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A CHARACTERIZATION OF DEEP-SEA CORAL AND SPONGE COMMUNITIES ALONG THE CALIFORNIA AND OREGON COAST USING A REMOTELY OPERATED VEHICLE ON THE EXPRESS 2018 EXPEDITION

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A CHARACTERIZATION OF DEEP-SEA CORAL AND SPONGE COMMUNITIES ALONG THE CALIFORNIA AND OREGON COAST USING A REMOTELY OPERATED VEHICLE ON THE EXPRESS 2018 EXPEDITION.

A REPORT TO NOAA DEEP-SEA CORAL RESEARCH AND TECHNOLOGY PROGRAM, 2021

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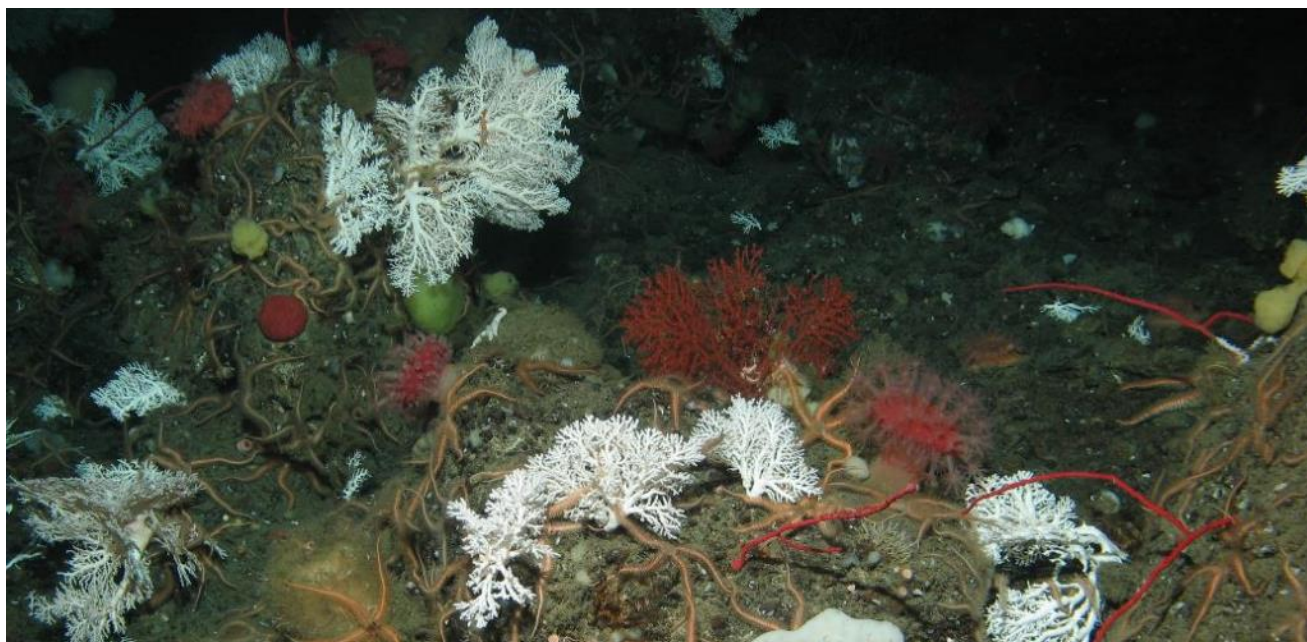
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INTRODUCTION AND SCIENTIFIC OBJECTIVES

Deep-sea coral and sponge (DSCS) communities serve as essential fish habitats (EFH) by providing shelter and nursery habitat, increasing diversity, and increasing prey availability (Freese and Wing, 2003; Bright, 2007; Baillon et al., 2012; Henderson et al., 2020). Threats to these long-lived, fragile organisms from bottom contact fishing gear, potential offshore renewable energy development, and ocean warming and acidification have increased the need for DSCS research along the U.S. West Coast (Gomez et al., 2018; Salgado et al., 2018; Yoklavich, et al., 2018; Gugliotti et al., 2019). The focus of these studies has varied from species distribution and abundance (Yoklavich and Love, 2005; Tissot et al., 2006) to developing and validating predictive distribution models (Huff et al., 2013; Rooper et al., 2017; Kreidler, 2020) to finding medicinal uses for corals and sponges (Essack et al., 2011; Shrestha et al., 2018). Due to the vast area of unexplored seafloor within the U.S. exclusive economic zone (EEZ; 200 nautical miles off the coast) and the technological requirements and expanse of deep-sea research, there is still much to learn about the distributions and biology of DSCS. This information is critical to resource managers for effective conservation and management of DSCS habitats. Protections are provided by the Pacific Fishery Management Council (PFMC) designation of groundfish

EFH conservation areas (EFHCA) and the National Marine Sanctuaries Act (NMSA). Areas designated as EFHCA are closed to bottom trawl fishing to protect and preserve seafloor habitats. Recently the PFMC adopted Amendment 28 to the Groundfish Fishery Management Plan (GFMP; Pacific Fishery Management Council, 2019), which modified EFHCAs by closing new areas identified as vulnerable and reopening areas deemed not vulnerable. The NMSA prohibits bottom disturbance from certain activities within areas designated as national marine sanctuaries, such as oil and gas exploration or extraction, cable laying, and other forms of seabed alteration or construction that disturb benthic communities.

NOAA's Deep-Sea Coral and Research Technology Program (DSCRTP) began a 4-yr funding initiative for the U.S. West Coast in 2017. The goals of the West Coast Deep-Sea Coral Initiative (WCDSCI) were to: 1) gather baseline information on areas subject to fishing regulation changes prior to the implementation of Amendment 28; 2) improve our understanding of known DSCS bycatch "hot spots"; and 3) explore and assess DSCS resources within NOAA National Marine Sanctuaries with emphasis on areas of sanctuary resource protection and management concerns. During the first year of the program, a research cruise was developed to survey the West Coast from Oregon to California studying the DSCS ecosystems in priority areas. The 31-day expedition (9 Oct – 8 Nov 2018) was launched from the NOAA Ship *Bell M. Shimada*, beginning in Newport, OR and ending in San Diego, CA.

The science team assembled for this cruise were members of the EXpanding Pacific Research and Exploration of Submerged Systems (EXPRESS) campaign, which brings together researchers from Federal and nonfederal institutions to collaborate on scientific expeditions targeting the deepwater areas off California, Oregon, and Washington. EXPRESS supports researchers leveraging funding, resources, personnel, and expertise to accomplish more science than would have been possible by a single entity alone. The 2018 coastwide expedition included research partners from National Marine Fisheries Service (NMFS) Southwest Fisheries Science Center (SWFSC) and Northwest Fisheries Science Center (NWFSC), National Ocean Service (Channel Islands, Cordell Bank, Greater Farallones, and Monterey Bay National Marine Sanctuaries), Bureau of Ocean Energy Management (BOEM), U.S. Geological Survey (USGS), and Monterey Bay Aquarium Research Institute (MBARI).

Research objectives for the cruise were to:

- 1) Collect DSCS baseline information at 10 of the EFHCA sites undergoing protection modifications by the Pacific Fishery Management Council.
- 2) Collect DSCS and fish data at previously unexplored sites within West Coast National Marine Sanctuaries.
- 3) Revisit a subset of previously surveyed sites to document if changes in DCSC have occurred over time.
- 4) Collect information to validate BOEM supported cross-shelf habitat suitability models for DSCS.
- 5) Collect samples to help in identifying (and understanding) West Coast DSCS and expand use of new technologies (ROV, AUV, and environmental DNA [eDNA]).
- 6) Collect water samples for coastwide eDNA, nutrient, and carbon chemistry studies.

STUDY SITES

We surveyed from Daisy Bank off central Oregon to Sverdrup Bank, an offshore bank in the Southern California Bight (see map below). Sites chosen to collect baseline DSCS information included areas undergoing EFH protection changes established by GFMP Amendment 28 and those being considered for offshore wind energy development (e.g., Santa Lucia Bank near Morro Bay, CA). Two sites (Daisy Bank and the top of Santa Lucia Bank) were surveyed to study potential changes in the fauna last surveyed over a decade earlier. The remaining sites were chosen to survey and characterize unexplored areas within several West Coast national marine sanctuaries.



Figure 1. Map of the West Coast of the United States. showing locations surveyed by Marine Applied Research and Exploration's ROV (yellow stars) as well EFHCA modifications.

FIELD SURVEY METHODS



Underwater visual surveys were conducted using the Marine Applied Research and Exploration (MARE) ROV, *Beagle*. The NWFSC/Pacific Islands Fisheries Science Center's (PIFSC) autonomous underwater vehicle (AUV), *Popoki*, was also utilized; methods and results of the AUV surveys will be provided in an upcoming Site Characterization from the NWFSC. The ROV was used to survey the seafloor through quantitative visual transects at each site during nighttime operations (~1600-0400). Although the ROV was rated to descend to 1,000 m, it was constrained to a maximum depth of ~600 m due to limitations of attached sensors. The ROV was equipped with one forward-facing and one downward facing HD video camera, a digital HD still camera, one reverse facing camera (to monitor the umbilical), 4 forward facing lights (2 x 200 watt and 2 x 250 watt), 2 red scaling lasers to estimate object sizes and transect width (set 10-cm apart), a BlueView multibeam sonar¹ (Teledyne Marine), and a SeaBird CTD and oxygen sensor (continuously recording temperature, depth, oxygen, and salinity). Dive routes were planned in advance in a geographic information system (GIS) using the most recent seafloor imagery available and located in areas of hard substrata when possible. Routes and seafloor imagery were loaded into Hypack software to guide the navigation of the ROV. During dives, the position of the ROV was tracked in real time using an ultra-short baseline (USBL) acoustic system and monitored in Hypack by the pilot and ship's crew. The ROV was equipped with a 5-function manipulator arm used to collect specimens and a "biobox" storage compartment located near the bottom of the ROV. One Niskin bottle was attached to the ROV frame and used to collect water samples at depth for water chemistry and eDNA analyses. One miniature autonomous plume recorder (MAPR) supplied by NOAA's Pacific Marine Environmental Laboratory was attached to the ROV to detect methane seeps.

Varying numbers of quantitative visual transects were conducted during each dive to assess the deep-sea coral, sponge, and fish communities. Transects targeted ~15 min duration and ~200 linear meters of seafloor. During transects, the ROV was flown between 0.5 and 1 m above the seafloor at a rate of 0.25-0.5 knots (0.1-0.2 m/s). Transects were separated by at least 200 m to increase sampling independence. While on transect, the pilots flew the ROV along a pre-planned route, avoiding directional changes to the extent practicable. While underway during transects, still images were recorded periodically to aid identifications. While transiting between transects, the pilots would stop the ROV to photograph DSCS and/or collect specimens. The width of the transect was calculated from the average of measurements taken during post cruise video review. Measurements were recorded approximately every 1 minute and at the start and end of each transect. Transect width was calculated as the ratio of the video monitor width to the laser spots on the video monitor (both measured with a ruler in cm) multiplied by the actual laser width of 10 cm. Transect area was calculated by multiplying the average transect width by the transect length as determined from the navigation data in ArcGIS software. Navigation data were edited and smoothed by MARE.

¹ Any use of trade, firm, or product names is for descriptive purposes only and does not imply endorsement by the U.S. Government.

Upon retrieval to the vessel, the ROV was secured, and the collected specimens were retrieved from the biobox and processed. Biological specimens were individually photographed, measured, catalogued, and either frozen or placed in 95% ethanol. Some specimens were further separated into subsamples for various projects and sent to taxonomic experts. Geologic samples were dried and packaged for delivery to USGS personnel.

Before or after most ROV dives, the ship's CTD (SeaBird SBE-9) was cast to measure oceanographic variables throughout the water column and to collect additional water samples for eDNA, carbonate chemistry, and nutrients using a Niskin bottle. The CTD was equipped with a dissolved oxygen sensor along with the standard temperature, depth, and conductivity sensors.

POST-DIVE DATA ANALYSES



Video analysts reviewed each video transect, identified DSCS and fishes to the lowest taxon possible, and enumerated and measured the maximum width and height of DSCS, and the total length of fishes. When available, the digital still images were used to augment the videos to aid in identifications of difficult to identify taxa and to evaluate invertebrate associations. Data on color, damage (pieces broken off the colony), health (healthy, = <10% dead, dying = 10-50% dead, and dead = >50% dead), disposition (upright or knocked over), and fish and invertebrate associations were collected for each coral and sponge entry. We defined a fish association as any fish within one body length of the coral or sponge and an invertebrate association as any invertebrate touching a coral or sponge (Yoklavich et al., 2013). Densities of DSCS and fishes were calculated for each study site by dividing the total number counted by the total area of the transects.

Seafloor habitat was classified based on video review of transects. Continuous patches of substrata were classified following Greene et al. (1999) using a two-letter code to depict the primary (>50%) and secondary (>20% of the remaining) habitats. Substratum types considered were bedrock outcrops (R), flat rock (horizontal slabs of rock or pavement; F) rock pinnacle (P), boulders (unattached, >25.6 cm; B), cobble (25.6– 6.4 cm; C), pebble (64 mm-2mm; P), veneer (rock covered with a thin layer of sediment; V), mud (M), and sand (S). A seafloor habitat patch had to last a minimum of 5 sec on the video to be considered a new and distinct patch. Transect length, habitat patch length, and global position for each DSCS and fish observation were determined from the ROV track lines, which allows each DSCS and fish observation to be given a specific location along the transect line.

Conductivity, salinity, temperature, and water depth (CTD) data were collected with a SeaBird SBE-9 profiling CTD. Raw data from the CTD were processed using the manufacturer's software, Seasave V 7.23.2. Depth was determined using a SeaBird CTD digiquartz pressure sensor with a stated accuracy of 0.015%. Data were accumulated into tab-delimited ASCII text files (in *.cnv format) are available

from Prouty and Baker (2020), and include profiles with temperature, conductivity, pressure, oxygen concentration, turbidity, fluorescence, altitude, salinity, and depth.

The pH was determined spectrophotometrically and total alkalinity (TA) was determined by means of automated Gran titration on a Metrohm 809 Titrando (Dickson et al., 2007) at the University of California at Davis, Bodega Marine Lab. Dissolved nutrient (ammonia and nitrate+nitrite [N+N], phosphate, and silicate) concentrations were measured at the University of California at Santa Barbara, Marine Science Institute, using flow injection analysis. Calcite and aragonite saturation states were calculated using an Excel Workbook Macro translation of the original CO2SYS program (Lewis and Wallace, 1998; Pierrot et al., 2006). Output from CO2SYS program and geochemistry lab analyses combined with CTD data from water sample collection are reported in Prouty and Baker (2020).

Select tissue samples from deep-sea corals, sponges, and clams, as well as filtered seawater for particulate organic matter (POM), were analyzed for stable carbon ($\delta^{13}\text{C}$) and nitrogen ($\delta^{15}\text{N}$) isotope composition following methods from Demopoulos et al. (2010). Analyses were conducted at Washington State University using a Costech (Valencia, USA) elemental analyzer interfaced with a GV instruments (Manchester, UK) Isoprime isotope ratio mass spectrometer. Prior to isotope analysis, tissue samples were dried to a constant weight at 50 to 60°C, ground to a fine powder and weighed into tin capsules. Invertebrate samples were acidified with 10% platinum chloride to remove inorganic carbon. POM filters were dried and treated with 1.0 N hydrochloric acid, then transferred into tin boats. Results from the stable isotope analysis are available at Demopoulos et al. (2021) and are reported using delta (δ) notation as per mil (‰): $\delta^{13}\text{C}$ or $\delta^{15}\text{N} = [(R_{\text{sample}}/R_{\text{standard}}) - 1] \times 1,000$, where R is the ratio of heavy to light isotope of the sample (R_{sample}) and standard (R_{standard}) respectively referenced to that of atmospheric N_2 (air) for $\delta^{15}\text{N}$ and Vienna PeeDee Belemnite (VPDB) for $\delta^{13}\text{C}$. The long-term standard deviation is 0.2‰ for ^{13}C and 0.3‰ for ^{15}N .

Tissue samples from deep-sea corals and sponges collected during dives were DNA sequenced for standard molecular barcodes (MutS, COI for corals; 28s for sponges) in order to confirm species identification and further develop the sequence voucher database for West Coast deep-sea coral and sponge species. Standard Sanger sequencing methods were carried out at NWFSC on an ABI 3500 sequencer as described in Everett and Park (2018). Additionally, select samples from coral species of interest were prepared using bestRAD methods (Ali et al., 2016) for population genetics and taxonomy. Library preparation was carried out at NWFSC, and the libraries were sequenced at the University of Oregon GC3 High-throughput sequencing facility. Initial sequencing of all samples has been completed and analysis of all molecular data is ongoing.

eDNA samples collected via the ROV or CTD rosette were extracted and sequenced at NWFSC following the methods described in Everett and Park (2018). eDNA samples were amplified using primers for octocorals described in Everett and Park (2018) with the addition of a novel reverse primer for the Paragorgiidae (Octo_eDNA_2R_Para-Illumina – GTCTCGTGGGCTCGGAGATGTGTATAAGAGACAGGCAGTCTTCTAAATTGCAACCGGGAGAATA) as well as primers developed for West Coast groundfish (Ford et al., 2016), and the resulting amplicons sequenced on an Illumina MiSeq at NWFSC. Initial extraction and sequencing of all eDNA samples has been completed and analysis of resulting sequence data is ongoing.

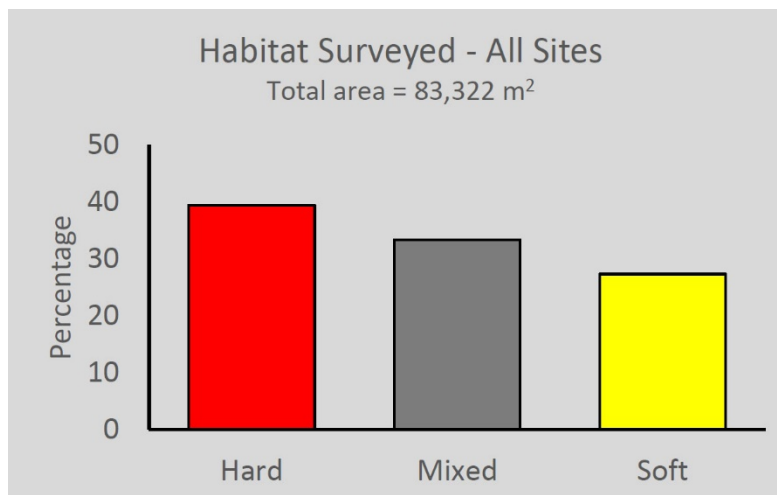
SITE SUMMARY

About 131 hours of video images and 41,000 still images were collected during nighttime operations (~1600-0400) on 37 dives at 16 locations along the West Coast (Table 1).

Table 1. Summary information for each site on the EXPRESS 2018 cruise

Start Date	End Date	PI	Site	Method	# of Transects	Start Lat First day	Start Lon First day	End Lat Last day	End Long Last day
10/11	10/14	Diana Watters	Daisy Bank	ROV, CTD	23	44.6353447	-124.73743	44.66529	-124.808
10/15	10/15	Diana Watters	Heceta Bank	ROV, CTD	7	44.2149611	-124.9124	44.09895	-124.968
10/16	10/16	Diana Watters	Bandon High Spot	ROV, CTD	11	42.9297523	-124.90551	42.9465	-124.884
10/17	10/17	Diana Watters	Brush Patch	ROV, CTD	4	42.067256	-124.80881	41.88846	-124.837
10/18	10/18	Diana Watters	Eel River Canyon	ROV, CTD	7	40.6640371	-124.53192	40.62303	-124.473
10/19	10/19	Diana Watters	Mendo Ridge	ROV, CTD	9	40.2875639	-124.69099	40.28847	-124.676
10/20	10/20	Diana Watters	Delgada Canyon	ROV, CTD	3	40.0341398	-124.18184	40.05156	-124.173
10/21	10/22	Diana Watters	Pt. Arena	ROV, CTD	18	38.6893784	-123.81037	38.64761	-123.784
10/25	10/25	Tom Laidig	Sur Slot Canyons	ROV, CTD	2	36.2455281	-121.91934	36.2463	-121.922
10/26	10/27	Tom Laidig	La Cruz Canyon	ROV, CTD	16	35.74292	-121.4913	35.72378	-121.428
10/29	10/29	Tom Laidig	Gull Island (SCI)	ROV, CTD	7	33.920438	-119.80143	33.91938	-119.792
10/30	10/30	Tom Laidig	NE Santa Cruz Is.	ROV, CTD	3	34.0819701	-119.49857	34.07338	-119.508
10/30	10/30	Tom Laidig	Anacapa Island	ROV, CTD	0	33.9921002	-119.37179	33.99264	-119.372
10/31	11/2	Tom Laidig	Santa Lucia Bank	ROV, CTD	24	34.6788851	-121.17138	34.97104	-121.353
11/3	11/4	Tom Laidig	Pt. Conception	ROV, CTD	10	34.5886078	-120.83079	34.45047	-120.506
11/5	11/6	Tom Laidig	Sverdrup Bank	ROV, CTD	6	33.1433001	-120.35275	33.12975	-120.378

A total of 83,322 m² of seafloor habitat was classified during the 150 quantitative transects. We combined the two-character habitat codes into 3 groups: hard, mixed, and soft. Hard habitat consisted of any combination of bedrock, boulder, cobble, flat rock or pinnacle. Soft habitat consisted of any combination of sand or mud. Mixed habitat was any combination of hard and soft habitats. The most common habitat type was hard (39.4%) followed by mixed (33.3%) and soft (27.3%).





Mud seafloor (soft habitat)



Cobble and mud seafloor (mixed habitat)



Boulder and mud (mixed habitat)



Rock Ridge (hard habitat)

We identified 35 coral taxa, 29 sponge taxa, and 133 fish taxa from observations of the video footage during the 150 quantitative transects conducted from Daisy Bank in Oregon, south to Sverdrup Bank in the Southern California Bight. We collected 117 specimens, including 41 corals, 54 sponges, 12 other invertebrates (e.g., clams, hydroids) and 10 geologic specimens (9 rock samples and 1 ball of tar). Genetic analyses are ongoing for many of these samples.

We counted a total of 35,757 deep-sea corals, 27,709 sponges, and 20,700 fishes during 150 quantitative transects. The most abundant coral taxa were mushroom corals (20,238 corals) and Plexauridae #3 (red *Swiftia* type sticks with unknown polyp colors; 5,359), which were found throughout the study area, and *Stylaster parageus* (common at Mendocino Ridge; 4,840) and *Calcigorgia cf japonica* (off Oregon; 2,052), which were confined to specific areas. Abundant sponge taxa were barrels (7,188 sponges), *Mycale* spp. (5,034), and vases (4,895), which were seen throughout the surveys. Fish taxa changed with depth, with shallow and mid depths dominated by sharpchin rockfish (*S. zacentrus*; 5,324 individuals) in the north and pygmy rockfish (*S. wilsoni*; 837 individuals) in the central and southern areas and abundant species at deeper depths were thornyheads (*Sebastolobus* spp.; 2,962) and Dover sole (*Microstomus pacificus*; 1,218). Overall densities for each site varied considerably for corals from a high of 612.5 corals per 100 m² at Mendocino Ridge to a low of 1 coral per 100 m² of seafloor at Delgada canyon. Sponge densities also varied from a high of 103.4 sponges per 100 m² (Mendocino Ridge) to a low of 0 sponges per 100 m² at northeast Santa Cruz Island (SCI). Fish densities were highest at northeast SCI (93.8 fish per 100 m²; mostly halfbanded rockfish, *Sebastes semicinctus*) to a low of 6.7 fishes per 100 m² at Mendocino Ridge. There were 35 recorded occurrences of anthropogenic debris with 21 instances of fishing gear and 14 pieces of marine debris (including 5 glass bottles and 4 aluminum cans).

Below we present summaries, by dive, of the diversity and density of corals, sponges, and fishes and associated habitats observed in the 150 quantitative transects. One site (Anacapa Island) had no

quantitative transects and was a quick test dive following ROV repairs. Therefore, Anacapa Island is not included in the remainder of this Site Characterization. We present profiles of sea temperature, salinity, dissolved oxygen, and pH with depth during the dives. Health and condition of the corals and sponges are reported, along with incidence of marine debris on each dive.

An image of a collected specimen of *Calcigorgia japonica*.



Scientists examining a tray full of collected specimens.



Table 2. Coral taxa observed from video surveys using a remotely operated vehicle (ROV) during the EXPRESS cruise along the United States West Coast from 9 Oct – 8 Nov 2018.

Scientific name	Common name	Number	Scientific name	Common name	Number
<i>Acanthogorgia</i> spp.	gold coral	11	<i>Parastenella ramosa</i>	primnoid	58
<i>Anthoptilum grandiflorum</i>	feather boa sea pen	20	<i>Pennatulula phosphorea</i>	phosphorescent sea pen	6
<i>Calcigorgia japonica</i>	white <i>Swiftia</i> -type fan	2052	Pennatulacea #1	sea pen (thin)	590
<i>Callogorgia</i> spp.	gorgonian	1	Pennatulidae	sea pen (thick)	16
<i>Chromoplexaura marki</i>	red stick coral	1	Plexauridae #1	<i>Swiftia</i> type (red w/ white polyps)	217
<i>Clavularia</i> spp.	soft coral	188	Plexauridae #3	<i>Swiftia</i> type (red w/ unknown polyps)	5359
<i>Desmophyllum dianthus</i>	cockscomb cup coral	450	<i>Plumarella longispina</i>	primnoid	150
<i>Funiculina</i> spp.	unidentified sea pen	12	<i>Primnoa pacifica</i>	red tree coral	11
<i>Gersemia</i> spp.	soft coral	4	<i>Ptilosarcus</i> spp.	orange sea pen	12
<i>Halipterus californica</i>	sea pen	11	Scleractinia	unidentified cup coral	8
<i>Heteropolypus ritteri</i>	mushroom coral	20238	<i>Stylaster californicus</i>	California lace coral	90
Hexacorallia/Octocorallia	unidentified coral	35	<i>Stylaster parageus</i>	white hydrocoral	4840
Isididae	unknown bamboo coral	3	<i>Swiftia pacifica</i>	sea fan (red with yellow polyps)	865
<i>Keratoisis</i> spp.	bamboo coral	1	<i>Swiftia</i> spp.	red sea fan	34
<i>Leptogorgia chilensis</i>	red gorgonian	34	Stolonifera	soft coral	83
<i>Lophelia pertusa</i>	white cup coral	1	<i>Umbellula lindahli</i>	droopy sea pen	72
<i>Paragorgia pacifica</i>	bubblegum coral	7	<i>Virgularia</i> spp.	sea pen	23
<i>Paragorgia</i> spp.	sea fan (white with red polyps)	249			

Table 3. Sponge taxa observed from video surveys using a remotely operated vehicle (ROV) during the EXPRESS cruise along the United States West Coast from 9 Oct – 8 Nov 2018.

Scientific name	Common name	Number	Scientific name	Common name	Number
<i>Asbestopluma</i> spp. #1	predatory pipecleaner sponge	489	Porifera #3	unidentified barrel sponges	7188
<i>Asbestopluma</i> spp. #2	predatory sponge (clear)	455	Porifera #4	unidentified shelf sponges	180
<i>Farrea occa</i>	lace (or cloud) foliose sponge	51	Porifera #5	unidentified vase sponges	4895
<i>Haliclona</i> (Gellius)	tan vase/trumpet sponge	89	Porifera #6	unidentified mound sponges	1684
<i>Heterochone calyx</i>	fingered goblet vase sponge	181	Porifera #7	unidentified branching sponge	1208
<i>Hexactinella</i> spp.	sponge (white)	1	Porifera #8	unidentified tube sponge	99
<i>Mycale</i> spp.	upright flat sponge (yellow)	5034	Porifera #9	unidentified puffball mound sponge	242
<i>Poecillastra</i> spp.	fringed shelf sponge	268	<i>Rhabdocalyptus dawsoni</i>	brown barrel sponge	251
<i>Polymastia</i> spp. #1	white nipple foliose sponge	13	<i>Rhizaxinella gadus</i>	club sponge	79
<i>Polymastia</i> spp. #2	nipple foliose sponge (yellow)	4	<i>Staurocalyptus</i> spp. #1	Picasso sponge	549
Porifera #1	unidentified foliose sponges	1935	<i>Staurocalyptus</i> spp. #2	<i>Staurocalyptus</i> like but white	59
Porifera #10	unidentified sponge (blue/white)	28	<i>Stylocordyla</i> spp.	stalked sponge	26
Porifera #12	unidentified sponge	1661	<i>Thenea muricata</i>	foliose sponge (clear)	167
Porifera #14	Valentines sponge	56	<i>Xestospongia</i> spp.	grey lobe sponge	102
Porifera #2	unidentified upright flat sponges	715			

Table 4. Fish taxa observed from video surveys using a remotely operated vehicle (ROV) during the EXPRESS cruise along the United States West Coast from 9 Oct – 8 Nov 2018. * = taxa seen off transect. NA = species numbers not quantified.

