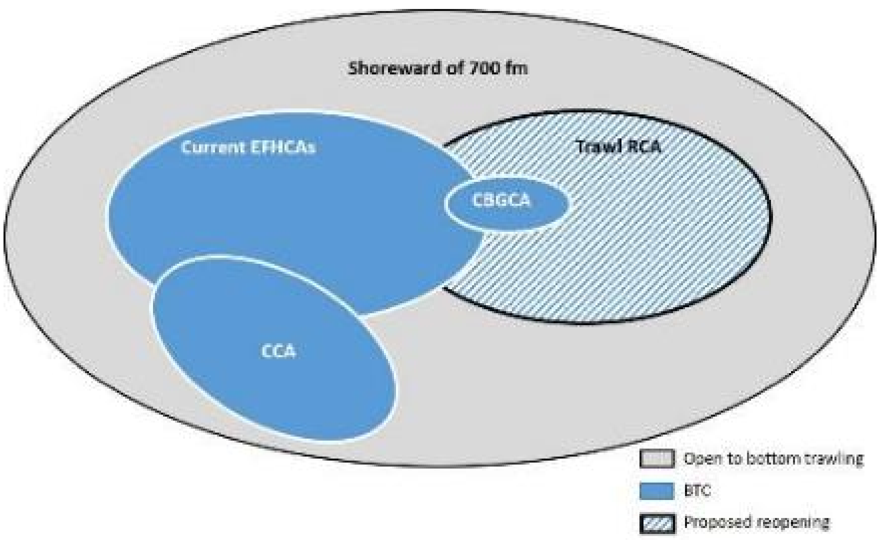

Figure 2-11. Conceptual Venn diagram showing the overlap of the trawl RCA with the other BTCs. Only the cross-hatched area would be reopened. Note: This figure is not to scale, and it is not intended to evaluate relative impacts.

2.3.1 Alternative 2.c: Remove the trawl RCA and implement BACs.

This alternative would remove the entire trawl RCA outside of the tribal U&As, allowing access to vessels fishing with groundfish bottom trawl gear. This alternative would open areas extending from Point Chehalis, Washington, to the United States/Mexico Border. Some portions of the trawl RCA have remained closed since it was implemented in 2002. While depths and latitudes can change through time to meet fishery management needs, some depths have never been opened. Areas that were closed to groundfish bottom trawling for three or more years have provided habitat protections. However, the groundfish trawl RCA was designed to reduce and manage catch of overfished species. Other fishing and gear types are currently allowed to fish inside the trawl RCA (e.g., state-managed shrimp trawling and midwater trawling) and would continue to be allowed if the trawl RCA were removed. Refer to Key Terms and Concepts for a description of the trawl RCA and its regulations. If the trawl RCA were removed, Section 6.6.1.1 of the FMP would still prohibit the use of bottom trawl gear with footrope larger than 8 inches in diameter shoreward of the line approximating the 100 fm depth contour (as defined at 50 CFR §660.73).

The use of any bottom trawl gear except selective flatfish trawl gear (as defined at §660.11) is prohibited in the area shoreward of the trawl RCA. If the trawl RCA were removed, this restriction would be revised to prohibit the use of any bottom trawl gear except selective flatfish trawl gear shoreward of the line approximating the 100 fm depth contour (as defined at §660.73). This alternative would allow the use of large footrope bottom trawl gear on the continental shelf in depths as shallow as 100 fm.

BACs would be available as a harvest management tool to prohibit fishing by vessels using groundfish bottom trawl gear across a variety of depths and latitudes. The waters off the West Coast from the coastline (including state waters) out to the 700 fm contour line could be divided into approximately 365 individual blocks that could be closed in any combination based on fishery management needs. Boundaries of BACs, described in Table 2-4, would be based on depth contours and latitudes defined in Federal regulations, and they may also be closed in combination to allow closures to be described as seaward, shoreward, north, or south of any of these lines. To allow for a quantitative discussion of the impacts of this alternative, which, in practice, would have billions of potential combinations, the coast is divided into 20 separate BACs (Figure 2-12).

Initially, the trawl RCA would be removed, and BACs would be open to fishing groundfish with bottom trawl gear. BACs could be closed in the future to reduce harvest of groundfish species or protected species, particularly salmon. BACs are intended to be inseason management tools for controlling harvest of target or non-target species, but they are not intended to be used for habitat protection because of their flexible nature. BACs could be closed in any spatial combination. For example, a single BAC could be closed in response to a sudden localized increase in yelloweye rockfish catch, or several BACs could be closed in response to higher than expected salmon bycatch levels in certain depths and latitudes. The Council could, if necessary, use BACs to reinstate the trawl RCA.

BACs could be implemented preseason based on new information on the anticipated needs to reduce the harvest of target or non-target species. BACs could also be implemented inseason in response to new fishery information indicating an immediate need to reduce the catch of a particular species or species complex. Procedures for closing or opening BACs through inseason action must meet the procedural criteria in the FMP in Section 6.2. Closing or opening BACs would be designated as a routine management measure for the Shorebased IFQ Program. Thus, BACs could either be closed or opened to bottom trawling through inseason action; BACs could not be used to modify other specifics on the type of fishing restrictions through inseason action.

Table 2-4. Boundaries that may be used to define future BACs under Alternative 2.c and 2.d. [13] fm=fathoms

State	Commonly Used Geographic Coordinates (50 CFR 660.11)	Boundary Lines Approximating Depth Contours (50 CFR 660.71-74)
Washington (WA)	U.S./Canada Border, Northern bound of EEZ[a/], Cape Alava, WA—48°10.00′ N. lat.[a/], Queets River, WA—47°31.70′ N. lat., Pt. Chehalis, WA—46°53.30′ N. lat., Leadbetter Point, WA—46°38.17′ N. lat., Columbia River—46°16.00′ N. lat. [b/]	10 fm, 20 fm, 25 fm, 25 fm modified, 30 fm, 50 fm, 60 fm, 75 fm, 100 fm, 125 fm, 150 fm, 150 fm modified, 180 fm coastwide, 200 fm, 200 fm modified, 250 fm, 250 fm [b/]
Oregon (OR)	Columbia River—46°16.00′ N. lat., Cape Falcon, OR—45°46.00′ N. lat., Cape Lookout, OR—45°20.25′ N. lat., Cascade Head, OR—45°03.83′ N. lat., Heceta Head, OR—44°08.30′ N. lat., Cape Arago, OR—43°20.83′ N. lat., Cape Blanco, OR—42°50.00′ N. lat., Humbug Mountain—42°40.50′ N. lat., Marck Arch, OR—42°13.67′ N. lat.	20 fm, 25 fm, 25 fm modified, 30 fm, 40 fm, 50 fm, 60 fm, 75 fm, 100 fm, 125 fm, 150 fm, 150 fm modified, 180 fm coastwide, 200 fm, 200 fm modified, 250 fm, 250 fm
California (CA)	Oregon/California border—42°00.00′ N. lat., Cape Mendocino, CA—40°30.00′ N. lat., North/South management line—40°10.00′ N. lat., Cape Vizcaino, CA—39°44.00′ N. lat., Point Arena, CA—38°57.50′ N. lat., Point San Pedro, CA—37°35.67′ N. lat., Pigeon Point, CA—37°11.00′ N. lat., Ano Nuevo, CA—37°07.00′ N. lat., Point Lopez, CA—36°00.00′ N. lat., Point Conception, CA—34°27.00′ N. lat., U.S./Mexico Border, southern bound of EEZ	30 fm, 40 fm, 50 fm, 60 fm, 75 fm, 100 fm, 125 fm, 150 fm, 150 fm modified, 180 fm coastwide, 180 fm California, 200 fm, 200 fm modified, 250 fm, 250 fm

[a/] Not applicable to Alternative 2.c or 2.d.
[b/] None of these are applicable to Alternative 2.d

2.3.2 Alternative 2.d: The Preferred Alternative

The Council selected this alternative as the FPA at its April 2018 meeting, and it is the NMFS Preferred Alternative. It would make no changes to the trawl RCA off Washington, maintaining the fishery management scheme described under the No-action Alternative. Off Oregon and California, the trawl RCA would be removed. Between the Oregon/California border and the U.S./Mexico border the waters off the West Coast from the coastline (including state waters) out to the 700 fm contour line could be

[13] Including latitudes of interest (defined with lines of N. latitude; that may form the north/south boundaries) and boundaries approximating depth contours (defined with latitude and longitude coordinates; that may form the east/west boundaries).

divided into approximately 313 BACs would be an available fishery management tool, as described above for Alternative 2.c in Section 2.3.1. Potential boundaries of BACs are described in Table 2-4.

2.3.3 Other Alternatives Considered, but Dismissed from Further Analysis-Subject Area 2

The Council considered two other alternatives in addition to Alternative 2.c, Remove the Trawl RCA and Implement BACs, and Alternative 2.d, the Preferred Alternative. These alternatives are described in additional detail in the PDEIS (April 2018), and they do not contribute to a reasonable range of alternatives to meet the stated purpose and need. The two alternatives are discussed below.

Alternative 2.a, the Remove the Trawl RCA, would contemplate removing the trawl RCA without replacing it with new spatial fishery management measures. The primary catch controls for vessels using bottom trawl gear within the Shorebased IFQ Program would be existing measures under the No-action Alternative, including limited entry permits, IFQ, trip limits for non-IFQ species, and NMFS' authority to close the fishery to prevent the trawl sector, either in aggregate or by individual trawl sectors, from exceeding an ACL, OY, ACT, or formal allocation specified in the FMP or regulation. The Council did not recommend this alternative because it wanted to retain flexible spatial management tools in the face of uncertainty.

Alternative 2.b, the Remove the Trawl RCA and Implement DACs in Washington Alternative, would contemplate eliminating the trawl RCA, as described under Alternative 2.c, outside of the tribal U&A and would consider optional DACs (Figure 2-12) in Washington. DACs would reduce bycatch of overfished species by prohibiting fishing in one or more of five polygons by vessels using groundfish bottom trawl gear. Five DACs were initially developed for darkblotched rockfish, yelloweye rockfish, and Pacific Ocean perch (POP), though darkblotched rockfish and POP were declared rebuilt in 2017. Cowcod and bocaccio were not included, as they are not overfished in waters north of 40°10' N. latitude. DACs were developed specific to single overfished stocks, some of which are now rebuilt, and they are not as flexible a management tool as BACs. Additionally, the Council did not pursue removing the trawl RCA off the coast of Washington at this time, so the optional DACs would already remain closed by the trawl RCA under Alternative 2.d, the Preferred Alternative. Therefore, this alternative was considered and rejected.

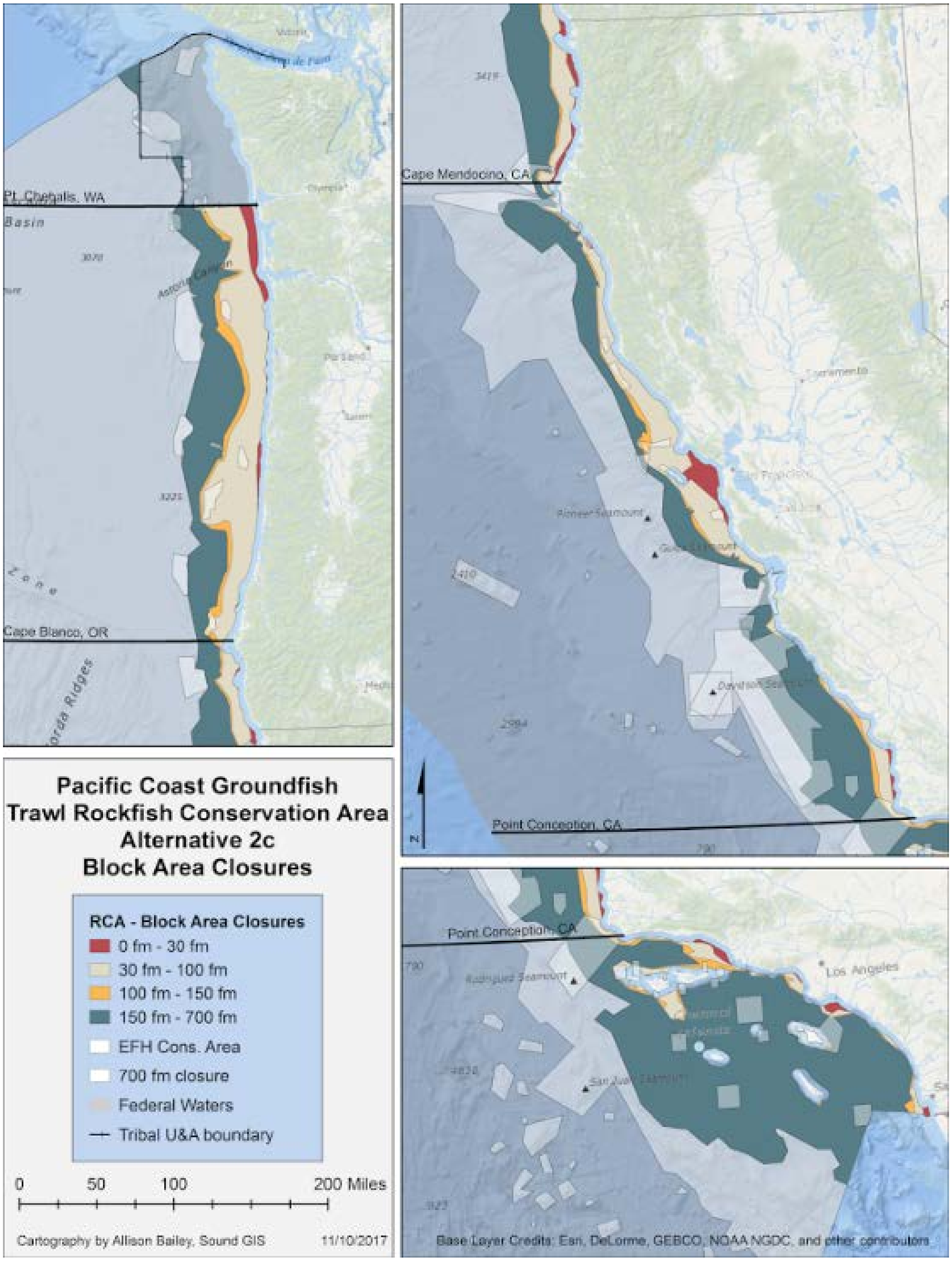

Figure 2-12. Depth and latitudinal zones that are used for the impacts analysis of BACs under Alternative 2.c: Remove trawl RCA and implement BACs Alternative.

2.4 Subject Area 3: Use of MSA Sec. 303(b) discretionary authorities

The sections below describe discretionary authorities to protect deep-sea corals and other ecosystem components in waters not defined as EFH. There is also discussion of exceptions to Alternative 3 closures.

2.4.1 Alternative 3: The Preferred Alternative

The Council selected this alternative as its FPA at its April 2018 meeting, and it is the NMFS Preferred Alternative. Alternative 3 would use the discretionary authorities under MSA Section 303(b) to prohibit all fishing with bottom contact gear (described in Key Terms and Concepts) in waters deeper than 3,500 m (shown in blue in Figure 2-13). These prohibitions would specifically include MSA Sections 303(b)(2)(A), 303(b)(2)(B), and 303(b)(12). These waters are seaward of groundfish EFH and shoreward of the EEZ (Figure 2-13). The discretionary authorities would allow regional fishery management councils to designate zones where fishing would be limited or not permitted, identify zones to protect deep-sea corals, and implement management measures to conserve target and non-target species and habitats.

2.4.1.1 Exceptions to Subject Area 3 closures

Exceptions could be made to this prohibition, but only if a vessel owner or operator were to apply for, and receive, approval from the Council to do so via a groundfish exempted fishing permit (EFP). Fishing with bottom contact gear without an EFP could only be authorized through an FMP amendment and changes in regulation. Issuance of an EFP would follow the groundfish EFP process described in Council Operating Procedure 19, Protocol for Consideration of Exempted Fishing Permits for Groundfish Fisheries. NMFS, in considering approval of an EFP, must ensure that the activities are consistent with applicable laws, including measures to protect EFH.

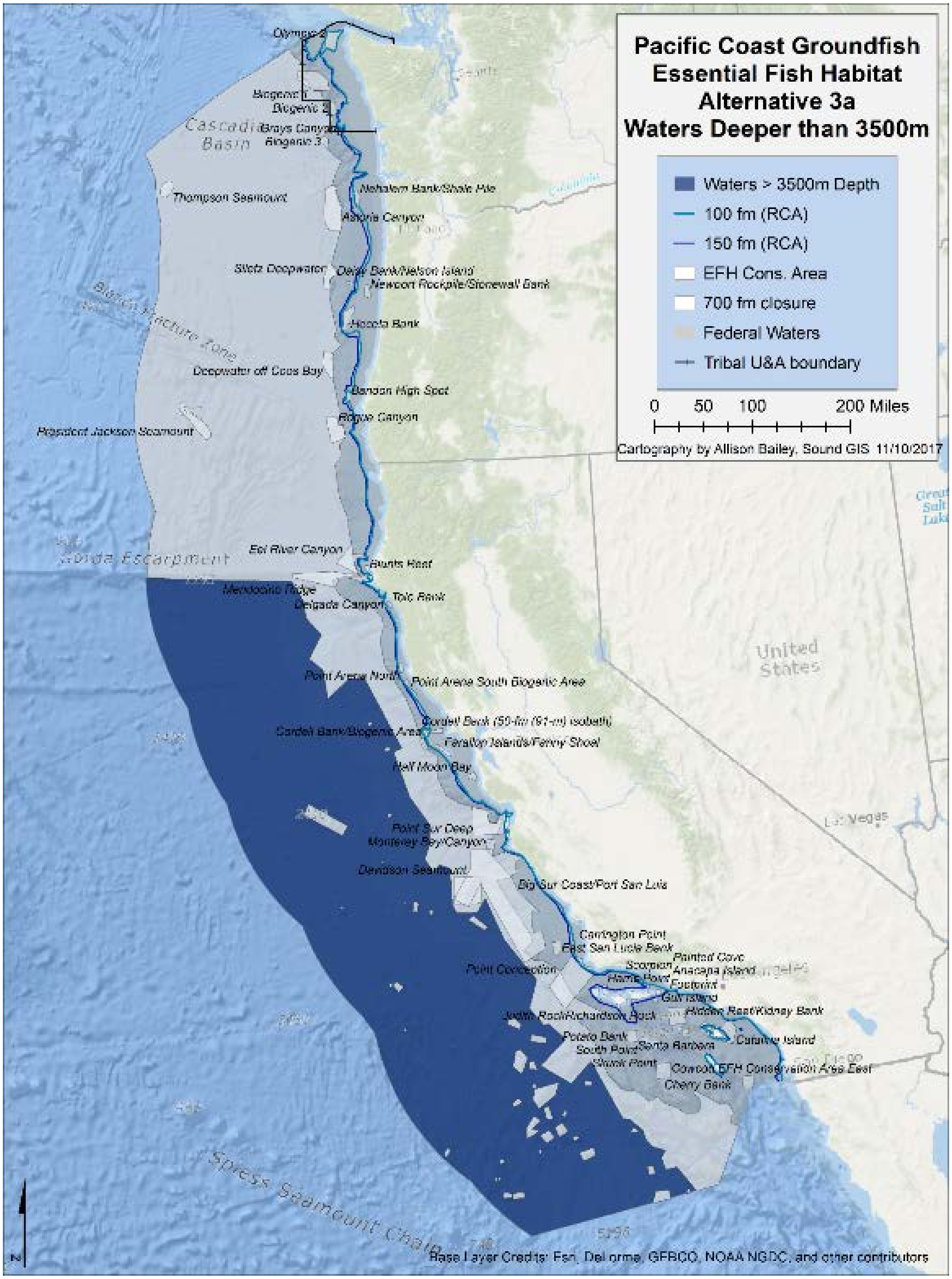

Figure 2-13. Alternative 3, waters deeper than 3,500 m.

3 AFFECTED ENVIRONMENT

This chapter describes the environment of the areas affected by the alternatives described in Chapter 2. The affected environment described below reflects current conditions before implementation of a proposed alternative or a combination of alternatives. It also provides a baseline for considering effects. See Chapter 1, Section 1.3, for a detailed description of the project area.

The NEPA Implementing Regulations at 40 C.F.R. 1502.15 require the following:

> The environmental impact statement shall succinctly describe the environment of the area(s) to be affected or created by the alternatives under consideration. The descriptions shall be no longer than is necessary to understand the effects of the alternatives. Data and analyses in a statement shall be commensurate with the importance of the impact, with less important material summarized, consolidated, or simply referenced. Agencies shall avoid useless bulk in statements and shall concentrate effort and attention on important issues.

As described in Section 1.3, the outer extent of the action area is the Pacific Coast of the United States EEZ, excluding Alaska. The area has physical resources (habitat), biological resources (fish and protected resources), and socioeconomic resources that may be affected by the alternatives analyzed in this EIS. The information presented in this chapter is divided into the above resources. The proposed action or alternatives are not expected to affect other resources in the action area. This action has been determined to be compliant with section 106 of the National Historic Preservation Act because there are no potential effects on historic properties. One historic property is present in the action area, but it overlaps with EFHCAs proposed to be closed under three alternatives for Subject Area 1 (Farallon Escarpment, Alternative 1.a, Collaborative Alternative, Alternative 1.h, Preferred Alternative, and Farallon Escarpment to Pioneer Canyon Deep, Alternative 1.b, Oceana, et al.).

Additional information on the affected resources may be found in the following documents:

- Pacific Coast Groundfish FMP (Council 2016)
- Essential Fish Habitat Designation and Minimization of Adverse Impacts Final Environmental Impact Statement, National Marine Fisheries Service (NMFS 2005)
- Harvest Specifications and Management Measures for 2015-2016 and Biennial Periods Thereafter, Includes the Reorganization of Groundfish Stock Complexes, Designation of Ecosystem Component Species and Amendment 24 to the Pacific Coast Groundfish Fishery Management Plan to Establish a Process for Determining Default Harvest Specifications Final Environmental Impact Statement (NMFS 2015; 2015-2016 SPEX)

3.1 Habitat Resources

Healthy marine habitat is basic to the well-being of marine species and their place in the food web. The marine habitats of the West Coast support living marine resources at the most fundamental level by providing the conditions necessary for populations to sustain themselves. From a broad perspective, habitat is the geographic area, as well as the characteristics of that area, where a species occurs at any time during its life. Habitat characteristics include a variety of attributes and scales, including physical (geological), biological, and chemical parameters, location, and time. The interactions between environmental variables comprise the habitat that determines a species' biological niche. These variables include both physical variables such as depth, substrate, temperature range, salinity, dissolved oxygen, and ecological variables such as the presence of competitors, predators, or facilitators.

Fish and other species rely on habitat characteristics to support primary biological functions comprising spawning, breeding, feeding, and growth to maturity. Important secondary functions that may form part of one or more of these primary functions include migration and shelter. Most habitats provide only a subset of these functions. The type of habitat available, its attributes, and its functions are important to species productivity and the maintenance of healthy ecosystems. While we know that marine organisms require habitat, the relationship of habitat to population dynamics or ecological function is not well understood. Groundfish habitat is the resource that will experience the greatest effects resulting from selection of a preferred alternative. These habitats consist of hard substrate, including rocky ridges and rocky slopes and seamounts; submarine canyons and gullies; HFI; and overfished species habitats.

3.1.1 Hard, Mixed, and Soft Substrates; Seamounts

Benthic habitat types include a variety of substrates. Hard bottom habitats in the ocean may consist of bedrock, boulders, and similar substrates. Many managed species depend on hard bottom habitat during some portion of their life cycle. Typically, deeper water, hard bottom habitats are inhabited by large, mobile, nektobenthic fishes (MMS 2002). Cross and Allen (1993) estimated that about 30 percent of the fish species and 40 percent of the families occur over hard substrates. For information on specific species, see the Amendment 19 FEIS (NMFS 2005, Section 3.2.2.2.3). Hard bottom habitats may also include seamounts. Seamounts are mountains rising from the ocean seafloor that do not reach to the water's surface. They often form from extinct volcanoes and reach 3,300 to 13,100 feet high. Because of their abundance, seamounts are common marine ecosystems. Interactions between seamounts and underwater currents, as well as their elevated position in the water, attract plankton, corals, fish, and marine mammals alike. Their aggregational effect has been noted by the commercial fishing industry, and many seamounts support fisheries.

One form of hard substrate, carbonate rock, can be formed via the anaerobic oxidation of methane bacteria at methane seeps. This oxidation increases the alkalinity of the sediment, leading to the precipitation of carbonate rock (Levin, et al. 2016). These areas of carbonate rock can be expansive and provide habitat for a variety of microbes, fauna, (Marlow, et al. 2014; Case, et al. 2015; Levin, et al. 2015), deep-sea corals, and sponges (Cordes, et al. 2008; Bowden, et al, 2013; Quattrini, et al. 2015). Therefore, methane seeps contribute to the formation of two of the Council's priority habitats for groundfishes: hard substrate and habitat-forming invertebrates.

Unconsolidated (mixed) bottom habitats consist of small particles (i.e., gravel, sand, mud, silt, and various mixtures of these particles). They contain little to no vegetative growth due to the lack of stable surfaces for attachment. Benthic fauna often consist of infaunal organisms. For information on specific species, see the Amendment 19 FEIS (NMFS 2005, Section 3.2.2.2.2).

3.1.2 Submarine Canyons and Gullies

Submarine canyons are steep-sided valleys cut into the seabed of the continental slope, sometimes extending well into the continental shelf, and having nearly vertical walls. Submarine canyons serve as channels for currents that move across the sea floor.

3.1.3 Habitat-forming Invertebrates (HFI)

HFI are large, filter-feeding, invertebrates that are generally sessile and look like plants. HFI, such as sponges and corals, enhance diversity and structural components of fish habitat. HFI provide structure and diversity for continental shelf ecosystems off the Pacific Coast. Some fishing activities affect HFIs (Tissot et al. 2006). HFIs (such as corals, basketstars, brittlestars, demosponges, gooseneck barnacles, sea anemones, sea lilies, sea urchins. sea whips, tube worms, and vase sponges) as biogenic habitat include numerous species. For information on specific species, see the Amendment 19 FEIS (NMFS 2005, Section 3.2.2.2.1). Impacts on specific types of HFIs are considered in this EIS, as described below.

3.1.3.1 Deep-sea Corals, Sponges and Seapens

Deep-sea corals are colonies of polyps (small anemone-like individuals). They are similar to their nearshore/shallow-water cousins, except that they do not have to photosynthesize to survive. Deep-sea corals may be calcified or soft. Corals generally settle and grow on hard bottom habitats; however, some soft corals occur in soft substrates. Corals may sustain permanent damage by physical disturbances, such as bottom trawl fishing.

Sponges are one of the simplest multi-cellular organisms in the world. Sponges settle and grow on hard surfaces, which may be the substrate (e.g., bedrock or boulders) or other available hard surfaces like shells.

Sea pens are a feather-shaped colony of polyps with a calcified skeleton. Sea pens generally reside in sandy-bottom areas, with a portion of their bodies buried in the sand or mud to anchor them in place. NOAA Deep Sea Coral and Sponge data show thousands of occurrences of these types of habitat forming invertebrates, including in waters deeper than 3,500 meters.

3.1.4 Overfished Species Habitat

Overfished species habitats include areas where the probability of occurrence of one or more of three overfished species (darkblotched rockfish, POP, yelloweye rockfish[14]) is at least 80 percent of the maximum probability of occurrence. Probabilities are predicted by models that were created during the Groundfish EFH Synthesis process (NMFS 2013).

3.2 Fish Resources

Many fish species are caught with bottom trawl gear. Those species, and species impacted incidentally, are the primary fish resources affected.

3.2.1 Groundfish Species

More than 100 stocks are managed under the Pacific Coast Groundfish FMP. They consist of more than 64 species of rockfish, 7 roundfish species, 12 flatfish species, assorted sharks, all endemic skates, all endemic grenadiers, ratfish, and a few miscellaneous bottom-dwelling marine fish species (SAFE 2016). Two overfished species are overfished and managed under rebuilding plans in 2018: yelloweye rockfish and cowcod. Overfished species habitat is a metric used in analysis of habitat impacts, as described in Section 3.1 and Section 4.1. A subset of groundfish species is commonly caught with trawl gear, and changes to time/area closures and conservation areas location/boundaries may affect harvest efficiency and net revenue. Groundfish species, most commonly caught with trawl gear are subject to catch limits in the form of IFQs. Groundfish IFQ species are listed below.

IFQ species are lingcod, Pacific cod, Pacific whiting, sablefish, Arrowtooth flounder, Dover sole, English sole, petrale sole, starry flounder, Pacific halibut (individual bycatch quota), bocaccio, canary rockfish, chilipepper, cowcod, darkblotched rockfish, longspine thornyhead, shortspine thornyhead, splitnose rockfish, POP, widow rockfish, yelloweye rockfish, and yellowtail rockfish. IFQ species complexes include the following: other flatfish, minor shelf rockfish, and minor slope rockfish. Other species may

[14] Five groundfish species (darkblotched rockfish, POP, yelloweye rockfish, cowcod, and bocaccio) were overfished and managed under rebuilding plans in 2015 when this impacts analysis began, and data sets were collated. Cowcod and bocaccio were not included, as they are not overfished in waters north of 40°10’ N. latitude. Since 2015, darkblotched rockfish, POP, and bocaccio have been declared rebuilt; only yelloweye rockfish and cowcod are considered overfished in 2018.

be harvested with bottom trawl gear, and they are subject to monitoring requirements. Some non-IFQ species are subject to trip limits (e.g., spiny dogfish). Section 6.6.1.2 of the Groundfish FMP describes trawl gear and trawl gear requirements for the action area.

3.2.2 State-managed Non-groundfish Fisheries

Some non-groundfish fisheries that use bottom trawl gear are subject to the gear/area restrictions of the EFHCAs. Fisheries that target these fish are not affected by the presence or absence of a groundfish trawl RCA (subject to change in this action).

3.2.2.1 Pacific pink shrimp

Pacific pink shrimp are harvested with trawl gear off the United States West Coast from northern Washington to central California between 60 fm and 100 fm (110 m to 180 m). Washington, Oregon, and California manage the Pacific shrimp fisheries (NMFS 2005). Shrimp trawl nets are usually constructed with net mesh sizes smaller than the net mesh sizes for legal groundfish trawl gear. Thus, shrimp trawlers commonly take groundfish in association with shrimp (rather than the reverse). Pink shrimp trawlers are prohibited from fishing in EFHCAs, and the areas to be reopened or closed (subject to change in this action) would affect them.

3.2.2.2 Sea cucumbers, California halibut, and ridgeback prawn

California halibut, ridgeback prawn, and sea cucumber are found in the action area and may be affected. These fisheries are prohibited from fishing inside EFHCAs, and the areas to be reopened or closed would affect them. Fisheries for these species are subject to a slightly different depth-based closure to conserve rockfish. This closure is called the non-groundfish trawl RCA (*not* subject to change in this action), which covers similar areas as the groundfish trawl RCA.

3.3 Socioeconomic Environment

Socioeconomic impacts flow from the groundfish fishery in the form of personal income to owners of harvester operations, captains and crew, owners of buyers and processors, their employees, and the community as a whole (as these individuals spend and take part in the social lives of their local communities). Groundfish fishery activity impacts suppliers, financers, and other related support industries. Products generated by the fishery flow into the fish and protein markets, generating jobs in the marketing chains and nutrition for domestic users. Some product also flows into the export market, affecting the balance of trade and foreign consumers. As with other natural resource-based jobs such as farming and wood products, declines in personal income and changing job conditions within fisheries affect quality of life and relationships, including individual and family well-being and health (Smith et al. 2003). See Section 4.2.2.1, the No-action Alternative, for a more extensive discussion of current conditions in the socioeconomic environment, including the value of the groundfish fishery in terms of landings (round weight pounds) and revenue. Also discussed are the potential effects of the fishery on social factors.

3.4 Protected Resources

The term “protected species” refers to organisms for which killing, capture, or harm is prohibited under several Federal laws, unless authorized. Incidental take of these species during operations may be allowed under provisions of applicable laws. The laws are as follows:

- The Endangered Species Act (ESA)—The ESA protects species at risk of extinction “throughout all or a significant portion of its range,” and protects critical habitat from Federal actions that would appreciably reduce its value for species recovery. Species may be listed as “threatened” or “endangered.” "Endangered" means a species is in danger of extinction throughout all or a significant portion of its range. "Threatened" means a species is likely to become endangered within the foreseeable future.
- The Marine Mammal Protection Act (MMPA)—The MMPA guides marine mammal protection and conservation. Stock assessments are conducted annually for strategic stocks and every three years for non-strategic stocks. All marine mammals are protected under the MMPA.
- The Migratory Bird Treaty (MBTA)—The MBTA implements treaties and conventions between the U.S. and Canada, Japan, Mexico, and the former Soviet Union for the protection of migratory birds.
- Executive Order (EO) 13186—EO 13186, *Responsibilities of Federal Agencies to Protect Migratory Birds*, directs Federal agencies to negotiate Memoranda of Understanding with the United States Fish and Wildlife Service (USFWS) that would obligate agencies to evaluate the impact on migratory birds as part of any NEPA process.

Numerous protected species inhabit the environment within the Pacific Coast Groundfish FMP management unit. Therefore, many protected species potentially occur in the operations area of the bottom trawl fishery. However, only a few of them are impacted by bottom trawl fishing activities. Table 3-1 lists the species, and Table 3-2 lists critical habitat, protected by ESA, MMPA, or MBTA, that may be impacted by the bottom trawl fishery and, therefore, the proposed action.

Table 3-1. Species present in the action area and potentially affected by the proposed action.

Species	Status under ESA and/or MMPA
Marine Mammals	
Steller sea lion (Eumetopias jubatus) eastern DPS*	Removed from list as of Dec 4, 2013 (78 FR 66140)
Steller sea lions (Eumetopias jubatus) – Eastern U.S. stock	Non-strategic stock
California sea lion (Zalophus californianus) – U.S. stock	Non-strategic stock
Marine and anadromous fish	
Green sturgeon (Acipenser medirostris) southern DPS*	Threatened
Pacific eulachon (Thaleichthys pacificus) southern DPS	Threatened
Chinook (Oncorhynchus tshawytscha) Sacramento River winter, evolutionarily significant unit (ESU)	Endangered
Chinook, Central Valley Spring ESU	Threatened
Chinook, California Coastal ESU	Threatened
Chinook, Puget Sound	Threatened
Chinook, Snake River Fall Run	Threatened
Chinook, Snake River Spring/Summer Run	Threatened
Chinook, Lower Columbia River	Threatened
Chinook, Upper Willamette River	Threatened
Chinook, Upper Columbia River Spring Run	Endangered
Coho (Oncorhynchus kistuch) Central California Coastal ESU	Endangered
Coho, S. Oregon/N. CA Coastal ESU	Threatened
Coho, Lower Columbia River	Threatened
Coho, Oregon Coast	Threatened
Marine Birds	
Short-tailed albatross (Phoebastria albatrus)	Endangered

*Species with designated critical habitat within marine waters.

Table 3-2. Critical habitats

Species	Critical Habitat
Steller sea lion (58 FR 45269)	Año Nuevo Island Southeast Farallon Island Sugarloaf Island and Cape Mendocino. Associated aquatic zones 3,000 feet seaward in State and Federally managed waters from the baseline of each rookery and the air zone 3,000 feet above each rookery measured vertically from sea level.
Green sturgeon, southern DPS (74 FR 52300)	US coastal marine waters within 60 fathoms from Monterey Bay, CA, to Cape Flattery, WA. Numerous rivers and estuaries adjacent to marine waters are also listed. See Federal Register notice for complete list.
Leatherback sea turtle (77 FR 4170)	Marine waters from Point Arena, CA to Point Arguello, CA from the nearshore to the 3,000 meter isobath.

Information on endangered and threatened marine species under NMFS's jurisdiction, including species information, status and designated critical habitat, can be found at the following website. Information on marine mammals protected under the MMPA can be found at the following website. https://www.fisheries.noaa.gov/protecting-marine-life

Other ESA-listed species occurring in the Action Area are either covered under existing, long-term ESA biological opinions or determinations (described in Section 3.4.1 and 3.4.2), or NMFS anticipates the proposed action is not likely to affect the species (described in Section 3.4.2).

3.4.1 Protected Species Potentially Adversely Affected

Species protected under the laws described above include salmon, eulachon, green sturgeon, marine mammals, and sea birds. The laws include procedures to determine whether impacts are significant enough to require regulatory action to reduce the impact. This section describes protected species that may be encountered in groundfish fisheries in the context of actions and standards pursuant to these laws (NMFS 2015).

3.4.1.1 Salmon

Chinook and coho salmon are caught in the bottom trawl fishery, and they have been the subject of previous biological opinions in 1999, 2006, and in 2017. On December 11, 2017, NMFS finalized a new Biological Opinion (NMFS 2017) under section 7 of the ESA for the Pacific Coast Groundfish FMP. An average of 580.6 salmon was observed to be caught in the bottom trawl fishery from 2011 to 2015. Of those, 556.4 were Chinook, and 23.2 were coho. The 2017 Biological Opinion concluded that the impacts of the groundfish FMP fisheries may have an adverse effect on the following ESA-listed species:

- Chinook Salmon ESUs
    - Puget Sound ESU
    - Lower Columbia River ESU
    - Upper Willamette River ESU
    - Upper Columbia River Spring-run ESU
    - Snake River Spring/Summer-run ESU
    - Snake River Fall-run ESU
- Coho Salmon ESUs
    - Lower Columbia River ESU
    - Oregon Coast ESU
    - Southern Oregon/Northern California Coast ESU
    - Central California Coast ESU

NMFS concluded that the groundfish fishery, including the proposed action, was conducted consistent with the terms of the incidental take statement (ITS), it is not likely to jeopardize the continued existence of the listed salmonid species that are subject of the opinion. Critical habitat for salmon species is not present within the action area. For additional information, see NMFS 2017.

3.4.1.2 Eulachon

Several indices of eulachon abundance have shown dramatic increases, beginning in 2011, to levels not seen since 2002. However, indices of abundance began to decline in 2015. Based on the overall magnitude of bycatch in groundfish fisheries, either there is limited interaction with eulachon in these fisheries, or most eulachon encounters result in fish escaping or avoiding trawl gear. Bycatch of eulachon in the bottom trawl and non-whiting midwater groundfish fisheries was 3,075 fish in 2014 and 699 fish in 2015. Bycatch in the pink shrimp fishery was 68.8 million eulachon in 2014 (NMFS 2017).

3.4.1.3 Green Sturgeon

Green sturgeon take in the Pacific Coast groundfish fishery, when considered within the context of these sources of mortality and other cumulative effects, results in a comparatively small increase in the mortality imposed on the subadult and adult population. From 2011 to 2016, a catch of 116 green sturgeon was observed. In most years, mortality due to the groundfish fishery would be low (0.03 percent to 0.09 percent of the total subadult and adult population). In the worst case (not expected to occur more than two years within a nine-year period), mortalities would account for 0.1 percent to 0.3 percent of the total subadult and adult population (NMFS 2015).

3.4.1.4 Marine Mammals

The MMPA requires that all commercial fisheries be placed in one of three categories, based on the relative frequency of incidental serious injuries and mortalities of marine mammals in the fishery:

- Category I designates fisheries with frequent serious injuries and mortalities incidental to commercial fishing.
- Category II designates fisheries with occasional serious injuries and mortalities.
- Category III designates fisheries with a remote likelihood or no known serious injuries or mortalities.

Annually, NMFS' Office of Protected Resources publishes an updated List of Fisheries with these categories. NMFS published the final 2019 List of Fisheries on May 16, 2019 (84 FR 22051). The bottom trawl fishery (listed as groundfish trawl), California halibut bottom trawl, California sea cucumber trawl, and the pink shrimp trawl are Category III fisheries. This is evident in the low number of observed interactions in the fishery from 2011 to 2014. See Chapter 4 for details on total groundfish fishery interactions with marine mammals, as part of the no-action alternative.

Potential biological removal (PBR) is used to assess the effects of human-caused incidental mortality under the MMPA. PBR represents the maximum level of human-caused mortality a stock can sustain and still have a high likelihood of achieving its optimum sustainable population level. PBR is reported in stock assessment reports, and estimates of PBR can be found in Carretta et al. 2018.

A new report on marine mammal bycatch was released in September 2018. Serious injuries or incidents of mortality of marine mammals have been observed in the groundfish bottom trawl fishery from 2011 to 2016 (Jannot et al. 2018), the same period for which this fishery has had 100 percent observer coverage. Those species (and mortality estimates) are California sea lion (31 animals); northern elephant seal (6 animals), Pacific white-sided dolphin (3 animals); seal, unidentified species (1 animal), and Stellar sea lions (52 animals). The California halibut bottom trawl fishery had observed serious injury or mortality of the following species in the 2003 to 2016 period: California sea lions (57 animals); northern elephant seal (1 animal), harbor porpoise (1 animal), stellar sea lion (9 animals), and northern fur seal (1 animal). Pink shrimp trawl fisheries had no observed serious injuries or incidents of mortality of marine mammals in the 2010 to 2016 period.

3.4.1.5 Seabirds

Seabird species found off the West Coast include resident and transitory species (migrating or foraging). Seabirds are federally protected under ESA, MBTA, or both. There is a possibility of seabird injury or mortality from airborne cables (third wire and warp cables) that connect the bottom trawl net to the boat while the gear is being towed, or from entanglement in netting while the gear is being hauled in, and birds are feeding on catch. Impacts of the proposed action on seabirds are considered.

NMFS reinitiated consultation on the take of short-tailed albatross in April 2016. USFWS finalized the biological opinion on May 2, 2017. The biological opinion indicated that implementation of the activities as described within the biological assessment (e.g., the ongoing groundfish fishery) would not jeopardize the continued existence of short-tailed albatross, and USFWS concurred with NMFS' determination that the proposed action would not likely adversely affect the marbled murrelet, California least tern, southern sea otter, bull trout, or bull trout critical habitat (UWFSW 2017). Seabirds, including other albatrosses, fly behind vessels or float in offal plumes that trail beyond vessels, where they can strike the trawl cables (warps) or the sonar cable (third wire) attached to the net or become entangled on the outside of nets towed at or near the surface. Those birds striking airborne cables are very unlikely to show up on the vessel's deck to be sampled. To date, no short-tailed albatross have been observed to be taken in trawl fisheries, but they have been observed near trawl vessels.

The bottom trawl fishery is restricted to ITS for short-tailed albatross under the 2017 Biological Opinion for seabirds (NMFS 2017b). Section 6.1.2 and 6.2 of the Biological Opinion discusses take in the trawl fishery. The NMFS 2017 Biological Opinion supported the finding that the fishery would not likely have an adverse effect on marbled murrelets or California least tern.

The non-trawl groundfish fishery (e.g., fixed gear) has had a documented take of ESA-listed short-tailed albatross (*Phoebastria albatrus*). No injury or mortality of short-tailed albatross has been observed in the groundfish or California halibut bottom trawl fisheries (2014 to 2015), though short-tailed albatross have been observed feeding on catch (Good et al. 2017).

The groundfish bottom trawl fishery had incidental take of non-ESA listed seabirds from 2002 to 2009, all in low numbers (Jannot et al. 2011). The California halibut bottom trawl fishery had incidental take of non-ESA listed seabirds from 2002 to 2009, in low numbers, but higher than the groundfish bottom trawl fishery (Jannot et al. 2011). A new seabird bycatch report was released in September 2018; it included fishery data from 2002 through 2016 (Jannot et al. 2018). This report indicated that the groundfish bottom trawl fishery, the California halibut trawl fishery, and the pink shrimp trawl fishery have continued to cause incidental take of non-ESA listed seabirds in low numbers, similar to the amounts observed in the 2002 to 2009 period. See NMFS' 2015-2016 SPEX for more detailed information on seabirds.

3.4.2 Protected Species and Habitats Unlikely to Be Affected

NMFS completed a biological opinion in 2012 assessing the impacts of the Pacific Coast Groundfish FMP (NMFS 2012) on several non-salmonid species. Section 2.2 of that opinion describes the status of species and critical habitat subject to the consultation, and Section 2.11 describes the rationale for reaching a "not likely to adversely affect" determination for a number of ESA listed species and their critical habitats that occur in the action area. The following ESA listed species occur in the action area, but NMFS has determined that the groundfish fishery is not likely to affect these species adversely or their critical habitat. These species and habitat include green sea turtles (*Chelonia mydas*), olive ridley sea turtles (*Lepidochelys olivacea*), loggerhead sea turtles (*Caretta caretta*), sei whales (*Balaenoptera borealis*), North Pacific right whales (*Eubalaena japonica*), blue whales (*Balaenoptera musculus*), fin whales (*Balaenoptera physalus*), sperm whales (*Physter macrocephalus*), Southern Resident killer whales (*Orcinus orca*), Guadalupe fur seals (*Arctocephalus townsendi*), and critical habitat of Steller sea lions. The groundfish fishery was determined to adversely affect green sturgeon, eulachon, humpback whales, stellar sea lions and leatherback sea turtles. Green sturgeon, eulachon, and stellar sea lions may be affected by vessels fishing with bottom trawl gear, and they are discussed in Section 3.4.1, as well as in Chapter 4. Humpback whales are primarily entangled in the buoy lines associated with pot/trap fishing gear, which is not the subject of this action. There has been no observed sea turtle mortality with West Coast groundfish or California halibut bottom trawl gears in the 2002 to 2014 period (NWFSC 2016). Therefore, the proposed action is unlikely to impact humpback whales or sea turtles.

Analysis of available data for previous consultations indicates that steelhead, sockeye, and cutthroat trout are rarely, if ever, encountered in the groundfish fishery. Chum are caught in relatively low numbers in the bottom trawl fishery on the order of tens of fish per year (NMFS 1992). In the 1999 Biological Opinion, NMFS concluded that there is little or no effect on the steelhead, sockeye, cutthroat trout, or chum salmon ESUs because of the groundfish FMP (NMFS 1999). Relevant information supporting this conclusion is reviewed briefly in Section IV of the 1999 Biological Opinion, but it is not further discussed in this document.

4 ANALYSIS OF IMPACTS

This chapter contains descriptions of the analytical approach applied to the alternatives in Section 4.1. Section 4.2 describes how the alternatives were analyzed.

4.1 Description of Analytical Approach and Methods

This section first describes the analytical approach applied to the alternatives. It also contains a description of the potential effects of those alternatives. The analyses focus on a series of metrics used to evaluate the effects of the alternatives on benthic marine habitat, fish resources, protected resources, and economics. For each alternative, the metrics were summarized over up to five different levels: 1) by alternative (alternative-wide), 2) on a state-by-state basis, 3) by latitudinal areas and depth zones, 4) by each port or port group, and 5) by the individual polygons in the alternative. Not all levels were analyzed in each resource because of data availability and uncertainty. The methods described in the sections below were reviewed and endorsed by the Council's Scientific and Statistical Committee (Agenda Item F.3.b, Supplemental SSC Report 1, April 2018).

4.1.1 Habitat

The sections below describe how the habitat effects of the alternatives were analyzed and the data limitations to conduct certain types of impacts analysis.

The effects of each alternative on habitat will be determined, in large part, by how that alternative changes the locations where the bottom trawling is prohibited and the intensity of trawling in areas that remain open or are reopened. The degree to which bottom trawling can adversely affect benthic habitats is associated with the concentration and abundance of diverse habitats at fishing grounds (PFMC 2012). In regions where a fishing ground is homogenous and fairly extensive the impact may be low, while in regions of highly diverse benthic habitats consisting of foraging and various bottom fish life stage habitats disturbances may be acute, as it may interrupt feeding, predation avoidance, and reproduction activities of certain species (NMFS 2013). The rates at which benthic habitat recovers from disturbance also varies by habitat type, with soft bottom habitats recovering more quickly than hard bottom, high relief habitats and habitat without habitat-forming invertebrates recovering more quickly than those with habitat-forming invertebrates (NMFS 2013). This analysis does not provide a discussion of the potential adverse effects of bottom trawling on benthic habitats. However, a discussion of these adverse effects can be found in the Phase 1 report by the Groundfish Essential Fish Habitat Review Committee (PFMC 2012), which summarizes the information on the adverse effects of bottom trawling found in Appendix C, Part 2, of the groundfish FMP (PFMC 2005) as well as more recent information that was available at the time of the review.

4.1.1.1 Criteria for Evaluating the Consequences of the Alternatives on Benthic Habitats

The analysis will rely on best available information, which is the extent of each habitat type in the areas to be closed or reopened by each alternative, as represented by the habitat metrics described below. Consistent with principles established in the EIS for Amendment 19 (NMFS 2005) to address the limited information on the ecosystem function of these habitat types, this analysis takes an approach to habitat protection that assumes, in the absence of definitive research, that it is advantageous to protect some portion of each habitat type and that higher levels of protection (by relative area) are more beneficial than lower levels (NMFS 2005). This analysis also compares the extent of the priority habitats (as defined in Key Terms and Concepts and described in Chapter 3, Section 3.1) that will be reopened, as they have had 10 to 16 years to recover from past trawling. Therefore, alternatives that protect more types of habitats, those that protect a greater net spatial extent of the priority habitats, or those that reopen a lesser spatial extent of the priority habitats, are viewed as providing greater benefits to habitat than those that protect fewer types, protect a lesser net spatial extent of priority habitats, or reopen more priority habitats. The extent of habitat protection will be determined by the net changes in the metrics described below when both the closures and reopenings are considered. When the net changes are positive, the effects of the alternative on habitat are viewed as beneficial. When they are negative, the effects of the alternative are viewed as adverse. Those alternatives with more positive (or fewer negative) changes will be viewed as more beneficial to habitat than those with fewer positive (or more negative) changes.

4.1.1.2 Habitat Metrics

The sections below describe aspects of the habitat metrics used to assess the effects of each alternative.

As part of Amendment 28, the Council determined that methane seeps should be identified as EFH for groundfish. However, the role of methane seeps as EFH for groundfish have recently garnered considerable scientific and public attention, as reflected in the number of public comments on the subject when the Council was considering Amendment 28 to the groundfish FMP. Recent surveys along the West Coast have identified a significant number of seeps (Embley, et al. 2017), and it is expected that many more will be found on future surveys. Although the precise relationships between methane seeps and Pacific Coast groundfish are not well understood, the scientific literature suggests that these relationships are important. While identified as EFH for groundfish, comprehensive, coast-wide data on methane seeps were not available when the habitat metrics were developed for this analysis. Therefore, they are not part of the habitat analysis in this EIS.

4.1.1.2.1 Spatial extent of closures and reopenings

This metric describes the spatial extent of the areas that would be closed or reopened to bottom trawling, in square miles (mi^2). Net changes in the spatial extent were calculated as "closed minus reopened." Boundary data for each alternative are available via the NWFSC FRAM Data Warehouse at the following website: https://www.nwfsc.noaa.gov/data/map.

4.1.1.2.2 Substrate composition of areas proposed for closures and reopenings

This metric describes the spatial extent, in mi^2 and the percentage of the seafloor area covered by each of three substrate types: 1) hard bottom, 2) mixed bottom, and 3) soft bottom. Where substrate data are lacking, the substrate type is listed as "unknown." Due to limitations in the available seafloor data, the percentages are not absolute values, but rather are estimates based on the best available science (for more detail see Section 4.1.1.3 Data Limitations in the Habitat Analysis).

Oregon State University (OSU) developed the substrate data in two versions. Version 3.6 of the substrate data covers the entire West Coast and was used for areas in central and southern California (Greene and Bizzarro, 2003). Version 4.0 contains limited updates to the Version 3.6 data that resulted from work with the Bureau of Ocean and Energy Management (Goldfinger et al. 2014). Version 4.0 was used for areas offshore of northern California, Oregon, and Washington. See the following website for additional information:

(https://www.webapps.nwfsc.noaa.gov/server/rest/services/FRAM/EFH_Habitat_Induration_v4_v361/MapServer).

4.1.1.2.3 Submarine Canyons and Gullies

This metric represents the spatial extent (mi^2) of submarine canyons and gullies. Submarine canyons and gullies were delineated as part of the geologic mapping for the Groundfish EFH process in 2005 (http://marinehabitat.psmfc.org/physical-habitat.html), and OSU updated the version for areas off of northern California, Oregon, and Washington, as described in Section 4.1.1.2, above. The boundaries for submarine canyon walls, canyon floors, and gullies were extracted from these data sets and overlaid with the EFHCA alternatives.

4.1.1.2.4 Seamounts

This metric represents the spatial extent (mi^2) of sea mounts, which were delineated as part of the Groundfish EFH process in 2005 (http://marinehabitat.psmfc.org/physical-habitat.html). For this metric, the boundaries from 2005 were supplemented by additional seamounts within the Pacific Coast EEZ that were delineated by GRID-Arendal (http://geonode.grida.no/layers/geonode:seamounts or http://www.grida.no/publications/story-maps/map/6596.aspx). Because the analysis found that seamounts do not occur in the areas to be closed or reopened under the EFHCA alternatives or within the trawl RCA, they will not be discussed further.

4.1.1.2.5 Overfished species (OFS) Habitat

This metric represents the area (mi^2) where the probability of occurrence of an OFS was at least 80 percent of the maximum probability of occurrence predicted by models that were created during the Groundfish EFH Synthesis process (NMFS 2013). The NWFSC and the National Center for Coastal and Ocean Science (NCCOS) each developed a set of gridded species models for a select group of groundfish species. For more information, see the following website:

http://efh-catalog.coas.oregonstate.edu/synthesis/)

These groups included three overfished species: darkblotched rockfish, POP, and yelloweye rockfish. From these models, NMFS used the predicted probability of occurrence for the following three overfished species: darkblotched rockfish and yelloweye rockfish from the NWFSC models and POP from the NCCOS models. The predicted probability of occurrence of each species was overlaid with a 1 km grid cell. Any grid cell that had at least 80 percent of the maximum probability of occurrence score for that species was considered priority habitat. Cowcod (*Sebastes levis*), another overfished species, was not modeled and was, therefore, not included in this metric.

Recently, NMFS declared two of the three species, darkblotched rockfish and POP, rebuilt. Therefore, while this metric identifies area with high probability of occurrence of these two species, it may overestimate the area with a high probability of species that are actually overfished.

4.1.1.2.6 Habitat-forming invertebrates

The metrics used to compare the effects on HFI from the various alternatives must, by necessity, be applicable across all the polygons under consideration. Ideally, sufficient information would be available to compare the abundances of each HFI taxon that occur within each polygon or alternative. However, the most comprehensive data set available, compiled by NOAA's Deep-Sea Coral Research and Technology Program (DSCRTP; https://deepseacoraldata.noaa.gov), provides abundance data from only a subset of surveys, and those surveys that do provide abundance data were not designed to enumerate the HFI in a specific polygon. The lack of consistent abundance data precludes the ability to determine, in a standardized way, the relative importance of individual areas to corals, sponges, or sea pens. While abundance data were unavailable to inform the quantitative analysis, there is some discussion of HFI abundances in the proposals that formed the basis for the alternatives and more information about these proposals are available on the Council's website at https://www.pcouncil.org/groundfish/groundfish-essential-fish-habitat/. The Council considered a variety of sources and types of HFI information when developing the Alternatives in addition to the quantitative metrics described in this EIS. For example, the Council modified the proposed boundaries of a new EFHCA, “the Football” based on qualitative HFI abundance data and substrate data from a 2014 survey by the GFNMS (Graiff, et al 2016).

Given the lack of abundance data, two other HFI metrics were developed that summarized the presence or bycatch of deep-sea corals (Class Anthozoa), sponges (Phylum Porifera), and sea pens (Order Pennatulacea). Presence and bycatch are detailed below.

Presence. The first metric summarizes presence data, compiled by NOAA’s Deep-Sea Coral Research and Technology Program (DSCRTP; https://deepseacoraldata.noaa.gov/). Data points represent the geographic locations of in situ observations, the midpoint of underwater vehicle transects, or NMFS trawl survey events in which observations or catch were summarized. A 1 km grid (0.39 mi^2) was overlaid on the DSCRTP records for each taxonomic group. Except for the NMFS trawl survey data, only those records with a locational accuracy of less than 1 km were included in the analysis. The number of grid cells within, or overlapping with, each polygon with presence data (defined as at least one record) were then counted for each taxonomic group. A more detailed description of the methods used is found in Appendix A.

Bycatch. The second metric summarizes standardized bycatch of deep-sea corals, sponges, and sea pens recorded in the United States Pacific Coast bottom trawl fishery by the West Coast Groundfish Observer Program (WCGOP). For bottom trawls, standardized catch is typically defined by catch (weight) per unit of effort (distance fished) (CPUE) for individual tows. A 0.5 km grid (0.01 mi^2) was overlaid on the fishery, and the mean bycatch CPUE for each taxon was calculated for each cell. For each taxonomic group, cells that exceeded the coastwide median bycatch CPUE of that group were counted. A more detailed description of the methods employed is found in Appendix A, Habitat Metrics, by Geographic Break and Polygon.

The data behind these two metrics were collected for different purposes using different methods. Therefore, they are unlikely to show the same pattern of distribution due to the different data sources, interpretations, and areas over which the data were collected. Presence consists of point data for positive observations, while the bycatch consists of data collected along a tow line that includes negative observations (i.e., no HFI in the tow). In addition, the sampling intensities and the sampling area vary significantly between the two data sets. The Presence data are based largely on targeted sampling and the NWFSC trawl survey, while the bycatch data are collected from commercial bottom trawling over the entire area that is fished.

4.1.1.3 Data Limitations in the Habitat Analysis

A full analysis of the consequences of each of the alternatives on benthic habitats would require detailed information on the following:

1) The current condition of the habitat
2) The impact on benthic habitat from closing or reopening areas to bottom trawling
3) The changes to the location and intensity of the bottom trawling effort that would result from the alternative
4) The spatial extent, geographic distribution, and ecosystem function provided by the discrete habitats that would be affected

The lack of comprehensive information on the first three types of information constrains NMFS' analysis of the effects of the alternatives on the spatial extent of the habitat types in the closures and openings, the net change to the extent of the habitat types that would be protected from bottom trawling, and the geographic distribution of those protections. Therefore, impact analysis is limited in scope, as described in Section 4.1.1.

As noted by the West Coast Governors' Agreement on Ocean Health (Johnson et al. 2010), while some high-resolution seafloor mapping has occurred along the West Coast, much of the region still lacks comprehensive maps to support improved management of marine resources and coastal communities. Johnson et al. (2010) estimated that the 2010 cost to map only state waters would exceed $20 million. While much of that work has been completed, high-resolution mapping with multi-beam echosounders outside of state waters is limited to a number of relatively small areas, with most of the seafloor remaining to be mapped (Waldo Wakefield, email sent to Galeeb Kachra, NMFS West Coast Region November 8, 2017, regarding the need for, and the costs to conduct, comprehensive seafloor mapping along the West Coast). The costs to conduct such mapping would be extraordinarily high due to the sheer extent of Federal waters along the West Coast. The cost to collect multibeam sonar data on the outer shelf and upper slope seafloor to a depth of 1,300 m was estimated, in 2010, to be approximately $15 million, with another $10 million to ground truth the data (Goldfinger et al. 2010). This estimate did not cover the cost for mapping the deeper waters. Although a plan to produce a comprehensive map of West Coast seafloor habitats was developed in 2015 (Yoklavich and Wakefield 2015), the project was shelved due to NOAA budget constraints.

Seafloor maps have improved significantly since Amendment 19, but they rely heavily on interpolated substrate type from adjacent surveys that were often conducted before the advent of high-resolution multibeam sonar and from core samples, resulting in a low level of confidence. As noted above, areas where substrate is mapped with high confidence occur primarily within state waters, with scattered areas in Federal waters. Substrate data confidence maps for northern California, Oregon, and Washington

(Version 4.0) are provided in Goldfinger, et al. (2014) but are unavailable for central and southern California (Version 3.6).

Higher resolution surveys may demonstrate that the actual substrate type differs from the interpolated substrate type in some areas. For example, although the substrate map used in this analysis indicates only soft substrate around the area off central California known as "the Football", recent surveys revealed that the Football is not entirely soft substrate, but rather contains features such as large boulder-like strata, rocky outcrops that form ledges and overhangs, and mixtures of sand and cobble that covered 60 percent of the surveyed area (Graiff, et al. 2016).

Given these caveats, the current seafloor habitat maps represent the best coastwide substrate information available, and they form the basis of the habitat analysis. When available, the Council supplemented the quantitative habitat analysis with other, more site-specific information when selecting its preferred alternative. For example, the substrate and HFI data collected by Graiff, et al (2016) was used to modify the boundaries of "the Football", finding a middle-ground between the Collaborative and Oceana, et al. alternatives.

4.1.2 Socioeconomic Resources

The sections below outline socioeconomic issues associated with the alternatives. The approach, metrics, data sources and data development, and data limitations are discussed in the subsections below.

4.1.2.1 Approach to Assessing Effects

The approach for the analysis is primarily qualitative. Where possible, some quantitative information is provided to help inform the qualitative analysis. Under the No-action Alternative, some ocean areas would remain open to bottom trawl fishing, and other areas (some RCA areas closed since 2002) would remain closed to bottom trawling. The area closures in the current fishery are discussed qualitatively in the context of recent changes to the management regime. Quantitative information is provided showing both conditions in the current fishery and how those conditions have changed from the time prior to EFH/RCA closures. The evaluation of the action alternatives is conducted through a general qualitative economic analysis (Section 4.2.2.2, Action Alternatives: General Qualitative Analysis) which is then informed with quantitative information on the recent and past importance of fishing grounds to be opened or closed.

Providing information on the past importance of the fishing grounds for which closures and reopenings are proposed under the action alternatives required two distinct approaches: one for areas proposed for closure and another for areas proposed for reopening. For areas that are currently open, but that are proposed for closure under an alternative, the most recent fishery data were used: bottom trawl fishery activity conducted from 2011 to 2014, a period that, at the time this analysis was started, included all completed PacFIN data years since implementation of trawl rationalization in 2011. For areas that are currently closed, but that are proposed to be reopened, no data after 2001 are available because there has been no recent bottom trawl fishing in the area. The most recent period of activity in which these areas were open, prior to establishment of trawl RCAs and EFHCAs and consequent closure of the areas to bottom trawl fishing, was 1997 to 2001. Quantitative information on proposed reopenings cannot be summed with the results for proposed closures because data differences prevent direct, quantitative comparison.

The data for each period contribute to the qualitative analysis only by providing indicators of the potential importance of particular grounds within the context of conditions present at the time—an importance that will vary depending on an array of other factors influencing the choices of fishermen. The net economic changes expected from any particular opening and closing are not possible to estimate quantitatively because the data and models are not available and developed to predict how fishermen will redeploy, increase, or decrease their effort, or how the resultant catches will change.

The 2011 to 2014 data used for new closures may indicate the amount of activity that closures potentially displaced. However, it is difficult to predict how fishing behavior would change in response to reconfiguring open and closed areas under each alternative because of the dynamic nature of the current trawl IFQ fishery and the involvement of vessels engaged in the non-whiting trawl fishery and in other fisheries off the West Coast (e.g., whiting IFQ, at-sea whiting, Dungeness crab, etc.) or Alaska (Gulf of Alaska groundfish trawl, Bering Sea/Aleutian Islands groundfish trawl, etc.). In response to the loss of some fishing grounds, some operators may choose to increase their vessels' involvement in one or more of these other fisheries and lease or sell their IFQ to other operators involved in the West Coast groundfish fishery who may use different strategies or participate on different areas of the coast.

The 1997 to 2001 data used for reopenings provide some information about the size of new opportunities that might arise with availability in these areas, but they do not indicate how much of any activity in the newly opened area will simply be relocation of existing activity and how much will manifest as expanded catch. While many factors may alter the importance of these grounds if reopened, an important issue will be that reopened grounds may provide the fishing areas to which vessels will move when displaced by closures. Based on this factor, a reopened area might be more important when some areas are closed than would be indicated by data summarized from a time when there were few, if any, area restrictions.

Relative efficiencies and other economic advantages of one fishing ground over another would have to be known to predict fishermen's responses to opening and closing and to determine net effects. These relative advantages/disadvantages will likely depend on multiple factors that include alternative fishing opportunities, vessel specific performance, time of year, and individual fishermen's knowledge, preferences, and risk tolerances. The modeling and determinations would require data beyond what are currently available. See Section 4.2.2.2, Action Alternatives: General Qualitative Analysis, for additional discussion of factors influencing vessel choices. Limitations on use of the quantitative data are further discussed in Section 4.1.4.3, Protected Resources.

Over the past several years, there has been an increasing effort by regional fisheries science centers to assess socioeconomic vulnerability in, and the degree of social change experienced by fishing-dependent communities throughout the United States (Colburn & Jepson, 2012; Jepson, 2007; Jepson & Colburn, 2013). MSA National Standard 8 set the precedent for social science research within the broader context of fishery management, as it recognizes that understanding socio-ecological systems is imperative for effective management of fisheries. According to the MSA, a "fishing" community is defined as depending significantly on fish harvesting or processing to meet social and economic needs (MSFCMA 2007). This definition of fishing communities, as significantly engaged with fishery resources, is important in determining a place-based unit and focus of study.

The process by which social change is measured is the social factor analysis, while the social impact assessment (SIA) is the product of the analysis. The social factor analysis and, ultimately, the SIA is intended to help identify the social and cultural effects of a proposed action or policy and its alternatives. Social factor analysis involves identification and analysis of social variables, or factors, which describe the fishery, its socio-cultural and community context, and its participants. Social factor analysis provides a way to assess potential impacts on the day-to-day quality of life of persons and communities whose environment may be affected by a proposed project or policy change.

Five categories of social factors should be considered in all fishery SIAs. Four of these social factor categories pertain to all SIAs, and the MSA specifically requires a fifth category. Central to understanding the impacts of a natural-resource-related management action, the social factors examined in this action are based on NMFS' guidance on SIA (NMFS 2007), as well as on other texts (e.g., Clay et al. 2010; Clay et al. 2014). These social impact factors are as follows:

1. *Size and Demographic Characteristics* of the fishery-related workforce residing in the area – These determine demographic, income, and employment effects relative to the workforce as a whole, by community and region.

2. The *Attitudes, Beliefs, and Values* of fishermen, fishery-related workers, other stakeholders, and their communities – These are central to understanding the behavior of fishermen on the fishing grounds and in their communities.

3. The effects of the proposed action on *Social Structure and Organization* – These are changes in the fishery's ability to provide necessary social support and services to families and communities, as well as the effects on the community's social structure, politics, etc.

4. The *Non-economic Social Aspects* of the proposed action – These include lifestyle, health and safety issues, and the non-consumptive and recreational uses of living marine resources and their habitats.

5. The *Historical Dependence on and Participation in* the fishery by fishermen and communities, reflected in the structure of fishing practices, income distribution, and rights (NMFS 2007) – A state or port groups' participation in a fishery is described by the proportion of the coastwide ex-vessel revenue that comes from that fishery's landings, one state or port group relative to another. For this analysis, data related to a state or port groups' *Dependence on and Participation in* the groundfish fishery come from the Status of the Pacific Coast Groundfish Fishery; SAFE report (Council 2018), which includes landings and revenue from the Pacific whiting fishery and bottom trawl groundfish fishery. These metrics, which are based on data that include the Pacific whiting sector of the groundfish fishery, describe an upper bound of a state or port groups' *Dependence on and Participation in* the bottom trawl sector of the groundfish fishery.

Social impacts are primarily assessed in terms of *Historic Dependence on and Participation* in the fishery because commercial fish landings, permit holdings, and vessel ownership can be used as indicators to compare alternatives. The other four social impact factors of *Size and Demographic Characteristics*; *Attitudes, Beliefs, and Values*; *Social Structure and Organization*; and *Non-economic Social Aspects* are also considered in qualitative discussions within Section 4.2.2. While the qualitative discussions in Section 4.2.2 do not quantify the effect of the management alternatives relative to these social impact factors, the analysis characterizes the likely direction and magnitude of effect. The qualitative assessments of the potential changes in these social impact factors are based on the available social science literature and inferences from the economic analyses. For example, alternatives that would have a negative impact on fishing profits would also contribute to lower employment opportunities in the fishery and a decrease in the *Size and Demographic Characteristics* of the fishery-related workforce. Summary qualitative discussions of net economic effects for each action alternative are presented in sections following the general qualitative analysis of the action alternatives. They are also addressed in Chapter 5, along with the synthesis of the effects of combinations of multiple alternatives.

4.1.2.2 Metrics

The following metrics are used to indicate past importance of the fishing grounds that may be opened or closed: effort (hours of bottom trawling), landings (round weight pounds), and ex-vessel value/revenues[15] (inflation-adjusted 2015 dollars[16]). These metrics were chosen because they are readily available from existing fishery databases, and they are comparable over time, as discussed in the following section.

As described in the previous section, landings in terms of round weight pounds and ex-vessel value in inflation-adjusted 2015 dollars have been summarized for two periods: 1997 to 2001 (to describe catch in areas currently closed) and 2011 to 2014 (to describe catch in areas that are currently open). The basis for choosing these periods is described above Section 4.1.2.1. To the degree that recent effort, landings, and ex-vessel values reflect what would continue to occur under the No-action Alternative, they can be characterized as measures of fishing activity that would be displaced from the closed areas. For areas to be reopened, historical information on the fishing grounds comes from a different fishery, market, and management era (one with relatively few area restrictions), and this information may no longer represent the current or future fishery under the proposed action.

Landing weights and ex-vessel values are presented both as absolute values (round weight pounds and ex-vessel dollars) and as percentages of non-whiting bottom trawl groundfish landing weights and value over the corresponding period. Percentages indicate relative importance of a fishing area under conditions present during the period used for the evaluation. Additionally, percentages place potential changes in proportion to total activity, aiding in overcoming distortions caused by differences in the relative size of the fishery in the two different periods, 1997 to 2001 and 2011 to 2014, and displaying the importance of an area within the context of the particular fishery.

Landing weights and ex-vessel value are provided for all groundfish species combined. Additional breakouts of landing weights and ex-vessel value by species and/or market category are included in Appendix C. Landing weights and values associated with the areas proposed for closures and openings are grouped at the aggregated port area, state, and coastwide levels.[17] Information is presented in

[15] "Ex-vessel revenue," in this case, consists of the round weight landings times the ex-vessel price. It represents the gross revenue received from the buyer by a fishing vessel making a landing.

[16] Ex-vessel revenue presented in the tables is inflation-adjusted to 2015 dollars using the gross domestic product (GDP) implicit price deflator. The base year used is 2015 because it is the year in which the primary datasets were compiled for this analysis.

[17] To help the reader understand high-level summary impacts, the analysis in this chapter provides aggregated non-whiting trawl groundfish landings and revenue data by the port group of landing. Appendix A contains more detailed, species-specific information. Available effort data are insufficiently detailed to associate overall historical

aggregate to enable use of confidential data. Port groups are derived from the input-output model for Pacific coast fisheries (IO-PAC) and are as follows: North Washington Coast; Puget Sound; South and Central Washington Coast; Astoria, Newport; Coos Bay; Brookings; Crescent City; Eureka; Fort Bragg; San Francisco; Monterey; and Morro Bay.[18] These groups are described in greater detail in a 2011 NOAA Technical Memorandum (Leonard and Watson 2011; Table 9).

4.1.2.3 Data Sources and Data Development

For the economic metrics described above, data on weight and effort were acquired as described below. Appendix D provides a description of the data selection process.

Effort, landings (weight), and ex-vessel revenue associated with areas to be opened and closed are used in the context of fishery-wide data to provide quantitative information that informs the qualitative analysis. Effort is derived from logbook data, and it measures the time spent and specific locations used by bottom trawl vessels engaged in relevant fishing activity. Landings are derived from the PacFIN database, and they are a measure of the weight of fish being delivered to buyers in the port groups.

Ex-vessel revenues are also derived from the PacFIN database; they measure the gross value of the fish being delivered to buyers in the port groups. Ex-vessel value was developed by multiplying the round weight landings times the ex-vessel price. It represents the gross revenue (ex-vessel revenue) a fishing vessel making a landing would receive from the buyer. Ex-vessel revenue has been inflation-adjusted to 2015 dollars by using the gross domestic product (GDP) implicit price deflator. The base year of 2015 is used because the primary datasets for this analysis were compiled in this year.

Data used include treaty (landings inside the U&A made by Native Americans under rights secured by treaties with the United States government). Data also include non-treaty commercial groundfish bottom trawl fishery landings (round weight) associated ex-vessel revenue, and effort (trawl hours) from trips conducted in open areas outside the tribal U&A areas. Only non-treaty data are used to quantify the catch from areas potentially affected by the action alternatives, but combined treaty and non-treaty information is used to put those effects in the context of the entire bottom trawl commercial fishery. For the non-treaty landing weights, PacFIN fish tickets have been adjusted using state logbook information to assign fishing locations. No logbook records are associated with treaty fishery landing records.

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effort or effort in areas proposed to be reopened or closed with individual species landings. This is because effort is a measure of the time a vessel's trawl net is in the water, and it is not differentiated by how long it took to catch and land any species caught during a trip, or to which port the most time-consuming catch was delivered.

[16] IO-PAC is used in some contexts to estimate gross changes in economic contributions and the economic impacts of policy, environmental, or other changes that affect fishery harvest.

Using these fishery data, NMFS reviewed only the landing weights of groundfish from areas that would close and areas that would reopen under each alternative. Because most of the areas to be reopened have been closed for more than 15 years, only older fishery data (1997 to 2001) could be used to inform such a location-specific analysis. For areas to be reopened, historical information on the fishing grounds is from a different fishery, market, and management era, and it may no longer represent the current or future fishery under the proposed action. Most of the areas to be closed have been open to bottom trawling in recent years. Fishery data from more recent periods (2011 to 2014[19]) were available to inform harvest levels from these areas. Because of the need to use two different data sets, the analysis of each alternative, where appropriate, is divided into two parts: 1) areas that would be closed and 2) areas that would be reopened.

Effort is reported in terms of catch location, since it is through the mechanism of changing restrictions of catch locations that the action alternatives would have impacts.

4.1.2.4 Data Limitations in the Economic Analysis

Limitations on the data used in the economic analysis included the following:

- Difficulties in assigning tows to specific locations
- Uncertainties about the relationship between fishing area data used as quantitative indicators for each historic period and the effects of closures (1997 to 2001 and 2011 to 2014)
- The inappropriateness of summing data from the two periods in the above bullet

One of the challenges with the logbook data was determining the location to which to assign particular tows. The location of non-tribal trawl fishing effort was obtained from landings tickets matched to logbook data. Logbook-reported coordinates of the tow set (starting point) were used only to define the location. The logbook-reported set point coordinates thereby defined the location for each bottom trawl tow and any resulting catch. Since a trawl tow moves and may last several hours, some error is associated with using this method to assign effort location and depth (Appendix D). Alternative methods such as using the end point rather than the set point or calculating the geographic average of the reported set point and end point coordinates may change the assignment of catch and effort to different locations and/or depths. However, analysts determined that using the end point rather than the set point to infer location would not reduce the bias, and the location-averaging method was unnecessarily complex for this application. Bias introduced by using any one of these methods to infer individual tow locations would likely average out when combining the thousands of tow records in the project dataset.

[17] A period that, at the time this analysis was started, included all completed PacFIN data years since implementation of trawl rationalization in 2011.

Uncertainties about responses to closures are discussed above in Section 4.1.2.1, Approach to Assessing Effects, and they limit interpretation of these quantitative data. Some areas proposed to be reopened have been closed since 2002 and, therefore, lack recent fishery history data. As a proxy, this analysis uses data from 1997 to 2001, a period when those areas were open, to gain a general sense of how important a particular area was to the industry historically. While NMFS cannot predict the actual activity associated with any specific reopening, analysts can reflect the relative level of fishing activity that occurred in an area prior to its closure. The 2011 to 2014 data are used to indicate landings associated with the effort that would be displaced from a particular area proposed for closure. Should an area be closed to fishing, the effort previously exerted in that area could be displaced and dispersed over areas that would remain open or would disappear. Some combination of these two effects could also occur.

Further, data for the two periods cannot be compared to each other. The magnitude of the metrics used in this analysis (effort, landing weights, and revenue) are generally larger from 1997 to 2001 than from 2011 to 2014. As shown in Figure 4-1, the number of participating vessels, landings, and revenue declined steadily from the start of the limited entry permit program in 1994 through 2003, after which there was a sharp decline in vessel participation due to a federally sponsored buyback program. A second drop in the number of vessels occurred during the transition to catch shares in 2011. With a much larger fleet, and relatively fewer restrictions prior to rebuilding plans, the bottom trawl fishery from 1997 to 2001 does not reflect the more recent period. Total coastwide participation (number of vessels), landings, and inflation-adjusted revenue were lower by 76 percent, 48 percent, and 45 percent, respectively, during the 2011 to 2014 period compared with 1997. As of 2017, all but yelloweye rockfish and cowcod south of 40°10' N. latitude were declared rebuilt, which should increase opportunities for fishermen to access target stocks in future years, compared to the first years of the catch share program.

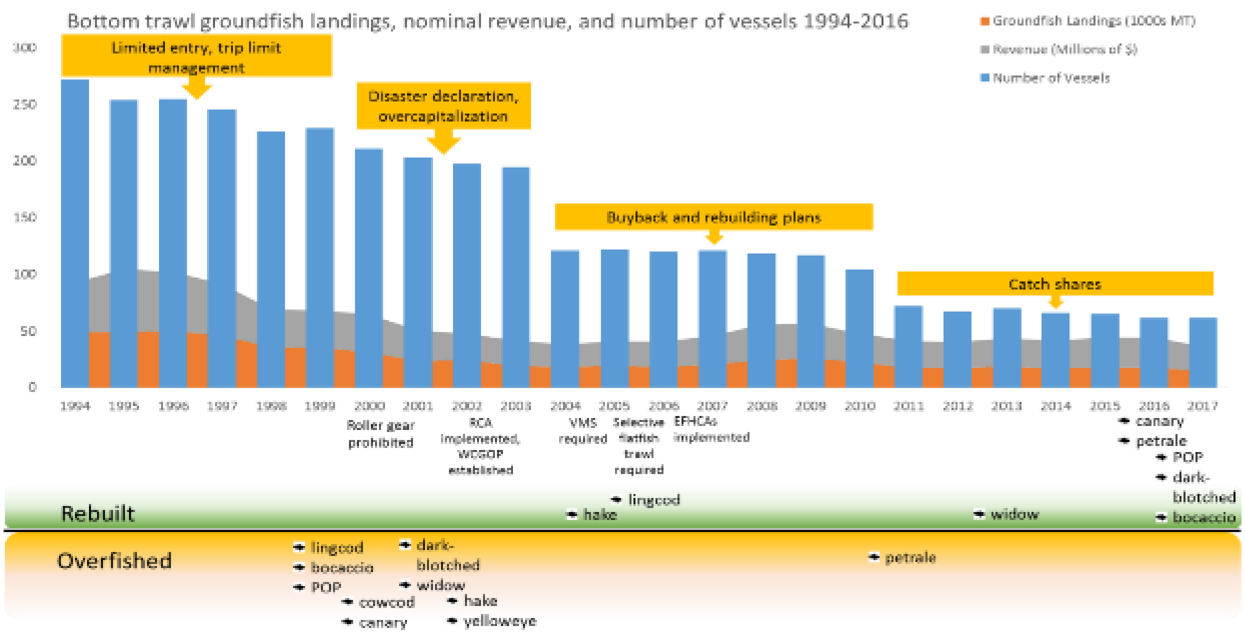

Figure 4-1. Timeline of major events and management of non-whiting groundfish.

As previously mentioned, readers may be tempted to view the values or percentages reported under a given alternative and conclude a gain or loss in absolute terms. Quantitative information on proposed reopenings cannot be summed with the results for proposed closures, because data differences prevent direct quantitative comparison. The available data represent vessel activity during different periods, management regimes, gear types, environmental conditions, conservation concerns, markets, combinations of open and closed areas, and other factors. The metrics are intended to inform the qualitative analysis by providing quantitative indicators of the relative importance of fishing grounds in the past within the context of conditions of those times.

4.1.3 Fish Resources

This section describes the approach and methods used to assess impacts of the alternatives on fish resources for the No-action Alternative and each of the alternatives in Subject Area 1, Subject Area 2, and Subject Area 3. Fish resources fall within multiple categories, and they include all finfish resources in the action area that may be affected by the proposed action. The discussion is largely qualitative, encompassing all fish resources for each alternative. The quantitative metrics used for analysis of impacts on habitat and the socioeconomic environment likely represent relative impacts on fish resources, particularly for EFHCAs and removal of the trawl RCA. Metrics used to assess habitat and socioeconomic impacts are used to inform some of the qualitative discussion on impacts to fish resources.

The results of the quantitative analysis of groundfish landings were used to inform largely qualitative comparisons.

Academic studies have explained potential positive effects on fish resources from closed areas such as increases in species richness, size, and productivity within the area boundaries (Lester et al. 2009; Lubchenco and Grorud-Colvert 2015; Vandeperre et al. 2011), as well as larval seeding of surrounding areas (Thompson et al. 2017). Detailed data for the various areas considered for closing or reopening under each alternative is not available, thus the data to evaluate these effects on an alternative-by-alternative basis do not exist. Therefore, these potential effects are analyzed qualitatively. The approach makes several assumptions:

1. Fish resources that use any part of the habitat will benefit from the habitat protections in areas where bottom trawl gear use is prohibited; the more mi^2 of habitat protected, the better it will be for fish resources.
2. Trawlable habitat that reopens to bottom trawling will have some level of harvest with bottom trawl gear, and operation of the fisheries in these areas will impact benthic habitats; the more mi^2 of habitat that are reopened, the worse it will be for fish resources.
3. Overall effort and total harvest with bottom trawl gear will continue to be limited by fishery management measures to promote healthy fisheries and prevent overfishing.

Harvest has not approached the allocations for many groundfish species that are managed with IFQ in recent years (Council and NMFS 2017; see Table 1). Factors that may limit attainment are anticipated to continue under every alternative (e.g., multi-species fishery, weak stock management, shifting market conditions, etc.), but it is uncertain how the effects of limiting factors might change under the any of the alternatives. Harvest of the full ACL for groundfish species is the anticipated greatest negative impact that the fleet could have on groundfish fish resources from directed harvest activities. Greater attainment of trawl allocations and/or ACLs is considered in more detail in Section 4.2.2, Socioeconomic Resources.

A limitation of the qualitative analysis is that not all mi^2 of habitat are equally beneficial for all fish resources. Impacts on fish resources of equal-size, closed/reopened areas are unlikely to be absolutely neutral for each species because of specific habitat characteristics of the polygons. Specific characteristics would include those for which EFH is designated. The definition is as follows: ‘‘those waters and substrate necessary to fish for spawning, breeding, feeding or growth to maturity’’ (16 U.S.C. 1802(10)). Specific characteristics would also depend on whether the affected areas are considered trawlable (e.g., soft bottom) habitat.

In addition to the considerations above, fishery data for groundfish species harvested with bottom trawl gear were considered to make comparisons among the alternatives. A key assumption is that if a species was harvested in an area recently or historically, then that area is utilized during the portion of that species' lifecycle when they are susceptible to harvest with bottom trawl gear. Therefore, those species may be either positively or negatively impacted by a closure or reopener, respectively, more than groundfish species whose landings were lesser for that area. There is considerable uncertainty, when based on historic data, in what the absolute impacts might be on fish resources by the future fishery. Therefore, landings data were used to see which species might most likely be affected.

Subject Area 2 alternatives both would have the potential for BACs, which would offer short-term protections to a variety of fish species. The proportion of coastwide landings was considered by depths and latitudes to see if certain depths and latitudes might provide greater protections for certain species if BACs would be implemented. A relative comparison of the potential species protections for BACs are described in Section 4.2.3.3, Subject Area 2 Alternatives.

4.1.3.1 State-managed Fishery Resources

Four state-managed fisheries on the West Coast use bottom trawl gear to target non-groundfish species. These fisheries are prohibited from fishing inside EFHCAs, thus EFH alternatives could impact them. Therefore, we qualitatively examined the potential impact of the EFH action alternatives on these fisheries by considering the spatial extent of overlap of EFHCA changes and these fisheries. Per the impact analysis presented in Section 4.2, all action alternatives would have very little spatial overlap with these fisheries and would have a negligible impact on state-managed non-groundfish bottom trawl fisheries. Therefore, we do not provide landings and revenue for these fisheries or quantify impacts on protected species. Instead we provide a qualitative analysis of the areas in which these fisheries operate relative to the areas that are proposed to be closed or reopened. We then examine whether these fisheries could impact fish and protected resources as a result of implementation of the Subject Area 1 alternatives.

4.1.4 Protected Resources

As described in Chapter 3, protected resources include ESA-listed species, marine mammals, and sea birds. Considerations are also made for marine mammals under the MMPA and sea birds subject to the MBTA. This section summarizes the analytical approach and methods used for assessing the impacts of the action alternatives on these resources.

4.1.4.1 Criteria for Evaluating the Consequences of the Alternatives on Protected Resources

The WCGOP monitors and summarizes protected species interactions each year in annual reports and stock assessment review documents. Monitoring by the WCGOP started in 2002. From 2002 to 2010, the

WCGOP monitored 20 percent of all groundfish bottom trawl trips with human observers. From 2011 to 2014, all bottom-trawl trips had human observers aboard the vessel. Beginning in 2015, an electronic monitoring (EM) system rather than an observer was used to monitor a portion of bottom trawl vessels; however, those data are not used in this analysis. Monitoring data (species and count), coupled with the location of interactions observed from 2011 to 2014, were used for spatial analysis of interactions with all protected species (see Appendix D, Data Source Selection Process, and Section 4.1.4.2, Data Limitations, for data source selection and limitations discussions). These data sets are the most recent fishery interaction information available at time of this analysis to summarize annual estimates and to conduct a spatial analysis coastwide for a comprehensive look at the fishery.

Observed interactions for salmon, green sturgeon, and eulachon from fishing year 2015 were added to the annual estimates to provide the most recent fishery information. Annual seabird and marine mammal interaction estimates were not available for 2015 at time of this analysis. We did not spatially analyze the 2015 data due to time constraints.

We provide a qualitative assessment of the impacts based on numbers or weight of species observed in the bottom-trawl fishery from areas that are currently open to fishing (the No-action Alternative including the tribal U&A). The qualitative assessment also includes areas inside and outside the trawl RCA (outside the tribal U&A) that are proposed for closures under each alternative.

Since we did not find a pattern of repeated interactions with salmon, marine mammals, or seabirds that would suggest interactions may occur in a particular area of the EEZ, we assume that observed interactions for these species groups are evenly dispersed throughout the EEZ. We also assume that the size of the area is related to the number of observed interactions. Green sturgeon and eulachon are found at certain depth ranges and latitudes; therefore, we do not assume that they are evenly dispersed. As such, we anticipate interaction based on where openings and closings are proposed relative to the depth and latitude of these proposals. Again, we assume that the size of the area in those depth bins and latitudes is related to the number of interactions that have occurred. Since we have limited observer data (less than 100 percent observer coverage or no data) for the proposed EFH openings, the larger the area, the more likely an interaction might occur, and vice versa. We cannot provide accurate predictions for the number of species that may be impacted under each alternative. Instead we describe what has been observed under the No-action Alternative, then speculate on whether interactions under each action alternative could be similar to, increase, or decrease from what has been observed under the No-action Alternative.

This analysis only discusses potential impacts on those species that have been observed in the fishery. Several ESA-listed species and marine mammals have not interacted with the bottom trawl fishery; therefore, they are not discussed further in this document. This includes, but is not limited to, unobserved salmon (including steelhead), marine turtles, marine mammals, and seabirds. Instead, we rely on NMFS and USFWS recent ESA determinations, and NMFS MMPA determinations regarding potential interactions with the bottom trawl fishery (Chapter 3).

Critical habitat is designated for several species, but we focus on green sturgeon. NMFS' recent opinions and determinations provide details regarding the impacts of the bottom trawl fishery on designated critical habitats (Chapter 3). The analysis in this document discusses where the fishery may operate under the alternatives and if the fishery would overlap with these designated areas.

4.1.4.2 Data Limitations

This analysis covers 2011 to 2015 because the fishery was monitored at nearly 100 percent. From 2002 to 2010, the WCGOP monitored approximately 20 percent of all bottom trawl trips. This data set was not used since the entire fleet was not observed, and it is not possible to assess the number of interactions that occurred at fine spatial scales. There was no observer program prior to 2002; therefore, we do not have any interaction estimates prior to 2002. EFHCAs were established in 2006, and the trawl RCA was established in 2003; therefore, there are limited amounts of observer data from these areas prior to their closure. This protected species analysis used the 2011 to 2014 period when the fishery was observed at 100 percent to develop a spatial analysis of observed protected species impacts. See Appendix C for a description of the data selection process. Some information from 2015 was used to examine trends in the number of species encountered; however, these data were not spatially analyzed. This analysis does not use data from 2016 to 2017 because the data were not yet available when we began this analysis.

In 2015, qualified vessels could choose EM rather than observers. NMFS placed observers on EM vessels to sample at least 20 to 30 percent of all EM trips and will continue to sample at this rate to observe protected species impacts and to collect other scientific information. Under the EM program, NMFS will continue to provide an annual estimate for protected species interactions based on data WCGOP observers collect, but NMFS may also use other sources, as necessary and appropriate, to create estimates. NMFS will continue to require fishermen to report interactions in their logbooks and may crosscheck logbooks with video for potential large marine mammal interactions and other identifiable interactions. Implementation of the action alternatives in this document would not change the EM program or NMFS' plans to observe EM vessels.

An interaction occurring in the past for a particular area does not mean it may happen again with certainty in the same area. We cannot examine the dataset by species to identify areas with consistent interactions because the dataset is from a short period. This makes it challenging to speculate on expected interactions in each area under the proposals. Instead, we rely on the location of individual species, the number of interactions observed, and interaction trends to discuss qualitative future impacts under each alternative.

4.1.5 Analytical Levels

The Project Team conducted a multi-level analysis of the EFHCA and trawl RCA alternatives. There are five levels of analysis for each alternative: 1) by the net effects of the alternatives (alternative-wide), 2) on a state-by-state basis, 3) by latitudinal areas and depth zones, 4) by each port or port group, and 5) by the individual polygons in the alternative. They are described in greater detail below.

The higher-level analyses sum comparable metrics for the individual polygons across the appropriate level. The net effect of the alternative on the habitat, but not economic or other metrics, was calculated. Net change in environmental protection was calculated as "areas closed minus areas reopened." Positive values indicate a net increase in habitat protections, and negative values indicate a net decrease in habitat protections. We did not calculate the net effects on the economic metrics, because the difference in time periods and associated fisheries would make those metrics inappropriate to compare.

4.1.5.1 Alternative-wide Analysis

The alternative-wide analysis summarizes data (when available) and impacts of all polygons in the proposed alternative. This is a big picture analysis that broadly describes how each alternative would impact environmental and economic resources and how it was used to conduct a relative comparison of the overall effects of the alternatives.

4.1.5.2 State-by-state Analysis

To evaluate impacts on individual states, the economic metrics have been summarized by state. There is some overlap between state boundaries and port groups, and landings into a particular state do not necessarily mean that the fishing occurred off that state. However, we provide total landings and revenue by state to illustrate the impacts on an individual state.

