July 31, 2013

A Proposal to Consider Options for New EFH HAPC(s) and Conservation Areas Submitted by Gulf of the Farallones National Marine Sanctuary

Rittenburg Bank   Cochrane Bank   Farallon Escarpment

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I. Proposal

1. **Date of Proposal:** July 31, 2013
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Background

Gulf of the Farallones National Marine Sanctuary (GFNMS or sanctuary) proposes options to the Pacific Fishery Management Council (Council) to modify Pacific Coast Groundfish Essential Fish Habitat (EFH) management measures. These options reflect a review of new information regarding the following three ecologically important habitat areas *(Figure 1)*:
   1) Area 1 - Rittenburg Bank to Fanny Shoal;
   2) Area 2 - "Cochrane" Bank (unofficial name); and
   3) Area 3 - Farallon Escarpment.
Proposed specific restrictions can be found in *Section 4 – Proposed Actions*.

GFNMS has developed the parameters of proposed options based on the Groundfish EFH Review Phase 1 Report (September 2012), the EFH Synthesis Report (April 2013), the Consolidated GIS Data Catalog and Online Registry for the 5-Year Review of Pacific Coast Groundfish EFH (or EFH Catalog for short), and has provided an in depth look at the geology, biogenic habitat and groundfish located within these areas. While the proposed options are designed to principally achieve the EFH provisions of the Magnuson-Stevens Fishery Conservation and Management Act (MSA), the principal statutory basis for fishery management within the Exclusive Economic Zone, they are also consistent with strategies in the GFNMS management plan that address ecosystem-based management, resource protection and fishing activities within the sanctuary. .

The proposed options to modify groundfish EFH are offered at the beginning of a potential Council process to review and change EFH management measures (Phase 3). As such, it should be noted that GFNMS has put forth boundary designs for three areas fully recognizing that additional changes may be warranted and could be made to these boundary designs. GFNMS supports and encourages additional discussions about the design and protections within the areas proposed. The current boundary designs were developed based on numerous discussions and feedback from local stakeholders, including the fishing community. However, stakeholders have not reached specific agreements with the particular boundary designs for these areas and/or proposed management measures that minimize to the extent practicable adverse impacts from fishing. GFNMS intends to coordinate with stakeholders, agencies, institutions, and organizations to help build partnerships to garner support for reviewing and supporting EFH HAPC and EFH Conservation Area designations within GFNMS.

GFNMS puts forward these options as a starting point for Council consideration. We are committed to continuing discussions with potentially affected fishermen to facilitate information to the Council and working through the Council process, regarding ways to protect groundfish EFH while minimizing economic impact to the fishery in a practicable manner.

FIGURE 1: Proposed Options for New Ecologically Important Habitat Areas (aka EFH Conservation Areas) off the Coast of Marin and San Francisco Counties
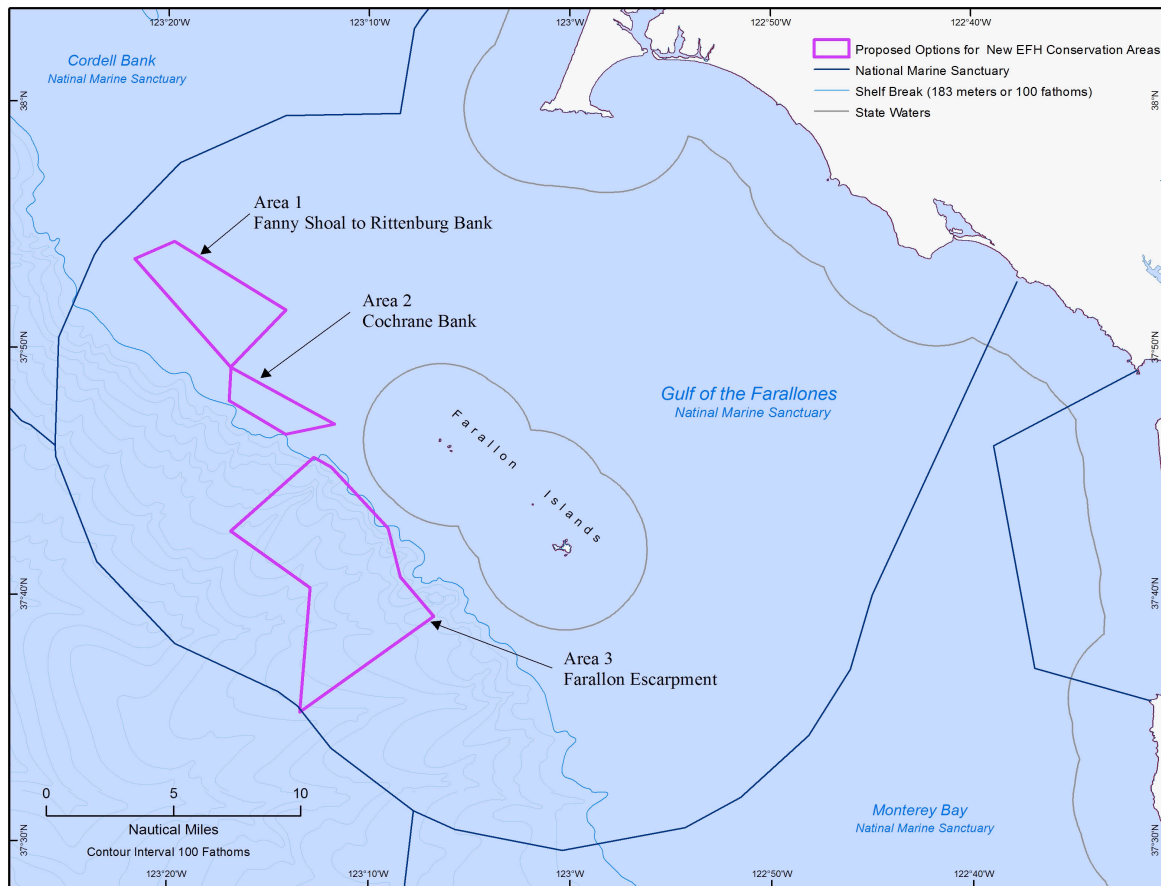

NOTE: GIS shapefiles have been submitted to the Council.

3a. Proposal Objectives

- *Primary Goal:* To 1) identify and present information on three habitat areas consistent with groundfish EFH within GFNMS that are currently not protected by EFH management measures that are unique, rare and/or ecologically sensitive either due to geologic features and/or contain known biogenic habitat (i.e. deep sea corals and sponges); and could be vulnerable to impacts of fishing on Groundfish Fishery Management Plan (FMP) EFH; 2) propose new EFH Habitat Areas of Particular Concern (HAPC) "Areas of Interest" and 3) propose options for new ecologically important habitat protection areas (aka EFH Conservation Areas) to minimize the adverse effects of fishing on groundfish EFH, while also minimizing socioeconomic impacts to the fishing community to the extent practicable, and furthering the protection of both biogenic and physical Groundfish FMP species habitat.
- *Objectives:*
    1. Present detailed relevant data recently collected in the proposed areas that can assist the Council if they move forward with a proposed action; and use Amendement 19 of the Groundfish FMP and the EFH Reports (Phase 1 Report and EFH Synthesis Report) as the basis for the proposed options.
    2. Propose Council consideration of new EFH HAPCs "Areas of Interest" at Rittenburg

Bank and Cochrane Bank.

3. Propose Groundfish FMP species habitat protection to the extent practicable on the upper slope and shelf by proposing options for three new groundfish EFH ecologically important habitat areas, or EFH Conservation Areas, within GFNMS (*Figure 1*). These areas are also shown as part of the Central Biogeographic Subregion in *Figure 2*.

4. Recommend action for new EFH designations within GFNMS that will protect groundfish EFH from adverse impact from fishing, while presenting options that meet the practicability standards of the MSA act while having minimal socioeconomic impact on the groundfish fishery using practicability standards.

FIGURE 2: Central Biogenic Region Map (Cape Mendocino to Pt. Conception) with Groundfish FMP EFH Prohibitions
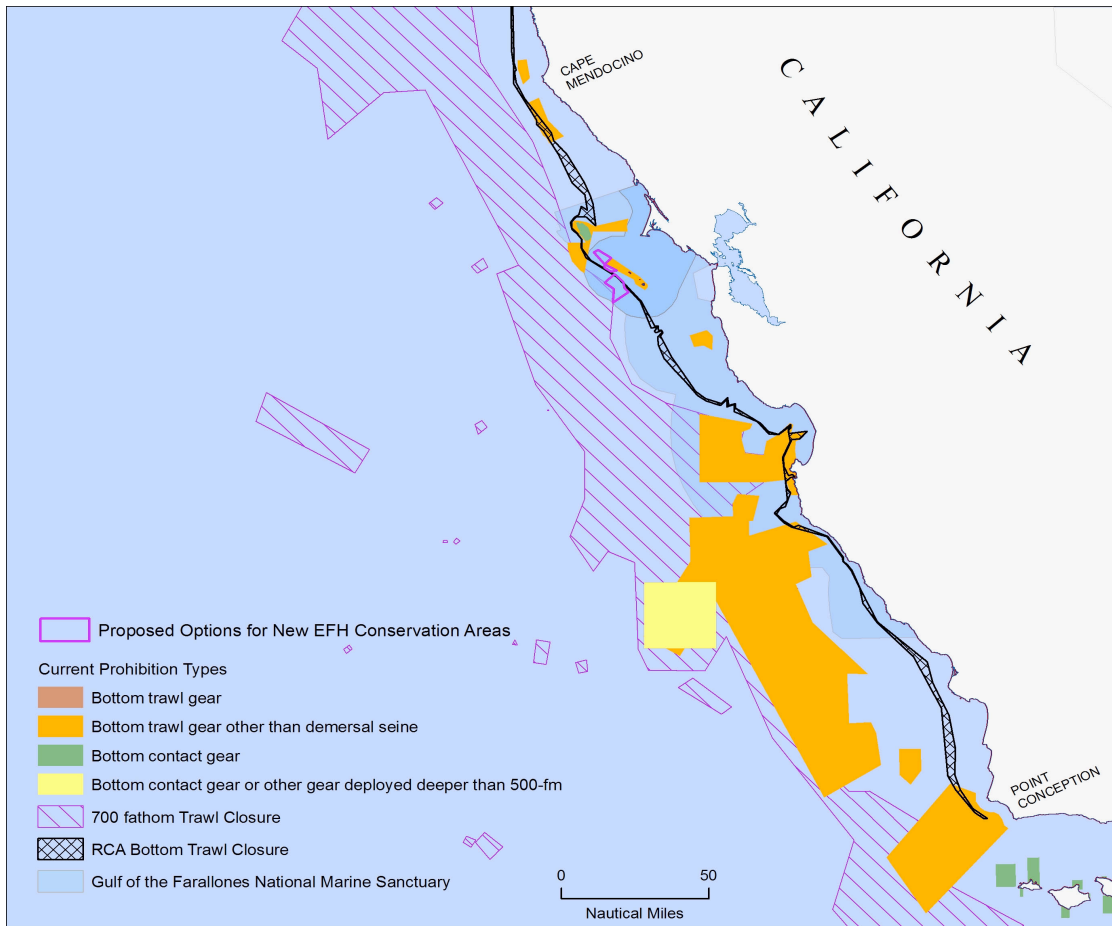
3b. Consistency with Council Responsibility

This "options" proposal provides information that the Council can use to better account for the function of Pacific Coast Groundfish EFH when making fishery management decisions. The Council is responsible for minimizing adverse effects on EFH to the extent practicable and, within that broader definition, to protect habitat areas of particular concern, which this proposal is designed to accomplish. The Council is also responsible for reviewing the best available science to determine whether protection of a particular area is warranted and assessing the

potential socio-economic effects on the fisheries that may be affected by any proposal; these items are also taken into account by the proposed options, to be consistent with the Council's goals, objectives and guidelines.

Information presented is consistent with the January 2002 National Marine Fisheries Service (NMFS) rule that established guidelines to assist the Regional Fishery Management Councils and the Secretary of Commerce in the description and identification of EFH in fishery management plans, the identification of adverse effects to EFH, and the identification of actions required to conserve and enhance EFH.

The source of data utilized in this document comes from the EFH Phase 1 Report, the Groundfish EFH Synthesis Report, and the EFH Catalog. It also elaborates at a finer scale, detailed information collected as part of NOAA's Deep Sea Coral Research and Technology Program (DSCRTP) on the west coast: the 2011 multibeam data and the 2012 Remotely Operated Vehicle (ROV) visual surveys of benthic habitat and fish.

3c. Overview of New Information

Until 2011, there was incomplete information about the offshore (80 meters to 1200 meters) hard and soft habitats of GFNMS. Prior to 2011, high-resolution habitat maps did not exist for any of the proposed areas. Additionally, only sidescan sonar was collected and available in limited areas throughout the federal waters of GFNMS. The sidescan sonar data did not contain a high enough resolution to accurately determine substrate texture or characterization. As part of NOAA's Deep Sea Coral Research and Technology Program (DSCRTP) on the west coast, US Geological Survey (USGS) in partnership with GFNMS and NOAA's National Centers for Coastal Ocean Science (NCCOS), conducted multibeam surveys to better define the offshore benthic habitats of the sanctuary in the fall of 2011. A main goal of research for the west coast DSCRTP was to collect information that could feed into a review of groundfish EFH. The multibeam data revealed highly detailed images of several significant underwater geologic features, including rocky bank and canyon features in the three areas presented in *Section 4*.

In October 2012, as a continuation of the west coast DSCRTP, staff from GFNMS, NCCOS, USGS, Marine Applied Research and Exploration, and California Academy of Sciences participated in a research cruise to characterize and map deep-sea corals and sponges; to identify associated fish and invertebrates; to groundtruth geologic habitat data gathered via multibeam in 2011; and to document impacts from marine debris and bottom contact fishing gear, by using video and photo observations obtained from an ROV. Specific target locations were selected based upon high-resolution habitat maps created from USGS 2011 multibeam data and focused on geologic features that would have with a high likelihood of associated biogenic habitat. Surveys were performed to provide the first visual information of biogenic habitat and fish aggregations within GFNMS. Survey methods can be found in *Appendix A-2012 Research Cruise Methods*.

Until 2012, information regarding the presence, abundance, and habitat associations of deep-water sensitive species (e.g., corals and sponges) and their associated communities in GFNMS was primarily only available through catch studies. The 2012 research cruise provided new information about the locations of fish, substrate, and biogenic habitat.

Both the multibeam data showing the geologic features (rock, mixed and soft) and the biogenic habitat information were submitted to the EFH review process in either the Phase 1 Report or the

Groundfish EFH Synthesis Report and can be found through the EFH Catalog. The finer details of this information, specifically related to the finer scale geologic features and species found through ROV surveys, which is available through the EFH Catalog, are presented in the proposed options. This information has been provided to improve management's ability to protect these unique and biologically diverse communities from anthropogenic disturbances. In particular, this new information is relevant to the Council's review of EFH designations, as all these areas surveyed are open to bottom trawling and other bottom contact gear. This new information can aid in the determination of Habitat Areas of Particular Concern and provides information about unique and rare habitat. (See *Section 6-Discussion* for more information.)

Additional information was presented in the Phase 1 Report and EFH Synthesis Report and is covered in *Sections 5 and 6* of this "options" proposal.

4. Proposed Actions

This section contains options for proposed actions for Council consideration. Each option can be taken individually or can be combined in the current design or a new design, and/or be put forth into a suite of proposed actions. As previously stated, GFNMS supports and encourages additional discussions about the design and protections within the areas presented, and can make changes to the designs as part of additional feedback from stakeholders, advisory body and committee reviews and/or if requested by the Council.

4.a-b. Spatial and Gear Options

4.a-b.i EFH CONSERVATION AREA OPTIONS *(Figure 1)*

Area 1 – Rittenburg Bank to Fanny Shoal

EFH CONSERVATION AREA OPTION 1 - Change the current boundary configuration of Farallon Islands/Fanny Shoal ecologically important habitat area (EFH Conservation Area), to include the following:
- Propose Rittenburg Bank to Fanny Shoal as a new EFH Conservation Area, that prohibits bottom trawl gear (as defined in 50 CFR § 660.302), other than demersal seine, to mitigate the adverse effects of fishing on groundfish EFH to the extent practicable. The proposed EFH Conservation Area around Rittenburg Bank is on the continental shelf approximately 38 miles due west of the mainland and approximately 5 mi from the edge of the shelf. It includes an offshore bank of rocky habitat (Rittenburg Bank) and adjacent soft sediment that extends to Fanny Shoal.