Scientific name	Common name	Number	Scientific name	Common name	Number
Agonidae	unidentified poachers	387	<i>Hippoglossus stenolepis</i>	Pacific halibut	2
<i>Agonopsis vulsa</i>	northern spearnose poacher	2	<i>Hydrolagus colliei</i>	spotted ratfish	66
<i>Anoplopoma fimbria</i>	sablefish	57	<i>Hydrolagus colliei</i> egg case	ratfish egg case	33
<i>Argentina sialis</i>	Pacific argentine	3	<i>Icelinus filamentosus</i>	threadfin sculpin	64
<i>Atheresthes stomias</i>	arrowtooth flounder	12	<i>Icelinus</i> spp.	<i>Icelinus</i> sculpins	109
<i>Bathyagonus nigripinnis</i>	blackfin poacher	3	<i>Icelinus tenuis</i>	spotfin sculpin	52
<i>Bathyagonus pentacanthus</i>	bigeye poacher	101	<i>Idiacanthus antrostomus</i>	Pacific blackdragon*	NA
<i>Bathyraja aleutica</i>	Aleutian skate*	NA	<i>Lepidopsetta bilineata</i>	rock sole	4
<i>Bathyraja interrupta</i>	sandpaper skate	8	Liparididae	unidentified snailfish	14
<i>Bathyraja trachura</i>	rougtail skate	1	<i>Lycenchelys crotalinus</i>	snakehead eelpout	1
<i>Bothrocara brunneum</i>	twoline eelpout*	NA	<i>Lycodes corteziianus</i>	bigfin eelpout	82
<i>Brosmophycis marginata</i>	red brotula	3	<i>Lycodes diapterus</i>	black eelpout	61
<i>Careproctus melanurus</i>	blacktail snailfish	2	<i>Lyconema barbatum</i>	bearded eelpout	19
<i>Cataetyx rubrirostris</i>	rubynose brotula	61	<i>Lyopsetta exilis</i>	slender sole	571
<i>Caulolatilus princeps</i>	ocean whitefish	3	Macrouridae	unidentified grenadier	4
<i>Chilara taylori</i>	spotted cusk-eel	279	<i>Merluccius productus</i>	Pacific hake	136
<i>Chitonotus pugetensis</i>	roughback sculpin	1	<i>Microstomus pacificus</i>	dover sole	1218
<i>Citharichthys</i> spp.	unidentified sanddab	93	Myctophidae	unidentified lanternfish	27
Cottidae	unidentified sculpin	76	<i>Myrichthys tigrinus</i>	spotted snake eel*	NA
<i>Damalichthys vacca</i>	pile perch	1	<i>Nezumia stelgidolepis</i>	California grenadier	8
Elasmobranchii	shark egg case	1	<i>Ophiodon elongatus</i>	lingcod	77
<i>Embassichthys bathybius</i>	deepsea sole	109	Osteichthyes	unidentified fishes	6
<i>Enophrys taurina</i>	bull sculpin	27	<i>Oxylebius pictus</i>	painted greenling	2
<i>Eopsetta jordani</i>	petrale sole	43	<i>Paricelinus hopliticus</i>	thornback sculpin	37
<i>Eptatretus</i> spp.	unidentified hagfish	385	<i>Parophrys vetulus</i>	English sole	9
<i>Eucryphycus californicus</i>	persimmon eelpout*	NA	<i>Peprilus simillimus</i>	Pacific butterfish*	NA
<i>Facciolella equatorialis</i>	dogface witch eel	6	<i>Phanerodon furcatus</i>	white seaperch	1
<i>Genyonemus lineatus</i>	white croaker*	NA	<i>Plectobanchus evides</i>	bluebarred prickleback	4
<i>Glyptocephalus zachirus</i>	rex sole	313	Pleuronectiformes	unidentified flatfishes	547
<i>Hexagrammos decagrammus</i>	kelp greenling	1	<i>Pleuronichthys</i> spp.	unidentified turbot	12

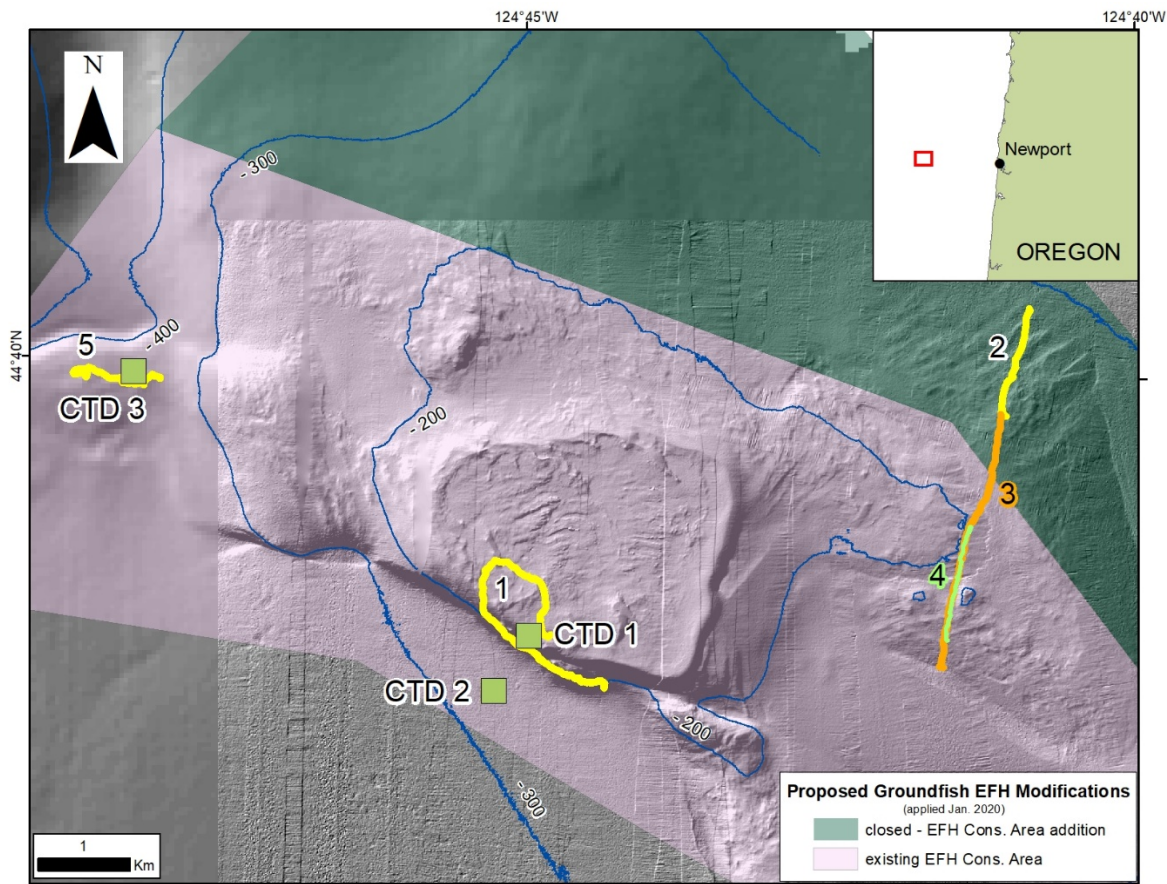
Scientific name	Common name	Number	Scientific name	Common name	Number
<i>Porichthys notatus</i>	plainfin midshipman	58	<i>Sebastes melanostictus</i>	blackspotted rockfish	1
<i>Prionace glauca</i>	blue shark*	NA	<i>Sebastes melanostomus</i>	blackgill rockfish	600
<i>Raja rhina</i>	longnose skate	71	<i>Sebastes miniatus</i>	vermilion rockfish	128
<i>Raja</i> spp.	unidentified skate	3	<i>Sebastes mystinus</i>	blue rockfish	4
<i>Raja stellulata</i>	starry skate	4	<i>Sebastes nigrocinctus</i>	tiger rockfish*	NA
Rajiformes egg cases	skate egg cases	32	<i>Sebastes ovalis</i>	speckled rockfish	23
<i>Rathbunella</i> spp.	unidentified ronquil	12	<i>Sebastes paucispinis</i>	bocaccio	29
<i>Rhacochilus toxotes</i>	rubberlip seaperch	3	<i>Sebastes phillipsi</i>	chameleon rockfish	4
<i>Rhamphocottus richardsonii</i>	grunt sculpin*	NA	<i>Sebastes pinniger</i>	canary rockfish	81
<i>Rhinogobiops nicholsii</i>	blackeye goby	1	<i>Sebastes proriger</i>	redstripe rockfish	12
<i>Scorpaena guttata</i>	spotted scorpionfish	31	<i>Sebastes rosaceus</i>	rosy rockfish	42
Scyliorhinidae	unidentified cat shark	106	<i>Sebastes rosenblatti</i>	greenblotched rockfish	3
Scyliorhinidae egg cases	cat shark egg cases	228	<i>Sebastes ruberrimus</i>	yelloweye rockfish	14
<i>Sebastes alutus</i>	Pacific Ocean perch	31	<i>Sebastes rubrivinctus</i>	flag rockfish	1
<i>Sebastes aurora</i>	aurora rockfish	216	<i>Sebastes rufus</i>	bank rockfish	250
<i>Sebastes babcocki</i>	redbanded rockfish	5	<i>Sebastes saxicola</i>	stripetail rockfish	241
<i>Sebastes borealis</i>	shortraker Rockfish*	NA	<i>Sebastes semicinctus</i>	halfbanded rockfish	652
<i>Sebastes brevispinis</i>	silvergrey rockfish	14	<i>Sebastes serranoides</i>	olive rockfish	13
<i>Sebastes caurinus</i>	copper rockfish	5	<i>Sebastes simulator</i>	pinkrose rockfish	2
<i>Sebastes chlorostictus</i>	greenspotted rockfish	31	<i>Sebastes</i> spp.	unidentified rockfishes	140
<i>Sebastes constellatus</i>	starry rockfish	31	<i>Sebastes</i> spp. YOY	juvenile rockfish	35
<i>Sebastes crameri</i>	darkblotched rockfish	80	<i>Sebastes wilsoni</i>	pygmy rockfish	837
<i>Sebastes dallii</i>	calico rockfish	281	<i>Sebastes zacentrus</i>	sharpchin rockfish	5324
<i>Sebastes diploproa</i>	splitnose rockfish	528	<i>Sebastolobus alascanus</i>	shortspine thornyhead	168
<i>Sebastes elongatus</i>	greenstriped rockfish	265	<i>Sebastolobus altivelis</i>	longspine thornyhead	343
<i>Sebastes emphaeus</i>	Puget Sound rockfish	1	<i>Sebastolobus</i> spp.	thornyheads	2451
<i>Sebastes ensifer</i>	swordspine rockfish	3	<i>Squalus suckleyi</i>	Pacific spiny dogfish	1
<i>Sebastes entomelas</i>	widow rockfish	93	Stichaeidae	unidentified pricklebacks	15
<i>Sebastes flavidus</i>	yellowtail rockfish	14	<i>Symphurus atricaudus</i>	California tonguefish*	NA
<i>Sebastes goodei</i>	chilipepper	5	<i>Tetranace californica</i>	torpedo ray*	NA
<i>Sebastes helvomaculatus</i>	rosethorn rockfish	721	<i>Trachurus symmetricus</i>	jack mackerel	2
<i>Sebastes hopkinsi</i>	squarespot rockfish	384	<i>Sebastomus</i>	unidentified <i>Sebastomus</i>	190
<i>Sebastes jordani</i>	shortbelly rockfish	82	<i>Xeneretmus latifrons</i>	blacktip poacher	2
<i>Sebastes levis</i>	cowcod	2	<i>Xeneretmus leiops</i>	smootheye poacher	183

Scientific name	Common name	Number
<i>Xeneretmus triacanthus</i>	bluespotted poacher	6
<i>Zalemnius rosaceus</i>	pink seaperch	84
<i>Zaniolepis frenata</i>	shortspine combfish	229

Scientific name	Common name	Number
<i>Zaniolepis latipinnis</i>	longspine combfish	22
Zoarcidae	unidentified eelpout	47

SITE AREA: Daisy Bank
DIVE NUMBER: ROV 0001-0005

GENERAL LOCATION AND DIVE TRACKS



STATION OVERVIEW (Daisy Bank)

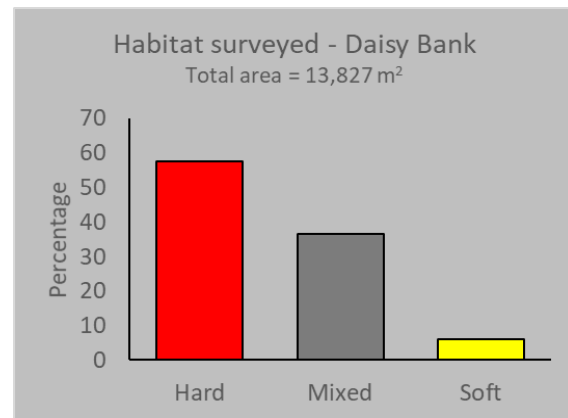
Project	EXPRESS 2018
Chief Scientists	Tom Laidig, Elizabeth Clarke, Chris Caldwell
Contact Information	NMFS, SWFSC, tom.laidig@noaa.gov
Purpose	Survey deep-sea coral communities along the U.S. West Coast
Vessel and Survey Vehicle	NOAA Ship <i>Bell M. Shimada</i> ; ROV <i>Beagle</i> (MARE)
Science Observers	Diana Watters, Meredith Everett, JT Robinson
Digital Video	22 hours
Digital Still Photos	5748 images
Positioning System	Ship: GPS; ROV: USBL
CTD Sensors	Yes
O₂ Sensor	Yes
pH Sensor	No
Specimens collected	24
Water sample	3 eDNA; 16 water chemistry
Other	Logbook, Relational database
Report Analyst	Tom Laidig
Date Compiled	07 July 2021

DIVE DATA (Daisy Bank)

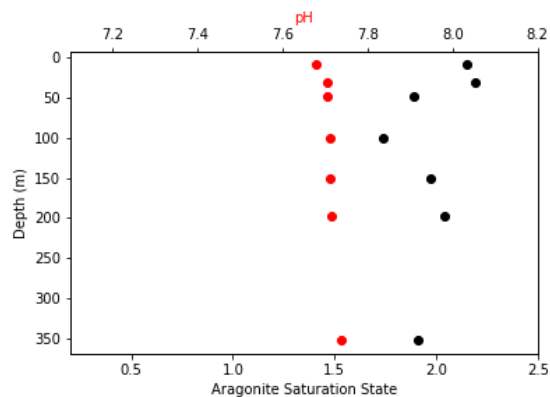
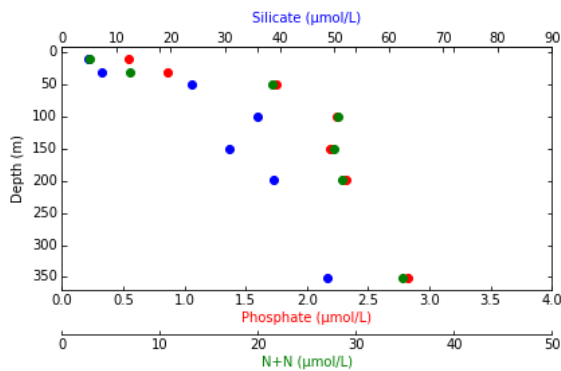
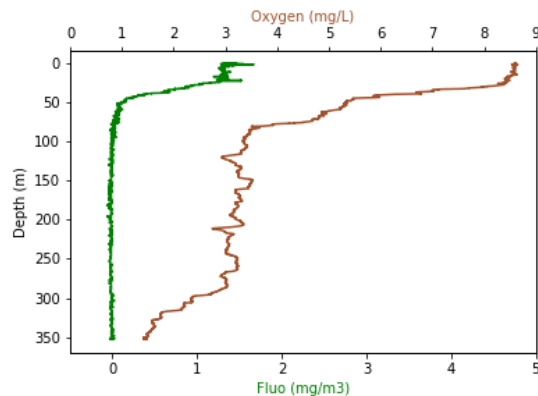
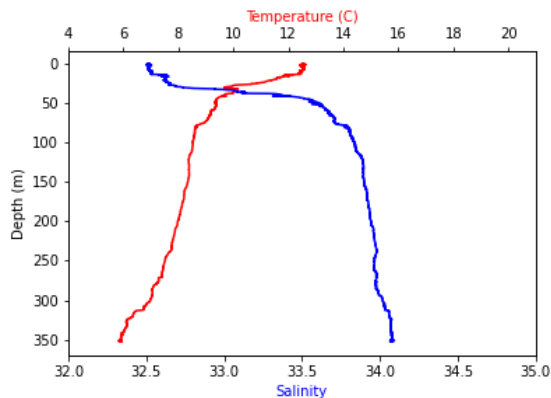
Date	11-14 Oct 2018	Starting Latitude (N)	44° 38.121'
Minimum Bottom Depth (m)	130	Starting Longitude (W)	124° 44.246'
Maximum Bottom Depth (m)	359	Ending Latitude (N)	44° 39.918'
Start Bottom Time (UTC)	02:11:22	Ending Longitude (W)	124° 48.477'
End Bottom Time (UTC)	10:06:42	Number of Dives	5
Number 15-min Transects	23		

PHYSICAL ENVIRONMENT (Daisy Bank)

In total, 13,827 m² of seafloor were surveyed during 23 quantitative transects conducted during Dive 0001, 0002, 0003, and 0005 on Daisy Bank off central Oregon. Habitat types were classified as (1) Hard (58% of the total area surveyed), which included large boulders, rock outcrops, and some cobbles; (2) Mixed (36%), including a combination of mud with boulder, cobbles, or rock; and (3) Soft (6%), which consisted entirely of mud.

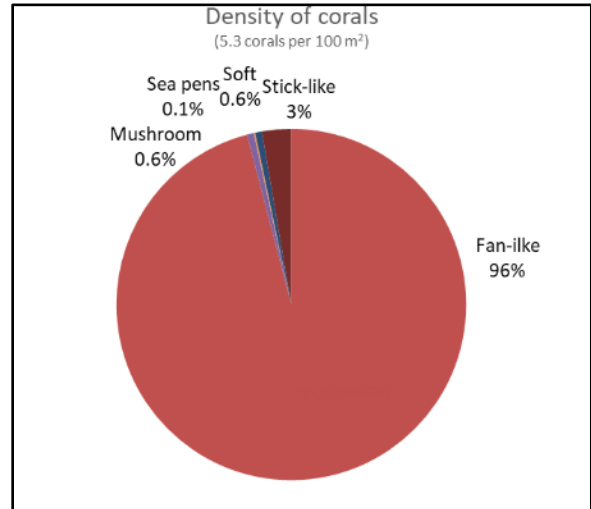


A thermocline was present (as measured from the shipboard CTD) from the surface to about 25 m, and afterwards the temperature gradually decreased with depth. Salinity increased with depth with a halocline from the surface to about 50 m. Oxygen decreased rapidly until about 100 m then slowly until 300 m where it decreased quickly again. Nutrient load (phosphate, silicate, and ammonia and N+N) gradually increased with depth. pH dropped initially during the first 30 m and then remained constant with depth.



BIOLOGICAL ENVIRONMENT: CORALS (Daisy Bank)

A total of 2,120 individual coral colonies, comprising at least 13 taxa, were enumerated from 23 quantitative transects conducted during Dive 0001, 0002, 0003, and 0005 on Daisy Bank off central Oregon. Coral density was relatively low at 5.3 corals per 100 m² of seafloor. Fan-like corals dominated the coral assemblage with 96% of all corals, and *Calcigorgia cf japonica* was the most abundant fan-like coral. Most of the *C. japonica* were small (10 cm or less).



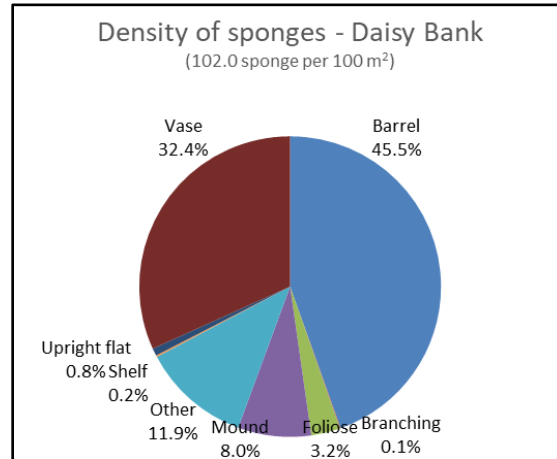
Colors in the pie diagram match colors in the list of coral taxa (below).

Scientific name	Common name	Number
<i>Calcigorgia cf japonica</i>	white <i>Swiftia</i> fan	2040
<i>Callogorgia</i> spp.	gorgonian	1
<i>Clavularia</i> spp.	soft coral	5
<i>Funiculina</i> spp.	unidentified sea pen	1
<i>Heteropolypus ritteri</i>	mushroom coral	5
Isididae	unknown bamboo coral	1
<i>Keratoisis</i> spp.	bamboo coral	1
<i>Paragorgia</i> spp.	sea fan (white with red polyps)	1
<i>Parastenella ramosa</i>	primnoid	19
Plexauridae #3	<i>Swiftia</i> type (red w/unknown polyps)	23
<i>Plumarella longispina</i>	primnoid	17
<i>Swiftia pacifica</i>	sea fan (red with yellow polyps)	6

Four coral specimens were collected during dives at Daisy Bank and sent to experts for identification. Shipboard identifications were *Swiftia beringi* (*Calcigorgia cf japonica*; 2 specimens), *Swiftia pacifica* (1 specimen), and *Plumarella longispina* (1 specimen). Verified identifications are still pending.

BIOLOGICAL ENVIRONMENT: SPONGES (Daisy Bank)

A total of 14,105 individual sponges from at least 19 different taxa were enumerated from 23 quantitative transects conducted during Dive 0001, 0002, 0003, and 0005 on Daisy Bank off central Oregon. Overall density was high at 102.0 sponges per 100 m² of seafloor. The sponge assemblage was dominated by barrel and vase sponges.



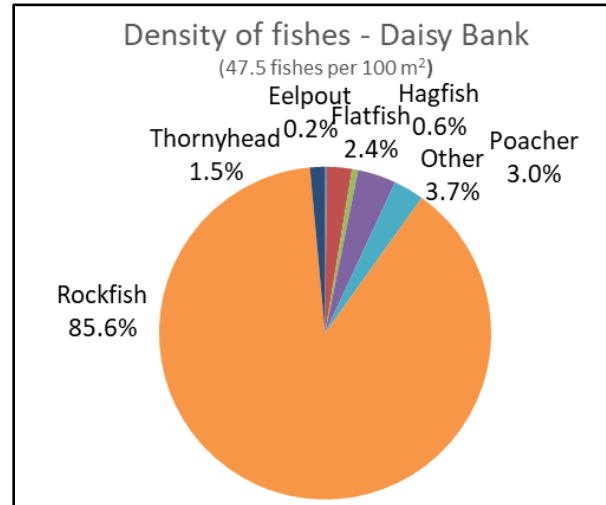
Colors in the pie diagram match colors in the list of sponge taxa (below).

Scientific name	Common name	Number
<i>Asbestopluma</i> spp. #1	predatory pipecleaner sponge	6
<i>Asbestopluma</i> spp. #2	predatory sponge (clear)	3
<i>Haliclona</i> (Gellius)	tan vase/trumpet sponge	88
<i>Heterochone calyx</i>	fingered goblet vase sponge	2
<i>Poecillastra</i> spp.	fringed shelf sponge	13
<i>Polymastia</i> spp. #1	white nipple foliose sponge	2
Porifera #1	unidentified foliose sponges	408
Porifera #12	unidentified sponge	1632
Porifera #2	unidentified upright flat sponges	114
Porifera #3	unidentified barrel sponges	6266
Porifera #4	unidentified shelf sponges	10
Porifera #5	unidentified vase sponges	4374
Porifera #6	unidentified mound sponges	951
Porifera #7	unidentified branching sponge	11
Porifera #8	unidentified tube sponge	2
Porifera #9	unidentified puffball mound sponge	156
<i>Rhabdocalyptus dawsoni</i>	brown barrel sponge	20
<i>Staurocalyptus</i> spp. #2	white vase sponge	18
<i>Thenea muricata</i>	foliose sponge (clear)	29

Ten sponge specimens were collected during dives on Daisy Bank and sent to experts for identification. Shipboard identifications were globular white sponge (2 specimens), dirty barrel sponge (1 specimen), potato sponge (1 specimen), branched white sponge (1 specimen), encrusting white sponge (1 specimen), olive green ball sponge (2 specimens), white vase sponge (1 specimen), vase sponge (1 specimen), and small ball sponge (on thick stalk, 1 specimen). Verified identifications from experts are still pending.

BIOLOGICAL ENVIRONMENT: FISHES (Daisy Bank)

At least 52 taxa of fishes were identified from 23 quantitative transects conducted during Dive 0001, 0002, 0003, and 0005 on Daisy Bank off central Oregon. A total of 6,565 individual fishes were enumerated, with an overall density of 47.5 fishes per 100 m² of seafloor. At least 15 species of rockfishes (*Sebastes* spp.) dominated by sharpchin rockfish (*S. zacentrus*) comprised 86% of fish density. The remainder of the fish assemblage included poachers (3%), flatfishes (2.4%), thornyheads (1.5%), other (3.7%), hagfishes (0.6%, *Eptatretus stoutii*), and eelpouts (0.2%). The category 'other' represented 3.7% of the total fish density and included at least 13 taxa, including sculpins, lingcod (*Ophiodon elongatus*), skates, and ratfish (*Hydrolagus colliei*).



Colors in the pie diagram match colors in the list of fish taxa (below).

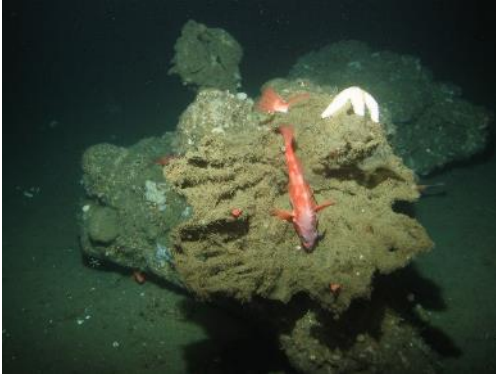
Sixteen percent (2,613 individuals) of the 16,225 corals and sponges had a fish association within one body length. Vase (1,058), barrel (853), and unidentified sponges (262) had the most fish associations, while *Calcigorgia cf japonica* (170) and stick-like *Swiftia* type corals (3) were the only corals with fish associations. Sharpchin and rosethorn rockfishes, the two most abundant fishes at Daisy Bank, were most commonly associated with DSCS.

Scientific name	Common name	Number
Agonidae	unidentified poachers	69
<i>Anoplopoma fimbria</i>	sablefish	1
<i>Atheresthes stomias</i>	arrowtooth flounder	3
<i>Bathyagonus pentacanthus</i>	bigeye poacher	10
<i>Bathyraja interrupta</i>	sandpaper skate	2
<i>Chilara taylori</i>	spotted cusk-eel	1
Cottidae	unidentified sculpin	8
<i>Embassichthys bathybius</i>	deepsea sole	2
<i>Eopsetta jordani</i>	petrale sole	1
<i>Eptatretus</i> spp.	unidentified hagfish	40
<i>Glyptocephalus zachirus</i>	rex sole	15
<i>Hippoglossus stenolepis</i>	Pacific halibut	1
<i>Hydrolagus colliei</i>	spotted ratfish	21
<i>Hydrolagus colliei</i> egg case	ratfish egg case	30
<i>Icelinus filamentosus</i>	threadfin sculpin	33
<i>Icelinus</i> spp.	<i>Icelinus</i> sculpins	46
<i>Icelinus tenuis</i>	spotfin sculpin	6
<i>Lycodes corteziianus</i>	bigfin eelpout	10
<i>Lyopsetta exilis</i>	slender sole	32
<i>Merluccius productus</i>	Pacific hake	7
<i>Microstomus pacificus</i>	dover sole	47
Myctophidae	unidentified lanternfish	22

Scientific name	Common name	Number
<i>Ophiodon elongatus</i>	lingcod	42
Osteichthyes	unidentified fishes	1
<i>Paricelinus hopliticus</i>	thornback sculpin	7
Pleuronectiformes	unidentified flatfishes	58
<i>Raja rhina</i>	longnose skate	8
<i>Raja stellulata</i>	starry skate	1
<i>Rajiformes egg cases</i>	skate egg cases	5
Scyliorhinidae	unidentified cat shark	1
Scyliorhinidae egg cases	cat shark egg cases	3
<i>Sebastes alutus</i>	Pacific Ocean perch	31
<i>Sebastes aurora</i>	aurora rockfish	2
<i>Sebastes brevispinis</i>	silvergrey rockfish	14
<i>Sebastes crameri</i>	darkblotched rockfish	23
<i>Sebastes diploproa</i>	splitnose rockfish	3
<i>Sebastes elongatus</i>	greenstriped rockfish	45
<i>Sebastes helvomaculatus</i>	rosethorn rockfish	505
<i>Sebastes jordani</i>	shortbelly rockfish	19
<i>Sebastes paucispinis</i>	bocaccio	1
<i>Sebastes pinniger</i>	canary rockfish	75
<i>Sebastes proriger</i>	redstripe rockfish	11
<i>Sebastes ruberrimus</i>	yelloweye rockfish	9
<i>Sebastes rufus</i>	bank rockfish	1
<i>Sebastes</i> spp.	unidentified rockfishes	11
<i>Sebastes wilsoni</i>	pygmy rockfish	59
<i>Sebastes zacentrus</i>	sharpchin rockfish	5009
<i>Sebastolobus alascanus</i>	shortspine thornyhead	12
<i>Sebastolobus</i> spp.	thornyheads	84
<i>Sebastomus</i>	unidentified <i>Sebastomus</i>	4
<i>Xeneretmus leiops</i>	smootheye poacher	113
Zoarcidae	unidentified eelpout	1

IMAGE GALLERY (Daisy Bank)

A sharpchin rockfish resting on a dead unidentified vase sponge at 210 m.



A yelloweye rockfish near an unidentified sponge covered in crinoids at 205 m.



An unidentified vase sponge at 212 m covered with crinoids.



A school of silvergrey rockfish at 210 m.



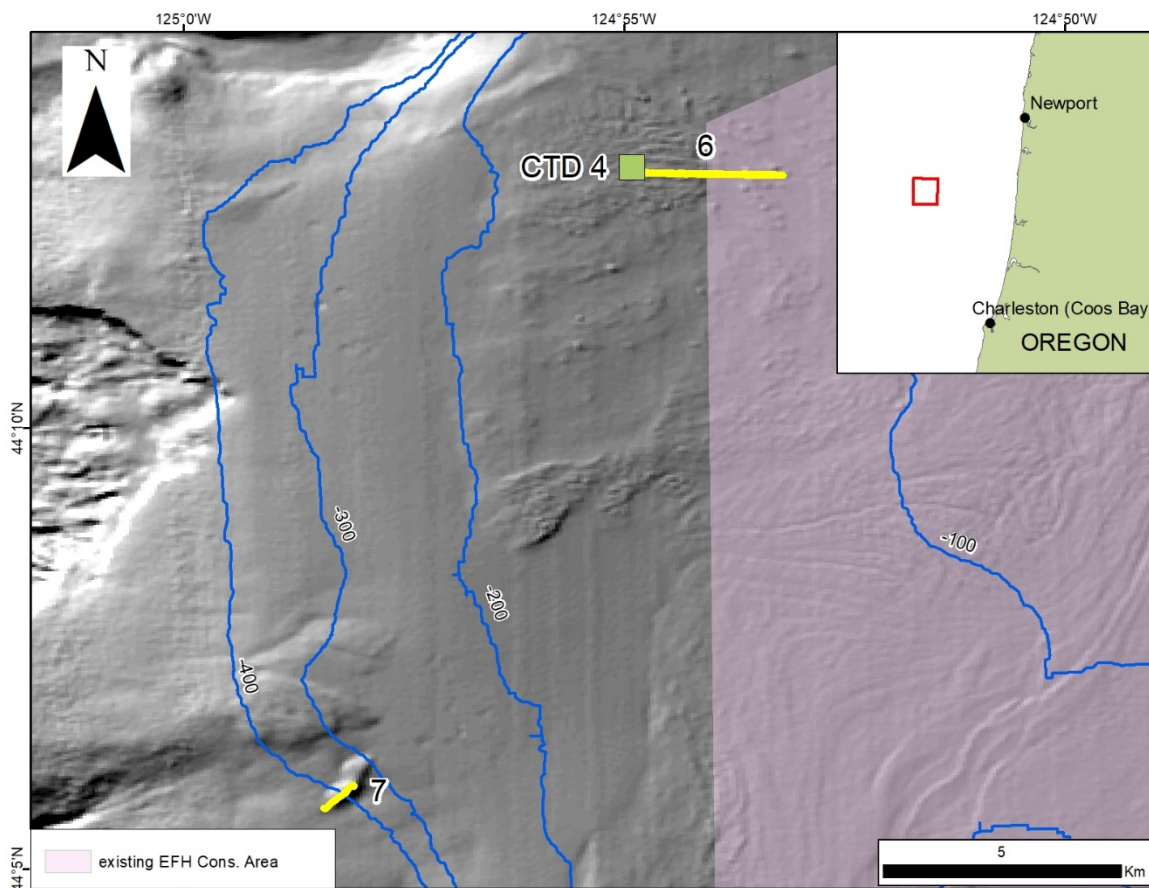
ADDITIONAL COMMENTS (Daisy Bank)

Seven anthropogenic debris items were documented during dives at Daisy Bank. One glass bottle, one strand of monofilament, three old longlines (all with growth), one old sablefish pot (covered in sediment and open), and one old trawl net. The trawl net was in view for three minutes during the transect and had become habitat for sponges. Damage to fauna by these items was not evident.