4.1.5.3 Geographic Break Analysis (Latitudinal Zones/Depth Zones)

This analysis divides the West Coast into five latitudinal zones and four depth zones, for a total of 20 separate latitudinal/depth zones (Figure 4-2). The latitudinal zones are based on existing latitudinal breaks the Council currently uses. The depth zones are based on the April 2015 recommendations by the Groundfish Management Team (GMT), and they are the same as the trawl RCA BACs described under Alternative 2.c. This analysis sums the individual metrics within each latitudinal zone and depth zone to illustrate the spatial distribution of the changes made by each alternative.

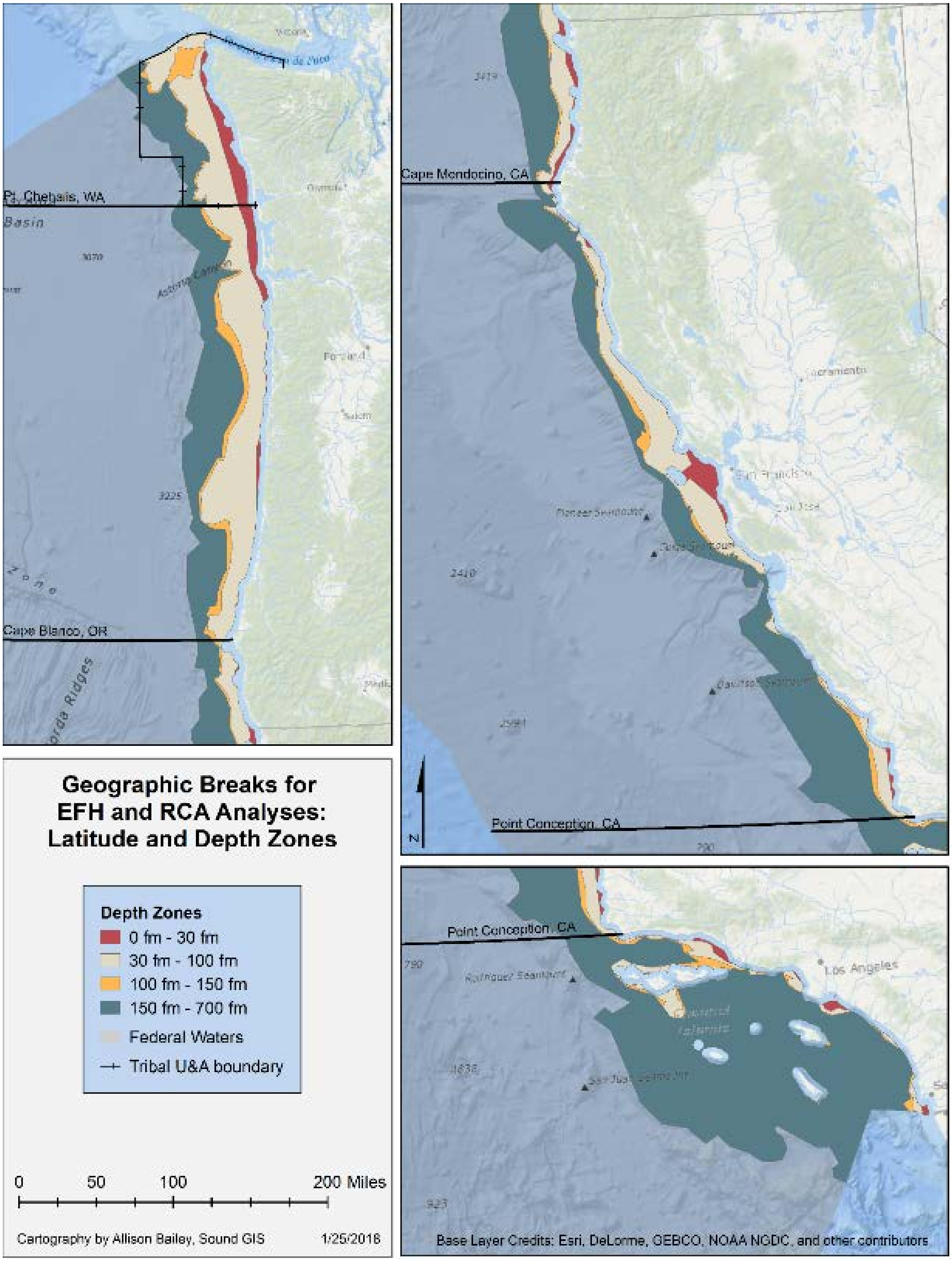

Figure 4-2. Latitudinal breaks and depth zones used in the analysis.

Latitudinal Zones

- United States/Canada Border-Point Chehalis (CFPC)
- Point Chehalis-Cape Blanco (PCCB)
- Cape Blanco-Cape Mendocino (CBCM)
- Cape Mendocino-Point Conception (CMPC)
- Point Conception-United States/Mexico Border (PCUSMB)

Depth Zones[20]

- State waters boundary to 30 fm (Nearshore)
- 30 fm to 100 fm (Shelf)
- 100 fm to 150 fm (Slope)
- 150 fm to 700 fm (Slope)

4.1.5.4 Port/Port Group Analysis

This analysis summed the economic metrics attributed to each port or port group across each alternative to show how the economic effects would be distributed across the West Coast's fishing communities. As described in Section 4.1.4.1, we used the list of port groups (Figure 4-3) and ports (Table 4-1) in Leonard et al. (2011).

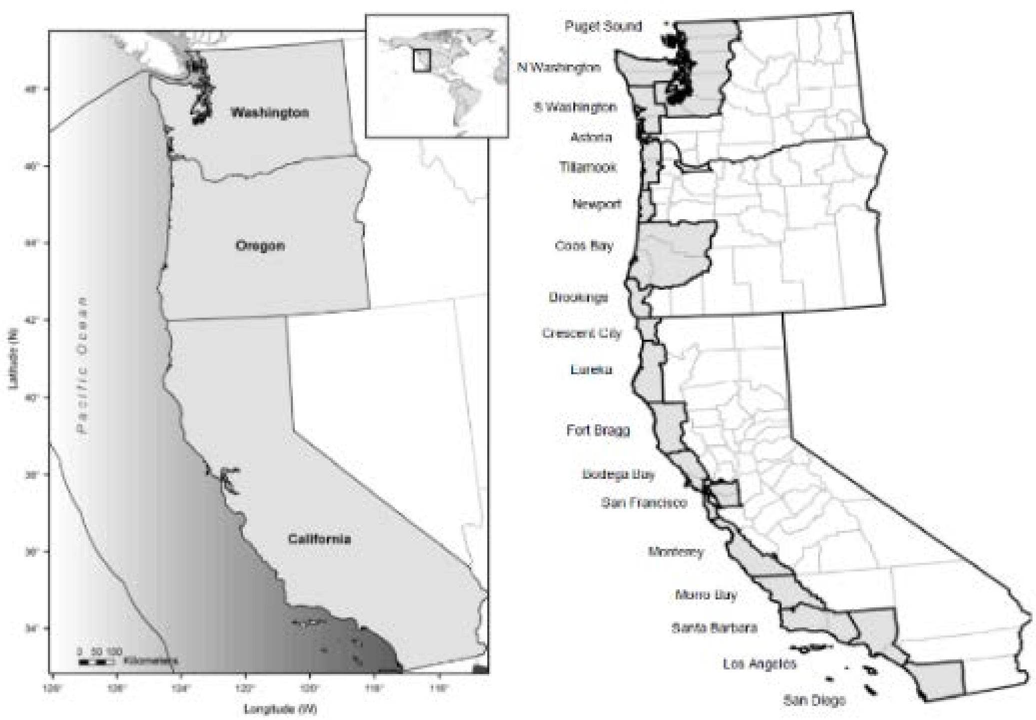

Figure 4-3. Port groups used in the economic analysis (from Leonard et al. 2011)

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[18] Areas within these depth contours that occur in state waters are excluded from analysis. Other than in Washington State, the 30 fm line is frequently within state waters, and the 100 fm and 150 fm lines occasionally cross into state waters, particularly in California.

Table 4-1. Port groups and ports used in analyzing effects of the action alternatives on economic resources (from Leonard et al. 2011).

State	IO-PAC Port Group	Port name
California	Bodega Bay	Bodega Bay
		Point Reyes
		Sausalito
		Tomales Bay
		Other Sonoma, Marin County outer coast ports
	Crescent City	Crescent City
	Eureka	Eureka
		Fields Landing
		Other Humboldt County ports
		Trinidad
	Fort Bragg	Albion
		Point Arena
		Fort Bragg
		Other Mendocino County ports
	Los Angeles	Dana Point
		Long Beach
		Newport Beach
		Other Los Angeles, Orange County ports
		San Pedro
		Terminal Island
		Wilmington
	Monterey	Santa Cruz
		Monterey
		Moss Landing
		Other Santa Cruz, Monterey County ports
	Morro Bay	Avila
		Morro Bay
		Other San Luis Obispo County ports
	San Diego	Oceanside
		Other San Diego County ports
		San Diego
	San Francisco	Alameda
		Berkeley
		Oakland
		Other San Francisco Bay, San Mateo County ports
		Princeton/Half Moon Bay
		Richmond
		San Francisco

Table 4-1. Port groups and ports used in analyzing effects of the action alternatives on economic resources (from Leonard et al. 2011) (continued)

State	IO-PAC Port Group	Port name
	Santa Barbara	Port Hueneme
		Other Santa Barbara, Ventura County ports
		Oxnard
		Santa Barbara
		Ventura
Oregon	Astoria	Astoria
		Cannon Beach
		Pseudo port code for Columbia River
		Gearhart/Seaside
	Tillamook	Nehalem Bay
		Netarts Bay
		Pacific City
		Tillamook/Garibaldi
	Brookings	Brookings
		Gold Beach
		Port Orford
	Columbia River	Columbia River pseudo port code
	Coos Bay	Bandon
		Charleston (Coos Bay)
		Florence
		Winchester Bay
	Newport	Depoe Bay
		Newport
		Waldport
Washington	North Washington coast	La Push
		Neah Bay
		Port Angeles
		Sequim
		Port Townsend
	Puget Sound	Anacortes
		Bellingham Bay
		Blaine
		Everett
		Friday Harbor
		La Conner
		Olympia
		Other north Puget Sound ports
		Seattle
		Shelton

Table 4-1. Port groups and ports used in analyzing effects of the action alternatives on economic resources (from Leonard et al. 2011) (continued)

State	IO-PAC Port Group	Port name
		Tacoma
	South and central Washington coast	Copalis Beach
		Grays Harbor
		Ilwaco/Chinook
		Other Columbia River ports
		Willapa Bay
		Westport

4.1.5.5 Polygon Analysis

This analysis presents the metrics, individually, for each polygon in each alternative. This analysis allows comparison of the impacts of the individual polygons within and between alternatives.

4.2 Analysis of Alternatives by Resources

The sections below contain descriptions of the effects of the alternatives on habitat, fish resources, protected resources, economic resources.

4.2.1 Habitat Analysis

This section presents the alternative-wide analyses of the effects of each alternative on benthic habitats. See Appendix A for the analyses by geographic breaks and polygons.

4.2.1.1 No-action Alternative

The No-action Alternative would maintain the current configuration of bottom trawl closures on the West Coast, as described in Section 2.1. These BTCs include the EFHCAs and GCAs. We analyzed the metrics of the No-action Alternative on habitat to evaluate the effects of maintaining the status quo and to serve as a benchmark for understanding the effects of the other alternatives.

The current commercial groundfish BTCs consist of the EFHCAs established by Amendment 19, the trawl RCA, the CCA, and the CBGCA (Figure 2-4).

Table 4-2 shows the habitat metrics for the No-action Alternative, and it identifies areas that are EFHCA-only, trawl RCA-only, CCA-only, as well as areas where two or more BTCs overlap. As described in Section 2.1, the No-action alternative would exclude all EFHCAs seaward of the 700 fm contour, including the "seaward of the 700 fm contour" EFHCA.

The No-action Alternative would maintain the current habitat protections provided by the combined BTCs across a total of 14,715 mi^2. Of this, 4,513 mi^2 is EFHCA-only, 3,485 mi^2 is trawl RCA-only, 4,198 mi^2 is CCA-only, and 2,519 mi^2 is covered by two or more of the BTCs.

As expected by the purpose of the different trawl closures, the largest amount of hard substrate (816 mi^2) and canyon habitat (445 mi^2) is found in the EFHCA-only, while the largest amount of OFS (849 mi^2) is found in the trawl RCA-only.

HFI presence is more or less equally distributed among the EFHCAs and trawl RCA, with lower numbers in the CCA. In contrast, HFI bycatch is more than double in the trawl RCA than in either the EFHCAs or CCA.

Also, as described in Section 2.1, the No-action Alternative would also continue to allow bottom-contact gear in 123,487 mi^2 of waters deeper than 3,500 m. Spatial extent is the only habitat metric available for waters deeper than 3,500 m. There is insufficient information available to assess other habitat metrics for waters deeper than 3,500 m.

Under the No-action Alternative, there would be no change in the current protections for benthic habitats. These protections are provided by the commercial bottom trawl prohibitions established by the four types of BTCs. Bottom trawling has been prohibited in the CCA since 2002, the CBGCA since 2005, and the EFHCA since 2006. Commercial groundfish bottom trawling has been prohibited in the trawl RCA since 2002.

Over the 11 to 17 years that these areas have been closed to bottom trawling, the habitats within them have had an opportunity to recover. The potential for recovery of these habitats, and the speed at which it has occurred, depends on the type of habitat, the degree to which it had been impacted by past trawling, and the conditions of the surrounding areas (i.e., trawled versus untrawled) (Hiddink et al. 2017).

Table 4-2. Habitat metrics for bottom trawl closures shoreward of 700 fm under the No-action Alternative. [21]

Metric					EFHCA-only	RCA-only	CCA-only	Overlap	Total
Spatial extent (mi^2)				mi^2	4,513	3,485	4,198	2,519	14,715
Substrate Type	Hard[a/]			mi^2	816	95	248	171	1,330
				%	18.1	2.7	5.9	6.8	9.0
	Mixed			mi^2	55	102	38	150	345
				%	1.2	2.9	0.9	6.0	2.3
	Soft			mi^2	3,604	3,283	3,912	2,186	12,985
				%	79.8	94.2	93.2	86.8	88.2
	Unknown			mi^2	40	5	0	11	56
				%	0.9	0.1	0.0	0.5	0.4
Priority Habitats	Canyon/Gullies			mi^2	445	188	48	98	779
				%	9.9	5.4	1.1	3.9	5.3
	OFS			mi^2	69	849	-	29	948
				%	1.5	24.4	0.0	1.2	6.4
	Habitat Forming Invertebrates	Presence[b/]	DSC	Count	192	234	124	365	915
			Sponges	Count	352	503	165	409	1,429
			Sea Pens	Count	383	269	32	222	906
		Bycatch[c/]	DSC	Count	1,299	3,536	-	138	4,973
			Sponges	Count	1,332	5,618	-	194	7,144
			Sea Pens	Count	887	4,610	-	201	5,698

[a/] Hard substrate is also a priority habitat.

[b/] Count of 1 kilometer (km) grid cells with presence data in NOAA's DSCRPT coral database

[c/] Count of 0.5 km grid cells that exceed the median bycatch, in kg (kilogram) per km (kg/km) trawled, based on WCGOP bycatch data

[21] BTC = bottom trawl closures, which include EFHCAs, trawl RCA, CCA, and CBGCA. Two or more BTCs indicate overlap of BTCs. All metrics except for spatial extent are estimates based on extrapolated data.

While state-managed pink shrimp trawling is prohibited in the EFHCAs, it is allowed in areas of the trawl RCA that do not overlap with an EFHCA and may be impacting those habitats. Although, as described in Section 4.1.1, it is difficult to determine the amount of past trawl effort in each habitat type, available information allows for a general estimate of the state of recovery for most habitat types. Soft substrates, which make up the vast majority (estimated at up to 88 percent) of the total area closed to bottom trawling, are the most resilient and the fastest to recover, with full recovery possible in as little as one year. Areas of soft substrate where state-managed trawling has not occurred, and HFI are not present, have likely fully recovered from past trawling (NMFS 2013), regardless of the intensity of that trawling. Full recovery is not expected in the areas where state- managed trawling occurs, but the degree of recovery cannot be predicted. Hard and mixed substrates without HFI require approximately 3 years to recover (NMFS 2013), and have, again, likely fully recovered in areas where state-managed trawling is not occurring. The most sensitive types of habitat are those with HFI, and they may require decades to hundreds of years to fully recover from bottom-trawl impacts. Because the closures have been in place less than two decades, it is likely that habitats with HFI have not fully recovered. However, we cannot estimate when full recovery will occur because we do not know the degree to which habitats were impacted by past trawling, which was significantly more intense and used more damaging gears than current fisheries or current state-managed trawling.

The No-action Alternative would continue protections from bottom trawling. This would allow the more sensitive types of habitats in the BTCs (i.e., HFIs) to continue their recovery trajectory.

Over the long term, habitats would likely recover, and ecosystem functions would be expected to improve. Improved ecosystem function could lead to increased biological production, including that of some managed groundfish, relative to the areas that are currently fished. Because most marine species have pelagic eggs and larvae, and many have mobile juveniles and adults, the benefits of increased biological production would not be confined to the closures, but they would be more broadly distributed as these life stages disperse into adjoining areas (Thompson et al., 2017).

The No-action Alternative would also continue to permit the use of bottom-contact fishing gear in waters deeper than 3,500 m. At present, however, there is no fishing with such gear in these waters. This is due to several factors, including the relatively low biomass of fishes, the lack of a market for the fishes that live there, and the depth limitations of the current fishing gear. It is unlikely that any fishery using bottom- contact fishing gear would develop in these waters for the foreseeable future, and the habitats in these areas would remain pristine. Should a fishery develop, however, the impacts on these sensitive habitats would depend on the type of gear used and the location and intensity of the effort. The most damaging of the bottom-contact gear would be bottom trawling, but fixed gear could also impact these habitats if conducted in the areas of HFI. Because we cannot anticipate what type of gear would be used or the location and intensity of the fishing effort, it is not possible to predict impacts on habitat with any certainty.

4.2.1.2 Subject Area 1 Alternatives

Habitat impacts of the Subject Area 1 alternatives are discussed in Sections 4.2.1.2.1 through 4.2.1.2.3. The Subject Area 1 alternatives are compared in Section 4.2.1.2.4.

4.2.1.2.1 Alternative 1.a, the Collaborative Alternative

The alternative-wide habitat metrics for Alternative 1.a, the Collaborative Alternative, are shown in Table 4-3. As described in Section 2.2.1, this alternative would make a number of changes to the current suite of EFHCAs along the West Coast. It would consist of 59 polygons: 43 closures and 16 reopenings.

<u>Change in BTCs (non-overlapping proposed EFHCAs).</u> The Collaborative Alternative would increase the total area of BTCs by 749 mi^2, for a net change of plus 5.2 percent compared to the No-action Alternative. These gains in protections from bottom trawling, relative to the No-action alternative, would be spread across all other habitat metrics, but to varying degrees.

The greatest relative increase in substrate protections would be for mixed substrate (plus 14.7 percent, 51 mi^2), followed by hard substrate (plus 7.4 percent, 97 mi^2). Although soft substrate would show the smallest relative increase (plus 4.7 percent), it would represent the largest portion of the net area closed by this alternative (600 mi^2).

Among the priority habitats, canyons would experience the largest relative increase in protections (plus 27.0 percent, 209 mi^2), and OFS would have the smallest increase (plus 0.9 percent, 9 mi^2). All priority habitats would increase from plus 6.92 percent (sponge presence) to plus 17.4 percent (OFS bycatch).

<u>Changes in total EFHCAs.</u> This alternative would increase EFHCA-specific protections, including those areas that overlap with other BTCs, by 748 mi^2. The habitat metrics, across all habitat types, are similar to those described above when other BTCs are excluded because net changes in the metrics (closed minus reopened) are generally small in the areas that overlap with other BTCs. However, given that the EFHCAs are a subset of the BTCs, the relative percentage increases are generally two or more times greater. For example, the net change in the spatial extent of coastwide BTCs is plus 5.2 percent, while the net increase in the spatial extent of coastwide EFHCAs is plus 12.9 percent.

The closures contained 0.2 percent of the 2011 to 2014 trawl effort. The reopenings contained 0.4 percent of the 1997 to 2001 trawl effort.

Table 4-3. Habitat metrics for Alternative 1.a, the Collaborative Alternative. [22]

Metric					Changes to EFHCAs		Net Change in Total EFHCA	Changes to BTCs		Net Change in total BTCs
					Close	Reopen		Close	Reopen	
Spatial extent				mi^2	994	246	748 12.9%	959	211	749 (5.1%)
Substrate Type	Hard[a/]			mi^2	105 10.5%	5 1.8%	100 11.3%	98 10.3%	1 0.5%	97 7.3%
Substrate Type	Mixed			mi^2	53 5.3%	- 0.0%	53 29.0%	51 5.3%	- 0.0%	51 14.7%
Substrate Type	Soft			mi^2	836 84.2%	241 98.2%	595 12.7%	810 84.5%	210 99.5%	600 4.6%
Substrate Type	Unknown			mi^2	- -	- -	- -	- -	- -	- -
Priority Habitats	Canyon/Gullies			mi^2	255	45	210 42.6%	252	43	209 26.9%
Priority Habitats	OFS			mi^2	14	5	8 8.6%	10	1	9 0.9%
Priority Habitats	Habitat Forming Invertebrates	Presence[b/]	DSC	Count	136	11	125 35.7%	102	6	96 10.5%
Priority Habitats	Habitat Forming Invertebrates	Presence[b/]	Sponges	Count	137	16	121 23.4%	107	8	99 6.9%
Priority Habitats	Habitat Forming Invertebrates	Presence[b/]	Sea Pens	Count	131	42	89 20.2%	109	38	71 7.8%
Priority Habitats	Habitat Forming Invertebrates	Bycatch[c/]	DSC	Count	948	89	859 60.3%	898	34	864 17.4%
Priority Habitats	Habitat Forming Invertebrates	Bycatch[c/]	Sponges	Count	1,041	82	959 63.4%	1,008	74	934 13.1%
Priority Habitats	Habitat Forming Invertebrates	Bycatch[c/]	Sea Pens	Count	707	62	645 58.0%	684	61	623 10.9%

a/ Hard substrate is also a priority habitat

b/ Count of 1-km grid cells with presence data in NOAA's DSCRPT coral database.

c/ Count of 0.5-km grid cells that exceed the median bycatch, in kg/km trawled, based on WCGOP bycatch data.

Alternative 1.a, the Collaborative Alternative, would directly affect habitat along the West Coast by 1) protecting the habitats in the closures from further degradation by bottom trawls and by 2) exposing the habitats that have been recovering since the areas were closed in 2006 to future degradation by commercial bottom trawls in the reopenings. As described above, Alternative 1.a, the Collaborative

[22] The proposed EFHCA changes are shown separate from their contribution to the coastwide BTCs. % Closed and % Reopened = percent of the total EFHCA or BTC closed or reopened by the alternative. Net mi^2 = Closed minus Reopened. % of Net Change is relative to the No-action Alternative EFHCAs and BTCs shoreward of 700 fm. All metrics except for spatial extent are estimates based on extrapolated data.

Alternative, would increase overall benthic habitat protections by 749 mi^2 by closing an additional 959 mi^2 and reopening 211 mi^2 with gains in EFH protections across all the habitat metrics (Table 4-3). The areas to be either closed or reopened would consist, primarily, of soft substrate, the substrate type least sensitive to bottom trawling and fastest to recover.

For all priority habitats except for OFS, the percent increase over current protections would be above 1 percent, with HFI habitats showing the greatest increase. The low extent of the priority habitats that would be reopened by this alternative means that the recovery that has occurred since they were closed in 2006 would remain largely intact, and EFH protections for those habitat types would increase under the closures in this alternative. The Grays Canyon Southern Modification is known to contain methane seep habitats.

The increase in habitat protections are spread across all latitudinal and most depth zones, as well as most of the habitat types within those zones (Appendix A). When areas to be reopened result in net losses of a habitat type in a depth zone, those losses were relatively small compared to the gains of that habitat type in other depth zones and the alternative as a whole.

The net increase in EFH protections across all habitat types would, in the long term, allow the recovery of those habitats and the restoration of ecosystem functions. As a result, biological production, including that of managed groundfish, would likely increase. Because most marine species have pelagic eggs and larvae, and many have mobile juveniles and adults, the benefits of increased biological production would not be confined to the closures, but they would be more broadly distributed as these life stages disperse into adjoining areas (Thompson et al., 2017).

While it is not possible to compare the trawl effort that would be displaced by the closures directly with the effort that might be restored by the reopenings, some general statements can be made about the effects of the Alternative 1.a, Collaborative Alternative, on trawl effort. First, the effort that would be displaced by the closures would represent a very small percentage (0.2 percent) of the 2011 to 2014 effort. This effort occurred in 16 of the 40 proposed closures, and those 16 closures had 0.05 percent or less of the coastwide effort. If this small amount of effort were to shift to other currently open areas or to areas that would be reopened, it would not significantly increase the pressures on benthic habitats, and the negative effects on benthic habitat from this shift in effort would likely be minimal.

Although it is not possible to predict the location or intensity of bottom trawling that would occur in the areas to be reopened, they were identified by the group that submitted the Alternative 1.a, the Collaborative Alternative, as being important historical fishing grounds, and 0.4 percent of the 1997 to 2001 coastwide trawl effort occurred there. Therefore, it is reasonable to assume that those areas will be fished to some extent. However, because the majority of the area is soft substrate (estimated at over 99 percent), which is the most resilient type of habitat, and fishermen generally avoid high-relief areas to protect their gear and to reduce bycatch of some limiting stocks, the negative effects of these reopenings on benthic habitat would likely be minimal.

Overall, Alternative 1.a, the Collaborative Alternative, would result in short- and long-term net benefits for groundfish EFH on the West Coast, as a whole, as well as in most of the geographic breaks. Two geographic breaks would see relatively small decreases in habitat protections: PCCB 100 fm to 150 fm (minus 3 mi^2) and CMPC deeper than 700 fm (minus 10 mi^2). For a comparison of Alternative 1.a, the Collaborative Alternative, with the other action alternatives under Subject Area 1, see Section 4.2.1.2.4.

4.2.1.2.2 Alternative 1.b, the Oceana, et al. Alternative

The alternative-wide habitat metrics for Alternative 1.b, the Oceana, et al. Alternative, are shown in Table 4-4. As described in Section 2.2.2, this alternative would make a number of changes to the current suite of EFHCAs along the West Coast, and it would consist of 68 polygons: 61 closures and 7 reopenings.

<u>Change in BTCs (non-overlapping EFHCAs).</u> This alternative would increase the total area of BTCs by 14,238 mi^2, almost doubling the BTCs under the No-action Alternative (plus 98 percent). These gains in protections from bottom trawling, relative to the No-action Alternative, would be spread across all other habitat metrics, but to varying degrees.

The largest increase in substrate protections would be for soft substrate (13,102 mi^2, plus 101 percent), followed by hard substrate (943 mi^2, plus 71 percent), and mixed substrate (149 mi^2, plus 43.2 percent). All priority habitats would experience gains in protections ranging from a high of plus 108 percent for DSC bycatch (5,383 grid cells) to a low of plus 6 percent for OFS (61 mi^2).

<u>Change in EFHCAs</u>. Alternative 1.b, the Oceana, et al. Alternative, would increase EFHCA-specific protections, including those areas that overlap with other BTCs, by 19,495 mi^2, more than tripling the area of EFHCAs under the No-action Alternative (plus 338 percent). Gains would be made across all habitat metrics.

The greatest increase in substrate protection would be for soft substrate (17,971 mi^2, plus 385 percent), followed by hard substrate (1,270 mi^2, plus 143 percent), and mixed substrate (207 mi^2, plus 113 percent). All priority habitats would experience increases in protections, ranging from a high of plus 428 percent for sponge bycatch (6,470 grid cells) to a low of plus 144 percent for hard substrate (1,270 mi^2).

Table 4-4. Habitat metrics for Alternative 1.b, the Oceana, et al. Alternative. [23]

Metric					Changes to EFHCAs Close	Changes to EFHCAs Reopen	Net Change in Total EFHCA	Changes to BTCs Close	Changes to BTCs Reopen	Net Change in total BTCs
Spatial extent				mi²	19,637	143	19,495 337.7%	14,380	143	14,238 (96.8%)
Substrate Type	Hard[a/]			mi²	1,271 6.5%	0 0.3%	1,270 143.8%	943 6.6%	0 0.3%	943 70.9%
Substrate Type	Mixed			mi²	207 1.1%	- 0.0%	207 113.2%	149 1.0%	- 0.0%	149 43.2%
Substrate Type	Soft			mi²	18,114 92.2%	142 99.7%	17,971 385.2%	13,244 92.1%	142 99.7%	13,102 100.9%
Substrate Type	Unknown			mi²	46 0.0	- -	46 1.1	44 0.0	- -	44 0.8
Priority Habitats	Canyon/Gullies			mi²	889	24	865 175.5%	784	24	760 97.6%
Priority Habitats	OFS			mi²	171	-	171 176.2%	61	-	61 6.4%
Priority Habitats	Habitat Forming Invertebrates	Presence[b/]	DSC	Count	651	4	647 184.9%	369	4	365 39.9%
Priority Habitats	Habitat Forming Invertebrates	Presence[b/]	Sponges	Count	1,400	2	1,398 270.9%	959	2	957 67.0%
Priority Habitats	Habitat Forming Invertebrates	Presence[b/]	Sea Pens	Count	654	13	641 145.4%	484	13	471 52.0%
Priority Habitats	Habitat Forming Invertebrates	Bycatch[c/]	DSC	Count	6,088	6	6,082 426.8%	5,389	6	5,383 108.2%
Priority Habitats	Habitat Forming Invertebrates	Bycatch[c/]	Sponges	Count	6,470	1	6,469 427.8%	4,929	1	4,928 69.0%
Priority Habitats	Habitat Forming Invertebrates	Bycatch[c/]	Sea Pens	Count	4,704	9	4,695 421.8%	3,641	9	3,632 63.7%

a/ Hard substrate is also a priority habitat

b/ Count of 1-km grid cells with presence data in NOAA's DSCRPT coral database.

c/ Count of 0.5-km grid cells that exceed the median bycatch, in kg/km trawled, based on WCGOP bycatch data.

[23] The proposed EFHCA changes are shown separate from their contribution to the coastwide BTCs. % Closed and % Reopened = percent of the total EFHCA or BTC closed or reopened by the alternative. Net mi^2= Closed minus Reopened. % of Net Change is relative to the No-action Alternative EFHCAs and BTCs shoreward of 700 fm. All metrics except for spatial extent are estimates based on extrapolated data.

Trawl Effort. The proposed closures would contain 3.0 percent of the 2011 to 2014 trawl effort, while the reopenings would contain 0.3 percent of the 1997 to 2001 effort.

Alternative 1.b, the Oceana, et al. Alternative, would directly affect habitat along the West Coast by 1) protecting the habitat in the closures from further degradation by bottom trawls and 2) exposing the habitat in the reopenings that has been recovering since the areas were closed to future degradation by commercial bottom trawls in 2006.

As described above, Alternative 1.b, the Oceana, et al. Alternative, would increase overall habitat protections by 14,380 mi^2 through closing 100 times more habitat than it would reopen, with gains in protections across all of the habitat metrics. The areas to be either closed or reopened would consist, primarily, of soft substrate (estimated at 92 percent and 99 percent, respectively), the substrate type that is the least sensitive to bottom trawling and the fasted to recover. For all priority habitat types, the protections would more than double over current protections, with the greatest percent increase among the HFI metrics (estimated at 40 percent to 108 percent). The following EFHCA polygons in Alternative 1.b, Oceana, et al. are known to contain methane seep habitats: Hydrate Ridge; Heceta Bank; and the Southern California Bight. The very low extent of the priority habitats that would be reopened by this alternative would mean that the recovery that has occurred in the EFHCAs would remain largely intact.

The increase in habitat protections would be spread across all latitudinal and most depth zones, as well as most of the habitat types within those zones. The exception would be a small decrease (5 mi^2) in the Cape Mendocino to Point Conception zone at depths greater than 700 fm (Appendix A).

The net increase in EFH protections across all habitat types in most of the latitudinal and depth zones would, in the long term, allow the recovery of those habitats and the restoration of ecosystem functions. As a result, biological production, including that of managed groundfish, would likely increase. Because most marine species have pelagic eggs and larvae, and many have mobile juveniles and adults, the benefits of increased biological production would not be confined to the closures, but they would be more broadly distributed as these life stages would disperse into adjoining areas (Thompson et al., 2017).

While it is not possible to make a direct comparison of the trawl effort that would be displaced by the closures to the effort that may be restored by the reopenings, some general statements can be made about the effects of Alternative 1.b, the Oceana, et al. Alternative, on trawl effort. First, 3 percent of the 2011 to 2014 effort occurred in the areas proposed for closure. This effort occurred in 35 of the 60 proposed closures. The highest effort occurred in the Samoa Reef closure (0.9 percent), with the remaining closures containing less than 0.6 percent each. If this amount of effort were to shift to other currently open areas or to areas that would be reopened, it would not significantly increase the pressures on benthic habitats, and the negative effects on benthic habitat from this shift in effort would likely be minimal.

Although it is impossible to predict the location or intensity of bottom trawling that would occur in the areas to be reopened, the Oceana, et al. Alternative identified them as important historical fishing grounds, and 0.3 percent of the 1997 to 2001 coastwide trawl effort occurred there. Therefore, it is reasonable to assume that those areas would be fished to some extent. However, because 99 percent of the area is soft substrate, which is the most resilient type of habitat, and fishermen generally avoid high-relief areas to protect their gear and reduce the bycatch of some limiting stocks, the negative effects of these reopenings on benthic habitat would likely be minimal.

Overall, Alternative 1.b, the Oceana, et al. Alternative, would result in short- and long-term net benefits, compared to the No-action Alternative, for benthic habitat on the West Coast, as a whole, as well as all geographic breaks shoreward of 700 fm. For a comparison of Alternative 1.b, the Oceana, et al. Alternative, with the other action alternatives under Subject Area 1, see Section 4.2.1.2.4.

4.2.1.2.3 Alternative 1.h, the Preferred Alternative

The alternative-wide habitat metrics for Alternative 1.h, the Preferred Alternative, are shown in Table 4-5. As described in Section 2.2.3, this alternative would make a number of changes to the current suite of EFHCAs along the West Coast. It would consist of 70 polygons: 53 closures and 17 reopenings.

<u>Change in BTCs (non-overlapping proposed EFHCAs).</u> The Preferred Alternative would increase the total area of BTCs by 12,240 mi^2, for a net change of plus 83.2 percent compared to the No-action Alternative. These gains in protections from bottom trawling, relative to the No-action Alternative, would be spread across all other habitat metrics, but to varying degrees. The greatest relative increase in substrate protections would be for soft substrate (plus 88 percent, 11,415 mi^2), followed by hard substrate (plus 53 percent, 710 mi^2) and mixed substrate (plus 21 percent, 71 mi^2).

Among the priority habitats, sponge presence would experience the greatest relative increase in protections (plus 55 percent, 787 grid cells), and OFS would have the smallest increase (plus 1.5 percent, 14 mi^2). All other priority habitats would increase from plus 8.5 percent (sea pen bycatch, 486 cells) to plus 53 percent (hard substrate, 710 mi^2).

<u>Changes in total EFHCAs.</u> This alternative would increase the total area of EFHCA by 17,413 mi^2 (Table 4-5), with the majority of that area (16,183 mi^2) contributed by the Southern California Bight closure (Appendix C, Tables C-2 and C-3). This represents a nearly threefold increase in the area covered by EFHCAs compared to the No-action Alternative. These gains in EFHCAs would be spread across all habitat metrics, but to varying degrees. The largest increase in EFHCA substrate protections is for soft

substrate (15,971 mi^2, plus 342 percent), followed by hard substrate (1,029 mi^2, plus 116 percent), and mixed substrate (121 mi^2, plus 66 percent).

Table 4-5. Habitat metrics for Alternative 1.h, the Preferred Alternative.[24]

Metric					Changes to EFHCAs: Close	Changes to EFHCAs: Reopen	Net Change in Total EFHCA	Changes to BTCs: Close	Changes to BTCs: Reopen	Net Change in total BTCs
Spatial extent				mi^2	17,413	246	17,167 297.3%	12,455	215	12,240 83.2%
Substrate Type	Hard[a/]			mi^2	1,032 5.9%	3 1.2%	1,029 116.4%	712 5.7%	1 0.6%	710 53.4%
Substrate Type	Mixed			mi^2	121 0.7%	- 0.0%	121 66.3%	71 0.6%	- 0.0%	71 20.5%
Substrate Type	Soft			mi^2	16,214 93.1%	243 98.8%	15,971 342.3%	11,629 93.4%	214 99.4%	11,415 87.9%
Substrate Type	Unknown			mi^2	46 0.0	- -	46 1.1	44 0.0	- -	44 0.8
Priority Habitats	Canyon/Gullies			mi^2	516	39	477 96.8%	434	37	397 51.0%
Priority Habitats	OFS			mi^2	41	4	36 37.5%	15	1	14 1.5%
Priority Habitats	Habitat Forming Invertebrates	Presence[b/]	DSC	Count	572	9	563 160.9%	302	5	297 32.5%
Priority Habitats	Habitat Forming Invertebrates	Presence[b/]	Sponges	Count	1,198	14	1,184 229.5%	793	6	787 55.1%
Priority Habitats	Habitat Forming Invertebrates	Presence[b/]	Sea Pens	Count	467	42	425 96.4%	328	38	290 32.0%
Priority Habitats	Habitat Forming Invertebrates	Bycatch[c/]	DSC	Count	779	89	690 48.4%	687	34	653 13.1%
Priority Habitats	Habitat Forming Invertebrates	Bycatch[c/]	Sponges	Count	1,141	61	1,080 71.4%	803	57	746 10.4%
Priority Habitats	Habitat Forming Invertebrates	Bycatch[c/]	Sea Pens	Count	741	40	701 63.0%	526	40	486 8.5%

a/ Hard substrate is also a priority habitat

b/ Count of 1-km grid cells with presence data in NOAA's DSCRPT coral database.

c/ Count of 0.5-km grid cells that exceed the median bycatch, in kg/km trawled, based on WCGOP bycatch data.

Among the priority habitats, sponge presence would experience the largest relative increase (plus 230 percent, 1,184 cells), and OFS would see the smallest increase (plus 37.5 percent, 36 mi^2). All other

[24] The proposed EFHCA changes are shown separate from their contribution to the coastwide BTCs. % Closed and % Reopened = percent of the total EFHCA or BTC closed or reopened by the alternative. Net mi^2 = Closed minus Reopened. % of Net Change is relative to the No-action Alternative EFHCAs and BTCs shoreward of 700 fm. All metrics except for spatial extent are estimates based on extrapolated data.

priority habitats would increase from plus 48 percent (coral bycatch, 690 cells) to plus 161 percent (coral presence). The following EFHCA polygons in Alternative 1.h, the Preferred Alternative are known to contain methane seep habitats: Hydrate Ridge (modified from Alternative 1.b. Oceana, et al.); the Southern California Bight (Alternative 1.b. Oceana, et al.); Heceta Bank (modified from Alternative 1.b Oceana, et al.); and Grays Canyon Southern Modification (1.a. Collaborative)

The closures contained 2.7 percent of the 2011 to 2014 trawl effort. The reopenings contained 3.5 percent of the 1997 to 2001 trawl effort.

This summary focuses on the changes to the coastwide BTCs that would occur under Alternative 1.h, the Preferred Alternative, because changes to the EFHCAs in areas that are closed to bottom trawling for other reasons would not affect overall habitat protections. This alternative would directly affect habitat along the West Coast by 1) protecting the habitat in the closures from further degradation by bottom trawls and by 2) exposing the habitat that has been recovering since the areas were closed in 2006 to future degradation by commercial bottom trawls in the reopenings.

As described above, Alternative 1.h, the Preferred Alternative, would have a net increase in coastwide BTCs of 12,240 mi^2, compared to the No-action Alternative, by closing an additional 12,455 mi^2 and reopening 215 mi^2 to bottom trawling, with gains in habitat protections across all the habitat metrics (Table 4-5). The areas to be either closed or reopened would consist, primarily (estimated at 93 percent and 99 percent respectively), of soft substrate, the substrate type least sensitive to bottom trawling and fastest to recover. Relative increases in priority habitat metrics would range from a high of 55 percent for sponge presence to a low of 1.5 percent for OFS. The low extent of the priority habitats that would be reopened under this alternative would mean that the recovery that has occurred since then would remain largely intact, and EFH protections for those habitat types would increase under the closures in this alternative.

The increase in habitat protections would be spread across all latitudinal and most depth zones, as well as most of the habitat types within those zones (Appendix A). Two depth zones, 100 fm to 150 fm and greater than 700 fm, would each have a net loss in spatial extent, but those losses would be relatively small compared to the gains in other depth zones (minus 2 mi^2 and minus 7 mi^2, respectively).

The net increase in habitat protections across all habitat types would, in the long term, allow the recovery of those habitats and the restoration of ecosystem functions. As a result, biological production, including that of managed groundfish, would likely increase. Because most marine species have pelagic eggs and larvae, and many have mobile juveniles and adults, the benefits of increased biological production would not be confined to the closures, but they would be more broadly distributed as these life stages disperse into adjoining areas (Thompson et al., 2017).

While it is impossible to compare the trawl effort that would be displaced by the closures directly with the effort that may be restored by the reopenings, some general statements can be made about the effects of the Preferred Alternative on trawl effort. First, the effort that would be displaced by the closures would represent a small percentage (3 percent) of the 2011 to 2014 effort. This effort occurred in 15 of the 53 proposed closures, and each of those 15 closures had 0.1 percent or less of the coastwide effort. If this amount of effort were to shift to other currently open areas or to areas that would be reopened, it would not significantly increase the pressures on benthic habitats, and the negative effects on benthic habitat from this shift in effort would likely be minimal. Although it is not possible to predict the location or intensity of bottom trawling that would occur in the areas to be reopened, they were all originally identified by either the Collaborative Alternative (Alternative 1.a, see Section 2.2.4) or the MTC Alternative (Alternative 1.c, see Section 2.2.4) as being important historical fishing grounds, and 3.5 percent of the 1997 to 2001 coastwide trawl effort occurred in those proposed reopenings. Therefore, it is reasonable to assume that those areas would be fished to some extent. However, because 99 percent of the area is soft substrate, which is the most resilient type of habitat, and fishermen generally avoid high-relief areas to protect their gear and to reduce bycatch of some limiting stocks, the negative effects of these reopenings on benthic habitat would likely be minimal.

Overall, Alternative 1.h, the Preferred Alternative, would result in short- and long-term net benefits for groundfish EFH on the West Coast, as a whole, spread across all latitudinal zones and most depth zones. For a comparison of Alternative 1.h, the Preferred Alternative, with the other action alternatives under Subject Area 1, see Section 4.2.1.2.4, below.

4.2.1.2.4 Comparison of Subject Area 1 Alternatives

All three action alternatives would increase habitat protections compared to the No-action Alternative, as described above. Alternative 1.b, Oceana, et al., would provide the greatest increase in protections, followed by Alternative 1.h, the Preferred Alternative. Alternative 1.a, the Collaborative Alternative, would provide the lowest increase in habitat protections. Sections 4.2.1.2.1 through 4.2.1.2.3 describe the changes in the spatial extent of BTCs under each alternative compared to the No-action Alternative.

Table 4-6 compares the net changes to BTCs under the three action alternatives as a ratio of the alternatives with the largest change in total spatial extent of BTCs to those with smaller changes. Alternative 1.b, the Oceana, et al. Alternative, would result in the greatest gains in habitat protection across all habitat metrics compared to the other two alternatives, followed by Alternative 1.h, the EFHCA Preferred Alternative, and Alternative 1.a, the Collaborative Alternative.

The Oceana, et al. Alternative would provide substantially greater benefits for habitat, across all metrics, than would the Alternative 1.a, the Collaborative Alternative. It would close 19 times more area overall to bottom trawling, with 3.6 (Canyons) to 9.7 (hard substrate and sea pen presence) times more of the individual priority habitat types. These differences are, in large part, due to the broader geographic scope of the Oceana, et al. Alternative compared to the Collaborative Alternative. The Oceana et al. Alternative would protect a greater number of documented methane seeps than the other two alternatives. The Preferred Alternative would close a greater number of documented methane seeps than Alternative 1.a, the Collaborative Alternative.

Table 4-6. Relative comparison of the habitat metrics for the Subject Area 1 Alternatives.[25]

Habitat Metrics				Relative Comparison of Net Habitat Metrics (X/Y)			
				X	**1.b Oceana et al.**		**1.h EFHCA Preferred Alternative**
				Y	**1.a Collaborative**	**1.h EFHCA Preferred Alternative**	**1.a Collaborative**
Spatial extent				mi^2	19.0	1.2	16.4
Substrate	Hard			mi^2	9.7	1.3	7.3
Substrate	Mixed			mi^2	2.9	2.1	1.4
Substrate	Soft			mi^2	21.8	1.1	19.0
Priority Habitats	Canyon			mi^2	3.6	1.9	1.9
Priority Habitats	OFS			mi^2	7.0	4.3	1.6
Priority Habitats	Habitat-Forming Invertebrates	Presence	DSC	count	3.8	1.2	3.1
Priority Habitats	Habitat-Forming Invertebrates	Presence	Sponge	count	9.7	1.2	7.9
Priority Habitats	Habitat-Forming Invertebrates	Presence	Sea Pen	count	6.6	1.6	4.1
Priority Habitats	Habitat-Forming Invertebrates	Bycatch	DSC	count	6.2	8.2	0.8
Priority Habitats	Habitat-Forming Invertebrates	Bycatch	Sponge	count	5.3	6.6	0.8
Priority Habitats	Habitat-Forming Invertebrates	Bycatch	Sea Pen	count	5.8	7.5	0.8

[25] See discussion in the habitat impacts sections for each alternative (4.2.1.2.1 through 4.2.1.2.3) to see how the spatial extent and other metrics compare to the No-action Alternative. Values are calculated as X/Y, where X represents the alternative with the greatest increase in overall spatial extent. All metrics except for spatial extent are estimates based on extrapolated data.

Alternative 1.b, the Oceana, et al. Alternative, would provide greater benefits to habitat than would Alternative 1.h, the Preferred Alternative, by closing 1.2 times more area overall to bottom trawling with 1.2 times more (DSC and sponge presence) to 8.2 times more (DSC bycatch) of the individual priority habitat types. The differences between these two alternatives would be much smaller than the differences between Alternative 1.b and Alternative 1.a because Alternative 1.b and Alternative 1.h would both include closures off the coast of Oregon and in the Southern California Bight.

Alternative 1.h, the EFHCA Preferred Alternative, would provide greater benefits to habitat than would Alternative 1.a, the Collaborative Alternative. It would close 16.4 times more area overall to bottom trawling, with increases across most priority habitat types ranging from 1.6 times more (OFS) to 7.9 times more (sponge presence). The gains in all three HFI bycatch metrics would be slightly less for the EFHCA Preferred Alternative (0.8 for each) than for the Collaborative Alternative.

4.2.1.3 Subject Area 2 Alternatives

The two Subject Area 2 alternatives habitat impacts are discussed in Sections 4.2.1.3.1 and 4.2.1.3.2. They are compared in Section 4.2.1.3.3.

4.2.1.3.1 Alternative 2.c., the Remove the Trawl RCA and implement BACs Alternative

As described in Section 2.3.1, this alternative would both eliminate the trawl RCA and establish BACs that could be implemented pre- or in-season to reduce catch of a particular species or species complex, south of Point Chehalis, Washington. BTCs for other purposes (i.e., EFHCAs and CBGCA) that overlap with the trawl RCA would remain in place. Therefore, the habitat metrics for this alternative cover only those areas that do not overlap with other BTCs. Percentages given represent the percent change in coastwide BTCs. As described above, we did not combine the habitat metrics for the elimination of the trawl RCA and the BACs into an alternative wide summary for two reasons: (1) we cannot predict when any of the BACs would be closed or reopened and (2) combining them would represent the entire area shoreward of the 700 fm contour. Instead, this section presents the effects on habitat from eliminating the trawl RCA south of Point Chehalis, Washington (Table 4-7), separately from the effects on habitat from the 20 BACs that were analyzed (Table 4-8).

<u>Eliminate RCA south of Point Chehalis.</u> As described in Section 2.3.1, Alternative 2.c would eliminate the trawl RCA south of the combined tribal U&A. However, BTCs for other purposes (i.e., EFHCAs and CBGCA) that overlap with the trawl RCA would remain in place. Therefore, the habitat metrics for removing the RCA under this alternative would cover only those areas that do not overlap with other BTCs.

This alternative would reopen 2,835 mi^2 to bottom trawling along the West Coast, reducing coastwide BTCs by 19 percent compared to the No-action Alternative. The loss of protection from bottom trawling would be spread across all habitat metrics, but to varying degrees.

The largest reduction, in terms of mi^2, of substrate protections would be for soft substrate (reopen 2,713 mi^2, minus 21 percent), followed by hard substrate (reopen 88 mi^2, minus 6.6 percent), and mixed substrate (reopen 32 mi^2, minus 9.3 percent).

Among priority habitats, reduction in protection would be greatest for OFS (reopen 807 mi^2, minus 85 percent). This is not surprising because the trawl RCA was established to control the bycatch of overfished species, and it contains a large amount of OFS habitat. HFI metrics, across all taxonomic groups, would be reduced by 22 percent (DSC presence, reopen 203 grid cells) to 79 percent (sea pen bycatch, reopen 4,341 grid cells). Approximately 10.8 percent of the coastwide trawl effort occurred there between 1997 and 2001.

Implement BACs south of Point Chehalis. The spatial extent of the individual BACs would vary greatly with depth and latitude. The 150 fm to 700 fm depth zone would have the largest extent, followed by the 30 fm to 100 fm, 100 fm to 150 fm, and 0 fm to 30 fm depth zones.

The spatial extent of the BACs would range in size from less than 1 mi^2 to 17,225 mi^2. Three BACs would have less than 1 mi^2, all in CFPC, due to the exclusion of the combined tribal U&A. The spatial extent of the other BACs would be determined largely by the depth range and slope of the seafloor. Larger depth ranges and shallower slopes result in larger spatial extents.

The amount of each substrate type varies among the BACs, but the general pattern for each type follows the same pattern as seen for spatial extent, with the highest amounts in 150 fm to 700 fm, followed by 30 fm to 100 fm, 100 fm to 150 fm, and 0 fm to 30 fm. Canyon habitat, on the other hand, is most common in the deepest depths, becoming less abundant at shallower depths. OFS habitat is most abundant in depths below 30 fm in all depth zones of PCCB and CBCM. It is minimal in all other BACs.

Alternative 2.c, the Remove the Trawl RCA and Implement BACs Alternative, would directly affect habitat along the West Coast by exposing 2,835 mi^2 along the West Coast from Point Chehalis south to the border with Mexico to commercial groundfish bottom trawling. These areas have been closed to such trawling since 2002 and have had 15 years to recover. The priority habitats in this area would experience a significant reduction in protections from bottom trawling. The relative reduction in protection is especially high for OFS (minus 85 percent), which is not unexpected because the trawl RCA was established to control the bycatch of overfished species and contains a large amount of OFS habitat. HFI would also experience a high coastwide reduction, ranging from 22 percent to 78 percent.

Table 4-7. Habitat metrics for Alternative 2.c, the Remove the trawl RCA and implement BACs south of Point Chehalis, Washington, Alternative. [26]

Metric					Changes to BTCs	% Change to Coastwide BTCs
Spatial extent				mi^2	-2835	-19.3
Substrate Type	Hard[a/]			mi^2	-88	-6.6
	Mixed			mi^2	-32	-9.3
	Soft			mi^2	-2713	-20.9
	Unknown			mi^2	-2	-3.9
Priority Habitats	Canyon/Gullies			mi^2	-132	-16.9
	OFS			mi^2	-807	-85.1
	Habitat Forming Invertebrates	Presence[b/]	DSC	Count	-203	-22.2
			Sponges	Count	-421	-29.5
			Sea Pens	Count	-247	-27.3
		Bycatch[c/]	DSC	Count	-3218	-64.7
			Sponges	Count	-5276	-73.9
			Sea Pens	Count	-4440	-77.9

[a/] Hard substrate is also a priority habitat.
[b/] Count of 1 km grid cells with presence date in NOAA's DSCRPT coral database
[c/] Count of 0.5 km grid cells that exceed the medial bycatch, in kg/km trawled, based on WCGOP bycatch data

[26] % Change = percent change from No-action Alternative in coastwide BTCs. All metrics except for spatial extent are estimates based on extrapolated data.

Table 4-8. Habitat metrics for Alternative 2.c, Remove Trawl RCA and Implement BACs for Groundfish Species and Protected Species. [27]

Latitudinal Zone	Depth Zone	Spatial extent (mi2)	Hard Sub-strate (mi^2) a/	Mixed Sub-strate (mi^2)	Soft Sub-strate (mi^2)	Un-known Sub-strate (mi^2)	Canyon a/	OFS a/	HFI DSC (Presence) a/	HFI Sponge (Presence) a/	HFI Sea Pen (Presence) a/	HFI DSC (Bycatch) a/	HFI Sponge (Bycatch) a/	HFI Sea Pen (Bycatch) a/
Cape Flattery to Point Chehalis	0fm-30fm	0	-	-	0	-	-	-	-	-	-	-	-	-
	30fm-100fm	0	-	-	0	-	-	0	-	-	1	-	-	-
	100fm-150fm	0	-	-	0	-	0	0	1	3	3	-	-	-
	150fm-700fm	281	-	-	281	-	182	7	7	20	10	348	434	179
Point Chehalis to Cape Blanco	0fm-30fm	410	2	1	406	0	-	-	1	1	2	-	-	316
	30fm-100fm	5,217	466	181	4,570	0	9	423	55	191	311	1,220	1,733	17,587
	100fm-150fm	928	19	9	900	-	39	596	22	64	32	1,145	1,798	2,166
	150fm-700fm	5,442	22	322	5,097	0	662	168	213	562	463	30,860	38,580	26,182
Cape Blanco to Cape Mendocino	0fm-30fm	199	0	-	199	-	-	-	1	-	1	-	49	11
	30fm-100fm	1,281	12	0	1,269	-	15	109	9	9	79	749	370	1,934
	100fm-150fm	204	1	-	203	-	27	148	7	15	8	430	166	15
	150fm-700fm	3,162	9	-	3,153	0	867	65	132	211	149	17,340	16,657	6,072

[27] The metrics represent the areas that would be closed to bottom trawling by implementing any of the BACs in this alternative. "-" = true zero; 0 = <1. All metrics except for spatial extent are estimates based on extrapolated data.

Table 4-8. Habitat metrics for Alternative 2.c, Remove Trawl RCA and Implement BACs for Groundfish Species and Protected Species. (continued)

Cape Mendocino to Point Conception	0fm-30fm	458	5	0	453	-	-	-	-	1	7	-	-	101
	30fm-100fm	3,169	84	1	3,084	-	15	1	95	159	434	149	120	1,422
	100fm-150fm	665	25	9	631	-	21	1	101	103	100	203	108	69
	150fm-700fm	8,641	1,002	7	7,583	50	899	11	265	332	600	1,793	2,291	10,310
Point Conception to United States/Mexico Border	0fm-30fm	167	12	0	155	1	0	-	5	4	5	-	-	-
	30fm-100fm	839	59	2	775	3	33	-	129	210	127	-	-	-
	100fm-150fm	447	28	-	417	1	24	-	52	123	45	-	-	-
	150fm-700fm	17,225	870	93	16,230	31	340	-	385	942	281	-	-	-

[a/] Priority habitat.
[b/] Count of 1 km grid cells with presence data in NOAA's DSCRPT coral database
[c/] Count of 0.5 km grid cells that exceed the median bycatch, in kg/km trawled, based on WCGOP bycatch data

Trawling in these areas would certainly degrade benthic habitats, but the extent is unknown. The location and intensity of bottom trawling depends on a variety of factors, including, but not limited to, changes to other fishery management measures (e.g., ACLs, IFQs), market demands for fish, the number of active vessels, and the effort by those vessels. Although neither the location nor the intensity of future bottom trawling can be predicted with any certainty, this alternative is specifically intended to reopen historically important fishing grounds, where more than 10 percent of coastwide effort occurred between 1997 and 2001, to provide additional opportunity to the fishing community. It is, therefore, reasonable to assume that bottom trawling would occur in the area that would be reopened. However, bottom trawling would likely be concentrated over soft substrates, which represent 96 percent of the area to be reopened, and are the least sensitive to, and the fastest to recover from, bottom trawling compared to hard and mixed substrates. This would not rule out trawling occurring over the more sensitive hard and mixed substrates, canyons, or areas with HFI taxa; it would only mean that those areas would make up a relatively small proportion of the total trawl RCA. If those habitats were trawled, they would certainly be degraded, but to an unknown degree.

The loss of protections for these habitats may, in the long term, indirectly reduce the ecosystem function that they provide as habitat is degraded by bottom trawling. As described above, the extent to which ecosystem functions would be impacted would depend on the habitat type, location, and intensity of bottom trawling in the reopened area. Although we cannot predict the location and intensity of bottom trawling, it is likely that most of it would occur over soft substrates, the least sensitive to, and fastest recover from, to bottom trawling. Bottom trawling over the more sensitive habitat types (e.g., hard substrate, HFI) would be expected to reduce habitat function over the long term. Because we cannot predict the location or intensity of trawling in the reopened area, we cannot predict the magnitude of any adverse effects on ecosystem function and biological productivity.

This alternative does not provide a schedule or plan for implementing the BACs, but they would be implemented using the process described in Section 2.3.1. Benefits to habitat would accrue if the BACs were implemented on a long-term basis, but not if they were implemented on a short-term basis. Similarly, the benefits would depend on the spatial extent and habitat types in those BACs that are implemented. However, given the uncertainty over which BACs would be implemented and for how long, it is impossible to estimate the effects on habitat of the BACs. In summary, eliminating the trawl RCA would likely result in short- and long-term adverse effects for benthic marine habitats on the West Coast.

4.2.1.3.2 Alternative 2.d, the Preferred Alternative

As described in Section 2.3.2, Alternative 2.d, the RCA Preferred Alternative, would both eliminate the trawl RCA and establish BACs that could be implemented pre- or in-season to reduce catch of a particular species or species complex, south of the border between Washington and Oregon. BTCs for other purposes (i.e., EFHCAs and CBGCA) that overlap with the trawl RCA would remain in place. Therefore, the habitat metrics for this alternative cover only those areas that do not overlap with other BTCs. Percentages given represent the percent change in coastwide BTCs.

As described above, we did not combine the habitat metrics for the elimination of the trawl RCA and the BACs into an alternative-wide summary for two reasons: (1) we cannot predict when any of the BACs would be closed or reopened and (2) combining them would represent the entire area shoreward of the 700 fm contour. Instead, this section presents the effects on habitat from eliminating the RCA off Oregon and California (Table 4-9), separate from the effects on habitat from the 16 BACs analyzed (Table 4-10).

The changes to BTCs from this alternative would be similar to those under Alternative 2.c, as the only difference between them would be that Alternative 2.c would remove the RCA off of Washington (outside the tribal U&A), while this alternative would not. This alternative would reopen 2,739 mi^2 to bottom trawling off the West Coast, reducing coastwide BTCs by 19 percent compared to the No-action Alternative. The loss of protection from bottom trawling would be spread across all habitat metrics, but to varying degrees. The largest reduction in substrate protections would be for soft substrate (reopen 2,617 mi^2, minus 20 percent), followed by hard substrate (reopen 88 mi^2, minus 6.6 percent) and mixed substrate (reopen 32 mi^2, minus 9.3 percent).

Among priority habitats, reduction in protection would be greatest for OFS (reopen 739 mi^2, minus 78 percent). This is not unexpected because the intent of the RCA was to control the bycatch of such species. HFI metrics, across all taxonomic groups, would be reduced by 22 percent (DSC presence, reopen 198 grid cells) to 71 percent (sponge bycatch, reopen 5,037 grid cells). Approximately 10.3 percent of the coastwide trawl effort occurred there between 1997 and 2001.

Table 4-9. Habitat metrics for Alternative 2.d, the RCA Preferred Alternative. [28]

Metric					Changes to BTCs	% Change to Coastwide BTCs
Spatial extent				mi²	-2739	-18.6
Substrate Type	Hard[a/]			mi²	-88	-6.6
	Mixed			mi²	-32	-9.3
	Soft			mi²	-2617	-20.2
	Unknown			mi²	-2	-3.9
Priority Habitats	Canyon/Gullies			mi²	-108	-13.8
	OFS			mi²	-738	-77.9
	Habitat Forming Invertebrates	Presence[b/]	DSC	Count	-198	-21.6
			Sponges	Count	-411	-28.8
			Sea Pens	Count	-241	-26.6
		Bycatch[c/]	DSC	Count	-2995	-60.2
			Sponges	Count	-5035	-70.5
			Sea Pens	Count	-3977	-69.8

[a/] Hard substrate is also a priority habitat.
[b/] Count of 1 km grid cells with presence data in NOAA's DSCRPT coral database
[c/] Count of 0.5 km grid cells that exceed the median bycatch, in kg/km trawled, based on WCGOP bycatch date

[28] %Change = percent change from No-action Alternative in coastwide BTCs. All metrics except for spatial extent are estimates based on extrapolated data.

Table 4-10. Habitat metrics for Alternative 2.d, the RCA Preferred Alternative. [29]

Latitudinal Zone	Depth Zone	Spatial extent (mi2)	Hard Sub-strate (mi^2) a/	Mixed Sub-strate (mi^2)	Soft Sub-strate (mi^2)	Un-known Sub-strate (mi^2)	Canyon a/	OFS a/	HFI DSC (Presence) a/	HFI Sponge (Presence) a/	HFI Sea Pen (Presence) a/	HFI DSC (Bycatch) a/	HFI Sponge (Bycatch) a/	HFI Sea Pen (Bycatch) a/
Point Chehalis to Cape Blanco	0fm-30fm	152	1	1	150	0	-	-	1	1	2	-	-	202
	30fm-100fm	4,509	446	181	3,882	0	0	396	46	179	280	677	1,716	13,244
	100fm-150fm	825	19	9	798	-	15	523	18	57	29	884	1,556	1,664
	150fm-700fm	4,545	22	322	4,201	0	158	123	188	500	399	27,270	35,355	23,123
Cape Blanco to Cape Mendocino	0fm-30fm	199	0	-	199	-	-	-	1	-	1	-	49	11
	30fm-100fm	1,281	12	0	1,269	-	15	109	9	9	79	749	370	1,934
	100fm-150fm	204	1	-	203	-	27	148	7	15	8	430	166	15
	150fm-700fm	3,162	9	-	3,153	0	867	65	133	212	151	17,340	16,657	6,072
Cape Mendocino to Point Conception	0fm-30fm	458	5	0	453	-	-	-	-	1	7	-	-	101
	30fm-100fm	3,169	84	1	3,084	-	15	1	95	159	434	149	120	1,422
	100fm-150fm	665	25	9	631	-	21	1	101	103	100	203	108	69

[29] The metrics represent the areas that would be closed to bottom trawling by implementing any of the BACs in this alternative. "-" = true zero; 0 = <1. All metrics except for spatial extent are estimates based on extrapolated data.

Table 4-10. Habitat metrics for Alternative 2.d, the RCA Preferred Alternative. (continued)

	150fm-700fm	8,641	1,002	7	7,583	50	899	11	265	332	600	1,793	2,291	10,310
Point Conception to United States/Mexico Border	0fm-30fm	167	12	0	155	1	0	-	5	4	5	-	-	-
	30fm-100fm	839	59	2	775	3	33	-	129	210	127	-	-	-
	100fm-150fm	447	28	-	417	1	24	-	52	123	45	-	-	-
	150fm-700fm	17,225	870	93	16,230	31	340	-	385	942	281	-	-	-

[a/] Priority habitat.

The effects on habitat from Alternative 2.d, the Preferred Alternative, would be similar to those described under Alternative 2.c. Alternative 2.c would cover an additional 95 mi^2 off of Washington.

This alternative would directly affect habitat along the West Coast by exposing 2,739 mi^2 from the Washington/Oregon border south to the border with Mexico to commercial groundfish bottom trawling. These areas have been closed to such trawling since 2002 and have had 15 years to recover. The priority habitats in this area would experience a significant reduction in protections from bottom trawling. The relative reduction in protection would be especially high for OFS (minus 78 percent), which is not unexpected because the trawl RCA was established to control the bycatch of overfished species, and it contains a large amount of OFS habitat. HFI would also experience a high coastwide reduction, ranging from 22 percent to 71 percent.

Trawling in these areas would degrade benthic habitats, but the extent is unknown. The location and intensity of bottom trawling depends on a variety of factors, including, but not limited to, changes to other fishery management measures (e.g., ACLs, IFQs), market demands for fish, the number of active vessels, and the effort by those vessels. Although neither the location nor the intensity of future bottom trawling can be predicted with any certainty, this alternative is specifically intended to reopen historically important fishing grounds, where more than 10 percent of the coastwide effort occurred between 1997 and 2001, to provide additional opportunity to the fishing community.

It is, therefore, reasonable to assume that bottom trawling would occur in the area that would be reopened. However, bottom trawling would likely be concentrated over soft substrates, which represents 96 percent of the area to be reopened, and are the least sensitive to, and the fastest to recover from, bottom trawling compared to hard and mixed substrates. This would not rule out trawling occurring over the more sensitive hard and mixed substrates, canyons, or areas with HFI taxa; it would only mean that those areas would make up a relatively small proportion of the total trawl RCA. If those habitats were trawled, they would certainly be degraded, but to an unknown degree.

The loss of protections for these habitats may, in the long term, indirectly reduce the ecosystem function that they provide as habitat is degraded by bottom trawling. As described above, the extent to which ecosystem functions would be impacted would depend on the habitat type and the location and intensity of bottom trawling in the reopened area. Although we cannot predict the location and intensity of bottom trawling, it is likely that most of it would occur over soft substrates, the least sensitive to, and fastest recover from, to bottom trawling. Bottom trawling over the more sensitive habitat types (e.g., hard substrate, HFI) would be expected to reduce habitat function over the long term. Because we cannot predict the location or intensity of trawling in the reopened area, we cannot predict the magnitude of any adverse effects on ecosystem function and biological productivity. In summary, at the alternative-wide scale, eliminating the trawl RCA would likely result in both short- and long-term adverse effects for benthic marine habitats on the West Coast.

4.2.1.3.3 Comparison of Subject Area 2 Alternatives

Both Subject Area 2 action alternatives would decrease BTCs compared to the No-action Alternative. They would, therefore, result in greater risk to habitats in the areas reopened to bottom trawling. Alternative 2.c would decrease the extent of BTCs, compared to the No-action Alternative, to a greater extent than Alternative 2.d.

This section describes the differences resulting from eliminating portions of the RCA between Alternative 2.c and Alternative 2.d. The BACs are not discussed because, as indicated above, there would be too much uncertainty in their implementation. The main difference between the two trawl RCA action alternatives is the geographic range that they would cover. Alternative 2.c would eliminate the trawl RCA and implement BACs south of Point Chehalis, Washington, while Alternative 2.d would eliminate the trawl RCA and implement BACs south of the Washington/Oregon border only.

The habitat metrics for Alternatives 2.c and 2.d are compared in Table 4-11. Alternative 2.c would result in greater risk to habitat because it would cover a larger area. However, the differences are relatively small, with ratios (2.c divided by 2.d) ranging from 1 (exactly the same effect) to 1.23 (larger effect). Therefore, Alternative 2.d would have a marginally lower, but similar, negative impact on benthic habitats.

Table 4-11. Comparison of the habitat metrics from Alternative 2.c, the eliminate RCA and Implement BACs South of Point Chehalis Alternative and 2.d, the RCA Preferred Alternative. [30]

Metric					Alternative 2.c	Alternative 2.d	Ratio (2.c/2.d)
Spatial extent				mi²	-2,835	-2,739	1.04
Substrate Type	Hard[a/]			mi²	-88.2	-88.1	1.00
Substrate Type	Mixed			mi²	-32	-32	1.00
Substrate Type	Soft			mi²	-2,713	-2,617	1.04
Priority Habitats	Canyon/Gullies			mi²	-132	-108	1.23
Priority Habitats	OFS			mi²	-807	-738	1.09
Priority Habitats	Habitat Forming Invertebrates	Presence[b/]	DSC	Count	-203	-198	1.03
Priority Habitats	Habitat Forming Invertebrates	Presence[b/]	Sponges	Count	-421	-411	1.02
Priority Habitats	Habitat Forming Invertebrates	Presence[b/]	Sea Pens	Count	-247	-241	1.02
Priority Habitats	Habitat Forming Invertebrates	Bycatch[c/]	DSC	Count	-3,218	-2,995	1.07
Priority Habitats	Habitat Forming Invertebrates	Bycatch[c/]	Sponges	Count	-5,276	-5,035	1.05
Priority Habitats	Habitat Forming Invertebrates	Bycatch[c/]	Sea Pens	Count	-4,440	-3,977	1.12

[a/] Hard substrate is also a priority habitat.
[b/] Count of 1 km grid cells with presence data in NOAA's DSCRPT coral database
[c/] Count of 0.5 km grid cells that exceed the median bycatch, in kg/km trawled, based on WCGOP bycatch data

[30] All metrics except for spatial extent are estimates based on extrapolated data.

4.2.1.4 Subject Area 3, Alternative 3, Use MSA discretionary authorities to close waters deeper than 3,500 m to bottom contact fishing gear

Alternative 3, the Use MSA discretionary authorities to close waters deeper than 3,500 m to bottom contact gear Alternative, would close the waters seaward of groundfish EFH out to the full extent of the EEZ to all bottom contact gear unless the vessel obtained an EFP. This area is off the coast of California, south of the Mendocino Ridge, and would cover 123,487 mi^2. Because the area covered by this alternative is poorly studied, the data necessary to calculate the other habitat metrics (substrate type, Canyons, OFS, and HFI) were unavailable. However, while the HFI metrics were not calculated for this alternative, the DSCRTP database contains 323 records of DSC, 5,313 records of sponges, and 2,080 records of sea pens in this area (note that a record may contain multiple individuals). Deep-sea benthic habitats are sensitive to disturbance and are slow to recover. Little is known about the types and distributions of benthic habitats in this area, although limited surveys west of Monterey Bay have found sponges and sea pens at depths up to 4,000 m (NOAA Deep-Sea Coral database). This area has never been commercially fished with bottom contact gear under the No-action Alternative; it is, therefore, likely to be in pristine condition.

The lack of commercial bottom fishing under the No-action Alternative is due to several factors, including the relatively low biomass of marketable fishes and invertebrates, the lack of a market for the organisms that live there, and the depth limitations of the current fishing gear. Given these limitations, it is unlikely that a fishery would develop in the foreseeable future under the No-action Alternative. Thus the benefits for habitat under Alternative 3 would be minimal. If a bottom fishery became feasible in the future, however, this alternative’s requirement for an EFP would result in significant benefits to the benthic habitats. The EFP requirement would prevent a commercial fishery from developing before the Council could develop management measures that would conserve the deep-sea habitats upon which the ecosystem depends. These EFPs could protect sensitive, pristine, deep-sea habitats through measures that would put restrictions on the location, timing, or gear used by the prospective EFP fishery.

The deep sea contributes to multiple ecosystem functions. It stores greenhouse gasses, contributes important nutrients to coastal ecosystems via upwelling, and hosts a level of biodiversity rivaling coral reef ecosystems. This alternative uses a precautionary approach to protect these little-known ecosystems from permanent damage of prospective fishing activities.

4.2.2 Socioeconomic Resources

This section describes impacts on the economic and social resources associated with the alternatives under consideration. Economic impacts are measured in terms of landings (round pounds), revenues (inflation-adjusted 2015 United States dollars), and effort (tow duration), which are presented in tables, both as absolute numbers and percentages. The social impacts of a management alternative are primarily assessed in terms of community *Historic Dependence on and Participation* in the fishery. Participation is a measure of the level of fishery engagement (commercial fish landings, permit holdings, and vessel ownership) of a community, relative to the coastwide participation in that fishery. Dependence is a measure of the level of revenue generated from a fishery by a community relative to other fisheries. A qualitative assessment of the social change described by the other four factors of *Size and Demographic Characteristics; Attitudes, Beliefs, and Values; Social Structure and Organization; and Non-economic Social Aspects*, These factors were also considered in the analysis presented below.

Economic impacts flow from the groundfish fishery in the form of personal income to owners of harvester operations, captains and crew, owners of buyers and processors, their employees, and the community as a whole (as these individuals spend and take part in the social lives of their local communities). Suppliers, financers, and other related support industries are also impacted by groundfish fishery activity. Additionally, the products generated by the fishery flow into the fish and protein markets, generating jobs in the marketing chains and nutrition for domestic users. Some product also flows into the export market, affecting the balance of trade and foreign consumers. As with other natural-resource-based jobs such as farming and wood products, declines in personal income and changing job conditions within fisheries affect quality of life and relationships, including individual and family well-being and health (Smith et al. 2003). Numerous studies have shown connections between regulations in fisheries, participant working conditions, and personal relations (e.g., Gien 2000; Pollnac and Poggie 2008; Pollnac et al. 2015, and Smith et al. 2003).

In the following sections, the geographic distribution of recent landings and effort provides an indicator of the level and initial distribution of this activity, assuming that activity under the No-action Alternative would be similar to that which has occurred in the recent past. The fishery continues to evolve as the natural and human system fluctuates. Stocks become rebuilt, changing fishery constraints; landings shift geographic locations as the fishery continues to adjust to the catch share program; changes in global market conditions alter demands for particular species creating or alleviating market constraints to which the fishery responds. The cumulative effects section provides a discussion of expected changes, including regulatory changes, which may alter these conditions in the future, even if no action is taken.

For the No-action Alternative, the port group values are presented as a percentage of coastwide values. For the action alternatives, the port group values are presented as a percentage of the total groundfish bottom trawl landings for that particular port group. This is done to present the data in terms of relevance to each individual port group.

4.2.2.1 No-action Alternative

The No-action Alternative provides a basis for comparison to analyze the effects of the action alternatives. The No-action Alternative is the same as the current conditions. As described in Chapter 3, this section will provide information on the current socioeconomic conditions. The No-action Alternative is described in Section 2.1. Although no changes are proposed for areas inside the tribal U&A, fisheries data are included from those areas because they are part of the coastwide bottom trawl fishery landings, revenues, and effort. Hence, they are used for a comparison to the action alternatives.

Under the No-action Alternative, existing closed areas would primarily affect the nonwhiting shoreside groundfish bottom trawl fishery, since this midwater whiting fishery is not constrained by EFH/RCA closed areas, except in the area south of 40º 10’ N. latitude (where the trawl RCA is closed to midwater trawling). Individual fishing quotas are the main management tool used to limit harvest in the shorebased fishery.

When the IFQ program was implemented as part of the Amendment 20 trawl catch share program in 2011, important changes in the incentive system affected the decisions made regarding operation of individual vessels. This, in turn, altered fishery participants’ perceptions regarding the limitations imposed by the EFH/RCA closed areas. Prior to IFQs, vessels delivering shoreside were held to landing limits for nonwhiting species in the form of bimonthly cumulative limits. When a vessel reached a landing limit for one species, it could continue to fish for other species, discarding those species for which it had reached its limit.

In 2002, the trawl RCA was set to minimize the incidental catch of a number of overfished rockfish species by eliminating fishing in areas where, and at times when, those overfished species would likely co-occur with more healthy target stocks of groundfish. Prior to the catch share program, but without the trawl RCA, trip limit management would have had to become much more restrictive to ensure that discarding species to comply with landing limits was not resulting in mortality exceeding management limits, particularly for overfished species under rebuilding plans. Under this scenario, where landing limits would have been more restrictive, the trawl RCA provided an economic advantage by reducing the risk of a fishery closure caused by incidental catch of overfished species.

Under the IFQ program, vessels are held to catch limits based on their amount of quota. This means they are responsible for each fish they catch, and they can no longer continue fishing once they have reached a limit, or they acquire additional quota. Under such a system, the ability to control the mix of catch became more incentivized, and the trawl RCA is one of the factors that can be used to alter catch mix in the fishing area. With the uncertainty of moving to the catch share program, with a market for quota trading/leasing and individual accountability, the trawl RCA was retained to control the mix of catch and prevent fishery closure because of an extremely high catch of a species with limited quota (i.e., an overfished species).

Since implementation of the catch-share based limits, the shorebased trawl fishery has significantly under-attained its allocations for most species managed with IFQ, except sablefish, petrale sole, and Pacific whiting. This under-attainment has been attributed to numerous possible causes, including market limits, constraining species (limited ability to harvest complexes in which sablefish is caught because of the small amounts of sablefish quota available) and constraints related to pre-catch share regulations that may no longer be needed (e.g., a number gear regulations and area restrictions such as RCAs). This last attribution, that regulatory constraints related to pre-catch share regulations contribute to the fishery not achieving its quota, is a consistent theme raised by fishery participants. The 2014 Pacific Groundfish Fishery Social Study (NMFS 2014) serves as an indicator of the *Attitudes, Beliefs, and Values* of fishery participants. The study found that respondents to the survey felt that the idea of increased accountability, which came with full observer program coverage, negated the need for the trawl RCA. Some respondents also stated that the prospect of removing gear restrictions and area closures had been promised to them as a selling point for catch shares before it was implemented in 2011 (NMFS 2014). With regard to the no-action alternative, maintaining the status-quo could negatively affect the formation of *Attitudes, Beliefs, and Values* towards management of the fishery.

In the absence of any action to reopen or close additional areas to trawl fishing under one of the action alternatives (i.e. the no-action alternative), we expect that changes in the social impact factors of *Size and Demographic Characteristics*, *Social Structure and Organization*, and *Non-economic Social Aspects* would follow recent trends. The 2014 Pacific Groundfish Fishery Social Study (NMFS 2014) follows general themes regarding recent trends in the groundfish fishery following the management change to a catch share program. In that study, the *Size and Demographics* of the groundfish fishery are characterized by fewer new participants entering the fishery because of significant economic barriers to entry and a lack of interest among perspective fishermen, resulting in an aging fishing population. With implementation of the catch share program, the *Social Structure and Organization* of the fishery has continued to change, trending more negative, particularly concerning the relationship between crew and vessel/quota owners, and between vessel operators and buyer/first receivers and processors. Participants in the fishery also identified increased safety, a *Non-economic Social Aspect* of the fishery, as a benefit of the fishery's change to catch shares. Finally, with implementation of the catch share program and the ability to trade or purchase quota, there has been a redistribution of landings, with more effort occurring in association with landings in Oregon ports. With this redistribution of effort, the relative effect of the EFH/RCA closures on different communities has also shifted, resulting a greater level of importance being placed on the trawl RCA off the coast of Oregon, compared to California and Washington.

Existing EFH/RCA closures have also likely impacted intrinsic and ecosystem services values associated with habitat and fish resources. These are discussed further in the general analysis of the action alternatives' (Section 4.2.2.2) closure impacts.

Enforcement and compliance costs are also aspects of the current RCA and EFH closures. Current RCA and EFH boundaries have been designed in consultation with enforcement experts to improve enforceability. Compliance with the closed areas not only includes avoiding fishing within them, but also maintaining continuous transit. RCA incursions and disputes over continuous transit provisions have resulted in court cases and led to a recent vessel movement monitoring rule designed to improve monitoring so that closed areas can be better enforced.

In the following section, quantitative indicators of economic activity associated with the groundfish fishery are provided for historic (1997 to 2001) and recent (2011 to 2014) periods. Data on the earlier period are included because they are used for indicators that inform the analysis of the action alternatives. These indicators are also used to assess a state, or port group's *Historic Dependence on and Participation in* a fishery, either relative to other states and port groups or relative to other species landed. Dependence on and participation in the groundfish fishery help to describe a community's relative vulnerability to changes in groundfish management. Those ports or port groups with a high level of historic participation but a low level of dependence may reflect a fishing community that is diversified and, therefore, somewhat insulated from changes in groundfish management. Alternatively, those communities described by a low level of historic participation, but a high level of dependence may experience a greater risk from management changes.

4.2.2.1.1 Coastwide and State Analysis

Landings

Table 4-12 shows landings (pounds round weight) of aggregated bottom trawl groundfish coastwide and by state during the No-action Alternative reference period, 2011 to 2014. During this period, 153,792,000 pounds were landed for an average of 38,448,000 pounds per year. Oregon had the highest percentage (61.8 percent) of landings, followed by California (25.7 percent) and Washington (12.5 percent).

Revenues

Table 4-5 shows that inflation-adjusted, ex-vessel revenues of aggregated bottom trawl groundfish coastwide were $98,861,000, for an average of $24,715,000 per year. Oregon had the highest percentage of coastwide revenues (58.4 percent), followed by California (29.6 percent) and Washington (12.1 percent).

Effort

During the 2011 to 2014 period, 77 non-tribal vessels participated in the fishery coastwide. Oregon had the most vessels (54), followed by California (35) and Washington (28). Many vessels participate in bottom trawl fisheries off more than one state. Coastwide, there were 146,601 hours of effort during that period, or an annual average of 39,150 hours. Appendix D summarizes bottom trawl effort (hours) during the 2011 to 2014 period by state, latitude zone, and depth zone.

Dependence and Participation

The relative dependence on the bottom trawl sector of the groundfish fishery is represented as the proportion of all fisheries revenue by state that is attributed to the bottom trawl sector of the groundfish fishery. From 2011 to 2014 Oregon was most dependent on groundfish ex-vessel revenue, with roughly 28 percent of the state's fisheries revenue being derived from the groundfish bottom trawl sector. Over the same period, California and Washington each derived 9 percent and 16 percent, respectively, of fisheries revenue from groundfish landings. Coastwide, ex-vessel groundfish landings account for 16 percent of the revenue generated from fisheries landings.

4.2.2.1.2 Port Group Analysis

Table 4-12 shows total landings and inflation-adjusted ex-vessel revenues of bottom trawl groundfish by port group during the No-action Alternative reference period, 2011 to 2014.

Landings

Table 4-12 shows that the Astoria port group landed the largest portion of coastwide aggregated groundfish bottom trawl landings (round weight) from 2011 to 2014, followed by Eureka, Coos Bay, Fort Bragg, Newport, and Brookings. All other port groups received less than 6 percent (10 million pounds) of landings during the period.

Revenue

Table 4-12 shows the greatest portion of inflation-adjusted ex-vessel value from aggregated groundfish landings was also in the Astoria port group from 2011 to 2014, followed by Eureka, Coos Bay, Fort Bragg, Newport, and Brookings. All other port groups received less than 5 percent ($4 million) of coastwide ex-vessel revenue during the period.

Table 4-12. No-action Alternative: Aggregated bottom trawl groundfish species landings and revenue coastwide, by state, and by port group; totals from 2011 to 2014.

Port Group	Landings (Thousand pounds)	Percent of Coastwide Non-whiting Groundfish Landings	Infl-adj. Ex-vessel Revenue ($000, 2015)	Percent of Coastwide Non-whiting Groundfish Revenue
North WA coast	6,971	4.5%	4,223	4.3%
Puget Sound	3,506	2.3%	2,020	2.0%
South and Central WA coast	8,763	5.7%	5,673	5.7%
Washington Total	**19,240**	**12.5%**	**11,916**	**12.1%**
Astoria	58,422	38.0%	32,811	33.2%
Newport	10,920	7.1%	7,755	7.8%
Coos Bay	15,516	10.1%	10,186	10.3%
Brookings	10,173	6.6%	6,963	7.0%
Oregon Total	**95,032**	**61.8%**	**57,715**	**58.4%**
Crescent City	1,125	0.7%	720	0.7%
Eureka	18,238	11.9%	12,988	13.1%
Fort Bragg	11,666	7.6%	8,963	9.1%
San Francisco	2,638	1.7%	1,953	2.0%
Monterey	3,213	2.1%	2,406	2.4%
Morro Bay	2,641	1.7%	2,200	2.2%
California Total	**39,520**	**25.7%**	**29,230**	**29.6%**
Coastwide Total	**153,792**	**100%**	**98,861**	**100%**

Dependence and Participation

Based on the historic groundfish landings reported in the Status of the Pacific Coast Groundfish Fishery; SAFE report (Council 2018) the port group with the highest dependence on groundfish ex-vessel revenue from 2011 to 2014 is Morro Bay, California, where more than half (54 percent) of the total ex-vessel revenue in the port came from landing groundfish species (including whiting). During the same period, the ports of Astoria, North Washington coast, Newport, Fort Bragg, and Brookings were most reliant on groundfish revenues, with each depending on groundfish ex-vessel revenue in excess of 25 percent. Participation, or the engagement of a port in the groundfish fishery, is expressed as the proportion of a port's ex-vessel groundfish revenue relative to the total coastwide groundfish revenue. Those ports most engaged, with the highest level of participation in the groundfish fishery are Astoria (23 percent), Newport (18 percent), South and Central Washington Coast (15 percent), Coos Bay (6 percent), and Morro Bay (6 percent). Combined, these ports generated 68 percent of the coastwide groundfish ex-vessel revenue from 2011 to 2014.

4.2.2.1.3 Alternative-wide Net Effects

Selection of the No-action Alternative would result in a status quo configuration of open and closed areas. The general patterns and the nature of impacts resulting from bottom trawl fishing would likely stay generally similar to recent years in terms of landings, ex-vessel revenues, and effort. However, external forces such as market demand, regulatory changes, and weather largely drive fishing behavior such as target strategies and timing. These factors could result in changes to landings, revenues, and effort, but those changes and any resulting impacts would not result from selecting the No-action Alternative.

4.2.2.2 Action Alternatives: General Qualitative Analysis

All of the action alternatives would involve some combination of opening areas currently closed and/or closing areas currently open. Most of these would likely result in some spatial shift or change in level of fishing effort using bottom trawl gear, except Alternative 3, which would close deep areas in which there currently is no active bottom trawl fishing. Additionally, the use of midwater trawl within the area of the trawl RCA may also be impacted under Subject Area 2 alternatives (midwater trawl is prohibited within the trawl RCA during certain times and areas; see Table 2-2).

A general qualitative analysis of the action alternatives is provided below. The following sections on each action alternative contain summaries of the qualitative analysis. They also provide a description of quantitative indicators that further inform the qualitative analysis and help distinguish likely impacts among the alternatives.

Economic impacts flow from the groundfish fishery in the form of personal income and changes in employment conditions (as discussed for the No-action Alternative). Affected groups include suppliers, financers, participants in marketing channels, and domestic and foreign consumers. The social impacts attributed to changes in management of the groundfish fishery are influenced by the income and characteristics of jobs in the fishery which, in turn, affect the quality of lives and relations among these individuals and groups. Additionally, intrinsic and ecosystem service values may also be impacted by the action alternatives. The effects of the action alternatives on these aspects of the human environment will depend on incremental changes in fishermen’s behaviors in response to changes in fishing opportunities posed by each to the alternatives.

When fishing areas are opened or closed, economic conditions and the social impact factors influenced by changes in income may be impacted through a number of mechanisms. Net harvesting revenue is a function of a number of interrelated factors. These factors include effort, quantities caught, fishing costs, and ex-vessel prices. As areas open and close, the amount and location of effort will be determined by how the factors in this array vary by area and by fishermen’s preferences for the mix offered by different fishing areas. Quantities caught are affected by CPUE and the mix of species, both of which may vary by fishing area. Fishing costs vary with CPUE, quantities caught, and time and distance traveled to the fishing area. Similarly, ex-vessel prices may be impacted by the size and quality of fish, as well as the species mixes, all of which may vary by fishing area. The degree of economic and social impact depends on the adjustments that vessels make in response to openings and closures, as well as the net differences between the array of factors for the previous fishing grounds and the array of factors for the new fishing areas.

Direct impacts of the action alternatives, e.g., changes in distance to and location of grounds and vessel net revenue, in turn, impact economic and social factors such as personal income, job conditions, social relations, and safety. If the action alternatives were to change personal income, a corresponding impact on *Social Structure and Organization* would be expected, where increased personal income may alleviate stress in families, but reductions in income may increase such stresses (Gien 2000; Polnac and Poggie 2008; Polnac et al. 2015 and, Smith et al. 2003). While increased travel time to fishing grounds affects vessel net revenue through factors such as additional payments required for fuel and observers, it also affects the *Non-Economic Social Aspects* of the fishery through changes in crew members' lifestyles from lost opportunities to use their time in other pursuits. The changes in the *Non-economic Social Aspects* of the fishery also affect the community, as fishermen may be forced to spend more time apart from friends and families. Greater distances to fishing grounds also impact the *Non-economic Social Aspect* of safety by increasing the number of hours spent at sea, providing more opportunity for unexpected weather and adverse sea conditions to arise during transit. Additionally, closed areas might increase the time a vessel spends searching for fishable aggregations of fish which in turn can exacerbate crew fatigue (e.g., Dyer 2000; Windle et al. 2008). The differences between the alternatives in terms of their possible effects on vessel safety would likely be negligible. Any proposed differences between the alternatives potentially pushing vessels to fish in much deeper waters or much closer to shore, would be minimal.

Extensive closed areas also require vessels to act to comply, including dealing with other regulatory complexities such as continuous transit rules. These rules impinge on vessel operations, including creating uncertainty about thresholds for altering courses when weather and sea conditions arise that might justify such changes for safety reasons. Enforcement of closed areas and continuous transit rules are also a burden on enforcement resources that may be impacted by changes to the extent and shape of the closed area boundaries. In general, the boundaries included in the alternatives have been developed in consultation with enforcement consultants' expertise to optimize enforceability.

With respect to time and distances to the fishing ground, opening or closing areas might increase or decrease the times for some trips, depending on the particular situations and vessel choices. For example, in response to trawl RCA closures, some trips might be made closer to shore (shoreward of the trawl RCA) rather than farther out over the shelf. Alternatively, a vessel might make a trip seaward of the trawl RCA instead of shoreward or travel greater latitudinal distances to reach preferred fishing grounds. Similarly, in response to a closed EFH area, a vessel might travel further to access grounds likely to have a more desirable CPUE and species mix or decide that it is better to spend less time in transit and fish at a higher probability of encountering a lower CPUE or a less desirable species mix.

The foregoing paragraphs list a large number of factors that fishermen running vessels may consider when deciding when, where, and how hard to fish in response to the changed array of opportunities posed by the new set of open and/or closed areas that would be created by the action alternatives. Increasing open areas would likely increase the array and allow vessels to better achieve their economic objectives, while closing areas would reduce the array. Thus, whatever choices a vessel would make, reducing closed areas would provide more optimization opportunities among many considerations, and closing open areas would incrementally reduce some of these opportunities.

While the adjustment that fishermen make would be uncertain, the original closures of the trawl RCA were intended to reduce harvest of shelf species, and they have been effective. It is reasonable to expect that reopening these areas would increase the harvest of at least some shelf species. Whether that increase would be offset by a decline in the harvest of nearshore and slope species would likely depend on available markets and the degree to which species such as sablefish would constrain harvest and would be required to prosecute fisheries in newly opened areas. The impacts of EFH closures on amount harvested would be less certain, since they were not necessarily originally intended to restrict the amounts harvested of any particular species but, rather, to protect certain habitats.

