OCEANA Protecting the World's Oceans

99 Pacific Street, Suite 155C
Monterey, CA 93940 USA

+831.643.9266
OCEANA.ORG

Agenda Item F.3.c
Public Comment 2
(Full Version Electronic Only)
April 2018

March 19, 2018

Phil Anderson, Chair
Pacific Fishery Management Council
7700 NE Ambassador Place, Suite 101
Portland, Oregon 97220-1384

RE: Groundfish Amendment 28, EFH-RCA Final Action

Dear Chair Anderson and Council members:

Following a thorough and deliberate public process beginning in 2010 with the commencement of the Essential Fish Habitat (EFH) 5-year review, the Pacific Fishery Management Council is now poised to take final action to advance the conservation and enhancement of groundfish essential fish habitat. We firmly believe it is possible to prevent irreversible impacts to fish habitats and address current impacts in a manner that maintains and supports vibrant fisheries and coastal communities. Furthermore, we believe the Council has before it the alternatives necessary to accomplish this objective. The Council can do this by taking final action to adopt those alternatives and conservation areas that provide for an overall net increase in the conservation of EFH, safeguarding priority habitats, and securing a net increase in restored fishing opportunity.

The combination of the Oceana et al. EFH Conservation Area Alternative (Alternative 1b) with opening of the trawl Rockfish Conservation Areas (RCA) (Alternative 2a) and the protection of the deep-water ecosystem off California (Alternative 3a) provides the best suite of actions to both protect sensitive seafloor habitat from bottom trawling in all regions off the Pacific coast and restore groundfish bottom trawl fishing opportunity.

The attached analysis compares the protection of habitat afforded by the Collaborative (Alternative 1a) and Oceana et al. (Alternative 1b) EFH alternatives when combined with removal of the entire trawl Rockfish Conservation Area south of Point Chehalis (2a). We also analyze what we call a Collaborative modified alternative that is Alterative 1a, plus 1c (MTC) and 1e (Rittenburg Bank), in combination with RCA removal. Our analysis is based on publicly available spatial data including data produced for the Council's EFH five-year review and new biogenic habitat data released last year by the NOAA Northwest Fisheries Science Center and the NOAA Deep Sea Coral and Sponge Research and Technology Program. The analysis focuses on priority habitats as defined in Amendment 19 to the Pacific Coast Groundfish FMP.

What is clear from this analysis is that the Collaborative and "Collaborative modified" alternatives have significant gaps in conservation overall, as well as in specific regions and depth zones off the West Coast. These gaps would result in a loss of habitat protection should the Council adopt either of these alternatives. In contrast, the Oceana alternative addresses those gaps, and with the removal of the RCA results in a win-win scenario for habitat and fisheries.

In addition to providing this updated analysis, we are also attaching select previously submitted reports and correspondence. As the EFH Review and Amendment process has been protracted, we feel it is important to bring these materials forward again for your consideration at final action.

Oceana appreciates the Council's continued work to advance the conservation and enhancement of groundfish essential fish habitat (EFH) and the protection of deep-sea ecosystems. Thank you for your hard work and commitment to science, conservation and sustainable fisheries.

Sincerely,

Geoffrey Shester, Ph.D.
California Campaign Director & Sr. Scientist

Ben Enticknap
Pacific Campaign Mgr. and Sr. Scientist

Attachments:

1. Oceana Updated Analysis (March 19, 2018). Comparative Geospatial Analysis of Combined U.S. West Coast Essential Fish Habitat and Trawl Rockfish Conservation Area Alternatives.

2. Oceana (March 19, 2018). Letter to the National Marine Fisheries Service and Pacific Fishery Management Council opposing the opening of certain EFH Conservation Areas. Originally submitted as Agenda Item B.1.b, Supplemental Public Comment 2 and updated here with modified action alternative numbers.

3. Cousteau and Danson (November 16, 2016). Stand Up For California's Seafloor. San Diego Union Tribune. Available at: http://fw.to/04jCx6Y

4. Gavin Newsom (Lt. Governor, California) (October 26, 2016). Letter to the National Marine Fisheries Service and Pacific Fishery Management Council regarding protection of the Southern California Bight. Agenda Item F.4.b, Supplemental Lt. Governor Report

5. Toni Atkins (California Assembly Speaker) and Lorena Gonzalez (California Assemblywoman) (November 2016). Letters to the National Marine Fisheries Service and Pacific Fishery Management Council regarding protection of the Southern California Bight. Available at: http://usa.oceana.org/responsible-fishing/california-legislative-letters-support

6. 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.

7. Tissot (September 13, 2015). Protection of deep sea habitat off California's coast needed now. Sacramento Bee. Available at: http://www.sacbee.com/opinion/op-ed/soapbox/article34975470.html

8. Oceana Proposal Overview and Update (Second edition, May 2017). Conservation Alternative to Modify U.S. West Coast Groundfish Essential Fish Habitat Conservation and Management. http://usa.oceana.org/sites/default/files/oceana_efh_report_second_ed_may_2017.pdf

9. Oceana (September 2017). Exploring the Living Seafloor: Southern California Expedition. Available: http://usa.oceana.org/publications/reports/exploring-living-seafloor-southern-california-expedition

Additional Information:

1. Oceana original EFH proposal storyboard, maps and video. Available: https://www.arcgis.com/apps/MapJournal/index.html?appid=d3a2b983248f4818a30c4d07b076e9b0

March 19, 2018

Attachment 1

Updated Comparative Geospatial Analysis of Combined U.S. West Coast

Essential Fish Habitat and Trawl Rockfish Conservation Area Alternatives

The protection of Essential Fish Habitat is fundamental to the sustainability and productivity of the Pacific Coast Groundfish Fishery and the health of the California Current marine ecosystem. In April 2018, the Pacific Fishery Management Council ("Council") will take final action on a range of alternatives to protect marine habitat off the U.S. West Coast, including Essential Fish Habitat (EFH). The range of alternatives for Amendment 28 to the groundfish Fishery Management Plan include designating new EFH Conservation Areas and protecting the deep-water ecosystem off California, but the Council is also considering alternatives that would open some EFH Conservation Areas and the trawl Rockfish Conservation Areas (RCA). In taking final action, the Council and the National Marine Fisheries Service ("NMFS") must act based on the best available science to minimize adverse impacts and adopt actions to ensure the conservation and enhancement of EFH. The Council and NMFS must consider the effects of lifting RCA protections together with revisions to EFH Conservation Areas.

In this updated analysis we show that, combined with the reopening of the trawl RCA, some alternatives result in a net conservation loss in some regions off the West Coast, as measured according to metrics which include total area and priority habitat protection. The Council's final action, however, should result in a net conservation gain across all regions and depth zones, while also restoring previously displaced fishing effort. EFH Conservation Areas and RCAs should not be reopened unless such action is well supported by science and would not adversely affect EFH.

In this document we present results of an updated Geographic Information Systems (GIS) analysis of EFH and trawl RCA alternatives finalized by the Council in November 2016 (available on the EFH Data Portal).[1] All results presented here are based on analysis of publicly available spatial data produced for the Council's EFH 5-Year Review, plus we have analyzed newly available biogenic habitat data provided by the NOAA Deep Sea Coral Research and Technology Program[2] and NOAA Fisheries Northwest Fisheries Science Center[3] and new seafloor habitat data, including information on the location and extent of submarine canyons.[4] The data we analyzed includes spatial data compiled by the Phase 1 effort of the EFH review and by the NOAA Fisheries Northwest Fisheries Science Center in its 2013 EFH Synthesis Report,[5] both of which were adopted by the Council as the basis for decision-making and for soliciting proposals to modify EFH Conservation Areas. We focus this analysis on "priority habitats" as defined in Amendment 19 to

[1] http://efh-catalog.coas.oregonstate.edu/overview/
[2] NOAA Deep Sea Coral and Sponge Database. Available: https://deepseacoraldata.noaa.gov/ Database version December 14, 2017. Coral, sponge and pennatulid observations.
[3] NOAA NWFSC FRAM Database Warehouse. Updated coral, sponge and pennatulid presence and bycatch data
[4] EFH Data Catalog, map services, data updates: http://efh-catalog.coas.oregonstate.edu/mapservice/
[5] NMFS. 2013. Groundfish Essential Fish Habitat Synthesis Report. Northwest Fisheries Science Center. PFMC Agenda Item D.6.b. April 2013. Available at http://www.pcouncil.org/wp-content/uploads/D6b_NMFS_SYNTH_ELECTRIC_ONLY_APR2013BB.pdf

the Pacific Coast Groundfish FMP and as defined by the EFH Project Team for the Amendment 28 analysis: hard substrate, habitat forming invertebrates (corals, sponges, sea whips and sea pens), submarine canyons and gullies, and habitat for overfished groundfish species.[6]

Here we present the percentage of each feature (e.g. total area, substrate type, biogenic habitat) protected from bottom trawling under four scenarios; 1) status quo management (baseline/ no-action) including maintaining the trawl RCA and no new EFH Conservation Areas, 2) adoption of the Collaborative alternative (Alternative 1a) with removal of the trawl RCA south of Pt. Chehalis, WA (Alternative 2a), 3) adoption of the Oceana et al. alternative (Alternative 1b) with removal of the trawl RCA, and a fourth alternative for analysis we call the "Collaborative modified". We defined the Collaborative modified alternative as equal to Alternative 1a (Collaborative) + Alternative 1c (Midwater Trawlers Cooperative) + 1e (Rittenburg Bank) + 2a (remove the trawl RCA). We chose to analyze this scenario to see how the Collaborative alternative would perform with the the addition of the MTC alternative, filling in gaps in the Newport region off Oregon where the collaborative group did not reach consensus. None of the alternatives include changes inside the Usual and Accustomed fishing areas off Washington. All action alternatives analyzed in this document are considered in combination with RCA Alternative 2a, removing the entire trawl RCA south of Point Chehalis, WA, in order to examine the net changes from the status quo baseline.

The baseline includes current, year-round non-tribal bottom trawl closures: EFH Conservation Areas, state water areas closed to bottom trawling, and the trawl RCA. Off Southern California the baseline also includes the Western Cowcod Conservation Area, which is not being considered for modification under the Amendment 28 action. Under the Oceana alternative, however, it would be closed to bottom trawling as an EFH Conservation Area and so from an EFH and bottom trawl perspective, this area would already be addressed should there be future decisions to modify the Cowcod Conservation Area as Cowcod recover to healthy levels.

Baseline (Status Quo/ No Action) = EFH Conservation Areas + state waters that are closed to bottom trawling + the coastwide trawl RCA + Western Cowcod Conservation Area.

Collaborative (Alternatives 1a + 2a) = Baseline –trawl RCA S. of Pt. Chehalis – proposed EFHCA openings + proposed EFHCA closures.

Collaborative Modified (Alternative 1a + 1c + 1e + 2a) = Baseline –trawl RCA S. of Pt. Chehalis – proposed EFHCA openings + proposed EFHCA closures

Oceana (Alternative 1b + 2a) = Baseline –trawl RCA S. of Pt. Chehalis – proposed EFHCA openings + proposed EFHCA closures.

This analysis divides the West Coast Exclusive Economic Zone into biogeographic regions consistent with the coastwide biogeographic areas and depth zones identified in the National Marine Fisheries Service Groundfish EFH Synthesis Report prepared for the Council EFH review process (PFMC 2013, see map below). NMFS identified large biogeographic regions (Northern, Central, Southern and the Salish Sea) and further divided these into three depth zones: a) Continental Shelf (coastline to continental

[6] Pacific Fishery Management Council. 2016. Agenda Item F.5.a EFH/RCA Project Team Report., April 2016. Pg. 5

shelf break, approximately 200 m/ 110 fathoms), b) Upper Slope (shelf break to 1,280 m/ 700 fathoms, which is the shoreward boundary of the "Bottom Trawl Footprint Closure") and c) the Lower Slope (1,280 m to the seaward EEZ boundary). However, we only present analysis for the shelf and upper slope (shortened here to "slope"), because the lower slope effects do not vary across the three alternatives and are dependent primarily on the deepwater closure off California (Alternative 3a). The deepwater closure would close all waters deeper than 3,500 meters to bottom contact fishing, through discretionary authority under the Magnuson-Stevens Act. It is, as of April 2016, a component of the Council's Preliminary Preferred Alternative for this action. We did not include the Salish Sea in our analysis as no EFH or RCA modification alternatives would affect this area. We summarize differences for key selected features across alternatives in terms of the proportion of the total available feature within bottom trawl closures in the figures below.

Key findings of this analysis include:

- The Oceana alternative combined with the opening of the core trawl RCA south of Pt. Chehalis, WA would result in a net increase in habitat conservation across all regions and would restore previously displaced trawl effort.
- Both the Oceana and Collaborative EFH alternatives would result in a net increase in bottom trawl fishing opportunity, when combined with the removal of the trawl RCA south of Point Chehalis, WA.
- The Oceana alternative combined with removal of the RCA south of Pt. Chehalis would maintain 95% of the hard substrate within the trawl RCA closed to bottom trawling.
- The Collaborative and Collaborative Modified alternatives combined with removal of the RCA south of Pt. Chehalis would reopen to trawling over half of the hard substrate that is currently closed within the trawl RCA.
- The Collaborative and Collaborative Modified alternatives combined with removal of the RCA south of Pt. Chehalis would result in a loss of total area closed to trawling in all biogeographic regions and coastwide.
- While the Collaborative alternative with RCA removal results in a net increase in the protection of some priority habitat features in some regions and depth zones off the coast, there would also be a net loss in the protection of other priority habitat features in some regions and depth zones. Thus a 'win-win' scenario is not achievable by only adopting the Collaborative alternative and opening the trawl RCA.
- New coral and sponge data in the NOAA Deep Sea Coral and Sponge database includes 4,000 coral and 1,100 sponge records inside the Collaborative (Alt 1a) proposed site off Northern California called the "Brush Patch." For the Collaborative alternative, this new data results in a significant increase in coral habitat protected in the Northern Upper Slope region.
- For Alterative 1b (Oceana), by including new coral and sponge data provided in the NOAA Deep Sea Coral and Sponge database, there are now nearly 8,000 corals and 13,750 sponges identified in the Southern California Bight proposal area, nearly 1,500 new coral records in the Mendocino Ridge Expansion, 2,071 corals in the Samoa Deepwater proposal

area and over 900 corals in a "Bamboo Coral Forest" identified in the Southern Oregon Footprint Area in deep-waters off Southern Oregon.[7]

- Adding the MTC proposed areas off Newport, Oregon (Alt 1c) to the Collaborative proposed areas (Alt 1a) still results in a net loss of total habitat protection by area and a loss in protection of some priority habitat features like hard substrate, habitat for overfished yelloweye rockfish, and coral and sponge presence protected along the Northern Upper Slope when combined with opening the trawl RCA.
- The Collaborative and Collaborative modified alternatives (in combination with removal of the trawl RCA) would result in a net loss of priority habitat protected and total area protected off Southern California.
- The Collaborative and Oceana alternatives with trawl RCA removal would result in an increase in priority habitat protection in the Monterey Bay National Marine Sanctuary (NMS).
- The Collaborative alternative combined with opening the trawl RCA would result in a net loss in the protection of some habitat features in the Greater Farallones NMS (overfished yelloweye occurrence), Cordell Bank NMS (mixed reef and yelloweye rockfish occurrence), and Channel Islands NMS (hard rocky reef, coral and sponge presence, submarine canyons, etc.).

[7] Bamboo Corals of the Oregon Coast, inside the "Southern Oregon Footprint" closure in Alternative 1b. https://nautiluslive.org/album/2016/06/17/bamboo-corals-oregon-coast

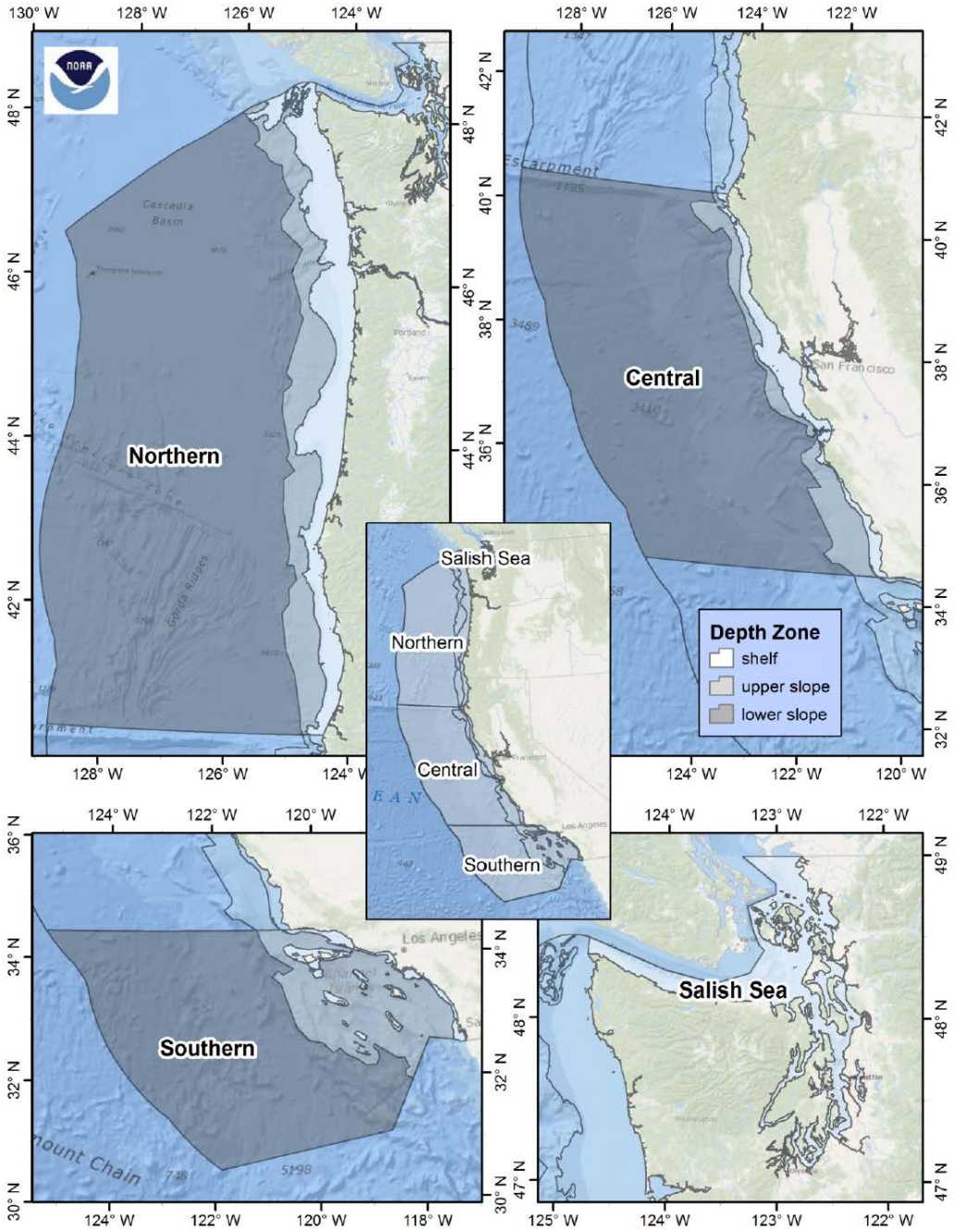
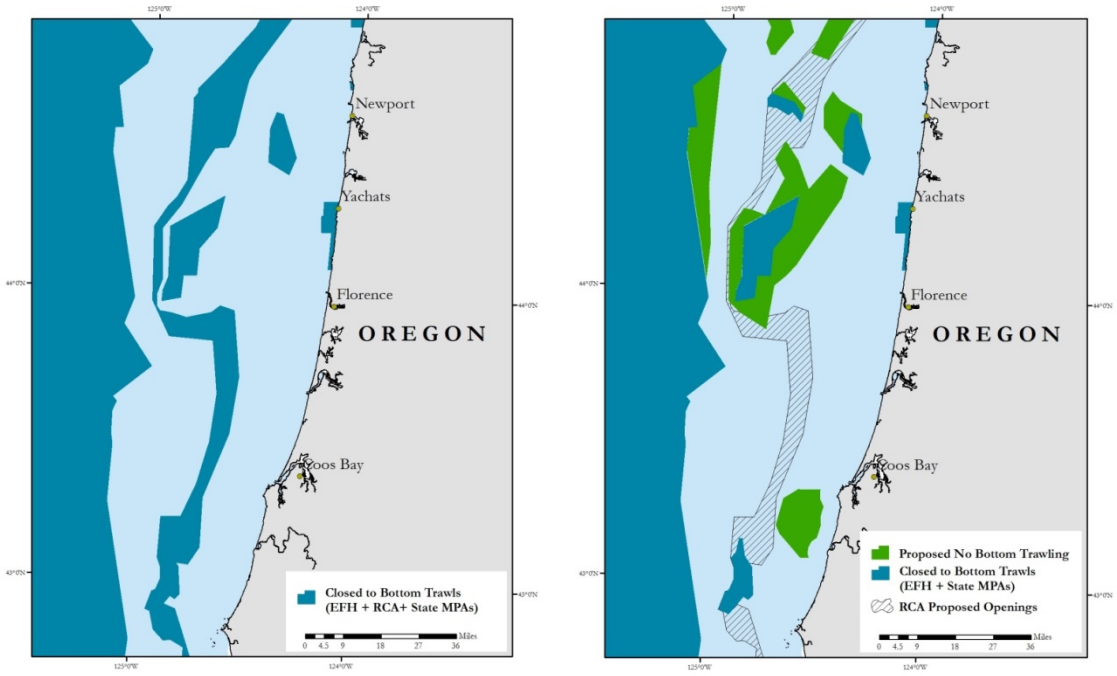


Figure 2.1. Map showing the spatial stratification, including four biogeographic sub-regions and three depth zones.

Biogeographic subregions as analyzed in this document. Developed by NMFS in the 2013 EFH Synthesis Report for use by the PFMC in decision making. Only the shelf and upper slope for the Northern, Central, and Southern Regions are analyzed in this document.



An example off central Oregon showing analysis of closed areas under status quo "Baseline" (left) versus "Oceana" Alternative 1b combined with reopening of the Trawl Rockfish Conservation Area (Alternative 2a) (Right).

Biogeographic Habitat Analysis: The following figures compare the amount of each habitat feature protected inside bottom trawl closures within each biogeographic sub-region and depth zone under status quo management (baseline RCA, current EFHCAs and state water closures) and three possible alternative scenarios; the Collaborative EFH alternative (Alt 1a), the "Collaborative modified" (Alt 1a + 1c + 1e) and the Oceana et al. alternative (Alt 1b), each combined with the RCA fully removed (Alt 2a).

Total Area and Physical Substrates/ Features

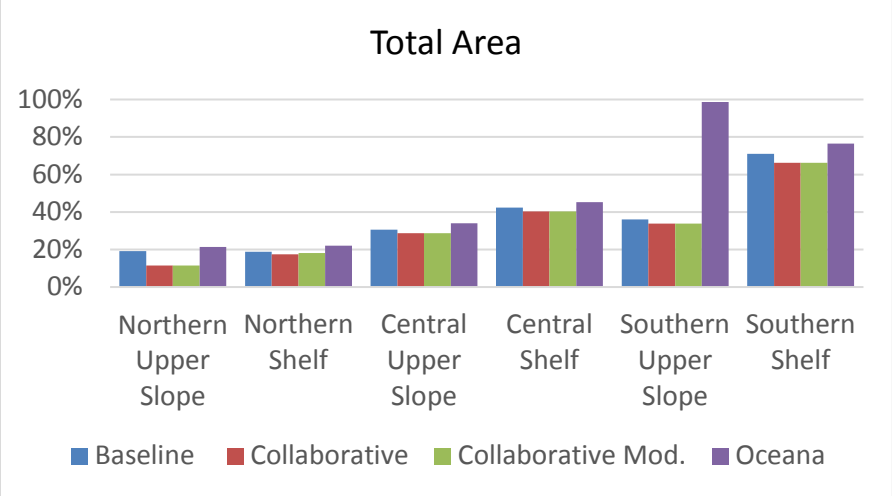


Figure 1. Proportion of *total area* in the Northern, Central and Southern biogeographic regions closed to bottom trawling (upper slope and shelf depth zones) under the baseline (status quo management) compared with adoption of the Collaborative (1a), Collaborative Modified (1a + 1c + 1e) and Oceana et al. (1b) EFH alternatives, with removal of the RCA south of Pt. Chehalis, WA (Alternative 2a).

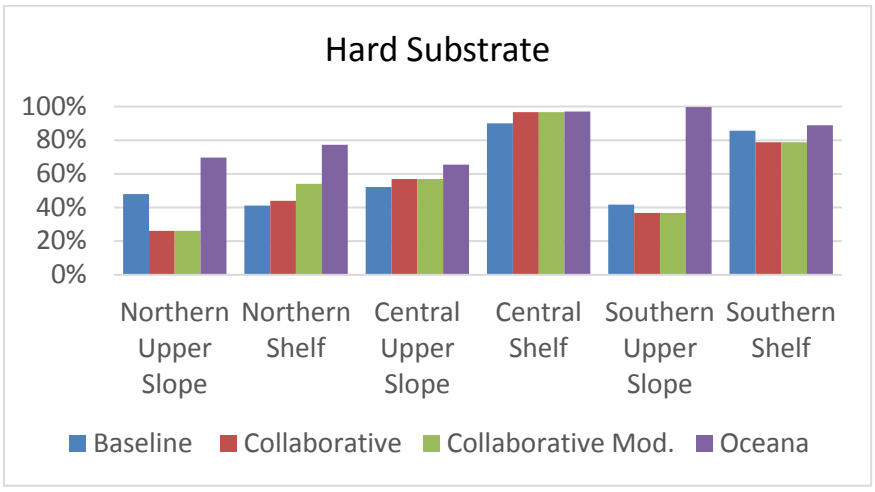


Figure 2. Proportion of *hard substrate* in the Northern, Central and Southern biogeographic regions closed to bottom trawling (upper slope and shelf depth zones).

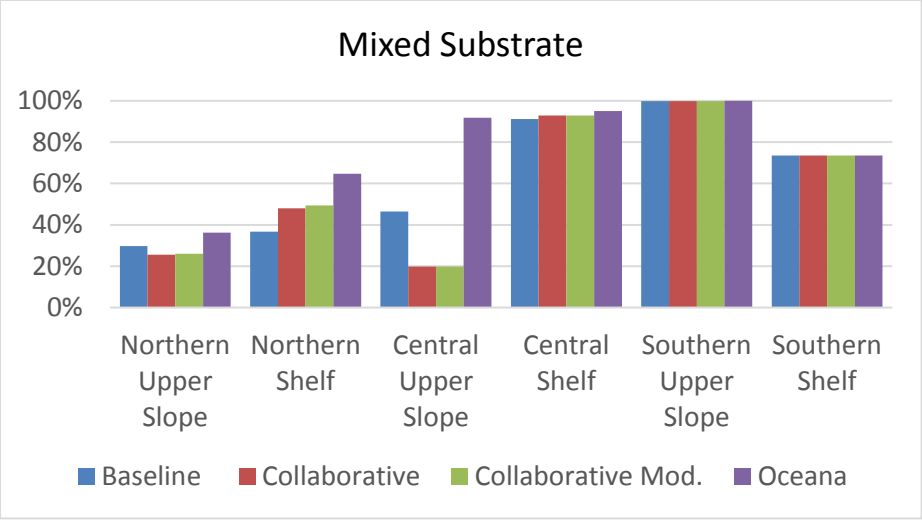


Figure 3. Proportion of *mixed substrate* in the Northern, Central and Southern biogeographic regions closed to bottom trawling (upper slope and shelf depth zones).

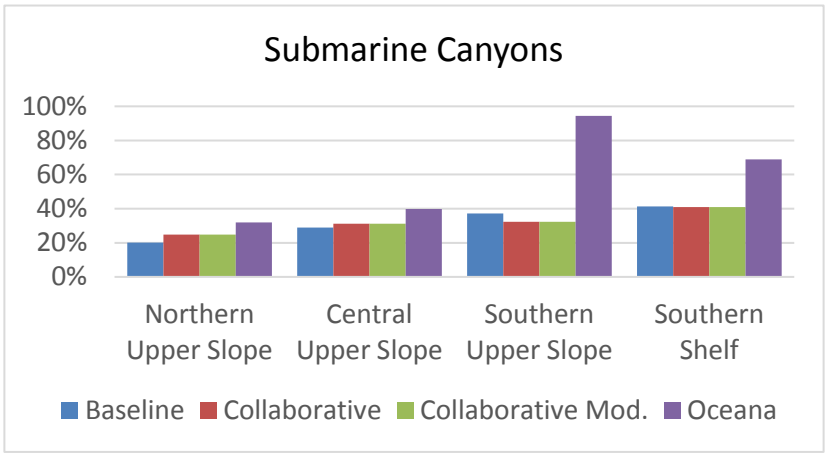


Figure 4. Proportion of *submarine canyons and gullies* in the Northern, Central and Southern regions closed to bottom trawling (canyons only intersect the upper slope in the Northern and Central Regions but extend into the Shelf in some areas in the Southern Region).

Habitat Forming Invertebrates:

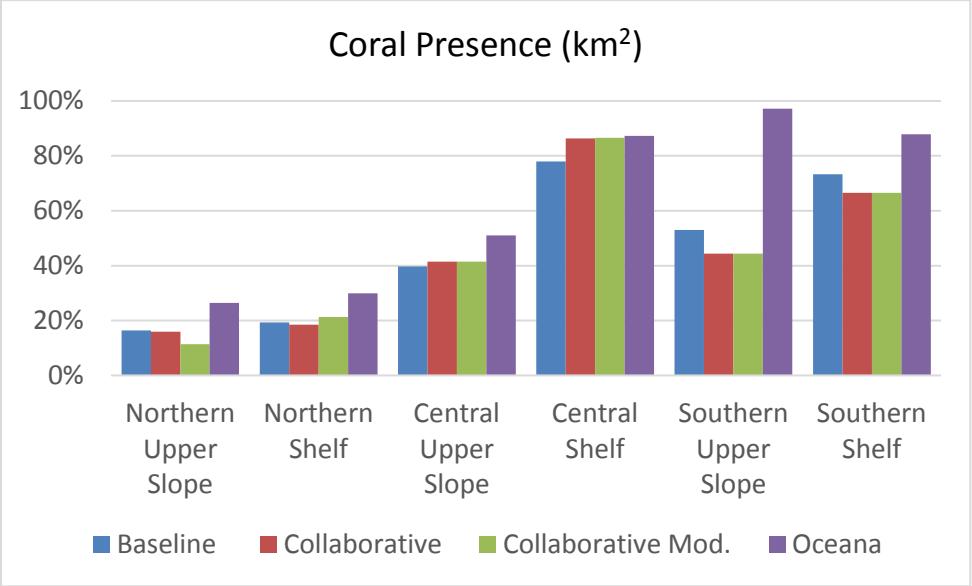


Figure 5. Proportion of *coral presence* (1x1 km^2 areas containing coral) in the Northern, Central and Southern biogeographic regions closed to bottom trawling (upper slope and shelf depth zones).

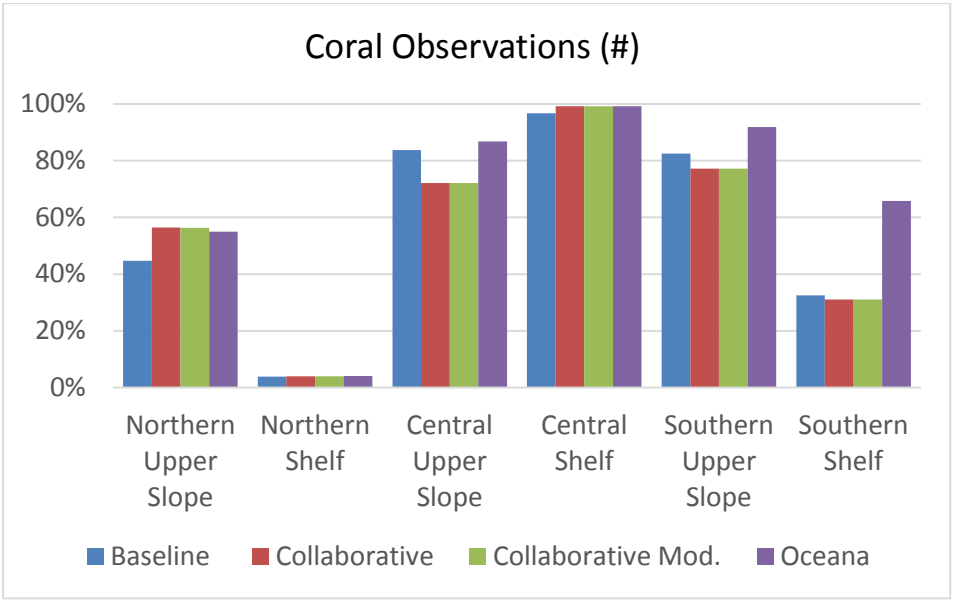


Figure 6. Proportion of *the number of coral records* in the Northern, Central and Southern biogeographic regions closed to bottom trawling (upper slope and shelf depth zones). This analysis includes new data provided by the NOAA Deep Sea Coral and Sponge Research and Technology Program (December 2017).

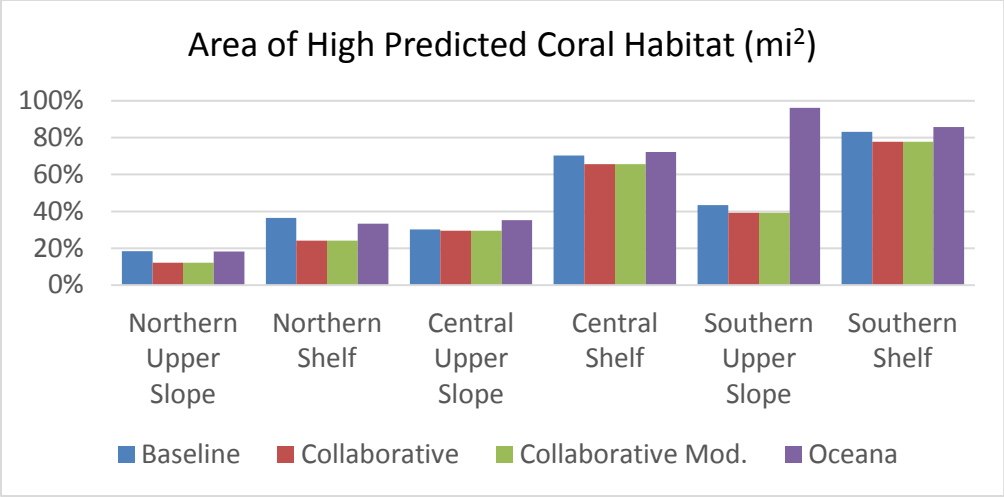


Figure 7. Proportion of *the 'high' predicted coral habitat* (all coral taxa combined) in the Northern, Central and Southern biogeographic regions closed to bottom trawling (upper slope and shelf depth zones). Data from this analysis were provided as part of the EFH 5-year review Data Catalog.[8]

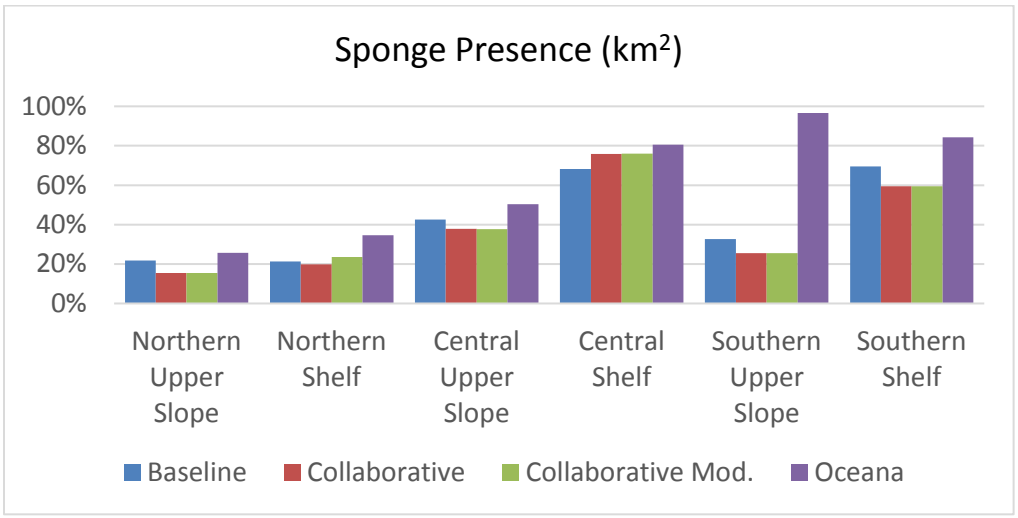


Figure 8. Proportion of *sponge presence (1x1 km^2 area blocks containing sponge)* in the Northern, Central and Southern biogeographic regions closed to bottom trawling (upper slope and shelf depth zones).

[8] Published by Guinotte JM, Davies AJ. 2014. Predicted Deep-Sea Coral Habitat Suitability for the U.S. West Coast. PLoS ONE 9(4): e93918. doi:10.1371/journal.pone.0093918

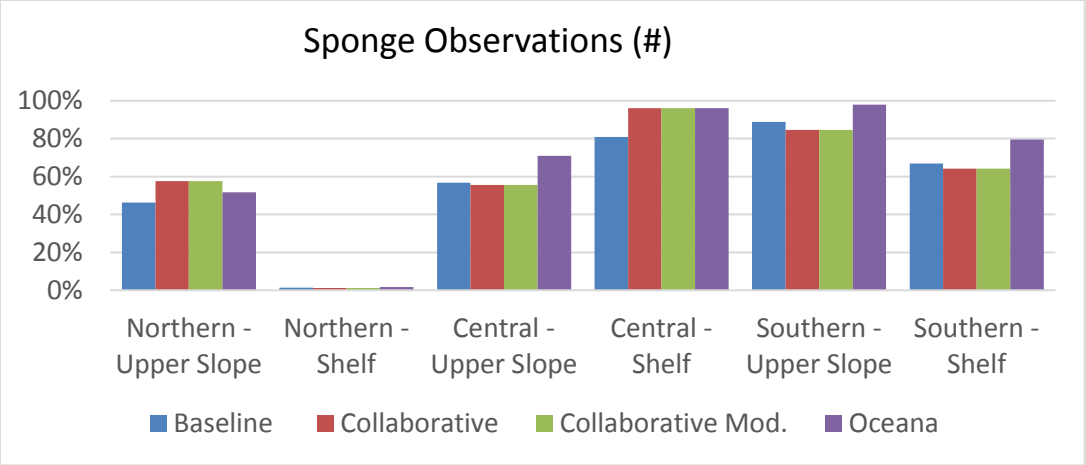


Figure 9. Proportion of *sponge observations* in the Northern, Central and Southern biogeographic regions closed to bottom trawling (upper slope and shelf depth zones). Most sponge observations in the Northern Shelf region are north of Grays Canyon inside the Tribal U&As and outside of this action, therefore only a very small proportion of sponge habitat on the Northern Shelf is protected under any alternative.

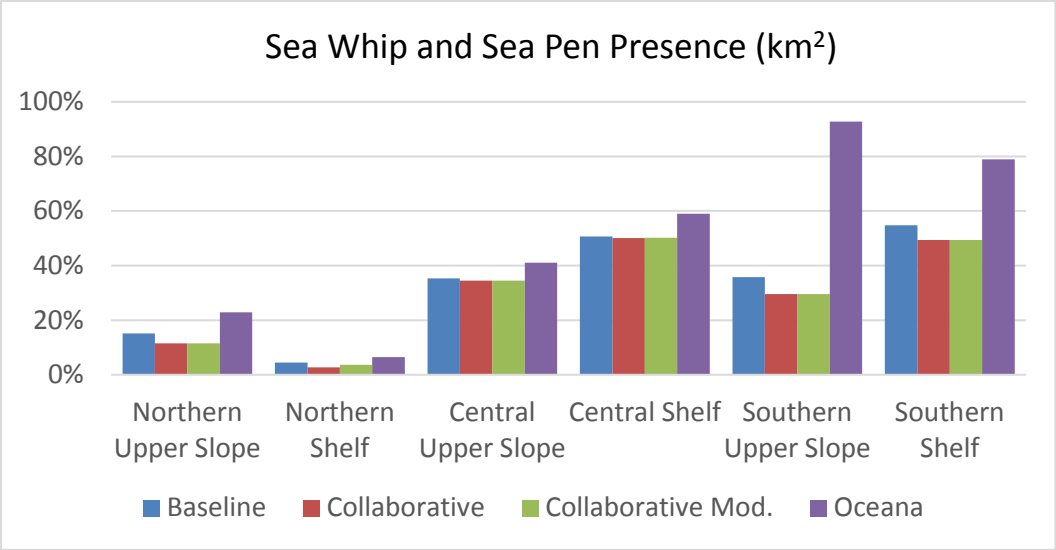


Figure 10. Proportion of *sea whip and sea pen presence (pennatulids)* in the Northern, Central and Southern biogeographic regions closed to bottom trawling (upper slope and shelf depth zones).

Groundfish Occurrence:

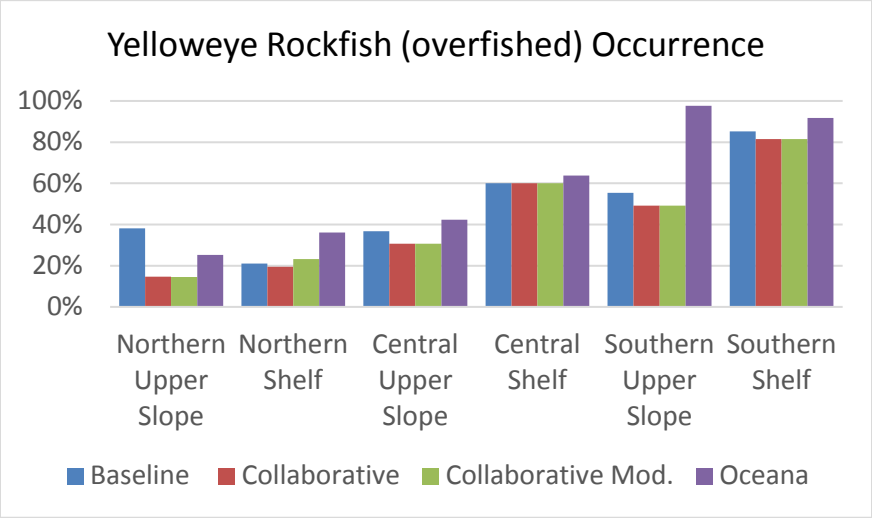


Figure 11. Proportion of overfished yelloweye rockfish habitat -- based on Northwest Fishery Science Center modeled probability of occurrence – contained within areas closed to bottom trawling under each scenario.

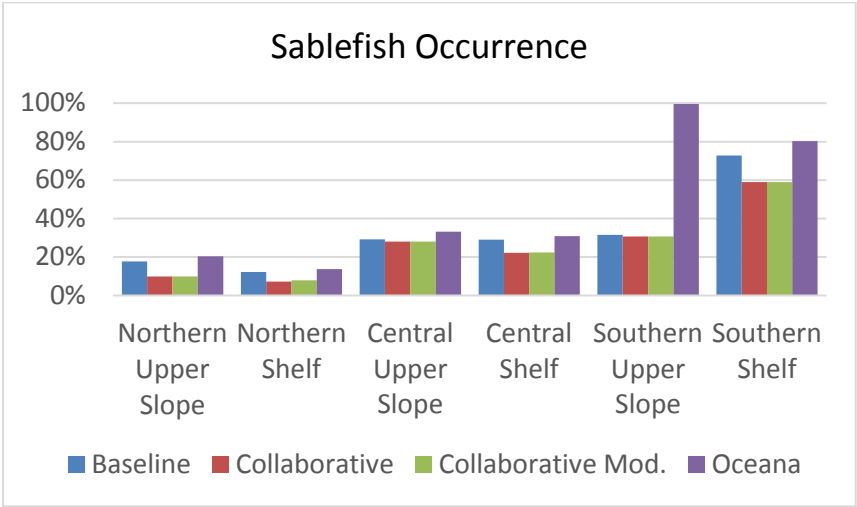


Figure 12. Proportion of sablefish habitat -- based on Northwest Fishery Science Center modeled probability of occurrence – contained within areas closed to bottom trawling under each scenario.

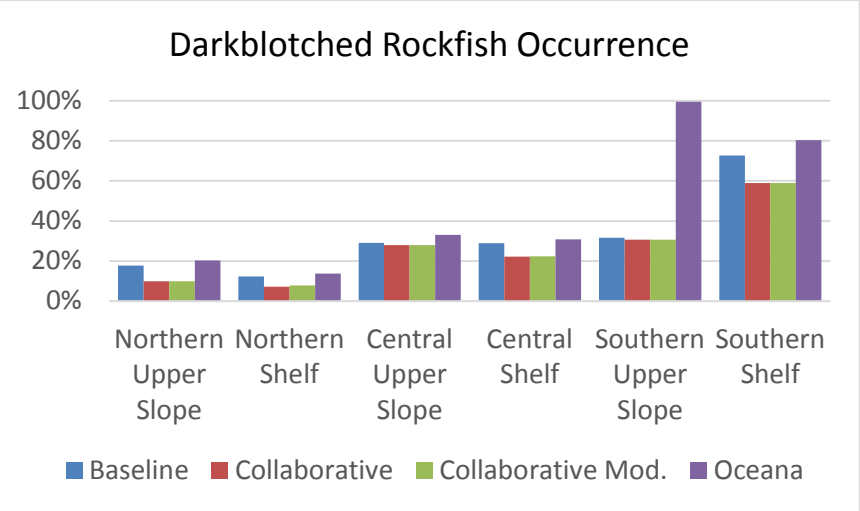


Figure 13. Proportion of darkblotched rockfish habitat -- based on Northwest Fishery Science Center modeled probability of occurrence – contained within areas closed to bottom trawling under each scenario.

Economic Analysis (Coastwide)

We present data on displaced bottom trawl fishing effort, as provided in the EFH Synthesis Report, which is consistent with the method and criteria used by the Council and NMFS in Amendment 19 to evaluate economic effects and practicability of EFH alternatives. The current and proposed configuration of closed areas was overlaid with bottom trawl effort data covering the period from "before" (1 Jan 2002 – 11 Jun 2006) and the "after" (12 Jun 2006 – 31 Dec 2010) implementation of Amendment 19 EFH regulations as provided in the EFH Synthesis Report. We note, however, that due to the way fishing effort was aggregated, displaced fishing effort 'after' gives the appearance of fishing effort inside closed areas. This is a product of the way effort data was aggregated to avoid releasing confidential information.

Since the current baseline closures result in a displacement of previous fishing effort, this analysis enables evaluation of whether net bottom trawl effort (a proxy for fishing opportunity) is increased or decreased under the new alternative scenarios. Using data from before or after 2006, this analysis indicates that both the Oceana alternative and the Collaborative alternative, combined with the Trawl RCA removal alternative result in a net increase in bottom trawl fishing effort relative to the status quo. In other words, the two alternatives restore more previously displaced fishing effort than they displace current fishing effort. Net Overall Restored Bottom Trawl Effort is calculated as the difference in each alternative from the baseline, as a percentage of the total baseline. This can be interpreted as the percentage of the displaced bottom trawl effort from current closures that would be restored.

For example, as seen in figure 15, the Oceana alternative restores 10% of bottom trawl fishing opportunities previously displaced by the current suite of closures. What this is telling you is that

even when accounting for additional closures, there would be net increase in fishing opportunities relative to what was previously displaced.

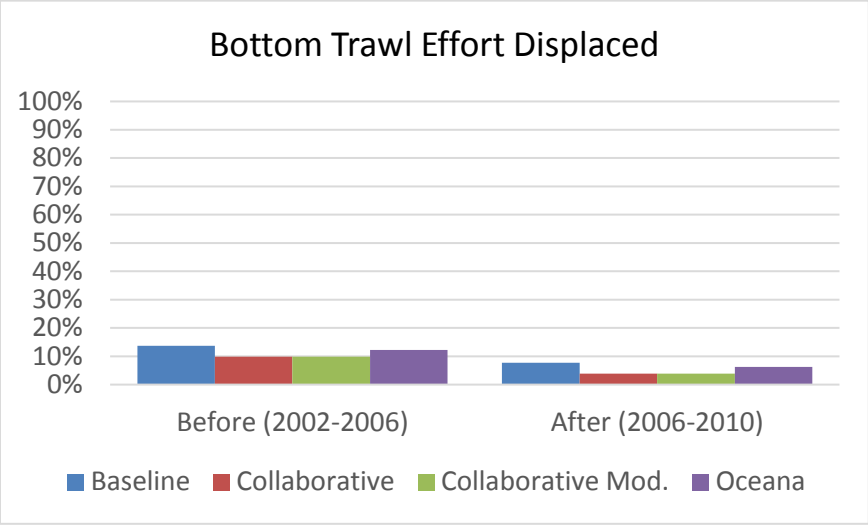


Figure 14. Percentage of total coastwide bottom trawl effort over two time periods contained within bottom trawl closures under each of three scenarios, based on data from EFH Synthesis Report.

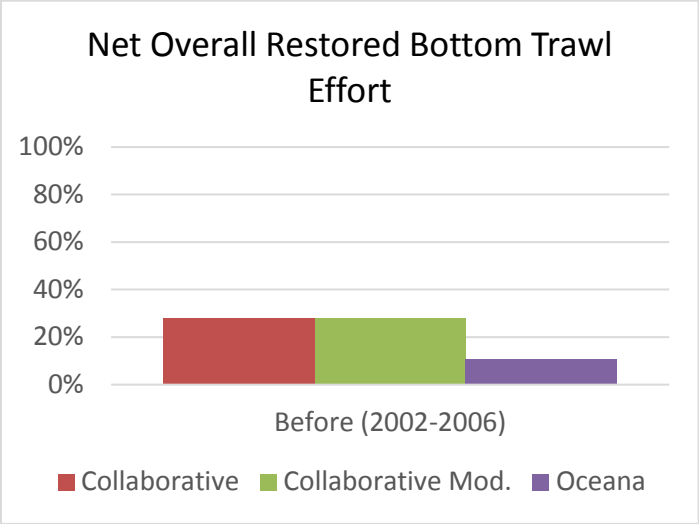


Figure 15. Estimated net increase in previously displaced coastwide bottom trawl effort that would be restored. This is a measure of the percentage of bottom trawl effort 'before' displaced by existing status quo bottom trawl closures (= Baseline Bottom Trawl Effort Displaced "before" – Alternative x bottom trawl effort displaced, "before"/ Baseline). While a precise net increase is difficult to estimate, analysis of publicly available data indicates an overall net increase in restored bottom trawl opportunity under the Oceana and Collaborative scenarios, with removal of the trawl RCA.

RCA-focused analysis (Coastwide)

This analysis examines only the habitats and features contained within the current core trawl RCA to evaluate which features within the trawl RCA would remain closed under four alternative scenarios. The first scenario is the full reopening of the trawl RCA south of Pt. Chehalis with no changes to EFH Conservation Areas. The other three scenarios examine the full reopening of the trawl RCA south of point Chehalis combined with the Collaborative EFH alternative (Alt 1a), the Collaborative Modified (Alt 1a + 1c+1e) and the Oceana EFH alternative (Alt 1b) respectively. The Oceana alternative would keep significant portions of the RCA closed, resulting in higher protections for priority habitats (e.g., hard substrate, corals, yelloweye habitat). In contrast to the Oceana proposal, the Collaborative alternative does not significantly add to protections within the RCA relative to what would remain closed by existing EFH Conservation Areas, marine protected areas, and state waters closures. Notably, with the lifting of the RCA, the existing status quo bottom trawl closures and Collaborative alternatives would reopen over half of all hard substrate inside the RCA.

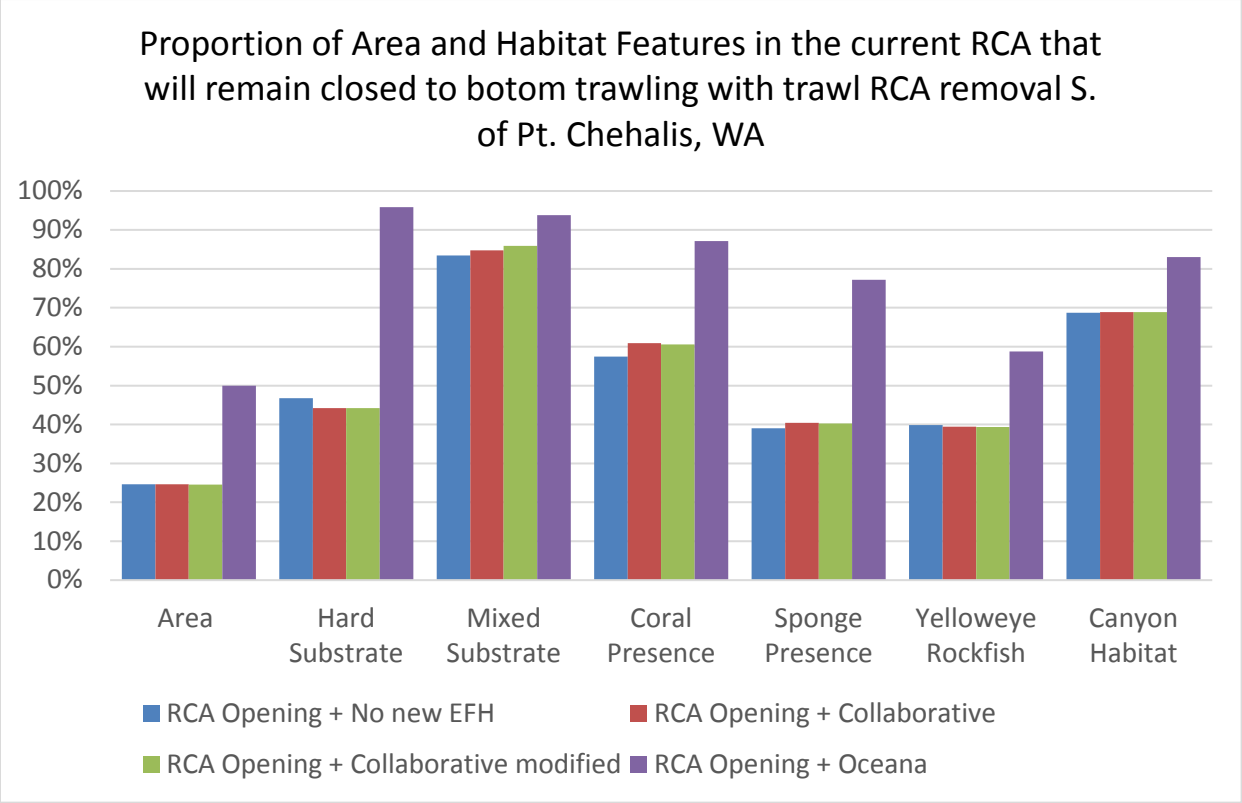


Figure 16. Comparative analysis of the proportion of each feature within the current coastwide trawl RCA that would remain closed to trawling under each scenario with removal of the RCA South of Pt. Chehalis, WA (Alt 2a).

Regional Analyses:

In addition to the analyses by biogeographic sub-region, we also analyzed the net changes in habitat features closed to bottom trawling off the combined Oregon shelf and upper slope (shore to 700 fathoms) and within each of the four West Coast National Marine Sanctuaries (NMS) off California that would be affected by the range of RCA and EFH alternatives. Analyses for the Greater Farallones NMS and Cordell Bank NMS use the revised sanctuary boundaries finalized in 2015. Bottom Trawl Effort Displaced refers to the period after 2006-2010.

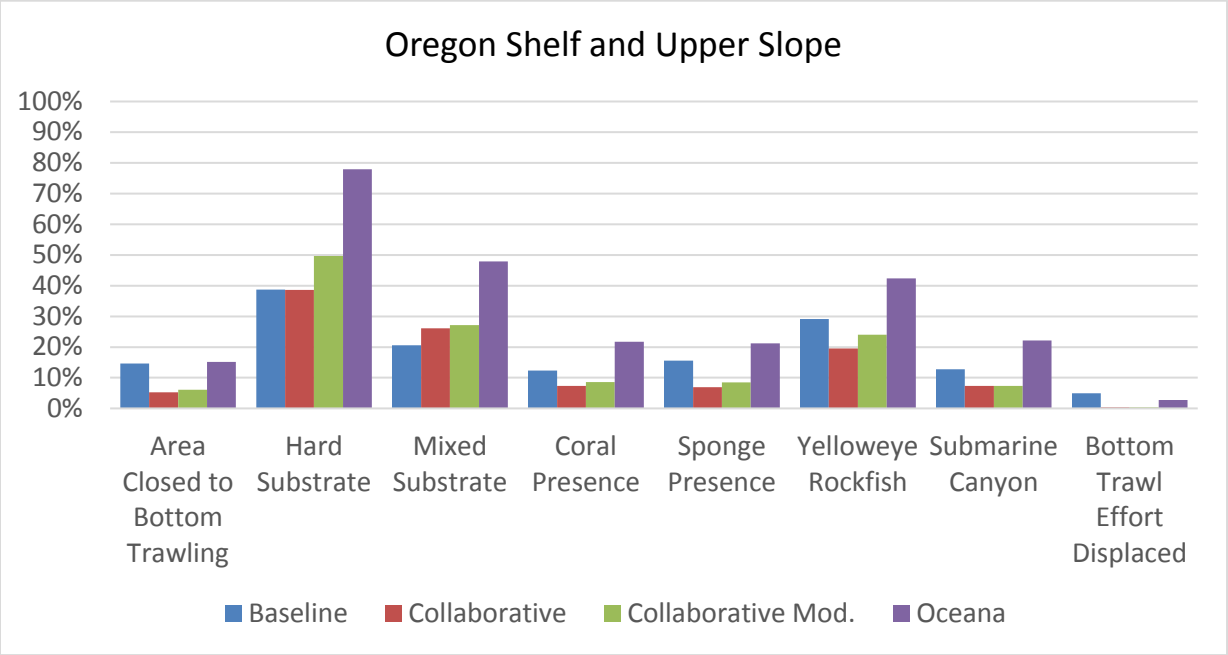


Figure 17. Comparative analysis for the areas off Oregon (shore to 700 fathoms/ 1280 meters, Columbia River to the OR/ CA border) under status quo management and the three alternative scenarios described in this document.