Three corals (two *Parastenella ramosa* and one *Calcigorgia cf japonica*) and 843 sponges (including 440 unidentified sponges, 323 vase sponges, and 57 barrel sponges) showed damage with broken sections. One coral (*C. japonica*) and 692 sponges (mostly unidentified sponges (338), 272 vase sponges, and 70 barrel sponges) were knocked over and laying on their sides. Sixteen percent of all sponges (2,263) were dead or dying while dead and dying corals accounted for <1% of corals (13 individuals). The most abundant dead or dying sponge taxa were vase sponges with 1,818 observations (80% of all sponges).

SITE AREA: Heceta Bank
DIVE NUMBER: ROV 0006-0007

GENERAL LOCATION AND DIVE TRACK



STATION OVERVIEW (Heceta Bank)

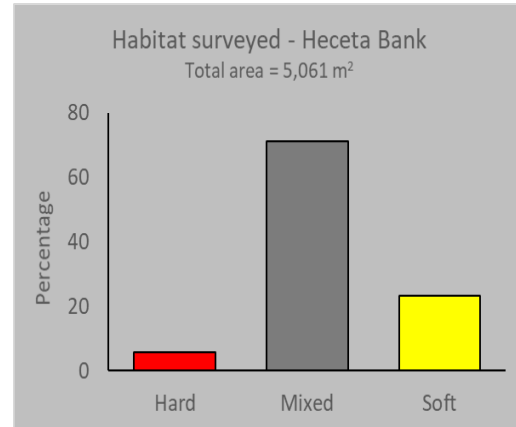
Project	EXPRESS 2018
Chief Scientists	Tom Laidig, Elizabeth Clarke, Chris Caldw
Contact Information	NMFS, SWFSC, tom.laidig@noaa.gov
Purpose	Survey deep-sea coral communities along the U.S. West Coast
Vessel and Survey Vehicle	NOAA Ship <i>Bell M. Shimada</i> ; ROV <i>Beagle</i> (MARE)
Science Observers	Diana Watters, Meredith Everett, JT Robinson
Digital Video	6.8 hours
Digital Still Photos	1,378 images
Positioning System	Ship: GPS; ROV: USBL
CTD Sensors	Yes
O₂ Sensor	Yes
pH Sensor	No
Specimens collected	5
Water sample	4 eDNA; 0 water chemistry
Other	Logbook, Relational database
Report Analyst	Tom Laidig
Date Compiled	07 July 2021

DIVE DATA (Heceta Bank)

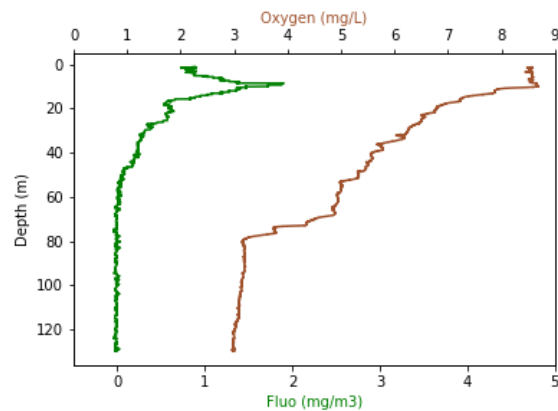
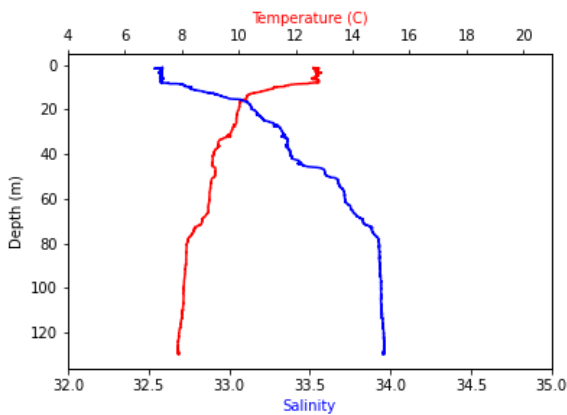
Date	15 Oct 2018	Starting Latitude (N)	44° 12.898'
Minimum Bottom Depth (m)	127	Starting Longitude (W)	124° 54.744'
Maximum Bottom Depth (m)	427	Ending Latitude (N)	44° 5.937'
Start Bottom Time (UTC)	23:40:35	Ending Longitude (W)	124° 58.107'
End Bottom Time (UTC)	06:23:47	Number of Dives	2
Number 15-min Transects	7		

PHYSICAL ENVIRONMENT (Heceta Bank)

In total, 5,251 m² of seafloor were surveyed during 7 quantitative transects conducted during Dive 0006 and 0007 on Heceta Bank off central Oregon. Habitat types were classified as (1) Hard (7% of the total area surveyed), which included bedrock outcrops, large boulders, and some cobbles; (2) Mixed (75%), including a combination of mud with boulder, cobbles, or rock; and (3) Soft (18%), which consisted entirely of mud.

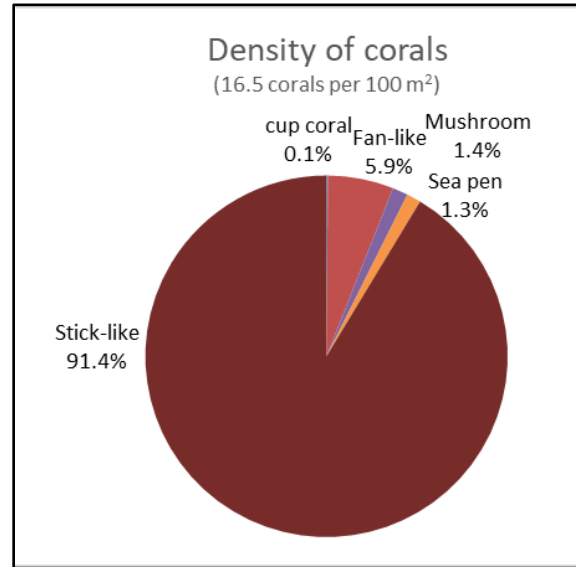


There was a mixed layer for the first 10 m. A thermocline was present (as measured from the shipboard CTD) from the surface to about 20 m, and afterwards the temperature gradually decreased with depth. Salinity increased with depth with a halocline from the surface to about 40 m. Oxygen decreased rather rapidly until about 70 m where the oxygen levels dropped significantly for 10 m and decreased slowly thereafter. Fluorescence reached a maximum at 10 m and decreased quickly after that until about 20 m and decreased gradually from that point until reaching zero around 80 m.



BIOLOGICAL ENVIRONMENT: CORALS (Heceta Bank)

A total of 868 individual coral colonies, comprising at least 9 taxa, were enumerated from 7 quantitative transects conducted during Dive 0006 and 0007 on Heceta Bank off central Oregon. Coral density was 16.5 corals per 100 m² of seafloor. Stick-like corals dominated the coral assemblage with 91% of all corals, with all being unidentified *Swiftia*-like types with either a single stalk or one branch. Fan-like corals were the next most abundant including *Calcigorgia cf japonica* and *Swiftia pacifica*. A few sea pens were observed in the soft sediments.



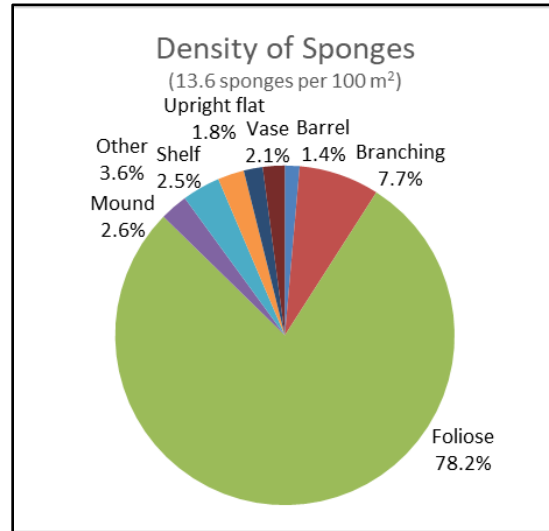
Colors in the pie diagram match colors in the list of coral taxa (below).

Scientific name	Common name	Number
<i>Calcigorgia cf japonica</i>	white <i>Swiftia</i> fan	23
<i>Desmophyllum dianthus</i>	cockscomb cup coral	1
<i>Funiculina</i> spp.	unidentified sea pen	10
<i>Heteropolypus ritteri</i>	mushroom coral	12
Pennatulacea #1	sea pen (thin)	1
Plexauridae #1	<i>Swiftia</i> type (red w/ white polyps)	1
Plexauridae #3	<i>Swiftia</i> type (red w/ unknown polyps)	792
<i>Plumarella longispina</i>	primnoid	1
<i>Swiftia pacifica</i>	sea fan (red with yellow polyps)	27

Two coral specimens were collected during dives at Heceta Bank and sent to experts for identification. Shipboard identifications were *Swiftia simplex* (1 specimen) and *Swiftia pacifica* (1 specimen). Verified identifications from experts are still pending.

BIOLOGICAL ENVIRONMENT: SPONGES (Heceta Bank)

A total of 717 individual sponges from at least 10 different taxa were enumerated from 7 quantitative transects conducted during Dive 0006 and 0007 on Heceta Bank off central Oregon. An overall density of 13.6 sponges per 100 m² of seafloor was calculated. Unidentified foliose sponges were the most abundant taxa (78%), followed by branching (7.7%), other (3.6%), mound (2.6%), and shelf (2.5%) sponges.



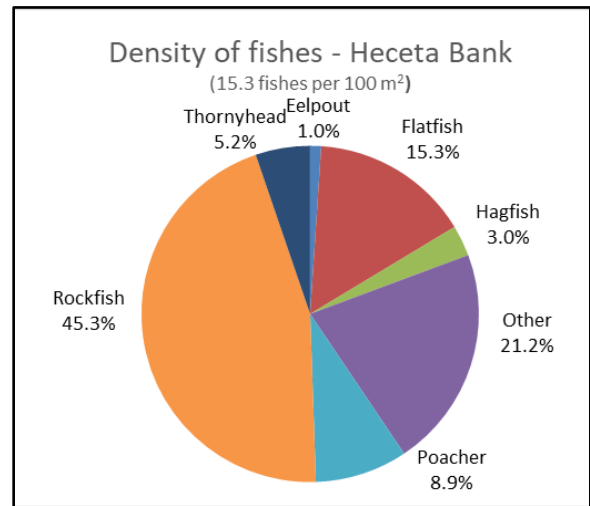
Colors in the pie diagram match colors in the list of sponge taxa (below).

Scientific name	Common name	Number
<i>Poecillastra</i> spp.	fringed shelf sponge	8
Porifera #1	unidentified foliose sponges	561
Porifera #12	unidentified sponge	26
Porifera #2	unidentified upright flat sponges	13
Porifera #3	unidentified barrel sponges	10
Porifera #4	unidentified shelf sponges	10
Porifera #5	unidentified vase sponges	15
Porifera #6	unidentified mound sponges	15
Porifera #7	unidentified branching sponge	55
Porifera #9	unidentified puffball mound sponge	4

Three sponge specimens were collected during dives on Heceta Bank and sent to experts for identification. Shipboard identifications were lumpy sponge (1 specimen) and white branching, encrusting sponge (2 specimens). Verified identifications from experts are still pending.

BIOLOGICAL ENVIRONMENT: FISHES (Heceta Bank)

At least 45 taxa of fishes were identified from 10 quantitative transects conducted during Dive 0006-0007 on Heceta Bank off central Oregon. A total of 804 individual fishes were enumerated, representing an overall density of 15.3 fishes per 100 m² of seafloor. At least 13 species of rockfishes (*Sebastes* spp.) accounted for over half (59.2%) of all fish taxa and the most abundant rockfish taxa were pygmy (*S. wilsoni*), greenstriped (*S. elongatus*), and rosethorn (*S. helvomaculatus*) rockfishes. The remainder of the fish assemblage included Other (21.8%), flatfishes (9.8%), poachers (4.7%), thornyheads (2.5%), hagfishes (1.5%, *Eptatretus stoutii*), and eelpouts (0.5%). The category 'other' included 175 fishes from at least 15 taxa, including sculpins (106 fishes, 60%), sablefish (30 fish, 17%), pricklebacks (15 fishes, 9%), and ronquils (12 fishes, 7%) and one spiny dogfish (*Squalus suckleyi*).



Colors in the pie diagram match colors in the list of fish taxa (below).

Five percent (79 individuals) of the 1,585 corals and sponges had a fish association within one body length. Plexauridae #3 had the most associations (54), followed by foliose sponges (15). The most common fishes associated were rockfishes (28) Dover sole (12), and sablefish (8).

Scientific name	Common name	Number
Agonidae	unidentified poachers	9
<i>Agonopsis vulsa</i>	northern spearnose poacher	2
<i>Anoplopoma fimbria</i>	sablefish	30
<i>Bathyagonus pentacanthus</i>	bigeye poacher	26
<i>Bathyraja interrupta</i>	sandpaper skate	1
Cottidae	unidentified sculpin	27
<i>Embassichthys bathybius</i>	deepsea sole	1
<i>Eopsetta jordani</i>	petrale sole	2
<i>Eptatretus</i> spp.	unidentified hagfish	12
<i>Glyptocephalus zachirus</i>	rex sole	23
<i>Icelinus filamentosus</i>	threadfin sculpin	4
<i>Icelinus tenuis</i>	spotfin sculpin	45
<i>Lepidopsetta bilineata</i>	rock sole	4
Liparididae	unidentified snailfish	1
<i>Lycodes cortezianus</i>	bigfin eelpout	2
<i>Lycodes diapterus</i>	black eelpout	2
<i>Microstomus pacificus</i>	Dover sole	26
Myctophidae	unidentified lanternfish	1
<i>Ophiodon elongatus</i>	lingcod	2
<i>Paricelinus hopliticus</i>	thornback sculpin	30
Pleuronectiformes	unidentified flatfishes	23
<i>Raja rhina</i>	longnose skate	3
<i>Rathbunella</i> spp.	unidentified ronquils	12

Scientific name	Common name	Number
Scyliorhinidae egg cases	cat shark egg cases	1
<i>Sebastes chlorostictus</i>	greenspotted rockfish	1
<i>Sebastes crameri</i>	darkblotched rockfish	22
<i>Sebastes diploproa</i>	splitnose rockfish	4
<i>Sebastes elongatus</i>	greenstriped rockfish	110
<i>Sebastes emphaeus</i>	Puget Sound rockfish	1
<i>Sebastes entomelas</i>	widow rockfish	2
<i>Sebastes flavidus</i>	yellowtail rockfish	11
<i>Sebastes helvomaculatus</i>	rosethorn rockfish	100
<i>Sebastes pinniger</i>	canary rockfish	5
<i>Sebastes proriger</i>	redstripe rockfish	1
<i>Sebastes saxicola</i>	stripetail rockfish	1
<i>Sebastes</i> spp. YOY	juvenile rockfish	1
<i>Sebastes wilsoni</i>	pygmy rockfish	173
<i>Sebastes zacentrus</i>	sharpchin rockfish	39
<i>Sebastolobus alascanus</i>	shortspine thornyhead	8
<i>Sebastolobus</i> spp.	thornyheads	12
<i>Squalus suckleyi</i>	Pacific spiny dogfish	1
Stichaeidae	unidentified pricklebacks	15
<i>Sebastomus</i>	unidentified <i>Sebastomus</i>	5
<i>Xeneretmus leiops</i>	smootheye poacher	1
<i>Zaniolepis frenata</i>	shortspine combfish	2

IMAGE GALLERY (Heceta Bank)

A young greenspotted rockfish on mud at 134 m.



Small sponges at 121 m.



A red Plexauridae stick coral on a lone rock at 403 m.



An octopus at 375 m.



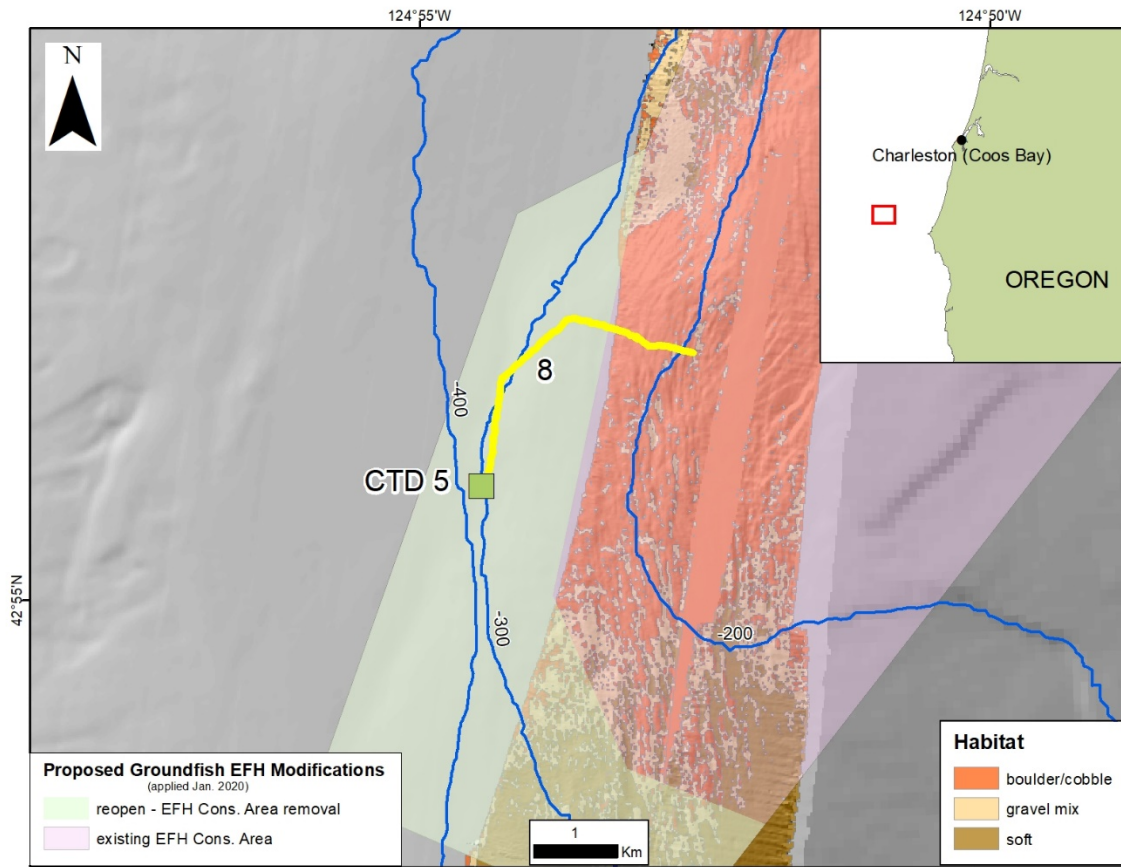
ADDITIONAL COMMENTS (Heceta Bank)

One brown bottle was the only anthropogenic debris item documented during dives at Heceta Bank. Damage to fauna by this item was not evident.

Five corals (Plexauridae #3) and one unidentified sponge showed damage with broken sections. The same five Plexauridae #3 corals were also knocked over (no sponges were knocked over). A total of 95 Plexauridae #3 were dead or dying (12% of all Plexauridae #3) and 2 *Swiftia pacifica* were dead or dying (7%). Sponges that were dead or dying (N= 482, 67% of all sponges) included 424 foliose (76%), 14 vase (93%), 10 upright flat (77%), and 10 shelf (100%).

SITE AREA: Bandon High Spot DIVE NUMBER: ROV 0008

GENERAL LOCATION AND DIVE TRACK



STATION OVERVIEW (Bandon High Spot)

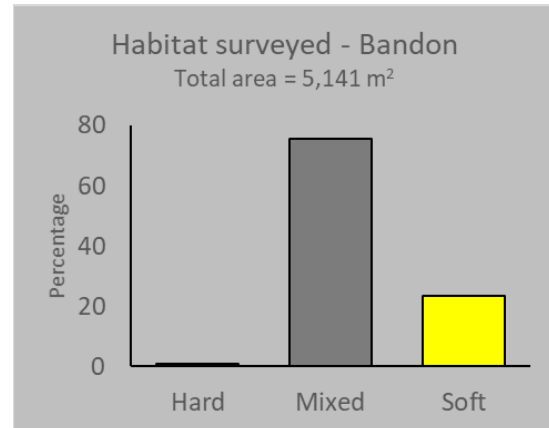
Project	EXPRESS 2018
Chief Scientists	Tom Laidig, Elizabeth Clarke, Chris Caldwell
Contact Information	NMFS, SWFSC, tom.laidig@noaa.gov
Purpose	Survey deep-sea coral communities along the U.S. West Coast
Vessel and Survey Vehicle	NOAA Ship <i>Bell M. Shimada</i> ; ROV <i>Beagle</i> (MARE)
Science Observers	Diana Watters, Meredith Everett, JT Robinson
Digital Video	5.8 Hours
Digital Still Photos	2,097 images
Positioning System	Ship: GPS; ROV: USBL
CTD Sensors	Yes
O₂ Sensor	Yes
pH Sensor	No
Specimens collected	8
Water sample	1 eDNA; 2 water chemistry
Other	Logbook, Relational database
Report Analyst	Tom Laidig
Date Compiled	07 July 2021

DIVE DATA (Bandon High Spot)

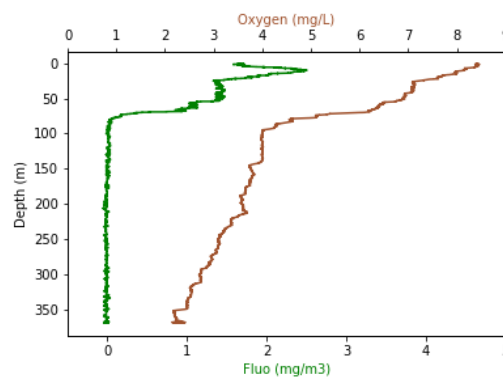
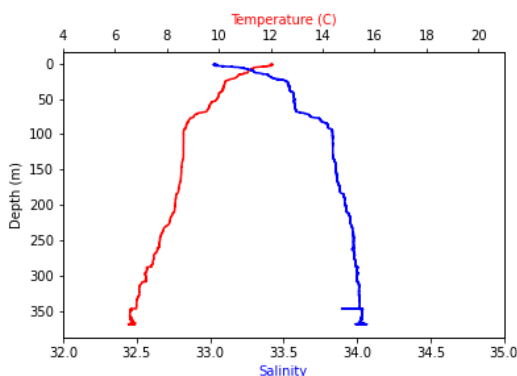
Date	16 Oct 2018	Starting Latitude (N)	42° 55.785'
Minimum Bottom Depth (m)	193	Starting Longitude (W)	124° 54.330'
Maximum Bottom Depth (m)	371	Ending Latitude (N)	42° 56.790'
Start Bottom Time (UTC)	02:39:20	Ending Longitude (W)	124° 53.063'
End Bottom Time (UTC)	08:26:59	Number of Dives	1
Number 15-min Transects	11		

PHYSICAL ENVIRONMENT (Bandon High Spot)

In total, 5,141 m² of seafloor were surveyed during 11 quantitative transects conducted during Dive 0008 on Bandon High Spot off southern Oregon. Habitat types were classified as (1) Hard (1% of the total area surveyed), which included boulders, cobbles, and flat bedrock covered in a veneer of mud; (2) Mixed (75%), including a combination of mud with boulder, cobbles, and flat bedrock; and (3) Soft (23%), which consisted entirely of mud.

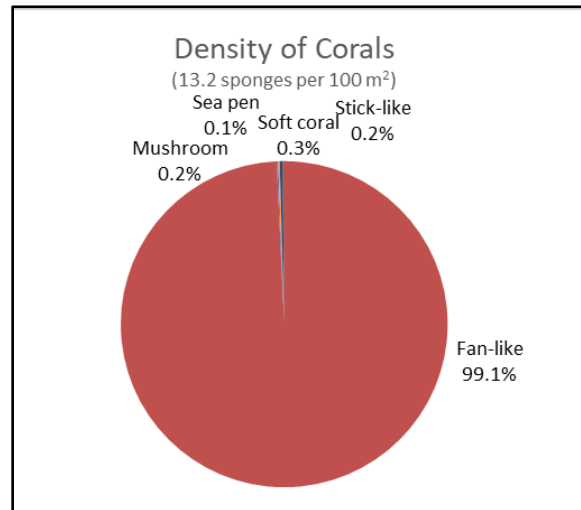


A small thermocline was present (as measured from the shipboard CTD) from the surface to about 20 m, and afterwards the temperature gradually decreased with depth. Salinity increased with depth with a halocline from the surface to about 30 m and a second halocline from about 60 – 80 m. Oxygen decreased rapidly until about 100 m with a gradual decrease after this depth. Fluorescence reached a maximum at 10 m and decreased quickly after that until about 80 m and decreased very slowly from that point.



BIOLOGICAL ENVIRONMENT: CORALS (Bandon High Spot)

A total of 682 individual coral colonies, comprising at least 7 taxa, were enumerated from 11 quantitative transects conducted during Dive 0008 on Bandon High spot off southern Oregon. Coral densities were calculated at 13.2 corals per 100 m² of seafloor. Fan-like corals dominated the coral assemblage (99% of all corals), with *Swiftia pacifica* accounting for 99% of the fan-like corals.



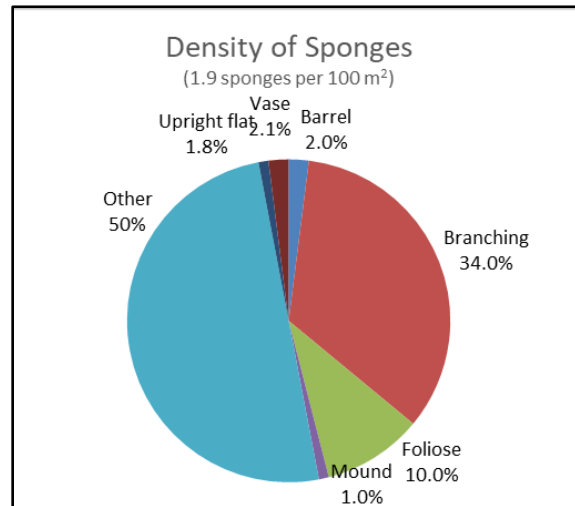
Colors in the pie diagram match colors in the list of coral taxa (below).

Scientific name	Common name	Number
<i>Clavularia</i> spp.	soft coral	2
<i>Funiculina</i> spp.	unidentified sea pen	1
<i>Heteropolypus ritteri</i>	mushroom coral	1
<i>Paragorgia</i> spp.	sea fan (white with red polyps)	5
Plexauridae #3	<i>Swiftia</i> type (red w/ unknown polyps)	1
<i>Plumarella longispina</i>	primnoid	2
<i>Swiftia pacifica</i>	sea fan (red with yellow polyps)	670

Three coral specimens were collected during dives at Bandon High Spot and sent to experts for identification. Shipboard identifications were *Paragorgia* spp. (1 specimen), *Swiftia pacifica* (1 specimen), and *Plumarella longispina* (1 specimen). Verified identifications from experts are still pending.

BIOLOGICAL ENVIRONMENT: SPONGES (Bandon High Spot)

A total of 100 individual sponges from at least 9 different taxa were enumerated from 11 quantitative transects conducted during Dive 0008 on Bandon High spot off southern Oregon. An overall density of 1.9 sponges per 100 m² of seafloor was calculated. The most abundant taxa was Other Sponges (50%), all of which were individuals in the genus *Asbestopluma* (flat blades commonly called the palm frond sponge). Unidentified branching (34%) and foliose (10%) sponges were the next most abundant taxa.



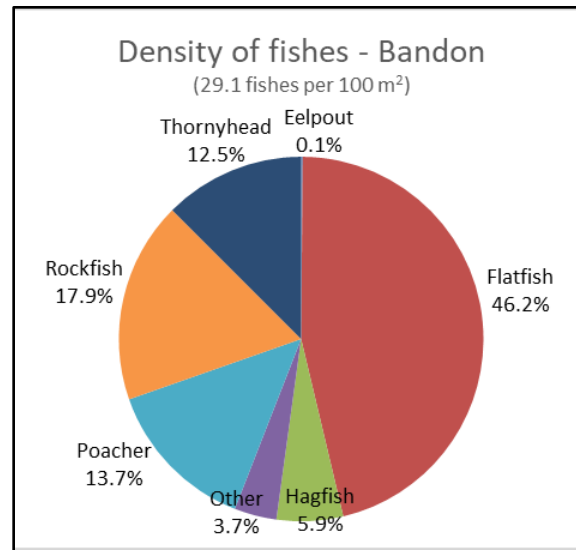
Colors in the pie diagram match colors in the list of sponge taxa (below).

Scientific name	Common name	Number
<i>Asbestopluma</i> spp. #2	predatory sponge (clear)	50
<i>Heterochone calyx</i>	fingered goblet vase sponge	1
<i>Polymastia</i> spp. #1	white nipple foliose sponge	7
Porifera #1	unidentified foliose sponges	3
Porifera #2	unidentified upright flat sponges	1
Porifera #3	unidentified barrel sponges	2
Porifera #5	unidentified vase sponges	1
Porifera #7	unidentified branching sponge	34
Porifera #9	unidentified puffball mound sponge	1

Three sponge specimens were collected during dives on Bandon High Spot and sent to experts for identification. Shipboard identifications were fan-shaped sponge (probably *Asbestopluma*, 2 specimens) and white ball sponge (1 specimen). Verified identifications from experts are still pending.

BIOLOGICAL ENVIRONMENT: FISHES (Bandon High Spot)

At least 38 taxa of fishes were identified from 11 quantitative transects conducted during Dive 0008 on Bandon High Spot off southern Oregon. A total of 1,495 individual fishes were enumerated, and an overall density of 29.1 fishes per 100 m² of seafloor was calculated. At least 6 species of flatfishes accounted for 46.2% of all fishes, while at least 8 species of rockfishes (*Sebastes* spp.) accounted for 17.9%. The most abundant flatfishes were Dover (*Microstomus pacificus*), slender (*Lyopsetta exilis*), and rex sole (*Glyptocephalus zachirus*), and the most abundant rockfishes were sharpchin (*S. zacentrus*) and rosethorn (*S. helvomaculatus*) rockfishes. The remainder of the fish assemblage included poachers (at least 3 species, 13.7%), thornyheads (12.5%), hagfishes (5.9%, *Eptatretus stoutii*), Other (3.7%), and eelpouts (0.1%). The category 'other' included fishes from at least 10 taxa, including sculpins, skates, sablefish, and spotted ratfish.



Colors in the pie diagram match colors in the list of fish taxa (below).

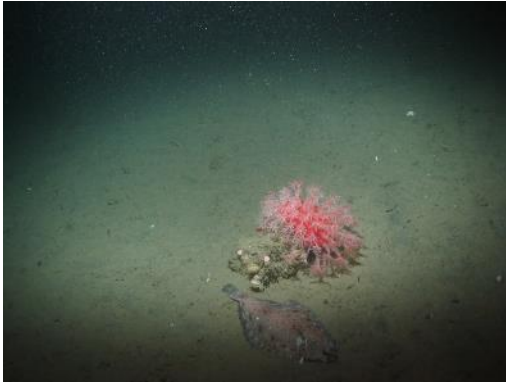
Only 6% (50 individuals) of the 782 corals and sponges had a fish association within one body length. More than three fourths of all associations were with *Swiftia pacifica*. The most common fishes associated with the corals and sponges were sharpchin and rosethorn rockfishes.