While individual vessels, the broader industry, and communities may well benefit from reducing the extent of closed areas, there would also be some risk that may be entailed with opening the trawl RCAs. As discussed under the No-action Alternative, RCAs originally provided managers with a way to control fishing mortality for overfished species, while allowing as much fishing activity as possible, prior to there being a way to regulate and account for catch on each vessel (when only a vessel’s landings, not total catch, could be monitored and controlled[31]).

Without RCAs, the landing limits used prior to catch shares would have had to be much more restrictive. Once the catch share program went into place (with its catch-based control and at-sea monitoring on every vessel), the trawl RCAs no longer provided that benefit of less restrictive landing limits, but they may have been providing some risk mitigation for the fleet. Under catch shares, if a vessel exceeds its

[31] Scientific observers were sometimes present, but their role was not to monitor a vessel’s catch for compliance with regulations.

quota by an amount sufficient to cause the fleet to exceed its allocation, or an ACL or HG to be exceeded, it may become necessary to close or restrict the fishery before many participants have had a chance to use their quota.

This has been a particular concern for overfished species for which rebuilding plans are in place and allocations are more limited. The RCAs are places where these species are more likely to be encountered. Because amounts of quota for these species have been so small, single large bycatch events exceeding a vessel's quota can potentially put the fleet over its allocation. Therefore, while leaving the trawl RCAs in place has constrained fleet harvest, it may have also provided some protection for the fleet as a whole against an accidental high bycatch event. The degree to which that protection might be useful is uncertain, given the individual incentives the catch share program provides to avoid overfished species. Further, most of the rockfish species that received some protection due to the trawl RCAs have been rebuilt. Now there are only two overfished species of concern, cowcod in the south (for which there are special conservation areas) and yelloweye rockfish coastwide.

Reduction of areas protected from bottom trawling may also impact intrinsic values such as existence values (the values that members of a society place on knowing, for example, that particular areas have been preserved from certain types of human disturbance or that certain species will continue to exist), as well as ecosystem services provided by these areas. On one hand, while existence values for habitat and sensitive organisms within that habitat may be obscure for most individuals, they should not be ruled out for consideration simply because most members of society have relatively little information (Bishop and Welsh 1992) about it. On the other hand, there is a high degree of substitutability in the existence values for environmental goods (Bishop and Welsh 1992), though perhaps not for individual species. Further, quantification of existence value is not provided here for the following reasons:

- There is uncertainty around existence value methodologies.
- Values placed on different marine habitat types and relatively unknown organisms would be difficult to assess.
- The habitats to be opened or closed are generally not pristine, but they have been subject to numerous other fishing and non-fishing human activities.
- The habitats will not be irreparably destroyed by the proposed fishing activity.
- It has not been proposed that the existence of any species in these areas would be endangered by these actions.
- Portions of each habitat type will continue to be protected by some closed areas.
- This analysis is primarily qualitative such that the absence of quantitative information on existence values will not bias the results.

At the same time, there are probably existence values for the habitats and sensitive organisms within these habitats, and a balanced impact evaluation and decision process requires their consideration as part of the trade-offs in decisions to open and close areas.

Another economic consideration is the valuation of ecosystem services. "Ecosystem services are those processes and functions that benefit people, consciously or un-consciously, directly or indirectly. They only exist if they contribute to human wellbeing and cannot be defined independently" (Costanza et al. 2017, p. 3). In their recent review of the history of theory on ecosystem services, Constanza et al. 2017, note the following:

> Even without any subsequent valuation, the very process of listing all the services derived from an ecosystem can help ensure their recognition in public policy. This makes the analysis of ecological systems more transparent and can help inform decision makers of the relative merits of different options. (Costanza et al. 2017, p. 7)

Where valuations can be made, they are useful for decision processes. The following are the categories ecosystem services likely most relevant to this proposed action: disturbance regulation, biological control, refugia, food production, recreation, and cultural services.[32] Among the ecosystem services provided by the habitat protected by closed areas are the commercial and recreational fisheries that must be prosecuted to benefit from those services. This situation illustrates that sometimes a balance must be struck between preserving ecosystem services and the human activities necessary to benefit from them. Part of the balance depends on the degree to which the human activity, in this case fishing, actually diminishes the ecosystem services. One of the concerns for food production and recreational fishing-related ecosystem services would be whether any diminishment of ecosystem resulting from gear impacts on habitat would affect stock productivity or the resilience of the ecosystem in the face of other disturbances.

The impacts of the alternatives on habitat and other species are provided in Section 4.2.1 and Section 4.2.3. In those sections, the first steps toward quantification of the impacts on these services are taken. Information is not available to convert those effects into dollar amounts that could be balanced with other economic effects. However, as noted with respect to existence values, that is not expected to lead to a biased analytical result because it has not been possible to quantify other economic effects. While some

[21] The complete list developed by Constanza et al, also includes gas regulation (e.g., CO_2), climate regulation, water regulation, water supply erosion control, and sediment retention; soil formation; nutrient cycling; waste treatment; pollination; raw materials, and genetic resources.

indicators give a sense of the relative magnitudes of the impacts (including indicators expressed in dollar values), those indicators are not converted to impact estimates and given dollar values.

While the analysis to this point has been qualitative, as mentioned, some quantitative indicators have been developed to help inform the decisions by differentiating the alternatives. The total areas to be opened and closed and the different associated habitat types are relevant to understanding something about the magnitude of the action alternative impacts on vessel choice arrays, existence values, and ecosystem services.

The following sections on each alternative focus on the *Historical Dependence on and Participation in* the fishery by fishermen and communities using recent indicators of the relative importance of various fishing grounds that would be subject to opening or closing under the various alternatives. Due to changing conditions in the fishery, these indicators, expressed mainly as percentages for the action alternatives, only provide a general feel for the potential importance of the fishing area. They should not be taken as predictions of the size of the impacts. The indicators of past importance (recent or historic) of the grounds also do not consider opportunities to adjust by shifting effort elsewhere, nor the many potential impacts of shifting effort and catch that have been discussed in this section. This is particularly true for the pre-catch share indicators (1997 to 2001), given the large number of factors that have changed, including the incentive system under which vessels operate. In the late 1990s, for example, a vessel might fish in an area because of a high CPUE and, without penalty, discard any incidental catch that could not be landed due to regulatory or market restrictions. Under the catch share system, that bycatch counts against the individual’s quota, and catching it could constrain future fishing. Conversely, an area that historically was not fished because of lower CPUE might become a more important fishing ground than indicated by historical data if there is a low frequency of occurrence of a constraining species.

State-managed fisheries (pink shrimp, California halibut, ridgeback prawn, and sea cucumber) may experience some impacts associated with closing or reopening areas, but only associated with proposed changes to EFHCAs. State-managed bottom trawl fisheries would not be impacted by any RCA alternative, because the non-groundfish RCA would restrict them from fishing in the trawl RCA footprint. EFH alternatives may have limited impacts on the pink shrimp, ridgeback prawn, and sea cucumber fisheries, because those fisheries are restricted from fishing inside an EFHCA, and they would, therefore, be able to fish in any EFHCA that is reduced or eliminated. The California halibut bottom trawl fishery has no spatial overlap in areas fished with EFHCA changes and would therefore not be impacted by any EFH alternatives. Therefore, they are not discussed further. See Section 4.1.3.1 for a description of state-managed fisheries.

4.2.2.3 Subject Area 1 Alternatives

4.2.2.4 Alternative 1.a, the Collaborative Alternative

Section 4.2.2.2 provides a general qualitative analysis of the action alternatives. Quantitative indicators related to the bottom trawl fishery are also presented here to help distinguish the alternatives in terms of the likely size of the impact. For the reasons described in Section 4.1, Description of Analytical Approach and Methods, and Section 4.2.2.2, Action Alternatives: General Qualitative Analysis, these values should not be treated as predictions or estimates but simply as measures of the past importance of particular fishing grounds within the context of the conditions of the time. Nonetheless, these values may serve as qualitative indicators of where fishermen may focus future effort. Impacts on state-managed bottom trawl fisheries are discussed in the alternative-wide net effects section.

Alternative 1.a includes a combination of proposed new closures and reopenings. It does not include areas off the central Oregon coast, or areas in the California Bight.

4.2.2.4.1 Coastwide and State Analysis

4.2.2.4.1.1 Proposed Closures

Table 4-13 shows landings and revenues coastwide, by state and by port group. Data cover the years from 2011 to 2014 in areas proposed for closure under Alternative 1.a.

Landings

Areas proposed for closure under this alternative account for less than 0.2 percent of the coastwide landings by weight from 2011 to 2014. Although California has relatively more landings affected than the other two states, the areas proposed for closure under this alternative accounted for less than 0.5 percent of California's landing weight from 2011 to 2014. Washington and Oregon coastwide landings were each less than one-tenth of 1 percent in areas proposed for closure under this alternative.

Revenues

Revenues followed the same pattern as landings, with less than 0.2 percent of coastwide revenues represented by proposed closures under this alternative. California shows the greatest amount of revenues coming from proposed closures, but that was under 0.5 percent of state totals. Washington and Oregon had less than or equal to 0.1 percent of state totals, for proposed closures.

Effort

The areas proposed for closure under Alternative 1.a accounted for 290 trawl hours, or 0.2 percent of coastwide effort. Data used covered 2011 to 2014.

Dependence and Participation

The *Historical Dependence on and Participation* in the fishery by fishermen and a community is reflected by the relative level of revenue generated by fishing effort. Changes to the area management of a fishery can influence communities' participation in a fishery, thereby changing the distribution of revenue generated by landings harvested from that area. A community's fishery dependence provides a measure of resilience to changes experienced by that fishery. The proposed area closures under Alternative 1.a would have minimal impact on fishery participation at the state level. California has the greatest amount of revenues coming from the proposed closures, but the overall expected change is less than 0.5 percent of coastwide ex-vessel revenues. The potential impact of the closure is also mitigated by California's relatively low dependence on groundfish revenues, where about 9 percent of total statewide ex-vessel revenues are generated from groundfish landings.

4.2.2.4.1.2 Proposed Reopenings

Landings

Areas proposed for reopening under this alternative accounted for less than 0.5 percent of coastwide landing weight from 1997 to 2001. California had relatively more areas affected by the proposed reopenings than the other two states, although the areas proposed for reopening under this alternative accounted for approximately 1 percent of California's landing weight from 1997 to 2001. Oregon had 0.2 percent of its revenues, and Washington had 0.02 percent coming from proposed closures under this alternative.

Revenues

Revenues followed the same pattern as landings, with 0.5 percent of coastwide revenues represented by proposed reopenings under this alternative. California showed the greatest amount of revenues coming from proposed reopenings, but that was under 1 percent of state totals. Oregon had 0.2 percent, and Washington had less than 0.1 percent of state totals for proposed reopenings.

Effort

The areas proposed for reopening under Alternative 1.a were associated with 2,650 trawl hours, or 0.4 percent of coastwide effort. Data used covered 1997 to 2001.

Dependence and Participation

The proposed reopening of areas considered under Alternative 1.a would have minimal impact on fishery participation at the state level. Again, California had the greatest amount of revenues coming from the areas proposed to be reopened, but the expected change in revenue amount would amount to less than

1 percent of state totals. The potential benefit of opening the areas under consideration in Alterative 1.a may be further diminished as, during the reference period of 1997 to 2001, all states had a greater level of dependence on the groundfish fishery. For California, with a relatively large *Historical Dependence on and Participation* in the groundfish fishery (18 percent), the potential benefit of opening areas that contributed less than 1 percent of state groundfish revenues 1997 to 2001 is expected to be lower, considering that the state's dependence on groundfish has decreased (9 percent).

4.2.2.4.2 Port Group Analysis

4.2.2.4.2.1 Proposed Closures

Table 4-13 shows landings (round weight) and inflation-adjusted ex-vessel revenues for bottom trawl groundfish by coastwide, by state, and by port group, from 2011 to 2014, in areas proposed for closure.

Table 4-13. Alternative 1.a, the Collaborative Alternative. Closures: landings and revenues coastwide, by state, and by port group from 2011 to 2014 in areas proposed for closure.

Port Group	Landings (Thousand pounds)	Percent of Port Group Non-whiting Groundfish Landings	Infl-adj. Ex-vessel Revenue ($000, 2015)	Percent of Port Group Non-whiting Groundfish Revenue
North WA coast	-	-	-	-
Puget Sound	-	-	-	-
South and Central WA coast	16	0.18%	12	0.20%
Washington Total	**16**	**0.08%**	**12**	**0.10%**
Astoria	60	0.10%	34	0.10%
Newport	-	-	-	-
Coos Bay	-	-	-	-
Brookings	8	0.08%	6	0.09%
Oregon Total	**68**	**0.07%**	**40**	**0.07%**
Crescent City	2	0.20%	2	0.25%
Eureka	141	0.77%	103	0.79%
Fort Bragg	3	0.03%	3	0.03%
San Francisco	12	0.44%	16	0.84%
Monterey	4	0.13%	4	0.18%
Morro Bay	11	0.43%	5	0.22%
California Total	**173**	**0.44%**	**133**	**0.46%**
Coastwide Total	**257**	**0.17%**	**185**	**0.19%**

Landings

Table 4-13 shows landings coastwide, by state and port group, for areas proposed for closure under Alternative 1.a. The data from 2011 to 2014 show that there could be displacement of landings. The Eureka port group would be the most affected by this alternative. However, the displaced landings as a percentage of that port group's groundfish landings would be less than 1 percent. All other port groups would have less than 0.5 percent of landings affected by the proposed closures. It is possible that fishing effort would shift to other areas, including those proposed for reopening, thereby mitigating the impacts of displaced landings from the proposed closed areas.

Revenue

Table 4-13 also shows revenues coastwide, by state and by port group, for areas proposed for closure under Alternative 1.a. The Eureka port group shows the greatest amount of revenue from the proposed closures, but the amount of revenue represents less than 1 percent of the total bottom trawl groundfish landings revenue in this port group from 2011 to 2014. San Francisco shows a higher percentage of affected revenues (0.84 percent), but a smaller absolute amount. All other port groups show less than 0.5 percent of estimated revenues from the proposed closures. It is possible that fishing effort would shift to other areas, including those proposed for reopening, thereby mitigating the impacts of displaced revenues from the proposed closed areas.

Dependence and Participation

As was stated, the Eureka port group shows the greatest amount of revenue generated from groundfish landings caught in the proposed closure areas, but that represents less than 1 percent of the total bottom trawl groundfish landings revenue in this port group from 2011 to 2014. Based on landings from the same time, Eureka has a relatively high dependence on groundfish landings with 17 percent of the port group's ex-vessel revenue coming from groundfish. A high dependence on the revenue generated from groundfish landings may mean that the community's participation in other fisheries is limited and not very diverse. Therefore, the community may be more susceptible to even small reductions in the revenue being generated by groundfish landings. In contrast, although San Francisco shows a higher percentage of affected revenues (0.84 percent) harvested from the areas proposed for closure under Alternative 1.a, the port group is only about 4 percent dependent on the revenue generated by groundfish landings. Communities like San Francisco, with a low dependence on groundfish revenues, may be at a lower risk of social disruption caused by changes in groundfish fishery management.

Proposed Reopenings

Table 4-14 shows landings and inflation-adjusted ex-vessel revenues of non-whiting trawl groundfish by port group that were caught from 1997 to 2001 in areas proposed for reopening.

Table 4-14. Alternative 1.a, the Collaborative Alternative. Reopening; aggregated total bottom trawl groundfish species landings and revenue coastwide, by state, and by port group from 1997 to 2001 in areas proposed for reopening.

Port Group	Landings (Thousand pounds)	Percent of Port Group Non-whiting Groundfish Landings	Infl-adj. Ex-vessel Revenue ($000, 2015)	Percent of Port Group Non-whiting Groundfish Revenue
North WA coast	-	-	-	-
Puget Sound	-	-	-	-
South and Central WA coast	11	0.08%	6	0.07%
Washington Total	**11**	**0.02%**	**6**	**0.02%**
Astoria	231	0.41%	135	0.40%
Newport	-	-	-	-
Coos Bay	38	0.12%	35	0.16%
Brookings	4	0.04%	3	0.04%
Oregon Total	**273**	**0.22%**	**172**	**0.21%**
Crescent City	2	0.01%	1	0.01%
Eureka	51	0.16%	32	0.15%
Fort Bragg	192	0.81%	113	0.72%
San Francisco	178	0.97%	104	0.90%
Monterey	685	4.90%	436	5.23%
Morro Bay	60	0.66%	40	0.66%
California Total	**1,167**	**1.02%**	**727**	**0.95%**
Coastwide Total	**1,451**	**0.50%**	**905**	**0.50%**

Landings

Table 4-14 shows historical landings by port group from areas proposed for reopening under Alternative 1.a. Based on landings from 1997 to 2001, The Monterey port group had the highest proportion (4.9 percent) of its total landings coming from areas proposed to be reopened under this alternative. No other port group had as much as 1 percent of its total landings from areas proposed to be reopened under this alternative.

Revenues

Table 4-14 also shows inflation-adjusted ex-vessel revenues by port group for bottom trawl groundfish that were caught from 1997 to 2001 in areas proposed for reopening. In terms of revenue, the Monterey port group also had the highest proportion (5.2 percent) of its total bottom trawl groundfish ex-vessel revenues coming from areas proposed to be reopened under this alternative. This could mean that the Monterey port group would see increased revenues under this alternative, compared to other port groups, depending on other factors which have changed since the 1997 to 2001 period. No other port group had as much as 1 percent of its total landings revenue from areas proposed to be reopened under this alternative.

Dependence and Participation

During the historic reference period of 1997 to 2001, many of the port groups were much more engaged in, and dependent on, the groundfish fishery. For example, the Monterey port group, contributed 5 percent of the coastwide groundfish revenue and derived 28 percent of its total ex-vessel revenue from groundfish landings during that time. In the more recent reference period, 2011 from 2014, Monterey has participated less in the groundfish fishery, contributing about 2 percent of coastwide groundfish revenue. During that period the Monterey port group was also less dependent on the groundfish fishery, deriving 7 percent of the port group’s total fisheries revenue from groundfish landings. Within this context, a potential increase in Monterey’s total bottom trawl groundfish ex-vessel revenues, as indicated by the historic (1997 to 2001) revenue coming from areas proposed to be reopened under this alternative, while notable, is likely to result in only a marginal increase in the port group’s fishery participation.

4.2.2.4.3 Alternative-wide Net Effects

Closings and openings affect the array of fishing choices available to vessels. This, in turn, impacts business incomes, personal income, quality of life, relations within communities, safety, domestic and foreign consumers, export balances, existence values, and ecosystem service value. Because it is impossible to develop useful predictions of the response that vessels will have to new choice arrays, we cannot produce quantitative estimates of economic impacts. Hence, indicators are presented of the past economic importance of fishing grounds to be opened and closed. Caveats for interpreting this information are presented in the methods section and the section on general qualitative analysis of the action alternatives.

The areas proposed for closure contributed less than 1 percent of port group landings and revenues for every individual port group, less than 0.5 percent of every state’s statewide landings and revenues, and less than 0.2 percent of coastwide landings and revenues during the 2011 to 2014 reference period. The areas proposed for reopening accounted for more than 1 percent of port group landings and revenues for only one California port (Monterey), but only 0.5 percent of coastwide landings and revenues during the 1997 to 2001 reference period.

There may be limited impacts on the state-managed pink shrimp, ridgeback prawn, and sea cucumber fisheries, because those fisheries are restricted from fishing inside EFHCAs. This alternative includes a mix of proposed closures and proposed reopenings. New closures that are currently open to these fisheries would preclude fishing in those areas. However, available data (Section 4.1.5) indicate low levels of fishing activity associated with EFHCAs proposed for modification. Proposed reopenings, if they are in areas not otherwise closed to state-managed bottom trawling, may allow increased access into new fishing grounds. Again, the available data show a low amount of this fishing in areas being considered for modification.

4.2.2.5 Alternative 1.b, the Oceana, et al. Alternative

Section 4.2.2.2 provides a general qualitative analysis of the action alternatives. Quantitative indicators related to the bottom trawl fishery are presented here to help distinguish the alternatives in terms of the likely size of the impact. For the reasons described in Section 4.2, Analysis of Alternatives by Resources, and Section 4.2.2.2, Action Alternatives: General Qualitative Analysis, these values should not be treated as predictions or estimates, but simply as indicators of the past importance of particular fishing grounds within the context of the conditions at the time. Nonetheless, these values may serve as qualitative indicators of where fishermen may focus future effort. Impacts on state-managed bottom trawl fisheries are discussed in the alternative-wide net effects section.

4.2.2.5.1 Coastwide and State Analysis

4.2.2.5.1.1 Proposed Closures

Landings

Table 4-15 shows landings by weight and inflation-adjusted ex-vessel revenues by port group for bottom trawl groundfish caught from 2011 to 2014 in areas proposed for closure. Areas proposed for closure under this alternative accounted for 2.8 percent of coastwide landings by weight from 2011 to 2014. California could be more affected by the proposed closures than the other two states. The areas proposed for closure under this alternative accounted for 8.8 percent of California’s landings from 2011 to 2014. The other two states received no more than 1 percent of statewide landings from areas proposed for closure under this alternative. However, it is unknown whether catch from other areas would compensate for a port’s displaced landings associated with the proposed closures.

Revenues

Table 4-15 shows that areas proposed for closure under this alternative accounted for 3.36 percent of coastwide ex-vessel revenue from 2011 to 2014. California could be more affected by the proposed closures than the other two states. The areas proposed for closure under this alternative accounted for 9 percent of statewide ex-vessel revenue from 2011 to 2014. The other two states received no more than 1 percent of statewide ex-vessel revenue from areas proposed for closure under this alternative. However, it is unknown whether catch from other areas would compensate for a port's displaced revenues associated with the proposed closures.

Effort

Areas proposed for closure under Alternative 1.b had 4,366 trawl hours. This represents 3 percent of coastwide effort recorded from 2011 to 2014.

Dependence and Participation

Taken as a whole, California had a relatively low level of dependence on the groundfish fishery, based on the proportion of total ex-vessel revenue attributed to groundfish landings (9 percent) from 2011 to 2014. During the same time period, California contributed 25 percent of total coastwide groundfish ex-vessel revenue, indicating a moderate level of participation in the fishery. Alternative 1.b would be expected to have a disproportionate effect on California compared to the other states, lowering the expected fishery engagement relative to the state's *Historic Dependence and Participation* in the fishery. The areas proposed for closure under Alternative 1.b accounted for 9 percent of California's ex-vessel revenue and 3.4 percent of coastwide ex-vessel revenue. California communities however, may still be at a lower overall risk from the disruptive effects of the proposed closures, as the state's low dependence on groundfish revenue means that the communities primarily generate fisheries revenue from the landings in other fisheries.

4.2.2.5.2 Proposed Reopenings

Landings

Table 4-16 shows landings by weight and inflation-adjusted ex-vessel revenues by port group for bottom trawl groundfish caught from 1997 to 2001 in areas proposed for reopening under this alternative. Areas proposed for reopening under this alternative accounted for 0.3 percent of coastwide landings and ex-vessel revenue from 1997 to 2001. The areas proposed for reopening under this alternative accounted for less than 1 percent of California's statewide landings and ex-vessel revenue from 1997 to 2001, and there are no proposed reopenings off Oregon or Washington.

Revenues

Table 4-16 shows inflation-adjusted ex-vessel revenues by port group, state, and coastwide, for bottom trawl groundfish caught from 1997 to 2001 in areas proposed for reopening under this alternative. Areas proposed for reopening under this alternative accounted for 0.3 percent of coastwide ex-vessel revenue from 1997 to 2001. The areas proposed for reopening under this alternative accounted for less than 1 percent of California's statewide ex-vessel revenue from 1997 to 2001, and there are no proposed reopenings off Oregon or Washington.

Effort

Areas proposed for reopening under this alternative represent 1,506 trawl hours. This represents 0.25 percent of coastwide effort from 1997 to 2001.

Dependence and Participation

The proposed area openings under Alternative 1.b would be expected to have a slight positive affect on the fishery participation in the state of California, as reflected by the revenue generated by groundfish caught within those areas from 1997 to 2001. However, with a relatively large *Historical Dependence on and Participation in* the groundfish fishery (18 percent), the potential benefit of opening areas that contributed less than 1 percent of state groundfish revenues from 1997 to 2001 would likely be lower today, considering that the state's dependence on groundfish has decreased (9 percent).

4.2.2.5.3 Port Group Analysis

4.2.2.5.3.1 Proposed Closures

Table 4-15 shows landings by weight and inflation-adjusted ex-vessel revenues by port group for bottom trawl groundfish caught from 2011 to 2014 in areas proposed for closure.

Table 4-15. Alternative 1.b, the Oceana, et al. Alternative. Closures; landings and revenues coastwide, by state, and by port group from 2011 to 2014 from catch in areas proposed for closure.

Port Group	Landings (Thousand pounds)	Percent of Port Group Non-whiting Groundfish Landings	Infl-adj. Ex-vessel Revenue ($000, 2015)	Percent of Port Group Non-whiting Groundfish Revenue
North WA coast	-	-	-	-
Puget Sound	-	-	-	-
South and Central WA coast	106	1.21%	100	1.77%
Washington Total	**106**	**0.55%**	**100**	**0.84%**
Astoria	376	0.64%	278	0.85%
Newport	153	1.40%	149	1.92%
Coos Bay	19	0.12%	19	0.18%
Brookings	184	1.81%	133	1.91%
Oregon Total	**732**	**0.77%**	**579**	**1.00%**
Crescent City	3	0.26%	2	0.31%
Eureka	3,083	16.90%	2,338	18.00%
Fort Bragg	301	2.58%	213	2.38%
San Francisco	34	1.29%	38	1.94%
Monterey	2	0.06%	2	0.09%
Morro Bay	51	1.94%	46	2.10%
California Total	**3,474**	**8.79%**	**2,640**	**9.03%**
Coastwide Total	**4,312**	**2.80%**	**3,319**	**3.36%**

Landings

Table 4-15 indicates possible displaced catch by port group for catch that was caught in areas proposed for closure under Alternative 1.b. The Eureka port group shows the largest amount of landings from the proposed closures, more than 3 million pounds (17 percent) of the total bottom trawl groundfish landings in this port group from 2011 to 2014. This represents one-sixth of that port group’s landings from the sector. Most of these impacts are from the Samoa Deepwater site, followed by North Eel River Canyon and Mendocino Ridge Expansion, as shown in (Appendix Table C-2).

The Fort Bragg port group shows the second largest amount of landings from the proposed closures, approximately 300 thousand pounds across all four years, representing 2.6 percent of total non-whiting trawl groundfish landings in this port group from 2011 to 2014, with the bulk of impacts split between the Noyo Canyonhead and the South Delgada Canyonhead (Appendix Table C-2). All other port groups have less than 2 percent of estimated port landings from the proposed closures. In terms of landings, Eureka and Fort Bragg are the port groups that would face the most displaced fishing from the proposed closures under this alternative. For the remaining port groups, areas proposed for closure would represent less than 2 percent of the total bottom trawl groundfish landings in each port group.

Revenues

The Eureka port group could potentially experience the largest amount of revenue change from the proposed closures. The amount of revenue landed from the areas proposed for closure ($2.33 million across all four years) represent 18 percent of total non-whiting trawl groundfish landings revenue in this port group from 2011 to 2014. This represents nearly one-fifth of that port group's revenues from the sector. Depending on the ability to increase effort and catch in open areas, the Fort Bragg port group could potentially lose the second largest amount of revenue from the proposed closures, approximately $213 thousand, representing 2.4 percent of total bottom trawl groundfish landings in this port group from 2011 to 2014. All other port groups showed less than 2 percent of estimated port revenue coming from the proposed closures.

Dependence and Participation

Based on data from the reference period of 2011 to 2014, both the Eureka and Fort Bragg port groups showed the largest amount of revenue generated from groundfish landings caught in the proposed closure areas, with Eureka generating 18 percent and Fort Bragg generating 2.4 percent of groundfish ex-vessel revenue landed in each port from the areas proposed to be closed. For the same time period, the dependence on the groundfish fishery by these two port groups, measured as the proportion of total port ex-vessel revenue coming from groundfish fisheries, was high. Eureka generated 17 percent of ex-vessel revenue from the groundfish fishery, while 27 percent of Fort Bragg's ex-vessel revenue came from groundfish. Given that both port groups have a relatively high level of dependence on the revenue generated from groundfish landings, this may mean that those communities' participation in other fisheries is limited, which may make them less resilient to changes in the management of the fisheries on which they depend.

4.2.2.5.3.2 Proposed Reopenings

Landings

Table 4-16 shows historical landing weights by port group from areas proposed for reopening under Alternative 1.b. Only port groups in California would be affected by the reopenings, because this alternative would not contain any proposed reopenings north of California. The Monterey port group had the highest proportion (685 thousand pounds from 1997 to 2001, 4.9 percent) of its total landings coming from areas proposed to be reopened under this alternative. No other port group had as much as 1 percent of its total historic landings for this period from areas proposed to be reopened under this alternative.

Revenues

Table 4-16 also shows inflation-adjusted ex-vessel revenues by port group for bottom trawl groundfish that were caught from 1997 to 2001 in areas proposed for reopening. In terms of revenue, the Monterey port group also had the highest proportion ($436 thousand from 1997 to 2001, 5.23 percent) of its total non-whiting trawl groundfish ex-vessel revenues coming from areas proposed to be reopened under this alternative. No other port group had as much as 1 percent of its total historic landings revenue for this period from areas proposed to reopen under this alternative.

Table 4-16. Alternative 1.b, the Oceana, et al. Alternative. Reopening; aggregated bottom trawl groundfish species landings and revenues, coastwide, by state and by port group from 1997 to 2001 from catch in areas proposed for reopening.

Port Group	Landings (Thousand pounds)	Percent of Port Group Non-whiting Groundfish Landings	Infl-adj. Ex-vessel Revenue ($000, 2015)	Percent of Port Group Non-whiting Groundfish Revenue
North WA coast	-	-	-	-
Puget Sound	-	-	-	-
South and Central WA coast	-	-	-	-
Washington Total	**-**	**-**	**-**	**-**
Astoria	-	-	-	-
Newport	-	-	-	-
Coos Bay	-	-	-	-
Brookings	-	-	-	-
Oregon Total	**-**	**-**	**-**	**-**
Crescent City	-	-	-	-
Eureka	1	0.00%	0	0.00%
Fort Bragg	48	0.20%	30	0.19%
San Francisco	85	0.46%	45	0.39%
Monterey	685	4.90%	436	5.23%
Morro Bay	60	0.66%	40	0.66%
California Total	**879**	**0.76%**	**551**	**0.72%**
Coastwide Total	**879**	**0.30%**	**551**	**0.30%**

Dependence and Participation

As described in the discussion of the indicators of change in ex-vessel revenue related to Alternative 1.b, the Monterey port group had the highest proportion (5.23 percent) of its total non-whiting trawl groundfish ex-vessel revenues coming from areas proposed to be reopened. The Monterey port group, which had a moderate level of participation in, and a high level of dependence on, the groundfish fishery during the reference period, contributed 5 percent of the coastwide groundfish revenue and derived 28 percent of its total ex-vessel revenue from groundfish landings from 1997 to 2001. In the more recent reference period, 2011 to 2014, Monterey participated in the groundfish fishery less, contributing about 2 percent of the coastwide groundfish revenue, and it has become less dependent on the groundfish fishery, deriving 7 percent of the port group's total fisheries revenue from groundfish landings. With this context, a potential increase in Monterey's total bottom trawl groundfish ex-vessel revenues, as indicated by the historic (1997 to 2001) revenue coming from areas proposed to be reopened, while notable, would likely result in only a marginal increase in the port group's fishery participation.

4.2.2.5.4 Alternative-wide Net Effects

Closings and openings affect the array of fishing choices available to vessels; this, in turn, impacts business incomes, personal income, quality of life, relations within communities, safety, domestic and foreign consumers, export balances, existence values, and ecosystem service value. Because it is impossible to develop useful predictions of the response that vessels will have to new choice arrays, we cannot develop quantitative estimates of economic impacts. Therefore, we present indicators of the past economic importance of fishing grounds to be opened and closed. Caveats for interpreting this information are presented in the methods section and in the section on general qualitative analysis of the action alternatives.

New reopenings may not increase catch if effort simply moves from currently open areas to newly opened areas. On the other hand, new open areas may increase catch if the species mix in the area is such that there is less co-occurrence of constraining species in the catch. Additionally, new open areas may increase net vessel revenue without increasing catch if CPUE is higher (reducing fishing costs), or if travel costs to the area are lower than for other fishing areas. Increases in catch or net revenue would likely increase personal income and local income impacts within communities.

Similarly, new closures may result in a decrease in catch or revenues. Depending on constraining species and the ability of the fleet to access equally productive fishing grounds, the changes could also be neutral.

The areas proposed for closure would likely affect every port group except the North Washington Coast group. Over the recent period, the areas proposed for closure contributed, and could displace, more than

1 percent of port group landings, revenues, and effort in seven port groups. The greatest contributions were to Eureka and Fort Bragg. Therefore, these ports would most likely experience the greatest local negative impacts from area closures and subsequent displacement of effort.

Statewide, more than 8 percent of California landing weights and revenues came from areas proposed for closure. Effects on Washington and Oregon port groups would be relatively minor by comparison, with coastwide landings and revenues from areas proposed for closure only 2.8 percent and 3.4 percent, respectively, of coastwide totals during the 2014 reference period. The areas proposed for reopening provided more than 1 percent of port group landings and revenues for only one California port (Monterey), but less than 1 percent of California statewide landings, and only 0.3 percent of coastwide landings and revenues during the 2001 reference period. This alternative might reduce opportunity somewhat in the active Eureka-Fort Bragg area, and it could provide somewhat increased opportunity associated with the relatively smaller Monterey port group.

This alternative may have limited impact on the state-managed pink shrimp, ridgeback prawn, and sea cucumber fisheries, because those fisheries are restricted from fishing inside EFHCAs. This alternative includes a mix of proposed closures and proposed reopenings. New closures that are currently open to these fisheries would preclude fishing in those areas. However, available data (see Section 4.1.5) indicate low levels of fishing activity associated with EFHCAs proposed for modification. Proposed reopenings in areas not otherwise closed to state-managed bottom trawling may allow increased access into new fishing grounds. Again, the available data show a low amount of this fishing in areas being considered for modification.

4.2.2.6 Alternative 1.h, the Preferred Alternative

Section 4.2.2.2 provides a general qualitative analysis of the action alternatives. Quantitative indicators related to the bottom trawl fishery are presented here to help distinguish the alternatives in terms of the likely size of the impact. For the reasons described in Section 4.2, Analysis of Alternatives by Resources, and Section 4.2.2.2, Action Alternatives: General Qualitative Analysis, these values should not be treated as predictions or estimates, but simply as indicators of the past importance of particular fishing grounds within the context of the conditions at the time. Nonetheless, these values may serve as qualitative indicators of where fishermen may focus future effort. Impacts on state-managed bottom trawl fisheries are discussed in the alternative-wide net effects section.

4.2.2.6.1 Coastwide and State Analysis

4.2.2.6.1.1 Proposed Closures

Landings

Table 4-17 shows that coastwide, 0.26 percent of landings occurred in areas identified for closures under the Final Preferred Alternative 1.h, or 395,000 lbs. This amount includes 0 percent of Washington's non-whiting groundfish landings from 2011 to 2014, 0.06 percent of Oregon's landings, and 0.85 percent of California's landings.

Revenues

Table 4-17 also shows that coastwide, 0.3 percent of ex-vessel revenue from 2011 to 2014 was from catch in areas identified for proposed closures under the Final Preferred Alternative 1.h, or $294,000 in inflation-adjusted dollars. This amount includes 0.01 percent of Washington's non-whiting groundfish revenue from 2011 to 2014, 0.06 percent of Oregon's revenue, and 0.89 percent of California's revenue.

Effort

Areas proposed for closure under Alternative 1.h had 409 trawl hours. This represents 0.3 percent of coastwide effort recorded from 2011 to 2014.

Dependence and Participation

The *Historical Dependence on and Participation* in the groundfish fishery by fishermen and communities is reflected by the level of revenue generated by the groundfish fishery relative to other fisheries and other ports. The proposed area closures under the Preferred Alternative (1.h), are likely to have minimal impact to fishery participation at the state level. California has the greatest amount of revenues coming from the proposed closures, but, overall, the expected change would be less than 0.9 percent of statewide ex-vessel revenues. The potential impact of these closures would also be mitigated by California's relatively low dependence on groundfish revenues, where about 9 percent of total statewide ex-vessel revenues were generated from groundfish landings during 2011 to 2014.

4.2.2.6.1.2 Proposed Reopenings

Landings

Table 4-18 shows that coastwide, 0.57 percent of landings from 1997 to 2001were from catch in areas identified for reopening under the Final Preferred Alternative 1.h, or 1,662,000 lbs. This amount includes 0.01 percent of Washington's non-whiting groundfish landings from 1997 to 2001, 0.2 percent of Oregon's landings, and 1.22 percent of California's landings.

Revenues

Table 4-18 also shows that coastwide, 0.59 percent of ex-vessel revenue from 1997 to 2001 was from catch in areas identified for reopening under the Final Preferred Alternative 1.h, or $1,063,000 in inflation-adjusted dollars. This amount includes 0.01 percent of Washington's non-whiting groundfish revenue from 1997 to 2001, 0.21 percent of Oregon's revenue, and 1.17 percent of California's revenue.

Effort

Areas proposed for reopening under alternative 1.h represent 2,934 trawl hours. This represents 0.5 percent of coastwide effort from 1997 to 2001.

Dependence and Participation

The proposed reopening of areas considered under the Preferred Alternative would likely have minimal impact to fishery participation at the state level. During the early reference period (1997 to 2001) California had the greatest amount of revenues coming from the areas proposed to be reopened with 1.17 percent of the state's groundfish ex-vessel revenue coming from groundfish harvested in those areas. When considering that this revenue was attained during 1997 to 2001 when all states had a greater level of dependence on the groundfish fishery relative to the more recent reference period (2011 to 2014), the potential benefit of opening the areas under consideration in Alterative 1.h would likely diminish. For California, with a relatively large *Historical Dependence on and Participation in* the groundfish fishery (18 percent), the potential benefit of opening areas that contributed about 1.2 percent of state groundfish revenues from 1997 to 2001 would likely be lower, considering that California's dependence on groundfish decreased to 9 percent from 2011 to 2014.

4.2.2.6.2 Port Group Analysis

4.2.2.6.2.1 Proposed Closures

Landings

As Table 4-17 shows, the only port group with greater than one percent of non-whiting groundfish landings that were caught in areas proposed for closure is Eureka, California, which had 1.67 percent, or 305,000 lbs. of landings from 2011 to 2014 in areas proposed for closure. Thus, impacts of proposed closures on landings in most ports, including Eureka, would likely be minimal under this alternative.

Table 4-17. Alternative 1.h, the Preferred Alternative. Closures; aggregated non-whiting trawl groundfish species landings and revenue by port group from catch in areas proposed for closure, 2011 to 2014.

Port Group	Landings (Thousand pounds)	Percent of Port Group Non-whiting Groundfish Landings	Infl-adj. Ex-vessel Revenue [Thousand dollars (2015)]	Percent of Port Group Non-whiting Groundfish Revenue
North Washington coast	-	-	-	-
Puget Sound	-	-	-	-
South and Central Washington coast	1	0.01%	1	0.01%
Washington Total	**1**	**0.00%**	**1**	**0.01%**
Astoria	47	0.08%	27	0.08%
Newport	9	0.09%	6	0.08%
Coos Bay	-	-	-	-
Brookings	-	-	-	-
Oregon Total	**56**	**0.06%**	**33**	**0.06%**
Crescent City	2	0.20%	2	0.25%
Eureka	305	1.67%	229	1.76%
Fort Bragg	3	0.03%	3	0.03%
San Francisco	12	0.44%	17	0.87%
Monterey	4	0.13%	5	0.19%
Morro Bay	11	0.43%	5	0.22%
California Total	**338**	**0.85%**	**260**	**0.89%**
Coastwide Total	**395**	**0.26%**	**294**	**0.30%**

Revenues

As Table 4-17 also shows, the only port group with greater than 1 percent of non-whiting groundfish ex-vessel revenues from areas proposed for closure is Eureka, California, which had 1.76 percent, or $229,000 of non-whiting groundfish revenue from 2011 to 2014 in areas proposed for closure. Thus, impacts of proposed closures on ex-vessel revenues in most ports, including Eureka, would likely be minimal under this alternative.

Dependence and Participation

Based on data from the reference period of 2011 to 2014, the Eureka port group showed the greatest amount of revenue generated from groundfish landings caught in the proposed closure areas with 1.8 percent of groundfish ex-vessel revenue coming from catch in those areas. All other port groups showed potentially affected revenues of less than 1 percent of non-whiting groundfish revenues during 2011 to 2014. For the same time period, the dependence on the groundfish fishery by the Eureka port group was high, generating 17 percent of ex-vessel revenue from the groundfish fishery. Given that this port group has a relatively high level of dependence on groundfish, this community is likely less resilient to changes in the management of the groundfish fishery on which it depends. Even with a relatively high level of dependence on the fishery, however, the small amount of revenue generated from groundfish harvested during the reference period, and from the areas proposed for closure, indicates that the impact of the closures would likely be small.

4.2.2.6.2.2 Proposed Reopenings

Landings

Table 4-18 shows that ports in Washington and Oregon, all with less than 1 percent of 1997 to 2001 non-whiting groundfish landings caught in areas proposed for reopening under this alternative, would not likely experience discernible impacts associated with the action. Fort Bragg, San Francisco, and, particularly, Monterey, California, would be most likely to experience some minor benefit from areas proposed to be reopened with, respectively, 1.49 percent, 1.3 percent, and 4.9 percent of landings from 1997 to 2001.

Table 4-18. Alternative 1.h, the Preferred Alternative. Reopening; aggregated non-whiting trawl groundfish species landings and revenue by port group from catch in areas proposed for opening, 1997 to 2001.

Port Group	Landings (Thousand pounds)	Percent of Port Group Non-whiting Groundfish Landings	Infl-adj. Ex-vessel Revenue [Thousand dollars (2015)]	Percent of Port Group Non-whiting Groundfish Revenue
North Washington coast				
Puget Sound	-	-	-	-
South and Central Washington coast	8	0.05%	3	0.04%
Washington Total	**8**	**0.01%**	**3**	**0.01%**
Astoria	12	0.02%	6	0.02%
Newport	3	0.01%	2	0.01%
Coos Bay	230	0.71%	154	0.72%
Brookings	8	0.08%	6	0.08%
Oregon Total	**254**	**0.20%**	**169**	**0.21%**
Crescent City	2	0.01%	1	0.01%
Eureka	61	0.20%	43	0.20%
Fort Bragg	355	1.49%	212	1.35%
San Francisco	239	1.30%	141	1.23%
Monterey	684	4.90%	452	5.42%
Morro Bay	60	0.66%	41	0.68%
California Total	**1,400**	**1.22%**	**891**	**1.17%**
Coastwide Total	**1,662**	**0.57%**	**1,063**	**0.59%**

Revenues

Table 4-18 also shows that ports in Washington and Oregon, all with less than one percent of 1997 to 2001 non-whiting groundfish ex-vessel revenue taken in areas proposed for reopening, are not likely to experience negative impacts associated with this action. Fort Bragg, San Francisco, and particularly, Monterey, California, would be most likely to experience some minor benefit from areas proposed for reopening with, respectively, 1.35 percent, 1.23 percent, and 5.42 percent of the non-whiting groundfish ex-vessel revenue from 1997 to 2001.

Dependence and Participation

Ex-vessel revenues from groundfish landings during the historic reference period of 1997 to 2001 show that only the California ports of Monterey, Fort Bragg, and San Francisco had any substantial proportion of revenues attributable to harvest from the areas proposed for reopening under the Preferred Alternative. For example, 5.4 percent of Monterey's groundfish revenue came from landings of fish harvested in the areas proposed for reopening. During this period, the Monterey port group contributed 5 percent of the coastwide groundfish revenue and derived 28 percent of its total ex-vessel revenue from groundfish landings. In the more recent reference period, 2011 to 2014, Monterey participated less in the groundfish fishery, contributing about 2 percent coastwide groundfish revenue with about 7 percent of the port group's total fisheries revenue coming from groundfish landings. Within this context of decreasing dependence and participation in the groundfish fishery, the potential for increased revenue and participation in the Monterey port group's bottom trawl groundfish fishery, as indicated by the historic (1997 to 2001) revenue coming from areas proposed to be reopened under this alternative, would likely be small.

4.2.2.7 Comparison of Subject Area 1 Alternatives

All of the action alternatives (1.a, 1.b, and 1.h) include multiple areas proposed for closure, which could have both positive (e.g., increased existence values) and negative (e.g., reductions in landings) socioeconomic impacts, compared to the No-action Alternative. Similar to the spatial extent (square miles) metrics presented for habitat impacts in Section 4.2.1, it is anticipated that the magnitude of socioeconomic impacts (both positive and negative) would be lowest for Alternative 1.a and highest for Alternative 1.b, and Alternative 1.h impacts would be somewhere in between. Closures under these alternatives had more than negligible contributions to the landings and revenues in the context of recent fisheries (2011 to 2014). These three alternatives are described in more detail here. Proposed areas to be reopened under all of the action alternatives cannot be quantitatively compared to the No-action Alternative because the areas to be reopened are closed under the No-action Alternative, so no data exist for the current fishery. Alternatively, proposed areas to be reopened could be considered as making zero contribution to landings and revenues under the No-Action Alternative.

4.2.2.7.1 Proposed Closures

For Alternative 1.a, the Collaborative Alternative, the economic data on catch in areas proposed to be closed suggest that, overall, landings from these areas would make a negligible contribution to harvest from a coastwide and state-by-state perspective. Table 4-13 shows that statewide landings and ex-vessel revenues in Washington, Oregon, and California taken from areas proposed for closure were all less than 1 percent of the total coastwide non-whiting groundfish landings and revenues from 2011 to 2014. The indicators that these grounds have had a negligible contribution to harvest must be balanced with consideration of the benefits from ecosystem services that may be enhanced by these closures and any associated existence values [neither of which can be quantitatively estimated, but which may have some correlation to the total areas of different habitat types closed (see Table 4-19). The closure of areas associated with negligible contributions to harvest would be at least partially offset by these benefits.

For Alternative 1.b, Oceana, et al., the landings and revenue data show somewhat mixed magnitudes of contributions from catch areas proposed for closure, with Washington at less than 1 percent, Oregon at between 1 percent and 5 percent, and California showing values in the 5 percent to 10 percent range, as compared to total statewide groundfish bottom trawl landings and revenues during 2011 to 2014. From a port group perspective, one port group, Eureka, would have areas closed that have made particularly noticeable contributions. Approximately 18 percent of its landings and revenues came from areas proposed for closure under this alternative. Landings delivered to the Eureka port group during 2011 to 2014 from areas proposed for closure account for approximately 80 percent of the contribution from areas proposed for closure under this alternative.

Closures selected under Alternative 1.h, the Preferred Alternative, would have negligible impacts on all port groups, with the possible exception of Eureka, which may have low negative impacts. While all Subject Area 1 alternatives would include closures, the landings and revenue contributions from closures proposed under Alternative 1.b would represent a higher percentage of landings and ex-vessel revenues than would the proposed closures under Alternative 1.a and Alternative 1.h, especially for the Eureka port group. Alternative 1.b would close areas that have contributed more to recent harvest compared to the other action alternatives.

Coastwide, these areas represent about 2.8 percent of landings and 3.36 percent of ex-vessel revenues taken in areas proposed for closure. These values contrast with the 0.26 percent of landings and 0.30 percent of ex-vessel revenues from the proposed closures under Alternative 1.h, with local impacts also proportionally lower in most ports and substantially lower in Eureka as noted above. These amounts are offset by benefits from ecosystem services and existence value benefits of the closures, which are likely to vary in proportion with the extent of areas closed. At the same time, however, one of the ecosystem services is the support of fisheries, and access to fish is required to accrue this benefit. Also to be considered is whether the closure would reduce harvest, displace existing effort to remaining open areas, or reduce efficiency or other opportunities to optimize fishing operations.

Table 4-19 provides a qualitative summary of the economic impacts resulting from proposed closures under Alternative 1.a, Alternative 1.b, and Alternative 1.h.

Table 4-19. Subject Area 1 closures; qualitative summary of recent contribution of landings in proposed closures under Subject Area 1 alternatives, net square miles proposed to be closed, and expected coastwide net economic impact.

	No-action Alternative	**Subject Area 1 Proposed Closures (2011 to 2014 data)**		
		Collaborative Alternative (1.a)	**Oceana, et al. Alternative (1.b)**	**Final Preferred Alternative (1.h)**
	Relative Contribution[1/] of a Port (2011 to 2014 data)	**Relative Contribution[2/] of Areas Proposed for the Following:**		
Port Group		**Closure**	**Closure**	**Closure**
North Washington coast	Low Contribution	No Data	No Data	Negligible Contribution
Puget Sound	Low Contribution	No Data	No Data	Negligible Contribution
South and Central Washington coast	Medium Contribution	Negligible Contribution	Low Contribution	Negligible Contribution
Washington Total	**High Contribution (~13%)**	**Negligible Contribution**	**Negligible Contribution**	**Negligible Contribution**
Astoria	High Contribution	Negligible Contribution	Negligible Contribution	Negligible Contribution
Newport	Medium Contribution	No Data	Low Contribution	Negligible Contribution
Coos Bay	High Contribution	No Data	Negligible Contribution	No Data
Brookings	Medium Contribution	Negligible Contribution	Low Contribution	No Data
Oregon Total	**High Contribution (~62%)**	**Negligible Contribution**	**Low Contribution**	**Negligible Contribution**
Crescent City	Negligible Contribution	Negligible Contribution	Negligible Contribution	Negligible Contribution
Eureka	High Contribution	Negligible Contribution	High Contribution	Low Contribution
Fort Bragg	Medium Contribution	Negligible Contribution	Low Contribution	Negligible Contribution
San Francisco	Low Contribution	Negligible Contribution	Low Contribution	Negligible Contribution
Monterey	Low Contribution	Negligible Contribution	Negligible Contribution	Negligible Contribution
Morro Bay	Low Contribution	Negligible Contribution	Low Contribution	Negligible Contribution
California Total	**High Contribution (~26%)**	**Negligible Contribution**	**Medium Contribution**	**Negligible Contribution**
Square Miles	**N/A**	**959 mi^2**	**14,380 mi^2**	**12,455 mi^2**
Summary	Landings accrued by bottom trawl vessels fishing in areas that are not closed to bottom trawling	Loss of areas of negligible contribution offset by gains in ecosystem services and existence	Loss of areas of low contribution offset by gains in ecosystem services and existence values for closed areas	Loss of areas of negligible contribution offset by gains in ecosystem services and existence values for closed areas that are less

Table 4-19. Subject Area 1 closures; qualitative summary of recent contribution of landings in proposed closures under Subject Area 1 alternatives, net square miles proposed to be closed, and expected coastwide net economic impact. (continued)

Port Group	No-action Alternative Relative Contribution[1/] of a Port (2011 to 2014 data)	Subject Area 1 Proposed Closures (2011 to 2014 data) Collaborative Alternative (1.a) Relative Contribution[2/] of Areas Proposed for the Following: Closure	Oceana, et al. Alternative (1.b) Closure	Final Preferred Alternative (1.h) Closure
		values for areas proposed to be closed Some reduction in the opportunity to optimize fishing activity	that are greater than in Alternative 1.a (based on mi^2 proposed to be closed) Some reduction in the opportunity to optimize fishing activity. (more reduction than Alternative 1.a)	than Alternative 1.b and more than Alternative 1.a (based on mi^2 proposed to be closed) Some reduction in the opportunity to optimize fishing activity; likely less than Alternative 1.a and more than Alternative 1.b

1/ Contribution of a port group to all coastwide bottom trawl landings in that period

2/ Contribution to port group of landings in impacted areas relative to all bottom trawl landings in port group in that period

No Data

Negligible Contribution	0%-1%
Low Contribution	1%-5%
Medium Contribution	5%-10%
High Contribution	>10%

4.2.2.7.2 Proposed Reopenings

Landings, revenues, and effort from areas proposed for reopening under Subject Area 1 alternatives are almost all less than 1 percent of the coastwide (or port group) values during the reference period of 1997 to 2001. For Alternative 1.a and Alternative 1.b, the only exception is Monterey Bay, for which approximately 5 percent of landings and revenues during the reference period came from areas proposed for reopening. For Alternative 1.h, the exceptions are Fort Bragg, San Francisco, and Monterey Bay, for which between 1 percent and 5 percent of landings and revenues for those port groups came from areas proposed for reopening.

The fact that historical activities in areas proposed for reopening among Subject Area 1 alternatives were almost all less than 1 percent of landings and revenues indicates the likelihood that the direct positive economic impacts on the fishing and related support industries and communities from these reopenings, with the exception of the Monterey port group, would be negligible. However, due to shifting distributions of harvest and changing management and market context, the historic importance of these grounds may not be a good indicator of the contribution if these grounds were reopened. Also to be considered is whether the reopening of these grounds would expand harvest, attract existing effort from open areas, change the efficiency, or create other opportunities to optimize fishing operations. Further, indirect negative impacts from any reduction in ecosystem services or existence values associated with these openings may occur, as discussed in the summary of proposed closures. Table 4-20 provides a qualitative summary of the economic impacts resulting from proposed reopenings under Alternative 1.a, Alternative 1.b, and Alternative 1.h.

Table 4-20. Subject Area 1 reopening; qualitative summary of historic contributions of areas proposed to be reopened and expected coastwide net economic impact under Subject Area 1 alternatives.

	Subject Area 1 Reopenings (1997 to 2001 data)[1/]		
	Collaborative Alternative (1a)	**Oceana, et al. Alternative (1.b)**	**Final Preferred Alternative (1.h.)**
	Relative Historic Contribution[2/] of Areas Proposed for the Following:		
Port Group	**Reopening**	**Reopening**	**Reopening**
North Washington coast	No Data	No Data	Negligible Contribution
Puget Sound	No Data	No Data	Negligible Contribution
South and Central Washington coast	Negligible Contribution	No Data	Negligible Contribution
Washington Total	**Negligible Contribution**	**No Data**	**Negligible Contribution**
Astoria	Negligible Contribution	No Data	Negligible Contribution
Newport	No Data	No Data	Negligible Contribution
Coos Bay	Negligible Contribution	No Data	No Data
Brookings	Negligible Contribution	No Data	No Data
Oregon Total	**Negligible Contribution**	**No Data**	**Negligible Contribution**
Crescent City	Negligible Contribution	No Data	Negligible Contribution
Eureka	Negligible Contribution	Negligible Contribution	Negligible Contribution
Fort Bragg	Negligible Contribution	Negligible Contribution	Low Contribution
San Francisco	Negligible Contribution	Negligible Contribution	Low Contribution
Monterey	Medium Contribution	Medium Contribution	Low Contribution
Morro Bay	Negligible Contribution	Negligible Contribution	Negligible Contribution
California Total	**Negligible Contribution**	**Negligible Contribution**	Low Contribution
Square Miles	**211 mi²**	**143 mi²**	**215 mi²**
Summary	• Gains of areas of negligible historic contribution offset by some losses in ecosystem services and existence values for reopened areas • Some increase in the opportunity to optimize fishing activity	• Gains of areas of negligible historic contribution offset by some losses in ecosystem services and existence values for reopened areas • Some increase in the opportunity to optimize fishing activity, possibly less than Alternative 1.a, based on square miles	• Gains of areas of negligible historic contribution offset by some losses in ecosystem services and existence values for reopened areas • Small increase in the opportunity to optimize fishing activity, likely greater than either Alternative 1.a or Alternative 1.b, based on square miles

1/The No-action Alternative is best characterized by recent fishery data, which are not available for proposed areas to be reopened because they are currently closed. Therefore, no comparison to the No-action Alternative is made in this table, as each cell in the column would be "No Data."

2/Contribution to port group of landings in impacted areas relative to all bottom trawl landings in port group in that period.

No Data	
Negligible Contribution	0%-1%
Low Contribution	1%-5%
Medium Contribution	5%-10%
High Contribution	>10%

4.2.2.8 Subject Area 2 Alternatives

4.2.2.8.1 Alternative 2.c, Remove the Trawl RCA and Implement BACs

Section 4.2.2 provides a general qualitative analysis of the action alternatives. Quantitative indicators related to the bottom trawl fishery are presented here to help distinguish the alternatives in terms of the likely size of the impact. For the reasons described in Section 4.1 on analytical approaches and in Section 4.2.2.2, these values should not be treated as predictions or estimates, but simply as indicators of the past importance of particular fishing grounds within the context of the conditions of the time.

This alternative would remove the trawl RCA coastwide, outside of the tribal U&As (south of Point Chehalis, Washington), thereby allowing groundfish bottom trawling in areas closed since 2002. However, the BACs could be turned on if the Council and NMFS agreed that spatial closures were necessary to curtail catch or bycatch (see Section 2.3, description of Subject Area 2 alternatives).

4.2.2.8.2 Proposed Reopenings

Areas that would be reopened under this alternative include fishery data from the core area of the RCA that has been closed since 2002 (100 fm to 150 fm) and some adjacent areas that periodically have been closed since 2002.

4.2.2.8.2.1 Coastwide and State Analysis

Landings

Areas proposed for reopening under this alternative accounted for 11.6 percent of coastwide landings from 1997 to 2001 (Table 4-21). Oregon would likely be most affected by the proposed reopenings since 14.2 percent of statewide landings were from these areas. California would likely be close behind Oregon in terms of statewide effects, with 13.9 percent of statewide landings from 1997 to 2001 coming from areas to be reopened. Less than 1 percent of Washington statewide landings originated from areas proposed for reopening under this alternative, because much of the trawl RCA in waters off Washington are in the tribal U&A and are not being considered for reopening.

For Oregon and California, a substantial portion of landings were caught from 1997 to 2001 in areas later closed by the trawl RCA. The portion of landings caught from 1997 to 2001 in areas proposed for reopening indicates that this alternative would increase landing opportunities for these ports.

Table 4-21. Alternative 2.c, reopening; aggregated bottom trawl groundfish species landings and revenues coastwide, by state, and by port group from 1997 to 2001 from catch in areas proposed for reopening. (excludes catch in U&A areas).

Port Group	Landings (Thousand pounds)	Percent of Port Group Non-whiting Groundfish Landings	Infl-adj. Ex-vessel Revenue ($000, 2015)	Percent of Port Group Non-whiting Groundfish Revenue
North WA coast	-	-	-	-
Puget Sound	33	0.11%	35	0.32%
South and Central WA coast	364	2.57%	190	2.41%
Washington Total	**396**	**0.75%**	**225**	**0.91%**
Astoria	3,152	5.60%	1,779	5.34%
Newport	6,626	25.74%	4,091	22.89%
Coos Bay	6,704	20.59%	3,754	17.42%
Brookings	1,230	11.77%	766	10.13%
Oregon Total	**17,713**	**14.16%**	**10,390**	**12.94%**
Crescent City	2,807	15.04%	1,522	11.75%
Eureka	5,298	17.01%	2,689	12.39%
Fort Bragg	2,978	12.53%	1,622	10.31%
San Francisco	2,750	14.98%	1,804	15.63%
Monterey	1,612	11.55%	904	10.83%
Morro Bay	543	6.00%	397	6.59%
California Total	**15,988**	**13.91%**	**8,939**	**11.72%**
Coastwide Total	**34,097**	**11.64%**	**19,554**	**10.78%**

Revenues

Areas proposed for reopening under this alternative accounted for 10.8 percent of coastwide non-whiting groundfish ex-vessel revenue from 1997 to 2001 (Table 4-21). Oregon would likely be most affected by the proposed reopenings with 12.9 percent of statewide revenues during the period originating from areas proposed for reopening, followed by California (11.7 percent), and Washington (less than 1 percent). In Washington, much of the trawl RCA is in the tribal U&A, which is not being considered for reopening.

Effort

Estimated vessel participation and fishing effort for the limited entry bottom trawl fishery under Alternative 2.c are displayed in Table 4-22 and Table 4-23. These tables summarize metrics for the fishery from 1997 to 2001, the most recent period when bottom trawling was permitted between depths from 100 fm to 150 fm. Beginning in 2002, areas between 100 fm and 150 fm were designated as trawl RCAs, and they have since been closed to bottom trawling.

Table 4-22. Counts of non-tribal vessels participating in the West Coast bottom trawl fishery by state from 1997 to 2001.

State	Total	Number Fishing in 100-150 fm	Percent Fishing in 100-150 fm
Washington	81	75	92.6%
Oregon	153	137	89.5%
California	169	138	81.7%
Total (Unique counts)	**254**	242	**95.3%**

Table 4-22 shows that nearly all of the 254 vessels that participated in the non-tribal bottom trawl fishery from 1997 to 2001 (95 percent) fished at some point in the 100 fm to 150 fm depth areas that were later designated as RCAs. Washington State had the greatest portion of trawl vessels fishing in the 100 fm to 150 fm range (92.6 percent), followed closely by Oregon (89.5 percent) and California (81.7 percent). Many vessels participated in bottom trawl fisheries off more than one state during the period.

Table 4-23 summarizes bottom trawl effort (trawl hours) from 1997 to 2001 by state, highlighting effort that occurred between 100 fm and 150 fm in areas later designated as trawl RCAs. Areas proposed for reopening under Alternative 2.c accounted for 65,818 trawl hours, or 10.8 percent of the coastwide trawl effort from 1997 to 2001. For vessels fishing off Washington, most of the effort occurred north of Point Chehalis, which is outside of the action area and, therefore, is not included in the Washington total. For vessels fishing off Oregon, 18.3 percent of overall effort occurred in areas between 100 fm and 150 fm, and 9.4 percent of bottom trawl effort for vessels fishing off California occurred between 100 fm and 150 fm, mostly between Cape Mendocino and Point Conception.

Table 4-23. Trawl hours of fishing effort for non-tribal vessels participating in the bottom trawl fishery by state from 1997 to 2001.

	Area Total Trawl Hours	**Trawl Hours in 100 fm to 150 fm**	**Percent Coastwide**
Washington	130,687	3,041	2.3%
Oregon	203,809	37,241	18.3%
California	272,649	25,536	9.4%
Total	607,145	65,818	10.8%

Dependence and Participation

All three states could expect some benefit from the increased access to the fishing grounds reopened under Alternative 2.c. Based on the ex-vessel revenues from the reference period of 1997 to 2001, roughly 13 percent of groundfish revenue in Oregon and about 12 percent in California came from landings harvested in the area proposed to be reopened. The proportion of groundfish ex-vessel revenue coming from the non-tribal U&A portion of the RCA, during the same reference period, was about 0.9 percent in Washington. As described by the historic participation in the groundfish fishery, and the ex-vessel revenues generated by harvest in the non-tribal U&A portion of the RCA, reopening those areas could redistribute coastwide participation in the fishery (groundfish ex-vessel revenue relative to other states or port groups), increasing participation in CA and OR relative to WA.

4.2.2.8.2.2 Port Group Analysis

Table 4-21 shows landing weights and inflation-adjusted ex-vessel revenues of non-whiting trawl groundfish by port group. The non-whiting trawl groundfish were caught from 1997 to 2001 in areas proposed for reopening.

Landings

Eight of twelve port groups had at least 10 percent of port group landings from 1997 to 2001 originating from areas proposed for reopening (Table 4-21). These include Newport (25.7 percent), Coos Bay (20.6 percent), Eureka (17 percent), Crescent City (15 percent), San Francisco (15 percent), Fort Bragg (12.5 percent), Brookings (11.8 percent), and Monterey (11.6 percent). Of the remaining four port groups, three, Morro Bay (6 percent), Astoria (5.6 percent), and South and Central Washington coast

(2.6 percent), received at least 2 percent of port group landings from areas proposed for reopening. In the Puget Sound port group, only 0.1 percent of port group landings from 1997 to 2001 originated from areas proposed for reopening under this alternative.

These data show that a substantial percent of coastwide landings for most port groups came from the trawl RCA from 1997 to 2001. The substantial landings from 1997 to 2001 from the area to be reopened indicate that this alternative would provide an opportunity to increase landings in these ports.

Revenue

With respect to revenue, 8 of 12 port groups had at least 10 percent of port group ex-vessel revenue from 1997 to 2001 originating from areas proposed for reopening, although the ranking order is somewhat different than with respect to landed weight (Table 4-21). The eight port groups include Newport (22.9 percent), Coos Bay (17.4 percent), San Francisco (15.6 percent), Eureka (12.4 percent), Crescent City (11.8 percent), Monterey (10.8 percent), Fort Bragg (10.3 percent), and Brookings (10.1 percent). Of the remaining four port groups, three, Morro Bay (6.6 percent), Astoria (5.3 percent), and South and Central Washington Coast (2.4 percent), each received at least 2 percent of port group landings revenue from areas proposed for reopening. In the Puget Sound port group, only 0.3 percent of port group landings revenue from 1997 to 2001 originated from areas proposed for reopening under this alternative.

Dependence and Participation

All port groups could expect some benefit from the increased access to the fishing grounds reopened under Alternative 2.c. The port groups with the highest proportion of groundfish ex-vessel revenues from the RCA areas during the reference period of 1997 to 2001 were Newport, Coos Bay, and San Francisco, with 22.9 percent, 17.4 percent, and 15.6 percent of groundfish revenue attributed to the RCA respectively. For those communities with a large proportion of groundfish ex-vessel revenues coming from areas managed by the RCA, and with a relatively high degree of dependence on the groundfish fishery like Newport (30 percent of total ex-vessel revenue coming from groundfish), the opening of the RCA would be expected to have a noticeable positive impact on the community social factors related to income, such as the *Size and Demographics* of the fishery. And, for those communities with a relatively low dependence on the groundfish fishery like San Francisco with 4 percent dependence, the opening of the RCA is less likely to have a significant impact on the community social factors related to income. Similarly, the communities that had little historic groundfish revenue attributed to harvest from areas closed by the RCA, like the port group of the South and Central Washington Coast, would not likely experience significant social change related to the opening of the RCA, regardless of a community's dependence on the groundfish fishery.

The potential for increased flexibility in operations, increased access to the resource, and possible increased quota from the reopened areas under Alternative 2.c would all influence a rise in a state or port group's dependence on the fishery. This sentiment was echoed during the April 2018 Council meeting's public comment period, when an Oregon commercial fisherman stated that the opening of the RCA would enable him to focus more on groundfish instead of having to participate in other fisheries.[33] While this particular fisherman spoke of the economic and social benefits of opening the RCA, there would also be risk associated with a community becoming more dependent on the groundfish fishery. With that risk would come added community vulnerability to changes in groundfish fishery management.

4.2.2.8.3 Proposed Closures

The entire EEZ and state waters could be closed with optional BACs. Two sets of data must be used to evaluate potential closures under this alternative. For those areas within the core portion of the trawl RCA (100 fm to 150 fm) that has been closed since 2002, historical fishery data are used to evaluate potential impacts. For those areas outside the core portion of the trawl RCA (shallower and deeper than 100 fm to 150 fm) that have mostly been open, more recent fishery data are used to evaluate potential impacts. Table 4-24 shows landings and revenues from 1997 to 2001 for those areas within the core trawl RCA, but outside the tribal U&A that could be closed under this alternative.

[33] https://www.pcouncil.org/wp-content/uploads/2018/04/INDEX_of_April_2018_Meeting_Recordings.pdf

Table 4-24. Alternative 2.c, closures; aggregated bottom trawl groundfish species landings and revenue coastwide, by state, and by port group from catch in optional BACs within the trawl RCA, excluding the trawl RCA within the tribal U&A fishing areas, 1997 to 2001.

Port Group	Landings (Thousand pounds)	Percent of Port Group Non-whiting Groundfish Landings	Infl-adj. Ex-vessel Revenue ($000, 2015)	Percent of Port Group Non-whiting Groundfish Revenue
North WA coast	-	-	-	-
Puget Sound	1	0.00%	1	0.01%
South and Central WA coast	360	2.54%	186	2.36%
Washington Total	**361**	**0.68%**	**186**	**0.75%**
Astoria	3,001	5.33%	1,673	5.02%
Newport	4,298	16.69%	2,510	14.05%
Coos Bay	4,279	13.14%	2,305	10.69%
Brookings	730	6.99%	428	5.67%
Oregon Total	**12,309**	**9.84%**	**6,916**	**8.61%**
Crescent City	1,938	10.38%	1,080	8.34%
Eureka	3,880	12.45%	1,912	8.81%
Fort Bragg	2,911	12.25%	1,582	10.05%
San Francisco	2,750	14.98%	1,804	15.63%
Monterey	1,612	11.55%	904	10.83%
Morro Bay	535	5.92%	392	6.50%
California Total	**13,625**	**11.85%**	**7,675**	**10.06%**
Coastwide Total	**26,295**	**8.97%**	**14,778**	**8.15%**

For those areas outside the core trawl RCA (deeper or shallower than 100 fm to 150 fm) proposed for BACs under this alternative, Table 4-25 shows landings and revenues from 2011 to 2014. The totals of the areas within and outside the trawl RCA, although representing different time periods, can be used as indicators of the landings and revenue associated with all the BACs that might, in the extreme case, be closed to groundfish bottom trawling at the same time. A more likely scenario is that closures would be implemented selectively, on a temporary basis, prior to or during the fishing season.

If these optional BACs were implemented to the extreme, it would effectively end groundfishing with bottom trawl gear in Oregon and California and parts of Washington south of Point Chehalis. This would be unlikely to occur, but should a groundfish bottom trawl fishery closure take place for any significant time, it could do irreparable harm to the fishery and the communities that support them. Significant impacts on all of the social factors would be expected.

Table 4-25. Alternative 2.c, closures; aggregated bottom trawl groundfish species landings and revenue coastwide, by state, and by port group from catch in optional BACs located outside the core trawl RCA (100 fm to 150 fm), excluding the portion outside the tribal U&A fishing areas, 2011 to 2014.

Port Group	Landings (Thousand pounds)	Percent of Port Group Non-whiting Groundfish Landings	Infl-adj. Ex-vessel Revenue ($000, 2015)	Percent of Port Group Non-whiting Groundfish Revenue
North WA coast	-	-	-	-
Puget Sound	212	6.05%	191	9.43%
South and Central WA coast	3,620	41.31%	2,826	49.82%
Washington Total	**3,832**	**19.92%**	**3,017**	**25.32%**
Astoria	37,396	64.01%	21,752	66.30%
Newport	10,797	98.87%	7,664	98.83%
Coos Bay	15,486	99.80%	10,167	99.81%
Brookings	10,166	99.93%	6,957	99.90%
Oregon Total	**73,845**	**77.71%**	**46,540**	**80.64%**
Crescent City	1,125	100%	720	100%
Eureka	18,232	99.97%	12,983	99.96%
Fort Bragg	11,666	100%	8,963	100%
San Francisco	2,638	100%	1,953	100%
Monterey	3,213	100%	2,406	100%
Morro Bay	2,641	100%	2,200	100%
California Total	**39,515**	**99.99%**	**29,225**	**99.98%**
Coastwide Total	**117,192**	**76.20%**	**78,782**	**79.69%**

4.2.2.8.4 Alternative-wide Net Effects

Closings and openings affect the array of fishing choices available to vessels. This, in turn, impacts business incomes, personal income, quality of life, relations within communities, safety, domestic and foreign consumers, export balances, existence values, and ecosystem service value. Because it is impossible to develop useful predictions of the response that vessels would have to new choice arrays, we cannot develop quantitative estimates of economic impacts. Therefore, we present indicators of the past economic importance of fishing grounds to be opened and closed. Caveats for interpreting this information are presented in Section 4.1, the methods section, and Section 4.2.2.2, the section on general qualitative analysis of the action alternatives.

Reopening RCA areas that have been closed to bottom trawling since 2002 would likely increase economic opportunities coastwide due to increased access to economically important trawl groundfish species. During the 1997 to 2001 reference period, 10.8 percent of the coastwide bottom trawl effort occurred in areas in the 100 fm to 150 fm range that would be reopened under this alternative. These areas were later designated as RCAs. While the greatest beneficiaries, based on 1997 to 2001 fishing data, appear to be port groups on the central Oregon coast (Newport and Coos Bay) and in northern California (Crescent City to San Francisco), all port groups would potentially experience enhanced economic opportunities derived from increased access to bottom trawl groundfish species, at least in the short term.

4.2.2.9 Alternative 2.d, the Preferred Alternative

This alternative would remove the trawl RCA off California and Oregon, thereby allowing bottom trawl groundfish fishing where it has been prohibited since 2002. Some areas would remain closed due to other trawl closures such as EFHCAs or state water closures, but most of the trawl RCA would open to bottom trawl fishing. Under this alternative, the trawl RCA would remain in place in waters off the Washington State coast, including the tribal U&A.

4.2.2.9.1 Proposed Reopenings

Coastwide and State Analysis

Landings and revenue impacts to the states of Oregon and California would be similar to those described under Alterative 2.c (see Section 4.2.2.8.1) for those two states. Although trawl RCA closures would remain in place off Washington, non-whiting groundfish landings and associated ex-vessel revenue in Washington would likely increase under this alternative due to deliveries from vessels fishing in reopened areas off Oregon, and to a lesser extent, California. A nominal amount (annual average of $37,000) of catch from the Oregon trawl RCA was landed in Washington from 1997 to 2001. However, the magnitude of this effect and the resulting distribution of landings, ex-vessel revenues, and associated benefits among the three states would be uncertain. The restored landings to Washington from the reopened trawl RCA in Oregon may be overestimated because of bottom trawl consolidation occurring among Washington ports at a faster rate than at the major Oregon ports.

Port Group Analysis

Landings and revenue impacts on port groups in Oregon and California under this alternative would be similar to those described under Alterative 2.c (see 4.2.2.8.1). Although trawl RCA closures would remain in place off Washington, landings and associated ex-vessel revenue in Washington Coast port groups would likely increase under this alternative due to deliveries from vessels fishing in reopened areas off Oregon, and to a lesser extent, California. However, the magnitude of this effect and the resulting distribution of landings, ex-vessel revenues, and associated benefits among port groups in the three states would be uncertain. Ports near the southern border (Ilwaco, Westport) of Washington may see some increased landings from trips in the areas of the trawl RCA that would be reopened off northern Oregon.

Dependence and Participation

All port groups could expect some benefit from the increased access to the fishing grounds reopened under Alternative 2.d (Table 4-26). Based on the ex-vessel revenues from the reference period from 1997 to 2001, roughly 12.9 percent of groundfish revenue in Oregon came from landings harvested in the area proposed to be reopened, with 11.7 percent in California, and 0.9 percent in Washington. In the port groups of Newport, Coos Bay, and San Francisco, the proportion of groundfish revenue from these RCA managed areas was 22.9 percent, 17.4 percent, and 15.6 percent, respectively. For those communities with a relatively high degree of dependence on the groundfish fishery like Newport (30 percent of total ex-vessel revenue coming from groundfish), the opening of the RCA would be expected to have a noticeable positive impact on community social factors related to income, such as the *Size and Demographics* of the fishery. For those communities with a relatively low dependence on the groundfish fishery, such as San Francisco with 4 percent dependence, the opening of the RCA would be less likely to have a significant impact on the community social factors related to income.

Table 4-26. Alternative 2.d, reopening; aggregated non-whiting trawl groundfish species landings and revenue by port group from catch in areas proposed for opening, 1997 to 2001.

Port Group	Landings (Thousand pounds)	Percent of Port Group Non-whiting Groundfish Landings	Infl-adj. Ex-vessel Revenue ($000, 2015)	Percent of Port Group Non-whiting Groundfish Revenue
Astoria	3,152	5.60%	1,779	5.34%
Newport	6,626	25.74%	4,091	22.89%
Coos Bay	6,704	20.59%	3,754	17.42%
Brookings	1,230	11.77%	766	10.13%
Oregon Total	**17,713**	**14.16%**	**10,390**	**12.94%**
Crescent City	2,807	15.04%	1,522	11.75%
Eureka	5,298	17.01%	2,689	12.39%
Fort Bragg	2,978	12.53%	1,622	10.31%
San Francisco	2,750	14.98%	1,804	15.63%
Monterey	1,612	11.55%	904	10.83%
Morro Bay	543	6.00%	397	6.59%
California Total	**15,988**	**13.91%**	**8,939**	**11.72%**
Coastwide Total	**33,701**	**11.50%**	**19,329**	**10.66%**

Although trawl RCA closures would remain in place off Washington, landings and associated ex-vessel revenue in Washington port groups would also likely increase under this alternative due to deliveries from vessels fishing in reopened areas off Oregon, and to a lesser extent, California. However, the magnitude of this effect and the resulting distribution of landings, ex-vessel revenues, and associated benefits among port groups in the three states would be uncertain. The potential for increased flexibility in operations, increased access to the resource, and possible increased quota from reopened areas under Alternative 2.d may influence a state or port group to increase its participation and dependence on the fishery.

4.2.2.9.2 Proposed Closures

Table 4-27 shows landings and revenues from 2011 to 2014 for those areas outside the core trawl RCA proposed for BACs under this alternative.

Table 4-27. Alternative 2d, closures; aggregated non-whiting trawl groundfish species landings and revenue by port group from catch in proposed BACs located outside the core trawl RCA, 2011 to 2014.

Port Group	Landings (Thousand pounds)	Percent of Port Group Non-whiting Groundfish Landings	Infl-adj. Ex-vessel Revenue ($000, 2015)	Percent of Port Group Non-whiting Groundfish Revenue
Astoria	37,396	64.01%	21,752	66.30%
Newport	10,797	98.87%	7,664	98.83%
Coos Bay	15,486	99.80%	10,167	99.81%
Brookings	10,166	99.93%	6,957	99.90%
Oregon Total	**73,845**	**77.71%**	**46,540**	**80.64%**
Crescent City	1,125	100%	720	100%
Eureka	18,232	99.97%	12,983	99.96%
Fort Bragg	11,666	100%	8,963	100%
San Francisco	2,638	100%	1,953	100%
Monterey	3,213	100%	2,406	100%
Morro Bay	2,641	100%	2,200	100%
California Total	**39,515**	**99.99%**	**29,225**	**99.98%**
Oregon and Washington Total	**113,360**	**84%**	**75,765**	**87%**

Table 4-28 shows landings and revenues from 1997 to 2011 for those areas outside the trawl RCA proposed for possible BACs under this alternative.

Table 4-28. Alternative 2.d, closures; aggregated non-whiting trawl groundfish species landings and revenue by port group from catch in proposed BACs located inside the core trawl RCA, 1997 to 2001.

Port Group	Landings (Thousand pounds)	Percent of Port Group Non-whiting Groundfish Landings	Infl-adj. Ex-vessel Revenue ($000, 2015)	Percent of Port Group Non-whiting Groundfish Revenue
Astoria	3,001	5.33%	1,673	5.02%
Newport	4,298	16.69%	2,510	14.05%
Coos Bay	4,279	13.14%	2,305	10.69%
Brookings	730	6.99%	428	5.67%
Oregon Total	**12,309**	**9.84%**	**6,916**	**8.61%**
Crescent City	1,938	10.38%	1,080	8.34%
Eureka	3,880	12.45%	1,912	8.81%
Fort Bragg	2,911	12.25%	1,582	10.05%
San Francisco	2,750	14.98%	1,804	15.63%
Monterey	1,612	11.55%	904	10.83%
Morro Bay	535	5.92%	392	6.50%
California Total	**13,625**	**11.85%**	**7,675**	**10.06%**
Oregon and Washington Total	**25,934**	**10.80%**	**14,592**	**9.32%**

4.2.2.10 Comparison of Subject Area 2 Alternatives

Both Subject Area 2 action alternatives would involve reopening the trawl RCA (excluding the tribal U&A off Washington). Both Subject Area 2 action alternatives would represent some degree of reopening; therefore, they would represent potential positive direct economic impacts on the fishing industry, supply chains, and communities through increased flexibility in harvest operations, access to the resource, and potential for increased utilization of allocations compared to the No-action Alternative. Alternative 2.c would remove the trawl RCA coastwide (outside of the tribal U&A fishing areas), and reopened areas are associated with the highest values of historic landings and revenues, as a percent of coastwide landings, during the reference period from 1997 to 2001. Table 4-21 (for Alternative 2.c) shows aggregated bottom trawl groundfish landings during the reference period from 1997 to 2001, by port group, state, and coastwide, excluding landings harvested in the tribal U&A. Several port groups had a substantial portion of landings and revenues caught from 1997 to 2001 in areas later closed in the RCA: Newport, Coos Bay, Brookings, Crescent City, Eureka, Fort Bragg, San Francisco, and Monterey all show between 10 percent and 26 percent of landings and revenues as coming from the areas enclosed by the trawl RCA.

The trawl RCA contributes to indirect economic benefits through ecosystem services and existence values. To the degree that there are some adverse impacts on habitat, reopening the trawl RCA may diminish those values. However, fishery-related ecosystem services require fishing activities; therefore, a balance must be drawn between those particular ecosystem services and fishing activities. In drawing this balance, a consideration is that these areas would continue to provide ecosystem services, though perhaps at a somewhat diminished rate. As discussed in 4.2.2.2, existence values tend to be substitutable and, therefore, do not likely increase in proportion to the amount of what is protected. In national policy, existence values are exemplified by the ESA, which only comes into play at extremely low population levels. Therefore, while there may be some impact on existence values, it seems less likely that there would be noticeable effects at the levels of protection being considered here.

Under both Subject Area 2 action alternatives, NMFS could implement BACs as needed to ensure that conservation objectives would continue to be met (including complete closure of the EEZ). The potential impacts could range between the impacts characterized for the reopening of the trawl RCA under Alternative 2.c, and complete closure of waters shoreward of 700 fm to groundfish bottom trawling. NMFS currently has the authority to close all groundfish bottom trawling. Both Subject Area 2 action alternatives would provide the ability to close selected depth and latitude segments shoreward of 700 fm (i.e., trawl RCA and BACs) rather than the entire EEZ. The economic impacts associated with a complete closure would include losing the landings and revenues associated with the No-action Alternative.

Alternatives 2.c and 2.d would start with trawl RCA removal (varying by state), but would include the possibility of reclosing certain areas to achieve goals and objectives of the FMP. The closures could be enacted preseason or inseason, but absent these closures, the trawl RCA would be considered open to groundfish bottom trawling (coastwide, outside the tribal U&A fishing areas [Alternative 2.c] and off Oregon and California [Alternative 2.d]), except in areas that are closed under other mechanisms, such as EFHCAs.

The closures that might be implemented under Alternative 2.c and Alternative 2.d would not likely provide the same habitat-related ecosystem services as those associated with permanent closures because they would not likely be in place for long enough periods to allow a habitat response. The closures would, however, likely provide at least some economic benefit related to the conservation of the fish resources they were intended to protect.

Coastwide, the most direct economic benefits would be associated with Alternative 2.c, followed by Alternative 2.d. Economic benefits to the fishing industry and fishing communities coastwide would be lower under Alternative 2.d than Alternative 2.c. because Washington port groups would likely receive less direct and indirect fishery-related economic benefit under Alternative 2.d due to retention of the trawl

RCA off Washington. Historic data indicate the port groups that would derive the most positive economic benefit from the Alternative 2.c or Alternative 2.d restoration of formerly important trawl RCA fishing grounds would be Newport, Coos Bay, Crescent City, Eureka, and San Francisco, with from 11.75 percent to 25.7 percent of each port group’s landings and revenues from 1997 to 2001 coming from areas proposed for reopening. Reopening the trawl RCA would likely benefit remaining bottom trawl vessels in those ports. However, consolidation of the fleet since this historic period may redistribute and locally depress some of these potential benefits compared to what was observed from 1997 to 2001, with fleet size drastically smaller in Coos Bay and the California ports, in particular. The action may encourage renewed participation of bottom trawlers in these areas; however, port infrastructure and processing capabilities may have to be rebuilt over time to accommodate this, which would slow realization of potential benefits. This change would not likely lead to a renewal of effort on the scale observed in the historic period; thus, actual benefits to communities impacted by consolidation would likely be lower than indicated by data from the pre-buyback era. Thus, for particular ports, the potential direct benefits from the reopenings may not accrue immediately.

4.2.2.11 Alternative 3, Use MSA Discretionary Authorities to Close Waters Deeper than 3,500 m to Bottom Contact Gear (Preferred Alternative)

This alternative would close areas of the United States West Coast EEZ to fishing with bottom contact gears in waters deeper than 3,500 m. These areas are limited to south of the Mendocino Ridge in waters off California. No current or historic bottom contact gear fishing has taken place or currently occurs in those areas, and there is no indication that this type of fishing activity would take place. Therefore, this alternative would not be expected to have any impact on landings, revenues, effort, or state-managed fisheries compared to the No-action Alternative.

This alternative would protect deep-sea areas that provide intrinsic and ecosystem services values. These values include undiscovered resources of the deep sea.

4.2.3 Fish Resources

This section describes impacts on fish resources for the No-action Alternative and each of the alternatives in the three Subject Areas. Fish resources fall within multiple categories that include all finfish (groundfish and non-groundfish) and shellfish resources that occur in the action area that may be affected by the proposed action. Most of the impacts on fish resources are due to harvest from or interaction with bottom trawl gear within the action area. Impacts of state-managed, non-groundfish bottom trawl fisheries on California halibut, sea cucumber, ridgeback prawns and pink shrimp are also considered. For each alternative there is a qualitative, alternative-wide summary presented, comparing the impacts of the alternative to the No-action Alternative.

In general, the effects on fish resources would be a change in location of where harvest occurs (i.e., displacement and redistribution of bottom trawl effort) and habitat effects in newly closed or newly opened areas. Generally, displacement of bottom trawl effort would neutrally affect fish resources if harvest levels remained similar to those considered under the No-action Alternative. Habitat protection and recovery would have positive effects on fish resources, especially for groundfish stocks for which the areas would be closed for long periods. However, the relative importance to fish resources of these specific areas to be closed to bottom trawling is uncertain.

Groundfish harvest by vessels using bottom trawl gear would continue to be limited by groundfish management measures like limited entry permits, IFQ, harvest specifications, etc., as described in Section 2.1.2, the No-action Alternative. Redistribution of fishing activities under any of the action alternatives, even if landings were to increase from the levels seen from 2011 to 2014, would not likely result in overfishing. Reopened trawlable areas may have localized negative effects on fish resources susceptible to harvest with bottom trawl gear, but catch controls in the IFQ management scheme would mitigate risks of overfishing.

The general effects described in this section would also apply to most non-groundfish species and ecosystem component species (ECS). Commercial harvest of these species in the bottom trawl fishery is monitored, and an increase in the catch of a non-groundfish stocks or ECS could trigger additional management measures under a separate action, if necessary to reduce the risk of overfishing. State-managed fisheries (California halibut, ridgeback prawn, sea cucumber, and pink shrimp) may be impacted by EFH alternatives; however, impacts on these resources would be relatively neutral, as discussed below.

4.2.3.1 No-action Alternative

The No-action Alternative would 1) retain the current suite of EFHCAs intended to minimize the adverse effects of fishing on groundfish EFH (Subject Area 1), 2) retain the groundfish trawl RCA closures in place to control the catch of overfished species (Subject Area 2), and 3) continue to allow the use of bottom-contact gear in waters deeper than 3,500 m (Subject Area 3). The No-action Alternative would also assume that allowable harvest (e.g., annual catch limits, Shorebased IFQ Program allocations, etc.), trawl gear restrictions, and the overall management scheme for the groundfish bottom trawl fishery would remain similar to recent years, as described in Section 4.1.3.

Under the No-action Alternative, bottom trawl participants would continue to be limited to areas that allow the use of bottom trawl gear, and areas that prohibit the use of bottom trawl gear would continue to provide some protections for habitat and the fish resources that utilize those habitats. Groundfish species would continue to be harvested with bottom trawl gear, subject to ACLs and other measures to prevent overfishing. It is unlikely that fishermen would begin bottom trawling in depths greater than 3,500 m because it is impractical. State-managed fisheries would continue to be limited to areas that allow the use of bottom trawl gear to target non-groundfish species, and areas that prohibit the use of bottom trawl gear would continue to provide some protections for habitat and the fish resources that utilize those habitats. We do not expect that there would be changes in impacts on these fisheries or their target resources under the No-action Alternative.

4.2.3.2 Subject Area 1 Alternatives

There is no quantifiable measure of how much habitat is required for a population of fish to attain a stable, productive age structure. However, healthy functioning habitat is important for sustaining populations of fish, and there is a level at which adverse effects to habitat will negatively affect fish populations. Alternatives that increase the total area of BTCs would protect more habitat compared to the No-action Alternative. Therefore, the Collaborative Alternative would have an overall positive effect on habitats. Protecting fish habitat benefits fish resources by increasing overall productivity of fish populations. Fish populations would respond positively to improvements in the quality and quantity of habitat, which could result in fish populations supporting increased harvest (e.g., ACLs would go up and the stock[s] would remain healthy).

Areas that would be closed by any of the Subject Area 1 alternatives would displace any bottom trawl fishing effort, including state-managed, non-groundfish trawl fisheries, that was occurring there into areas that would remain open. Fish resources harvested with bottom trawl gear and occurring in the areas that would be protected by the new BTCs would experience immediate positive effects. If species are not utilizing these areas during any life stages where they are susceptible to harvest with bottom trawl gear, the benefits to them are believed to be negligible. Species subject to harvest in areas that would be closed, or that use those habitats during other life history stages, may also get long-term habitat protection benefits. Non-groundfish bottom trawl fisheries generally have not operated in the areas proposed for closure under any of the Subject Area 1 alternatives; therefore, we expect that impacts on these species would be negligible.

Reopening areas could negatively influence fish resources, but the extent is unknown, primarily due to uncertainty as to how fisheries would respond to newly reopened areas. Reopening areas does not necessarily mean that bottom trawl fishermen would concentrate efforts in these newly reopened areas. Localized increases in harvest of fish resources would occur in these areas compared to the No-action Alternative. However, fish resources managed under MSA would continue to be subject to a suite of regulations intended to promote healthy fish populations and prevent overfishing, the same as the No-action Alternative. In addition to the generally applicable impacts discussed above, the sections below are intended to highlight meaningful differences between the three Subject Area 1 alternatives.

4.2.3.2.1 Alternative 1.a, the Collaborative Alternative

This alternative would make a number of changes to the EFHCAs described in the No-action Alternative. Changes would include 42 closures and 26 reopenings. Under this alternative, there would be a net increase of 749 mi^2 (plus 5.2 percent) in the spatial extent of coastwide BTCs compared to the No-action Alternative.[34]

Specifically, areas that would be closed were the source of landings for many groundfish species, including arrowtooth flounder, bocaccio, Dover sole, longnose skate, longspine thornyheads, petrale sole, sablefish, shortspine thornyheads, and cowcod. Therefore, these species may see the most benefits of proposed closures under Alternative 1.a. Areas that would be reopened were a source of historic landings for a variety of species, including bocaccio, cowcod, Dover sole, lingcod, longnose skate, longspine thornyheads, petrale sole, sablefish, shortspine thornyheads, and yellowtail rockfish. Therefore, these species would have the potential to be impacted more than other groundfish species if the future fishery were to operate similar to the historic fishery. State-managed non-groundfish bottom trawl fisheries are generally allowed to operate near Alternative 1.a areas; however, there is very little spatial overlap between these fisheries and the proposed closures and reopenings under Alternative 1.a.

The net effects of this alternative would be positive compared to the No-action Alternative. This is because benefits to habitats would provide benefits to fish resources.

[23] The analysis of this alternative assumes that the trawl RCA would remain in place.