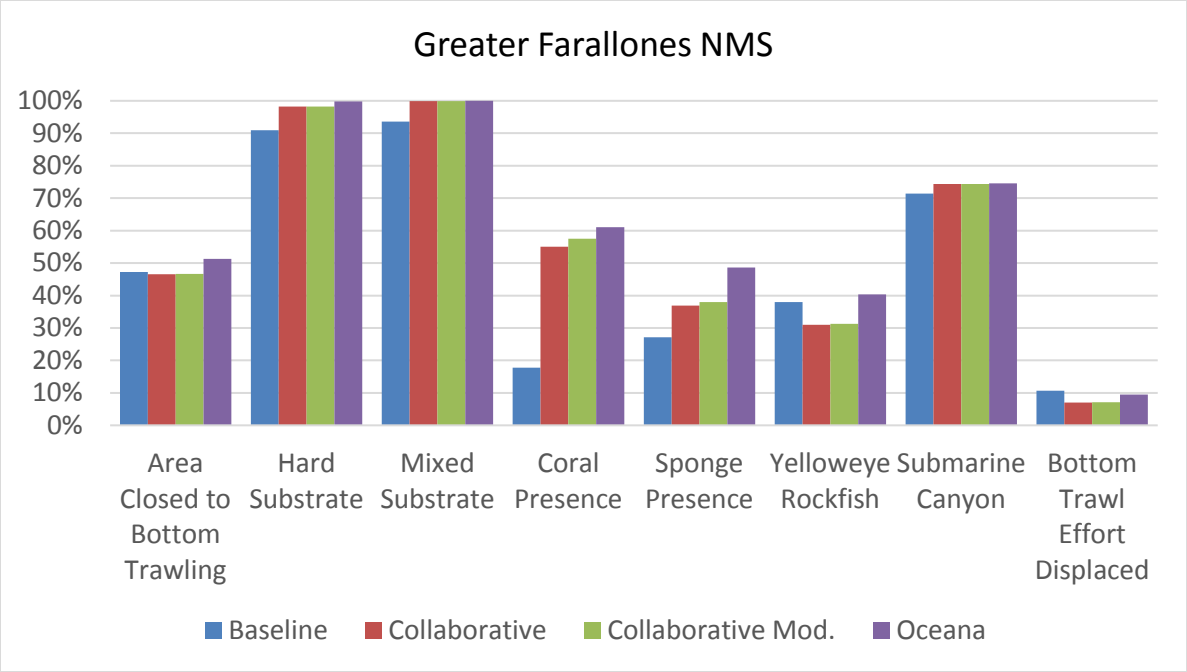


Figure 18. Comparative analysis for the area within the Greater Farallones National Marine Sanctuary. The "Collaborative Modified" scenario here uses the Rittenburg Bank area from EFH Alternative 1e.

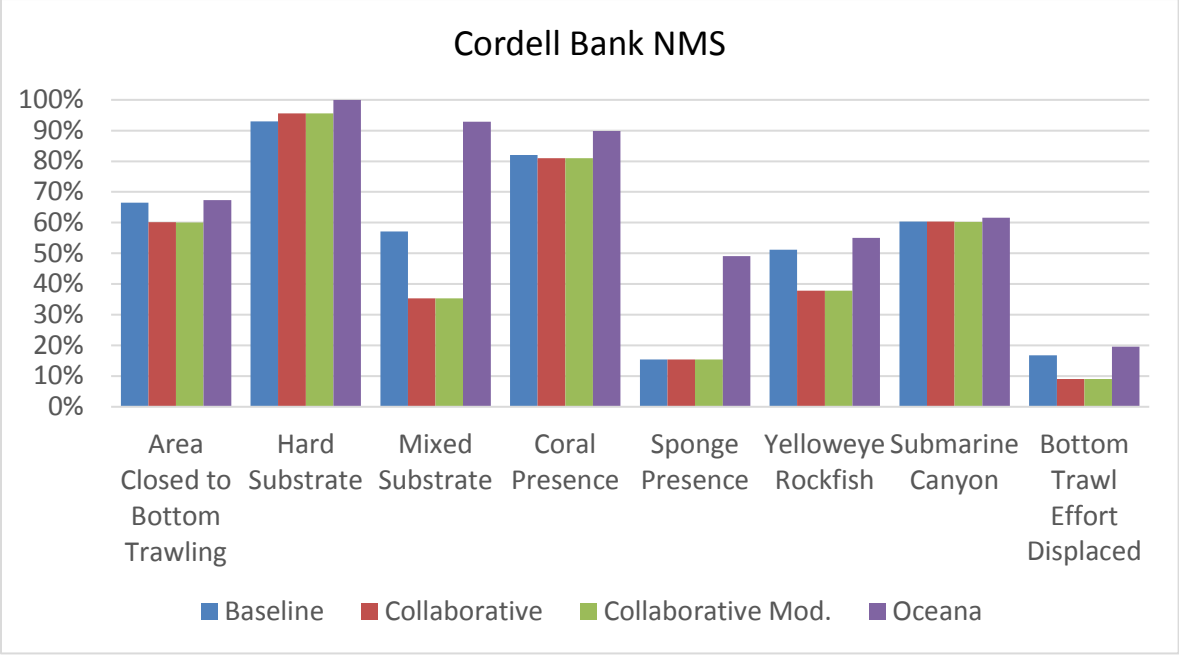


Figure 19. Comparative analysis for the area within the Cordell Bank National Marine Sanctuary. Proposed RCA and EFH Conservation Area openings in the Collaborative scenarios result in a loss of total area, mixed substrate and yelloweye rockfish habitat protected from bottom trawling compared with the status quo.

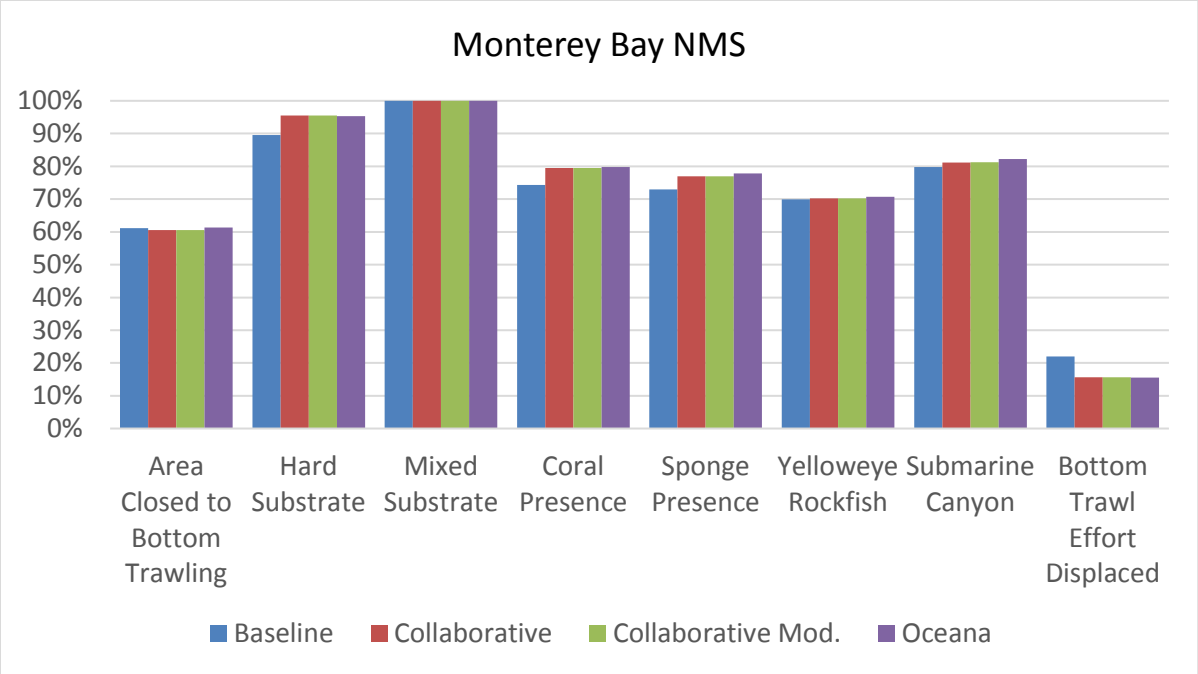


Figure 20. Comparative analysis for the area within the Monterey Bay National Marine Sanctuary. The Collaborative and Oceana scenarios are highly similar due to both alternatives incorporating the Monterey Bay National Marine Sanctuary proposal. The Oceana Alternative is identical to the Collaborative Alternative at 13 of the 15 areas originally proposed by the Sanctuary.

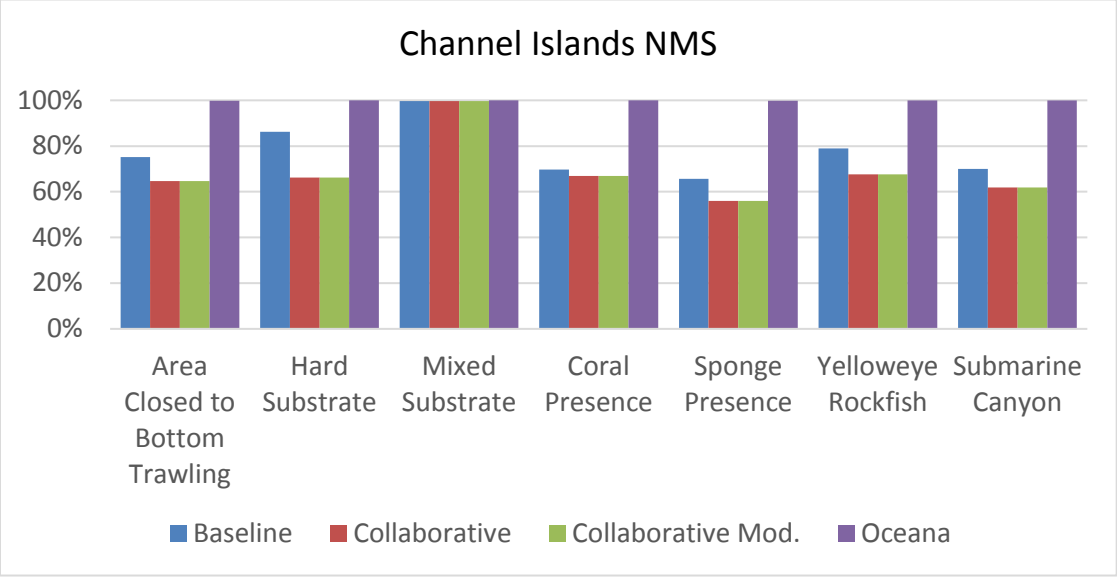


Figure 21. Comparative analysis for the area within the Channel Islands National Marine Sanctuary. The Oceana Southern California Bight proposal area would keep priority habitats in the Sanctuary protected from bottom trawling with the removal of the trawl RCA.

OCEANA Protecting the World's Oceans

222 NW Davis Street, Suite 200
Portland, OR 97209 USA

+1.503.235.0278
OCEANA.ORG

Attachment 2

A version of this letter was submitted to the PFMC May 31, 2017 but updated here to reflect new action alternative numbers

March 19, 2018

Mr. Phil Anderson, Chair
Pacific Fishery Management Council
7700 NE Ambassador Place, Suite 101
Portland, OR 97220

Mr. Barry Thom, Regional Administrator
National Marine Fisheries Service
1201 Northeast Lloyd Boulevard, Suite 1100
Portland, OR 97232

RE: Opposition to opening EFH Conservation Areas to bottom trawling

Dear Chair Pollard, Regional Administrator Thom, and Council members:

Thank you for your continued effort to advance the protection of essential fish habitat (EFH) off the U.S. West Coast. The Pacific Fishery Management Council (Council) has long recognized that seafloor habitat protection is fundamental to maintaining vibrant groundfish fisheries, and it has a track record of leadership on this pillar of ecosystem-based management. In April 2018, the Council is scheduled to take final action on both groundfish EFH and trawl rockfish conservation area modifications. Oceana urges adoption of the combination of the Oceana et al. coastwide EFH conservation alternative, 1b, protection of the deep-water ecosystem off California (alternative 3a), and removal of the trawl RCA South of Pt. Chehalis, WA (alternative 2a). The purpose of this letter is to express opposition to 14 specific proposed EFH conservation area openings included in the range of alternatives.

Based on the presence of priority habitat features, current West Coast EFH conservation areas were designed to meet the Magnuson-Stevens Fishery Conservation and Management Act (MSA) requirement to minimize adverse fishing impacts to the extent practicable, while identifying actions to encourage the conservation and enhancement of such habitat.[1] Before opening any of these closed areas to bottom trawling, the Council and NMFS must provide new information that justifies the change and shows that the opening is consistent with the statutory mandate. Without new scientific information or other persuasive explanation, EFH conservation area openings are not warranted.

EFH conservation areas should not be opened unless:

[1] 16 U.S.C. § 1853(a)(7)

1. Existing data do not show any known priority habitats, and the proposed opening is paired with new closures that increase the net overall protection of priority habitats in the immediate vicinity; or
2. New information, like high resolution seafloor mapping and *in situ* video shows conclusively that there are no priority habitats within the area proposed for reopening.

Accordingly, in certain specific cases, we support minor boundary modifications based on a thorough review of available scientific information, coupled with the designation of additional EFH conservation areas in the immediate vicinity that provide an overall increase in priority habitat protection. For example, the proposed EFH conservation area modifications in the Monterey Bay National Marine Sanctuary, as described in both the collaborative and Oceana alternatives, satisfy these criteria.

We strongly oppose opening EFH conservation areas to bottom trawling where data show that priority habitat features are present. Further, very few EFH conservation areas have been fully mapped and surveyed. In most cases, there are no new data to demonstrate that current EFH conservation areas can be opened consistent with the best science and legal mandate.

Of the 27 proposed openings in 15 different EFH conservation areas contained in EFH alternatives 1a (collaborative), 1b (Oceana) and 1c (Midwater Trawlers Cooperative), we have identified 14 that should not be allowed. For each, the available information suggests that the proposed reopening risks harm to priority habitats or features, proposed adjacent closures do not provide for a net increase in priority habitat protection, or there is no new conclusive information showing priority habitats are not present. These areas are listed in the attached table.

Any conservation area openings create risk to EFH from bottom trawling. Accordingly, we urge NMFS to work with its Science Centers and scientific partners to evaluate the impacts of EFH conservation areas and trawl rockfish conservation areas that are reopened. This evaluation should include detailed surveys of the habitats and species as well as a robust scientific assessment or study of bottom trawl fishing impacts.

Thank you for your ongoing commitment to minimizing the adverse effects of fishing on EFH, while providing for vibrant West Coast fishing opportunities. We look forward to working with you as this process moves forward.

Sincerely,

Geoffrey Shester, Ph.D.
California Campaign Director & Senior Scientist

Ben Enticknap
Pacific Campaign Mgr. & Senior Scientist

Attachment: Table of proposed EFH conservation area openings opposed by Oceana.

Table. Oceana strongly opposes the following fourteen proposed EFH conservation area openings contained in the collaborative EFH alternative 1a, and Midwater Trawlers Cooperative EFH alternative 1c, based on existing data showing the presence of priority habitats, a resulting net loss in priority habitat conservation or because no new information is available showing conclusively that priority habitats are not present. Priority habitats include submarine canyons and gullies, hard substrates, habitat-forming invertebrates (e.g. corals, sponges, pennatulids), untrawlable areas, seamounts and the highest 20 percent habitat suitability for overfished groundfish as defined by NOAA.[2]

Number	Alternative	Name
1	1a	Grays Canyon Western Modification
2	1c	Shale Pile Northeast Side (Nehalem Bank)
3	1c	Daisy Bank Southeastern Modification
4	1c	Daisy Bank Western Modification
5	1a	Bandon High Spot Northern Modification
6	1a	Bandon High Spot Southern Modification
7	1a	Eel River Canyon Modification 1
8	1a	Eel River Canyon Modification 3
9	1a	Mendocino Ridge Modification 2
10	1a	Delgada Canyon
11	1a	Spanish Canyon Line Adjustment 1
12	1a	Point Arena South Modification 1
13	1a	Point Arena South Modification 4
14	1a	Cordell Bank Modification 3

[2] PFMC Agenda Item F.5a. EFH/RCA Project Team Report. April 2016, at 5

Attachment 3

The San Diego Union-Tribune

Stand up for California's seafloor

A starfish, coral and a green spotted rockfish. (Photo Courtesy of Oceana)

Available at: http://fw.to/04jCx6Y

ALEXANDRA COUSTEAU & TED DANSON

November 16, 2016, 5:15pm

The Pacific Ocean off California is unlike any other place in the world. Its fluorescent sunsets and powerful waves have been the inspiration for pop culture, art, education and conservation. Visitors and locals alike flock to California's 840 miles of breathtaking coastline. However, just beyond the limits of the naked eye lies an important part of the ocean that many people don't know about, the seafloor. Remarkably, we know more about the moon orbiting the Earth about 230,000 miles away than we do about the seafloor.

While ocean exploration has come a long way in the last several decades, less than 0.5 percent of the world's ocean has been explored, photographed or filmed. This summer a team of researchers and explorers with Oceana, MARE (Marine Applied Research & Exploration) and the National Oceanic and Atmospheric Administration embarked on a scientific expedition to document deep

sea life in the Southern California Bight offshore of Los Angeles. The resulting footage and data unveiled a remarkable underwater world unlike any other.

Imagine a colorful underwater forest of gold, purple and pink coral colonies comprised of thousands of individual animals. These structures, like sponges, rocky reefs and underwater canyons, are habitat for dozens of fish species — many are sought after in commercial and sport fisheries — and are frequented by octopus, sea stars and crabs. The expedition's images show shark egg cases hanging on coral branches like decorations, rockfish nestling into cylindrical sponges, eels peering out of rocky reefs and basket stars precariously balancing on sponges shaped like vases. These diverse seafloor structures provide shelter, feeding grounds and breeding areas for countless species of marine life.

Without healthy productive seafloor habitats, the oceans wouldn't be the same. In order to balance a vibrant fishing economy and ocean biodiversity, we must protect the oceans from the seafloor up.

The greatest known threat to seafloor habitat is destructive bottom trawl fishing gear. In this industrial fishing practice, heavy equipment that drags along the ocean floor holds open large nets, scooping up not only the targeted commercial fish species, but also nearly everything else in the path of the trawl. Corals, sponges and other living seafloor structures are toppled, crushed or ripped from the seafloor. Growing only millimeters a year, corals and sponges could take hundreds to thousands of years to recover, if ever. Currently, bottom trawling off Southern California only occurs in shallow, nearshore waters, leaving the vast majority of seafloor wilderness pristine. This provides a unique opportunity to protect this exquisite habitat now.

The California coast is an aquatic treasure trove supporting one of the busiest marine highways in the world. Fed by cold nutrient-rich waters, the California Current has been nicknamed the "Blue Serengeti" as it is home to whales, dolphins, fish and sea turtles that migrate up and down the coast, provides nurseries for sharks, hosts rookeries for sea lions and so much more. The brilliance of ocean wildlife that converges here makes it globally significant. A healthy seafloor, in turn, helps this ocean wilderness flourish.

Federal fishery managers have an opportunity at their meeting in Southern California this month to safeguard these deep sea ecosystems from a future of destruction by bottom trawl gear. The Pacific Fishery Management Council has taken action before to prevent the expansion of destructive bottom trawling. We are asking this management body to extend this precautionary approach to seafloor areas off Southern California, a truly unique gem right off our coast, while maintaining the nearshore fishing grounds where trawling already takes place.

While most of the Southern California seafloor has yet to be explored, the places that scientists have visited are vibrant, unspoiled and unlike any other across our water planet. We want new discoveries to be made through a camera lens, not seen for the first time broken and dead in a trawl net.

Some of the most known fragile seafloor structures from California to northern Washington were protected in 2006. Research expeditions over the last decade demonstrate the many undersea

treasures still being discovered that are risk if we expand bottom trawling over the California seafloor.

The Pacific Fishery Management Council is scheduled to discuss the fate of Southern California's seafloor and accept public comments at its meeting in Garden Grove on Friday.

We invite Southern Californians to stand up for the deep sea and help save the seafloor.

Cousteau is a senior advisor to Oceana, is a part of the National Geographic Emerging Explorers Program, and a filmmaker and globally recognized advocate on water issues who continues the work of her renowned grandfather Jacques-Yves Cousteau and her father Philippe Cousteau Sr. Danson is an award-winning actor, longtime ocean advocate and Oceana board member.

Attachment 4

Agenda Item F.4.b
Supplemental CA Lt. Governor Report
November 2016

GAVIN NEWSOM
LIEUTENANT GOVERNOR

October 26, 2016

Mr. Herb Pollard, Chair
Pacific Fishery Management Council
7700 NE Ambassador Place, Suite 101
Portland, OR 97220-1384

Mr. Barry Thom
West Coast Regional Administrator
National Marine Fisheries Service West Coast Region
7600 Sand Point Way NE, Bldg. 1
Seattle, WA 98115-0070

Dear Chair Pollard and Mr. Thom:

I am writing to express my support for the protecting living seafloor project to ensure sustainable fisheries and healthy ocean ecosystems along the Southern California Bight – the area extending from Point Conception, California to the U.S./Mexico border. We have an opportunity to implement a precautionary management approach to a truly unique ocean habitat which will ensure that the Pacific Ocean off Southern California continues to be a global hotbed for marine wildlife by eliminating the threat of bottom trawling on the seafloor.

The deep sea is a vast unexplored territory and the complexity of undersea geology is lined with rocky reefs, faults, canyons, and underwater mountains throughout Southern California waters, which makes for a diverse seafloor unlike any other place off the U.S. west coast. Federal government advisors are aware of this unique global hotspot, and as Californians, we have an opportunity to work together secure habitat for a broad variety of sea life. This includes migratory large whales, nurseries for white shark pups, breeding habitat for California sea lions; and productive ocean ecosystems for biodiversity such as deep sea corals, octopus, and sponges that provide food and shelter for the economically robust commercial and sport fisheries in Southern California.

It is timely and crucial that we continue to develop new innovative ways to prepare, manage, and mitigate changing ocean conditions caused by climate change along our coastlines, and develop policy and programs to research issues such as ocean acidification and hypoxia. Protection of pristine deep sea habitat found in the Southern California Bight is essential for data collection and understanding California's greatest ally – the Pacific Ocean. Critically, these areas are threatened because of possible expansion of bottom trawling along the seafloor. If bottom trawling is stretched beyond its current small near shore areas, we run the risk of significant and long-term negative impacts to these ecosystems and biodiversity.

STATE CAPITOL, ROOM 1114, SACRAMENTO, CALIFORNIA 95814 • PHONE (916) 445-8994
WWW.LTG.CA.GOV

GAVIN NEWSOM
LIEUTENANT GOVERNOR

We are in a position to continue to be at the forefront of protecting essential wildlife in our ocean ecosystems by implementing the precautionary management approach. We have the opportunity to set a precedent for the best possible way to protect these systems, while encouraging the discovery of even more species in the process. The ultimate goal is to designate all un-trawled areas south of Point Conception as an Essential Fish Habitat Conservation Area closed to bottom-trawling. This would eliminate the single greatest impact to seafloor habitats among all fishing gears in use off the West Coast.

Please stand together with me as we lead the advancement of sustainable protection of our precious marine wildlife and California's ocean heritage. I am excited at the opportunity to advance meaningful change to protect these species while ensuring sustainability of our fisheries, and I hope that you will join me in this effort.

Sincerely,

Gavin Newsom
Lieutenant Governor

STATE CAPITOL, ROOM 1114, SACRAMENTO, CALIFORNIA 95814 • PHONE (916) 445-8994
WWW.LTG.CA.GOV

Attachment 5

TONI G. ATKINS
SPEAKER EMERITUS

November 16, 2016

Mr. Herb Pollard, Chair
Pacific Fishery Management Council
7700 NE Ambassador Place, Suite 101
Portland, OR 97220-1384

Mr. Barry Thom, West Coast Regional Administrator
National Marine Fisheries Service West Coast Region
7600 Sand Point Way NE, Bldg. 1
Seattle, WA 98115-0070

RE: Support for Essential Fish Habitat Protections off Southern California

Dear Chair Pollard and Mr. Thom:

Californians have a vested interest in the stewardship of healthy oceans, from the seafloor up. As a member of the California State Legislature, I am writing in support of protecting the living seafloor in federal waters off our Southern California districts as an Essential Fish Habitat Conservation Area closed to bottom trawling to support dynamic deep sea ecosystems and sustainable fisheries.

Thousands of Californians have expressed support for protecting ocean resources that provide us with valuable services that contribute towards our coastal economy. Nutrient-rich ocean waters off the coast of Southern California boast amazing diversity of wildlife and support recreational and commercial fishing opportunities that drive our coastal economy. The seafloor on the continental shelf—extending more than one hundred miles from the shoreline—abounds with special habitats like coral gardens, sponge beds, rocky reefs, and underwater canyons. Images of gold corals adorned with shark eggs, Christmas tree corals decorated with crabs, and sponge beds teeming with fish, illustrate what an uncommon place this is. We are only beginning to understand where new biological discoveries are still being made. What we do know, however, is that these deep sea ecosystems are ecologically significant.

Fragile seafloor habitats like these are susceptible to disturbance from bottom trawls, the most damaging fish gear to the seafloor off the U.S. West Coast. While bottom trawl fishing is used in nearshore state fisheries to target California halibut, sea cucumbers, prawns and other species, most of the seabed in the Southern California Bight—stretching from Point Conception to the U.S./Mexico border—has never been trawled, and is largely pristine. Expansion of bottom trawling in the Southern California Bight beyond the nearshore areas where it currently takes place could have significant detrimental effects to the health and productivity of this deep sea ecosystem.

CAPITOL OFFICE: STATE CAPITOL, ROOM 319 · SACRAMENTO, CA 95814 · PHONE (916) 319-2078 · FAX (916) 319-2178
DISTRICT OFFICE: 1350 FRONT STREET, ROOM 6054 • SAN DIEGO, CA 92101 • (619) 645-3090 • FAX: (619) 645-3094
WEB SITE: ASMDC.ORG/MEMBERS/ATKINS • E-MAIL: ASSEMBLYMEMBER.ATKINS@ASSEMBLY.CA.GOV

As stewards of healthy oceans, we support actions that ensure productive marine ecosystems and sustain healthy fisheries. We strongly urge you to safeguard Southern California's living seafloor for the benefit of future generations by designating all un-trawled areas south of Point Conception as an Essential Fish Habitat Conservation Area closed to bottom trawling.

Sincerely,

TONI G. ATKINS
Speaker Emeritus of the Assembly
Assembly District 78

Cc: Chuck Bonham, California Department of Fish and Wildlife, Director

STATE CAPITOL
P.O. BOX 942849
SACRAMENTO, CA 94249-0080
(916) 319-2080
FAX (916) 319-2180

DISTRICT OFFICE
1350 FRONT STREET, SUITE 6022
SAN DIEGO, CA 92101
(619) 338-8090
FAX (619) 338-8099

Assembly
California Legislature

LORENA GONZALEZ
ASSEMBLYWOMAN, EIGHTIETH DISTRICT

COMMITTEES
CHAIR: APPROPRIATIONS

SELECT COMMITTEES
CHAIR: WOMEN IN THE WORKPLACE

November 11, 2016

Mr. Herb Pollard, Chair
Pacific Fishery Management Council
7700 NE Ambassador Place, Suite 101
Portland, OR 97220-1384

Mr. Barry Thom
West Coast Regional Administrator
National Marine Fisheries Service West Coast Region
7600 Sand Point Way NE, Bldg. 1
Seattle, WA 98115-0070

RE: Support for Essential Fish Habitat Protections off Southern California

Dear Chair Pollard and Mr. Thom:

Californians have a vested interest in stewardship of healthy oceans, from the seafloor up. We, the undersigned representatives of the State of California, are writing in support of protecting the living seafloor in federal waters off our Southern California districts as an Essential Fish Habitat Conservation Area closed to bottom trawling to support dynamic deep sea ecosystems and sustainable fisheries. Thousands of Californians have expressed support for protecting ocean resources that provide us with valuable services that contribute towards our coastal economy.

Nutrient-rich ocean waters off the coast of Southern California boast amazing diversity of wildlife and support recreational and commercial fishing opportunities that drive our coastal economy. The seafloor on the continental shelf—extending more than one hundred miles from the shoreline—abounds with special habitats like coral gardens, sponge beds, rocky reefs, and underwater canyons. Images of gold corals adorned with shark eggs, Christmas tree corals decorated with crabs, and sponge beds teeming with fish illustrate what a unique place this truly is. We are only beginning to understand this special place, where new biological discoveries are still being made. What we do know, however, is that these deep sea ecosystems are ecologically significant.

Fragile seafloor habitats like these are susceptible to disturbance from bottom trawls, the most damaging fish gear to the seafloor off the U.S. West Coast. While bottom trawl fishing is used in nearshore state fisheries to target California halibut, sea cucumbers, prawns and other species,

most of the seabed in the Southern California Bight—stretching from Point Conception to the U.S./Mexico border—has never been trawled, and is largely pristine. Expansion of bottom trawling in the Southern California Bight beyond the nearshore areas where it currently takes place could have significant detrimental impacts to the health and productivity of this deep sea ecosystem.

As stewards of healthy oceans, we support actions that ensure productive marine ecosystems and sustain healthy fisheries. We strongly urge you to safeguard Southern California's living seafloor for the benefit of future generations by designating all un-trawled areas south of Point Conception as an Essential Fish Habitat Conservation Area closed to bottom trawling.

Sincerely,

LORENA S. GONZALEZ
Assemblywoman, 80th District

Attachment 6

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, after 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, Ph.D. Director and Professor, Marine Laboratory, Humboldt State University
Tissot@humboldt.edu | 707-826-5827 | HSUMarineLab.org

Citations

Andrews, A.H., R.P. Stone, C.C. Lundstrom, A.P. DeVogelaere. 2009. Growth rate and age determination of bamboo corals from the northeastern Pacific Ocean using refined ^{210}Pb dating. Mar. Ecol. Prog. Ser. 397: 173-185.

Auster, P.J. and R.W. Langton. 1999. The effects of fishing on fish habitat. In: Benaka, L., ed. Fish habitat: essential fish habitat and rehabilitation. Am Fish Soc Symp. 22:150-187.

Clarke, M.E., C.E. Whitmire, M.M. Yoklavich. 2015. State of Deep-Sea Coral and Sponge Ecosystems of the U.S. West Coast: 2015. In: Hourigan T.F., Etnoyer P.J., Cairns S.D., Tsao C-F (eds.) The State of Deep-Sea Coral and Sponge Ecosystems of the United States: 2015. NOAA Technical Memorandum X. NOAA, Silver Spring, pp 5-1 – 5-42.

Collie, J.S., S.J. Hall, M.J. Kaiser and I.R. Poiners. 2000. A quantitative analysis of fishing impacts on shelf-sea benthos. J Anim Ecol. 69:785-798.

Guinotte, J.M., and A.J. Davies. 2014. Predicted Deep-Sea Coral Habitat Suitability for the U.S. West Coast. PLoS ONE 9(4): e93918. doi:10.1371/journal.pone.0093918

Hixon, M. A. and B. N. Tissot. 2007. Comparison of trawled vs. untrawled mud seafloor assemblages of fishes and macroinvertebrates at Coquille Bank, Oregon. J. Exp. Mar. Biol. Ecol. 344: 23-34.

Hourigan, T.F. 2009. Managing fishery impacts on deep-water coral ecosystems of the U.S.A. emerging best practices. Mar. Ecol. Prog. Ser. 397: 333-340.

Kaiser, M.J., K.R. Clarke, H. Hinz, M.C.V. Austen, P.J. Somerfield and I. Karakassis. 2006. Global analysis of response and recovery of benthic biota to fishing. Mar Ecol Prog Ser. 311:1-14.

Levin, L.A., and N. Le Bris. 2015. The deep ocean under climate change. Science. 350, 766-768

Marliave, J.B., K.W. Conway, D.M. Gibbs, A. Lamb, and C. Gibbs. 2009. Biodiversity and rockfish recruitment in sponge gardens and bioherms of southern British Columbia, Canada. Marine Biology 156: 2247–2254.

Morgan, L.E., and R. Chuendpagdee. 2003. Shifting Gears: addressing the collateral impacts of fishing methods in U.S. Waters. Pew Science Series, Washington DC, 42pp

NOAA (National Oceanic and Atmospheric Administration). 2014. Deep Sea Coral Research and Technology Program. 2014 Report to Congress. Accessed at:
http://www.habitat.noaa.gov/pdf/FINAL_DSCRtC_4_17_2014_Interactive.pdf

NRC (National Research Council). 2002. Effects of trawling and dredging on seafloor habitat. National Academy Press, Washington D.C.

PFMC (Pacific Fishery Management Council). 2005. Pacific coast groundfish fishery management plan: essential fish habitat designation and minimization of adverse impacts: Final environmental impact statement. Pacific Fishery Management Council, Portland, Oregon, USA

Roark, E.B., T.P. Guilderson, R.B. Dunbar, S.J. Fallon, and D.A. Mucclarone. 2009. Extreme longevity in proteinaceous deep-sea corals. PNAS 106(13) 5204-5208 DOI: 10.1073/pnas.0810875106

Rooper, C.N., J.L. Boldt, and M. Zimmermann. 2007. An assessment of juvenile Pacific Ocean perch (*Sebastes alutus*) habitat use in a deepwater nursery. Estuarine Coastal and Shelf Science 75: 371–380.

Rooper, C.N., and M.H. Martin. 2012. Comparison of habitat-based indices of abundance with fishery independent biomass estimates from bottom trawl surveys. Fishery Bulletin, U.S. 110:21–35.

Tissot, B.N., M.M. Yoklavich, M.L. Love, K. York, and M. Amend. 2006. Benthic invertebrates that form habitat on deep banks off southern California, with special reference to deep sea coral. Fish. Bull. 104: 167-181.

Whitmire, C.E. and M.E. Clarke. 2007. State of Deep Coral Ecosystems of the U.S. Pacific Coast: California to Washington. In: S.E. Lumsden, Hourigan T.F., Bruckner A.W. and Dorr G. (eds.) The State of Deep Coral Ecosystems of the United States. NOAA Technical Memorandum CRCP-3. Silver Spring MD 365 pp.

Supporting Signatures

Andrew R. Thurber, Ph.D.
Assistant Professor
College of Earth, Ocean, and Atmospheric Sciences
Oregon State University
Corvallis, OR

Alan Shanks, Ph.D.
Professor of Marine Biology
Oregon Institute of Marine Biology
University of Oregon
Charleston, OR

Paul Dayton, Ph.D.
Professor Emeritus
Scripps Institution of Oceanography
University of California, San Diego
San Diego, CA

Gregor M. Cailliet, Ph.D.
Professor Emeritus
Moss Landing Marine Laboratories
California State University
Moss Landing, CA

Peter J. Auster, Ph.D.
Research Professor Emeritus, Department of Marine Sciences
Univ. of Connecticut at Avery
Point Groton, CT

Erik Cordes, Ph.D.
Associate Professor of Biology
Temple University
Philadelphia, PA

Jennifer Smith, Ph.D.
Associate Professor
Scripps Institution of Oceanography
University of California, San Diego
San Diego, CA

Daniel Pauly, Ph.D.
Professor & Principal Investigator
Sea Around Us
Institute for the Oceans and Fisheries
The University of British Columbia
Vancouver, B.C., Canada

Elizabeth M. De Santo, Ph.D.
Assistant Professor of Environmental Studies
Department of Earth and Environment
Franklin & Marshall College
Lancaster, PA

Douglas McCauley, Ph.D.
Assistant Professor
Ecology, Evolution, & Marine Biology
University of California, Santa Barbara
Santa Barbara, CA

Mark Hixon, Ph.D.
Professor and Hsiao Endowed Chair in Marine Biology
Department of Biology
University of Hawai‘i at Mānoa
Honolulu, HI

Thomas C. Shirley, Ph.D.
Professor Emeritus,
School of Fisheries & Ocean Science
Univ. of Alaska Fairbanks &
Professor Emeritus
Harte Research Institute
Texas A&M Univ.
Corpus Christi, TX

Benjamin M. Grupe, Ph.D.
Visiting Postdoctoral Fellow
Institute of Ocean Sciences
Fisheries & Oceans Canada
Sidney, BC, Canada

Fiorenza Micheli, Ph.D.
Professor of Biology
Hopkins Marine Station
Stanford University
Pacific Grove, CA

Catherine de Rivera, Ph.D.
Professor
Environmental Science & Management
Portland State University
Portland, OR

Donna Kline
Research Specialist
Fisheries & Conservation Biology
Moss Landing Marine Labs
Moss Landing, CA

Lance Morgan, Ph.D.
President
Marine Conservation Institute
Glen Ellen, CA

Gary C. Williams, Ph.D.
Curator of Invertebrate Zoology
California Academy of Sciences
San Francisco, CA

Matthew Bracken, Ph.D.
Associate Professor
Ecology and Evolutionary Biology
University of California, Irvine

Stephen Barrager, Ph.D.
Publisher
Baker Street Publishing
San Francisco, CA

Richard M. Starr, Ph.D.
Research Faculty
Moss Landing Marine Labs
8272 Moss Landing Road
Moss Landing, CA

Sean Rooney
Ph.D. Candidate
Washington State University
Vancouver, WA

Erik Sperling, Ph.D.
Assistant Professor
Geological Sciences
Stanford University
Stanford, CA

John (Jack) A. Barth, Ph.D.
Executive Director
Marine Studies Initiative
Oregon State University
Corvallis, OR

Elise Granek, Ph.D.
Professor
Environmental Science & Management
Portland State University
Portland, OR

George N. Somero, Ph.D.
David and Lucile Packard Professor Emeritus of Marine Sciences
Hopkins Marine Station
Stanford University
Pacific Grove, CA

Sandra Brooke, Ph.D.
Associate Research Faculty
Coastal and Marine Laboratory
Florida State University
St. Teresa, FL

Larry G. Allen, Ph.D.
Professor of Biology
California State University
Northridge, CA

Michael F. Vardaro, Ph.D.
Research Scientist
Department of Marine & Coastal Sciences
Rutgers University
New Brunswick, NJ

Kirsten Grorud-Colvert, Ph.D.
Assistant Professor- Senior Research
Integrative Biology
Oregon State University
Corvallis, OR

Stacy Kim, Ph.D.
Research Professor
Benthic Lab
Moss Landing Marine Labs
Moss Landing, CA

Samantha B. Joye, Ph.D.
Distinguished Professor
Marine Sciences
University of Georgia
Athens, GA

Michael Reuscher, Ph.D.
Postdoctoral Research Associate
Texas A&M University- Corpus Christi
Corpus Christi, TX

R. Dean Grubbs, Ph.D.
Associate Director of Research
Florida State University Coastal and Marine Lab
St. Teresa, FL

Les Watling, Ph.D.
Professor
Dept. of Biology
University of Hawaii at Manoa
Honolulu, HI

Geoffrey S. Cook, Ph.D.
Assistant Professor of Marine Ecology
Department of Biology, University of Central Florida
Orlando, FL

Ron J. Etter, Ph.D.
Professor
Biology Department
University of Massachusetts
Boston, MA

Jeffrey C. Drazen, Ph.D.
Professor
Department of Oceanography
University of Hawaii at Manoa
Honolulu, HI

Diva Amon, Ph.D.
Postdoctoral Fellow
Department of Oceanography
University of Hawaii
Honolulu, HI

Lea-Anne Henry, Ph.D.
Chancellor's Fellow
School of GeoSciences
University of Edinburgh
Edinburgh, United Kingdom

Neus Campanya-Llovet
PhD Candidate
Ocean Sciences
Memorial University of Newfoundland
St. John's, NL, Canada

Amanda Kahn, Ph.D.
Postdoctoral Fellow
Department of Biological Sciences
University of Alberta
Edmonton, AB, Canada

Yann Marcon, Ph.D.
Senior Scientist
Deep Sea Ecology and Technology
Alfred Wegener Institute, Helmholtz Center for Polar and Marine Research
Bremerhaven, Germany

Clifton C. Nunnally, Ph.D.
Research Associate
Louisiana Universities Marine Consortium
Chauvin, LA

Verena Tunnicliffe, Ph.D.
Canada Research Chair I in Deep Oceans
Biology
University of Victoria
Victoria, BC, Canada

Cherisse Du Preez, Ph.D.
Postdoc in Dr. Chuck Fisher's Lab
Biology
The Pennsylvania State University
State College, PA

Michael S Heard Snow, Ph.D.
Postgraduate
School of Geosciences
University of Edinburgh
Edinburgh, Scotland

Sarah Hameed, Ph.D.
Postdoctoral Fellow
Marine Conservation Institute
Glen Ellen, CA

Santiago Herrera, Ph.D.
Visiting Assistant Professor
Lehigh University
Bethlehem, PA

Samuel Georgian, Ph.D.
Marine Biogeographer
Marine Conservation Institute
Seattle, WA

Etienne Rastoin
Project Scientist
Marine Biology Department
Charles Darwin Foundation for the Galapagos Islands
Galapagos, Ecuador

Melanie Bergmann, Ph.D.
Senior Scientist
Alfred-Wegener-Institut Helmholtz-Zentrum für Polar- und Meeresforschung
Bremerhaven, Germany

Derek C. Sowers
Ph.D. Candidate
Oceanography
University of New Hampshire
Durham, NH

Emanuela Fanelli, Ph.D.
Researcher
Marine Environment Research Center
ENEA
Lerici, Italy

Tammy Horton, Ph.D.
Research Scientist
National Oceanography Centre, Southampton
Southampton, U.K.

Luciano Gomes Fischer, Ph.D.
Professor
Núcleo de Desenvolvimento Socioambiental de Macaé (NUPEM)
Federal University of Rio de Janeiro (UFRJ)
Macaé, Rio de Janeiro

Attachment 7

THE SACRAMENTO BEE

On Tuesday, the Pacific Fishery Management Council is scheduled to consider establishing precautionary protection of this deep-water habitat along the West Coast. Chelsey Lewis Milwaukee Journal Sentinel

Protection of deep sea habitat off California's coast needed now

BY BRIAN TISSOT

Special to The Bee

September 13, 2015 04:00 PM

Available at: http://www.sacbee.com/opinion/op-ed/soapbox/article34975470.html

Imagine an area nearly as large as the state of California, a frontier of largely unexplored terrain known to harbor forms of life hundreds or even thousands of years old. A place where the number of species is so high it rivals the diversity of coral reefs but remains an ecological enigma.

Welcome to the deep sea, a huge area off the California coast more than 11,000-feet deep that is extremely valuable ecologically and currently unprotected.

On Tuesday, the Pacific Fishery Management Council is scheduled to consider establishing precautionary protection of this deep-water habitat along the West Coast. Because of this area's uniqueness, vulnerability and lack of protection I've joined more than 100 marine scientists encouraging the council to do just that. Here's why:

These deep sea habitats are huge and mostly unexplored. These untouched, unprotected areas of seafloor comprise a surprisingly large area of American territory off our coast – roughly 40

percent of all U.S. territory out to 200 miles from the California shore. Even though we know very little about this area as exploring it is extremely costly and difficult, we do know this: The more we look, the more we discover.

Using remotely operated submersibles, scientists have documented ecologically important habitat that sustains marine life and indirectly human life. Ancient deep sea corals and sponges are extremely long-lived and serve as “ecosystem engineers” because they create habitat that myriad species of fish and invertebrates need to survive. The deep seafloor also includes areas of soft-bottom habitat that, at a glance, appear to be inert mud. Scientists who have probed more closely are discovering a rich array of life – including sea stars, urchins and worms – that capture a vast amount of greenhouse gases like carbon dioxide and methane, and help regulate climate. Many of these species are long-lived, slow-growing and fragile.

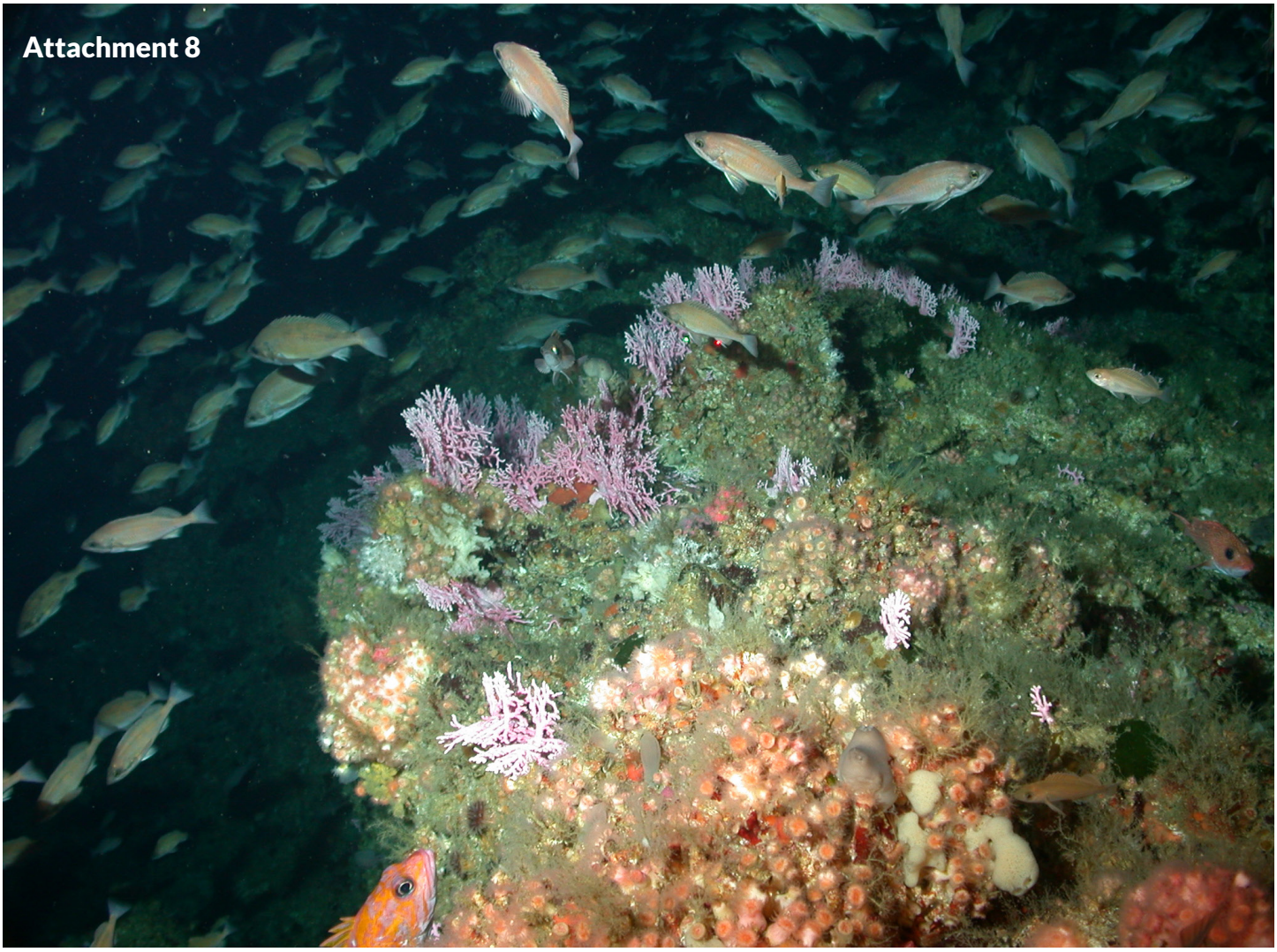
Scientists have documented long-lasting damage to deep sea environments from bottom trawling, a type of fishing that involves the use of large nets dragging along the seafloor. My research off the Oregon coast documented that bottom trawls reduce the abundance of sea pens by 99 percent and decreased the overall abundance of bottom-dwelling invertebrates by more than half. In even deeper areas of seafloor, we know that a single trawl can damage sensitive coral and sponges that may have grown over centuries or even millennia.

Now is the time to put protections in place because we know technological advancements will, sooner or later, enable bottom-trawling and mining to expand into these pristine areas of deep water seafloor off the California shore. It’s important to act now, well before fishing expands into deep-water areas so that no one is taken by surprise.

The deep seafloor off our coast is a tremendous natural asset worthy of protection by the stewards of our ocean resources. By acting now, the Pacific Fishery Management Council has an opportunity to pass it on to future generations.

Brian Tissot is director of the Marine Laboratory and Humboldt Marine and Coastal Science Institute at Humboldt State University in Arcata.

Attachment 8



OCEANA Protecting the World's Oceans

PROPOSAL OVERVIEW AND UPDATE

Comprehensive Conservation Alternative to Modify U.S. West Coast Groundfish Essential Fish Habitat Conservation and Management

Prepared By
Ben Enticknap, Geoff Shester, Brianne Mecum and Erin Kincaid

June 14, 2016

Second Edition, May 2017

Introduction

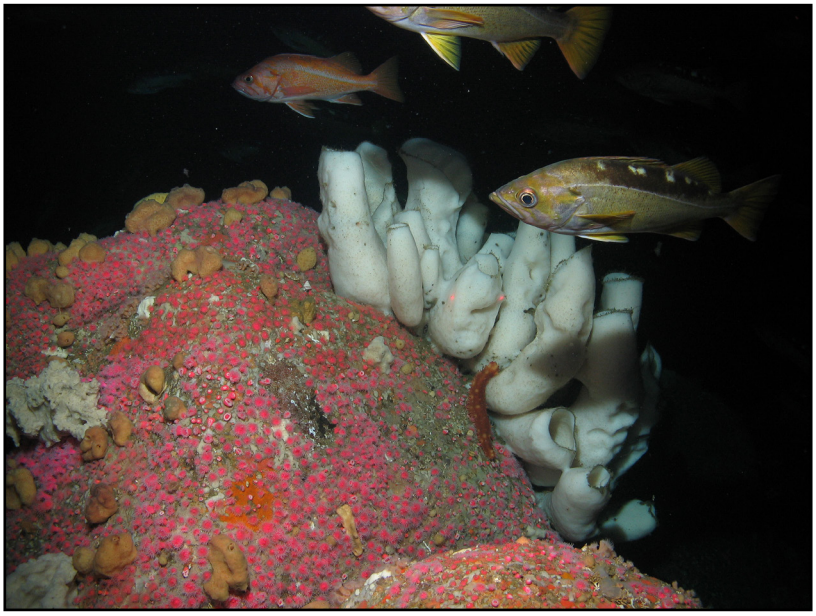
Protecting ocean habitats is a critical and integral part of responsible fishery management. It is necessary for ensuring long-term sustainable and productive fisheries, vibrant coastal communities and healthy marine ecosystems. In response to a call for proposals, in July 2013 Oceana, Natural Resources Defense Council and Ocean Conservancy submitted a Comprehensive Conservation Proposal to modify Pacific Coast Groundfish Essential Fish Habitat (EFH) designation, conservation and enforcement as part of the Pacific Fishery Management Council's (Council) EFH review process. Since that time the Council has made much progress, including the initiation of the Pacific Coast Groundfish Fishery Management Plan (FMP) Amendment 28 process, through which the Council will consider a range of alternatives to modify groundfish EFH Conservation Areas closed to bottom trawling, open parts or all of the coastwide trawl Rockfish Conservation Area (RCA), and consider protecting the deep-water ecosystem off California (>3,500 meters) from all bottom contact gear using discretionary Magnuson-Stevens Act authorities.

At the April 2016 meeting the Council finalized its range of alternatives for Amendment 28, including adopting the proposed EFH Conservation Area modifications (bottom trawl openings and closures) contained in our July 31, 2013 proposal as a distinct alternative, with modifications per our request. Since our original 2013 proposal has now been modified and because there have been significant developments in the EFH process to date, Oceana is submitting this document to the Council to provide updated information, maps and summary analysis.

We recognize that at the April 2016 meeting the Council also voted to exclude further consideration of all proposed EFH Conservation Areas and trawl Rockfish Conservation Area (RCA) modifications inside the Tribal Usual and Accustomed fishing areas (U&As) off Washington State. Here we include information on the three EFH Conservation Areas in our modified proposal that are within Tribal U&A areas for reference and informational purposes. Our modified proposal includes those portions of the Grays Canyon and Quinault Canyon proposal areas that occur outside the Tribal U&As. We provide summary analysis of possible trawl RCA changes and EFH Conservation Area changes in light of the Council motion to exclude changes inside Tribal U&As off Washington.

Also at the April 2016 meeting, the Council voted to adopt the protection of the deep-water ecosystem off California (>3500 meters) as a "preliminary preferred alternative" (PPA). In this report we include additional information on the deep-water habitat area under Council consideration.

We encourage you to view an on-line version of these proposed EFH Conservation Areas with underwater images, video and an interactive map at: at www.oceana.org/PacificSeafloorTour.



Yellowtail rockfish over boot sponges on Rittenburg Bank.
Photo Credit: NOAA GFNMS.
Cover Image: Hydrocoral, cup coral and square spot rockfish at Cortes Bank.
Photo Credit: NOAA Southwest Fisheries Science Center, Advanced Survey Technologies Group.

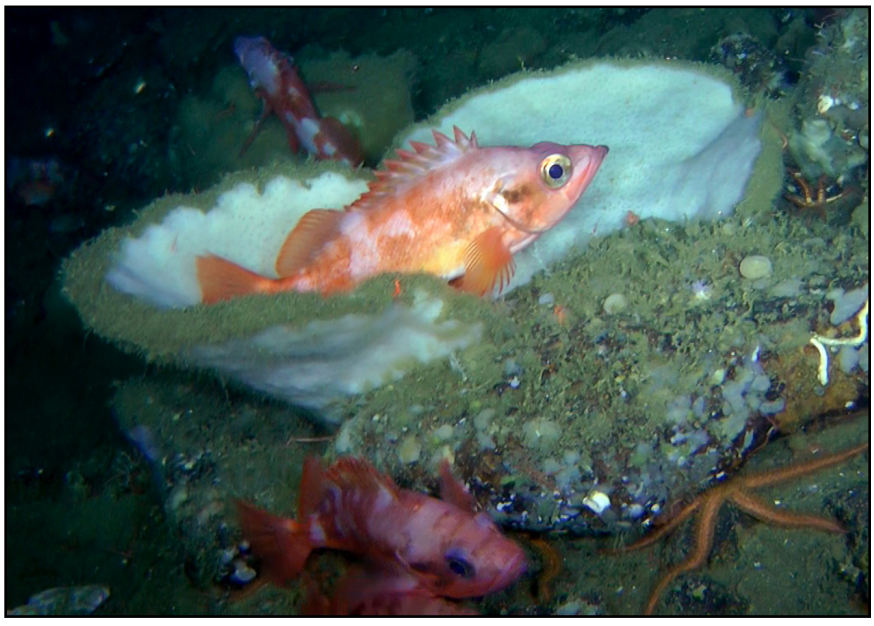
Proposal Approach and Priority Habitats

The overall goal of this proposal is to protect EFH for the full suite of Pacific Coast groundfish species while maintaining vibrant fishing opportunities and coastal communities. The proposed EFH Conservation Areas and deep-water habitat conservation area build off the approach adopted by the Council in 2005 to prohibit the geographic expansion of bottom trawling to protect areas that are potentially pristine and to close known ecologically sensitive and important areas to bottom trawling. Efforts were made to avoid significant bottom trawl effort displacement.

The proposed EFH Conservation Areas focus on priority habitat features, consistent with the Pacific Coast Groundfish FMP Amendment 19 definitions of complex sensitive habitats and Habitat Areas of Particular Concern. We used updated habitat and bottom trawl spatial information provided in this EFH review process, made available on the Pacific Coast Groundfish EFH Data Catalog (http://efh-catalog.coas.oregonstate.edu/overview/). The priority habitat features we focused on include:

- **Hard substrate**: rocky reefs, rocky ridges and rocky slopes (hard, mixed and predicted rock substrate data, with emphasis on areas with new substrate data since 2005)
- **Habitat-forming invertebrates**: particularly corals, sponges, sea pens and sea whips (identified from NOAA trawl surveys, dive surveys (e.g. ROV, AUV), areas of predicted high deep-sea coral suitability, and areas indicating recent high coral and sponge bycatch), and
- **Submarine canyons and gullies**: identified from bathymetric data and maps, where the combination of steep slopes, strong currents and enhanced access to food create places of unique ecological significance for managed fish species, invertebrates, cetaceans and seabirds.

Methane Seeps: Some areas in our proposal include unique and rare deep-sea methane vents and seeps, also known as cold seeps. These are areas where methane and hydrogen sulfide gas leaks through the Earth's crust. While deep-sea seeps alone were not identified as a priority habitat type in Amendment 19, new science suggests these areas provide valuable ecosystem services (Thurber et al. 2014) and they are actually associated with the Council's priority habitat features such as hard substrate and habitat forming invertebrates (Levin et al. 2016). These seeps and vents create distinct chemical environments and substrate conditions including microbial mats, hard carbonates, and support invertebrate aggregations such as cold-water corals, sponges and hydroids. Hard and biogenic substrates produced by these seeps are used by other animals, including flatfish and thornyhead rockfish, for shelter and access to food (Levin et al. 2016). Several Oceana proposed EFH Conservation Areas contain active methane seeps or associated formations including Grays Canyon, Hydrate Ridge, Samoa Deep-water, and the Southern California Bight.



Sharpchin rockfish in sponge at Daisy Bank.
Photo Credit: Oceana.

Proposal Summary (as modified in April 2016)

Oceana's modified proposal (excluding any EFH changes in the U&As) includes 61 EFH Conservation Areas/ modifications, plus seven proposed EFH Conservation Area openings, and protection for the deep-water ecosystem off California. If the Council were to adopt our modified proposal there would be the following habitat conservation area changes:

Total area of additional EFH Conservation Areas:	**19,633 mi^2**
Total area of proposed EFH Conservation Area openings:	**143 mi^2**
Net change in EFH Conservation Areas:	**19,490 mi^2**
Deep-water habitat conservation area:	**123,222 mi^2**
Total increase in area protected:	**142,712 mi^2**

Adoption of the EFH Conservation Area modifications in our proposal (excluding any changes in the U&As), plus the deep-water ecosystem protection, would protect from bottom trawling:

- An additional 1,289 square statute miles of hard rocky reef;
- An additional 208 square miles of mixed (hard/soft) reef;
- 4,729 coral observations as in the NOAA Deep Sea Coral Database plus thousands more documented in habitat surveys since 2013;
- 2,083 sponge observations;
- An additional 2,594 square miles of predicted highly suitable coral habitat.

In order to maintain significant opportunity for the bottom trawl fleet and minimize any economic impacts or displacement, our proposal would:

- Keep open to bottom trawling over 30,000 square miles on the continental shelf and slope off California, Oregon and Washington - with RCA removal south of Pt. Chehalis, WA.
- Displace no more than 2.3% of recent groundfish bottom trawl effort. But, if the Council also removes the entire trawl RCA south of Pt. Chehalis, WA the net change would result in restoration of approximately 1.6% of previous (Jan 1, 2002 - Jun 11, 2006) coastwide trawl effort; this would restore 11.7% of the trawl effort that was previously displaced by the current suite of closures.
- Displace zero bottom contact fishing effort with adoption of the deep-water area (>3,500 meters) off California.

Trawl Rockfish Conservation Area

In the Amendment 28 process, the Council will consider a range of alternatives to open part or the entire coastwide trawl RCA from the California/ Mexico border to the southern extent of the Tribal U&As off Washington (Point Chehalis, WA). The core trawl RCA - a narrow depth-based ribbon from 100 to 150 fathoms and 100 to 200 fathoms in some areas - spans the West Coast EEZ from north to south and is closed year-round to bottom trawling. The first trawl RCA was implemented in 2002 to protect overfished darkblotched rockfish and it was subsequently expanded in 2003 to protect canary rockfish, Pacific ocean perch, lingcod, widow and yelloweye rockfish. Regardless of the original purpose, the core trawl RCA is serving as a de facto habitat protection measure that, in combination with other conservation areas, reduces adverse impacts to EFH.

The trawl RCA overlaps existing EFH Conservation Areas. In some areas off California it overlaps state waters closed to bottom trawling. Those portions of the RCA that overlap with EFH Conservation Areas or state waters would remain closed to trawling if the RCA were lifted. When designing our proposal in 2013, we looked closely at priority habitat features overlapping the trawl RCA. Thirty-one of the proposed 61 EFH Conservation Areas partially overlap the coastwide trawl RCA. Below is a summary of the current RCA and what would remain protected within the trawl RCA with adoption of our proposal versus removal of the coastwide trawl RCA south of Point Chehalis, WA (south of the U&As).