Total Area (mi^2)	Hard (mi^2)	Soft (mi^2)
17	1.8	15.2

Latitude	Longitude
37° 53.60128′	-123° 21.64388′
37° 54.31576′	-123° 19.68812′
37° 51.54334′	-123° 14.15085′
37° 42.24007′	-123° 16.86290′

Design Rationale: Designed to protect rocky geological features, and biogenic (coral and sponge) habitat, in an area where groundfish FMP species are known to occur, while allowing bottom trawling in soft substrate north, east, and west of the Rittenburg Bank. Designed to link

up with the current Farallon Islands/Fanny Shoal EFH Conservation Area. Designed to encompass soft substrate and biogenic (pennatulid) habitat on the shelf in the southern portion of this design in an untrawled or lightly trawled area. (See *Sections 5.e. Socioeconomic Characteristics of the Combined Areas and 6-Discussion* for more information).

Area 2 – Cochrane Bank

EFH CONSERVATION AREA OPTION 2 – Add new ecologically important habitat area (EFH Conservation Area) at Cochrane Bank.

- *OPTION 2A* - Propose Cochrane Bank as a new EFH Conservation Area, that prohibits bottom trawl gear (as defined in 50 CFR § 660.302), other than demersal seine, to mitigate to the extent practicable, the adverse effects of fishing on groundfish EFH on the continental shelf to the extent practicable. This is the deepest known rocky bank within GFNMS. This area is on the continental shelf approximately 39 miles due west of the mainland and approximately 1.3 miles from the edge of the shelf.

- *OPTION 2B* - Propose Cochrane Bank as a new EFH Conservation Area, that prohibits all bottom contact gear (as defined in 50 CFR § 660.302), to mitigate to the extent practicable, the adverse effects of fishing on groundfish EFH on the continental shelf. The same coordinates would be used as Option 2. This is to further protect Cochrane Bank from all gear impacts. This area had the highest observed on-transect percentage of derelict fishing gear, which included nets and line. Cochrane Bank also has long-lived coral *Antipathes dendrochristos*, known as Christmas Tree Coral, a species previously thought to be endemic to Southern California, but now discovered in GFNMS and believed to be at the northern extent of its range. The size and growth rate of this species makes it vulnerable to potential habitat damage by all gear types, and according to the NOAA publication, "The State of Deep Coral Ecosystems of the United Stated," chapter Pacific Coast: California to Washington (Whitmire and Clarke 2007), *A. dendrochristos* has a high rating of structural importance, meaning they are known to provide vertical structure above the sea floor that can be utilized by other invertebrates or fish. See *Sections 5.a.ii-Biological Characteristics and 6-Discussion* for more information.

Total Area (mi^2)	Hard (mi^2)	Soft (mi^2)
6	3.4	2.6

Latitude	Longitude
37° 49.21048′	-123° 16.84594′
37° 46.93308′	-123° 11.78145′
37° 46.51283′	-123° 14.12915′
37° 47.86938′	-123° 16.92357′

Design Rationale: Designed to protect rocky geological features and biogenic habitat in an area where Groundfish FMP species are known to occur, while allowing bottom trawling on the shelf edge from the south or north to the edge of the southern or northern boundary of the Bank. Also designed to allow bottom trawling between the Farallon Escarpment proposed area (Option 3 below), and Cochrane Bank, if the trawl Rockfish Conservation Area (RCA) is lifted.

Area 3 – Farallon Escarpment

EFH CONSERVATION AREA OPTION 3 – Add new ecologically important habitat area (EFH Conservation Area) at the Farallon Escarpment.

- Propose Farallon Escarpment as a new EFH Conservation Area, that prohibits bottom trawl gear (as defined in 50 CFR § 660.302), other than demersal seine, to mitigate to the extent practicable, the adverse effects of fishing on groundfish EFH on the upper continental slope. This area is approximately 38 mi due west of the mainland.

Total Area (mi^2)	Hard (mi^2)	Soft (mi^2)
47.3	0	47.3*

Latitude	Longitude
37° 45.56513′	-123° 12.73588′
37° 45.18191′	-123° 11.85590′
37° 42.70001′	-123° 9.03646′
37° 40.73383′	-123° 8.40765′
37° 39.16925′	-123° 6.77138′
37° 35.33683′	-123° 13.37145′
37° 40.28894′	-123° 12.89435′
37° 42.58959′	-123° 16.81867′

Note: Exposed bedrock on the Farallon Escarpment was described after the substrate maps were produced in the EFH Synthesis Report, and therefore shows as soft habitat in the Report.

Design Rationale: Designed to protect canyons, known areas of exposed bedrock on fault scarps and biogenic habitat in an area where groundfish FMP species are known to occur. (See *Section 5.b.iii and Section 6-Discussion-Substrate* for more information.) Designed to minimize socioeconomic impacts to the fishery by allowing bottom trawling on the shelf while protecting the area of moderate/high coral and sponge observations and slope habitat in an area with low bottom trawl effort, according to the cumulative fishing effort presented in the EFH Synthesis (See *Section 5.e-Socioeconomic Characteristics of the Combined Areas*). Also designed to allow bottom trawling between the Farallon Escarpment and Cochrane Bank proposed areas if the trawl RCA is lifted.

4.a-b.ii HAPC DESIGNATION OPTIONS (*Figure 3*)

The proposed options are consistent with the MSA, the principal statutory basis for fishery management within the Exclusive Economic Zone. As per the MSA, habitat areas of particular concern (HAPC) are types of areas of habitat with EFH that are identified based on one or more of the following considerations: the importance of the ecological function provided by the habitat; the extent to which the habitat is sensitive to human-induced environmental degradation; whether, and to what extent development activities are or will be stressing the habitat type; and the rarity of the habitat type. The Groundfish FMP currently identifies the following habitat types as HAPC: estuaries, canopy kelp, seagrass, and rocky reefs. In addition the FMP identifies specific areas as HAPC, called "Areas of Interest", which are a variety of submarine features, such as banks, seamounts, and canyons. Two rocky banks, Rittenburg Bank and Cochrane Bank, have been delineated in GFNMS based on multibeam echosounder data and ROV observations of deep sea corals and sponges collected in 2011 and 2012. GFNMS is proposing that these areas be added as "Areas of Interest" for a HAPC designation because they contain habitat types consistent with existing HAPC designations.

HAPC OPTION 1 – Propose Council consideration of new EFH HAPCs "Areas of Interest" at Rittenburg Bank. (See *Section 6-Discussion* for more information about design rationale.)

HAPC OPTION 2 – Propose Council consideration of new EFH HAPCs "Areas of Interest" at Cochrane Bank. (See *Section 6-Discussion* for more information about design rationale.)

Note: GFNMS is not proposing a HAPC "Area of Interest" for the proposed EFH Conservation Area at the Farallon Escarpment. The entire Escarpment heads north, south and west of GFNMS boundary, placing portions of it beyond GFNMS jurisdiction. The Escarpment is also larger than the current GFNMS proposed EFH Conservation area boundary.

FIGURE 3: Proposed new HAPCs - This figure shows the two proposed HAPC options. The left maps show the shape of these areas as proposed in each option. The right map shows these areas with substrate and biogenic habitat data from the EFH Synthesis Report. The top maps show HAPC Option 1, the bottom maps show HAPC Option 2.
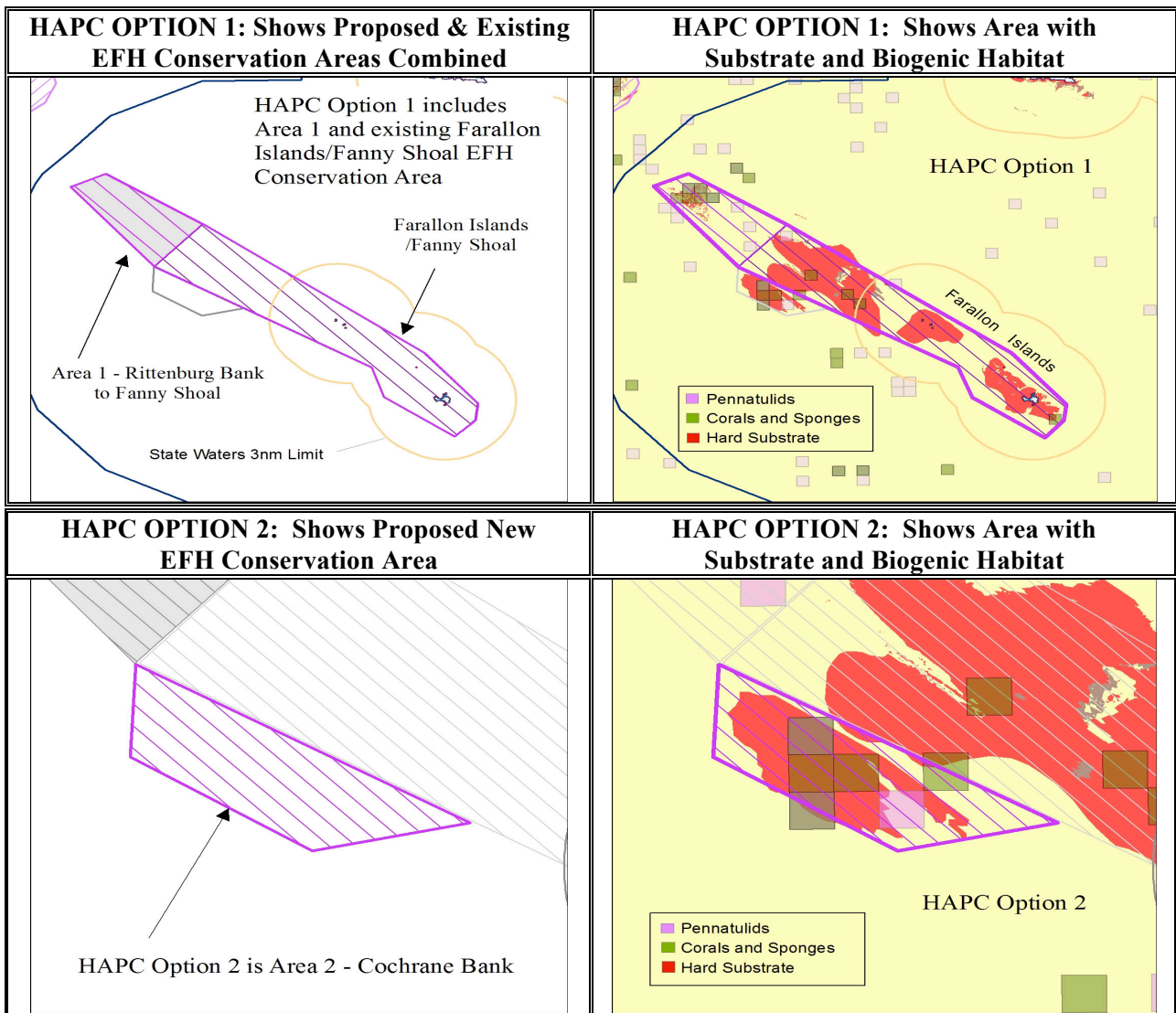
4.c. Changes to the Description and Identification of Groundfish EFH

As indicated above, the areas described are options for EFH Conservation Areas, and options for designation of HAPC "Areas of Interest."

5. Relevant and Applicable Characteristics Information

This section provides a general overview of the biological, geological and socioeconomic characteristics of the proposed areas: Rittenburg Bank to Fanny Shoal; Cochrane Bank; and Farallon Escarpment.

5.a and 5.b.   Biological and Geological Characteristics

These sections provide an overview of the biological and geological characteristics of each proposed area. It is organized by proposed area.   It includes photos of featured habitat in each area, a summary of observed groundfish and biogenic habitat based on photo annotations, and an interpretation of the geologic characteristics. More information about the importance these areas, including maps and charts, can be found in *Section 6- Discussion*.
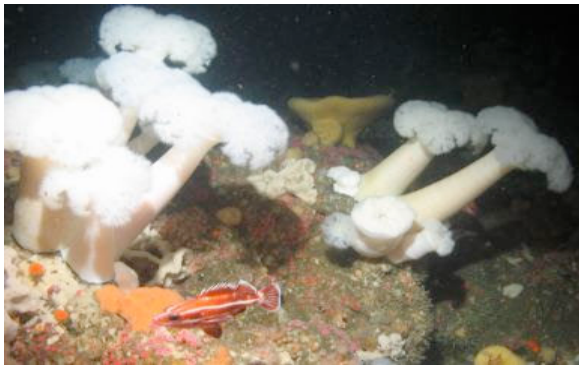
Area 1- Rittenburg Bank to Fanny Shoal

Rosy Rockfish with *Chromoplexaura* Octooral and Biogenic Habitat
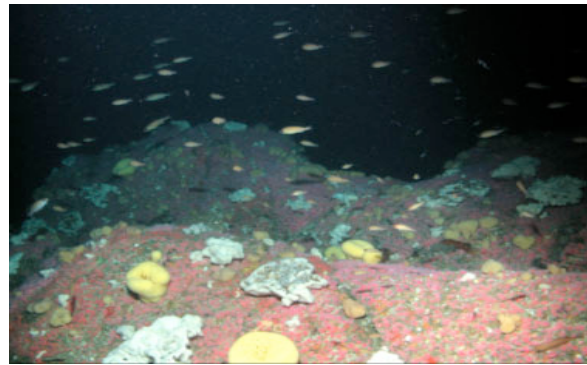
Juvenile Rockfish over Dense Biogenic Habitat

Juvenile Yelloweye Rockfish with *Metriduim*, Biogenic Habitat, and Exposed Rock

Yellowtail and Yelloweye Rockfish Hovering Over Biogenic Habitat

Schooling Yelloweye and Yellowtail Rockfish

Quillback and Juvenile Yellowtail Rockfish

5.a.i   BIOLOGICAL CHARACTERISTICS OF RITTENBURG BANK TO FANNY SHOAL

Visual ROV surveys of the proposed areas occurred in the northern portion of the current design on both hard and soft substrate. In this area, a total of 18 transects were conducted, each 120 meters in length and a total of 860 images were analyzed from the 2012 research cruise. Approximately 0.24% of the area of Rittenburg Bank was surveyed. Of the 91 species of groundfish managed under the Groundfish FMP, 23 taxa were observed in photos, as well as numerous juvenile rockfish for which the species could not be identified.

Observed Rittenburg Bank Groundfish Species List and Occurrence		
Focal Fish Species	**Scientific Name**	**Count**
Greenstriped Rockfish	*Sebastes elongatus*	7
Yelloweye Rockfish	*Sebastes ruberrimus*	67
Groundfish FMP Rockfish		
Bocaccio	*Sebastes paucispinis*	8
Canary Rockfish	*Sebastes pinniger*	32
China Rockfish	*Sebastes nebulosus*	1
Dover Sole	*Microstomus pacificus*	13
Lingcod	*Ophiodon elongatus*	35
Rosethorn Rockfish	*Sebastes helvomaculatus*	8
Speckled Rockfish	*Sebastes ovalis*	1
Pygmy Rockfish	*Sebastes wilsoni*	580
Quillback Rockfish	*Sebastes maliger*	6
Rosy Rockfish	*Sebastes rosaceus*	145
Squarespot Rockfish	*Sebastes hopkinsi*	16
Starry Rockfish	*Sebastes constellatus*	7
Stripetail Rockfish	*Sebastes saxicola*	2
Vermilion Rockfish	*Sebastes miniatus*	2
Widow Rockfish	*Sebastes entomelas*	11
Yellowtail rockfish	*Sebastes flavidus*	179
Vermilion/Canary Rockfish	*Sebastes miniatus/pinniger*	3
Unidentified Juvenile Rockfishes	***Sebastes* spp.**	**475**
Unidentified Rockfishes	*Sebastes* spp.	100
Unidentified Sebastomus	*Sebastomus* spp.	108
Groundfish FMP Flatfish		
Rex Sole	*Glytocephalus zachirus*	3
English sole	*Parophrys vetulus*	3
Unidentified Sanddab	*Citharichthys* spp.	24
Unidentified Flatfishes		38
Other FMP Groundfish		
Kelp Greenling	*Hexagrammos decagrammus*	7
Spotted Ratfish	*Hydrolagus colliei*	1
Longnose Skate	*Raja rhina*	1
Unidentified Skate	*Raja* spp.	1

Biogenic Components

At least 113 coral colonies; 322 sea pens and sea whips (Order Pennatulacea); and 2,628 sponges were observed in 860 on-transect photos from the 2012 research cruise at Rittenburg Bank. Colonies of the red sea whip called *Euplexaura marki* were observed but the counts were combined with *Chromoplexaura marki* due to the uncertainty of photo-based identifications of these genera. Rittenburg Bank had the highest number of combined coral and sponge colonies observed, with sponges greatly outnumbering the corals in terms of abundance, diversity, and density.