4.2.3.2.2 Alternative 1.b, the Oceana, et al. Alternative

This alternative would make a number of changes to the EFHCAs described in the No-action Alternative. Changes would include 61 closures and 7 reopenings. Under this alternative, there would be a net increase of approximately 14,000 mi^2 (plus 98 percent; almost a doubling) in the spatial extent of coastwide BTCs compared to the No-action Alternative.[35] Specifically, areas that would be closed were the source of landings for many groundfish species, including arrowtooth flounder, bocaccio, Dover sole, darkblotched rockfish, longnose skate, POP, petrale sole, sablefish, thornyheads and yelloweye rockfish. Therefore, these species may see the most benefits of proposed closures under Alternative 1.b. Proposed reopenings are the smallest spatial extent compared to Alternative 1.a, the Collaborative Alternative and Alternative 1.h., the Preferred Alternative. Areas that would be reopened were a source of historic landings for variety of species, including cowcod, darkblotched rockfish, bocaccio, Dover sole, lingcod, longnose skate, petrale sole, sablefish, and thornyheads. Therefore, these species would have the potential to be impacted more than other groundfish species, if the future fishery were to operate similar to the historic fishery.

State-managed, non-groundfish bottom trawl fisheries operate near Alternative 1.b. Harvest locations of the California halibut fishery, do not overlap with Alternative 1.b areas. Harvest locations of the ridgeback prawn, sea cucumber, and pink shrimp fisheries overlap with Alternative 1.b areas, mostly in the Southern California Bight. The proportion of harvest of these species in the areas of overlap is low, indicating that the magnitude of the fishery in the areas of overlap is low. Overlap of the pink shrimp fishery with the areas to be closed under Alternative 1.b would be approximately twice that of Alternative 1.a, but it would still be a small proportion of the pink shrimp fishery.

The net effects of this alternative would be positive compared to the No-action Alternative. This is because benefits to habitats would enhance fish resources.

4.2.3.2.3 Alternative 1.h, the Preferred Alternative

This alternative would make a number of changes to the EFHCAs described in the No-action Alternative. Changes would include 53 closures and 17 reopenings. Under this alternative, there would be a net increase of 12,240 mi^2 (plus 83.2 percent) in the spatial extent of coastwide BTCs compared to the No-action Alternative.[36] Specifically, areas that would be closed were the source of landings for many groundfish species, including arrowtooth flounder, bocaccio, cowcod, Dover sole, longnose skate, longspine thornyheads, petrale sole, shortspine thornyheads, petrale sole, sablefish, and yelloweye

[24] The analysis of this alternative assumes that the trawl RCA would remain in place.

rockfish. Therefore, these species may see the most benefits of proposed closures under Alternative 1.h. Areas that would be reopened were a source of historic landings for variety of species, including bocaccio, cowcod, Dover sole, lingcod, longnose skate, longspine thornyheads, petrale sole, sablefish, shortspine thornyheads, yelloweye rockfish, and yellowtail rockfish. Therefore, these species would have the potential to be impacted more than other groundfish species, if the future fishery were to operate similar to the historic fishery.

State-managed, non-groundfish bottom trawl fisheries operate near Alternative 1.h. areas. Harvest locations of the California halibut fishery do not overlap with Alternative 1.h. Harvest locations of the ridgeback prawn, sea cucumber, and pink shrimp fisheries overlap with Alternative 1.h, mostly in the Southern California Bight. The proportion of harvest of these species in the areas of overlap is low, indicating that the magnitude of the fishery in the areas of overlap is low. The overlap of the pink shrimp fishery with the areas to be closed under Alternative 1.h is less than under Alternative 1.b and slightly more than under Alternative 1.a. However, as with the other alternatives, it would still be a small proportion of the pink shrimp fishery.

The net effects of this alternative would be positive compared to the No-action Alternative. This is because benefits to habitats would provide benefits to fish resources.

4.2.3.2.4 Comparison of Subject Area 1 Alternatives

The net effects of all three alternatives would be positive compared to the No-action Alternative. Alternative 1.b, the Oceana, et al. Alternative, would have the highest proportions of coastwide landings from areas to be closed and the lowest proportions of coastwide landings from areas to be reopened. Alternative 1.b, the Oceana, et al. Alternative, would be the most protective and would have the greatest potential for positive effects on fish resources, primarily due to benefits to fish populations that would occur from habitat protections. Alternative 1.h, the EFHCA Preferred Alternative, would also benefit fish resources, but less than Alternative 1.b. Alternative 1.a, the Collaborative Alternative, while the least protective, would still benefit fish populations due to increases in habitat protections compared to the No-action Alternative.

4.2.3.3 Subject Area 2 Alternatives

Subject Area 2 alternatives would reopen portions of the trawl RCA closure outside of the tribal U&As, allowing access to vessels fishing with groundfish bottom trawl gear in some areas that have not been fished with bottom trawl gear for more than 15 years. These alternatives would open areas primarily in the 100 fm to 150 fm depth range, but would include some sections that were modified out to the 200 fm line (mostly in Oregon and northern California). Under each Subject Area 2 alternative, there would be a net decrease in BTCs compared to the No-action Alternative[37], but the amount would vary between the alternatives.

The trawl RCA alternatives would also establish optional BACs that could be closed to reduce harvest of target or non-target stocks, including salmon. As described in Chapter 2, the EEZ out to the 700 fm contour would be divided into separate BACs designated by depth contours and latitude. BACs are a more flexible management tool than the trawl RCA described in the No-action Alternative. One or more of these BACs could be implemented through routine inseason management with a single Council meeting and a single FR notice.

There is no quantifiable measure of how much habitat is required for a population of fish to attain a stable, productive age structure. However, healthy functioning habitat is important for sustaining fish populations, and there is a level at which adverse effects on habitat will negatively affect fish populations. All Subject Area 2 alternatives would decrease the total area of BTCs, exposing more habitat to bottom trawl gear compared to the No-action Alternative. Therefore, all of the trawl RCA alternatives could have an overall negative effect on habitats if opening these areas would reduce the quality and quantity of habitats used by fish resources. Fish populations may have lower productivity due to habitat loss, which could result in lower ACLs. However, fish resources managed under MSA would continue to be subject to a suite of regulations intended to promote healthy fish populations and prevent overfishing, the same as under the No-action Alternative. Even if landings were to increase from the levels seen from 2011 to 2014, none of the trawl RCA Alternatives would likely result in overfishing.

Reopened trawlable areas may have localized negative effects on fish resources susceptible to harvest with bottom trawl gear. This could include a higher risk of unpredictable, large tows of species commonly occurring in these areas, particularly the rockfishes that these areas were designed to protect. However, it is impossible to predict how fishing behavior would change. It is unlikely that such tows would result in overfishing because of catch controls in the IFQ management scheme. No changes in impacts on state-managed bottom trawl species (California halibut, sea cucumber, ridgeback prawn, and pink shrimp) are anticipated from these alternatives because the trawl RCA would apply in the same way as described under the No-action Alternative for vessels harvesting California halibut, sea cucumber, or ridgeback prawn, and the pink shrimp trawl fishery is not subject to the trawl RCA under the No-Action Alternative or any of the action alternatives. BACs, if implemented, would not apply to vessels fishing non-groundfish trawl. The effects of this the trawl RCA Alternatives on fish resources would be negative

[37] The analysis of Subject Area 2 alternatives assumes that no new EFH or discretionary closures would be implemented.

compared to the No-action Alternative, particularly if the quantity and the quality of habitats were reduced.

It is impossible to predict the impacts on fish resources of the BACs that could be closed in any combination, either preseason or inseason, under these trawl RCA alternatives. However, BACs could reduce harvest of many groundfish species and species groups, including yelloweye rockfish, POP, darkblotched rockfish, flatfish, skates, and other rockfish. One or several BACs could be implemented in combination and would offer fewer protections to fish resources than the No-action Alternative. Many BACs could be implemented in combination, and they would have the potential to provide greater short-term protections to fish resources than the 2015 trawl RCA configuration considered under the No-action Alternative. During times when one or more BACs are closed, fish resources within those areas would not be subject to harvest with bottom trawl gear. However, as described in Section 4.1.3, we would be unlikely to see habitat recovery benefits for fish resources if BACs were closed on an as-needed basis over short periods. It is unlikely that short-term closures of this spatial extent would offset the negative impacts of trawl RCA removal. The net effects of these alternatives on fish resources would be negative compared to the No-action Alternative, particularly if quantity and quality of habitats were reduced. The BACs overlap with many BTC areas associated with the No-action Alternative. Therefore, the impacts on fish resources of closing BACs that would overlap with existing BTCs, including the trawl RCA, would be the same as those under the No-action Alternative. They are described in Section 4.2.2.1. The trawl RCA Alternatives would differ from the No-action Alternative if there were newly closed BAC areas outside of the trawl RCA, as discussed below.

Based on groundfish landings data from 2011 to 2014, some species are more likely to be present, and they would, therefore, be more likely to be protected by a BAC, and the species groups that would benefit would vary by depth and latitude. Fishery landings data could be used to infer which groundfish species may have benefited in the past from BACs (Table 4-29). For example, when landings of a species from the area of a depth/latitude block were negligible (e.g., a relatively minimal proportion of the coastwide landings of that species), it is less likely that having closed that block would have made an appreciable difference on coastwide landings, and the closure may have offered a relatively small amount of protection of that species from harvest impacts with bottom trawl gear during the 2011 to 2014 period.

Table 4-29. Relative impacts to groundfish from bottom trawl groundfish fishing in the BACs, based on the proportion of coastwide landings by latitude and depth zone, from 2011 to 2014. High = >50% coastwide landings; Medium: 20-50% coastwide landings; Low: 1-20%; Negligible: <1%.

	700 fm-150 fm	**150fm-100fm**	**100 fm-30 fm**	**Shoreward of 30 fm**
Cape Flattery to Pt. Chehalis	Negligible: Yelloweye RF, Arrowtooth flounder, Dover sole, lingcod, longnose skate, P. cod, petrale sole, sablefish, thornyheads, yellowtail RF, darkblotched RF, POP	a/	Negligible landings of any groundfish species	Negligible landings of any groundfish species
Pt. Chehalis to Cape Blanco	High: Darkblotched RF, POP. Medium: Arrowtooth flounder, Dover sole, longnose skate, petrale sole, sablefish, thornyheads. Low: Yelloweye RF, lingcod, P. cod, yellowtail RF	a/	High: Yellowtail RF. Medium: Lingcod, P. cod. Low: Arrowtooth flounder, Dover sole, longnose skate, petrale sole, sablefish, darkblotched RF, POP. Negligible: Thornyheads	Negligible: Arrowtooth flounder, Dover sole, lingcod, longnose skate, P. cod, petrale sole, sablefish, thornyheads, yellowtail RF, darkblotched RF, POP
Cape Blanco to Cape Mendocino	Medium: Dover sole, longnose skate, petrale sole, sablefish, thornyheads. Low: Arrowtooth flounder. Negligible: Lingcod, yellowtail RF.	a/	Low: Lingcod, petrale sole. Negligible: Yelloweye RF, arrowtooth flounder, Dover sole, longnose skate, P. cod, sablefish, thornyheads, yellowtail RF, darkblotched RF	Negligible: Dover sole, lingcod, longnose skate, petrale sole, thornyheads.
Cape Mendocino to Point Conception	Medium: Cowcod, sablefish, bocaccio. Low: Arrowtooth flounder, Dover sole, lingcod, longonse skate, petrale sole, darkblotched RF. Negligible: Thornyheads, POP.	a/	High: Cowcod, bocaccio. Low: Yelloweye RF, lingcod, longnose skate. Negligible: Arrowtooth flounder, Dover sole, petrale sole, sablefish, thornyheads, yellowtail RF, darkblotched RF, POP	Negligible: Longnose skate, petrale sole, sablefish.

a/ Closure of these depths/latitudes would have similar effects on fish resources as the No-Action Alternative.

Source: Logbook and PacFIN data from fishing in the areas to be reopened by the trawl RCA, 1997 to 2001.

The information presented in Table 4-29 may not be representative of the future fishery, but it is meant to illustrate the types of fishery information that could be considered by the Council and NMFS when making decisions about closing or reopening BACs. Additionally, more recent fishery information would be evaluated through the Council’s public process to determine and disclose the impacts BACs might have on fish resources. Regardless, closure of any block would benefit fish resources that live in that block. In addition to the generally applicable impacts of the trawl RCA Alternatives discussed above, the sections below are intended to highlight meaningful differences between the two Subject Area 2 alternatives.

4.2.3.3.1 Alternative 2.c, Remove Trawl RCA and Implement BACs

Alternative 2.c would reopen all of the area defined as the trawl RCA between Cape Flattery, Washington, and the United States/Mexico border, and BACs could extend between Cape Flattery and the United States/Mexico border (e.g., off Washington, outside the tribal U&A fishing areas, Oregon, and California). The BACs could be imposed in any combination, either preseason or inseason. Alternative 2.c would have a net decrease in BTCs of 25.6 percent compared to the No-action Alternative. Areas that would be reopened were a source of historic landings for variety of species, including arrowtooth, bocaccio, cowcod, darkblotched rockfish, Dover sole, lingcod, longnose skate, longspine thornyheads, POP, petrale sole, sablefish, shortspine thornyheads, yelloweye rockfish, and yellowtail rockfish. Therefore, these species would have the potential to be impacted more than other groundfish species, if the future fishery were to operate similar to the historic fishery. BACs could be used coastwide outside the area of the tribal U &A to benefit fish resources, including groundfish species shown in Table 4-29.

4.2.3.3.2 Alternative 2.d, the Preferred Alternative

Alternative 2.d would reopen all of the area defined as the trawl RCA between the Columbia River (46°16’ N. latitude) and the United States/Mexico border (e.g., off Oregon and California). This alternative would retain the trawl RCA off the Washington coast, as described in the No-action Alternative. BACs could extend between the Columbia River and the United States/Mexico border, and they could be closed in any combination, either preseason or inseason. Alternative 2.d would have a net decrease in BTCs of 19 percent compared to the No-action Alternative. Areas that would be reopened would have the potential to affect similar species to Alternative 2.c, Remove the Trawl RCA, with potentially smaller effects on northern species that occur more frequently in the trawl RCA off the Washington coast. BACs could be used to control fishery impacts on salmon, for example, or groundfish, including groundfish species shown in Table 4-29, for the areas off the coast of Oregon and California.

4.2.3.3.3 Comparison of Subject Area 2 Alternatives

Both Subject Area 2 action alternatives would remove portions of the trawl RCA, which would reopen areas that have been closed for more than 15 years. The impacts on fish resources would be negative compared to the No-action Alternative. Both alternatives would include options to implement BACs, as needed, after partial removal of the trawl RCA. With no BACs implemented, the negative impacts of

Alternative 2.c on fish resources would be greater than those of Alternative 2.d. because Alternative 2.c would have a greater reduction in BTCs by reopening the trawl RCA off Washington. With the optional BACs, Alternative 2.c would provide greater flexibility to respond with protective BTCs than Alternative 2.d. because BACs are a more flexible management tool than the trawl RCA under the No-action Alternative.

4.2.3.4 Alternative 3: Use MSA discretionary authorities to close waters deeper than 3,500 m to bottom contact fishing gear.

As noted in Section 4.2.3.4, Alternative 3 would close waters deeper than 3,500 m to bottom contact gear, at approximately 1,914 fm. This would have very little effect on fish resources when compared to the No-action Alternative, because fish resources in this area are generally not harvested with bottom trawl or bottom contact gear, are not overfished, and are not economically important to bottom trawl fisheries. Prohibiting bottom contact gear under this alternative could have a low positive effect on fish resources that live in deep water that would be closed under Alternative 3, because it would eliminate potential exploratory fishing activities with bottom contacting gear. However, it is unlikely that bottom contact gear fisheries would develop in this area due to the impracticality of fishing with such gears in such deep water. Overall, no effects to fish resources are anticipated under Alternative 3.

4.2.4 Protected Resources

As described in Chapter 3, protected resources are species protected under MMPA, MBTA, and ESA, including salmon, eulachon, green sturgeon, marine mammals, and sea birds. This section summarizes expected impacts of the No-action Alternative and each of the alternatives in the three Subject Areas.

For each alternative there is a qualitative, alternative-wide summary presented, comparing the impacts of the alternative to the No-action Alternative. Implementation of an alternative, including the No-action Alternative, may change fishing behavior and areas fished. Therefore, we expect some level of impact to protected species under each alternative, including the No-action Alternative. We discuss the potential for impact under each alternative qualitatively based on observed interactions. State-managed fisheries (pink shrimp, California halibut, ridgeback prawn, and sea cucumber) would not be impacted by any trawl RCA alternative; therefore, protected resources impacts from those fisheries are not expected to change and are not discussed further. EFH alternatives may have limited impacts on California halibut, ridgeback prawn, sea cucumber, and pink shrimp fisheries; therefore, qualitative impacts on protected resources are described. Impacts on resources are noted in the appropriate sections.

4.2.4.1 No-action Alternative

This section summarizes impacts of the No-action Alternative. Under the No-action Alternative, the fishery would continue to operate with the current set of closures (EFHCA and RCA) in place, and we expect that the fishery would operate in a similar way as 2011 to 2015. The No-action Alternative assumes that harvest levels (e.g., annual catch limits), trawl gear restrictions, and the overall management scheme for the groundfish bottom trawl fishery would remain similar to recent years. The area of operations for the fishery would not be expected to change, and effort might slowly increase as available annual catch limits increased. We expect some gear changes to occur in the future (allowing the use short footrope roller gear and changes in mesh size); however, these changes are considered under the cumulative effects section.

The fishery continues to target Dover sole, sablefish, and thornyhead from 150 to 700 fm and flatfish between 30 and 100 fm. We expect fisherman would continue to return to these familiar grounds in those depth ranges to harvest these species. We also expect fishing activity in these areas would continue under the No-action Alternative. There is no clear correlation between the level fishing effort or areas fished and the number of interactions observed in the bottom trawl fishery, so it is difficult to predict interactions. Under the No-action Alternative, we expect that the number of observed interactions and the species caught would remain similar to that observed from 2011 through 2015 since fishing operations would not likely change.

The groundfish bottom trawl fishery and state-managed non-groundfish fisheries for California halibut and pink shrimp operate in designated critical habitat for green sturgeon, and these fisheries catch green sturgeon and eulachon. We do not expect the operation of these fisheries to change under the No Action Alternative; therefore, we expect impacts under the No-action Alternative on these species and the critical habitat of green sturgeon would be similar to those recently observed. Other state-managed bottom trawl fisheries do not impact protected species or critical habitat.

4.2.4.2 Subject Area 1

Areas that would be closed by any of the Subject Area 1 alternatives would displace any bottom trawl fishing effort, including state-managed non-groundfish trawl fisheries, that was occurring there into areas that would remain open. Protected resources impacted by bottom trawl gear and occurring in the areas that would be protected by the new BTCs would experience immediate positive effects. If species are not utilizing these areas during any life stages where they are susceptible to harvest with bottom trawl gear, the benefits to them would likely be negligible. Species that were subject to impacts in areas that would be closed, or that would use those habitats during other life history stages, may also get long-term habitat protection benefits. Non-groundfish fisheries generally have not operated in the areas proposed for closure under any of the Subject Area 1 alternatives; therefore, we expect impacts on these species would be negligible.

Reopening areas could negatively influence protected resources, but the extent is unknown, primarily due to uncertainty in how fisheries would respond to newly reopened areas. Reopening areas does not necessarily mean that bottom trawl fishermen would concentrate efforts in these newly reopened areas.

4.2.4.2.1 Alternative 1.a, the Collaborative Alternative

This section presents the impacts of Alternative 1.a. The Collaborative Alternative would close 959 mi^2 and would reopen 211 mi^2 to bottom trawling. We provide a qualitative assessment of potential interactions with protected species in EFH proposed closures and reopenings for Alternative 1.a. We do not have observer data for areas that are proposed to be opened, so we cannot quantify interactions that have occurred in the past for these areas. We assume that reopenings would likely result in similar level of interactions as those seen in the proposed closures, but they would be proportional to the size of the area. For example, if 10 animals were found in a 10 mi^2 closed area, we assume that 2 animals may be found in 2 mi^2 reopenings.

4.2.4.2.1.1 ESA-listed Fish (salmon, eulachon, green sturgeon)

From 2011 to 2014, Chinook salmon were rarely caught with bottom trawl gear in the proposed closures under Alternative 1.a. No other salmon or steelhead species were observed in the proposed closed areas. These proposed closures would be unlikely to noticeably decrease the total number of salmon encountered in the fishery on an annual basis. The proposed reopening would expose salmon if they were in the area at the time of fishing; however, it is difficult to speculate on the frequency of interactions under a permanent reopening of the area. If we were to apply a proportional amount to the reopenings based on the number of interactions and size of proposed closures, then we could assume that Chinook salmon may be caught in the proposed reopenings over four years. This amount of take could increase the total number of salmon taken in the fishery, but salmon taken in the fishery is capped and the fishery would be closed under the terms and conditions of the ITS if the cap is reached. Therefore, based on these assumptions, we expect that the fishery would continue to interact with Chinook and coho salmon. We expect that the number of salmon interactions would be similar to or lower than those observed under the No-action Alternative.

Eulachon and green sturgeon were not observed in the groundfish bottom trawl fishery in the proposed closed areas from 2011 to 2014; therefore, implementation of the proposed area closures would not likely change the population sizes or exceed the current ITS for these species. The proposed reopening could expose green sturgeon if they were in the area at the time of fishing; however, it is difficult to speculate on the frequency of interactions. Since none of the polygons under Alterative 1.a falls within the critical habitat of the green sturgeon, we do not anticipate impacts on it.

The pink shrimp fishery has impacted eulachon in the past. It operates in the Alternative 1.a areas; therefore, implementation of proposed closures under Alternative 1.a could benefit this species by lowering exposure to the pink shrimp fishery. However, proposed reopenings could expose eulachon to the pink shrimp fishery. We cannot quantify the extent the benefits or negative impacts on eulachon; however, the percent overlap of the fishery with Alternative 1.a is a small proportion of the pink shrimp fishery.

The California halibut fishery impacts green sturgeon; therefore, implementation of closures under Alternative 1.a may benefit the species through less exposure to California halibut trawling. The fishery generally has not operated in the areas proposed to be closed under this alternative; therefore, there may only be indirect benefits to green sturgeon through the closures. Again, we cannot quantify the extent of the benefits or the negative impacts on green sturgeon.

4.2.4.2.1.2 Marine Mammals

WCGOP data from 2011 to 2014 were used for protected species interactions analysis. We can only summarize information for proposed closures, and we must infer potential interactions for proposed reopenings. In the closures under Alternative 1.a, observers documented interactions with Steller sea lions and almost all were seen feeding on catch in deeper water (150 fm to 700 fm). One was observed entangled in gear. These closures could prevent interactions with marine mammals that reside or travel through that area. However, the magnitude of interaction is unknown. If we assume that the number of animal interactions is proportional to the size of the area closed, then we might expect that Steller sea lion interactions could be observed in proposed reopenings.

Under Alternative 1.a, vessels would likely move to other areas (shift effort) to harvest. This could push vessels to unfamiliar or old fishing grounds. As noted under the No-action Alternative, there are no clear correlations between areas fished and marine mammal interactions. Therefore, changes in fishing patterns or areas fished may or may not increase or decrease impacts on marine mammals. The proposed closed and opened areas would not be placed in areas designated as critical habitat for Steller sea lions; therefore, Alternative 1.a would not impact or change these designations.

Based on this information, the number of interactions and type of species under Alternative 1.a would likely be similar to or lower than those observed under the No-action Alternative. Overall, the number of interactions that might result under Alternative 1.a may not noticeably change marine mammal populations.

4.2.4.2.1.3 Seabirds

ESA-listed or MBTA-listed seabirds were not observed interacting with the fishery in the proposed closed areas from 2011 to 2014. In addition, we have not found clear correlations between areas fished and the type or number of interactions observed in the fishery. Therefore, we do not anticipate the type and total number of protected species interactions to change beyond what has already been observed under the No-Action Alternative.

4.2.4.2.2 Alternative 1.b, the Oceana, et al. Alternative

This section presents the impacts of Alternative 1.b, the Oceana, et al. Alternative. Alternative 1.b would close 14,380 mi^2 and would reopen 143 mi^2 to bottom trawling. Since we have not found clear correlations between areas fished and the type or number of interactions observed in the fishery, we do not anticipate that proposed reopenings or closings, either separate or combined, would result in substantial changes to the type and total number of interactions over what has been observed under the No-action Alternative. The proposed closure area under Alternative 1.b would be significantly larger than that under Alternative 1.a and the No-action Alternative EFH closures; however, much of the additional closure would in southern California where bottom trawling does not occur. Overlap of the pink shrimp fishery with the areas to be closed under Alternative 1.b would be approximately twice that of Alternative 1.a, but it would still be a small proportion of the pink shrimp fishery. Therefore, we do not anticipate impacts on the pink shrimp fishery to change.

Harvest locations of the California halibut fishery would not overlap with Alternative 1.b areas. Harvest locations of the ridgeback prawn, sea cucumber, and pink shrimp fisheries would overlap with Alternative 1.b areas, mostly in the Southern California Bight. The proportion of harvest of these species in the areas of overlap is low, indicating that the magnitude of the fishery in the areas of overlap is low. Therefore, the proposed changes under Alternative 1.b would pose negligible impacts or savings to protected species.

4.2.4.2.2.1 ESA-Listed Fish (salmon, eulachon, and green sturgeon)

From 2011 to 2014, Chinook salmon and coho salmon were rarely caught with bottom trawl gear in the closure areas proposed under Alternative 1.b. Neither the proposed reopening nor the closures would noticeably decrease or increase the total number of salmon encountered in the fishery on an annual basis if conservation would offset exposure. If we assume that the size of the proposed closed areas would be directly related to the magnitude of preventing interactions, then Alternative 1.b may provide the most conservation for salmon. However more than half the areas proposed for closure is not trawled; therefore, the conservation value may be lower overall, but greater than Alternative 1.a and the No-action Alternative EFH closures.

From 2011 to 2014, negligible numbers of eulachon were caught in the groundfish bottom trawl fishery between Point Chehalis, Washington, and Cape Blanco, Oregon, and green sturgeon were not observed in the proposed closed areas. The polygons in Alternative 1.b would not fall within the critical habitat of green sturgeon or eulachon; therefore, their habitat would not be impacted.

The pink shrimp fishery has impacted eulachon in the past, and it operates in the areas of Alternative 1.b. Therefore, implementation of proposed closures under Alternative 1.a could benefit these species by lessoning exposure to the pink shrimp fishery. However, proposed reopenings could expose eulachon to the pink shrimp fishery. The overlap of Alternative 1.b with the pink shrimp fishery would be larger than Alternative 1a and Alternative 1.h. While we cannot quantify the extent of the benefits or negative impacts on eulachon, the percent overlap of the fishery with Alternative 1.b is low compared to the entire footprint of the fishery.

The California halibut fishery impacts green sturgeon; therefore, implementation of closures under Alternative 1.b may benefit the species through less exposure to California halibut trawling. The fishery generally does not operate in the proposed closure area of Alternative 1.b; therefore, there may only be indirect benefits for green sturgeon through the closures. Again, we cannot quantify the extent of the benefits for or negative impacts on green sturgeon.

Based on this information, the number of interactions and the types of species of salmon, eulachon, and green sturgeon under Alternative 1.b would likely be similar to or lower than those observed under the No-action Alternative. Overall, the number of interactions that might result under Alternative 1.b may not noticeably change salmon, eulachon, or green sturgeon populations.

4.2.4.2.2.2 Marine Mammals

Under Alternative 1.b closed areas, observers documented Steller sea lions feeding on catch, and only a few were observed entangled in gear. Observers also documented California sea lions feeding on catch, and one was observed to be killed by gear.

The proposed closures could reduce marine mammal encounters with all species known to interact with the fishery; however, it is unclear how much additional savings could be realized, since not all areas are trawled or trawlable. If we assume that the number of observed Steller or California sea lions that were observed in the proposed closed areas reflects a savings, then we could assume that the number of annual mortalities would be lower than that observed under the No-action Alternative.

We can assume that the proposed reopenings would expose marine mammals to fishing activity. If we assume that the number of interactions in the proposed opening would be proportional to that observed in the proposed closures, then we may expect some interactions to occur, but they would likely be fewer than those observed under the No-action Alternative. Under this assumption, and because the openings would be relatively small in size (143 mi^2) compared to total square miles of the EEZ or the No-action Alternative EFH areas, the proposed openings may not noticeably increase the total number of marine mammal interactions or change population sizes, especially for Steller or California sea lions.

Under Alternative 1.b, vessels would likely move to other areas (shift effort) to harvest. This could push vessels to unfamiliar or old fishing grounds. As noted under the No-action Alternative, there are no clear correlations between areas fished and marine mammal interactions. Therefore, changes in fishing patterns or areas fished may not increase or decrease exposure of the fishery to marine mammals. Based on this information, the number of interactions and type of species under Alternative 1.b would likely be similar to or lower than those observed under the No-action Alternative.

4.2.4.2.2.3 Seabirds

Black-footed albatross were observed boarding vessels in the proposed closures under Alternative 1.b. No other ESA-listed or MBTA seabirds were observed interacting with the fishery in the proposed closure areas from 2011 to 2014. In addition, we do not anticipate that movement of the fishery would increase or decrease exposure to seabirds or result in an increase in interactions because seabirds follow fishing vessels, regardless of where they fish. Based on this information, the number of interactions and type of species under Alternative 1.b would likely be similar to, or less than, those observed under the No-action Alternative.

4.2.4.2.3 Alternative 1.h, the Preferred Alternative

This alternative would make a number of changes to the EFHCAs described in the No-action Alternative. Changes would include 53 closures and 17 reopenings. Under this alternative, there would be a net increase of 12,240 mi^2 (plus 83.2 percent) in the spatial extent of coastwide BTCs compared to the No-action Alternative. We do not anticipate that changes in the area of operation of the fisheries under Alternative 1.h would affect species beyond what has been observed under the No Action Alternative.

In addition we expect impacts on incidental catch of protected species by state-managed fisheries to be similar to those described under Alternative 1.a and Alternative 1.b. State-managed fisheries operate near Alternative 1.h areas. Harvest locations of the California halibut fishery would not overlap with Alternative 1.h areas. Harvest locations of the ridgeback prawn, sea cucumber, and pink shrimp fisheries would overlap with Alternative 1.h areas, mostly in the Southern California Bight. The proportion of harvest of these species in the areas of overlap is low, indicating that the magnitude of the fishery in the areas of overlap is low. Therefore, the proposed changes under Alternative 1.h would pose negligible impacts or savings to protected species.

4.2.4.2.3.1 ESA-listed Fish

No ESA-listed salmon, eulachon, or green sturgeon were observed interacting with the groundfish bottom trawl fishery in the proposed closure areas from 2011 to 2014. We expect that the fishery would continue to interact with Chinook and coho salmon. We expect that the number of interactions would be similar to or lower than those observed under the No-action Alternative, because the closures and areas to be reopened result in a net increase in bottom trawl fishery closures.

4.2.4.2.3.2 Marine Mammals

Low numbers of Stellar and California sea lions were observed in the groundfish bottom trawl fishery feeding on catch in the proposed closed areas. The proposed closures could reduce marine mammal encounters with all species known to interact with the fishery; however, it is unclear how much additional savings could be realized since not all areas are trawled or trawlable. If we assume that the number of observed Steller or California sea lions that were observed in the proposed closed areas would reflect a savings, then we could assume that the number of annual mortalities would be lower than that observed under the No-action Alternative.

4.2.4.2.3.3 Seabirds

No ESA-listed or MBTA seabirds, were observed interacting with the groundfish bottom trawl fishery in the proposed closure areas from 2011 to 2014. MBTA seabirds were observed interacting with the fishery in the proposed closure areas from 2011 to 2014. In addition, we do not anticipate that movement of the fishery would increase or decrease exposure to seabirds or result in an increase in interactions, because seabirds follow fishing vessels, regardless of where they fish. Based on this information, the number of interactions and type of species under Alternative 1.h would likely be similar to, or less than, those observed under the No-action Alternative.

4.2.4.3 Comparison of Subject Area 1 Alternatives

Of the three action alternatives, Alternative 1.b would have the greatest spatial extent of closures. Alternative 1.b would be the most likely to reduce the impacts of the fishery on protected resources compared to the No-action Alternative. However, Alternative 1.a and Alternative 1.h would also increase the spatial extent of BTCs and could potentially benefit protected species. Alternative 1.h is the second highest spatial extent, extending approximately 1.2 percent less than the spatial extent of Alternative 1.b

(Table 4-6). Alternative 1.a would have the lowest spatial extent, approximately 19 percent less than the spatial extent of Alternative 1.b. Therefore, Alternative 1.a would be the most likely alternative to have protected resources impacts that are similar to the No-action Alternative. However, the alternatives are anticipated to pose negligible impacts on or savings for protected species overall compared to the No-action Alternative, because they would not likely appreciably change effort in bottom trawl fisheries.

4.2.4.4 Subject Area 2

Subject Area 2 alternatives would reopen portions of the trawl RCA closure outside of the tribal U&As, allowing access to vessels fishing with groundfish bottom trawl gear in some areas that have not been fished with bottom trawl gear for more than 15 years. These alternatives would open areas primarily in the 100 fm to 150 fm depth range, but they would include some sections that were modified out to the 200 fm line (mostly in Oregon and northern California). Under each Subject Area 2 alternative, there would be a net decrease in BTCs compared to the No-action Alternative, but the amount would vary between the alternatives.

The trawl RCA alternatives would also establish optional BACs that could be closed to reduce harvest of target or non-target stocks, including salmon. As described in Chapter 2, the EEZ out to the 700 fm contour would be divided into separate BACs designated by depth contours and latitude. BACs are a more flexible management tool than the trawl RCA described in the No-action Alternative. One or more of these BACs could be implemented through routine inseason management, with a single Council meeting and a single FR notice. Implementation of Alternative 2.c or Alternative 2.d would not affect state-managed fisheries. If we assume that implementation of BACs may be an effective management tool to reduce the number of interactions, then BAC implementation could lower impacts on protected species. BACs may decrease the number of interactions with all protected species from what has been observed under the No-action Alternative.

4.2.4.4.1 Alternative 2.c, the Remove the Trawl RCA and Implement BACs

Alternative 2.c would remove the 2015 trawl RCA outside the tribal U&A. This alternative would also provide NMFS and the Council with the option of using BACs to address a species management concern. The closures would be based on depth and latitude, and they could be implemented in any combination. Since, we are not certain when or where these closures would be implemented, it is difficult to assess the overall benefits of BACs for protected species. Benefits may be localized through implementation of one BAC or applied coastwide using all BACs. To assess the impacts of these depth-based and latitude-based area closures, we considered observed interactions data for those depth and latitudinal breaks that contained observed protected species.

Even though an area is currently open to fishing, some BACs had no protected species observations. In addition, we cannot provide protected species observations for the BACS within the trawl RCA since no observations occurred. Therefore, we infer that BACs for these areas would have some benefit for protected species, but we do not know to what extent (i.e., the number of interactions that may not occur due to a closure).

Bottom trawling would be permitted in the current trawl RCA area under Alternative 2.c; however, gear restrictions may change. If the trawl RCA were removed, we assume that large footrope gear may be used seaward of the 100 fm line (currently it is required seaward of the 150 fm line). We assume that other small footrope gear may be used shoreward of the trawl RCA in the future, because vessels are using EFPs to be exempt from the use of selective flatfish trawl (SFFT) gear, and they use other small footrope gear. The use of these different gear types in various depth bins could impact eulachon or green sturgeon, but we are uncertain to what extent. See Chapter 6, Cumulative Effects, for a discussion of impacts.

The effectiveness of BACs to reduce impacts of the fishery on protected resources may be limited. Since this alternative may be implemented inseason or before the start of the fishing year, near real-time data would be necessary for the Council and NMFS to determine the need for action inseason and to determine its effectiveness (i.e., preventing exceedance of ITS or for some other conservation and management need).

The WCGOP provides updates and annual reports each year. This information is crosschecked, and some numbers are expanded to fleet wide totals to monitor mortality real time (salmon) or for an annual mortality report at the end of the fishing year. Any new information provided could be used to close a BAC before the start of the next fishing season or under an inseason action as needed. The ESA Section 7(a)(2) Biological Opinion (NMFS 2017d) requires at-sea and dockside monitoring so that NMFS can monitor the salmon ITS in the non-whiting sector, including bottom trawl. Therefore, NMFS and the Council may have enough information to consider BAC closures inseason for salmon for a short time or for the remainder of the season. If catch of eulachon or green sturgeon were to increase, the Council could consider closing certain depth and latitudinal bins where these species typically reside or where catch occurs.

BAC closures may not be effective due to the lag of information and the general movement of some species. Although WCGOP gets real-time interaction information for short-tailed albatross and marine mammals such as whales, a closure may not be effective for these species since they are rare, and these animals move great distances.

Bottom trawling would be permitted in the trawl RCA; however, all other bottom trawl closures would remain in place (EFHCAs, CCAs, and GCAs). As noted, we do not have WCGOP observation data inside the trawl RCA to summarize impacts and speculate on potential impacts to protected species. As discussed under the No-action Alternative, protected species interactions occur coastwide shoreward and seaward of the trawl RCA. Therefore, removal of the trawl RCA would increase the potential for interactions with protected species. We anticipate interactions would occur, but the magnitude of change (decrease or increase) cannot be estimated. Interactions may simply be a function of effort and not area-based, so interactions may occur in other areas, rather than increase or decrease because of trawl RCA removal. We expect the fishery would shift some effort into this area; therefore, interactions may simply be transferred to other areas of the ocean.

4.2.4.4.1.1 Salmon

Under the ESA Section 7(a)(2) Biological Opinion, (NMFS 2017d), NMFS estimated the effects of the proposed action and concluded that the current IFQ management system, management tools, bycatch avoidance incentives, and near-real time catch data would likely result in larger groundfish catches, but lower salmon bycatch rates, than occurred historically. The 2017 Biological Opinion assumed that the trawl RCA would be removed off California and Oregon and that bycatch rates would remain similar to those recently estimated by WCGOP, regardless of whether the trawl RCA off Oregon and California would stay in place or be removed. The 2017 Biological Opinion reasoned that incentives and improved efficiencies associated with the catch share program, along with real-time, 100 percent monitoring and near-real-time data reporting would mean that IFQ fishermen could selectively choose where, when, and how to fish to increase catch of target species yet minimize bycatch. These tools were not available to managers or fishermen in the 1980s and 1990s. Also, the catch share program and the vessel buyback program have resulted in significant fleet consolidation. These programs, combined with improved efficiencies, have resulted in increased CPUE of groundfish species with fewer trips and tows that may encounter salmon.

The trawl industry has the additional incentive of reducing bycatch of all species to remain certified by the Marine Stewardship Council (NMFS and Council 2017). The Marine Stewardship Council certified the West Coast LE groundfish trawl fishery as sustainable in 2014 (MSC.org). It is unlikely that fishing strategies will change dramatically throughout the EEZ, due to reasons described above, and any changes in distribution of effort and gear type could be strategic (i.e., to improve efficiency and maintain or reduce bycatch; NMFS and Council 2017; Agenda Item G.8 Attachment, March 2016; Matson and Erickson 2017). The availability of these measures and the increased incentives to avoid bycatch, combined with advancements in management, monitoring, and technology, would result in Chinook salmon bycatch rates similar to those of recent years. The analysis assumed that large roller gear would be used seaward of the 100 fm line and that the SFFT would continue to be required shoreward of the trawl RCA. Based on this information, the number of interactions and salmon species under Alternative 2.c would likely be similar to those observed under the No-action Alternative and would remain within the confines of the salmon ITS.

4.2.4.4.1.2 Eulachon and Green Sturgeon

We do not have observer data for these species inside the trawl RCA. Therefore, we cannot quantify the potential impacts. The fishery would return to some of these areas to fish for flatfish; therefore, we would expect some level of interaction with eulachon and green sturgeon. However, based on observed depth-based bycatch in the bottom trawl fishery and the fishery footprint for the California halibut fishery, green surgeon are typically not caught deeper than 100 fm. Therefore, under Alternative 2.c, more fishing may occur in 100 fm to 150 fm depths (reopened trawl RCA) where green sturgeon are generally not caught, and impacts may be lower than what has been observed under the No-action Alternative. Eulachon has been observed in the 100 fm to 150 fm and the 150 fm to 700 fm depth ranges, however, in lower numbers than those caught in the 0 fm to 30 fm depth range. Therefore, we would expect some level of eulachon catch if the trawl RCA were removed. We would anticipate that catch of eulachon under Alternative 2.c may be higher than what has been observed under the No-action Alternative, given the presence of the species in the trawl RCA. We cannot provide estimates of the anticipated increase.

4.2.4.4.1.3 Marine Mammals

Marine mammals may be more exposed to the fishery based on the amount of area available to be fished, but we should not assume that an increase in interactions would occur. We do not anticipate that the opening of the trawl RCA would dramatically increase overall fishery effort or add vessels to the fleet. The fleet would likely shift some of its effort to inside the trawl RCA, and we anticipate that interactions would occur with marine mammals, but it is not possible to predict annual occurrences. We assume that interactions outside the trawl RCA would reflect the type of interaction (entanglement, feeding on catch, etc.) and the type of species that has been observed under the No-action Alternative. We expect that some portion of the observed interactions outside the trawl RCA would then be observed inside it. Based on these assumptions, we expect that the annual number of interactions and species observed under Alternative 2.c would be similar to those observed under the No-action Alternative.

4.2.4.4.1.4 Seabirds (ESA-listed and MBTA)

Seabirds follow fishing vessels; therefore, we anticipate that new fishing areas would not increase or decrease exposure to seabirds. We expect that the annual number of interactions and species observed under Alternative 2.c would be similar to those observed under the No-action Alternative.

The Council may implement BACs as needed for an extended time (all year) or for a short time (two-month period). The implementation of these closures may benefit species that happen to be in the area during the closure; however, the magnitude of the benefit is unknown. Even though a closure may occur, protected species move frequently, and they may be impacted in areas that are still open to fishing.

If we continue to assume that implementation of BACs could reduce the number of interactions, then BAC implementation could lower impacts to protected species on an annual basis. Based on this information and bycatch observed, BACs may decrease the number of interactions with all protected species from what has been observed under the No-action Alternative.

4.2.4.4.2 Alternative 2.d the Preferred Alternative

Alternative 2.d would reopen all of the area defined as the trawl RCA between the Columbia River (46°16’ N. latitude) and the United States/Mexico border (e.g., off Oregon and California). This alternative would retain the trawl RCA off the Washington coast, as described in the No-action Alternative. BACs could extend between the Columbia River and the United States/Mexico border and could be closed in any combination, either preseason or inseason. Alternative 2.d would have a net decrease in BTCs of 19 percent compared to the No-action Alternative. Areas that would be reopened would have the potential to affect species in a manner similar to Alternative 2.c, Remove the Trawl RCA, with potentially smaller effects on northern species that occur more frequently in the trawl RCA off the Washington coast.

4.2.4.5 Comparison of Subject Area 2 Alternatives

The impacts of Alternative 2.d would be similar to Alternative 2.c, but not as extensive, because the proposed removal of the trawl RCA and implementation of BACs would only be for waters off Oregon and California. Removal of the trawl RCA would expose protected species more than the No-action Alternative, but less than Alternative 2.c. The temporary benefits of closures of BACs would be less than those described for Alternative 2.c.

4.2.4.6 Subject Area 3, Alternative 3, the Use MSA Sec. 303(b) discretionary authorities to close waters deeper than 3,500 m

This alternative would close waters deeper than 3,500 m to bottom contact gear. There are no known groundfish or non-groundfish bottom trawl trips beyond 3,500 m, and there are no protected species interactions with bottom trawling in these areas to analyze. A closure of the area would prevent interactions and may benefit all protected species that reside or travel through the area. We do not expect that implementation of this alternative would negatively affect protected species compared to the No-action Alternative. This is because it would prohibit prospective future bottom-contacting gear fishing activities in this area, and is not anticipated to differ from the impacts of the No-action Alternative.

5 SYNTHESIS COMBINATIONS

This chapter describes and compares the net effects of a range of combinations of Subject Area 1 (EFHCAs) and Subject Area 2 (trawl RCA) alternatives, as well as the No-action Alternative, on habitat, fish resources, protected resources, and economics. It is intended to inform the decision maker and the public when they consider the combined effects of these actions. The Subject Area 3 alternative (closing areas deeper than 3,500 m to all bottom contact gear) was not included, because it would not affect the bottom trawl fishery for the foreseeable future, and it does not overlap spatially with either Subject Area 1 or Subject Area 2.

The Project Team identified a set of combinations that cover the range of possible combinations, from the most protective of habitat to the least protective of habitat and the most restrictive on fishing to the least restrictive on fishing and a combination of the preferred alternative under each Subject Area. Those combinations re shown in Table 5-1 and Figure 5-1, Figure 5-2, Figure 5-3, and Figure 5-4.

Table 5-1. Combinations of alternatives that were compared to the No-action Alternative and to each other.

		Combination of Alternatives			
Alternative	**No-action Alternative**	**Combination 1**	**Combination 2**	**Combination 3**	**Combination 4 - Preferred**
No-action Alternative	**X**		**X (RCA only)**		
1.a, the Collaborative Alternative		**X**			
1.b, the Oceana, et al. Alternative			**X**	**X**	
1.h, the EFHCA Preferred Alternative					**X**
2.c, the Eliminate RCA south of Pt Chehalis w/optional BACs Alternative		**X**		**X**	
2.d, the RCA Preferred Alternative					**X**

This analysis compares, for each combination of alternatives, the metrics in the total area of coastwide BTCs resulting from implementation of that combination to current closures under the No-action Alternative. The EFHCA alternatives are combined with the removal of the trawl RCA under the RCA alternatives, but not with the BTCs in those alternatives, because they unlikely to contribute to habitat protections in a meaningful way.

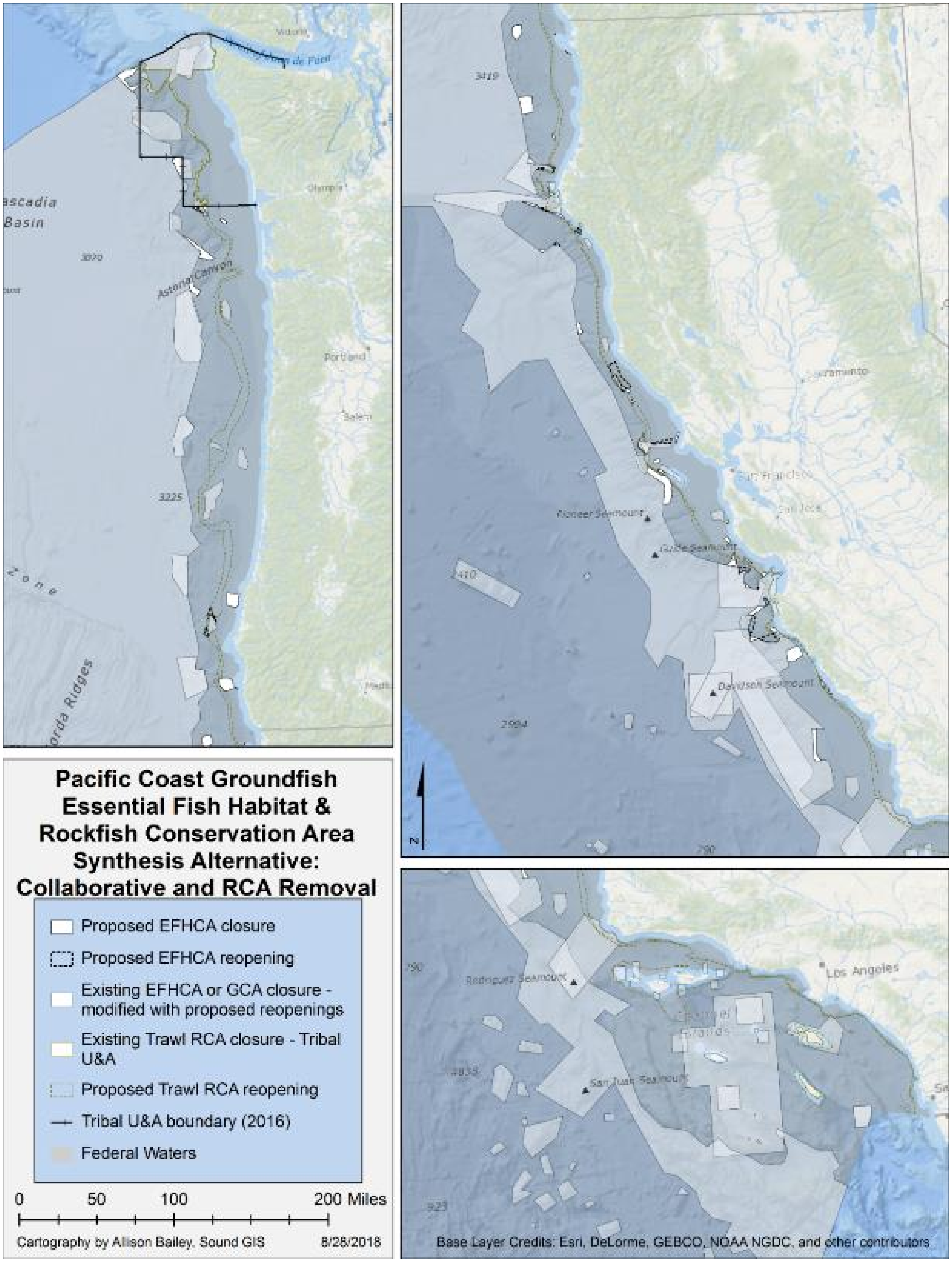

Figure 5-1. Coastwide bottom trawl closures with implementation of Combination 1.

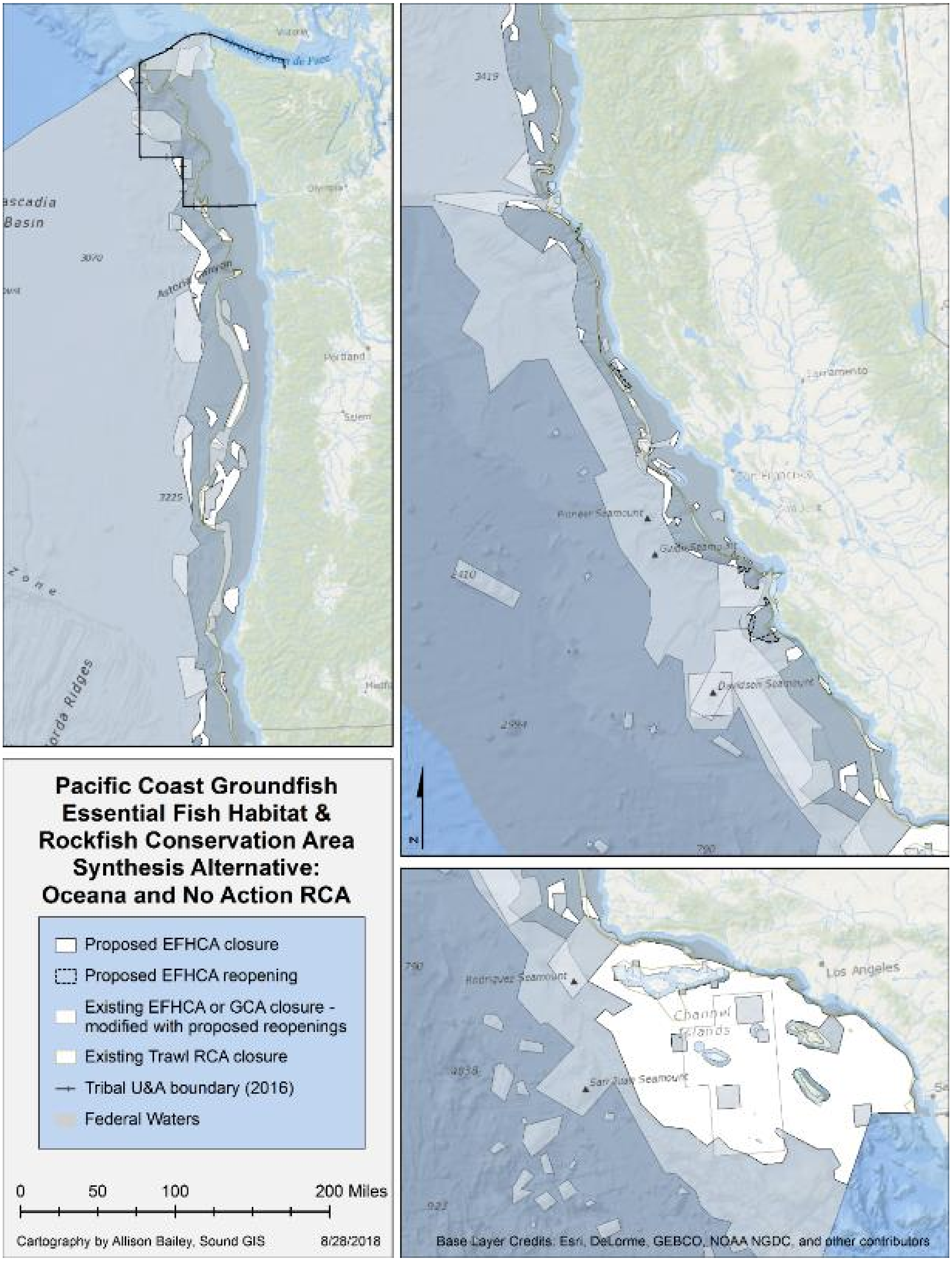

Figure 5-2. Coastwide bottom trawl closures with implementation of Combination 2.

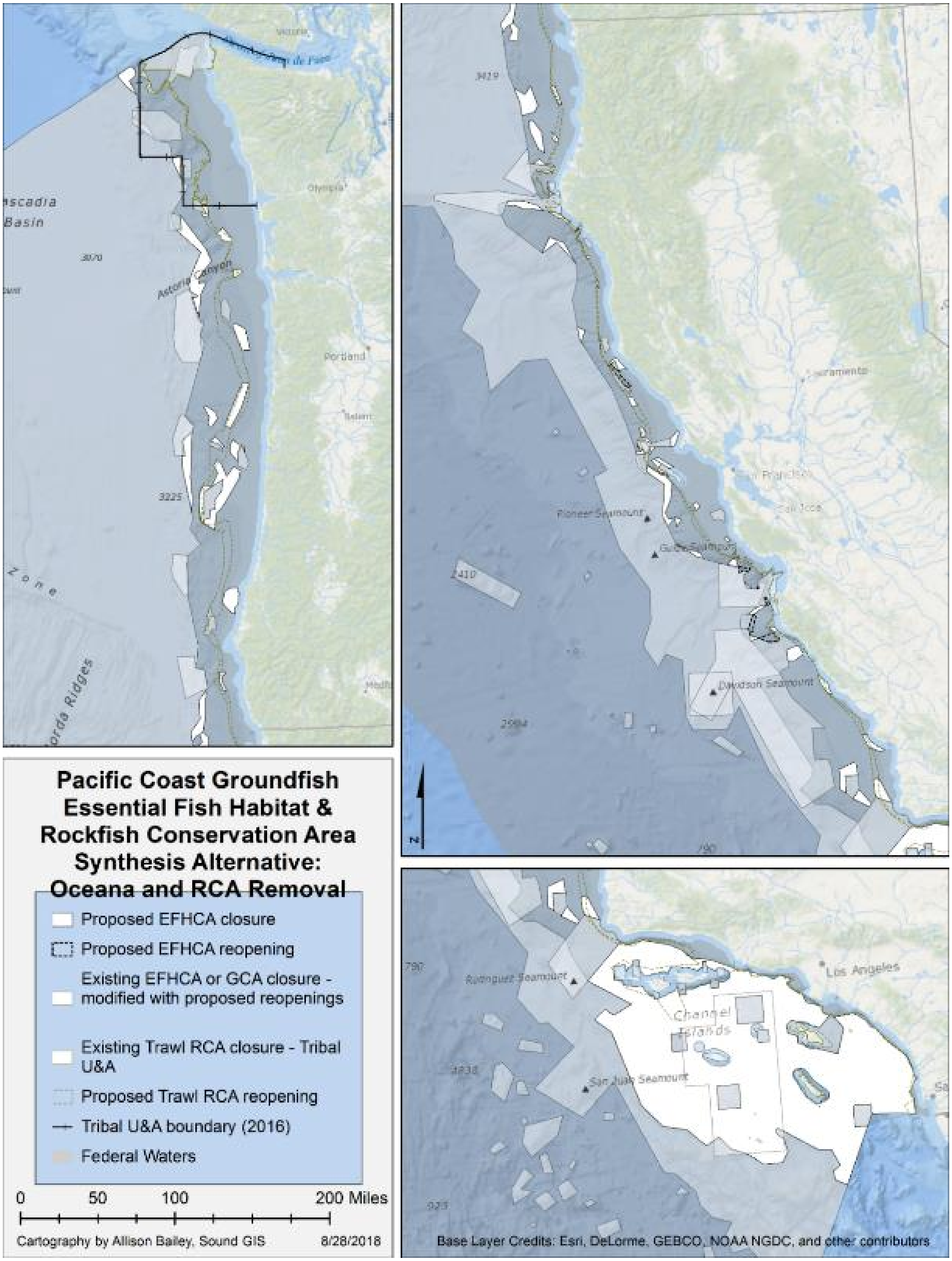

Figure 5-3. Coastwide bottom trawl closures with implementation of Combination 3.

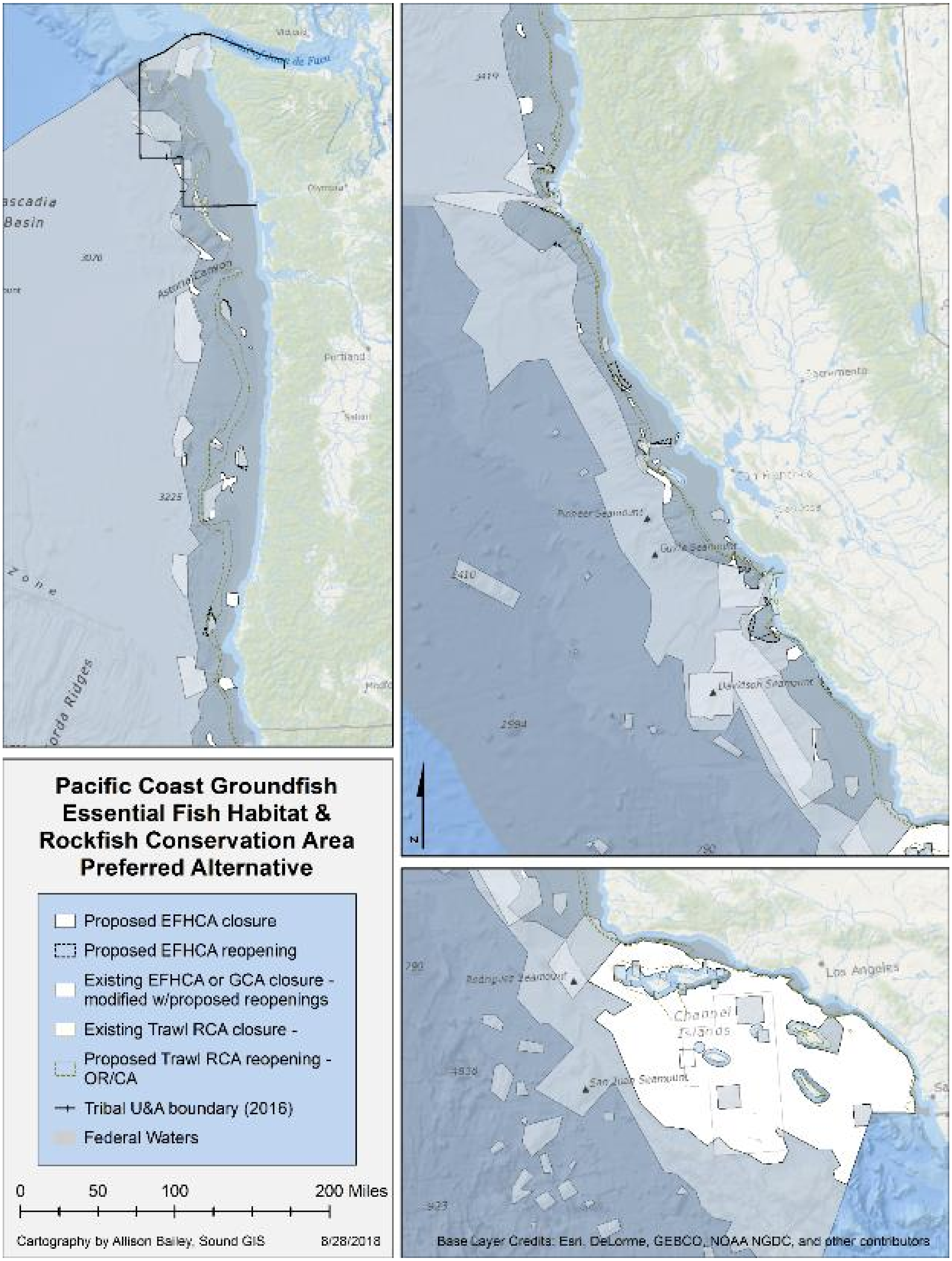

Figure 5-4. Coastwide bottom trawl closures with implementation of Combination 4.

These net metrics for Combination 3 are the same as the metrics under Alternative 1.b, the Oceana, et al. Alternative shown in Chapter 4, Section 4.2.1.3. However, the metrics for the remaining three combinations are unique to this synthesis, because they account for areas where the proposed EFHCA alternatives would overlap with the area to be reopened when the trawl RCA is eliminated (Figure 5-5).

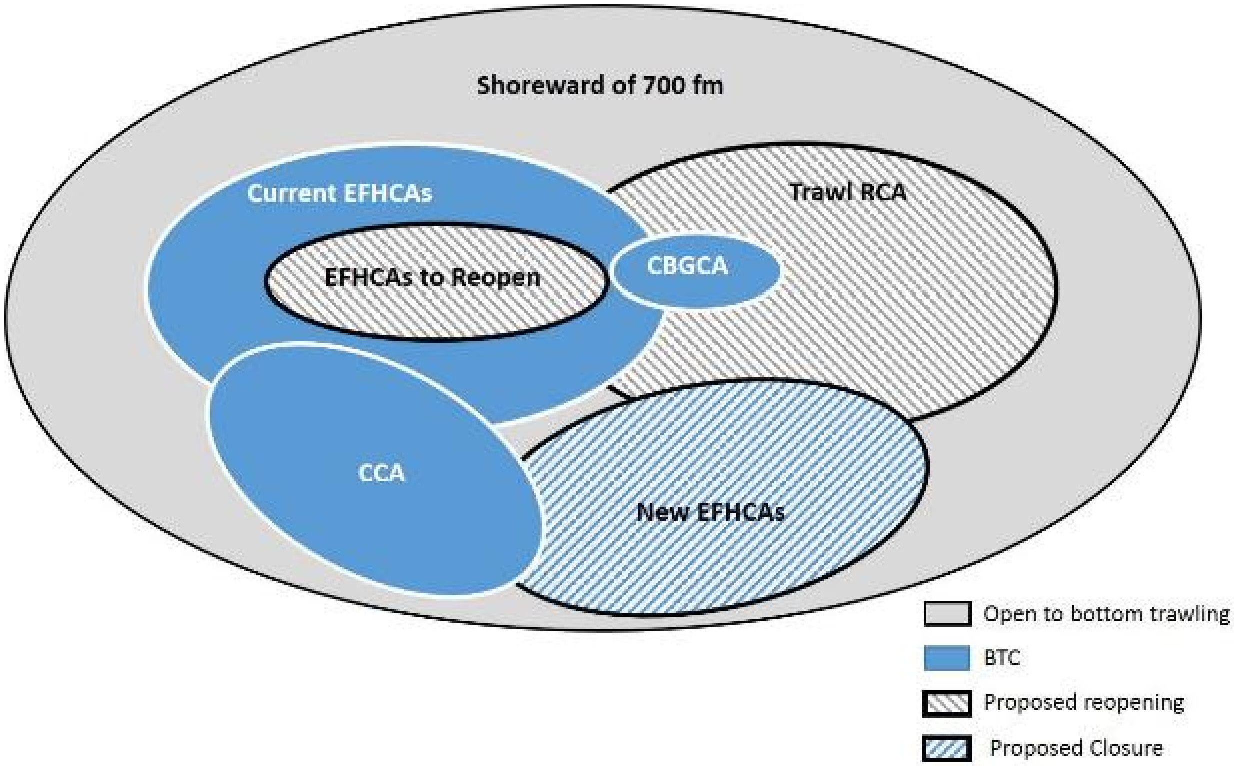

Figure 5-5. Conceptual Venn diagram of the relationship between the EFHCA changes, elimination of the trawl RCA, and areas to remain closed. Cross-hatched areas indicate changes to coastwide BTCs. Note: This figure is not to scale, and it is not intended to evaluate relative impacts.

5.1 Habitat Impacts

The net changes in spatial extent and habitat types of each combination are shown in Table 5-2.

Table 5-3 ranks the alternative combinations, including the No-action Alternative, relative to the total area that would be closed to bottom trawling, upon implementation of the combination, for each habitat metric (1 = highest habitat protection, 5= lowest habitat protection).

No-action Alternative. The No-action Alternative would maintain the status quo on coastwide BTCs, with a spatial extent of 14,715 mi^2 (Table 5-2), and would rank fourth among the combinations (Table 5-3). The mean rank score across all habitat metrics is 3.8, with OFS ranking second, the three HFI bycatch metrics ranking third, and the remaining nine metrics ranking either fourth or fifth, relative to the other combinations.

Combination 1. Combination 1, consisting of Alternative 1.a, and Alternative 2.c would close 987 mi^2 and reopen 3,081 mi^2, reducing the coastwide spatial extent of BTCs by 2,094 mi^2 (minus 14 percent) relative to the No-action Alternative (Table 5-2). This is the only combination that would reduce protections from bottom trawling, and it has a mean rank score of 4.8 (Table 5-3). Although Alternative 1.a would have positive gains across all habitat metrics on its own, these gains were more than offset by the removal of the RCA under Alternative 2.c, resulting in negative values, and a fifth-place ranking, for all but three habitat metrics. These losses would range from a low of minus 9 percent in cells with DSC presence data to a high of minus 84 percent in coastwide OFS habitat. The three positive metrics are estimated for hard substrate (plus 11 mi^2, 1 percent), mixed substrate (plus 21 mi^2, 6 percent), and canyons (plus 78 mi^2, 10 percent), which rank fourth among the combinations, ahead of the No-action Alternative only. However, those increases are relatively small compared to the gains in the other three action combinations.

Combination 2. Combination 2, consisting of Alternative 1.b, would close 14,380 mi^2 and reopen 143 mi^2 for a net increase in the coastwide spatial extent of BTCs by 14,238 mi^2 (plus 97 percent) (Table 5-2), relative to the No-action Alternative. This combination has a mean rank score of 1.0 (Table 5-3). It would increase habitat protections (i.e., positive habitat metrics) and ranks the highest among the combinations (Table 5-3), across all metrics. Relative increases in protections for each habitat type, except OFS, would range from a low of plus 40 percent for DSC present to a high of plus 108 percent for the DSC bycatch. OFS would increase, but only by 6.4 percent.

Combination 3. Combination 3, consisting of Alternative 1.b and Alternative 2.c, would close 15,440 mi^2 and reopen 2,978 mi^2, for a net increase in the coastwide spatial extent of BTCs of 12,462 mi^2 (plus 85 percent) (Table 5-2) relative to the No-action Alternative. This combination has a mean rank score of 3.3 (Table 5-3). It would increase habitat protections across, and ranks the second highest among, the combinations, for all metrics except for OFS (minus 636 mi^2, minus 67 percent), which would rank third behind the No-Action Alternative. This is not surprising because the trawl RCA was established to control the bycatch of overfished species and contains a large amount of OFS habitat that would be reopened under this combination. Increases in protection would range from a low of plus 5 percent (cells exceeding median sea pen bycatch) to a high of plus 88 percent (canyons). The difference between this combination and Combination 2 is due entirely to the presence of the RCA.

Combination 4. Combination 4, consisting of Alternatives 1.h (EFHCA PA) and 2.d (RCA PA), would close 13,151 and reopen 2,958 mi^2, for a net increase in the coastwide spatial extent of BTCs of 10,166 mi^2 (plus 69 percent), relative to the no-action Alternative (Table 5-2). This combination has a mean rank score of 3.3 (Table 5-3). It would increase protections across all habitat metrics except for OFS and the three HFI bycatch metrics, which would have a decrease of 47 percent to 77 percent. Although

Alternative 1.h would have gains across all habitat metrics, the gains in OFS and the three metrics of HFI bycatch would be more than offset by elimination of the RCA off Oregon and California. This combination ranks third highest across most habitat metrics, relative to the other combinations. The exceptions are those four negative metrics (OFS and the three bycatch metrics: DSC, sponges and sea pens), which would rank fourth behind the No-action Alternative.

Based on this analysis, the effects on habitat from Combination 4, which incorporates the preferred alternatives for the EFHCAs and RCA, fall in the middle of the range of effects represented by the suite of combinations analyzed.

Table 5-2. Net change from No-action Alternative to total area closed to bottom trawling, by all management measures combined (EFHCAs, trawl RCA, and West CCA) under a range of combinations of EFHCA and trawl RCA alternatives. Combinations are ordered from left to right, based on the magnitude of net change from the No-action Alternative. "%" = percent change from the No-action Alternative. Positive values = gains in habitat protection, negative values = reduction in habitat protection.

Metric					**No-action Alternative**	**Net changes to area closed to bottom trawling, shoreward of 700 fm, by alternative combination**							
						Combo 1 (1.a & 2.c)		**Combo 2 (1.b)**		**Combo 3 (1.b & 2.c)**		**Combo 4 (1.h & 2.d; Preferred Alternatives)**	
Spatial extent				mi²	14715	-2094	-14.2%	14238	96.8%	12462	84.7%	10166	69.1%
Substrate Type	Hard			mi²	1330	11	0.9%	943	70.9%	936	70.4%	694	52.2%
Substrate Type	Mixed			mi²	345	21	6.1%	149	43.2%	137	39.6%	50	14.5%
Substrate Type	Soft			mi²	12985	-2124	-16.4%	13102	100.9%	11346	87.4%	9378	72.2%
Substrate Type	Unknown			mi²	56	-2	-3.9%	44	78.3%	44	78.3%	44	78.3%
Priority Habitats	Canyons			mi²	779	78	10.0%	760	97.6%	686	88.1%	311	39.9%
Priority Habitats	OFS			mi²	948	-799	-84.3%	61	6.4%	-636	-67.1%	-726	-76.6%
Priority Habitats	Habitat Forming Invertebrates	Grid Cell Counts											
Priority Habitats	Habitat Forming Invertebrates	Presence	DSC		915	-84	-9.2%	365	39.9%	317	34.6%	236	25.8%
Priority Habitats	Habitat Forming Invertebrates	Presence	Sponges		1429	-300	-21.0%	957	67.0%	814	57.0%	601	42.1%
Priority Habitats	Habitat Forming Invertebrates	Presence	Sea Pens		906	-161	-17.8%	471	52.0%	362	40.0%	152	16.8%
Priority Habitats	Habitat Forming Invertebrates	Bycatch	DSC		4973	-2359	-47.4%	5383	108.2%	2864	57.6%	-2350	-47.3%
Priority Habitats	Habitat Forming Invertebrates	Bycatch	Sponges		7144	-4317	-60.4%	4928	69.0%	1193	16.7%	-4161	-58.2%
Priority Habitats	Habitat Forming Invertebrates	Bycatch	Sea Pens		5698	-3795	-66.6%	3632	63.7%	255	4.5%	-3333	-58.5%

Table 5-3. Ranking of habitat metrics for total area closed to bottom trawling by each combination of alternatives. Combinations and the No-action Alternative are ordered left to right based on rank of total spatial extent. 1 = highest, 5 = lowest.

<table>
<tr><th colspan="3" rowspan="2">Metric</th><th colspan="5">Rank</th></tr>
<tr><th>Combo 2</th><th>Combo 3</th><th>Combo 4 (Preferred)</th><th>No-action Alternative</th><th>Combo 1</th></tr>
<tr><td colspan="3">Spatial extent</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr>
<tr><td rowspan="4">Substrate Type</td><td colspan="2">Hard</td><td>1</td><td>2</td><td>3</td><td>5</td><td>4</td></tr>
<tr><td colspan="2">Mixed</td><td>1</td><td>2</td><td>3</td><td>5</td><td>4</td></tr>
<tr><td colspan="2">Soft</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr>
<tr><td colspan="2">Unknown</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr>
<tr><td rowspan="8">Priority Habitats</td><td colspan="2">Canyons</td><td>1</td><td>2</td><td>3</td><td>5</td><td>4</td></tr>
<tr><td colspan="2">OFS</td><td>1</td><td>3</td><td>4</td><td>2</td><td>5</td></tr>
<tr><td rowspan="6">Habitat-forming Invertebrates</td><td rowspan="3">Presence</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr>
<tr><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr>
<tr><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td></tr>
<tr><td rowspan="3">Bycatch</td><td>1</td><td>2</td><td>4</td><td>3</td><td>5</td></tr>
<tr><td>1</td><td>2</td><td>4</td><td>3</td><td>5</td></tr>
<tr><td>1</td><td>2</td><td>4</td><td>3</td><td>5</td></tr>
<tr><td colspan="3">Mean Rank</td><td>1.0</td><td>2.1</td><td>3.3</td><td>3.8</td><td>4.8</td></tr>
</table>

5.2 Socioeconomic Impacts

Table 5-4 displays the indices related to net economic impacts of four combinations of Subject Area 1 (EFHCA changes) and Subject Area 2 (RCA changes) alternatives, as well as the No-action Alternative relative to RCA changes. All of the Subject Area 2 alternatives, including the No-action Alternative, include discretionary actions that the Council and NMFS may take prior to or during a fishing season to close areas to bottom trawling. We do not explicitly address the impacts of optional closures within those alternatives, which would fall within the range of impacts described here.

Table 5-4. Summary of synthesis combination impacts. Values are percent of coastwide values, for the reference period (2011 to 2014 for proposed closures; 1997 to 2001 for proposed reopenings).

Combination	**Proposed Closures**	**Proposed Closures**	**Proposed Closures**	**Proposed Reopenings**	**Proposed Reopenings**	**Proposed Reopenings**
	Landings (1000s lbs.)[a/]	**Revenues (2015 dollars, 1000s $) [a/]**	**Square Miles**	**Landings (1000s lbs.)[b/]**	**Revenues (2015 dollars, 1000s $) [b/]**	**Square Miles**
Comb #1 (Alt 1a & Alt 2c)	0.17%	0.19%	987	12.14%	11.28%	3,081
Comb #2 Alt 1b & No Action for RCA	2.8%	3.36%	14,380	0.3%	0.3%	143
Comb #3 (Alt 1b & Alt 2c)	2.8%	3.36%	15,440	11.94%	11.08%	2,978
Comb #4 (Alt 1.h & Alt 2.d)	0.26%	0.30%	13,151	12.72%	11.83	2,958

a/ As a percent of 2011 to 2014 values. Note: The percent values for proposed closures and proposed reopenings cannot be directly compared, and they should not be summed in an effort to calculate net impacts. Rather, this table shows the percent values relative only to the individual reference period (either 1997 to 2001 for reopenings, or 2011 to 2014 for closures).

The potential impacts of the Subject Area 2 alternatives could range between the impacts of the Alternative 2.c reopenings (remove the trawl RCA), and complete closure of waters shoreward of 700 fm to groundfish bottom trawling. NMFS currently has the authority to prohibit fishing groundfish with bottom trawl gear. All of the alternatives would provide the ability to close specific depth and latitude segments shoreward of 700 fm (i.e., BACs), rather than the entire EEZ. The economic impacts associated with a complete closure would be equal to losing the landings and revenues associated with the No-action Alternative, minus those associated with the tribal U&A off Washington (see Table 4-2).

Alternatives 2.c and 2.d would provide the agency with some additional flexibility that may allow them to implement closures more precisely targeted on conservation needs such that there would be a lesser direct economic impact on the industry. The closures that might be implemented under Alternative 2.c and Alternative 2.d would not likely provide the same habitat-related ecosystem services as those associated with permanent closures, because they would not likely be in place for long enough periods to allow a habitat response. They would likely provide at least some economic benefit related to the conservation of the fish resources the closures would be intended to protect.

We do not include Alternative 3, the Close Waters Deeper than 3,500 m to Bottom Contact Gear, because there has been no bottom trawl fishing in those areas, for either reference period (1997 to 2001 or 2011 to 2014). Closing these waters would, therefore, not displace any past known groundfish bottom trawl fishing. While this action may potentially restrict flexibility in the fishery to access these areas in the future, the lack of historic participation indicates that these areas are not profitable for vessels under recent management, technology, and market conditions; thus, economic and social impacts are expected to be negligible or zero.

The combinations are shown here to present a range of options, with varying degrees of economic impact, as indicated by the indices and summaries of qualitative factors. Three of the four combinations show varying degrees of positive economic impacts coastwide, while one (Combination 2: Alternative 1.b and no trawl RCA changes) shows a modest negative coastwide economic impact.

5.2.1 Combination 1

Combination 1 merges Alternative 1.a (Collaborative) with Alternative 2.c (Remove trawl RCA w/option for BACs). It would close areas contributing less than 0.2 percent of coastwide landings (pounds) and revenues in recent years (2011 to 2014), and it would reopen areas contributing 12.14 percent and 11.28 percent, respectively, for landings (pounds) and revenues in the historic period (1997 to 2001). The proposed closures would restrict access to fishing grounds that are currently open, which may result in a negative impact since fishermen would experience some reduction in their ability to optimize their fishing activity (including operational efficiency). Fishermen might increase their effort to find alternative areas to compensate for the newly closed areas, such that harvest and revenue would be maintained to at least some degree, but with less optimal trip characteristics (costs, travel time, etc.).

The proposed reopenings would allow access to fishing grounds that have been closed between 12 and 16 years. Although groundfish bottom landings are limited by ACLs, opening new fishing areas would give the fleet flexibility to optimize its fishing effort, including potentially increasing ACL attainment for some species. Flexibility for operations and access to more fishing area with the potential for increased attainment in those areas over the attainment in the No-action Alternative would provide economic benefits to the fleet, supply chains, and associated coastal communities. Also, adopting a management strategy that would rely less on pre-catch share regulations, like the time/area closures of the trawl RCA would likely have a positive effect on the formation of *Attitudes, Beliefs, and Values* towards the management of the fishery, as doing so would make good on the promised benefit of the catch-share system.

Areas closed would contribute to ecosystem services and existence values, while reopened areas may detract from those indirect economic benefits. Fishery-related ecosystem services require fishing activities; therefore, a balance has to be drawn between those particular ecosystem services and fishing activities. As discussed in Chapter 4, existence values tend to be substitutable and, therefore, do not likely increase in proportion to the amount of something protected. In national policy, existence values are exemplified by the ESA, which only comes into play at extremely low levels. Therefore, while there may be some impact on existence values, it seems less likely that there would be noticeable affects at the levels of protection that are being considered here.

5.2.2 Combination 2

Combination 2 merges Alternative 1.b (Oceana, et al.) with no changes to the trawl RCA. The metrics are identical to a stand-alone Alternative 1.b. It would result in closing areas contributing 2.8 percent and 3.36 percent of coastwide landings (pounds) and revenues, respectively, in the recent period (2011 to 2014), and it would reopen areas representing 0.3 percent of both coastwide landings (pounds) and revenues in the historic period (1997 to 2001). See the second and third paragraphs under Combination 1 (Section 5.2.1) for a discussion of the immediate direct impacts of closures and openings on the fishing industry, supply chain, and communities. The proposed reopenings may result in some localized compensatory benefit to surrounding communities, with access to areas that have been closed since 2002. These reopened areas would not likely provide enough new opportunity to offset the loss of the closures under this combination, resulting in likely negative immediate direct economic impacts for vessels, processors, and communities, particularly those in ports near the largest closures. Also, with no changes to the trawl RCA, maintaining the status quo could negatively affect the formation of *Attitudes, Beliefs, and Values* towards management of the fishery.

Areas closed would contribute to ecosystem services and existence values, while areas open may detract from those indirect economic benefits. See the last paragraph under Combination 1 (Section 5.2.1) for further discussion of the dynamics of these costs and benefits.

5.2.3 Combination 3

Combination 3 merges Alternative 1.b (Oceana, et al.) with Alternative 2.c (remove trawl RCA w/option for BACs). It would result in closing areas contributing 2.8 percent and 3.36 percent of coastwide landings (pounds) and revenues, respectively, in the recent period (2011 to 2014), and it would reopen areas contributing 11.94 percent and 11.08 percent of coastwide landings (pounds) and revenues, respectively, in the historic period (1997 to 2001). The proposed closures could be considered a negative economic impact because fishermen must find alternative areas to fish to compensate for the lack of access to those newly closed areas. However, the newly reopened areas, represented primarily by the trawl RCA, would likely compensate to some degree for the closed areas by giving fishermen additional flexibility and the opportunity to fish more selectively. Most of these areas have been closed for 16 years, and reopening them could result in higher achievement of ACLs, which would be a positive economic impact to the fleet and to coastal communities with high *Dependence on* the groundfish fishery. A community or port groups' *Dependence on* the groundfish fishery is described by the proportion of total ex-vessel revenue generated by landings from the fishery within a port group.

Areas closed would contribute to ecosystem services and existence values, while areas opened may detract from those indirect economic benefits. See the last paragraph under Combination 1 for further discussion of the dynamics of these costs and benefits.

5.2.4 Combination 4 (the Preferred Alternative)

Combination 4 merges Alternative 1.h (the Preferred Alternative) with Alternative 2.d (remove trawl RCA w/option for BACs off Oregon and California only). It would result in closing areas contributing 0.26 percent and 0.3 percent of coastwide landings (pounds) and revenues, respectively, in the recent period (2011 to 2014), and would reopen areas contributing up to 12 percent and 11 percent of coastwide landings (pounds) and revenues, respectively, in the historic period (1997 to 2001), depending on the degree to which block area closures would be implemented that would reclose newly opened areas. The proposed closures could be considered a negative economic impact because fishermen must find alternative areas to fish to compensate for the lack of access to those newly closed areas. However, the newly reopened areas, represented primarily by the trawl RCA, would likely compensate to some degree for the closed areas by giving fishermen additional flexibility and the opportunity to fish more selectively. Most of these areas have been closed for 16 years, and reopening them could result in higher achievement of ACLs, which would be a positive economic impact to the fleet and to fishing-dependent coastal communities

Areas closed would contribute to ecosystem services and existence values, while areas open may detract from those indirect economic benefits. See the last paragraph under Combination 1 (Section 5.2.1) for further discussion of the dynamics of these costs and benefits.

5.3 Fish Resources and Protected Species Impacts

Habitat protections benefit fish resources; therefore, the impacts of the combinations on fish resources due to habitat closures from all Subject Area 1 alternatives would be similar to those discussed in Section 5.1, Habitat, and they are shown in Table 5-3. Regardless of how alternatives are combined, the biggest potential for direct and immediate impacts on fish resources would be from Subject Area 2 alternatives. Alternative 2.c and Alternative 2.d would both remove portions of the trawl RCA and may increase landings of groundfish stocks compared to the 2011 to 2014 period, but negative impacts on fish resources from harvest are controlled by regulations that prevent overfishing. These impacts are discussed in more detail in Section 4.2.3.3.1 for Alternative 2.c, which would have impacts similar to Alternative 2.d. Therefore, any combination that includes removal of the trawl RCA (Combination 1, Combination 3, and Combination 4) would have impacts similar to those described in Chapter 4.

We expect some level of impact on protected species under each alternative and combination, but none of the synthesis combinations would change the impacts on protected resources considered and discussed in Chapter 4, because shifts in locations of fishing effort does not correlate with protected species interactions. As discussed in Section 4.2.4, impacts of all alternatives would likely be similar to those under the No-action Alternative. If a change in impacts were to occur in the groundfish bottom trawl fishery, they would be observable, because we do not expect that additional areas being closed or opened in combination with one another would change observation rates under the WCGOP (100 percent monitoring with EM or human observers for vessels fishing groundfish IFQ with bottom trawl gear).

6 CUMULATIVE EFFECTS

The Council for Environmental Quality (CEQ) regulations implementing NEPA reference the need for a cumulative effects analysis (CEA) (40 CFR 1508.25). CEQ regulations define cumulative impacts as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or nonfederal) or person undertakes such other action." The purpose of a CEA is to consider the effects of the proposed action combined with the effects of many other actions on the human environment. The CEA assesses impacts that would be missed if each action were evaluated separately. CEQ guidelines recognize that it is not practical to analyze the cumulative effects of an action from every conceivable perspective. Rather, the intent is to focus on those effects that are truly meaningful. The CEA baseline condition consists of the present condition of the affected resources plus the combined effects of past, present, and reasonably foreseeable future actions that are described below. Chapter 3 describes the present condition of the affected resources.

Chapter 5 provides a detailed summary of the direct and indirect impacts of four synthesis combinations. The four synthesis combinations, plus Alternative 3, are considered the proposed action for the purposes of this CEA. The four synthesis combinations bracket a range of potential impacts, described in Chapter 5, and the Alternative 3 impacts are additive and are described in Chapter 4. For the purposes of this CEA, "all of the alternatives" refers to the four Chapter 5 synthesis combinations and the Subject Area 3 alternative, Alternative 3, Deep-water closure.

6.1 Geographic and Temporal Scope of the CEA

The geographic scope for habitat, fish resources, and protected resources is the West Coast EEZ. For socioeconomic resources, the geographic scope is those United States fishing communities directly involved in the harvest or processing of Council-managed resources, particularly those of the states of Washington, Oregon, and California.

The temporal scope of past and present actions for the affected resources encompasses actions that occurred since FMP implementation in 1982. The temporal scope of reasonably foreseeable future actions is based on the following two criteria.

1. Actions in the West Coast EEZ that affect the same resources impacted by the proposed action. Administrative fishery management actions that have no discernible effect are not included.

2. Actions that are not speculative, in that the action is defined to an extent that it can be analyzed, including actions for which the Council has decided on a preliminary proposed alternative (PPA) or an FPA.

Based on the above criteria, the following reasonably foreseeable future actions are considered in this CEA (Table 6-1).

Table 6-1. Reasonably foreseeable future actions and estimated effective dates.

Reasonably Foreseeable Future Action	**Estimated Effective Date**
Pacific Coast Groundfish Fishery 2019-2020 Harvest Specifications and Management Measures	January 1, 2019
Gear Changes for the Pacific Coast Groundfish Fishery's Trawl Catch Share Program	January 1, 2019
Amendment 26 to the Pacific Coast Groundfish Fishery Management Plan (FMP) (Allocation of Harvest Opportunity Between Sectors of the Pacific Coast Groundfish Fishery of Blackgill Rockfish and Other Species Managed in the Slope Rockfish Complex South of 40° 10' N. Latitude)	mid to late 2019
Vessel Movement and Monitoring rulemaking to increase frequency of Vessel Monitoring System ping rates[38]	2020
Salmon bycatch mitigation measures consistent with the 2017 ESA biological opinion terms and conditions	2020
Seabird bycatch mitigation measures consistent with the 2017 ESA biological opinion terms and conditions	2020
Select non-fishing actions (described in 6.3.2)	Ongoing

The anticipated effects of these actions, as they pertain to fisheries, extend into the future and are unlikely to decrease in magnitude. Substantive future actions such as 2020-2021 groundfish specifications will be analyzed in future NEPA documents. Therefore, we do not quantify a temporal scope for the effects of the reasonably foreseeable future actions.

The Council's past action that may impact the same resources includes the Fishery Ecosystem Plan and Amendment 25 to the FMP for unfished and unmanaged forage fish protections (81 FR 19054, April 4, 2016, and effective May 4, 2016).

[38] The vessel movement and monitoring rule is administrative in nature, however, it is directly related to enforcement and effectiveness of closed areas, such as EFHCAs, and is therefore pertinent to the discussion in this chapter.

6.2 Summary of Direct and Indirect Impacts of the Proposed Action

The combinations that include closure of the Southern California Bight (approximately 16,000 mi^2; Combinations 2 through 4) would have similar spatial extents of closures and net changes in bottom trawl closures. The combinations that would include partial removal of the trawl RCA (between approximately 4,071 mi^2 [Combinations 1 and 3] and approximately 3,968 mi^2 [Combination 4]) would have the most similarity relative to the spatial extent of areas to be reopened. Alternative 3 would close approximately 123,000 mi^2 to all bottom contact groundfish gear, in waters deeper than 3,500 meters, and it would have negligible environmental impacts, as described in Chapter 4.

Combinations 1 through 4 are designed and intended to protect groundfish EFH, minimizing the impacts of bottom trawl fishing on EFH. Amendment 19 introduced EFHCAs to reduce the impacts of bottom contact gears in sensitive areas, and Combinations 1 through 4 would increase the total area of the EFHCAs, especially those EFHCAs with priority habitat. Combinations 1, 3, and 4 would allow some long-term trawl RCA closures to reopen, expanding the areas where bottom trawl gear may be used. Therefore, although three combinations may reduce trawl RCA restrictions, there would be less access to sensitive EFH areas than were fished historically. The overall effect of all four combinations on habitat would likely be positive in the long-term. The habitat protections resulting from these closures would benefit fish resources.

Combinations 1, 3, and 4 would remove the trawl RCA, reopening the depth-based closures to bottom trawl gear. It is possible fishing effort would shift, including those areas proposed for reopening. This may result in minor changes in the composition of species caught. However, as described in Chapter 4, it is impossible to predict with any precision how effort would shift in the future or how species composition of catch would change. Opening new fishing areas would potentially increase ACL attainment for some species. While higher attainment of underutilized groundfish species such as Dover sole is possible, overall catch limits would not change, nor would ACLs be more likely to be exceeded under any of the alternatives. Although Combinations 1, 3, and 4 may reduce the trawl RCA restrictions, there would likely be less access to sensitive EFH areas than were fished historically because of new and existing EFHCAs.

Combinations 1 through 4 may slightly change impacts on target species composition due to the minor shifts in areas fished coastwide, and the species would continue to be monitored. A shift in fishing effort could impact eulachon positively or negatively, but catch levels in the trawl fishery are relatively low compared to other fisheries and would be monitored. Additional areas being closed or opened would be unlikely to change observation rates under the WCGOP (100 percent monitoring with EM or human observers), nor would the combinations be likely to change the observed number of interactions with, or impacts on, other protected resources.

Combinations 1 through 4 could shift fishing effort to other areas, including those areas proposed for reopening, thereby mitigating the impacts of displaced landings and displaced revenues from the proposed closed areas. Although the groundfish trawl allocation limits bottom trawl harvest, opening new fishing areas would give the fleet flexibility to optimize its fishing effort, including potentially increasing attainment of the trawl allocation for some species. Flexibility for operations and access to more fishing area with the potential for increased attainment in those areas would provide positive economic benefits to the fleet, supply chains, and associated coastal communities. Areas closed would contribute to ecosystem services and existence values, while reopened areas may detract from those benefits.

6.3 Past, Present, and Reasonably Foreseeable Future Actions

This section discusses the fishery and non-fishery related past, present, and reasonably foreseeable future actions, not including Combinations 1 through 4, described in Chapter 5.