	Protected in the current coastwide trawl RCA	Protected with trawl RCA removal south of Pt. Chehalis, WA	Trawl RCA removal + Oceana Proposed EFH Conservation Areas (excluding changes in U&As)
Total area (mi2)	3,574	881(-75%)	1,785 (-50%)
Rocky reef (mi2)	146	68 (-53%)	140 (-4%)
Mixed reef (mi2)	193	161 (-17%)	181 (-6%)
# Coral observations	18,554	18,214 (-2%)	18,506 (-0.3%)
# Sponge observations	514	263 (-49%)	407 (-21%)

Importantly, to ensure this action continues to minimize the adverse impacts of fishing on EFH, any changes to the trawl RCA and EFH Conservation Areas should result in an overall net increase in habitat protection in terms of total area and priority habitat features across all biogeographic regions (Northern, Central and Southern Biogeographic Regions) and depth strata (shelf and upper slope). While we understand the Council may choose to maintain certain portions of the trawl RCA as a management measure to control bycatch, we have designed and analyzed our modified proposal to ensure adequate habitat protections in the event the trawl RCA is removed.

Biogeographic Regions and Analysis

This report is structured by biogeographic region consistent with the coastwide biogeographic areas and depth zones identified in the National Marine Fisheries Service Groundfish EFH Synthesis Report prepared for the Council EFH review process (PFMC 2013). NMFS identified large biogeographic regions (Northern, Central, Southern and the Salish Sea) and further divided these into three depth zones: a) Continental Shelf (coastline to continental shelf break (approximately 200 m (110 fathoms)), b) Upper Slope (shelf break to 1,280 m/ 700 fathoms, which is the shoreward boundary of the "Bottom Trawl Footprint Closure", and the Lower Slope (1,280 m to the seaward EEZ boundary).

The following figures compare the percentage of the total area and substrate type protected from bottom trawling under status quo management (baseline) with adoption of the Oceana proposed EFH Conservation Area changes (Oceana modified and excluding changes in U&As), combined with removal of the core trawl RCA south of Point Chehalis, WA. The baseline includes current year-round non-tribal bottom trawl closures: EFH Conservation Areas, state water areas closed to bottom trawling, and the trawl RCA. Off Southern California the baseline includes the Western Cowcod Conservation Area, which would also remain closed as an EFH Conservation Area under our proposal. These figures show that if the trawl RCA is removed, our proposal would result in a net gain in total area and priority reef features protected from bottom trawling in the Northern, Central and Southern regions of the continental shelf and slope.

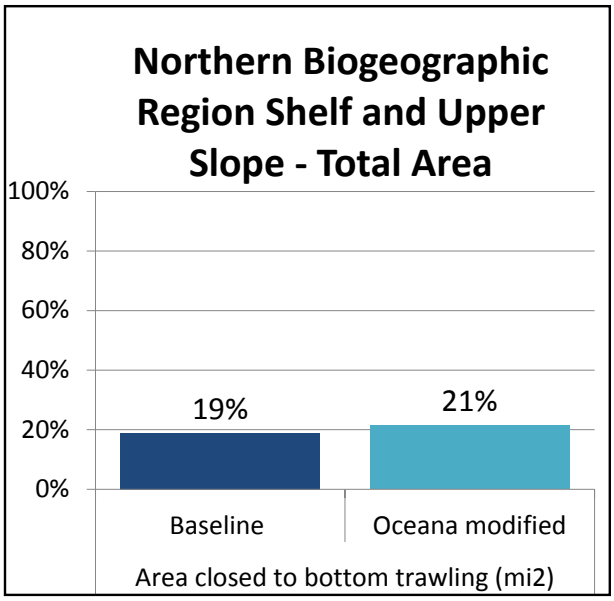


Chart 1. Northern Region (Shelf and Slope), percent of total area closed to bottom trawling.

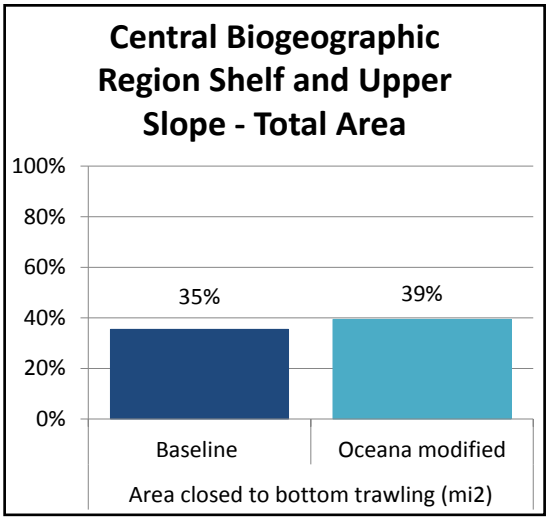


Chart 2. Central Region (shelf and slope), percent of total area closed to bottom trawling.

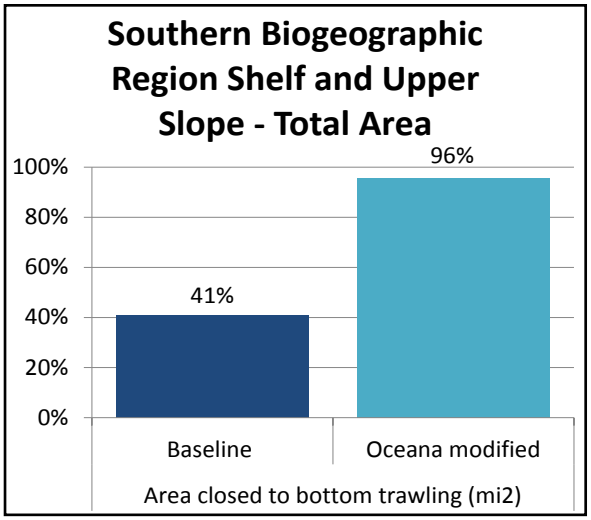


Chart 3. Southern Region (shelf and slope), percent of total area closed to bottom trawling.

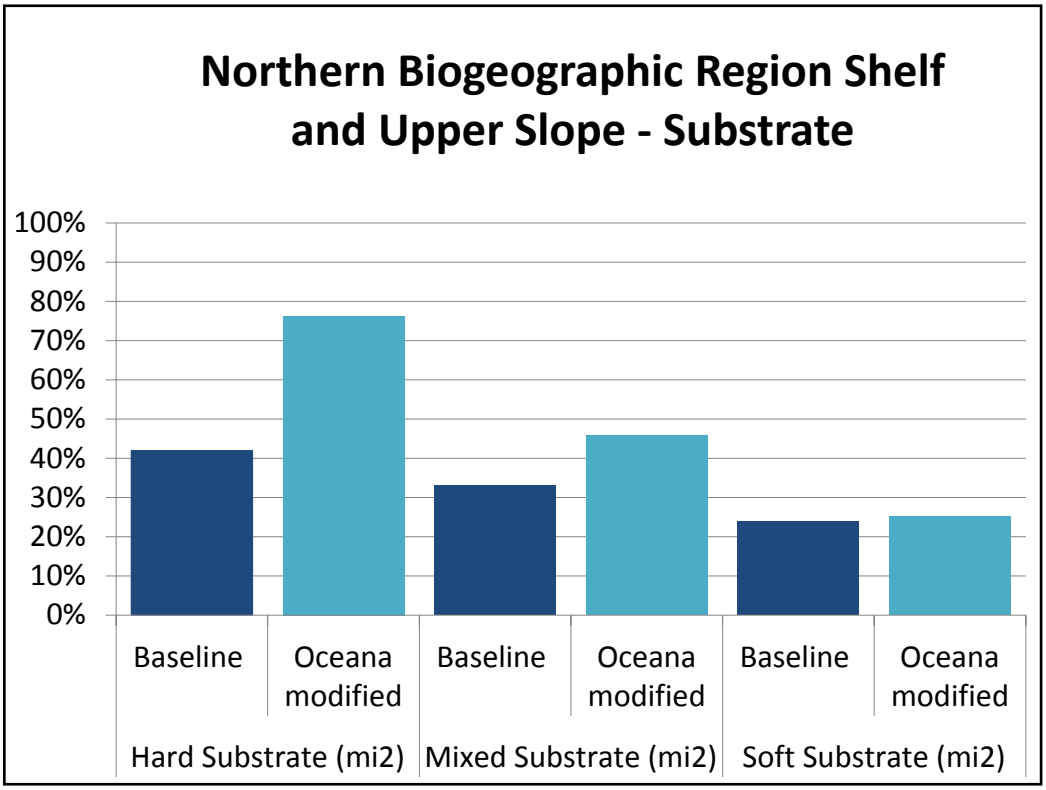


Chart 4. Percent substrate protected in the Northern Biogeographic Region, shelf and upper slope combined, under the baseline (status quo areas closed to bottom trawling) and the Oceana modified proposal, and with trawl RCA removal south of Point Chehalis, WA.

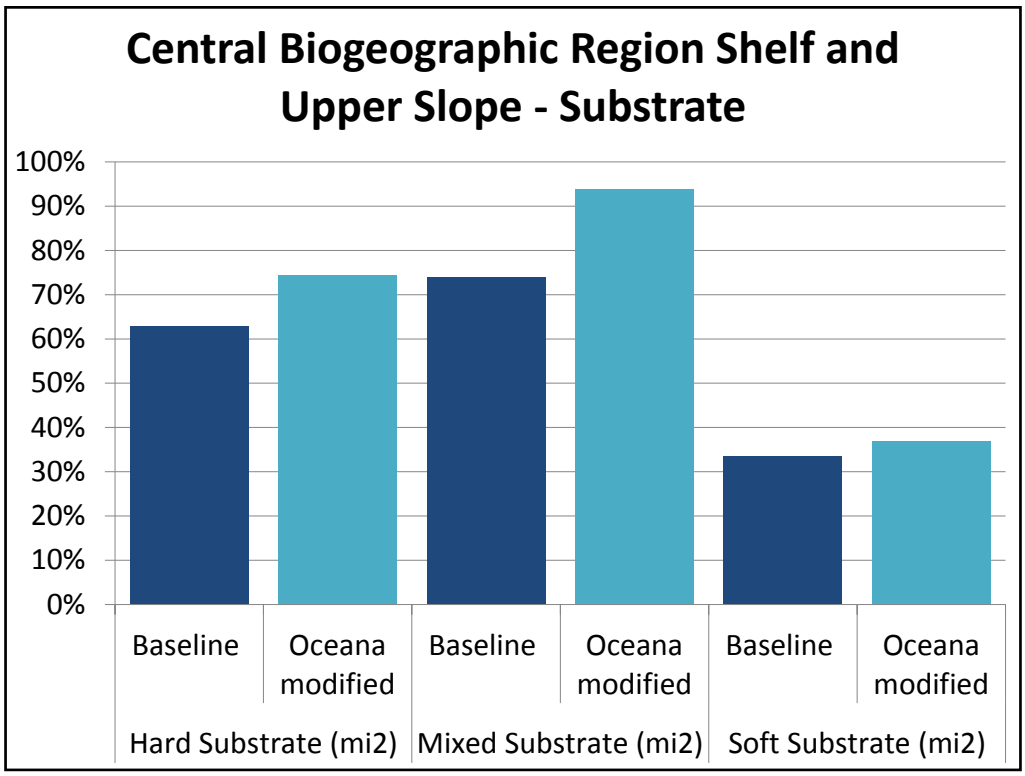


Chart 5. Percent substrate type protected in the Central Biogeographic Region, shelf and upper slope combined, under baseline (status quo areas closed to bottom trawling) and the Oceana modified proposal, with trawl RCA removed.

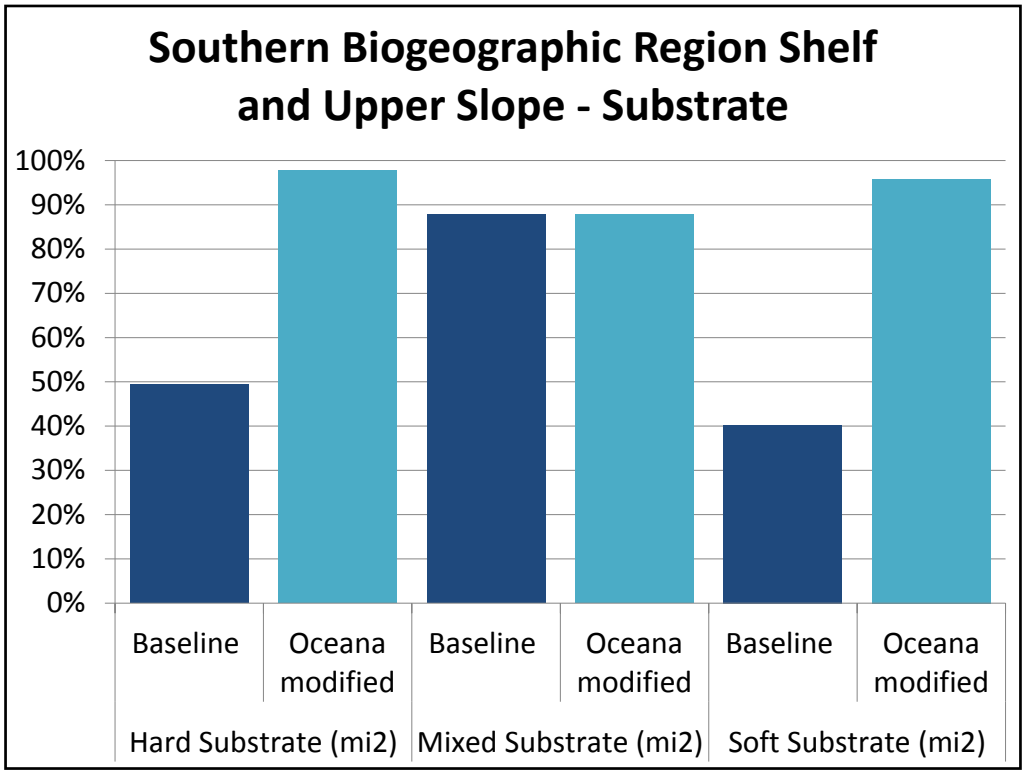
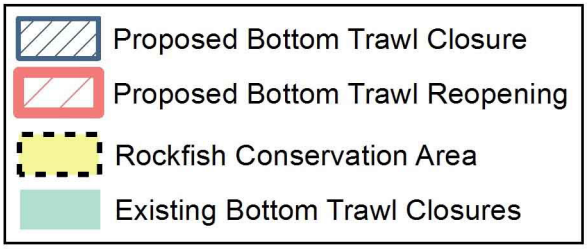
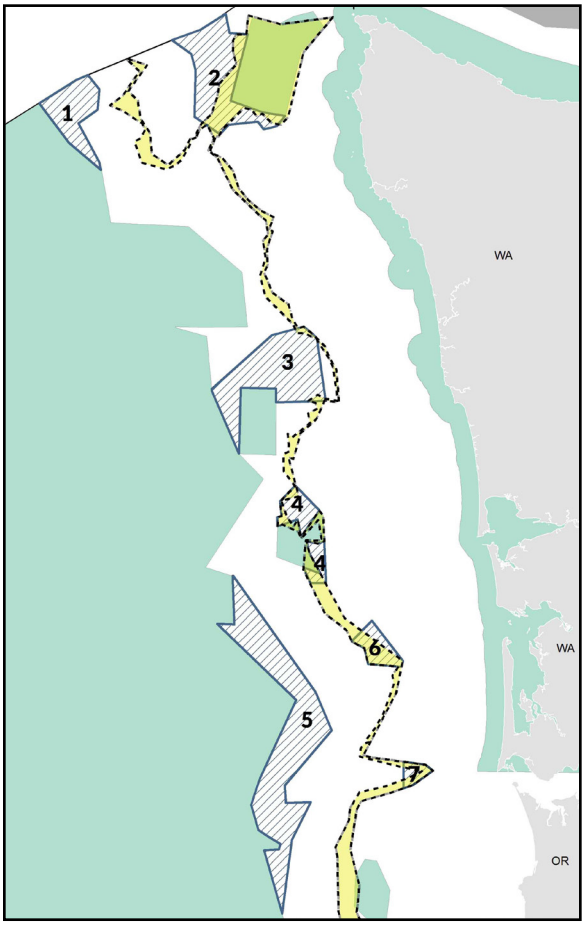


Chart 6. Percent substrate protected in the Southern Biogeographic Region, shelf and upper slope combined, under baseline (status quo areas closed to bottom trawling) and the Oceana modified proposal, with trawl RCA removed. The baseline analysis includes the Western Cowcod Conservation Area, which would remain closed under the Oceana proposal.

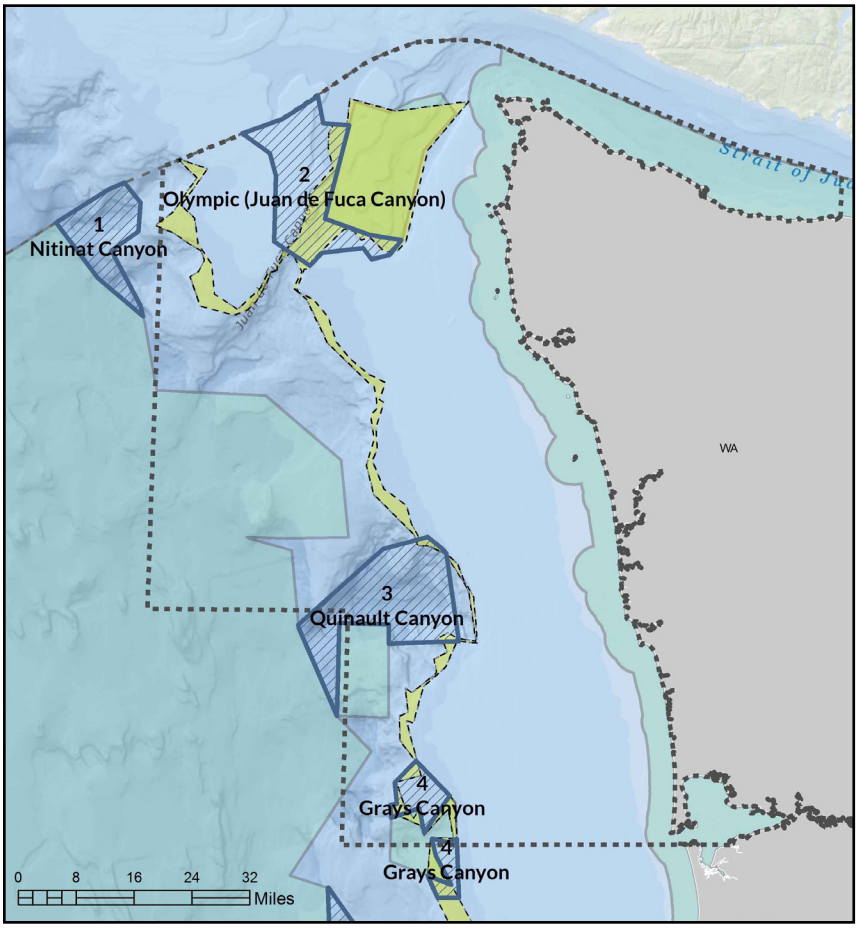
Northern Biogeographic Region
(U.S. Canada Border to Cape Mendocino, California)



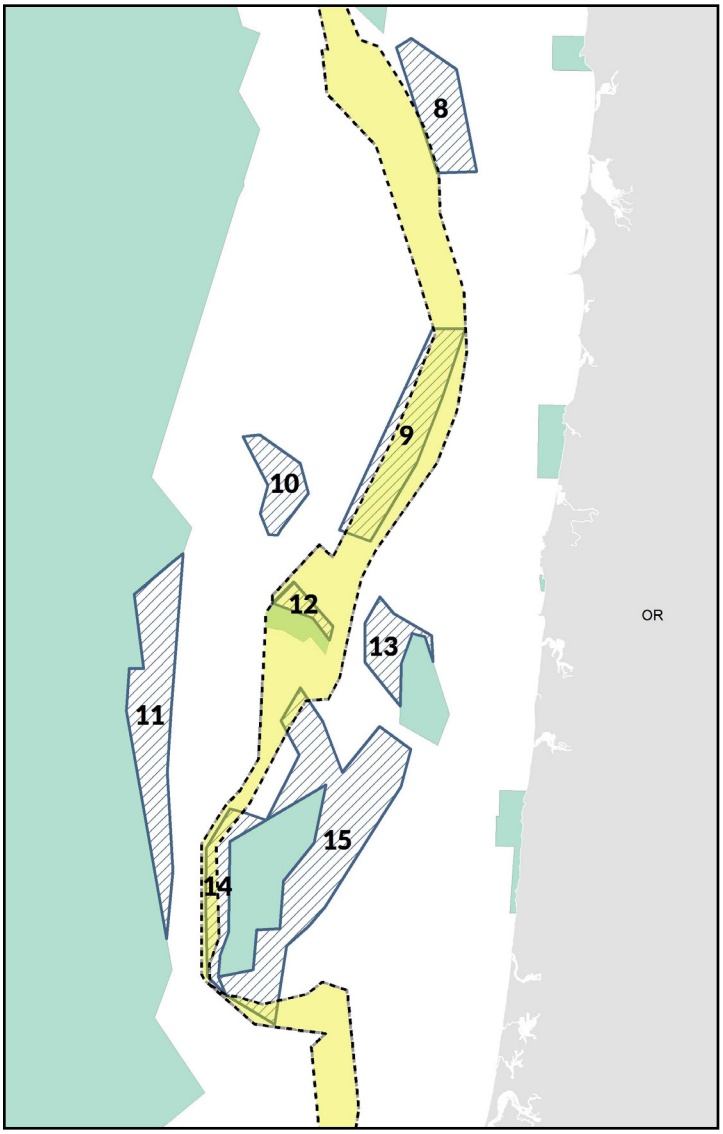
Master Legend for Overview Maps



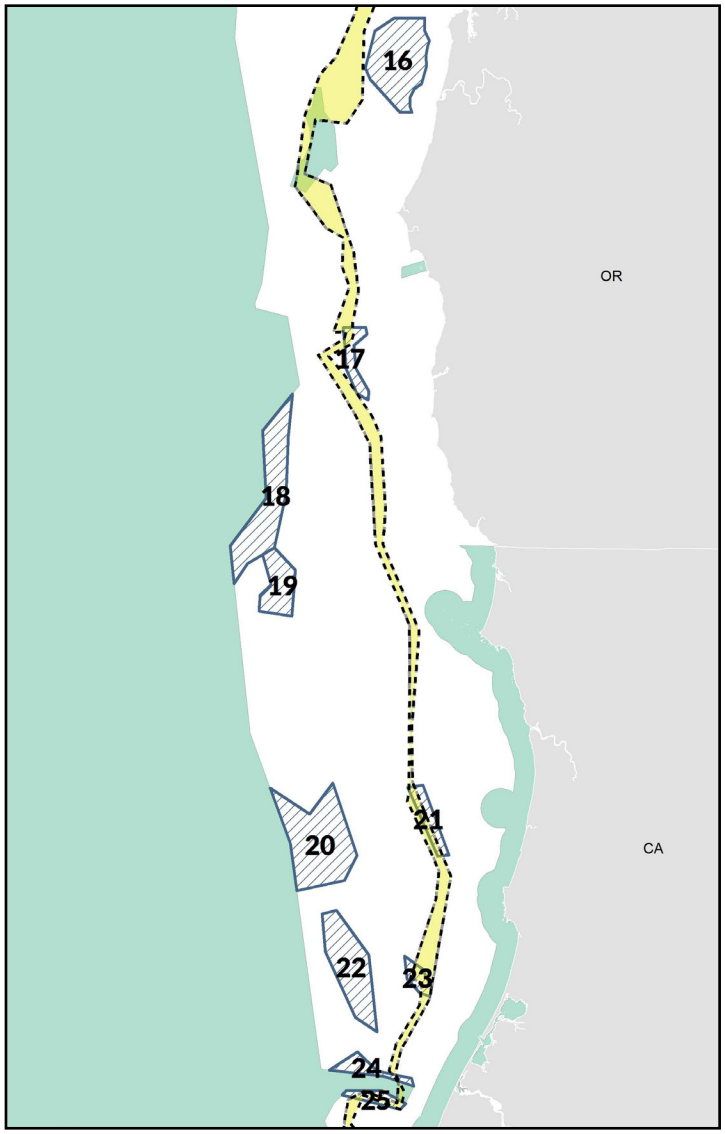
Overview Map 1. Nitinat Canyon (1) to the proposed Astoria Deep EFH Conservation Area (5). The trawl RCA in yellow is overlapping existing areas closed to bottom trawling (light green) and the proposed conservation areas (blue stripes).



Overview Map 2. Nitinat Canyon (1) to Grays Canyon (4) proposal areas, showing the intersection with the outer Tribal U&A boundary off Washington in the dashed line and existing areas closed to non-tribal bottom trawling including Washington State waters, EFH Conservation Areas, and the trawl RCA (yellow, which overlays the Olympic 2 EFH Conservation Area).

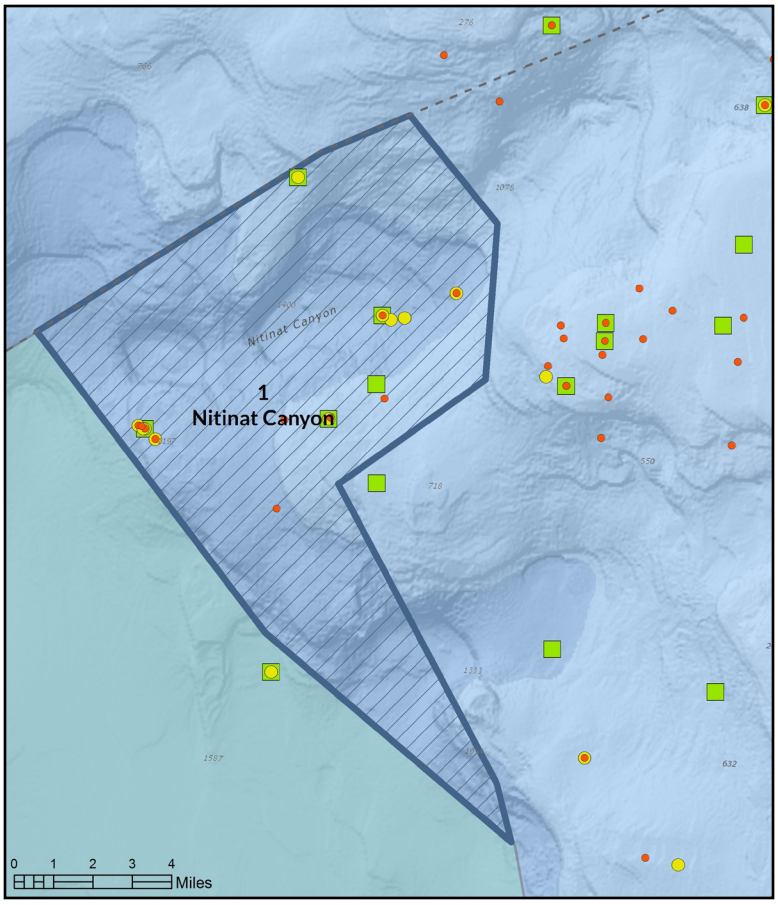


Overview Map 3. South Nehalem (8) to Heceta Bank (14 &15) proposal areas showing existing EFH and Oregon state water areas closed to bottom trawling and the overlapping trawl RCA.



Overview Map 4. Northern Region, Cape Arago Reef, OR (16) to South Eel River Canyon, CA (25).

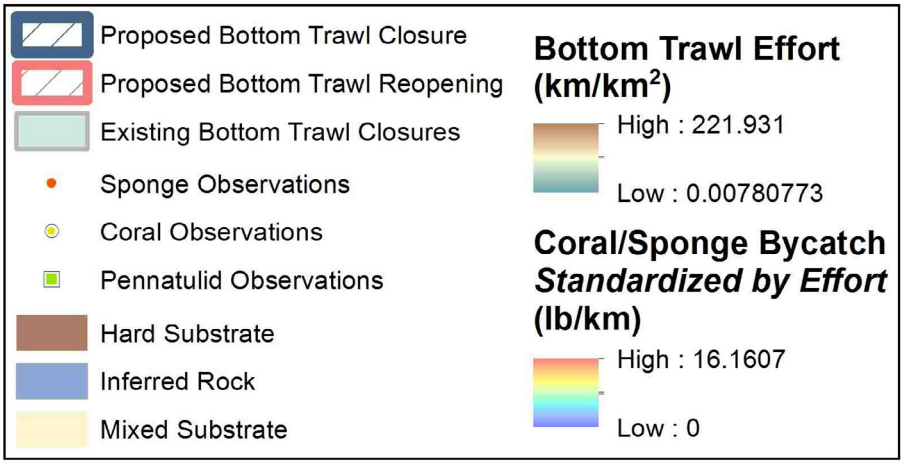
1. Nitinat Canyon



Considered highly suitable for coral growth due to slope, depth, and chemical conditions, this area will protect the canyon features and coral and sponges of Nitinat Canyon west of Washington. Trawl surveys have confirmed the presence of gorgonian corals, black corals, glass sponge, and other important structure-forming species. The area is EFH for groundfish including Dover sole, sablefish, shortspine thornyheads, and longspine thornyheads known to have high levels of occurrence or abundance here based on Northwest Fishery Science Center (NWFSC) models prepared for the PFMC EFH review.

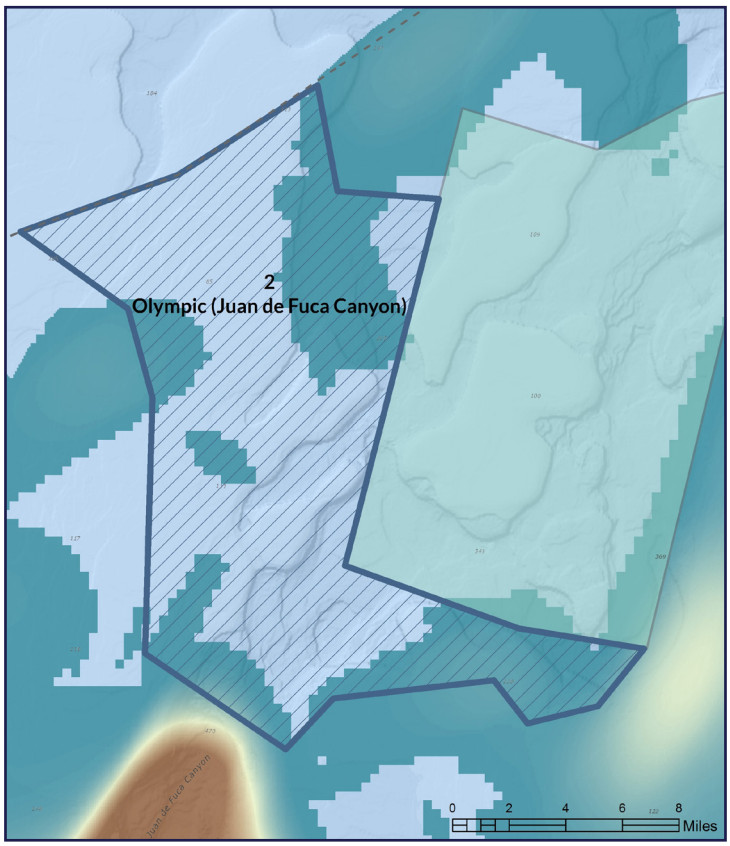
Substrate characteristics are uncertain as this area has yet to be mapped with high resolution sonar. Depths included range from 600 m to 1,500 m, protecting upper slope habitat. Very little to zero bottom trawl effort occurs here according to the trawl data available in the EFH Data Catalog, allowing for minimal interference with fishing activities while protecting priority habitat features. Relatively high coral and sponge bycatch, however, has been observed in the southeast corner of Nitinat Canyon. The shape of this area is designed to encompass the canyon feature, link to the deep-water footprint closure, avoid areas of high bottom trawl effort, incorporate coral and sponge observations and have enforceable lines. The proposed area is outside of Tribal U&As.

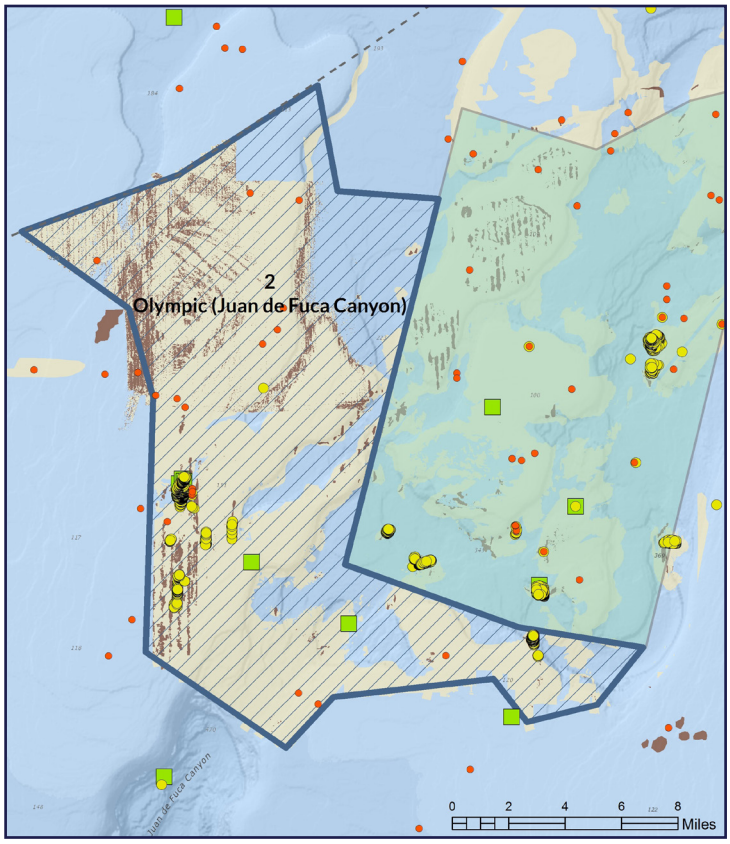
2. Olympic (Juan de Fuca Canyon)



Master Legend for Overview Maps

Heavily studied by NOAA and several academic institutions, this area is characterized by significant deep-sea coral and sponge communities. There are over 7,600 coral observations in the proposal area. Average coral density, based on a 2010 NOAA ROV survey, is 33 individual coral structures per 1,000 m^2. These communities consist of black, gorgonian, and stony corals, as well as reef building sponges. These coral and sponge communities host fish species such as rosethorn, yellowtail, yelloweye, canary, tiger, and Puget Sound rockfishes, lingcod, spotted ratfish, Pacific halibut, and kelp greenling. Gravid female rockfish were noted in these communities suggesting their importance for breeding and spawning. Hard and mixed reef substrates are important for many groundfish species and this area covers nearly 150 square miles of these habitat types. The proposal area encompasses the upper portion of the Juan de Fuca Canyon with depths reaching 300 m.

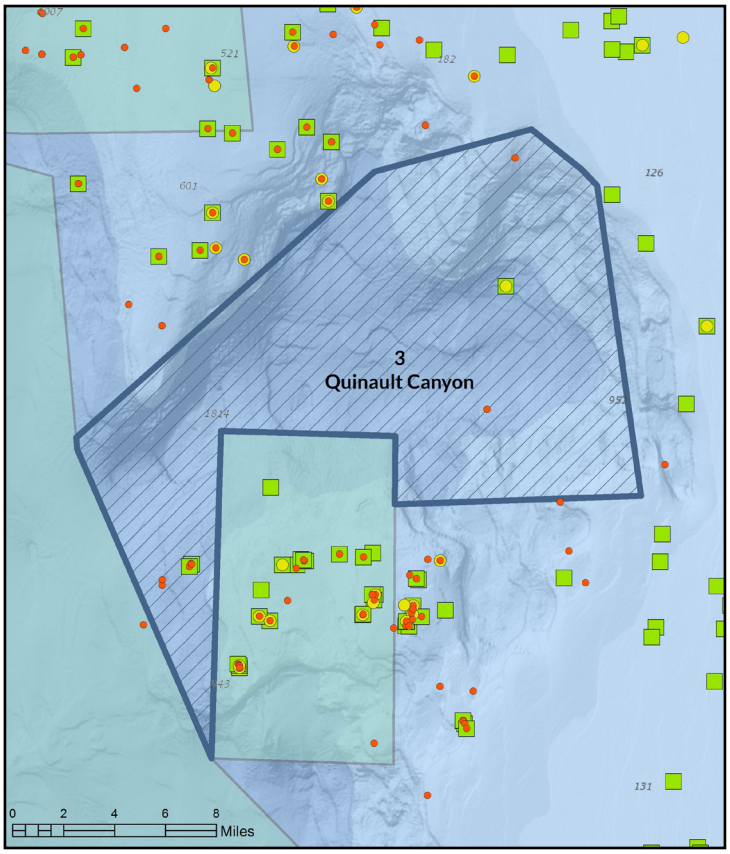


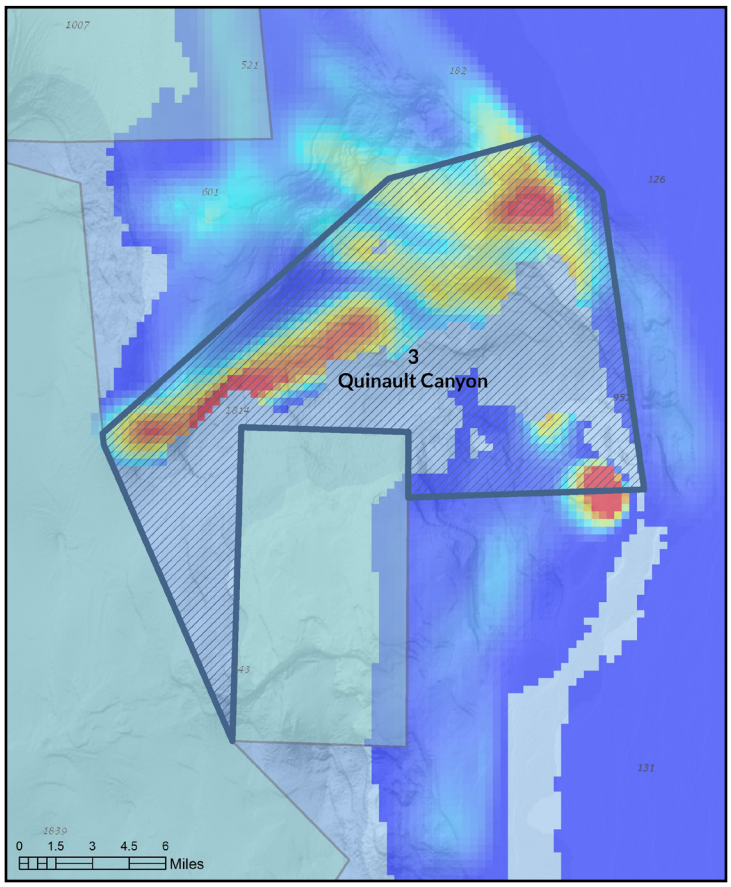


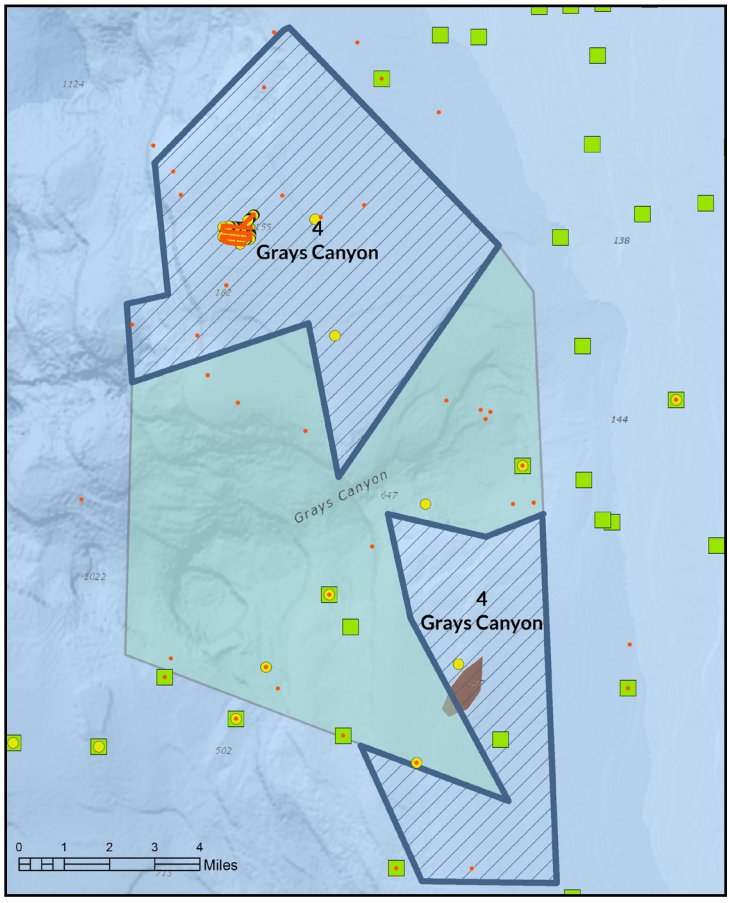
The proposed Olympic area would build off the adjacent Olympic 2 EFH Conservation Area to the east. The shape is designed to encompass the well-documented hard and mixed substrate and observed biogenic habitat while avoiding areas important to the bottom trawl fishery. In addition, the design of this site would incorporate a portion of the RCA that runs up the canyon, maintaining protections for this important habitat area should the trawl RCA be reopened. This area overlaps Makah and Quileute U&As.

3. Quinault Canyon

This large submarine canyon is particularly important for many fish, invertebrate, and cetacean species due to the productive topographically induced upwelling that occurs here. Rockfish have been observed to utilize the high relief offered by boulders, vertical walls, and ridges of the canyon. Despite low sampling efforts, there are 14 records of corals, sponges, and pennatulids including black coral and glass sponge.







The proposed Quinault Canyon area spans depths between 200 m to nearly 1,700 m, encompassing a wide diversity of geologic structure and depth. The design is enforceable and builds on to the existing Biogenic 2 closure to the south. This area includes disproportionately high levels of sponge and coral bycatch that have been observed here; indicating that designating this site as an EFH Conservation Area will protect important coral and sponge biogenic habitat and minimize adverse fishing impacts. This area overlaps Tribal U&As. The proposal area west of the adjacent EFH Conservation Area (Biogenic 2) is outside of the U&A boundary. The proposal area overlaps with the RCA at the canyon rim on the east side.

4. Grays Canyon

This proposed EFH Conservation Area would expand on the existing canyon area and includes known locations of black coral, gorgonian coral, and a large, unique glass sponge reef. There are also methane seeps in the reef area. There are over 2,800 sponge observations at the reef and video analysis found rockfish were nine times more likely to be observed in video frames with sponges than frames without sponges, suggesting the sponge reef is important rockfish refugia. The environmental conditions here are nearly identical to the location of the largest known glass sponge reef located off British Columbia. NOAA surveys and studies by Washington Sea Grant and University of Washington scientists (Bjorklund et al. 2008) documented the sponge reef and found two of three reef-building glass sponge species present there.

This proposal area aims to protect, from non-Tribal bottom trawling, the shelf habitat adjacent to the canyon known to have a high density of sponges. There is hard substrate in this area and a high level of topographical diversity. In shaping the area, one goal was to avoid areas import to groundfish and shrimp bottom trawling, in addition to protecting the essential reef habitat and other physical and biogenic structures. The area overlaps part of the trawl RCA but the sponge reef is outside of the year round trawl RCA. The proposed area to the north overlaps the Quinault Nation U&A and most of the area on the south side is outside of the U&A.

5. *Astoria Footprint Modification*

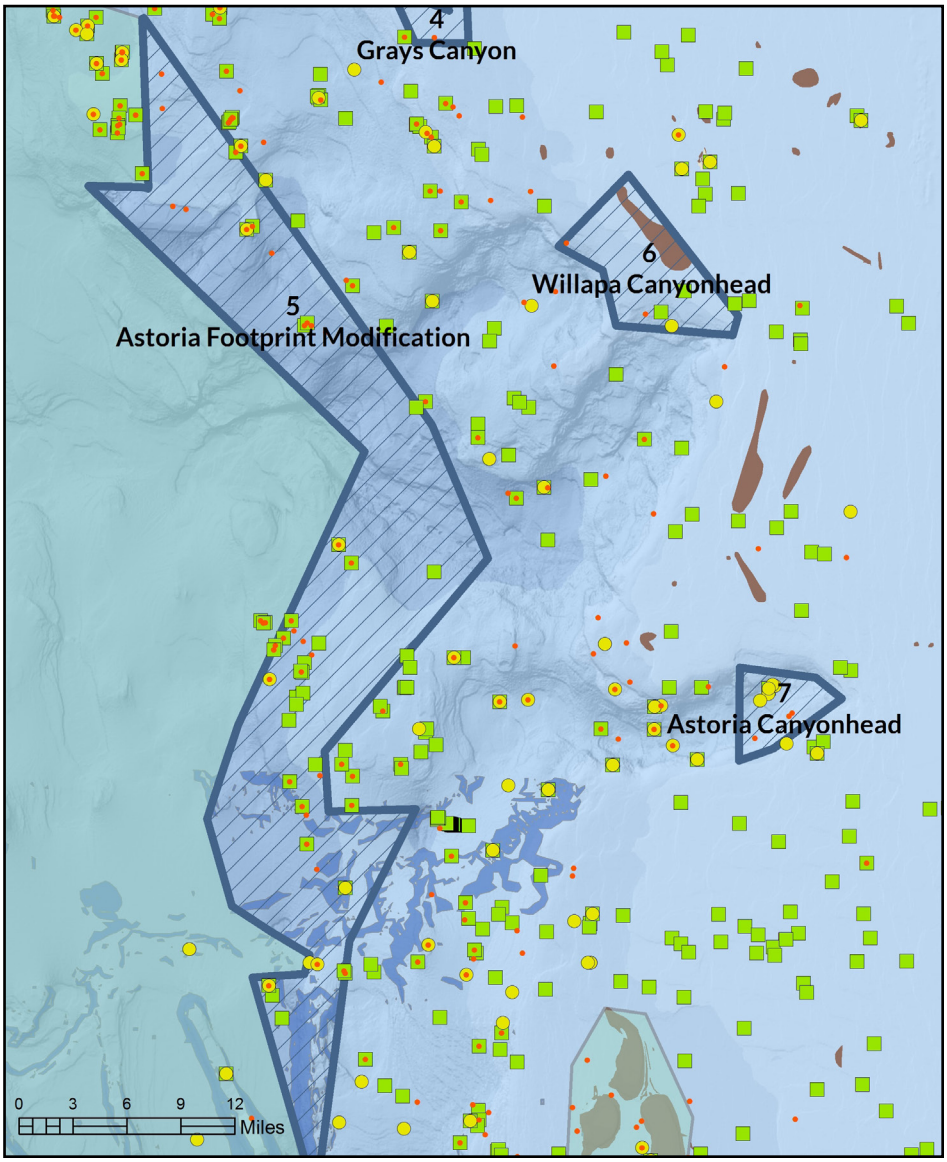
This extension of the Astoria footprint trawl closure covers deep regions of the Astoria and Willapa submarine canyons west of Washington and Oregon. In total, 97 observations of corals, sponges, and pennatulids have been made in this area. Glass sponges, sea pens, black coral and other coral species live here. Terrain, chemical, and biological characteristics of the region suggest high suitability for all coral taxa. NMFS NWFSC describes the area as high value habitat for sablefish and longspine thornyheads, and EFH for several rockfish species and petrale sole.

There is predicted rock substrate in the proposal area (dark blue) and depths spanning 500 m to 1,700 m, suggesting topographical complexity. This proposal location was designed adjacent to the current trawl footprint closure and it includes almost no recent trawl effort. Protecting it would conserve high value habitat with very limited, if any fishery impacts.

6. *Willapa Canyonhead*

West of Willapa Bay, Washington, the Willapa Canyonhead area is high value habitat for several groundfish species. According to the NWFSC species models, the area is important for darkblotched rockfish, greenstriped rockfish, and sablefish with rocky reef areas of likely importance for overfished yelloweye rockfish. Several species of sponges, coral, and sea pens have been found here.

The proposed area accounts for the ecological importance of submarine canyon systems. The site incorporates known mixed and hard substrates, indicating geologic complexity and diversity. It crosses shelf and some upper slope habitat between approximately 130 and 400 meters deep. The design is primarily within the current year-round trawl RCA but extends slightly east to include rocky reef habitat.



7. *Astoria Canyonhead*

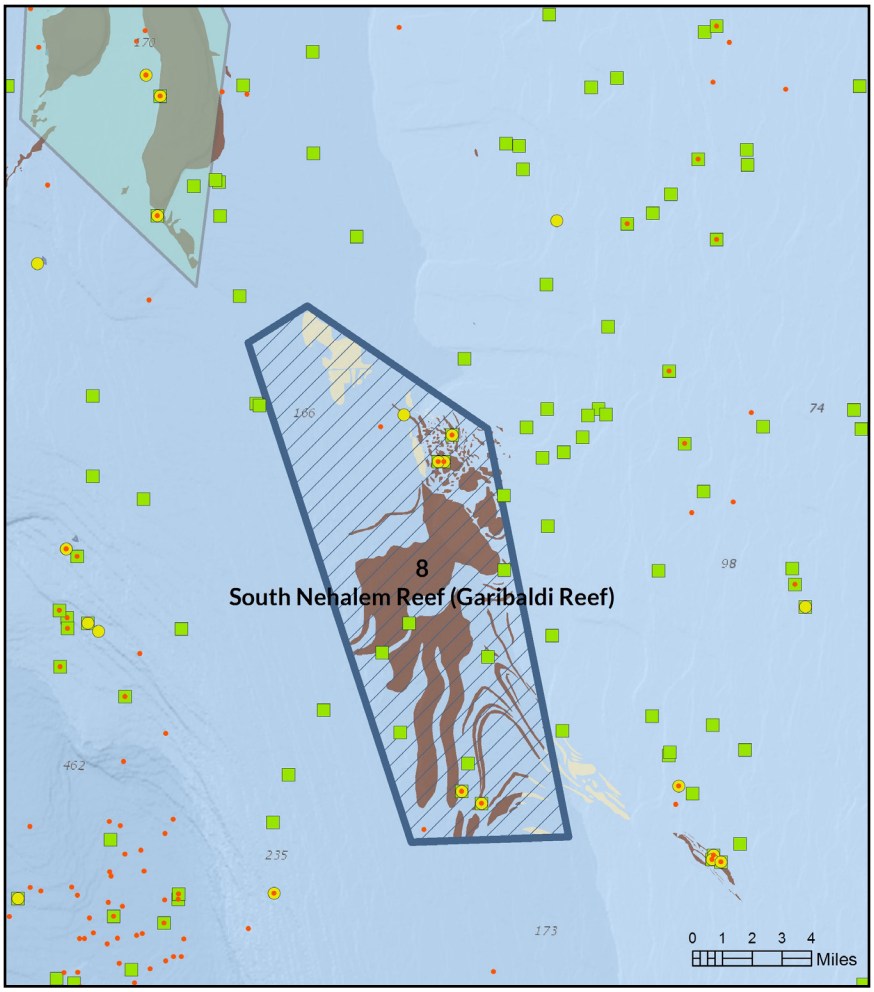
The proposal area at Astoria Canyonhead – roughly 12 miles west of Washington and Oregon off the mouth of the Columbia River - is important for sponge and corals with high predicted habitat suitability for all coral taxa combined due to depth, slope, and other chemical variables. The area is designed to overlap the priority features of the upper canyon where the canyon overlaps the trawl RCA. NOAA trawl surveys yielded six coral records including black and gorgonian corals, plus glass sponge. Fish found here may include darkblotched rockfish and sablefish, according to NWFSC species models. This section of steep and narrow canyon receives key terrestrial carbon inputs from a flux of freshwater coming from the Columbia River, making this an important center of accessible energy along the seafloor.

A study conducted by Bosley et al. (2004) explored the hydrography and trophic relationships of this canyon. Turbulence between the canyon walls directs the transfer of deep nutrients and energy to the nearby shelf habitat (Bosley et al. 2004). Availability of nutrients and prey draws a number of fish species to this canyon. Trawl surveys conducted by Bosley et al. (2004) found nine species of rockfish as well as sablefish, Dover sole, deepsea sole and lanternfish. Prey was identified for each of these fish species with bocaccio at the highest trophic level feeding primarily upon Pacific ocean perch (Bosley et al. 2004). Other prey species such as shrimp, krill, squid, copepods, and myctophids are abundant in this canyon (Bosley et al. 2004). Overall, high densities of pelagic rockfish have been observed here and the canyon appears to be important as rockfish feeding grounds (Bosley et al. 2004). This area, and other canyonheads, may be critical for heavily exploited *Sebastes spp.*

8. South Nehalem Reef (Garibaldi Reef)

This rocky reef habitat to the northwest of Tillamook, OR, represents new data since 2005. The 26 observations of coral, sponge, and pennatulid species include black coral in the northern portion of the site. The southern portion of the area contains sponges and gorgonian corals. Oceana dove on this are in 2013 with an ROV and confirmed the presence of bedrock, gorgonian coral, sponge and pennatulids. In between fingers of reef there are soft, mud seafloor habitats. Species that may be utilizing the habitat in this area, according to NWFSC models are darkblotched, greenstriped, and overfished yelloweye rockfish.

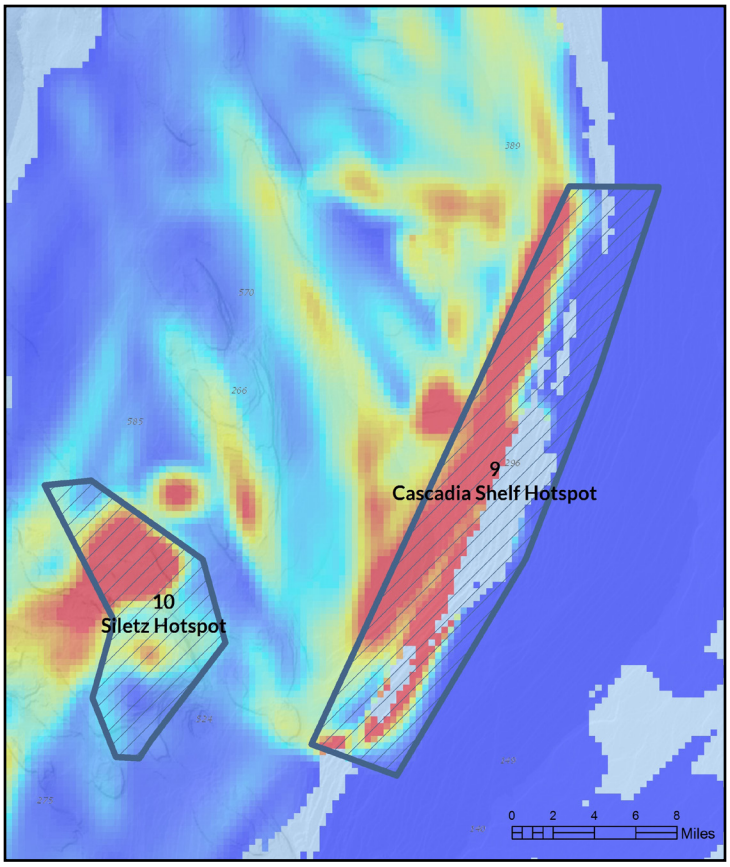
Bottom trawl data shows little to no effort occurs here. Data provided by ODFW to utilize in consideration of shrimp trawling activity, informed the lines of this area to avoid sections important to this industry to the north and east of the proposal area. This site has easily enforceable lines, and according to ODFW data, will affect less than one percent of Oregon pink shrimp trawl effort.



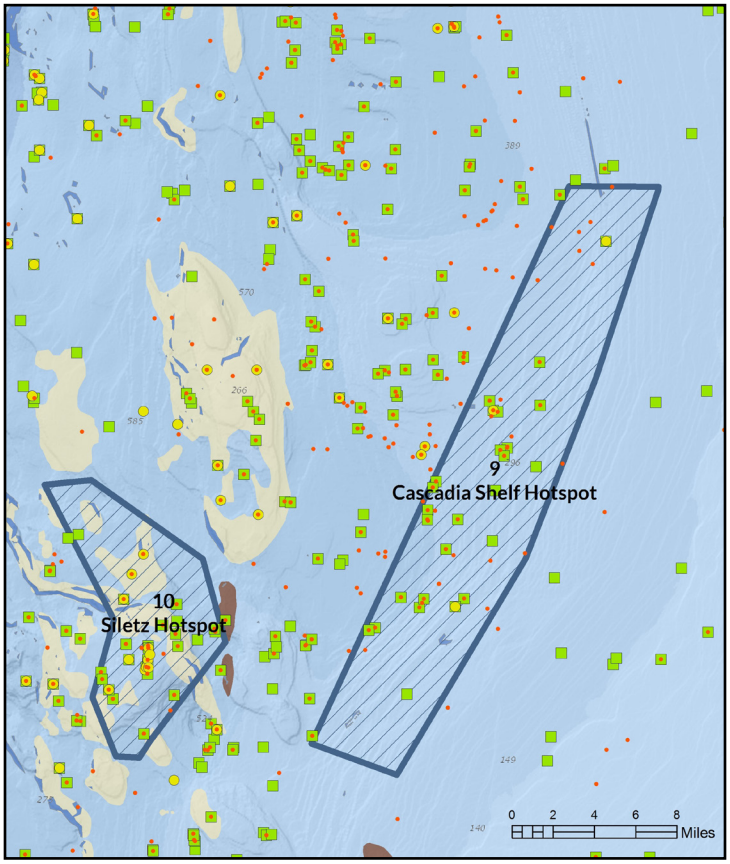
9. Cascadia Hotspot

Located west of Lincoln City, Oregon, this area was identified due to the relatively high sponge bycatch according to the West Coast Groundfish Observer Program and to include portions of the adjacent trawl RCA. The Cascadia Hotspot has the highest bycatch rate score of all the areas proposed for EFH Conservation Area designation. Taxa observed here include, but are not limited to, glass sponges, black corals, and pennatulids, each integral to seafloor habitat complexity.

Much of the upper slope habitat along the West Coast is open to bottom trawling and this at-risk area is a very small portion of this bioregion that would clearly benefit from protection. Closing this hotspot presents the unique opportunity to reduce bycatch at a high rate area while restricting a relatively low amount of seafloor area from bottom trawling. Less than one percent of bottom trawl effort in the state of Oregon has occurred here in recent years. The highest levels of bycatch occur within the western portion of the proposed area. The eastern portion of the area incorporates the trawl RCA.