Scientific name	Common name	Number
Agonidae	unidentified poachers	76
<i>Anoplopoma fimbria</i>	sablefish	2
<i>Atheresthes stomias</i>	arrowtooth flounder	3
<i>Bathyagonus pentacanthus</i>	bigeye poacher	59
<i>Chilara taylori</i>	spotted cusk-eel	1
<i>Eopsetta jordani</i>	petrale sole	1
<i>Eptatretus</i> spp.	unidentified hagfish	88
<i>Glyptocephalus zachirus</i>	rex sole	67
<i>Hippoglossus stenolepis</i>	Pacific halibut	1
<i>Hydrolagus colliei</i>	spotted ratfish	2
<i>Hydrolagus colliei</i> egg case	ratfish egg case	1
<i>Icelinus filamentosus</i>	threadfin sculpin	25
<i>Icelinus</i> spp.	<i>Icelinus</i> sculpins	3
Liparididae	unidentified snailfish	1
<i>Lycodes corteziianus</i>	bigfin eelpout	13
<i>Lyopsetta exilis</i>	slender sole	137
<i>Merluccius productus</i>	Pacific hake	10
<i>Microstomus pacificus</i>	Dover sole	345
<i>Ophiodon elongatus</i>	lingcod	1
Osteichthyes	unidentified fishes	1
Pleuronectiformes	unidentified flatfishes	136

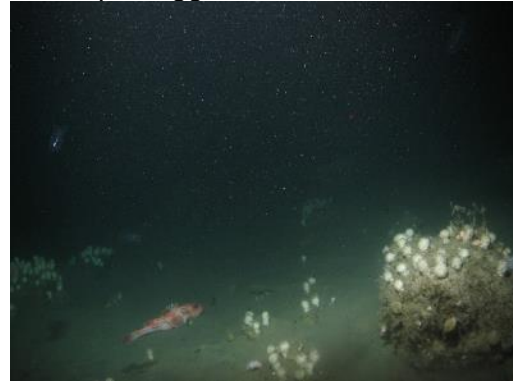
Scientific name	Common name	Number
<i>Raja rhina</i>	longnose skate	3
<i>Raja</i> spp.	unidentified skate	1
Scyliorhinidae egg cases	cat shark egg cases	5
<i>Sebastes aurora</i>	aurora rockfish	6
<i>Sebastes chlorostictus</i>	greenspotted rockfish	1
<i>Sebastes crameri</i>	darkblotched rockfish	5
<i>Sebastes diploproa</i>	splitnose rockfish	17
<i>Sebastes elongatus</i>	greenstriped rockfish	24
<i>Sebastes entomelas</i>	widow rockfish	4
<i>Sebastes helvomaculatus</i>	rosethorn rockfish	84
<i>Sebastes</i> spp.	unidentified rockfishes	6
<i>Sebastes</i> spp. YOY	juvenile rockfish	1
<i>Sebastes zacentrus</i>	sharpchin rockfish	119
<i>Sebastolobus alascanus</i>	shortspine thornyhead	16
<i>Sebastolobus</i> spp.	thornyheads	171
<i>Xeneretmus leiops</i>	smootheye poacher	57
Zoarcidae	unidentified eelpout	2

IMAGE GALLERY (Bandon High Spot)

Mushroom coral at 363 m.



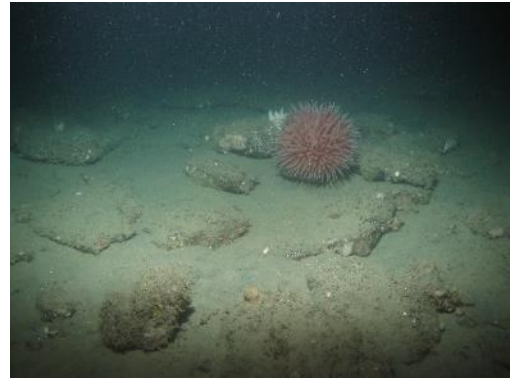
Gastropod egg cases at 354 m.



Sea cucumbers and a seastar on a rock at 361 m.



Pom pom anemone and branching sponge at 242 m.



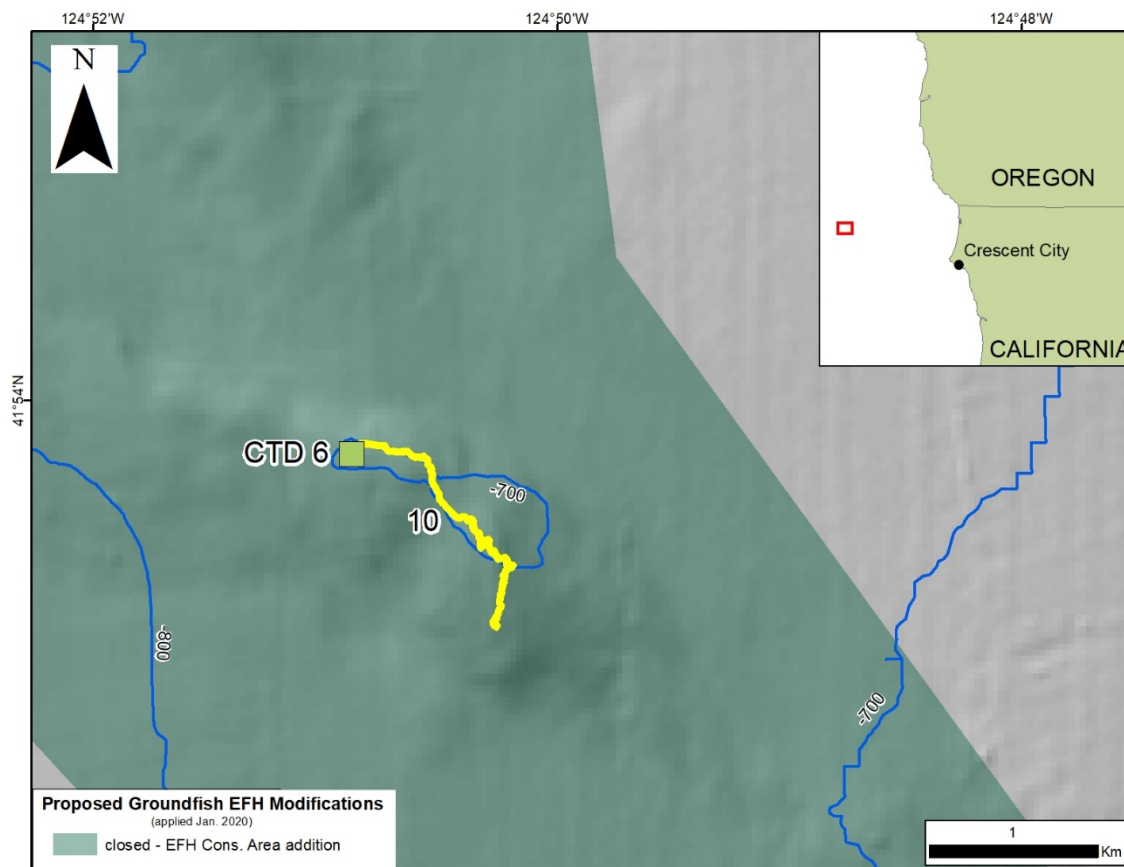
ADDITIONAL COMMENTS (Bandon High Spot)

One piece of trash (looked like green fishing weight) was the only anthropogenic debris item documented during dives at Bandon High Spot. Damage to fauna by this item was not evident.

No damaged corals and only one damaged sponge (a branching sponge) was observed. No knocked over corals or sponges were observed. Seven *Swiftia pacifica* and four *Polymastia* spp. #1 were classified as dying and no dead corals or sponges were observed.

SITE AREA: Brush Patch
DIVE NUMBER: ROV 0010

GENERAL LOCATION AND DIVE TRACK



STATION OVERVIEW (Brush Patch)

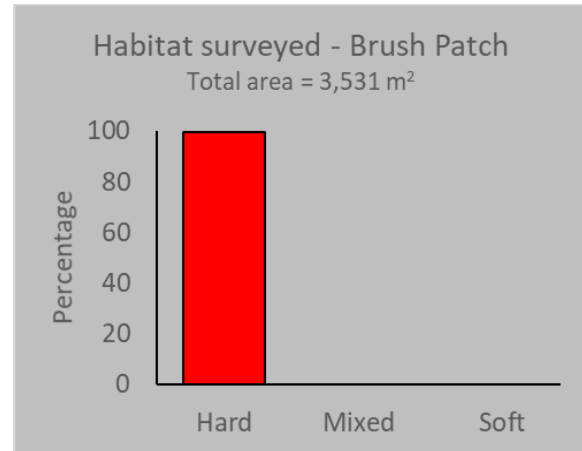
Project	EXPRESS 2018
Chief Scientists	Tom Laidig, Elizabeth Clarke, Chris Caldw
Contact Information	NMFS, SWFSC, tom.laidig@noaa.gov
Purpose	Survey deep-sea coral communities along the U.S. West Coast
Vessel and Survey Vehicle	NOAA Ship <i>Bell M. Shimada</i> ; ROV <i>Beagle</i> (MARE)
Science Observers	Diana Watters, Meredith Everett, JT Robinson
Digital Video	4.3 Hours
Digital Still Photos	1,622 images
Positioning System	Ship: GPS; ROV: USBL
CTD Sensors	Yes
O₂ Sensor	Yes
pH Sensor	No
Specimens collected	4
Water sample	0 eDNA; 9 water chemistry
Other	Logbook, Relational database
Report Analyst	Tom Laidig
Date Compiled	07 July 2021

DIVE DATA (Brush Patch)

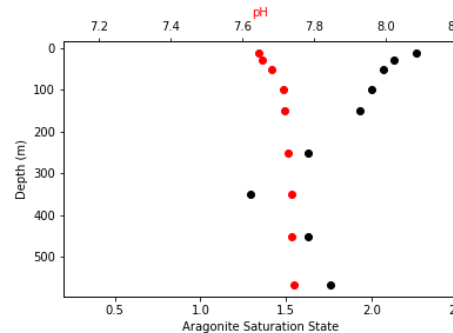
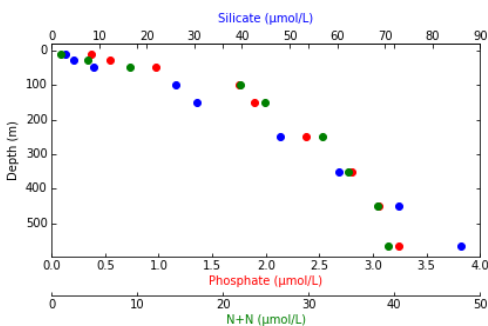
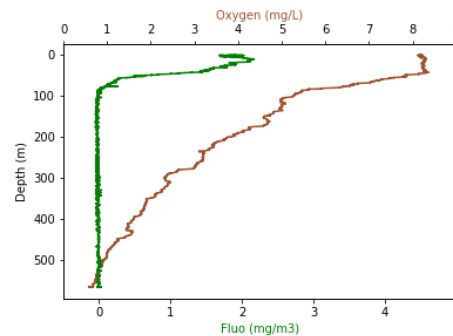
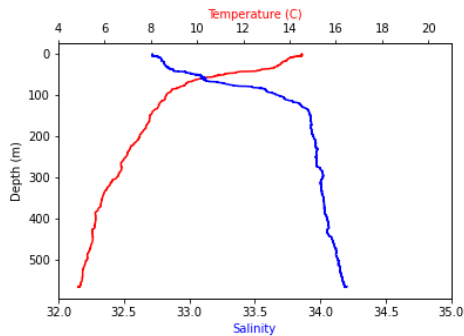
Date	17 Oct 2018	Starting Latitude (N)	42° 4.035'
Minimum Bottom Depth (m)	560	Starting Longitude (W)	124° 48.529'
Maximum Bottom Depth (m)	615	Ending Latitude (N)	41° 53.309'
Start Bottom Time (UTC)	03:31:50	Ending Longitude (W)	124° 50.208'
End Bottom Time (UTC)	07:24:39	Number of Dives	1
Number 15-min Transects	4		

PHYSICAL ENVIRONMENT (Brush Patch)

In total, 3,531 m² of seafloor were surveyed during 4 quantitative transects conducted during Dive 0010 on the Brush Patch off northern California. Habitat types were classified as (1) Hard (99.5% of the total area surveyed), which included bedrock outcrops, large boulders, and cobbles; (2) Mixed (0.5%), including a combination of mud with cobbles; and (3) Soft (none observed).

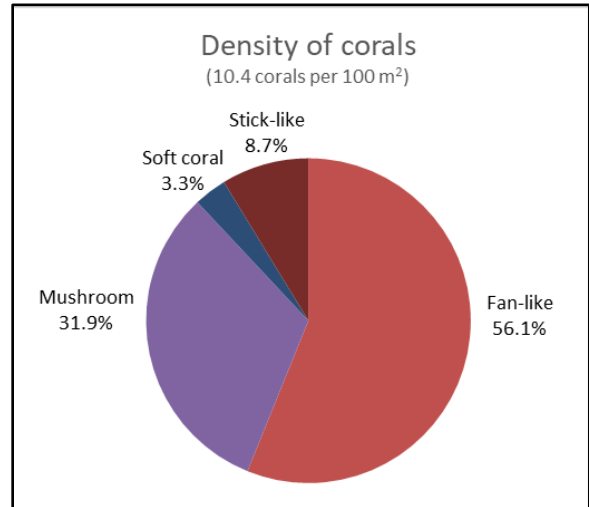


A thermocline was present (as measured from the shipboard CTD) from the surface to about 80 m with a gradual decrease after that. Salinity increased with depth with a halocline from the surface to about 100 m. Oxygen decreased rapidly until about 100 m then slowly to the seafloor (~550 m). Fluorescence peaked near the surface (~10 m) and reduced to zero near 100 m. Nutrient load (phosphate, silicate, and ammonia and N+N) gradually increased with depth. pH slowly increased with depth whereas aragonite saturation decreased with depth.



BIOLOGICAL ENVIRONMENT: CORALS (Brush Patch)

A total of 367 individual coral colonies, comprising at least 10 taxa, were enumerated from 4 quantitative transects conducted during Dive 0010 on the Brush Patch off northern California. Coral densities were calculated at 10.4 corals per 100 m² of seafloor. Fan-like corals dominated the coral assemblage (56% of all corals), consisting mainly of *Paragorgia* spp. and *Swiftia pacifica*. Mushroom corals were also very abundant (32%). A surprise was to find two *Primnoa pacifica* – a south-ward range extension and first documented occurrences in California.



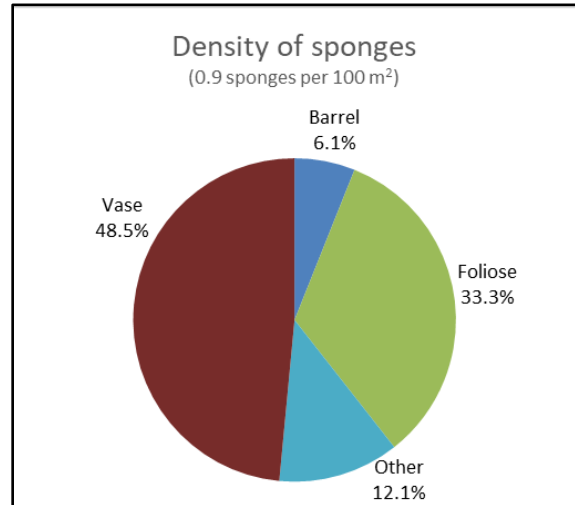
Colors in the pie diagram match colors in the list of coral taxa (below).

Scientific name	Common name	Number
<i>Clavularia</i> spp.	soft coral	8
<i>Gersemia</i> spp.	soft coral	4
<i>Heteropolypus ritteri</i>	mushroom coral	117
Isididae	unknown bamboo coral	2
<i>Paragorgia</i> spp.	sea fan (white with red polyps)	154
<i>Parastenella ramosa</i>	primnoid	7
Plexauridae #3	<i>Swiftia</i> type (red w/ unknown polyps)	32
<i>Plumarella longispina</i>	primnoid	10
<i>Primnoa pacifica</i>	red tree coral	2
<i>Swiftia pacifica</i>	sea fan (red with yellow polyps)	31

Two coral specimens were collected during dives at Brush Patch and sent to experts for identification. Shipboard identifications were *Paragorgia* spp. (1 specimen) and *Primnoa pacifica* (1 specimen). Verified identifications from experts are still pending.

BIOLOGICAL ENVIRONMENT: SPONGES (Brush Patch)

A total of 33 individual sponges from at least 5 different taxa were enumerated from 4 quantitative transects conducted during Dive 0010 on the Brush Patch off northern California. An overall density of 0.9 sponges per 100 m² of seafloor was calculated. The most abundant taxon was Other sponges (50%), all of which were individuals in the genus *Asbestopluma* (flat blades commonly called the palm frond sponge). Unidentified branching (34%) and foliose (10%) sponges were the next most abundant taxa.



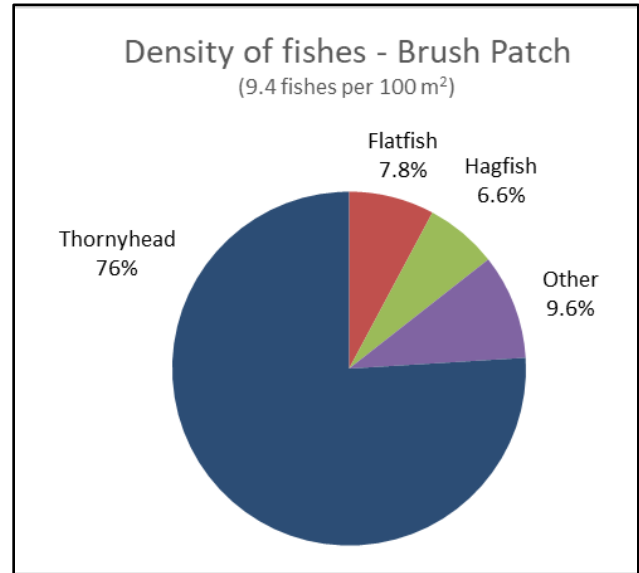
Colors in the pie diagram match colors in the list of sponge taxa (below).

Scientific name	Common name	Number
<i>Asbestopluma</i> spp. #2	predatory sponge (clear)	4
<i>Farrea occa</i>	lace (or cloud) foliose sponge	5
Porifera #1	unidentified foliose sponges	6
Porifera #3	unidentified barrel sponges	2
Porifera #5	unidentified vase sponges	16

One sponge specimen was collected during dives on the Brush Patch and sent to experts for identification. Shipboard identifications were *Farrea* sponge (1 specimen). Verified identifications from experts are still pending.

BIOLOGICAL ENVIRONMENT: FISHES (Brush Patch)

At least 10 taxa of fishes were identified from 4 quantitative transects conducted during Dive 0010 on the Brush Patch off northern California. A total of 333 individual fishes were enumerated, and an overall density of 9.4 fishes per 100 m² of seafloor was calculated. Thornyheads (*Sebastolobus* spp.) accounted for over three quarters (76%) of all fishes. Other taxa present were the Other category (9.6%), flatfishes (7.8%), and hagfishes (6.6%). The Other category consisted of deeper living taxa including grenadiers (Macrouridae), rubynose brotula (*Cataetyx rubrirostris*), and rougtail skate (*Bathyraja trachura*). The reduced diversity of fishes reflects that this was a deeper dive.



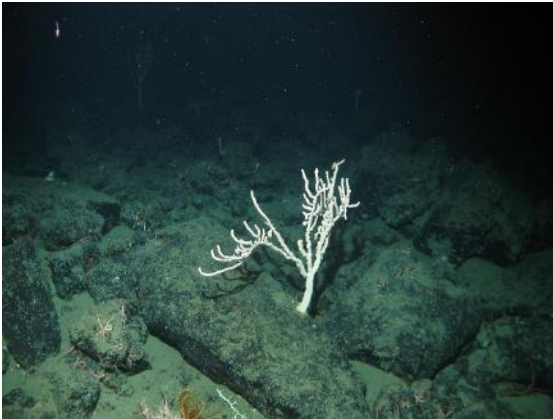
Colors in the pie diagram match colors in the list of fish taxa (below).

Scientific name	Common name	Number
<i>Anoplopoma fimbria</i>	sablefish	8
<i>Bathyraja trachura</i>	rougtail skate	1
<i>Cataetyx rubrirostris</i>	rubynose brotula	18
<i>Embassichthys bathybius</i>	deepsea sole	16
<i>Eptatretus</i> spp.	unidentified hagfish	22
Macrouridae	unidentified grenadier	1
<i>Microstomus pacificus</i>	Dover sole	10
Rajiformes egg cases	skate egg cases	4
<i>Sebastolobus alascanus</i>	shortspine thornyhead	3
<i>Sebastolobus altivelis</i>	longspine thornyhead	63
<i>Sebastolobus</i> spp.	thornyheads	187

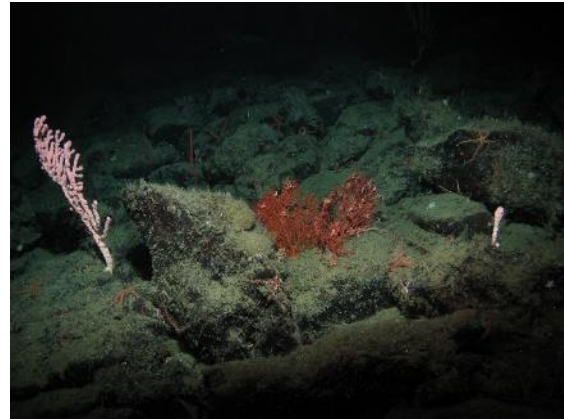
Two sponges (1 barrel, and 1 vase) and seven corals (2%) of the 400 corals and sponges had a fish association within one body length. *Paragorgia* spp. (3), *Heteropolypus ritteri* (2) and *Swiftia pacifica* (2) were the only corals with fish associations. Thornyheads (5) had the most invertebrate associations.

IMAGE GALLERY (Brush Patch)

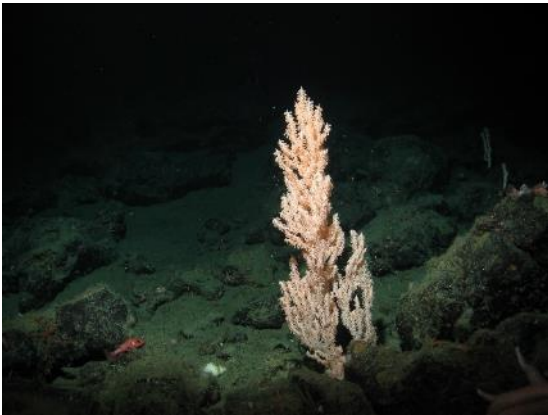
A large *Paragorgia* spp. at 587 m.



A large *Paragorgia* spp. and a *Swiftia pacifica* at 582 m.



A large *Primnoa pacifica* at 581 m, the first documented occurrence in California.



A large flat upright sponge with a live *Paragorgia* spp. in the background and a broken, dead piece of *Paragorgia* in the foreground at 572 m.



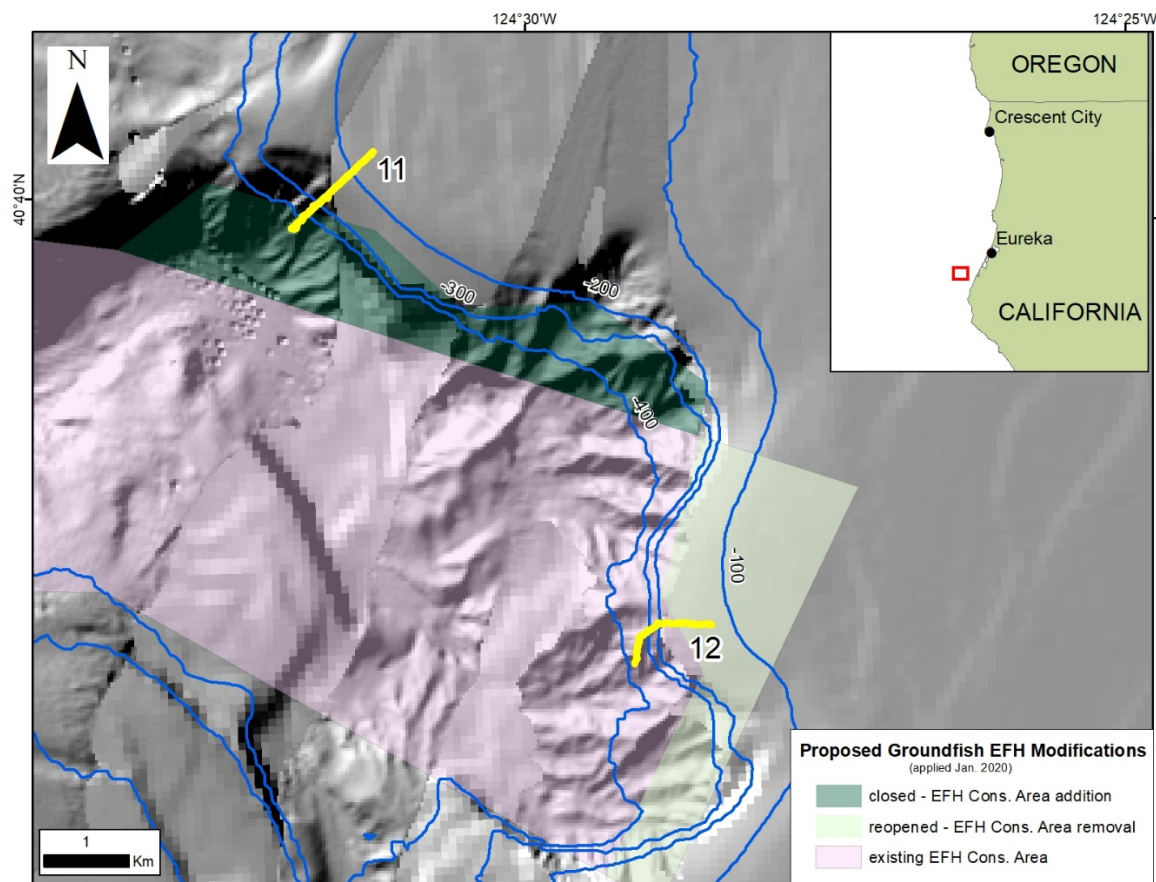
ADDITIONAL COMMENTS (Brush Patch)

Four anthropogenic debris items were documented during dives at Brush Patch. Three of the items were trash (one rusted tin can, one new-looking aluminum can, and one black canvas bag covered in sediment) and one was an old longline suspended off the seafloor. Damage to fauna by these items was not evident.

Six corals (*Paragorgia* spp.) and no sponges had damaged sections. All six of these *Paragorgia* spp. were also knocked over, with three dead or dying, one slightly injured and two appeared to be healthy and growing on their sides. One other whole *Paragorgia* spp. colony was knocked over but was almost completely dead. Almost two thirds of the sponges were dead or dying (64%, 21 specimens), while only 4% of the corals were dead and dying (14 individuals).

SITE AREA: Eel River Canyon DIVE NUMBER: ROV 0011-0012

GENERAL LOCATION AND DIVE TRACK



STATION OVERVIEW (Eel River Canyon)

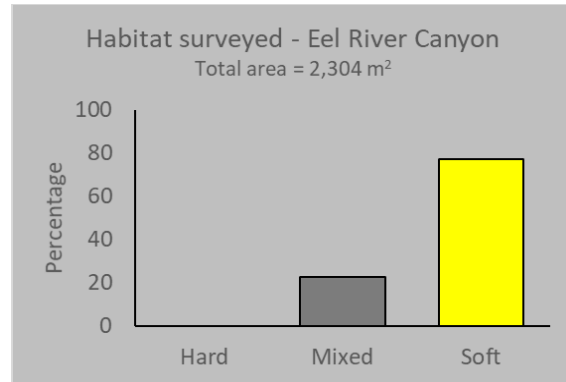
Project	EXPRESS 2018
Chief Scientists	Tom Laidig, Elizabeth Clarke, Chris Caldow
Contact Information	NMFS, SWFSC, tom.laidig@noaa.gov
Purpose	Survey deep-sea coral communities along the U.S. West Coast
Vessel and Survey Vehicle	NOAA Ship <i>Bell M. Shimada</i> ; ROV <i>Beagle</i> (MARE)
Science Observers	Diana Watters, Meredith Everett, JT Robinson
Digital Video	8.5 Hours
Digital Still Photos	1,560 images
Positioning System	Ship: GPS; ROV: USBL
CTD Sensors	Yes
O₂ Sensor	Yes
pH Sensor	No
Specimens collected	3
Water sample	1 eDNA; 0 water chemistry
Other	Logbook, Relational database
Report Analyst	Tom Laidig
Date Compiled	07 July 2021

DIVE DATA (Eel River Canyon)

Date	18 Oct 2018	Starting Latitude (N)	40° 39.842'
Minimum Bottom Depth (m)	100	Starting Longitude (W)	124° 31.915'
Maximum Bottom Depth (m)	645	Ending Latitude (N)	40° 37.382'
Start Bottom Time (UTC)	21:23:22	Ending Longitude (W)	124° 28.360'
End Bottom Time (UTC)	06:03:03	Number of Dives	2
Number 15-min Transects	7		

PHYSICAL ENVIRONMENT (Eel River Canyon)

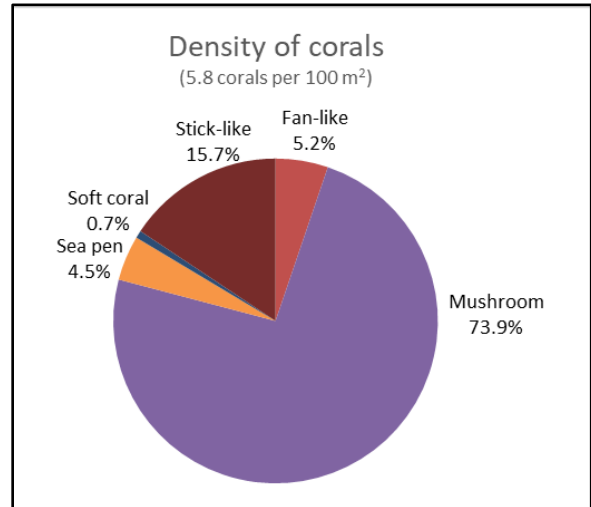
In total, 2,304 m² of seafloor were surveyed during 7 quantitative transects conducted during Dive 0011 and 0012 on Eel River Canyon off northern California. Habitat types were classified as (1) Hard (none observed); (2) Mixed (31%), including a combination of mud with bedrock; and (3) Soft (69%), which consisted entirely of mud.



The ship's CTD was not deployed here and no water chemistry was completed for this dive.

BIOLOGICAL ENVIRONMENT: CORALS (Eel River Canyon)

A total of 134 individual coral colonies, comprising at least 5 taxa, were enumerated from 7 quantitative transects conducted during Dive 0011 and 0012 at Eel River Canyon off northern California. Coral densities were calculated at 5.8 corals per 100 m² of seafloor. Mushroom corals dominated the coral assemblage (74% of all corals). Even with the abundance of soft sediment, only six sea pens were observed on the transect.