Corals, Sponges, Sea Pens and Sea Whips Observed			
Scientific Name	**Common Name**	**Species Group**	**n = 860**
Stylaster sp.	Pink/Purple Lace Coral	Hydrocoral	15
Pennatulacea	Sea Pen or Whip	Octocoral	322
Chromoplexaura marki	Red gorgonian	Octocoral	198
Euplexaura marki	Red sea whip	Octocoral	Present
Brown Rippled Sponge	Brown Rippled Sponge	Sponge	8
Aphrocallistes sp.	White Goblet Sponge	Sponge	79
Golden Fan Sponge	Golden Fan Sponge	Sponge	19
Dysidea sp. cf. *fragilis*	Gray Plate Sponge	Sponge	5
Halichondria panicea	Orange/Brown Potato Sponge	Sponge	515
Heterochone calyx	White/Orange Vase Foliose	Sponge	197
Iophon piceum var. *pacifica*	White Finger or Catcher's Mitt	Sponge	905
Mycale sp. cf. *lingua*	Yellow Vase Sponge	Sponge	299
Orange Lobe	Orange Lobe	Sponge	5
Poecillastra sp.	White Shelf Sponge	Sponge	31
Acanthascus (Staurocalyptus) fasciculatus	Boot Sponge	Sponge	43
Xestospongia diprosopea	Aureolated Grey Lobe Sponge	Sponge	522

5.b.i GEOLOGICAL CHARACTERISTICS OF RITTENBURG BANK TO FANNY SHOAL

The depth of the proposed area ranges from 85 m to 115 m (46-63 fathoms). The design includes Rittenburg Bank and soft substrate that connects the Bank to Fanny Shoal. If adopted as currently designed, this area would include the only sizeable soft substrate within GFNMS on the continental shelf. Multibeam surveys have not been conducted in the southern soft substrate portion of this design, but the design is proposed as an option in order to bring continuity of both shelf soft and hard substrate into one design (See *Section 6-Discussion* for more information about the importance of hard and soft substrate).

Rittenburg Bank and Fanny Shoal are outcroppings of the Salinian Block, a geologic province of granitic continental crust. Salinian rocks share origins with the core of the Sierra Nevada Mountains to the south and have been rifted to their present location by the northward movement of the Pacific Plate west of the San Andreas Fault. Other nearby examples of the Salinian Block outcrops are found on the Farallon Islands, Point Reyes Peninsula, and Bodega Head. Submerged Salinian rock outcrops are similar to the outcrops visible on the Farallon Islands, homogeneous, massive, erosion resistant pinnacles, domes and pavements. Boulders and smaller rocks including cobble and gravel are often present on flat pavement areas of Salinian outcrops or near submerged Salinian outcrops, formed from pieces of the outcrop separated by fracturing which is

ubiquitous in rocks subjected to fault regime stresses. The unusual overall shape of Rittenburg Bank is the result of compression and uplift in an area between two conjugate faults located on the southwest and east edges of the Bank (unpublished preliminary interpretation).

Area 2- Cochrane Bank

Greenstripe Rockfish resting on a Yellow Vase Sponge with Crinoids and Exposed Rock
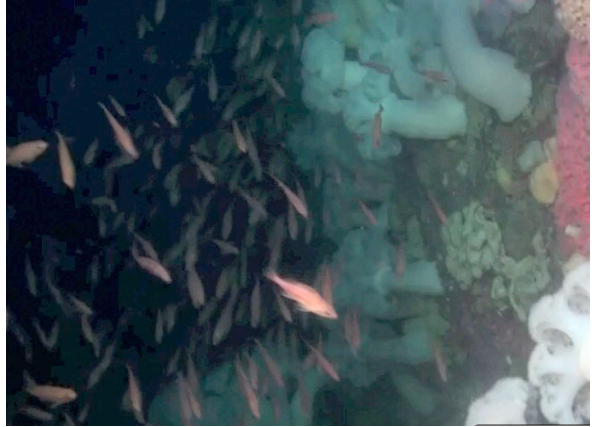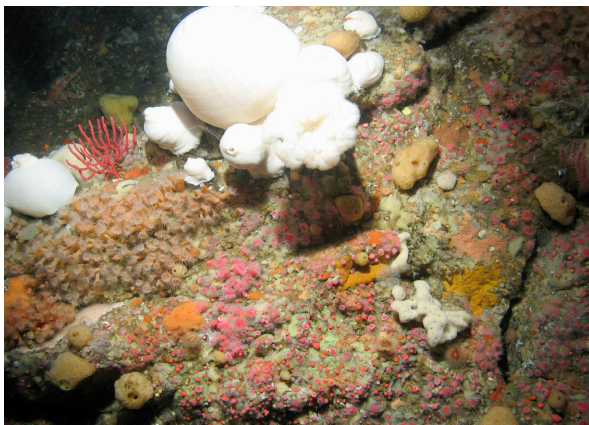
Juvenile Rockfish Over Biogenic Habitat and Exposed Rock

Black "Christmas Tree" Coral with hovering Yelloweye Rockfish

Black "Christmas Tree" Coral on rock with Rosy Rockfish

Biogenic Habitat including *Chromoplexaur*a Octocoral and *Metridium* anemones

Rosy Rockfish and Juvenile Rockfish with Biogenic Habitat

5.a.ii BIOLOGICAL CHARACTERISTICS OF COCHRANE BANK

At Cochrane Bank a total of 13 transects were conducted, each 120 meters in length, and a total of 541 on-transect images were analyzed from the 2012 research cruise. Approximately 0.28% of Cochrane Bank was surveyed. Of the 91 species of groundfish managed under the Groundfish FMP, 23 taxa were observed, including numerous juvenile pygmy rockfish and other unidentified juvenile rockfish based on photo annotations from the 2012 research cruise.

Cochrane Bank Groundfish Species List and Occurrence		
Focal Fish Species	**Scientific Name**	**Count**
Greenstriped Rockfish	*Sebastes elongatus*	48
Yelloweye Rockfish	*Sebastes ruberrimus*	7
Groundfish FMP Rockfish		
Pygmy Rockfish	*Sebastes wilsoni*	903
Quillback Rockfish	*Sebastes maliger*	1
Greenspotted Rockfish	*Sebastes chlorostictus*	42
Canary Rockfish	*Sebastes pinniger*	11
Rosethorn Rockfish	*Sebastes helvomaculatus*	9
Greenblotched Rockfish	*Sebastes rosenblatti*	1
Rosy Rockfish	*Sebastes rosaceus*	21
Sharpchin Rockfish	*Sebastes zacentrus*	2
Sharpchin/stripetail rockfish	*Sebastes zacentrus/saxicola*	1
Starry Rockfish	*Sebastes constellatus*	9
Stripetail Rockfish	*Sebastes saxicola*	1
Vermilion Rockfish	*Sebastes miniatus*	1
Yellowtail Rockfish	*Sebastes flavidus*	5
Unidentifed Juvenile Rockfish	***Sebastes* spp.**	**57**
Unidentified Rockfishes	*Sebastes* spp.	35
Unidentified Sebastomus	*Sebastomus spp.*	46
Groundfish FMP Flatfish		
Dover Sole	*Microstomus pacificus*	2
Rex Sole	*Glytocephalus zachirus*	1
English Sole	*Parophrys vetulus*	3
Unidentified Sanddab	*Citharichthys* spp.	42
Unidentified Flatfishes		28
Other FMP Groundfish		
Lingcod	*Ophiodon elongatus*	23
Kelp Greenling	*Hexagrammos decagrammus*	4
Spotted Ratfish	*Hydrolagus colliei*	3
Unidentified Skate	*Raja* spp.	1

Biogenic Components

Three colonies of corals were observed, based on photo annotations from the 2012 research cruise, one of which was a large *Antipathes dendrochristos,* making this the most northern observation of this species (Opresko 2005). This colony was estimated to be at least 2 meters wide and 1 meter tall, making it over 100 years old (see *Section 6-Discussion* for more

information).   Also observed at Cochrane Bank were 119 sea pens and sea whips and 600 sponges. Cochrane Bank had similar number of species of corals and sponges, but fewer individual colonies in comparison to Rittenburg Bank and the Farallon Escarpment.

| Corals, Sponges, Sea Pens and Sea Whips Observed			
Scientific Name	**Common Name**	**Species Group**	**n = 541**
Antipathes dendrochristos	Christmas Tree Coral	Black Coral	1
Anthomastus sp.	Mushroom Coral	Octocoral	2
Pennatulacea	Sea Pen or Whip	Octocoral	119
Euplexaura markii	Red sea whip	Octocoral	na
Aphrocallistes sp.	White Goblet Sponge	Sponge	5
Golden Fan Sponge	Golden Fan Sponge	Sponge	5
Dysidea sp. cf. fragilis	Grey Plate Sponge	Sponge	11
Halichondria panicea	Orange/Brown Potato Sponge	Sponge	45
Heterochone calyx	White/Orange Vase Foliose	Sponge	4
Iophon piceum var. *pacifica*	White Finger or Catcher's Mitt	Sponge	503
Mycale sp.	Yellow Vase Sponge	Sponge	14
Orange Lobe	Orange Lobe	Sponge	3
Staurocalyptus fasciculatus	Boot Sponge	Sponge	6
Xestospongia diprosopea	Aureoled Grey Lobe Sponge	Sponge	4

5.b.ii GEOLOGICAL CHARACTERISTICS OF COCHRANE BANK

The proposed area depth ranges from approximately 95 to 160 m (52-87 fathoms). The Bank was mapped for the first time by USGS in 2011 and does not appear on NOAA Charts as of July 2013. The preliminary interpretation of the geology of the Bank is that it is composed of Salinian bedrock as are the neighboring islands and banks. Boulders, and smaller rocks, including cobble and gravel observed here are the products of break-up of the outcrop along fractures resulting from stress in the strike-slip fault regime. Areas lacking fracture endure as pinnacles, domes and pavements due to the high resistance to erosion characteristic of Salinian rocks.

Area 3- Farallon Escarpment
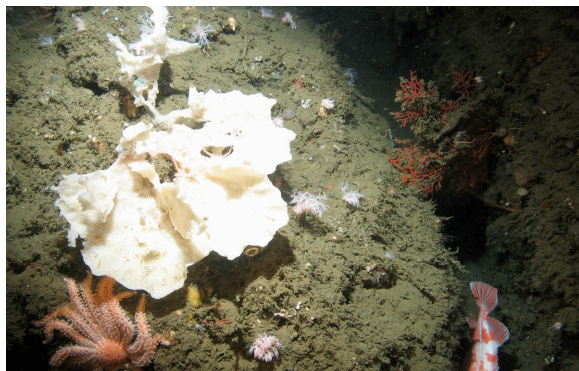
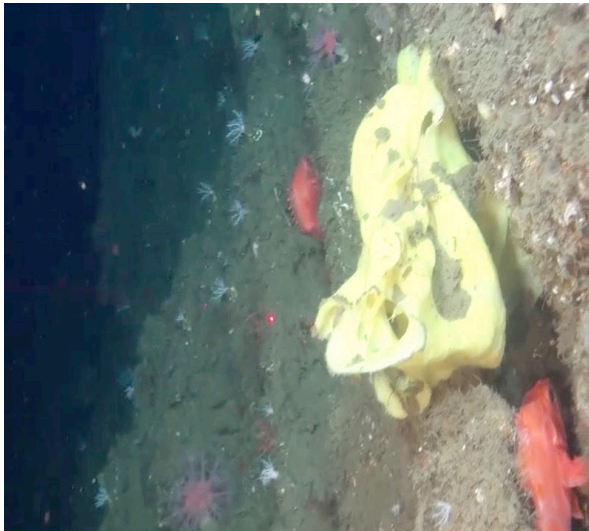White Sponges, *Swiftia sp*. Sea Fan, Aurora Rockfish and Sun Star
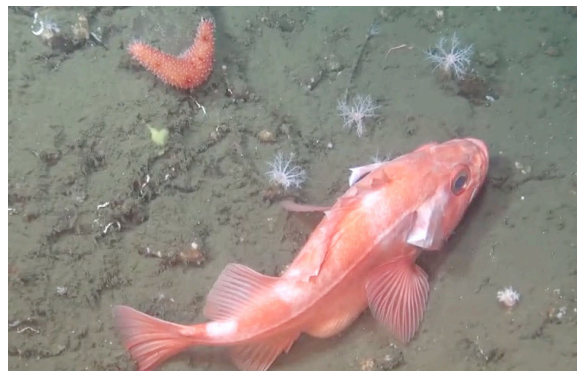
Gravid Blackgill Rockfish with Sea Cucumber

Bubblegum Coral, White finger Sponge and
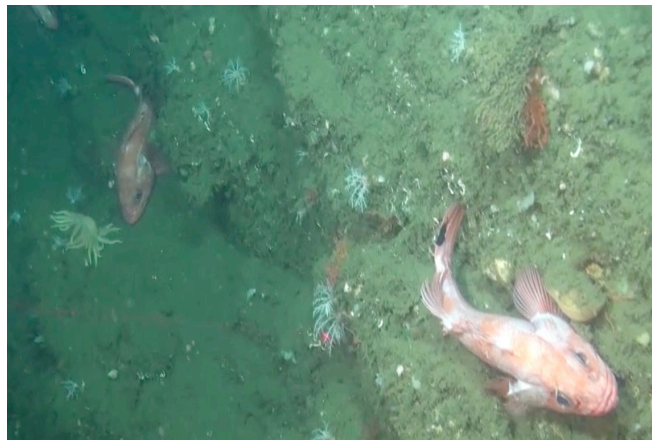Blackgill Rockfish and Sessile Sea Cucumbers

Aurora Rockfish and White Sponge with Sediment

Rockfish in Crevices on Face of Rocky High Relief
with Sponge

Rockfishes in Crevices, and Aurora Rockfish Habitat
with Sponge and Sun Star

Blackgill Rockfish on Rock with *Swiftia* sp. Sea Fan Coral

5.a.iii BIOLOGICAL CHARACTERISTICS OF THE FARALLON ESCARPMENT

Due to time a constraint, only two transects were performed at Farallon Escarpment during the 2012 research cruise. Each transect was approximately 200 to 300 meters in length, and a total of 131 on-transect images were analyzed. We are unable to give an estimate of the percentage of the Farallon Escarpment surveyed because additional surveys took place north of GFNMS. However, only a small fraction of the Escarpment was surveyed in 2012, even in the context of the proposed area, which is a small subset of the entire Escarpment. Of the 91 species of groundfish managed under the Groundfish FMP, 7 taxa were observed in photos from the 2012 research cruise. Most fish were observed resting on ledges, in crevices, or on corals and sponges.

Farallon Escarpment Groundfish Species List and Occurrence		
Focal Fish Species	**Scientific Name**	**Count**
Darkblotched Rockfish	*Sebastes crameri*	1
Groundfish FMP Rockfish		
Aurora Rockfish	*Sebastes aurora*	23
Blackgill Rockfish	*Sebastes melanostomus*	31
Splitnose Rockfish	*Sebastes diploproa*	12
Unidentified Rockfishes	*Sebastes* spp.	32
Unidentified Thornyheads	*Sebastolobus* spp.	4
Groundfish FMP Flatfish		
Dover Sole	*Microstomus pacificus*	1
Unidentified Flatfishes		3
Other FMP Groundfish		
Longnose Skate	*Raja rhina*	1

Biogenic Components

The area surveyed on the Farallon Escarpment had high concentrations of corals and sponges (see *Section 6-Discussion* for more information on species density). 64 sponges and 57 colonies of corals were observed including *Iophon piceum* sponges, *Paragorgia sp.,* bubblegum corals *Swiftia sp.,* sea fans, and *Anthomastus* sp. mushroom corals on hard substrate. No sea pens or sea whips were observed.

Corals and Sponges Observed			
Scientific Name	**Common Name**	**Species Group**	**n = 131**
Desmophyllum sp.	Large Cup Coral	Scleractinian	2
Anthomastus sp.	Mushroom Coral	Octocoral	22
Swiftia sp. Cf	Red sea fan	Octocoral	29
Paragorgia sp.	Bubblegum Coral	Octocoral	6
Aphrocallistes sp.	White Goblet Sponge	Sponge	10
Heterochone calyx	White/Orange Vase Foliose	Sponge	4
Iophon piceum var. *pacifica*	White Finger or Catcher's Mitt	Sponge	503
Mycale sp.	Yellow Vase Sponge	Sponge	14
Orange Lobe	Orange Lobe	Sponge	3
Poecillastra sp.	White Shelf Sponge	Sponge	0
Acanthascus (Staurocalyptus) fasciculatus	Boot Sponge	Sponge	6
Xestospongia diprosopea	Aureoled Grey Lobe Sponge	Sponge	4

5.b.iii GEOLOGICAL CHARACTERISTICS OF THE FARALLON ESCARPMENT

The proposed area depth ranges from approximately 182 to 1280 meters (100-700 fathoms) and includes a portion of the Farallon Escarpment. The following paragraph is a description for the entire Farallon Escarpment. The design of the proposed area is based on a review of the elements described in the next paragraph in combination with feedback from fishermen regarding areas trawled. The design attempted to exclude a trawl area to the south, while still protecting representative canyon habitat throughout the upper slope.