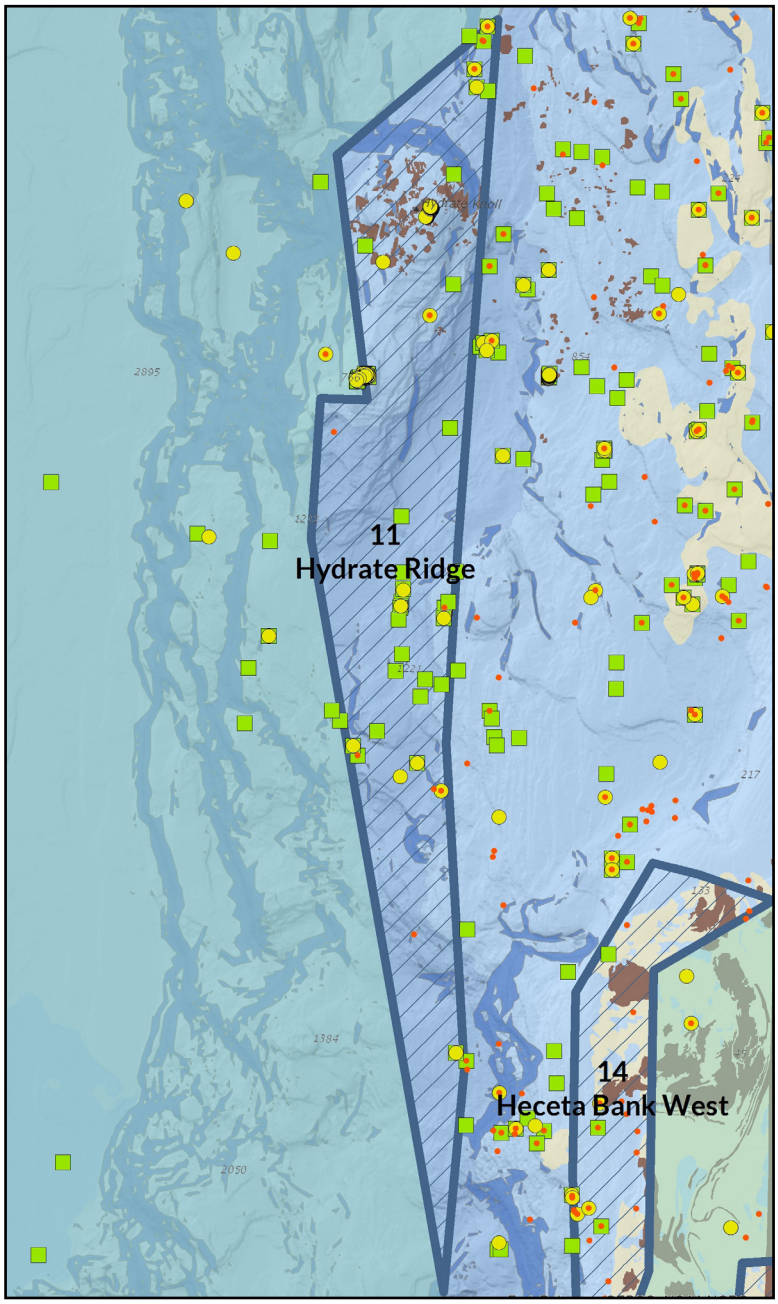
10. Siletz Hotspot



To the west of the Cascadia Hotspot, is another area that is characterized by high coral and sponge bycatch rates. With a total of 69 coral, sponge, and pennatulid observations at this site, designating this area for EFH Conservation would protect black coral, gorgonian coral, glass sponge, and other habitat-building species. According to the NMFS NWFSC species models, this location appears especially important to darkblotched rockfish, longspine thornyhead and sablefish. Oceana dove on this site with an ROV in 2013 and documented and confirmed mixed reef habitat with boulders, cobble and sand, multiple rockfish species, sponge, gorgonian coral and soft coral.

The boundaries of this site were defined primarily in response to the high levels of coral and sponge bycatch in the area while trying to avoid areas of relatively high trawl intensity immediately adjacent to the proposed site. Bathymetric data shows this area includes an offshore bank that rises up to 240 m and then drops to 800 m in the north. Protecting this site would limit impacts to fishing while simultaneously protecting important biological features, as less than one percent of trawl effort in Oregon has occurred here over recent years.

11. Hydrate Ridge/Central Oregon Footprint Modification



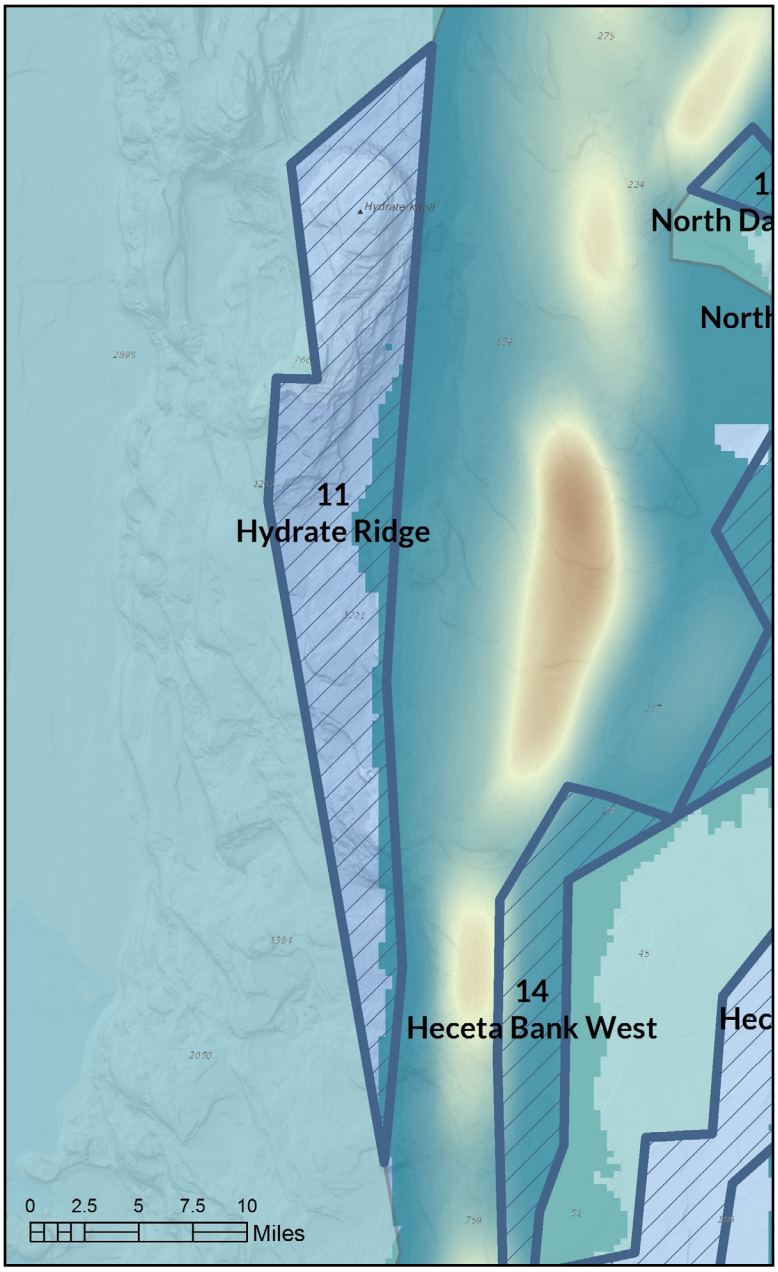
With 343 coral and sponge observations, this site has been relatively well-documented as an important location for biogenic habitat and associated fish species. In addition to gorgonian corals, black corals, and glass sponges, soft corals and Paragorgia (bubblegum coral) have also been observed here. Researchers have found gas hydrate and methane seep carbonates in this region (Johnson et al. 2003, Pasulka et al. 2016). These unique biological and physical characteristics are important for maintaining diverse ecosystems within the oceans and deserve protection. Physical and chemical conditions within this site have been found to be highly conducive for the growth of all coral taxa. Based on species models, this site is ranked high for occurrence and abundance of sablefish and longspine thornyheads.

Hydrate Ridge has high topographic, geochemical, and ecological variability that makes it ideal for conducting research on methane seep communities (Pasulka et al. 2016). The various methane seep assemblages on this ridge include microbial mats, clam beds, and carbonates. Clam bed assemblages, in particular, are important for associated macrofauna as they release higher levels of oxygen (Levin et al. 2010). The southern portion of Hydrate Ridge is in an oxygen minimum zone (OMZ) and has greater microbial diversity than northern Hydrate Ridge (Pasulka et al. 2016). Southern Hydrate Ridge is the proposed site for the OOI Cabled Array to begin continuous study of this seep environment (Interactive Oceans 2016).

The top of Hydrate Ridge (also called Hydrate Knoll) in the north of the proposal area rises up to 574 m and there is a deep ravine to the southwest of the ridge that drops to over 1,200 m. The site's benthos is composed of hard substrate, predicted rock, and soft substrates. Protecting this locale will not significantly displace bottom trawl effort (see map showing very little to no recent bottom trawl effort) and will benefit methane seep communities, groundfish, and several unique structure-forming species.

12. North Daisy Bank

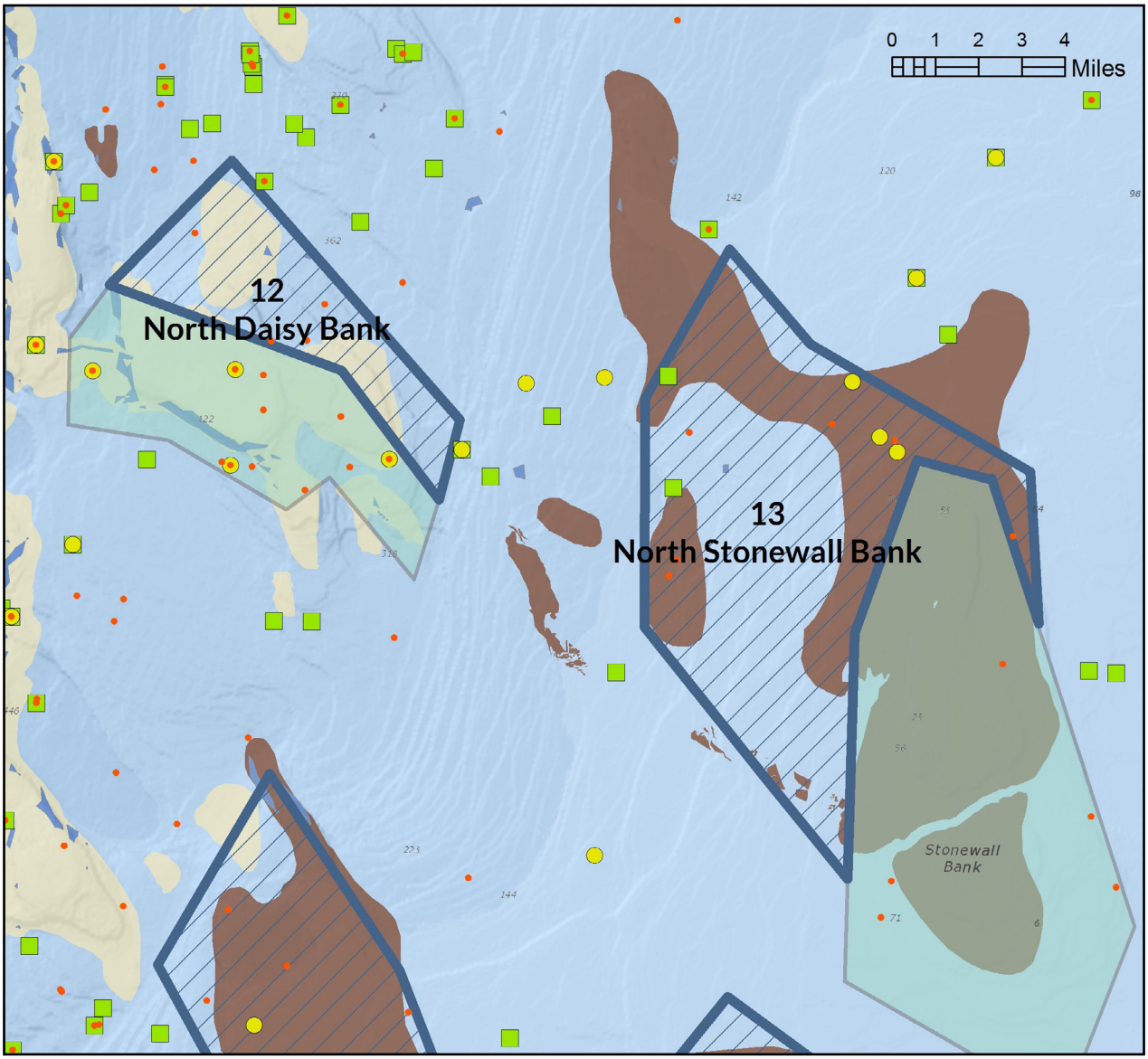
New substrate maps made available as part of the Council's EFH review show the presence of "mixed" reef habitat north of the existing Daisy Bank EFH Conservation Area. This newly identified habitat is incorporated in this proposal area. The boundaries of this area encompass records of sponges, primarily glass sponges, from NOAA trawl surveys. Dive surveys conducted by Oceana confirmed the presence of mixed reef seafloor habitat and showed that other sessile invertebrate species, including gorgonian corals and barrel sponges, are found on this bank. At varying levels of probability, all groundfish species analyzed in NWFSC models occur or are abundant here with sablefish having the highest probability of occurrence and abundance. The proposed area is inside the year round trawl RCA indicating that the conservation area would not displace any recent trawl effort.



13. North Stonewall Bank

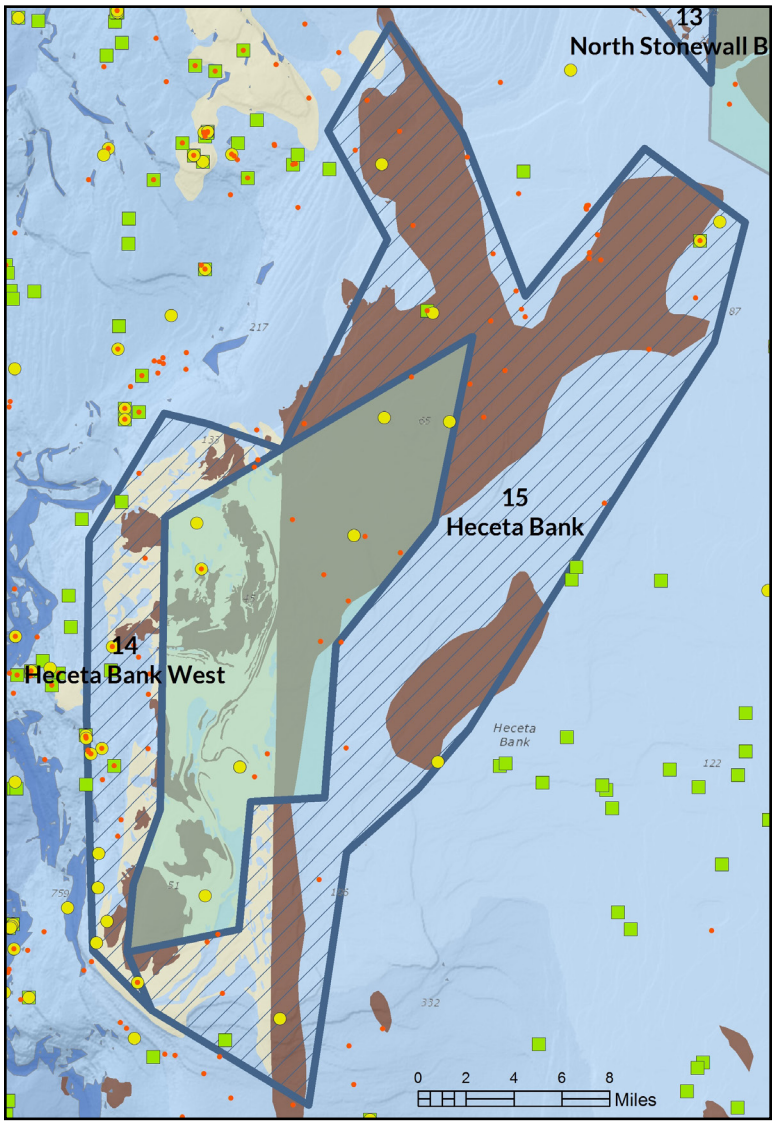
Contained within this proposed site are coral, sponge, and pennatulid observations, according to the EFH Review Catalog. In addition to gorgonian corals and glass sponges, also found here are managed groundfish species. Greenstriped rockfish and petrale sole have the highest probability of abundance according to NWFSC models. This shelf habitat contains hard reef substrate and the data provided for the EFH review represent a new understanding of the extent of the reef. In 2014, Hannah & Blume (2014) observed blue, canary, quillback, rosethorn, silvergray, widow, yelloweye, and yellowtail rockfishes as well as kelp greenling, lingcod, northern ronquil, spotted ratfish, and sculpin within a survey of 160 sites around the whole of Stonewall Bank. Oceana documented sponge, coral, managed groundfish species and hard and mixed reef features during ROV dives in this proposal area.

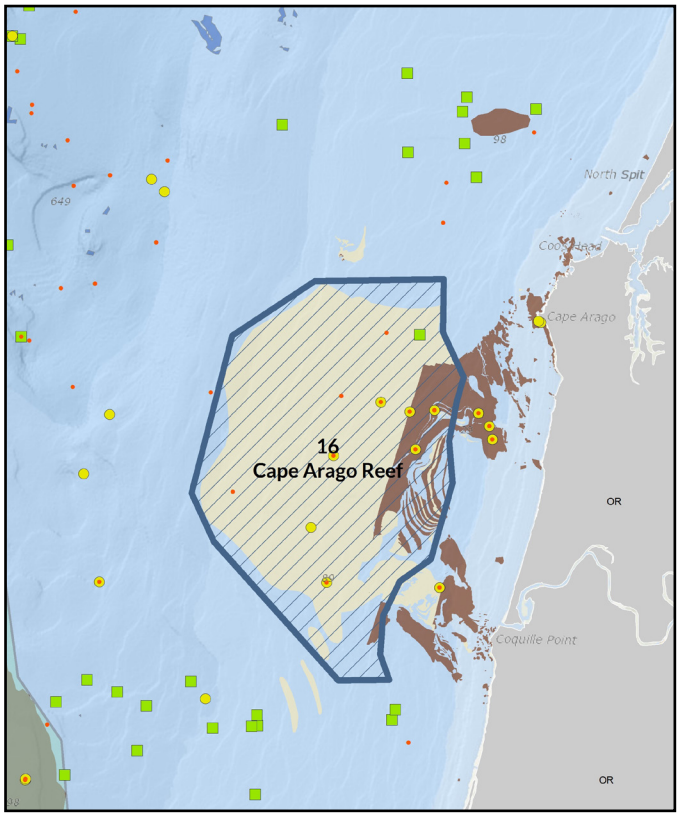
This proposal area is an extension of the north and west boundaries of the current Stonewall Bank EFH Conservation Area, with the goal of protecting a greater amount of the reef habitat there. However, we do not propose the entire reef be protected as it appears from the trawl data there is fishing effort in close proximity to the northern stretch of the reef. Thus, in order to limit impacts to groundfish bottom trawl and Oregon pink shrimp trawl fisheries, this extension is smaller than originally planned and remains distinct from nearby protected areas at Heceta Bank and Daisy Bank. Very little to no trawl effort occurs in this proposed area expansion, and designating this site as an EFH Conservation Area would yield the benefit of protecting priority habitat features.



14. & 15. Heceta Bank & Heceta Bank West

Heceta Bank is the largest contiguous rocky reef complex in the U.S. EEZ north of Cape Mendocino, California. This area is essential to groundfish for feeding and breeding, and is also a hotspot for pelagic birds and marine mammals. The modifications here included two sites – Heceta Bank West (#14) and Heceta Bank (#15) to the east. Both sites are predominately located on the continental shelf at depths less than 200 m, however, the western area drops to roughly 500 m in one spot and both partially overlap sections of the trawl RCA. Heceta Bank West includes newly identified reef habitat mapped with high resolution sonar and the two sites combined include over 200 square miles of hard and mixed rocky reef. The area also includes 40 records of coral, sponge, and pennatulid observations including gorgonian corals, black coral, and glass sponge. In 2013 Oceana completed five ROV dives in the northern section of the Heceta Bank proposal area and confirmed the presence of large contiguous reef habitat, boulders, coral, sponge and other invertebrates, plus managed groundfish.
According to the NWFSC species models, all modeled groundfish are found in this proposed area at varying probability levels of abundance and occurrence; greenstriped rockfish, petrale sole, and sablefish have the highest probability of abundance and occurrence. For areas within the Northern Biogeographic Region, this site has the highest probability of occurrence for overfished yelloweye rockfish.





16. Cape Arago Reef

Significant new information on this reef complex southwest of Coos Bay and west of Bandon, Oregon has been made available since 2005, including new seafloor substrate maps and ROV habitat surveys. In 2011 Oceana conducted eight dives to survey this reef habitat and found hundreds of widow rockfish, greenstriped rockfish, quillback rockfish, blue rockfish, tiger rockfish, rosy rockfish, olive/yellowtail rockfish, rex sole, kelp greenling, and lingcod (Enticknap et al. 2013). In addition, this area appears to be important for canary rockfish and overfished yelloweye. Corals and sponges were present at seven of eight dive sites including gorgonian corals, soft corals, and stony corals. Several sponge types were also observed.

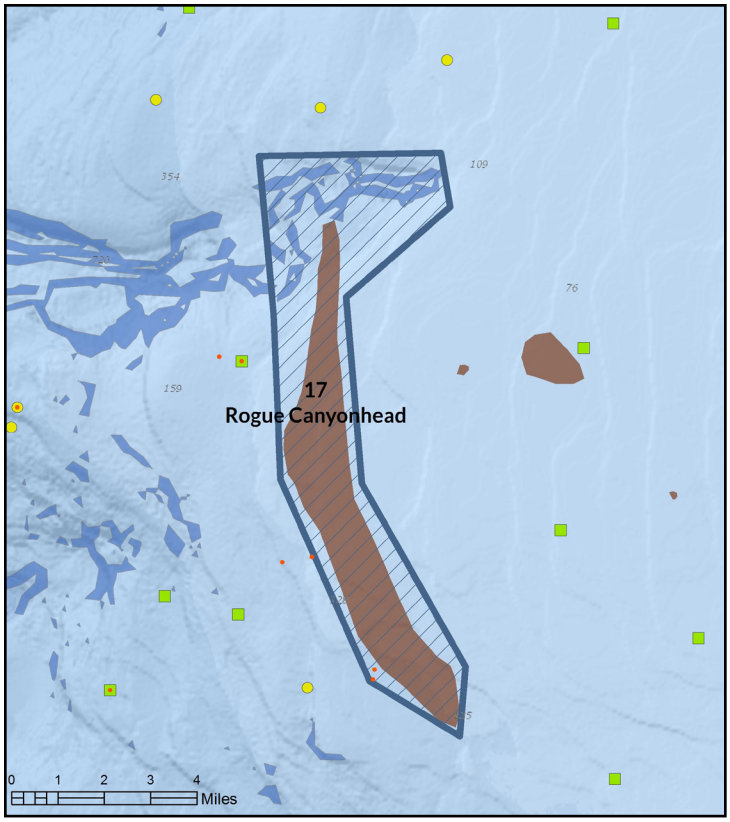
A significant amount of hard and mixed substrate is incorporated in this area. The geologic structure observed here is diverse, as mixed substrate consists of large boulders, cobble, and gravel mixed with mud. According to trawl effort data off southern Oregon, no trawling occurs here making this site easily enforceable with no impacts to bottom trawl fishing.

This proposal area includes the reef in federal waters, immediately adjacent to Oregon state waters.

17. Rogue Canyonhead

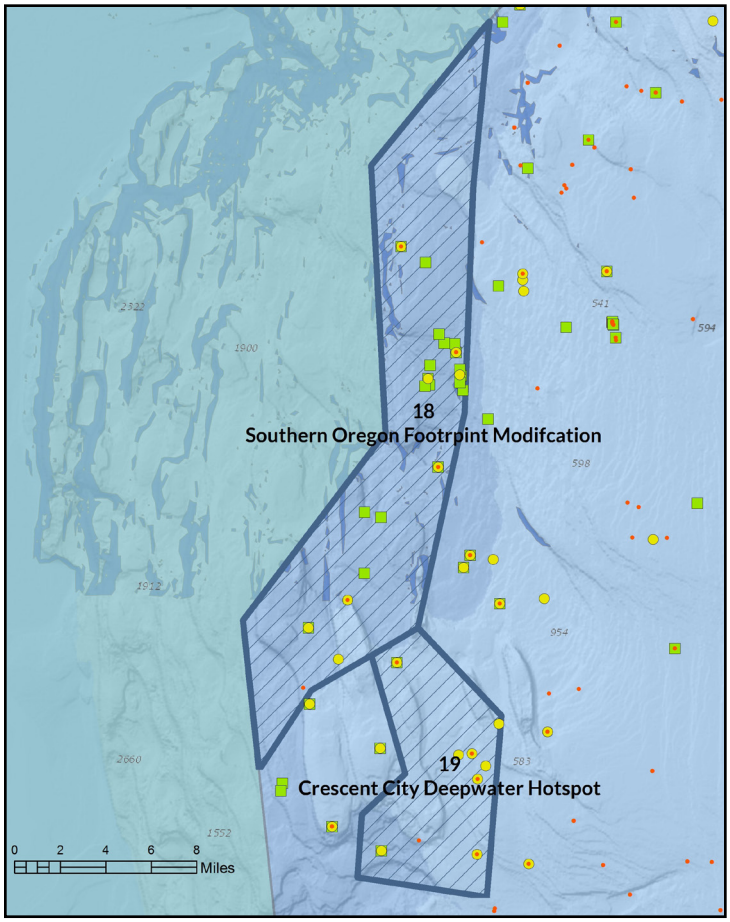
This proposal area includes a long, narrow reef and it is rated as highly suitability habitat for all coral taxa combined (Guinotte & Davies 2012). All NWFSC modeled groundfish are found here with varying probability levels. Sablefish and greenstriped rockfish have the highest probability of abundance.

Hard and inferred rock substrates are covered by this proposed site. The design of this proposed conservation area aims to incorporate the ecologically important canyonhead and reef habitat, while avoiding those areas important to the groundfish bottom trawl and shrimp trawl fisheries. This area also overlaps with the groundfish trawl RCA closure at the canyonhead. Virtually no trawl effort of either fishery occurs here, indicating minimal to no economic impacts from giving this site EFH Conservation Area status.



18. Southern Oregon Footprint Modification

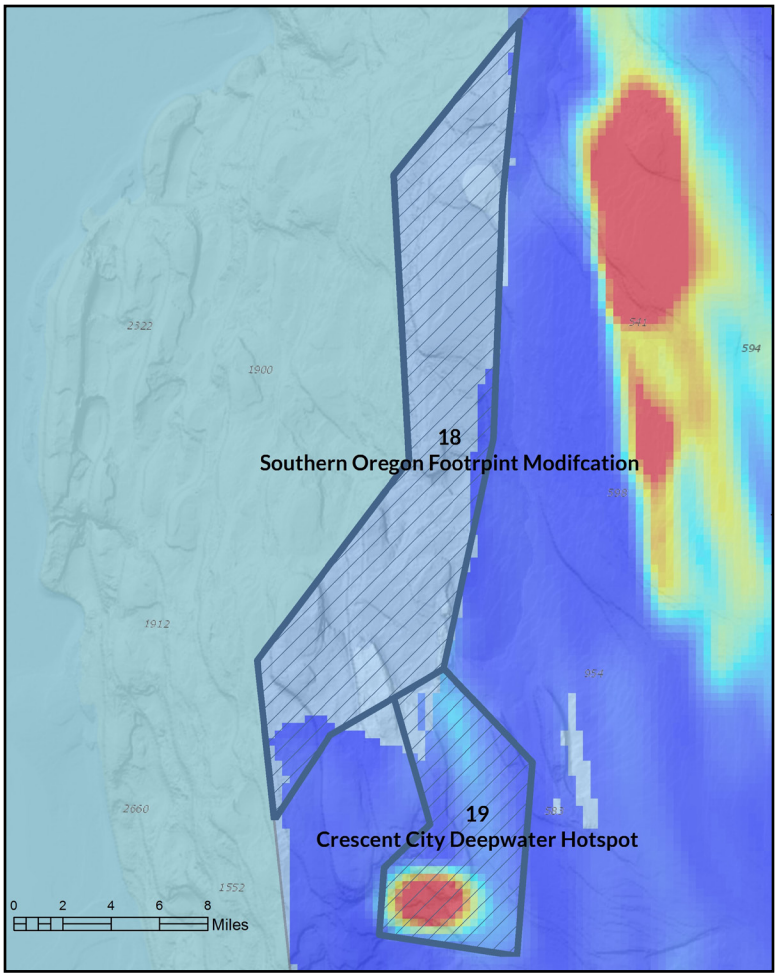
This eastward addition to the 700 fathom deep-water trawl footprint closure encompasses 37 observations of gorgonian corals, black corals, glass sponge, and pennatulids. Also included is an area of high predicted suitability for all coral taxa combined (Guinnotte & Davies 2012). Both NWFSC and NCCOS species models indicate that longspine thornyhead and sablefish have a high probability of abundance and occurrence here. This area of the upper slope spans a depth here range from 820 m at the shallowest point to 1,410 m, and includes areas of predicted rock habitat. No trawl effort occurs here according to 2006-2010 data. The design of this area is enforceable and incorporates essential upper slope habitat with a known diversity of structure-forming invertebrates.



19. Crescent City Deep-water Hotspot

NOAA's Deep Sea Coral Research and Technology Program confirmed that this site contains significant coral habitat (NOAA 2014) and that there has been high bycatch of sponges and corals in this area documented in both NMFS trawl surveys and in the groundfish trawl fishery. This region accounts for nearly a quarter of the coral bycatch coastwide, and protecting this area provides the distinct opportunity to mitigate and prevent adverse impacts to corals. Protection would result in a disproportionately greater reduction in adverse impacts compared with the size of the area and displaced trawl effort.

The proposed area ranges from 780 to 1,200 m. Research dives less than four miles east of this site were conducted by NMFS and academic partners in 2014. During that expedition areas of hard and mixed substrates were identified. What is more, the four research dives combined documented a total of 12,831 corals comprising at least 13 different taxa (including two species of black coral and "peppermint" coral) plus 629 sponges (Yoklavich et al. 2016).



20. Eureka Footprint Modification (Trinidad Canyon)

This important submarine canyon and basin represents the deeper portion of the convergence of a system of offshore submarine canyons. Glass sponges, black corals, and pennatulids have been documented at this site. There is high modeled occurrence and abundance of longspine thornyheads in this area. Very low to no recent trawl effort has occurred here and very few trawl tracks are evident from the 2000-2005 logbook data.

No definitive substrate data is available; however, the canyon structure and range of depths show topographical complexity. Almost no displacement of bottom trawl effort would occur with this proposed area, and no shrimping occurs over the basin. This area represents an excellent opportunity for deep-water protections (1,100 m to 1,600 m) off Northern California with minimal disruption to bottom trawl effort.

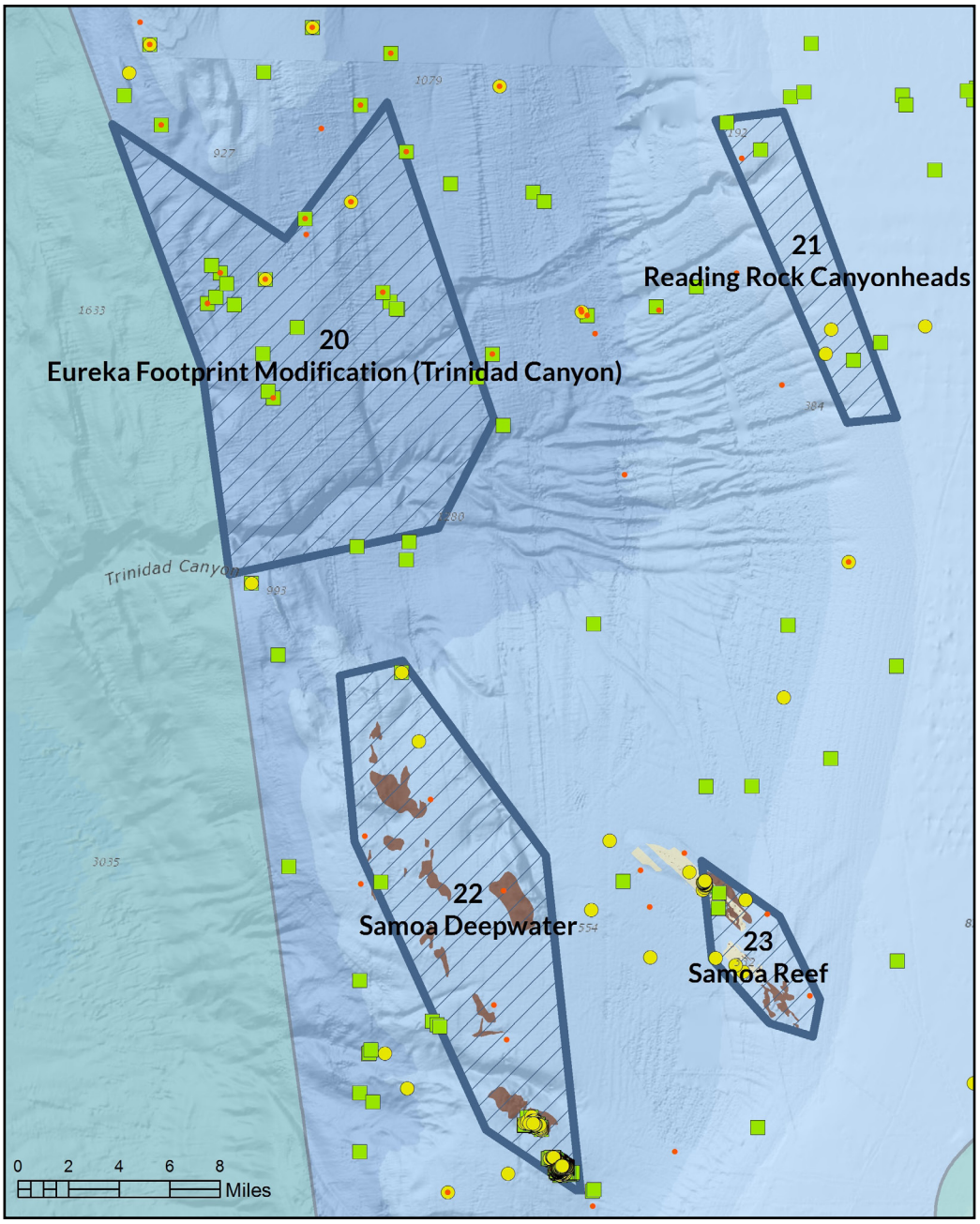
21. Reading Rock Canyonheads

This proposed area would complement the deep-water proposal area at Trinidad Canyon with the conservation of a series of canyonheads that bisect the convergence of the continental shelf and upper slope. It includes areas of high predicted suitability for coral species (Guinnotte & Davies 2012). Gorgonian and other corals, sponges, and pennatulids have been observed here. The proposal area is located west of California's Reading Rocks State Marine Reserve and spans a depth range of 150 to 370 meters. It also overlaps the trawl RCA. Designating this area as an EFH Conservation Area would protect the canyonhead habitat for groundfish species even if the trawl RCA is lifted. Despite the presence of some trawl effort outside the RCA, very little overall displacement would occur in designating this site as an EFH Conservation Area.

22. *Samoa Deep-water*

This proposal area includes several of the very few deep rocky reefs between Cape Mendocino, California and Cape Blanco, Oregon. This area contains gorgonian corals and glass sponges among other valuable and sensitive invertebrate taxa. Two rocky reef sites in the southwest corner of the proposal area were surveyed by the Monterey Bay Aquarium Research Institute. In total, these surveys yielded 2,071 individual coral observations according to data contained in the NOAA Deep Sea Coral Research Technology Program deep sea coral and sponge database.

Levin et al. (2003) conducted dives to assess methane seep sediments and associated macrofaunal communities at the southern tip of this area. Dives explored unique and diverse seafloor habitats including clam beds, microbial mats, and nearby non-seep sediments (Levin et al. 2003). This habitat encourages scientific interest and may be an important setting for enhancing knowledge of seafloor ecosystems, in addition to being an essential site for slow-growing corals and sponges. Although limited trawl effort has occurred in the proposal area, it is limited to only approximately one percent of the trawl effort off California.



23. Samoa Reef

This area contains rocky reef habitat and numerous observations of biogenic habitats, including black corals, gorgonians, and sponges. The area is offshore the Samoa State Marine Conservation Area, and it includes rocky and mixed habitat overlapping the trawl RCA. The design of this shape aims to account for the reef habitat and observations of important corals, sponges, and pennatulids while avoiding areas important to the bottom trawl fishery. This area encompasses very little of total recent trawl effort off California. The full extent of the reef extends deeper beyond the boundaries of this proposed area, but we do not propose designation for the full reef due to overlap with a core trawl area.

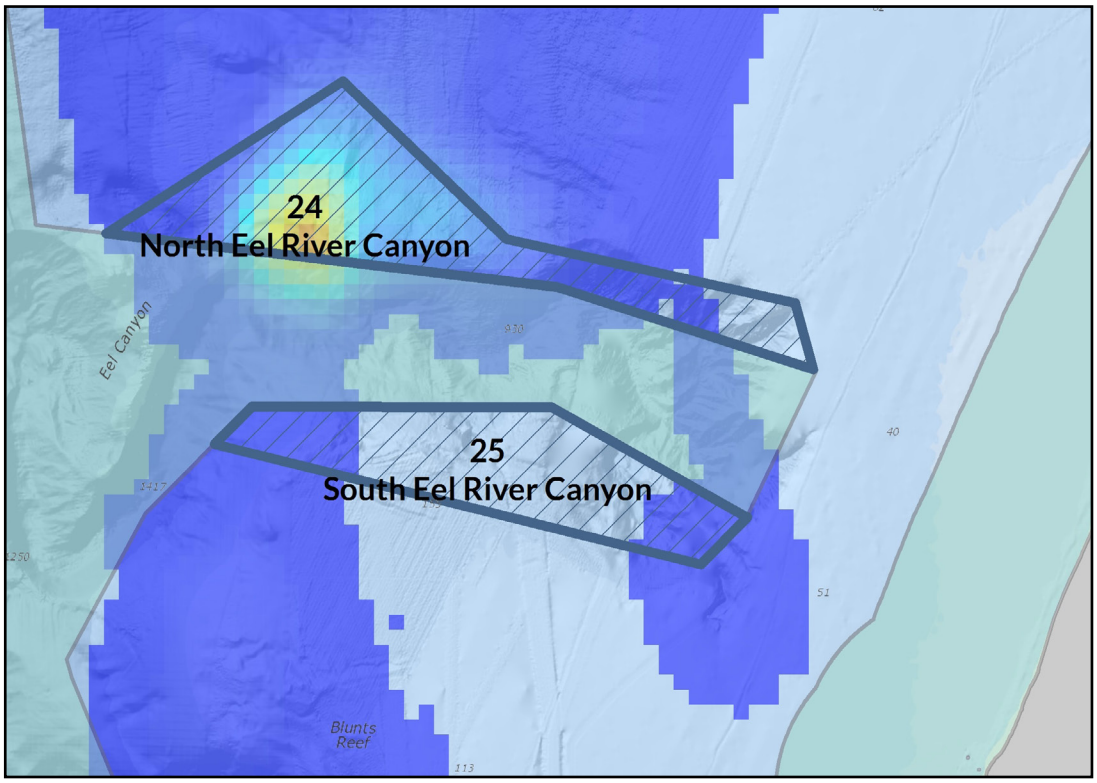
24. North Eel River Canyon

North Eel River Canyon is a proposed expansion of the existing Eel River Canyon EFH Conservation Area. Included here are records of gorgonian corals and glass sponges. This area was identified primarily to encompass a major sponge bycatch hotspot. In total, this one hotspot represents nearly 8% of the sponge bycatch off California. It appears to be located on a series of sequential banks and ridges on the northern edge of Eel River Canyon where there are also multiple records of glass sponges and other sponge types from trawl surveys.

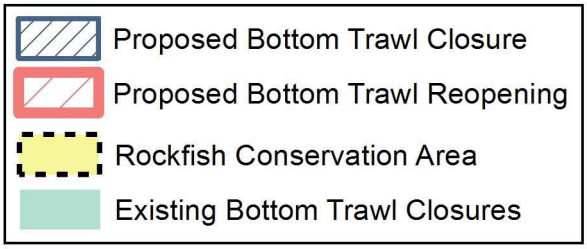
The proposal area would also add a portion of the trawl RCA into an EFH Conservation Area, maintaining protection should surrounding RCAs be re-opened. NOAA's Deep Sea Coral Research and Technology Program has confirmed this proposed site as having significant coral and sponge bycatch (NOAA 2014). We believe this closure is warranted despite the limited trawl effort that would be displaced.

25. South Eel River Canyon

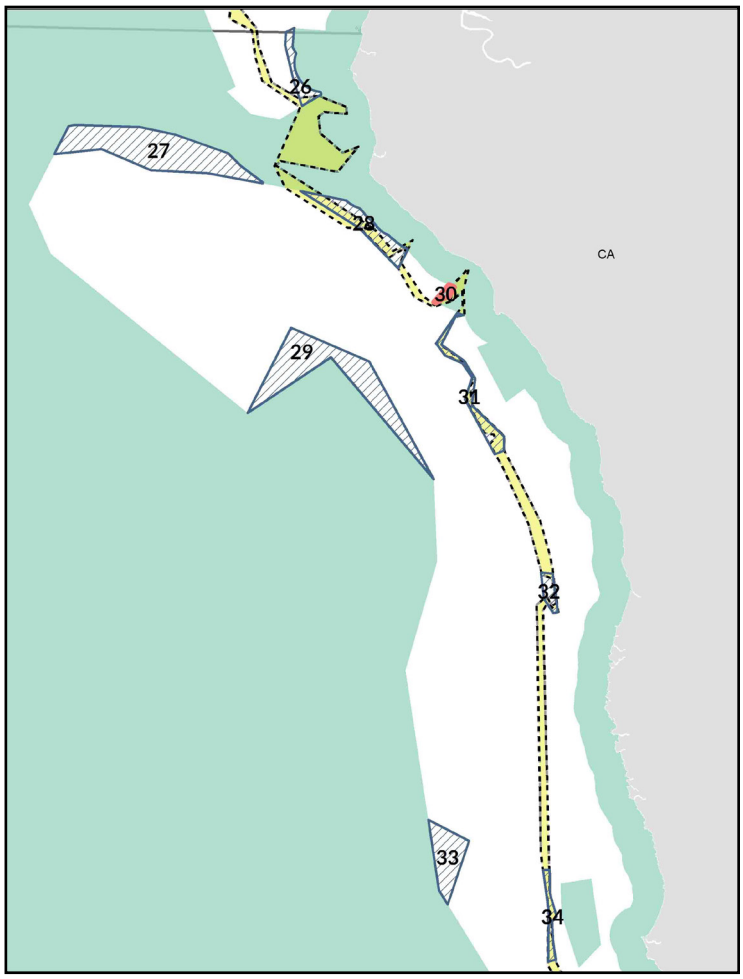
This area is a proposed expansion of the existing Eel River Canyon EFH Conservation Area. It contains observations of sponges, including glass sponges and it also contains high modeled occurrence and abundance of longspine thornyhead. The area is topographically diverse with steep canyon walls and canyon edges. It is primarily in an area with very low to no trawling, and its designation would add the southern canyon edge, much of which is part of the current trawl RCA.



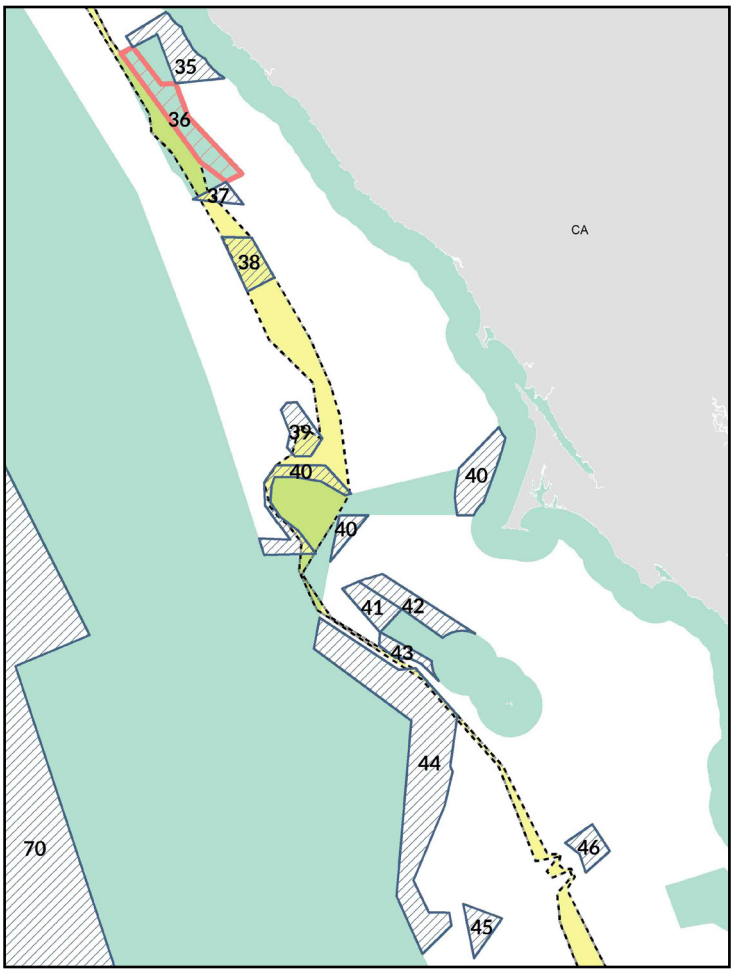
Central Biogeographic Region
(Cape Mendocino, California to Point Conception, California)



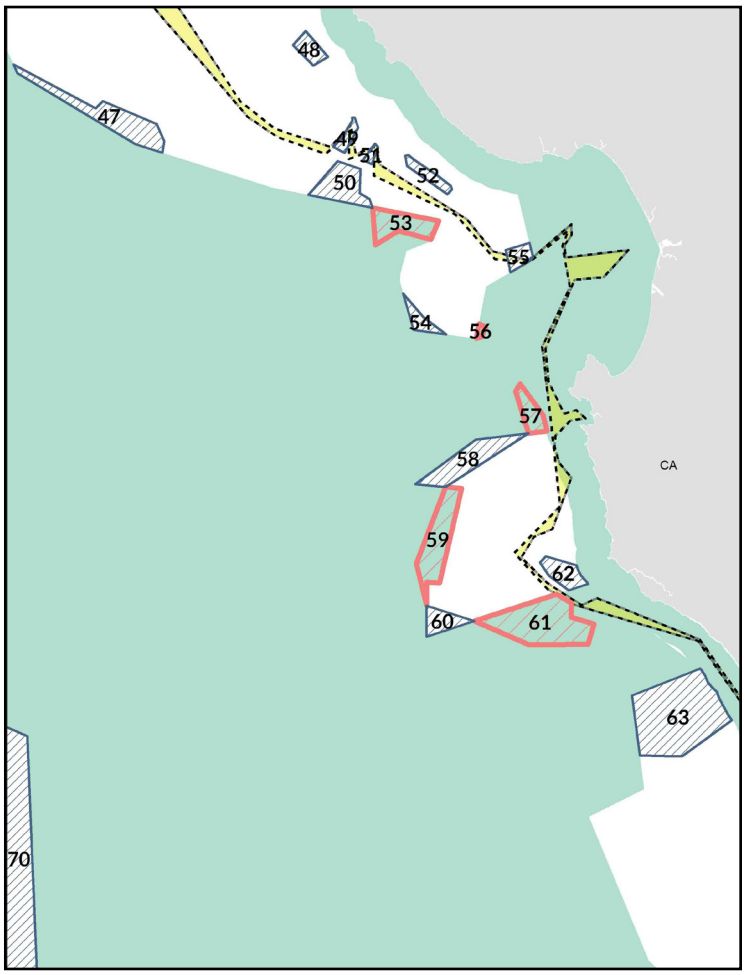
Master Legend for Overview Maps



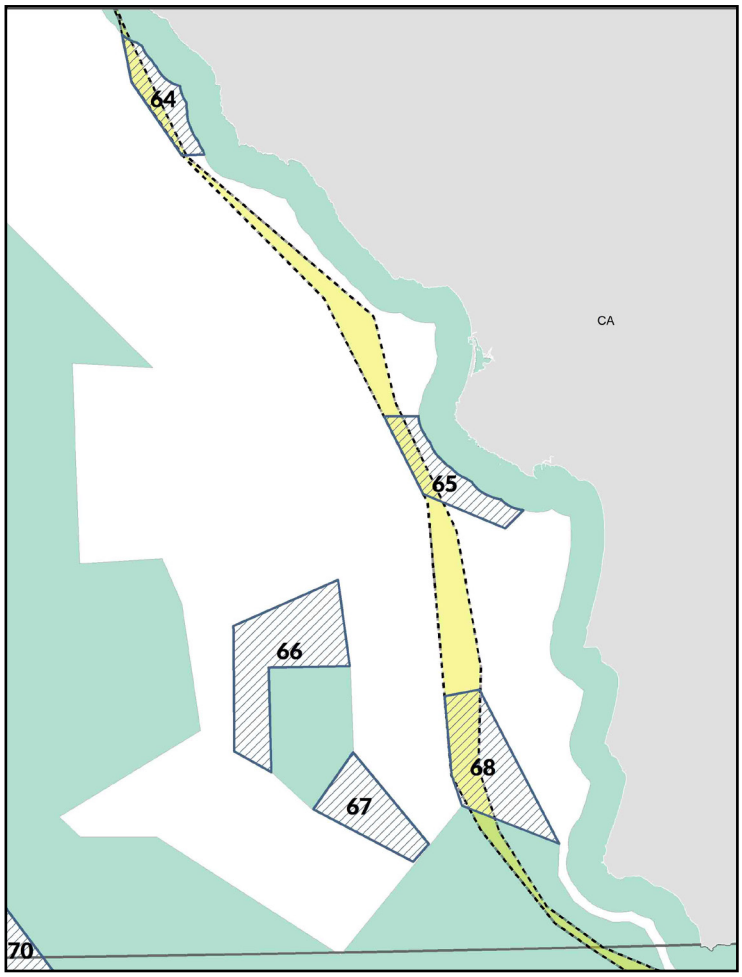
Overview Map 5. Blunts Reef (26) to Point Arena Canyonheads (34). The trawl RCA in yellow is overlapping existing EFH and state areas closed to bottom trawling (light green) and proposed conservation areas (blue stripes) and proposed openings (light red).



Overview Map 6. Saunders Reef (25) to Pioneer Canyonhead (46).

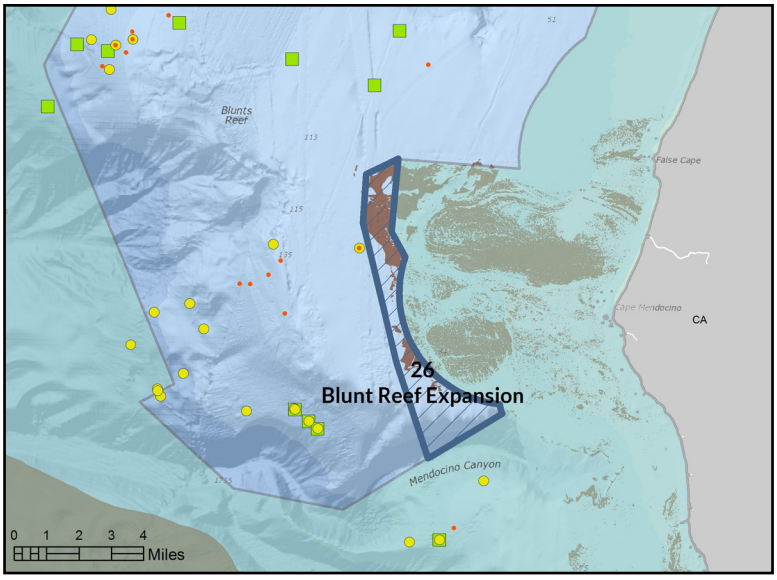


Overview Map 7. Cabrillo Canyon (47) to Between Partington Point and Lopez Point (63).



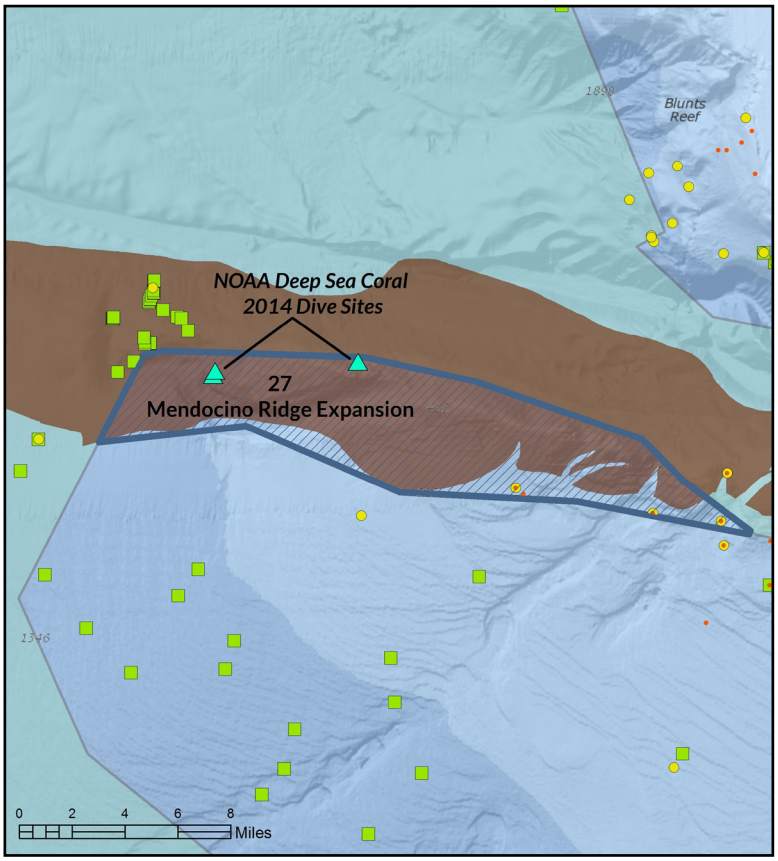
Overview Map 8. La Cruz Canyon/ Piedras Blancas (64) to Point Arguello (68).

26. Blunts Reef Expansion



This rocky reef habitat west of Cape Mendocino, California is strongly important for groundfish species as indicated by the high occurrence and abundance of all six NWFSC modeled species. Additionally, a significant portion of this area has been identified as high predicted coral habitat for all taxa. This is a proposed expansion of the current Blunts Reef EFH Conservation Area that adds the remaining hard substrate mapped at this reef. This proposed area and the Mendocino Ridge Expansion (#27) contain the highest predicted habitat for yelloweye rockfish in the Northern California region. Virtually no trawling is indicated throughout the entire proposed closure area. This area would protect the northern portion of the Mendocino submarine canyon where it drops off to a depth of 800 m, as well as part of the trawl RCA. This closure is designed to connect to the existing EFH Conservation Area at Blunts Reef, the Mendocino Ridge EFH Conservation Area and California state waters to act as a single, enforceable conservation area connecting nearshore and offshore environments.

27. Mendocino Ridge Expansion



The current Mendocino Ridge EFH Conservation Area protects important hard substrate and incorporates a significant amount of coral and sponge observations. This proposal area, however, expands on that to protect a large section of hard substrate extending to the south of the ridge. Towed cameras deployed by NOAA scientists in 2014 documented that the survey area inside our proposal area was 97% hard substrate of relatively high relief at depths between 631 and 798 meters (Yoklavich et al. 2016). They also documented over 10,000 coral colonies during their 2014 research there (see dive locations on map). Soft corals were found at shallower depths as well as gorgonians including bubblegum corals and sea fans (Yoklavich et al. 2016). At deeper slope areas more dominated by soft sediments, researchers documented gorgonian corals including 230 bamboo corals, 10 *Paragorgia* corals (peppermint coral) and 615 sea fans (*Swiftia* spp.) (Yoklavich et al. 2016). Estimated density of corals at one dive site is this area is the highest of any areas surveyed during this Northern California cruise at over 3,300 corals per 1,000 m^2 (Yoklavich et al. 2016).

Mendocino Ridge is characterized by topographic complexity and geologic and biological diversity. The boundaries of this area encompass depths from about 300 m to over 1,400 m. According to trawl effort data in the EFH Data Catalog, little to no trawl effort occurs here. This area is a clear choice for designation as an EFH Conservation Area due to the extensive presence of coral, hard substrate, and the likely high impact to EFH should bottom trawls be used there.

28. Spanish Canyon

This proposed site includes the entire canyonhead of Spanish Canyon currently in the trawl RCA and it extends to the state water boundary, adjacent to Big Flat State Marine Conservation Area. This area has predicted high occurrence and abundance of greenstriped rockfish, darkblotched rockfish, petrale sole, and sablefish according to NWFSC models. Most of the site contains high predicted coral habitat for all taxa (Guinnotte & Davies 2012), and depths range from 100 m to 530 m. This proposal area allows for increased connectivity between the Mendocino Canyon feature and the major submarine canyon complex to the south (Spanish Canyon and Delgada Canyon complex) as well inshore/ offshore connectivity between areas in state and federal waters. This area is in the current trawl RCA and reopening of this area to bottom trawling would subject sensitive habitats to adverse impacts.

29. Delgada Canyon Deep

Delgada Canyon Deep encompasses deep-water habitat from 1,000 m (600 fathoms) to nearly 1,500 m (820 fathoms). There are records of biogenic habitat from NOAA trawl surveys including pennatulids, sponges, and the black coral *Chrysopathes speciosa*. This location includes substantial and biologically important canyon habitat that is part of the Delgada Canyon complex. These canyons all have high predicted coral habitat suitability and high NWFSC modeled occurrence and abundance for longspine thornyhead and sablefish. We previously discussed this area extensively with the fishing industry, and the northern waypoints are based on specific feedback from the industry. The original shape was reduced in size to avoid important trawl grounds shallower than 1,000 m (600 fm). This area is designed to encompass important deep-water habitat and extends from the current closure while avoiding recent trawl effort off California.

30. Delgada Canyon Reopening

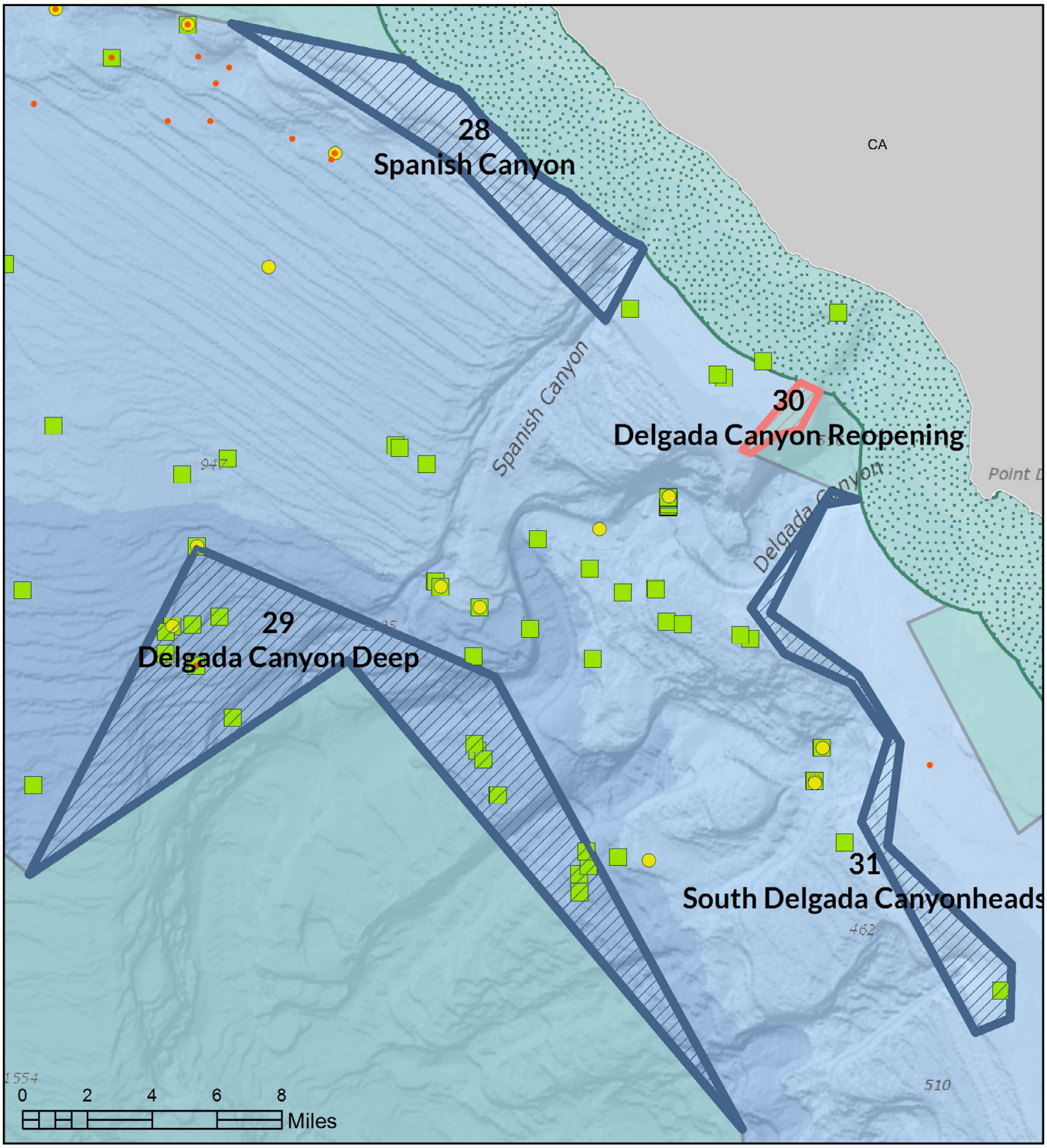
The original designation of the Delgada Canyon EFH Conservation Area was a critical component of the Amendment 19 action to protect known priority habitats in this region off Northern California. This was the result of thorough and deliberate consideration by the Council and the State of California. Fishery managers recognized this action was necessary to prevent adverse impacts to EFH even in light of the known importance of this area as a fishing ground and to promote recovery of this area. The fishing industry requested the entire EFH Conservation Area and RCA be reopened to bottom trawling. However, doing so would cause adverse impacts to sensitive habitats that have been protected from trawling since 2006. In the interest of being responsive to the industry request, and after careful consideration, we proposed reopening as much of the area on the shelf as possible while maintaining the most sensitive areas closed. The area that would be reopened is very important and productive habitat for groundfish and includes some high predicted coral habitat, isolated patches of hard substrate, and the northern canyon edge. In contrast to the opening in the collaborative proposal, the trawl RCA and deeper depths of the existing Delgada Canyon EFH Conservation Area would not be affected by this reopening. As with all other proposed reopening areas, our support for this reopening is contingent on the adoption of the closure components of this proposal as a regional package.