6.3.1 Fishery-related Actions

The Council’s management practices for the groundfish fishery are based in the statutory requirements of the MSA, which focus on ensuring that United States fishery resources and their habitats are conserved and maintained to provide optimum fishery yields on a continuing basis. The MSA’s fishery management process is intended to provide the Council and NMFS with regular opportunities to assess the status of the fisheries and to make necessary adjustments to ensure that there is a reasonable expectation of meeting the MSA’s requirements and the objectives of the groundfish FMPs. To the degree that the Council and NMFS comply the MSA-based regulatory regime, the cumulative impacts of past, present, and reasonably foreseeable future federal fishery management actions on the affected resources should generally be associated with positive long-term outcomes in contrast with unregulated fishing effort and gear. Constraining fishing effort through regulatory actions can often have negative short-term socioeconomic impacts. These impacts are usually necessary to bring about long-term sustainability of a given resource, which should promote positive effects on human communities, especially those that are economically dependent upon the managed stocks.

In 2004, NMFS implemented a vessel monitoring program, an enforcement tool implemented to monitor compliance with areas closed to fishing (i.e. conservation areas). Federal funds were made available at the start of the program to reimburse industry for purchases of required hardware and software, and industry was responsible for monthly service payments to the services that transmit vessel monitoring system (VMS) data (also called a ping) from vessels to fishery managers and enforcement. In April 2016 the

Council recommended and NMFS is preparing a proposed rule to increase vessel monitoring system ping rates to enforce with greater precision conservation areas like the trawl RCA and EFHCAs. This rulemaking is referred to as the vessel movement and monitoring (VMM) action.

Amendment 19 to the FMP, implemented in 2006, described groundfish EFH and implemented over 130,000 mi^2 of habitat protections through spatial closures to certain bottom-contacting gear types. Additional information on Amendment 19 can be found in Appendix E, History of Council Action.

When the trawl catch share program was implemented in 2011, accountability measures were built into the program by using vessels and sector specific harvester allocations, set asides, and increased monitoring. The accountability measures encouraged harvesters to reduce bycatch of non-target species, including discarding undersized groundfish. Increased monitoring allowed for increased accuracy in bycatch estimates of non-groundfish species, including those managed under non-groundfish FMPs and protected species. The trawl catch share program strengthened provisions to ensure the integrity of the observer monitoring program was maintained at the vessel level.

Amendments 20 and 21 based initial allocations in the catch share program on historical harvest levels in specific geographic management areas as used in the harvest specifications. Historic management areas were based on stock distribution and landings and have evolved overtime with new information and stock assessments. For each geographic management area species, specifications have been at the species level or a species may be managed within a stock complex. Within the trawl catch share program, differences in species and complexes were allocated and managed by area, while vessels have been prohibited from fishing in different IFQ management areas during the same trip.

The Council implemented a fisheries ecosystem plan and in 2016 and modified all of the Council-managed FMPs to add protections for unmanaged forage fish. The groundfish FMP was modified, and restrictions were defined in regulation.

The Council conducts biennial reviews of the groundfish harvest specifications, considers new information, and then establishes specifications for the next two-year period. Examples of a harvest specification include annual catch limits for a species or species complex. Examples of management measures include cumulative landing limits for commercial fisheries, RCA (trawl and non-trawl) boundary adjustments, bag limits, and seasons. Management measures are adjusted as necessary to control total fishing mortality. Past and future harvest specifications contribute to the current status of managed stocks. Management measures directly or indirectly control catch, affecting stock status, fishing opportunity, harvester costs, net revenue, personal income, and employment in fishing communities. At its June 2018 meeting, the Council took final action and selected final preferred alternatives for the 2019-

2020 harvest specifications. The Council selected harvest control rules (HCRs) for four stocks that depart from the default HCRs used for 2017-2018 harvest specifications (California scorpionfish, yelloweye rockfish, and lingcod north and south of 40°10’ N. latitude). Under the Council’s final preferred alternative, the yelloweye rockfish ACL would increase by 18 metric tons (mt) to 48 mt in 2019, and by 19 mt to 49 mt in 2020. The Council’s final preferred alternative and NMFS’ rulemaking (83 FR 63970, December 12, 2019) included the following new management measures:

- Removal of automatic authority to close at-sea Pacific whiting fisheries if darkblotched rockfish or POP set-asides are exceeded
- Elimination of daily vessel limits in the IFQ trawl fishery
- New sablefish and lingcod discard mortality rates for the IFQ trawl fishery
- Changing the seaward boundary of the non-trawl RCA between 40°10’N. latitude and 42°N. latitude
- Allowance to fish shoreward of the 40 fm line in the Western CCA by commercial and recreational fixed gear fisheries
- Stock complex reorganization (nearshore rockfish complex north of 40°10' N. latitude and the other fish complex coastwide)
- Modifying lingcod retention in the salmon troll fishery
- Addressing certain reasonable and prudent measures in NMFS’ biological opinion for impacts on ESA-listed salmon species under implementation of the Pacific Coast Groundfish Management Plan (NMFS 2017d)

The 2019-2020 harvest specifications addressed the following three reasonable and prudent measures specified in the biological opinion (NMFS 2017d):

- Term and Condition 2a requires the Council to review the existing mechanisms in the FMP and related regulations for avoiding and reducing salmon bycatch, including the effectiveness of the Ocean Salmon Conservation Zone and bycatch reduction areas (BRAs).
- Term and Condition 3a requires the Council and NMFS to develop and implement initial regulations governing the reserve of 3,500 Chinook as part of the 2019-2020 biennial specifications and management measures. These regulations will be designed to, among other things, allow for inseason action to prevent any sector guideline plus the full amount of the Reserve from being exceeded and to minimize the chance that the Reserve is used in three out of any consecutive five years.

- Term and Condition 3c requires NMFS and the Council to develop and implement regulations governing closure of the fishery sector(s) when either the whiting or non-whiting fishery sector exceeds its Chinook bycatch guideline plus the Reserve.

The measures described above and implemented by the 2019-2020 harvest specifications and management measures were effective January 1, 2019. Additional salmon mitigation measures are being developed (Agenda Item G.3 ESA Mitigation Measures for Salmon, April 2019).

Over the years, numerous actions have been taken to manage gear use in the trawl fisheries to meet the objectives of the FMP and the MSA. Prior to the catch share program, gear restrictions were imposed to limit effort in specific areas (i.e., EFH conservation areas), reduce bycatch, and increase size selectivity of certain species. To allow for the escapement of small or undersized fish, historic fishery management actions increased the effective mesh size. The restrictions applied to net mesh, codend mesh, chafing gear mesh, coverage and attachment, and use of double-walled codends. Midwater trawl chafing gear requirements were modified over time to align with requirements in the Alaska groundfish fishery, allowing gear to be used in both regions. Bottom trawl chafing gear restrictions were restricted to reduce fishing effort on more abrasive bottom substrate. Regulations that limited the protection on footropes at the front end of the net were implemented for midwater trawl to encourage the gear to remain off bottom. Footropes greater than 19 inches that allowed fishing in rocky habitat were prohibited, and large and small footrope trawl were defined. The use of large footrope trawl was prohibited in nearshore areas (shoreward of a line approximating 100 fm). To address concerns about overfished species catch and staying within the harvest specification specified for rebuilding, selective flatfish trawl was introduced. This type of small footrope trawl was developed to maintain a nearshore flatfish trawl fishery while reducing the catch of overfished rockfish species.

In addition to gear restrictions, regulations specify where and when specific gears can be used. These time and area restrictions have primarily been used to address concerns over the catch of listed salmonids and overfished species. Gear restrictions on the numbers and types of gears on a vessel were adopted prior to catch shares to aid enforcement in monitoring fishing activities in areas where certain types of fishing was restricted for either catch concerns or habitat concerns.

NMFS and the Council implemented gear changes for the Pacific Coast Groundfish Fishery's Trawl Catch Share Program. A NEPA analysis[39] considered proposed changes to legal gear used in the trawl catch share program, which includes both trawl and fixed gear (NMFS 2018). The action provides more

[39] The Council prepared a preliminary draft EIS in March 2016. Since that time, new information has become available. On June 8, 2018, NMFS announced its intent to withdraw preparation of an EIS and prepare an EA (83 FR 26640) instead.

flexibility in the configuration and use of gear for participants in the trawl rationalization program, while at the same time ensuring that conservation objectives are met. The eight trawl-gear changes are as follows:

- Minimum Mesh Size
- Measuring Mesh Size
- Codend Regulations
- Selective Flatfish Trawl
- Chafing Gear
- Multiple Gears On Board
- Fishing in Multiple IFQ Management Areas
- Fishing Before Previous Catch is Stowed

The measures described above were implemented by the trawl gear rule (83 FR 62269, December 3, 2018) and were effective January 1, 2018.

In 2018, the Council and NMFS were developing Amendment 26 (Blackgill Rockfish Reallocation). In November 2015, the Council took final action to remove blackgill rockfish from the slope rockfish complex south of 40º 10' N. latitude and reallocate blackgill rockfish and the remaining species in the southern slope rockfish complex to trawl and non-trawl sectors as follows:

- Blackgill rockfish sector allocations: 41 percent to limited entry trawl and 59 percent to Non-trawl sectors
- Remaining southern slope rockfish allocations: 91 percent to limited entry trawl and 9 percent to non-trawl sectors

At its November 2018 meeting, the Council made a final decision to make no changes to blackgill allocations. More information on this decision is available in the November 2018 Council briefing book. Therefore Amendment 26 is not discussed further in this chapter.

NMFS will also be addressing certain reasonable and prudent measures in NMFS' biological opinion for impacts on ESA-listed salmon species under implementation of the Pacific Coast Groundfish Management Plan (NMFS 2017d). The specifics of those measures are still under development with the Council, but will address the remaining reasonable and prudent measures articulated in the 2017 biological opinion.

At its June 2019 meeting, the Council recommended measures to address reasonable and prudent measures in USFWS biological opinion for impacts on ESA-listed seabirds under implementation of the

Pacific Coast Groundfish Management Plan (USFWS 2017). The Council recommended requiring streamerlines to be deployed when longline vessels are fishing during daylight hours, for all vessels greater than 25 feet length overall. The Council recommended that if vessels do not want to or cannot deploy streamerlines, then they must fish at night, when seabirds are not active. Vessels over 55 feet length overall are currently required to deploy streamerlines.

6.3.2 Non-fishing Actions

Human-induced non-fishing activities tend to be localized in the nearshore areas and the marine project areas where they occur. Examples of these activities include, but are not limited to, agricultural runoff, port maintenance, coastal development, marine transportation, marine mining, beach nourishment, dredging, and disposal of dredged material. These non-fishing activities that introduce chemical pollutants, sewage, changes in water temperature, salinity, dissolved oxygen, and suspended sediment into the marine environment pose a risk to all of the identified affected resources. Wherever these activities co-occur, they are likely to work additively or synergistically in their impact on the affected resources. Under ESA, NMFS and USFWS may review these effects for projects authorized, permitted, or carried out by Federal agencies. Under the MSA, NMFS may also review impacts on EFH caused by projects authorized, permitted, or carried out by Federal agencies. For example, NMFS may review projects in “waters of the U.S.” permitted by the United States Army Corps of Engineers under Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act.

The Bureau of Energy Management (BOEM) manages the exploration and development of offshore energy and marine mineral resources on the United States outer continental shelf, including renewable energy, oil and natural gas, and sand and gravel. In January 2018, BOEM announced a draft proposed program for responsibly developing the National Outer Continental Shelf Oil and Gas Leasing Program for 2019-2024 (BOEM 2018). The plan proposes making more than 90 percent of the total OCS acreage and more than 98 percent of undiscovered, technically recoverable, oil and gas resources in Federal offshore areas available to consider for future exploration and development. By comparison, the previous program put 94 percent of the OCS off limits. The draft proposed program proposes seven lease sales in the Pacific Region (two each for Northern California, Central California, and Southern California, and one for Washington/Oregon). There have been no sales in the Pacific Region since 1984. Currently there are 43 leases in producing status in the Southern California Planning Area.

Regional projects that are restorative or beneficial in nature include estuarine wetland restoration, offshore artificial reef creation, and eelgrass (*Zostera marina*) restoration. These types of projects improve habitats, including nursery habitats for several commercial groundfish species.

In 2012, the United States Coast Guard (USCG) established a standard for the allowable concentration of living organisms in ships' ballast water discharged in waters of the United States, with the intent of preventing and controlling invasions of aquatic nuisance species transported in ships' ballast water. In 2013, the EPA built on the USCG ballast water regulations and standards with general vessel permits for vessel discharges, limiting ballast water and pollutant discharge in United States waters.

Five national marine sanctuaries have been designated in the United States West Coast EEZ. The National Marine Sanctuaries Act authorizes the Secretary of Commerce to designate and protect areas of the marine environment with special national significance due to their conservation, recreational, ecological, historical, scientific, cultural, archeological, educational, or esthetic qualities as national marine sanctuaries.

The United States Navy's Northwest Training Range Complex conducts warfare training, research, development, testing, and evaluation operations. These operations take place in areas containing groundfish, protected species, and other affected resources.

The changing climate is a long-term trend that is occurring throughout the world. A variety of physical forces control climate, affecting the input of energy in the California Current Ecosystem and the distribution of energy and material through the system. Climatic shifts, like the short-term El Niños and La Niñas or long-term Pacific Decadal Oscillation may affect the California Current Ecosystem through amounts of upwelling and thus shifts in the trophic cascade. The changing climate contributes to ocean acidification and sea level rise.

6.4 Effects of Past, Present, and Reasonably Foreseeable Future Actions

The effects of past, present, and reasonably foreseeable future actions are divided into resource categories. The four categories, habitat, fish resources, protected resources, and socioeconomic resources, are described below.

6.4.1 Habitat

The MSA requires, on an ongoing basis, that NMFS base conservation and management measures on the best scientific information available (16 U.S.C. 1851(a)(2)) and consider actions to conserve and enhance EFH (16 U.S.C. 1855(b)). Together, those requirements anticipate a Federal fisheries management regime that results in additional direct and indirect positive effects on habitat through actions that protect EFH for federally managed species and that protect the ecosystem structure on which these species' productivity depends.

The VMM action taken by the Council in April 2016 will increase VMS ping rates, which will improve closed area enforceability and thus increase the effectiveness of the regulations associated with the final preferred alternative.

Since implementation of the FMP, fishery management actions (amendments, biennial harvest specifications and management measures) taken through the FMP processes have had positive trends in the cumulative effects of fisheries on habitat and EFH. Amendment 19 had positive effects on habitat and fish resources. Groundfish bottom trawl fishery landings (in metric tons) on the coastwide/fishery-wide level were very similar in the three years leading up to Amendment 19 (2003 to 3005) to the three years after Amendment 19 was implemented (2006 to 2008) (PFMC and NMFS 2010, Table 3-17). This is an indication that the socioeconomic impacts on the coastwide groundfish bottom trawl fishery of Amendment 19 may have been negligible. Implementation of the trawl catch share program has had a positive effect on habitat as it has reduced the number of vessels on the water and the overall trawl fishing hours, given increased efficiency and gear switching provisions. The Fishery Ecosystem Plan added protections for unmanaged forage fish to the Groundfish FMP, and these protections have had an indirect positive impact on habitat.

Increases in harvest specifications amounts for 2019-2020, particularly for yelloweye rockfish, could result increased fishing effort and negative habitat impacts compared to the 2017-2018 harvest specification levels. Of the new management measures evaluated in the 2019-2020 groundfish harvest specifications, only adjusting the seaward boundary of the non-trawl RCA and the shoreward, depth-based boundary in the Western CCA for open access fixed gear and recreational fisheries may have discernable impacts on groundfish EFH. This measure would open areas that have been previously closed to fishing to gear types other than trawl, and it would apply to gear types with the potential to result in negative impacts (commercial pot and longline gear) to negligible impacts (recreational gear). The area of the non-trawl RCA proposed to be opened is estimated to be 99.7 percent soft substrate with relatively few observations of habitat forming organisms. Soft substrate within the area to be open is unlikely to be materially affected by fixed gear while hard substrate may be negatively affected, for example, by entanglement of line gear on outcrops or biogenic habitat and contact by fish pots. The effects of this proposed change would likely be negligible to negative on habitat.

The trawl gear action could provide additional protection to trawl nets from rips and tears (or abrasion) when contacting the bottom or being pulled up the stern ramp. If codend and chafing gear specifications are relaxed, it is unlikely gear may be armored to the extent that bottom trawling over rock habitat may increase. Armoring would be unlikely due to (a) increased drag and decreased flow; (b) increased expense while hauling due to increased fuel consumption; (c) increased expense to purchase smaller mesh, additional chafing gear, and double-walled nets; and (d) increased retention of undersized and unmarketable fish. Changes in SFFT requirements would likely have a neutral impact on habitat. Fishing would not occur outside of areas typically fished. EFH protections would continue to prohibit bottom contact gear, including bottom trawl, from specific areas designated as EFHCA. Footrope restrictions would continue, and they would, therefore, provide additional protection for rocky habitats that may not be closed to bottom contact gear.

Requiring deployment of streamerlines or night setting for longline vessels is not anticipated to have any effect on benthic habitats.

Non-fishing actions would likely have localized negative impact on habitat near the project or source. Wherever these activities co-occur, they would likely work additively or synergistically to decrease habitat quality. Exploration and development of offshore energy and marine mineral resources on the United States outer continental shelf could adversely affect groundfish species and their habitat, although projects undergo environmental review (e.g., NEPA, MSA, MMPA, and ESA) before being approved for implementation.

Habitat restoration projects have improved habitats, including nursery habitats, for several commercial groundfish species. Due to past and present adverse impacts from human activities on these types of habitat, restoration projects likely have low positive effects at the local level. Ballast water regulations have been preventing and will continue to help control invasions of aquatic nuisance species transported in ships' ballast water, as well as pollutant discharge, in United States waters. These regulations would positively affect groundfish habitat. The marine sanctuaries' science, education, and conservation programs provide positive indirect effects on the marine environment, including groundfish habitat. The United States Navy's Northwest Training Range Complex activities would occur in areas containing groundfish habitat resulting in direct negative effects.

Climate changes may indirectly impact habitat and ecosystem productivity. The way in which climate forcing will affect EFH is not well understood. Effects would depend on the location of EFH and changes in climate forcing vectors such as water temperature and chemistry, currents, and upwelling. Cyclical changes have transient effects on the productivity of the constituent organisms and, thus, on the California Current Ecosystem structure. These variations may be considered part of the baseline, and they would continue to occur in the future. Climate change would likely have medium to high negative impacts on California Current Ecosystem structure. Overall, past, present, and reasonably foreseeable future actions have had a low positive effect on habitat.

6.4.2 Fish Resources

Those past, present, and reasonably foreseeable future actions that may affect fish resources are described below. Actions with effects on fish resources may be localized or broad in scope. However, it is anticipated that positive actions with broad implications have been, and will continue to be, taken to improve the conditions of fish resources.

Fishery management actions taken through FMP processes have had positive trends in the cumulative effects on fish resources. The MSA requires, on an ongoing basis, that conservation and management measures be based on the best scientific information available, prevent overfishing and minimize bycatch (16 U.S.C. 1851(a)), and rebuild overfished fish stocks (16 U.S.C. 1854(e)). Together, those and other MSA requirements anticipate a Federal fisheries management regime that would result in ongoing direct and indirect positive effects on fish resources. Future fishery management actions would have neutral impact to positive effects on fish resources, thereby continuing ongoing positive trends for fish stocks managed under the MSA.

The catch share program (Amendment 20) and the biennial harvest specifications process have allowed for harvest of groundfish species at sustainable levels on a continuing basis. Since implementation of the catch share program, several overfished stocks have been rebuilt. Mesh size and chafing gear restrictions on midwater and bottom trawl have reduced the catch of smaller-sized bycatch species, including any incidentally caught forage fish species, by allowing those species to escape through the trawl net top and side panels. Implementation of the catch share program has reduced groundfish and non-groundfish bycatch and greatly improved the availability of information on catches and discards of groundfish and non-groundfish species, including protected species and forage fish. The overall effect of the groundfish FMP is a positive effect on fish resources. Forage fish protection measures under the Fishery Ecosystem Plan may have a marginal positive effect on maintaining stock abundance of prey species for fish-eating groundfish and non-groundfish.

Specifications of catch limits for 2019-2020 would continue to consider stock productivity and fishing mortality, and they are expected to continue to be effective at ending and preventing overfishing. The proposed new management measures (including the stock complex reorganization proposals) could increase the risk of overfishing, but the catch share system would mitigate their effects. The management measures under consideration to address the salmon biological opinion are intended to limit the bycatch of salmon, and they do not directly control the catch of groundfish species. Harvest policies or fishery performance would not be expected to change substantially. Therefore, specification and management measures would be unlikely to result in a big change in the composition of incidentally caught non-groundfish.

Requiring deployment of streamerlines or night setting for longline vessels is not anticipated to have any appreciable effects on fish resources.

Non-fishing actions would likely have localized negative impacts on fish resources near the project or source. Wherever these activities co-occur, they would likely work additively or synergistically to decrease the quality of the groundfish habitat, and they would, thus, have a negative effect on fish resources. Groundfish species that rely on nearshore habitats and live close to greater concentrations of humans are most likely to be affected by non-fishing human activities. In addition, water pollution may have a negative impact on pelagic species, whether introduced by point or non-point sources from land, by ships or energy installations at sea, or by nearshore aquatic human activities like port operations and aquaculture. Exploration and development of offshore energy and marine mineral resources on the United States outer continental shelf could adversely affect groundfish, non-groundfish, and protected species, although projects undergo environmental review (e.g., NEPA, MSA, MMPA, and ESA) before being approved for implementation. Habitat restoration projects have improved habitats, including nursery habitats, for several commercial groundfish species. Due to past and present adverse impacts from human activities on these types of habitat, restorative projects likely have low positive effects on the fish resources at the local level.

Ballast water regulations have been preventing and will continue to help control invasions of aquatic nuisance species transported in ships' ballast water as well as pollutant discharge in United States waters. These regulations would positively affect groundfish, non-groundfish, and protected species. The marine sanctuaries' science, education, and conservation programs provide positive indirect effects on the marine environment, including fish resources. The United States Navy's Northwest Training Range Complex activities would occur in areas containing groundfish and non-groundfish, resulting in direct negative effects on fish resources.

Climate changes may indirectly impact the productivity of fish resources. Warm-water phases in cyclical climate phenomena decrease the productivity of many groundfish stocks. Climate change may lead to range shifts, decreasing or increasing local abundance of groundfish. Climate change could positively or negatively affect non-groundfish population productivity and abundance, depending on the species and its requirements. This shifting interdependence affects species, in different ways at different life stages. In other words, some climate conditions may be beneficial to the survival of larvae of a particular species, but may have no effect on an adult of that same species. Climate change would likely affect water temperature, current patterns, water chemistry, and other features contributing to system dynamics, such as coastal upwelling. These physical factors, in turn, will affect biological components such as physiology, productivity, and species distribution. Section 4.5 of the Fishery Ecosystem Plan discusses the effects of climate change in detail. Statistical analyses of past climate data have improved our understanding of how climate has affected North Pacific ecosystems and associated marine species productivities. The net effect of climate change on fish resources cannot be predicted. Overall, past, present, and reasonably foreseeable future actions have had a positive effect on the fish resources.

6.4.3 Protected Resources

This section describes those past, present, and reasonably foreseeable future actions that may affect protected resources. Actions with effects on protected resources may be localized or broad in scope. However, positive actions with broad implications likely have been, and will continue to be, taken to improve the conditions of protected resources.

Past fishery management actions taken through the Council process have had a positive cumulative effect on protected resources through reduction of fishing effort and implementation of gear requirements for bycatch minimization. Implementation of the catch share program has greatly improved the availability of information on protected resources. Management measures aim to keep incidental take of protected species within specified thresholds and are adjusted as necessary to address conservation concerns. The Fishery Ecosystem Plan did not contain initiatives that would change interaction rates with protected resources.

The trawl gear action is anticipated to have a neutral to a low-positive impact on salmon, whereas a neutral impact would be likely for very small species, such as eulachon. Low-negative to low-positive impacts could occur for intermediate-size species (e.g., species where the L50 may be larger than the smallest fishes encountered); however, it is likely that few fishermen would reduce the mesh size of their codend (or other large areas of the net) to something smaller than what they currently use.

In the groundfish bottom trawl fishery, selective flatfish trawl gear (gear modified to allow rockfish to escape) is required shoreward of the trawl RCA (shallower than 100 fm). Since all sturgeon were caught shoreward of the trawl RCA, we know that the sturgeon were caught with selective flatfish trawl gear. The trawl gear rule allows any small footrope gear to now be used shoreward of the trawl RCA, including the selective flatfish trawl gear; large footrope gear would still be prohibited. Combinations in this rule that re-open all or part of the trawl RCA would maintain status quo depth restrictions for large and small footrope. Therefore, the two actions combined would not likely change the impacts analysis we presented, nor would it change the incidental catch rate of sturgeon if small footrope gear other than the selective flat fish trawl were used. We would expect similar incidental rates for sturgeon because the flat fish trawl gear is designed to exploit rockfish behavior whereby they rise above the net in an attempt to escape the path of the net. Sturgeon tend to remain low on the ocean floor when encountered by trawl nets. Therefore, based on current trends in catch, including catch in the California halibut fishery, that do not indicate an upward or downward trend since 2011, it is unlikely that incidental catch rates would change (increase or decrease) under the No-action Alternative or under Combinations 1 through 4 with implementation of these gear changes.

The management measures under consideration in the 2019-2020 specification to address the Salmon Biological Opinion (NMFS 2017d), together with additional mitigation measures that are being considered, are intended to limit the bycatch of salmon and do not directly control the catch of groundfish species. These measures would likely be negligible to modestly beneficial for salmon. Harvest policies or fishery performance would not be expected to change substantially. Therefore, specifications and other new management measures would be unlikely to result in a big change in protected resources impacts.

The new streamerline requirements the Council recommended to comply with the 2017 USFWS biological opinion are anticipated to benefit seabirds, by deterring them from attempting to feed on bait or fish being reeled in on longline gear. Streamerlines are anticipated to reduce the likelihood of entanglements or mortality caused by the birds interacting with longlines, including baited hooks.

Non-fishing actions would likely have a localized negative impact on protected resources near the project or source. Wherever these activities would co-occur, they would likely work additively or synergistically to decrease the quality of the environment. Protected resources that rely on nearshore habitats and live in close proximity to greater concentrations of humans would be most likely to be affected by non-fishing human activities. In addition, water pollution may have a negative impact on pelagic species, whether introduced by point or non-point sources from land, by ships or energy installations at sea, or by nearshore aquatic human activities like port operations and aquaculture. Exploration and development of offshore energy and marine mineral resources on the United States outer continental shelf could adversely affect protected resources, although projects undergo environmental review (e.g., NEPA, MSA, MMPA, and ESA) before being approved for implementation. Habitat restoration projects have improved habitats, including nursery habitats, for protected salmon species. Due to past and present adverse impacts from human activities on these types of habitat, restorative projects would likely have low positive effects on protected resources at the local level.

Ballast water regulations have been preventing and will continue to help control invasions of aquatic nuisance species transported in ships' ballast water, as well as pollutant discharge in United States waters. These regulations would positively affect protected resources. The marine sanctuaries' science, education, and conservation programs would continue to provide positive indirect effects on the marine environment, including protected species. The United States Navy's Northwest Training Range Complex activities would occur in areas containing protected resources, resulting in direct negative effects.

Climate changes may indirectly impact the productivity of the biological environment. Climate change could positively or negatively affect productivity and abundance of a protected resource population and their prey species, depending on the species and its requirements. This shifting interdependence affects prey species in different ways at different life stages. In other words, some climate conditions may be beneficial to the survival of larvae of a particular prey species, but they may have no effect on an adult of that same species. Climate change is likely to affect water temperature, current patterns, water chemistry, and other features contributing to system dynamics, such as coastal upwelling. These physical factors, in turn, will affect biological components such as physiology, productivity, and species distribution.

Section 4.5 of the Fishery Ecosystem Plan discusses the effects of climate change in detail. Statistical analyses of past climate data have improved our understanding of how climate has affected North Pacific ecosystems and associated marine species productivities. The net effect of climate change on the protected resources cannot be predicted. Overall, past, present, and reasonably foreseeable future actions have had a positive effect on protected resources.

6.4.4 Socioeconomic Resources

This section discusses those past, present, and reasonably foreseeable future actions that may affect socioeconomic resources. The magnitude of the effects of these actions on socioeconomic resources may be small when considered in the context of the large geographic and economic scope of the United States West Coast, but they are important to harvesters, processors, and fishing communities.

Fishery management actions taken through the FMP processes have had both positive and negative effects on socioeconomic resources. Actions to bring United States West Coast fisheries management and catch limits into compliance with sustainability and conservation requirements of the 1996 Sustainable Fisheries Act amendments to the MSA had short-term and notable negative effects on fishing communities dependent on groundfish resources. Measures to rebuild overfished species have restricted access to rebuilt stocks over the past 15 years. These measures include gear restrictions, area closures, and trip limit restrictions. Measures to conserve and protect groundfish EFH from the impacts of fishing include gear restrictions and area closures. Closed areas, such as the trawl RCA and EFHCAs, have costs associated to industry in the form of VMS data transmittal, or ping rates. Commercial groundfish fisheries have costs associated with human observers or electronic monitoring systems to speciate and enumerate catch (both retained and discarded) and other fishery information to inform management decisions. However, since implementation of the catch share program and the rebuilding of several overfished stocks, revenues from groundfish fisheries have generally increased (Council and NMFS 2017). Continued careful management of FMP resources should have a long-term trend of neutral to positive effects on human communities. The catch share program has had a positive effect on harvesters as they were issued tradable allocations. However, consolidation of the fleet has resulted in less trawl revenue for some processors and communities. The forage fish initiative in the Fishery Ecosystem Plan has had neutral effects on socioeconomic resources as it has not resulted in substantially reduced harvest opportunities for managed species.

Increases in harvest specifications amounts for 2019-2020, particularly for yelloweye rockfish, could result in increased commercial and recreational fishing opportunities and revenues compared to the 2017-2018 harvest specification levels. Analysis indicates that West Coast groundfish communities would see an increase of about 900 jobs and $60 million in income in 2019, mostly from changes in recreational access to scorpionfish in California. New management measures would be expected to have mixed socioeconomic impacts. Addressing certain reasonable and prudent measures in the salmon biological opinion (NMFS 2017d) is likely to increase operational costs for groundfish trawl fisheries. Measures such as changes to the seaward boundary of the non-trawl RCA between 40°10'N. latitude and 42°N. latitude, as well as modifications to the allowable fishing depths in the Western CCA for commercial fixed gear and/or recreational fisheries, are anticipated to result in a modest socioeconomic benefit. Overall, the 2019-2020 harvest specification are anticipated to have a positive socioeconomic impact.

The trawl gear action would likely increase operational flexibility and would have positive socioeconomic impacts. For example, no minimum mesh size requirements would allow harvesters flexibility to experiment with trawl gear to reduce catch of unwanted species and to increase catch of marketable fish, as well as to reduce gilling when targeting rockfish.

The Council recommendation for streamerlines or night-setting would require changes in behavior and or additional work by deck hands to ensure the vessel is complying with seabird avoidance requirements. This could slightly increase operational costs. Deterring seabirds from feeding on bait may would allow more baited hooks to make it to fishing depths. This could slightly reduce operational costs by reducing bait losses. The Council, when making their recommendation for streamerline requirements for vessels between 25 and 55 feet length overall also considered safety at sea and provided foul weather exemptions when the National Weather Service has issues small craft advisories. Vessels fishing during a small craft advisory could choose not to deploy streamerlines if it posed a risk to safety of human life.

Many of the non-fishing actions are localized in nearshore areas and marine project areas where they occur. Therefore, the magnitude of those impacts on socioeconomic resources would likely be mixed and limited in scope. It may, however, displace fishermen from project areas. Agricultural runoff may be much broader in scope, and the impacts of nutrient inputs to the coastal system may be larger in magnitude. This may result in indirect negative impacts on socioeconomic resources by reducing resource availability. As described above, NMFS has several means under which it can review non-fishing actions of other Federal or state agencies prior to permitting or implementation of those projects. This serves to minimize the extent and magnitude of indirect negative impacts those actions could have on socioeconomic resources. Habitat restoration projects would likely have indirect positive impacts on socioeconomic resources if the projects would lead to increased fishing opportunities through increases in stock abundance.

Ballast water regulations likely resulted in some cost to the shipping industry, but they would positively affect socioeconomic resources in the long term through control of invasions of aquatic nuisance species. Marine sanctuaries may limit some activities, but they would likely have a positive, long-term socioeconomic impact thorough preservation, as well as science, education, and conservation programs. The United States Navy's Northwest Training Range Complex activities could displace fisherman, but it would have long-term positive impacts on socioeconomic resources through enhancements to the safety and security of the United States.

Climate changes may indirectly impact socioeconomic resources in positive and negative ways. Over the very long term (more than 10 years), sea level rise and changes in storm activity could increase operational costs for maintaining and/or replacing fishery-related infrastructure in fishing communities. If infrastructure were not maintained or replaced in a port, fishery landings would be made elsewhere, reducing income for the affected port. Shifts in the distribution of economically important groundfish, such that less of the stock would be available to the fishery, would have adverse impacts. Despite the potential for some actions to have neutral to negative short-term effects on socioeconomic resources, there would likely be a positive long-term effect on socioeconomic resources due to the long-term sustainability of the groundfish resource.

6.5 Cumulative Effects of the Alternatives and Past, Present, and Reasonably Foreseeable Future Actions

Chapter 5 provides a detailed summary of the direct and indirect impacts of four synthesis combinations. The four synthesis combinations, plus Alternative 3, are considered the proposed action for the purposes of this CEA. The four synthesis combinations bracket a range of potential impacts, described in Chapter 5, and the Alternative 3 impacts are additive and are described in Chapter 4. Combinations 2 through 4 and Alternative 3 would not have appreciably different cumulative effects, because they would have new bottom trawl closures with a very similar spatial extent. Combination 1 may have slightly different cumulative effects, because it would have a much smaller spatial extent than the other combinations. Potential differences in cumulative effects between the combinations are noted in the discussions in the following sections. Chapter 5 and Section 6.2 describe the direct and indirect impacts of the proposed action on the affected resources. The magnitude of the cumulative effects, which include the additive and synergistic effects of Combinations 1 through 4 and Alternative 3, as well as past, present, and future actions, have been considered throughout this section. The alternatives in this document build off actions taken in the original FMP and subsequent amendments.

6.5.1 Habitat Resources

Trawl fishermen would be able to access the trawl RCA if it were partially reopened under Combinations 1, 3, and 4. It is the footrope, and not chafing gear or double wall codend, that discourages fishing over high-relief areas due to the potential for costly damage or loss of gear. The codend typically floats above the bottom, due to the taper in the net and floats attached to the codend. So, if fishermen moved into high-relief areas within the trawl RCA, they would do so regardless of the relaxed chafing gear and double-wall codend requirements proposed in the trawl gear action. Soft substrate is estimated to make up the majority (94.2 percent) of the habitat within the RCA boundaries. Soft substrates are the most resilient and the fastest of the substrates to recover, with full recovery possible in as little as one year after bottom trawling. While hard substrate (including high rocky, relief areas) is more vulnerable to the negative impacts associated with trawl gear fishing, only a small portion (2.7 percent) of the trawl RCA area is estimated to consist of hard substrate.

Most bottom trawl fisherman are expected to target flatfish with small footropes inside the former trawl RCA. If fishermen target pelagic rockfish inside of the trawl RCA, they would probably use the "modified" midwater trawl prior to May 15, as shown by actions of fishermen during the 2017 EFP. Matson and Erickson (2017) described how the distribution of fishing effort may change for bottom trawl in the near future (e.g., new bottom trawl effort within what is currently the boundaries of the trawl RCA). Fishermen may opt to use the selective flatfish trawl while targeting flatfish, whether within or shoreward of the RCA to avoid salmon, Pacific whiting, or other unwanted semi-pelagic species. Fishermen who may target pelagic or semi-pelagic rockfish within the trawl RCA or shoreward of the trawl RCA may choose to do so with high-rise, hooded nets in the future, but they may also opt to install salmon excluder devices or select areas and times where Chinook salmon bycatch may be low.

The trawl RCA was not implemented as a habitat protection measure. It was implemented as a way to reduce catch of overfished rockfish species. Fishing historically took place in the trawl RCA as vessels targeted rockfish in these areas. The habitat type within the trawl RCA is estimated to be mostly soft substrate, with some mixed and hard substrate. EFHRCAs would still be in place and would provide protection for hard bottom habitat areas. All alternatives would likely result in a net gain in protection of high relief habitat, even if the RCA were partially reopened.

While the impact analysis in this action is focused on direct and indirect impacts to habitat, there are a number of non-fishing impacts that must be considered when assessing cumulative impacts. Many of these activities are concentrated near-shore and would likely work either additively or synergistically to decrease habitat quality. Other non-fishing factors such as climate change would also likely play a role in habitat degradation.

Overall, when combined with the low positive effects of past, present, and reasonably foreseeable future actions, the incremental effect of all of the synthesis combinations except Combination 1 would have a medium positive influence on habitat. Combination 1 could have a slightly less positive influence on habitat than the other combinations, because it would have a net change that would decrease the spatial extent of bottom trawl closures, but it would have a net increase in protection of priority habitats, and it would still have a low to medium positive influence on habitat. Keeping the trawl RCA in place under Combination 2 would maintain the status quo closures of this predominantly soft-bottom habitat. It would, therefore, not likely have appreciably higher positive cumulative effects on habitat than Combinations 3 or 4. When combined with other actions, the deep-water closure considered under Alternative 3 would have a negligible positive effect in the short term because no bottom-contact fishing occurs there currently, but may have a low positive long-term effect, because it would prohibit prospective fishing without an EFP.

6.5.2 Fish Resources

All of the alternatives would protect groundfish habitat. The deep-water closure considered under Alternative 3 would not likely have an impact on fish resources, because little to no fishing is occurring in the area that would be closed under this alternative. Combinations 1, 3, and 4 may shift the distribution of fishing effort through the partial removal of the trawl RCA and changes to the EFHRCA areas. When combined with the trawl gear action and the expected increase in catch limits under the 2019-2020 harvest specifications, Combinations 1, 3, and 4 would serve to increase flexibility and efficiency so fishermen may increase catch of rebuilt groundfish species and attain more of the trawl allocation. None of the alternatives would change the amount of target species that could be harvested. These amounts would be set consistent with the Pacific Coast Groundfish FMP, based on the best available science, and would be intended to prevent overfishing while achieving OY as required by the MSA. There is 100 percent monitoring and accountability for groundfish IFQ species caught.

The trawl gear action may have an impact on stock productivity if changes to the trawl mesh size cause smaller fish to be harvested. However, the incentive to target smaller fish or reduce the net size to catch more small fish is not there, nor would the 2019-2020 harvest specifications change this incentive. Small fish are not marketable, and catch would be covered by IFQ. Therefore, the harvesters would likely reduce their mesh size just enough to address concerns with gilled fish (fish stuck in the net). This, along with improved used and experimentation with selective devices, may change size or species selectivity slightly. If, at any time, a conservation concern arises such as the exceedance of an annual catch limit in the 2019-20 harvest specifications, the fishery can be restricted through spatial closures, closure of a sector, or closure of the fishery via routine inseason management or through automatic action authority. Synthesis Combinations 1, 3, and 4 would establish another management tool with BACs that could be closed to reduce harvest of target or non-target stocks.

Overall, when combined with the positive effects of past, present, and reasonably foreseeable future actions, the incremental effect of all of the synthesis combinations except Combination 2 would have a low positive effect on fish resources. Synthesis Combination 2 could have a slightly more positive effect on fish resources because it would keep the trawl RCA closed, but it would likely still have a low positive effect because harvest with bottom trawl gear would continue in open areas. When combined with other actions, the deep-water closure considered under Alternative 3 would have a negligible positive effect on fish resources in the short term because no bottom-contact fishing occurs there currently, but it may have a low positive long-term effect because it would prohibit prospective fishing without an EFP.

6.5.3 Protected Resources

All of the alternatives and the reasonably foreseeable future actions would be unlikely to cause significant changes in fishing strategies throughout the EEZ. Any changes in distribution of effort and gear type could be strategic (i.e., to improve efficiency and to maintain or reduce bycatch; Council and NMFS 2017; Agenda Item G.8 Attachment, March 2016; Matson and Erickson 2017). The trawl industry has an additional incentive of reducing bycatch of all species to remain certified by the Marine Stewardship Council (Council and NMFS 2017). The Marine Stewardship Council certified the West Coast limited entry groundfish trawl fishery as sustainable in 2014 (MSC.org). Total catch of non-target, non-groundfish species such as coastal pelagic, forage fish, highly migratory species, shrimp, and halibut, may increase or decrease with changes in trawl gear configuration and use, but it would likely remain within acceptable harvest levels.

When considered in the context of the fishery management system, the effects of all of the alternatives on salmon and other protected resources would not likely be significant. The 2017 ITS for salmon (NMFS 2017) requires the Council to create salmon hard caps and develop mechanisms to close the groundfish fishery upon reaching certain take thresholds, and some of those mechanisms were implemented in the 2019-2020 harvest specifications. Additional measures are being developed. The hard-cap mechanisms would close a sector (Pacific whiting or non-whiting) once a certain amount of salmon has been taken. Additional measures in the 2019-2020 harvest specifications, such as prohibiting all midwater trawling and all bottom trawling except selective flatfish trawl inside the Klamath River Salmon Conservation Zone and the Columbia River Salmon Conservation Zone, provide additional protection in areas where salmon (and green sturgeon) are known to occur.

Under the trawl gear action, the ability to fish with high-rise trawls shoreward of the RCA may increase salmon catch compared to SFFT if both were towed through the same school of salmon and if fishermen did not use salmon excluders or other trawl modifications. Elimination of SFFT requirements may cause a shift of effort shoreward of the RCA only when midwater trawling is not allowed (January 1 through May 15). After that, most "beach draggers" that target summer flatfish would likely still use SFFT to avoid bycatch, while those interested in widow and yellowtail rockfish would switch to midwater trawl. During January through March, Chinook salmon bycatch for bottom trawl in deeper waters (seaward of the trawl RCA) is higher than in shallow waters (shoreward of the trawl RCA). Generally, the magnitude of Chinook salmon bycatch is highest during winter months (November to April) and lowest during summer months (May to October). However, bycatch during summer is higher in shallow waters than deeper waters. Eliminating the selective flatfish trawl requirements, fishermen who would shift effort from deeper to shallower waters during January through March might expect a lower bycatch rate.

Overall salmon catch would likely be held below the 2017 Biological Opinion estimates (e.g. 5,500 Chinook salmon for non-whiting trawl). The trawl fishery has 100 percent monitoring, and salmon bycatch reports are available approximately 24 hours after the trip. NMFS and the Council should be able to monitor salmon bycatch by species, area, and sector for the trawl fisheries on a weekly basis. Since the majority of historical salmon bycatch has been from the trawl fisheries, the timely reporting of salmon bycatch in the trawl fishery should help ensure that inseason monitoring would include the majority of salmon bycatch.

NMFS and the Council have area management tools in place to address salmon bycatch concerns. BRAs can be used to close depths shallower than a specified depth contour to vessels using midwater gear to minimize impacts on groundfish, or any prohibited or protected species, such as salmon. Currently in regulation, BRAs are available to close areas shoreward of the 75 fm, 100 fm, and 150 fm depth contours, and they can be implemented for a specific sector (i.e., catcher/processor, mothership, shoreside whiting, and shoreside non-whiting midwater) at any latitudinal break (50 CFR 660.11).

The Ocean Salmon Conservation Zone (OSCZ) consists of all waters shoreward of a boundary line approximating the 100 fm (183 m) depth contour. When triggered, the OSCZ is closed to the non-tribal whiting fleet. This closure would be implemented coastwide through automatic action should NMFS project that the Pacific whiting fishery (tribal and non-tribal) may take in excess of 11,000 Chinook salmon within a calendar year (50 CFR 660.131(c)(3)).

NMFS and the Council can currently modify the RCAs inseason through routine action to ease salmon bycatch by the bottom trawl sector, and this would be a tool at least until any of the alternatives would take effect. BACs in the proposed action could prohibit fishing by vessels using groundfish bottom trawl gear at certain depths and latitudes. The waters off the West Coast, seaward of state waters to the 700 fm contour line, are proposed to be divided into separate BACs using existing depth contours and latitudes in regulation. Regardless of any regulations or procedures proposed in the reasonably foreseeable future actions, NMFS' Regional Administrator has the authority to close certain areas to fishing or, in the most extreme case, to close the entire fishery should a conservation concern arise. The Biological Opinion (NMFS 2017d) requires NMFS manage to the salmon guidelines.

The fishing industry is also equipped to react quickly, and more directly, to high bycatch events of salmon compared to broad Council or NMFS actions. In recent years, some industry sub-sectors have shown the ability to be proactive in minimizing salmon bycatch. As an example, the at-sea sectors have instituted self-regulated hotspot closures and move-along rules. The industry has economic and social incentives to minimize salmon bycatch. Voluntary use of salmon and halibut excluder devices would be expected.

The trawl industry has the incentive of reducing bycatch of all species to remain certified by the Marine Stewardship Council (Council and NMFS 2017). The Marine Stewardship Council certified the West Coast limited entry groundfish trawl fishery as sustainable in 2014 (MSC.org). The Pacific whiting mid-water trawl fishery first achieved Marine Stewardship Council certification as a sustainable and well-managed fishery in 2009, and it was recertified in 2017 (MSC.org). It is unlikely that fishing strategies would change significantly throughout the EEZ, due to the reasons described above, and any changes in distribution of effort and gear type could be strategic (i.e., to improve efficiency and maintain or reduce bycatch; Council and NMFS 2017; Agenda Item G.8 Attachment, March 2016; Matson and Erickson 2017). The availability of these measures and the increased incentives to avoid bycatch, combined with advancements in management, monitoring, and technology, would likely result in Chinook salmon bycatch rates similar to those of recent years. Additional areas being closed or opened in combination with one another under any of the alternatives would not change observation rates under the WCGOP (100 percent monitoring with EM or human observers) or change the observed number of interactions beyond what has been observed under baseline conditions.

The 2019-2020 harvest specifications action is unlikely to change impacts for very small species such as eulachon. Three new management measures applicable to the trawl fishery are included in the 2019-2020 harvest specifications. None of these measures would directly affect eulachon bycatch, but may have a modest effect on the operation of trawl fisheries, which could indirectly affect bycatch. If the trawl RCA were partially removed under Synthesis Combinations 1, 3, or 4, large footrope gear may be used seaward of the 100 fm line (currently it is required seaward of the 150 fm line, or the seaward of the trawl RCA). We assume that other small footrope gear may be used shoreward of the trawl RCA in the future because vessels are using EFPs to be exempt from the requirement to use selective flatfish trawl gear, and they use other small footrope gear. The use of these different gear types in various depths could impact eulachon or green sturgeon, but we are uncertain to what extent. Given the relatively small amount of eulachon caught the groundfish trawl fishery, and the level of monitoring and tools with which NMFS can respond, cumulative effects to eulachon are not expected to be significant.

The seabird bycatch mitigation measures are anticipated to have an appreciable positive change in the effects of the groundfish fishery on seabirds.

Overall, when combined with the positive effects of past, present, and reasonably foreseeable future actions, the incremental effect of all of the alternatives would have a neutral influence on protected resources.

6.5.4 Socioeconomic Resources

Combinations 1, 3, and 4 and the trawl gear action increase operational flexibility, and they would likely result in positive socioeconomic impacts. Increases in harvest specifications amounts for 2019-2020, particularly for yelloweye rockfish, could result in increased commercial and recreational fishing opportunities on the continental shelf and increased revenues compared to the 2017-2018 harvest specification levels. New management measures would likely have mixed socioeconomic impacts, but, overall, the 2019-2020 harvest specifications would likely have a positive impact on socioeconomic resources. Increased flexibility and efficiency may increase catch of rebuilt groundfish species and allow fishermen to attain more of the ACL. This would help to stabilize fishing portfolios and would alleviate some of the negative effects of declining catch limits in other fisheries such as salmon. Groundfish catch limits would continue to be set consistent with the Pacific Coast Groundfish FMP, and they would be based on the best available science with the goal of preventing overfishing while achieving OY, as required by the MSA.

Overall, when combined with the effects of past, present, and reasonably foreseeable future actions, even when accounting for costs to industry (VMM, seabird mitigation, SFFT), the incremental effect of all of the synthesis combinations except Combination 2 would have a medium positive influence on socio-economic resources. With respect to Combination 2, its incremental effect, when combined with the positive effects of past, present, and reasonably foreseeable future actions, would have a neutral effect on socioeconomic resources. This is because the negative impact of closed fishing grounds that were of relatively low importance to the bottom trawl fisheries would be offset by a positive increase in existence values, greater flexibility in gear use and configuration under the gear change action, and higher allocations for yelloweye rockfish under the 2019-2020 harvest specifications. When combined with other actions, the deep-water closure considered under Alternative 3 would be low positive because it would have an incrementally negligible socioeconomic effect when combined with positive impacts of the Synthesis Combinations 1, 3, or 4, the added flexibility from the trawl gear rule, and the higher catch limits from the 2019-2020 harvest specifications and management measures.

7 COMPLIANCE WITH ALL APPLICABLE LAWS

Several Federal laws and EOs are applicable to the (proposed) action. The Council process and this EIS are intended, where possible, to meet the public involvement requirements and provide the information and analysis necessary to address the mandates described above. Mandates that require additional analysis, documentation, and process not met through NEPA are discussed in this section. The information and analysis in this EIS support the following findings with respect to other applicable law.

7.1 Magnuson-Stevens Act

Below are the 10 National Standards contained in the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) and a brief discussion of how each alternative is consistent with the National Standards, where applicable. In recommending a preferred alternative, the Council must consider how to balance the national standards.

7.1.1 National Standard 1 – Conservation and management measures shall prevent overfishing while achieving, on a continuing basis, the optimum yield from each fishery for the United States fishing industry.

The biennial harvest specifications and management measures undertaken and described in Chapter 6, Cumulative Effects, establish harvest levels consistent with NS1 and the harvest management framework described in Chapter 4 of the Groundfish FMP. This action does not revise the harvest management framework, or groundfish harvest limits. EFHCA closures under the preferred alternative protect groundfish habitat, which contributes to productive fish populations and may help prevent a stock from becoming overfished due to loss of or damage to habitat. EFHCA closures would not displace much fishing effort, and would be unlikely, therefore, to prevent the bottom trawl fishery from achieving optimum yield. Opening certain EFHCA areas and the trawl RCA that has been closed, may provide opportunities to achieve optimum yield.

7.1.2 National Standard 2 —Conservation and management measures shall be based upon the best scientific information available.

The best available science standard applies to the following areas relative to this proposed action: benthic habitat mapping and methods for determining habitat suitability, biological fishery information, and socioeconomic fishery information. Scientific information uncertainties and limitations are discussed in Section 4.1. The supporting science is discussed below.

Seafloor mapping is the primary source of information about benthic groundfish habitats. The high-resolution scanning used to produce these maps is relatively new and expensive, so limited seafloor areas, and not the entire EEZ, are available as high-resolution seafloor maps at this time. The seafloor habitat maps used to conduct the habitat impacts analysis, as described in Section 4.1.1, incorporate the best available information, which includes inferences from these high-resolution seafloor maps. The habitat suitability of any given area for groundfish is based on the occurrence of fish species in NMFS trawl survey catches, when possible. For species not well represented in the trawl catches, information from scientific literature was used. Species and life stages for which no specific information could be found were considered using the precautionary principle.

The best available data include bottom trawl fishery observer, logbook, fish ticket and electronic vessel monitoring system data. These data are used to estimate impacts of the proposed action on the socioeconomic environment, fish resources, and protected resources. As discussed in Section 4.1.2, Socioeconomic Resources, there is less robust information about areas proposed for reopening because of the lack of recent fishing activity in those (currently closed) areas. In these cases, the available historic observer, logbook, and fish ticket data is used, and are the best indicators of historic importance of an area to the fishery. Also, as discussed in Section 4.1.2.1, Approach to Assessing Effects, the fishery data that were available when the compilation of information began for the analysis presented in this EIS were used and generally included information through the 2014 fisheries. NMFS undertook an evaluation of more recent fishery data in 2018 and concluded that the new information would not result in appreciably different impacts that those characterized in this EIS.

7.1.3 National Standard 3—To the extent practicable, an individual stock of fish shall be managed as a unit throughout its range, and interrelated stocks of fish shall be managed as a unit or in close coordination.

The Council develops and designates management units for groundfish, which include stocks, stock complexes, or geographic subdivisions thereof. The proposed action does not change any management units for groundfish. This EIS contemplates groundfish habitat protections and fishery management actions in a coastwide context, encompassing the geographic ranges for all groundfish stocks in the FMP. All of the Subject Area 1 alternatives would likely conserve groundfish EFH for groundfish FMP stocks throughout their range. All of the Subject Area 2 alternatives would maintain depth-based area management options coastwide and would likely improve management flexibility compared to the No-action Alternative. The Subject Area 3 alternative would not likely have different impacts on fish stocks than would the No-action Alternative. The alternatives considered in all three Subject Areas would not likely result in stocks being managed differently throughout their range, nor would they likely fail to manage stocks as a unit.

7.1.4 National Standard 4—Conservation and management measures shall not discriminate between residents of different states. If it becomes necessary to allocate or assign fishing privileges among various United States fishermen, such allocation shall be (A) fair and equitable to all such fishermen; (B) reasonably calculated to promote conservation; and (C) carried out in such a manner that no particular individual, corporation, or other entity acquires an excessive share of such privileges.

Chapter 4 describes the impacts of the alternatives and, where possible, presents impacts on a state-by-state basis and port-group basis. None of the alternatives, including the preferred alternative, would discriminate between residents of different states. Decision-making occurs through the Council process, which facilitates substantial participation by state representatives and the public. For the preferred alternative, state-specific Council recommendations were crafted and integrated from an initial range of alternatives, designed to meet each state's priority management objectives and needs.

7.1.5 National Standard 5—Conservation and management measures shall, where practicable, consider efficiency in the utilization of fishery resources, except that no such measure shall have economic allocation as its sole purpose.

EFHCA closures and reopenings would not likely appreciably change efficiency in the utilization of non-groundfish fishery resources (ridgeback prawn, California halibut, and sea cucumber) because of the relatively low importance of the affected fishing areas. EFHCA closures could have a negative impact on utilization of fishery resources in the groundfish bottom trawl fishery. However, the trawl RCA reopening would likely more than offset any negative impacts on utilization in this fishery. EFHCA reopenings could also have a positive impact on utilization, but to a lesser degree than the trawl RCA changes. The deep-water gear restrictions considered in Subject Area 3 would have no impact on efficiency or utilization of fishery resources, as no fishing with bottom-contact gear occurs in this area under the No-action Alternative.

7.1.6 National Standard 6—Conservation and management measures shall take into account and allow for variations among, and contingencies in, fisheries, fishery resources, and catches.

EFHCAs are management measures to conserve and to protect groundfish EFH. Impacts were assessed based on data from across numerous years, which help account for seasonal and inter-annual variability. The results of the impacts analysis, described in Section 4.2, helped develop the location, size, and shape of the EFHCA alternatives. EFHCAs are designed to provide long-term protections minimizing the negative effects of fishing on groundfish EFH. Groundfish EFH is reviewed approximately every 5 years, which provides opportunities to re-evaluate available information and revise EFHCAs to respond to new information and variations, including information on fisheries, fishery resources, and catches.

All of the alternatives that contemplate changes to the trawl RCA consider and allow for variation and contingencies relating to fisheries, fishery resources, and catches. The trawl RCA and BACs are management measures to control catch of groundfish and incidentally caught species by imposing time/area closures for vessels harvesting groundfish with bottom trawl gear in the catch share program. Like EFHCAs, impacts were assessed based on data from across numerous years, which helped to account for seasonal and inter-annual variability. Also, the trawl RCA (e.g., a measure considered under the No-action Alternative) and BACs (e.g., a measure considered under the action alternatives) are time/area closures that can be closed, reopened, or modified pre-season or in-season to be responsive to the management needs of the fishery, based on most recently available information regarding the fishery, fishery resources, and catches.

7.1.7 National Standard 7—Conservation and management measures shall, where practicable, minimize costs and avoid unnecessary duplication.

Generally, by the Council and NMFS coordinating management, monitoring, and enforcement activities between the three West Coast states, duplication and, thus, cost are minimized. This action contemplates changes to the suites of spatial management tools relating to groundfish EFH and rebuilding overfished rockfish species. Adding new closures may increase the burden on enforcement resources, and removal of closures may decrease the burden on enforcement resources. In general, the boundaries of new and revised closed areas have been developed in consultation with enforcement consultants' expertise to optimize enforceability and avoid duplication.

7.1.8 National Standard 8—Conservation and management measures shall, consistent with the conservation requirements of this Act (including the prevention of overfishing and rebuilding of overfished stocks), take into account the importance of fishery resources to fishing communities by utilizing economic and social data that meet the requirements of National Standard 2, in order to (A) provide for the sustained participation of such communities, and (B) to the extent practicable, minimize adverse economic impacts on such communities.

West Coast fishing communities depend on a portfolio of commercial and recreational fisheries to support year-round operations. Recent coastwide declines in commercial and recreational fisheries for non-groundfish species due to changing environmental conditions and changes in management have created considerable instability for many communities. Protecting and conserving groundfish EFH, relieving fishing restrictions, and enabling flexibility in management measures are anticipated to contribute to sustained participation by, and increased stability in, coastal fishing communities.

All of the alternatives take the importance of the fishery resources to West Coast fishing communities into account. The EFHCA and trawl RCA changes considered in this EIS balance the conservation of fishery resources and EFH with providing for sustained participation for coastal fishing communities. All of the alternative EFHCA closures were designed to mitigate adverse socioeconomic impacts. As noted above under National Standard 2, and described in detail in Sections 4.1 and Section 4.2, the socioeconomic impacts information was analyzed and considered on a coastwide, state-by-state, and port-group basis. This allowed the Council and NMFS to assess differential impacts of the EFHCA alternatives among and between port groups. The trawl RCA alternatives were considered to take advantage of the individual accountability in the catch share program by relieving restrictions and providing additional harvest opportunities for coastal fishing communities. The preferred alternative would minimize adverse economic impacts, while meeting EFH conservation objectives. Reopening the trawl RCA off Oregon and California would provide greater opportunity in the groundfish bottom trawl fishery, improving income stability for dependent communities.

7.1.9 National Standard 9—Conservation and management measures shall, to the extent practicable, (A) minimize bycatch, and (B) to the extent bycatch cannot be avoided, minimize the mortality of such bycatch.

Several groundfish management measures are in place that minimize bycatch in bottom trawl fisheries, particularly of overfished species. These management measures are not revised by the alternatives. Catch share management of the groundfish bottom trawl fishery has reduced bycatch by eliminating most regulatory discards (some non-target species are managed with cumulative trip limits, which may induce some level of regulatory discards). EFHCA changes could change bycatch in bottom trawl fisheries, but it is impossible to predict the magnitude or direction of potential changes. However, the magnitude likely would be small, because the primary impact of new closures would be displacement of bottom trawl effort, and the same catch share incentives to keep discards low would be maintained. The small amount of displacement of non-groundfish species by EFHCA changes would not likely make an appreciable difference in bycatch, compared to No-action Alternative, because so little effort would be displaced from those areas.

Reopening the trawl RCA may change when and where catch of all species, including non-target species, would occur in the groundfish bottom trawl fishery. For groundfish species, the catch share incentives will likely continue to keep discards low. Additionally, if bycatch of any non-target species were high, BACs might be implemented pre-season or in-season. There is considerable uncertainty in how reopening the trawl RCA could change impacts on incidentally caught protected species, particularly salmon. Through other groundfish fishery management actions considered in Chapter 6, Cumulative Effects, new salmon bycatch mitigation measures would be implemented in addition to those already in place. These measures would include, but would not be limited to, monitoring and reporting requirements in the groundfish bottom trawl fishery. If bycatch of salmon were higher than anticipated, the Council and NMFS could respond by implementing BACs to close certain depths and latitudes.

7.1.10 National Standard 10—Conservation and management measures shall, to the extent practicable, promote the safety of human life at sea.

The catch share program, implemented in 2011, has had a profound effect on safety in this sector of the fishery, with many vessels using bottom trawl gear to harvest their IFQ. The catch share program has removed Federal trip limits for IFQ species; therefore, it no longer imposes specific time periods where catch must be harvested or the opportunity for that period is effectively forfeited. A study reported to the Council in the 2015 Annual State of the California Current Ecosystem Report (California Current Integrated Ecosystem Assessment Team 2015) found that since catch share (IFQ) management was implemented in the groundfish fishery "the overall average annual rate of fishing on high wind days… decrease[d] by 85 percent, even accounting for the influence of safety trainings and other types of Coast Guard regulations that have varied over time." However, individual accountability under catch shares has also resulted in bottom trawl vessels fishing seaward of the trawl RCA more often to avoid catch of species such as canary and yelloweye rockfish, for which the allocations and resulting available quota have been limited.[40] Safety benefits seen since the start of the catch share program are unlikely to change with new EFHCAs considered in Subject Area 1, because the closures would occur across varying depths and latitudes, in varying proximities to fishing ports, and would not likely displace effort on a scale such that safety at sea would decrease. Partial removal of the trawl RCA, contemplated in Subject Area 2, would provide opportunities to harvest groundfish closer to shore and in areas that were historically productive for the fishery. This may reduce the distance travelled and the length of trips, thus promoting safety at sea. Subject Area 3 alternatives would have no effect on safety at sea because no bottom-contact gear fishing occurs now or is likely to occur in the near future in the areas to be closed.

7.1.11 EFH Provisions

Portions of the area affected by the proposed action has been identified as EFH for groundfish. The proposed action will have a positive impact on EFH, even with the proposed re-opening of the trawl

[40] Canary rockfish was declared rebuilt in 2017, and allocations and quotas may increase, beginning in 2019. See Chapter 6, Cumulative Effects, for additional information on how the impacts of the biennial groundfish harvest specifications and management measures, combined with this action, would impact the environment.

RCA. Areas of important benthic habitat will remain closed by EFHCAs even when the trawl RCA is re-opened. The proposed action in the context of the fishery as a whole will not have an adverse impact on EFH. Therefore, not EFH consultation is required and none was prepared. The basis for this determination is described in the Section 4.2.1, Habitat Analysis and in Chapter 6, Cumulative Effects, of this EIS.

7.2 Administrative Procedures Act

The Administrative Procedures Act, or APA, governs the Federal regulatory process and establishes standards for judicial review of Federal regulatory activities. Most Federal rulemaking, including regulations promulgated pursuant to the MSA, is considered "informal," which is determined by the controlling legislation. Provisions at 5 U.S.C. 553 establish rulemaking procedures applicable to the proposed action. The rulemaking associated with this proposed action would be conducted in accordance with the APA and procedures identified in section 304 of the MSA.

7.3 Coastal Zone Management Act

Section 307(c)(1) of the Federal Coastal Zone Management Act (CZMA) of 1972 requires that all Federal activities directly affecting the coastal zone be consistent with approved state coastal zone management programs to the maximum extent practicable. A determination as to whether the proposed action would be implemented in a manner that is consistent to the maximum extent practicable with the enforceable policies of the approved coastal zone management programs of Washington, Oregon, and California will be submitted to the responsible state agencies for review under Section 307(c)(1) of the CZMA. The relationship of the Groundfish FMP with the CZMA is discussed in Section 11.7.3 of the Groundfish FMP. The Groundfish FMP has been found to be consistent with the Washington, Oregon, and California coastal zone management programs. The proposed action is consistent and within the scope of the actions contemplated under the framework FMP.

Under CZMA, each state develops its own coastal zone management program that is then submitted for federal approval. This has resulted in programs that vary widely from one state to the next. The proposed action is not expected to affect any state's coastal zone management program.

The proposed action is consistent to the maximum extent practicable with the approved coastal zone management programs of Washington, Oregon, and California. This determination will be submitted for review by the responsible state agencies under section 307 of the Coastal Zone Management Act.

7.4 Endangered Species Act

The Endangered Species Act of 1973 (ESA) was signed on December 28, 1973, and it provides for the conservation of species that are endangered or threatened throughout all or a significant portion of their range and the conservation of the ecosystems on which they depend. The ESA replaced the Endangered Species Conservation Act of 1969; it has been amended several times.

A species is considered endangered if it is in danger of extinction throughout all or a significant portion of its range. A species is considered threatened if it is likely to become an endangered species within the foreseeable future.

Federal agencies are directed, under section 7(a)(1) of the ESA, to utilize their authorities to carry out programs for the conservation of threatened and endangered species. Federal agencies must also consult with NMFS or USFWS, under section 7(a)(2) of the ESA, on activities that may affect a listed species. These interagency consultations, or section 7 consultations, are designed to assist Federal agencies in fulfilling their duty to ensure that Federal actions do not jeopardize the continued existence of a species or destroy or adversely modify critical habitat. Should an action be determined to jeopardize a species or result in the destruction or adverse modification of critical habitat, NMFS or USFWS will suggest reasonable and prudent alternatives that would not violate section 7(a)(2).

Biological opinions document whether the Federal action is likely to jeopardize the continued existence of listed species, or to result in the destruction or adverse modification of critical habitat. Where appropriate, biological opinions provide an exemption for the “take” of listed species, while specifying the extent of take allowed, the reasonable and prudent measures necessary to minimize impacts from the Federal action, and the terms and conditions with which the action agency must comply.

NMFS has concluded that the implementation of the proposed action is not expected to jeopardize the continued existence of any endangered or threatened species under the jurisdiction of NMFS, or results in the destruction or adverse modification of critical habitat. The proposed action is within the scope of the biological opinions for the groundfish fishery that are discussed in the sections below.

7.4.1 Non-salmonid marine species

7.4.1.1 Turtles, whales, seals, and sea lions

On December 7, 2012, NMFS completed a biological opinion (NMFS 2012) concluding that the groundfish fishery is not likely to jeopardize non-salmonid marine species, including listed eulachon, the southern DPS of green sturgeon, humpback whales, the eastern DPS of Steller sea lions, and leatherback sea turtles. The opinion also concluded that the fishery is not likely to adversely modify critical habitat for green sturgeon and leatherback sea turtles. An analysis included in the same document as the opinion concludes that the fishery is not likely to adversely affect green sea turtles, olive ridley sea turtles, loggerhead sea turtles, sei whales, North Pacific right whales, blue whales, fin whales, sperm whales, Southern Resident killer whales, Guadalupe fur seals, or the critical habitat for Steller sea lions. Since that biological opinion, the eastern DPS of Steller sea lions was delisted on November 4, 2013 (78 FR 66140); however, this delisting did not change the designation of the codified critical habitat for the eastern DPS of Steller sea lions. In 2016, NMFS revised the listing of the humpback whale and divided the globally listed species into 14 distinct population segments, 4 of which are now listed as endangered and 1 as threatened. Three of the listed DPSs occur in United States waters (Western North Pacific, Mexico, Central America). Efforts are ongoing to establish the best way to address these reclassifications. Meanwhile, the groundfish fishery continues to maintain compliance with the Terms and Conditions, and the ITS, of the 2012 Biological Opinion.

On January 21, 2013, NMFS evaluated the fishery's effects on eulachon to consider whether the 2012 Biological Opinion should be reconsidered in light of new information from the 2011 fishery and the proposed chafing gear modifications. NMFS determined that information about bycatch of eulachon in 2011 and chafing gear regulations did not change the effects that were analyzed in the December 7, 2012, Biological Opinion or provide any other basis to reinitiate consultation. At the Pacific Fishery Management Council's June 2015 meeting, new estimates of eulachon take from fishing activity under the FMP indicated that the incidental take threshold in the 2012 Biological Opinion was exceeded again in 2013. The increased bycatch may be due to increased eulachon abundance. In light of the new fishery and abundance information, NMFS reinitiated consultation on eulachon. If the consultation identifies either reasonable and prudent alternatives to address jeopardy concerns, or reasonable and prudent measures to minimize incidental take, NMFS would coordinate with the Council to put additional alternatives or measures into place, as required. After reviewing the available information, NMFS concluded that, consistent with ESA sections 7(a)(2) and 7(d), this action will not jeopardize any listed species, will not adversely modify any designated critical habitat, and will not result in any irreversible or irretrievable commitment of resources that would have the effect of foreclosing the formulation or implementation of any reasonable and prudent alternative measures. Impacts of the proposed action on listed species are evaluated in Section 4.2 of this EIS.

7.4.1.2 Seabirds

On May 2, 2017, USFWS issued a biological opinion concluding that the groundfish fishery will not jeopardize the continued existence of the short-tailed albatross. USFWS also concurred that the fishery is not likely to have an adverse effect on the marbled murrelet, California least tern, southern sea otter, bull trout, nor bull trout critical habitat. The 2017 Biological Opinion estimated an annual bycatch of short-tailed albatross in the limited entry sablefish sector of the groundfish fishery at 0.425 birds/year with an upper confidence limit of 2.44 birds/year. The biological opinion estimated effects for this sector only because mortality or injury to short-tailed albatross in other longline or trawl sectors has not been observed. Low levels of interactions are estimated to continue and to be encompassed in the conservative maximum estimated take of five birds in any two-year period. Take of short-tailed albatross has not been observed in the whiting fishery, which is a midwater trawl fishery. NMFS, in coordination with the Council, is working to implement the reasonable and prudent measures identified in the biological opinion.

7.4.2 Salmonids

NMFS issued biological opinions under the ESA on August 10, 1990; November 26, 1991; August 28, 1992; September 27, 1993; May 14, 1996; and December 15, 1999. The biological opinions pertained to the effects of the Groundfish FMP fisheries on the following listed salmonid ESUs:

- Chinook salmon – Puget Sound, Snake River spring/summer, Snake River fall-run, upper Columbia River spring, lower Columbia River, upper Willamette River, Sacramento River winter, Central Valley spring, California coastal
- Coho salmon – Central California coastal, southern Oregon/northern California coastal;
- chum salmon – Hood Canal summer, Columbia River
- Sockeye salmon – Snake River, Ozette Lake
- Steelhead – upper, middle and lower Columbia River, Snake River Basin, upper Willamette River, central California coast, California Central Valley, south/central California, northern California, southern California

These biological opinions indicated that implementation of the FMP would be unlikely to jeopardize the continued existence of any endangered or threatened species under NMFS' jurisdiction, nor would implementation result in the destruction or adverse modification of critical habitat.

NMFS issued a Supplemental Biological Opinion on March 11, 2006, concluding that neither the higher observed bycatch of Chinook salmon in the 2005 whiting fishery, nor new data regarding salmon bycatch in the groundfish bottom trawl fishery would require a reconsideration of its "no jeopardy" conclusion from 1999. NMFS also reaffirmed its 1999 determination that implementation of the FMP is not likely to jeopardize the continued existence of any of the affected ESUs. Lower Columbia River coho (70 FR 37160, June 28, 2005) and Oregon Coastal coho (73 FR 7816, February 11, 2008) were relisted as threatened under the ESA. The 1999 Biological Opinion indicated that the bycatch of salmonids in the Pacific whiting fishery was almost entirely Chinook salmon, with little or no bycatch of coho, chum, sockeye, and steelhead.

In October 2014, NMFS reinitiated ESA section 7 consultation on the Pacific Coast Groundfish FMP with respect to its effects on ESA-listed salmonids to consider changes to the fishery and exceedances of the take threshold for the whiting fishery. On December 11, 2017, NMFS completed the consultation and found that the continued implementation of the Pacific Coast Groundfish FMP would be likely to adversely affect, but would be unlikely to jeopardize the continued existence of the following listed ESUs:

- Chinook salmon – Puget Sound, Snake River fall-run, lower Columbia River, upper Willamette River, Snake River spring/summer-run, California coastal)
- Coho salmon – lower Columbia River, Oregon coast, southern Oregon/northern California, and central California coastal)

The opinion also concluded that implementation of the FMP would be unlikely to have an adverse effect on Sacramento winter-run or Central Valley spring-run Chinook salmon.

7.5 Marine Mammal Protection Act

The MMPA of 1972 is the principle Federal legislation that guides marine mammal species protection and conservation policy in the United States. Under the MMPA, NMFS is responsible for the management and conservation of 153 stocks of whales, dolphins, porpoise, as well as seals, sea lions, and fur seals, while USFWS is responsible for walrus, sea otters, and the West Indian manatee.

Off the West Coast, the Steller sea lion (*Eumetopias jubatus*) eastern stock, Guadalupe fur seal (*Arctocephalus townsendi*), and southern sea otter (*Enhydra lutris*) California stock are listed as threatened under the ESA. The sperm whale (*Physeter macrocephalus*), Washington, Oregon, and California stock; humpback whale (*Megaptera novaeangliae*), Washington, Oregon, and California – Mexico stock; blue whale (*Balaenoptera musculus*), eastern north Pacific stock; and fin whale, (*Balaenoptera physalus*) Washington, Oregon, and California stock/ are listed as depleted under the MMPA. Any species listed as endangered or threatened under the ESA is automatically considered depleted under the MMPA.

Pursuant to the MMPA, the List of Fisheries (LOF) classifies United States commercial fisheries into one of three categories, according to the level of incidental mortality or serious injury of marine mammals:

I. Frequent incidental mortality or serious injury of marine mammals

II. Occasional incidental mortality or serious injury of marine mammals

III. Remote likelihood of/no known incidental mortality or serious injury of marine mammals

The MMPA mandates that each fishery be classified by the level of serious injury and mortality of marine mammals that occurs incidental to each fishery and be reported in the annual Marine Mammal Stock

Assessment Reports for each stock. On the 2012 LOF, the Washington/Oregon/California sablefish pot fishery is listed as a category II fishery due to interactions with marine mammals. All other West Coast groundfish fisheries are listed as category III fisheries. NMFS is currently working on the process leading to any necessary authorization of incidental take under MMPA section 101(a)(5)(E). On February 27, 2012, NMFS published notice that the incidental take of Steller sea lions in the West Coast groundfish fisheries is addressed in NMFS' December 29, 2010, Negligible Impact Determination, and this fishery has been added to the list of fisheries authorized to take Steller sea lions (77 FR 11493, Feb. 27, 2012).

Section 3.4 describes interactions of the fishery with marine mammals, and Section 4.2.4 assesses the effects of the proposed action on marine mammals. Although the proposed action would shift the operation of bottom trawl groundfish fisheries spatially, the gear types and level of effort are not modified by the proposed action. The available information does not indicate that the proposed action would lead to an increase in serious injury/mortality of non-ESA-listed marine mammals.

7.6 Migratory Bird Treaty Act

The MBTA of 1918 was designed to end the commercial trade of migratory birds and their feathers that, by the early years of the twentieth century, had diminished the populations of many native bird species. The MBTA states that it is unlawful to take, kill, or possess migratory birds and their parts (including eggs, nests, and feathers), and it is a shared agreement between the United States, Canada, Japan, Mexico, and Russia to protect a common migratory bird resource. The MBTA prohibits the directed take of seabirds. However, the incidental take of seabirds does occur.

Interactions between seabirds and fishing operations are widespread 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. In the groundfish fishery, 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 they 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. In trawl fisheries, seabirds may be taken when they strike trawl cables, in particular the trawl warps and data cables. 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 this 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, observers collect information on interactions between seabirds and groundfish fisheries. The non-whiting portion of the groundfish fishery has had observer coverage since the fall of 2001. However, seabird mortality on trawl fishing vessels is often unreported and undetected, because when a bird strikes a cable and is seriously injured or killed, the birds carcass is not likely to be recovered and counted, resulting in cryptic mortality. NMFS is currently researching mitigation measures for cable strikes by seabirds as part of the terms and conditions of the biological opinion following the 2011 take of a listed short-tailed albatross. Impact on ESA-listed seabirds is evaluated in Section 4.2.4 of this EIS.

Non-ESA-listed seabirds are also incidentally taken in the groundfish fishery. Mitigation measures currently being implemented to reduce the risk of takes of ESA-listed, short-tailed albatross will likely have a mitigating effect on non-listed seabird species as well. The proposed action does not change the level of effort or timing of the groundfish fishery, and it does not affect the number of hooks deployed because it concerns bottom-trawl gear. The proposed action may potentially change the impact on seabirds because it shifts fishing effort geographically. However, available information on seabird interactions is not geographically specific enough to make an accurate estimate the level of incidental take the proposed action would cause to seabirds protected by MBTA. The impacts of the proposed action on MBTA protected seabirds is, therefore, unknown.

7.7 Paperwork Reduction Act

The Paperwork Reduction Act requires that agency information collections minimize duplication and burden on the public, have practical utility, and support the proper performance of the agency's mission. The proposed action, as implemented by any of the alternatives considered in this EIS, would not require collection of information subject to the Paperwork Reduction Act.

7.8 Regulatory Flexibility Act

The Regulatory Flexibility Act requires government agencies to assess the effects that regulatory alternatives would have on small entities, including small businesses, and to determine ways to minimize those effects. A fish-harvesting business is considered a small business by the Small Business Administration if it has annual receipts not in excess of $4.0 million. For related fish-processing businesses, a small business is one that employs 500 or fewer persons. For wholesale businesses, a small business is one that employs not more than 100 people. For marinas and charter/party boats, a small business is one with annual receipts that do not exceed $6.5 million. The projected impact of any of the alternatives are not anticipated to exceed $100 million.

7.8.1 Regulatory Flexibility Analysis Certification

For any rule subject to notice and comment rulemaking, the RFA requires Federal agencies to prepare, and make available for public comment, both an initial and final regulatory flexibility analysis, unless the agency can certify that the proposed and/or final rule would not have a "significant economic impact on a substantial number of small entities." This determination can be made at either the proposed or the final rule stage. If the agency can certify a rule, it need not prepare an IRFA, a FRFA, a "Small Entity Compliance Guide," or undertake a subsequent periodic review of the rule under Section 610 of the RFA. The NMFS Regional Administrator/Office Director, using analyses and rationale provided by the Council or NMFS, prepares a memorandum from the Chief Counsel for Regulation (CC/Regs) of the DOC to the Chief Counsel for Advocacy certifying and setting forth the factual basis for the certification. The CC/Regs will sign and transmit the certification to SBA at the time the notice of proposed rulemaking or final rulemaking is published in the FR, along with a statement providing the factual basis for such certification.

7.8.1.1 Request for comment on proposed rules

In addition to comments on the analysis below, the agency requests comments on the decision to certify this rule based on the conclusion that, while a significant number of entities in the bottom trawl sector will potentially benefit from the large-scale area openings offered under this primarily deregulatory rule, there will not be significant adverse impacts on these entities from these openings or the closures of new EFHCAs.

7.8.1.2 Statement of the objectives of and the legal basis for the proposed rule

The reasons why agency action is being considered and the legal basis for the proposed rule are explained in Section 1.2, entitled "Purpose and Need," of this EIS.

7.8.1.3 A description and, where feasible, an estimate of the number of small entities to which the proposed rule will apply and a description and estimate of the economic effects on entities, by entity size, and industry

This rule would not directly impose any costs, include any reporting or recordkeeping requirements, or require other types of administrative costs for any (small or large) of the directly regulated entities discussed in greater detail below.

This rule directly regulates access to fishing areas for bottom trawl vessels. Under the current management regime, any groundfish trawl vessel may fish with any legal gear type. Thus, for the purposes of applying the rule, the number of entities is estimated based on the total number of groundfish trawl permits, as well as on the subset of those permits actively used in bottom trawl fishing.

Part 121 of Title 13, Code of Federal Regulations (CFR), sets forth, by North American Industry Classification System (NAICS) categories, the maximum number of employees or average annual gross receipts a business may have to be considered a small entity for RFAA purposes. See 13 C.F.R. § 121.201. Under this provision, the U.S. Small Business Administration established criteria for businesses in the fishery sector to qualify as small entities. Standards are expressed either in number of employees, or as annual receipts in millions of dollars. The number of employees or annual receipts indicates the maximum allowed for a concern and its affiliates to be considered small (13 C.F.R. § 121.201). business primarily engaged in Seafood Product Preparation and Packaging (NAICS 311710) is a small business if it employs 750 or fewer persons on a full time, part time, temporary, or other basis (13 CFR § 121.106), at all its affiliated operations. Two small processing entities each own one groundfish permit, which is required on both catcher vessels and catcher processors, and they would be regulated by the proposed rule. Seven entities own 30 groundfish vessel permits, and they are considered large, both when estimated independently, using the definition above, and through self-reported (using the definition above) ownership affiliation and entity size on groundfish permits and first receiver site license permits.

Provisions are made under SBA's regulations for an agency to develop its own industry-specific size standards following consultation with Advocacy and an opportunity for public comment (see 13 CFR 121.903(c)). NMFS has established a small business size standard for businesses, including their affiliates, whose primary industry is commercial fishing (80 FR 81194, December 29, 2015). This standard is only for use by NMFS and only for the purpose of conducting an analysis of economic effects in fulfillment of the agency's obligations under the RFA.

NMFS' small business size standard for businesses, including their affiliates, whose primary industry is commercial fishing is $11 million in annual gross receipts. This standard applies to all businesses classified under NAICS code 11411 for commercial fishing, including all businesses classified as commercial finfish fishing (NAICS 114111), commercial shellfish fishing (NAICS 114112), and other commercial marine fishing (NAICS 114119) businesses (50 C.F.R. § 200.2; 13 C.F.R. § 121.201).

Limited entry groundfish vessels must self-report size across all affiliated entities. Of the businesses that earn most of their revenue from commercial fishing, one self-reported as large. This entity owns four groundfish permits. The remaining 117 entities primarily involved in seafood harvest self-identified as small and own 139 permits.

Not all permit owners choose to fish vessels each season, and active bottom trawl vessels are the most likely to be impacted directly by regulations. In 2018, 58 vessels harvested groundfish in the catch share program and would potentially benefit from some or all of the fishing area flexibility offered in the proposed rule. Vessels in California and Oregon are likely to experience the greatest benefits from the opening of the Rockfish Conservation Area, although many vessels fish in multiple states: 19 bottom trawl vessels landed fish in California in 2018 and 38 in Oregon. The five bottom trawl vessels landing fish in Washington would still have access to expanded fishing opportunities in other states and, thus, would still experience expected benefits from this rule.

In addition to small businesses, the RFA recognizes other kinds of small entities, including small organizations, defined as any not-for-profit enterprise that is independently owned and operated and not dominant in its field (5 U.S.C. § 601). There is no available guidance beyond this statutory language regarding how to determine if not-for-profit organizations are "small" for RFA purposes. The Small Business Administration (SBA) does have provisions for determining whether a business is “small” for RFA purposes and whether it is “dominant in its field,” and those provisions can inform how NMFS classifies not-for-profit organizations for the purposes of RFA analyses in rulemaking. After consultation with the SBA, NOAA Fisheries has decided to use SBA’s size standards for non-profit organizations to determine whether a non-profit organization is “small” and, in turn, whether it is “dominant in its field,” to apply the statutory definition of a “small organization” in practice.

A nonprofit organization is determined to be “not dominant in its field” if it is considered “small” under SBA size standards, which, for environmental, conservation, or professional organizations (NAICS 813312, 813920), has combined annual receipts of $15 million or less.

One not-for-profit organization owns four limited entry trawl permits which, if actively fished, would be impacted by the rule. This entity self-reported fiscal year 2017 receipts of $1.1 billion and would, thus, be considered large by the criteria outlined above.

7.8.1.4 An explanation of the criteria used to evaluate whether the rule would impose “significant” economic effects

NMFS considers two criteria in determining the significance of adverse regulatory effects: disproportionality and profitability. They are described below.

<u>Disproportionality</u>. This criterion compares the effect of the regulatory action between small and large entities. These regulations are anticipated to benefit all entities, and they are not expected to place any of the small entities described above at a significant competitive disadvantage to large entities.

Profitability. As discussed above, there are no anticipated compliance costs for entities associated with this rule. It is assumed, based on available analyses in the supporting EIS document, that there will not be any explicit costs associated with this rule. As stated in Section 5.2.4, “Combination 4 (the Preferred Alternative) synthesis analysis, this rule is estimated to result in closing areas contributing 0.26 percent and 0.3 percent of coastwide landings (pounds) and revenues, respectively. Areas slated for reopening contributed 12 percent of the coastwide landed pounds and 11 percent of the coastwide revenue in the last period in which they were open (1997 to 2001). This rule is not anticipated to increase coastwide revenue or pounds by the net of these closures and openings, but to offer, on the whole, increased flexibility for active operations in terms of access to expanded fishing areas.

Total/variable/operating costs are not available for most sectors; however, analyses summarized in the EIS above indicate either neutral or positive changes in expected total gross revenue in the synthesized alternatives. These increases in not-for-profit total revenue would overstate the likely impacts on profits, as they do not account for variable operating costs; i.e., to access new fishing areas, vessels may use more gas or have higher crew costs. With increased flexibility in fishing grounds may come increased opportunity, and annual variable costs may rise for harvesters increasing their days at sea or experimenting with new fishing grounds. However, costs are not predicted to increase as a proportion of revenue within given end market constraints in the short run. It is rational to assume that entities will only take additional trips into reopened RCA grounds off the coasts of California and Oregon, if doing so increases their profits; thus, with no compliance costs, the rule is expected to be either neutral or positive for profitability.

7.8.1.5 An explanation of the criteria used to evaluate whether the rule would impose effects on “a substantial number” of small entities

This rule provides flexibility for gear configurations and use to the entire catch share portion of the groundfish fishery, with 189 trawl permits and 58 vessels actively harvesting in 2018. The components of the rule impact the bottom trawl gear portion of the limited entry groundfish sector. The rule is expected to provide some level of benefit, through area access flexibility, to a substantial number of impacted small entities. Areas closed for EFH are generally not actively fished with bottom trawl, contributing less than half a percent of total revenue coastwide. Areas opened represent a substantial increase in potential fishing grounds for active operations off the coasts of California and Oregon. Because changing areas fished within the new regulatory regime to better fit targeting strategies is optional, and up to the discretion of the operator, some vessels may choose not to access reopened areas and, thus, would not be affected by this rule. For vessels that do anticipate expanding operations into newly reopened areas, effects would likely be positive.

7.8.1.6 A description of and an explanation of the basis for assumptions used

Data used to inform this analysis come primarily from PacFIN, which includes data provided by Oregon, California, and Washington on commercial fishing trips and landings, in addition to the West Coast Region permit database. The number of entities predicted to be impacted is generally based on the level of participation in the previous year (2018). However, it is possible that environmental or management condition changes in other fisheries would impact the level of participation in the groundfish fishery beyond what is predicted here.

7.8.1.7 Certification statement by the head of the agency

The agency preliminarily finds, per 5 U.S.C. § 605 (the RFA), that “the proposed rule, if promulgated, will not have a significant economic impact on a substantial number of small entities.”

7.9 Executive Order 12866 (Regulatory Impact Review)

EO 12866, Regulatory Planning and Review, covers a variety of regulatory policy considerations and establishes procedural requirements for analysis of the benefits and costs of regulatory actions. It directs agencies to choose those approaches that maximize net benefits to society, unless a statute requires another regulatory approach. The agency must assess both the costs and the benefits of the intended regulation and, recognizing that some costs and benefits are difficult to quantify, propose or adopt a regulation only after a reasoned determination that the benefits of the intended regulation justify the costs. In reaching its decision, the agency must use the best reasonably obtainable information, including scientific, technical, and economic data, about the need for and the consequences of the intended regulation. NMFS requires the preparation of a regulatory impact review (RIR) for all regulatory actions of public interest. The purpose of the analysis is to ensure that the regulatory agency systematically and comprehensively considers all available alternatives, so that the public welfare can be enhanced in the most efficient and cost-effective way. The RIR will address many of the items in the regulatory philosophy and the principles of EO 12866.

At the proposed rule stage, NMFS concluded that Amendment 28 is unlikely to be determined to be significant by OMB because the total value of the West Coast groundfish fishery is less than 100 million dollars. Also, this rule does not raise any novel legal or policy issues because it has a similar legal basis and policy foundation as Amendment 19 and is not anticipated to have negative net effects to the fishing industry or to essential fish habitat. The deep-water closure implemented using the MSA discretionary authority may be novel for the West Coast groundfish fishery, but is unlikely to raise legal or policy issues because it is anticipated to have no economic effects.

7.9.1 Regulatory Impact Review

The President of the United States signed E.O. 12866, "Regulatory Planning and Review," on September 30, 1993. This order established guidelines for promulgating new regulations and reviewing existing regulations. The E.O. covers a variety of regulatory policy considerations and establishes procedural requirements for analysis of the benefits and costs of regulatory actions. The E.O. stresses that, in deciding whether and how to regulate, agencies should assess all of the costs and benefits of available regulatory alternatives. Based on this analysis, they should choose those approaches that maximize net benefits to the Nation, unless a statute requires another regulatory approach.

NMFS satisfies the requirements of E.O. 12866 through the preparation of an RIR. The RIR provides a review of the potential economic effects of a proposed regulatory action in order to gauge the net benefits to the Nation that are associated with the proposed action. The analysis also provides a review of the problem and policy objectives prompting the regulatory proposal and an evaluation of the available alternatives that could be used to solve the problem.

The RIR provides an assessment that can be used by the Office of Management and Budget to determine whether the proposed action could be considered a significant regulatory action under E.O. 12866. E.O. 12866 defines what qualifies as a "significant regulatory action" and requires agencies to provide analyses of the costs and benefits of such an action and of potentially effective and reasonably feasible alternatives. An action may be considered significant if it is expected to (1) have an annual effect on the economy of $100 million or more or adversely affect in a material way the economy, a sector of the economy, productivity, competition, jobs, the environment, public health or safety, or state, local, or tribal governments or communities; (2) create a serious inconsistency or otherwise interfere with an action taken or planned by another agency; (3) materially alter the budgetary impact of entitlement, grants, user fees, or loan programs or the rights and obligations of recipients thereof; or (4) raise novel legal or policy issues arising out of legal mandates, the President's priorities, or the principles set forth in the EO.

7.9.1.1 Statement of the Problem

A statement of the problem is available above in Section 1.2, entitled "Purpose and Need" of the EIS.

7.9.1.2 Description of the fishery and other affected entities

A detailed description of the fishery and affected entities is covered in Section 3.3 of the EIS, entitled "Socioeconomic Environment." A description of the affected fisheries area is available in Section 1.3 of the EIS, entitled "Action Area."

7.9.1.3 Description of the management goals and objectives

A description of the management goals and objectives is covered in Section 1.2 of the EIS, entitled "Purpose and Need."

7.9.1.4 Description of the Alternatives

The Council-adopted alternatives for analysis are described in Chapter 2 of the EIS.

7.9.1.5 An Economic Analysis of the Expected Effects of Each Selected Alternative Relative to the No-action Alternative

A detailed analysis of the expected socioeconomic effects of each selected alternative relative to the No-action Alternative is found in Section 4.2.2, entitled "Socioeconomic Resources." A synthesis of anticipated impacts is available in Chapter 5.

7.9.1.6 RIR-Determination of Significant Impact

As noted above, under E.O. 12866, a regulation is a "significant regulatory action" if it is likely to (1) have an annual effect on the economy of $100 million or more or adversely affect in a material way the economy, a sector of the economy, productivity, competition, jobs, the environment, public health or safety, or state, local, or tribal governments or communities; (2) create a serious inconsistency or otherwise interfere with an action taken or planned by another agency; (3) materially alter the budgetary impact of entitlements, grants, user fees, or loan programs or the rights and obligations of recipients thereof; or (4) raise novel legal or policy issues arising out of legal mandates, the President's priorities, or the principles set forth in this E.O. Pursuant to the procedures established to implement section 6 of E.O. 12866, NMFS has preliminarily determined that this action is not significant.