The Farallon Escarpment, west of Cordell Bank and the Farallon Islands, differs significantly from adjacent areas of the continental slope. The escarpment is less than half the width (35 km) and twice the gradient (5°) than the area to the south. The escarpment is extensively dissected by submarine canyons and gullies that stretch from the shelf break (approximately 150 m depth) down to the deep basin. The sawtooth or crenulated appearance of the bathymetry over the escarpment is highly irregular. Substrate in the gullies and canyons varies from areas of continental shelf bedrock exposed by slumping along the shelf break and ridges between gullies, coarser sediment in the canyon axes deposited by slumping, and muds and fine sands deposited by ocean currents everywhere else. Coarser slump sediment can include all grain sizes from sand to boulder. Northwest trending ridges observed in the new mapping data that cut across the northeast trending gully-ridge slope complex are interpreted to be fault scarps. Continental shelf bedrock is exposed on the fault scarps. The exposed areas of bedrock provide habitat for fish and three-dimensional corals and sponges, which were observed during ROV surveys (*Figure 4*).

FIGURE 4: Portion of the Proposed Farallon Escarpment Area
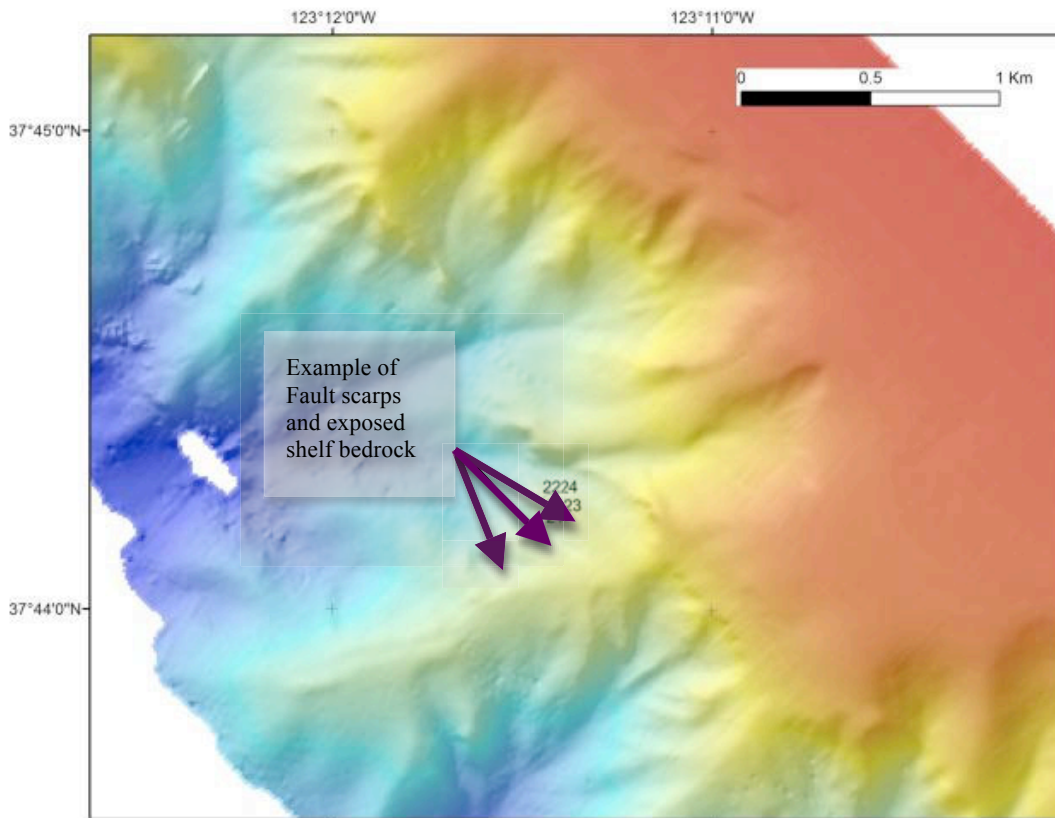
5.c-d. Physical Oceanographic and Chemical Characteristics

Information on the physical oceanographic and chemical characteristics is incorporated herein by reference to the EFH Synthesis Report. In summary, the oceanographic and chemical characteristics of the three proposed areas are consistent with the Central Biogeographic Region.

## 5.e. Socioeconomic Characteristics of the Combined Areas

This section provides a general overview and characterization of fishing occurring within or near proposed areas and a summary of engaging the fishing community in nearby ports in discussions of the EFH process and potential proposed areas.

Overview

The waters off the North-central coast of California have long supported fishing activities that are integral to the cultural and economic history of the area. Fisheries exemplify the interdependencies between the natural environment and coastal communities that have characterized California since well before statehood. Although the proposed areas are off the coast of San Francisco and Marin Counties, landing ports are not necessarily the same as homeports, especially in fisheries such as the groundfish bottom trawl fishery where vessels travel considerable distances to and from the fishing grounds, and fishing trips can be several days in duration. Therefore, GFNMS staff met with over 35 fishermen representing groundfish trawl, groundfish hook and line, groundfish trap and halibut trawl from the ports of Ft. Bragg, San Francisco, Half Moon Bay, and Monterey to discuss areas of interest and receive feedback. By 2000 the groundfish fishery had virtually disappeared from Bodega Bay, so GFNMS staff did not meet with any Bodega Bay fishermen. Information about the meeting discussions, accomplishments and identified gaps can be found below in the section "*Engaging the Fishing Community*.".

Based on the bottom trawl fishing effort and intensity data in the EFH Synthesis Report, bottom trawl fishing effort since 2002 has been relatively low within the proposed areas (*Figure 5*). This data was analyzed spatially using tows from trawl logbooks by connecting a straight line between the start and end points to represent each tow event. This data also excludes areas where less than three vessels were operating. Based on feedback received in discussions with the fishing community, trawling is rarely conducted in a straight line, and in fact, GFNMS staff received feedback on specific trawl tows that are conducted in GFNMS that are curved to avoid high relief geologic features. Additionally, because data from less than three vessels was excluded and because there are currently less than 10 active groundfish bottom-trawl fishermen from Fort Bragg to Monterey, it is important to note that some areas with low or no fishing effort are still utilized by trawlers. However, each of these proposed designs aims to minimize impact to the fishery to the extent practicable.

Figure 5: Cumulative Bottom Trawl Fishing Effort and Intensity – The data presented in this figure shows distribution of cumulative trawl fishing effort in 2x2 km cells, and temporal change in bottom trawl fishing intensity (2002-2010).
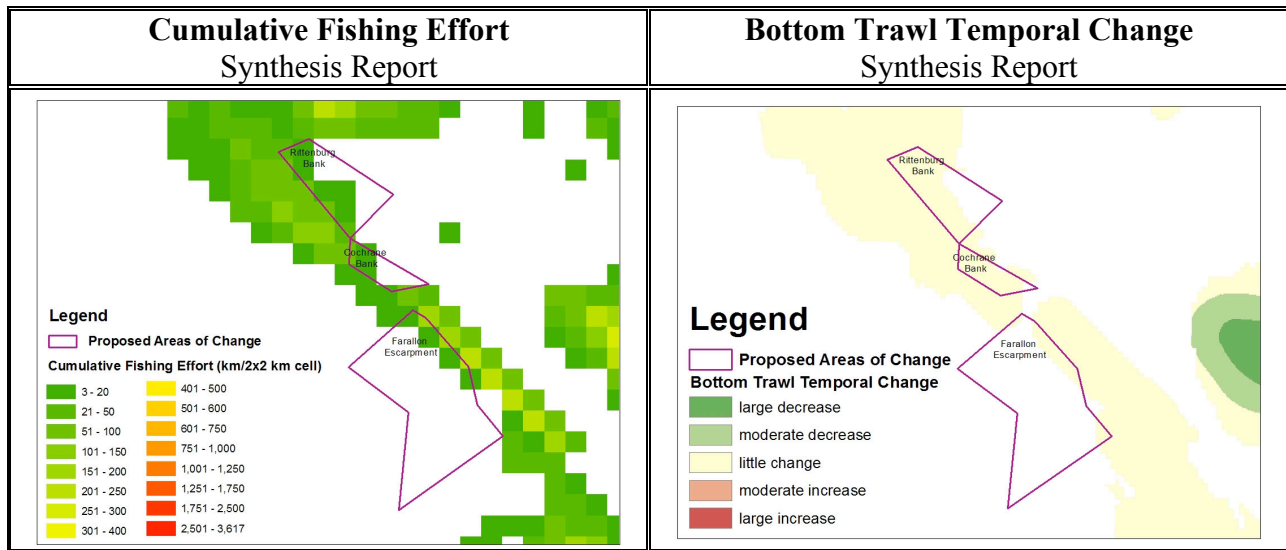

Another piece of information to consider is that in 2005, in cooperation with fishermen from the ports of Half Moon Bay, San Francisco, Bolinas and Bodega Bay, a report titled "Socioeconomic Profile of Fishing Activities and Communities Associated with the Gulf of the Farallones and Cordell Bank National Marine Sanctuaries." was released, which provided information on landings, areas fished and revenues. One of the fisheries covered in the report was the groundfish fishery (Schultz et. al 2005). The profile looked at groundfish gear evolution from 1981 to 2003 and also looked at the relative importance of sanctuaries from 1997 to 2003 for the flatfish, sablefish, and shelf and slope rockfish fisheries (fixed gear and trawl). This snapshot in time is before EFH prohibitions went into effect, but after the beginning of the first RCA closure. Some of the key findings were:

- Statewide commercial landings peaked in 1981 at over 900 million pounds, and declined to 370 million pounds by 1991. The declining trend of landings over this period is mirrored in ports adjacent to GFNMS.
- The number of vessels making landings in adjacent ports has declined, from 2,200 in 1981 to 603 in 2004.
- Groundfish and herring, with periods of increased salmon, urchin, or squid landings, historically dominated landings. However, the groundfish fishery in adjacent ports has experienced an overall decline in numbers of fishermen and volume of landings between 1997 and 2003.

Since the publication of the 2005 report, discussions with the fishing community in adjacent ports have revealed that there have been further declines in the number of groundfish fishermen in adjacent ports (trawl and hook and line).

The EFH Phase 1 Report and the EFH Synthesis Report show intensity of landings in a time period that is mostly after the initial declines in the fishery. The data show that there were further declines in fishing intensity in and adjacent to the three proposed areas after EFH measures were put into place (*Figure 6*). This is consistent with feedback from fishermen.

Figure 6: Bottom Trawl Fishing Effort and Intensity – The data presented in this figure shows effort "Before" (1 Jan 2002 – 11 Jun 2006) and "After" (12 Jun 2006 – 31 Dec 2010) implementation of Amendment 19 regulations that implemented EFH. The color spectrum in the legend refers to a coast wide scale, but these figures show only low intensity.
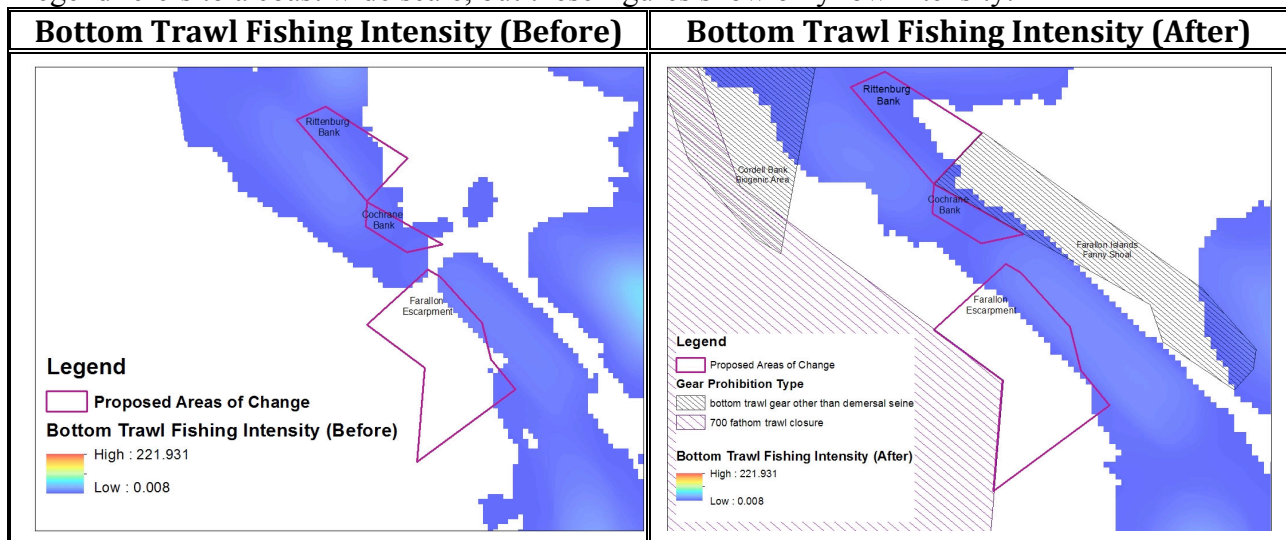
Engaging the Fishing Community

GFNMS waited until the EFH Synthesis Report was released and the Council initiated a "Request for Proposal" process before engaging the fishing community in possible areas of interest to designate new EFH Area Closures. GFNMS reviewed the data in the EFH Synthesis Report and identified 7 Areas of Interest to discuss with the fishing community (*Figure 7*).

Due to the short timeframe (~90 days) to: 1) review the final EFH Reports; 2) meet with the fishing community from 4 different ports spanning almost 300 miles of coastline; 3) meet with NGO stakeholders; and 4) prepare a comprehensive proposal, GFNMS was only able to initiate initial discussions and receive general feedback on seven areas of interest. After discussions with the fishing community about the seven areas of interest, GFNMS designed EFH Conservation Areas in three locations and did not put forth a proposal for the other four locations. To fully understand trawl fishing behaviors, discussions with individual bottom trawlers is critical. The final designs of the proposed EFH Conservation Area closures are a result of these preliminary discussions and feedback. However, as stated in the cover letter, stakeholders have not reached specific agreements with these particular boundary designs and/or areas at this time. GFNMS staff is committed to continuing discussions with possible affected fishermen to facilitate information to the Council as the EFH proposal process moves forward.

The six meetings that were held in the four ports of interest can be found in the table below. At each of these meetings GFNMS staff presented data in the EFH Phase I report and the EFH Synthesis Report by utilizing the GIS layers in these reports that were downloaded from the EFH Catalog. An example of one of these images is shown in *Figure 7*. Our intent was to show areas of interest based on the substrate, fish, fishing pressure, and biogenic habitat data presented in the reports. Almost all data layers available in the EFH Catalog were shown during these meetings. Additionally, GFNMS showed finer scale data collected from the 2012 research cruise

including images of the underwater habitat. Our goal of each of these meetings was to receive feedback on these areas of interest in order to better understand trawl behaviors and needs of the area. Based on the limited time we had, and the number of ports we were meeting with, we were not seeking agreement on specific designs. However, all designs were a product of feedback during each of the six meetings. The information presented through these options and continuing dialogue with potentially affected fishing communities is fundamental to developing a final practicable action. In absence of full endorsement by the fishing community for a GFNMS proposal, GFNMS is confident putting forward design options for three proposed areas (See *Sections 3 through 5.d*).

"Areas of Interest" Discussion Meetings with the Fishing Community	
Date	*Location*
April 29, 2013	San Francisco
May 16, 2013	Ft. Bragg
June 3, 2013	Monterey
June 17, 2013	Half Moon Bay
July 9, 2013	Monterey
July 11, 2013	San Francisco

FIGURE 7 – GFNMS Areas of Interest Discussed with the Fishing Community*
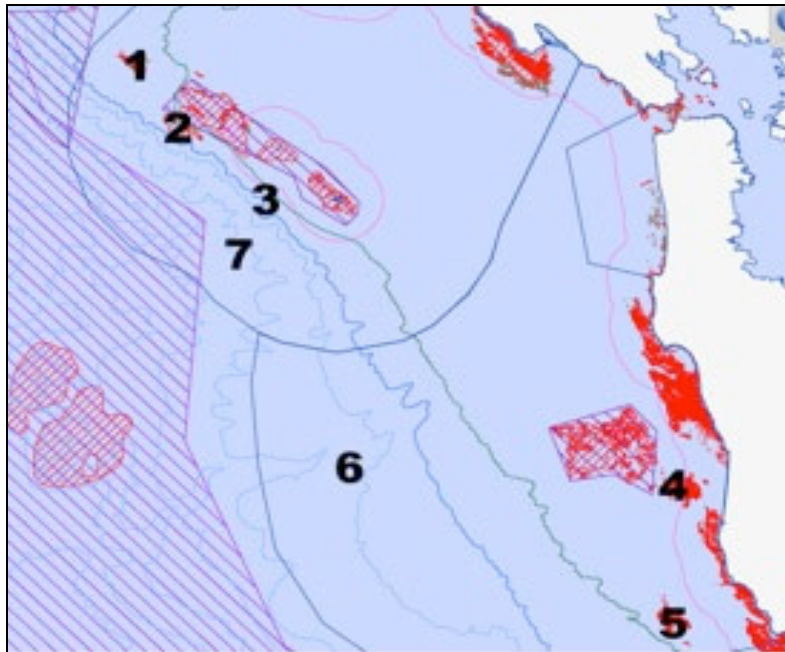
*NOTE: This included areas in the northern portion of the Monterey Bay National Marine Sanctuary (MBNMS) off Half Moon Bay. GFNMS implements the MBNMS management plan and regulations for most activities in this region. GFNMS is not submitting a proposal for this area at this time, but is interested in reviewing any proposals for EFH area closures or HAPC designations in this region.