31. South Delgada Canyonheads

Coextensive with the trawl RCA boundaries, this area encompasses the major canyonheads in the Delgada Canyon complex. According to NWFSC models, the area includes high abundance and occurrence of greenstriped and darkblotched rockfish; it also includes high abundance and occurrence of chilipepper rockfish, Dover sole, and lingcod according to NCCOS models. Since the area is entirely within the current trawl RCA, it will not result in any displacement of current trawl effort. While much of the RCA in Northern California may be reopened to trawling under in the Amendment 28 process, this area is one of the key areas within the RCA containing priority habitats that should remain closed as EFH so as to prevent adverse impacts.

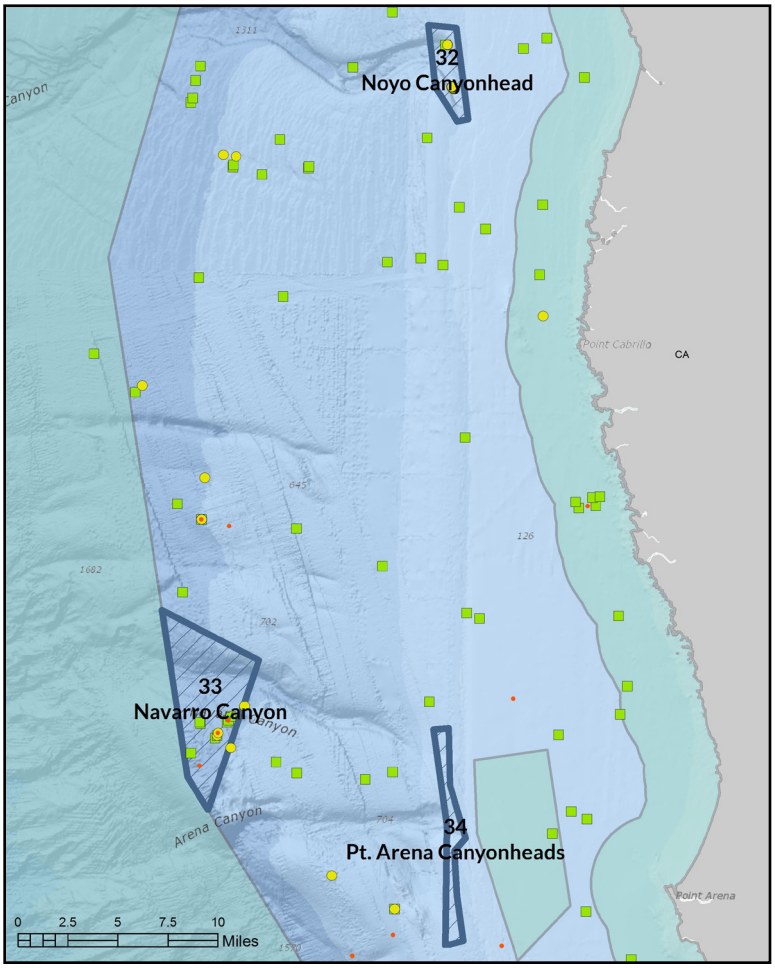
32. *Noyo Canyonhead*

Encompassing the trawl RCA portion of Noyo Canyon and its canyonhead, this site contains multiple coral and sponge records documented by the Monterey Bay Aquarium Research Institute, including the bubble gum coral *Paragorgia spp*., and it is high predicted coral habitat (Guinnotte & Davies 2012). While this general area is an important fishing ground close to Ft. Bragg, most of is the proposal area is currently part of the trawl RCA and the area includes virtually no recent trawl effort. Due to the targeted nature of this closure, there will still be opportunities for continuous trawl tows along the canyon edges.



33. Navarro Canyon

Navarro Canyon is a new proposed EFH Conservation area encompassing deep-water canyon habitat adjacent to the 700 fathom EFH trawl closure. This area contains multiple records of biogenic habitat, including the gorgonian coral *Euplexaura marki*, the glass sponge *Aphrocallistes vastus*, and numerous other sponges and pennatulids. The boundaries of this area have been revised based on fishing industry input to avoid areas of high importance to the trawl fleet. Early versions of this area included the canyon to the south and much more of the shallower depths of the canyon, but those were removed based on feedback we received. Our proposal for this area was designed carefully to include a known aggregation of corals and sponges to the south of the canyon. That coral and sponge area is not included in the collaborative proposal. According to the EFH data, there is little to no trawl intensity in this area.

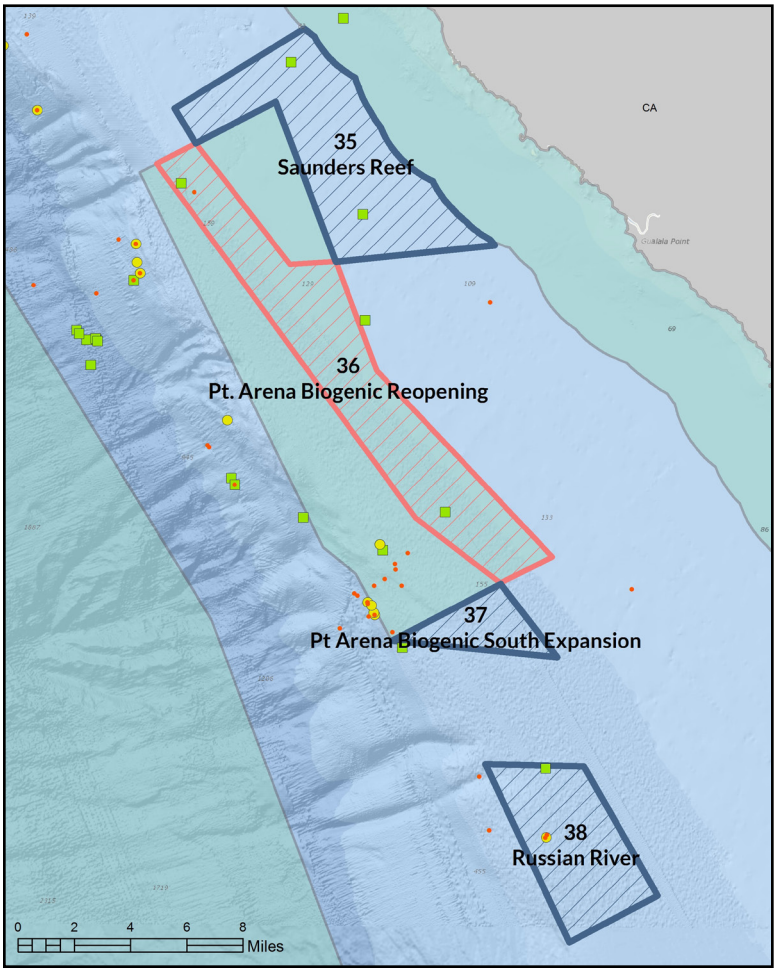


34. Pt. Arena Canyonheads

Exclusively within the trawl RCA, this area is in a high coral habitat suitability region and spans three major canyonheads. This area is located directly offshore of Point Arena Reef, Point Arena State Marine Protected Area, and the Point Arena North EFH Conservation Area. It would provide long-term protection for the trawl RCA in the central biogeographic region. Since the entire area is currently within the trawl RCA, there will be no displacement of current trawl effort. Additionally, nutrient-rich canyonhead and shelf-break habitat would be protected. Since large portions of the trawl RCA in this region may be reopened, it is critical that priority habitats sensitive to bottom trawl impacts remain protected. This proposal is designed to maintain a bottom trawl area located between the current RCA and the nearby Point Arena North EFH Conservation Area. This area intersects the northern boundary of the Greater Farallones National Marine Sanctuary.

35. Saunders Reef

Saunders Reef is a new proposed EFH Conservation area which would increase protection of shallow soft sediment shelf habitat, including known records of pennatulids. The southern boundary is drawn based on specific input from the fishing industry designed to maintain potential shrimp trawl grounds, and the northern boundary is drawn to create continuity with the Northern boundary of the Saunders Reef State Marine Conservation Area while avoiding significant trawl grounds. This area is an essential component of a proposed restructuring of the Point Arena South Biogenic EFH Conservation Area. The overall configuration of the proposed Saunders Reef EFH Conservation Area and the Pt. Arena Biogenic Reopening and extension (areas 36 and 37) achieves a 1:1 exchange between the total area reopened and closed. This is in contrast to the collaborative proposal for modifying the Pt. Arena Biogenic EFH Conservation Area which would result in a significant decrease in protected area. According to the EFH Phase I Report data, there is very low trawl intensity in this area. This and other proposed sites (36 to 38) are now within the Greater Farallones National Marine Sanctuary.



36. Pt. Arena Biogenic Reopening

In the Pt. Arena Biogenic Reopening, a significant section of the Pt. Arena Biogenic South EFH Conservation Area would be reopened for trawling. A substantial area of trawl grounds that were closed in 2006 would be reopened in soft sediment shelf habitat in the 60-100 fathom (about 110-180 m) depth range. This proposed reopening is based on a specific geographic request from the fishing industry to resume trawling in this area, and our proposal for reopening this area is contingent on the designation of additional closures in this region (Saunders Reef #35 and Pt. Arena Biogenic South Expansion #37) to compensate for any potential adverse impacts to EFH associated with this reopening. This reopening includes some sponge and pennatulid records and is among the major EFH protections in Northern California. It is, therefore, essential to mitigate impacts to protected habitat from this reopening through the protection of additional proposed closures.

37. Pt. Arena Biogenic South Expansion

The Pt. Arena Biogenic South Expansion is part of the proposed restructuring of the Pt. Arena South Biogenic EFH Conservation Area. It includes part of the trawl RCA area and incorporates the southern tip of the rocky reef feature outside the existing conservation area. The southeast waypoint was based on specific geographic input from the fishing industry. There is local knowledge about highly unique geological features in this area, described as large rocky pinnacles surrounded by soft bottom. According to the EFH Phase I Report data, there has been little to no recent trawl effort in this area.

38. Russian River (aka "The Football")

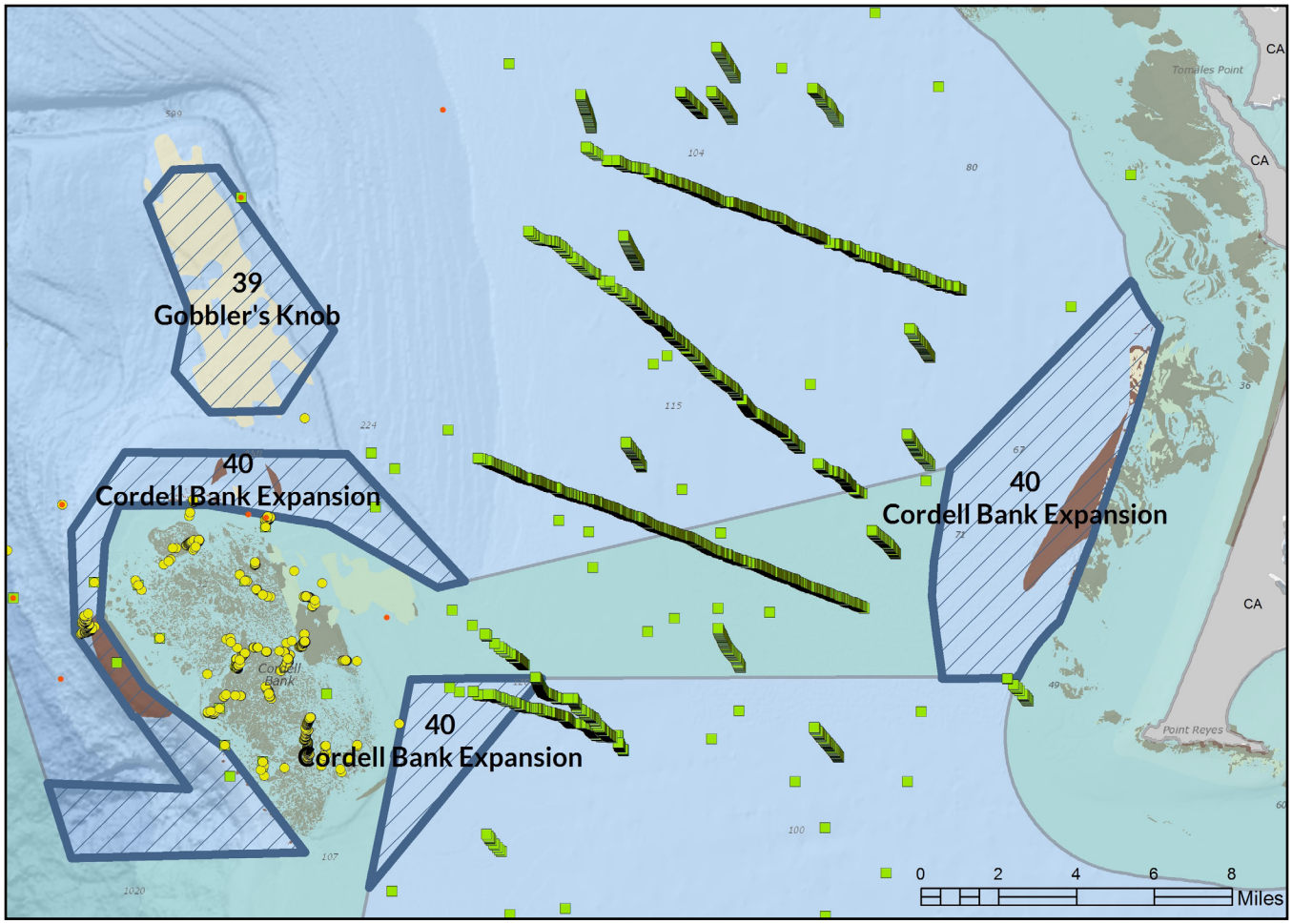
The Russian River site is a new proposed EFH Conservation Area fully within the trawl RCA. The area, known locally as "The Football," is a large rocky bank approximately 180 to 280 meters deep. Recent NOAA ROV surveys documented 22 coral colonies including eight colonies of a new gorgonian coral species (*Swiftia farallonesica*) (Graiff et al. 2016). NOAA also discovered a cat shark nursery with hundreds of egg casings. While the EFH data catalog does not show rocky habitat here, recent habitat mapping and underwater surveys confirmed extensive hard substrate of both high and low relief throughout the football area. Input from fishermen suggests that this area is highly productive for many groundfish species and this was confirmed by NOAA researchers who documented 16 species of *Sebastes*, plus flatfishes, lingcod and others. The majority of the NOAA research dives were inside the proposed area, however during a few outside the proposed area - deeper than 250 m – researchers discovered additional cat shark nursery habitat. There are also observations of the glass sponges *Farrea occa* and *Acanthascus dawsoni*, the demosponge *Ampilectus spp.*, and the Scleractinian coral *Desmophyllum sp.* (Stierhoff et al. 2011) in the proposal area. Since the entire area is currently part of the trawl RCA, there will be no displacement of recent trawl effort. In contrast to the much smaller polygon in the collaborative proposal, this proposal area contains extensive known presence of priority habitats that would be subject to adverse impacts if the RCA is reopened. This area is also part of the newly designated Greater Farallones National Marine Sanctuary.

39. Gobbler's Knob

Located to the south of Bodega Canyon, Gobbler's Knob is within the recently expanded Cordell Bank National Marine Sanctuary. According to local knowledge, this area was named by fishermen because it would "gobble" up trawl nets due to the various snags and trawl hangs in the area. This area includes the majority of a newly mapped mixed reef substrate that had not been identified when the PFMC made its final EFH decision in 2005 and there is significant overlap with trawl RCA.

A 2016 report from the Office of National Marine Sanctuaries describes the findings of nine dives conducted in the proposal area (Graiff et al. 2016). Primarily hard substrate was observed (93%) and the total density of fish was estimated to be 79 fish per 1,000 m^2 with nearly half of fish observations consisting of rockfish (at least 12 species) and about a quarter were flatfish (at least five species) (Graiff et al. 2016). Researchers documented pennatulids, sponges, mushroom coral, primnoid octocoral and other invertebrates (Graiff et al. 2016).

The southern half of the area is within the trawl RCA and southern boundary maintains a mile-wide trawl path between this area and the proposed Cordell Bank EFH Conservation Area Expansion. The Northern boundary maintains an important trawl tow along the southern rim and edge of Bodega Canyon, allowing for continuous tows along the 200 fathom depth range on the western boundary of Gobbler's Knob and to the west of Cordell Bank.



40. Cordell Bank Expansion

The proposed Cordell Bank Expansion builds off the existing Cordell Bank EFH Conservation Area in three places. One section to the north and west of the current closure would protect rocky reef habitat on shelf and upper slope habitat, while increasing connectivity between the Cordell Bank area and the trawl footrpint conservation area. Much of the proposed area is inside the trawl RCA. It also incorporates a major study site documenting hard substrate and several invertebrate species, including gorgonians (Graiff et al. 2011). In total, over 2,400 observations of at least six deep sea coral species and over 60 observations of sponges were made here (Graiff et al. 2011).

The proposed modification to the southeast of the Cordell Bank EFH Conservation Area encompasses an area that local knowledge suggests contains significant trawl hangs and high risk of interaction with overfished species; some fishermen report voluntarily avoiding the area as a result. The southeast expansion encompasses areas surveyed by the Cordell Bank National Marine Sanctuary that contain significant pennatulids and other biogenic soft sediment habitat.

The proposed expansion to the east connects with state waters offshore the Pt. Reyes National Seashore. It includes the federal waters portion of a major hard reef feature that has been newly mapped and this area would create a corridor of protections from the shoreline to deep, offshore habitats. This area has had minimal trawl intensity in recent years according to trawl data in the EFH Data Catalog.

A wide, extensive area of RCA runs through the Cordell Bank National Marine Sanctuary. Without additional EFH Conservation Areas, as proposed here, removal of the RCA risks a significant increase in habitat impacts inside the Sanctuary. Given the widely recognized ecological importance of this area and newly identified priority habitats outside existing EFH Conservation Areas, a net increase in habitat protections is clearly warranted.

41. Rittenberg Bank

Rittenberg Bank is a new proposed EFH Conservation Area that adjoins the northwestern boundary of the existing Fanny Shoal EFH Conservation Area. The proposed area is identical to the area proposed by the Greater Farallones National Marine Sanctuary (GFNMS). The rationale for this area is based on visual surveys and mapping conducted by the GFNMS that indicate high habitat value for multiple groundfish species as well as habitat forming corals and sponges. The soft sediment area is important to crabbing, and we are proposing that only trawling be prohibited; all other gear, including fixed gear, would be allowed. Some fishermen indicated this soft sediment area between Rittenberg Bank and Fanny Shoal is potentially trawlable, but little to no recent trawl effort has occurred here and doing so would risk impacting the bank and surrounding environment. We consulted with NOAA's Deep Sea Coral Research and Technology Program on this proposed site and received feedback confirming this area is identified as having significant corals and sponges; it has earned the nickname "sponge heaven." Further information on this area can be found in the GFNMS proposal (GFNMS 2013) as well as the NOAA Deep-Sea Coral Research and Technology Program report on biogenic habitat in the GFNMS (Etnoyer et al. 2014).

42. Fanny Shoal Shelf Extension

The Fanny Shoal Shelf Extension is a proposed expansion of the Fanny Shoal/ Farallon Islands EFH Conservation Area that would widen the overall bottom trawl protections around Fanny Shoal and Rittenberg Bank to provide an even buffer around the hard substrate features there. The area proposed here encompasses some hard substrate extending from Fanny Shoal that is outside the current EFH Conservation Area. Most of the area is primarily soft substrate, and this would protect this representative habitat along the relatively wide portion of the continental shelf from bottom trawling. NMFS data suggests very low to no trawl activity in this area.

43. Cochrane Bank

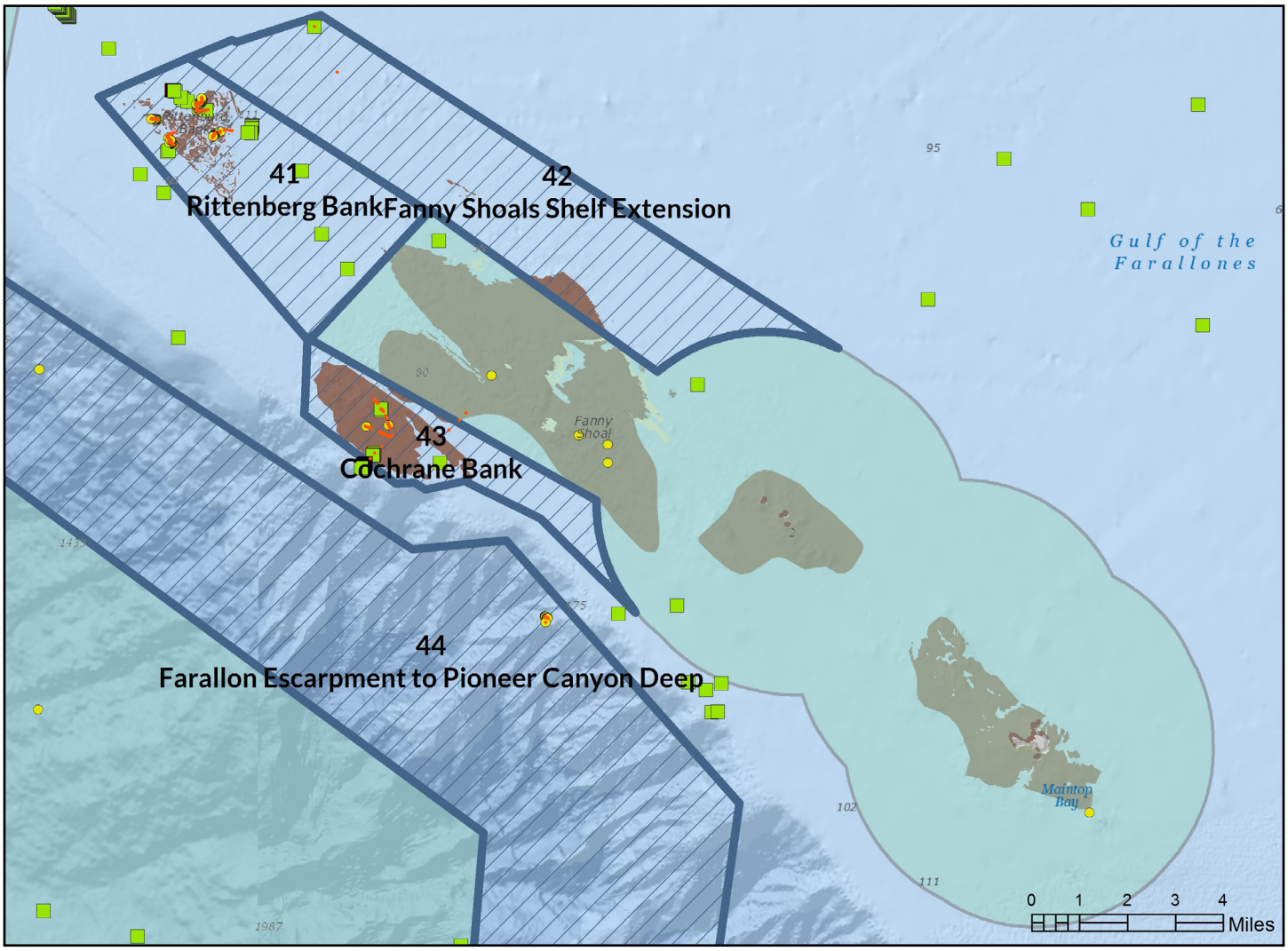
The Cochrane Bank proposal area adjoins the western boundary of the Fanny Shoal/ Farallon Islands EFH Conservation Area. This area is among the few newly identified hard substrate features in federal waters off California (EFHRC 2012). The area includes significant hard substrate and many biogenic habitat observations. GFNMS has done extensive surveys and mapping in the area and identified a long-lived species of black coral called Christmas Tree Coral (*Leiopathes dendrochristos*), which is used as habitat by multiple species of juvenile and adult groundfish (Graiff et al. 2011). This particular species was previously thought to inhabit only southern California waters. One black coral colony was observed with an adult rosy rockfish under it and many juvenile fish and crabs living in its branches. It was over two meters wide and estimated to be at least 100 years old. Etnoyer et al. (2014) conducted dives in this area and observed over 500 sponges, over 1,200 corals, primarily pennatulids, and 72 taxa of fish, primarily rockfish. Overfished yelloweye rockfish were observed here (Etnoyer et al. 2014).

This proposed area is similar to that being proposed by the Gulf of the Farallones National Marine Sanctuary for this feature. Our proposed area is slightly larger to more continuously adjoin with the state waters boundary surrounding the islands and to maintain an additional buffer around the hard substrate features. The overall configuration maintains an important continuous tow path between Fanny Shoals and the Farallon Escarpment.

44. Farallon Escarpment to Pioneer Canyon

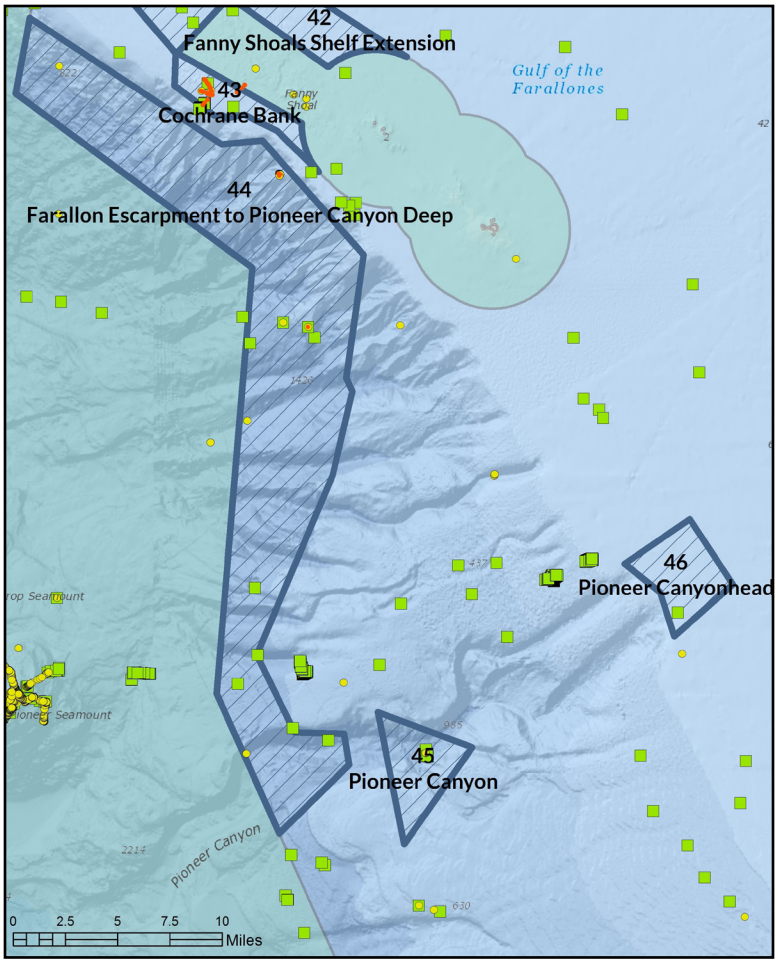
Farallon Escarpment to Pioneer Canyon Deep is a proposed area adjacent to the 700 fathom EFH Footprint Closure. The Escarpment is an impressive and unique geologic feature with exceptionally steep slope and numerous submarine canyons ranging in depth from about 160 m to over 1,600 m. There was no hard substrate in this area identified in the 2012 EFHRC report, however, ROV evidence indicates that continental shelf bedrock is exposed on the fault scarps (a step in the slope where one side of the earthquake fault has moved) and that the exposed areas of bedrock provide habitat for fish and three-dimensional corals and sponges. Hard substrate was confirmed for a site in the eastern portion of the area across from Cochrane Bank (Etnoyer et al. 2014). At this study site, 200 coral observations were made including bubblegum and mushroom corals (Etnoyer et al. 2014). A total of 69 sponges were observed at this site, as well as 10 taxa of fish (Etnoyer et al. 2014). The majority of this area is predicted to be highly suitable for corals.

The proposal area is subject to little to no recent trawl effort. The shoreward boundary is specifically designed to maintain a valuable trawl tow path between this area and Cochrane Bank. The shoreward boundary generally follows the 200 fathom contour and incorporates a portion of the trawl RCA west of the Farallon Islands. At this point the shoreward boundary moves further offshore to deeper water - following the 600 fathom depth contour (the deepest extent of previous trawling in this region) - and connects with the base of Pioneer Canyon. Please refer to the GFNMS proposal for additional information and data about this area (GFNMS 2013).


41
Rittenberg Bank
42
Fanny Shoals Shelf Extension
43
Cochrane Bank
44
Farallon Escarpment to Pioneer Canyon Deep
Gulf of the Farallones
Fanny Shoal
Maintop Bay
95
80
175
102
111
1987
0 1 2 3 4
Miles

45. Pioneer Canyon

This proposed EFH Conservation Area encompasses slope canyon habitat in an area with multiple coral and pennatulid observations. This area was identified in collaboration with the Greater Farallones National Marine Sanctuary, and the Sanctuary facilitated meetings with fishermen to refine the boundaries. The boundaries are designed to maintain continuous tow paths along depth contours on the northern edge of Pioneer Canyon, the southern edge of Pioneer Canyon, and a "canyon jump" tow in deeper waters. According to the EFHRC data on trawl intensity, this area contains virtually no recent trawl intensity off California.

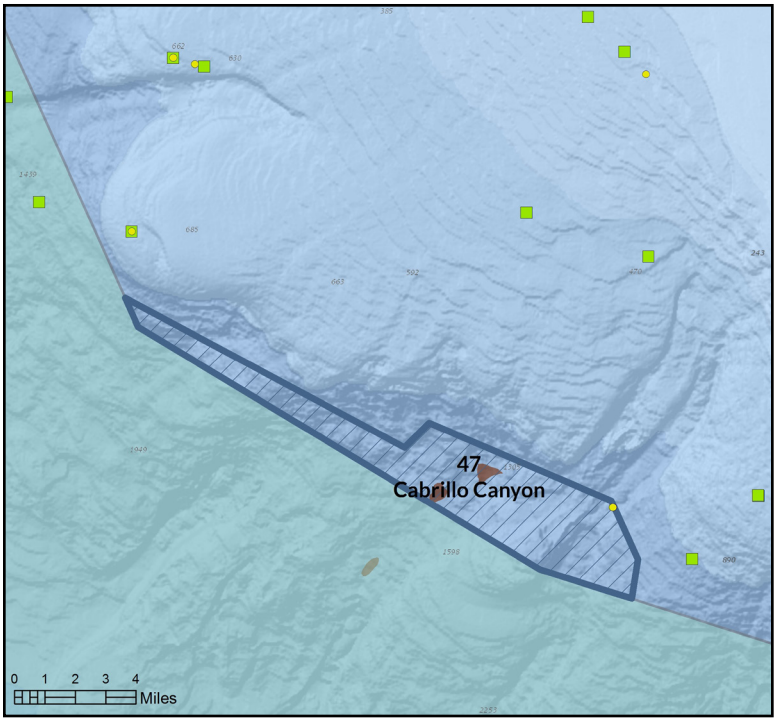


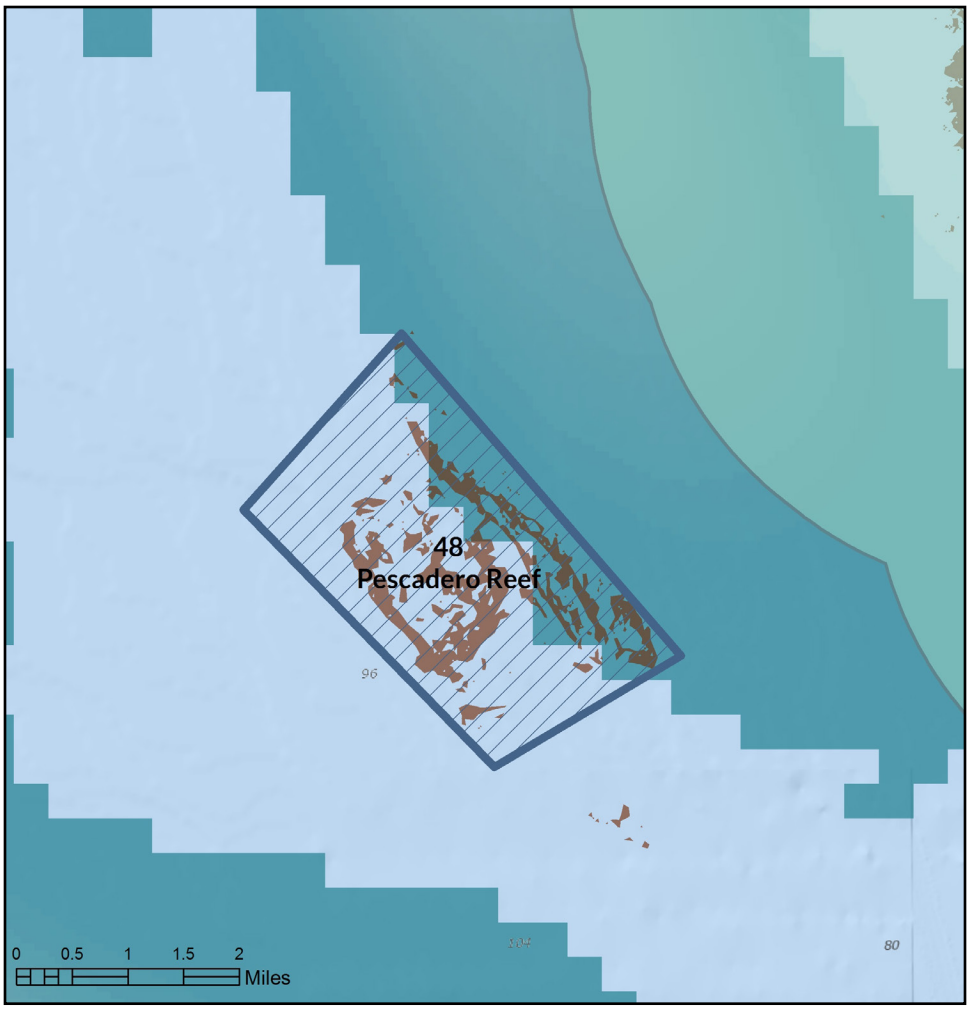
46. Pioneer Canyonhead

Pioneer Canyonhead is a proposed new EFH Conservation Area slightly shoreward of the current trawl RCA at the head of Pioneer Canyon. The boundaries were determined based on specific geographic feedback from the fishing industry and are designed to include areas with high quality habitat for a wide suite of groundfish species—both overfished and target species (e.g., widow rockfish). It includes high abundance and occurrence of greenstriped rockfish and Petrale sole based on NWFSC models. Local knowledge indicates that this area contains some hard substrate features not currently identified in the EFH Data Catalog. The area has high predicted coral suitability and was identified in the context of establishing EFH Conservation Areas focused on current RCA boundaries so that important habitat is protected into the long-term as overfished species rebuild. This site encompasses very little to no recent trawl intensity off California.

47. Cabrillo Canyon

Adjacent to the 700 fathom trawl footprint closure, this site includes significant depths that extend beyond 700 fathoms that were not included in the 2006 EFH trawl closures. This area includes corals observed with ROV video by the Monterey Bay Aquarium Research Institute, as well as hard substrate and high predicted coral habitat. Discussions to date with industry have indicated this area is deep enough so as not to disrupt trawl tows, and the area encompasses minimal recent trawl intensity. It also contains an isolated rocky feature identified in the EFH Phase I Report substrate data.





48. Pescadero Reef

The proposed Pescadero Reef area is designed to protect one of the few hard substrate features open to trawling along the shelf in this region. To address concerns raised in discusions with the trawl industry, this proposal keeps open a wide channel between the California state waters boundary and the proposal area,and the conservation area is drawn tightly around the reef feature. This feature was identified as an area of interest in collaboration with the Greater Farallones National Marine Sanctuary, and the Sanctuary helped facilitate regional discussions with the fishing industry to refine the boundaries of this area. There may be flatfish tows around this feature, but little to no recent trawl effort has occurred in the proposal area according to trawl data in the EFH Data Catalog. Trawl data in the EFH Catalog are buffered giving the appearance of possible trawling on the western edge of the reef when in fact there is likely none.

49. Ascension Canyonhead

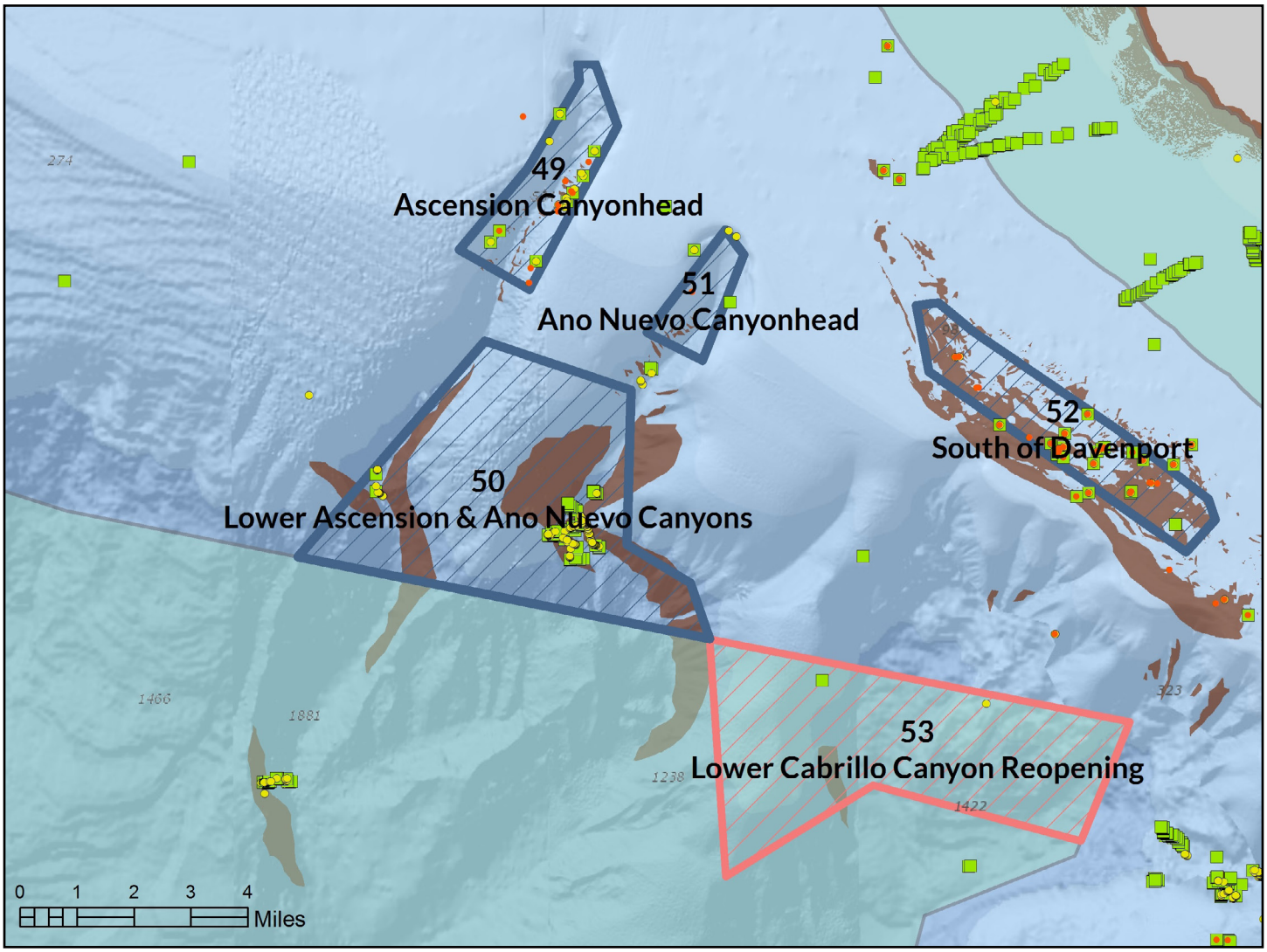
Ascension Canyonhead is a proposed new EFH Conservation area encompassing 4.1 square miles of upper Ascension Canyon. This area, along with areas 50 and 51, overlaps with the Sanctuary Ecologically Significant Area (SESA) for Año Nuevo and Ascension Canyon (MBNMS SESA 2016). This SESA is characterized by relatively high densities of seabirds and marine mammals. The area includes 18 coral observations, 10 sponge observations, and nine pennatulid observations. This closure is targeted to include the majority of biogenic habitat records and hard substrate features in the canyon. Much of this area is within the current trawl RCA, but the boundaries are drawn to include identified priority habitat features. The specific boundaries were drawn based on input from the fishing industry and are designed to maintain a “horseshoe tow” between Ascension Canyonhead and Año Nuevo Canyonhead, a tow along the northern canyon edge, and a continuous tow path between these canyonheads and the proposed closure of the deeper parts of these canyons.

50. *Lower Ascension & Año Nuevo Canyons*

The proposed Lower Ascencion and Año Nuevo Canyons EFH Conservation Area is part of the consensus agreement contained in the Monterey Bay National Marine Sanctuary's (MBNMS) EFH Proposal, and we worked with MBNMS to include this area as a part of our proposal. Please refer to the MBNMS Proposal for detailed information on the rationale for including this area.

51. *Año Nuevo Canyonhead*

Año Nuevo Canyonhead is a proposed new EFH Conservation Area encompassing a portion of the upper Año Nuevo Canyon from 150 to 170 meters depth. The area includes hard substrate features within the upper canyon, and there are multiple biogenic records collected in trawl surveys in the immediate vicinity. Much of this area is within the current trawl RCA, but the boundaries are drawn to include priority features of the canyon. Input from the fishing industry was considered and the shape is designed to maintain important nearby tow paths (as described for area 49).



52. South of Davenport &

53. Lower Cabrillo Canyon Reopening

South of Davenport is a new proposed EFH Conservation Area and Lower Cabrillo Canyon is a proposed reopening. Both areas are identical to the consensus agreement contained in the Monterey Bay National Marine Sanctuary's EFH Proposal and we worked with MBNMS to include this area as a part of our proposal. We provided additional analysis in our 2013 proposal, but please refer to the MBNMS Proposal for a detailed rationale for this area (MBNMS 2013).

Overlap with the Monterey Bay National Marine Sanctuary Proposal.

On July 31, 2013 the Monterey Bay National Marine Sanctuary submitted a proposal to the Council to modify EFH Conservation Areas in the region of the Sanctuary. That proposal represents the product of an eleven-month stakeholder process to identify ecologically important habitat areas, propose new EFH Conservation Areas and to propose the re-opening of parts of existing EFH Conservation Areas. The overall goal of the MBNMS proposal is to protect more total area and more sensitive habitats within the Sanctuary while improving fishing opportunities.

Oceana participated in that process and we worked with the MBNMS to include those consensus areas in our proposal. *Our proposal is identical to the MBNMS proposal for 13 of the 15 areas*. The MBNMS proposal notes there was not full agreement for the proposed sites at the La Cruz Canyon Complex and West of Piedras Blancas. The MBNMS proposal includes two separate sites for these areas where our proposal includes one contiguous site for the purpose of maintaining continuity and net overall habitat protections in light of the RCA being reopened here.

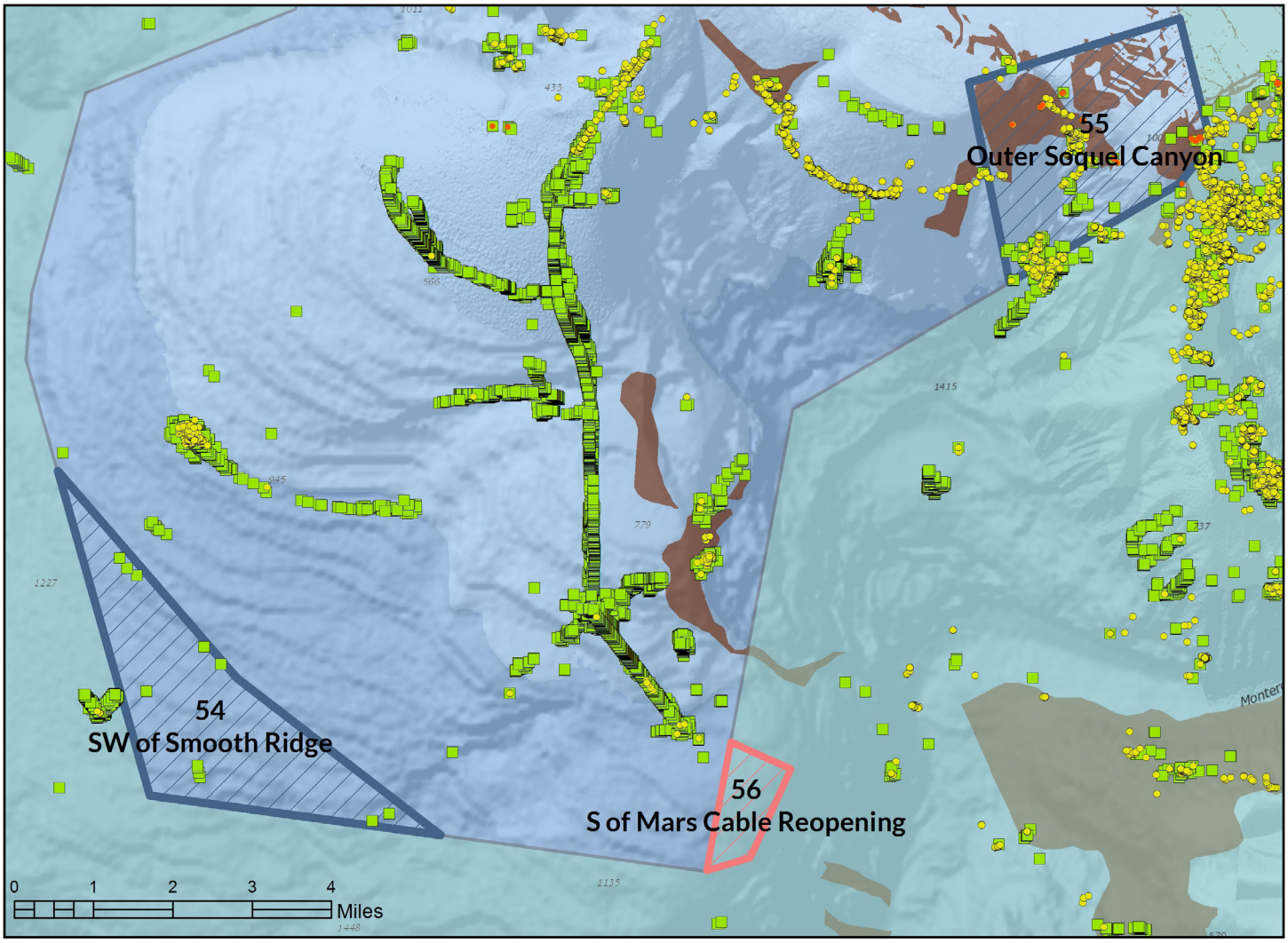
Ascension Canyonhead (#49) and Año Nuevo Canyonhead (#51) address the fact that the MBNMS consensus process did not consider reopening the trawl RCA and so with these closures there is still an overall net gain of protection for all priority habitats in the Sanctuary even if the RCA is removed.

54. SW of Smooth Ridge,

55. Outer Soquel Canyon, &

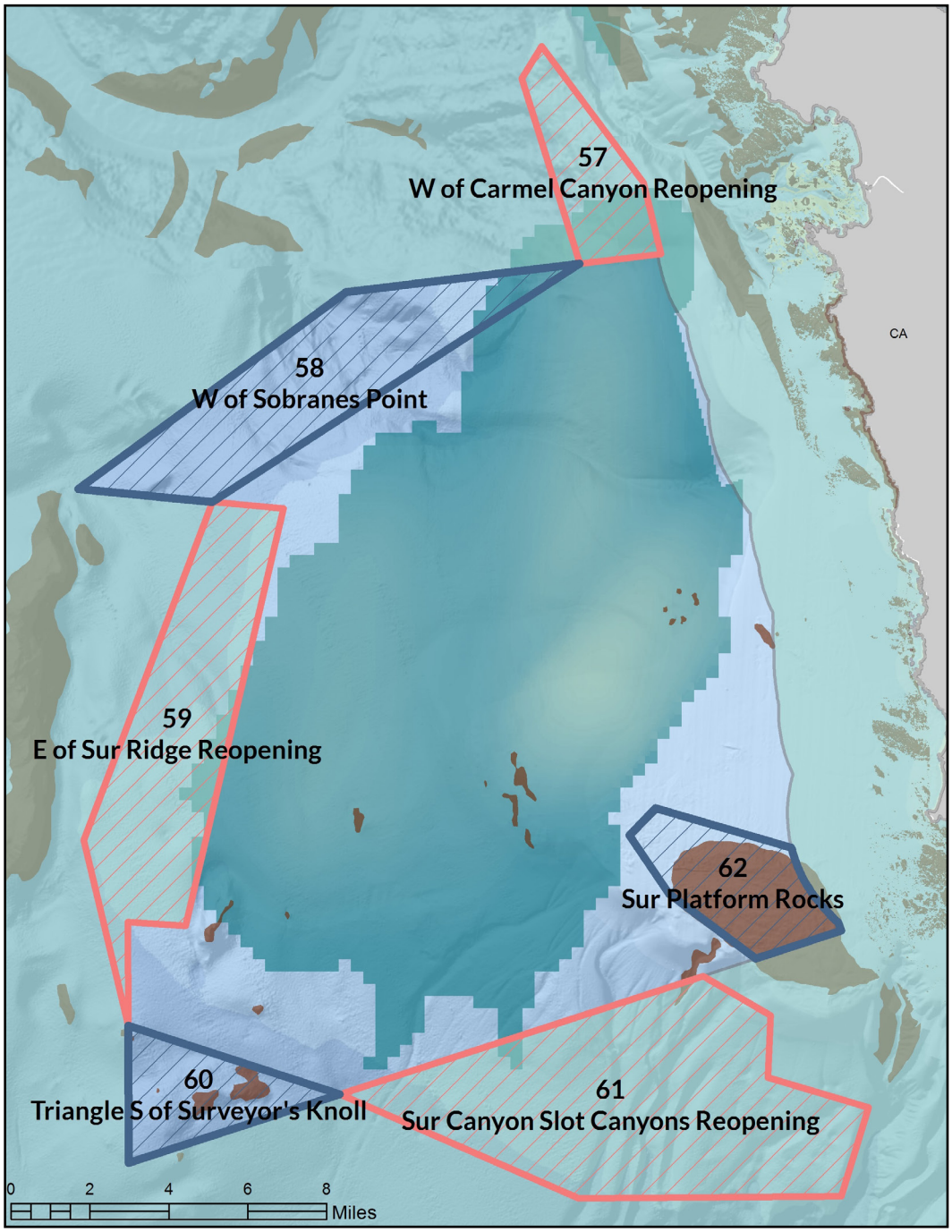
56. South of Mars Cable Reopening

SW of Smooth Ridge and Outer Soquel Canyon are proposed new EFH Conservation Areas and South of Mars Cable is a reopening, all of which are part of the consensus agreement contained in the Monterey Bay National Marine Sanctuary's EFH Proposal. We worked with MBNMS to include these areas as parts of our proposal. We provide additional analysis in our 2013 proposal, but please refer to the MBNMS Proposal for a detailed rationale for including these areas (MBNMS 2013). Additional information on the ecological diversity of these new proposal areas (54 and 55) is available through the MBNMS Sanctuary Ecologically Significant Areas technical reports (MBNMS SESA 2016).



57. to 62. West of Carmel Canyon Reopening, W of Sobranes Pt., East of Sur Ridge Reopening, Triangle South of Surveyor's Knoll, Sur Canyon Slot Canyons Reopening & Sur Platform Rocks

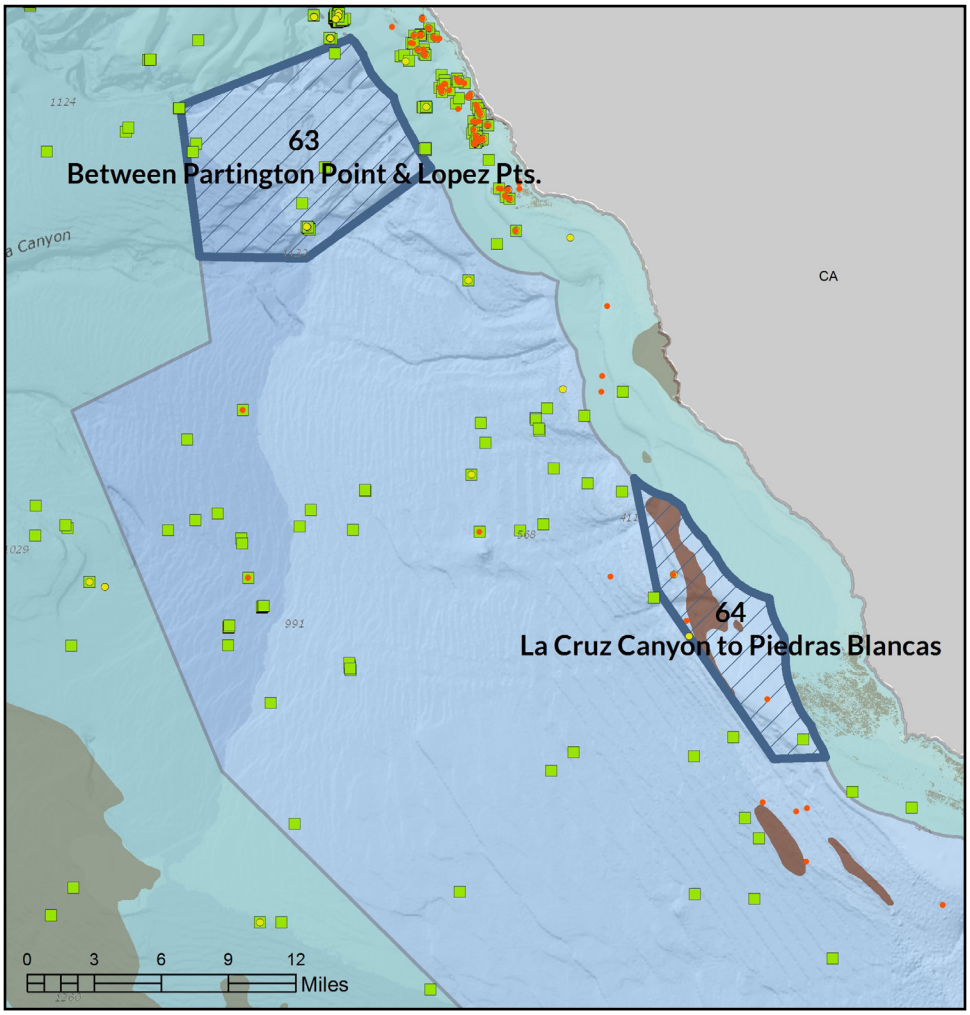
Each of these proposed EFH Conservation Areas and reopenings are part of the consensus agreement contained in the Monterey Bay National Marine Sanctuary's EFH Proposal. We worked with MBNMS to include this area as a part of our 2013 proposal. We provide additional analysis in our 2013 proposal, but please refer to the MBNMS Proposal for a detailed rationale for changes in this area (MBNMS 2013). Additional information on the ecological diversity of these proposal areas is available in the MBNMS Sanctuary Ecologically Significant Areas technical reports (MBNMS SESA 2016). The below map shows the proposed conservation area changes, seafloor bathymetry, hard substrate, and the recent trawl effort southwest of Monterey Bay.



63. Between Partington & Lopez Pts.

Between Partington Point and Lopez Point is a new proposed EFH Conservation Area that is part of the consensus agreement contained in the Monterey Bay National Marine Sanctuary's EFH Proposal. We provide additional analysis in our proposal, but please refer to the MBNMS Proposal for a detailed rationale for including this area (MBNMS 2013).