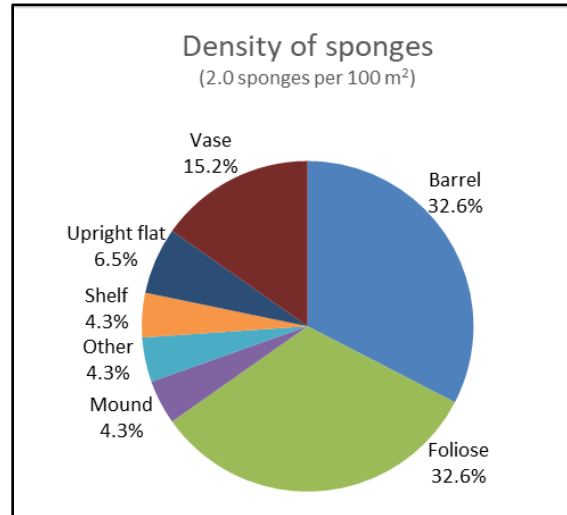
Colors in the pie diagram match colors in the list of coral taxa (below).

Scientific name	Common name	Number
<i>Clavularia</i> spp.	soft coral	1
<i>Halipteris californica</i>	sea pen	6
<i>Heteropolypus ritteri</i>	mushroom coral	99
Plexauridae #3	<i>Swiftia</i> type (red w/ unknown polyps)	21
<i>Swiftia pacifica</i>	sea fan (red with yellow polyps)	7

No coral specimens were collected during dives at Eel River Canyon.

BIOLOGICAL ENVIRONMENT: SPONGES (Eel River Canyon)

A total of 46 individual sponges from at least 10 different taxa were enumerated from 7 quantitative transects conducted during Dive 0011 and 0012 at Eel River Canyon off northern California. An overall density of 2.0 sponges per 100 m² of seafloor was calculated. This low density was probably due to the lack of hard substrate for the sponges to attach. The most abundant two taxa were barrel and foliose sponges at 33% of all sponges. Vase sponges were about half as abundant at 15%.



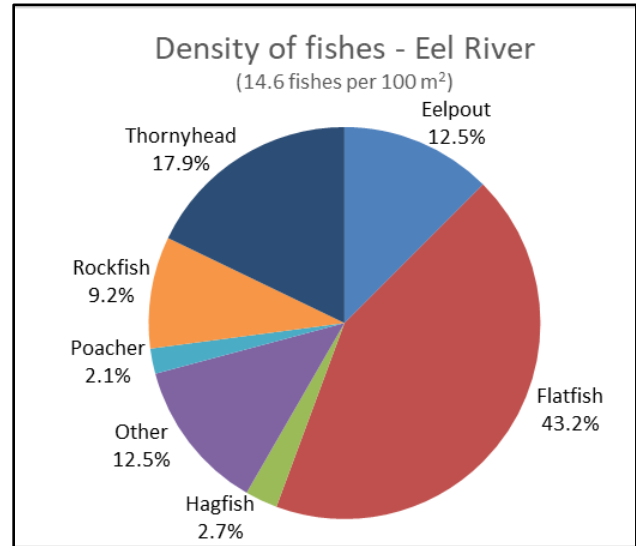
Colors in the pie diagram match colors in the list of sponge taxa (below).

Scientific name	Common name	Number
<i>Farrea occa</i>	lace (or cloud) foliose sponge	13
<i>Heterochone calyx</i>	fingered goblet vase sponge	1
Porifera #1	unidentified foliose sponges	2
Porifera #12	unidentified sponge	2
Porifera #2	unidentified upright flat sponges	3
Porifera #3	unidentified barrel sponges	15
Porifera #4	unidentified shelf sponges	2
Porifera #5	unidentified vase sponges	6
Porifera #6	unidentified mound sponges	1
Porifera #9	unidentified puffball mound sponge	1

Two sponge specimens were collected during dives on Eel River Canyon and sent to experts for identification. Shipboard identifications were white barrel sponge (1 specimen) and *Farrea* sponge (1 specimen). Verified identifications from experts are still pending.

BIOLOGICAL ENVIRONMENT: FISHES (Eel River Canyon)

At least 31 taxa of fishes were identified from 7 quantitative transects conducted during Dive 0011-0012 at the Eel River Canyon off northern California. A total of 336 individual fishes were enumerated, and an overall density of 14.6 fishes per 100 m² of seafloor was calculated. Flatfishes were the most abundant group at 43.2% and included at least 6 species. Other taxa present were the thornyheads (17.9%), eelpouts (12.5%), Other fishes (12.5%), rockfishes (9.2%), hagfishes (2.7%), and poachers (2.1%). The Other category included unidentified snailfish, longnose skates (*Raja rhina*), Pacific hake (*Merluccius productus*), and a single blackeye goby.



Colors in the pie diagram match colors in the list of fish taxa (below).

A little over 6% (11 individuals) of the 180 corals and sponges had a fish association within one body length. *Heteropolypus ritteri* had the most fish associations (6), followed by *Farrea* spp. (2) and one each of Porifera #9, Plexauridae #3, and *Swiftia pacifica*. Dover sole were the most commonly associated fish (6) with the corals and sponges, followed by thornyheads (3) and hagfish (2).

Scientific name	Common name	Number
Agonidae	unidentified poachers	4
<i>Atheresthes stomias</i>	arrowtooth flounder	2
<i>Bathyagonus nigripinnis</i>	blackfin poacher	2
<i>Chilara taylori</i>	spotted cusk-eel	1
<i>Embassichthys bathybius</i>	deepsea sole	2
<i>Eopsetta jordani</i>	petrale sole	1
<i>Eptatretus</i> spp.	unidentified hagfish	9
<i>Glyptocephalus zachirus</i>	rex sole	48
<i>Hydrolagus colliei</i>	spotted ratfish	2
Liparididae	unidentified snailfish	4
<i>Lycodes corteziianus</i>	bigfin eelpout	2
<i>Lycodes diapterus</i>	black eelpout	23
<i>Lyopsetta exilis</i>	slender sole	25
<i>Merluccius productus</i>	Pacific hake	8
<i>Microstomus pacificus</i>	Dover sole	33
<i>Ophiodon elongatus</i>	lingcod	3
Osteichthyes	unidentified fishes	1
<i>Parophrys vetulus</i>	English sole	5
Pleuronectiformes	unidentified flatfishes	29
<i>Raja rhina</i>	longnose skate	4
<i>Rhinogobiops nicholsii</i>	blackeye goby	1
Scyliorhinidae egg cases	cat shark egg cases	17
<i>Sebastes aurora</i>	aurora rockfish	6
<i>Sebastes babcocki</i>	redbanded rockfish	1
<i>Sebastes diploproa</i>	splitnose rockfish	6

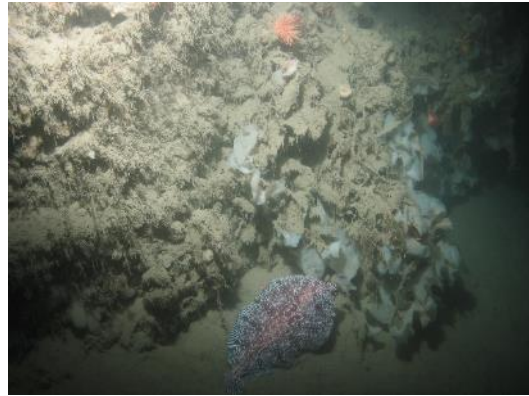
Scientific name	Common name	Number
<i>Sebastes elongatus</i>	greenstriped rockfish	1
<i>Sebastes pinniger</i>	canary rockfish	1
<i>Sebastes saxicola</i>	stripetail rockfish	13
<i>Sebastes</i> spp.	unidentified rockfishes	3
<i>Sebastolobus alascanus</i>	shortspine thornyhead	7
<i>Sebastolobus</i> spp.	thornyheads	53
<i>Xeneretmus leiops</i>	smootheye poacher	1
<i>Zaniolepis latipinnis</i>	longspine combfish	1
Zoarcidae	unidentified eelpout	17

IMAGE GALLERY (Eel River Canyon)

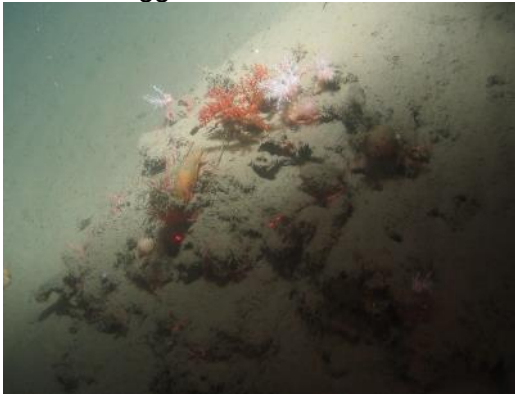
A mushroom coral and a crinoid at 564 m.



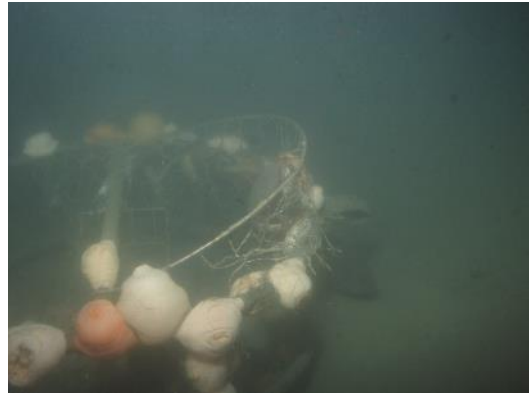
A deepsea sole and a dying *Farrea* spp. sponge at 542 m.



Swiftia pacifica, sea cucumber tentacles, and a catshark egg case at 537 m.



An old fishing trap covered in sea anemones at 110 m.



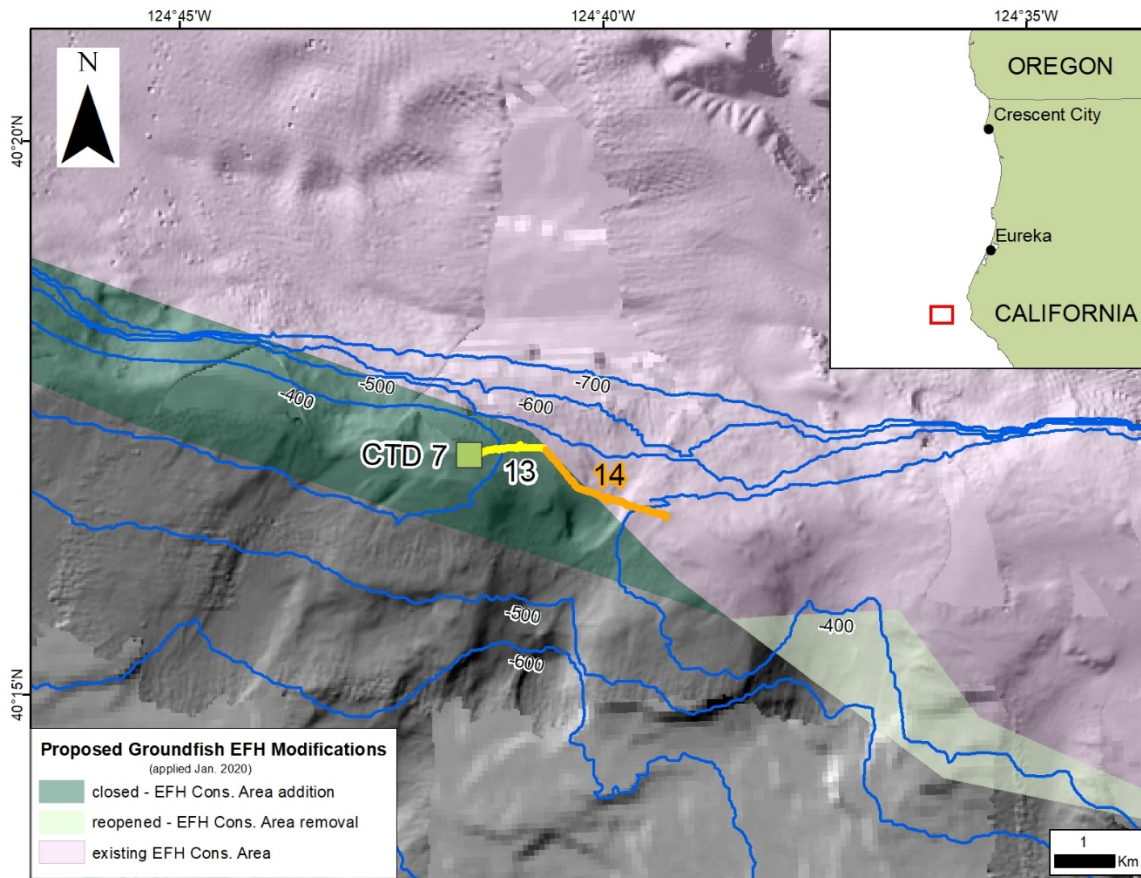
ADDITIONAL COMMENTS (Eel River Canyon)

No anthropogenic debris items were documented during transects at Eel River Canyon.

No corals or sponges displayed any damaged sections and all were growing upright. One Plexauridae #3 coral and 25 sponges (mostly *Farrea* spp. and barrel sponges) were classified as dead and dying.

SITE AREA: Mendocino Ridge
DIVE NUMBER: ROV 0013-0014

GENERAL LOCATION AND DIVE TRACK



STATION OVERVIEW (Mendocino Ridge)

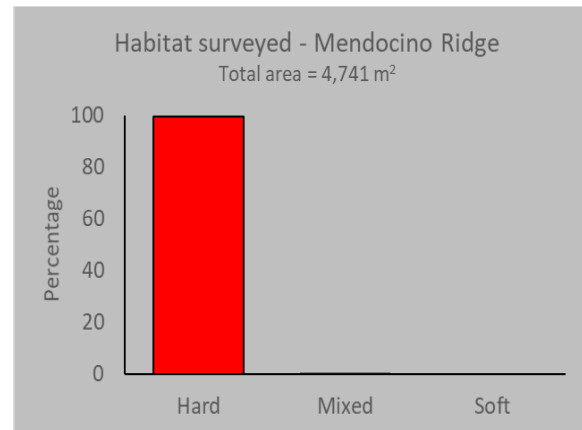
Project	EXPRESS 2018
Chief Scientists	Tom Laidig, Elizabeth Clarke, Chris Caldw
Contact Information	NMFS, SWFSC, tom.laidig@noaa.gov
Purpose	Survey deep-sea coral communities along the U.S. West Coast
Vessel and Survey Vehicle	NOAA Ship <i>Bell M. Shimada</i> ; ROV <i>Beagle</i> (MARE)
Science Observers	Diana Watters, Meredith Everett, Kaitlin Graiff
Digital Video	8.8 Hours
Digital Still Photos	3,053 images
Positioning System	Ship: GPS; ROV: USBL
CTD Sensors	Yes
O₂ Sensor	Yes
pH Sensor	No
Specimens collected	12
Water sample	3 eDNA; 7 water chemistry
Other	Logbook, Relational database
Report Analyst	Tom Laidig
Date Compiled	07 July 2021

DIVE DATA (Mendocino Ridge)

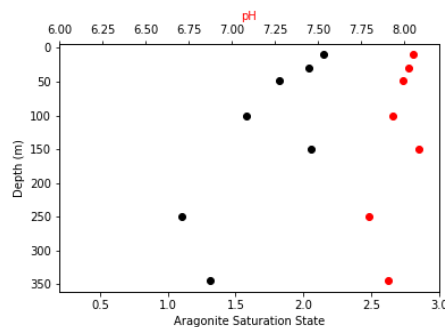
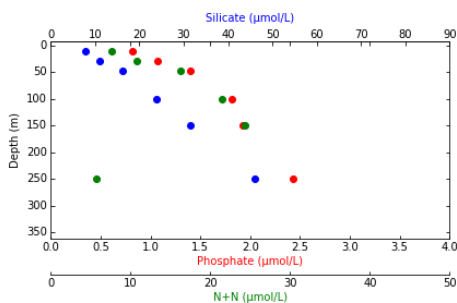
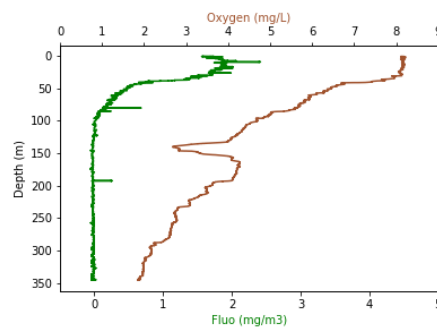
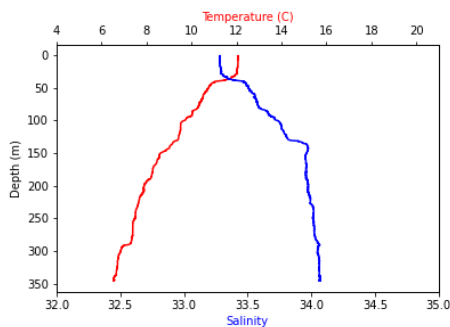
Date	19 Oct 2018	Starting Latitude (N)	40° 17.254'
Minimum Bottom Depth (m)	356	Starting Longitude (W)	124° 41.459'
Maximum Bottom Depth (m)	511	Ending Latitude (N)	40° 17.314'
Start Bottom Time (UTC)	00:34:23	Ending Longitude (W)	124° 40.588'
End Bottom Time (UTC)	09:20:14	Number of Dives	2
Number 15-min Transects	9		

PHYSICAL ENVIRONMENT (Mendocino Ridge)

In total, 4,741 m² of seafloor were surveyed during 9 quantitative transects conducted during Dive 0013 and 0014 on Mendocino Ridge off northern California. Habitat types were classified as (1) Hard (99.4% of the total area surveyed), which included bedrock outcrops, large boulders, flat rock, and cobbles; (2) Mixed (0.4%), including a combination of mud with boulder or flat rock; and (3) Soft (none observed).

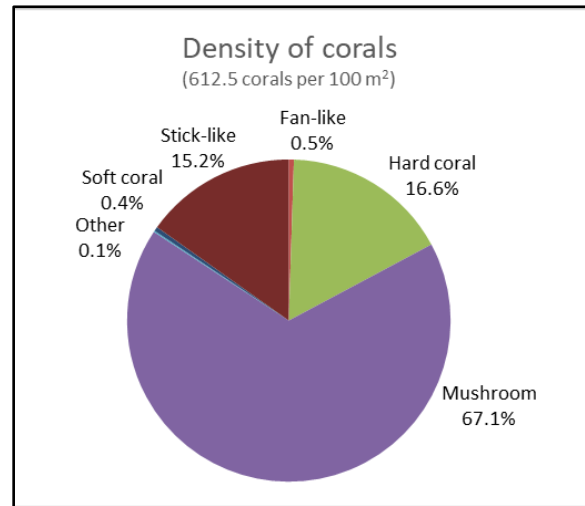


There was a mixed layer from the surface to 40 m. A thermocline was present (as measured from the shipboard CTD) around 40 m with a gradual decrease in temperature after that. Salinity increased with depth with a halocline from the surface to 40 m. Oxygen decreased rapidly with a low spike at ~ 140 m. Fluorescence peaked near the surface (~10 m) and reduced to zero near 100 m. Nutrient load (phosphate, silicate, and ammonia and N+N) gradually increased with depth. pH and aragonite saturation state slowly decreased with depth with an inflection point at 150 m.



BIOLOGICAL ENVIRONMENT: CORALS (Mendocino Ridge)

A total of 29,043 individual coral colonies, comprising at least 13 taxa, were enumerated from 9 quantitative transects conducted during Dive 0013 and 0014 on Mendocino Ridge off northern California. Overall coral density was the highest for the entire research survey at 612.5 corals per 100 m² of seafloor. Mushroom corals dominated the coral assemblage (67% of all corals). Hard corals (*Stylaster parageus*; 17%) and stick-like corals (unidentified *Swiftia* type; 15%) were also abundant. Both *Stylaster parageus* and *Primnoa pacifica* were found here and both were range extensions (*P. pacifica* was extended from a sighting at Brush Patch during an earlier dive on this cruise).



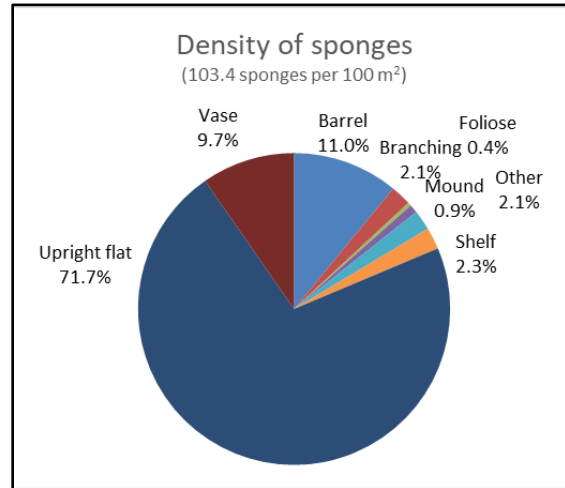
Colors in the pie diagram match colors in the list of coral taxa (below).

Scientific name	Common name	Number
<i>Clavularia</i> spp.	soft coral	42
<i>Heteropolypus ritteri</i>	mushroom coral	19493
Hexacorallia/Octocorallia	unidentified coral	35
<i>Paragorgia pacifica</i>	bubblegum coral	7
<i>Paragorgia</i> spp.	sea fan (white with red polyps)	35
<i>Parastenella ramosa</i>	primnoid	6
Plexauridae #3	<i>Swiftia</i> type (red w/ unknown polyps)	4397
<i>Plumarella longispina</i>	primnoid	2
<i>Primnoa pacifica</i>	red tree coral	9
Stolonifera	soft coral	83
<i>Stylaster parageus</i>	white hydrocoral	4840
<i>Swiftia pacifica</i>	sea fan (red with yellow polyps)	89
<i>Swiftia</i> sp.	red sea fan	5

Seven coral specimens were collected during dives at Mendocino Ridge and sent to experts for identification. Shipboard identifications were *Paragorgia* spp. (1 specimen), *Stylaster parageus* (1 specimen), *Swiftia kofoidi* (possibly *S. pacifica*, 1 specimen), *Clavularia* spp. (attached to rock, 1 specimen), *Heteropolypus ritteri* (attached to rock, 1 specimen) and *Primnoa pacifica* (2 specimen). Verified identifications from experts are still pending.

BIOLOGICAL ENVIRONMENT: SPONGES (Mendocino Ridge)

A total of 4,905 individual sponges from at least 19 different taxa were enumerated from 9 quantitative transects conducted during Dive 0013 and 0014 on Mendocino Ridge off northern California. An overall density of 103.4 sponges per 100 m² of seafloor was calculated. This was the highest sponge density during the entire research cruise. The most abundant taxon was upright flat (with 3,454 individuals of *Mycale* spp.). Barrel and vase sponges were also rather abundant at 11 and 10% of all sponges. This was the northernmost observation of *Rhizaxinella gadus* (a species common in southern California).



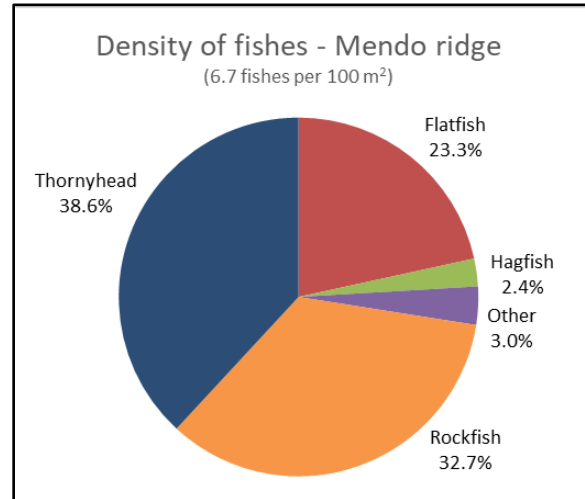
Colors in the pie diagram match colors in the list of sponge taxa (below).

Scientific name	Common name	Number
<i>Asbestopluma</i> spp. #2	predatory sponge (clear)	101
<i>Farrea occa</i>	lace foliose sponge	5
<i>Heterochone calyx</i>	fingered goblet vase sponge	2
<i>Hexactinella</i> spp.	sponge (white)	1
<i>Mycale</i> spp.	upright flat sponge (yellow)	3454
<i>Poecillastra</i> spp.	fringed shelf sponge	82
<i>Polymastia</i> spp. #1	white nipple foliose sponge	4
Porifera #1	unidentified foliose sponges	9
Porifera #2	unidentified upright flat sponges	62
Porifera #3	unidentified barrel sponges	387
Porifera #4	unidentified shelf sponges	29
Porifera #5	unidentified vase sponges	11
Porifera #6	unidentified mound sponges	37
Porifera #7	unidentified branching sponge	102
Porifera #9	unidentified puffball mound sponge	5
<i>Rhabdocalyptus dawsoni</i>	brown barrel sponge	151
<i>Rhizaxinella gadus</i>	club sponge	2
<i>Staurocalyptus</i> spp. #1	Picasso sponge	427
<i>Staurocalyptus</i> spp. #2	white vase sponge	34

Five sponge specimens were collected during dives on Mendocino Ridge and sent to experts for identification. Shipboard identifications were plate sponge (with additional *Stylaster*, 1 specimen), yellow vase sponge (1 specimen), knobby white barrel sponge (1 specimen), white vase sponge (1 specimen), and yellow blob sponge (1 specimen). Verified identifications from experts are still pending.

BIOLOGICAL ENVIRONMENT: FISHES (Mendocino Ridge)

At least 16 taxa of fishes were identified from 9 quantitative transects conducted during Dive 0013-0014 on Mendocino Ridge off northern California. A total of 320 individual fishes were enumerated, and an overall density of 6.7 fishes per 100 m² of seafloor was calculated. Thornyheads (*Sebastolobus* spp.) accounted for 38.6% and rockfishes (*Sebastes* spp.) accounted for 32.7% of all fishes observed. Other taxa present were the two species of flatfishes (23.3%), Other fishes (12.5%), and hagfishes (2.7%). Although the highest densities of corals and sponges occurred at Mendocino Ridge, fish density was the lowest out of all 16 sites for the entire research cruise.



Colors in the pie diagram match colors in the list of fish taxa (below).

Although there were 33,948 corals and sponges enumerated at this site, only 2% of the corals and sponges (517 individuals) were associated with fishes. There was a total of 454 coral and 63 sponge associations with fishes, and the most abundant species associations were *Stylaster parageus* (219 corals) and mushroom corals (199 corals). Blackgill rockfish and thornyheads were the most commonly associated fish species with corals and sponges.

Scientific name	Common name	Number
<i>Anoplopoma fimbria</i>	sablefish	3
Cottidae	unidentified sculpin	4
<i>Embassichthys bathybius</i>	deepsea sole	34
<i>Eptatretus</i> spp.	unidentified hagfish	8
<i>Hydrolagus colliei</i>	spotted ratfish	1
<i>Microstomus pacificus</i>	Dover sole	35
<i>Raja</i> spp.	unidentified skate	1
Rajiformes egg cases	skate egg cases	2
<i>Sebastes aurora</i>	aurora rockfish	12
<i>Sebastes crameri</i>	darkblotched rockfish	25
<i>Sebastes helvomaculatus</i>	rosethorn rockfish	7
<i>Sebastes melanostomus</i>	blackgill rockfish	44
<i>Sebastes</i> spp.	unidentified rockfishes	9
<i>Sebastes zacentrus</i>	sharpchin rockfish	11
<i>Sebastolobus alascanus</i>	shortspine thornyhead	8
<i>Sebastolobus altivelis</i>	longspine thornyhead	20
<i>Sebastolobus</i> spp.	thornyheads	94
<i>Sebastomus</i>	unidentified <i>Sebastomus</i>	2

IMAGE GALLERY (Mendocino Ridge)

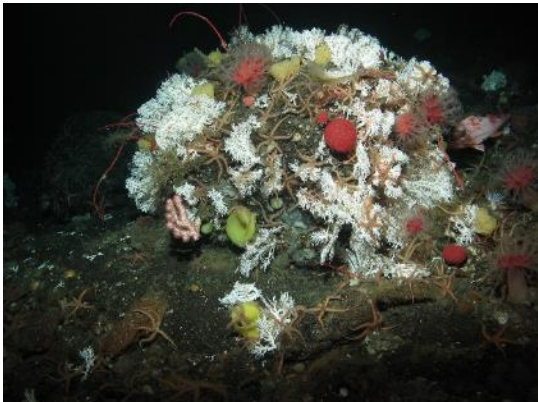
Heteropolypus ritteri, *Stylaster parageus*, Plexauridae red coral sticks, and brittle stars at 356 m.



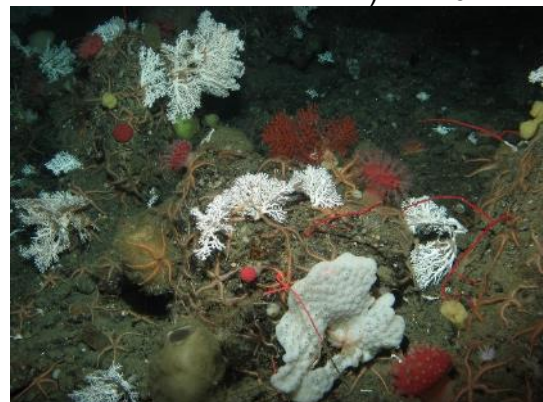
A *Primnoa pacifica* at 352 m. This is a southern range extension for this species.



A boulder covered in sponges and corals (*Heteropolypus ritteri*, *Stylaster parageus*, Plexauridae red coral sticks, *Paragorgia* spp.) at 429 m.



Many sponges and corals (*Heteropolypus ritteri*, *Stylaster parageus*, *Swiftia pacifica*, Plexauridae red coral sticks) at 446 m.



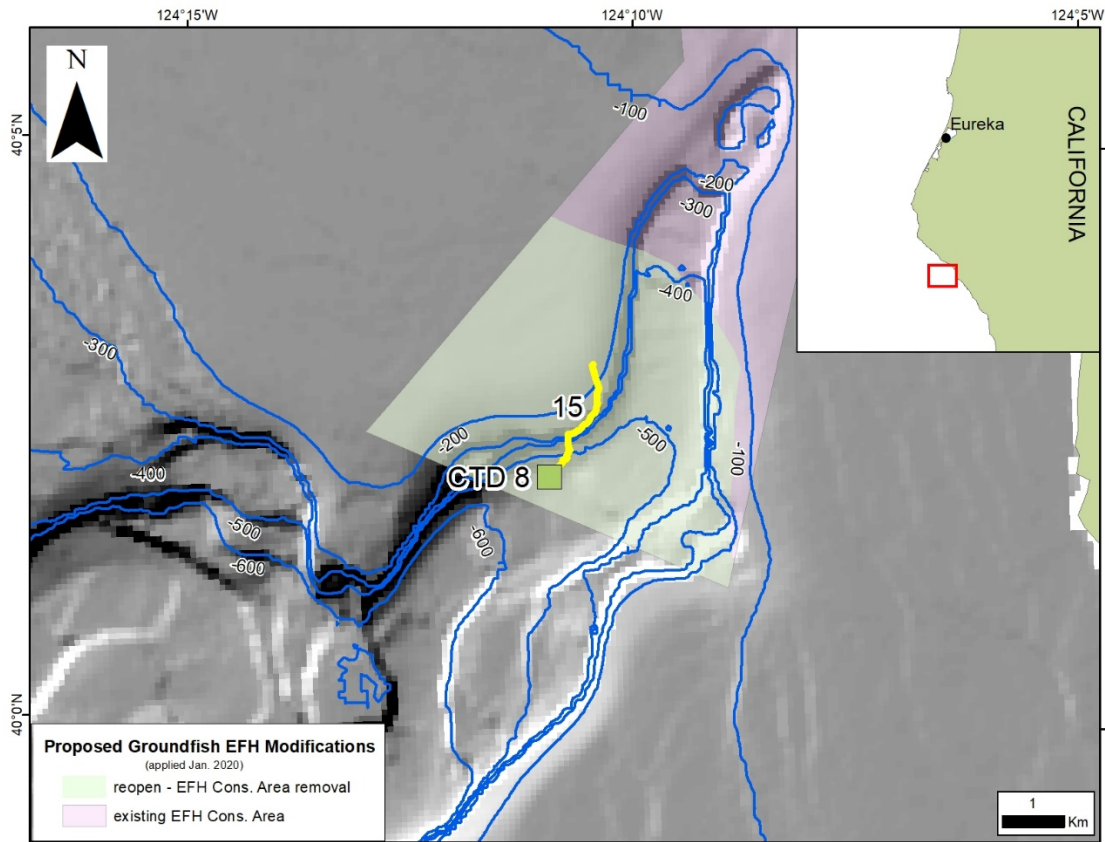
ADDITIONAL COMMENTS (Mendocino Ridge)

Five anthropogenic debris items (three longlines, a trap with line attached, and an aluminum can) were documented during dives at Mendocino Ridge. All the items were old and had growth on them (one longline had a 15 cm high white, barrel sponge). Damage to fauna by these items was not evident.