7.10 Information Quality Act (IQA)

The IQA (Section 515 of the Treasury and General Government Appropriations Act for Fiscal Year 2001, Public Law 106-554), directed the White House Office of Management and Budget (OMB) to issue government-wide guidelines that "provide policy and procedural guidance to federal agencies for ensuring and maximizing the quality, objectivity, utility and integrity of information disseminated by federal agencies." OMB complied by issuing guidelines directing each federal agency to issue its own guidelines to ensure and maximize the quality, objectivity, utility, and integrity of information disseminated by the agency. In fulfillment of this requirement, NOAA issued the NOAA Information Quality Guidelines on October 1, 2002 (Revised November 6, 2006).

It is the policy of NMFS to comply with NOAA's Information Quality Guidelines. To achieve this policy objective, NMFS has developed procedures and guidance to assist staff with compliance with the NOAA

Information Quality Guidelines. This policy directive guides staff in complying with the IQA and the NMFS IQA procedures. The directive applies to all NMFS staff involved in the generation of information disseminated to the public and to those who review and approve such information prior to release.

7.11 Executive Order 12898 (Environmental Justice)

EO 12898 obligates Federal agencies to identify and address "disproportionately high adverse human health or environmental effects of their programs, policies, and activities on minority and low-income populations in the United States" as part of any overall environmental impact analysis associated with an action. NOAA guidance NAO 216-6, at Section 7.02, states that "consideration of EO 12898 should be specifically included in the NEPA documentation for decision-making purposes." Agencies should also encourage public participation, especially by affected communities during scoping, as part of a broader strategy to address environmental justice issues.

The environmental justice analysis must first identify minority and low-income groups that live in the project area and may be affected by the action. Typically, census data are used to document the occurrence and distribution of these groups. Agencies should be cognizant of distinct cultural, social, economic, or occupational factors that could amplify the adverse effects of the proposed action. For example, if a particular kind of fish is an important dietary component, fishery management actions affecting the availability, or price of that fish, could have a disproportionate effect. In the case of Indian tribes, pertinent treaty or other special rights should be considered. Once communities have been identified and characterized, and potential adverse impacts of the alternatives are identified, the analysis must determine whether these impacts are disproportionate. Because of the context in which environmental justice is developed, health effects are usually considered, and three factors may be used in an evaluation:

1. Whether the effects are deemed significant, as the term is employed by NEPA
2. Whether the rate or risk of exposure to the effect appreciably exceeds the rate for the general population or some other comparison group
3. Whether the group in question may be affected by cumulative or multiple sources of exposure.

If disproportionately high adverse effects are identified, mitigation measures should be proposed. Community input into appropriate mitigation is encouraged.

The proposed action does not affect tribal U&A fishing areas. Community level impacts are considered in Section 4.2.2. Fishery participants make up a small proportion of the total population in these communities, and their demographic characteristics may be different from the community as a whole. However, information specific to fishery participants is not available. Furthermore, different segments of the fishery-involved population may differ demographically. For example, workers in fish processing plants may more often be from a minority population, while deckhands may more frequently be low income compared to vessel owners.

Participation in decisions about the proposed action by communities that could experience disproportionately high and adverse impacts is another important principle of the EO. The Council offers a range of opportunities for participation by those affected by its actions, and it disseminates information to affected communities about its proposals and their effects through several channels. In addition to Council membership, which includes representatives from the fishing industries affected by Council action, the Groundfish Advisory Panel, a Council advisory body, draws membership from fishing communities affected by the proposed action. While no special provisions are made for membership to include representatives from low income and minority populations, concerns about disproportionate effects on minority and low-income populations could be voiced through this body or to the Council directly.

Although Council meetings are not held in isolated coastal communities for logistical reasons, they are held in different places up and down the West Coast to increase accessibility. Materials include a newsletter, describing business conducted at Council meetings, notices for meetings of all Council bodies, and fact sheets intended for the general reader. The Council maintains a postal and electronic mailing list to disseminate this information. The Council also maintains a website (http://www.pcouncil.org) to provide information about the Council, its meetings, and its decisions. Most of the documents produced by the Council, including NEPA documents, can be downloaded from the website.

NMFS does not expect the proposed action to have large effects to the environment that would result in a disproportionately large and adverse effect on minority or low-income populations with respect to the availability of fish, other environmental effects, or health effects if NMFS implements the proposed action.

7.12 Executive Order 13132 (Federalism)

EO 13132, which revoked EO 12612, an earlier federalism EO, enumerates eight “fundamental federalism principles.” The first of these principles states the following:

> “Federalism is rooted in the belief that issues that are not national in scope or significance are most appropriately addressed by the level of government closest to the people.”

In this spirit, the EO directs agencies to consider the implications of policies that may limit the scope of or preempt states' legal authority. Preemptive action having such "federalism implications" is subject to a consultation process with the states; such actions should not create unfunded mandates for the states; and any final rule published must be accompanied by a "federalism summary impact statement."

The Council process offers many opportunities for states (through their agencies, Council appointees, consultations, and meetings) to participate in the formulation of management measures. This process encourages states to institute complementary measures to manage fisheries under their jurisdiction that may affect federally managed stocks. The proposed action does not have federalism implications subject to EO 13132.

7.13 Executive Order 13175 (Consultation and Coordination with Indian Tribal Government)

EO 13175 is intended to ensure regular and meaningful consultation and collaboration with tribal officials in the development of Federal policies that have tribal implications, to strengthen the United States government-to-government relationships with Indian tribes, and to reduce the imposition of unfunded mandates upon Indian tribes.

The Secretary recognizes the sovereign status and co-manager role of Indian tribes over shared Federal and tribal fishery resources. In Section 302(b)(5), the MSA reserves a seat on the Council for a representative of an Indian tribe with federally recognized fishing rights from California, Oregon, Washington, or Idaho.

The United States government formally recognizes the four Washington coastal tribes (Makah, Quileute, Hoh, and Quinault) that have treaty rights to fish for groundfish. In general terms, the quantification of those rights is 50 percent of the harvestable surplus of groundfish available in the tribes' U&A fishing areas (described at 50 CFR 660.324). Each of the treaty tribes has the discretion to administer its fisheries and to establish its own policies to achieve program objectives. The proposed action does not change designated EFH in the tribes' usual and accustomed fishing areas. The proposed action has been developed in coordination with the affected tribes and, insofar as possible, with tribal consensus.

7.14 Executive Order 13186 (Responsibilities of Federal Agencies to Protect Migratory Birds)

EO 13186 supplements the MBTA (above) by requiring Federal agencies to work with USFWS to develop memoranda of agreement to conserve migratory birds. NMFS and USFWS entered into a Memorandum of Understanding on June 14, 2012. The protocols in this consultation guide agency regulatory actions and policy decisions to address this conservation goal. The Memorandum of Understanding expired on July 16, 2017. NMFS and USFWS are working to renew the agreement.

The EO also directs agencies to evaluate the effects of their actions on migratory birds in environmental documents prepared pursuant to the NEPA. This evaluation can be found in Section 4.2.4 and Section 5.3. For the reasons stated at Section 4.2.4, and Section 5.3, the effects of this action on migratory seabirds are consistent with EO 13186.

7.15 Executive Order 13771 (Reducing Regulatory Burden)

EO 13771 requires Federal agencies to remove two regulations for every new regulation for rulemakings that are determined to be "significant" by OMB. Partial removal of the trawl RCA contemplated in this EIS is anticipated to relieve restrictions such that it would more than outweigh new restrictions imposed by new and revised EFHCAs or by possible BACs. See also discussion in Section 7.9, regarding Executive Order 12866.

8 LISTS

8.1 List of Preparers

The lead agencies, Pacific Fishery Management Council and National Marine Fisheries Service are responsible for the contents of the EIS. A list of principal preparers, contributors, and document reviewers is provided below with relevant information on roles in producing this document.

8.1.1 Pacific Fishery Management Council

Griffin, Kerry: Council staff. Provided consultation on development of measures, data analysis, and biological impact; completed FMP Amendment language (main document), per Council guidance; coordinated and provided support for FMP appendices; completed regulatory deeming, per Council guidance.

Seger, Jim: Council staff. Coordinated delivery of landings/revenue data set with Pacific States; contributed to narrative for landings and revenue impacts; reviewed and commented on draft regulations and impacts analyses.

Wiedoff, Brett: Council staff. Reviewed and commented on affected environment, draft regulations, and impacts analyses; completed protected species impact analyses.

8.1.2 National Oceanic and Atmospheric Administration (NOAA) and NOAA Fisheries/National Marine Fisheries Service (NMFS)

Cantillon, Karen: West Coast Region, SFD (contracting). Drafted Affected Environment; completed Executive Summary, coordinated completion of Record of Decision, edited NEPA and other documents.

Harley, Abigail: West Coast Region SFD. Coordinated delivery of landings/revenue data set with Pacific States; contributed to narrative for landings and revenue impacts; provided consultation on and review of economic impact analyses.

Hanshew, Gretchen: West Coast Region SFD, project manager. Coordinated and oversaw NEPA and rulemaking; consulted on biological impact analyses; completed fish resources impact analysis; identified potential policy, regulatory, and administrative issues during development and review; completed regulations for deeming, per Council guidance; prepared rulemaking documents.

Hooper, Brian: West Coast Region, SFD. Completed analysis and narrative on cumulative effects.

Johnson, Stephanie: Northwest Section, NOAA General Counsel, Consulted on potential legal issues and questions.

Kachra, Galeeb: West Coast Region, NOAA NEPA Coordinator (contracting). Reviewed document for completeness in terms of meeting NEPA requirements during development and review.

Kent, Keeley: West Coast Region SFD. Coordinated delivery and consideration of landings data for impacts analysis on fish resources.

Mann, Benjamin: West Coast Region. Provided consultation on development of measures, data analysis, and biological impact analysis.

Sawyer, Evan: West Coast Region. Supplemented and completed the narrative for social impacts; provided administrative support for filing and publication of the Draft EIS.

Somers, Kayleigh: Northwest Fisheries Science Center, FRAM. Supported observer data requests; reviewed and commented on analytical use of observer data.

Stadler, John; West Coast Region, Oregon-Washington Coastal Area Office. Provided consultation on development of measures, data analysis, and biological impact analyses; completed habitat impact analyses; reviewed and commented on draft regulations; collaborated on completion of FMP appendices.

Ushio, Miako: West Coast Region, SFD (contracting). Completed “Compliance with Applicable Laws” narrative for the EIS.

Whitmire, Curt: Northwest Fisheries Science Curt Whitmire, Northwest Fisheries Science Center, FRAM. Provided scientific information and insights to inform and refine analytics that supported the decision-making process; collaborated on completion of FMP appendices.

8.2 Distribution List

Copies of this EIS will be sent by NMFS to the following contacts and entities at the start of the public comment period:

- The “wcgroundfish” e-mailing list, a voluntary mailing list for interested parties in West Coast Groundfish fishery management issues;
- Notice on the login webpage for IFQ accounts;
- Washington, Oregon and California Departments of Fish and Wildlife
- Individuals and entities that submitted comments on the NOI to prepare this EIS
- Proponents of early proposals for EFH, including but not limited to:
    - Environmental Defense Fund (withdrawn)
    - Fishermen’s Marketing Association (FMA)
    - Greenpeace (GP)
    - Greater Farallones National Marine Sanctuary (GFNMS)

  - Marine Conservation Institute
  - Monterey Bay National Marine Sanctuary (MBNMS)
  - Oceana/Natural Resources Defense Council/Oceana/Ocean Conservancy (Oceana et al.)
  - Olympic Coast National Marine Sanctuary (withdrawn)
  - Alternative 1.a, Collaborative proponents

- Individuals and entities that offered public testimony on this topic at the April 2018 Council meeting.
- Individuals and entities that submitted public comments on the Draft EIS.

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10 RESPONSE TO COMMENTS ON THE DRAFT EIS

NMFS received six comment letters during the DEIS comment period, which closed on November 19, 2018. Six letters were received from the following persons or entities:

1. The Office of National Marine Sanctuaries (ONMS);
2. Oceana;
3. The PEW Charitable Trusts;
4. Dr. Andrew R. Thurber;
5. The Environmental Protection Agency (EPA); and
6. The California Coastal Commission.

The first four comment letters were generally supportive of the proposed action, and recommended corrections or additions on a variety of topics regarding the environmental impact analysis. The EPA suggested improvements to maps and the California Coastal Commission concurred with NMFS' determination that the proposed action was consistent with the CZMA.

All of the comment letters and their attachments received on the DEIS can be found in Appendix F to this EIS.

10.1 ONMS Comment Letter

#	Comment	Response
10.1.1	Concur with the conclusions as they relate to the proposed changes to EFHCAs in national marine sanctuaries.	Thank you for your support and for your participation in the Amendment 28 process.
10.1.2	The following paper gives insight to the possible assumptions made in the substrate map: Romsos, C.G., Goldfinger, C., Robison, R., Milstein, R.L., Chaytor, J.D., and Wakefield, W.W., 2007, *Development of a regional seafloor surficial geologic habitat map for the continental margins of Oregon and Washington, USA.* Did the elements in above referenced paper guide the substrate map produced by OSU and used in the DEIS? If so, when, and how these elements determined California seafloor substrate is not clear.	The 2007 paper by Romsos et al. referred to in this ONMS comment was not a primary source of information used in the EIS impacts analysis for Oregon and Washington, as more recent information was available for those areas of the coasts. Additional explanation and references regarding the OSU substrate data are added in Section 4.1.1.2.2. Detailed information about the assumptions that went into the OSU substrate data can be found in the referenced papers. Central and southern California seafloor substrate classification was estimated based on data through 2003.
10.1.3	NMFS should provide more information about the assumptions for the substrate classifications or expand the explanation of how substrate types were estimated. NMFS should clarify when the substrate type map was last updated.	The methods, uncertainty, and assumptions of the EIS impacts analysis are described in Section 4.1. Additional explanation and references regarding the source information for the substrate classification estimates are

#	Comment	Response
		added in Section 4.1.1.2.2 and 4.1.1.3. NMFS notes that the most recent research updating the seafloor substrate classification estimates differs across the coast. Washington, Oregon, and northern California was last updated in 2014 and central and southern California was last updated in 2003.
10.1.4	Provide more clear explanation of the limitations of the benthic substrate data potentially leading to substrate classifications that vary in accuracy. This could be covered in Section 4.1.1.2.2 or 4.1.1.3.	The methods, uncertainty, and assumptions of the EIS impacts analysis are described in Section 4.1. Additional explanation and references regarding limitations of substrate type estimates are added in Section 4.1.1.2.2 and 4.1.1.3. NMFS notes that the measurements of substrate types are estimates and refers readers to published documents that describe in greater detail the methods used for calculating the percentage of the seafloor area covered by each of three substrate types used in the EIS impacts analysis.
10.1.5	Review the DEIS for statements that utilize a substrate type as a justification for minimal impact determinations and consider being less absolute about the assumption.	When quantitative information is provided on substrate type it is an "estimate" based on the best available scientific information. Qualifying language has been

#	Comment	Response
		added in Chapters 4, and 6 when discussing the substrate types.
10.1.6	Please change the name of Fanny Shoal to add Cochrane Bank to the name, so it is inclusive of the features that are included in that closed area.	NMFS acknowledges that Cochrane Bank is a feature that would be encompassed by this EFHCA expansion and has added "Cochrane Bank" to the name of the EFHCA in the proposed regulations for the Alternative 1.h, the Preferred Alternative. However, to maintain continuity with past proposals and other documents, the name change is not reflected in the EIS.
10.1.7	Add a few suggested sentences about what restrictions already exist within Sanctuaries.	Additional information has been added to the marine sanctuaries description in Chapter 2.
10.1.8	Add coordinates for EFHCAs to the EIS	Latitude and longitude coordinates for Alternative 1.h, the Preferred Alternative, were developed after publication of the DEIS as part of the FMP Amendment and rulemaking process. These coordinates are published in Appendix C-2 of the FMP, available at the link below.

#	Comment	Response
		https://www.pcouncil.org/wp-content/uploads/2019/06/Appendix-C2-Coordinates-csv-FINAL.csv Public comments will be accepted on these coordinates during the comment period on Amendment 28 and the associated proposed rule for implementing regulations. See the Notice of Availability for public comment instructions. Notice of Availability, 84 FRN 27072, June 11, 2019; comments due no later than August 10, 2019.
10.1.9	Fix section reference in Table 6-1	This change has been made.
10.1.10	Change "Gulf of the Farallones NMS" to "Greater Farallones NMS" and remove the GFNMS abbreviation (page xii) because it is unnecessary,	The correction to the definition of the acronym has been made. The corrected GFNMS abbreviation remains at page xiii because this acronym is used in multiple places in the document.

10.2 Oceana Comment Letter

	Comment	Response
10.2.1	We strongly support the suite of Final Preferred Alternatives	Thank you for your support and for your participation in the Amendment 28 process.
10.2.2	The EIS should reference scientific literature that documents the impacts of bottom trawl on benthic habitat	The scientific literature that documents impacts of bottom trawl fishing on benthic habitat was extensively explored during Phase 1 of the groundfish EFH 5-year review. Conclusions from the review are incorporated into 4.1.1.1.
10.2.3	The EIS should include reference to the October 25, 2018 tribal U&A Federal Register notice and point out that the Council used the revised tribal U&A boundaries when adopting the Grays Canyon Northern Modification area in Alternative 1.h.	Since publication of the DEIS, NMFS promulgated implementing regulations for the 2018 Court order (83 FR 53827, October 25, 2018). A reference to this final rule has been added in Section 1.3. Alternative 1.h, the Preferred Alternative, included the Grays Canyon northern modification EFHCA, defined for the boundary for the Grays Canyon northern modification EFHCA with latitude and longitude coordinates that the Council considered to be consistent with the 2018 court order. This information has been added to the description of Alternative 1.h, the Preferred Alternative, in Section 2.2.3.
10.2.4	EIS should use coral and sponge observations to quantify the abundance in	Ideally, sufficient information would be available to compare the abundances of each HFI taxon that occur within each polygon or

	Comment	Response
	areas proposed to opened or closed. In some places coral and sponge abundance data was instrumental in the design of proposed EFHCAs and it was important in the decision-making process	alternative. However, the most comprehensive data set available, compiled by NOAA's Deep-Sea Coral Research and Technology Program (DSCRTP; https://deepseacoraldata.noaa.gov), provides abundance data from only a subset of surveys, and those surveys that do provide abundance data were not designed to enumerate the HFI in a specific polygon. The lack of consistent abundance data precludes the ability to determine, in a standardized way, the relative importance of individual areas to corals, sponges, or sea pens. Therefore, abundance was not considered an appropriate habitat metric. While abundance data were unavailable to inform the quantitative analysis, there is some discussion of HFI abundances in the proposals that formed the basis for the alternatives, and more information on these proposals is available at https://www.pcouncil.org/groundfish/groundfish-essential-fish-habitat/. In addition, the Council did consider recent qualitative abundance data when they modified the boundaries of "the Football" EFHCA for the preferred alternative. This information has been added to Section 4.1.1.2.6 and 4.1.1.3
10.2.5	Table A-13, is mislabeled as "Alternative 1.n, the Preferred Alternative". It should be Alternative 1.h, the Preferred Alternative.	This error has been corrected.

	Comment	Response
10.2.6	Table C.3 is mislabeled as “Alterative 1.a, Preferred Alternative” when it should be 1.h	This error has been corrected.

10.3 PEW Comment Letter

	Comment	Response
10.3.1	We concur with the overall conclusion that the habitat and socioeconomic effects of Am 28 will be positive.	Thank you for your support and for your participation in the Amendment 28 process.
10.3.2	The affected environment description and impacts analysis for Alternative 3.a (the closure of waters deeper than 3,500 meters) should be further developed. There is a great deal of information on the sensitivity of abyssal plain habitats and their importance to the ecosystem, including some that is specific to the area affected by Amendment 28. For example, the DEIS states that spatial extent is the only habitat metric available for waters deeper than 3,500 m (DEIS Section 4.2.1.1). However, NOAA's Deep Sea Coral Research and Technology database contains over 7,500 coral and sponge observations in this area, indicating that the Habitat-Forming Invertebrate (HFI) presence metric could be informative for this alternative.	NMFS describes in Section 3.1.3.1 the types of deep-sea HFI, including corals, which are part of the action area considered in this EIS. Information regarding the sensitivity of these habitats, their importance to the ecosystem and their intrinsic value, is added in Section 4.2.1.4 and 4.2.2.11. The area covered by this alternative is vast and poorly studied, with only scattered surveys for HFI that cover only a very small portion of the area. Based on this, NMFS determined that the HFI presence metric (1 km grid cells with at least one record) would not help inform the analysis of the environmental effects of Alternative 3. However, NMFS agrees that the number of coral and sponge records in this area are informative and added text describing these records in Section 4.2.1.4. Additionally, since bottom contact fishing has not occurred there and is unlikely to be developed in the foreseeable future, no quantitative metrics were

	Comment	Response
		necessary for assessing the socioeconomic impacts of Alternative 3.
10.3.3	We suggest that the DEIS should also include a description of the methodology review conducted by the Council's Scientific and Statistical Committee (SSC), a review that resulted in an SSC endorsement.	The SSC conducted a review of the methods for assessing the environmental impacts described in this EIS. This information has been added in Section 4.1 and can be viewed in their April 2018 report. See https://www.pcouncil.org/wp-content/uploads/2018/04/F3b_Supp_SSC_Rpt1_Apr2018BB.pdf
10.3.4	The description of reasonably foreseeable future actions in the Cumulative Effects Analysis (CEA) should include the Vessel Movement and Monitoring (VMM) action taken by the Council in April 2016. This action, which is expected to complete NMFS rulemaking in March 2019, will increase Vessel Monitoring System (VMS) ping rates, which will improve closed area enforceability and thus increase the effectiveness and efficiency of the Amendment 28 regulations.	Information regarding the VMM rule has been incorporated into Sections 6.3.1, 6.4, and 6.5.4, describing how the VMM rule, when combined with other past, present and reasonably foreseeable future actions will help enforce the habitat protection provisions considered in the proposed action.

10.4 Dr. Thurber Comment Letter

	Comment	Response
10.4.1	Support precautionary approach to protect deep-sea corals.	Thank you for your support and for your participation in the development of Amendment 28.
10.4.2	We urge you to include a statement regarding the importance of methane seeps in the FPA.	NMFS agrees that methane seeps are an important habitat type. References to the importance and presence of methane seeps have been added to Sections 3.1.1, 4.1.1.2 and 4.2.1.2.4, and specific EFHCA polygons have been identified as containing methane seeps in Sections 4.2.1.2.1, 4.2.1.2.2 and 4.2.1.2.3.
10.4.3	We encourage you to protect seep habitats in the FPA by closing known seeps to bottom trawling through the creation of new EFHCAs, such as Oceana's proposed closure of unfished areas in the Southern California Bight, an area that is also rich in Amendment 28 priority habitats such as rocky substrate, submarine canyons and gullies, and structure-forming invertebrates like corals and sponges.	Although there is not sufficient information available to compare the number of methane seeps protected by the individual alternatives, some of the areas closed by Alternative 1.h, the Preferred Alternative, are known to contain methane seeps. These areas include the Southern California Bight, Hydrate Ridge, Heceta Bank, and Grays Canyon. See edits to include this information in Sections 4.2.1.2.3.

	Comment	Response
10.4.4	We understand that there are newly discovered seeps in a number of areas that are currently within EFHCAs, but that are proposed for reopening. The presence of these sensitive habitats should preclude reopenings.	The proposed action strikes a balance between sustainable fishing opportunities and minimizing, to the extent practicable, the impacts of fishing on designated EFH. The net effects to habitat protections from the Preferred Alternative are estimated to result in an increase of priority habitat protections of between 38 percent and 230 percent (see Table 4-5, Habitat metrics for Alternative 1.h, the Preferred Alternative). Methane seeps are not, as of yet, a priority habitat type. However, they can be associated with two of the priority habitat types, hard substrate and HFI. Because Amendment 28 will increase protections for these habitat types, it is reasonable to assume that it will also increase protections for methane seeps. Therefore, Alternative 1.h, the Preferred Alternative, is estimated to protect significantly more habitat than it is reopening, increases the net area of bottom trawl closures, and is consistent with the MSA mandates.

10.5 EPA Comment Letter

	Comment	Response
10.5.1	Figures are hard to read due to small scale and type face...Include a link to the data files.	The scale for figures presented in Chapter 2 represent the coastwide action. Figures at a larger scale would lose the context of the coastwide action, and would be too numerous to be useful. Therefore, a web-based tool was developed so that the audience could view alternatives at whatever scale would best serve their particular needs and interests. NMFS has added a link to a web-based mapping tool in Chapter 2 of the FEIS. Readers can customize the map scales and view only the data in which they are interested. http://www.soundgis.com/efh/efh2018eis-metrics/ Information regarding this proposed action, including geo-spatial data, will be made available on the following websites after the action is approved by the Secretary of Commerce. https://www.nwfsc.noaa.gov/data/map, and https://www.fisheries.noaa.gov/

10.6 California Coastal Commission Comment Letter

	Comment	Response
10.6.1	We concur with your determination of consistency with the California Coastal Management Program	Thank you for your support.

Appendix A.

Habitat metrics, by geographic breaks and polygon

APPENDIX A

This Appendix contains the habitat metrics, by geographic break, and polygon, for Alternatives 1.a, 1.b, and 1.h. The information is presented in tables and figures.

Methodology

The metrics for the priority habitats in the polygon tables are color coded to help the reader compare one polygon with another. The bins for hard substrate, canyons, and overfished species (OFS) habitat are based on the spatial extent (mi2), while the bins for habitat-forming invertebrates (HFI) presence and bycatch are based on the number of grid cells. The HFI bins were chosen to approximate the spatial extent of the mi2 bins. For example, 1 mi2 is equivalent to 2.6 of the 1 km grid cells used in the HFI presence, and 10.2 of the 0.5 km grid cells. The same bins and color codes are used for all alternatives, as shown in Table A-1.

Table A-1. Color codes for extent of priority habitats in each polygon.

Closures			**Reopenings**		
mi^2	**Presence (1 km grid cells)**	**Bycatch (0.5 km grid cells)**	**mi^2**	**Presence (1 km grid cells)**	**Bycatch (0.5 km grid cells)**
0	**0**	**0**	**0**	**0**	**0**
<1	**<3**	**<10**	**<1**	**<3**	**<10**
1-5	**4-13**	**10-52**	**1-5**	**4-13**	**10-52**
5-10	**14-26**	**53-104**	**5-10**	**14-26**	**52-104**
10-20	**27-52**	**105-207**	**10-20**	**27-52**	**105-207**
>20	**<52**	**>207**	**>20**	**>52**	**>207**

No-action Alternative

Geographic Break Analysis

Tables A-2 and Table A-3 show the habitat metrics summarized by latitudinal zone and depth zone. Table A-4 shows the habitat metrics for each geographic break.

Table A-2. No-action Alternative habitat metrics, summarized by latitudinal zone. Values in underlined italics are lowest for that metric and values in bold italics are highest for that metric, among the latitudinal zones. “Unkn” = unknown; “**-**“= true zero. 0 = <1mi2.

Latitudinal Zone	METRICS												
						Priority Habitats							
								Habitat-Forming Invertebrates					
		Substrate Type (mi^2)						Presence (1km gridcell)			Bycatch (0.5 km gridcell)		
	Spatial extent (mi^2)	Hard	Mixed	Soft	Unkn	Canyon (mi^2)	OFS (mi^2)	DSC	Sponge	Sea Pen	DSC	Sponge	Sea Pen
Cape Flattery to Pt Chehalis	1,496	23	122	1,348	4	217	64	79	217	85	1,312	892	737
Pt Chehalis to Cape Blanco	1,796	206	99	1,491	-	54	710	57	190	90	2,817	5,312	4,752
Cape Blanco to Cape Mendocino	350	2	-	348	-	114	170	17	22	12	548	611	19
Cape Mendocino to Pt Conception	3,316	607	10	2,660	40	271	4	310	345	470	296	329	190
Pt Conception to US/Mexico Border	**7,527**	477	115	6,924	11	119	-	504	729	280	-	-	-
Grand Total	0	0	0	0	0	0	0	0	0	0	0	0	0

Table A-3. No-action Alternative habitat metrics, summarized by depth zone. "Unkn" = unknown. "-"= true zero.

Depth Zone	METRICS												
	Spatial extent (mi2)	Substrate Type (mi^2)				Priority Habitats							
						Canyon (mi^2)	OFS (mi^2)	Habitat-Forming Invertebrates					
								Presence (1km grid cell)			Bycatch (0.5 km grid cell)		
		Hard	Mixed	Soft	Unkn			DSC	Sponge	Sea Pen	DSC	Sponge	Sea Pen
0-30 fm	430	29	10	384	8	-	-	35	21	8	-	-	-
30-100 fm	1,903	335	112	1,453	5	12	55	198	318	200	180	620	333
100-150 fm	2,830	90	94	2,645	1	210	793	350	544	320	2,050	2,224	2,435
150-700 fm	**9,321**	**861**	**130**	**8,289**	**41**	**553**	100	**384**	**620**	**409**	**2,743**	**4,300**	**2,930**
Grand total	14,485	1,315	345	12,770	54	775	948	967	1,503	937	4,973	7,144	5,698

Table A-4. No-action Alternative habitat metrics by latitudinal and depth zones. “Unkn” = unknown. “-“= true zero. 0 mi2 = <1mi2; 0.0% = <0.1%.

		METRICS												
							Priority Habitats							
									Habitat-Forming Invertebrates					
			Substrate Type (mi^2)						**Presence (1km grid cell)**			**Bycatch (0.5 km grid cell)**		
Latitudinal Zone	**Depth Zone**	**Spatial extent (mi2)**	**Hard**	**Mixed**	**Soft**	**Unkn**	**Canyon (mi^2)**	**OFS (mi^2)**	**DSC**	**Sponge**	**Sea Pen**	**DSC**	**Sponge**	**Sea Pen**
Cape Flattery to Pt Chehalis	0fm-30fm	106	12	-	93	1	-	-	-	-	-	-	-	-
	30fm-100fm	435	8	45	379	3	2	1	14	39	5	25	272	153
	100fm-150fm	432	2	77	354	-	57	53	51	103	27	332	82	213
	150fm-700fm	523	0	-	523	-	158	10	14	75	53	955	538	371
	Total	1,496	23	122	1,348	4	217	64	79	217	85	1,312	892	737
Pt Chehalis to Cape Blanco	0fm-30fm	-	-	-	-	-	-	-	-	-	-	-	-	-
	30fm-100fm	335	186	54	96	-	-	53	9	36	4	149	303	138
	100fm-150fm	924	19	8	896	-	39	594	25	66	33	1,123	1,869	2,133
	150fm-700fm	537	1	37	499	-	15	62	23	88	53	1,545	3,140	2,481
	Total	1,796	206	99	1,491	-	54	710	57	190	90	2,817	5,312	4,752
Cape Blanco to Cape Mendocino	0fm-30fm	1	0	-	1	-	-	-	-	-	-	-	-	-
	30fm-100fm	5	0	-	5	-	4	0	-	-	1	-	45	-
	100fm-150fm	199	1	-	198	-	26	143	7	15	8	392	165	15
	150fm-700fm	145	0	-	145	-	85	26	10	7	3	156	401	4
	Total	350	2	-	348	-	114	170	17	22	12	548	611	19
Cape Mendocino to Pt Conception	0fm-30fm	18	3	-	15	-	-	-	-	-	-	-	-	-
	30fm-100fm	317	46	0	271	-	4	1	19	31	79	6	-	42
	100fm-150fm	716	33	9	673	-	45	2	188	194	191	203	108	74
	150fm-700fm	2,265	525	-	1,701	40	222	1	103	120	200	87	221	74
	Total	3,316	607	10	2,660	40	271	4	310	345	470	296	329	190
Pt Conception to US/Mexico Border	0fm-30fm	305	13	10	275	7	-	-	35	21	8	-	-	-
	30fm-100fm	812	95	12	703	2	2	-	156	212	111	-	-	-
	100fm-150fm	559	34	0	524	1	43	-	79	166	61	-	-	-
	150fm-700fm	5,851	334	93	5,422	2	73	-	234	330	100	-	-	-
	Total	7,527	477	115	6,924	11	119	-	504	729	280	-	-	-
Grand Total		14,485	1,315	345	12,770	54	775	948	967	1,503	937	4,973	7,144	5,698

Alternative 1.a, the Collaborative Alternative

Geographic Break Analysis

Tables A-5 and A-6 show the habitat metrics summarized by latitudinal zone and depth zone. Table A-7 shows the habitat metrics for each geographic break.

Polygon Analysis

The habitat metrics for each polygon in the Collaborative Alternative are found in Table A-8. They are not discussed in in detail, but are provided here as additional information.

This alternative contains 43 proposed closures and 16 proposed reopenings. The closures would range in size from 1 mi^2 (Saint George Reef) to 126 mi^2 (Farallon Escarpment). Of the remaining 41 closures, 21 closures would be smaller than 10 mi^2, 14 would be between 10 and 50 mi^2, and 6 would be between 50 and 100 mi^2, The Saint George Reef closure, as originally proposed, would have been much larger, but it would have been mostly in state waters (Figure A-1). When the state waters were removed, all that remained were two small polygons that, when summed, would total 0.9 mi^2.

The 16 reopenings would range in size from 1 mi^2 (Point Arena South Modification 4 and Monterey Bay NMS South of Mars Cable) to 74 mi^2 (Point Arena South Modification 1).

Table A-5. Alternative 1.a, the Collaborative Alternative, net habitat metrics (closures minus reopenings), summarized by latitudinal zone. Values in underlined italics are lowest for that metric, and values in bold italics are highest for that metric, among the latitudinal zones. "Δ%" = percent change within latitudinal zone from No Action Alternative. "-"= true zero. 0 mi2 = <1mi2; 0.0% = <0.1%. ** = 0 in No-action Alternative. Values in parentheses are negative.

		METRICS												
							Priority Habitats							
									Habitat-Forming Invertebrates					
		Spatial extent (mi2)	Substrate Type (mi^2)						Presence(1km grid cells)			Bycatch (0.5 km grid cells)		
Latitudinal Zone			**Hard**	**Mixed**	**Soft**	**Unkn**	**Canyon (mi^2)**	**OFS (mi^2)**	**DSC**	**Sponge**	**Sea Pen**	**DSC**	**Sponge**	**Sea Pen**
Cape Flattery to Pt Chehalis	mi^2	126	-	-	126	-	96	0	2	3	2	91	195	60
	Δ%	8.4	-	-	9.4	-	44.2	0.0	2.5	1.4	2.4	6.9	21.9	8.1
Pt Chehalis to Cape Blanco	mi^2	174	11	50	112	-	67	3	6	4	1	254	-7	191
	Δ%	9.7	5.3	51.1	7.5	**	123.0	0.4	10.5	2.1	1.1	9.0	-0.1	4.0
Cape Blanco to Cape Mendocino	mi^2	209	12	-	197	-	24	0	22	23	23	527	649	446
	Δ%	59.7	664.7	**	56.6	**	20.8	0.1	129.4	104.5	191.7	96.2	106.2	2347.4
Cape Mendocino to Pt Conception	mi^2	250	75	0	175	-	30	6	70	74	49	-8	97	48
	Δ%	7.5	12.4	4.2	6.6	-	11.0	133.8	22.6	21.4	10.4	-2.7	29.5	25.3
Pt Conception to US/Mexico Border	mi^2	-	-	-	-	-	-	-	-	-	-	-	-	-
	Δ%	-	-	-	-	-	-	-	-	-	-	-	-	-
Grand Total	mi^2	759	98	51	610	-	217	9	100	104	75	864	934	745
	Δ%	5.2	7.4	14.7	4.8	-	27.9	0.9	10.3	6.9	8.0	17.4	13.1	13.1

Table A-6. Alternative 1.a, the Collaborative Alternative, net habitat metrics (closures minus reopenings), summarized by depth zone. Values in underlined italics are lowest for that metric, and values in bold italics are highest for that metric, among the latitudinal zones. "Δ%" = percent change within depth zone from No Action Alternative. "-"= true zero. 0 mi2 = <1mi2; 0.0% = <0.1%. ** = 0 in No-action Alternative. Values in parentheses are negative.

		METRICS												
							Priority Habitats							
									Habitat-Forming Invertebrates					
		Spatial extent (mi2)	Substrate Type (mi^2)						Presence (1km grid cells)			Bycatch (0.5km grid cells)		
Depth Zone			Hard	Mixed	Soft	Unkn	Canyon (mi^2)	OFS (mi^2)	DSC	Sponge	Sea Pen	DSC	Sponge	Sea Pen
0-30 fm	mi^2	7	3	1	3	-	-	-	1	1	-	-	-	5
	Δ%	1.6	9.0	9.5	0.8	-	**	**	2.9	4.8	-	**	**	**
30-100fm	mi^2	143	48	50	45	-	0	3	54	66	19	96	48	104
	Δ%	7.5	14.3	44.7	3.1	-	0.9	5.5	27.3	20.8	9.5	53.3	7.7	31.2
100-150fm	mi^2	-2	-0	-	-2	-	0	0	-	-	-	-26	1	-
	Δ%	-0.1	-0.2	-	-0.1	-	0.1	0.0	-	-	-	-1.3	0.0	-
150-700fm	mi^2	608	47	-	561	-	214	5	45	37	55	794	885	636
	Δ%	6.5	5.5	-	6.8	-	38.7	5.5	11.7	6.0	13.4	28.9	20.6	21.7
>700fm	mi^2	3	-	-	3	-	2	-	-	-	1	-	-	-
	Δ%	**	**	**	**	**	**	**	**	**	**	**	**	**
Grand Total	mi^2	759	98	51	610	-	217	9	100	104	75	864	934	745
	Δ%	5.2	7.4	14.7	4.8	-	27.9	0.9	10.3	6.9	8.0	17.4	13.1	13.1

Table A-7. Alternative 1.a, the Collaborative Alternative, net habitat metrics (closed minus reopen) by geographic break. "Δ%" = percent change within latitudinal zone from No Action Alternative. "-"= true zero. 0 mi2 = <1mi2; 0.0% = <0.1%. Values in parentheses are negative.

Latitudinal Zone	Depth Zone	METRICS					Priority Habitats							
			Substrate Type (mi^2)						Habitat-Forming Invertebrates					
									Presence (1 km grid cells)			Bycatch (0.5 km grid cells)		
		Spatial extent (mi2)	Hard	Mixed	Soft	Unkn	Canyon (mi^2)	OFS (mi^2)	DSC	Sponge	Sea Pen	DSC	Sponge	Sea Pen
Cape Flattery to Pt Chehalis	0fm-30fm	-	-	-	-	-	-	-	-	-	-	-	-	-
	30fm-100fm	0	-	-	0	-	-	0	-	-	-	-	-	-
	100fm-150fm	-	-	-	-	-	-	-	-	-	-	-	-	-
	150fm-700fm	126	-	-	126	-	96	-	2	3	2	91	195	60
	Total	126	-	-	126	-	96	0	2	3	2	91	195	60
	Δ%	8.4	-	-	9.4	-	44.2	0.0	2.5	1.4	2.4	6.9	21.9	8.1
Pt Chehalis to Cape Blanco	0fm-30fm	3	1	1	1	-	-	-	1	1	-	-	-	-
	30fm-100fm	80	10	49	20	-	-	3	6	6	1	94	-	73
	100fm-150fm	(3)	(0)	-	(2)	-	-	-	-	-	-	(26)	-	-
	150fm-700fm	93	-	-	93	-	67	(1)	(1)	(3)	-	186	(7)	118
	Total	174	11	50	112	-	67	3	6	4	1	254	(7)	191
	Δ%	9.7	5.3	51.1	7.5	**	123.0	0.4	10.5	2.1	1.1	9.0	(0.1)	4.0
Cape Blanco to Cape Mendocino	0fm-30fm	1	0	-	0	-	-	-	-	-	-	-	-	-
	30fm-100fm	63	11	-	52	-	(1)	(0)	-	5	4	8	21	-
	100fm-150fm	0	-	-	0	-	0	0	-	-	-	-	1	-
	150fm-700fm	142	1	-	141	-	23	0	22	18	18	519	627	446
	>700fm	3	-	-	3	-	2	-	-	-	1	-	-	-
	Total	209	12	-	197	-	24	0	22	23	23	527	649	446

Latitudinal Zone	Depth Zone	METRICS												
							Priority Habitats							
									Habitat-Forming Invertebrates					
			Substrate Type (mi^2)						**Presence (1 km grid cells)**			**Bycatch (0.5 km grid cells)**		
Latitudinal Zone	**Depth Zone**	**Spatial extent (mi2)**	**Hard**	**Mixed**	**Soft**	**Unkn**	**Canyon (mi^2)**	**OFS (mi^2)**	**DSC**	**Sponge**	**Sea Pen**	**DSC**	**Sponge**	**Sea Pen**
	Δ%	59.7	664.7	**	56.6	**	20.8	0.1	129.4	104.5	191.7	96.2	106.2	***2,347.4***
Cape Mendocino to Pt Conception	0fm-30fm	3.1	1	-	2	-	-	-	-	-	-	-	-	5
	30fm-100fm	0	27	0	*(27)*	-	1	-	48	55	14	(6)	27	31
	100fm-150fm	-	-	-	-	-	-	-	-	-	-	-	-	-
	150fm-700fm	247	47	-	200	-	29	6	22	19	35	(2)	70	12
	>700fm	(10)	(0)	-	(10)	-	(7)	-	-	-	-	-	-	-
	Total	240	75	0	165	-	23	6	70	74	49	(8)	97	48
	Δ%	7.2	12.3	4.2	6.2	-	8.4	133.8	22.6	21.4	10.4	(2.7)	29.5	25.3
Pt Conception to US/Mexico Border	0fm-30fm	-	-	-	-	-	-	-	-	-	-	-	-	-
	30fm-100fm	-	-	-	-	-	-	-	-	-	-	-	-	-
	100fm-150fm	-	-	-	-	-	-	-	-	-	-	-	-	-
	150fm-700fm	-	-	-	-	-	-	-	-	-	-	-	-	-
	Total	-	-	-	-	-	-	-	-	-	-	-	-	-
	Δ%	-	-	-	-	-	-	-	-	-	-	-	-	-
Grand Total		749	97	51	600	-	209	9	100	104	75	864	934	745
Δ%, coastwide		5.2	7.4	14.7	4.7	-	27.0	0.9	10.3	6.9	8.0	17.4	13.1	13.1

Table A-8. Alternative 1.a, the Collaborative Alternative, habitat metrics for polygons. Color codes indicate extent of priority habitat in each polygon (see Section 1). "Unkn" = Unknown. "-" = true zero. 0 = <1 mi2.

						Priority Habitats							
		Sediment (mi2)						Habitat-Forming Invertebrates					
								Presence (1 km grid cells)			Bycatch (0.5 km grid cells)		
Polygon Name	Spatial Extent (mi^2)	Hard	Mixed	Soft	Unkn	Canyons (mi2)	OFS (mi2)	DSC	Sponge	Sea Pen	DSC	Sponge	Sea Pen
Proposed Closures													
Arago Reef	67	11	50	6	-	-	-	5	6	-	-	-	-
Ascension Canyonhead	6	0	-	6	-	4	-	5	5	5	-	1	1
Astoria Deep	39	-	-	39	-	14	-	-	-	-	7	12	7
Big Sur Coast Modification	45	28	-	17	-	-	-	-	-	3	-	18	-
Biogenic 2 Northern Modification	44	-	-	44	-	23	-	-	1	-	83	91	60
Blunts Reef Modification	9	3	-	6	-	2	-	1	1	-	-	-	-
Brush Patch	46	-	-	46	-	0	-	11	11	4	471	472	350
Cordell Bank Modification 1	4	0	0	3	-	-	-	2	-	-	-	-	-
Cordell Bank Modification 2	4	1	-	3	-	-	-	7	-	5	-	-	-
Eel River Canyon Modification 2	2	-	-	2	-	2	0	2	1	2	-	19	-
Eel River Canyon Modification 4	11	-	-	11	-	7	-	1	-	1	-	-	-
Farallon Escarpment	126	-	-	126	-	10	-	2	2	-	-	-	-
Farallon Islands Modification	6	3	-	3	-	-	-	3	5	2	-	-	-
Gobbler's Knob	2	-	2	0	-	-	-	-	-	-	-	-	-
Grays Canyon Southern Modification	13	0	-	12	-	-	7	2	3	1	106	11	38
Mad River Rough Patch	5	1	-	4	-	1	0	5	3	3	-	2	-

Polygon Name	Spatial Extent (mi^2)	Sediment (mi2)				Priority Habitats							
						Canyons (mi2)	OFS (mi2)	Habitat-Forming Invertebrates					
								Presence (1 km grid cells)			Bycatch (0.5 km grid cells)		
		Hard	Mixed	Soft	Unkn			DSC	Sponge	Sea Pen	DSC	Sponge	Sea Pen
MBNMS Ascension and Ano Nuevo Canyon Complex	20	5	-	14	-	14	-	6	5	6	-	44	-
MBNMS Between Partington Point and Lopez Point	74	-	-	74	-	20	-	2	2	11	-	-	-
MBNMS La Cruz Canyon	9	7	-	2	-	-	-	1	2	-	-	-	-
MBNMS Outer Soquel Canyon	6	2	-	4	-	1	-	16	19	17	-	-	-
MBNMS Point Sur Platform	11	8	-	3	-	-	-	9	10	4	-	25	2
MBNMS South of Davenport	6	3	-	3	-	-	-	16	20	14	-	-	-
MBNMS Southwest of Smooth Ridge	6	-	-	6	-	-	-	1	-	4	-	-	-
MBNMS Triangle South of Surveyors Knoll	9	1	-	9	-	-	-	1	-	3	-	-	-
MBNMS West of Piedras Blancas SMCA	3	0	-	3	-	-	-	-	-	1	-	-	-
MBNMS West of Sobranes Point	24	-	-	24	-	5	-	-	-	1	-	21	2
Mendocino Ridge Modification 1	12	12	-	0	-	-	6	-	-	-	-	15	-
Mendocino Ridge Modification 3	10	0	-	10	-	-	-	1	1	1	-	24	-
Navarro Canyon	18	-	-	18	-	-	-	-	-	2	-	-	-
Nitinat Canyon	82	-	-	82	-	73	-	2	2	2	8	104	-
Pescadero Reef	3	1	-	2	-	-	-	-	-	-	-	-	5

Polygon Name	Spatial Extent (mi^2)	Sediment (mi2)				Priority Habitats							
								Habitat-Forming Invertebrates					
								Presence (1 km grid cells)			Bycatch (0.5 km grid cells)		
		Hard	Mixed	Soft	Unkn	Canyons (mi2)	OFS (mi2)	DSC	Sponge	Sea Pen	DSC	Sponge	Sea Pen
Pigeon Point Reef	10	1	-	8	-	-	-	-	-	-	-	-	-
Point Arena South Modification 2	6	-	-	6	-	-	-	1	-	1	-	-	-
Point Arena South Modification 3	6	0	-	6	-	-	-	-	1	-	-	-	-
Point Reyes Reef	8	3	0	5	-	-	-	-	-	-	-	-	-
Rittenburg Bank	10	1	-	9	-	-	-	5	6	6	-	-	-
Rogue River Reef	63	10	-	53	-	-	0	-	5	5	8	41	-
Saint George Reef	1	0	-	1	-	-	-	-	-	-	-	-	-
Spanish Canyon Line Adjustment 2	5	-	-	5	-	-	-	-	-	-	-	-	-
The Football	2	-	-	2	-	-	-	3	5	1	13	-	-
Trinidad Canyon	88	-	-	88	-	20	-	3	3	8	48	141	96
Willapa Deep	63	-	-	63	-	59	-	-	-	-	179	-	89
Willapa Shelf	8	0	-	8	-	-	-	-	-	1	25	-	57
Proposed Reopenings													
Bandon High Spot Northern Modification	12	1	-	10	-	-	3	3	3	2	37	8	-
Bandon High Spot Southern Modification	9	3	-	7	-	-	2	1	1	2	38	-	-
Cordell Bank Modification 3	20	-	-	20	-	-	-	-	-	23	-	-	29
Delgada Canyon	8	0	-	8	-	5	-	-	-	-	14	-	-
Eel River Canyon Modification 1	2	-	-	2	-	2	0	-	-	1	-	26	-

Polygon Name	Spatial Extent (mi^2)	Sediment (mi2)				Priority Habitats							
								Habitat-Forming Invertebrates					
								Presence (1 km grid cells)			Bycatch (0.5 km grid cells)		
		Hard	Mixed	Soft	Unkn	Canyons (mi2)	OFS (mi2)	DSC	Sponge	Sea Pen	DSC	Sponge	Sea Pen
Eel River Canyon Modification 3	4	-	-	4	-	4	-	-	-	-	-	-	-
Grays Canyon Western Modification	9	-	-	9	-	6	1	1	3	-	-	19	23
MBNMS East of Sur Ridge	27	-	-	27	-	1	-	1	-	4	-	1	-
MBNMS Lower Portion of Cabrillo Canyon	17	0	-	17	-	14	-	1	-	1	-	-	3
MBNMS South of Mars Cable	1	-	-	1	-	0	-	1	-	1	-	-	-
MBNMS Sur Canyon Slot Canyons	45	0	-	44	-	9	-	-	-	2	-	-	-
MBNMS West of Carmel Canyon	9	-	-	9	-	-	-	1	1	1	-	-	6
Mendocino Ridge Modification 2	3	0	-	3	-	-	-	2	2	1	-	28	1
Point Arena South Modification 1	74	-	-	74	-	-	-	-	3	4	-	-	-
Point Arena South Modification 4	1	-	-	1	-	-	-	-	1	-	-	-	-
Spanish Canyon Line Adjustment 1	5	-	-	5	-	4	-	-	-	-	-	-	-

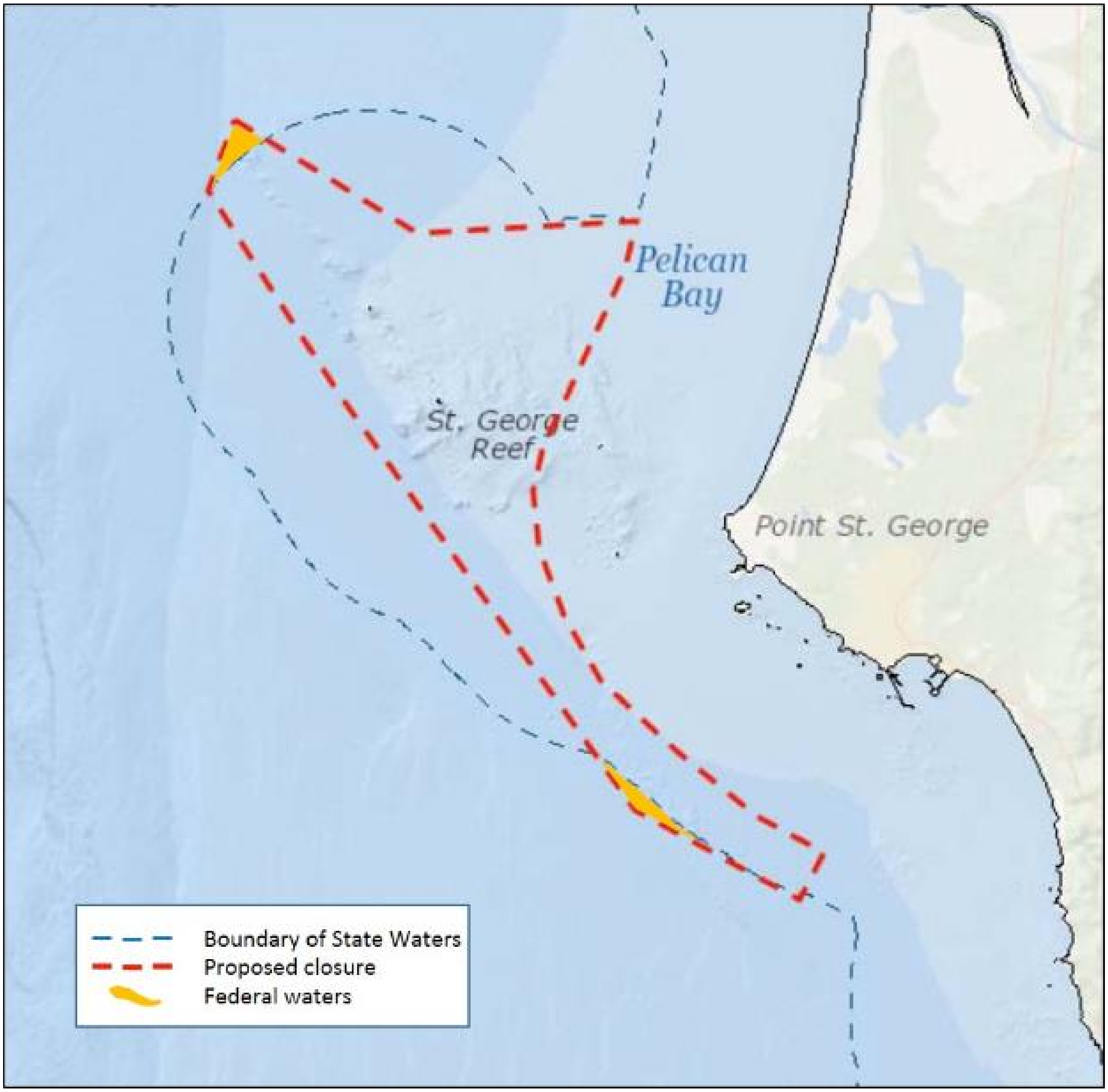

Figure A-1. The Saint George Reef in Alternative 1.a, the Collaborative Alternative, showing small polygons remaining when portions in state waters are eliminated.

A.1 Alternative 1.b, the Oceana, et al. Alternative

A.1.1 Geographic Break Analysis

Table A-9 and Table A-10 show the habitat metrics summarized by latitudinal zone and depth zone. Table A-11 shows the habitat metrics for each geographic break.

A.1.2 Polygon analysis

The habitat metrics for each polygon in Alternative 1.b, the Oceana, et al. Alternative are found in Table A-12. They are not discussed in in detail, but are provided here as additional information.

This alternative would contain 61 proposed closures and 7 proposed reopenings. The closures would range in size from 2 mi^2 (MBNMS south of Mars Cable) to 16,184 mi^2 (Southern California Bight). Of the other closures, 12 would be less than 10 mi2, 26 would be between 10 mi^2 and 50 mi^2, 11 would be between 50 mi^2 and 100 mi^2, and 1, Farallon Escarpment, would be more than 100 mi^2.

The seven reopenings would range from 1 mi^2 (MBNMS south of Mars Cable) to 45 mi^2 (MBNMS Sur Canyon Slot canyons).

Table A-9. Alternative 1.b, the Oceana, et al. Alternative, net habitat metrics (closures minus reopenings), summarized by latitudinal zone. Values in underlined italics are lowest for that metric, and values in bold italics are highest for that metric, among the latitudinal zones. "Δ%" = percent change within latitudinal zone from No Action Alternative. "-"= true zero. 0 mi2 = <1 mi2; 0.0% = <0.1%. ** = 0 in No-action Alternative. Values in parentheses are negative.

		METRICS													
							Priority Habitats								
									Habitat-Forming Invertebrates						
			Substrate Type (mi^2)						**Presence (1km grid cells)**			**Bycatch (0.5km grid cells)**			
Latitudinal Zone		**Spatial extent (mi2)**	**Hard**	**Mixed**	**Soft**	**Unkn**	**Canyon (mi^2)**	**OFS (mi^2)**	**DSC**	**Sponge**	**Sea Pen**	**DSC**	**Sponge**	**Sea Pen**	
Cape Flattery to Pt Chehalis	mi^2	143	-	-	143	-	105	0	3	7	2	172	228	75	
	Δ%	9.5	-	-	10.6	-	48.4	0.0	3.8	3.2	2.4	13.1	25.6	10.2	
Pt Chehalis to Cape Blanco	mi^2	1336	233	143	960	-	178	34	45	128	79	3455	2766	2443	
	Δ%	74.4	113.1	144.7	64.4	-	328.0	4.7	78.9	67.4	87.8	122.6	52.1	51.4	
Cape Blanco to Cape Mendocino	mi^2	519	19	-	499	0	94	17	39	38	47	1615	1503	727	
	Δ%	148.1	1101.9	**	143.4	-	81.9	9.9	229.4	172.7	391.7	294.7	246.0	3826.3	
Cape Mendocino to Pt Conception	mi^2	881	150	7	724	-	114	10	106	142	153	141	431	405	
	Δ%	26.6	24.8	68.0	27.2	-	42.1	234.2	34.2	41.2	32.6	47.6	131.0	213.2	
Pt Conception to US/Mexico Border	mi^2	11,360	540	-	10,776	44	269	-	181	652	199	-	-	-	
	Δ%	150.9	113.1	-	155.6	385.2	226.3	-	35.9	89.4	71.1	-	-	-	
Grand Total	mi^2	14,238	943	149	13,102	44	760	61	374	967	480	5383	4928	3650	
	Δ%	98.3	71.7	43.2	102.6	80.4	98.0	6.4	38.7	64.3	51.2	108.2	69.0	64.1	

Table A-10. Alternative 1.b, the Oceana, et al. Alternative, net habitat metrics (closures minus reopenings), summarized by depth zone. Values in underlined italics are lowest for that metric and values in bold italics are highest for that metric, among the latitudinal zones. "Δ%" = percent change within depth zone from No Action Alternative. "-"= true zero. 0 mi2 = <1mi2; 0.0% = <0.1%. ** = 0 in No-action Alternative. Values in parentheses are negative.

		METRICS												
							Priority Habitats							
									Habitat-Forming Invertebrates					
		Spatial extent (mi2)	Substrate Type (mi^2)						Presence (1km grid cells)			Bycatch (0.5km grid cells)		
Depth Zone			**Hard**	**Mixed**	**Soft**	**Unkn**	**Canyon (mi^2)**	**OFS (mi^2)**	**DSC**	**Sponge**	**Sea Pen**	**DSC**	**Sponge**	**Sea Pen**
0-30 fm	mi^2	3	1	1	1	-	-	-	1	1	-	-	-	-
	Δ%	0.7	3.3	9.0	0.3	-	**	**	2.9	4.8	-	**	**	**
30-100fm	mi^2	975	269	125	582	0	10	40	82	152	110	369	550	392
	Δ%	51.2	80.3	111.9	40.0	0.9	84.2	71.8	41.4	47.8	55.0	205.0	88.7	117.7
100-150fm	mi^2	1	0	0	1	0	0	0	1	1	1	1	1	-
	Δ%	0.0	0.1	0.0	0.0	26.3	0.1	0.0	0.3	0.2	0.3	0.0	0.0	-
150-700fm	mi^2	13,264	673	23	12,524	43	752	21	290	813	369	5013	4377	3258
	Δ%	142.3	78.2	18.0	151.1	105.7	135.9	20.9	75.5	131.1	90.2	182.8	101.8	111.2
>700fm	mi^2	-5	-0	-	-5	-	-3	-	-	-	-	-	-	-
	Δ%	**	**	**	**	**	**	**	**	**	**	**	**	**
Grand Total	mi^2	14,238	943	149	13,102	44	760	61	374	967	480	5383	4928	3650
	Δ%	98.3	71.7	43.2	102.6	80.4	98.0	6.4	38.7	64.3	51.2	108.2	69.0	64.1

Table A-11. Alternative 1.b, the Oceana, et al. Alternative, net habitat metrics (closed minus reopen) by geographic break. “Δ%” = percent change within latitudinal zone from No Action Alternative. “-“= true zero. 0 mi2 = <1mi2; 0.0% = <0.1%.. Values in parentheses are negative.

Latitudinal Zone	Depth Zone	METRICS												
							Priority Habitats							
									Habitat-Forming Invertebrates					
		Spatial extent (mi2)	Substrate Type (mi^2)				Canyon (mi^2)	OFS (mi^2)	Presence (1km grid cells)			Bycatch (0.5km grid cells)		
			Hard	Mixed	Soft	Unkn			DSC	Sponge	Sea Pen	DSC	Sponge	Sea Pen
Cape Flattery to Pt Chehalis	0fm-30fm	-	-	-	-	-	-	-	-	-	-	-	-	-
	30fm-100fm	0	-	-	0	-	-	0	-	-	-	-	-	-
	100fm-150fm	-	-	-	-	-	-	-	-	-	-	-	-	-
	150fm-700fm	143	-	-	143	-	105	-	3	7	2	172	228	75
	Total	143	-	-	143	-	105	0	3	7	2	172	228	75
	Δ%	9.5	-	-	10.6	-	48.4	0.0	3.8	3.2	2.4	13.1	25.6	10.2
Pt Chehalis to Cape Blanco	0fm-30fm	3	1	1	1	-	-	-	1	1	-	-	-	-
	30fm-100fm	659	225	124	310	-	0	25	20	61	23	352	477	359
	100fm-150fm	0	-	0	0	-	-	-	-	-	-	-	-	-
	150fm-700fm	673	8	18	648	-	178	9	24	66	56	3,103	2,289	2,084
	Total	1,336	233	143	960	-	178	34	45	128	79	3,455	2,766	2,443
	Δ%	74.4	113.1	144.7	64.4	**	328.0	4.7	78.9	67.4	87.8	122.6	52.1	51.4
Cape Blanco to Cape Mendocino	0fm-30fm	-	-	-	-	-	0	-	-	-	-	-	-	-
	30fm-100fm	46	10	-	35	-	6	15	1	3	2	23	46	-
	100fm-150fm	1	0	-	1	-	0	0	1	1	1	1	1	-
	150fm-700fm	472	9	-	464	0	88	2	37	34	44	1,591	1,456	727
	Total	519	19	-	499	0	94	17	39	38	47	1,615	1,503	727
	Δ%	148.1	1,101.9	**	143.4	**	81.9	9.9	229.4	172.7	391.7	294.7	246.0	3,826.3
	0fm-30fm	0	-	-	0	-	-	-	-	-	-	-	-	-

Latitudinal Zone	Depth Zone	METRICS												
							Priority Habitats							
									Habitat-Forming Invertebrates					
		Spatial extent (mi2)	Substrate Type (mi^2)				Canyon (mi^2)	OFS (mi^2)	Presence (1km grid cells)			Bycatch (0.5km grid cells)		
			Hard	Mixed	Soft	Unkn			DSC	Sponge	Sea Pen	DSC	Sponge	Sea Pen
Cape Mendocino to Pt Conception	30fm-100fm	254	30	1	223	-	2	-	53	74	73	(6)	27	33
	100fm-150fm	-	-	-	-	-	-	-	-	-	-	-	-	-
	150fm-700fm	632	121	6	506	-	114	10	53	68	80	147	404	372
	>700fm	(5)	(0)	-	(5)	-	(3)	-	-	-	-	-	-	-
	Total	881	150	7	724	-	114	10	106	142	153	141	431	405
	Δ%	26.6	24.8	68.0	27.2	-	42.1	234.2	34.2	41.2	32.6	47.6	131.0	213.2
Pt Conception to US/Mexico Border	0fm-30fm	16	3	-	13	0	2	-	8	14	12	-	-	-
	30fm-100fm	0	-	-	-	0	-	-	-	-	-	-	-	-
	100fm-150fm	11,343	536	-	10,763	43	266	-	173	638	187	-	-	-
	150fm-700fm	11,360	540	-	10,776	44	269	-	181	652	199	-	-	-
	Total	14,238	943	149	13,102	44	760	61	374	967	480	5,383	4,928	3,650
	Δ%	150.9	113.1	-	155.6	385.2	226.3	-	35.9	89.4	71.1	-	-	-
Grand Total		14,238	943	149	13,102	44	760	61	374	967	480	5,383	4,928	3,650
Δ%, coastwide		98.3	71.7	43.2	102.6	80.4	98.0	6.4	38.7	64.3	51.2	108.2	69.0	64.1

Table A12. Alternative 1.b, the Oceana, et al. Alternative, habitat metrics for polygons. Color codes indicate extent of priority habitat in each polygon (see Section 1). "-" = true zero. 0 = <1 mi2.

Polygon Name	Spatial Extent (mi²)	Sediment (mi²)				Priority Habitats							
								Habitat-Forming Invertebrates					
								Presence (1 km grid cells)			Bycatch (0.5 km grid cells)		
		Hard	Mixed	Soft	Unkn	Canyons (mi²)	OFS (mi²)	DSC	Sponge	Sea Pen	DSC	Sponge	Sea Pen
Proposed Closures													
Ano Nuevo Canyonhead	2	0	-	2	-	2	-	2	4	2	-	-	-
Ascension Canyonhead	4	0	-	4	-	3	-	6	5	6	-	-	-
Astoria Canyonhead	18	-	-	18	-	14	12	-	2	-	39	-	124
Astoria Footprint Modification	379	-	-	379	-	174	-	9	27	25	1,602	800	1,264
Blunt Reef Expansion	9	3	-	6	-	2	-	1	1	-	-	-	-
Cabrillo Canyon	31	1	-	30	-	14	-	1	2	-	9	-	-
Cape Arago Reef	127	11	90	26	-	-	0	6	9	3	-	5	1
Cascadia Shelf Hotspot	152	-	-	152	-	-	52	2	29	17	736	1,114	977
Cochrane Bank	9	4	-	6	-	-	-	3	5	3	-	-	-
Cordell Bank Expansion	71	6	0	65	-	-	-	9	-	14	-	-	31
Crescent City Deepwater Hotspot	52	-	-	52	-	9	-	6	6	4	514	530	263
Delgada Canyon Deep	69	-	-	69	-	39	-	2	1	6	-	-	6
East Santa Lucia Bank (Northwest Expansion)	114	48	-	66	-	-	-	3	11	13	-	54	144
East Santa Lucia Bank (Southeast Expansion)	57	17	-	41	-	-	-	-	-	4	28	67	95
Eureka Footprint Modification	157	-	-	157	-	42	-	5	8	14	515	404	252

Polygon Name	Spatial Extent (mi^2)	Sediment (mi^2)				Priority Habitats							
								Habitat-Forming Invertebrates					
								Presence (1 km grid cells)			Bycatch (0.5 km grid cells)		
		Hard	Mixed	Soft	Unkn	Canyons (mi^2)	OFS (mi^2)	DSC	Sponge	Sea Pen	DSC	Sponge	Sea Pen
Fanny Shoals Shelf Extension	27	1	0	26	-	-	-	-	-	2	-	-	-
Farallon Escarpment to Pioneer Canyon Deep	173	-	-	173	-	22	-	4	3	6	-	-	-
Gobbler's Knob	18	-	11	7	-	1	-	4	5	7	-	-	-
Grays Canyon	20	0	-	19	-	-	11	2	3	1	142	22	63
Heceta Bank	329	153	17	159	-	-	-	4	31	5	46	374	243
Heceta Bank West	68	10	22	36	-	0	9	2	8	1	209	401	135
Hydrate Ridge/ Central OR Footrpint Modification	197	7	-	190	-	-	-	9	8	13	832	531	-
La Cruz Canyon to Piedras Blancas	37	8	-	29	-	-	-	1	3	2	-	-	-
MBNMS Ascension and Ano Nuevo Canyon Complex / ONO Lower portion of Ascension and Ano Nuevo canyons	20	5	-	14	-	14	-	6	5	6	-	44	-
MBNMS Between Partington Point and Lopez Point	74	-	-	74	-	20	-	2	2	11	-	-	-
MBNMS Outer Soquel Canyon	6	2	-	4	-	1	-	16	19	17	-	-	-
MBNMS Point Sur Platform / ONO Sur Platform Rocks	11	8	-	3	-	-	-	9	10	4	-	25	2
MBNMS South of Davenport	6	3	-	3	-	-	-	16	20	14	-	-	-
MBNMS SW of Smooth Ridge	6	-	-	6	-	-	-	1	-	4	-	-	-

Polygon Name	Spatial Extent (mi^2)	Sediment (mi^2)				Priority Habitats							
								Habitat-Forming Invertebrates					
								Presence (1 km grid cells)			Bycatch (0.5 km grid cells)		
		Hard	Mixed	Soft	Unkn	Canyons (mi^2)	OFS (mi^2)	DSC	Sponge	Sea Pen	DSC	Sponge	Sea Pen
MBNMS Triangle S of Surveyors Knoll	9	1	-	9	-	-	-	1	-	3	-	-	-
MBNMS W of Sobranes Point	24	-	-	24	-	5	-	-	-	1	-	21	2
Mendocino Ridge Expansion	78	48	-	29	-	-	10	9	12	2	98	188	70
N. Daisy Bank	19	-	7	11	-	-	1	2	8	2	-	107	157
N. Eel River Canyon	23	-	-	23	-	10	1	5	4	2	-	187	-
N. Stonewall Bank	58	24	-	34	-	-	-	-	7	2	-	-	-
Navarro Canyon	25	-	-	25	-	-	-	3	2	2	-	-	-
Noyo Canyonhead	6	0	-	6	-	5	-	3	3	1	-	-	-
Olympic Footprint Modification	97	-	-	97	-	82	-	3	6	2	81	124	13
Pescadero Reef	7	1	-	6	-	-	-	-	-	-	-	-	-
Pioneer Canyon	13	-	-	13	-	11	-	1	1	3	-	31	46
Pioneer Canyonhead	14	-	-	14	-	-	-	-	-	2	-	-	-
Pt Arena Biogenic South Expansion	7	0	-	7	-	-	-	-	1	-	-	-	-
Pt. Arena Canyonheads	6	-	-	6	-	1	-	-	-	-	-	26	-
Pt. Arguello	90	-	-	90	-	0	-	2	13	17	-	-	-
Pt. Buchon	49	1	0	48	-	-	-	-	7	6	-	-	-
Quinault Canyon	45	-	-	45	-	23	-	-	1	-	91	104	62
Reading Rock Canyonheads	29	-	-	29	-	7	26	1	1	2	71	-	-
Rittenberg Bank	17	1	-	16	-	-	-	5	6	8	-	-	-

Polygon Name	Spatial Extent (mi²)	Sediment (mi²)				Priority Habitats							
								Habitat-Forming Invertebrates					
								Presence (1 km grid cells)			Bycatch (0.5 km grid cells)		
		Hard	Mixed	Soft	Unkn	Canyons (mi²)	OFS (mi²)	DSC	Sponge	Sea Pen	DSC	Sponge	Sea Pen
Rogue Canyonhead	26	10	-	16	-	5	0	-	2	-	-	58	-
Russian River	20	-	-	20	-	-	-	3	8	4	51	3	-
S. Eel River Canyon	18	-	-	18	-	9	6	-	3	-	-	13	6
S. Nehalem Reef	104	28	3	73	-	-	13	8	8	11	-	20	11
S. Oregon Footrpint Modification	129	-	-	129	0	17	-	7	4	11	515	220	77
Samoa Deepwater	101	7	-	94	-	5	-	8	7	10	47	119	129
Samoa Reef	16	2	-	14	-	2	6	7	5	3	-	6	-
Saunders Reef	33	-	-	33	-	-	-	-	-	3	-	-	-
Siletz Hotspot	59	0	18	41	-	-	8	6	14	13	398	610	443
South Delgada Canyonheads	14	-	-	14	-	5	-	-	-	1	-	-	-
Southern CA Bight	16,184	853	38	15,246	46	337	-	390	959	293	-	-	-
Spanish Canyon	28	0	-	28	-	3	-	2	3	2	43	103	-
Willapa Canyonhead	44	6	-	39	-	6	16	1	1	2	21	159	88
Proposed Reopenings													
Delgada Canyon Reopening	2	0	-	2	-	-	-	-	-	-	6	-	-
MBNMS E of Sur Ridge	27	-	-	27	-	1	-	1	-	4	-	1	-
MBNMS Lower Portion of Cabrillo Canyon	17	0	-	17	-	14	-	1	-	1	-	-	3
MBNMS S of Mars Cable	1	-	-	1	-	0	-	1	-	1	-	-	-
MBNMS Sur Canyon Slot Canyons	45	0	-	44	-	9	-	-	-	2	-	-	-

Polygon Name	Spatial Extent (mi^2)	Sediment (mi^2)				Priority Habitats							
								Habitat-Forming Invertebrates					
								Presence (1 km grid cells)			Bycatch (0.5 km grid cells)		
		Hard	Mixed	Soft	Unkn	Canyons (mi^2)	OFS (mi^2)	DSC	Sponge	Sea Pen	DSC	Sponge	Sea Pen
MBNMS W of Carmel Canyon	9	-	-	9	-	-	-	1	1	1	-	-	6
Pt. Arena Biogenic Reopening	42	-	-	42	-	-	-	-	1	4	-	-	-

A.2 Alternative 1.h, the Preferred Alternative

A.2.1. Geographic Break Analysis

Table A-13 and Table A-14 show the habitat metrics summarized by latitudinal zone and depth zone. Table A-15 shows the habitat metrics for each geographic break

A.2.2. Polygon analysis

The habitat metrics for each polygon in Alternative 1.hb, the Preferred Alternative are found in Table A-16. They are not discussed in detail, but are provided here as additional information.

This alternative would contain 53 proposed closures and 16 proposed reopenings. The closures would range in size from 1 mi2 (Shale Pile East Side) to 16,183 mi2 (Southern California Bight). Of the other closures, 22 would be less than 10 mi$_2$, 22 would be between 10 mi2 and 50 mi$_2$, 6 would be between 50 mi2 and 100 mi$_2$, and one, Potato Bank Correction, would be more than 100 mi$_2$.

Of the 16 reopenings, 11 would range in size from 1 mi^2 to 10 mi^2, four would be 10 to 50 mi^2 and one would be between 50 and 100 mi^2 (Point Arena South Modification).

Table A-13. Alternative 1.h, the Preferred Alternative, net habitat metrics (closures minus reopenings), summarized by latitudinal zone. Values in underlined italics are lowest for that metric, and values in bold italics are highest for that metric, among the latitudinal zones. "Δ%" = percent change within latitudinal zone from No Action Alternative. "-"= true zero. 0 mi2 = <1 mi2; 0.0% = <0.1%. ** = 0 in No-action Alternative. Values in parentheses are negative.

Latitudinal Zone		METRICS					Priority Habitats		Habitat-Forming Invertebrates					
		Spatial extent (mi2)	Substrate Type (mi^2)				Canyon (mi^2)	OFS (mi^2)	Presence (1km grid cells)			Bycatch (0.5km grid cells)		
			Hard	Mixed	Soft	Unkn			DSC	Sponge	Sea Pen	DSC	Sponge	Sea Pen
Cape Flattery to Pt Chehalis	mi^2	28	0	5	23	-	4	6	3	8	-	4	11	-
	Δ%	1.9	1.2	4.0	1.7	-	1.7	8.6	3.8	3.7	-	0.3	1.2	-
Pt Chehalis to Cape Blanco	mi^2	313	82	60	172	-	73	2	16	26	8	283	86	134
	Δ%	17.4	39.6	60.9	11.5	**	134.2	0.3	28.1	13.7	8.9	10.0	1.6	2.8
Cape Blanco to Cape Mendocino	mi^2	212	14	-	198	-	29	0	29	28	32	373	552	382
	Δ%	60.5	793.6	**	56.8	**	25.5	0.1	170.6	127.3	266.7	68.1	90.3	2010.5
Cape Mendocino to Pt Conception	mi^2	249	75	6	169	-	23	6	74	79	57	-7	97	-30
	Δ%	7.5	12.3	60.8	6.3	-	8.4	133.8	23.9	22.9	12.1	-2.4	29.5	-15.8
Pt Conception to US/Mexico Border	mi^2	11,438	540	-	10855	44	269	-	181	654	201	-	-	-
	Δ%	162.6	148.9	61.6	164.9	385.2	334.5	**	60.1	109.1	106.4	**	**	**
Grand Total	mi^2	12,240	710	71	11415	44	397	14	303	795	298	653	746	486
	Δ%	84.5	54.0	20.5	89.4	80.4	51.2	1.5	31.3	52.9	31.8	13.1	10.4	8.5

Table A-14. Alternative 1.h, the Preferred Alternative, net habitat metrics (closures minus reopenings), summarized by depth zone. Values in underlined italics are lowest for that metric and values in bold italics are highest for that metric, among the latitudinal zones. "Δ%" = percent change within depth zone from No Action Alternative. "-"= true zero. 0 mi2 = <1mi2; 0.0% = <0.1%. ** = 0 in No-action Alternative. Values in parentheses are negative.

Depth Zone		METRICS					Priority Habitats		Habitat-Forming Invertebrates					
		Spatial extent (mi2)	Substrate Type (mi^2)				Canyon (mi^2)	OFS (mi^2)	Presence (1km grid cells)			Bycatch (0.5km grid cells)		
			Hard	Mixed	Soft	Unkn			DSC	Sponge	Sea Pen	DSC	Sponge	Sea Pen
0-30 fm	mi^2	7	3	1	3	-	-	-	1	1	-	-	-	5
	Δ%	0.2	2.9	1.0	0.1	-	-	-	0.3	0.2	-	-	-	0.2
30-100fm	mi^2	279	122	64	92	0	3	8	72	104	36	75	95	11
	Δ%	3.0	14.2	49.5	1.1	0.1	0.5	7.7	18.8	16.8	8.8	2.7	2.2	0.4
100-150fm	mi^2	-2	-0	-	-2	0	0	0	-	-	-	-26	1	-
	Δ%	-0.0	-0.0	-	-0.0	0.5	0.0	0.0	-	-	-	-0.5	0.0	-
150-700fm	mi^2	11,964	586	5	11,329	43	399	6	230	690	261	604	650	470
	Δ%	422.8	650.6	5.8	428.3	4,239.7	190.5	0.8	65.7	126.8	81.6	29.5	29.2	19.3
>700fm	mi^2	-7	-0	-	-7	-	-5	-	-	-	1	-	-	-
	Δ%	**	**	**	**	**	**	**	**	**	**	**	**	**
Grand Total	mi^2	12,240	710	71	11,415	44	397	14	303	795	298	653	746	486
	Δ%	84.5	54.0	20.5	89.4	80.4	51.2	1.5	31.3	52.9	31.8	13.1	10.4	8.5

Table A-15. Alternative 1.h, the Preferred Alternative, net habitat metrics (closed minus reopen) by geographic break. "Δ%" = percent change within latitudinal zone from No Action Alternative. "-"= true zero. 0 mi2 = <1mi2; 0.0% = <0.1%. Values in parentheses are negative.

Latitudinal Zone	**Depth Zone**	**METRICS**												
							Priority Habitats							
									Habitat-Forming Invertebrates					
		Spatial extent (mi2)	**Substrate Type (mi^2)**				**Canyon (mi^2)**	**OFS (mi^2)**	**Presence (1km grid cells)**			**Bycatch (0.5km grid cells)**		
			Hard	**Mixed**	**Soft**	**Unkn**			**DSC**	**Sponge**	**Sea Pen**	**DSC**	**Sponge**	**Sea Pen**
Cape Flattery to Pt Chehalis	0fm-30fm	-	-	-	-	-	-	-	-	-	-	-	-	-
	30fm-100fm	7	0	5	2	-	0	6	3	7	-	4	11	-
	100fm-150fm	-	-	-	-	-	-	-	-	-	-	-	-	-
	150fm-700fm	21	-	-	21	-	3	0	-	1	-	-	-	-
	Total	28	0	5	23	-	4	6	3	8	-	4	11	-
	Δ%	1.9	1.2	4.0	1.7	-	1.7	8.6	3.8	3.7	-	0.3	1.2	-
Pt Chehalis to Cape Blanco	0fm-30fm	3	1	1	1	-	-	-	1	1	-	-	-	-
	30fm-100fm	191	81	59	51	-	-	2	13	23	6	69	36	38
	100fm-150fm	(3)	(0)	-	(2)	-	-	-	-	-	-	(26)	-	-
	150fm-700fm	122	0	-	121	-	73	-	2	2	2	240	50	96
	Total	313	82	60	172	-	73	2	16	26	8	283	86	134
	Δ%	17.4	39.6	60.9	11.5	-	134.2	0.3	28.1	13.7	8.9	9.9	1.6	2.8
Cape Blanco to Cape Mendocino	0fm-30fm	0	0	-	0	-	-	-	-	-	-	-	-	-
	30fm-100fm	62	10	-	51	-	(1)	(0)	-	5	4	8	21	-
	100fm-150fm	0	-	-	0	-	0	0	-	-	-	-	1	-
	150fm-700fm	146	3	-	143	-	28	0	29	23	27	365	530	382
	>700fm	3	-	-	3	-	2	-	-	-	1	-	-	-
	Total	212	14	-	198	-	29	0	29	28	32	373	552	382

Latitudinal Zone	Depth Zone	METRICS												
		Spatial extent (mi2)	Substrate Type (mi^2)				Priority Habitats							
							Canyon (mi^2)	OFS (mi^2)	Habitat-Forming Invertebrates					
									Presence (1km grid cells)			Bycatch (0.5km grid cells)		
			Hard	Mixed	Soft	Unkn			DSC	Sponge	Sea Pen	DSC	Sponge	Sea Pen
	Δ%	60.5	793.6	-	56.8	-	25.5	0.1	170.6	127.3	266.7	67.9	91.4	2,122.2
Cape Mendocino to Pt Conception	0fm-30fm	3	1	-	2	-	-	-	-	-	-	-	-	5
	30fm-100fm	3	27	0	(25)	-	1	-	48	55	14	(6)	27	(27)
	100fm-150fm	-	-	-	-	-	-	-	-	-	-	-	-	-
	150fm-700fm	254	47	5	202	-	29	6	26	24	43	(1)	70	(8)
	>700fm	(10)	(0)	-	(10)	-	(7)	-	-	-	-	-	-	-
	Total	249	75	6	169	-	23	6	74	79	57	(7)	97	(30)
	Δ%	7.5	12.3	60.8	6.3	-	8.4	133.8	23.9	22.9	12.1	(2.3)	27.3	(14.6)
Pt Conception to US/Mexico Border	0fm-30fm	-	-	-	-	-	-	-	-	-	-	-	-	-
	30fm-100fm	16	3	-	13	0	2	-	8	14	12	-	-	-
	100fm-150fm	0	-	-	-	0	-	-	-	-	-	-	-	-
	150fm-700fm	11,421	536	-	10,842	43	266	-	173	640	189	-	-	-
	Total	11,438	540	-	10,855	44	269	-	181	654	201	-	-	-
	Δ%	152.0	113.1	-	156.8	385.2	226.3	-	35.9	89.7	71.8	-	-	-
Grand Total		12,240	710	71	11,415	44	397	14	303	795	298	653	746	486
Δ%, coastwide		84.5	54.0	20.5	89.4	80.4	51.2	1.5	31.3	52.9	31.8	13.0	10.3	8.4

Table A-16. Alternative 1.h, the Preferred Alternative, habitat metrics for polygons. Color codes indicate extent of priority habitat in each polygon (see Section 1). "Unkn" = Unknown. "-" = true zero. 0 = <1 mi2.

Polygon Name	Spatial Extent (mi²)	Sediment (mi2)				Priority Habitats							
								Habitat-Forming Invertebrates					
								Presence (1 km grid cells)			Bycatch (0.5 km grid cells)		
		Hard	Mixed	Soft	Unkn	Canyons (mi2)	OFS (mi2)	DSC	Sponge	Sea Pen	DSC	Sponge	Sea Pen
Proposed Closures													
Arago Reef	67	11	50	6	-	-	-	5	6	-	-	-	-
Ascension Canyonhead	6	0	-	6	-	4	-	5	5	5	-	1	1
Astoria Deep	39	-	-	39	-	14	-	-	-	-	7	12	7
Big Sur Coast Modification	45	28	-	17	-	-	-	-	-	3	-	18	-
Blunts Reef Modification	9	3	-	6	-	2	-	1	1	-	-	-	-
Brush Patch	30	-	-	30	-	-	-	12	12	5	317	317	269
Cordell Bank Modification 1	4	0	0	3	-	-	-	2	-	-	-	-	-
Cordell Bank Modification 2	4	1	-	3	-	-	-	7	-	5	-	-	-
Eel River Canyon Modification 2	2	-	-	2	-	2	0	2	1	2	-	19	-
Eel River Canyon Modification 4	11	-	-	11	-	7	-	1	-	1	-	-	-
Farallon Escarpment	126	-	-	126	-	10	-	2	2	-	-	-	-
Farallon Islands Modification	6	3	-	3	-	-	-	3	5	2	-	-	-
Garibaldi Reef North	15	7	0	7	-	-	-	5	3	4	-	15	6

Polygon Name	Spatial Extent (mi^2)	Sediment (mi2)				Priority Habitats							
								Habitat-Forming Invertebrates					
								Presence (1 km grid cells)			Bycatch (0.5 km grid cells)		
		Hard	Mixed	Soft	Unkn	Canyons (mi2)	OFS (mi2)	DSC	Sponge	Sea Pen	DSC	Sponge	Sea Pen
Garibaldi Reef South	3	0	0	2	-	-	-	-	-	-	-	-	-
Gobbler's Knob	12	-	9	2	-	-	-	4	4	6	-	-	-
Grays Canyon Northern Modification	13	1	6	7	-	6	10	3	7	-	9	47	-
Grays Canyon Southern Modification	13	0	-	12	-	-	7	2	3	1	106	11	38
Heceta Bank Northeastern Modification	69	46	-	23	-	-	-	1	10	1	-	-	-
Heceta Bank Southern Modification	25	8	9	8	-	-	-	1	2	-	-	23	17
Hydrate Ridge	19	0	-	19	-	-	-	2	2	2	54	38	-
Mad River Rough Patch	5	1	-	4	-	1	0	5	3	3	-	2	-
MBNMS Ascension and Ano Nuevo Canyon Complex	20	5	-	14	-	14	-	6	5	6	-	44	-
MBNMS Between Partington Point and Lopez Point	74	-	-	74	-	20	-	2	2	11	-	-	-
MBNMS La Cruz Canyon	9	7	-	2	-	-	-	1	2	-	-	-	-
MBNMS Outer Soquel Canyon	6	2	-	4	-	1	-	16	19	17	-	-	-
MBNMS Point Sur Platform	11	8	-	3	-	-	-	9	10	4	-	25	2

Polygon Name	Spatial Extent (mi²)	Sediment (mi2)				Priority Habitats							
								Habitat-Forming Invertebrates					
								Presence (1 km grid cells)			Bycatch (0.5 km grid cells)		
		Hard	Mixed	Soft	Unkn	Canyons (mi2)	OFS (mi2)	DSC	Sponge	Sea Pen	DSC	Sponge	Sea Pen
MBNMS South of Davenport	6	3	-	3	-	-	-	16	20	14	-	-	-
MBNMS Southwest of Smooth Ridge	6	-	-	6	-	-	-	1	-	4	-	-	-
MBNMS Triangle South of Surveyors Knoll	9	1	-	9	-	-	-	1	-	3	-	-	-
MBNMS West of Piedras Blancas SMCA	3	0	-	3	-	-	-	-	-	1	-	-	-
MBNMS West of Sobranes Point	24	-	-	24	-	5	-	-	-	1	-	21	2
Mendocino Ridge Modification 1	12	12	-	0	-	-	6	-	-	-	-	15	-
Mendocino Ridge Modification 3	10	0	-	10	-	-	-	1	1	1	-	24	-
N. Daisy Bank	18	-	7	11	-	-	1	2	8	2	-	107	157
Navarro Canyon	18	-	-	18	-	-	-	-	-	2	-	-	-
Pescadero Reef	3	1	-	2	-	-	-	-	-	-	-	-	5
Pigeon Point Reef	10	1	-	8	-	-	-	-	-	-	-	-	-
Point Arena South Modification 2	6	-	-	6	-	-	-	1	-	1	-	-	-
Point Arena South Modification 3	6	0	-	6	-	-	-	-	1	-	-	-	-
Point Reyes Reef	8	3	0	5	-	-	-	-	-	-	-	-	-
Potato Bank Correction	111	1	9	101	-	-	-	10	25	2	-	-	-

Polygon Name	Spatial Extent (mi^2)	Sediment (mi2)				Priority Habitats							
								Habitat-Forming Invertebrates					
								Presence (1 km grid cells)			Bycatch (0.5 km grid cells)		
		Hard	Mixed	Soft	Unkn	Canyons (mi2)	OFS (mi2)	DSC	Sponge	Sea Pen	DSC	Sponge	Sea Pen
Quinault Canyon	21	-	-	21	-	3	-	-	1	-	-	-	-
Rittenburg Bank	13	1	-	12	-	-	-	5	6	6	-	-	-
Rogue River Reef	63	10	-	53	-	-	0	-	5	5	8	41	-
Samoa Deepwater	19	2	-	17	-	5	-	6	4	8	-	58	17
Shale Pile East Side	1	0	-	0	-	-	-	-	-	-	-	-	-
Southern CA Bight	16183	852	29	15,256	46	337	-	380	938	293	-	-	-
Spanish Canyon Line Adjustment 2	5	-	-	5	-	-	-	-	-	-	-	-	-
Stonewall Bank Northwestern Modification	21	9	-	12	-	-	-	-	3	1	-	-	-
The Football	12	-	-	12	-	-	-	3	7	4	48	3	-
Trinidad Canyon	88	-	-	88	-	20	-	3	3	8	48	141	96
Willapa Canyonhead	31	0	-	30	-	6	16	1	1	1	3	159	35
Willapa Deep	63	-	-	63	-	59	-	-	-	-	179	-	89
Proposed Reopenings													
Bandon High Spot Northern Modification	9	0	-	9	-	-	2	2	3	2	37	4	-
Bandon High Spot Southern Modification	8	2	-	6	-	-	1	1	1	2	38	-	-
Cordell Bank Modification 3	20	-	-	20	-	-	-	-	-	23	-	-	29
Delgada Canyon	8	0	-	8	-	5	-	-	-	-	14	-	-

Polygon Name	Spatial Extent (mi²)	Sediment (mi2)				Priority Habitats							
								Habitat-Forming Invertebrates					
								Presence (1 km grid cells)			Bycatch (0.5 km grid cells)		
		Hard	Mixed	Soft	Unkn	Canyons (mi2)	OFS (mi2)	DSC	Sponge	Sea Pen	DSC	Sponge	Sea Pen
Eel River Canyon Modification 1	2	-	-	2	-	2	0	-	-	1	-	26	-
Eel River Canyon Modification 3	4	-	-	4	-	4	-	-	-	-	-	-	-
MBNMS East of Sur Ridge	27	-	-	27	-	1	-	1	-	4	-	1	-
MBNMS Lower Portion of Cabrillo Canyon	17	0	-	17	-	14	-	1	-	1	-	-	3
MBNMS South of Mars Cable	1	-	-	1	-	0	-	1	-	1	-	-	-
MBNMS Sur Canyon Slot Canyons	45	0	-	44	-	9	-	-	-	2	-	-	-
MBNMS West of Carmel Canyon	9	-	-	9	-	-	-	1	1	1	-	-	6
Mendocino Ridge Modification 2	3	0	-	3	-	-	-	2	2	1	-	28	1
Point Arena South Modification 1	74	-	-	74	-	-	-	-	3	4	-	-	-
Point Arena South Modification 4	1	-	-	1	-	-	-	-	1	-	-	-	-
Shale Pile Northeast Side	5	0	-	5	-	-	1	-	1	-	-	2	1
Spanish Canyon Line Adjustment 1	5	-	-	5	-	4	-	-	-	-	-	-	-

Appendix B
Habitat Metrics – Habitat-forming Invertebrates

APPENDIX B

Metrics for Habitat-forming Invertebrate

The Project Team developed two metrics for habitat-forming invertebrates that summarized 1) presence and 2) bycatch of corals (Class Anthozoa), sponges (Phylum Porifera) and sea pens (Order Pennatulacea) off the United States Pacific coast.