64. La Cruz Canyon to Piedras Blancas



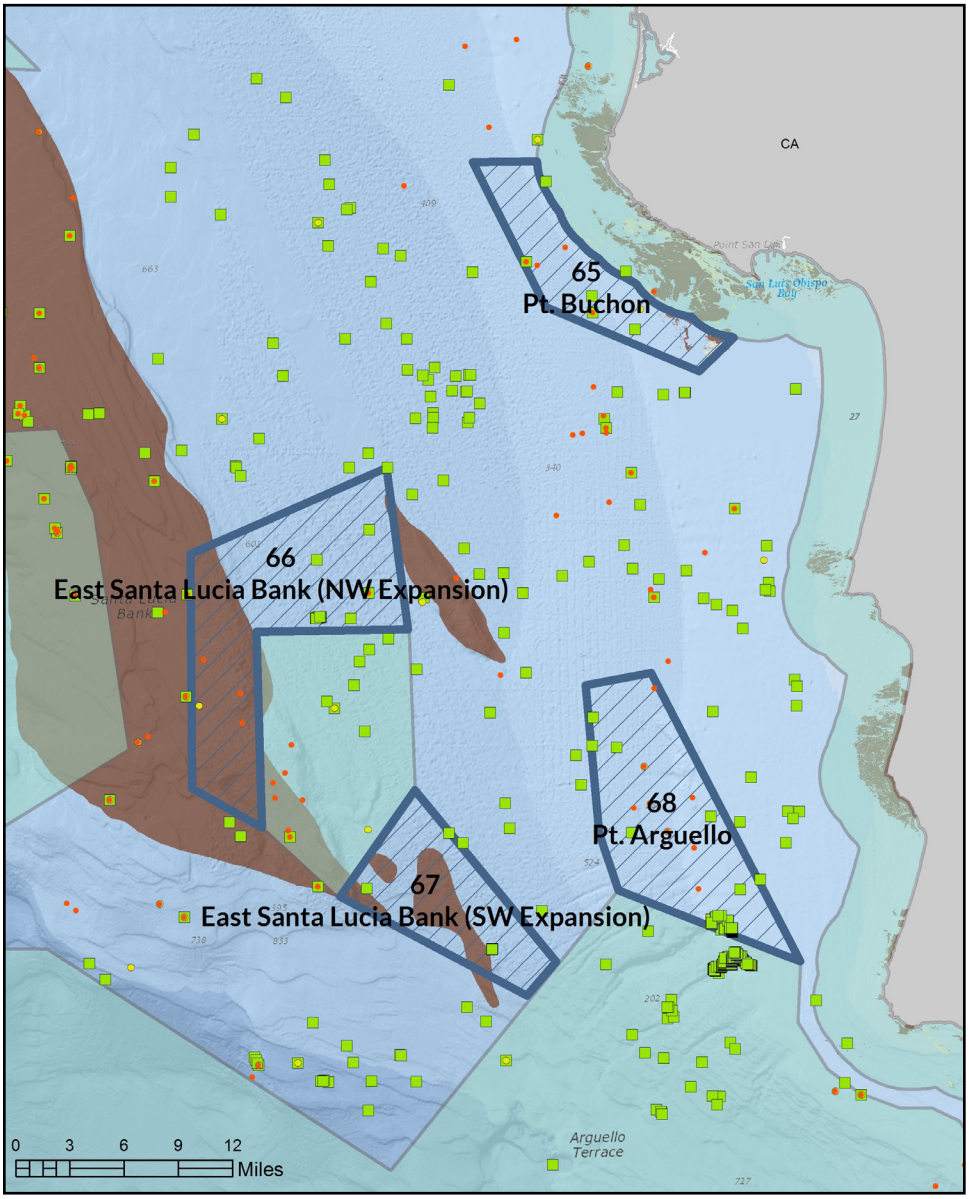
La Cruz Canyon to Piedras Blancas is a new proposed EFH Conservation Area encompassing part of the nearshore canyon, hard substrate and trawl RCA. Situated adjacent to the Piedras Blancas State Marine Protected Area, pennatulids, sponges, and corals have been observed here, including gorgonians and glass sponges. This nearshore area includes the upper reaches of two submarine canyons and reaches a depth of nearly 400 m. The area encompasses the current trawl RCA and extends to the state waters boundary to include important nearshore habitat. The northern boundaries encompass one of the few hard substrate features in this region. The southern boundaries include the portion of the Piedras Blancas reef extending into federal waters, providing substantial habitat connectivity and management benefits. This proposed area is a slightly larger, more comprehensive alternative to Areas 14 and 15 of the MBNMS proposal which did not obtain consensus across stakeholders. Specifically, our proposal differs by providing continuous protections across several priority habitat features and adjacency to state waters to provide uninterrupted ecological connectivity from the shoreline to the outer extent of these priority habitats.

65. Pt. Buchon

Point Buchon includes an important area of the trawl RCA in nearshore federal waters adjacent to the Pt. Buchon State Marine Protected Area. It follows the state waters boundary to include key hard and mixed substrate off Avila. The included portion of the RCA is in an area of steep slope and high predicted coral habitat. Boundaries were drawn to avoid key halibut trawl grounds off Avila and historic pink shrimp trawl grounds to the south while including key habitat features inside and near the RCA. There is currently no recent data available for trawl intensity in this region, but information on trawling from 2000-2005 indicates very low effort in this area.

66. East Santa Lucia Bank (NW Expansion)

This northern extension of the existing East Santa Lucia Bank EFH Conservation Area encompasses an area with multiple biogenic habitat records. It also extends it to the west to include additional hard substrate on the Bank itself. This site offers to protect a significant amount of hard substrate that is currently open to trawling. According to NMFS trawl surveys, the area on the Bank contains multiple coral records and several distinct areas with glass sponges. There is little current information on trawl effort in this area due to the extremely low fishing effort throughout this region in recent years, although previous data on trawl effort from 2000-2005 suggests this area had low effort relative to other areas in the region.

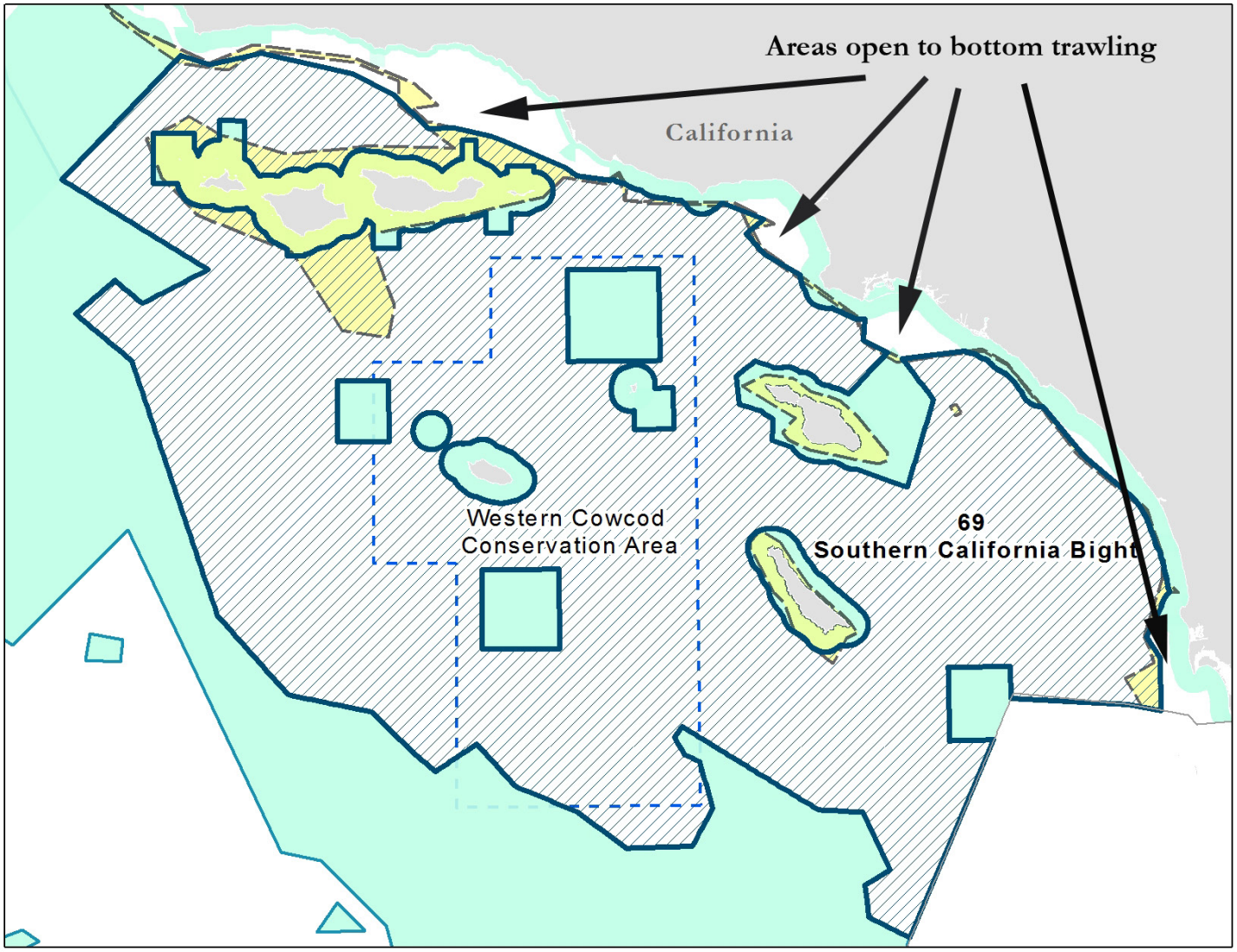


67. East Santa Lucia Bank (SW Expansion)

East Santa Lucia Bank (Southeast Expansion) is the proposed addition to the south of the existing East Santa Lucia Bank EFH Conservation Area. This area connects East Santa Lucia Bank to the Point Conception EFH Conservation Area. It contains significant hard substrate at the southernmost end of Santa Lucia Bank and multiple sea pen records from trawl surveys. There is no recently available data on trawl effort for this area, due to the extremely low effort in this region in recent years. However, from previous 2000-2005 logbook data, it appears that this proposal area would not impact important trawl grounds on either side of the conservation area.

68. Pt. Arguello

Point Arguello adjoins the existing Pt. Conception EFH Conservation Area and includes a portion of the trawl RCA. The proposal area includes a significant feature at the northern end within the current trawl RCA that was identified in discussions with fishermen, as well as additional canyonhead habitat not encompassed in the current Pt. Conception EFH Conservation Area. It also includes multiple sponge and other biogenic habitat records, including gorgonian corals. Boundaries for this area were drawn to avoid trawl paths to the north as indicated by 2000-2005 trawl logbook information. It is critical that priority habitats here remain protected to ensure no net increase in potential adverse impacts associated with the reopening of the trawl RCA in this region.



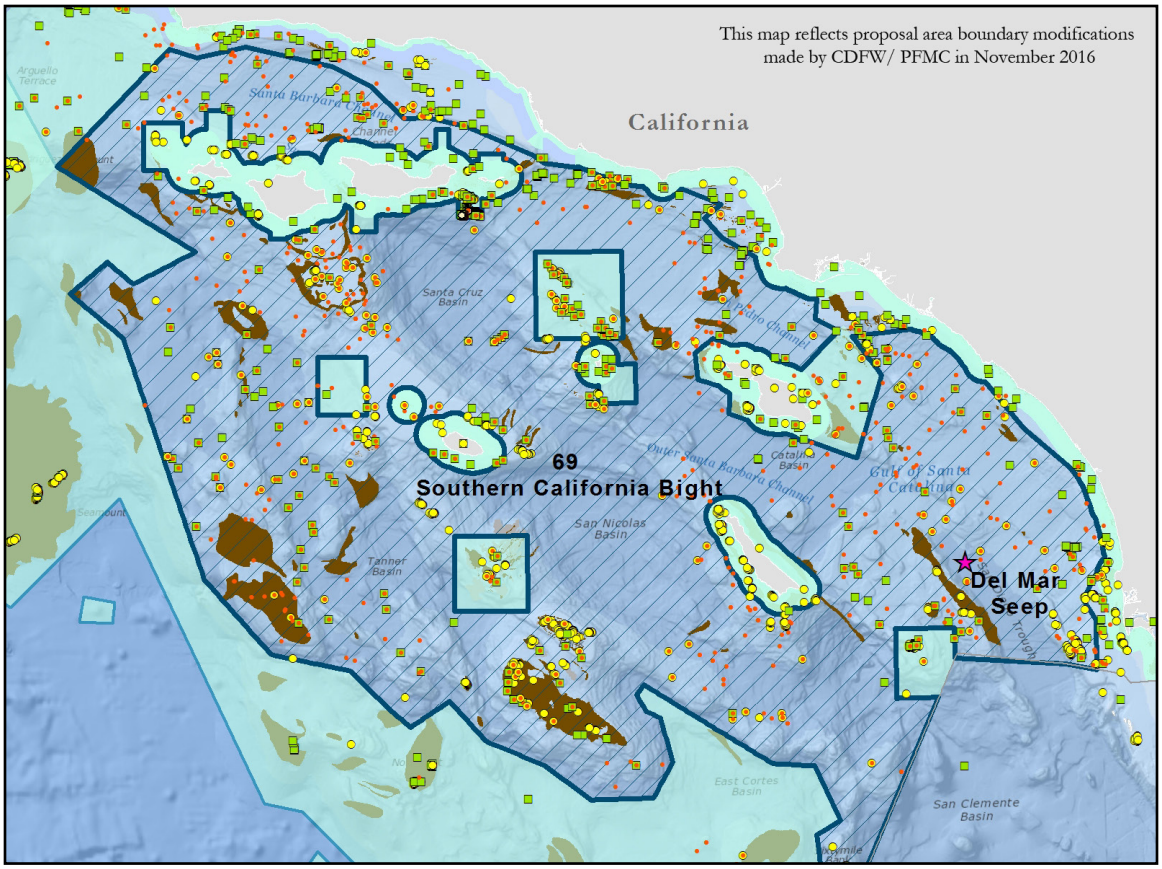
Overview Map 9. Southern Biogeographic Region showing the proposed EFH Conservation Area for the Southern California Bight, existing state water groundfish trawl closures and EFH Conservation Areas, plus the trawl RCA (yellow) and the Western Cowcod Conservation Area (blue dashed line). In addition to surrounding areas in the Bight, this proposal area would designate the Western Cowcod Conservation Area as an EFH Conservation Area closed to bottom trawling.

69. Southern California Bight

The Southern California Bight region is exceptionally biologically and geologically diverse. Many offshore islands and banks create unique physical conditions that support a high abundance and diversity of biogenic habitats. We are proposing that this area, beyond the current bottom trawl footprint, be designated as an EFH Conservation Area closed to bottom trawling.

The basis for this proposed area is to maintain a precautionary approach consistent with the Council's approach in Amendment 19 of prohibiting trawling in un-trawled areas outside the existing trawl footprint. It is responsive to new data and information all indicating this region contains phenomenal biogenic and physical habitat diversity. Plus, the various banks off the Southern California Bight are highly valuable for recreational fishing.

Protection from bottom trawling will ensure continued productive habitats for both recreational and fixed gear commercial fisheries.



Researchers have documented thousands of coral colonies and sponges here. There are over 3,300 coral observations, over 10,200 sponge observations, and over 5,600 pennatulid observations according to the NOAA Deep Sea Coral Database. Additionally, the recent discovery of the Del Mar Seep in the northern portion of the San Diego Trough (and included in this proposal area) has garnered significant scientific interest. A mosaic of habitat including microbial mats and carbonate rock substrates supports high densities of sponges and other important seafloor species at the seep area (Grupe et al. 2015). Researchers have documented important managed fish species within this seep habitat including longspine thornyhead and Dover sole, with longspine thornyheads appearing closely associated with seep activity (Grupe et al. 2015). Grupe et al. (2015) suggest that a relationship between methane seeps and rockfish may exist based on findings at this site.

What is more, the area contains over 800 square miles of hard substrate as identified in the EFH Phase I Report. A significant portion of the area is predicted to be highly suitable coral habitat (Guinnotte & Davies 2012). This closure fully encompasses the boundaries of the Channel Islands National Marine Sanctuary and would, thereby, increase the amount of Sanctuary area currently protected from bottom trawling.

Protecting this area would be consistent with NOAA's precautionary policy regarding deep-sea corals (NOAA 2010). It would create a "study first" system in which areas where the industry seeks approval to trawl would have to be first studied and explored, and a determination made that bottom trawling would not adversely affect vulnerable habitats in the area. While a "feature-based" approach of only protecting known priority habitats may be appropriate in areas where bottom trawling occurs or in areas that have been fully mapped and explored, the vast areas of unexplored habitat and the continued new discoveries of additional vibrant priority habitats in previously unexplored areas warrants a precautionary approach.

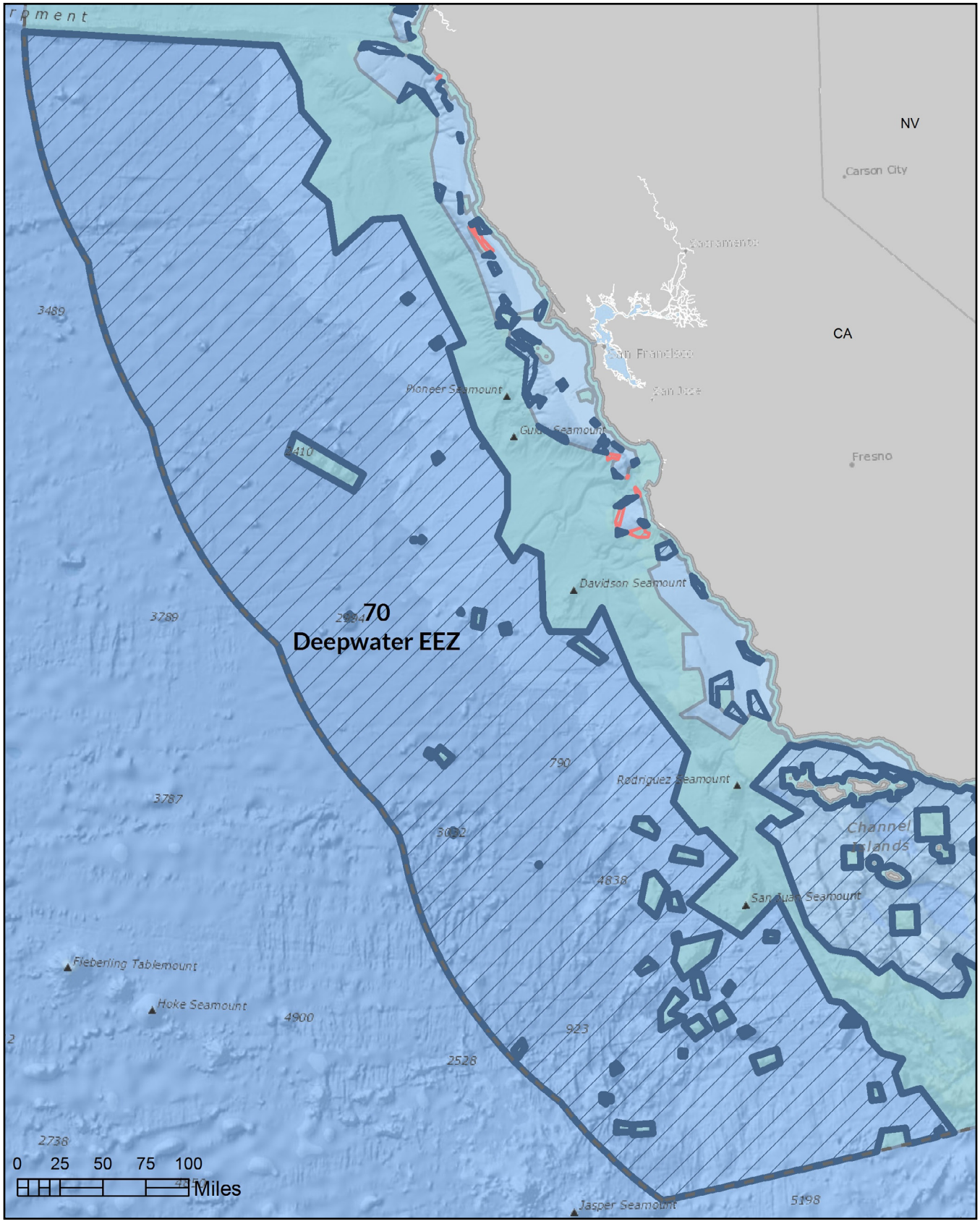
The boundaries of this area have been drawn based on discussions with the Southern California fishing industry and are intended to maintain all current trawl tow areas in the four nearshore areas where halibut, sea cucumber, and ridgeback prawn trawling occur (see overview map 9). In federal waters, areas shallower than the following depths would remain open to trawling: 100 fathoms from Oceanside to Mexican Border; 100 fathoms at San Pedro Bay; 100 fathoms at Santa Monica Bay; and 120 fathoms from Hueneme Canyon to Pt. Conception.

70. Deep-water Conservation Area > 3,500 meters

At the April 2016 meeting the Council selected a preliminary preferred alternative to prohibit bottom contact fishing in the deep-water area off California (>3,500 meters) using its discretionary MSA Section 303(b) authorities. The proposed Deep-water Closure would add to the 700-fathom trawl footprint closure, protecting this area from not only bottom trawling, but all bottom contact between the 3,500 meter depth contour and the outer extent of the U.S. EEZ. This area would protect ~ 123,222 square miles of seafloor habitat. These protections are consistent with the Council's recommendation in 2005 that was later partially disapproved by NMFS because the area was not designated as EFH. With new MSA authorities for protecting habitats, ecosystem and corals, the Council can now complete this action.

This area includes 195 distinct coral observations including black coral *Bathypathes alternata* and stony coral *Fungiacyathus marenzelleri*, the gorgonian coral *Chrysogorgia* sp., mushroom coral *Anthomastus robustus*, bamboo corals *Keratoisis* sp. and *Lepidisis* sp. and 1,141 pennatulid observations. These coral observations indicate the area contains essential deep sea coral ecosystems. According to the EFH Data, the deepest identified depth within the U.S. West Coast EEZ is 4,810 meters. Protecting this area would not displace any groundfish fishery effort.

These deep-water areas are known to be highly sensitive to fishing impacts. The Final Rule implementing the 2006 EFH Regulations states that "NMFS acknowledges that features that occur beyond 3,500 m include hydrothermal vents, soft-bottom sediments, and hard bottom areas with high biogenic structures such as deep sea corals. All or most of the deep sea environment may be highly sensitive to impact, including at very low levels of fishing effort (e.g. a single contact), and have extended recovery times (over seven years)" (NMFS 2006). Clearly a precautionary approach is warranted.


70
Deepwater EEZ
NV
Carson City
CA
Fresno
Pioneer Seamount
Davidson Seamount
Rodriguez Seamount
Channel Islands
San Juan Seamount
Jasper Seamount
Fieberling Tablemount
Hoke Seamount
3489
3410
3789
3787
3032
4838
790
923
2528
4900
5198
2738
0 25 50 75 100
Miles

Citations

Bjorklund, T., R. Crandall, P. Johnson, M. Lilley, and T. McGinnis (2008). Sponge cruise presentation. University of Washington and Washington SeaGrant.

Bosley, K. L., J. W. Lavelle, R. D. Brodeur, W. W. Wakefield, R. L. Emmett, E. T. Baker, and K. M. Rehmke (2004). Biological and physical processes in and around Astoria submarine Canyon, Oregon, USA. Journal of Marine Systems. 50: 21-37.

Etnoyer, P. J., G. Cochrane, E. Salgado, K. Graiff, J. Roletto, G. Williams, K. Reyna, and J. Hyland (2014). Characterization of deep coral and sponge communities in the Gulf of the Farallones National Marine Sanctuary: Rittenburg Bank, Cochrane Bank and the Farallon Escarpment. NOAA Technical Memorandum NOS NCCOS 190. NOAA National Centers for Coastal Ocean Science, Charleston, SC. 32 pp.

Enticknap, B., G. Shester, M. Gorny, and M. Kelley (2013). Important ecological areas seafloor habitat expedition off the Southern Oregon Coast. Oceana, available at: http://www.pcouncil.org/wp-content/uploads/D6d_PC2_APR2013BB.pdf.

GFNMS (2013). A proposal to consider options for the new EFH HAPC(s) and Conservation Areas submitted by Gulf of the Farallones National Marine Sanctuary. Accessed at: ftp://ftp.pcouncil.org/pub/EFH_Proposals_2013/H7a_Att3_GFNMS_proposal_NOV2013BB/EFH%20Proposal_GF-073113-final-low%20res.pdf

Graiff, K., D. Lipski, P. Etnoyer, G. Cochrane, G. Williams, E. Salgado (2016). Benthic characterization of deep-water habitat in the newly expanded areas of Cordell Bank and Greater Farallones National Marine Sanctuaries. Marine Sanctuaries Conservation Series ONMS-16-01. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Office of National Marine Sanctuaries, Silver Spring, MD. 38 pp.

Graiff, K., D. Roberts, D. Howard, P. Etnoyer, G. Cochrane, J. Hyland and J. Roletto (2011). A characterization of deep-sea coral and sponge communities on the continental slope west of Cordell Bank, using a remotely operated vehicle. Report to NOAA Deep-Sea Coral Program.

Grupe, B. M., M. L. Krach, A. L. Pasulka, J. M. Maloney, L. A. Levin, and C. A. Frieder (2015). Methane seep ecosystem functions and services from a recently discovered southern California seep. Marine Ecology 36: 91-108.

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.

Hannah, R. W. and M. T. O. Blume (2014). The influence of bait and stereo video on the performance of a video lander as a survey tool for marine demersal reef fishes in Oregon waters. Marine and Coastal Fisheries 6(1): 181-189.

Interactive Oceans (2016, May 24). Methane hydrates: southern Hydrate Ridge. University of Washington, accessed at: http://www.interactiveoceans.washington.edu/story/Methane_Hydrates_Southern_Hydrate_Ridge

Johnson, J. E., C. Goldfinger and E. Suess (2003). Geophysical constraints on the surface distribution of authigenic carbonates across the Hydrate Ridge region, Cascadia margin. Marine Geology 202: 79-120.

Levin, L. A., A. R. Baco, D. A. Bowden, A. Colaco, E. E. Cordes, M. R. Cunha, A. W. J. Demopoulos, J. Gobin, B. M. Grupe, J. Le, A. Metaxas, A. N. Netburn, G. W. Rouse, A. R. Thurber, V. Tunnicliffe, C. L. Van Dover, A. Vanreusel, and L. Watling (2016). Hydrothermal vents and methane seeps: Rethinking the sphere of influence. Frontiers in Marine Science doi: 10.3389/fmars.2016.00072.

Levin, L. A., M. Sibuet, A. J. Gooday, C. R. Smith, and A. Vanreusal (2010). The roles of habitat heterogeneity in

generating and maintaining biodiversity on continental margins: an introduction. Marine Ecology 31: 1-5.

Levin, L. A., W. Ziebis, G. F. Mendoza, V. A. Growney, M. D. Tryon, K. M. Brown, C. Mahn, J. M. Gieskes, and A. E. Rathburn (2003). Spatial heterogeneity of macrofauna at northern California methane seeps: influence of sulfide concentration and fluid flow. Marine Ecology Progress Series 265: 123-139.

MBARI 2013 (2016, May 24). Northern 13, Leg 1 – Gas Hydrates. Accessed at: http://www.mbari.org/northern-2013-gas-hydrates/#toggle-id-1

Monterey Bay National Marine Sanctuary (MBNMS) (2013). Collaborative Groundfish Essential Fish Habitat Proposal: Protecting Groundfish Essential Fish Habitat While Balancing Fishing Opportunities in Monterey Bay National Marine Sanctuary, South of Año Nuevo. Monterey Bay National Marine Sanctuary.

MBNMS SESA (2016). Sanctuary Ecologically Significant Areas (SESAs) Quick Look Reports. Monterey Bay National Marine Sanctuary. Accessed at: http://montereybay.noaa.gov/research/techreports/trmbnms2016.html

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.

National Oceanic and Atmospheric Administration (2014). Deep Sea Coral Research and Technology Program 2014 Report to Congress. Accessed at: http://www.habitat.noaa.gov/pdf/FINAL_DSCRtC_4_17_2014_Interactive.pdf

National Marine Fisheries Service (2006). 71 Fed. Reg. 27,403, 27,410 (May 11, 2006).

Pacific Fishery Management Council (PFMC). April 2013. Agenda Item D.6.b NMFS Synthesis Report, at 10. Accessed at: http://www.pcouncil.org/wp-content/uploads/D6b_NMFS_SYNTH_ELECTRIC_ONLY_APR2013BB.pdf

Pasulka, A. L., L. A. Levin, J. A. Steele, D. H. Case, M. R. Landry, and V. J. Orphan (2016). Microbial eukaryotic distributions and diversity patterns in a deep-sea methane seep ecosystem. Environmental Microbiology doi:10.1111/1462-2920.13185

Stierhoff, K. L., P. J. Etnoyer, D. W. Murfin, and J. L. Butler (2011). A survey of deep-water coral and sponge habitats along the West Coast of the US using a remotely operated vehicle. NOAA Technical Memorandum NOS NCCOS 138. NOAA Center for Coastal Environmental Health and Biomolecular Research, Charleston, SC. 38 pp.

Thurber, A. R., A. K. Sweetman, B. E. Narayanaswamy, D. O. B. Jones, J. Ingels, and R. L. Hansman (2014). Ecosystem function and services provided by the deep sea. Biogeosciences 11: 3941-3963.

Yoklavich, M., M. E. Clarke, T. Laidig, E. Fruh, L. Krigsman, J. Anderson, J. Taylor and C. Romsos (2016). A characterization of deep-sea coral and sponge communities in areas of high bycatch in bottom trawls off Northern California. NOAA Technical Memorandum NMFS doi:10.7289/V5/TM-SWFSC-556.

Attachment 9

Exploring the Living Seafloor: Southern California Expedition

OCEANA Protecting the World's Oceans

Acknowledgements

The authors would like to recognize and thank Alexandra Cousteau, for joining us on our 2016 expedition, for her guidance and her inspiration to explore and protect our oceans. We thank Susan Murray, Oceana Deputy Vice President, Pacific who was instrumental in making this and past Oceana Pacific Ocean expeditions possible. May there be many more! We thank the Oceana team – Ashley Blacow, Mariel Combs, Cheryl Eldemar, Melissa Forsyth, Lianne Holzer, Jenny Jones, Erin Kincaid, Mike Levine, Amelie Malafosse, Brianne Mecum, Jackie Savitz, Jim Simon, Jon Warrenchuk, Betsy Wood, and Molly Zaleski – for their many contributions to successful expedition planning, communications, science and law.

A very special thanks to Marine Applied Research and Exploration (MARE) for partnering on this expedition with Oceana. In addition to co-authors Dirk Rosen and Andy Lauermann, MARE team members Rick Botman and Steve Holtz provided invaluable expertise at sea. MARE's Heidi Lovig, Yuko Yokozawa, Johnathan Centoni and Greta Goshorn were critical in the data analysis.

Importantly, we thank Captain Terrence Shinn and First Mate Charles Lara for taking us to sea and providing a safe platform for our surveys. We thank Dr. Tom Hourigan and Dr. Peter Etnoyer of the National Oceanic and Atmospheric Administration (NOAA) Deep Sea Coral Research and Technology Program for technical expertise in deep sea ecology. Finally, we thank the NOAA Channel Islands National Marine Sanctuary and LT. j.g. Libby Mackie for allowing us to work aboard NOAA's R/V Shearwater.

Graphic Design: Betsy Wood

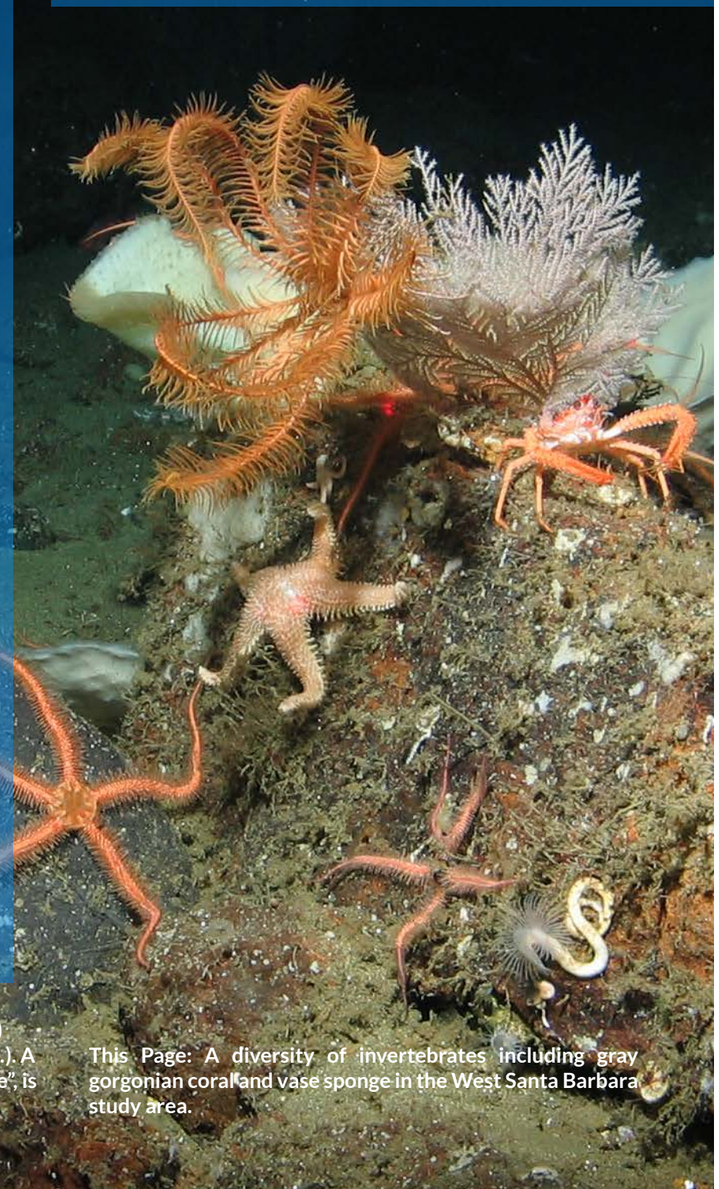
[1]Oceana. 99 Pacific St., Ste. 155 C, Monterey, CA 93940
[2]Oceana. 222 NW Davis Street, Ste. 200, Portland, OR 97209
[3]Marine Applied Research and Exploration. 1230 Brickyard Cove Road #101, Richmond, CA 94801

Authors

Geoff Shester[1]
Ben Enticknap[2]
Erin Kincaid[2]
Andy Lauermann[3]
Dirk Rosen[3]

Contents

September 2017



Cover Image: A greenspotted rockfish (*S. chlorostictus*) hides behind yellow gorgonian coral (*Acanthogorgia sp.*). A cat shark (*Scyliorhinidae*) egg case, or "mermaid's purse", is attached to the coral.

This Page: A diversity of invertebrates including gray gorgonian coral and vase sponge in the West Santa Barbara study area.

ABSTRACT

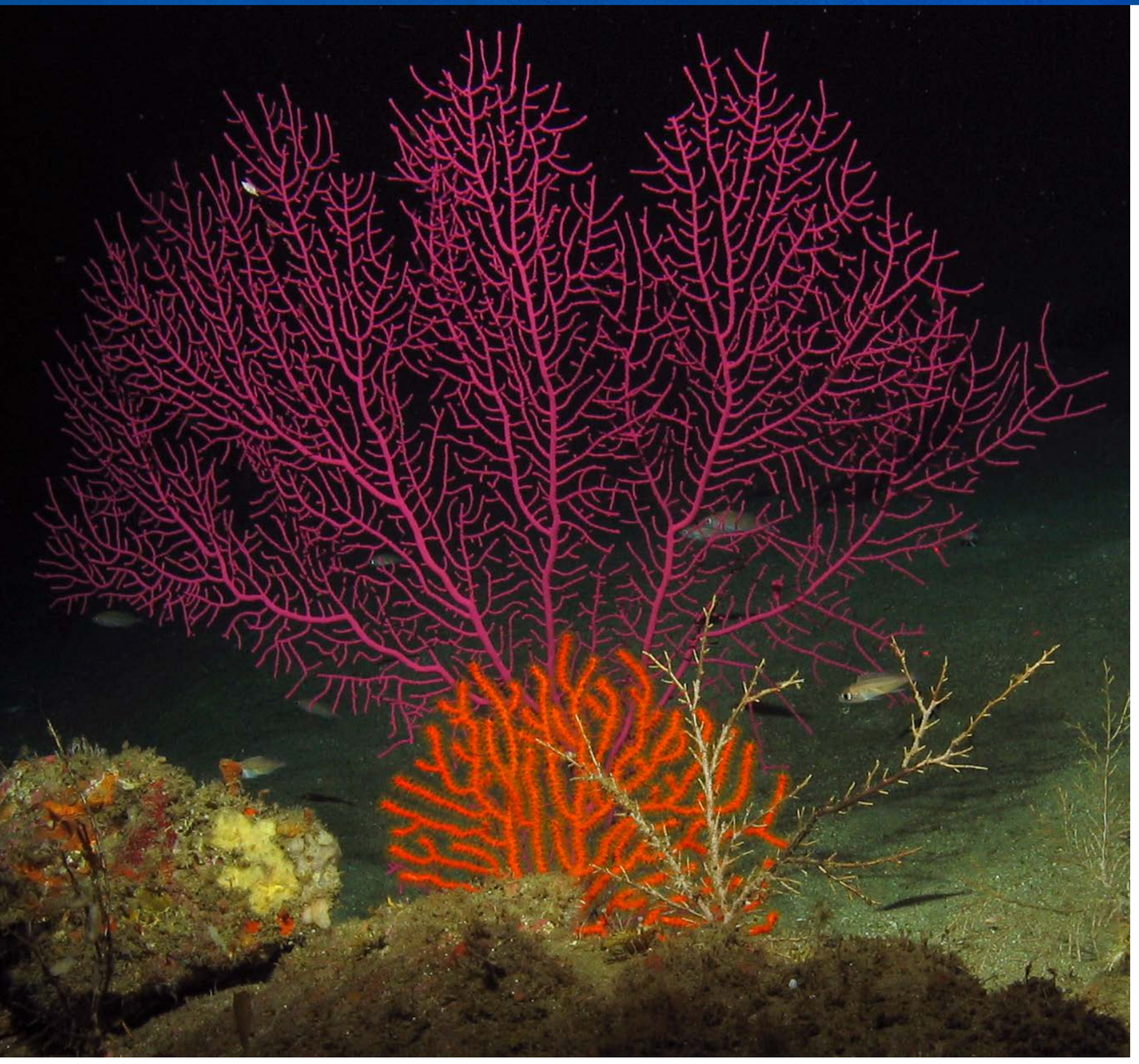
In August of 2016 Oceana, in coordination with Marine Applied Research and Exploration (MARE) and Channel Islands National Marine Sanctuary (CINMS), conducted a five-day research expedition in the Pacific Ocean waters off Southern California to document and characterize seafloor habitats and their associated biological communities, and to help inform and advance the long-term conservation and management of Important Ecological Areas. Using MARE's Remotely Operated Vehicle (ROV) Beagle mounted with high definition video and still cameras, we completed 13 dives including 25 individual, fifteen minute transects from three to 75 miles offshore Southern California at depths ranging from 80 meters (263 feet) to 435 meters (1,427 feet). This study documents the location of fragile living seafloor habitats including deep-sea corals and sponges and characterizes and compares the physical and biological structure across five geographic study areas in the Southern California Bight. In this study, we also document the co-occurence of managed fish species with habitat forming invertebrates at each transect area.

To our knowledge, areas we surveyed off Southeast Santa Rosa Island, Santa Barbara Island and at Butterfly Bank had never been surveyed with underwater cameras. Our findings likely represent the first *in situ* observations of these areas. We documented cold-water corals and sponges at each study area, including a total of 4,786 deep-sea corals, sponges and pennatulids (a type of octocoral including sea pens and sea whips), adding significantly to existing records of such biogenic habitat features in the Southern California Bight region. We also observed 5,059 individual fishes, 4,505 (89 percent) of which we identified as federally managed fish species, principally rockfishes belonging to the genus *Sebastes*. In total, we identified 45 different fish species/groups, 32 of which are federally managed.

All observed managed fish species were present on dives containing corals and sponges, providing additional evidence of co-occurrence between biogenic habitat features and managed fish species. The dive sites surveyed, both in protected and unprotected waters, are biologically diverse, contain sensitive structure-forming invertebrates, and are designated as essential fish habitat (EFH) for managed fish species.

New discoveries of ecologically important and sensitive habitats support taking a precautionary

Lingcod (*O. elongatus*) at the West Santa Barbara study area.



Colorful species of gorgonian corals including this purple *Eugorgia rubens* and orange *Adelogorgia phyllosclera* found off the Channel Islands inside the Oceana EFH proposal area.

approach to the conservation of essential fish habitat with management actions that protect these habitats from bottom trawl fisheries. While bottom trawl fishing effort in the Southern California Bight currently occurs in a few small areas along the mainland coast in waters less than approximately 183 meters (100 fathoms, 600 feet), it should not be allowed to expand into deeper offshore areas that are known to or may contain deep-sea coral and sponge communities.

INTRODUCTION

The Southern California Bight, stretching from Point Conception to the U.S./Mexico border (Figure 1), is a biologically and topographically diverse region of the California Current Ecosystem. Here, productive ocean waters support diverse fish, seabird, sea turtle, and marine mammal populations. The region includes a broad network of submarine canyons, ridges, seamounts, banks and other unique geologic features. This complex underwater topography combined with converging ocean currents of cold, nutrient-rich and warm waters creates ideal circumstances for a thriving and diverse ocean ecosystem.

Also integral to the health of this ecosystem are vibrant communities of seafloor invertebrates. Corals, sponges and pennatulids create biogenic, living habitats in the deep-sea. In the Northeastern Pacific Ocean, these biogenic habitats have been widely documented to provide shelter, and feeding and breeding grounds for commercially and recreationally important fish like rockfish and lingcod (Krieger & Wing 2002, Pirtle 2005, Tissot et al. 2006, Bright 2007, Heifetz et al. 2007, Love et al. 2008, Du Preez & Tunnicliffe 2011, Bizzaro 2014). Like their tropical reef-forming counterparts, these cold-water coral and sponge communities create beautiful "coral gardens"

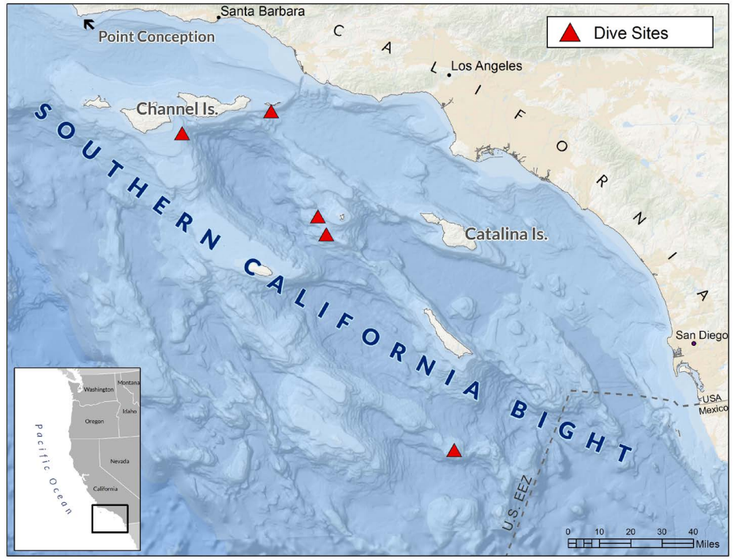


Figure 1. The Southern California Bight showing Oceana study areas.

interspersed along the banks and ridges of the Southern California Bight (Love et al. 2010, Yoklavich et al. 2011). As scientists continue to explore these deep environments, new species and never-before-seen coral gardens are being discovered (Yoklavich & Love 2005, Love et al. 2007, Etnoyer et al. 2017). Not only are these discoveries significant in their own right, the biological importance and sensitivity of these biogenic and relief habitats, like ridges and banks, highlight the need to protect these fragile ecosystems before they are lost.

Identifying Important Ecological Areas and determining biogenic habitat distributions are critical steps in protecting vulnerable marine ecosystems (Ayers et al. 2010). In the Pacific Ocean waters off the U.S. West Coast, scientists use scuba surveys, sonar mapping, bottom trawl surveys, manned submarines, Autonomous Underwater Vehicles (AUVs), and Remotely Operated Vehicles (ROVs) to document habitats containing corals, sponges and pennatulids (Clarke et al. 2015). Despite these studies, many benthic ecosystems along the coast remain unexplored, including vast areas within the Southern California Bight.

Scientists who have explored the deep ocean waters off Southern California have made astounding discoveries. In 2005, for example, scientists reported the discovery of a new species of black coral (*Antipathes dendrochristos*) called "Christmas tree coral" in the Southern California Bight, inspiring further efforts to document this benthic

ecosystem (Yoklavich & Love 2005). Christmas tree corals can vary in color from white to red. Off Southern California, communities of these large, black corals have been observed at densities ranging from zero to 24.4 corals/1,000 square meters (m^2) and total coral density ranged from three to 148 corals/1,000 m^2 (Yoklavich et al. 2013). Researchers have determined that the corals grow slowly at approximately 1.5 centimeters per year. They are also long-lived. One black coral colony collected off Southern California was determined to be 140 years old (Love et al. 2007) while another black coral species collected off Hawaii was determined to be over 4,200 years old (Roark et al. 2009).

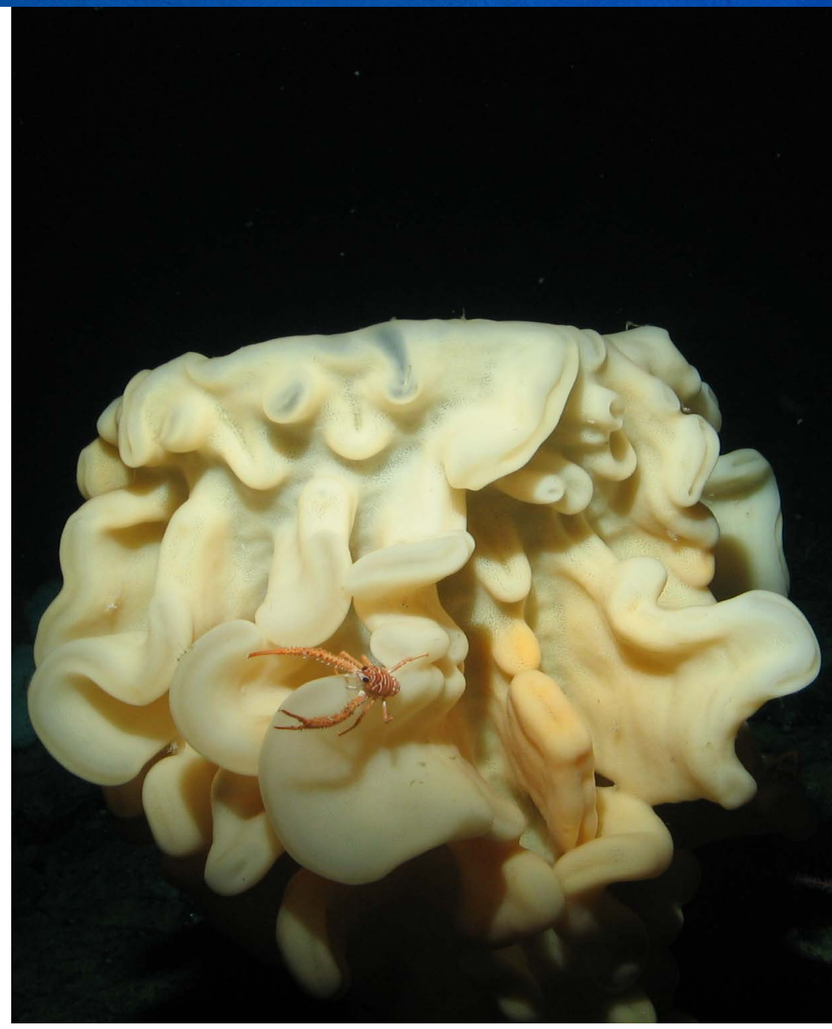
"The discovery of the Christmas tree coral clearly demonstrates how much there is yet to learn about marine communities on the seafloor, even along the most populated sections of the west coast" (Yoklavich & Love 2005).

Another important group of corals found off the West Coast is gorgonian coral of the order *Alcyonacea*. Gorgonians can be branching and fan-like or feathery in structure and are sometimes called sea fans. Composed of many tiny polyps, they come in a variety of colors including yellow, red and sometimes purple. Other organisms, such as brittle stars, crabs, barnacles, and polychaetes, attach themselves to gorgonian and black corals to get a better position for collecting food from passing currents.

Seafloor habitats, such as those in the Southern California Bight, are especially vulnerable to fishing impacts. The biggest direct threat to deep-sea coral communities is bottom trawling. Bottom trawls, with weighted nets and large steel doors, are dragged along the seafloor off the U.S. West Coast to catch species including rockfish, lingcod, California halibut, sea cucumbers, and ocean shrimp (Figure 2). At the same time, however, bottom trawls may catch an abundance of other marine life as bycatch; crush and topple communities of corals, sponges and other habitat forming invertebrates; as well as alter the physical structure of seafloor habitats (Puig et al. 2012, Hannah et al. 2009, Hixon & Tissot 2007, Auster & Langton 1999). Globally, bottom trawling has been shown to reduce habitat complexity, productivity, and alter ecological communities (Davies et al. 2007, NRC 2002) and it is recognized to be among the most damaging fishing gears to seafloor habitats on the U.S. West Coast (PFMC 2005, Morgan & Chuenpagdee 2003).

Figure 2. 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 along the seafloor. If used in important coral and sponge habitats, they can cause long-lasting damage that may not recover for decades to centuries. While gear configurations vary, the distance between the heavy trawl doors can be from 110 to 650 feet wide and the doors can weigh up to 1,300 pounds.

Bottom trawls threaten the health of ecosystems that support fish populations by disturbing important biogenic habitats and seafloor substrates upon which fish rely for shelter, feeding and breeding. To protect such essential fish habitat, fishery management councils are required to "prevent, mitigate, or minimize any adverse effects from fishing, to the extent practicable, if there is evidence that a fishing activity adversely affects EFH in a manner that is more than minimal and not temporary in nature." 50 C.F.R § 600.815(a)(2)(ii); 16 U.S.C. § 1853(a)(7). Actions to achieve this may include, but are not limited to fishing equipment restrictions and time and area closures. *Id.* § 600.815(a)(2)(iii). Thus, to enhance and protect vulnerable seafloor habitats and associated fish communities, in 2005 the PFMC—a 14-voting member federal advisory body—adopted EFH conservation areas which are closed to bottom trawling (Shester & Warrenchuk 2007). While some areas off Southern California were included in those protections, the majority of federal waters off Southern California were not protected (Figure 3).



A lobed sponge with squat lobster observed at Butterfly Bank.

In response to a call for proposals by the PFMC during its five-year review of EFH designation, conservation and management, Oceana, Natural Resources Defense Council and Ocean Conservancy (Oceana et al. 2013) submitted a Comprehensive EFH Conservation proposal. This proposal includes protecting more than 16,000 square miles of the Southern California Bight from bottom trawling. Incorporating minor revisions to avoid impacting current bottom trawl activity, the California Department of Fish and Wildlife submitted a modified version of this proposal (CDFW 2016), which as of the date of this publication is currently under

consideration by the PFMC and National Marine Fisheries Service (NMFS) as part of a distinct EFH conservation alternative (Oceana 2016, Figure 3). Concurrently, the PFMC is also considering removing some parts or all of the trawl Rockfish Conservation Area (RCA). The trawl RCA was implemented to help rebuild overfished rockfish and it may all be reopened to bottom trawling unless simultaneously protected as an EFH conservation area.

To advance the understanding and location of coral and sponge communities and promote their conservation, Oceana, in partnership with MARE and aboard the CINMS research vessel, *R/V Shearwater*, conducted a five-day ocean expedition, from August 7-11 2016, to study this area off southern California.

Here we describe and characterize the seafloor habitats and associated biological communities at five areas surveyed. Four of these areas are within the Oceana EFH conservation proposal being considered by the PFMC and NMFS for protection from bottom trawling. We dove on two other areas in the CINMS that have been previously studied – inside an area called the Footprint and another site south of Santa Rosa Island. Findings on these sites are reported elsewhere (Yoklavich et al. 2013, Etnoyer et al. 2017). In the five areas reported here, we collected more than nine hours of high definition video footage using an ROV along 25 transects.

This expedition is part of larger effort by Oceana to identify, map and characterize Important Ecological Areas in the California Current Ecosystem, which stretches from Vancouver Island, Canada to Baja California, Mexico. Other regions surveyed to date include Monterey Bay, California, areas off the Southern Oregon Coast, the Central Oregon Coast and San Juan Islands in Washington's Puget Sound (Shester et al. 2012, Enticknap et al. 2013). Important Ecological Areas are geographic areas that have distinguishing ecological characteristics such as high productivity or biological diversity, are important for maintaining habitat heterogeneity or the viability of a species, or contribute disproportionately to an ecosystem's health, including its function, structure, or resilience (Ayers et al. 2010, CEQ 2010).

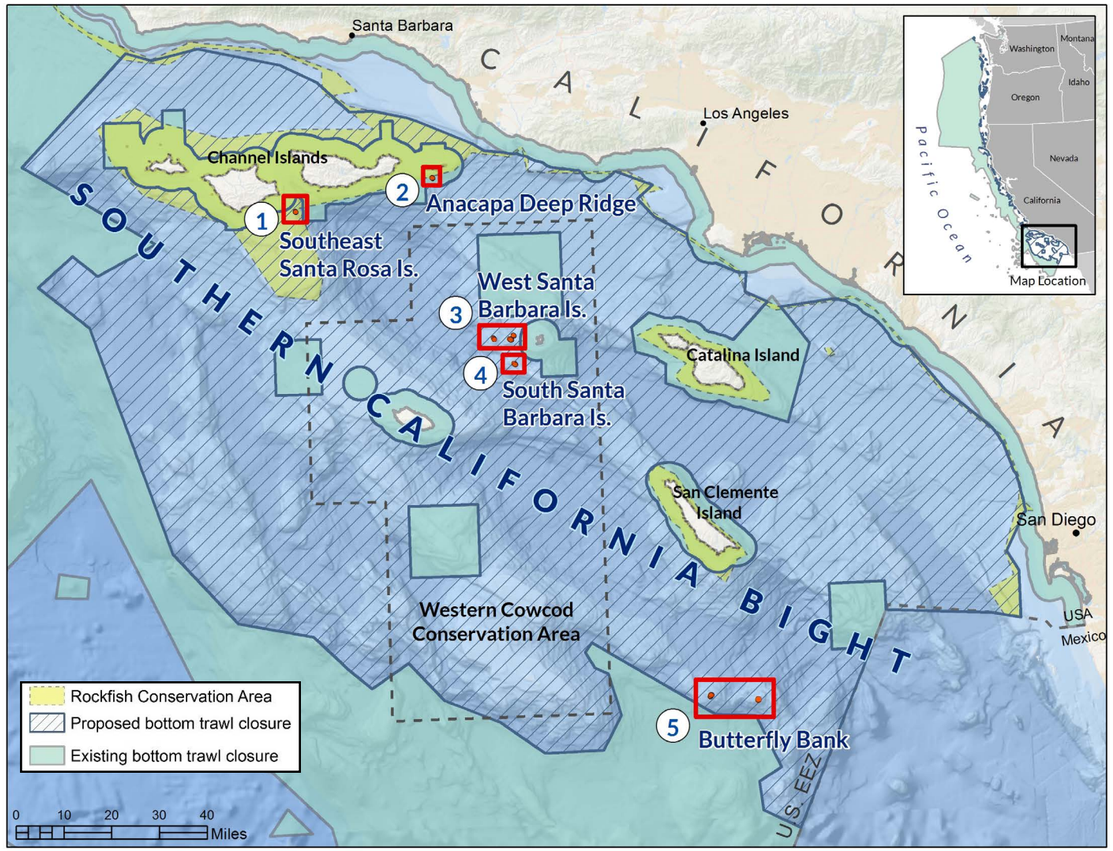


Figure 3. Oceana proposed EFH conservation area for the Southern California Bight as modified by the California Department of Fish and Wildlife (CDFW 2016) (blue hash), showing existing state water groundfish trawl closures and EFH conservation areas, the trawl Rockfish Conservation Area, and the Western Cowcod Conservation Area (grey dashed line). The five study areas where we conducted a combined 25 ROV transects are outlined in red.

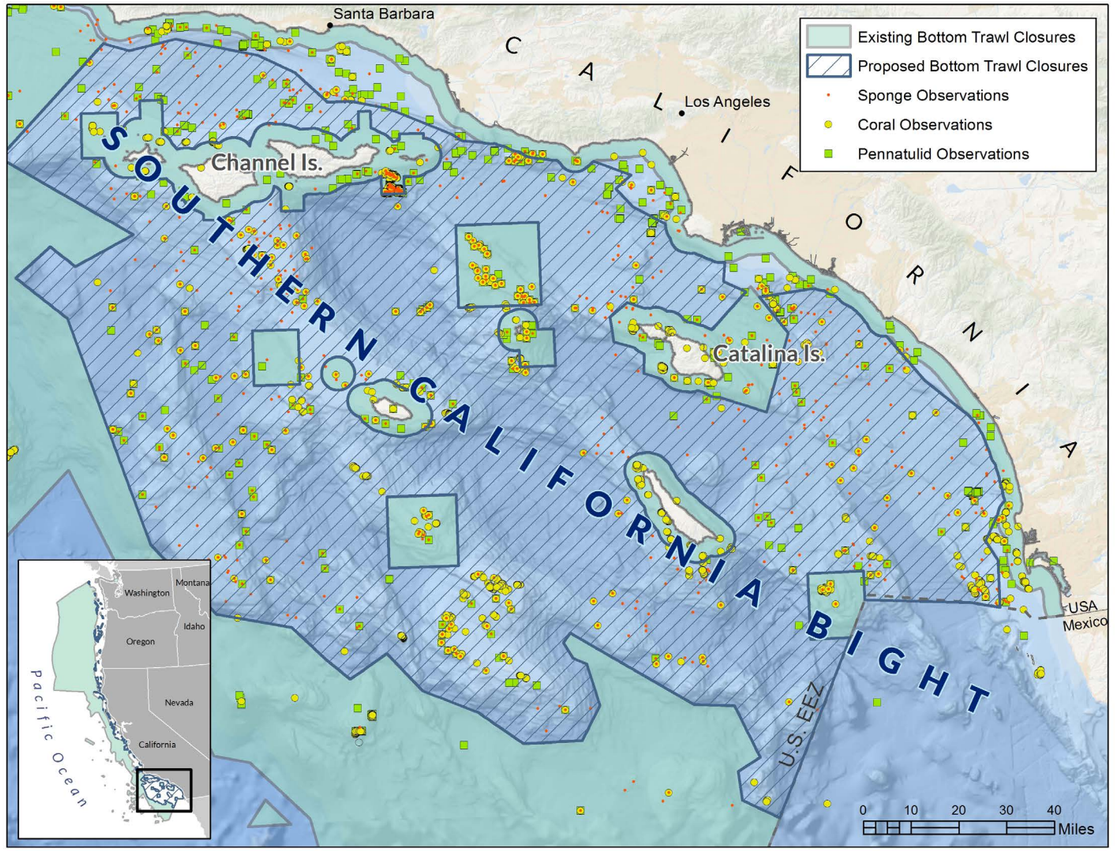
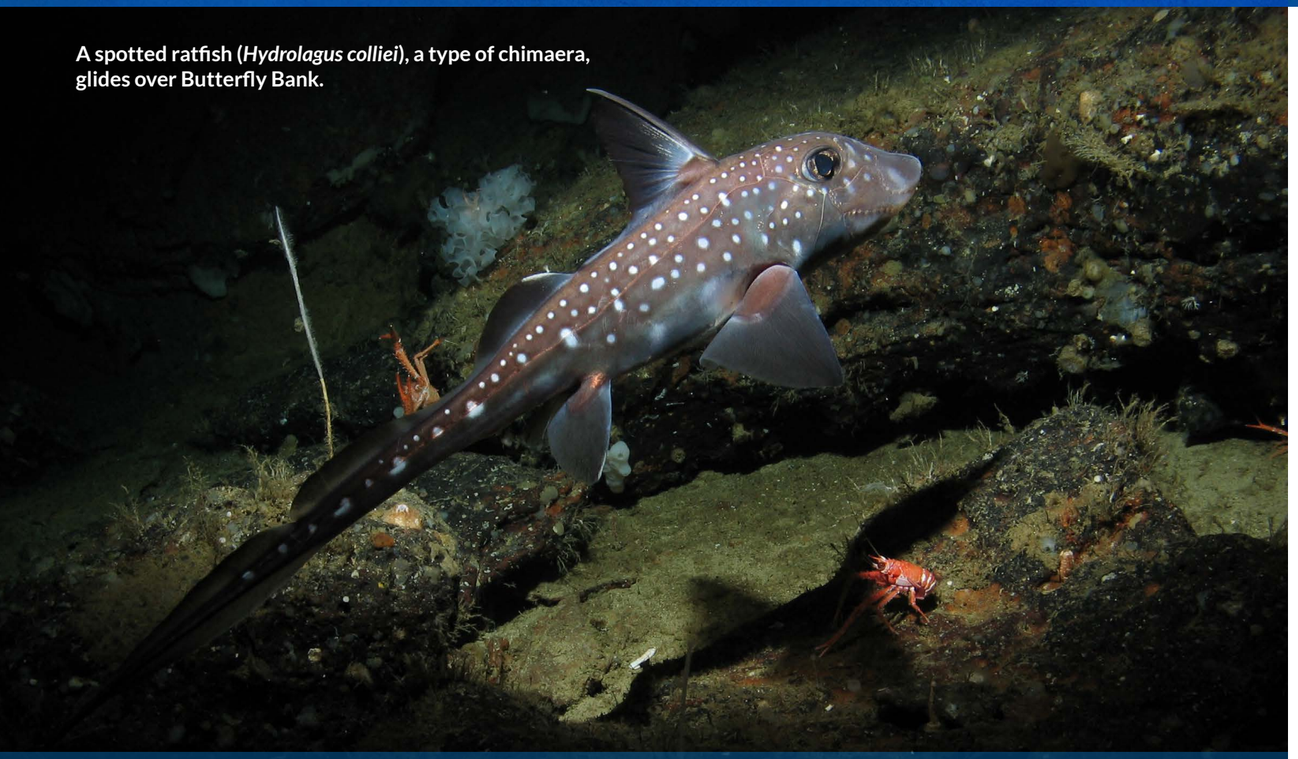


Figure 4. Southern California EFH conservation area proposal area with coral (yellow), sponge (red), and pennatulid (green) records from the NOAA Deep Sea Coral and Sponge Database.