6.   Discussion

This section reviews data from the EFH Phase 1 Report and the EFH Synthesis Report and it provides a more in depth look at the data collected during the 2012 research cruise of Rittenburg Bank, Cochrane Bank, and Farallon Escarpment that characterized and mapped deep-sea corals and sponges, substrate, fish and other invertebrates. This section includes a discussion about the following where relevant and applicable:

a. The importance of the biological and geological characteristics of the proposed HAPCs and closure areas to groundfish FMP stocks for their spawning, breeding, feeding, or growth to maturity through the review of 6 focal species presented in the EFH Synthesis Report.
b. A summary of the densities of biogenic habitat and their co-occurrence with groundfish FMP species.
c. The presence and location of habitat that is vulnerable to the effects of fishing and other activities.
d. The presence and location of unique, rare, or threatened habitat.
e. The socioeconomics and management of the proposed actions.

This section is broken into two sub-sections:
- Part A presents brief summaries, maps and figures related to fish, fish-habitat models, substrate, biogenic habitat, and habitat vulnerability.
- Part B is broken out by proposed areas as follows:
  - Area 1 – Rittenburg Bank to Fanny Shoal
  - Area 2 – Cochrane Bank
  - Area 3 – Farallon Escarpment

  Part B further discusses the information shown on the maps and figures from Part A and provides additional information related to topics a-d above as relevant to each area.

PART A. MAPS AND FIGURES

Fish and Fish/Habitat Models

Maps of the species-habitat abundance models for the 6 focal species identified in the EFH Synthesis Report are found in *Figures 8 through 13*. These data are presented in order to show modeled abundance of each of the 6 focal species. Brief summaries of the model strengths and limitations are also provided.

 According to the Report, the two data sources used in the analysis are the NOAA trawl survey (years 2003 to 2011) and visual observation data. It is important to note that the model was run before GFNMS was able to release the observed photo-annotated fish data for the 2012 research cruise. Fish observation data has since been annotated from photos of transects surveyed in 2012. To show where there is consistency between the models and the visual observation data collected in 2012, we have included these visual observations in the figures.   Conclusions are not drawn in Part A of this section; a discussion of these figures as they relate to each proposed area can be found in Part B. A list of all groundfish species observed in each area can be found in *Section 5.a.i-iii.* Of the 91 species of groundfish managed under the Pacific Coast Groundfish FMP (December 2011), 37 taxa were observed.

FIGURE 8: Darkblotched Rockfish (*Sebastes crameri, SECR*)

Darkblotched rockfish prefer soft sediments on a narrow range of the outer shelf and slope (~100m to 400m). SECR is not predicted to have high abundance in any of the proposed areas. According to the NMFS Synthesis Report, SECR are one of the three less abundant species and the models show SECR at the edge of its range in the three proposed areas. This species-geographic range can be modeled by both NWFSC and NCCOS, but it is poorly explained by any of the habitat variables in either model.

[*NOTE: RED DOT IS FOR 1 OBSERVED SECR FROM PHOTO ANNOTATION OF 2012 SURVEY*]

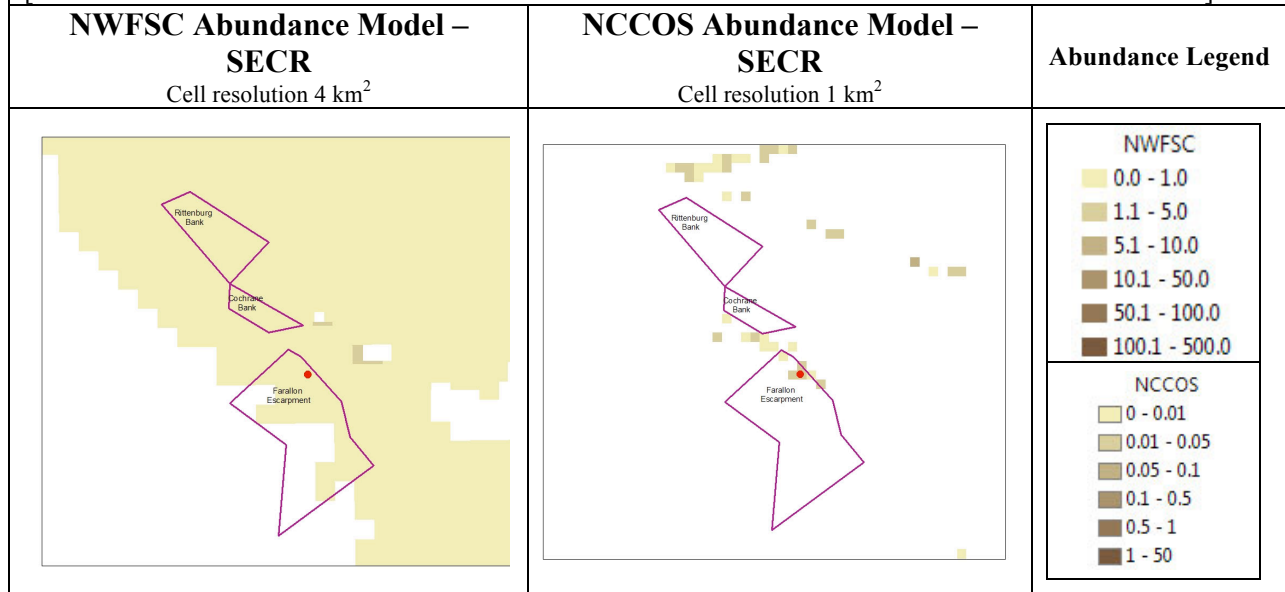| NWFSC Abundance Model – SECR Cell resolution 4 km^2	NCCOS Abundance Model – SECR Cell resolution 1 km^2	Abundance Legend

FIGURE 9: Greenstriped Rockfish (*Sebastes elongates, SEEL*)

Greenstriped rockfish prefer mixed hard and soft substrates in proximity to rocky outcrops within a moderate depth range of 100-250 m and are most common and abundant north of Monterey Bay. SEEL has moderate (NWFSC) to high (NCCOS) predicted abundance in two of the proposed areas. SEEL were also observed in both of these areas.

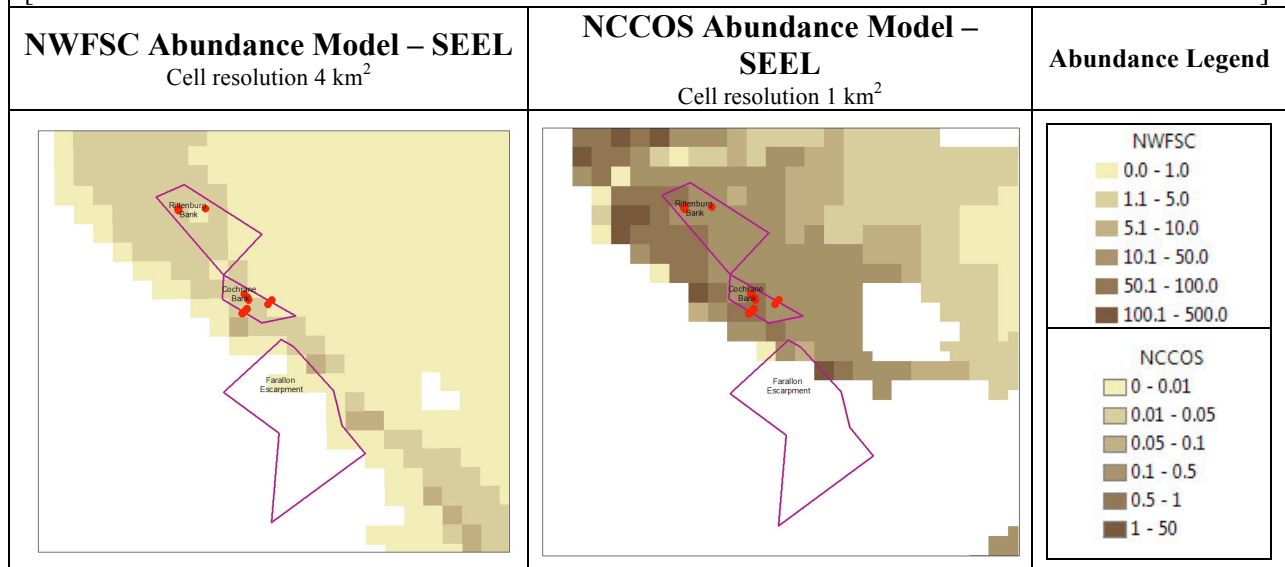[*NOTE: RED DOTS ARE FOR 55 OBSERVED SEEL FROM PHOTO ANNOTATION OF 2012 SURVEY*]

NWFSC Abundance Model – SEEL Cell resolution 4 km^2	NCCOS Abundance Model – SEEL Cell resolution 1 km^2	Abundance Legend

FIGURE 10: Longspine Thornyhead (*Sebastolobus altivelis, SEAL*)

Longspine thornyhead benthic habitats include low relief mixed cobble and pebble sediments across the shelf, preferring depths greater than 250 m. This species is notable for a lack of variation in probability of occurrence and abundance along the coast. The NWFSC model predicted moderate abundance of SEAL in one of the three proposed areas. SEAL were also observed in that area.

[NOTE: RED DOT IS FOR 4 OBSERVED SEAL FROM PHOTO ANNOTATION OF 2012 SURVEY]
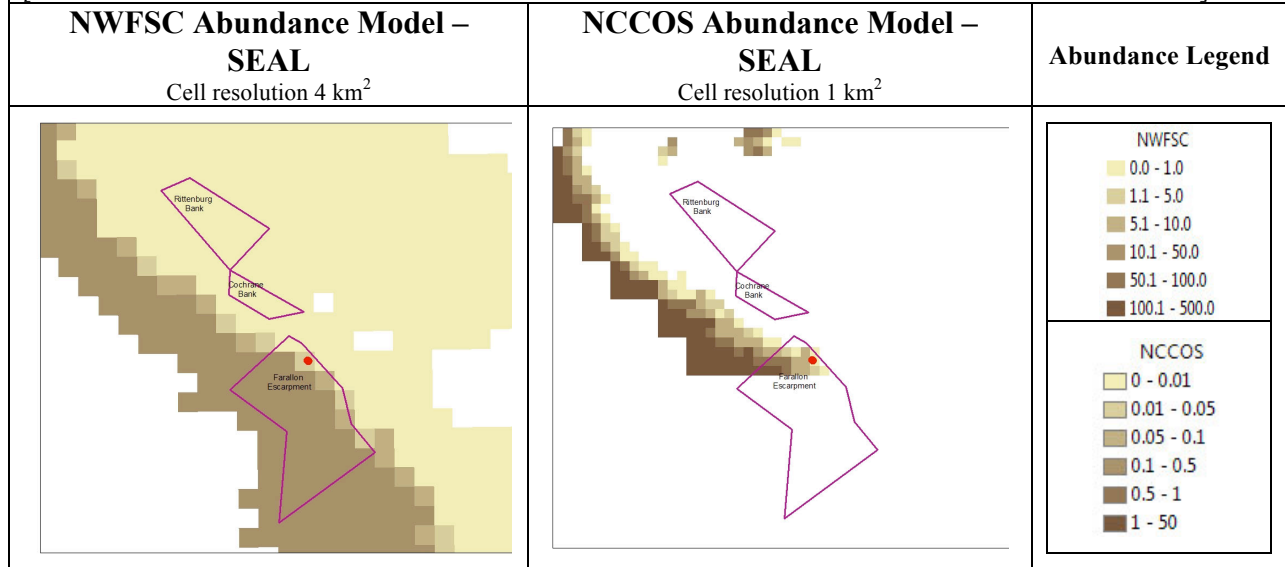
NWFSC Abundance Model – SEAL Cell resolution 4 km²	NCCOS Abundance Model – SEAL Cell resolution 1 km²	Abundance Legend

FIGURE 11: Petrale Sole (*Eopsetta jordani, EOJO*)

Petrale sole is an abundant shelf species utilizing soft sediment but frequently found on or near small cobbles. Abundance models were more heterogeneous with catch hotspots predicted off Point Reyes, which is approximately 15-20 miles inshore of the proposed areas. The NCCOS model shows high abundance of EOJO in two areas.

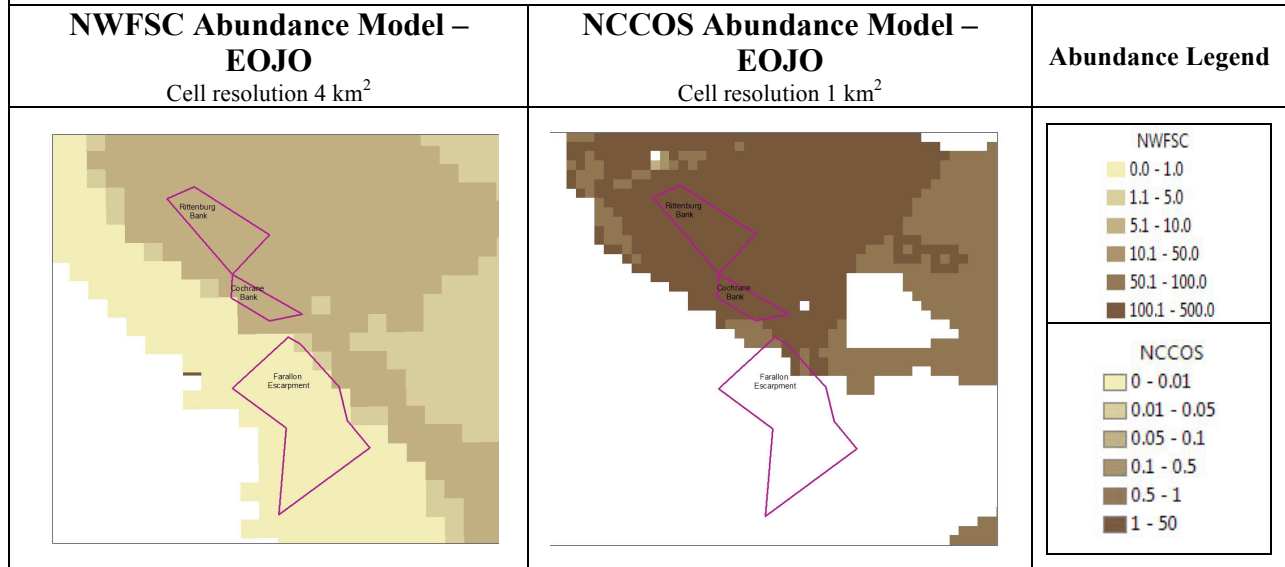| NWFSC Abundance Model – EOJO Cell resolution 4 km²	NCCOS Abundance Model – EOJO Cell resolution 1 km²	Abundance Legend

FIGURE 12: Sablefish (*Anoplopoma fimbria*, ANFI)