Sixty-one corals (*Stylaster parageus*) and one sponge (*Mycale* spp.) had broken sections. Forty-seven corals (43 *Stylaster parageus*, 2 *Paragorgia* spp., and 1 Plexauridae #3) and 2 sponges (1 *Rhabdocalyptus dawsoni* and 1 *Mycale* spp.) were knocked over. Twelve sponges (mostly shelf sponges – 6 specimens) were dead or dying, while 475 corals were dead or dying. These corals were mostly Plexauridae #3 (438 unknown red sticks) with about two thirds classified as dying (284) and one third as dead (154).

SITE AREA: Delgada Canyon
DIVE NUMBER: ROV 0015

GENERAL LOCATION AND DIVE TRACK



STATION OVERVIEW (Delgada Canyon)

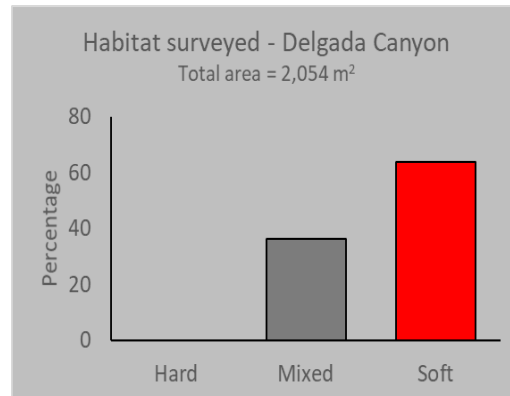
Project	EXPRESS 2018
Chief Scientists	T. Laidig, E. Clarke, C. Caldow
Contact Information	NMFS, SWFSC, tom.laidig@noaa.gov
Purpose	Survey deep-sea coral communities along the U.S. West Coast
Vessel and Survey Vehicle	NOAA Ship <i>Bell M. Shimada</i> ; ROV <i>Beagle</i> (MARE)
Science Observers	Diana Watters, Meredith Everett, Kaitlin Graiff
Digital Video	2.1 hours
Digital Still Photos	828 images
Positioning System	Ship: GPS; ROV: USBL
CTD Sensors	Yes
O₂ Sensor	Yes
pH Sensor	No
Specimens collected	0
Water sample	0 eDNA; 0 water chemistry
Other	Logbook, Relational database
Report Analyst	Tom Laidig
Date Compiled	07 July 2021

DIVE DATA (Delgada Canyon)

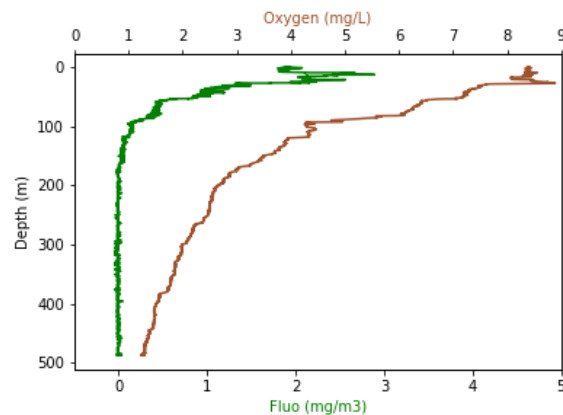
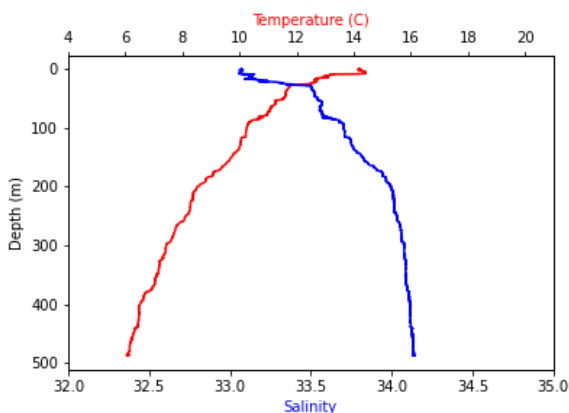
Date	20 Oct 2018	Starting Latitude (N)	40° 2.048'
Minimum Bottom Depth (m)	197	Starting Longitude (W)	124° 10.910'
Maximum Bottom Depth (m)	518	Ending Latitude (N)	40° 3.093'
Start Bottom Time (UTC)	02:38:00	Ending Longitude (W)	124° 10.390'
End Bottom Time (UTC)	04:37:39	Number of Dives	1
Number 15-min Transects	3		

PHYSICAL ENVIRONMENT (Delgada Canyon)

In total, 2,054 m² of seafloor were surveyed during 3 quantitative transects conducted during Dive 0015 on Delgada Canyon off northern California. Habitat types were classified as (1) Hard (no hard habitat was observed); (2) Mixed (36% of the total area surveyed), including a combination of mud with boulder, cobbles, or rock; and (3) Soft (64% of the total area surveyed), which consisted entirely of mud.

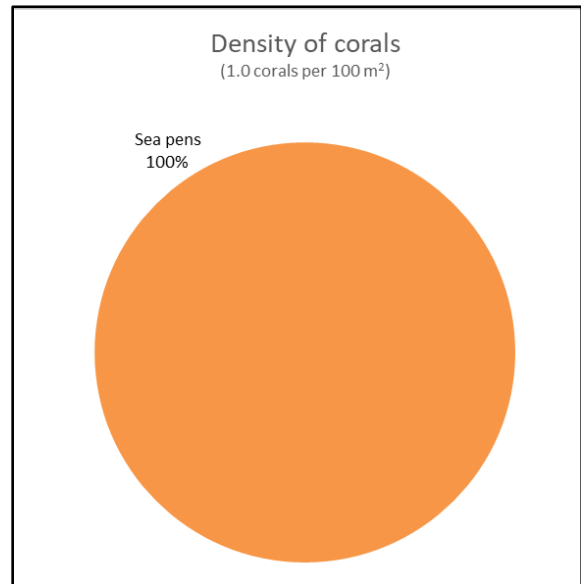


A thermocline was present (as measured from the shipboard CTD) from the surface to about 30 m, and the temperature gradually decreased with depth. Salinity increased with depth with a halocline from the surface to about 30 m. Oxygen decreased rapidly until about 100 m with a gradual decrease after this depth. Fluorescence reached a maximum at 10 m and decreased quickly after that until about 80 m and decreased very slowly to zero after that.



BIOLOGICAL ENVIRONMENT: CORALS (Delgada Canyon)

A total of 20 individual coral colonies, comprising at least 1 taxon, were enumerated from 3 quantitative transects conducted during Dive 0015 at Delgada Canyon off northern California. Overall coral density was the lowest for the entire research survey at 1.0 corals per 100 m² of seafloor. The 20 sea pens were the only corals observed at this site.



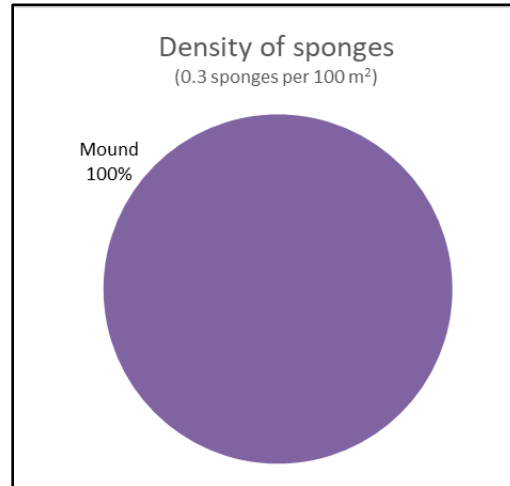
Colors in the pie diagram match colors in the list of coral taxa (below).

Scientific name	Common name	Number
■ <i>Virgularia</i> spp.	sea pen	20

No coral specimens were collected during dives at Delgada Canyon.

BIOLOGICAL ENVIRONMENT: SPONGES (Delgada Canyon)

A total of 7 individual sponges, from 1 taxon, were enumerated from 3 quantitative transects conducted during Dive 0015 at Delgada Canyon off northern California. An overall density of 0.3 sponges per 100 m² of seafloor was calculated. This was one of the lowest sponge densities during the entire research cruise. Only seven unidentified mound sponges were observed



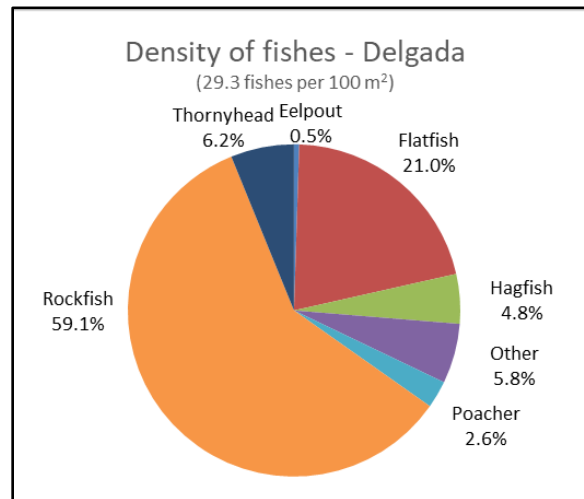
Colors in the pie diagram match colors in the list of sponge taxa (below).

Scientific name	Common name	Number
Porifera #6	unidentified mound sponges	7

No sponge specimens were collected on dives at Delgada Canyon.

BIOLOGICAL ENVIRONMENT: FISHES (Delgada Canyon)

At least 24 taxa of fishes were identified from 3 quantitative transects conducted during Dive 0015 at Delgada Canyon off northern California. A total of 601 individual fishes were enumerated, and an overall density of 29.3 fishes per 100 m² of seafloor was calculated. Rockfishes (*Sebastes* spp.) accounted for 59.1% of all fishes observed. Other taxa present were flatfishes (21.0%), thornyheads (6.2%), Other fishes (5.8%), hagfishes (4.8%), poachers (2.6%), and 3 species of eelpouts (0.5%).



Colors in the pie diagram match colors in the list of fish taxa (below).

No fishes were associated within one body length with 27 corals and sponges.

Scientific name	Common name	Number
Agonidae	unidentified poachers	16
<i>Chilara taylori</i>	spotted cusk-eel	9
<i>Eopsetta jordani</i>	petrale sole	5
<i>Eptatretus</i> spp.	unidentified hagfish	29
<i>Glyptocephalus zachirus</i>	rex sole	11
<i>Hydrolagus colliei</i>	spotted ratfish	12
<i>Icelinus</i> spp.	<i>Icelinus</i> sculpins	6
<i>Lycodes cortezianus</i>	bigfin eelpout	2
<i>Lycodes diapterus</i>	black eelpout	1
<i>Lyopsetta exilis</i>	slender sole	59
<i>Merluccius productus</i>	Pacific hake	5
<i>Microstomus pacificus</i>	Dover sole	23
<i>Ophiodon elongatus</i>	lingcod	3
Pleuronectiformes	unidentified flatfishes	28
<i>Sebastes chlorostictus</i>	greenspotted rockfish	8
<i>Sebastes diploproa</i>	splitnose rockfish	1
<i>Sebastes elongatus</i>	greenstriped rockfish	66
<i>Sebastes helvomaculatus</i>	rosethorn rockfish	4
<i>Sebastes paucispinis</i>	bocaccio	1
<i>Sebastes saxicola</i>	stripetail rockfish	150
<i>Sebastes</i> spp.	unidentified rockfishes	56
<i>Sebastes zacentrus</i>	sharpchin rockfish	68
<i>Sebastolobus</i> spp.	thornyheads	37
<i>Sebastomus</i>	unidentified <i>Sebastomus</i>	1

IMAGE GALLERY (Delgada Canyon)

Flapjack octopus on a mud seafloor at 504 m.



A Dover sole on a mud seafloor at 398 m.



Spot prawns and a young redbanded rockfish at 204 m.



Basket star and a sharpchin rockfish at 204 m.



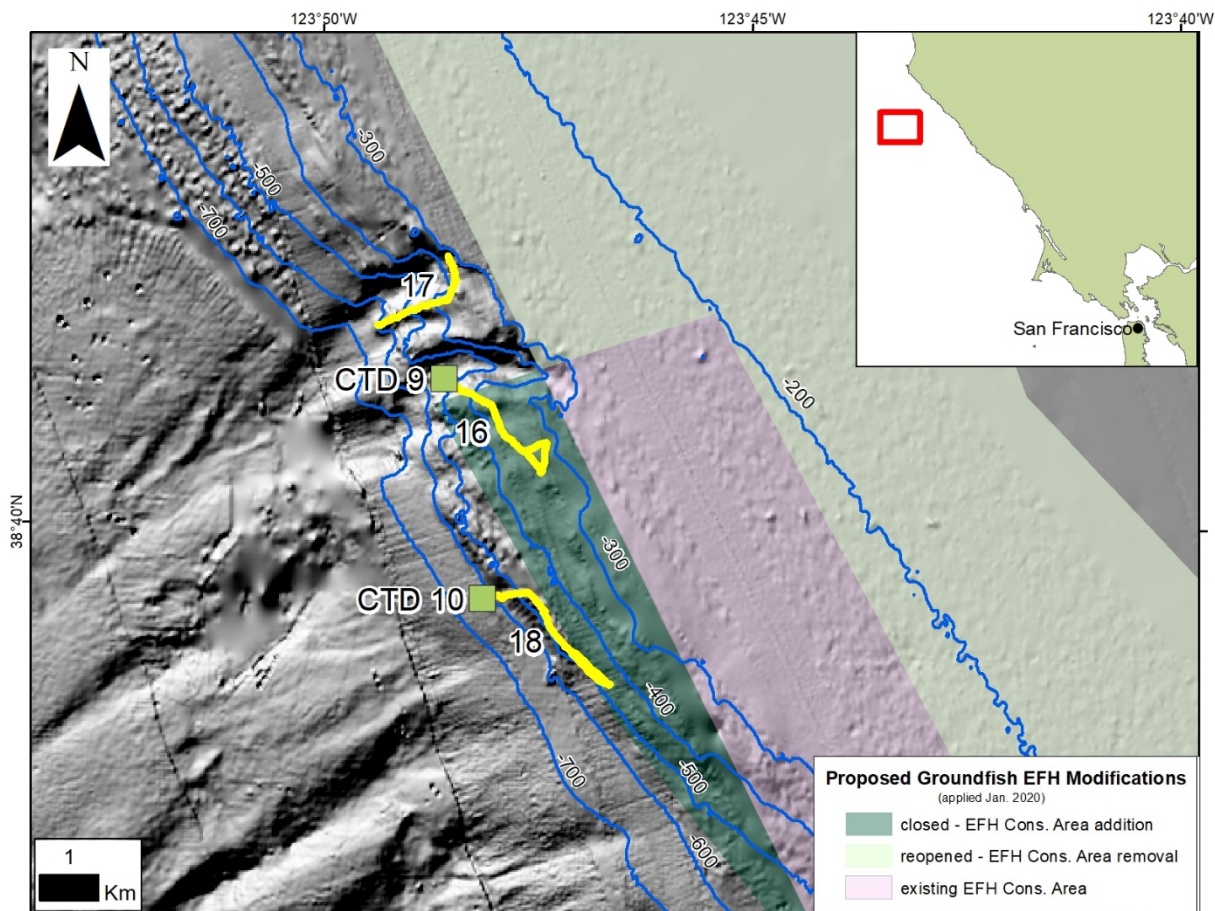
ADDITIONAL COMMENTS (Delgada Canyon)

No anthropogenic debris items were documented during dives at Delgada Canyon.

No damaged, knocked over, or dead and dying corals or sponges were observed on transect.

SITE AREA: Pt. Arena
DIVE NUMBER: ROV 0016-0018

GENERAL LOCATION AND DIVE TRACK



STATION OVERVIEW (Pt. Arena)

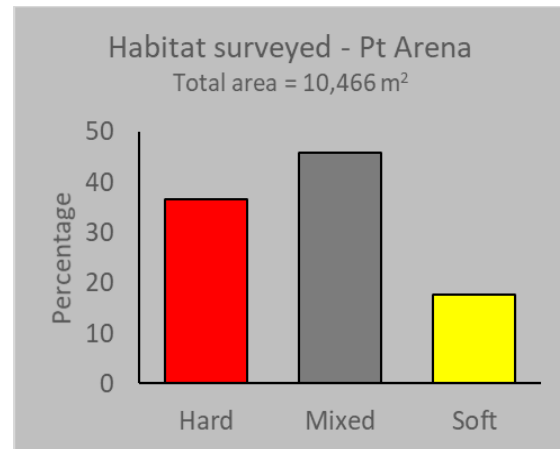
Project	EXPRESS 2018
Chief Scientists	T. Laidig, E. Clarke, C. Caldw
Contact Information	NMFS, SWFSC, tom.laidig@noaa.gov
Purpose	Survey deep-sea coral communities along the U.S. West Coast
Vessel and Survey Vehicle	NOAA Ship <i>Bell M. Shimada</i> ; ROV <i>Beagle</i> (MARE)
Science Observers	Diana Watters, Meredith Everett, Kaitlin Graiff
Digital Video	13.1 hours
Digital Still Photos	5,301 images
Positioning System	Ship: GPS; ROV: USBL
CTD Sensors	Yes
O₂ Sensor	Yes
pH Sensor	No
Specimens collected	9
Water sample	3 eDNA; 10 water chemistry
Other	Logbook, Relational database
Report Analyst	Tom Laidig
Date Compiled	07 July 2021

DIVE DATA (Pt. Arena)

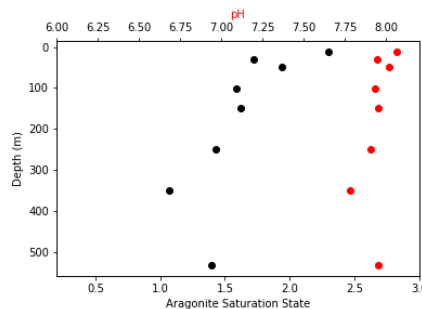
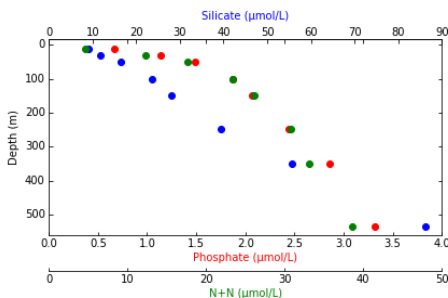
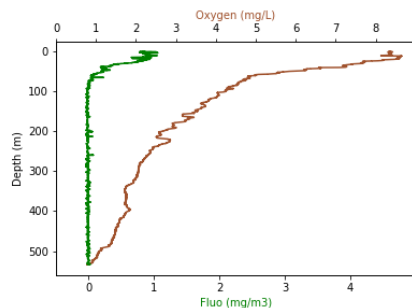
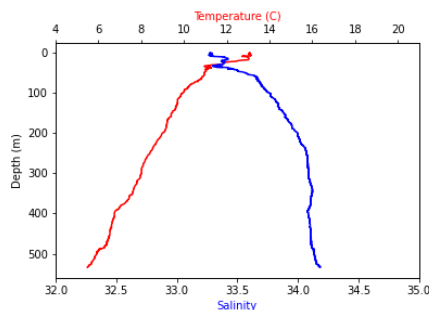
Date	21-22 Oct 2018	Starting Latitude (N)	38° 41.363'
Minimum Bottom Depth (m)	300	Starting Longitude (W)	123° 48.622'
Maximum Bottom Depth (m)	615	Ending Latitude (N)	38° 38.857'
Start Bottom Time (UTC)	01:46:26	Ending Longitude (W)	123° 47.052'
End Bottom Time (UTC)	09:49:06	Number of Dives	3
Number 15-min Transects	18		

PHYSICAL ENVIRONMENT (Pt. Arena)

In total, 10,466 m² of seafloor were surveyed during 18 quantitative transects conducted during Dive 0016-0018 on Pt. Arena Biogenic Area off northern California. Habitat types were classified as (1) Hard (37% of the total area surveyed), which included bedrock outcrops, large boulders, cobbles and rock covered with a veneer of mud; (2) Mixed (46% of the total area surveyed), including a combination of mud with boulder, cobbles, or rock covered with a veneer of mud; and (3) Soft (17% of the total area surveyed), which consisted entirely of mud.

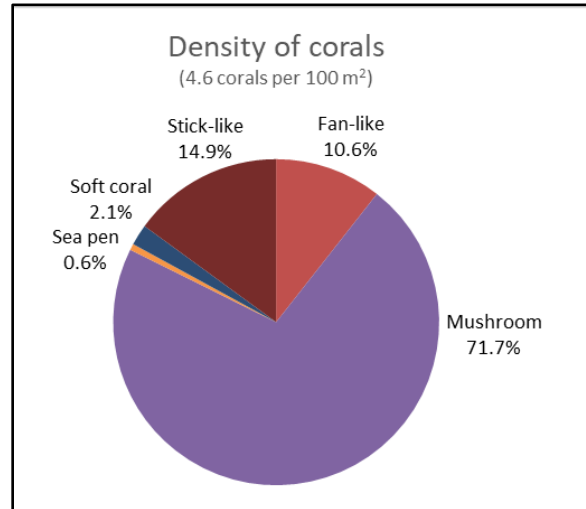


A thermocline was present (as measured from the shipboard CTD) around 40 m with a gradual decrease in temperature with depth. Salinity increased with depth with a halocline from 40 to 60 m. Oxygen decreased rapidly from the surface to approximately 80 m and gradually thereafter. Fluorescence peaked near the surface (~10 m) and reduced to zero near 90 m. Nutrient load (phosphate, silicate, and ammonia and N+N) gradually increased with depth. pH and aragonite saturation state slowly decreased with depth.



BIOLOGICAL ENVIRONMENT: CORALS (Pt. Arena)

A total of 481 individual coral colonies, comprising at least 9 taxa, were enumerated from 18 quantitative transects conducted during Dive 0016-0018 at Pt. Arena Biogenic Area off northern California. Overall coral density was 4.6 corals per 100 m² of seafloor. Mushroom corals dominated the coral assemblage (71.7%). Stick-like (14.9%) and fan-like (10.6%) corals were also abundant



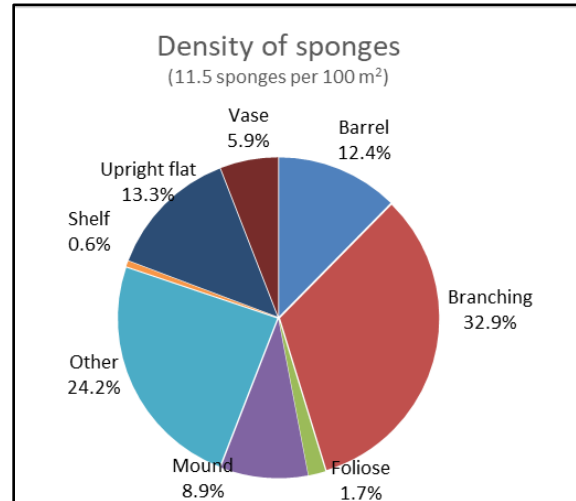
Colors in the pie diagram match colors in the list of coral taxa (below).

Scientific name	Common name	Number
<i>Clavularia</i> spp.	soft coral	10
<i>Heteropolypus ritteri</i>	mushroom coral	345
<i>Paragorgia</i> spp.	sea fan (white with red polyps)	3
Pennatulacea #1	sea pen (thin)	1
Plexauridae #1	<i>Swiftia</i> type (red w/ white polyps)	5
Plexauridae #3	<i>Swiftia</i> type (red w/ unknown polyps)	60
<i>Plumarella longispina</i>	primnoid	48
<i>Swiftia</i> sp.	red sea fan	7
<i>Virgularia</i> spp.	sea pen	2

Two coral specimens were collected during dives at Pt. Arena Biogenic Area and sent to experts for identification. Shipboard identifications were *Plumarella longispina* (2 specimens). Verified identifications from experts are still pending.

BIOLOGICAL ENVIRONMENT: SPONGES (Pt. Arena)

A total of 1,206 individual sponges from at least 15 different taxa were enumerated from 18 quantitative transects conducted during Dive 0016-0018 at Pt. Arena Biogenic Area off northern California. An overall density of 11.5 sponges per 100 m² of seafloor was calculated. Branching sponges were the most abundant group (32.9%), followed by other sponges (24.2%), upright flat (13.3%), barrel (12.4%), mound (8.9%), and vase (5.9%). The other sponges were all the predatory sponge *Asbestopluma* (the palm frond sponge).



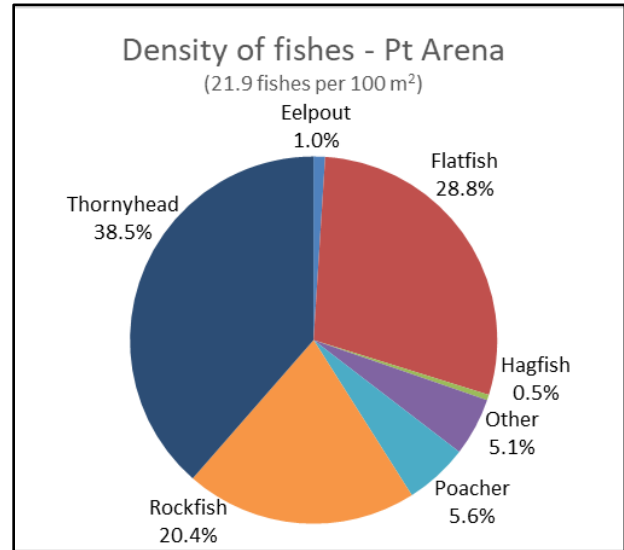
Colors in the pie diagram match colors in the list of sponge taxa (below).

Scientific name	Common name	Number
<i>Asbestopluma</i> spp. #2	predatory sponge (clear)	293
<i>Farrea occa</i>	lace foliose sponge	21
<i>Heterochone calyx</i>	fingered goblet vase sponge	1
<i>Poecillastra</i> spp.	fringed shelf sponge	6
Porifera #2	unidentified upright flat sponges	161
Porifera #3	unidentified barrel sponges	72
Porifera #4	unidentified shelf sponges	1
Porifera #5	unidentified vase sponges	62
Porifera #6	unidentified mound sponges	51
Porifera #7	unidentified branching sponge	369
Porifera #9	unidentified puffball mound sponge	56
<i>Rhabdocalyptus dawsoni</i>	brown barrel sponge	77
<i>Rhizaxinella gadus</i>	club sponge	28
<i>Staurocalyptus</i> spp. #1	Picasso sponge	7
<i>Staurocalyptus</i> spp. #2	white vase sponge	1

Five sponge specimens were collected during dives from Pt. Arena Biogenic Area and sent to experts for identification. Shipboard identifications were olive green ball sponge (1 specimen), white branching sponge (1 specimen), knobby white barrel sponge (1 specimen), unknown white sponge with big pores (seen on Mendocino too, 1 specimen), and yellow lobed sponge (1 specimen). Verified identifications from experts are still pending.

BIOLOGICAL ENVIRONMENT: FISHES (Pt. Arena)

At least 39 taxa of fishes were identified from 18 quantitative transects conducted during Dive 0016-0018 at Pt. Arena Biogenic Area off northern California. A total of 2,287 individual fishes were enumerated, and an overall density of 21.9 fishes per 100 m² of seafloor was calculated. Thornyheads were the most abundant group accounting for 38.5% of all fishes. Flatfishes (28.8%) and rockfishes (20.4%) were also abundant, with flatfishes represented by at least 5 species and rockfishes with at least 9 species. Other taxa present were Other fishes (5.1%), poachers (5.6%), eelpouts (1.0%), and hagfishes (0.5%). The other category included sculpins, skates, rubynose brotula (*Cataetyx rubrirostris*), and Pacific hake.



Colors in the pie diagram match colors in the list of fish taxa (below).

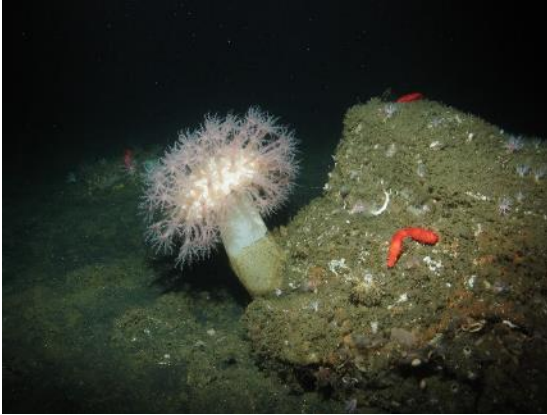
Only 3 branching sponges of the 1,687 corals and sponges (0.2%) had a fish association within one body length. All three sponges were associated with blackgill rockfish (*Sebastes melanostomus*).

Scientific name	Common name	Number
Agonidae	unidentified poachers	120
<i>Anoplopoma fimbria</i>	sablefish	5
<i>Atheresthes stomias</i>	arrowtooth flounder	4
<i>Bathyagonus nigripinnis</i>	blackfin poacher	1
<i>Bathyagonus pentacanthus</i>	bigeye poacher	2
<i>Bathyraja interrupta</i>	sandpaper skate	2
<i>Careproctus melanurus</i>	blacktail snailfish	1
<i>Cataetyx rubrirostris</i>	rubynose brotula	10
Cottidae	unidentified sculpin	32
<i>Embassichthys bathybius</i>	deepsea sole	36
<i>Eopsetta jordani</i>	petrale sole	2
<i>Eptatretus</i> spp.	unidentified hagfish	11
<i>Glyptocephalus zachirus</i>	rex sole	49
<i>Hydrolagus colliei</i>	spotted ratfish	4
<i>Icelinus</i> spp.	<i>Icelinus</i> sculpins	15
<i>Lycodes corteziianus</i>	bigfin eelpout	15
<i>Lycodes diapterus</i>	black eelpout	4
<i>Lycinema barbatum</i>	bearded eelpout	4
<i>Lyopsetta exilis</i>	slender sole	276
<i>Merluccius productus</i>	Pacific hake	6
<i>Microstomus pacificus</i>	Dover sole	246
<i>Ophiodon elongatus</i>	lingcod	1
Pleuronectiformes	unidentified flatfishes	46
<i>Raja rhina</i>	longnose skate	9
Rajiformes egg cases	skate egg cases	2
Scyliorhinidae	unidentified cat shark	30

Scientific name	Common name	Number
<i>Sebastes aurora</i>	aurora rockfish	74
<i>Sebastes babcocki</i>	redbanded rockfish	2
<i>Sebastes crameri</i>	darkblotched rockfish	2
<i>Sebastes diploproa</i>	splitnose rockfish	127
<i>Sebastes helvomaculatus</i>	rosethorn rockfish	10
<i>Sebastes melanostictus</i>	blackspotted rockfish	1
<i>Sebastes melanostomus</i>	blackgill rockfish	102
<i>Sebastes phillipsi</i>	chameleon rockfish	1
<i>Sebastes rufus</i>	bank rockfish	91
<i>Sebastes</i> spp.	unidentified rockfishes	18
<i>Sebastolobus alascanus</i>	shortspine thornyhead	41
<i>Sebastolobus altivelis</i>	longspine thornyhead	117
<i>Sebastolobus</i> spp.	thornyheads	724
<i>Sebastomus</i>	unidentified <i>Sebastomus</i>	39
<i>Xeneretmus latifrons</i>	blacktip poacher	1
<i>Xeneretmus leiops</i>	smootheye poacher	4

IMAGE GALLERY (Pt. Arena)

A mushroom coral, *Heteropolypus ritteri*, at 300 m.