A spotted ratfish (*Hydrolagus colliei*), a type of chimaera, glides over Butterfly Bank.

Study Objectives:

The overall goal of this study is to identify and document Important Ecological Areas off the southern California coast to help inform the long-term conservation and management of marine habitats and biodiversity in this region of the California Current Ecosystem, while demonstrating the importance of a precautionary approach to management. The objectives of this research are to:

1. Survey and characterize the distribution and relative abundance of coral and sponge communities at sites where occurrences have not been documented, including in proposed EFH conservation areas under consideration by the PFMC and NMFS,

2. Quantify associations of federally managed groundfish species with physical and biological habitat features,

3. Characterize physical and biogenic habitats in designated protected areas and areas that are not protected, and

4. Add additional observations of corals and sponges to the NOAA database on the occurrence of these biogenic habitat features.

METHODS

Data Collection

Study Areas and Dive Sites

We identified five general study areas for the expedition based on a variety of data and information including a thorough review of available bathymetric data, predictive coral and substrate models, vessel range, accessibility due to weather conditions, and input from NOAA's Deep-Sea Coral Ecology Program. Within each study area, we conducted one or more dives in an attempt to obtain multiple transects representative of the diversity of features in the study area. Criteria for these study areas included:

1) areas outside EFH conservation areas that have not yet been explored by ROV or other submersibles but where seafloor mapping data or models predict suitable coral habitat (Guinotte & Davies 2014) or hard substrate. These areas included West Santa Barbara Island (four dives), South Santa Barbara Island (one dive), Butterfly Bank (two dives); and

2) areas that have previously been explored but where additional data and observations would add to the areas' site characterization. These areas included Southeast Santa Rosa Island (one dive), and Anacapa Deep Ridge (one dive, Figure 6).

The Oceana expedition team with Alexandra Cousteau, Marine Applied Research and Exploration (MARE), and captain and crew of the Channel Islands National Marine Sanctuary R/V Shearwater. In the forefront is the ROV Beagle.

ROV Sampling Operations

We used the R/V Shearwater, a 22 meter (m) NOAA research vessel, to complete the 2016 survey. At each dive site, the ROV was piloted along one or more 15-minute transect lines and was flown off the vessel's stern using a "live boat" technique that employed a 317.5 kg (700 lb) clump weight. Using this method, all but 50 m of the ROV umbilical was isolated from current-induced drag by coupling it with the clump weight cable, and suspending the clump weight at least 10 m off the seafloor. The 45 m tether allowed the ROV pilot sufficient maneuverability to maintain a constant speed (0.5 to 0.75 m/sec) and a straight course down the planned survey line, while on transect.

We kept the ship within 35 horizontal meters of the ROV position at all times. To achieve this, we used an acoustic tracking system to calculate the position of the ROV relative to the ship. We calculated the ROV position every two seconds and recorded this along with coordinated universal timecode (UTC) using navigational software. Additionally, the ROV pilot and ship captain utilized real-time video displays of the location of the ship and the ROV, in relation to the planned transect line. We achieved

a consistent transect width, from the forward camera's field of view, using sonar readings to sustain a consistent distance from the camera to the substrate (at the screen horizontal mid-point) between 1.5 and 3 m. In areas with low visibility, we used BlueView multibeam sonar to navigate hazardous terrain.

ROV Equipment

We used the Beagle, an observation class ROV, to complete benthic surveys of select Southern California Bight study locations. The ROV was equipped with a three-axis autopilot including a rate gyro-damped compass and altimeter. Together, these allowed the pilot to maintain a constant heading (± 1 degree) and constant altitude (± 0.3 m) with minimal corrections. In addition, we used forward speed control to help the pilot maintain a consistent forward velocity between 0.25 and 0.5 m/sec while on transect. We used a Tritech® 500 kHz ranging sonar, which measures distance across a range of 0.1–10 m using a 6° conical transducer as the primary method for measuring transect width from the forward-facing high definition (HD) video. We pointed the transducer at the center of the camera's viewing area and used it to calculate the distance to the middle of the screen, which we subsequently converted to width using the known properties of the cameras field of view. We averaged readings from the sonar five times per second and recorded at a one-second interval with all other sensor data. Measurements of transect width using a ranging sonar are accurate to ± 0.1 m (Karpov et al. 2006). The ROV Beagle was also equipped with parallel lasers set with a 10 cm spread and positioned to be visible in the field of view of the primary forward camera. These lasers provided a scalable reference of size when we reviewed the video.

The R/V Shearwater was 'home' for researchers over the 5-day expedition.

We used an ORE Offshore Trackpoint III® ultra-short baseline acoustic positioning system with ORE Offshore Motion Reference Unit (MRU) pitch and roll sensor to reference the ROV position relative to the ship's Wide Area Augmentation System Global Positioning System. We determined the ship's heading using a KVH magnetic compass. The Trackpoint III® positioning system calculated the XY position of the ROV relative to the ship at approximately two-second intervals. We corrected the ship-relative position to real world position and recorded in meters as X and Y using the World Geodetic System (WGS)1984 Universal Transverse Mercator (UTM) coordinate system using HYPACK® 2013 hydrographic survey and navigation software. Measurements of ROV heading, depth, altitude, water temperature, camera tilt and ranging sonar distance were averaged over a one-second period and recorded along with the position data.

The ROV had four cameras, including one forward facing HD camera, two standard definition cameras and one HD still camera. The primary data collection camera (HD video camera) and HD still camera were oriented obliquely forward. We linked all video and still images using UTC timecode recorded as a video overlay or using the camera's built-in time stamp which was set to UTC time each day.

We linked all data collected by the ROV, along with subsequent observations extracted during post-processing of the video, in a Microsoft Access® database using GPS time. We used GPS time to provide a basis for relating position, field data and video observations (Veisze & Karpov 2002). We used data management software to expand all data records to one second of Greenwich Mean Time (GMT). During video post-processing, we used a Horita® Time Code Wedge (model number TCW50) in conjunction with a customized computer keyboard to record the audio time code in a Microsoft Access® database.


Oceana Senior Scientist Geoff Shester guides ROV cable off the stern of the R/V Shearwater.

Post-Processing and Habitat Characterization

Following data collection, we processed the ROV position data to remove outliers and data anomalies caused by acoustic noise and vessel movement (Karpov et al. 2006). Outliers included deviations from sampling protocols such as pulls (ROV pulled by the ship), stops (ROV stops to let the ship catch up), or loss of target altitude caused by traveling over backsides of high relief structures.

We made an exception at Butterfly Bank- East, where the ROV positional data files were corrupted and we used an average speed method to estimate distance traveled. Using the video, we recorded the timecode for when the ROV was moving at normal operating protocol speeds (m/sec). Next, we calculated the average speed for when the ROV was moving (normal operating speed) for Butterfly Bank-West, which had similar habitat and oceanographic conditions as Butterfly Bank- East. We then used the average speed (m/sec) in combination with the ROVs forward sonar to estimate area covered. Once the data and locations of the remaining

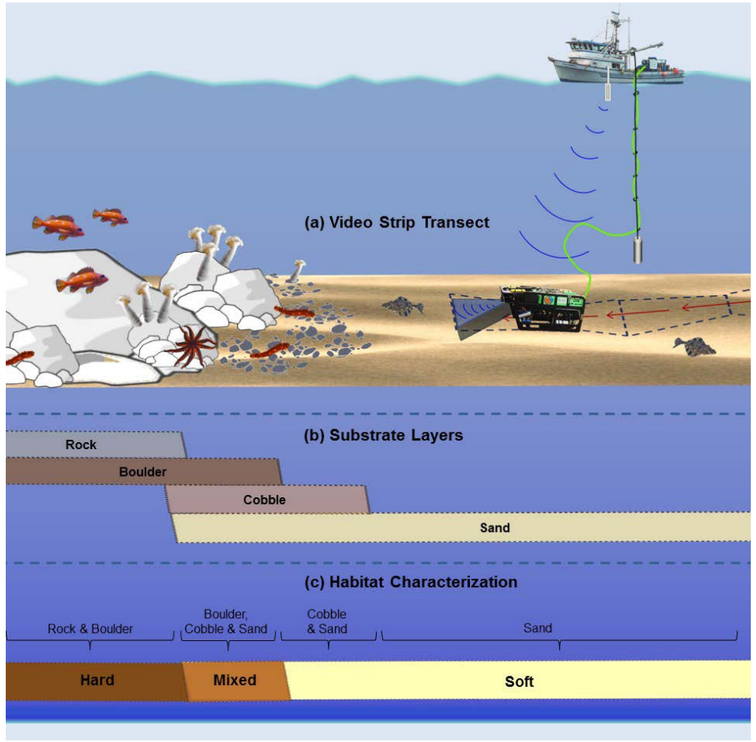


Figure 5. Illustration of (a) basic ROV strip transect methodology used to collect video data along the seafloor, (b) overlapping base substrate layers produced during video processing and (c) habitat types (hard, mixed soft) derived from the overlapping base substrate layers after video processing is completed. Illustration courtesy of MARE.

transects were processed and linked to video, we conducted the following characterizations of the 15-minute transects.

Substrate and Habitat

For each site, we reviewed all collected video for up to six different substrate types: rock, boulder, cobble, gravel, sand and mud (Green et al. 1999). We recorded each substrate as discrete segments by entering the beginning and ending UTC timecode. We completed substrate annotation in a multi-viewing approach, in which each substrate type was recorded independently, enabling us to capture the often overlapping segments of substrates (Figure 5). These overlapping substrate segments allowed us to identify mixed substrate areas along the transect line.

After the video review process, we combined the substrate data to create three independent habitat types: hard, soft, and mixed habitats (Figure 5). We categorized rock and boulder as hard substrate types, while cobble, gravel, sand, and mud were all considered to be unconsolidated substrates and categorized as soft. We defined hard habitat as any combination of the hard substrates, soft habitat as any combination of soft substrates, and mixed habitat as any combination of hard and soft substrates.

Finfish and Invertebrate Enumeration

After completion of habitat and substrate review, we processed video to collect data for use in estimating finfish and macro-invertebrate distribution, relative abundance and density. During the review process, we simultaneously reviewed both the forward and down video files, yielding a continuous and slightly overlapping view of what was present in front of and below the ROV. This approach effectively increased the resolution of the visual survey, by identifying animals that were difficult to recognize in the forward camera, but were clearly visible and identifiable in the down camera.

We enumerated all clearly visible finfish and macro-invertebrates from the video record for the transects only. During multiple subsequent viewings, we classified finfish and macro-invertebrates to the lowest taxonomic level possible. Observations that could not be classified to species level were identified to a taxonomic complex, or recorded as unidentified (UI). During video review, we used both the HD video and HD still imagery to aid in species identification. Each fish or invertebrate observation was entered into a Microsoft Access® database along with UTC timecode, taxonomic name/grouping, sex/developmental stage (when applicable), and count. From the species/groupings of invertebrates, we analyzed corals, sponges and pennatulids per study area. We also analyzed the number of fish managed under the Pacific Coast Groundfish Fishery Management Plan (FMP) (PFMC 2016). Throughout this report, consistent with data used at the PFMC, we discuss pennatulids separately from other octocorals, which we refer to as corals. We identified dives in which groups of corals (Alcyonacea, Antipatharia), pennatulids (Pennatulacea), and sponges (branched, boot, gray moon *Spheciospongia confoederata*, hairy boot, laced, large yellow, lobed, nipple, orange puffball *Tethya aurantia*, trumpet, vase) co-occurred with managed fish species/groupings.

Alexandra Cousteau, Oceana Senior Advisor, with the ROV Beagle.

"The oceans are the lifeblood of the planet. Living structures on the ocean floor, like corals and sponges, provide nurseries, food and shelter essential for the survival and productivity of important commercial and sportfish species, like rockfish and lingcod. The waters surrounding the islands and offshore banks of Southern California contain prime examples of these spectacular habitats."

-Alexandra Cousteau, Senior Advisor for Oceana

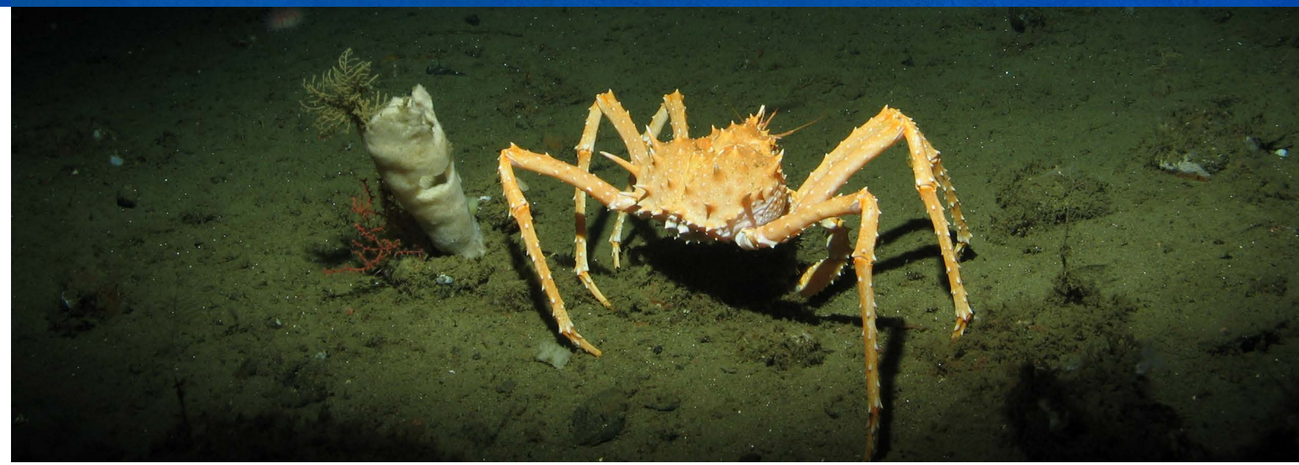
RESULTS

In total, we collected more than nine hours of high definition footage in the five study areas where we completed 25 transects (Figure 3, Table 1, coordinates provided in Appendix A). The transects covered a total distance of 10.8 kilometers (km) and depths ranging from 126 m to 379 m (Table 1). The number of fish observations in the 25 transects totaled 5,059 and comprise 27 distinct species and 17 species groups or complexes; the majority of which are managed under the Pacific Coast Groundfish FMP. Within these transects, we observed a total of 14,006 invertebrates, including 4,786 corals, sponges and pennatulids (1,120; 3,644; and 22 records, respectively). We observed a range of substrate types, however soft and mixed substrates were the most frequent throughout the study.

Table 1. Total sampling effort at five Southern California study areas, showing total transect distance surveyed, total transects and depth range of surveyed areas.

Study Area		Southeast Santa Rosa Is.	Anacapa Deep Ridge	West Santa Barbara Is.	South Santa Barbara Is.	Butterfly Bank	Total:
Number of Transects		3	2	11	3	6	25
Distance (m)		1288	712	5236	1485	3030	11751
Depth (m)	*Min*	126	289	148	220	287	
	Max	171	371	365	272	379	
	Avg	147	324	240	250	316	

A wolf eel (*Anarrhichthys ocellatus)* hides under a large boulder in the Southeast Santa Rosa study area, while the spines of a rockfish can be seen behind a nearby sponge.



California king crab (*Paralithodes californiensis*) off West Santa Barbara Island.

SUBSTRATE AND HABITAT

Overall, the most commonly observed substrates were mud, cobble and rock. Habitat types derived from substrate data show that over the course of this study, 10 percent of observed habitat consisted of hard substrate (rock and boulder), 43 percent was mixed (cobble, boulder, and sand) and 47 percent was soft substrate (cobble, sand, and mud).

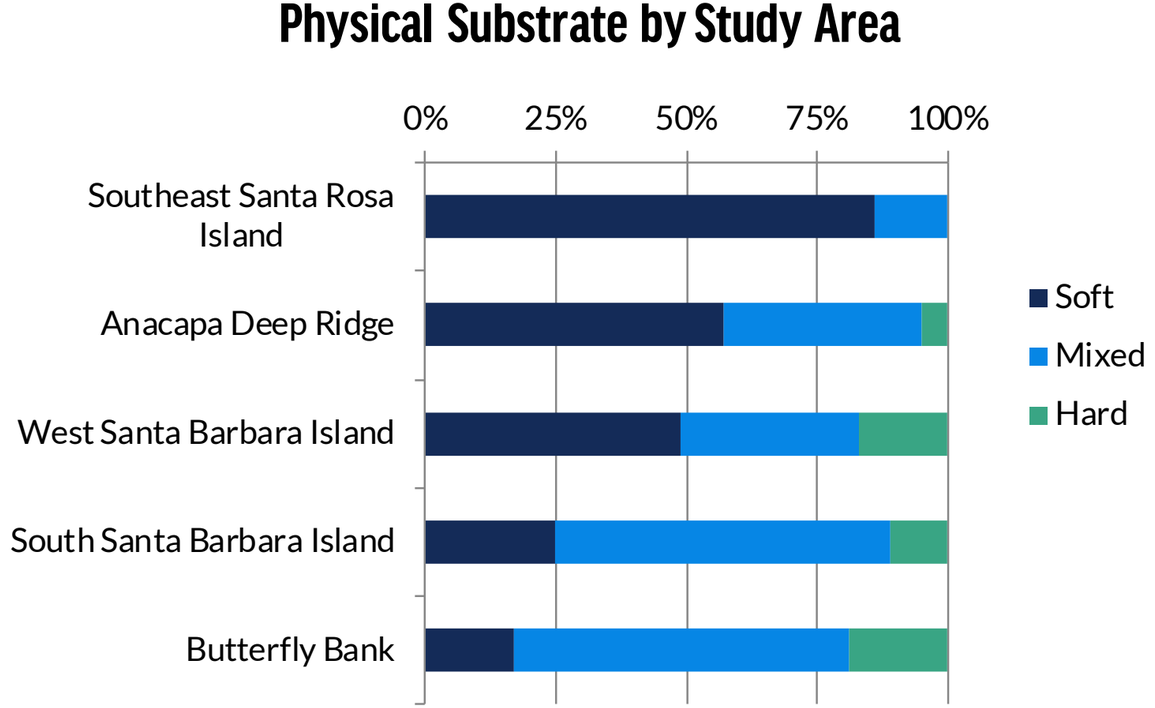


Figure 6. Comparison of relative substrate composition across study areas.

Cowcod rockfish (*S. levis*) were heavily overfished in the 1970s and 1980s. Scientists now project they will recover to healthy levels by 2020. This one was observed in the South Santa Barbara Island study area.

Fish and Invertebrates

Fish

The majority of fish we observed were rockfish (*Sebastes spp.*) which account for 92.7 percent of the total fish count at all study areas combined (Appendix B). Halfbanded rockfish (*Sebastes semicinctus*) were the most abundant rockfish species, accounting for nearly 40 percent of all fish observed. The species groups including juvenile rockfish (young of the year — YOY), swordspine rockfish (*Sebastes ensifer*), *Sebastomus* rockfish (unidentified rockfish of subgenus *Sebastomus*), unidentified adult rockfish, and pygmy rockfish accounted for another 44 percent of all fish observations. We observed cowcod (*Sebastes levis*) at 0.3 percent of the total fish count. Cowcod rockfish were designated as overfished in 2000 but are projected to recover to healthy levels by 2020 (Dick & MacCall 2014). The most abundant non-rockfish grouping was the combfish complex (*Zaniolepis spp.*), which accounts for 2.4 percent of fish observations.

At Southeast Santa Rosa Island, fish densities were higher than at any other study area, with 53 fish/100 m^2 (Appendix B). Halfbanded rockfish represented the majority of the density, accounting for over 45

fish/100 m^2. When halfbanded rockfish are not included in the overall densities of each study area, West Santa Barbara Island had the highest overall density at almost 12 fish/100 m^2. The Butterfly Bank study area had the lowest overall fish density at nearly three fish per 100 m^2.

Invertebrates

Four species/groupings of macro-invertebrates account for approximately 66 percent of the total invertebrate counts (Appendix B). The fragile pink urchin (*Strongylocentrotus fragilis*) is the most abundant species we observed and accounts for approximately 24 percent of the overall count; followed by the squat lobster (*Munida quadrispina*), unidentified lobed sponge (unidentified *Porifera*) and white slipper sea cucumber (*Pusolus sp.*) which account for the remaining 42 percent.

We observed more than 3,600 structure forming sponges from 11 species groupings, accounting for 26 percent of the total invertebrate observations. Corals represent eight percent of invertebrate observations with more than 1,100 records (nine species/groupings). The order Alcyonacea, also called gorgonians, dominates the number of coral species we observed, with three species/groupings representing the majority of observations: gray (*Plumarella sp.*), red *Swiftia sp.* and yellow (*Acanthogorgia sp.*) gorgonians. We also observed fifteen species/groupings of sea stars, but these represented less

Splitnose rockfish (*S. diploproa*) live to at least 86 years. This one rests near urchins, anemones and a feather star at Anacapa Deep Ridge.

Table 2. Co-occurrence of managed groundfish species with each category of corals and sponges on the same transect, indicating where groundfish were observed in habitats containing respective corals and sponges.

	Biogenic Habitat Taxa													
	Corals			Sponges										
FMP fish	Alcyonacea	Antipatharia	Pennatulacea	Branched	Boot	Gray Moon	Hairy Boot	Laced	Large Yellow	Lobed	Nipple	Orange Puffball	Trumpet	Vase
Aurora/splitnose complex	x	x	x	x	x		x	x		x			x	x
Bank rockfish	x	x		x	x	x	x	x	x	x	x		x	x
Blackgill rockfish	x	x	x	x	x		x	x	x	x	x	x	x	x
Bocaccio	x	x		x	x		x			x				x
Bronzespotted rockfish	x			x	x	x	x		x	x				x
Cowcod	x			x	x	x	x			x				x
Dover sole	x	x	x		x				x	x	x	x		x
Flag rockfish	x			x	x		x	x		x			x	x
Greenspotted rockfish	x	x		x	x	x	x			x				x
Greenstriped rockfish	x	x	x	x	x	x	x			x				x
Halfbanded rockfish	x			x	x					x				
Lingcod	x	x		x	x		x			x				x
Longnose skate	x		x		x				x		x	x		x
Mexican rockfish	x			x	x					x				x
Pacific hake	x			x	x		x		x	x				x
Pinkrose rockfish	x			x	x	x	x		x	x				x
Pygmy rockfish	x	x		x	x		x			x				x
Sebastomus rockfish	x	x	x	x	x	x	x	x	x	x	x		x	x
Shortbelly rockfish	x	x		x	x	x	x		x	x				x
Shortspine thornyhead	x	x	x		x		x	x		x			x	x
Small schooling rockfish	x	x		x	x		x			x				x
Splitnose rockfish	x	x	x	x	x		x	x	x	x	x	x	x	x
Spotted ratfish	x	x		x	x		x	x		x	x		x	x
Squarespot rockfish	x	x		x	x		x			x				x
Squarespot/Widow complex	x	x		x	x		x			x				x
Stripetail rockfish			x											
Swordspine rockfish	x	x		x	x	x	x		x	x				x
Thornyhead complex	x	x	x	x	x		x	x		x			x	x
Unidentified rockfish	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Whitespeckled rockfish	x	x		x	x		x			x				x
Young of Year	x	x		x	x	x	x		x	x				x
TOTAL fish species/groups	30	22	11	27	30	11	26	10	13	29	8	5	10	29

A garden of orange gorgonian corals found south of Santa Rosa Island in the Oceana EFH proposal area.

than five percent of the total macro-invertebrate observations.

While Anacapa Deep Ridge had the highest overall density of macro-invertebrates, we found that the Butterfly Bank study area has the highest combined density of corals, sponges and pennatulids, with over 37 of these invertebrates/100 m^2 (Appendix B). West Santa Barbara Island had the most coral, sponge and pennatulid species/groupings of any study area we surveyed with a total of 19 species/groupings (Appendix B).

Co-occurrence

We observed all federally managed groundfish in transects containing corals and sponges or pennatulids (Table 2). The coral group Alcyonacea (gorgonians) and unidentified lobed sponges were present on all dives. The associations identified in Table 2 are consistent with presence/ absence (i.e., Level 1) criteria for designating and protecting a habitat as EFH, as described in the NOAA EFH regulatory guidance, (50 CFR 600.815)

A large vase sponge adorned with basket stars and a gray gorgonian coral at West Santa Barbara Island.

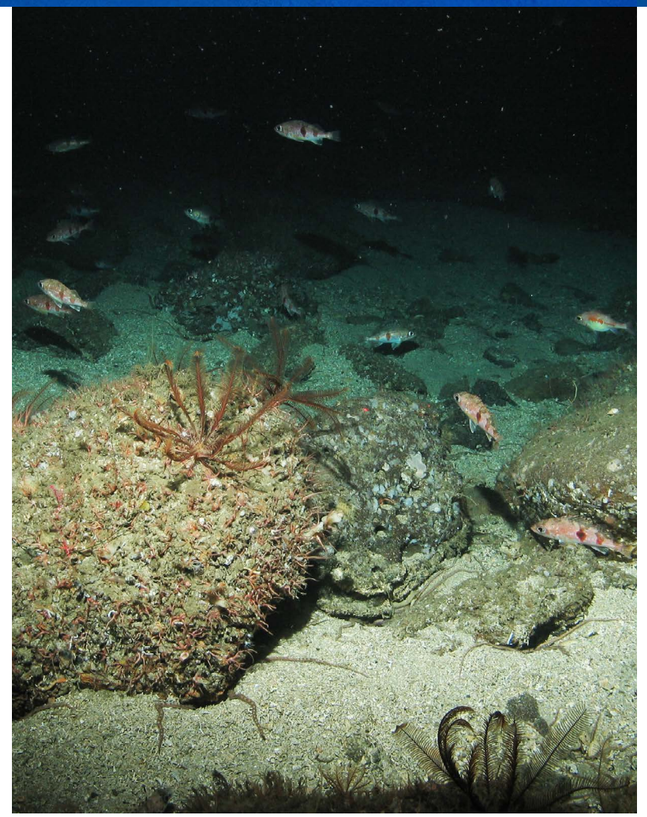
Study Areas

1. Southeast Santa Rosa Island

In this study area, we conducted three transects along the seafloor, exploring a total distance of 1.3 km in an area approximately eight km southeast of Santa Rosa Island. This area is inside the Channel Islands National Marine Sanctuary and inside Oceana's proposed Southern California Bight EFH conservation area. While the area is currently closed to bottom trawling as a trawl RCA (Figure 3) for rebuilding overfished rockfish, the Pacific Fishery Management Council is considering removing this trawl RCA.

Much of the seafloor we surveyed at the Southeast Santa Rosa Island study area consisted of soft substrate. Soft substrate composed 86 percent of the area surveyed and the remaining 14 percent was mixed substrate (Figure 6). This is the shallowest study area and the only site where we observed sand. We also documented 2,337 fish at this site , including a large number of juvenile halfbanded rockfish, indicating this area may serve as a nursery habitat for this species. Of these, 2,226 individuals, representing 16 different species/groupings, are federally managed under the Pacific Coast Groundfish FMP (Appendix B). In total, we observed 237 invertebrates at this location. Of those invertebrates, 62 were corals, sponges or pennatulids (Appendix B, Table 3).

We observed the highest total species density and managed fish species density at this site, but the lowest invertebrate and combined coral, sponge and pennatulid densities (Appendix B). The fish that we documented at highest densities over the transects were halfbanded rockfish followed by combfish, pygmy rockfish, and swordspine rockfish (Appendix B). The number of halfbanded rockfish far exceeded other fish species counted in this area. We observed one bocaccio, as well as lingcod and widow rockfish (Appendix B). The invertebrates we observed at the highest densities include basket stars and unidentified lobed sponge (Appendix B).



Halfbanded rockfish (*S. semicinctus*) at Southeast Santa Rosa Island.

We discovered high numbers of juvenile rockfish at this site, indicating it may be an important nursery area.

Table 3. Counts of biogenic habitat species (corals, sponges, and pennatulids) at Southeast Santa Rosa Island.

Biogenic Habitat Species	
Coral	**Count**
Red *Swiftia* gorgonian	8
Yellow gorgonian	8
Sponge	**Count**
Unidentified branched sponge	6
Unidentified lobed sponge	33
Pennatulid	**Count**
Sea whip	7
Total	**62**

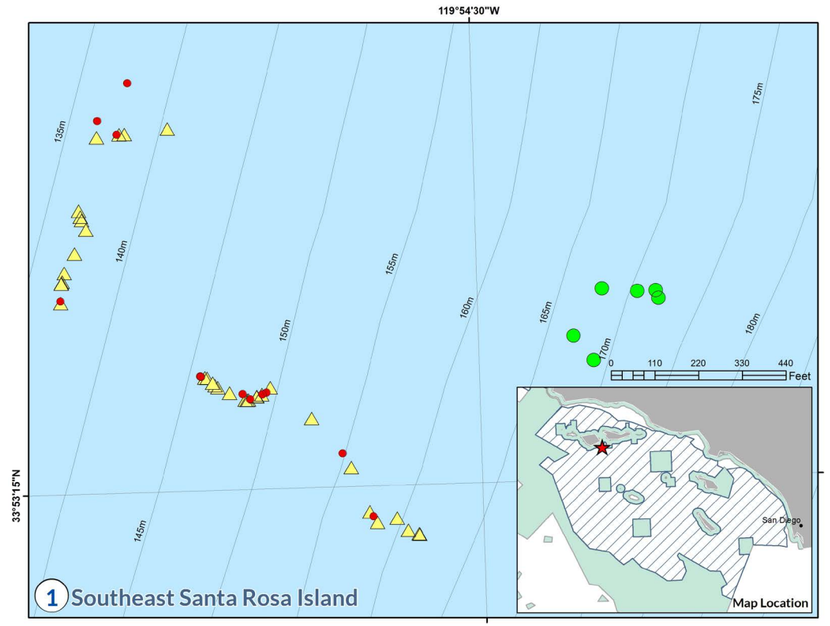


Figure 7. Map of coral, sponge and pennatulid observations along three completed transects at Southeast Santa Rosa Island.

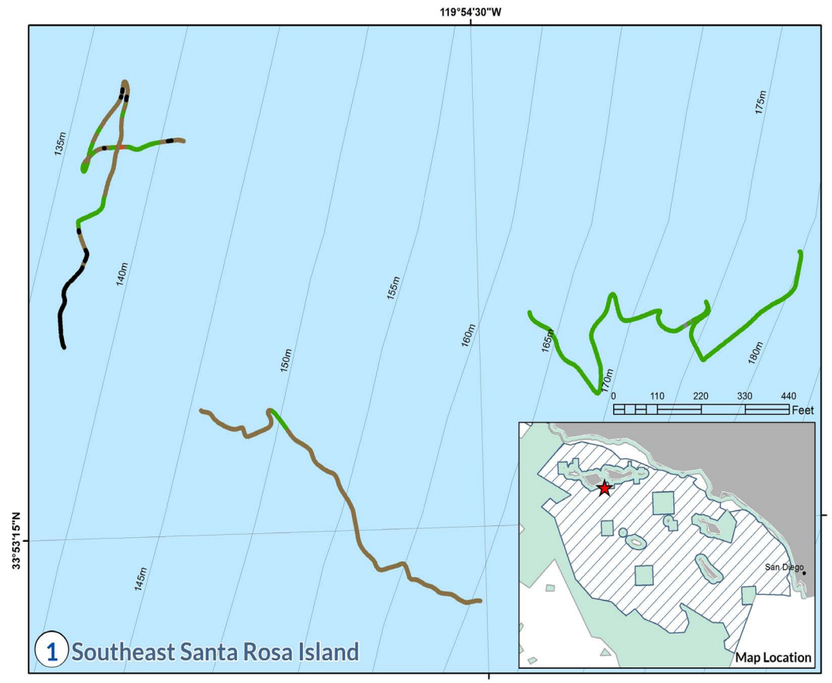


Figure 8. Map of substrate type along the three completed transects at Southeast Santa Rosa Island.

2. Anacapa Deep Ridge

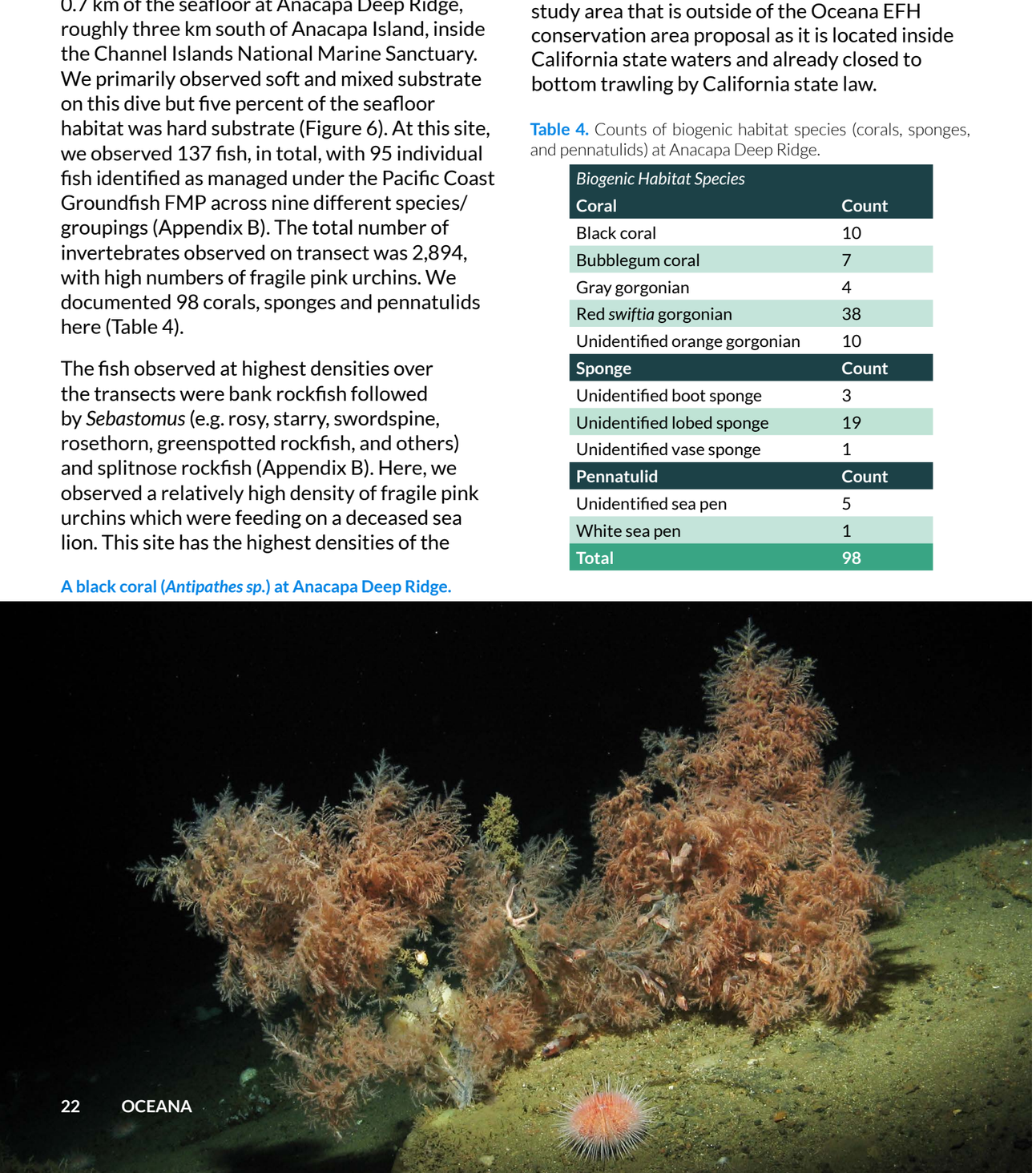
We completed two transects covering more than 0.7 km of the seafloor at Anacapa Deep Ridge, roughly three km south of Anacapa Island, inside the Channel Islands National Marine Sanctuary. We primarily observed soft and mixed substrate on this dive but five percent of the seafloor habitat was hard substrate (Figure 6). At this site, we observed 137 fish, in total, with 95 individual fish identified as managed under the Pacific Coast Groundfish FMP across nine different species/groupings (Appendix B). The total number of invertebrates observed on transect was 2,894, with high numbers of fragile pink urchins. We documented 98 corals, sponges and pennatulids here (Table 4).

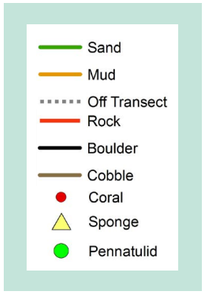
The fish observed at highest densities over the transects were bank rockfish followed by *Sebastomus* (e.g. rosy, starry, swordspine, rosethorn, greenspotted rockfish, and others) and splitnose rockfish (Appendix B). Here, we observed a relatively high density of fragile pink urchins which were feeding on a deceased sea lion. This site has the highest densities of the Antipatharia, black coral and the Alcyonacea, bubblegum coral (*Paragorgia sp.*) of the five study areas surveyed (Appendix B). This is the only study area that is outside of the Oceana EFH conservation area proposal as it is located inside California state waters and already closed to bottom trawling by California state law.

Table 4. Counts of biogenic habitat species (corals, sponges, and pennatulids) at Anacapa Deep Ridge.

Biogenic Habitat Species	
Coral	**Count**
Black coral	10
Bubblegum coral	7
Gray gorgonian	4
Red *swiftia* gorgonian	38
Unidentified orange gorgonian	10
Sponge	**Count**
Unidentified boot sponge	3
Unidentified lobed sponge	19
Unidentified vase sponge	1
Pennatulid	**Count**
Unidentified sea pen	5
White sea pen	1
Total	**98**

A black coral (*Antipathes sp.*) at Anacapa Deep Ridge.





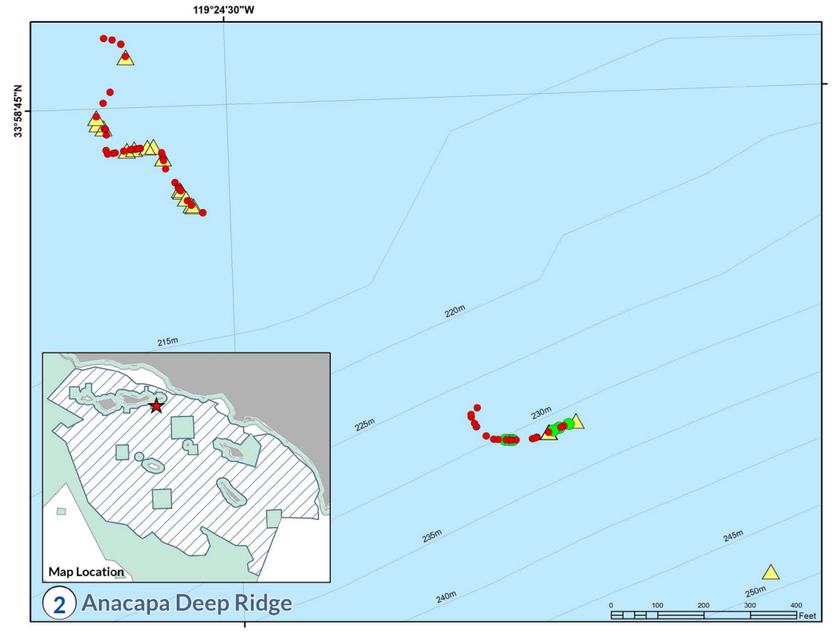


Figure 9. Map of coral, sponge and pennatulid observations along two completed transects at Anacapa Deep Ridge.

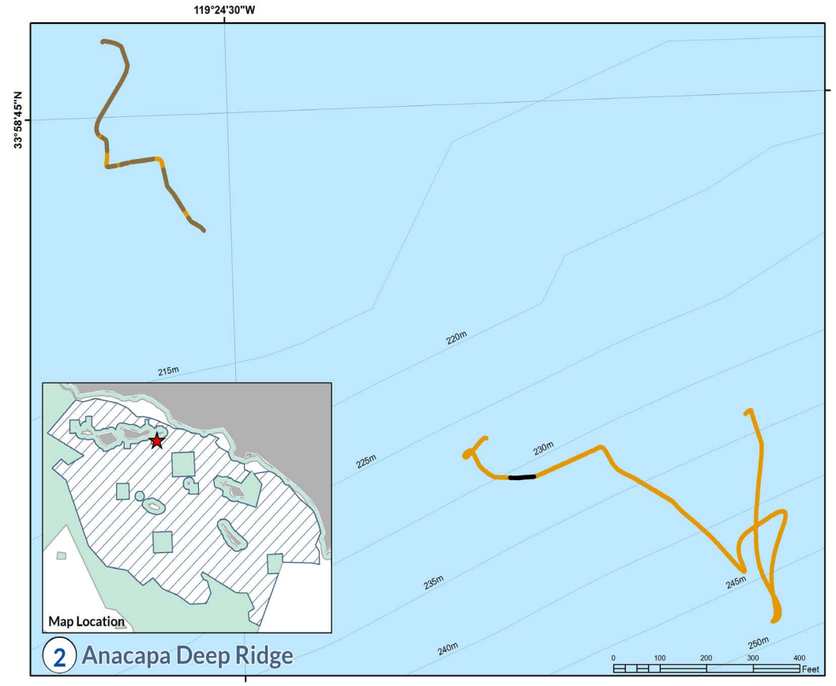


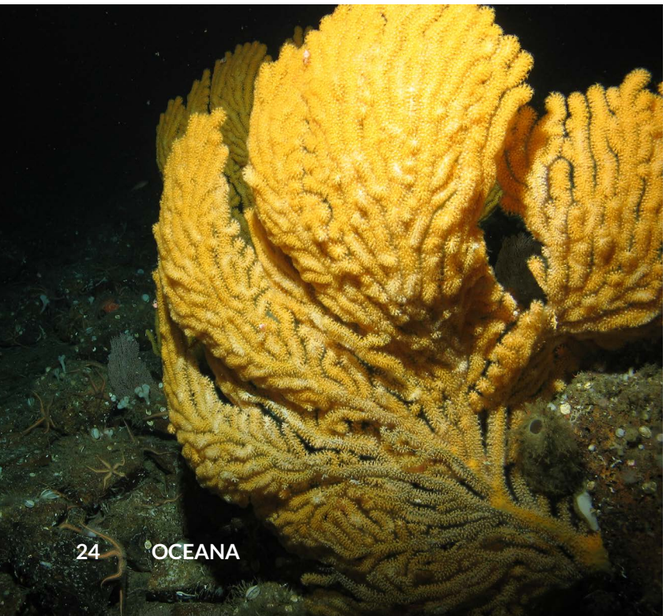
Figure 10. Map of substrate type along the two completed transects at Anacapa Deep Ridge.

3. West Santa Barbara Island

In this study area located nine to 15 km west of Santa Barbara Island, we covered 5.2 km of seafloor along eleven transects. This area is within the Western Cowcod Conservation Area where bottom trawls and most other bottom fishing have been prohibited since 2001 for rebuilding cowcod rockfish. The area, however, is not currently protected from bottom trawling as EFH and the Cowcod Conservation Area may be modified or fully lifted in the future as this rockfish species recovers.

The substrate we observed on this dive is divided between soft substrate and a combination of mixed and hard substrates (Figure 6). We observed a total of 2,098 fish with high numbers of young of the year rockfish and swordspine rockfish. We identified 22 managed fish species/groupings, accounting for 1,963 of the individual fish (Appendix B). We also observed 4,543 invertebrates including relatively high numbers of lobed sponges. We found other corals, sponges and pennatulids here with a total of 2,087 individual organisms counted, representing nineteen species/groupings (Appendix B, Table 5). Of those observations, we documented 845 individual coral colonies.

A large yellow gorgonian coral (*Acanthogorgia sp.*) at West Santa Barbara Island.



The fish we observed at the highest densities over these transects were YOY juvenile rockfish followed by swordspine rockfish (Appendix B). The invertebrate we observed at the highest density is unidentified lobed sponge, followed by squat lobster and gray gorgonians (Appendix B). This study area has the greatest density of gray and yellow gorgonians of all sites surveyed. This site also has the greatest diversity of coral types among surveyed areas.

We discovered previously unidentified coral gardens and rocky reefs here; located inside and outside of the CINMS boundaries.

Table 5. Counts of biogenic habitat species (corals, sponges, and pennatulids) at West Santa Barbara Island.

Biogenic Habitat Species	
Coral	**Count**
Black coral	19
Bubblegum coral	9
Gray gorgonian	552
Mushroom soft coral	4
Red gorgonian	1
Red *Swiftia* gorgonian	111
Unidentified gorgonian	3
Yellow gorgonian	146
Sponge	**Count**
Gray moon sponge	1
Orange puffball sponge	1
Unidentified boot sponge	66
Unidentified branched sponge	206
Unidentified hairy boot sponge	27
Unidentified large yellow sponge	44
Unidentified lobed sponge	724
Unidentified nipple sponge	1
Unidentified vase sponge	167
Pennatulid	**Count**
Unidentified sea pen	2
White sea pen	7
TOTAL	**2087**

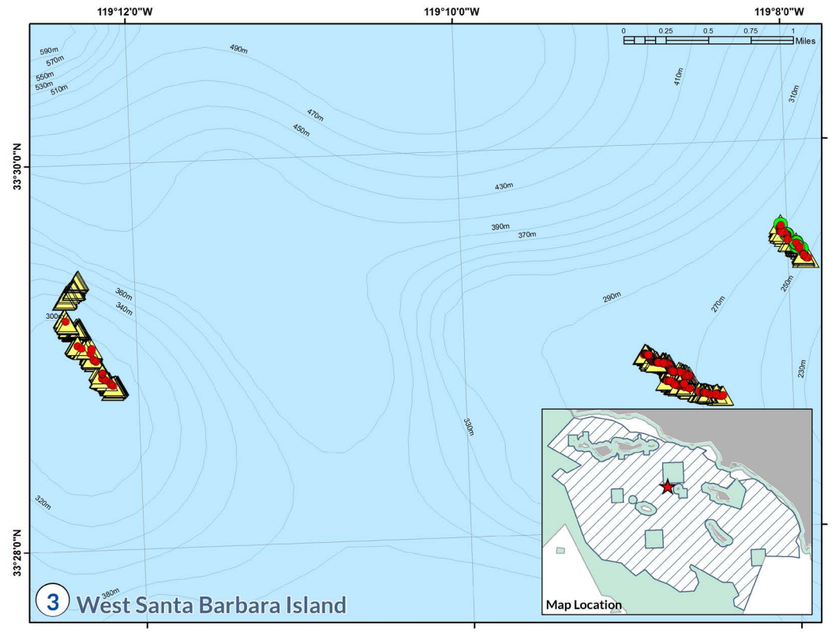


Figure 11. Map of coral, sponge and pennatulid observations along eleven completed transects at West Santa Barbara Island.

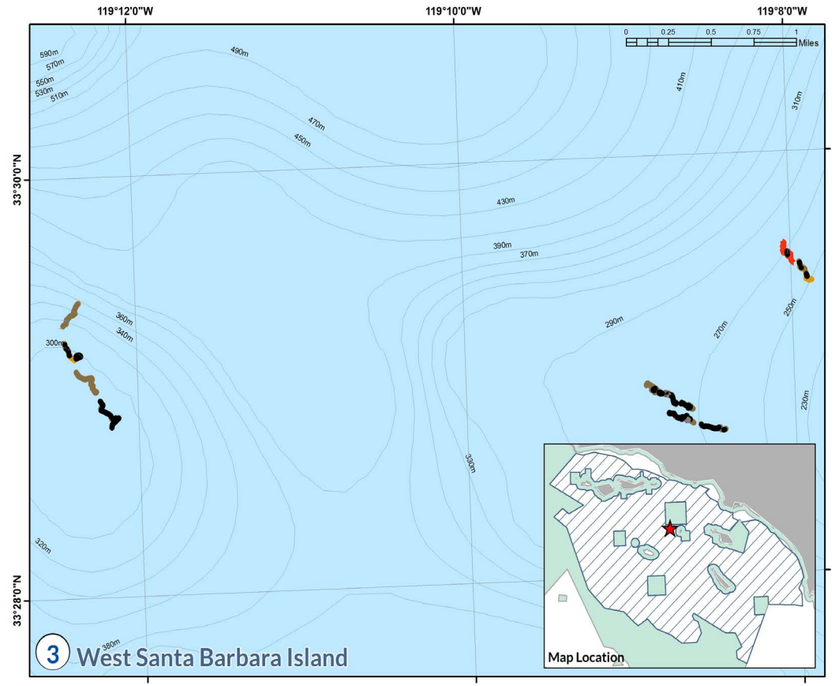


Figure 12. Map of substrate type along the eleven completed transects at West Santa Barbara Island.

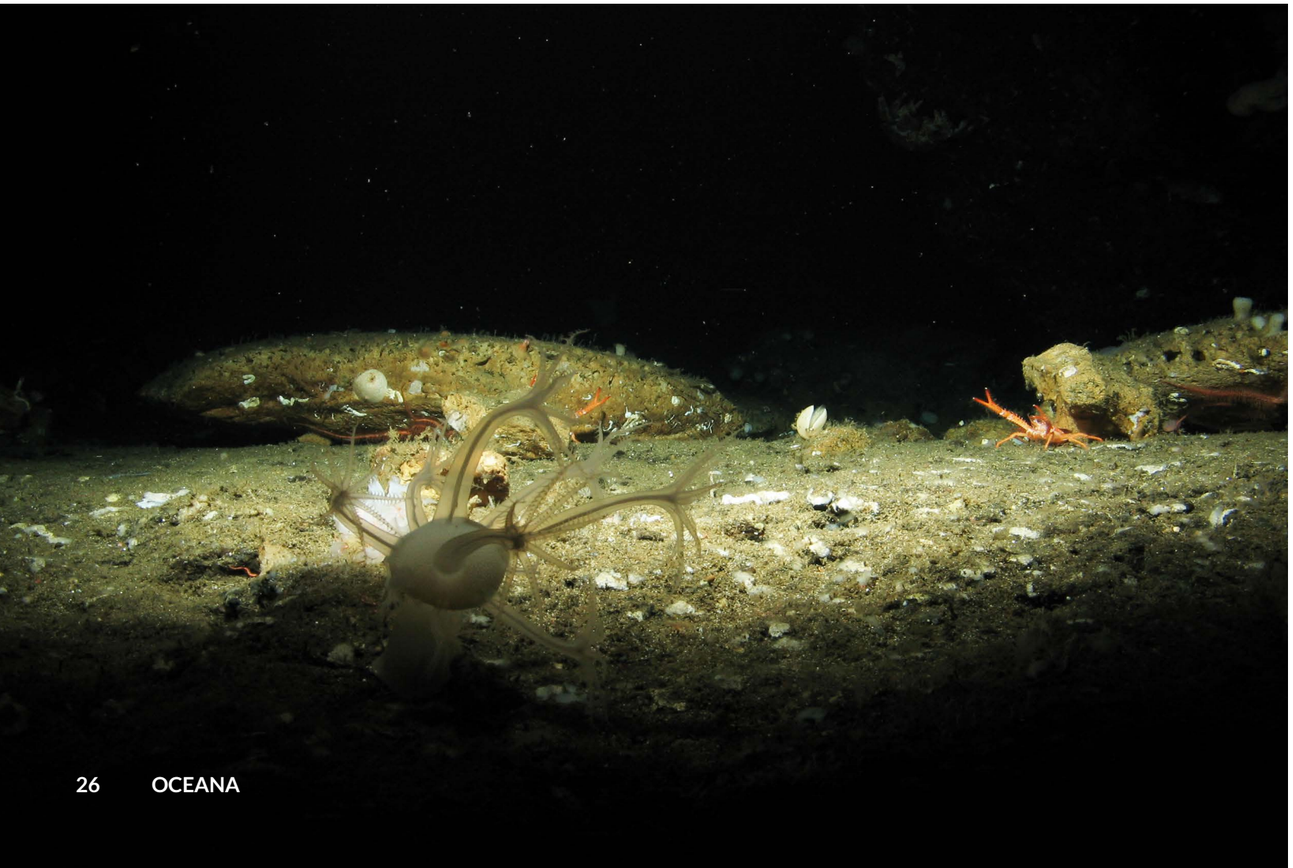
4. South Santa Barbara Island

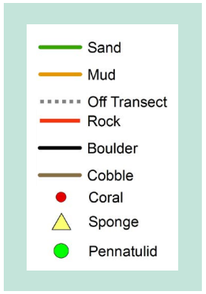
At the South Santa Barbara Island study area, located 11 km off Santa Barbara Island and 76 km from the mainland, we surveyed 1.5 km of the seafloor at a depth up to 272 m. The substrate in this area composed primarily mixed habitat with 11 percent hard and 25 percent soft substrate (Figure 6). At this site, we observed a total of 251 fish, 220 of which are federally managed (Appendix B). While we observed *Sebastomus* rockfish most frequently, this was the only site where we observed cowcod rockfish (Appendix B). The total count of 1,189 invertebrates includes 187 corals and sponges (Appendix B, Table 6). We observed the *Sebastomus* rockfish at the highest density at this site (Appendix B). For the invertebrates, we found squat lobsters and urchins at the highest densities, and across study areas, we observed mushroom soft corals at their highest density at this site (Appendix B).

Table 6. Counts of biogenic habitat species (corals, sponges, and pennatulids) at South Santa Barbara Island.

Biogenic Habitat Species	
Coral	**Count**
Black coral	5
Bubblegum coral	3
Mushroom Soft Coral	20
Red *Swiftia* gorgonian	15
Unidentified orange gorgonian	1
Yellow gorgonian	3
Sponge	**Count**
Gray moon sponge	1
Unidentified boot sponge	7
Unidentified branched sponge	20
Unidentified hairy boot sponge	1
Unidentified lobed sponge	105
Unidentified vase sponge	6
Total	**187**

A mushroom soft coral (*Anthomastus ritteri*) (foreground) at South Santa Barbara Island.





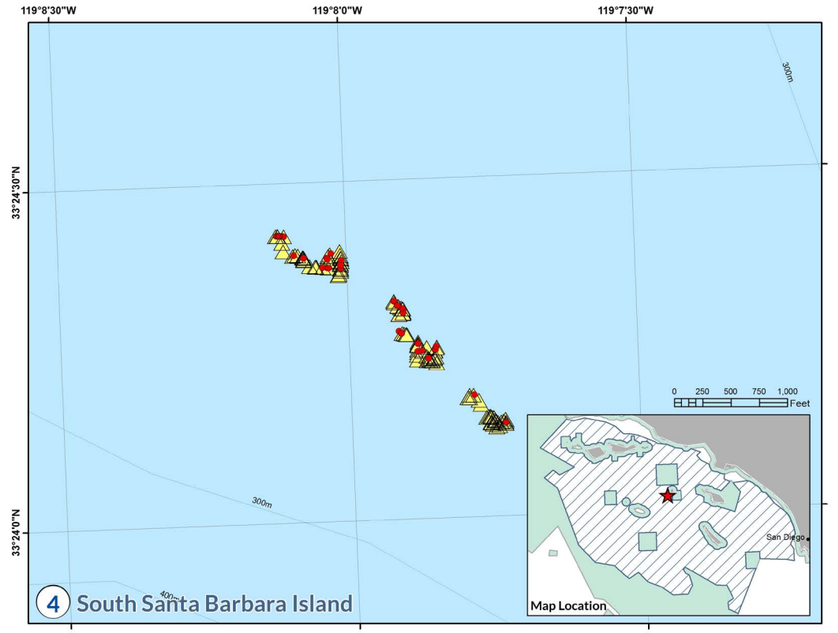


Figure 13. Map of coral, sponge and pennatulid observations along the three completed transects at South Santa Barbara Island.

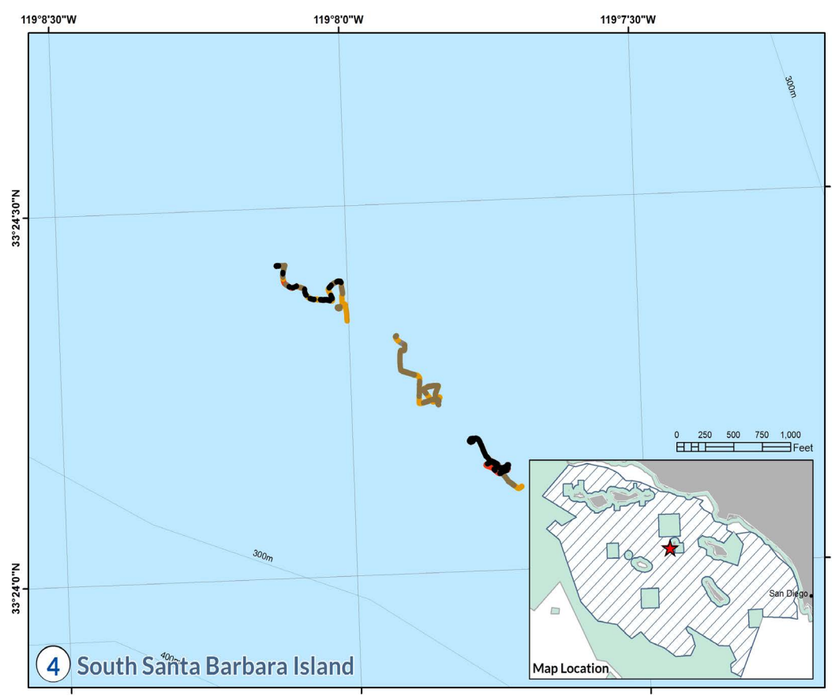


Figure 14. Map of substrate type along the three completed transects at South Santa Barbara Island.