Sablefish are a common species in deep water (300-1000m) and soft sediments, are among the most commonly observed species in the trawl survey, and were well described by both the NWFSC and NCCOS models. Both NWFSC and NCCOS found the abundance model difficult to estimate due to rare occasional extremely high catches in the trawl survey (occasional trawl survey catches of > 1000 kg/ha). Therefore, these models may not be the best predictors of abundance. Based on depth, ANFI would most likely occur in the area that encompasses the upper slope.
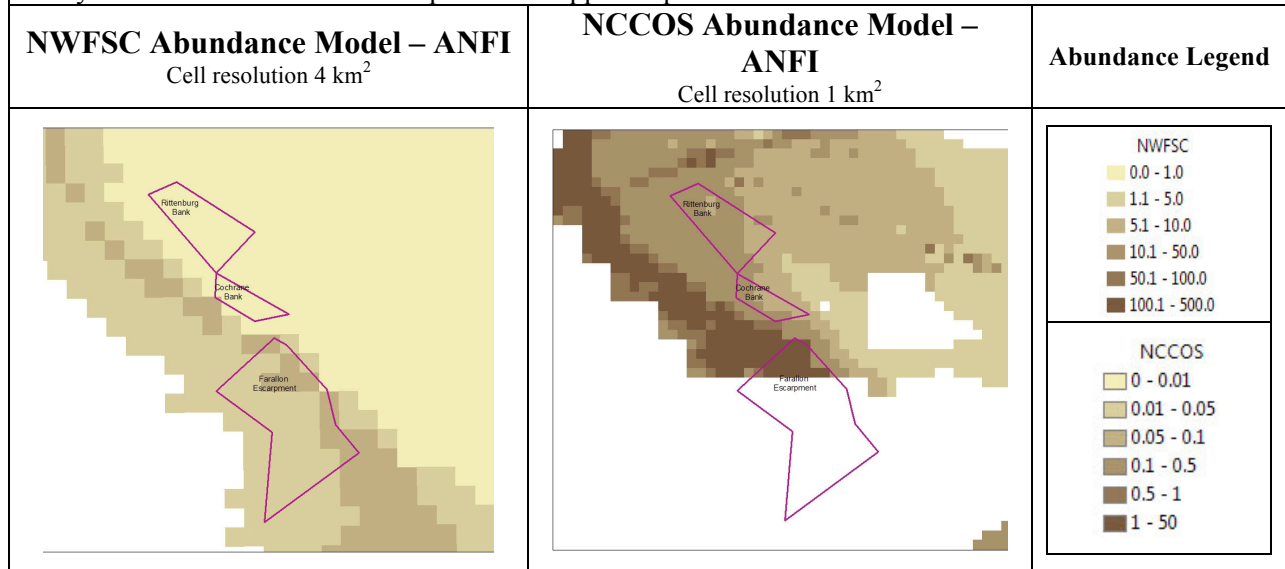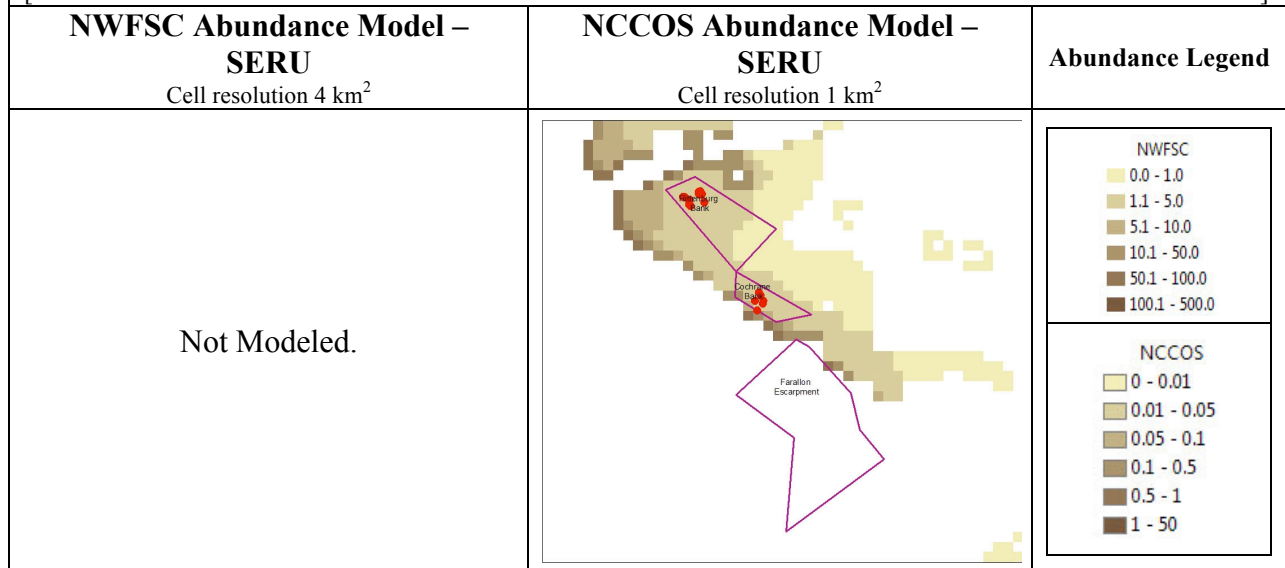
NWFSC Abundance Model – ANFI Cell resolution 4 km^2	NCCOS Abundance Model – ANFI Cell resolution 1 km^2	Abundance Legend

FIGURE 13: Yelloweye Rockfish (*Sebastes ruberrimus, SERU*)

Yelloweye rockfish exhibit strong site fidelity to rocky bottoms with steep outcrops. SERU are primarily associated with rocky, untrawlable habitats. SERU are poorly sampled by the trawl survey (present in ~2% of survey trawls), and this rarity made estimating species-habitat relationships difficult. This emphasizes the importance of additional sampling. Of the 6 focal species SERU, the highest numbers were observed in the 2012 research cruise within one of the proposed areas.
[*NOTE: RED DOTS ARE FOR 74 OBSERVED SERU FROM PHOTO ANNOTATION OF 2012 SURVEY*]

| NWFSC Abundance Model – SERU Cell resolution 4 km^2	NCCOS Abundance Model – SERU Cell resolution 1 km^2	Abundance Legend
Not Modeled.		

Substrate

As noted in the Groundfish FMP, rocky habitat may be composed of bedrock, boulders, or smaller rocks, such as cobble and gravel. Hard substrates are one of the least abundant benthic habitats, yet they are among the most important habitats for groundfish. Much of the habitat use database builds on the observations of Love et al. (1991). They reported that 70% of the 58 species of Pacific rockfish they examined used hard substrate. According to the EFH Phase 1 Report of the three proposed areas, Area 1 (Rittenburg Bank to Fanny Shoal) and Area 2 (Cochrane Bank) show hard substrate within their boundaries (*Figure 14*). According to the EFH Synthesis Report, hard and mixed substrates appear to be relatively rare (7.2% and 3.3%, respectively) when compared coast-wide to soft substrate (89.5%). However, it also should be noted that the majority of federal waters within GFNMS have not been surveyed in enough detail to determine substrate characterization or complexity (by sidescan sonar, multibeam, or visual observation) so most habitats are unknown, and are therefore shown as soft sediment in *Figure 14*. Also according to the Report, soft substrate is much less protected by EFH Conservation Areas in the Central Biogeographic Region as compared to hard substrate in terms of percentage protected. The Rittenburg Bank design option was drawn to include soft substrate that connects two hard and mixed substrate areas to better represent all shelf substrates within GFNMS.

Additionally, bedrock was found on the fault scarps on the Farallon Escarpment during the 2012 visual survey. These small, but unique hard substrate areas on the Farallon Escarpment are shown as soft substrate due to the fact that the visual groundtruthing was not conducted prior to the release of the EFH Phase 1 report (See *5.b.iii - Geological Characteristics of the Farallon Escarpment* for additional information about substrate).

FIGURE 14: Substrate Data from the EFH Synthesis Report
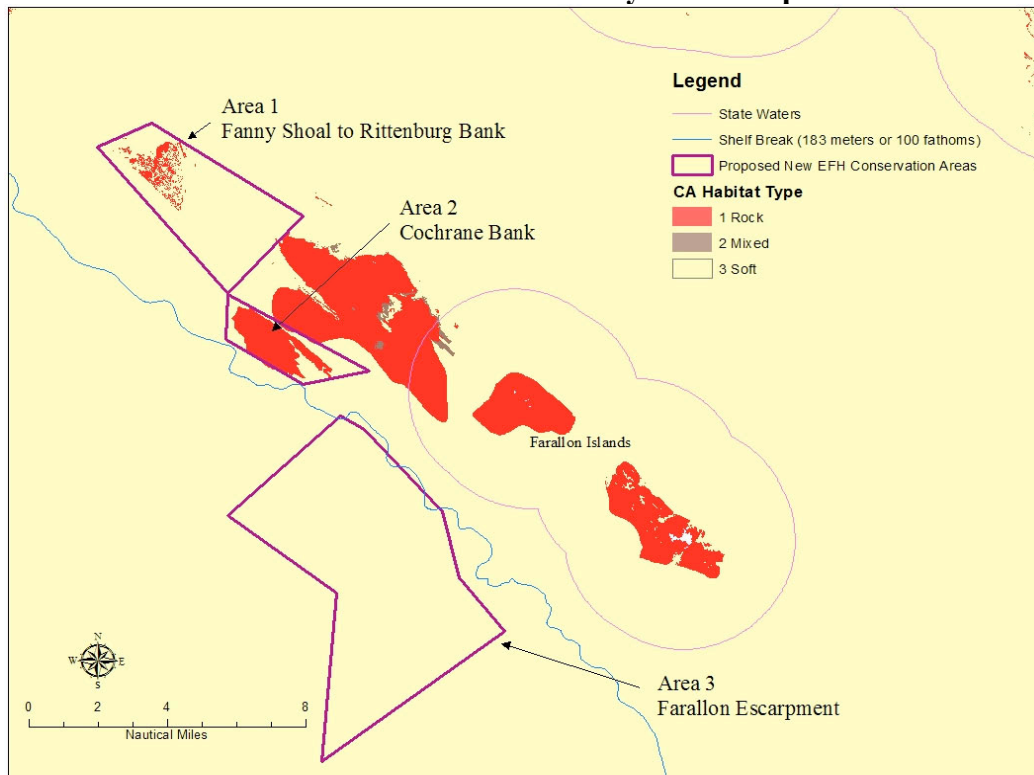
Biogenic Habitat

The EFH Synthesis Report presented information regarding the presence and abundance of corals and sponges and pennatulids (*Figure 15*). It is important to note that not all areas within the FMP area have been surveyed for presence of corals and sponges, and areas that are surveyed but found not to support coral and sponge communities are not always documented. Within GFNMS, the only areas with hard substrate to have been visually surveyed are the areas surveyed in the 2012 research cruise. This information was provided for the EFH Synthesis Report.

The biogenic habitat analysis in the EFH Synthesis Report showed that within the FMP management area (0.5%) had records of coral-sponge presence, and (0.5%) had records of pennatulids (sea pens). This only represents where corals and sponges have been observed over the last 23 years, not necessarily where they don't occur. Most (62%) areas of coral and sponge presence are located within the upper slope, with 28% and 10% of presence in the shelf and lower slope, respectively. The central biogeographic sub-region had the fewest areas with coral and sponge presence, but this rank order may be largely influenced by survey effort. Pennatulid presence shows a similar relative distribution to that of corals and sponges with about half of known areas on the upper slope, 38% on the shelf and 12% on the lower slope.

On the continental shelf and upper slope, most areas where corals and sponges have been observed are outside EFH Conservation Areas. As noted in the EFH Synthesis Report, there are sites within Gulf of the Farallones National Marine Sanctuary outside EFH conservations areas where corals and sponges have been observed in higher relative numbers (*Figure 15)*. Information about species observed can be found in *Section 5.a.i-iii-Biological Characteristics*.

The Guinotte and Davies habitat suitability model for west coast corals is additional information that could be an indication of possible hotspots for coral habitat. Data from this model are presented for all taxa, and for Suborder Holaxonia, and Order Scleractinia (*Figure 16*). These two were chosen in particular because according to the EFH Phase 1 Report, most of the majority of suitable habitat for Suborder Holaxonia and Order Scleractinia was predicted in areas outside of existing EFH area closure boundaries. As the EFH Synthesis Report notes, it is important to recognize that predictive distribution models estimate potential habitat suitability rather than realized habitat suitability, which represents a more limited spatial area. However the Report also notes that this study is significant in the context of the EFH review, as no habitat suitability models for West Coast corals were available in 2005. Additional discussions about this model can be found in *Section 6-Discussion-Area 3 – Farallon Escarpment*.

The MSA allows NOAA to manage fishing-related threats to deep-sea corals and sponges in federal waters through fishery management plans developed in conjunction with the Regional Fishery Management Councils. The MSA was amended in 2007, requiring NOAA to establish the Deep Sea Coral Research and Technology Program and providing new discretionary authority to protect deep-sea coral and sponge areas from damage caused by fishing gear. It is noteworthy that in 2010, NOAA released a Strategic Plan for Deep-Sea Coral and Sponge Ecosystems that discussed deep-sea coral or sponge habitats that have been identified as EFH for a number of fisheries. Additionally, the Plan states that NOAA takes a precautionary approach

to manage bottom-tending gear, especially mobile bottom-tending gear, and other adverse impacts of fishing on deep-sea coral and sponge ecosystems. One of the tools identified is the use of EFH management measures.

FIGURE 15: Coral, Sponge and Pennatulid Presence and Abundance from the EFH Synthesis Report

Pennatulid Presence & Abundance	Coral/Sponge Presence & Abundance
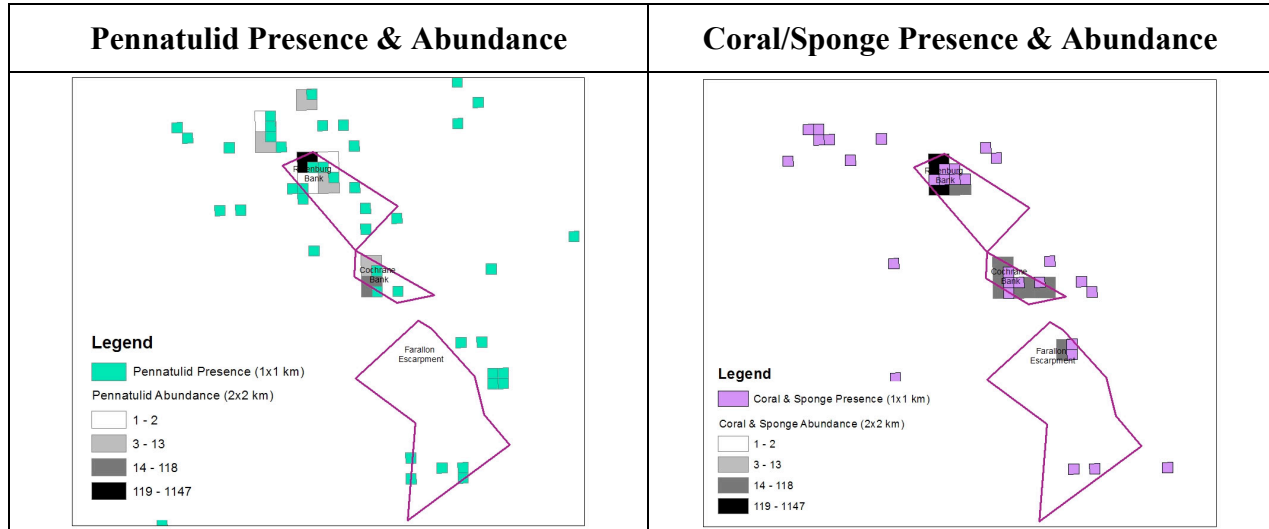
Differences in how data were collected make it challenging to estimate relative abundance. The metric of relative observed abundance is defined as mean counts of corals and sponges observed per km. For 2x2 km cells with only one count value, the mean value was equal to the count, with a variance of 0. Because effort varied widely between cells, mean values rather than sum of counts were used as the metric in order to standardize the abundance values per cell. For example, some studies summarized counts over individual photo or video frames, while others summarized over the course of entire dive. In order to compare the distributions in a standardized manner, presence data were summarized within 1x1 km contiguous grid cells.

FIGURE 16: Guinotte and Davies Habitat Suitability Models

Guinotte & Davies HSA Model	Suborder Holaxonia	Order Scleractinia
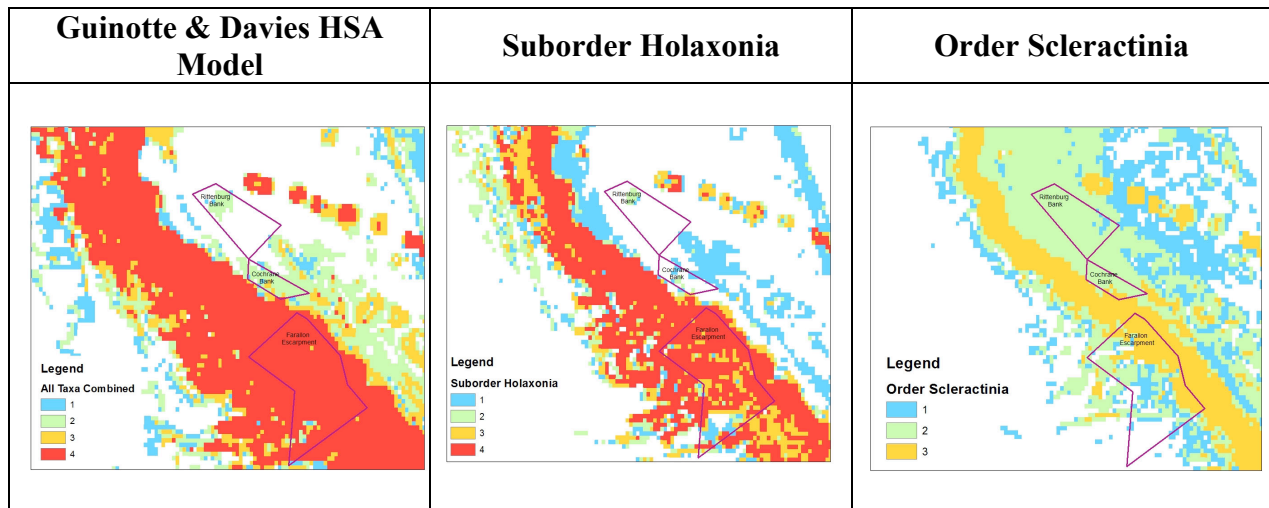
Biogenic Habitat Suitability for Groundfish FMP Species

According to Amendment 19 of the Groundfish FMP, ideally EFH would be defined by delineating habitat in terms of its contribution to spawning, breeding, feeding, growth to maturity, and production; however, comprehensive data on these functions are not available for these areas. According to the EFH Phase 1 Report, strong, consistent benthic habitat associations of many groundfishes, in conjunction with recent advances in acoustic seafloor mapping techniques, suggest that habitat determination may serve as a proxy for predicting groundfish distribution and abundance at broad regional scales (Anderson et al. 2009). Therefore, it should be possible to model and predict these spatial patterns using habitat maps and quantified habitat relationships. Although GFNMS has not run any groundfish habitat suitability models for the three proposed areas, we recognize the potential to use these models, such as the updated habitat suitability probability (HSP) model, termed the "EFH Model", in the analysis phase of EFH review for and Environmental Impact Statement under National Environmental Policy Act. The information provided throughout this proposal can be made available in more detail for the HSP.