Presence

The first metric summarizes presence of habitat-forming invertebrates off the United States Pacific coast. Presence data were aggregated within contiguous 1x1 kilometer (km) cells from a database of point records of coral, sponge, and sea pen occurrence compiled by the National Oceanic and Atmospheric Administration's (NOAA's) Deep-Sea Coral Research and Technology Program.[41] Those data originate from a variety of sources, including surveys conducted by public and private research institutions (Monterey Bay Aquarium Research Institute, Washington State University, Oregon State University), governmental agencies (NOAA Fisheries, NOAA National Marine Sanctuaries), museums (Smithsonian National Museum of Natural History, California Academy of Sciences, Santa Barbara Museum of Natural History), and non-governmental organizations (Oceana). Points represent geographic locations of either in situ observations, or the mid-point of underwater vehicle transects or fishing events (trawls) in which observations or catch were summarized. The lack of absence or consistent abundance data preclude the ability to determine, in a standardized way, the relative importance of individual areas to corals and sponges.

Given these data limitations, the following approach was used to generate a usable measure of the presence of habitat-forming invertebrates. First, a 1km x 1km grid was overlaid on the DSCRTP database records with a locational accuracy rating of better than 1km. Based on recommendations from the Scientific and Statistical Committee at the November 2016 Council meeting, trawl-based catch records from the Northwest Fisheries Science Center groundfish bottom trawl survey (2001 to 2015) were included in this updated product; however, similar records from the Alaska Fisheries Science Center bottom trawl surveys were excluded because those tows were nominally twice the duration as NWFSC survey tows (15 minutes), and coordinates represent vessel and not gear locations. Two related metrics were then calculated for each polygon: 1) the number of grid cells within, or overlapping with, each polygon that have at least one observation, and 2) the proportion of the total number of grid cells within, or overlapping with, the polygon that have an observation. Figure 1 shows an example of how these

[41] The DSCRTP database is available at: https://deepseacoraldata.noaa.gov/website/AGSViewers/DeepSeaCorals/mapSites.htm

metrics were calculated. In the example, 15 of the 60 cells overlapping with the polygon have observations, giving a cell count of 15 and a proportion of 0.25. For each alternative and geographic area, the cell counts were summed across all polygons.

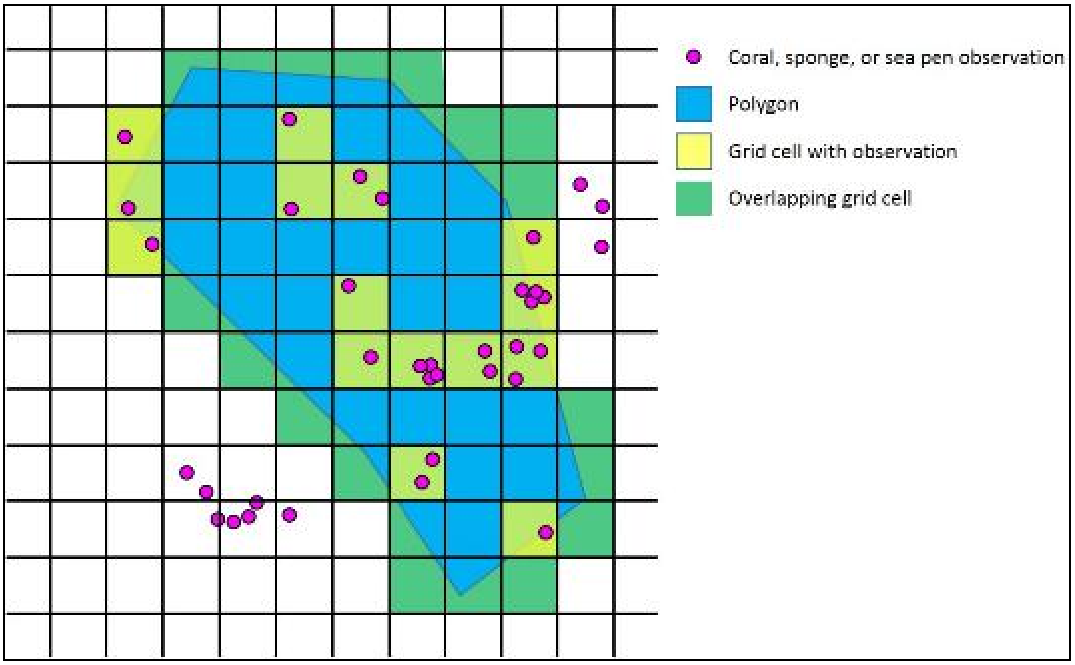

Figure 1. Calculation of habitat-forming invertebrate aggregated presence metric.

Bycatch

The second metric summarizes standardized bycatch of habitat-forming invertebrates recorded in the United States Pacific coast bottom trawl fishery. Bycatch data were recorded during commercial fishing trips using bottom trawls as part of the West Coast Groundfish Observer Program (WCGOP, January 1, 2002, to December 31, 2015). The WCGOP database includes records of trips for vessels using a variety of bottom trawl gear configurations, including small and large footrope groundfish trawl and set-back flatfish net. Since all fishing operations have not been observed consistently throughout the aforementioned time period, the data cannot be used to characterize bycatch completely.[42]

For bottom trawls, standardized catch is typically defined by catch (weight [kg]) per unit effort (distance fished [km]) (catch per unit of effort) for individual tows. In order to preserve the confidentiality of fishing locations, however, catch and effort data were aggregated over larger areas using two density tools in ArcGIS™ geographical information system software (Environmental System Research Institute, Incorporated, Redlands, California). A straight line connecting the set and up points was used to represent

[42] Annual WCGOP coverage of the limited entry and catch shares trawl sectors can be found online at https://www.nwfsc.noaa.gov/research/divisions/fram/observation/data_products/sector_products.cfm.

each tow event. The numerator for this bycatch metric is catch, calculated using a kernel density tool. The kernel density tool fits a smoothly curved surface around each line based on a user-specified population field (catch), radius (3 km) and cell size (500 m). The surface values are highest on the line, and they diminish with increasing distance away from the line, and they finally reach zero at a distance away from the line equal to the search radius. Kernel density values ($kg*km/km^2$) are calculated by adding the cell values for each individual kernel surface. The denominator describing effort was calculated using a line density tool, which sums the overlapping line segments within a specified search radius (3 km) and calculates the density of lines (km/km^2) for each raster cell of a specified size (500 m). In order to maintain the confidentiality of individual vessels, any cells with density values calculated from fewer than three vessels were removed from the final raster layer.

The resulting quotient of catch and effort was used to represent standardized bycatch for each taxonomic group. Two related metrics were then calculated for each polygon: 1) the mean and standard deviation of all overlapping bycatch values for each of the three taxonomic groups and 2) the number of raster cells exceeding the coastwide median bycatch of each of the three taxonomic groups. For each alternative and geographic area, the metrics were summed across all polygons.

The median bycatch of each taxa is 1) deep-sea coral 0.10 kg/km trawled; 2) sponges 0.6 kg/km trawled; and 3) sea pen 0.01 kg/km trawled.

Appendix C
Landings and Revenues by Alternative and by Polygon

Table C-1. Summary of Historical Landings and Ex-vessel Revenue in EFH Areas Proposed under The Collaborative Alternative 1a.

"-" denotes no landings data. "c" means data is confidential meaning less than 3 vessels fished in the area.

Summaries for reopenings use 1997-2001 data. Summaries for closures are a mix of 1997-2001 data for fish caught in RCAs and 2011-2014 data for catch from outside RCAs.

		Landings Weight (Roundweight pounds)				Exvessel Revenue (2015 $ Infl-Adjusted)			
Site name	Reg Action	Non-RCA	% of Coastwide	RCA	% of Coastwide	Non-RCA	% of Coastwide	RCA	% of Coastwide
Arago Reef	close	-	-	-	-	-	-	-	-
Ascension Canyonhead	close	c	-	c	-	c	-	c	-
Astoria Deep	close	c	-	-	-	c	-	-	-
Big Sur Coast Modification	close	c	-	-	-	c	-	-	-
Biogenic 2 Northern Modification	close	c	-	-	-	c	-	-	-
Blunts Reef Modification	close	-	-	c	-	-	-	c	-
Brush Patch	close	c	-	-	-	c	-	-	-
Cordell Bank Modification 1	close	-	-	52,885	0.0181%	-	-	30,389	0.0168%
Cordell Bank Modification 2	close	-	-	117,210	0.0400%	-	-	72,978	0.0402%
Eel River Canyon Modification 2	close	-	-	c	-	-	-	c	-
Eel River Canyon Modification 4	close	c	-	-	-	c	-	-	-
Farallon Escarpment	close	c	-	c	-	c	-	c	-
Farallon Islands Modification	close	c	-	-	-	c	-	-	-
Gobbler's Knob	close	-	-	34,283	0.0117%	-	-	19,009	0.0105%
Grays Canyon Southern Modification	close	29,572	0.0192%	c	-	17,839	0.0180%	c	-
Mad River Rough Patch	close	115,666	0.0752%	232,948	0.0795%	75,527	0.0764%	119,079	0.0657%
MBNMS Ascension and Ano Nuevo Canyon Complex	close	c	-	-	-	c	-	-	-
MBNMS Between Partington Point and Lopez Point	close	c	-	-	-	c	-	-	-
MBNMS La Cruz Canyon	close	-	-	11,441	0.0039%	-	-	6,371	0.0035%
MBNMS Outer Soquel Canyon	close	-	-	19,353	0.0066%	-	-	9,983	0.0055%
MBNMS Point Sur Platform	close	-	-	-	-	-	-	-	-
MBNMS South of Davenport	close	-	-	-	-	-	-	-	-
MBNMS Southwest of Smooth Ridge	close	-	-	-	-	-	-	-	-
MBNMS Triangle South of Surveyors Knoll	close	-	-	-	-	-	-	-	-
MBNMS West of Piedras Blancas SMCA	close	-	-	-	-	-	-	-	-
MBNMS West of Sobranes Point	close	-	-	-	-	-	-	-	-
Mendocino Ridge Modification 1	close	-	-	-	-	-	-	-	-
Mendocino Ridge Modification 3	close	-	-	157,983	0.0539%	-	-	91,528	0.0505%
Navarro Canyon	close	-	-	-	-	-	-	-	-
Nitinat Canyon	close	-	-	-	-	-	-	-	-
Pescadero Reef	close	-	-	-	-	-	-	-	-
Pigeon Point Reef	close	-	-	-	-	-	-	-	-
Point Arena South Modification 2	close	-	-	c	-	-	-	c	-
Point Arena South Modification 3	close	c	-	c	-	c	-	c	-
Point Reyes Reef	close	-	-	-	-	-	-	-	-
Rittenburg Bank	close	-	-	-	-	-	-	-	-
Rogue River Reef	close	-	-	-	-	-	-	-	-
Saint George Reef	close	-	-	-	-	-	-	-	-
Spanish Canyon Line Adjustment 2	close	-	-	-	-	-	-	-	-
The Football	close	-	-	126,604	0.0432%	-	-	63,766	0.0352%
Trinidad Canyon	close	c	-	-	-	c	-	-	-
Willapa Deep	close	c	-	-	-	c	-	-	-
WIllapa Shelf	close	c	-	-	-	c	-	-	-
Bandon High Spot Northern Modification	reopen	13,180	0.0045%	254,760	0.0870%	10,210	0.0056%	146,054	0.0805%
Bandon High Spot Southern Modification	reopen	30,612	0.0104%	51,680	0.0176%	28,852	0.0159%	33,418	0.0184%
Cordell Bank Modification 3	reopen	22,337	0.0076%	-	-	19,346	0.0107%	-	-
Delgada Canyon	reopen	84,580	0.0289%	43,626	0.0149%	55,058	0.0304%	24,843	0.0137%
Eel River Canyon Modification 1	reopen	9,585	0.0033%	-	-	6,243	0.0034%	-	-
Eel River Canyon Modification 3	reopen	27,947	0.0095%	-	-	17,541	0.0097%	-	-
Grays Canyon Western Modification	reopen	242,166	0.0827%	2,249	0.0008%	140,475	0.0775%	1,389	0.0008%
MBNMS East of Sur Ridge	reopen	32,845	0.0112%	-	-	18,073	0.0100%	-	-
MBNMS Lower Portion of Cabrillo Canyon	reopen	371,563	0.1268%	-	-	232,137	0.1280%	-	-
MBNMS South of Mars Cable	reopen	c	-	-	-	c	-	-	-
MBNMS Sur Canyon Slot Canyons	reopen	236,568	0.0808%	-	-	153,995	0.0849%	-	-
MBNMS West of Carmel Canyon	reopen	141,807	0.0484%	-	-	87,439	0.0482%	-	-
Mendocino Ridge Modification 2	reopen	c	-	c	-	c	-	c	-
Point Arena South Modification 1	reopen	170,792	0.0583%	187,326	0.0639%	94,337	0.0520%	105,222	0.0580%
Point Arena South Modification 4	reopen	c	-	-	-	c	-	-	-
Spanish Canyon Line Adjustment 1	reopen	c	-	-	-	c	-	-	-

Table C-2. Summary of Historical Landings and Ex-vessel Revenue in EFH Areas Proposed under The Oceana et al. Alternative 1b.

"-" denotes no landings data. "c" means data is confidential meaning less than 3 vessels fished in the area.

Summaries for reopenings use 1997-2001 data. Summaries for closures are a mix of 1997-2001 data for fish caught in RCAs and 2011-2014 data for catch from outside RCAs.

		Landings Weight (Roundweight pounds)				Exvessel Revenue (2015 $ Infl-Adjusted)			
Sitename	**Reg Action**	**Non-RCA**	**% of Coastwide**	**RCA**	**% of Coastwide**	**Non-RCA**	**% of Coastwide**	**RCA**	**% of Coastwide**
Ano Nuevo Canyonhead	close	-	-	30,260	0.0103%	-	-	14,989	0.0083%
Ascension Canyonhead	close	-	-	c	-	-	-	c	-
Astoria Canyonhead	close	207,885	0.1352%	97,715	0.0334%	209,802	0.2122%	58,762	0.0324%
Astoria Footprint Modification	close	110,109	0.0716%	-	-	67,169	0.0679%	-	-
Blunt Reef Expansion	close	-	-	13,614	0.0046%	-	-	9,682	0.0053%
Cabrillo Canyon	close	c	-	-	-	c	-	-	-
Cape Arago Reef	close	-	-	-	-	-	-	-	-
Cascadia Shelf Hotspot	close	33,102	0.0215%	916,603	0.3129%	33,656	0.0340%	601,012	0.3314%
Cochrane Bank	close	c	-	-	-	c	-	-	-
Cordell Bank Expansion	close	58,130	0.0378%	503,978	0.1720%	33,772	0.0342%	308,043	0.1699%
Crescent City Deepwater Hotspot	close	c	-	-	-	c	-	-	-
Delgada Canyon Deep	close	-	-	-	-	-	-	-	-
East Santa Lucia Bank (Northwest Expansion)	close	c	-	-	-	c	-	-	-
East Santa Lucia Bank (Southeast Expansion)	close	c	-	-	-	c	-	-	-
Eureka Footprint Modification	close	c	-	-	-	c	-	-	-
Fanny Shoals Shelf Extension	close	c	-	-	-	c	-	-	-
Farallon Escarpment to Pioneer Canyon Deep	close	c	-	c	-	c	-	c	-
Gobbler's Knob	close	-	-	84,098	0.0287%	-	-	45,987	0.0254%
Grays Canyon	close	29,572	0.0192%	20,207	0.0069%	17,839	0.0180%	12,302	0.0068%
Heceta Bank	close	19,880	0.0129%	572,205	0.1953%	12,990	0.0131%	363,639	0.2005%
Heceta Bank West	close	46,195	0.0300%	677,395	0.2312%	26,560	0.0269%	446,292	0.2461%
Hydrate Ridge/ Central OR Footrpint Modification	close	c	-	-	-	c	-	-	-
La Cruz Canyon to Piedras Blancas	close	-	-	74,970	0.0256%	-	-	41,350	0.0228%
MBNMS Ascension and Ano Nuevo Canyon Complex / ONO Lower portion of Ascension and Ano Nuevo canyons	close	c	-	-	-	c	-	-	-
MBNMS Between Partington Point and Lopez Point	close	c	-	-	-	c	-	-	-
MBNMS Outer Soquel Canyon	close	-	-	19,353	0.0066%	-	-	9,983	0.0055%
MBNMS Point Sur Platform / ONO Sur Platform Rocks	close	-	-	-	-	-	-	-	-
MBNMS South of Davenport	close	-	-	-	-	-	-	-	-
MBNMS SW of Smooth Ridge	close	-	-	-	-	-	-	-	-
MBNMS Triangle S of Surveyors Knoll	close	-	-	-	-	-	-	-	-
MBNMS W of Sobranes Point	close	-	-	-	-	-	-	-	-
Mendocino Ridge Expansion	close	522,929	0.3400%	-	0.0000%	498,395	0.5041%	-	0.0000%
N. Daisy Bank	close	-	-	49,546	0.0169%	-	-	36,725	0.0203%
N. Eel River Canyon	close	904,207	0.5879%	c	-	631,336	0.6386%	c	-
N. Stonewall Bank	close	-	-	-	-	-	-	-	-
Navarro Canyon	close	c	-	-	-	c	-	-	-
Noyo Canyonhead	close	c	-	51,403	0.0175%	c	-	24,924	0.0137%
Olympic Footprint Modification	close	c	-	-	-	c	-	-	-
Pescadero Reef	close	-	-	-	-	-	-	-	-
Pioneer Canyon	close	c	-	-	-	c	-	-	-
Pioneer Canyonhead	close	c	-	-	-	c	-	-	-
Pt Arena Biogenic South Expansion	close	c	-	4,200	0.0014%	c	-	2,629	0.0014%
Pt. Arena Canyonheads	close	-	-	308,543	0.1053%	-	-	171,624	0.0946%
Pt. Arguello	close	-	-	194,991	0.0666%	-	-	164,375	0.0906%
Pt. Buchon	close	-	-	c	-	-	-	c	-
Quinault Canyon	close	c	-	-	-	c	-	-	-
Reading Rock Canyonheads	close	c	-	591,300	0.2018%	c	-	275,835	0.1521%
Rittenberg Bank	close	-	-	-	-	-	-	-	0.0000%
Rogue Canyonhead	close	-	-	222,606	0.0760%	-	-	157,058	0.0866%
Russian River	close	c	-	1,296,862	0.4427%	c	-	675,101	0.3723%
S. Eel River Canyon	close	c	-	303,860	0.1037%	c	-	173,097	0.0955%
S. Nehalem Reef	close	-	-	c	-	-	-	c	-
S. Oregon Footrpint Modifcation	close	-	-	-	-	-	-	-	-
Samoa Deepwater	close	1,277,007	0.8303%	-	-	971,334	0.9825%	-	-
Samoa Reef	close	380,957	0.2477%	549,673	0.1876%	231,458	0.2341%	259,344	0.1430%
Saunders Reef	close	-	-	-	-	-	-	-	-
Siletz Hotspot	close	109,342	0.0711%	-	-	118,236	0.1196%	-	-
South Delgada Canyonheads	close	108,123	0.0703%	439,671	0.1501%	80,602	0.0815%	254,231	0.1402%
Southern CA Bight	close	-	-	c	-	-	-	c	-
Spanish Canyon	close	15,512	0.0101%	291,192	0.0994%	9,570	0.0097%	182,312	0.1005%
Willapa Canyonhead	close	-	-	628,328	0.2145%	-	-	338,446	0.1866%
Delgada Canyon Reopening	reopen	16,199	0.0055%	-	-	10,171	0.0056%	-	-
MBNMS E of Sur Ridge	reopen	32,845	0.0112%	-	-	18,073	0.0100%	-	-
MBNMS Lower Portion of Cabrillo Canyon	reopen	371,563	0.1268%	-	-	232,137	0.1280%	-	-
MBNMS S of Mars Cable	reopen	c	-	-	-	c	-	-	-
MBNMS Sur Canyon Slot Canyons	reopen	236,568	0.0808%	-	-	153,995	0.0849%	-	-
MBNMS W of Carmel Canyon	reopen	141,807	0.0484%	-	-	87,439	0.0482%	-	-
Pt. Arena Biogenic Reopening	reopen	48,799	0.0167%	-	-	28,475	0.0157%	-	-

Table C-3. Summary of Historical Landings and Ex-vessel Revenue in EFH Areas Proposed unde Alternative 1.h, Preferred Alternative.

"-" denotes no landings data. "c" means data is confidential meaning less than 3 vessels fished in the area.

Summaries for reopenings use 1997-2001 data. Summaries for closures are a mix of 1997-2001 data for fish caught in RCAs and 2011-2014 data for catch from outside RCAs.

		Landings Weight (Roundweight pounds)				Ex-vessel Revenue ($2015 infl adj)			
Sitename	**Reg Action**	**Non-RCA**	**% of Coastwide**	**RCA**	**% of Coastwide**	**Non-RCA**	**% of Coastwide**	**RCA**	**% of Coastwide**
Arago Reef	close	-	-	-	-	-	-	-	-
Ascension Canyonhead	close	c	-	c	-	c	-	c	-
Astoria Deep	close	c	-	-	-	c	-	-	-
Big Sur Coast Modification	close	c	-	-	-	c	-	-	-
Blunts Reef Modification	close	-	-	c	-	-	-	c	-
Brush Patch	close	-	-	-	-	-	-	-	-
Cordell Bank Modification 1	close	-	-	52,885	0.0181%	-	-	30,585	0.0169%
Cordell Bank Modification 2	close	-	-	117,210	0.0400%	-	-	73,455	0.0405%
Eel River Canyon Modification 2	close	-	-	c	-	-	-	c	-
Eel River Canyon Modification 4	close	c	-	-	-	c	-	-	-
Farallon Escarpment	close	c	-	c	-	c	-	c	-
Farallon Islands Modification	close	c	-	-	-	c	-	-	-
Garibaldi Reef North	close	-	-	-	-	-	-	-	-
Garibaldi Reef South	close	-	-	-	-	-	-	-	-
Gobbler's Knob	close	-	-	66,847	0.0228%	-	-	37,108	0.0205%
Grays Canyon Northern Modification	close	-	-	406,469	0.1387%	-	-	229,195	0.1264%
Grays Canyon Southern Modification	close	29,574	0.0192%	c	-	17,957	0.0182%	c	-
Heceta Bank Northeastern Modification	close	-	-	-	-	-	-	-	-
Heceta Bank Southern Modification	close	c	-	-	-	c	-	-	-
Hydrate Ridge	close	-	-	-	-	-	-	-	-
Mad River Rough Patch	close	115,666	0.0752%	232,948	0.0795%	75,964	0.0768%	119,835	0.0661%
MBNMS Ascension and Ano Nuevo Canyon Complex	close	c	-	-	-	c	-	-	-
MBNMS Between Partington Point and Lopez Point	close	c	-	-	-	c	-	-	-
MBNMS La Cruz Canyon	close	-	-	11,441	0.0039%	-	-	6,413	0.0035%
MBNMS Outer Soquel Canyon	close	-	-	19,353	0.0066%	-	-	10,048	0.0055%
MBNMS Point Sur Platform	close	-	-	-	-	-	-	-	-
MBNMS South of Davenport	close	-	-	-	-	-	-	-	-
MBNMS Southwest of Smooth Ridge	close	-	-	-	-	-	-	-	-
MBNMS Triangle South of Surveyors Knoll	close	-	-	-	-	-	-	-	-
MBNMS West of Piedras Blancas SMCA	close	-	-	-	-	-	-	-	-
MBNMS West of Sobranes Point	close	-	-	-	-	-	-	-	-
Mendocino Ridge Modification 1	close	-	-	-	-	-	-	-	-
Mendocino Ridge Modification 3	close	-	-	157,983	0.0539%	-	-	92,111	0.0508%
N. Daisy Bank	close	-	-	41,197	0.0141%	-	-	31,593	0.0174%
Navarro Canyon	close	-	-	-	-	-	-	-	-
Pescadero Reef	close	-	-	-	-	-	-	-	-
Pigeon Point Reef	close	-	-	-	-	-	-	-	-
Point Arena South Modification 2	close	-	-	c	-	-	-	c	-
Point Arena South Modification 3	close	c	-	c	-	c	-	c	-
Point Reyes Reef	close	-	-	-	-	-	-	-	-
Potato Bank Correction	close	-	-	-	-	-	-	-	-
Quinault Canyon	close	-	-	-	-	-	-	-	-
Rittenburg Bank	close	-	-	-	-	-	-	-	-
Rogue River Reef	close	-	-	-	-	-	-	-	-
Samoa Deepwater	close	164,218	0.1068%	-	-	118,488	0.1199%	-	-
Shale Pile East Side	close								
Southern CA Bight	close	-	-	c	-	-	-	c	-
Spanish Canyon Line Adjustment 2	close	-	-	-	-	-	-	-	-
Stonewall Bank Northwestern Modification	close	-	-	-	-	-	-	-	-
The Football	close	-	-	1,204,667	0.4112%	-	-	624,630	0.3445%
Trinidad Canyon	close	c	-	-	-	c	-	-	-
Willapa Canyonhead	close	-	-	628,328	0.2145%	-	-	340,638	0.1878%
Willapa Deep	close	c	-	-	-	c	-	-	-
Bandon High Spot Northern Modification	reopen	13,180	0.0045%	156,716	0.0535%	10,275	0.0057%	91,286	0.0503%
Bandon High Spot Southern Modification	reopen	30,612	0.0104%	42,098	0.0144%	29,038	0.0160%	27,314	0.0151%
Cordell Bank Modification 3	reopen	22,337	0.0076%	-	-	19,470	0.0107%	-	-
Delgada Canyon	reopen	84,580	0.0289%	43,626	0.0149%	55,418	0.0306%	25,005	0.0138%
Eel River Canyon Modification 1	reopen	9,585	0.0033%	-	-	6,283	0.0035%	-	-
Eel River Canyon Modification 3	reopen	27,947	0.0095%	-	-	17,655	0.0097%	-	-
MBNMS East of Sur Ridge	reopen	32,845	0.0112%	-	-	18,190	0.0100%	-	-
MBNMS Lower Portion of Cabrillo Canyon	reopen	372,048	0.1270%	-	-	233,805	0.1289%	-	-
MBNMS South of Mars Cable	reopen	c	-	-	-	c	-	-	-
MBNMS Sur Canyon Slot Canyons	reopen	236,568	0.0808%	-	-	154,996	0.0855%	-	-
MBNMS West of Carmel Canyon	reopen	142,137	0.0485%	-	-	88,126	0.0486%	-	-
Mendocino Ridge Modification 2	reopen	c	-	c	-	c	-	c	-
Point Arena South Modification 1	reopen	170,815	0.0583%	187,326	0.0639%	94,965	0.0524%	105,909	0.0584%
Point Arena South Modification 4	reopen	c	-	-	-	c	-	-	-
Shale Pile Northeast Side	reopen	23,632	0.0081%	-	-	11,709	0.0065%	-	-
Spanish Canyon Line Adjustment 1	reopen	c	-	-	-	c	-	-	-
Stonewall Bank Southern Modification	reopen	-	-	-	-	-	-	-	-

Appendix D
Additional Methodology Descriptions

D-1 Data Source Selection Process for Catch, Revenue, and Protected Resources
D-2 Discrete Area Closure (DAC) Methodology/Hotspot Analysis

PRELIMINARY DRAFT ENVIRONMENTAL IMPACT STATEMENT
SUPPLEMENTAL APPENDICES D-1 AND D-2

APPENDIX D-1
Data Source Selection Process for Catch, Revenue, and Protected Resources

Goal

Select data source time frame(s) for the EFH openings and closures and RCA reopenings that will provide the best balance between spatial coverage (i.e., coastwide vs something more limited), representativeness of fishing behavior (past effort, catch, and revenue) of groundfish bottom trawl vessels, and robust observer data with protected species information. This information will assist the Team to qualitatively assess impacts of each alternative under Amendment 28. The data sets selected need to be comprehensive for the Team to analyze impacts to fish resources, economic impacts, and impacts to protected species.

Data Source Selected

The Team decided to use two base periods for the analysis: 1997-2001 and 2011-2014. Table 1 provides the data sets used when analyzing each alternative. In our decision to use these data sets, we considered the pre and post disaster time periods, implementation of regulatory prohibition of roller gear, drastic declines in trip limits, available observer data, logbook completeness, if logbooks contained both start and end point locations, and summarizing trawl effort. We also provide state-managed data sources we used for the impact analysis.

Data Source Time Periods We Considered

The Team evaluated several possible time periods to analyze:

1. 1994-1998 (5 years) - GAP recommendation; Advantage is that it was prior to the disaster declaration. Disadvantage is that the fishery used large roller gear and operated under a very different regulatory scenario.
2. 1997-2001 (5 years) – Advantage is prior to both RCA and EFH implementation, includes years with roller gear (i.e., 1998, 1999), and includes three years pre-disaster and two years post-disaster. Disadvantage is it doesn't reflect effort in southern areas south of 36 degrees.
3. 1994-2001 (8 years) – Advantage covers entire time period and is more robust data set, is coast wide information (including areas south of 36 degrees). Disadvantage is that it does not contain start and end point tow locations from 1994 to 1996 and single point estimates for tow locations limits spatial confidence.
4. 2000-2001 (2 years) – Advantage is that it uses the most recent years prior to RCA and EFH implementation, includes the highest level of complete tows (set/up points), is post-disaster, and the fishery did not use roller gear. Disadvantage is that it is only two years of data and no observer coverage data.
5. 2002-2005 (4 years) – Advantage is that it contains more recent data for EFH areas proposed to be opened outside RCA, observers are present on trips (approx. 10 -15% coverage). Disadvantage that it does not provide data for areas inside the RCA and less comprehensive observer coverage for protected species.

6. 2011-2014 (4 years) – Advantage is that it is the most recent observer data for EFH areas outside the RCA that are proposed to be closed, and provides basic fishery information for No Action description. 100% observer coverage provides most comprehensive info for protected species. Disadvantage that it does not provide data for areas inside the RCA or EFHCAs.

Table 1. Summary of Commercial Trawl Data Sources for Analysis of EFH and RCA Alternatives. Note: Data used in our analysis are logbook tow locations (starting point location only), logbook tow duration in hours trawled, landings on fish tickets, 2015 inflation-adjusted ex-vessel values, and WCGOP protected species interaction data. All data is from either PacFIN or NMFS West Groundfish Observer Program.

Alternative	**Data Sources**
Subject Area 1: EFH Conservation Areas Alternatives	
No Action - (Maintain 2015 Trawl RCA and Maintain Closed Areas - EFHCAs, CCA, all other BTCs)	Logbook records and fish ticket data 2011-2014[1]
Alt 1a through 1f	
• For New EFH Closures Outside RCA	Logbook records and fish ticket data 2011-2014
• For EFH Areas to be Reopened Outside RCA	Logbook records and fish ticket data 1997 - 2001
• For New EFH Closures Inside RCA[2]	Chapter 4: No Analysis since RCA is closed Chapter 5: Conduct integrated analysis with Logbook and Fish Tickets data 1997 - 2001
• For EFH Areas to be Reopened Inside RCA[2]	Chapter 4: No Analysis since RCA is closed Chapter 5: Conduct integrated analysis with Logbook and Fish Tickets data 1997 - 2001
Alt 1g New EFHCAs within the RCA based on Priority Habitats (WA only)	Logbook records and fish ticket data 1997 – 2001
Subject Area 2:Trawl RCA Alternatives	
No Action – (Maintain 2015 Trawl RCA and Maintain Closed Areas - EFHCAs, CCA, all other BTCs)	Logbook records and fish ticket data 2011-2014[1]
2a. Eliminate RCA	Logbook records and fish ticket data 1997 – 2001
<u>Discrete Area Closures</u> **2b. Remove RCA and Implement DAC (Washington only)**	Logbook records and fish ticket data 2011-2014 for areas outside RCA; Logbook records and fish ticket data 1997 - 2001 for areas inside RCA
<u>Block Area Closures</u> **2c. Remove RCA and Implement BAC**	Logbook records and fish ticket data 2011-2014 for areas outside RCA; Logbook records and fish ticket data 1997 - 2001 for areas inside RCA

[1] Tribal fishery data inside the U&A is included under the No Action data set; when calculating percentage of coastwide the denominator includes No Action data.

[2] For the Chapter 4 analysis of proposed EFH areas to be closed or opened inside the RCA we assume the RCA remains intact and fishing activity is still prohibited. Therefore, the Chapter 4 analysis will assume there is no impact on the ex-vessel revenue or catch within the RCA. Under the Chapter 5 analysis, we qualitatively discuss the integrated effect of making EFH changes and RCA changes at the same time.

Pre and Post Disaster Data, Regulatory Actions Information, & Observer Data Availability

Inclusion of pre disaster time-period in the 1997-2001 data set would increase the available data for inside the RCA and prior to implementation of EFHCAs. We considered that the trip limits were larger in that time period and that fishing on the continental shelf would be included. By including this information, we would expect specific fishing grounds for economically important species to be revealed on a map to provide past fishing patterns and inform a qualitative analysis of relative importance of areas inside the RCA or EFHCAs that are proposed to be opened or closed. This allows us to summarize past effort in light of potential future fishing grounds.

In the past there were major regulatory changes and milestones in the groundfish fishery that influence our choice of years (Table 2). The fishing footprint is larger from 1997 to 2001 because large roller gear was allowed from 1997-1999 (i.e., provides greater access to rocky areas), we used this data set to qualitatively examine the extent of the fishery and where vessels may return if access is granted in the future with large roller gear. This will provide context to areas that may be fished inside the RCA and under the proposed EFHCA openings where this gear is allowed. We also wanted to use data that includes the prohibition of roller gear (2000-2001) to incorporate data that reflects the fleet's response and area of operation under the new regulations. We also considered picking a historical period of years that have regulations similar to current gear regulations (prohibition of roller gear); however, this would truncate the time period for the analysis to only 2000-2001. This data set was not robust for the analysis. Data sets

Table 2. Regulatory Milestones, 1994 – 2006.

Year	Regulatory Milestone
1994	Limited entry permits issued
1999	Bocaccio, lingcod, and Pacific ocean perch declared overfished
2000	Groundfish disaster declaration Regulations define small and large footrope, effectively prohibiting use of large roller gear (>19 inches). Trip limits became gear specific
2002	WCGOP begins observations in the trawl fishery Coastwide RCA implemented Trip limits become area specific (e.g., shoreward RCA, seaward RCA) Large footrope prohibited shoreward of the RCA
2003	Trawl buyback program implemented, fleet reduced by 1/3
2004	Vessel Monitoring System implemented
2005	Selective flatfish trawl gear required shoreward of the RCA, north of 40°10′ N. lat
2006	EFHCAs implemented

In our decision to use 2011 to 2014 data, we looked for data that would best represent the No Action alternative yet include comprehensive observer coverage data (100% monitoring) to assess protected species impacts. More recent fish ticket information for 2015 was available at the time of our analysis; however, the WCGOP data set for protected species observations were only available through 2014. Therefore, we truncated the fish ticket data set to 2014 to reflect this. We believe this data set reflects what is currently happening in the bottom trawl fishery and is the most recent available information to assess proposed closures outside the RCA and represent protected species interactions under the No Action alternative.

In our decision to use 2011 to 2014 and 1997-2001, we looked for the most comprehensive data sets that would represent best available information coastwide for each time period to summarize fishery landings and effort, and analyze where the fishery may target economically important species if the areas were opened. A GIS plot shows different catch densities along the coast in major time periods Figure 1. Pre 1998 data represents coastwide activity best and has the greatest spatial coverage, particularly south of 40°10´. Current IFQ spatial coverage south of 40°10´ is greater than in the 1998-2001 (or 2000-2001) time period.

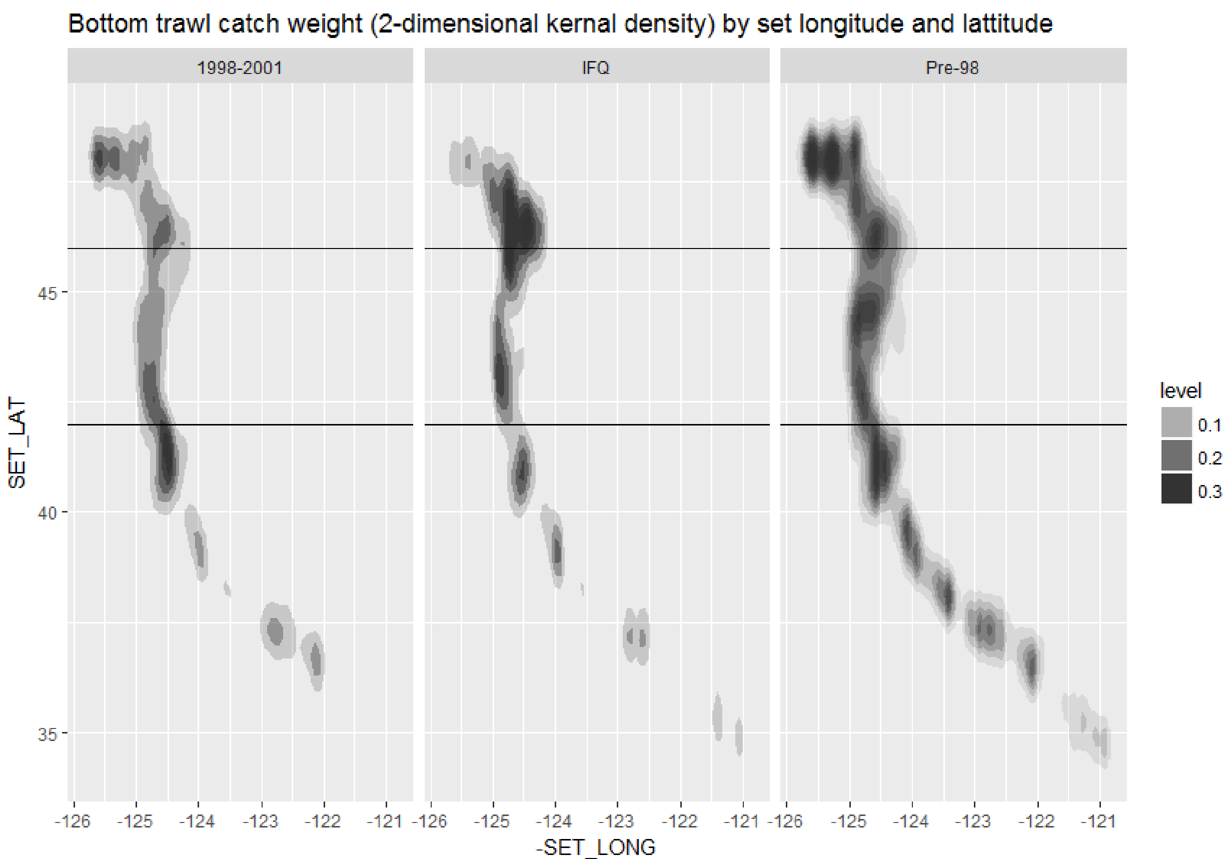

Figure 1. Bottom trawl catch density along West Coast for major time periods.

We considered picking years that have the greatest spatial coverage to provide the most information about the potential for catch to be restored. For example, from 1998-2001 there was less effort south of 36 degrees than from 1994-1998. If we use data from 1997-2001 we will have little to say about the restored catch south of 36 degrees. However, trawling effort south of 36 degrees has been less frequent since 1998. Data after 1997 may better inform our analysis of the alternatives when discussing areas that the fishery may return to if they are opened, or areas that may no longer be available their relative importance to the fishery. Therefore, we chose 1997-2001 rather than 1994-1998.

Logbook Completeness and Matching Fish Ticket Analysis

We evaluated completeness of logbook reporting. Specifically we examined whether all trips had matching fish tickets and if logbooks included both start and end points. Our goal was to choose the years in which completeness for these two criteria was highest (i.e., most representative of the fleet).

Regarding fish ticket and logbook completeness, the Team explored how many fish tickets have matching logbooks, those that do not have matches, and those that have matches but have discrepancies from 1998 to 2006. Figure 1 shows an increase in the percentage of fish tickets that match. In all time periods the matches are greater than 73%, with recent years (2004-2006) greater than 80%. There's no difference between 1998-2001 (avg. 18%) and 2000-2001 (avg. 18%). EFH closures were implemented in mid-2006, as such some analysis truncates the data to 2006. We concluded that completeness is not a factor in selecting one of these time periods over another.

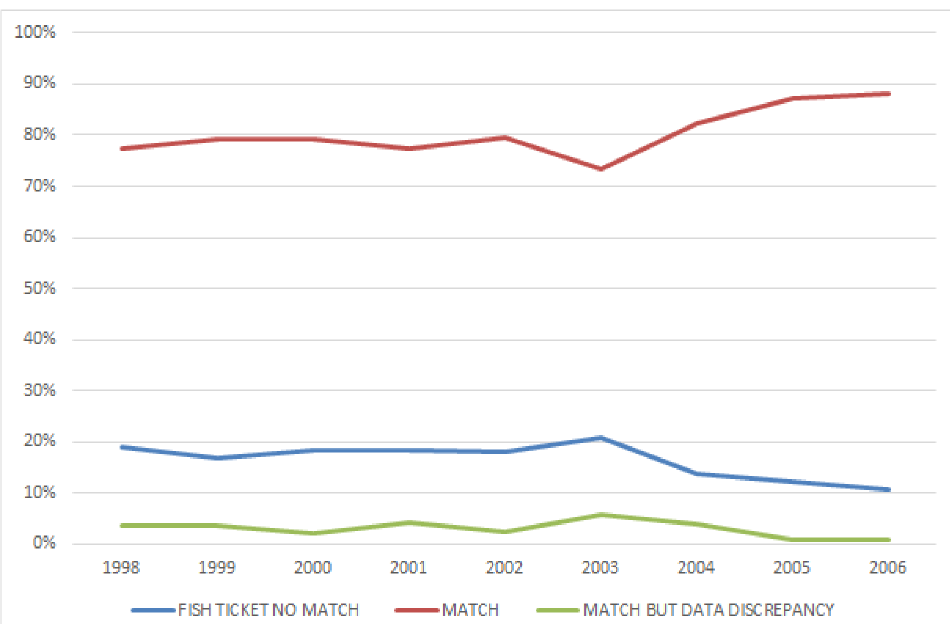

Figure 1. Percentage of matching logbooks and fish tickets, 1998 to 2006.

Start and End Point Logbook Analysis

When selecting logbook data for the analysis, the Team wanted to ensure that both time periods selected (1997-2001 and 2011-2014) had similar tow location data (both start and end points). The Team assumed that logbook data included both start and end points for both data sets and it could assign catch to tows. However, we discovered that earlier time periods lacked end point locations (Table 3). Therefore, the Team decided to use only set point location data for both time periods and assigned catch (logbook adjusted fish ticket data) to each start tow point.

Prior to 2000, many logbooks had start points but did not include end points. Washington logbooks began including end points in 2000. Oregon logbooks included end points after 1999, and California after 1997 (Table 3). The Team also looked for the percentage of fish tickets that matched with logbooks but either had no spatial data, no end point, or included both start and end point to gauge completeness of the data set.

Table 3. Historical bottom trawl logbook spatial data completeness/coverage, as a percentage of landed metric tons of (dahl-sector 4 bottom trawl) groundfish by agency and year, 1994-2001[3].

State	Year	Percent of fish tickets with no logbook spatial data	Percent fish tickets with no haul end point spatial data	Percent fish tickets with both start and end spatial data
CA	1994	2%	98%	0%
	1995	1%	99%	0%
	1996	2%	98%	0%
	1997	2%	0%	98%
	1998	3%	1%	96%
	1999	3%	1%	96%

[3] Code for selecting groundfish tows and fish tickets from PacFIN: select landing_year, ft.AGENCY_CODE, case when set_lat between 32.6 and 49 and set_long>117 then 'SetPoint' else 'NoSet' end as SETPOINT, case when up_lat between 32.6 and 49 and up_long>117 then 'UpPoint' else 'NoUp' end as UPOINT,sum(ft.EXVESSEL_REVENUE) REV, sum(ft.ROUND_WEIGHT_MTONS) MTONS, sum(tow.DURATION) HOURS from PACFIN_MARTS.COMPREHENSIVE_FT ft left join pacfin.lbk_ftid lb on lb.TICKET_DATE=ft.LANDING_DATE and ft.AGENCY_CODE=lb.AGID and lb.FTID=ft.ftid left join pacfin.lbk_tow tow
on tow.TRIP_ID=lb.TRIP_ID and tow.AGID=lb.AGID where ft.DAHL_GROUNDFISH_CODE='04' and ft.PACFIN_GEAR_CODE<>'MDT' and landing_year<2002 group by landing_year, ft.AGENCY_CODE, case when set_lat between 32.6 and 49 and set_long>117 then 'SetPoint' else 'NoSet' end, case when up_lat between 32.6 and 49 and up_long>117 then 'UpPoint' else 'NoUp' end

State	Year	Percent of fish tickets with no logbook spatial data	Percent fish tickets with no haul end point spatial data	Percent fish tickets with both start and end spatial data
	2000	3%	2%	95%
	2001	4%	0%	96%
OR	1994	7%	93%	0%
	1995	10%	90%	0%
	1996	13%	87%	0%
	1997	4%	96%	0%
	1998	1%	99%	0%
	1999	0%	14%	85%
	2000	0%	16%	84%
	2001	0%	8%	92%
WA	1994	0%	100%	0%
	1995	0%	100%	0%
	1996	0%	100%	0%
	1997	1%	99%	0%
	1998	0%	100%	0%
	1999	0%	100%	0%
	2000	0%	3%	97%
	2001	0%	3%	97%

The discovery that end points were missing for the earlier time periods (prior to 2000 for WA, prior to 1999 for OR, and prior to 1997 for CA) prompted the Team to consider how to assign the catch and revenue data from those hauls to a tow location for our analysis. The Team also wanted the earlier time period data set to be consistent with the 2011- 2014 data set.

The Team considered several options to develop end points for the missing data so that data could be used to proportionally assign catch throughout the tow path (i.e., catch inside and outside a closed area could be assigned throughout the tow path based on the amount of the tow inside and outside the area proposed to be opened or closed). The Team considered the following options to develop missing end points or assign catch:

- Derive tow path based on bathymetry - Preliminary analysis in CA by SWFSC shows tows follow bathymetry contours
- Use circle approach, assumes equal prob. of catch - Most likely overestimates the area from which the catch was taken, less certainty about how much of the tow occurred in the polygon
- Use circle approach with kernel density idea - Same as above
- Estimate the missing end points - Look at historical data and determine the direction that the majority of the tows go after being set (e.g., north), assume all tows went that direction

After careful consideration of these methods, the Team decided that the uncertainty added to the data and the added effort by the Team to develop one of these methods did not add enough benefits to the overall analysis.

Therefore, the Team considered several approaches to address the uncertainty in using only a start point location:

1. Make an educated guess about which tow direction was most likely, and use an average tow length to estimate the area from which the catch came;
2. Buffer the points by drawing a circle around each start point and apportion the catch where the circle intersects a polygon;
3. Follow the depth contours based on the depth at the starting point of the tow;
4. Buffer the polygons themselves by one, two, or three miles, and include any points that fall within that buffer; and
5. Use only the starting points, recognizing that some may fall just inside a polygon while some may fall just outside a polygon.

The Team considered the five approaches above, and agreed that #5 above was the best option. This approach assumes that with thousands of data points over the two time periods (167,504 tows), that location bias and the assignment of catch, revenue and protected species interactions to a single point will largely balance each other out. We were not able to examine the data set for bias. The other four approaches would require significant amounts of work, and are very speculative in approach.

Trawl Effort Information

Since the available logbook data sets are limited to start points, trawl effort is defined as the total hours of trawl tows rather than miles towed. Total hours trawled are summarized for proposed closures or reopenings in the habitat, fish resources sections. Trawl effort in the proposed closures would be displaced, as it is assumed that the fishery would shift to other areas, and trawl effort in the proposed reopenings would be restored.

Predicting the effort that would be restored by the reopenings or displaced by closings is very difficult because of the limitations and availability of data, and changes to the fishery that have occurred since the EFHCAs and trawl RCAs were first implemented, in particular the catch shares program. Therefore, we cannot quantify the amount of trawl hours that may be shifted to other areas as a result of proposed closures and openings. The total hours can only provide the past and recent effort in an area to help show the relative importance of an area and the past and present impact to habitats in the area.

State-Managed Fisheries Data Source

Pink shrimp, California halibut, ridgeback prawn, and sea cucumber trawl are bottom trawl fisheries; therefore, the Team needed to qualitatively analyze the impacts of the alternatives. The Team worked with NMFS and state representatives in California to gather information about where these fisheries operate. The pink shrimp fishery operates coastwide; therefore, a trawl footprint created by NMFS was provided to the Team to examine overlap of the area of operation for the fishery and proposed EFH closures and openings (data is for years 2009-2013). Similarly, CDFW provided recent fishery operations info for California halibut, ridgeback prawn, and sea cucumber trawling to show where these fisheries are operating in state and federal waters off California (data is for years 2011-2017). Again, we analyzed the overlap of these fisheries and proposed EFH closures and openings. No revenue information was used because we were are not able to assign catch and revenue at a fine enough scale to inform an analysis.

APPPENDIX D-2
Discrete Area Closure Methodology/Hotspot Analysis

At the November, 2016 Council meeting the EFH/RCA project team presented a team report regarding the method for development of draft discrete area closures (DAC) for overfished species in the Council's groundfish fishery management plan to support the Amendment 28 analysis. During the November meeting, the Council refined the range of alternatives by eliminating consideration of DACs off the coasts of Oregon and California and recommended further analysis of DACs off the coast of Washington outside of the Tribal U & A.

During this meeting, Council staff also presented the analysis to the SSC showing the method and results for identifying DACs. The SSC rejected the method because the statistical algorithm utilized by the ArcGIS "hot spot" tool properties and analysis were not fully understood (Agenda Item F.4.b, Supplemental SSC Report, November 2016). The SSC recommended using the results of habitat suitability probability (HSP) modeling or a geostatistical hurdle approach such as that developed by Dr. Jim Thorson to identify hot spots.

This section documents the final methodology used to develop the DACs off Washington. The Project Team used two models developed by the Northwest Fisheries Science Center (NWFSC) and by the National Centers for Coastal Ocean Science (NCCOS). Both models are more recent than the HSP, and incorporate more recent data. Both the NWFSC and NCCOS models are based on fisheries independent survey data. The NCCOS uses exclusively data from the NWFSC trawl survey while the NWFSC incorporated data from the trawl survey and some visual submersible surveys. Both approaches use spatial regression approaches and habitat variables to explain both the occurrence and abundance of each species, to generate areas of high probability of occurrence, for darkblotched rockfish, Pacific Ocean perch, and yelloweye rockfish. Cowcod and bocaccio are not included, as they are not found in waters off the Washington coast. Darkblotched and yelloweye rockfish probabilities are based on NWFSC model results, while Pacific Ocean perch probabilities are results of NCCOS model. Hot spots identified from fishery-dependent and independent data are overlaid on this model for reference (Figure 1). Additional details are described in pages 75-119 of the NMFS Synthesis Report (Agenda Item D.6.b, NMFS Report, April 2013).

Grid cells in Figure 1 representing yelloweye rockfish occurrence greater than 0.25 are few and dispersed. This is a result of infrequent catches in trawl survey catches and renders estimates based on probability of occurrence (PO) and hotspot identification unreliable. As also indicated in Figure 1, there is little correlation between yelloweye rockfish PO and hot spots identified from catch data. It is also worth noting that yelloweye rockfish occurrences based on PO greater than 0.25 do not correlate well with current RCA closures.

By contrast, modeling PO for darkblotched rockfish (Figure 2) results in a wide band of occurrences greater than 0.25 and there is a strong correlation between occurrences and increasing depth. Pacific Ocean perch is intermediate in terms of the number and clustering of grid cells with probabilities greater than 0.25 (Figure 1). These grid cells overlap with the two overlapping hotspots for Pacific Ocean perch and darkblotched just north of 46°30´ N. latitude.

Because there is an intermediate level of numbers and grouping of Pacific Ocean perch, the identification of DACs could be reasonably considered. For illustrative purposes, Figure 3 shows an example of DACs identified to encompass Pacific ocean perch, Yelloweye rockfish, and darkblotched rockfish clusters relative to PO greater than 0.25. In addition, Figure 3 shows the PO of 80 percent of the maximum for darkblotched rockfish. The DACs in Figure 3 were created empirically, based on the overlap of the results.

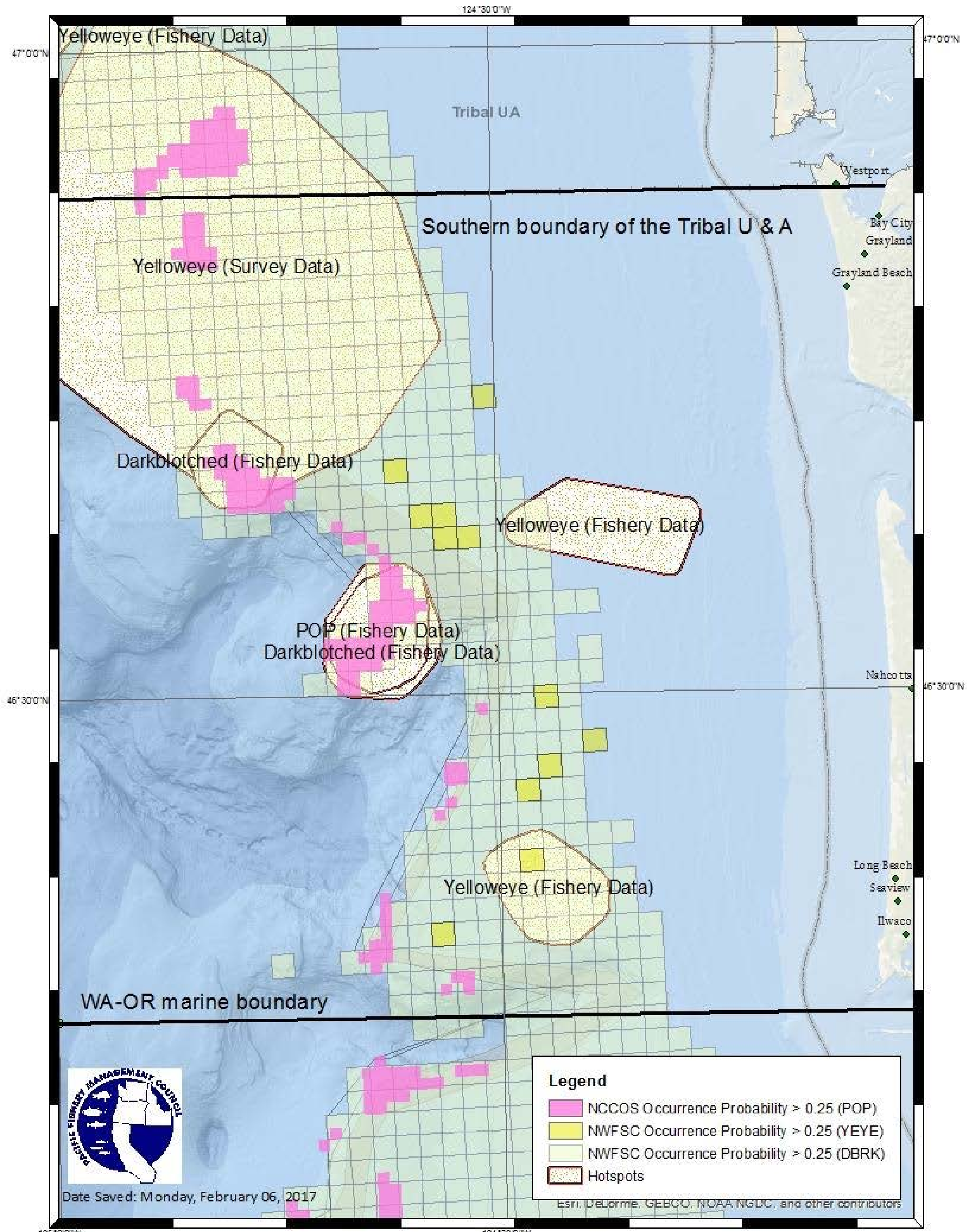

Figure 1. Comparison of hotspots identified from catch data to habitat suitability probability results.

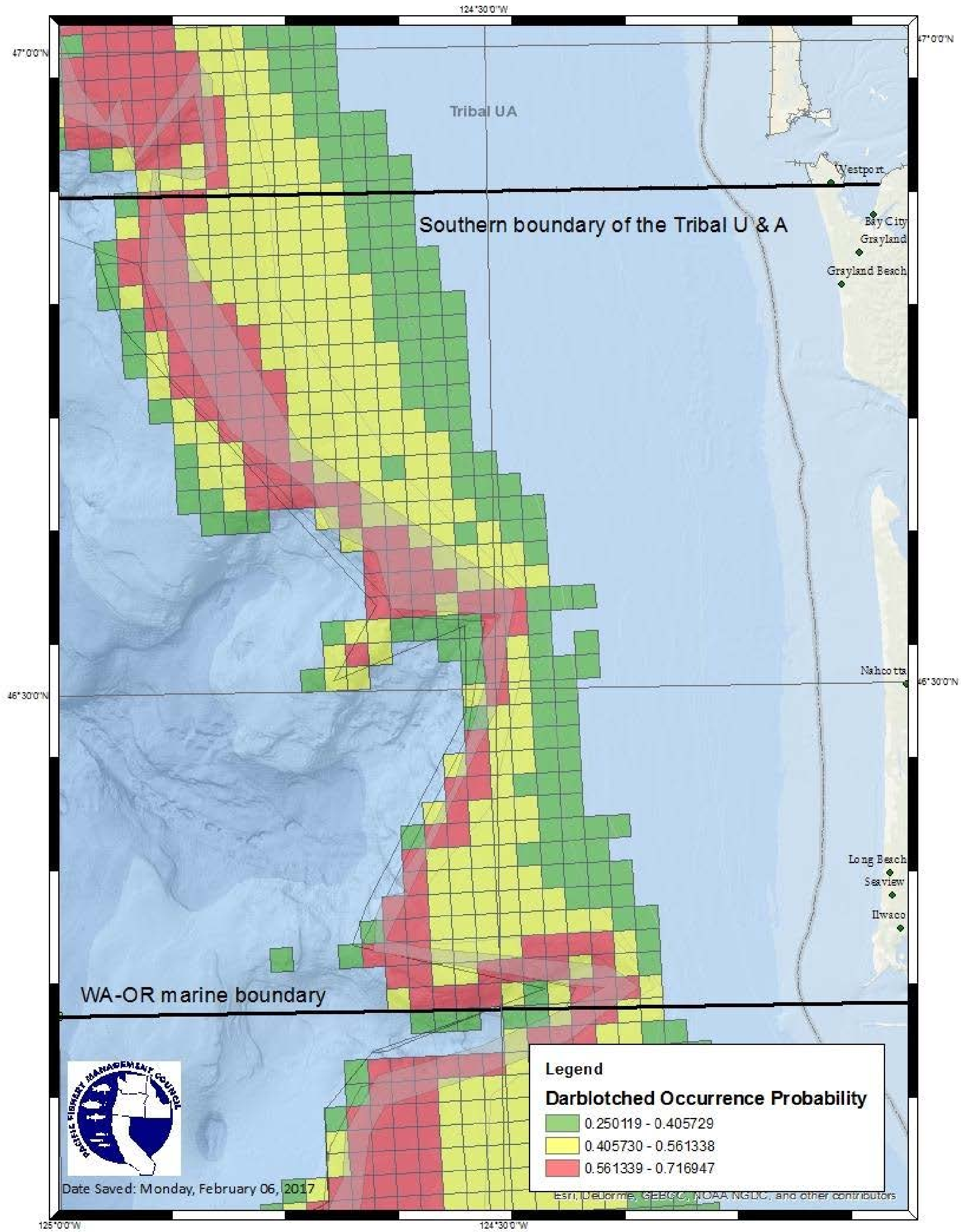

Figure 2. Darkblotched rockfish probability of occurrence with grid cells >0.25 binned in three equal intervals, data is based on NWFSC data.

Final DACs were developed by drawing lines along grids cells that would be straight to develop lat/long coordinates that are enforceable (Figure 3). To do this we examined the general overlap between HSP data and available fishery dependent (catch data) or independent data (trawl survey data) to pinpoint areas that had the best correlation. As noted in Figure 1, there are areas that the yelloweye rockfish HSP data do not align with trawl survey and fishery independent data. In this case, we used HSP data to develop one of the DACs since fishery independent data was in close proximity to the HSP grid cells.

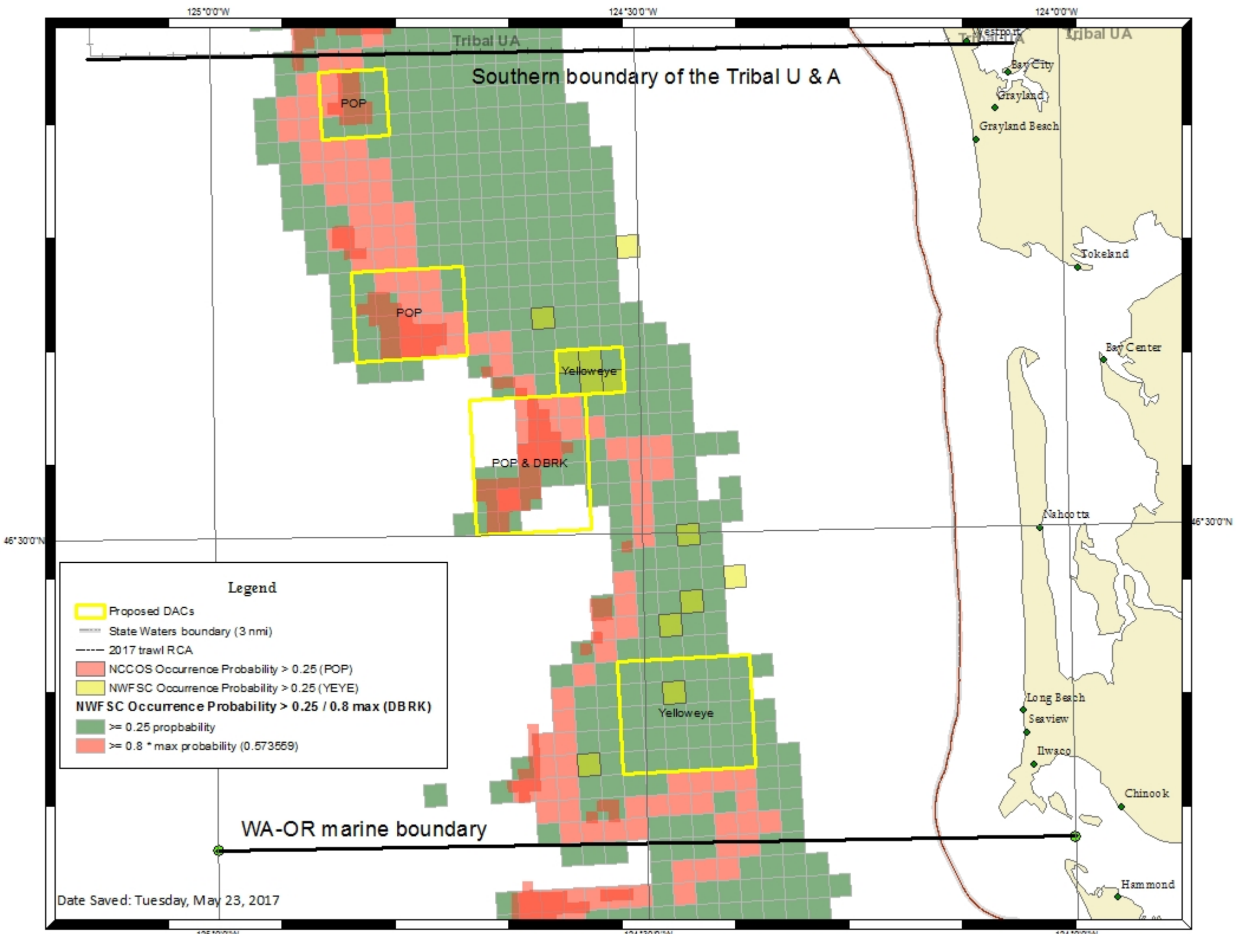

Figure 3. Final DACs used for the Amendment 28 analysis.

Appendix E
History of Council Action

APPENDIX E

History of Council Action

This section briefly describes the history of Council actions that led to the development of the alternatives in Amendment 28 and the analyses of those alternatives.

Pacific Coast groundfish EFH was first identified and described in 1998, in accordance with the 1996 MSA, and it was incorporated into the FMP as part of Amendment 11. In addition to describing EFH for Pacific Coast groundfish, Amendment 11 also defined optimum yield, overfishing rates, and thresholds.

In 2006, Amendment 19 revised groundfish EFH as a response to a lawsuit by American Oceans Campaign (*AOC v. Daley*, 183 F. Supp. 2.d 1 (D.D.C. 2000)). The Council performed the following actions:

- It reaffirmed the 1998 designation of EFH.
- It established HAPCs.
- It described the adverse effects on EFH from fishing.
- It established EFHCAs to minimize those effects.
- It described the life history, habitat, and major prey items of groundfishes.
- It established a process for the review and revision of EFH.

The Council's periodic review of the EFH provisions in the groundfish FMP, required by NMFS' regulatory guidance (50 CFR §600.815(10)), began in December 2010. The preliminary findings of the review were presented to the Council in September 2012 (Agenda Item H.6.b). Based on these findings, the Council issued a request for proposals for changes to the groundfish EFH provisions in 2013. Eight proposals were submitted, two of which were subsequently withdrawn. The eight original proposals are as follows:

- Environmental Defense Fund (withdrawn)
- Fishermen's Marketing Association (FMA)
- Greenpeace (GP)
- Greater Farallones National Marine Sanctuary (GFNMS)
- Marine Conservation Institute
- Monterey Bay National Marine Sanctuary (MBNMS)
- Oceana/Natural Resources Defense Council/Oceana/Ocean Conservancy (Oceana, et al.)
- Olympic Coast National Marine Sanctuary (withdrawn)

The EFH review concluded in March 2014, when the Council determined that the new information, including the public proposals, warranted further consideration of changes to EFH components, and it established a process and schedule to develop and consider alternatives for those changes.

RCA Actions Prior to September 2014

Management of the groundfish trawl fishery changed from cumulative landing limits and area closures (i.e., command and control measures to reduce catch) to IFQ (i.e., individual accountability) in 2011. Given the new management regime, the Council received requests to reevaluate the purpose and utility of trawl RCA (November 2011 Agenda Item E.7.b, Supplemental Trawl Rationalization Regulatory Evaluation Committee Report). At its April 2013 meeting, the Council considered the performance of the shorebased IFQ fishery in 2011 and 2012 and the progress to date in 2013. Based on this review, the Council recommended a 100 fm shoreward boundary and a 150 fm seaward boundary for the trawl RCA for Period 6 in 2013 throughout 2014 in the area from 40°10’ N. latitude to 48°10’ N. latitude. The trawl RCA boundary adjustments were intended to provide greater access to target species, while allowing the individual accountability afforded by the IFQ program to minimize bycatch of overfished species. At its September 2013 meeting, the Council reaffirmed action taken in April after reviewing NMFS’ draft environmental assessment (Agenda Item G.6.b, Draft EA, September 2013), advisory body reports, and public comment.

On April 17, 2014, NMFS partially approved the Council-recommended trawl RCA boundary adjustments (, Attachments 1, 2, and 3, June 2015). NMFS disapproved the Council’s recommendations in the area from 40°10’ N. latitude to 45°46’ N. latitude because the Council did not consider area-specific analysis and whether to mitigate the adverse effects on EFH caused by the proposed fishing activities, to the extent practicable, as required by MSA (16 U.S.C. 1853(a)(7)).

Council Actions September 2014 to Present

In September 2014, the Council opted to combine the potential EFHCA revisions and trawl RCA modification into a single FMP amendment. Although they have different purposes, both of them prohibit bottom trawl activities in specific areas, thereby providing direct (EFHCAs) or indirect (trawl RCA) habitat protections in those areas. In addition, combining the two actions would allow the trawl RCA modifications to be considered in the context of EFH, which was a reason NMFS initially rejected RCA changes.

In April 2015, the Council established the scope of the action and formed the Project Team to develop the FMP amendment and NEPA documents. At this meeting, an additional proposal, in draft form, was submitted via public comment by a collaborative group consisting of fishing interests and environmental groups (the "Collaborative"). The proposal included changes to the EFHCAs and elimination of the trawl RCA. A final proposal was submitted in November 2016.

In September 2015, the Council adopted a preliminary range of alternatives for analysis. The Project Team began developing analytical frameworks and metrics to assess the environmental impacts of the various alternatives.

In April 2016, the Project Team provided a progress report and a preliminary analysis of the fishery management alternatives for consideration. At that meeting, the Council established a range of alternatives (ROA) that addressed potential changes to the current EFHCA configuration and trawl RCA, as well as the closure of waters deeper than 3,500 m to bottom contact gear. For a full list of alternatives considered, see the April 2016 Project Team Report (Agenda Item F.5.a, EFH/RCA Project Team Report). The Council also eliminated EFHCA or trawl RCA changes within the combined tribal U&A off the coast of Washington from consideration.

In November 2016, the Council reviewed a draft that included analysis of habitat impacts, but did not yet include the economic impacts analysis. At this meeting, an additional proposal was submitted via public comment by the MTC that included changes to the EFHCAs off the coast of Oregon. The Council chose a partial suite of PPAs, pending further analysis of impacts by the Project Team, and it provided guidance to the Project Team for continuing the analysis of alternatives. In particular, the Council directed the Project Team to include four additional EFH alternatives in the analysis: the MTC Proposal, Garibaldi Reef South, Rittenburg Bank Modifications, and the Potato Bank Correction. The Council's partial PPA for waters off California and Oregon included removing the trawl RCA and adopting block area closures (BACs; Alternative 2c). For waters off Washington, PPAs are the No-action Alternative for both EFHCA modifications and trawl RCA modifications.

In April 2018, the Council reviewed a PDEIS that included analyses of the impacts of a wide range of alternatives on habitat, fish resources, protected resources, and economics. The Council selected preferred alternatives under both Subject Area 1 and Subject Area 2. The Subject Area 1 preferred alternative, described in detail in Section 2.2.3, consists of components of the Collaborative, Oceana, et al., MTC, Rittenburg Bank, and Potato Bank alternatives. In doing so, the range of Subject Area 1 alternatives analyzed in the DEIS was narrowed to the Collaborative Alternative (1.a), the Oceana, et al. Alternative (1.b), and the Preferred EFHCA Alternative (1.h). Section 2.2.4 describes the rational for not including the other Subject Area 1 alternatives in this DEIS.

The Council's preferred alternative for Subject Area 2 (2.d), described in detail in Section 2.3.2, is a modified version of Alternative 2.c, eliminate the trawl RCA south of the combined U&A of the

Washington coastal treaty tribes and establish block area closures. It differs from 2.c in that the trawl RCA would stay in place in waters off the Washington Coast. In doing so, the range of Subject Area 2 alternatives analyzed in this DEIS was narrowed to Remove the Trawl RCA (2.a), Remove the Trawl RCA and Implement BACs (2.c), and the Preferred RCA Alternative (2.d). Section 2.3.3 describes the rational for not including those other Subject Area 2 alternatives in this DEIS.

Appendix F
Comments on the Draft EIS

APPENDIX F

Comments on the Draft EIS

This appendix reproduces in full the comment letters received on the Draft EIS, including the attachments to those letters.

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL OCEAN SERVICE

Office of National Marine Sanctuaries | West Coast Region
99 Pacific Street, Suite 100F
Monterey, CA 93940

November 19, 2018

Gretchen Hanshew
National Marine Fisheries Service, West Coast Region
7600 Sand Point Way NE
Seattle, WA 98115

RE: Groundfish Plan Amendment 28

Dear Ms. Hanshew:

The NOAA Office of National Marine Sanctuaries (ONMS) serves as trustee for the nation's system of marine protected areas. A primary objective of the National Marine Sanctuaries Act is resource protection of marine areas of special national significance, including protection of biodiversity and ecosystem health. The ONMS West Coast Region engaged in the review of Essential Fish Habitat (EFH) designations for Pacific Coast Groundfish because of the close alignment between protection of groundfish EFH from adverse impacts from fishing through the Magnuson-Stevens Fishery Conservation and Management Act (MSA) with the ONMS's goals of protecting benthic habitat and associated ecological communities.

When the Council initially implemented EFH measures in 2006, ONMS applauded the decision for addressing sanctuary requests for benthic habitat conservation while also meeting EFH provisions of the MSA. We have appreciated the opportunity to collaborate and coordinate on the recent Groundfish EFH review with the Council, National Marine Fisheries Service (NMFS), and fishermen as members of the EFH Review Committee and the Habitat Committee. Staff from the west coast sanctuaries have worked diligently to characterize the status of benthic habitat and EFH designations within sanctuary boundaries, providing staff expertise and vessel time and have shared information throughout EFH review process. We also appreciate the recent collaborations between NMFS and ONMS on EFH related research and monitoring. As additional funding becomes available, we hope to continue coordinated efforts to characterize and monitor EFH modification areas in national marine sanctuaries.

We appreciate the opportunity to comment on the Draft Environmental Impact Statement and MSA Analysis regarding the recent proposed changes to Groundfish Essential Fish Habitat Conservation Areas (EFHCAs). We applaud the team at NMFS for the excellent analysis provided and we concur with the conclusions as they relate to the proposed changes to EFHCAs in national marine sanctuaries. Our comments herein mainly focus on Subject Area 1, revising the existing suite of EFHCAs and, more specifically, EFHCAs within Monterey Bay National Marine Sanctuary (MBNMS) and Greater Farallones National Marine Sanctuary (GFNMS).

In 2013, MBNMS submitted a proposal and GFNMS submitted options, to modify EFH for Pacific Coast Groundfish. These submittals were based on information from the Phase 1 Report (September 2012), the EFH Synthesis Report (April 2013) and new information on the geology (hard and soft substrate), biogenic habitats, groundfish, and existing fishing effort within these national marine sanctuaries. While the submittals were designed to achieve the EFH provisions of the MSA, they were also consistent with strategies outlined in the sanctuary management plans that address ecosystem-based management, resource protection and fishing activities within the sanctuaries. In addition, each offering ultimately reflected discussions and feedback from local stakeholders, particularly the fishing community and minimized economic impact to the fishery in a practicable manner.

The areas within MBNMS and GFNMS described in the Preferred Alternative (Subject Area 1, Alternative 1.h) of the DEIS are generally consistent with the areas each sanctuary put forward in 2013, and the subsequent suggested modification made by GFNMS at Rittenburg Bank in 2017. Please note however that our specific comment in the attachment, requesting the Final EIS include a table of coordinates, would ensure the shape of the analyzed areas is consistent with the areas recommended by MBNMS and GFNMS and adopted by the Pacific Fishery Management Council on April 8, 2018.

Enclosed for your consideration are recommended changes to specific language in the DEIS.

Sincerely,

William J. Douros
Regional Director

Attachment: Suggested Changes to the Draft Amendment 28 EIS

Attachment to Letter from ONMS, West Coast Region
Suggested Changes to the Draft Amendment 28 EIS

The text below provides comments on specific additions and deletions. We provide suggested deletions as ~~strikethrough~~ text and additions in [brackets].

General Comments Regarding Substrate Composition:

We understand that the Draft Environmental Impact Statement (DEIS) makes assumptions about substrate types for the purposes of the analysis and that the habitat metrics utilize substrate data and subsequent map developed by Oregon State University (OSU). The link provided in Section 4.1.1.2.2 (Substrate composition of areas proposed for closures and reopenings) brings the reader to the metadata for the substrate map. However, it is more difficult for the reader to do a deeper dive into the methodologies in order to determine how substrate is first identified and then classified.

The following paper gives insight to the possible assumptions made in the substrate map: Romsos, C.G., Goldfinger, C., Robison, R., Milstein, R.L., Chaytor, J.D., and Wakefield, W.W., 2007, Development of a regional seafloor surficial geologic habitat map for the continental margins of Oregon and Washington, USA. This paper explains that each data type is comprised of individual datasets varying in quality, resolution and spatial density. To address spatial variations in habitat map accuracy caused by disparate input data, the team developed a simple assessment method. Quality layers capture the relative value of each dataset in the habitat interpretation process and ultimately provide a guide among data rich and data poor regions.

Did the elements in above referenced paper guide the substrate map produced by OSU and used in the DEIS? If so, when, and how these elements determine California seafloor substrate is not clear. When we review the substrate map provided as part of the DEIS, we are unable to determine the data confidence level that drives the substrate interpretation. The DEIS defines substrate as: 1) hard bottom, 2) mixed bottom, and 3) soft bottom, and there is an additional "unknown" classification.

Our concern is that much of the interpretative data results in a classification as "soft" when data, or lack thereof, would indicate that many areas are actually unknown. For example, in much of the northern portion of GFNMS, researchers have determined that the only mapping previously conducted was coarse-scale bathometry and/or unreliable sonar from the 1980s. Recent habitat characterization surveys have shown that the classification of soft habitat in several locations is inaccurate.

Since the substrate map is the basis of subsequent analysis in the DEIS and because the indicators can range in levels of confidence, we recommend the following changes to the EIS:

1. Provide more information about the assumptions and drivers for the substrate classifications and more clearly explain the limitations of the data potentially leading to classifications that vary in accuracy. This could be covered in Section 4.1.1.2.2 or 4.1.1.3.
2. Clarify when the substrate type map was last updated.

3. Review the DEIS for statements that utilize a substrate type as a justification for minimal impact determinations and consider being less absolute about the assumption.

For example, the DEIS states the following on page 4-36: "However, because 99 percent of the area is soft substrate, which is the most resilient type of habitat, and fishermen generally avoid high-relief areas to protect their gear and to reduce bycatch of some limiting stocks, the negative effects of these reopenings on benthic habitat would likely be minimal."

> We recommend a more measured, cautious approach over the use specific numbers, such as "However, because ~~99 percent of~~ [the substrate composition of] the area is [primarily] soft substrate, which is the most resilient type of habitat…"

These types of changes would link the reader back to an updated Section 4.1.1.2.2 that explains the uncertainty in the data and contains information about the last update to the OSU map. It also helps alleviates problems where soft substrate indicated on the habitat map has been recently observed to be mixed or hard, which would change the percentages. It further ensures that the conclusions in the analysis that "negative effects would be minimal" is not linked to a specific percentage of soft substrate.

<u>Farallon Islands Modification</u>

Although we understand that the "Farallon Islands Modification" links the reader to the currently named Farallon Islands/Fanny Shoal EFHCA, this addition to the current EFHCA is a newly discovered bank (recommended to be named "Cochrane Bank") that is west of Fanny Shoal and at a different depth than Fanny Shoal and the Farallon Islands. Cochrane Bank was submitted to the National Geospatial-Intelligence Agency's GEOnet Names Server for inclusion as a listed name, and the design of the modification in the preferred alternative captures this bank, which is not technically connected to Fanny Shoal.

Therefore, we recommend that the Final Rule change the name Farallon Islands/Fanny Shoal EFHCA to Cochrane Bank/Fanny Shoal EFHCA. This reflects the names of the underwater features that drove the designation of these EFHCAs, and removes the name of the place that is above water, abutting California State waters and located in an area bottom trawling is already prohibited through California State law (Farallon Islands).

<u>Non-fishing Actions</u>

Page 6-9, Section 6.3.2

Since all five west coast national marine sanctuaries have similar regulations related to oil and gas exploration, discharge and alteration of submerged lands, and we suggest adding additional language as follows to the paragraph describing National Marine Sanctuaries:

[Without exception, all five west coast national marine sanctuaries prohibit exploring for, developing, or producing oil, gas or minerals. With few exceptions, west coast national marine sanctuaries prohibit discharge from vessels and drilling into, dredging, and constructing, placing or abandoning any structure on or in the submerged lands of each sanctuary.]

Coordinates Table

We recommend adding an appendix that includes all coordinates for each EFHCA. Although we recognize that this information will be in the final rule, the lack of coordinates in the DEIS makes it difficult to confirm the shapes without using the FRAM and GIS. Our goal is to check the size and shape of EFHCAs proposed by GFNMS and MBNMS in 2013 and 2017 that were incorporated without changes into the Preferred Alternative.

Suggested Changes Address Typos and Other Non-Substantive Recommendations

Page 6-2

There is a typo in Table 6-1. Reasonably foreseeable future actions and estimated effective dates. Select non-fishing actions (described in 6.~~2~~ [3].2)

Pages xii, 8-2 and E-1

Change "Gulf of the Farallones National Marine Sanctuary (GFNMS)" to Greater Farallones National Marine Sanctuary and remove the abbreviation (page xii), which is not needed as the full name is used on page 8-2 and E-1.

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November 19, 2018

Barry Thom, Regional Administrator
National Marine Fisheries Service, West Coast Region
1201 NE Lloyd Boulevard, Suite 1100
Portland, OR 97232-1274

RE: Groundfish Plan Amendment 28, Draft Environmental Impact Statement

Dear Mr. Thom:

Oceana greatly appreciates the hard work of the National Marine Fisheries Service (NMFS) and the Pacific Fishery Management Council in preparing the Draft Environmental Impact Statement (DEIS) for Amendment 28 to the Pacific Coast Groundfish Fishery Management Plan (FMP). The NMFS and Council preferred alternatives identified in the DEIS reflect a thorough and deliberate essential fish habitat (EFH) review and amendment process, which culminated with a unanimous Council decision in April 2018. All combined, the preferred alternatives for EFH conservation areas, trawl rockfish conservation areas (RCA), and establishment of the deep-sea conservation area off California, significantly advance the conservation and enhancement of EFH and deep-sea ecosystems while simultaneously increasing bottom trawl fishing opportunities. In doing so, NMFS will be protecting and maintaining healthy, functioning habitats, which support West Coast fish and fisheries and a diverse marine ecosystem.

It is our view that the Council's public process, with the hard work and contributions by many people involved, including West Coast states, conservation NGOs, the fishing industry, members of the public, West Coast Sanctuaries, Tribes, NMFS and Council staff, made for a successful, unanimous decision heralded as a "grand bargain" and a "win-win" for habitat conservation and sustainable fisheries.[1] While Oceana has expressed disagreements with particular proposed EFH conservation area openings[2] and we believe there are other areas in EFH Alternative 1.b (Oceana et al.) that should have received protections, we view the approach as a whole – to prevent the expansion of the bottom trawl footprint and to protect ecologically important areas and priority habitats – as a major accomplishment for sustainable fisheries management and marine habitat conservation. Therefore, we strongly support the suite of Final Preferred Alternatives embodied in the April 2018 Council final action.

We reviewed the DEIS and conclude it provides important and sufficient information and analyses necessary for understanding the effects of the proposed suite of actions. We appreciate the

[1] e.g. Seattle Times (April 14, 2018). Conservationists, West Coast bottom fishermen embrace 'grand bargain'. Available: https://www.seattletimes.com/seattle-news/conservationists-west-coast-bottom-fishermen-embrace-grand-bargain/.

[2] See Oceana (April 2018), open public comment 2, attachment 2 at 21-23. Available: https://www.pcouncil.org/wp-content/uploads/2018/04/F3c_Public_Comment2_Oceana_Full_Electric_Only_Apr2018BB.pdf.

complexity of the geospatial analyses, and the value of considering the proposed EFH modifications simultaneously with the proposed RCA changes to understand the net effects of bottom trawl openings and closures on priority habitats, the economics of the groundfish fishery and fishing communities.

1. **The combined result of the final preferred alternatives for EFH, RCAs and the protection of the Deep-Sea Ecosystem will significantly benefit fish habitats, protect priority habitat features, provide a net increase in bottom trawl fishing opportunities and ensure sustainable fisheries into the future.**

The DEIS shows the preferred alternatives for essential fish habitat conservation areas (**Alternative 1.h**) and rockfish conservation areas (**Alternative 2.d**), when combined, results in an overall "positive economic impact to the fleet and to fishing-dependent coastal communities."[3] The DEIS analysis finds the combination of these preferred alternatives would result in "closing areas contributing 0.26 percent and 0.3 percent of coastwide landings (pounds) and revenues, respectively, in the recent period (2011 to 2014), and would reopen areas contributing up to 12 percent and 11 percent of coastwide landings (pounds) and revenues, respectively, in the historic period (1997 to 2001)…."[4]

Meanwhile the habitat conservation measures would "result in short- and long-term net benefits for groundfish EFH on the West Coast, as a whole, spread across all latitudinal zones and most depth zones."[5] These habitat protections ensure lasting conservation of seafloor ecosystems from the impacts of bottom trawling and they are critically important to the overall health of the ecosystem, including managed groundfish. As described in the DEIS:

> "Healthy marine habitat is basic to the well-being of marine species and their place in the food web. The marine habitats of the West Coast support living marine resources at the most fundamental level by providing the conditions necessary for populations to sustain themselves."[6]

What is more, the precautionary approach to protecting the deep-sea ecosystem (**Alternative 3**) from bottom contact gears, will not have negative economic impact to West Coast groundfish fisheries but will "limit prospective fishing activities in the future, and it would reduce the potential damage by fishing activities on habitat features such as deep-sea corals."[7]

These facts confirm and support the overall approach taken by the Council to prevent the expansion of bottom trawling into previously un-trawled areas and to protect priority habitat features within the trawl footprint, while simultaneously avoiding significant bottom trawl effort displacement or potentially significant economic impacts. By all accounts, as demonstrated in the DEIS, this action protects priority habitat features throughout the West Coast EEZ while keeping open important bottom trawl fishing grounds so that annual catch limits can still be attained. This smart, forward-thinking approach ensures lasting habitat protection and sustainable fisheries into the future. It is a key approach adopted nationally by NOAA in the Strategic Plan for Deep Sea Coral and Sponge

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[3] National Marine Fisheries Service and Pacific Fishery Management Council (September 2018). Draft Environmental Impact Statement for Groundfish Amendment 28 (DEIS), at 5-14.
[4] DEIS at 5-14.
[5] DEIS at 4-36.
[6] DEIS at 3-2.
[7] DEIS at ES-8.

Ecosystems for managing bottom-tending gear (BTG), "especially mobile BTG and other adverse impacts of fishing on deep-sea coral and sponge ecosystems."[8]

If anything, the DEIS understates the true value of this important action. The DEIS describes the benefits overall as having "a neutral to medium positive influence on habitat" and "a neutral to medium positive influence on socioeconomics."[9] The analysis in the DEIS, however, shows a significant overall increase in the protection of priority habitat features and a significant increase in restored fishing opportunity. In addition, the near doubling of total area protected from mobile bottom-tending gear off the US West Coast EEZ will undeniably extend protections to a wide diversity of habitats including priority habitat features that have not been discovered yet. These increases in habitat protections will benefit the biodiversity of the deep-sea, preserve ancient groves of corals and sponges, and enhance and protect the productivity of the many species of groundfish that use seafloor habitats.

At multiple stages in the Council process, Oceana submitted comparative GIS analyses to demonstrate how the proposed alternatives would result in either a net gain or a net loss in priority habitat protection, either coastwide or at regional scales.[10] The DEIS takes a similar approach, with like results. Attached to this letter is a science poster we prepared for the 15th Deep-Sea Biology Symposium held in September, in Monterey, California, that presents our most recent analysis comparing the Council's final action under Amendment 28 to status quo management.

Our results, like the DEIS, show the actions under Amendment 28 significantly increases the total area and proportion of priority habitats protected from bottom trawling throughout the U.S. West Coast EEZ (90% of the EEZ will be protected from bottom trawling). In some biogeographic regions and depth zones, however, such as the northern upper slope, Amendment 28 will result in a net loss in the protection of area and a loss in protection for some priority habitat features protected. This action, however, significantly increases coral and sponge protection throughout the West Coast region and in all five National Marine Sanctuaries. Importantly, even with the overall increase in habitat protections, the Amendment 28 preferred alternatives result in a net increase in bottom trawl fishing opportunities by reopening certain historic fishing grounds where bottom trawling has been prohibited in recent years to recover overfished rockfish populations. The combined effects of the three preferred alternatives (Alt. 1.h, Alt 2.d, and Alt. 3) is why this action is widely viewed as a "win-win" for fisheries and conservation.

2. The proposed EFH conservation areas in Alternative 1.h will protect ecologically important seafloor habitats.

We wish to emphasize our strong support for EFH Alternative 1.h. Included in this preferred alternative are many important ecological areas like the glass sponge reef north of Grays Canyon off

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[8] National Oceanic and Atmospheric Administration, Coral Reef Conservation Program. 2010. NOAA Strategic Plan for Deep-Sea Coral and Sponge Ecosystems: Research, Management, and International Cooperation. Silver Spring, MD: NOAA Coral Reef Conservation Program. NOAA Technical Memorandum CRCP 11. 67 pp. Page 31.

[9] DEIS at ES-9.

[10] E.g. Oceana (March 19, 2018) Updated Comparative Geospatial Analysis of Combined U.S. West Coast Essential Fish Habitat and Trawl Rockfish Conservation Alternatives. Pacific Fishery Management Council, April 2018 Briefing Book, Public Comment 2. Available: https://www.pcouncil.org/wp-content/uploads/2018/04/F3c_Public_Comment2_Oceana_Full_Electric_Only_Apr2018BB.pdf,

Washington (the largest known glass sponge bioherm off the U.S. West Coast), Arago Reef off Oregon, Samoa Deepwater (over 2,000 coral observations), the Farallon Escarpment and the 'Football' located in the Greater Farallon's National Marine Sanctuary off California, to name a few.

We strongly support the Southern California Bight EFH Conservation Area in Alternative 1.h. This precautionary closure will afford protections to both known and yet to be discovered living seafloor habitats that provide nursery grounds and complex structure supporting the productivity of this region's fisheries. Deep-sea research by NOAA, Oceana and others have demonstrated seafloor habitats in this area are incredibly rich and biodiverse.[11] According to the NOAA Deep Sea Coral and Sponge database there are nearly 8,000 coral records and over 13,750 sponge records in the proposed Southern California Bight EFHCA. NOAA research currently underway is sure to produce new discoveries. Earlier this year, NOAA scientists published a peer-reviewed scientific journal article entitled Distribution of deep-water corals, sponges, and demersal fisheries landings in Southern California, USA: implications for conservation priorities, which developed a new method to identify areas of high richness, abundance, and fishing intensity. The study concluded that many highly ranked areas (e.g., West Catalina Island, San Clemente Island, 9-Mile Bank, Santa Rosa Flats) are included in the Southern California Bight EFH Conservation Area in Alternative 1.h.[12] (Attached).

We also appreciate the work by the California Department of Fish and Wildlife (CDFW) to examine logbook data and historical catches in this region, which along with direct consultations with key fishing representatives, helped refine the shoreward boundary to maintain existing trawl grounds in federal waters used by the state-managed bottom trawl fleet. The proposed Southern California Bight EFHCA was supported by the Council's Groundfish Advisory Panel[13] This, and the other proposed EFHCAs in Alternative 1.h would not negatively impact existing fisheries. These protections apply to bottom trawling only, while continuing to allow and safeguard important recreational and fixed gear commercial groundfish fisheries.