5. Butterfly Bank

At Butterfly Bank – located 120 km offshore San Diego, CA, we completed four transects in the western portion of the bank and two transects in the eastern portion (Figure 15). These transects covered a 2 km distance. The dive at east Butterfly Bank was the only night dive on this expedition. Most of the substrate we observed at the western portion of this site is mixed with a greater percentage of hard habitats, 19 percent, than soft habitats, 17 percent (Figure 6). This is the deepest area we explored during this study, reaching 379 m. Here we documented 236 fish, 222 of which are managed under the Pacific Coast Groundfish FMP (Appendix B). We observed *Sebastomus* rockfish at the highest abundance of the ten, managed species/groupings found here (Appendix B). We documented 5,143 invertebrates including 2,352 corals, sponges and pennatulids (Appendix B, Table 7).

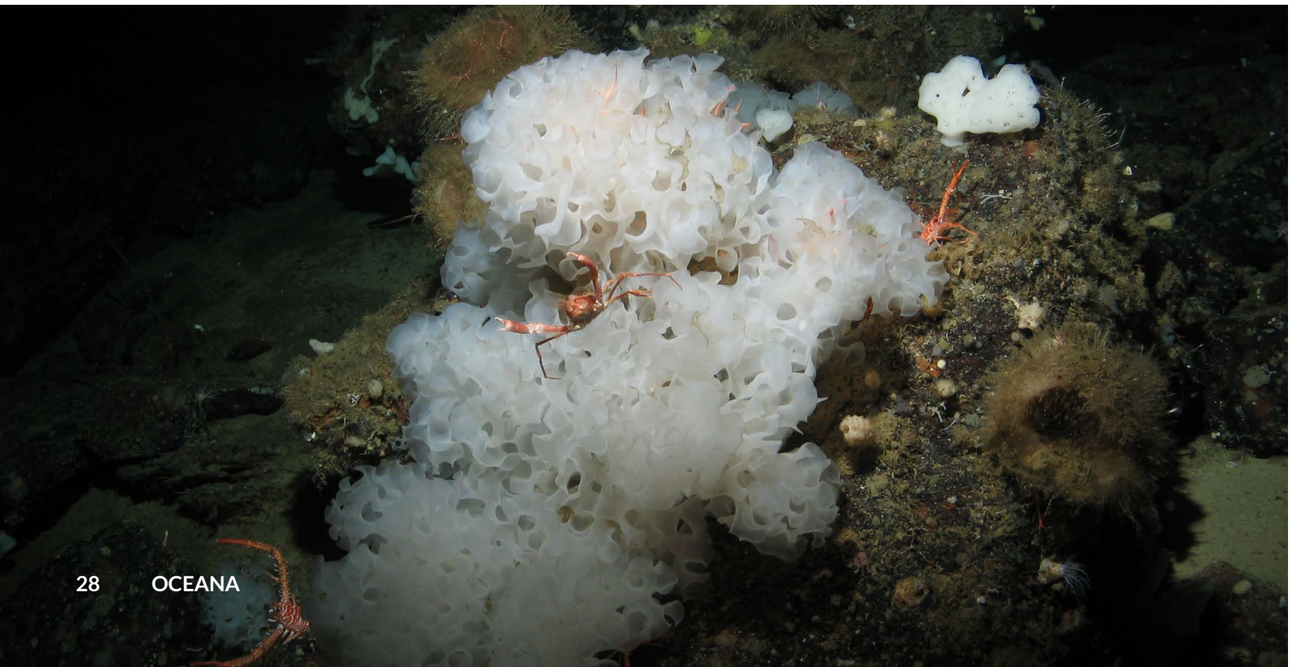
We observed *Sebastomus* rockfish at the highest density for fish species/ groupings at this study area (Appendix B). Here, we observed the highest density of corals and sponges of all study areas including a high density of unidentified lobed, laced, and hairy boot sponge (Appendix B).

We found high numbers and densities of lobed and laced sponges adorning pinnacles and rocky outcrops at Butterfly Bank.

Table 7. Counts of biogenic habitat species (corals, sponges, and pennatulids) at Butterfly Bank.

Biogenic Habitat Species	
Coral	**Count**
Bubblegum coral	6
Mushroom soft coral	13
Red *Swiftia* gorgonian	94
Unidentified orange gorgonian	29
Yellow gorgonian	1
Sponge	**Count**
Unidentified boot sponge	56
Unidentified branched sponge	13
Unidentified hairy boot sponge	403
Unidentified laced sponge	633
Unidentified lobed sponge	1048
Unidentified nipple sponge	3
Unidentified trumpet sponge	14
Unidentified vase sponge	39
Total	**2352**

Laced sponge and squat lobster at Butterfly Bank.



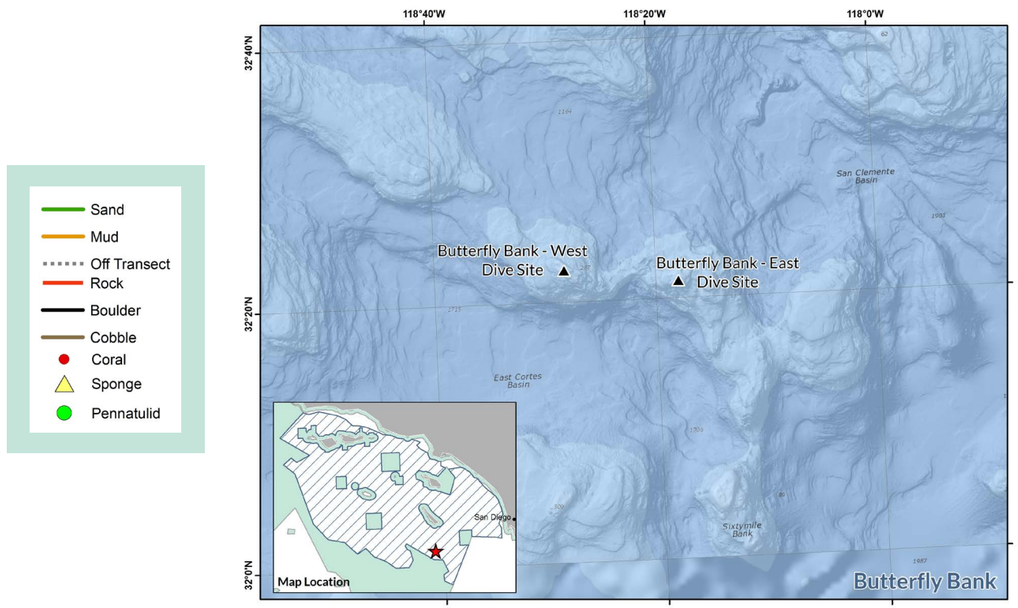


Figure 15. Map of two dive sites in the Butterfly Bank study area.

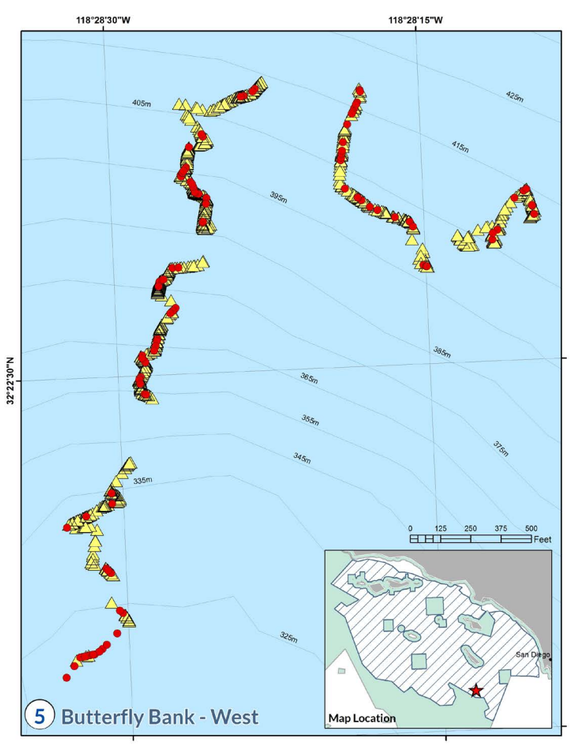


Figure 16. Map of coral and sponge observations along four completed transects at Butterfly Bank- West.

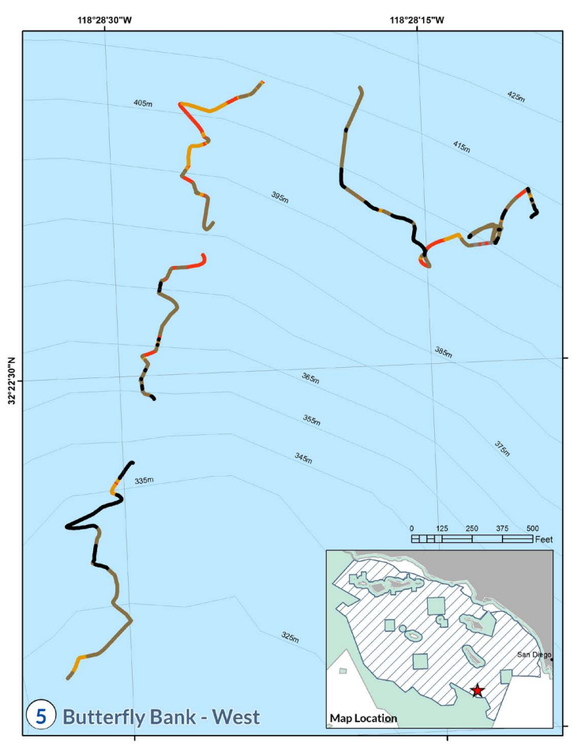
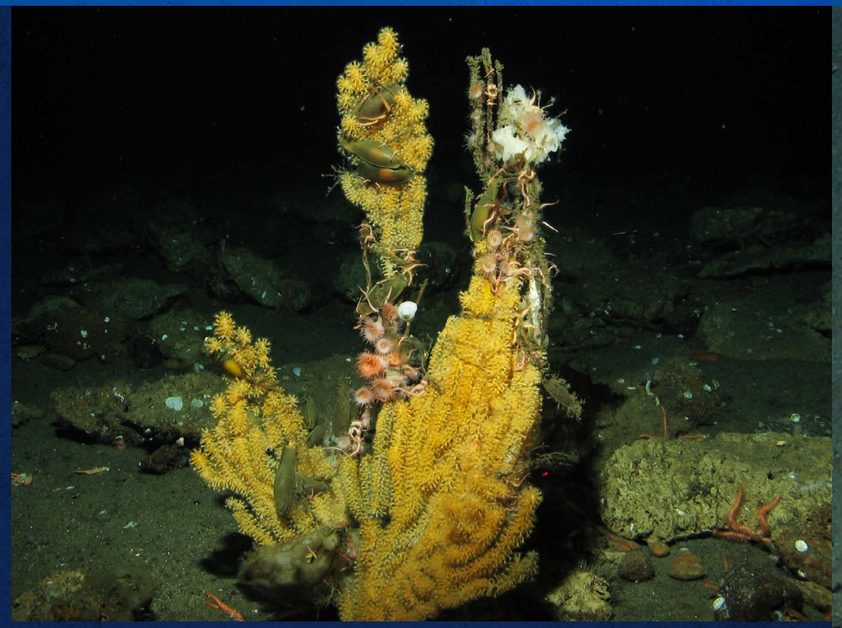


Figure 17. Map of substrate type along four completed transects at Butterfly Bank- West.

Other Observations

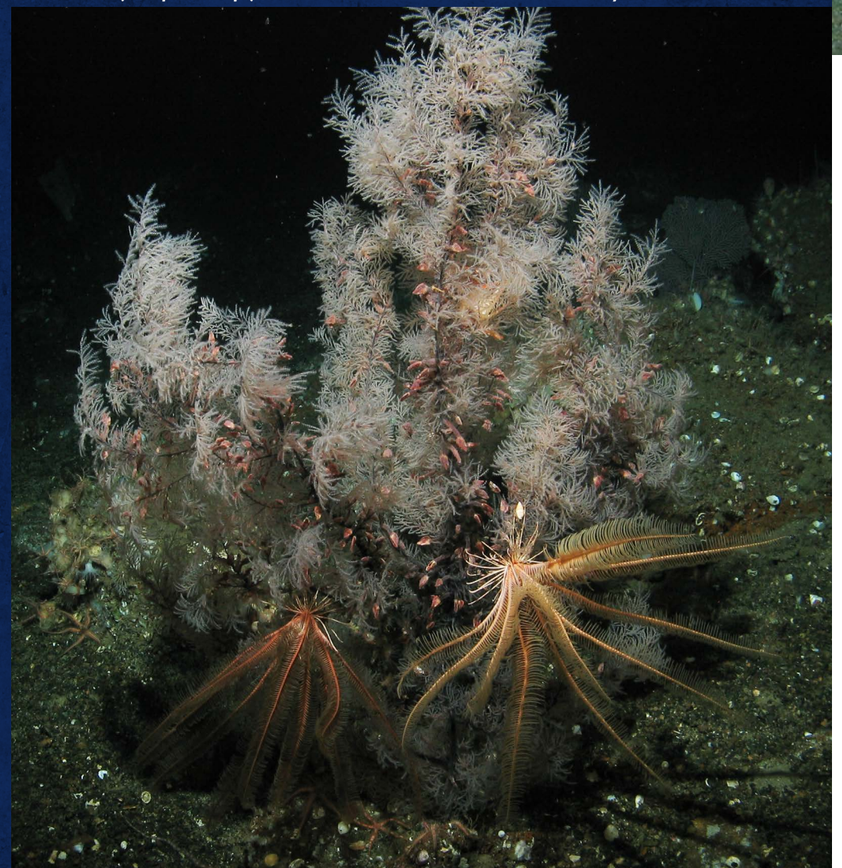
Some other observations and highlights from the expedition include:

- Black corals adorned with hundreds of associated animals, including bright pink barnacles.
- Adult rockfish, including vermillion, flag, bocaccio and cowcod, as well as other commercially valuable fish like lingcod in close association with deep sea corals and sponges.
- Cat shark (*Scyliorhinidae*) eggs laid on yellow corals and laced sponges.
- Octopus wrapped around the base of a vase sponge, appearing to use the sponge for camouflage.
- Ocean sunfish (*Mola mola*), wolf eel, octopus, nudibranchs and other non-commercial marine life associated with the seafloor.
- A large, possible mating aggregation of box crabs on a deep ledge at the South Santa Barbara Island study area.
- Territorial use of sponges by squat lobsters and California king crabs.
- A deceased sea lion at Anacapa Deep Ridge being eaten by pink urchins and spot prawns.



A yellow gorgonian coral adorned with invertebrates and cat shark eggs at the South Santa Barbara Island study area.

Black coral (*Antipathes sp.*) in the West Santa Barbara Island study area.



A flag rockfish (*S. rubrivinctus*) swims among orange gorgonian corals (*Adelogorgia phyllosclera*) off Santa Rosa Island.

Discussion

Corals and sponges create complex and sensitive biological communities in the deep-sea. On the 25 transects we completed in this expedition, we documented 3,644 sponges and 1,120 deep-sea corals, plus 22 pennatulids. Gorgonian corals (Alcyonacea) were the most commonly observed coral type, with three species/groupings representing the majority of coral observations: gray, red *Swiftia* and yellow gorgonians. While species diversity and abundance varied between sites, this study confirms the seafloor of the Southern California Bight contains many complex and sensitive habitat features essential to an array of commercially important deep-sea fishes.

At West Santa Barbara Island, we observed the greatest number of fish and invertebrate species, but we also completed more transects here (eleven) over a greater distance than the remaining four study areas. At Southeast Santa Rosa Island, we documented the highest abundance of fish despite a low abundance of invertebrates, primarily due to a very large count of halfbanded rockfish (Appendix B). At Butterfly Bank, we observed the highest number of invertebrates and the highest density of biogenic habitat species compared with other survey areas (Appendix B). We observed the highest density of invertebrates at Anacapa Deep Ridge, primarily due to very high counts of fragile pink urchin. At the West Santa Barbara Island study area, we observed high numbers of fish and invertebrates, including habitat forming corals and sponges (Appendix B).

We documented a variety of important biogenic habitat (corals, sponges and pennatulids) and important fish species managed under the Pacific Coast Groundfish FMP and noted their associations.

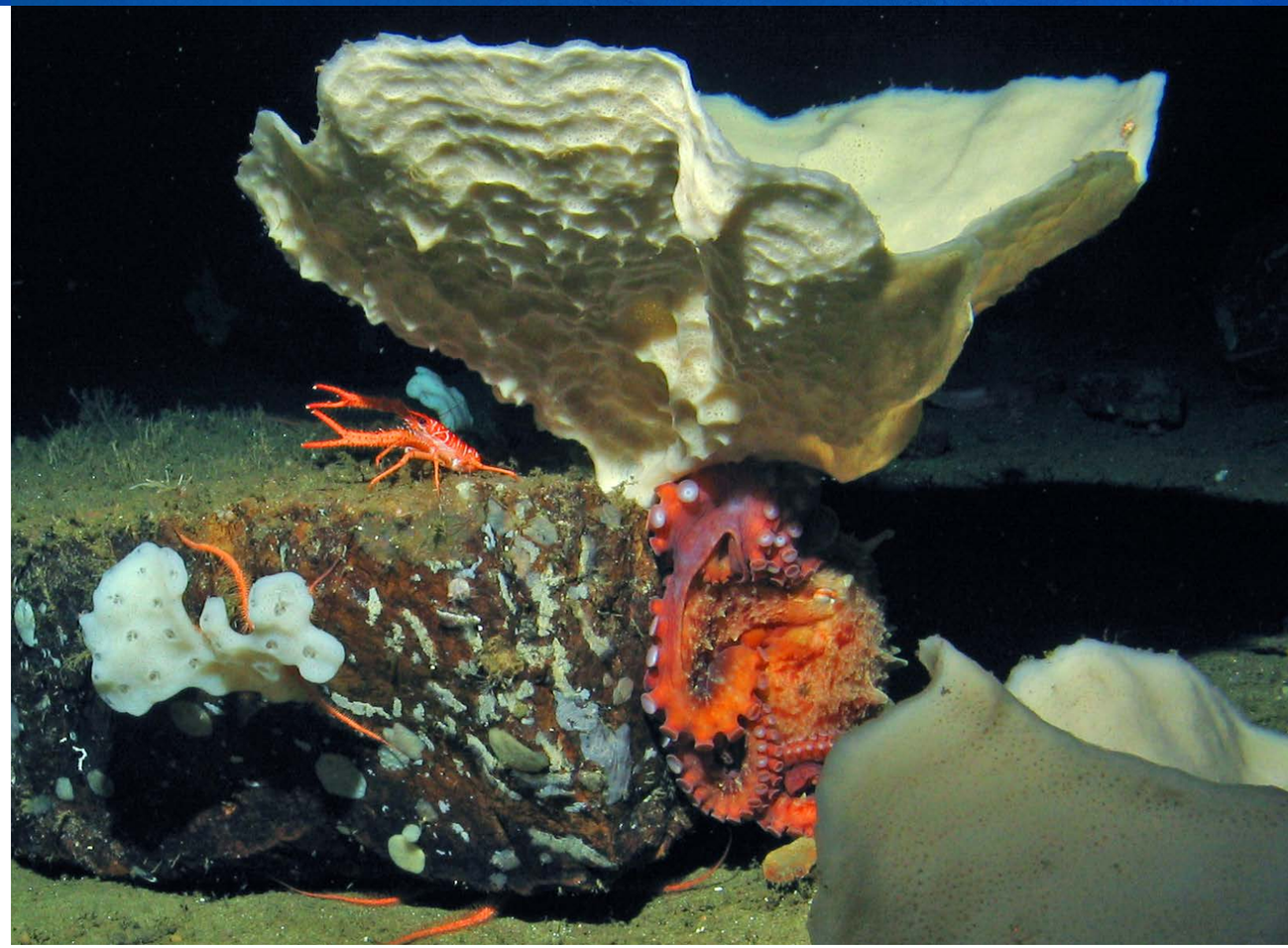
For example, we documented previously overfished species including lingcod, widow, and bocaccio rockfish, plus cowcod rockfish that are currently rebuilding. We also found structure-forming corals, including yellow gorgonian coral, bubblegum coral, and black corals. All observed managed fish species were present at transects that had corals and sponges or pennatulids (Table 2). All observed fish species co-occurred with gorgonian corals (Alcyonacea) and lobed sponges on at least one dive.

Deep-sea corals grow extremely slowly and are highly sensitive to disturbance. Damaged corals and their associated biological communities can take decades to centuries to recover, if at all. We did not observe any evidence of bottom trawl activity at any of the areas we surveyed. Data on the spatial extent of bottom trawling in the Southern California Bight indicates that trawling currently occurs only in areas less than 183 meters (100 fathoms, 600 feet) deep along the mainland coast (CDFW 2016). There is currently no federal groundfish trawling in Southern California due to current economic and regulatory conditions. The sites we surveyed are located further offshore and most are currently protected from bottom trawling because they are either inside the trawl RCA (South Santa Rosa Island), inside California state waters closed to bottom trawling (Anacapa Deep Ridge) or inside the Cowcod Conservation Area (West and South Santa Barbara Island survey areas). Butterfly Bank, however, is open to trawling.

The South Santa Rosa survey area may be imminently vulnerable to trawling if the PFMC decides to lift the trawl RCA without simultaneously adopting the Oceana EFH proposal area for this region. Similarly, areas inside the Cowcod Conservation Area may soon be vulnerable to trawling as this depleted species recovers.

Our findings show that this region warrants a precautionary approach to protections as new discoveries are made and the unique diversity within the Bight is further confirmed. Bottom trawling should not be allowed to expand without first surveying for vulnerable seafloor habitats and a determination made that trawling could occur without adverse impacts. The Southern California Bight portion of the Oceana proposal, as modified by the California Department of Fish and Wildlife (CDFW 2016, Figure 3), would protect more than 16,000 square miles of seafloor habitat. Based on the NOAA Deep Sea Coral and Sponge Database (NOAA 2017), 2,928 coral, 4,568 sponge and 855 sea pen and sea whip records (8,351 combined) have been identified to date inside the Oceana proposed Southern California Bight EFH conservation area. Our study adds an additional 3,289 records inside this area for a total of 882 corals, 2,386 sponges and 21 pennatulids. This is a 39 percent increase in the combined number of coral, sponge and pennatulid records currently in the NOAA Deep Sea Coral and Sponge Database.

A rockfish finds shelter under a sponge adorned with a brightly colored basket star and feather like fern stars at Anacapa Deep Ridge.



An octopus hides out while a squat lobster stands guard beneath a vase sponge in the West Santa Barbara Island study area.

Deep-sea studies are important for the discovery of new biogenic habitat species, like the Christmas tree coral, as well as for documentation of coral, sponge and pennatulid locations. Protecting these vibrant communities is essential, not only for fisheries but as a part of Southern California's diverse ocean heritage and unique wildlife. Beautiful coral gardens, such as those we found off Santa Barbara Island, are being discovered just off the coast of one of the most populated areas in the United States.

As a part of an ongoing effort to identify and protect Important Ecological Areas, this study documented the distribution and abundance of coral and sponge communities, co-occurrence between federally managed groundfish species and physical and biogenic habitat features, and characterized habitats in designated protected areas and areas that are not protected in the Southern California Bight. All biogenic habitat records will be submitted to NOAA's Deep Sea Research and Technology Program for inclusion in the National Deep-Sea Coral and Sponge Database. Future research will further document the location and extent of deep-sea coral and sponge communities, and build on the connections between those habitats and the fish populations that live there.

LITERATURE CITED

Auster PJ, Langton RW (1999) The effects of fishing on fish habitat. In: *Fish Habitat: Essential Fish Habitat and Rehabilitation*. Benaka, L. (ed.). American Fisheries Society, Bethesda, MD.

Ayers J, Blacow A, Enticknap B, Krenz C, Murray S, Roberts S, Shester G, Short J, Warrenchuk J (2010) Important Ecological Areas in the Ocean: A comprehensive ecosystem protection approach the spatial management of marine resources. Oceana. Available: http://oceana.org/en/news-media/publications/reports/important-ecological-areas-in-the-ocean

Bizzaro J (2014) Overview of Recent Studies on Biogenic Habitat Use by FMP Groundfishes in the Eastern North Pacific. Submitted to the Pacific Fishery Management Council by NRDC and Oceana. Agenda Item D.2.d Public Comment. March 2014. Available: http://www.pcouncil.org/wp-content/uploads/D2d_PC_MAR2014BB.pdf

Bright JL (2007) Abundance and distribution of structure-forming invertebrates and their association with fishes at the Channel Islands "footprint" off the southern coast of California. M.S. Thesis. Washington State University. Vancouver, WA.

CDFW (2016). California Department of Fish and Wildlife Report on Modifications to Essential Fish Habitat. Pacific Fishery Management Council. Agenda Item F.4b Supplemental CDFW Report November 2016.

Clarke ME, Whitmire CE, Yoklavich MM (2015) State of Deep-Sea Coral and Sponge Ecosystems of the U.S. West Coast: 2015. In: Hourigan TF, Etnoyer PJ, Cairns SD (eds.) The State of Deep-Sea Coral and Sponge Ecosystems of the United States: 2015. NOAA Technical Memorandum X. NOAA, Silver Spring, pp 5-1 – 5-42.

Council on Environmental Quality (CEQ), The White House (2010) Final Recommendations of the Interagency Ocean Policy Task Force. Executive office of the President of the United States. July 19, 2010.

Davies AJ, Roberts JM, Hall-Spencer J (2007) Preserving deep-sea natural heritage: Emerging issues in offshore conservation and management. Biological Conservation 138: 299-312.

Dick EJ, MacCall AD (2014) Cowcod Rebuilding Analysis. Pacific Fishery Management Council, Portland, OR. 19p.

Du Preez C, Tunnicliffe V (2011) Shortspine thornyhead and rockfish (Scorpaenidae) distribution in response to substratum, biogenic structures and trawling. Marine Ecology Progress Series 425: 217–231.

Enticknap B, Shester G, Gorny M, Kelley M (2013) Important ecological areas: seafloor habitat expedition off the southern Oregon coast. Oceana. Portland, OR. 27p. Available: http://oceana.org/sites/default/files/reports/Oceana_S.OregonIEA.ExpeditionReport_Final.pdf

Etnoyer PJ, Shuler AJ, Frometa J, Lauermann A, Rosen D (2017). Cruise Report for 'Patterns in Deep-Sea Corals' Expedition 2016: NOAA ship Shearwater SW-16-08. NOS NCCOS 233, NOAA National Ocean Service, Charleston, SC 29412. 21p.

Greene, HG, Yoklavich MM, Starr RM, O'Connell VM, Wakefield WW, Sullivan DE, McRea Jr. JJ, Cailliet GM (1999). A classification scheme for deep seafloor habitats: Oceanologica Acta 22(6): 663–678.

Guinotte JM, Davies AJ (2014) Predicted deep-sea coral habitat suitability for the U.S. West Coast. PLoS ONE 9(4): e93918. doi:10.1371/journal.pone.0093918

Hannah RW, Jones SA, Miller W, Knight JS (2009) Effects of trawling for ocean shrimp (*Panadalus jordani*) on macroinvertebrate abundance and diversity at four sites near Nehalem Bank, Oregon. Fishery Bulletin 108(1): 30-38.

Heifetz J, Woodby D, Reynolds J, Stone RP (2007) Deep sea coral distribution and habitat in the Aleutian Archipelago. North Pacific Research Board Final Report 304, 303p.

Hixon MA, Tissot BN (2007) Comparison of trawled vs untrawled mud seafloor assemblages of fishes and macroinvertebrates at Coquille Bank, Oregon. Journal of Experimental Marine Biology and Ecology. 344: 23-34.

Karpov K, Lauermann A, Bergen M, Prall M (2006) Accuracy and Precision of Measurements of Transect Length and Width Made with a Remotely Operated Vehicle. Marine Technical Science Journal 40(3):79–85.

Krieger KJ, Wing BL (2002) Megafaunal associations with deepwater corals (*Primnoa* sp.) in the Gulf of Alaska. Hydrobiologia 471:83–90.

An octopus observed at the Butterfly Bank study area.

Brown box crab (*Lopholithodes foraminatus*) aggregation observed at South Santa Barbara Island study area.

Love MS, Lenarz B, Snook L (2010) A survey of the reef fishes, purple hydrocoral (*Stylaster californicus*), and marine debris of Farnsworth Bank, Santa Catalina Island. Bull. Mar. Sci. 86: 35–52.

Love MS, Schroeder DM, Snook L, York A, Cochrane G (2008). All their eggs in one basket: a rocky reef nursery for the longnose skate (*Raja rhina*) in the southern California Bight. Fishery Bulletin 106: 471–475.

Love MS, Yoklavich MM, Black BA, Andrews AH (2007) Age of black coral (*Antipathes dendrochristos*) colonies, with notes on associated invertebrate species. Bull. Mar. Sci. 80(2): 391-400.

Morgan LE, Chuenpagdee R (2003) Shifting Gears: addressing the collateral impacts of fishing methods in U.S. Waters. Pew Science Series, Washington DC, 42pp.

National Oceanographic and Atmospheric Administration (NOAA) (2017) NOAA Deep-sea Coral Data Portal. Available: https://deepseacoraldata.noaa.gov/ Accessed July 20, 2017.

National Research Council (NRC) (2002) Effects of Trawling and Dredging on Seafloor Habitat. Washington, D.C, National Academy of Sciences, National Research Council.

Oceana (2016) Proposal Overview and Update: Comprehensive conservation alternative to modify U.S. West Coast groundfish essential fish habitat conservation and management. Oceana. Portland, OR. 49p. Available: http://usa.oceana.org/publications/reports/conservation-alternative-modify-us-west-coast-efh-conservation-and-management#

Oceana, NRDC, Ocean Conservancy (2013) Proposal to the Pacific Fishery Management Council to Modify Groundfish Essential Fish Habitat Designation, Conservation, and Enforcement: Comprehensive Conservation Proposal. Oceana. Monterey, CA. 183p. Available: https://s3.amazonaws.com/s3.oceana.org/images/Final.Oceana.NRDC.OC.7.31.13.EFHProposal-2.pdf

Pacific Fishery Management Council (PFMC) (2016) Pacific Coast Groundfish Fishery Management Plan for the California, Oregon and Washington Groundfish Fishery. PFMC. Portland, OR 148p. Available: http://www.pcouncil.org/groundfish/fishery-management-plan/

Pacific Fishery Management Council (PFMC) (2005) Pacific Coast Groundfish Fishery Management Plan. Appendix C, Part 2. The Effects of Fishing on Habitat: West Coast Perspective. November 2005. Available: http://www.pcouncil.org/wp-content/uploads/GF_FMP_App_C2.pdf

Bubblegum corals (*Paragorgia sp.*) are a type of gorgonian sea fan found throughout the Southern California Bight. We observed this specimen at Butterfly Bank.

Pirtle JL (2005) Habitat-based assessment of structure-forming megafaunal invertebrates and fishes on Cordell Bank, California. M.S. Thesis. Washington State University. Vancouver, WA.

Puig P, Canals M, Company JB, Martin J, Amblas D, Lastras G, Planques A, Calafat AM (2012) Ploughing the deep sea floor. Nature. Doi:10.1038/nature11410

Roark EB, Guilderson TP, Dunbar RB, Fallon SJ, Mucclarone DA (2009) Extreme longevity in proteinaceous deep-sea corals. PNAS 106(13) 5204-5208 Doi: 10.1073/pnas.0810875106

Shester G, Warrenchuk J (2007) U.S. Pacific Coast experiences in achieving deep-sea coral conservation and marine habitat protection. Bulletin of Marine Science 81(1): 169-184.

Shester G, Donlou N, Gorny M (2012) Important Ecological Areas Seafloor Habitat Expedition, Monterey Bay, California. Oceana. Monterey, CA. 95p. Available: http://oceana.org/en/news-media/publications/reports/important-ecological-areas-in-monterey-bay

Tissot BN, Yoklavich MM, Love MS, York K, Amend M (2006) Benthic invertebrates that form habitat on deep banks off southern California, with special reference to deep sea coral. Fish. Bull. 104:167-181.

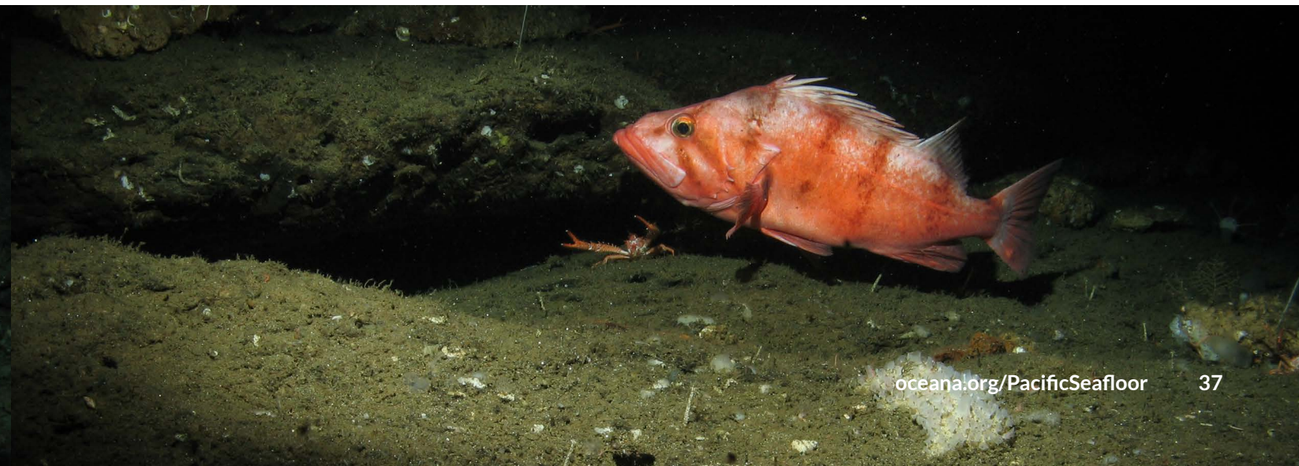
Veisze P, Karpov K (2002) Geopositioning a Remotely Operated Vehicle for Marine Species and Habitat Analysis. Pages 105–115 in Undersea with GIS. Dawn J. Wright, Editor. ESRI Press.

Yoklavich MM, Love MS (2005) Christmas tree corals: A new species discovered off Southern California. The Journal of Marine Education 21(4): 27-30.

Yoklavich MM, Laidig T, Krigsman L, Taylor A, Watters D, Love MS, Lundsten L, Negrete B (2011) A characterization of the coral and sponge community on Piggy Bank seamount in southern California from a survey using a remotely operated vehicle. A report to NOAA Deep-Sea Coral Research and Technology Program. 63p.

Yoklavich MM, Laidig T, Taylor A, Watters D, Krigsman L, Love MS (2013) A characterization of the Christmas tree coral (*Antipathes dendrochristos*) community on three seamounts in the Southern California Bight from a survey using a manned submersible. A report to NOAA Deep-Sea Coral Research and Technology Program. 82p.

Cowcod rockfish (*Sebastes levis*) near a rocky outcrop at South Santa Rosa Island. Once severely overfished, cowcod rockfish are making a recovery in Southern California thanks to catch limits and habitat protections.



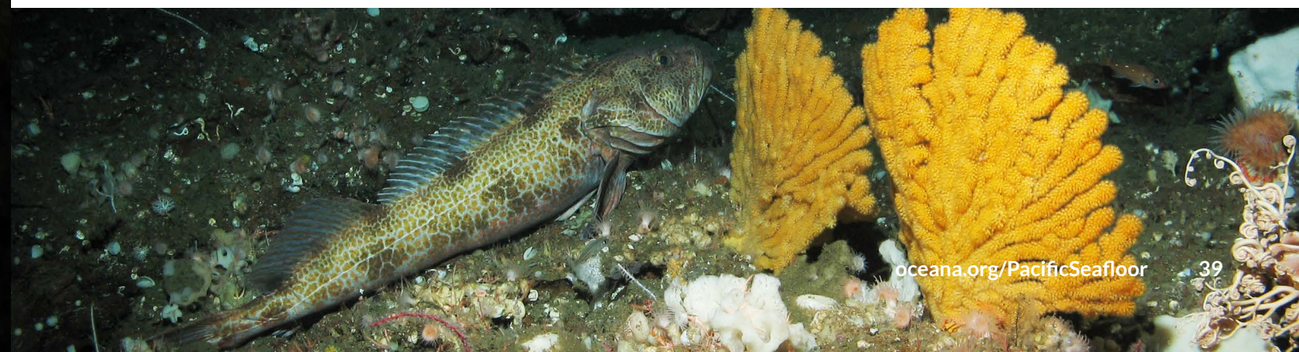
Gray gorgonian corals (*Plumarella sp.*) with rockfish and an orange gorgonian coral (*Adelogorgia phyllosclera*) found in the Oceana EFH proposal area, south of Santa Rosa Island.

APPENDICES

APPENDIX A: Table of start and end coordinates for each analyzed transect.

Site	TransectID	Start Lat	Start Lon	End Lat	End Lon
SE Santa Rosa	SESR-1-b	33.88873208	-119.911876	33.89028745	-119.911311
SE Santa Rosa	SESR-1-c	33.88886079	-119.9080285	33.88865557	-119.9075135
SE Santa Rosa	SESR-1-a	33.88702285	-119.9085018	33.88829904	-119.9107633
Anacapa DR	ADR-1-a	33.97740742	-119.4048535	33.97732768	-119.4066937
Anacapa DR	ADR-2-a	33.97852503	-119.4086452	33.97958121	-119.4093187
W Santa Barbara	WSB-5-a	33.47955466	-119.1462378	33.47872011	-119.1437867
W Santa Barbara	WSB-5-b	33.47860279	-119.1430663	33.478148	-119.1405657
W Santa Barbara	WSB-6-b	33.48696949	-119.2073866	33.48577093	-119.2063201
W Santa Barbara	WSB-6-c	33.48464124	-119.2062952	33.48296122	-119.2044324
W Santa Barbara	WSB-6-d	33.48225412	-119.2039603	33.48014788	-119.2028522
W Santa Barbara	WSB-6-a	33.49008253	-119.2058367	33.48813071	-119.2076495
W Santa Barbara	WSB-1-a	33.49279854	-119.1341597	33.49109802	-119.1331036
W Santa Barbara	WSB-1-b	33.49119242	-119.132573	33.48964863	-119.1315828
W Santa Barbara	WSB-4-a	33.48181518	-119.148465	33.4811477	-119.1468137
W Santa Barbara	WSB-4-b	33.48105358	-119.1465378	33.4802162	-119.1455654
W Santa Barbara	WSB-4-c	33.4802579	-119.1449724	33.47988814	-119.1440318
S Santa Barbara	SSB-1-a	33.40703744	-119.1354126	33.40574421	-119.133425
S Santa Barbara	SSB-1-b	33.40536544	-119.1320221	33.40393756	-119.1308265
S Santa Barbara	SSB-1-c	33.40298562	-119.1299172	33.40186821	-119.1285594
Butterfly Bank W	WBB-2-a	32.37161291	-118.4758973	32.37401972	-118.4749094
Butterfly Bank W	WBB-2-b	32.3747324	-118.4745903	32.37633754	-118.4738562
Butterfly Bank W	WBB-2-c	32.37669753	-118.4737028	32.37827167	-118.472955
Butterfly Bank W	WBB-3-a	32.37815887	-118.4716697	32.37660989	-118.4694546
Butterfly Bank E	EBB-1-a	32.35462709	-118.3047882	32.35613277	-118.3047511
Butterfly Bank E	EBB-1-b	32.35713963	-118.3047851	32.35871724	-118.3047491

A lingcod (*O. elongatus*) and yellow gorgonians (*Acanthogorgia sp.*) in the West Santa Barbara Island Study Area.

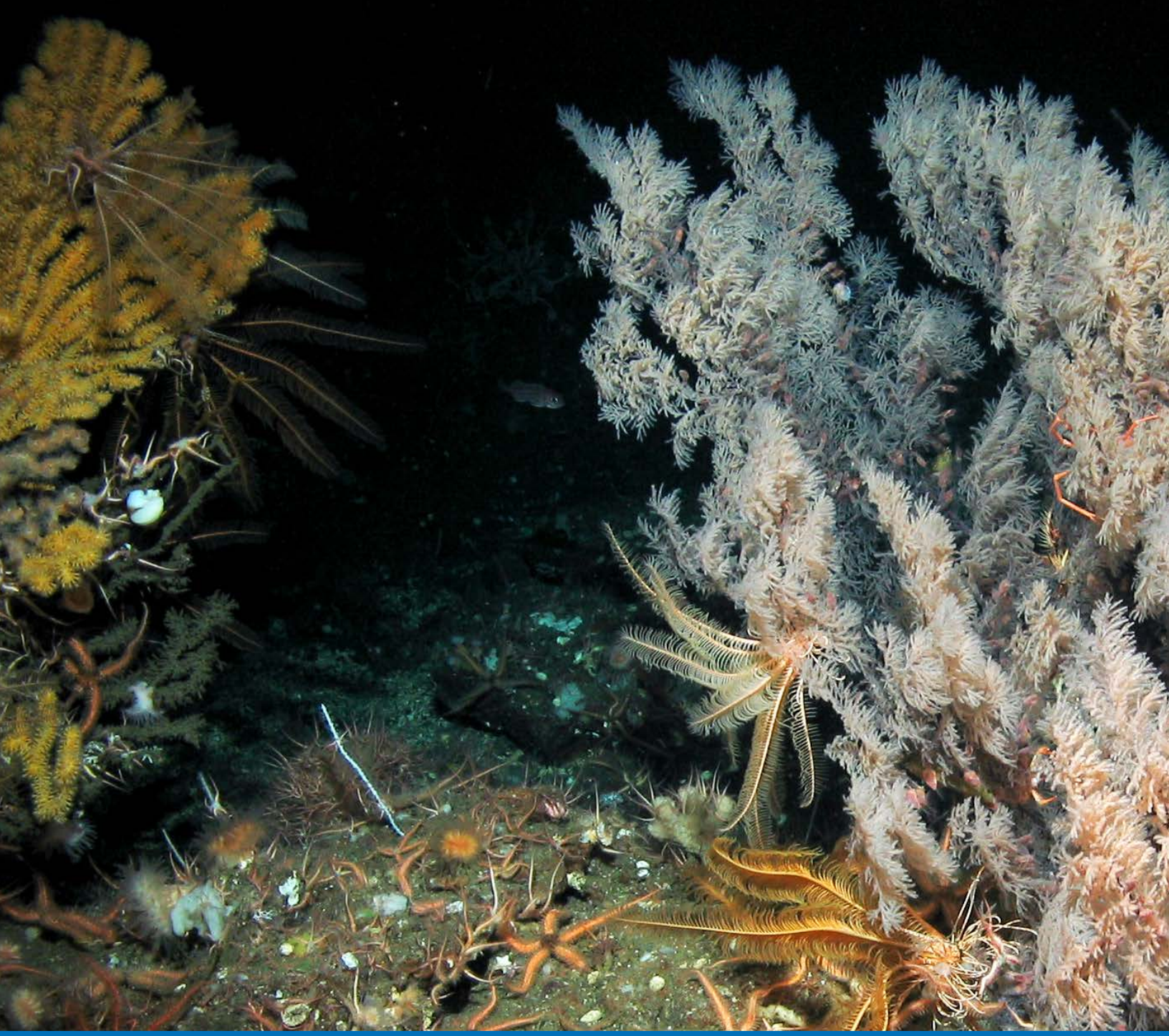


APPENDIX B: Counts and density of species/groupings of fish and invertebrates, and species richness of FMP fish and corals, sponges and pennatulids by study area.

Species observed		Counts					Density (count/100m²)					
FMP Fish		Southeast Santa Rosa Is.	Anacapa Deep Ridge	West Santa Barbara Is.	South Santa Barbara Is.	Butterfly Bank	*Total Observations*	Southeast Santa Rosa Is.	Anacapa Deep Ridge	West Santa Barbara Is.	South Santa Barbara Is.	Butterfly Bank
Fish Transect Area:		4,399 m²	2,270 m²	17,900 m²	5,477 m²	9,450 m²		4,399 m²	2,270 m²	17,900 m²	5,477 m²	9,450 m²
Common Name	**Species Name**											
Aurora/splitnose complex	*Sebastes aurora* or *diploproa*	—	1	—	—	20	21	—	0.04	—	—	0.21
Bank rockfish	*Sebastes rufus*	—	26	11	15	40	92	—	1.15	0.06	0.27	0.42
Blackgill rockfish	*Sebastes melanostomus*	—	4	10	—	1	15	—	0.18	0.06	—	0.01
Bocaccio	*Sebastes paucispinis*	1	—	1	—	—	2	0.02	—	0.01	—	—
Bronzespotted rockfish	*Sebastes gilli*	—	—	1	—	—	1	—	—	0.01	—	—
Cowcod	*Sebastes levis*	—	—	—	17	—	17	—	—	—	0.31	—
Dover sole	*Microstomus pacificus*	—	4	7	—	—	11	—	0.18	0.04	—	—
Flag rockfish	*Sebastes rubrivinctus*	1	—	—	—	1	2	0.02	—	—	—	0.01
Greenspotted rockfish	*Sebastes chlorostictus*	17	—	10	1	—	28	0.39	—	0.06	0.02	—
Greenstriped rockfish	*Sebastes elongatus*	5	—	2	20	—	27	0.11	—	0.01	0.37	—
Halfbanded rockfish	*Sebastes semicinctus*	1981	—	—	—	—	1981	45.03	—	—	—	—
Lingcod	*Ophiodon elongatus*	3	—	3	—	—	6	0.07	—	0.02	—	—
Longnose skate	*Raja rhina*	—	—	1	—	—	1	—	—	0.01	—	—
Mexican rockfish	*Sebastes macdonaldi*	—	—	—	1	—	1	—	—	—	0.02	—
Pacific hake	*Merluccius productus*	—	—	1	—	—	1	—	—	0.01	—	—
Pinkrose rockfish	*Sebastes simulator*	—	—	7	—	—	7	—	—	0.04	—	—
Pygmy rockfish	Sebastes wilsoni	64	—	74	—	—	138	1.45	—	0.41	—	—
Sebastomus rockfish	*Sebastomus sp.*	41	22	181	71	93	408	0.93	0.97	1.01	1.30	0.98
Shortbelly rockfish	*Sebastes jordani*	—	—	7	44	—	51	—	—	0.04	0.80	—
Shortspine thornyhead	*Sebastolobus alascanus*	1	—	—	—	1	2	—	—	—	0.02	0.01
Small schooling rockfish	10-15cm rockfish sp.	15	—	40	—	—	55	0.34	—	0.22	—	—
Splitnose rockfish	*Sebastes diploproa*	—	20	34	—	15	69	—	0.88	0.19	—	0.16
Spotted ratfish	*Hydrolagus colliei*	2	4	—	—	3	9	0.05	0.18	—	—	0.03
Squarespot rockfish	*Sebastes hopkinsi*	3	—	21	—	—	24	0.07	—	0.12	—	—
Squarespot/Widow complex	*Sebastes hopkinsi* or *entomelas*	8	—	44	—	—	52	0.18	—	0.25	—	—
Stripetail rockfish	*Sebastes saxicola*	3	—	—	—	—	3	0.07	—	—	—	—
Swordspine rockfish	*Sebastes ensifer*	53	—	650	18	—	721	1.20	—	3.63	0.33	—
Thornyhead complex	*Sebastolobus altivelis* or *alascanus or macrochir*	—	2	—	—	3	5	—	0.09	—	—	0.03
UI rockfish	Unidentified Sebastes sp.	15	12	125	25	45	222	0.34	0.53	0.70	0.46	0.48
Whitespeckled rockfish	*Sebastes moseri*	—	—	3	—	—	3	—	—	0.02	—	—
YOY rockfish	Young of Year (<10 cm rockfish sp.)	14	—	730	7	—	751	0.32	—	4.08	0.13	—
Total		**2227**	**95**	**1963**	**219**	**222**	**4726**	**50.63**	**4.19**	**10.97**	**4.00**	**2.35**
Number of Species	FMP Fish	*17*	*9*	*22*	*10*	*10*	**31**					

Species observed		Counts					Density (count/100m²)					
Other Fish		Southeast Santa Rosa Is.	Anacapa Deep Ridge	West Santa Barbara Is.	South Santa Barbara Is.	Butterfly Bank	*Total Observations*	Southeast Santa Rosa Is.	Anacapa Deep Ridge	West Santa Barbara Is.	South Santa Barbara Is.	Butterfly Bank
	Fish Transect Area:	4,399 m²	2,270 m²	17,900 m²	5,477 m²	9,450 m²		4,399 m²	2,270 m²	17,900 m²	5,477 m²	9,450 m²
Common Name	**Species Name**											
Combfish complex	*Zaniolepis frenata* or *latipinnis*	71	3	27	21	—	122	1.61	0.13	0.15	0.38	—
Pacific hagfish	*Eptatretus stoutii*	—	1	2	—	—	3	—	0.04	0.01	—	—
Pink surfperch	*Zalembius rosaceus*	3	—	—	—	—	3	0.07	—	—	—	—
UI cod	Unidentified Gadidae	—	—	—	—	8	8	—	—	—	—	0.08
UI eel pout etc.	Unidentified Zoarcidae, Blennidae, Pholididae or Stichaeidae	9	3	—	—	—	12	0.20	0.13	—	—	—
UI flatfish	Unidentified Pleuronectidae	18	10	6	—	1	35	0.41	0.44	0.03	—	0.01
UI grenadier	Unidentified Macrouridae	—	—	—	—	2	2	—	—	—	—	0.02
UI poacher	Unidentified Agonidae	—	19	52	—	—	71	—	0.84	0.29	—	—
UI ray/skate	Unidentified ray or skate	1	—	—	—	—	1	0.02	—	—	—	—
UI sanddab	Unidentified *Citharichthys sp.*	2	—	—	—	—	2	0.05	—	—	—	—
UI sculpin	Unidentified Cottidae	—	2	10	3	—	15	—	0.09	0.06	0.05	—
UI small benthic fish	Unidentified small benthic fish	6	4	38	7	3	58	0.14	0.18	0.21	0.13	0.03
Wolf Eel	*Anarrhichthys ocellatus*	1	—	—	—	—	1	0.02	—	—	—	—
Total		**111**	**42**	**135**	**31**	**14**	**333**	**2.52**	**1.85**	**0.75**	**0.57**	**0.15**
Corals, Sponges, Pennatulids		Southeast Santa Rosa Is.	Anacapa Deep Ridge	West Santa Barbara Is.	South Santa Barbara Is.	Butterfly Bank	*Total Observations*	Southeast Santa Rosa Is.	Anacapa Deep Ridge	West Santa Barbara Is.	South Santa Barbara Is.	Butterfly Bank
	Invert Transect Area:	2,860 m²	1,476 m²	11,635 m²	3,560 m²	6,322 m²		2,860 m²	1,476 m²	11,635 m²	3,560 m²	6,322 m²
Common Name	**Species Name**											
Black coral	*Antipathes sp.*	—	10	19	5	—	34	—	0.68	0.16	0.14	—
Bubblegum coral	*Paragorgia sp.*	—	7	9	3	6	25	—	0.47	0.08	0.08	0.09
Gray gorgonian	*Plumarella sp.*	—	4	552	—	—	556	—	0.27	4.74	—	—
Gray moon sponge	*Spheciospongia confoederata*	—	—	1	1	—	2	—	—	0.01	0.03	—
Mushroom soft coral	*Anthomastus ritteri*	—	—	4	20	13	37	—	—	0.03	0.56	0.21
Orange puffball sponge	*Tethya aurantia*	—	—	1	—	—	1	—	—	0.01	—	—
Red gorgonian	*Lophogorgia chilensis*	—	—	1	—	—	1	—	—	0.01	—	—
Red Swiftia gorgonian	*Swiftia sp.*	8	38	111	15	94	266	0.28	2.57	0.95	0.42	1.49
Sea whip	*Halipteris californica*	7	—	—	—	—	7	0.24	—	—	—	—
UI boot sponge	Unidentified Porifera	—	3	66	7	56	132	—	0.20	0.57	0.20	0.89
UI branched sponge	Unidentified Porifera	6	—	202	20	13	241	0.21	—	1.74	0.56	0.21
UI gorgonian	Unidentified Gorgonacea	—	—	3	—	—	3	—	—	0.03	—	—
UI hairy boot sponge	Unidentified Porifera	—	—	27	1	403	431	—	—	0.23	0.03	6.37
UI laced sponge	Unidentified Porifera	—	—	—	—	633	633	—	—	—	—	10.01
UI large yellow sponge	Unidentified Porifera	—	—	44	—	—	44	—	—	0.38	—	—
UI lobed sponge	Unidentified Porifera	33	19	724	105	1048	1929	1.15	1.29	6.22	2.95	16.58
UI nipple sponge	Unidentified Porifera	—	—	1	—	3	4	—	—	0.01	—	0.05
UI orange gorgonian	Unidentified orange Gorgonacea	—	10	—	1	29	40	—	0.68	—	0.03	0.46
UI sea pen	*Virgularia sp.*	—	5	2	—	—	7	—	0.34	0.02	—	—
UI trumpet sponge	Unidentified Porifera	—	—	—	—	14	14	—	—	—	—	0.22
UI vase sponge	Unidentified Porifera	—	1	167	6	39	213	—	0.07	1.44	0.17	0.62
White sea pen	*Stylatula elongata*	—	1	7	—	—	8	—	0.07	0.06	—	—
Yellow gorgonian	*Acanthogorgia sp.*	8	—	146	3	1	158	0.28	—	1.25	0.08	0.02
Total		**62**	**98**	**2087**	**187**	**2352**	**4786**	**2.17**	**6.64**	**17.94**	**5.25**	**37.20**
Number of species	Corals, Sponges, Pennatulids	*5*	*10*	*19*	*12*	*13*	**23**					

Species observed		Counts					Density (count/100m²)					
Other Macro-Invertebrates		Southeast Santa Rosa Is.	Anacapa Deep Ridge	West Santa Barbara Is.	South Santa Barbara Is.	Butterfly Bank	*Total Observations*	Southeast Santa Rosa Is.	Anacapa Deep Ridge	West Santa Barbara Is.	South Santa Barbara Is.	Butterfly Bank
	Invert Transect Area:	2,860 m²	1,476 m²	11,635 m²	3,560 m²	6,322 m²		2,860 m²	1,476 m²	11,635 m²	3,560 m²	6,322 m²
Common Name	**Species Name**											
Basket star	*Gorgonocephalus eucnemis*	92	22	272	4	63	453	3.22	1.49	2.34	0.11	1.00
Benthic siphonophore	*Dromalia alexandri*	—	7	7	8	3	25	—	0.47	0.06	0.22	0.05
Brown box crab	*Lopholithodes foraminatus*	—	2	—	—	—	2	—	0.14	—	—	—
California king crab	*Paralithodes californiensis*	—	1	10	2	—	13	—	0.07	0.09	0.06	—
Cookie star	*Ceramaster patagonicus*	18	4	36	34	16	108	0.63	0.27	0.31	0.96	0.25
Crested sea star	*Lophaster furcilliger*	—	—	6	—	2	8	—	—	0.05	—	0.03
Cushion star	*Pteraster tesselatus*	—	—	1	—	—	1	—	—	0.01	—	—
Decorator crab	*Loxorhynchus crispatus*	—	—	2	—	—	2	—	—	0.02	—	—
Deep sea cucumber	*Pannychia moseleyi*	—	—	17	—	4	21	—	—	0.15	—	0.06
Fish eating star	*Stylasterias forreri*	5	—	2	14	3	24	0.17	—	0.02	0.39	0.05
Fragile pink urchin	*Strongylocentrotus fragilis*	1	2667	424	285	26	3403	0.03	180.69	3.64	8.01	0.41
Henricia complex	*Henricia sp.*	17	1	26	8	15	67	0.59	0.07	0.22	0.22	0.24
Long legged sunflower star	*Rathbunaster californicus*	—	—	249	21	38	308	—	—	2.14	0.59	0.60
Pom-pom anemone	*Liponema brevicornis*	—	—	7	4	2	13	—	—	0.06	0.11	0.03
Red octopus	*Octopus rubescens*	—	—	1	—	—	1	—	—	0.01	—	—
Red sea star	*Mediaster aequalis*	10	—	1	7	—	18	0.35	—	0.01	0.20	—
Rose star	*Crossaster paposus*	—	—	1	—	—	1	—	—	0.01	—	—
Sand star	*Luidia foliolata*	1	—	—	—	—	1	0.03	—	—	—	—
Solaster sun star complex	*Solaster sp.*	—	—	3	—	3	6	—	—	0.03	—	0.05
Spiny red star	*Hippasteria spinosa*	1	—	6	2	10	19	0.03	—	0.05	0.06	0.16
Spiny/thorny star complex	*Poraniopsis inflata* or *Hippasteria spinosa*	—	—	3	—	—	3	—	—	0.03	—	—
Spot prawn	*Pandalus platyceros*	—	16	2	1	—	19	—	1.08	0.02	0.03	—
Squat lobster	*Munida quadrispina*	—	65	672	544	1351	2632	—	4.40	5.78	15.28	21.37
Thorny sea star	*Poraniopsis inflata*	—	—	2	14	—	16	—	—	0.02	0.39	—
UI anemone	Unidentified Actiniaria	—	—	10	1	6	17	—	—	0.09	0.03	0.09
UI anemone 1	Unidentified Actiniaria	—	—	1	—	—	1	—	—	0.01	—	—
UI anemone 2	Unidentified Actiniaria	—	—	10	3	1	14	—	—	0.09	0.08	0.02
UI anemone 4	Unidentified Actiniaria	—	6	49	4	8	67	—	0.41	0.42	0.11	0.13
UI nudibranch	Unidentified Nudibranchia	—	1	—	—	—	1	—	0.07	—	—	—
UI octopus	Unidentified Octopodidae	—	—	3	—	2	5	—	—	0.03	—	0.03
UI prawn	Unidentified Decapoda	—	—	—	—	10	10	—	—	—	—	0.16
UI sand dwelling anemone	Unidentified Actiniaria	2	—	2	—	—	4	0.07	—	0.02	—	—
UI sea star	Unidentified Asteroidea	9	1	27	15	18	70	0.31	0.07	0.23	0.42	0.28
UI thin red star	Unidentified Asteroidea	1	1	—	—	57	59	0.03	0.07	—	—	0.90
UI tubeworm	Unidentified Annelida	10	—	21	22	11	64	0.35	—	0.18	0.62	0.17
UI urchin	Unidentified Echinoidea	—	—	1	—	—	1	—	—	0.01	—	—
White slipper sea cucumber	*Pusolus sp.*	3	2	318	6	1079	1408	0.10	0.14	2.73	0.17	17.07
White spine sea cucumber	*Parastichopus leukothele*	4	—	264	3	63	334	0.14	—	2.27	0.08	1.00
White-plumed anemone	*Metridium farcimen*	1	—	—	—	—	1	0.03	—	—	—	—
Total		**175**	**2796**	**2456**	**1002**	**2791**	**9220**	**6.12**	**189.43**	**21.11**	**28.15**	**44.15**



Oceana is the largest international advocacy organization dedicated solely to ocean conservation. Oceana is rebuilding abundant and biodiverse oceans by winning science-based policies in countries that control one third of the world's wild fish catch. With over 100 victories that stop overfishing, habitat destruction, pollution and killing of threatened species like turtles and sharks, Oceana's campaigns are delivering results. A restored ocean means that one billion people can enjoy a healthy seafood meal, every day, forever. Together, we can save the oceans and help feed the world.

Visit www.oceana.org to learn more.

OCEANA Protecting the World's Oceans

A black Christmas tree coral (*Antipathes sp.*) observed on the Oceana Southern California Bight Expedition.