Habitat Vulnerability

Fishing Pressures

Appendix J of the EFH Phase 1 Report covered the effects of fishing gear on benthic habitats through a literature review and covered predictive modeling of fishing impacts to habitat both during and subsequent to the EFH Final Action in 2005. The findings of that section are incorporated herein by reference. Briefly, the following summarizes some of the major findings:

- Unlike in 2005, several studies looked at the impacts of bottom trawling on mud-seafloor ecosystems of the continental shelf and slope. Results are best examined in the context of the many rigorous studies worldwide demonstrating that bottom trawling alters communities of seafloor species.
- Some studies suggest that densities of demersal fish and epibenthic macroinvertebrate communities are lower in bottom trawled habitat (Hixon and Tissot 2007; De Marignac et al. 2008; Hannah et al. 2010).
- One study found that bottom longlines can cause significant damage to sensitive habitats through entanglement and concluded that management of areas to be fished appear to be the main mitigating strategy for this problem (Baer et al. 2010).
- One study documented the impacts model used in the Alaska EFH process (Fujioka 2006). Key outcomes of the analysis were that the Long-term Effect Index results for hard corals were typically greater than 50% even under low levels of trawl effort and that substantial long-term impacts could occur to soft sediment habitats depending on trawl intensity.
- One study on the effects of marine debris on benthic habitats showed some physical disturbance to habitats from fishing gear (including common structure-forming macroinvertebrates) (Watters et al. 2010). However, Chiappone et al. (2005) found that less than 0.2% of the available invertebrates were affected by lost hook-and-line fishing gear, even though this gear caused 84% of the documented impacts (primarily tissue abrasion) to sponges and cnidarians.
- Several papers underscored the fact that little has been written about recovery of seafloor habitat from the effects of fishing. There are few long-term studies, control sites or research closures, which hinder the ability to fully evaluate impacts.

Derelict fishing gear was observed in the 2012 survey of Rittenburg Bank and Cochrane Bank (*Figure 17*). Out of 34 transects, derelict fishing gear was observed on an average of 20% (7) of transects, based on photo observations. No derelict gear was observed on the 2 transects surveyed at Farallon Escarpment.   Although more derelict gear was found at Rittenburg Bank, it had a lower overall percentage on transect because surveys were conducted on a higher number of transects (18 transects total), compared to Cochrane Bank, where only 11 transects were surveyed. Additionally, two pieces of derelict gear were observed on one transect at Rittenburg Bank, so although 5 incidents of derelict gear were annotated, they were only observed on 4 transects. The gear types are listed in the table below, by bank location. The percentages represent the total percentage of transects with observed derelict gear, by bank location.

Derelict Fishing Gear by Transect from Photo Observations*		
	Rittenburg Bank	**Cochrane Bank**
Non-monofilament or Long Line		1
Fishing Net	1	2
Monofilament Line	4	
Percent of Transects With Derelict Gear	**22%**	**27%**

Figure 17

★ NET
● LINE

Image of Fishing Net at Cochrane Bank

Non-fishing Pressures

As the EFH Synthesis Report states, pressures do not act upon groundfish EFH individually, but collectively. The Report covered the cumulative effects of non-fisheries pressures by assuming that pressures were additive and each had equal weight. Information provided is incorporated herein by reference. Generally, the proposed areas are offshore and show lower pressure intensity primarily because of distance from mainland. An additional consideration is to note that these areas are within boundaries of GFNMS, which has additional water quality and seabed alteration protections. Placing an EFH Conservation Area within a sanctuary can offer greater overall protections from non-fishing pressures.

Socioeconomics and Management of Proposed Actions

GFNMS understands and expects that a more comprehensive analysis of anticipated fishery and socio-economic impacts, which may result from these options, would be developed through the Council's National Environmental Policy Act process (i.e., Phase 3). However, for preliminary information about the socioeconomics profile of the combined proposed areas can be found in *Section 5.e-Socioeconomic Characteristics of the Combined Areas*.

All proposed options are in federal waters. Fisheries management and oversight can include the Council, NMFS, the California Department of Fish and Wildlife, California Fish and Game Commission, or the California State Legislature depending on the species managed. GFNMS regulates and has management oversight on certain non-fishing activities (15 CFR § 922.82).

PART B. DISCUSSION OF FINDINGS BY AREA

Area 1- Rittenburg Bank to Fanny Shoal

GROUNDFISH

Of the 6 focal species presented in the models, petrale sole has the strongest species-habitat association within Area 1, according to both the NMFSC and NCCOS Abundance Models. This is to be expected because petrale sole is a common species in the soft substrate of shallow shelf waters between Rittenburg Bank and Fanny Shoal. Greenstriped rockfish and sablefish have relatively high habitat associations for this area based on the models. Greenstripe rockfish were observed based on photo annotations from the 2012 research cruise, but petrale sole were not. However, there were 38 unidentified flatfish observed so it is possible petrale sole could be one of the unidentified species. Sablefish was not observed, but they are more common in deeper water (300-1000 m). The NWFSC Model did not predict any yelloweye rockfish in this area. However, data limitations for the model (see *Figure 13*) are the likely reason. Both juvenile and adult yelloweye rockfish were observed in this area during the 2012 research cruise. In fact, the highest observed numbers of yelloweye rockfish were found in this area (see *Section 5.a.i - Biological Characteristics of Rittenburg Bank to Fanny Shoal*).
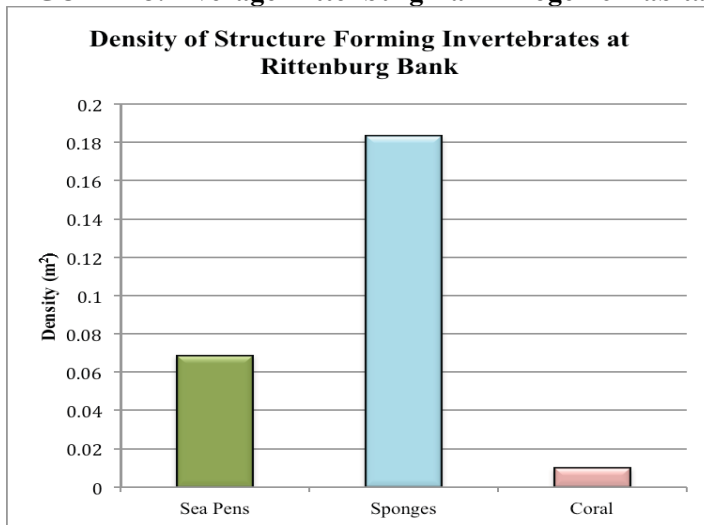
BIOGENIC HABITAT DENSITY

Observation data from the 2012 research cruise showed that Rittenburg Bank had the highest number of coral colonies and sponges combined, with sponges greatly outnumbering the corals in terms of abundance, diversity and density (*Figure 18*). Rittenburg Bank also had the highest maximum density of sea pens. Density calculations were conducted using video from the beginning to end of each transect, and are reported for transects only; not the entire survey, and not the entire Bank. The methods summary can be found in *Appendix A-2*.

Sponge density averaged 0.18 sponges per m^2, with a range from 0.00 to 0.86 sponges per m^2. The highest concentration of sponges was found along high-relief, hard bottom transects. The density of corals averaged 0.01 coral colonies per m^2, with a range from 0.00 to 0.04 corals per m^2. The density of sea pens averaged 0.09 sea pens per m^2, with a range from 0.00 to 1.21 sea pens per m^2. The highest concentration of sea pens occurred along low-relief, soft bottom transects. Corals and sponges were predominant in hard substrate, while sea pens and sea whips were common in mixed and soft substrate. There was a highly significant positive correlation (*Figure 19*, $P < 0.01$, $R^2 = 0.47$) between the number of biogenic invertebrate colonies and the

number of rockfish individuals. There was also a highly significant positive correlation between the abundance of colonies and the number of rockfish species ($p = 0.01$, $R^2 = 0.33$).

FIGURE 18: Average Rittenburg Bank Biogenic Habitat Density

BIOGENIC HABITAT AND ROCKFISH ABUNDANCE

There was a significant positive correlation between the number of rockfish and habitat forming invertebrates (corals, sponges, and pennatulids) at Rittenburg Bank (*Figure 19*). Habitat forming invertebrate abundance can explain 47% of the variation in fish abundance. The correlation holds true for sponges and rockfish, since sponges outnumbered corals. For every three invertebrates, we counted one rockfish at Rittenburg Bank. These data are not implying that invertebrates cause rockfish abundance. It's more likely that they both prefer high-relief hard bottom habitat.

FIGURE 19
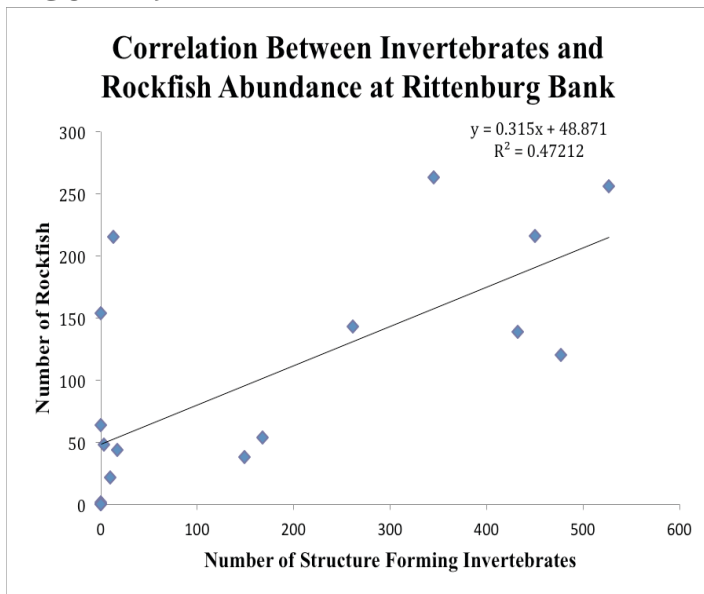
Note: *Structure Forming Invertebrates include corals, sponges, and pennatulids and exclude mobile invertebrates, consistent with species presented in the EFH Synthesis Report.*

PROPOSED HAPC DESIGNATION FOR RITTENBURG BANK

In addition to a proposed bottom trawl EFH Conservation Area, the proposed Area 1 -Rittenburg Bank to Fanny Shoal is an excellent candidate for a HAPC "Area of Interest" because it has unique biological and geological characteristics, including rocky habitat as defined in the Groundfish FMP, and range of biogenic habitat including one of the highest levels of observed abundance in the region (*Figure 18*). According to the EFH Synthesis Report, hard substrate appears to be relatively rare (7.2%) when compared coast-wide to soft substrate (89.5%). This proposed area includes known hard substrate: 1.8 mi^2 (11%) and soft substrate: 15.2 mi^2 (89%). Adult and juvenile groundfish species have also been observed in this area, with a minimum of 23 taxa identified, with a significant positive correlation between observed rockfish and biogenic habitat (*Figure 19*). Also according to the Report, HAPCs have a greater proportion of areas exposed to 'high' non-fisheries threats (i.e. nearshore pollution) - both individual and cumulative - than were present in non-HAPC areas. This is largely due to HAPCs in shelf areas being exposed to land-based threats, and their selection in 2005 by the Council to address non-fishing impacts. However, Area 1 is on the shelf, in offshore waters and shows lower pressure intensity primarily because of distance from the mainland. Designation of a HAPC where non-fishing pressures are currently lower and substrate protections are higher within sanctuary waters can help protect these areas from new non-fishing pressures.
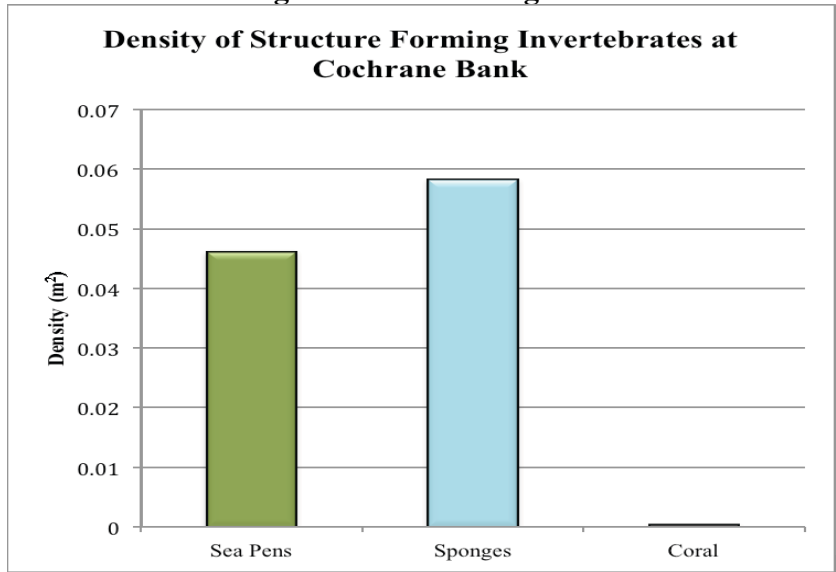
Area 2- Cochrane Bank

GROUNDFISH

Of the 6 focal species presented in the models, petrale sole has the strongest species-habitat association within Area 2, according to both the NMFSC and NCCOS Abundance Models. greenstriped rockfish and, to a lesser extent, sablefish have relatively high probability of abundance in the primarily rocky substrate of Area 2. Cochrane Bank also provides mixed moderate-high habitat availability for yelloweye rockfish according to the NCCOS model. Of these four species, greenstripe rockfish and yelloweye were observed based on photo annotations from the 2012 research cruise. Of the 6 focal species, greenstripe rockfish had the highest number of observations, and both juvenile and adult yelloweye rockfish were observed in this area during the 2012 research cruise. Petrale sole and sablefish were not observed. However, there were 38 unidentified flatfish observed so it is possible petrale sole could be one of the unidentified species. Despite the models, sablefish are more common in deeper water (300-1000m), and were not expected here. Due to data limitation explained previously, the NWFSC Model did not predict any yelloweye rockfish in this area. (See *Section 5.a.ii - Biological Characteristics of Cochrane Bank.*)

BIOGENIC HABITAT DENSITY

On-transect video observations from the 2012 research cruise showed that Cochrane Bank had lower average densities of corals, sponges, sea pens and sea whips as compared to Rittenburg Bank (*Figure 20*). The density of corals averaged less than 0.01 coral colonies per m^2, with a range from 0.00 to 0.002 coral colonies per m^2. Sponge density averaged 0.06 sponges per m^2, with a range from 0.00 to 0.19 sponges per m^2. The density of sea pens averaged 0.05 coral colonies per m^2, with a range from 0.00 to 0.47 sea pens per m^2. Corals and sponges were primarily found in hard substrate, with the highest concentrations of sponges in hard substrate; while sea pens and sea whips were found in mixed and soft substrate. Density calculations were

conducted using video of each transect, and are reported for transects only; not the entire survey, and not the entire Bank. The methods summary can be found in *Appendix A-2*.

FIGURE 20: Average Densities of Biogenic Colonies on Cochrane Bank

BIOGENIC HABITAT AND ROCKFISH ABUNDANCE

There was a slightly positive, non-significant correlation ($p > 0.05$, $R^2 = 0.06$) between the number of rockfish and habitat forming invertebrates (corals, sponges, and pennatulids) at Cochrane Bank (*Figure 21*). Habitat forming invertebrate abundance can explain 6.6% of the variation in fish abundance. The weak correlation applies primarily to sponges and rockfish, since sponges outnumbered corals. One outlier is a transect with a school of juvenile pygmy rockfish over soft bottom sea pens and sea whips. Without this data point, the correlation remains weak and insignificant.