A *Halipteris cf willamoesi* sea pen and a small thornyhead (*Sebastolobus* spp.) at 445 m.



A large vase sponge with brittle stars at 427 m.



A large *Heterochone calyx* sponge at 440 m.



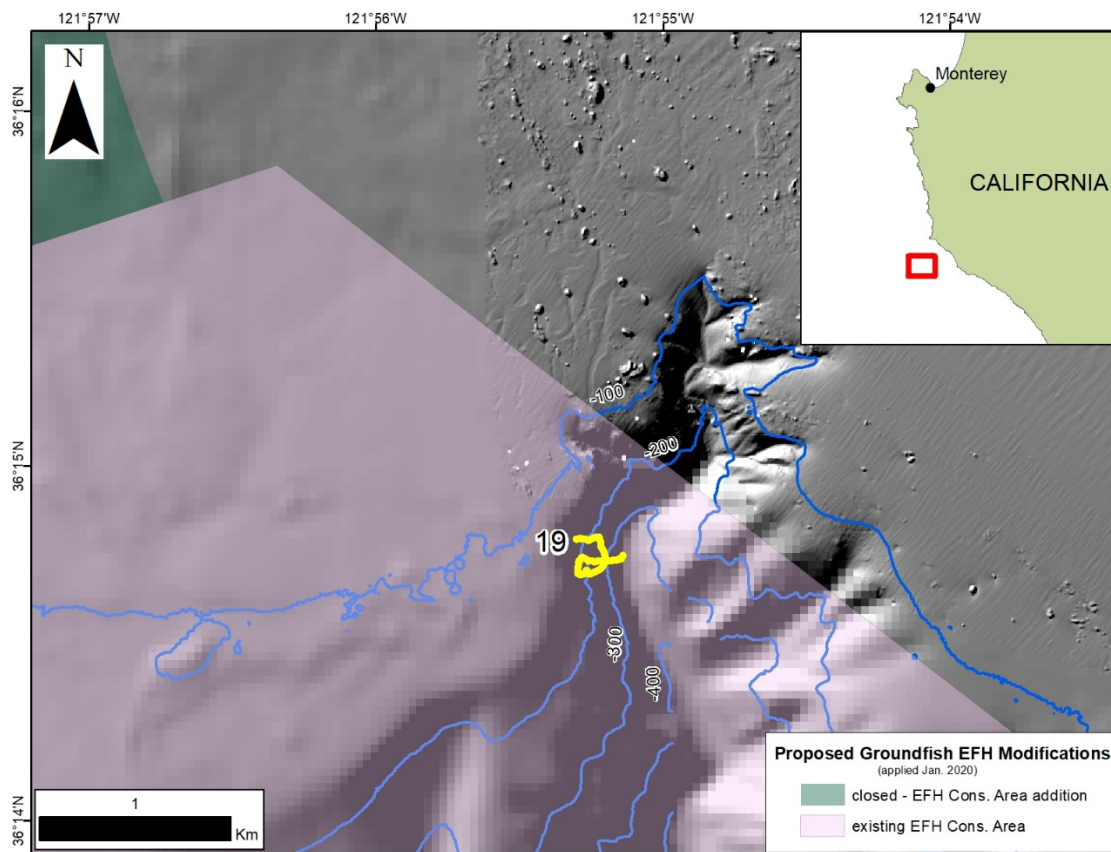
ADDITIONAL COMMENTS (Pt. Arena)

Three anthropogenic debris items (one ball of monofilament line, one longline, and one metal crate) were documented during dives at Pt. Arena Biogenic Area. The metal crate was rusting and had an octopus living inside. Damage to fauna by these items was not evident.

No damaged corals or sponges were observed on transect. Fourteen sponges (9 vase, 2 upright shelf, 1 barrel, 1 branched, and 1 *Rhabdocalyptus dawsoni*) and no corals were knocked over. There were 8 dead or dying corals (4 *Plumarella longispina* and 4 Plexauridae #3) and 74 sponges (vase sponges were most abundant with 43 individuals).

SITE AREA: Sur Slot Canyons DIVE NUMBER: ROV 0019

GENERAL LOCATION AND DIVE TRACK



STATION OVERVIEW (Sur Slot Canyons)

Project	EXPRESS 2018
Chief Scientists	T. Laidig, E. Clarke, C. Caldw
Contact Information	NMFS, SWFSC, tom.laidig@noaa.gov
Purpose	Survey deep-sea coral communities along the U.S. West Coast
Vessel and Survey Vehicle	NOAA Ship <i>Bell M. Shimada</i> ; ROV <i>Beagle</i> (MARE)
Science Observers	Tom Laidig, Meredith Everett, Kaitlin Graiff
Digital Video	2.1 hours
Digital Still Photos	474 images
Positioning System	Ship: GPS; ROV: USBL
CTD Sensors	Yes
O₂ Sensor	Yes
pH Sensor	No
Specimens collected	1
Water sample	0 eDNA; 0 water chemistry
Other	Logbook, Relational database
Report Analyst	Tom Laidig
Date Compiled	07 July 2021

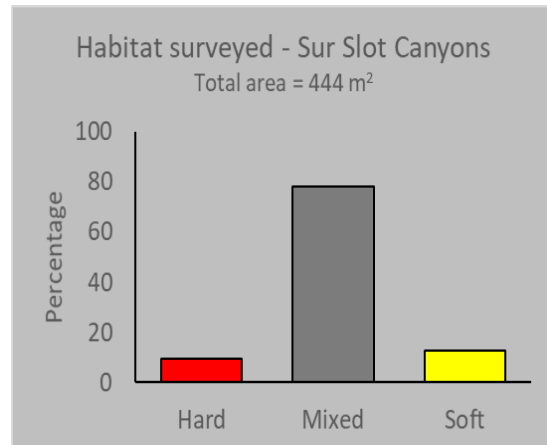
DIVE DATA (Sur Slot Canyons)

Date	25 Oct 2018
Minimum Bottom Depth (m)	180
Maximum Bottom Depth (m)	350
Start Bottom Time (UTC)	08:59:26
End Bottom Time (UTC)	10:44:18
Number 15-min Transects	2

Starting Latitude (N)	36° 14.732'
Starting Longitude (W)	121° 55.160'
Ending Latitude (N)	36° 14.778'
Ending Longitude (W)	121° 55.322'
Number of Dives	1

PHYSICAL ENVIRONMENT (Sur Slot Canyons)

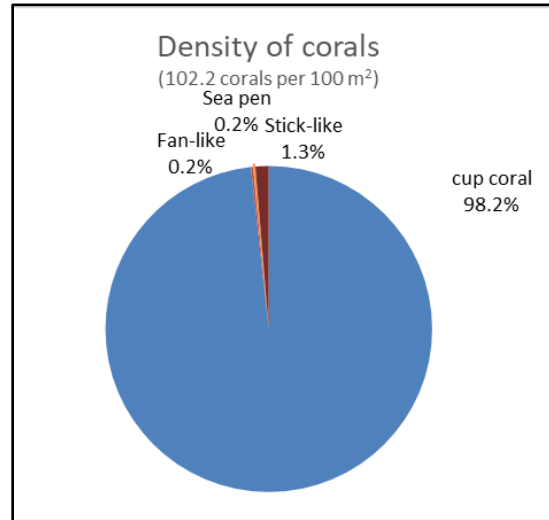
In total, 444 m² of seafloor were surveyed during 2 quantitative transects conducted during Dive 0019 at Sur Canyon Slot Canyons off central California. Habitat types were classified as (1) Hard (10% of the total area surveyed), which included only bedrock outcrops; (2) Mixed (78% of the total area surveyed), including a combination of mud with boulder, cobbles, or rock outcrops; and (3) Soft (12% of the total area surveyed), which consisted entirely of mud.



No ship CTD was deployed at this location.

BIOLOGICAL ENVIRONMENT: CORALS (Sur Slot Canyons)

A total of 457 individual coral colonies, comprising at least 4 taxa, were enumerated from 2 quantitative transects conducted during Dive 0019 at Sur Canyon Slot Canyons off central California. Overall coral density was high at 102.2 corals per 100 m² of seafloor. Cup corals (*Desmophyllum dianthus*) dominated the coral assemblage (98.2%). Stick-like corals (1.3%), fan-like corals (0.2%), and sea pens (0.2%) were also observed, but in low numbers.



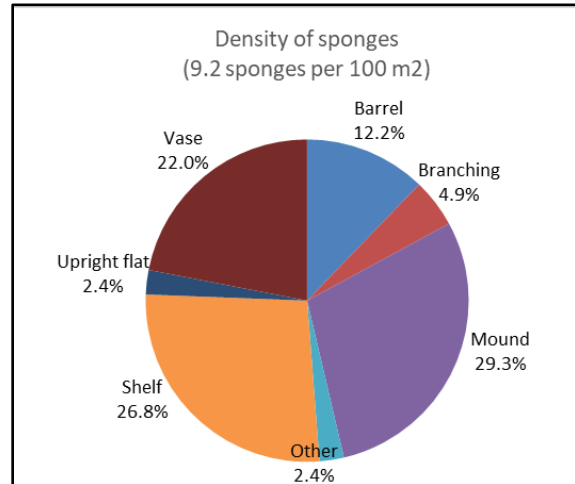
Colors in the pie diagram match colors in the list of coral taxa (below).

Scientific name	Common name	Number
<i>Desmophyllum dianthus</i>	cockscomb cup coral	449
Pennatulacea #1	sea pen (thin)	1
<i>Swiftia pacifica</i>	sea fan (red with yellow polyps)	1
<i>Swiftia</i> sp.	red sea fan	6

One coral specimen was collected during dives at Sur Canyon Slot Canyons and sent to experts for identification. Shipboard identification was *Desmophyllum dianthus* (1 specimen). Verified identifications from experts are still pending.

BIOLOGICAL ENVIRONMENT: SPONGES (Sur Slot Canyons)

A total of 41 individual sponges from at least 9 different taxa were enumerated from 2 quantitative transects conducted during Dive 0019 at Sur Canyon Slot Canyons off central California. An overall density of 9.2 sponges per 100 m² of seafloor was calculated. Mound (29.3%), shelf (26.8%), and vase (22.0%) sponges were the most abundant.



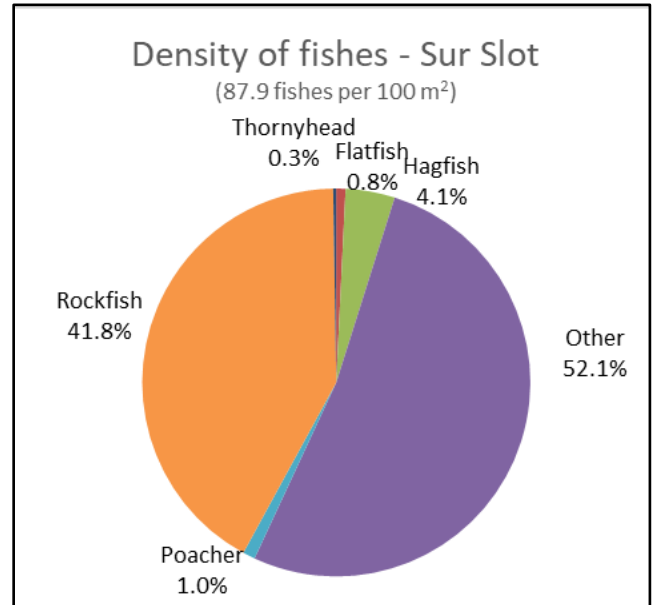
Colors in the pie diagram match colors in the list of sponge taxa (below).

Scientific name	Common name	Number
<i>Asbestopluma</i> spp. #2	predatory sponge (clear)	1
<i>Poecillastra</i> spp.	fringed shelf sponge	10
Porifera #2	unidentified upright flat sponges	1
Porifera #3	unidentified barrel sponges	4
Porifera #4	unidentified shelf sponges	1
Porifera #5	unidentified vase sponges	9
Porifera #6	unidentified mound sponges	12
Porifera #7	unidentified branching sponge	2
<i>Rhabdocalyptus dawsoni</i>	brown barrel sponge	1

No sponge specimens were collected on dives at Sur Slot Canyons.

BIOLOGICAL ENVIRONMENT: FISHES (Sur Slot Canyons)

At least 23 taxa of fishes were identified from 2 quantitative transects conducted during Dive 0019 at Sur Canyon Slot Canyons off central California. A total of 390 individual fishes were enumerated, and an overall density of 87.9 fishes per 100 m² of seafloor was calculated. The Other fish category accounted for over half of all fishes. Most of these observations were catshark egg cases attached to hard surfaces or laying out on the mud. The remaining groups were dominated by rockfishes (41.8%) and hagfish (4.1%), poachers (1.0%), flatfish (0.8%), and thornyheads (0.3%) were also present.



Colors in the pie diagram match colors in the list of fish taxa (below).

Only 2 sponges of the 498 corals and sponges (0.4%) had a fish association within one body length. The sponge taxa were *Poecillastra* spp. and an unidentified barrel sponge. Each sponge was associated with a splitnose rockfish (*Sebastes diploproa*).

Scientific name	Common name	Number
Agonidae	unidentified poachers	4
<i>Chilara taylori</i>	spotted cusk-eel	1
Cottidae	unidentified sculpin	4
<i>Eptatretus</i> spp.	unidentified hagfish	16
<i>Icelinus</i> spp.	<i>Icelinus</i> sculpins	2
<i>Lyopsetta exilis</i>	slender sole	1
<i>Microstomus pacificus</i>	Dover sole	2
<i>Ophiodon elongatus</i>	lingcod	6
<i>Plectobranchnus evides</i>	bluebarred prickleback	2
Scyliorhinidae egg cases	cat shark egg cases	188
<i>Sebastes babcocki</i>	redbanded rockfish	1
<i>Sebastes chlorostictus</i>	greenspotted rockfish	2
<i>Sebastes diploproa</i>	splitnose rockfish	9
<i>Sebastes ensifer</i>	swordspine rockfish	2
<i>Sebastes helvomaculatus</i>	rosethorn rockfish	4
<i>Sebastes melanostomus</i>	blackgill rockfish	4
<i>Sebastes phillipsi</i>	chameleon rockfish	3
<i>Sebastes ruberrimus</i>	yelloweye rockfish	1
<i>Sebastes rufus</i>	bank rockfish	2
<i>Sebastes saxicola</i>	stripetail rockfish	3
<i>Sebastes</i> spp.	unidentified rockfishes	20
<i>Sebastes zacentrus</i>	sharpchin rockfish	71
<i>Sebastolobus</i> spp.	thornyheads	1
<i>Sebastomus</i>	unidentified <i>Sebastomus</i>	41

IMAGE GALLERY (Sur Slot Canyons)

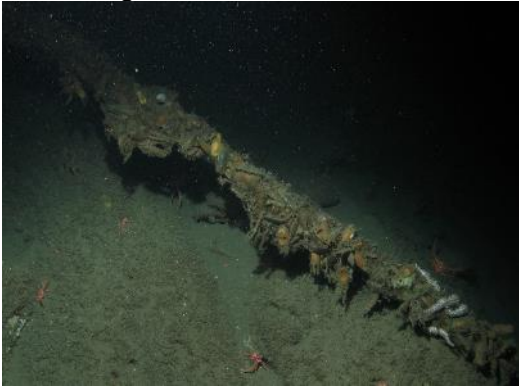
A chameleon rockfish, spot prawn and squat lobsters at 284 m.



Many *Desmophyllum dianthus*, chameleon rockfish, and other invertebrates at 267 m.



A rope covered in catshark egg cases and a fish eating seastar at 235 m.



A lingcod and squarespot rockfish at 204 m.



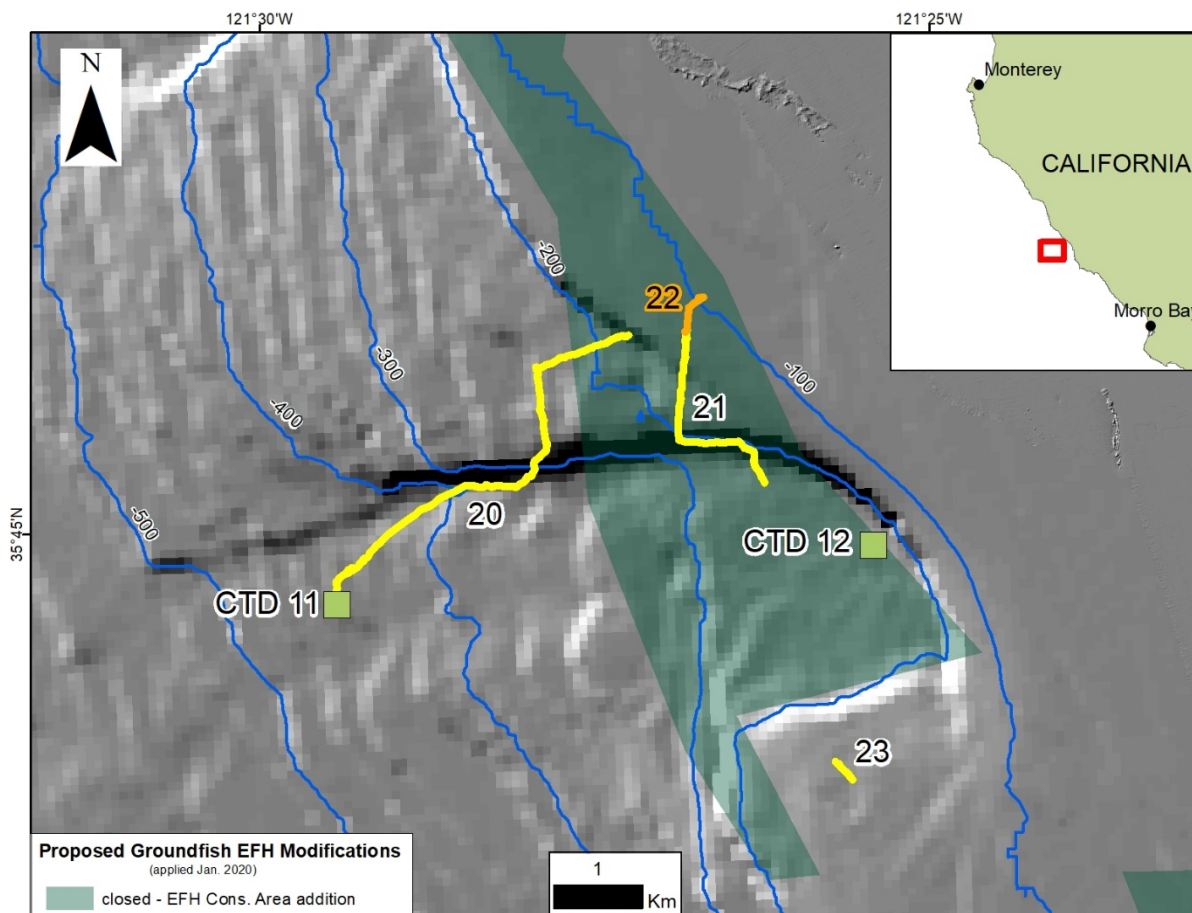
ADDITIONAL COMMENTS (Sur Slot Canyons)

Two anthropogenic debris items (an old rusted cable and a longline) were documented during dives at Sur Slot Canyons. Both items were old and covered in sediment and invertebrate growth. Damage to fauna by these items was not evident.

Four corals (*Desmophyllum dianthus*) were damaged, knocked over, and appeared dead. Sixty-three other *D. dianthus* appeared dead and upright with no visible damage. One vase sponge was intact and knocked over but appeared dead. Seven other vase sponges and a shelf sponge were also dead but were upright and not damaged.

SITE AREA: La Cruz Canyon
DIVE NUMBER: ROV 0020-0023

GENERAL LOCATION AND DIVE TRACK



STATION OVERVIEW (La Cruz Canyon)

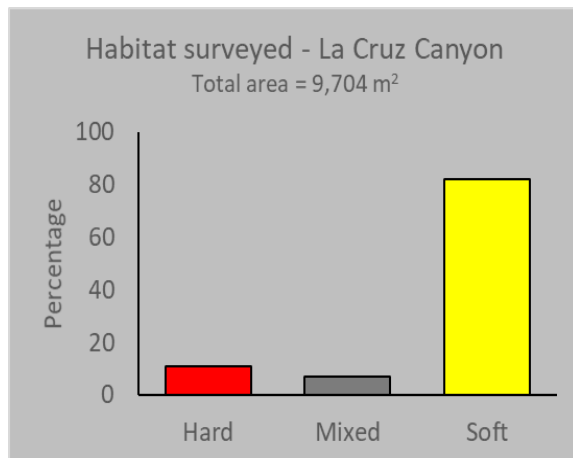
Project	EXPRESS 2018
Chief Scientists	T. Laidig, E. Clarke, C. Caldw
Contact Information	NMFS, SWFSC, tom.laidig@noaa.gov
Purpose	Survey deep-sea coral communities along the U.S. West Coast
Vessel and Survey Vehicle	NOAA Ship <i>Bell M. Shimada</i> ; ROV <i>Beagle</i> (MARE)
Science Observers	Tom Laidig, Meredith Everett, Kaitlin Graiff
Digital Video	14 hours
Digital Still Photos	3,481 images
Positioning System	Ship: GPS; ROV: USBL
CTD Sensors	Yes
O₂ Sensor	Yes
pH Sensor	No
Specimens collected	11
Water sample	2 eDNA; 12 water chemistry
Other	Logbook, Relational database
Report Analyst	Tom Laidig
Date Compiled	07 July 2021

DIVE DATA (La Cruz Canyon)

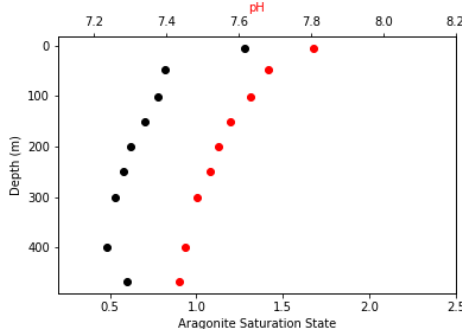
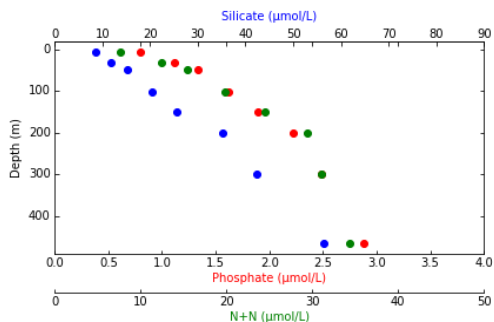
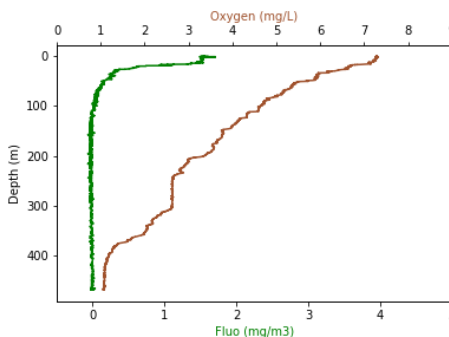
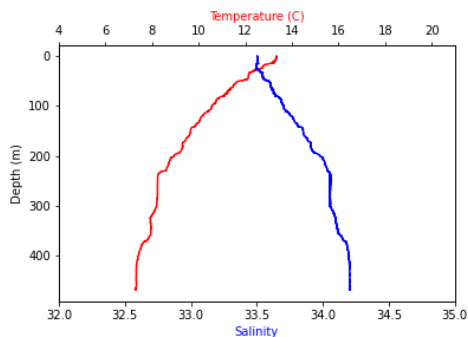
Date	26-27 Oct 2018	Starting Latitude (N)	35° 44.575'
Minimum Bottom Depth (m)	86	Starting Longitude (W)	121° 29.478'
Maximum Bottom Depth (m)	475	Ending Latitude (N)	35° 43.427'
Start Bottom Time (UTC)	02:52:07	Ending Longitude (W)	121° 25.670'
End Bottom Time (UTC)	09:04:02	Number of Dives	4
Number 15-min Transects	16		

PHYSICAL ENVIRONMENT (La Cruz Canyon)

In total, 9,704 m² of seafloor were surveyed during 16 quantitative transects conducted during Dive 0020-0023 at La Cruz Canyon off central California. Habitat types were classified as (1) Hard (11% of the total area surveyed), which included only bedrock outcrops, flat rock, boulders, and cobble; (2) Mixed (7% of the total area surveyed), including a combination of mud with boulder, cobbles, or rock outcrops; and (3) Soft (82% of the total area surveyed), which consisted entirely of mud.

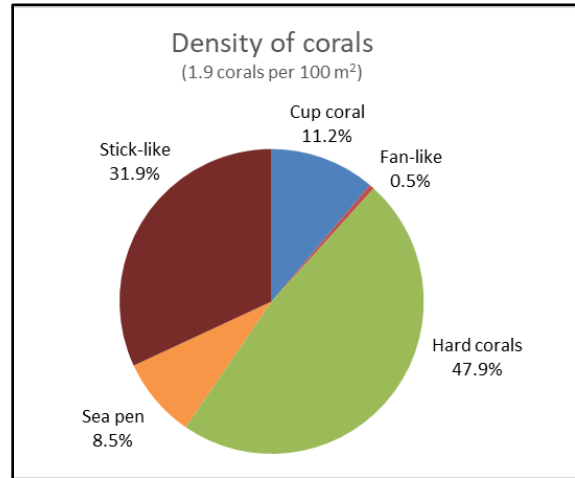


Temperature (as measured from the shipboard CTD) decreased gradually with depth. Salinity increased with depth. Oxygen decreased gradually from the surface to 450 m. Fluorescence peaked near the surface and reduced to zero near 100 m. Nutrient load (phosphate, silicate, and ammonia and N+N) gradually increased with depth. pH and aragonite saturation state slowly decreased with depth.










BIOLOGICAL ENVIRONMENT: CORALS (La Cruz Canyon)

A total of 244 individual coral colonies, comprising at least 7 taxa, were enumerated from 16 quantitative transects conducted during Dive 0020-0023 at Sur Canyon Slot Canyons off central California. Overall coral density was 1.9 corals per 100 m² of seafloor. Hard corals (*Stylaster californicus*) accounted for about half (47.9%) of the corals. These corals were located in the shallow portions of this site. Small stick-like (31.9%) and cup corals (11.2%) were seen on hard habitats. Sea pens (8.5%) were common in the soft sediments of the canyon.



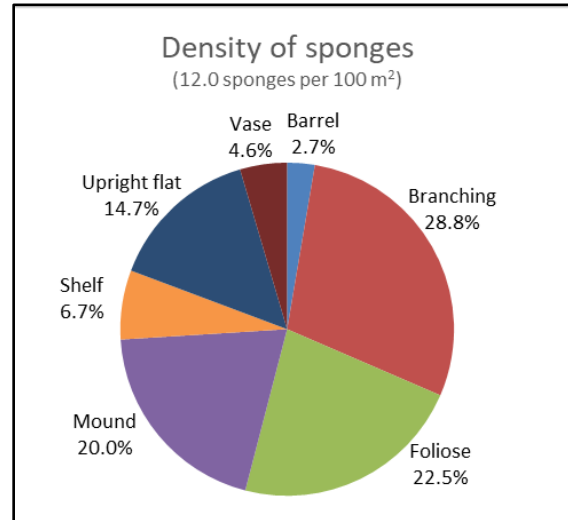
Colors in the pie diagram match colors in the list of coral taxa (below).

Scientific name	Common name	Number
 Pennatulacea #1	sea pen (thin)	96
 Plexauridae #1	<i>Swiftia</i> type (red w/ white polyps)	1
 Plexauridae #3	<i>Swiftia</i> type (red w/ unknown polyps)	32
 Scleractinia	unidentified cup coral	8
 <i>Stylaster californicus</i>	California lace coral	90
 <i>Swiftia pacifica</i>	sea fan (red with yellow polyps)	1
 <i>Swiftia</i> sp.	red sea fan	16

Four coral specimens were collected during dives at La Cruz Canyon and sent to experts for identification. Shipboard identifications were 2 different forms of *Swiftia* spp. (stick-like coral), yellow twig *Swiftia* (1 specimen), and *Swiftia spauldingi* (1 specimen). The yellow *Swiftia* twig was identified as *Chromoplexaura cordellbankensis* by Gary Williams of California Academy of Sciences. The remaining specimen identifications by experts are still pending.

BIOLOGICAL ENVIRONMENT: SPONGES (La Cruz Canyon)

A total of 1,161 individual sponges from at least 17 different taxa were enumerated from 16 quantitative transects conducted during Dive 0020-0023 at Sur Canyon Slot Canyons off central California. An overall density of 12.0 sponges per 100 m² of seafloor was calculated. Branching (28.8%), foliose (22.5%), and mound (29.3%), sponges were the most abundant taxa. The grey lobe sponge (*Xestospongia* spp.) was abundant in the shallow areas.



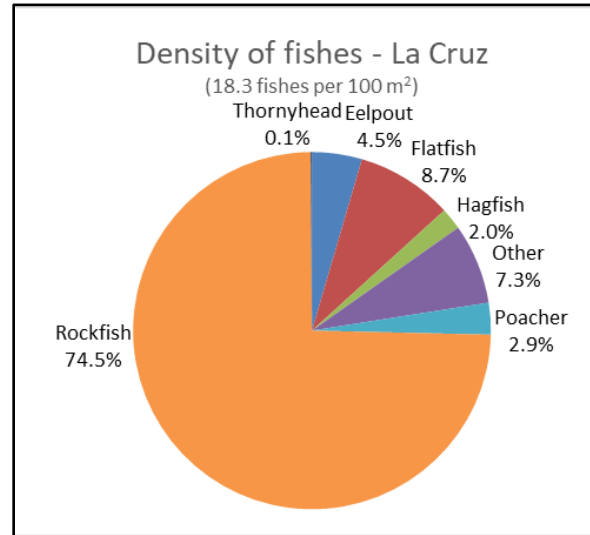
Colors in the pie diagram match colors in the list of sponge taxa (below).