3. **The proposed deep-sea conservation area off California encompassing all areas deeper than3,500 meters, is an important precautionary action to safeguard deep-sea ecosystems.**

Oceana strongly supports Alternative 3 to protect the deep-water region offshore California (> 3,500 m) from all bottom-contact gear using MSA authorities under Section 303(b) of the Act. We agree with the agency's decision as described in the DEIS to implement this conservation area specifically using "MSA Sections 303(b)(2)(A), 303(b)(2)(B), and 303(b)(12)."[14] As described in the DEIS, "Although no bottom fishing is currently occurring in these waters, this proposed closure is viewed as a precautionary measure to protect sensitive deep-sea habitats."[15]

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[11] Marine Applied Research and Exploration has provided the following link to share highlights from their recent expedition in partnership with NOAA's Greater Farallones and Cordell Bank National Marine Sanctuaries, United States Geologic Society, and the California Academy of Sciences to locate deep-sea corals and sponges, map sea floor habitats, and assess EFH: https://www.maregroup.org/national-marine-sanctuaries---august-2018.html.

[12] Salgado et al. (2018), Distribution of deep-water corals, sponges, and demersal fisheries landings in Southern California, USA: implications for conservation priorities. PeerJ 6:e5697; DOI 10.7717/peerj.5697, available at https://peerj.com/articles/5697.pdf.

[13] April 2018 PFMC Supplemental GAP Report 1. Available: https://www.pcouncil.org/wp-content/uploads/2018/04/F3b_Supp_GAP_Rpt1_Apr2018BB.pdf.

[14] DEIS at 2-26.

[15] DEIS at 1-2.

In its motion adopting Amendment 19, the Council recommended protecting all waters deeper than 700 fathoms from bottom trawling. NMFS only partially approved this action, however, limiting the extent of the footprint closure to 3,500 meters depth. NMFS acknowledged in the Amendment 19 Record of Decision that "bottom trawling outside 3,500 m . . . is likely to have long-lasting environmental consequences."[16] NMFS continued on to state that hydrothermal vents, soft-bottom sediments and hard bottom areas with biogenic habitat such as deep sea corals beyond 3,500m "are likely to be highly sensitive to impact, including very low levels of fishing effort (e.g. a single trawl), and have extended recovery times (over 7 years)" and concluded that they "can be very sensitive to bottom trawling and would take a long time to recover from this impact."[17] This precautionary closure is supported by deep-sea scientists from around the world, as evidenced in the September 2015 letter submitted to the Council signed by over 100 scientists. [18]

Based on our GIS analysis of the area beyond 3,500 meters to the edge of the West Coast EEZ, this alternative would protect roughly 123,172 square miles of the deep-sea seafloor. NOAA Deep Sea Coral and Sponge Data show this area includes 419 distinct coral observations (including the black coral *Bathypathes alternata* and the stony coral *Fungiacyathus marenzelleri*, the gorgonian coral *Chrysogorgia* sp., and the mushroom soft coral *Anthomastus robustus* at depths from 3,800-4,100 m depth and the bamboo coral *Keratoisis* sp. and *Lepidisis* sp.), plus 1,766 pennatulid observations and 5,211 sponge observations, indicating that this area contains deep sea coral and sponge ecosystems. Moreover, based on fishing effort data provided by NMFS in the EFH review process and based on the DEIS, protecting this area would not displace groundfish fishing effort and therefore not have an economic impact on the fishery.

4. **The effects of bottom trawling on seafloor habitats are significant but not well documented in the DEIS.**

The effects of bottom trawling, while extensively documented in the scientific literature and in the Council record, are assumed but not well documented in the Amendment 28 DEIS. In a few places in the DEIS, there are statements that bottom trawls impact seafloor habitats. For example, the DEIS states, "The most sensitive types of habitat are those with HFI [habitat forming invertebrates], and they may require decades to hundreds of years to fully recover from bottom-trawl impacts."[19] The DEIS also states, "The most damaging of the bottom-contact gear would be bottom trawling...."[20] and, "[t]he loss of protections for these habitats may, in the long term, indirectly reduce the ecosystem function that they provide as habitat is degraded by bottom trawling."[21]

We recommend, however, that the Amendment 28 EIS reference the scientific literature on the effects of bottom trawling on seafloor habitats, including, at a minimum, referring to the PFMC EFH

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[16] National Marine Fisheries Service, Record of Decision: Final EIS for EFH Designation and Minimization of Adverse Impacts at 18 (2006).
[17] *Id.* at 24.
[18] PFMC, September 2015 Briefing Book, Agenda Item H.8.b, Suppl. Public Comment 6. http://www.pcouncil.org/wp-content/uploads/2015/09/H8b_SUP_PubCom6_SEPT2015BB.pdf.
[19] DEIS at 4-26.
[20] DEIS at 4-26.
[21] DEIS at 4-43.

Review Committee five-year review report, Appendix J,[22] which synthesizes current studies on bottom trawl impacts as well as the NMFS 2005 EFH EIS.[23]

The literature documenting the effects of bottom trawling, dredging and other fishing on seafloor habitat is substantial. There is general scientific consensus that bottom trawling has wide ranging effects on habitats and ecosystems. According to the National Academy of Sciences National Research Council (NRC 2002) Report on the Effects of Trawling and Dredging on Seafloor Habitat,[24] these adverse impacts include:

- changes in physical habitat of ecosystems
- changes in biologic structure of ecosystems
- reductions in benthic habitat complexity
- changes in availability of organic matter for microbial food webs
- changes in species composition
- reductions in biodiversity

Bottom trawling is the leading, most widespread cause of reduced habitat complexity that is taking place among major fishing grounds along the North American continental shelf. As trawl gear can crush, displace, expose and bury marine life on the sea floor, habitats that are trawled are far more likely to have reduced overall species diversity. The National Research Council report concluded that the impacts of trawling can lead to measurable changes in benthic habitats over time, with the greatest impact on those communities which are ecologically most complex. Extended trawling over the same habitat can lead to "a shift from communities dominated by species with relatively large adult body size towards dominance by high abundances of small-bodied organisms."[25] Significantly, areas of intense trawling activities have the potential to be permanently affected and will lead to the emergence of short-lived organisms which are "readapted to conditions of frequent physical disturbance." (NRC 2002).

5. The thorough PFMC EFH review and public process demonstrates strong support for the preferred EFH, RCA and deep-sea ecosystem alternatives.

The Council initiated its EFH review process in 2010 when it convened its EFH review committee. That process ensured a robust examination of the scientific information on the location and extent of priority habitat features, fishing effort and distribution, and an open public process that encouraged stakeholder participation. This process led toward a positive, win-win outcome as evidenced by the Council's final action in April 2018. The Council process included three important phases: Phase 1) data collection, Phase 2) data synthesis and a request for proposals to modify EFH designation or

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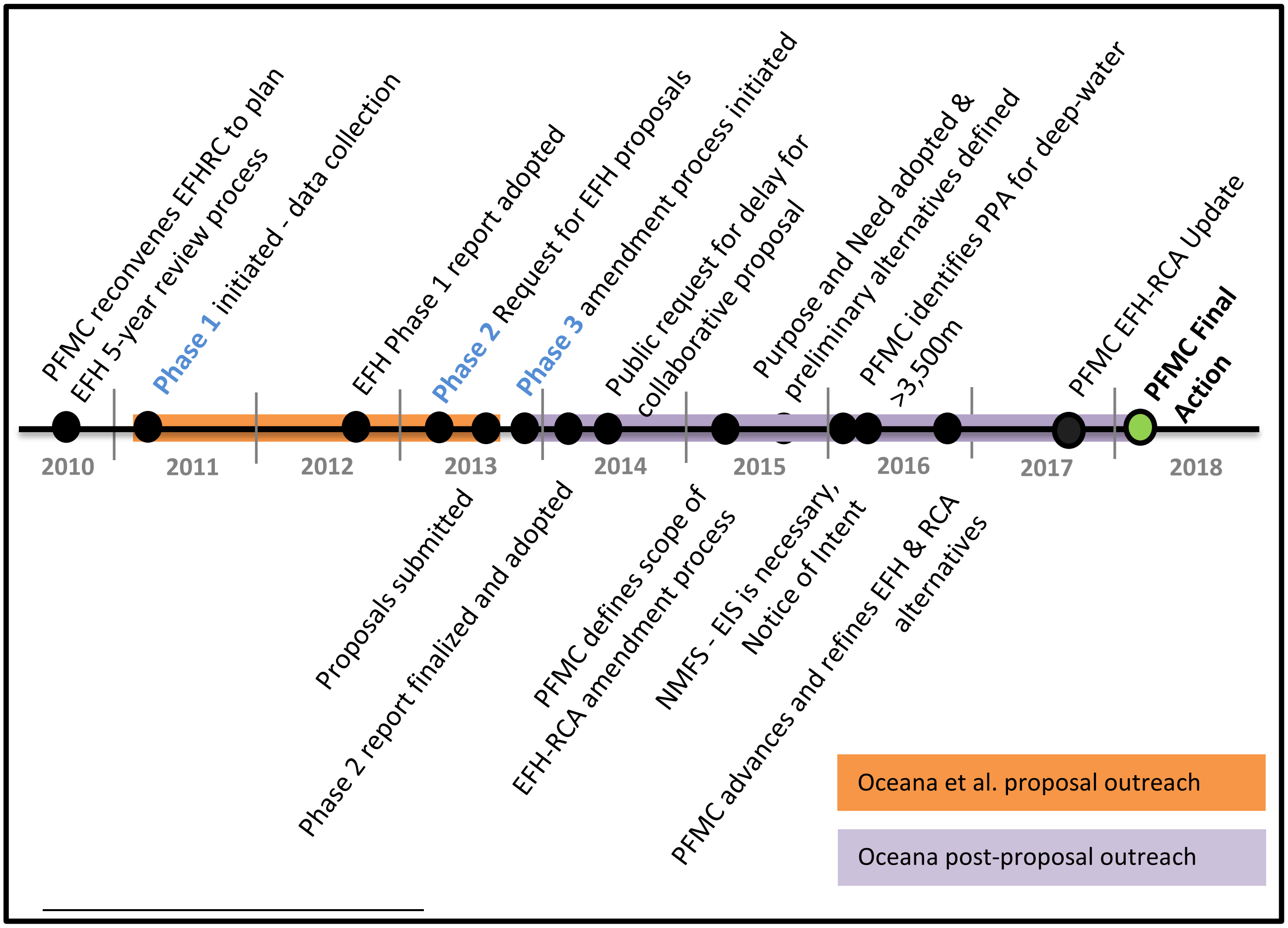
[22] Pacific Fishery Management Council (PFMC) (2012). Pacific Coast Groundfish 5-year Review of Essential Fish Habitat; Report to the Pacific Fishery Management Council Phase I: New Information. Available at: http://www.pcouncil.org/groundfish/background/document-library/pacific-coast-groundfish-5-year-review-of-efh/ Appendix J: Fishing Gear Impacts Findings from Amendment 19 (EFH) to the Groundfish FMP as Compared to Current Information.
[23] NMFS (National Marine Fisheries Service) 2005. Pacific coast groundfish fishery management plan, Essential fish habitat designation and minimization of adverse impacts, Final environmental impact statement. NMFS, Northwest Region, Seattle, WA.
[24] National Research Council (NRC) (2002). Effects of Trawling and Dredging on Seafloor Habitat. Washington, D.C, National Academy of Sciences, National Research Council.
[25] Id.

conservation, and Phase 3) a Groundfish FMP amendment process based on the Phase 1 data and Phase 2 proposals (Figure 1).

In Phase 1 the Groundfish EFH Review Committee (EFHRC) solicited, gathered, and provided new scientific information to the Council detailing significant changes in knowledge since the last EFH review was completed in 2006.[26] The EFHRC report included new information on the location and extent of priority habitats, improved bathymetry, changes in fishing effort and area, and updated science on the effects of bottom trawling on seafloor habitats. "Priority habitats" are defined consistent with the Amendment 19 Environmental Impact Statement (EIS) definition of "complex sensitive habitats." Priority habitats include hard substrate, including rocky ridges and rocky slopes; habitat-forming invertebrates, including deep-sea corals, sponges and sea pens; submarine canyons and gullies; seamounts; and the highest 20 percent habitat suitability for overfished groundfish species as defined by NMFS.[27,28]

Many members of the public including scientists, the fishing industry and conservation organizations made significant investments in this process. The Council and NMFS should be proud of the robust public process and significant stakeholder engagement.

Figure 1. Timeline of Pacific Fishery Management Council EFH review process



[26] PFMC 2012. Pacific Coast Groundfish 5-Year Review of Essential Fish Habitat Report to the Pacific Fishery Management Council Phase 1: New Information. Agenda Item H.6.b EFHRC Report 1. September 2012. Available: https://www.pcouncil.org/wp-content/uploads/H6b_EFHRC_RPT_1_SEP2012BB.pdf.
[27] PFMC 2006. Agenda Item F.5.a EFH/RCA Project Team Report, at 5.
[28] DEIS at xviii

Oceana contributed to this process by collecting new data on the location of priority habitat features, and groundfish distributions and associations. We collected this data using remotely operated vehicles to survey seafloor habitats off California, Oregon and Washington during at-sea expeditions in 2010, 2011, 2013, and 2016. We participated as an active member of the EFHRC. We worked with partners at the Ocean Conservancy and Natural Resources Defense Council to submit a comprehensive proposal for modifications to EFH. Starting as early as February 2011, before, during, and then after the development of our proposal, we reached out to and met with Tribes, West Coast fishermen, fishing representatives and other stakeholders coastwide, plus members of the Council and its committees, NMFS managers and scientists, West Coast Sanctuaries, and state fish and wildlife agencies (Figure 1). We participated in the Monterey Bay National Marine Sanctuary collaborative EFH proposal process from the fall of 2012 through proposal submission in July 2013. We contributed to an updated literature review on biogenic habitats and groundfish EFH, and we provided the Council with scientific reports, proposal summaries, and GIS analyses to help inform understanding of the areas we are working to protect. We also conducted a series of scientific expeditions throughout the U.S. West Coast using remotely operated vehicles that characterized seafloor habitats and documented the co-occurrence of dozens of Pacific Coast Groundfish FMP species with a variety of types of corals and sponges. For example, in the Southern California expedition, we documented 31 FMP species on transects containing corals and sponges. We provided detailed analysis of the results of each of these expeditions to the Pacific Fishery Management Council throughout this process.[29]

6. Other comments on the DEIS.

a. The discussion of Tribal usual and accustomed boundaries on page 1-5 of the DEIS should be updated to reflect the October 25, 2018 notice in the Federal Register[30] implementing the revised western boundaries of the usual and accustomed fishing areas of the Quileute Indian Tribe and Quinault Indian Nation. Maps in the DEIS do not show this revised boundary, however, it may be important to point out that the revised boundaries were used by the PFMC at the time of final action when adopting the Grays Canyon Northern Modification area in Alternative 1.h.

b. The DEIS does not use coral and sponge observations to quantify the abundance of these habitat forming invertebrates in the proposed open and closed areas. The DEIS states that "the absence of consistent abundance data precludes the ability to determine, in a standardized way, the relative importance of individual areas to corals, sponges, or sea pens."[31] While this is true when reviewing the modifications on a whole, we note that in some places coral and sponge abundance data was instrumental in the design of proposed EFH conservation areas and it was important in the decision-making process.

[29] Oceana Southern California Expedition (2016):
https://usa.oceana.org/sites/default/files/exploring_the_living_seafloor_report_med_res_spreads.pdf.
Oceana Southern Oregon Expedition (2011):
https://oceana.org/sites/default/files/reports/Oceana_S.OregonIEA.ExpeditionReport_Final.pdf.
Oceana Monterey Bay Expedition (2010):
https://oceana.org/sites/default/files/reports/Monterey_Bay_Report.pdf.
[30] 83 Fed Reg. 53,827 (October 25, 2018).
[31] DEIS at 4-4.

Data collected from NOAA, Oceana and MBARI cruises helped inform the identification and adoption of EFH conservation areas contained in Alternative 1.h. For example, just the presence of corals in the "Brush Patch" area off Northern California was not the reason for the wide support for this site. This proposed EFHCA has broad support because of industry knowledge of the area <u>and</u> because NOAA identified over 7,000 coral colonies there. Shortly before final Council action, the boundaries of the site were modified to include additional coral observations identified during NOAA cruises. As another example, the DEIS states there are seven one kilometer grid cells containing sponge in the Grays Canyon Northern Modification area, but this understates the fact that there are over 3,600 records of glass sponges identified there, making this site a high priority for conservation. Similarly, NOAA National Marine Sanctuary coral data at the Football and MBARI coral observations at the Samoa Deep-water area were used in the design and adoption of these areas in Alternative 1.h. We recommend the DEIS at least include qualitative discussion of areas like these where coral and sponge abundance data influenced the design and adoption of the proposed EFHCAs.

c. Table A-13, is mislabeled as "Alternative *1.n*, the Preferred Alternative". It should be Alternative 1.h. Similarly, Table C.3 is mislabeled at "Alterative *1.a*, Preferred Alternative" when it should be 1.h.

7. We encourage NMFS to finalize the Amendment 28 DEIS and promulgate implementing regulations.

The Pacific Fishery Management Council and NMFS West Coast Region has long recognized that habitat protection is fundamental to maintaining vibrant West Coast groundfish fisheries, and it has a track record of leadership on this pillar of ecosystem-based management. We appreciate the deliberate, step-wise approach and the resources that the Council and NMFS invested in the process. This deliberate and inclusive process has already paid major dividends with a unanimous final Council decision.

We believe the DEIS sufficiently analyzes a reasonable and full range of alternatives that enable implementation of the three final preferred alternatives. Alternatives 1.h, 2.d and 3, when combined, significantly increase overall habitat protection from bottom trawling and increase bottom trawl fishing opportunities. We urge NMFS to prioritize the completion of this analysis and to finalize rulemaking by late 2019 as described in the DEIS.[32]

Thank you for your time and attention to this important conservation and fishery management issue.

Sincerely,

Ben Enticknap
Pacific Campaign Manager & Sr. Scientist

Geoff Shester, Ph.D.
California Campaign Director & Sr. Scientist

[32] DEIS at ES-9.

Attachments:

Enticknap et al. (2018). Protecting the Deep-Sea: Geospatial Analysis of U.S. West Coast Pacific Essential Fish Habitat and Rockfish Conservation Area Changes.

Tissot et al. (2016). Scientist sign-on letter on U.S. West Coast Essential Fish Habitat and Conservation. Letter to Barry Thom (NMFS) and the Pacific Fishery Management Council. Agenda Item F.4c Public Comment November 2016.

Protecting the Deep-Sea

Geospatial Analysis of U.S. West Coast Pacific Essential Fish Habitat and Rockfish Conservation Area Changes

B. Enticknap, B. Mecum, G. Shester, E. Kincaid, A. Blacow, M. Combs and S. Murray

Introduction

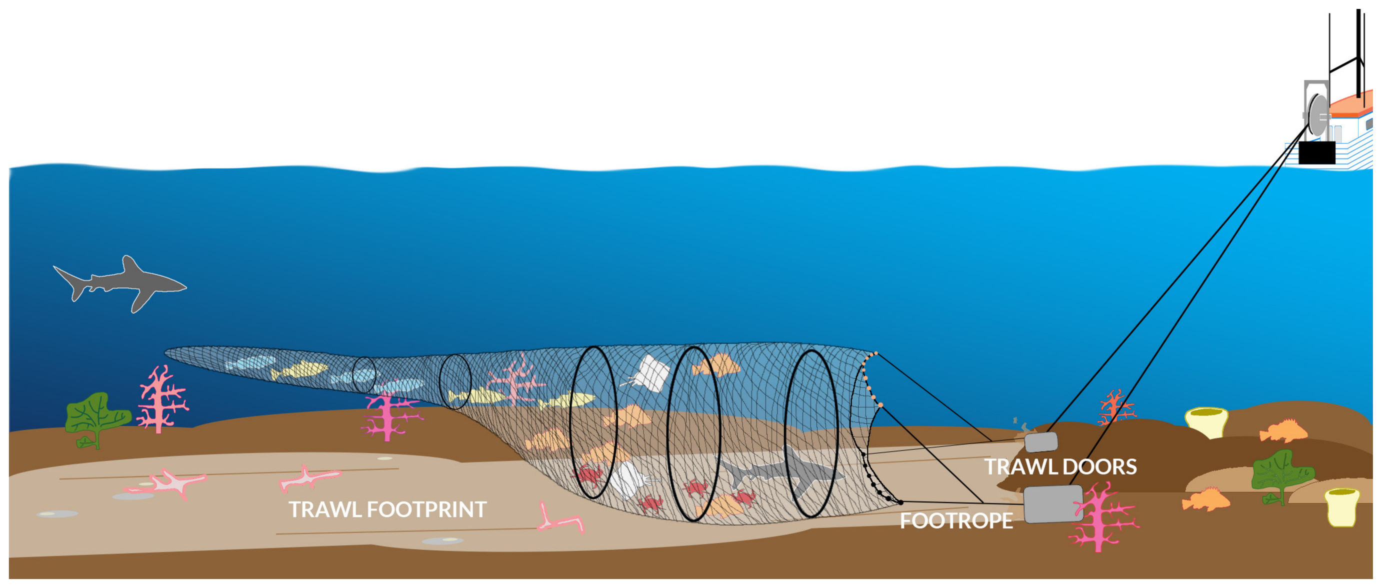
In April 2018, the U.S. West Coast federal Pacific Fishery Management Council took final action on a range of alternatives to protect over 140,000 square miles of marine habitats in federal ocean waters (3 – 200 nautical miles) off the U.S. West Coast from bottom trawling and other bottom contact fishing gears. The fishery council's unanimous decision followed an intensive review of existing essential fish habitat (EFH) conservation areas closed to bottom trawling, bottom trawl fishing effort, and new science on the location and extent of priority habitat features like deep-sea corals, sponges, submarine canyons and rocky substrates. The decision reflects public proposals for new and modified conservation areas, including a comprehensive coastwide conservation proposal developed by the international marine conservation organization, Oceana.

Here we present results of our Geographic Information Systems (GIS) analysis of the fishery council's final combined deep-sea conservation area, EFH conservation area, and rockfish conservation area recommendations, compared with current, status quo management. Once implemented by the National Marine Fisheries Service, 90% of all federal and state ocean waters off the U.S. West Coast will be closed to bottom trawling and significant bottom trawl fishing opportunity will be maintained and restored.

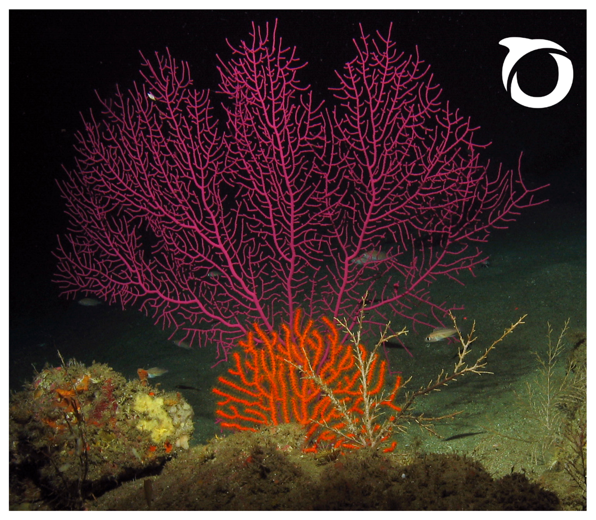
The Oceana Approach to Protecting Seafloor Habitats

The overall goal of Oceana's Pacific seafloor habitat campaign is to protect vulnerable marine ecosystems from the primary threat of bottom trawl fishing gear while supporting and maintaining vibrant fishing opportunities and coastal communities. We designed and advocated for a comprehensive coastwide conservation proposal to prohibit the geographic expansion of bottom trawling, protect areas with known sensitive and diverse seafloor habitats, and minimize fishing effort displacement.

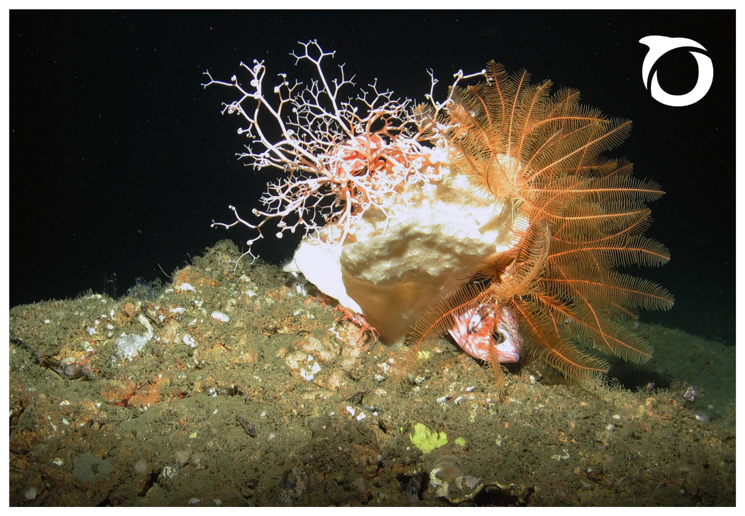
We used publicly available spatial data compiled for the fishery council's EFH review to identify areas that warrant protection from bottom trawling. With GIS data and analysis, we identified areas known to contain priority habitat features sensitive to bottom trawl impacts, including hard substrate, biogenic habitats, submarine canyons, ridges, banks and escarpments. We identified areas with high regional coral and/or sponge bycatch, priority habitats within National Marine Sanctuaries, and areas currently subject to very low or no trawl effort that may contain sensitive habitats, but where little or no habitat data are available. We analyzed bottom trawl fishing effort data to avoid areas of high importance to the fishery and to assess potential economic costs in terms of potential fishing effort displacement. We mapped and analyzed our proposal at coastwide and biogeographic scales, analyzed and compared other alternatives under consideration, and presented our comparative analyses to decision makers to inform the fishery council's final decision.



Commercial bottom trawl vessels targeting rockfish, California halibut, dover sole, Pacific cod and lingcod off the U.S. West Coast drag large, heavy doors and footropes across important coral and sponge habitats, destroying nearly everything in their path. The distance between the heavy trawl doors can be from 110 to 650 feet wide and the doors can weigh up to 1300 pounds. * *Illustration is representative of gear used, not set to actual scale.*



Colorful species of gorgonian corals including this purple *Eugorgia rubens* and orange *Adelogorgia phyllosclera* in the new Southern California Bight EFH conservation area.



A rockfish finds shelter under a sponge adorned with a basket star and fern stars offshore Southern California.

Results: Pacific Fishery Management Council Final Action

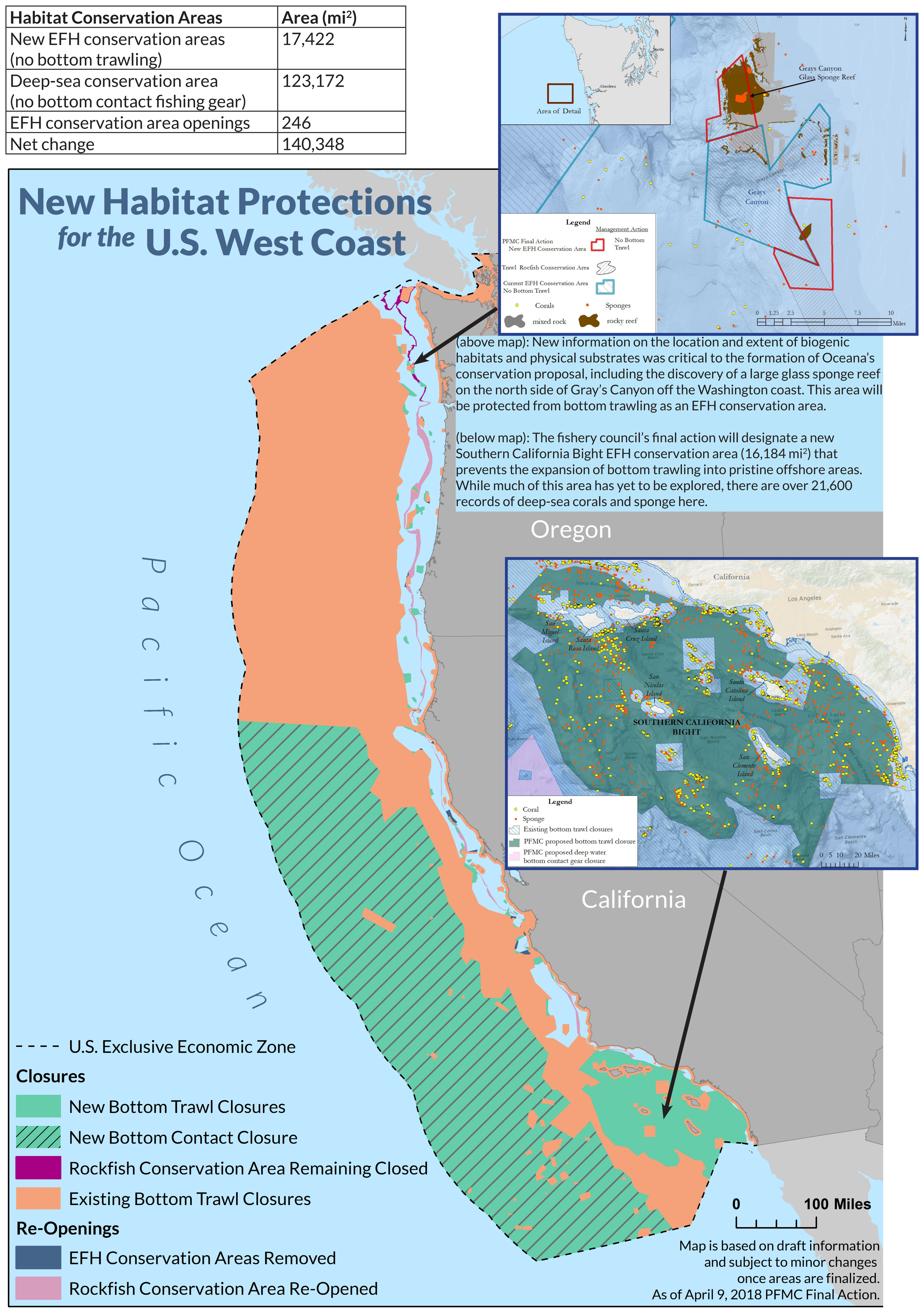
The fishery council's final action in April 2018:

1. Designates 53 new and modified EFH conservation areas closed to bottom trawling adding 17,422 mi² and removing 246 mi² of currently designated conservation areas with a net increase of 17,176 mi²;
2. Removes 2,092 mi² of the trawl rockfish conservation area off Oregon and California, while keeping 1,482 mi² of the rockfish conservation area closed in the area off Washington and in certain places off Oregon and California where the rockfish conservation area overlaps new and existing EFH conservation areas or state-waters closed to trawling;
3. Protects the deep-sea ecosystem off California (>3,500 m) from all bottom contact fishing gears in an area totaling 123,172 mi².

Since there is overlap between some EFH conservation areas and rockfish conservation areas, we evaluated the total area and the proportion of priority habitats inside all year-round bottom trawl closures in the baseline (current suite of state and federal regulations) and what will be protected under the council's final action.

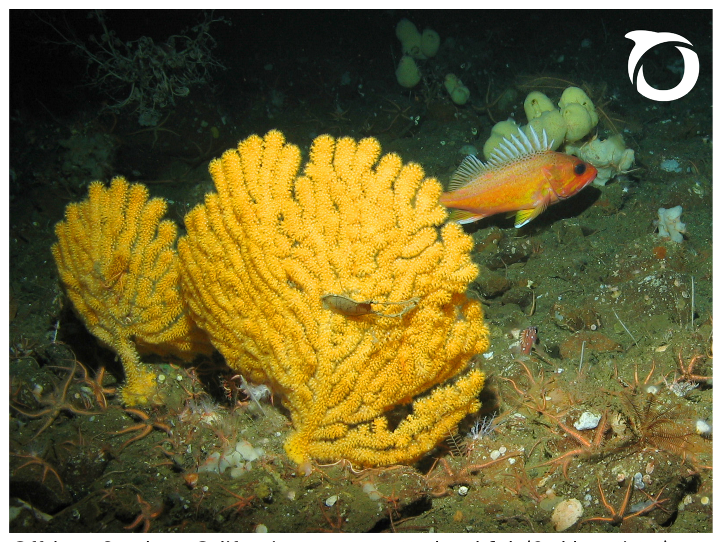
Overall, the council action significantly increases the total area and proportion of priority habitats protected from bottom trawling throughout the U.S. West Coast EEZ (Figures 1-2). In some biogeographic regions and depth zones, such as the northern upper slope, the council's action resulted in a net loss in the protection of area and a loss in protection for some priority habitat features (Fig. 3). The council action increases coral and sponge protection in all five National Marine Sanctuaries (Fig. 4). Even with the overall increase in habitat protections, the fishery council's action results in a net increase in bottom trawl fishing opportunities by reopening certain historic fishing grounds where bottom trawling has been prohibited in recent years to recover overfished rockfish populations (Figure 5). Considering both the new openings and closures, the net sum of the action will restore approximately 25% of the historic fishing effort that was previously displaced.

Habitat Conservation Areas	Area (mi²)
New EFH conservation areas (no bottom trawling)	17,422
Deep-sea conservation area (no bottom contact fishing gear)	123,172
EFH conservation area openings	246
Net change	140,348

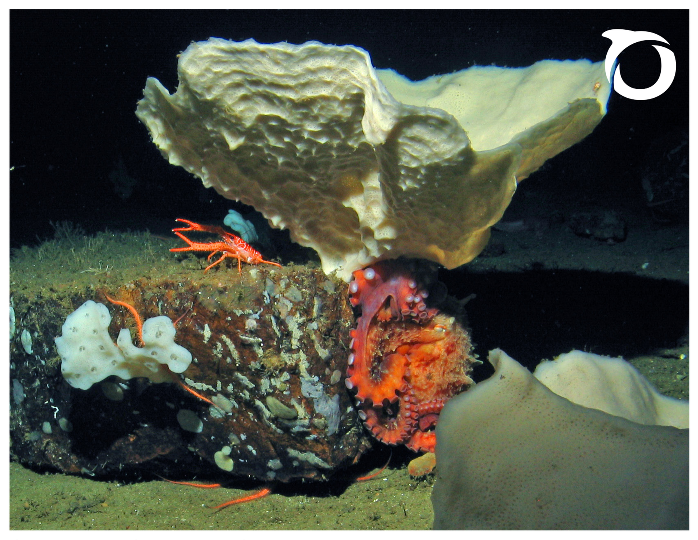


(above map): New information on the location and extent of biogenic habitats and physical substrates was critical to the formation of Oceana's conservation proposal, including the discovery of a large glass sponge reef on the north side of Gray's Canyon off the Washington coast. This area will be protected from bottom trawling as an EFH conservation area.

(below map): The fishery council's final action will designate a new Southern California Bight EFH conservation area (16,184 mi²) that prevents the expansion of bottom trawling into pristine offshore areas. While much of this area has yet to be explored, there are over 21,600 records of deep-sea corals and sponge here.



Offshore Southern California, a greenspotted rockfish (*S. chlorostictus*) hides behind yellow gorgonian coral (*Acanthogorgia sp.*).



An octopus hides out while a squat lobster stands guard beneath a vase sponge west of Santa Barbara Island, California.

Figure 1

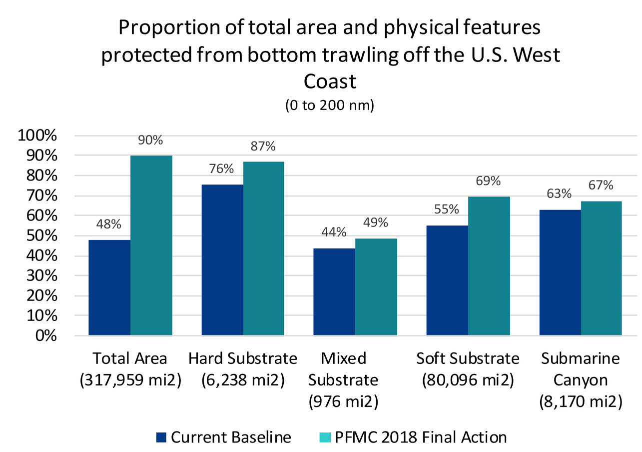


Figure 2

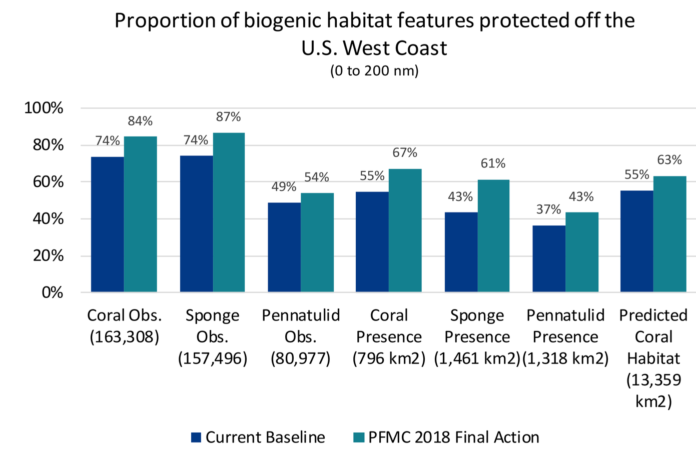


Figure 3

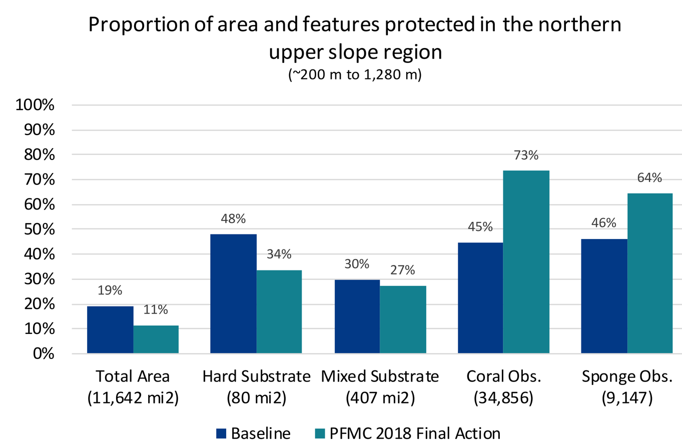
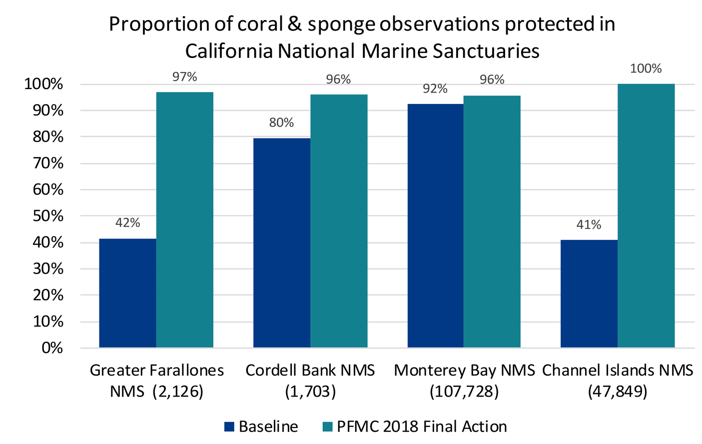
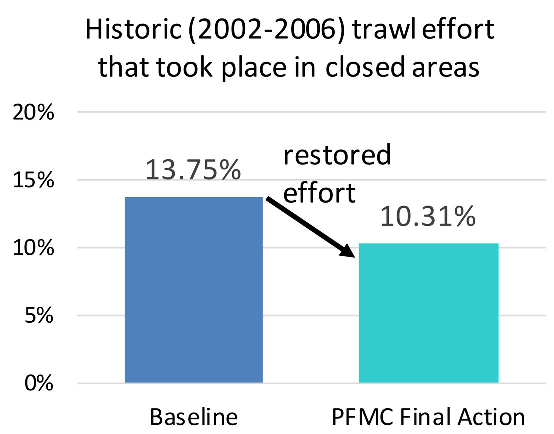


Figure 4



Figures 1 to 4. Proportion of total area, substrate and/or biogenic habitat features in the U.S. West Coast EEZ, northern upper slope (Cape Mendocino, CA to U.S./ Canada border) and California National Marine Sanctuaries protected from bottom trawling under current management (baseline) compared with the final action alternatives adopted by the Pacific Fishery Management Council (PFMC). Numbers in parenthesis represent the total amount of each feature represented in the study area.

Figure 5



Study Area: U.S. West Coast (0 to 200 nm)	Total in Study Area	Closed to Bottom Trawling	
		Baseline	PFMC Final Action
Total Area (mi²)	317,959	152,021	285,497
Hard Substrate (mi²)	6,238	4,710	5,409
Mixed Substrate (mi²)	976	428	475
Soft Substrate (mi²)	80,096	44,261	55,610
Submarine Canyon (mi²)	8,197	5,153	5,498
Coral Observations (#)	163,308	120,388	137,815
Sponge Observations (#)	157,496	116,605	136,530
Pennatulid Observations (#)	80,977	39,524	43,373
Coral Presence (1x1 km²)	796	436	536
Sponge Presence (1x1 km²)	1,461	634	898
Pennatulid Presence (1x1 km²)	1,318	481	572
Predicted Coral Habitat (km² of high suitability, all taxa)	13,359	7,399	8,466

Figure 5. Proportion of total coastwide bottom trawl effort (2002-2006) contained within areas closed to bottom trawling under the baseline set of closed areas and under the PFMC final action. Publicly available trawl tow data is based on an aggregate line density analysis provided in the NOAA, OSU EFH Data Catalog. Aggregated data likely overestimates displaced effort due to buffers around trawl tows overlapping closed areas.

Conclusion

GIS analysis played an important role in the Pacific Fishery Management Council's process to protect seafloor habitats from bottom trawling. Oceana submitted a comprehensive coastwide proposal and provided comparative GIS analyses to help the council select among various proposed open and closed areas and to achieve win-win outcomes that increase fishing opportunities and habitat protections at coastwide and regional scales. These increases in habitat protections will benefit the biodiversity of the deep-sea, preserve ancient groves of corals and sponges, and enhance the productivity of the many species of groundfish that use seafloor habitats. In a few specific areas, however, particularly the upper-slope depth zone off northern California and Oregon, the council's final action will result in a loss of protection for some priority habitat features. This is because of the simultaneous opening of the trawl rockfish conservation area and the opening of some existing EFH conservation areas. The fishery council's recommendations are now before the National Marine Fisheries Service for rulemaking.

Spatial Data Sources

NOAA, Oregon State University. Consolidated EFH Geographic Information Data Catalog. Available: http://efh-catalog.coas.oregonstate.edu/overview/

Biogenic Habitat Data from: NOAA Deep Sea Coral and Sponge Database (observations). Available: https://deepseacoraldata.noaa.gov/ Database version December 14, 2017 & NOAA NWFSC FRAM Data Warehouse (coral, sponge and pennatulid presence).

Areas of high predicated coral habitat: Guinnotte, J. M. and A. J. Davies (2012). Predicted deep-sea coral habitat suitability for the U.S. West Coast. Report to NOAA-NMFS. 85 pp.

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SCIENTIST SIGN-ON LETTER ON U.S. WEST COAST ESSENTIAL FISH HABITAT CONSERVATION AND MANAGEMENT

October 18, 2016

Mr. Barry Thom, Administrator
National Marine Fisheries Service West Coast Region
7600 Sand Point Way NE, Bldg. 1
Seattle, WA 98115-0070

Mr. Herb Pollard, Chair
Pacific Fishery Management Council
7700 NE Ambassador Place, Suite 101
Portland, OR 97220-1384

RE: U.S. West Coast Essential Fish Habitat Conservation and Management

Dear Mr. Thom, Mr. Pollard and Council members:

Seafloor habitats are important to the health and biodiversity of our oceans. In order to conserve seafloor habitats, we the undersigned 57 marine scientists and conservation biologists write in support of amending the Pacific Fishery Management Council's (PFMC) Groundfish Fishery Management Plan to designate new and expanded Essential Fish Habitat Conservation Areas off the U.S. West Coast that would be closed to bottom trawling. As you evaluate alternatives to modify existing Essential Fish Habitat (EFH) Conservation Areas closed to bottom trawling, and consider new EFH Conservation Areas, changes to Rockfish Conservation Areas, and the protection of deep-sea habitats, we recommend a comprehensive spatial habitat protection approach designed to protect and conserve ecologically important, sensitive and unique habitats. We caution against opening existing EFH Conservation Areas unless there is compelling scientific information which demonstrates that impacts to the habitats in those areas are minimal.

1. **Effects of bottom trawling on seafloor habitats**

The substantial harmful effects of bottom trawling on seafloor communities have been well documented in many scientific reviews and empirical studies worldwide (e.g. Auster and Langton 1999, Collie et al. 2000, NRC 2002, Kaiser et al. 2006; Hixon and Tissot, 2007). Specific to the West Coast region, bottom trawls have the greatest impact to seafloor habitats of all gear types used (Morgan and Chuendpagdee 2003 and Whitmire and Clarke 2007). While gear configuration depends on the target species and depth, the distance between trawl doors, which are designed to contact the seafloor and spread the net open, spans anywhere between 34 and 50 meters (112 to 164 feet) for trawls fishing on the continental shelf to 50 to 200 meters (164 to 656 feet) for slope trawls (PFMC 2005). All trawl gear components that contact the seafloor have the potential to ensnare, undercut or topple seafloor habitat structures.

Bottom trawling can cause long-term, adverse impacts to fish habitat. According to findings of the National Academy of Sciences, bottom trawling has direct effects on species and habitat structure and indirect effects on community structure and ecosystem processes (NRC 2002). The effects of bottom trawling include:

- Changes in physical habitat and biological structure of ecosystems
- Reduced benthic habitat complexity and productivity
- Changes in availability of organic matter for microbial food webs
- Changes in species composition
- Reduced biodiversity
- Increased susceptibility to other stressors.

Even with existing conservation areas, bottom trawling damages other sensitive seafloor habitats. For example, U.S. West Coast groundfish observers on commercial bottom trawl vessels documented nearly 997 kg (2,198 pounds) of coral bycatch and 20,585 kg (45,382 pounds) of sponge bycatch between June 2006 and December 2010, <u>after</u> EFH Conservation Areas were implemented (Clarke et al. 2015). Impacts to sponges have become twice as frequent, with nearly five times the magnitude as before. Bycatch and *in situ* observations of damaged coral and sponges are direct evidence of adverse fishing impacts. These losses are not inconsequential.

2. Ecological importance of seafloor habitats

Marine habitats are fundamental to the health and diversity of marine species. The marine habitats of the West Coast support fish and wildlife at the most basic level by providing the conditions necessary for populations to sustain themselves. Biologically diverse, sensitive and unique habitats off the West Coast include nearshore and offshore reefs, submarine canyons, biogenic habitats (e.g. kelp, corals and sponges), hydrothermal vents, methane seeps and more.

Living habitat-forming invertebrates such as corals and sponges increase habitat complexity and sustain patterns of biodiversity in ocean ecosystems. By providing structure, corals and sponges increase the areas necessary for fish spawning, feeding, and growth and thus meet the definition of EFH. What is more, coldwater corals can be extremely long-lived and recovery from disturbance may take decades to centuries. Bamboo corals from Davidson Seamount off California, for example, were aged to be greater than 145 years old with growth rates of no more than 0.28 cm/ year (Andrews et al. 2009). Deep-sea corals in other Pacific regions have been aged to over 4,000 years (Roark et al. 2009). While corals and sponges are relatively conspicuous biogenic structures, they generally occur in diverse biological communities with other invertebrates such as crinoids, basket stars, ascidians, annelids, and bryozoans.

Many marine species utilize the vertical and three-dimensional structure provided by corals, sponges and other living seafloor habitats. Managed fish species off the U.S. West Coast have been documented in association with structure-forming invertebrates with some studies finding significantly higher densities of fish in these habitats than in surrounding areas (e.g., PFMC 2005 at 3-6, Tissot et al. 2006, Marliave et al. 2009, Rooper et al. 2007, Rooper and Martin 2012). Based on the levels of information currently available (i.e., presence, density), corals, sponges and other biogenic habitat types should be considered to be components of EFH for multiple fish species managed in the U.S. Pacific Coast groundfish fishery management plan.

Since 2006 much new information has been gathered on the location and extent of seafloor habitats off the West Coast. The NOAA Deep Sea Coral Research and Technology Program released a geo-database of almost 140,000 coral and sponge records identified from trawl surveys and *in situ* observations. NOAA has generated new maps showing the extent and intensity of commercial bottom trawl fishing effort, as well as the bycatch of corals and sponges (NOAA 2014). There is a new predictive deep sea coral habitat suitability model (Guinotte and Davies 2014) as well as new high resolution maps of various reefs, banks and escarpments off Washington, Oregon and California. All combined these new data and maps illustrate areas of interaction between bottom trawls and sensitive seafloor habitats.

3. Precautionary and adaptive management approaches are warranted

Ocean ecosystems face major stressors including fishing impacts, offshore development, marine pollution and the growing changes brought by climate change, in particular ocean acidification. Ocean acidification poses a significant and long-term concern for some coral species. While reducing carbon dioxide emissions is urgently needed, fishery managers can take actions that address direct impacts to ocean habitats. Protecting seafloor habitats from bottom trawling will help these habitats and associated communities remain intact and thus will be more resilient to other stressors and help maintain the ecological functions they provide (Levin and Le Bris 2015).

As you evaluate and consider the range of alternatives before you to modify EFH and Rockfish Conservation Areas and to protect deep-water habitats, we urge a precautionary approach that maximizes habitat protection across a range of habitat types, biogeographic regions and depth zones. Best practices include approaches to freeze the bottom trawl footprint thus limiting future bottom trawling to previously trawled areas, area closures for sensitive and representative habitat features, gear modification and effort reduction (Hourigan 2009, NRC 2002). A precautionary approach is paramount, especially where the data are poor and unclear, where recovery times are long (e.g. corals and sponges) and where habitat impacts are high even when the abundance of managed fish species is above overfished levels.

Protecting seafloor habitats from bottom trawling will help limit and prevent direct disturbance, reduce cumulative stresses, and help ecological communities be more resilient to change. While comprehensive information may not be available on the location of all habitat types and species-habitat associations, there is much new and existing data that can be used in combination with a precautionary approach to continue to protect diverse seafloor habitats from bottom trawl impacts.

Sincerely,

Brian Tissot

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Citations

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November 19, 2018

Gretchen Hanshew
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National Marine Fisheries Service
West Coast Region
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RE: Groundfish Fishery Management Plan Amendment 28

Dear Ms. Hanshew,

I am writing today regarding the Notice of Availability (NOA) of the Draft Environmental Impact Statement (DEIS) for Amendment 28 (Am 28) to the U.S. West Coast Groundfish Fishery Management Plan (FMP). Am 28 updates Essential Fish Habitat (EFH) designations and protections including changes to Essential Fish Habitat Conservation Areas (EFHCA), revises a longstanding mortality closures known as the trawl gear Rockfish Conservation Area (RCA), and closes a sensitive unfished area off California to bottom-contact fishing gear under Magnuson Stevens Act (MSA) discretionary authorities.

We are highly supportive of the Final Preferred Alternative (FPA) for Am 28 adopted by the Pacific Fishery Management Council (Council) in April 2018 (consisting of Alternatives 1.h + 2.d + 3.a of the DEIS). This FPA would create 53 new or expanded EFHCA's, partially or completely re-open 17 EFHCA's, replace the RCA off Oregon and California with a system of Block Area Closures (BAC), and close waters deeper than 3,500 meters (123,487 square miles) to bottom-contact fishing gear.

The DEIS contains an accurate and thorough analysis of the biological and socioeconomic impacts of Am 28, and we appreciate the efforts of the National Marine Fisheries Service (NMFS) and Council staff who prepared the document. We concur with the overall conclusion that the habitat and socioeconomic effects of Am 28 will be positive.

Within the fishery footprint the FPA will result in a net increase in areas closed to bottom trawling of over 10,000 square miles, with a 52 percent increase in protections for hard-bottom seafloor (DEIS Section 5.1). Hard bottom, such as rocky reef, is the highest value substrate for habitat-forming invertebrates like corals and sponges, and critically important to juvenile fish.

Am 28 will meet its EFH conservation objectives while also increasing economic opportunity. The FPA reopens important historical fishing grounds, especially by removing the RCA off Oregon and California. The total re-openings (2,958 square miles) constituted nearly 12 percent of fishery revenues during the last period for which data were available just prior to the closure of those areas, contrasted with a loss of only 0.3 percent of revenues from the new closures in

Am 28 (DEIS Section 5.2). We note that the DEIS states that the FPA will "likely increase efficiency and flexibility in management of the groundfish bottom trawl fishery" (DEIS page ES-8).

We appreciate the ongoing efforts of NMFS and the Council to incorporate ecosystem based fishery management (EBFM) in decision-making and analysis, including in Am 28. The precautionary protection of pristine seafloor areas beyond 3,500 meters from future fishing impacts is a forward-looking application of EBFM. Another is the recognition of the importance of methane seeps and their associated biological communities to groundfish resources and the broader ecosystem. We also appreciate the thoughtful analysis of existence values and ecosystem services in the DEIS (Section 4.2.2.2).

While the DEIS is very well developed, we suggest the following additions to the document that will improve the analysis:

- The affected environment description and impacts analysis for Alternative 3.a (the closure of waters deeper than 3,500 meters) should be further developed. There is a great deal of information on the sensitivity of abyssal plain habitats and their importance to the ecosystem, including some that is specific to the area affected by Am 28. For example, the DEIS states that spatial extent is the only habitat metric available for waters deeper than 3,500 m (DEIS Section 4.2.1.1). However, NOAA's Deep Sea Coral Research and Technology database contains over 7,500 coral and sponge observations in this area, indicating that the Habitat-Forming Invertebrate (HFI) Presence metric could be informative for this alternative.[1]

- We agree that despite the significant data limitations described in the DEIS, the economic analysis methodology utilized represents the best information available and an effective decision-making tool. We suggest that the DEIS should also include a description of the methodology review conducted by the Council's Scientific and Statistical Committee (SSC), a review that resulted in an SSC endorsement.[2]

- The description of reasonably foreseeable future actions in the Cumulative Effects Analysis (CEA) should include the Vessel Movement and Monitoring (VMM) action taken by the Council in April 2016. This action, which is expected to complete NMFS rulemaking in March 2019, will increase Vessel Monitoring System (VMS) ping rates, which will improve closed area enforceability and thus increase the effectiveness and efficiency of the Am 28 regulations.

[1] National Oceanic and Atmospheric Administration (2015) National Database for Deep-Sea Corals and Sponges (version 20170324-0). https://deepseacoraldata.noaa.gov/; NOAA Deep Sea Coral Research & Technology Program (data queried 3/22/18)
[2] See PFMC, April 2018 Briefing Book, Agenda Item F.3.b, Supplemental SSC Report 1

In conclusion, we again thank the NMFS and Council staff for this well-developed DEIS. Am 28 is a highly complex action, and the DEIS describes and analyzes it in a concise yet complete manner. We also agree with the conclusions of the DEIS that the overall impacts on habitat, socioeconomics, and fish resources will be positive, and the impact on protected resources will be neutral. Am 28 represents a very successful effort by the Council, in that it substantially increases both habitat protection and fishing opportunity. We appreciate the opportunity to comment, and we look forward to working with NMFS and the Council as Am 28 rulemaking continues next year.

Sincerely,

Tom Rudolph
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The Pew Charitable Trusts
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November 19, 2018

Gretchen Hanshew
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7600 Sand Point Way NE Seattle, WA 98115

RE: Groundfish Fishery Management Plan Amendment 28

Dear Ms. Hanshew,

I wanted to write in strong support of the Draft Environmental Impact Statement for Amendment 28 to the Groundfish Fishery Management Plan. This impressive analysis by the National Marine Fisheries Service (NMFS) and Council staff correctly identifies the Council's Final Preferred Alternative as an important advance in protecting significant habitats while increasing the economic resources that can be accessed by the fishing community.

I particularly would like to draw attention to the use of MSA discretionary authorities to close waters deeper than 3,500m to bottom contact gear. The Draft Environmental Impact Statement identifies several factors that are supportive of this alternative including a lack of understanding of these habitats and the potential long-term and deleterious impacts on cold-water coral species if trawling were to occur. Protection of cold-water corals in these habitats is also consistent with US Fisheries law to minimize adverse effects on essential fish habitat that are not considered temporary; some cold-water corals are known to live for more than a thousand years and can be removed by a single trawling event. I would also emphasize that these depths, as well as other areas at depths <700 fathoms proposed for protection under Am 28, are areas where the processes that occur are key to a healthy ocean; nutrient regeneration in the deep sea fuels surface primary productivity and biological activity impacts the oxygen dynamics of the water that is upwelled on the coast. There are significant benefits to ocean health gained by protecting these habitats that may be lost if the current technological impediments to fishing at those depths were overcome.

During the development and adoption of the Final Preferred Alternative, I have led three separate letters to the council that discuss the importance of and rationale for the >3,500m closure. I am attaching them here as supporting materials. They lend strong support from a diverse range of scientists from around the globe by emphasizing the role of the deep sea, including depths >3,500m, to marine ecosystems and healthy fisheries. In these letters, my colleagues and I identify a variety of Ecosystem Services provided by this habitat and expound why this closure is forward thinking and highly defensible for application of the discretionary authorities under the MSA.

I applaud the NMFS and Council staff for this comprehensive Draft Environmental Impact Statement, a document that very effectively describes and analyzes a highly complex action.

Thank you,

Andrew R. Thurber, PhD
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Please Note: This letter is not a statement on behalf of Oregon State University, and instead summarizes my personal opinions based on my expertise as a deep-sea ecosystem ecologist.

March 30, 2018

Mr. Phil Anderson, Chair

Pacific Fishery Management Council

7700 NE Ambassador Place, #101

Portland, OR 97220

RE: Scientists statement on Groundfish FMP Amendment 28 Final Preferred Alternatives (public comment for agenda item F.3)

Dear Chair Anderson and Council Members:

Many of the undersigned scientists wrote to the Council in September of 2015[1] in support of closing valuable and vulnerable seafloor habitat deeper than 3,500 meters to bottom trawl gear. We appreciate your decision at that time to include such protection in Amendment 28 (Am 28) to the West Coast Groundfish Fishery Management Plan (FMP), as well as your subsequent decisions to identify the closure of water deeper than 3,500 meters to all bottom-contacting gear as a Preliminary Preferred Alternative (PPA). Now, as you consider final action on Am 28, we and the additional scientists below write to encourage you to adopt Alternative 3(a), the bottom-contact closure of areas deeper than 3,500 meters, as a Final Preferred Alternative (FPA). In addition, due to recent discoveries of abundant methane seep habitats throughout the margin, and our increased understanding of their importance to groundfish and the larger ecosystem, we encourage the Council to recognize and protect methane seeps through Am 28. Inclusion of methane seeps in revisions to the description of groundfish Essential Fish Habitat (EFH) and protection of the un-trawled portion of the Southern California Bight and other areas known to contain seep habitats through EFH Conservation Areas are two key components we hope you will include in the FPA.

The deep sea, including areas deeper than 3,500 meters now under consideration for protection by the Council, is critical to humanity and the health of the global oceans. The deep sea provides a host of benefits to society including trapping greenhouse gases, slowing the rate at which our climate changes and regenerating nutrients that are ultimately upwelled back to the surface to fuel fisheries, including those of the U.S. west coast. The importance of the deep sea to society is the subject of increasing focus at both national and international scales: recent publications have explored the growing anthropogenic threats to deep-sea structure and function (including fisheries, mining, and climate change) and the need to protect these environments (for example Cordes and Levin 2018, Niner et al. 2018; Van Dover et al. 2018; Danovaro et al. 2017; Le et al.

[1] See Pacific Fishery Management Council, September 2015 Briefing Book Agenda Item H.8.b Supplemental Public Comment 6, letter from Thurber et. al.

2017; Davies et al. 2017; Levin and Le Bris 2015; Aanesen et al. 2015; Armstrong et al. 2010; Grehan et al 2009).

In our previous letter, which we include here for reference, we explored the value and vulnerability of the deep sea in detail, in support of the proposal to protect it from fishing gear impacts. Here we highlight a few key elements of that letter with a focus on new information that has emerged since 2015:

The deep sea off of the West Coast supports a variety of habitats with fauna that are vulnerable to disturbance and which are critical to the ecosystem services provided by the deep sea. Within the Exclusive Economic Zone (EEZ) of the US West Coast there are important regional habitats that inject structural and biological diversity, such as seamounts, canyons, hydrothermal vents and methane seeps. In many cases we are constantly discovering new locations of these habitats and are just beginning to appreciate their role in the ocean ecosystem. For example, in just the past two years, rich sponge reefs, cold water coral thickets, and an abundance of methane seeps have been either discovered or visited for the first time throughout the US West Coast's EEZ. These discoveries are not limited to one region but stretch from northern Washington to southern California (Seabrook et al. 2017; Grupe et al. 2015); the rate of discovery is limited by resources rather than lack of habitats to discover.

Deep-sea habitats are vulnerable to disturbance with impacts that can last decades. While there is much that remains to be discovered in the deep sea, the susceptibility of these habitats to negative anthropogenic impact is becoming increasingly clear. Cold-water corals can live for thousands of years if undisturbed (Roark et al. 2009) and coral communities that have been impacted by trawling have 3 fold less diversity and density of fauna present compared to those that have not been disturbed (Althaus et al. 2009). Deep-sea sponges have age estimates that range from 400 (Fallon et al. 2010) to 18,000 years (Jochum et al. 2017). Even deep-sea sediment, an epicenter of nutrient regeneration, is slow to recover from disturbance. Across seven sites at depths similar to those under consideration for protection by the Council, seafloor disturbances impacted the animal community for more than 20 years (Jones et al. 2017). While this study by Jones et al. focused on more extreme disturbance than trawling, trawling been shown to reduce biodiversity in the deep sea (Pusceddu et al. 2014) and biodiversity loss can cause an exponential loss of function in deep-sea habitats (Danovaro et al. 2008).

The deep sea remains largely unexplored, makes up a significant component of federally managed waters, and is a location where relevant discoveries are a common occurrence. More than 95% of the deep sea remains unexplored and more than 85% of the United States EEZ is considered deep sea (Bureau of Ocean Energy Management). The unknown nature of much of these vast habitats means that new information is steadily accumulating, including information that is relevant to management. For instance, at the time of our last letter to the Council in September 2015, approximately 1,500 coral and sponge observations were on record in the US West Coast EEZ beyond 3,500 meters depth. Today, just under three years later, NOAA's Deep

Sea Coral Research and Technology database contains over 7,500 observations in the same area, a five-fold increase (NOAA, 2018).

There is growing awareness of the importance of methane seeps. We also appreciate the Council's efforts to recognize and address the importance of methane seeps (also known as cold seeps) and their associated biological communities as an important component of groundfish habitat and for their critical contribution to ecosystem structure and function. Methane seeps are areas where energy from the seafloor is harnessed through chemosynthesis, augmenting production from the surface ocean. We appreciate your decision in November of 2016 to revise Appendix B of the FMP (the description of groundfish EFH) to include methane seeps and we urge that you include this in the FPA. Where practicable, we also encourage you to protect seep habitats in the FPA by closing known seeps to bottom trawling through the creation of new EFH Conservation Areas, such as Oceana's proposed closure of unfished areas in the Southern California Bight, an area that is also rich in Am 28 priority habitats such as rocky substrate, submarine canyons and gullies, and structure-forming invertebrates like corals and sponges. Finally, we understand that there are newly discovered seeps in a number of areas that are currently within EFH Conservation Areas, but that are proposed for re-opening. The presence of these sensitive habitats should preclude re-openings. For further information we refer you to a letter submitted in November 2016 by Dr. Andrew Thurber and Dr. Ben Grupe, included here for reference, which provided detail on some of these specific areas.[2]

The steady stream of new information extends to these methane seep habitats as well, habitats whose importance to the ocean and society is just beginning to be fully understood (Levin et al. 2016). Just off the coast of Oregon and Washington, more than 700 new methane seeps have been discovered over the past five years[3]. These habitats include slow-growing, long-lived species like Vestimeniferan tubeworms which, like cold water corals and sponges, live for hundreds of years (Cordes et al. 2007; Durkin et al. 2017) and greatly impact the community present (Bergquist et al. 2003; Cordes et al. 2009). This group of animals was largely unknown from the region prior to these recent discoveries (Seabrook et al. 2017). In addition, the microbial activity at seep habitats deposits hard substrate that in turn forms habitat for cold water corals and sponge reefs. Given the longstanding recognition of hard substrate as a key component of groundfish EFH, it is not surprising that researchers found an elevated abundance of groundfish (e.g. long spine thornyhead) around a recently discovered methane seep off Southern California (Grupe et. al. 2015).

In conclusion, we very much appreciate the Council's steady progress in applying an ecosystem-based approach to seafloor habitat protection and its management decisions in general. It is the consensus of the undersigned scientists that the large, precautionary closures of areas beyond 3,500 meters depth (to bottom contact gear) and of un-trawled areas in the Southern California Bight (to trawl gear), are consistent with ecosystem-based fishery management, are within the authority of the Magnuson-Stevens Act, and are scientifically defensible. We also hope that you

[2] See Pacific Fishery Management Council, November 2016 Briefing Book Agenda Item F.4.c, Supplemental Public Comment 2, pp. 72-75, letter from Thurber and Grupe
[3] Ibid

will consider the importance of methane seeps in your selection of FPA's for Am 28, by including them in a revised description of groundfish EFH and considering them carefully in your selection of which closures and re-openings to include in the FPA inside 700 fathoms.

Sincerely,

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International Signatories: Many of the ecosystem services provided by the deep sea extend far beyond the jurisdictions of one country. While the stakeholders for the extractable resources in these areas are U.S.-based, the stakeholders for the regulating services provided by the deep sea are the global population. As the alternatives proposed here have ramifications far outside of the U.S. EEZ, we have included signatories from outside of the U.S. to show support for this letter.

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What follows is an updated version of a letter originally submitted to the PFMC on September 2, 2015 with the addition of 36 signatories, making a total of 137 as of September 14, 2015.

September 14, 2015

Dorothy Lowman, Chair
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1100 NE Ambassador Place, #101
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RE: Scientists statement on habitat protection for waters beyond 3,500 meters (public comment for agenda item H.8)

Dear Chair Lowman and Council Members,

We the undersigned 137 marine scientists write to request that you include an alternative for closing federally managed waters deeper than 3,500 meters to bottom trawl fishing gear in your upcoming habitat amendment to the Groundfish Fishery Management Plan (FMP). We appreciate the previous steps taken by the Pacific Fishery Management Council (Council) to protect unfished deepwater areas, including the existing bottom trawl closure of seabed between 1,280 meters and 3,500 meters water depth.[1] We also appreciate your past attempt to include waters deeper than 3,500 meters in this protective closure. [2] While that previous attempt was ultimately unsuccessful, new information on the area, a bolstered legal authority for habitat protection, and the current FMP amendment now provide another opportunity to protect this area.

Our scientific understanding of the area in question is still quite limited and yet we know that it has the paired attributes of value and vulnerability that justify protection. The deep sea is of critical importance to the global ecosystem and human society, providing a variety of services that support, provision and regulate everything from shallower-water productivity to the global climate.[3] An ecosystem-based approach to fisheries management (EBFM), which this Council has increasingly used in its decision-making, calls for recognizing the intrinsic value and vulnerability of these pristine deep-sea habitats and protecting them until the potential impacts of any human activity that might be authorized in the future are fully understood and addressed.

<u>Deep-sea areas and their characteristics:</u>

The deep sea, including the abyssal plain areas now under consideration for protection by the Council, is crucial to our lives and to the health of global oceans. The deep sea provides a host of important ecosystem functions and services. It helps reduce the impacts of anthropogenic carbon release by transporting, oxidizing and storing greenhouse gasses like carbon dioxide and methane.[4] It provides important natural resources to humans, from fish stocks to potential new medicine, mineral or energy resources.[5] Off the U.S. west coast, the upwelling that makes the California Current one of the most vibrant and productive marine ecosystems in the world is an example of deep-sea nutrient regeneration, where the bounty of the deep sea is brought back to the surface to fuel primary production and thus harvestable fish stocks.[6] Finally, the living marine habitat of the deep sea, including the corals found beyond 3,500 meters off California, are a crucial foundation of this important ecosystem. In fact, scientists refer to cold-water corals found on deep shelf, slope, and abyssal plain habitats as "ecosystem engineers" because of their role in creating habitats used by invertebrates and fish.[7]

The deep-sea floor can generally be divided into two broad zones: continental margins (~ 200 meters to 4,000 meters depth) and abyssal plains (generally dominated by soft sediments and found from ~ 4,000 meters to 6,000 meters depth).[8] Within these broad zones there are important regional habitats that inject additional structural and biological diversity, such as seamounts, canyons, hydrothermal vents and methane seeps. Combined, deep-sea ecosystems are the largest environment on Earth, with over 63% of the surface area of the globe found deeper than 200 meters. Marine life is similarly concentrated here: 50% of total marine benthic biomass is found below 3,000 meters.[9]

Unprotected seafloor deeper than 3,500 meters makes up ~ 40% of federally managed ocean waters in the Exclusive Economic Zone (EEZ) of the U.S. West Coast. This area is found off California south of the undersea feature known as the Mendocino Ridge. The diversity of habitats found in this region has long been recognized, for example the National Oceanic and Atmospheric Administration's Fisheries Service (NOAA Fisheries) describes this area as follows: "*features that occur beyond 3500m include hydrothermal vents, soft-bottom sediments, and hard bottom areas with biogenic habitats such as deep sea corals*."[10] While the presence of these features is recognized their location and abundance is still largely uncharted. For example, it is estimated that globally over 100,000 seamounts over one kilometer in height remain uncharted.[11]

Despite its vast size and importance as an ecosystem, the deep sea remains among the least known and understood environments on Earth. According to a National Research Council report, some estimates suggest that as much as 95 percent of the world ocean and 99 percent of the ocean floor are still unexplored.[12] This limited exploration presents fundamental and recognized challenges to sustainable management of extractive industries in the deep sea. For example NOAA's Deep-Sea Coral Research and Technology Program states that "*Currently, it is impossible to ascertain the overall extent of deep coral communities, much less their condition or conservation status in U.S. waters, because so many of the deeper areas these communities inhabit have been explored incompletely or have not been explored at all.*"[13] The deep sea off the U.S. West Coast is no exception. NOAA Fisheries recently described the state of deep-sea habitat surveys in this area: "*seabed habitat mapping has been conducted only over continental shelf and slope and inland seas, and coverage of those areas is very patchy across the West Coast. The abyssal plain and continental rise remain largely un-described for seabed type and extent.*"[14]

Despite the limits of our knowledge, we have learned enough to say that the deep-sea floor is a vibrant ecosystem whose biodiversity rivals that of coral reefs.[15] The deep-sea floor features extensive areas of living marine (biogenic) habitat, three dimensional structures created by organisms including corals and sponges. Deep-sea corals are fragile, bottom-dwelling animals that grow at depths greater than 50 meters with certain species capable of living for more than 4,000 years if undisturbed.[16] Throughout their extensive lives, deep-sea corals are thought to form essential fish habitat.[17] While we do not know the precise distribution of deep-sea corals off California, we do know they occur in the federally-managed waters deeper than 3,500 meters.[18]

While corals are obvious epicenters of biodiversity, much of the total deep-sea diversity is found living in or on mud. These are areas fueled by a steady but slow diet of falling "marine snow" (comprised of mucus, fecal matter, and body parts) with periodic and dramatic "feasts" of organic matter delivered quickly due to a bloom of marine creatures miles above on the surface.[19]

Occasionally larger food deposits occur, such as "whale falls" that bring an unexpected bounty of food to the deep sea and result in a unique community that can persist for a century.[20] Each of these deposits to the deep sea bring with them carbon from the atmosphere, helping to mitigate global climate variability. Concurrently, the activity of animals on the seafloor release the nutrients trapped in this deposited food so they may later fuel the phytoplankton that shallower water fisheries need to thrive.[21]

In addition to the supporting and regulating services that the deep-sea delivers, the mystery of the deep sea provides important cultural and historical services to society. Each new scientific expedition to the deep ocean floor yields new discoveries ranging from novel species, such as a carnivorous sponge found off California,[22] to entirely new habitats, such as new methane seeps found right offshore of San Diego in 2012.[23] In December 2014, deep-sea life made headlines all over the world when an expedition to the Mariana Trench set a new world record for the deepest observation of a living fish, an unidentified and possibly new species of snailfish filmed at 8,143 meters (26,872 feet).[24] Just this year off California, researchers from NOAA led a team that located and surveyed the wreck of the World War Two aircraft carrier USS *Independence* in water half a mile deep within the Gulf of the Farallones National Marine Sanctuary.[25]

These areas and the services they provide are not impervious to human impacts.[26] Climate change is expected to pervasively impact the functions of the deep sea in several ways as a result of ocean acidification, declining oxygen and productivity, and increasing temperature.[27] In addition to these global stressors, the deep sea and its ecosystem services are under increasing demand and pressure on multiple fronts, including fishing, hydrocarbon extraction, and mining.[28] NOAA Fisheries, discussing the seafloor beyond 3,500 meters off California, stated that "*all or most of the deep sea environments are likely to be highly sensitive to impact, including very low levels of fishing effort (e.g. a single trawl), and have extended recovery times (over 7 years). Thus, they can be very sensitive to bottom trawling and would take a long time to recover from this impact*."[29]

The aforementioned extensive lifespan of deep-sea corals is clearly irreconcilable with requirements in U.S. fisheries law to minimize adverse effects to essential fish habitat that are more than minimal and not temporary, as any fishing impacts cannot be considered temporary on human time scales.[30] The impacts of trawling on these communities has also been shown: deep-sea coral communities that have experienced trawling have a three-fold decrease in the diversity and density of fauna present.[31]Further, impacts such as this that result in biodiversity loss have been found to result in an exponential decline in the functions that occur in the deep sea.[32] There is little question that deep-sea habitats will be exposed to multiple human impacts in the coming decades with unknown ramifications to the ecosystem services they provide. However physical disturbance from extractive fishing practices, if it occurs, would likely exacerbate or overshadow these other stressors by modifying the structure and biodiversity of the deep.

Protecting pristine deep-sea floor is consistent with an ecosystem-based approach:

Almost twenty years ago, in its report to Congress, the Ecosystem Principles Advisory Panel (EPAP) articulated basic policies for implementing EBFM that included two key recommendations consistent with a precautionary bottom trawling closure beyond 3,500 meters: (1) proactively evaluate the effects of potential new fisheries in advance and (2) apply the precautionary approach.[33] Additionally, the EPAP further articulates the importance of habitat protection in its report for both target and non-target species.[34] More recently, over 200 scientists and policy experts developed a consensus statement on EBFM that highlighted scientific understanding of marine ecosystems and articulated the vision of the scientific community when it recommends ecosystem-based management for the ocean. This 2005 statement includes recommendations that bolster the case for protecting the abyssal plain areas off California now. In particular, the signatories to this statement include the following as one of nine key elements of marine ecosystem based management: "*Require evidence that an action will not cause undue harm to ecosystem functioning before allowing that action to proceed*."[35] They also articulate what it means to apply a precautionary approach, stating that "*levels of precaution should be proportional to the amount of information available such that the less that is known about a system, the more precautionary management decisions should be.*"[36]

Conclusions

In light of the current lack of information on the remote seafloor beyond 3,500 meters, including the fact that corals and other biogenic habitat are known to exist there but are largely unmapped, it is clear that a precautionary closure is appropriate. The impacts of fishing there cannot be adequately estimated or analyzed at this time given current information, except to say that there would almost certainly be detrimental impacts.

Therefore it is the consensus of the undersigned scientists that protection of this valuable and vulnerable area is a sensible and scientifically defensible action. It is consistent with the best scientific information available and with an ecosystem based approach to management. We recognize and appreciate the past efforts of the Council to implement an ecosystem based approach and to protect important habitats, and we now encourage you to include alternatives to close waters beyond 3,500 meters to bottom trawling.

Sincerely,

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International Signatories: Many of the ecosystem services provided by the deep sea extend far beyond the jurisdictions of one country. While the stakeholders for the extractable resources in this area are U.S.-based, the stakeholders for the regulating services provided by the deep sea are the global population. As the alternative proposed here has ramifications far outside of the U.S. EEZ, we have included signatories from outside of the U.S. to show support for this letter.

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Notes:

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November 8, 2016

Herb Pollard, Chair
Pacific Fishery Management Council
1100 NE Ambassador Place, #101
Portland, OR 97220

RE: Agenda Item F.4

Dear Chair Pollard and Council Members,

We would like to commend the Council for its April 2016 identification of the deep-water bottom contact closure (>3500m) off of the Pacific Coast as a Preliminary Preferred Alternative (PPA) under Amendment 28 to the Groundfish Fishery Management Plan. This forward thinking and precautionary closure will protect pristine habitats that are inhabited by long-lived species and an ecosystem that is critical to the overall function of our planet and in part responsible for our productive surface oceans.

Now, as the Council turns its attention to PPA's for the Essential Fish Habitat (EFH) and Rockfish Conservation Area (RCA) components of Amendment 28, we strongly encourage that methane seep habitats be included as a priority in the designation of new Essential Fish Habitat Closed Areas (EFHCA), including new EFHCA's in any areas of the RCA that are deemed too sensitive to re-open if the RCA itself is rescinded.

Methane seep habitats (also known as cold seeps) are areas where energy from the seafloor is harnessed to augment production from the surface ocean; it is estimated that 10% of the total energy that is used by deep-sea organisms come from such habitats (Levin *et al.* 2016 *Frontiers in Marine Science* http://dx.doi.org/10.3389). These areas provide essential services to mankind through their consumption and storage of greenhouse gases (Schrag *et al.* 2013 *Science 339, 540-543*) and their modification of the seafloor through the creation of hard substrate that is considered EFH. This hard substrate in turn is used by taxa that also provide refugia to groundfish (specifically cold-water corals and sponges), amplifying the habitat services provided by seeps. While concrete evidence is limited, provocative preliminary evidence does exist linking the activity of methane seep habitats to commercial fish species, including Council-managed groundfish.

Microbial processes at methane seeps consume methane, a potent greenhouse gas, and they also deposit rock. Methane is 25 times as effective as carbon dioxide at warming our atmosphere and exists in vast reservoirs in the marine environment, including large deposits on the west coast of the United States extending from Mexico to Canada. As a byproduct of methane consumption, carbonate rock is deposited creating hard substrate on the seafloor. Carbon dioxide from seawater is also captured by this carbonate rock, resulting in a potentially important carbon dioxide sink in the oceans (Schrag *et al.*

2013 *Science 339, 540-543*). The rock itself becomes an attachment point for cold-water corals, deep-water sponges, large anemones, and especially soft corals (*Anthomastus* spp.) on the NW Pacific coast. These 'background' taxa augment fauna that are dependent on the seep for their survival. Thus, seeps directly create habitat suitable for fauna identified as biogenic habitat and which are currently considered a priority in the design of new habitat conservation areas. Further, large worms called vestimentiferans are known to increase the biodiversity at seeps by creating three-dimensional habitat structure and releasing chemicals through their 'roots', increasing the rate at which carbonate rock forms. These taxa are long-lived species, with life spans estimated to be >100 years (Cordes *et al.* 2007 *Marine Ecology 28, 160-168*). Damage to these habitats and seep endemic species (including these long-lived worms) cannot be considered temporary on human time scales and they should be considered for protection under U.S. fisheries law.

The direct role of seeps on fish stocks is currently unknown but a variety of evidence from many regions suggests an important role for certain species. Recently discovered methane seeps off of Southern California had an elevated abundance of longspine thornyhead (Grupe *et al.* 2015 *Marine Ecology* 36, 91–108). Similar observations have been repeated at seeps all along the west coast (pers. observations). Off Chile, the Patagonian Toothfish is found in greater densities at seeps than other locations (Sellanes *et al.* 2012 *Lat. Am. J. Aquat. Res.* 40, 980–991) and aggregations of commercially exploited fish including Orange Roughy, Oreo, Sablefish, and Dover Sole (Bowden *et al.* 2013 *PLoS ONE 8:e76869* ; Grupe *et al.* 2015 *Marine Ecology* 36, 91–108 ; Levin *et al.* 2016 *Frontiers in Marine Science* http://dx.doi.org/10.3389) are common at seep sites. In addition, dense aggregations of crabs, especially Grooved Tanner Crabs (*Chionoecetes tanneri*) are often found at seep environments. Grooved Tanner crabs are not commercially harvested, however it has periodically been considered as a harvestable stock and is closely related to other species of Tanner crabs that are the focus of fisheries. In addition, elasmobranchs have been shown to use seep habitats as a refugia for their egg capsules (Treude *et al.* 2011 *Marine Ecology Progress Series 437, 175-181*). Though methane seeps have yet to be conclusively linked to the distribution and health of fish stocks, it is an area of active research with evidence suggesting that seeps may act as an essential fish habitat for at least some species.

While the distribution of methane seeps remains largely unknown, recent cruises have found them in abundance in the depth strata under consideration for the EFH and RCA PPA's at this meeting. During the last two years as many as 700 new sites of seepage have been identified between Northern California and the Canadian border (Johnson *et al.* G^3 16:3825 ; NA-072 Nautilus Cruise Report: http://www.pmel.noaa.gov/eoi/pdfs/2016-PacificCoast-NA072-CruiseReport-hires.pdf). Most of these sites are identified at this time only as bubble plumes in the water column, but it should be noted that to date, Remotely Operated Vehicle (ROV) dives have reliably verified the presence of seafloor seeps in association with overlying bubble plumes. While there is debate on how many of these plumes should be lumped into one site (impacting the number of 'seeps' discovered), it is clear that seeps are a widespread and integral part of the California Current Ecosystem, including but not limited to the benthic habitat. Many of these new seep sites overlap with areas proposed for protection as new or expanded EFHCA's in Amendment 28. Others are in areas proposed for re-opening.

While many seeps likely remain to be discovered in the areas under consideration, we specifically would like to highlight the following sites that co-occur with dense plume fields and are likely hotspots of seep activity on the coast. In addition, during recent Cruises aboard the E/V *Nautilus* (NA-072 and NA-066 Nautilus Cruise Report: https://www.tos.org/oceanography/assets/images/content/29-1_supplement.pdf, pp 40-43) some of these sites were visited by an ROV allowing basic information to be gathered (observations from S. Seabrook, pers. com. And Grupe, pers. observation):

Gray's Canyon: This site has not been directly dived on, however it is an area of active seepage with many plumes found within the canyon. Some known plumes are currently protected by the existing EFHCA and others by the RCA, but some proposed alternatives would remove protections and others would expand them. We support the Oceana *et al.* proposal for an expansion of the EFHCA to the east, which would protect additional plumes, and we do not support re-opening parts of the current EFHCA to the west as proposed under the Collaborative alternative, which would expose currently protected plumes to fishing effort. In all cases, our recommendations are outside the Tribal Usual and Accustomed Areas, consistent with the Council's prior decision to limit the scope of Amendment 28 to exclude the U+A Areas.

Astoria Canyon: This site was recently dived on by the E/V *Nautilus* and abundant seep habitats and carbonate outcrops were found at 494m water depth. Sablefish were observed in addition to fauna known to typically inhabit seeps. This area had intense and active seepage and we support the expanded coverage of the MCI alternative, which would protect the areas where we know the most active seepage occurs.

Heceta Bank: Also an area of active seepage across a diversity of depth profiles, this habitat included vestimentiferan tube worms known to be long-lived ecosystem engineers (Cordes *et al.* 2003, Ecology Letters 6:212-219). Anemones were also observed growing on carbonate outcrops. We encourage the Council to include the westward expansion of the current EFHCA proposed by MCI and Oceana in the PPA.

Bandon High Spot: This area has living seep fauna and carbonates created by seep activity with active seep sites at 615m depth. It is among the most dense seeping areas recently discovered, with 19 areas counted as distinct 'seeps' and 48 separate bubble plumes rising from the seafloor (data from Susan Merle and Dr. Robert Embley, NOAA). This area is proposed to be closed to trawling under the MCI-proposed "Bandon High Spot West" polygon, and we encourage the Council to include this site in the PPA.

Southern California Bight: ROV dives off the coasts of San Diego, Palos Verdes, and Point Dume near Malibu, CA also discovered seep habitats of note. Off of Palos Verdes, carbonate mounds associated with methane seeps from 350-450m depth contained very dense numbers of thornyheads and crabs. A methane seep discovered at about 700-750m depth near Point Dume is particularly noteworthy, as it was measured to be over 1.4 km long and up to several hundred meters wide. This may be the largest methane seep known in United States Pacific waters and contained abundant catsharks, thornyheads, and Dover sole. As a result, we support the Oceana proposed closure of areas in this region not subject to trawl effort. This closure would protect a number of these documented seeps.

Trawling on seep habitats has a clear effect on the fauna that live there, although implications for large-scale cycles of methane and carbon have not been quantified. We do not know whether trawling leads to altered methane release from the sediment, however we have seen evidence that the growth orientation of vestimentiferan tubeworms shifts from upright to a lower growth form in areas with evidence of fishing (Baco *et al.* 2010 *Marine Geology* 272, 251-259). It is proposed that this impacts their efficacy as ecosystem engineers. Research on these tubeworms has occurred only in other regions. Until they were discovered at Heceta Bank seeps this year, they were not known to occur in the Pacific Northwest.

In just one cruise to the regions being discussed, over 500 new areas of seafloor seepage were observed, covering, in many cases, a single swatch of the seafloor along the 500m depth contour. We propose that those areas discovered with the greatest densities of seeps be included for consideration for protection from trawl fisheries under the Amendment 28 PPA. While the link between commercial fish production and seeps is unclear, their role in creating hard substrate for corals, anemones, and sponges, and the extreme longevity of some of their fauna makes them important considerations in the designation of conservation areas.

Sincerely,

Andrew Thurber, PhD

Benjamin Grupe, PhD

About the Signatories: Andrew Thurber is an Assistant Professor in Ocean Ecology and Biogeochemistry and Microbiology at Oregon State University. Methane seeps are an area of his expertise, however this public comment is not meant as a statement on behalf of his University.

Benjamin Grupe is a Visiting Postdoctoral Fellow in Fisheries and Oceans Canada at the Institute for Ocean Sciences. His research at the University of California, San Diego focused on methane seeps, and this comment reflects his own views and not those of Fisheries and Oceans Canada.

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OFFICE OF
ENVIRONMENTAL REVIEW
AND ASSESSMENT

November 14, 2018

Gretchen Hanshew
Fishery Management Specialist
National Marine Fisheries Service
7600 Sand Point Way NE
Seattle, Washington 98115

Dear Ms. Hanshew:

The U.S. Environmental Protection Agency has reviewed the Changes to Groundfish Essential Fish Habitat Conservation Areas and Boundaries for the Trawl Gear Rockfish Conservation Areas Draft Environmental Impact Statement (CEQ Project Number 20180231, EPA Region 10 Project Number: 16-0009-NOA) pursuant to Section 309 of the Clean Air Act and the National Environmental Policy Act.

The purpose of the proposal is to protect essential fish habitat and other benthic habitats by closing marine areas off the coasts of Washington, Oregon, and California to bottom trawl fishing. The proposal also includes re-opening productive fishing grounds to trawl gear vessels that participate in the groundfish individual quota program off the coasts of Oregon and California.

The DEIS analyzes alternatives based on three Subject Areas: 1) Essential Fish Habitat revisions: 2) adjustments to the groundfish trawl rockfish conservation areas; and 3) closures to bottom contact fishing gear in waters deeper than 3,500 meters. The DEIS identifies a preferred alternative for each of these subject areas. The preferred alternatives are:

- Subject Area 1, Alternative 1.h considers reopening 17 areas and closing 53 areas (16 times more closures than current management).
- Subject Area 2, Alternative 2.d proposes no changes to closure off the coast of Washington. Changes to Oregon and California include utilizing block area closures in place of the current rockfish conservation areas as a tool to manage fisheries on a more site-specific basis.
- Subject Area 3, Alternative 3 uses authorities under the Magnuson-Stevens Fishery Conservation and Management Act to close waters deeper than 3,500 meters to bottom contact gear.

The preferred alternatives aim to conserve and protect EFH to the maximum extent possible by adding new EFH conservation areas and closing deeper waters to bottom fishing. Two other action alternatives evaluated under Subject Area 1 vary by amount of area closed and area re-opened. One additional action alternative was considered under Subject Area 2, which would remove all rockfish conservation areas coastwide rather than only in Oregon and California. The threshold to close waters deeper than 3,500 meters would remain the same under any alternative selected.

The EPA supports the changes to the current suite of essential fish habitat conservation areas, proposed in the preferred alternatives, to protect priority habitats, including increasing the total area of bottom trawl closures, and expanding the total area of EFH conservation areas. In addition, we agree with the application of block area closures as an adaptive management strategy to allow the agency flexibility in managing the groundfish bottom trawl fishery.

The DEIS includes figures illustrating the variety of management areas (e.g., EFH and rockfish conservation areas). We note that many of these figures are challenging to interpret due to the reduced scale and small typeface and suggest representing portions of the coastal area across several images to increase the scale and provide a clearer understanding of the current conditions and proposed management changes. In addition, we recommend that it would be useful to include a link to the data files so that agency decision makers and the public can view areas of interest more closely.

Effective October 22, 2018, the EPA no longer includes ratings in our comment letters. Information about this change and the EPA's continued roles and responsibilities in the review of federal actions can be found on our website at: https://www.epa.gov/nepa/epa-review-process-under-section-309-clean-air-act.

We appreciate the opportunity to comment on the DEIS. If you have any questions, please contact Lynne Hood of my staff at (208) 378-5757 or hood.lynne@epa.gov, or you may contact me at (206) 553-1841 or nogi.jill@epa.gov.

Sincerely,

Jill A Nogi

Jill A. Nogi, Manager
Environmental Review and Sediment Management Unit

STATE OF CALIFORNIA—NATURAL RESOURCES AGENCY EDMUND G. BROWN, JR., *GOVERNOR*

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September 28, 2018

Ryan Wulff
Assistant Regional Administrator
For Sustainable Fisheries
West Coast Region
National Marine Fisheries Service
650 Capitol Mall, Suite 5-100
Sacramento, CA 95814

Attn: Gretchen Hanshew

Re: Consistency Determination, National Marine Fisheries Service (NMFS), Changes to Pacific Coast Groundfish Fishery Management Plan (FMP) and implementing regulations

Dear Mr. Wulff:

We have received your letter dated September 28, 2018, in which you have determined that several changes (Amendment 28 and revisions to areas closed to Bottom Trawling) to the Pacific Coast Groundfish Fishery Management Plan (FMP) would be consistent to the maximum extent practicable with the California Coastal Management Program (CCMP). The changes are analyzed in the Draft Environmental Impact Statement included with your submittal and titled “Changes to Groundfish EFH Conservation Areas and Boundaries of the Trawl Gear RCAs.”

We concur with your determination that the changes would be consistent to the maximum extent practicable with the CCMP. If you have any questions, please contact me at (415) 904-5289.

Sincerely,

Mark Delaplaine

MARK DELAPLAINE
Manager, Energy, Ocean Resources,
and Federal Consistency Division

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