FIGURE 21
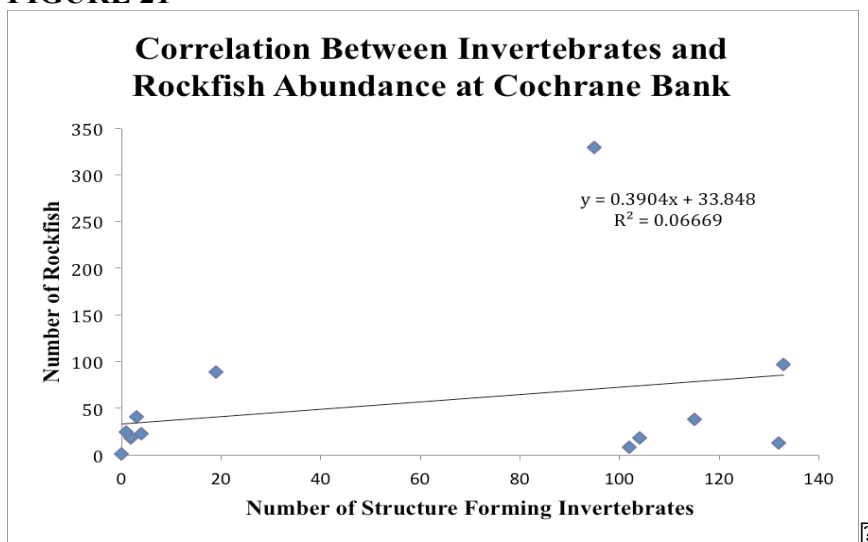
Note: *Structure Forming Invertebrates include corals, sponges, and pennatulids and exclude mobile invertebrates, consistent with species presented in the EFH Synthesis Report*

PROPOSED HAPC DESIGNATION AND ADDITIONAL PROTECTIONS FROM ALL BOTTOM CONTACT GEAR (*EFH Conservation Area 2 – Cochrane Bank - Option 2B*)

In addition to a proposed bottom trawl EFH Conservation Area, the proposed Area 2 is an excellent candidate for a HAPC "Area of Interest," because it has unique biological and geological characteristics, including rocky habitat as defined in the Groundfish FMP, and vulnerability of biogenic habitat. Again, according to the EFH Synthesis Report, hard substrate appears to be relatively rare (7.2%) when compared coast-wide to soft substrate (89.5%). More than half of the proposed area includes known hard substrate: 3.4 mi^2. Adult and juvenile groundfish species have also been observed in this area, with a minimum of 23 taxa identified, with a positive, although less than significant, correlation between observed rockfish and biogenic habitat (*Figure 21*). As is the case with Rittenburg Bank, designation of a HAPC at Cochrane Bank where non-fishing pressures are currently lower and substrate protections are higher within sanctuary waters can help protect these areas from new non-fishing pressures.

One large black coral colony, *Antipathes dendrochristos* (Opresko 2005), was found on Cochrane Bank, representing a substantial range extension for the species. It is estimated to be at least 2 meters wide and 1 meter tall, suggesting the colony is near 100 years old, based upon growth rate studies (1.5 cm/yr, Love et al. 2007). Previously this species was only observed via submersible on several deepwater banks off southern California, south of Point Conception (Love et al. 2007; Tissot et al. 2006; Yoklavich and Love 2005). Many of these specimens showed epifaunal associations with other invertebrates including crinoids, amphipods, brittle stars, anemones, sponges and crabs. One large (2.1 m high) dead colony, which was heavily colonized by over 2500 invertebrate individuals, was recently aged to 140 years (Love et al. 2007). For these reasons, *Antipathes* spp. were given a high rating of structural importance, meaning the colonies are known to provide vertical structure above the sea floor that can be utilized by other invertebrates or fish (Whitmire and Clarke 2007). During the 2012 ROV survey, we observed these fish and invertebrates associated with the colony:

- *FISH* **-** One rosy rockfish that was sitting under the black corals. Two other fish may have been associated with the coral (a sub-adult yelloweye and a kelp greenling). Both of these species swam through the coral, but they weren't resting on the coral.
- *INVERTEBRATES* - There were many (>15) *Chorilia* spp. crabs (possibly *C. longipes*) crabs throughout the coral, but it was difficult to count each individual for a total count because we did not circumnavigate each coral. There also appeared to be some smaller crustaceans (within in the coral, as seen on the close-up view), but these went by too fast and were unclear for positive ID.

Slow-growing, long-lived, structure-forming biogenic corals like *Antipathes dendrochristos* are particularly vulnerable to fishing gear impacts. Of the four instances of fishing gear we observed during the surveys, 27% was found a Cochrane Bank. The Bank was first mapped in 2011, was further delineated based on 2012 observations, is in the process of being officially named, and the final report has not been published. The Bank is also not on the NOAA Charts as of July 2013. For all of these reasons, Cochrane Bank may warrant protection from all bottom contact gear. This is why GFNMS proposed EFH Conservation Area Option 2A (See *Section 4.a-b.*).
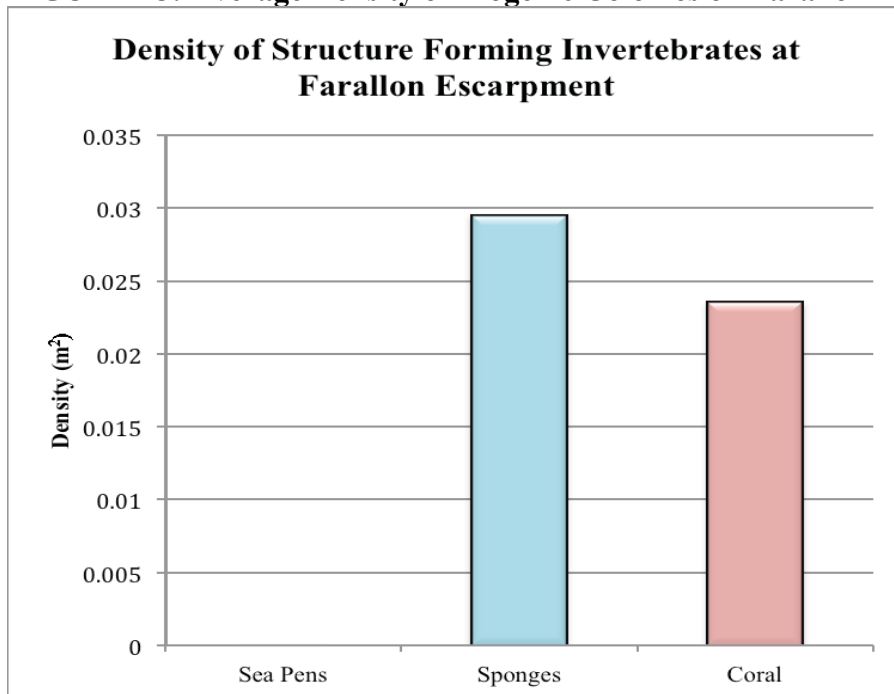
Area 3- Farallon Escarpment

GROUNDFISH

Of the 6 focal species presented in the models, longspine thornyhead has the strongest species-habitat association within Area 3, according to both the NMFSC and NCCOS Abundance Models. This is to be expected because only the Escarpment provides the deep (>250 m) low relief cobble/pebble habitats preferred by longspine thornyhead. Moderate to good habitat is also modeled for Sablefish in Area 3 due to the species preferred depths. (For undetermined reasons, NCCOS shows a habitat break for both longspine thornyhead and sablefish mid-way through Area 3, although there is excellent habitat predicted above and below, along the Farallon Escarpment.) Longspine thornhead were observed based on photo annotations from the 2012 research cruise, but sablefish were not. One darkblotched rockfish was observed in this area based on photo annotations, but both models also showed darkblotched rockfish at very low abundance levels. (See *Section 5.a.iii - Biological Characteristics of the Farallon Escarpment.*)

BIOGENIC HABITAT DENSITY

Observation data from the 2012 research cruise showed that the Farallon Escarpment had the highest density of corals compared to Rittenburg and Cochrane Banks, averaging 0.02 coral colonies per m^2, with a range from 0.01 to 0.02 corals per m^2 (*Figure 25*). Large anemones were also common Sponge density ranged from 0.02 to 0.03 sponges per m^2. No sea pens or sea whips were observed at the Farallon Escarpment. Density calculations were made using continuous video along transects, with laser based areal estimates and counts of colonies and individuals. The methods summary can be found in *Appendix A-2*.

FIGURE 25: Average Density of Biogenic Colonies on Farallon Escarpment

BIOGENIC HABITAT AND ROCKFISH ABUNDANCE

No regression analysis for Farallon Escarpment was conducted due to insufficient sample size (n = 2 transects).

ADDITIONAL CONSIDERATIONS OF THE IMPORTANCE OF SUBSTRATE AND BIOGENIC HABITAT

The design at the Farallon Escarpment encompasses the largest area of the three options, which is a product of drawing an area that includes important geologic features throughout the entire upper shelf depth while also allowing trawling north, south and east of the proposed area. As noted in *Section 5.a.iii – Geological Characteristics*, the Farallon Escarpment substrate is unique because it contains canyons, gullies, ridges and fault scarps, exposing continental shelf bedrock. The escarpment also is less than half the width (35 km) and twice as steep (gradient of 5°) compared to the area to the south. According to Amendment 19 to the Groundfish FMP, canyons are complex habitats that may provide a variety of ecological functions. Shelf-edge canyons have enhanced biomass due to onshore transport and high concentrations of zooplankton, a principal food source of juvenile and adult rockfish (Brodeur 2001). Canyons may have hard and soft substrate and are high relief areas that can provide refuge for fish, and localized populations of groundfish may take advantage of the protection afforded by canyons and the structure-forming invertebrate megafauna that grow there (Monterey Bay National Marine Sanctuary 2013).

The proposed design for the Farallon Escarpment EFH Conservation Area is on the Upper Slope. According to the EFH Synthesis Report, coast-wide, the Upper Slope accounts for 12.2% of the total area for all combined (shelf, upper slope, lower slope) habitats. A large proportion of all habitats along the U.S. West Coast is included in EFH Conservation Areas. However, the bottom trawl closure of seabed seaward of 700 ftm accounts for the majority of the EFH Conservation Area (on the lower slope); coast-wide ~10% of the upper slope and shelf areas have such protections. In the Central Biogeographic Region, 27% of soft habitat on the upper slope (the Farallon Escarpment is currently shown in the EFH Synthesis Report to consist of soft habitat) prohibits bottom trawling (except demersal seine) through an EFH Conservation Area. Although this is a higher percentage when compared coast-wide, the portion of the Escarpment with moderate to high observed abundance of biogenic habitat is not within this area. The EFH Synthesis Report points out that on the upper slope, most areas where corals and sponges have been observed are outside current EFH Conservation Areas.

Although visual observations were recorded for only two transects of the Farallon Escarpment, density calculations showed the highest average density of corals as compared to Rittenburg Bank and Cochrane Bank, averaging 0.03 coral colonies per m^2. Because data was collected on a small fraction of the Escarpment, one secondary source of information that can be considered for the area not surveyed is the Guinotte and Davies habitat suitability model for west coast corals. It is important to note that this is a coarse regional model, and no data from the GFNMS region were available at the time the model was run, so results should be interpreted with caution. However, in absence of observational biogenic habitat data, and given the above caveats, this model does show that the Farallon Escarpment has high coral habitat suitability predicted for all taxa, and for Suborder Holaxonia and Order Scleractinia, which were predicted in areas outside of existing EFH area closure boundaries (*Figure 16*).   Some Holaxonia are long lived.. Scleractinia in this region includes *Desmophyllum sp.*, which can also be long lived,

observed on the Farallon Escarpment west of Cordell Bank in 2010 (north of GFNMS). In the current proposed Area 3, we observed Holaxonia (*Swiftia sp.* in 2012).

II.   Contributors

The following individuals contributed data, maps, charts, and/or summaries presented in this proposal document.

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Appendix A

A.1. 2012 Research Cruise Methods

Sampling plan was to perform three to five transects in three substrate categories: areas of high relief and likely to have hard substrate (high-hard), low relief and likely to be hard substrate (low-hard), and areas of low relief and likely to be soft substrate (low-soft).   The substrate classifications were initially based on side scan and multibeam data available for each area, Rittenburg Bank, Cochrane Bank and part of the Farallon Escarpment. Cochrane Bank was identified during multibeam surveys performed in 2011. Transects were selected in a haphazard fashion, considering logistics, sampling time, deployment and recovery of the ROV. Transects were pre-selected for proximity and substrate heterogeneity to maximize sample sizes and the amount of "bottom" time.

Planned Transects				
	Low Relief-Soft Substrate	Low Relief-Hard Substrate	High Relief-Hard Substrate	Unknown Substrate
Rittenburg Bank (RB)	5	5	5	
Cochrane Bank (CB)	5	5	5	
Farallon Escarpment (FE)				2
Fanny Shoal (FS)				3
Completed Transects				
	Low Relief-Soft Substrate	Low Relief-Hard Substrate	High Relief-Hard Substrate	
Rittenburg Bank (RB)	5	4	9	
Cochrane Bank (CB)	2	8	1	
Farallon Escarpment (FE)			2	
Fanny Shoal (FS)		3		

 (Data from Fanny Shoal EFH are not presented in this proposal.)

Each photo transect consisted of 50 high-resolution still images (one image per two meters seabed). Transects RB-6, RB-7, RB-10, RB-42, and CB-46 did not yield the target of 50 images. The still frames for these transects were supplemented with high-resolution video frame-grabs to bring the transect total to 50. Poor quality images and duplicates were not considered.

The number of transects completed was 34 (FE was broken out into 2 transects, each 120 meter segment for consistency).

Low, Soft	7
Low, Hard	13
High, Hard	14

Low relief, soft bottom substrates were characterized by flatfish and sea pens. Low-relief, hard bottom substrates were characterized by moderate numbers of sponges and rockfish, and high relief hard bottom substrates were characterized by high numbers of rockfish, sponges and

corals. Low-relief and high-relief hard bottom substrates were most similar in species diversity and composition. Low-hard relief substrate was is mix of what Groundfish EFH Phase 1 Report defines as "Hard", "Mixed" and "Soft" substrates. Additional analysis is needed to redefine "Mixed" for this study.

FIGURE A.1: Transect Centroid Coordinates from the 2012 Research Cruise - Transect centroid coordinates were calculated by averaging the latitudes and longitudes of the transect endpoints.
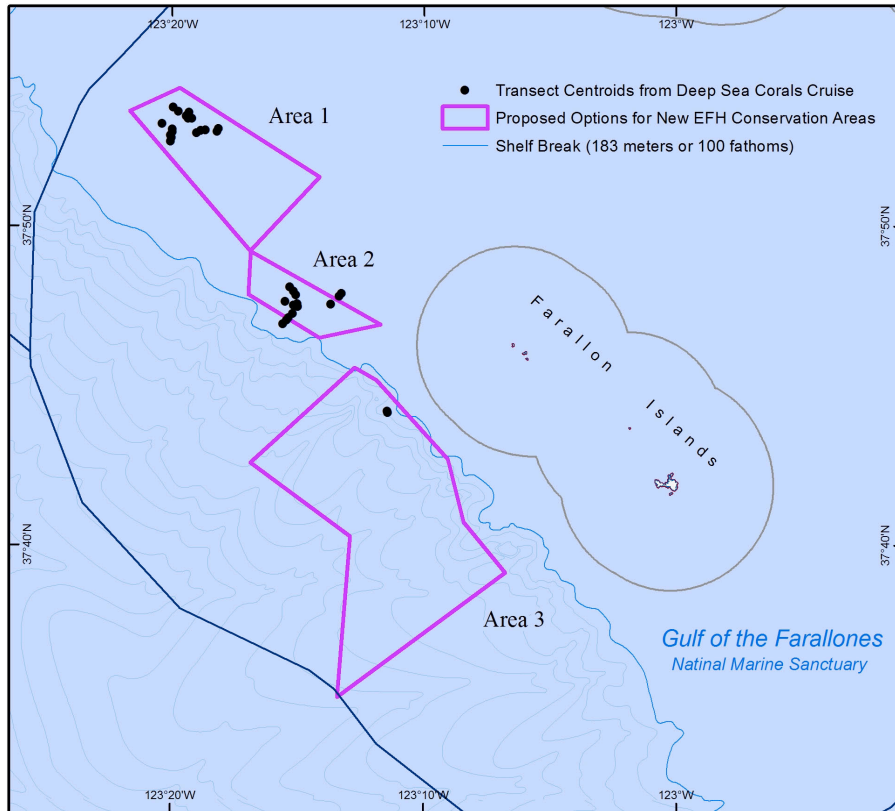
A.2. Video Transect Density Calculation

Methods summary

Density was calculated by dividing the number of taxa observed along a transect by the area surveyed. Counts were obtained for all taxa of interest from analysis of HD video segments collected from the ROV's oblique front-facing camera. Area was estimated using height above bottom, the camera lens length, and the camera angle. Accuracy is estimated to be at 95%. Density was calculated for each taxa of interest and reported in units of number of colonies per square meter. The average density was estimated for each taxa at each site by calculating the mean density value among transects. The results were plotted as columns showing mean density.

Due to the continuous nature of video, the counts obtained during the video-based density analyses represent an increase in the total numbers of colonies and species observed, compared to numbers obtained using discrete, intermittent still photographs.