Scientific name	Common name	Number
<i>Mycale</i> spp.	upright flat sponge (yellow)	137
<i>Poecillastra</i> spp.	fringed shelf sponge	132
<i>Polymastia</i> spp. #2	nipple foliose sponge (yellow)	2
Porifera #1	unidentified foliose sponges	121
Porifera #10	unidentified sponge (blue/white)	2
Porifera #14	Valentines sponge	56
Porifera #2	unidentified upright flat sponges	32
Porifera #3	unidentified barrel sponges	32
Porifera #4	unidentified shelf sponges	24
Porifera #5	unidentified vase sponges	36
Porifera #6	unidentified mound sponges	216
Porifera #7	unidentified branching sponge	250
Porifera #9	unidentified puffball mound sponge	14
<i>Rhabdocalyptus dawsoni</i>	brown barrel sponge	2
<i>Staurocalyptus</i> spp. #2	white vase sponge	2
<i>Thenea muricata</i>	foliose sponge (clear)	1
<i>Xestospongia</i> spp.	grey lobe sponge	102

Six sponge specimens were collected during dives on La Cruz Canyon and sent to experts for identification. Shipboard identifications were yellow/orange funky sponge (2 specimens), white vase sponge (1 specimen), complex vase glass sponge (1 specimen), *Heterochone* like sponge (1 specimen), and white branched sponge (1 specimen). Verified identifications from experts are still pending.

BIOLOGICAL ENVIRONMENT: FISHES (La Cruz Canyon)

At least 58 taxa of fishes were identified from 16 quantitative transects conducted during Dive 0020-0023 at La Cruz Canyon off central California. A total of 1,774 individual fishes were enumerated, and an overall density of 18.3 fishes per 100 m² of seafloor was calculated. Rockfishes (*Sebastes* spp.) dominated the fish assemblage (74.5%) with at least 26 species. The small-sized species, pygmy (*S. wilsoni*) and squarespot (*S. hopkinsi*) rockfish accounted for over 70% of all rockfishes. Other taxa included flatfishes (8.7%), the Other category (7.3%), eelpouts (4.5%), poachers (2.9%), hagfishes (2.0%), and thornyheads (0.1%).



Colors in the pie diagram match colors in the list of fish taxa (below).

Only 25 sponges (no corals) of the 1,405 corals and sponges (1.8%) had a fish association within one body length. Branching sponges (11) were the most abundant sponges with fish associations. Squarespot (*Sebastes hopkinsi*) and pygmy (*S. wilsoni*) rockfishes were the most common fishes associated with the sponges.

Scientific name	Common name	Number
Agonidae	unidentified poachers	50
<i>Brosmophycis marginata</i>	red brotula	2
<i>Careproctus melanurus</i>	blacktail snailfish	1
<i>Chilara taylori</i>	spotted cusk-eel	34
<i>Chitonotus pugetensis</i>	roughback sculpin	1
<i>Citharichthys</i> spp.	unidentified sanddab	4
<i>Eopsetta jordani</i>	petrale sole	1
<i>Eptatretus</i> spp.	unidentified hagfish	35
<i>Glyptocephalus zachirus</i>	rex sole	38
<i>Hexagrammos decagrammus</i>	kelp greenling	1
<i>Hydrolagus colliei</i>	spotted ratfish	14
<i>Hydrolagus colliei</i> egg case	ratfish egg case	1
<i>Icelinus filamentosus</i>	threadfin sculpin	1
Liparididae	unidentified snailfish	8
<i>Lycodes cortezianus</i>	bigfin eelpout	18
<i>Lycodes diapterus</i>	black eelpout	27
<i>Lycinema barbatum</i>	bearded eelpout	8
<i>Lyopsetta exilis</i>	slender sole	31
Macrouridae	unidentified grenadier	2
<i>Merluccius productus</i>	Pacific hake	29
<i>Microstomus pacificus</i>	Dover sole	28
Myctophidae	unidentified lanternfish	2
<i>Ophiodon elongatus</i>	lingcod	8
Osteichthyes	unidentified fishes	1
Pleuronectiformes	unidentified flatfishes	53
<i>Porichthys notatus</i>	plainfin midshipman	3

Scientific name	Common name	Number
<i>Raja rhina</i>	longnose skate	8
<i>Raja stellulata</i>	starry skate	1
Scyliorhinidae	unidentified cat shark	5
Scyliorhinidae egg cases	cat shark egg cases	1
<i>Sebastes aurora</i>	aurora rockfish	15
<i>Sebastes caurinus</i>	copper rockfish	1
<i>Sebastes chlorostictus</i>	greenspotted rockfish	2
<i>Sebastes constellatus</i>	starry rockfish	20
<i>Sebastes diploproa</i>	splitnose rockfish	75
<i>Sebastes elongatus</i>	greenstriped rockfish	11
<i>Sebastes ensifer</i>	swordspine rockfish	1
<i>Sebastes entomelas</i>	widow rockfish	33
<i>Sebastes goodei</i>	chilipepper	3
<i>Sebastes helvomaculatus</i>	rosethorn rockfish	3
<i>Sebastes hopkinsi</i>	squarespot rockfish	338
<i>Sebastes jordani</i>	shortbelly rockfish	5
<i>Sebastes melanostomus</i>	blackgill rockfish	6
<i>Sebastes miniatus</i>	vermilion rockfish	32
<i>Sebastes mystinus</i>	blue rockfish	4
<i>Sebastes ovalis</i>	speckled rockfish	17
<i>Sebastes paucispinis</i>	bocaccio	3
<i>Sebastes rosaceus</i>	rosy rockfish	30
<i>Sebastes rosenblatti</i>	greenblotched rockfish	2
<i>Sebastes ruberrimus</i>	yelloweye rockfish	4
<i>Sebastes rubrivinctus</i>	flag rockfish	1
<i>Sebastes rufus</i>	bank rockfish	2
<i>Sebastes saxicola</i>	stripetail rockfish	41
<i>Sebastes semicinctus</i>	halfbanded rockfish	1
<i>Sebastes</i> spp.	unidentified rockfishes	5
<i>Sebastes</i> spp. YOY	juvenile rockfish	33
<i>Sebastes wilsoni</i>	pygmy rockfish	591
<i>Sebastes zacentrus</i>	sharpchin rockfish	6
<i>Sebastolobus</i> spp.	thornyheads	2
<i>Sebastomus</i>	unidentified <i>Sebastomus</i>	37
<i>Xeneretmus latifrons</i>	blacktip poacher	1
<i>Zaniolepis frenata</i>	shortspine combfish	6
Zoarcidae	unidentified eelpout	27

IMAGE GALLERY (La Cruz Canyon)

A stand of giant plumose anemones (*Metridium farcimen*) at 186 m.



A vermilion rockfish and a red, branching Plexauridae coral at 108 m.



A lingcod with a squarespot rockfish hanging out its mouth at 85 m. Rocks are covered in Strawberry anemones and *Stylaster californicus*.



A tar mound at 95 m. This was seen on October 31 and was named the witch's hat.



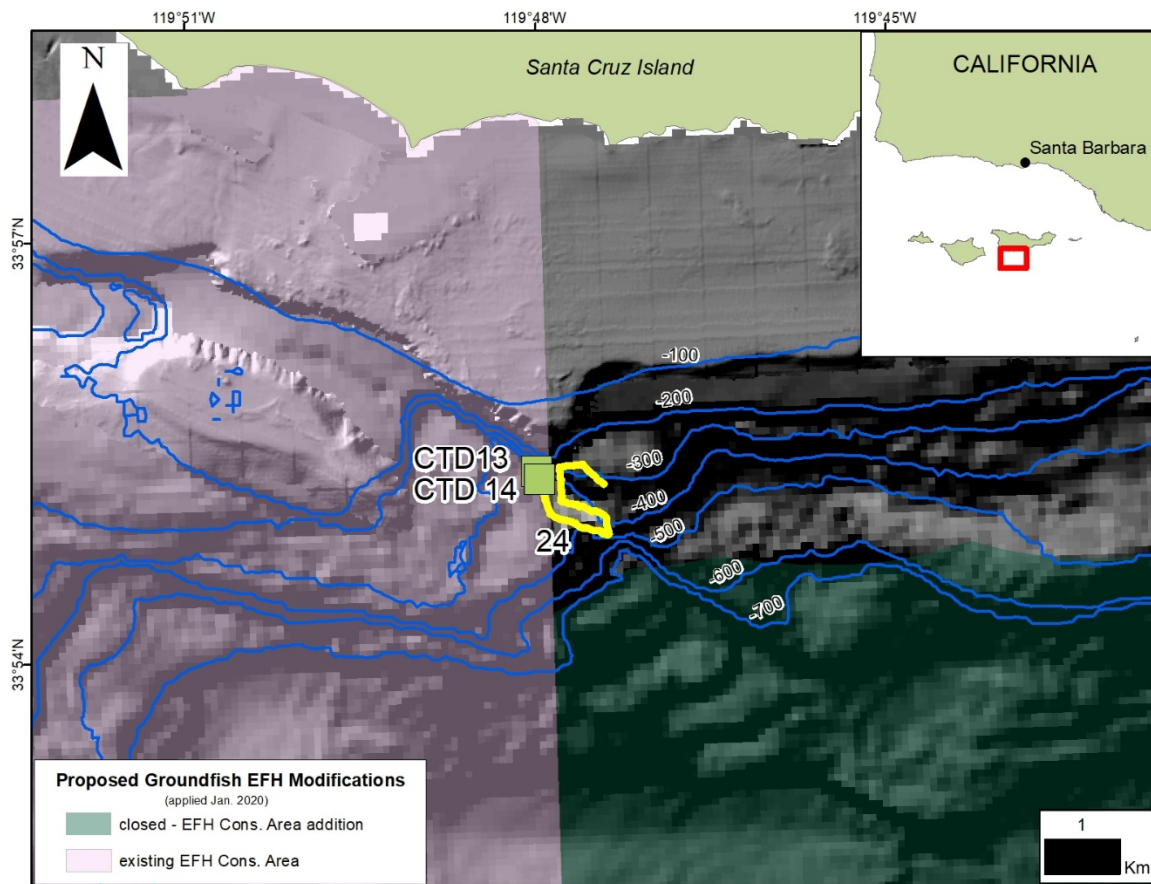
ADDITIONAL COMMENTS (La Cruz Canyon)

Two anthropogenic debris items (one glass bottle and one monofilament fishing line) were documented during dives at La Cruz Canyon. Damage to fauna by these items was not evident.

No damaged or knocked over corals were observed on transect. Two vase sponges were knocked over and appeared dead. In total, 2 Plexauridae #3 corals and 66 sponges (34 foliose, 15 vase, 7 upright flat, 6 shelf, and 4 other sponges) were either dead or dying.

SITE AREA: Gull Island
DIVE NUMBER: ROV 0024

GENERAL LOCATION AND DIVE TRACK



STATION OVERVIEW (Gull Island)

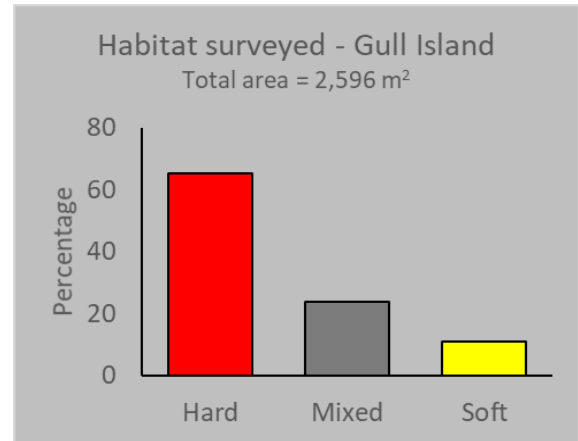
Project	EXPRESS 2018
Chief Scientists	T. Laidig, E. Clarke, C. Caldw
Contact Information	NMFS, SWFSC, tom.laidig@noaa.gov
Purpose	Survey deep-sea coral communities along the U.S. West Coast
Vessel and Survey Vehicle	NOAA Ship <i>Bell M. Shimada</i> ; ROV <i>Beagle</i> (MARE)
Science Observers	Tom Laidig, Meredith Everett, Lisa Krigsman
Digital Video	7.2 hours
Digital Still Photos	2,090 images
Positioning System	Ship: GPS; ROV: USBL
CTD Sensors	Yes
O₂ Sensor	Yes
pH Sensor	No
Specimens collected	8
Water sample	1 eDNA; 15 water chemistry
Other	Logbook, Relational database
Report Analyst	Tom Laidig
Date Compiled	07 July 2021

DIVE DATA (Gull Island)

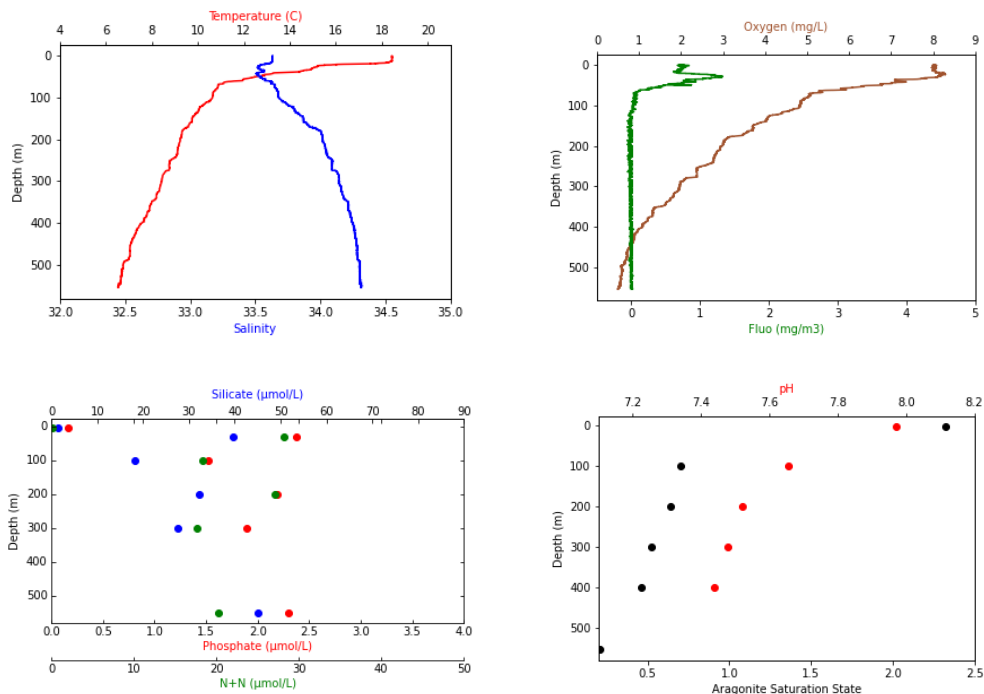
Date	29 Oct 2018	Starting Latitude (N)	33° 55.226'
Minimum Bottom Depth (m)	200	Starting Longitude (W)	119° 48.086'
Maximum Bottom Depth (m)	579	Ending Latitude (N)	33° 55.163'
Start Bottom Time (UTC)	02:26:47	Ending Longitude (W)	119° 47.538'
End Bottom Time (UTC)	09:30:51	Number of Dives	1
Number 15-min Transects	7		

PHYSICAL ENVIRONMENT (Gull Island)

In total, 2,596 m² of seafloor were surveyed during 7 quantitative transects conducted during Dive 0024 at Gull Island off southern California. Habitat types were classified as (1) Hard (65% of the total area surveyed), which included only bedrock outcrops, flat rock, boulders, and cobble; (2) Mixed (24% of the total area surveyed), including a combination of mud with boulder, cobbles, or rock outcrops; and (3) Soft (11% of the total area surveyed), which consisted entirely of mud.

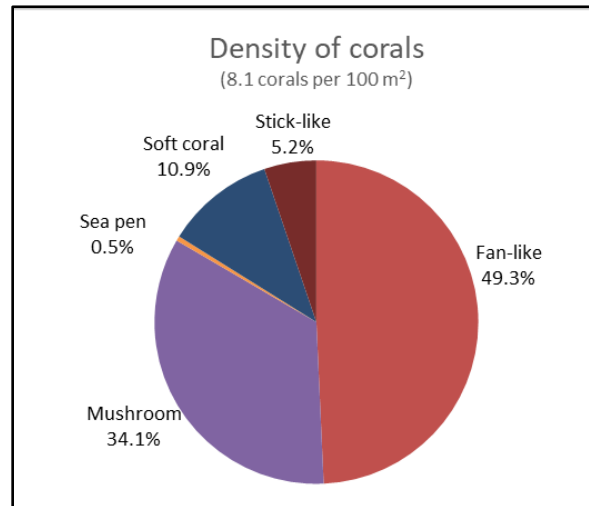


Temperature (as measured from the shipboard CTD) decreased gradually after a thermocline ended at about 80 m. Salinity increased with depth. Oxygen decreased gradually from the surface to 550 m. Fluorescence peaked near the surface (~20 m) and reduced to zero near 120 m. Nutrient load (phosphate, silicate, and ammonia and N+N) was variable and no apparent trend with depth. pH and aragonite saturation state decreased quickly until approximately 100 m, and then more gradually after that.



BIOLOGICAL ENVIRONMENT: CORALS (Gull Island)

A total of 211 individual coral colonies, comprising at least 8 taxa, were enumerated from 7 quantitative transects conducted during Dive 0024 at Gull Island off southern California. Coral density was 8.1 corals per 100 m² of seafloor. Fan-like corals (mostly *Plumarella longispina*) accounted for half (49.3%) of the coral taxa. Mushroom corals (34.1%) were also abundant. The soft coral, *Clavularia* spp., was somewhat common in the deeper areas (10.9%).



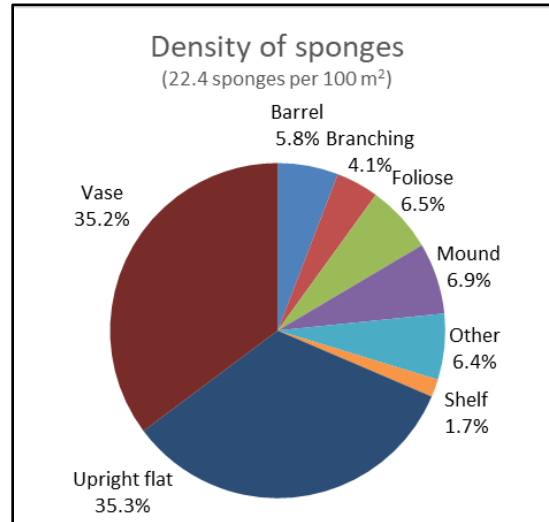
Colors in the pie diagram match colors in the list of coral taxa (below).

Scientific name	Common name	Number
<i>Clavularia</i> spp.	soft coral	23
<i>Heteropolypus ritteri</i>	mushroom coral	72
<i>Paragorgia</i> spp.	sea fan (white with red polyps)	23
<i>Parastenella ramosa</i>	primnoid	12
Pennatulacea #1	sea pen (thin)	1
Plexauridae #1	<i>Swiftia</i> type (red w/ white polyps)	11
<i>Plumarella longispina</i>	primnoid	66
<i>Swiftia pacifica</i>	sea fan (red with yellow polyps)	3

Six coral specimens were collected during dives at Gull Island and sent to experts for identification. Shipboard identifications included 4 different forms of *Swiftia* spp. (stick-like coral, 4 specimens), *Paragorgia* spp. (1 specimen), and *Plumarella longispina* (1 specimen). Verified identifications from experts are still pending.

BIOLOGICAL ENVIRONMENT: SPONGES (Gull Island)

A total of 582 individual sponges from at least 14 different taxa were enumerated from 7 quantitative transects conducted during Dive 0024 at Gull Island off southern California. An overall density of 22.4 sponges per 100 m² of seafloor was calculated. Upright flat (mostly *Mycale* spp.; 35.3%) and vase (mostly unidentified and *Staurocalyptus* spp.; 35.2%) sponges were the most abundant taxa.



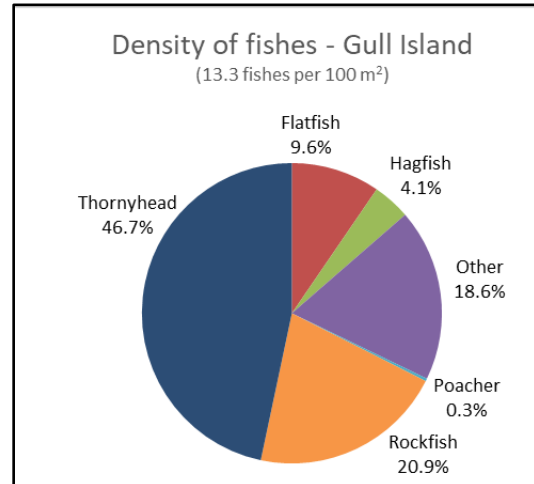
Colors in the pie diagram match colors in the list of sponge taxa (below).

Scientific name	Common name	Number
<i>Asbestopluma</i> spp. #1	predatory pipecleaner sponge	29
<i>Heterochone calyx</i>	fingered goblet vase sponge	67
<i>Mycale</i> spp.	upright flat sponge (yellow)	182
Porifera #1	unidentified foliose sponges	31
Porifera #2	unidentified upright flat sponges	12
Porifera #3	unidentified barrel sponges	34
Porifera #4	unidentified shelf sponges	10
Porifera #5	unidentified vase sponges	69
Porifera #6	unidentified mound sponges	40
Porifera #7	unidentified branching sponge	21
Porifera #8	unidentified tube sponge	8
<i>Rhizaxinella gadus</i>	club sponge	3
<i>Staurocalyptus</i> spp. #1	Picasso sponge	69
<i>Thenia muricata</i>	foliose sponge (clear)	7

Two sponge specimens were collected during dives at Gull Island and sent to experts for identification. Shipboard identifications were white vase sponge (1 specimen) and yellow crumplet sponge (1 specimen). Verified identifications from experts are still pending.

BIOLOGICAL ENVIRONMENT: FISHES (Gull Island)

At least 28 taxa of fishes were identified from 7 quantitative transects conducted during Dive 0024 at Gull Island off southern California. A total of 345 individual fishes were enumerated, and an overall density of 13.3 fishes per 100 m² of seafloor was calculated. Thornyheads were the dominant taxa (46.7%) at Gull Island. Rockfishes (*Sebastes* spp.) were abundant (20.9%) in shallower depths. The remaining taxa included the Other fishes (18.6%), flatfishes (9.6%), hagfishes (4.1%), and poachers (0.3%).



Colors in the pie diagram match colors in the list of fish taxa (below).

Three sponges (2 vase sponges and 1 *Heterochone calyx*) of the 793 corals and sponges (0.4%) had a fish association within one body length. The three fish taxa that were associated with the sponges were an aurora rockfish (*Sebastes aurora*), a thornyhead (*Sebastolobus* spp.), and an *Icelinus* sculpin.

Scientific name	Common name	Number
<i>Anoplopoma fimbria</i>	sablefish	1
<i>Argentina sialis</i>	Pacific argentine	1
<i>Bathyagonus pentacanthus</i>	bigeye poacher	1
<i>Cataetyx rubrirostris</i>	rubynose brotula	2
<i>Chilara taylori</i>	spotted cusk-eel	1
<i>Eptatretus</i> spp.	unidentified hagfish	14
<i>Glyptocephalus zachirus</i>	rex sole	2
<i>Icelinus</i> spp.	<i>Icelinus</i> sculpins	16
<i>Merluccius productus</i>	Pacific hake	11
<i>Microstomus pacificus</i>	Dover sole	30
<i>Facciolella equatorialis</i>	dogface witch eel	6
<i>Nezumia stelgidolepis</i>	California grenadier	8
Pleuronectiformes	unidentified flatfishes	1
Scyliorhinidae	unidentified cat shark	7
<i>Sebastes aurora</i>	aurora rockfish	7
<i>Sebastes chlorostictus</i>	greenspotted rockfish	2
<i>Sebastes diploproa</i>	splitnose rockfish	3
<i>Sebastes elongatus</i>	greenstriped rockfish	7
<i>Sebastes hopkinsi</i>	squarespot rockfish	1
<i>Sebastes jordani</i>	shortbelly rockfish	1
<i>Sebastes melanostomus</i>	blackgill rockfish	4
<i>Sebastes ovalis</i>	speckled rockfish	1
<i>Sebastes rufus</i>	bank rockfish	26
<i>Sebastes saxicola</i>	stripetail rockfish	10
<i>Sebastes semicinctus</i>	halfbanded rockfish	2

Scientific name	Common name	Number
<i>Sebastes</i> spp.	unidentified rockfishes	2
<i>Sebastolobus alascanus</i>	shortspine thornyhead	5
<i>Sebastolobus altivelis</i>	longspine thornyhead	22
<i>Sebastolobus</i> spp.	thornyheads	134
<i>Sebastomus</i>	unidentified <i>Sebastomus</i>	6
<i>Zaniolepis frenata</i>	shortspine combfish	11

IMAGE GALLERY (Gull Island)

A massive *Heterochone calyx* at 542 m.



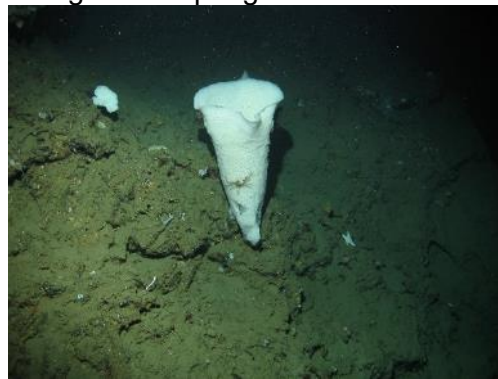
Clavularia spp. and *Mycale* spp. at 552 m.



Parastenella ramosa and *Mycale* spp. on a rock ridge at 558 m.



A large vase sponge at 573 m.



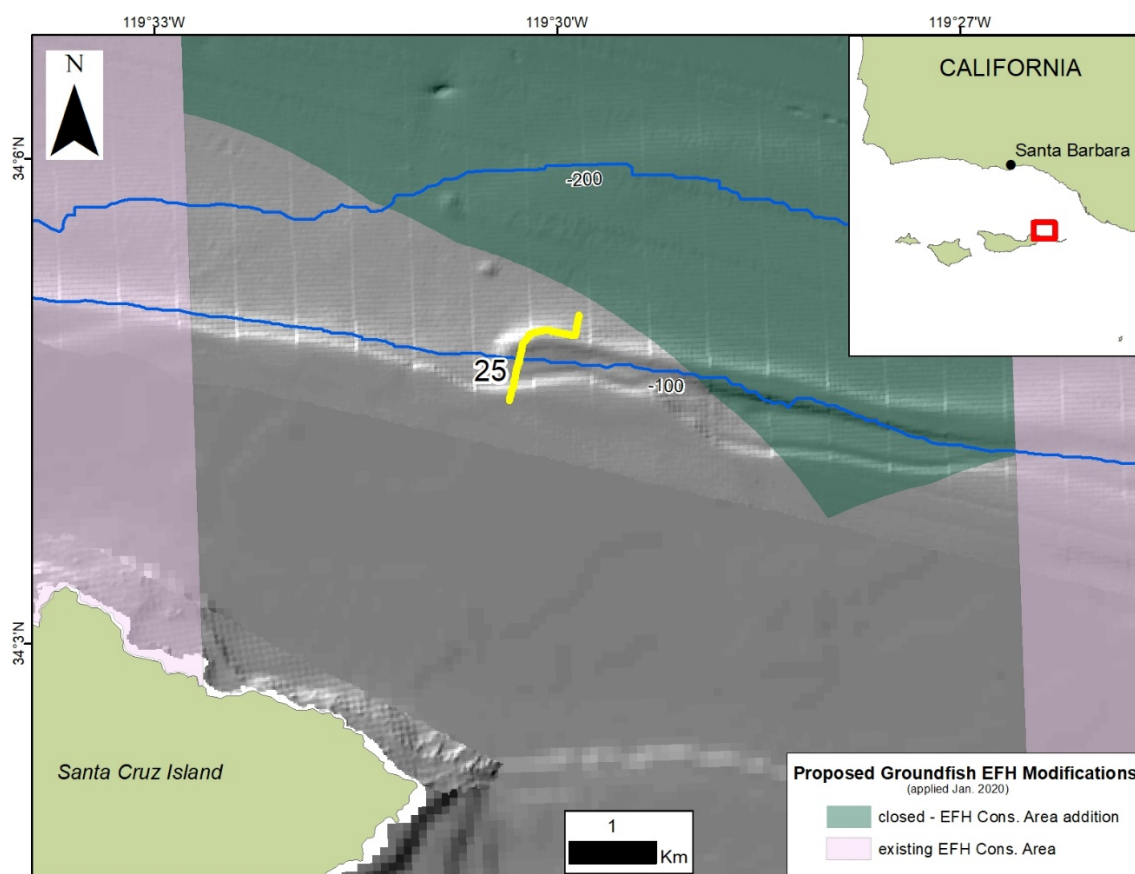
ADDITIONAL COMMENTS (Gull Island)

One monofilament fishing line was the only anthropogenic debris item documented during dives at Gull Island. Damage to fauna by this item was not evident.

No corals and 17 sponges (one *Heterochone calyx* and 16 unidentified vase sponges) were damaged. Five sponges (4 *Heterochone calyx* and 1 vase) and no corals were knocked over. Two of the *Heterochone calyx* were dead, while the other 2 appeared to be healthy and undamaged except for being knocked over. Overall, 26 sponges (25 *Heterochone calyx* and 1 vase sponge) were dead or dying and all corals appeared healthy.

SITE AREA: NE Santa Cruz Island
DIVE NUMBER: ROV 0025

GENERAL LOCATION AND DIVE TRACK



STATION OVERVIEW (NE Santa Cruz Island)

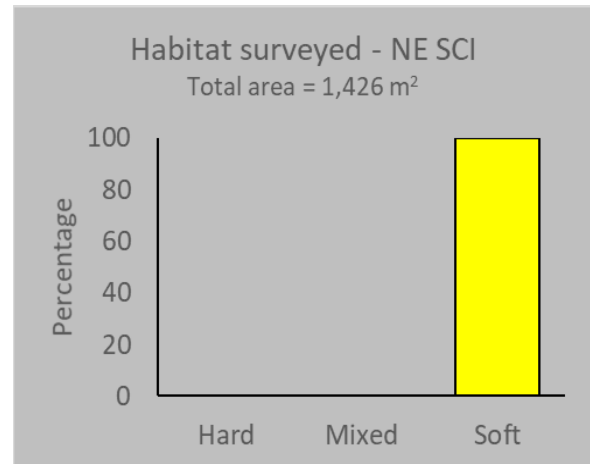
Project	EXPRESS 2018
Chief Scientists	T. Laidig, E. Clarke, C. Caldow
Contact Information	NMFS, SWFSC, tom.laidig@noaa.gov
Purpose	Survey deep-sea coral communities along the U.S. West Coast
Vessel and Survey Vehicle	NOAA Ship <i>Bell M. Shimada</i> ; ROV <i>Beagle</i> (MARE)
Science Observers	Tom Laidig, Meredith Everett, Lisa Krigsman
Digital Video	1.5 hours
Digital Still Photos	514 images
Positioning System	Ship: GPS; ROV: USBL
CTD Sensors	Yes
O₂ Sensor	Yes
pH Sensor	No
Specimens collected	0
Water sample	0 eDNA; 0 water chemistry
Other	Logbook, Relational database
Report Analyst	Tom Laidig
Date Compiled	07 July 2021

DIVE DATA (NE Santa Cruz Island)

Date	30 Oct 2018	Starting Latitude (N)	34° 4.918'
Minimum Bottom Depth (m)	85	Starting Longitude (W)	119° 29.914'
Maximum Bottom Depth (m)	120	Ending Latitude (N)	34° 4.403'
Start Bottom Time (UTC)	02:25:50	Ending Longitude (W)	119° 30.352'
End Bottom Time (UTC)	04:00:12	Number of Dives	1
Number 15-min Transects	3		

PHYSICAL ENVIRONMENT (NE Santa Cruz Island)

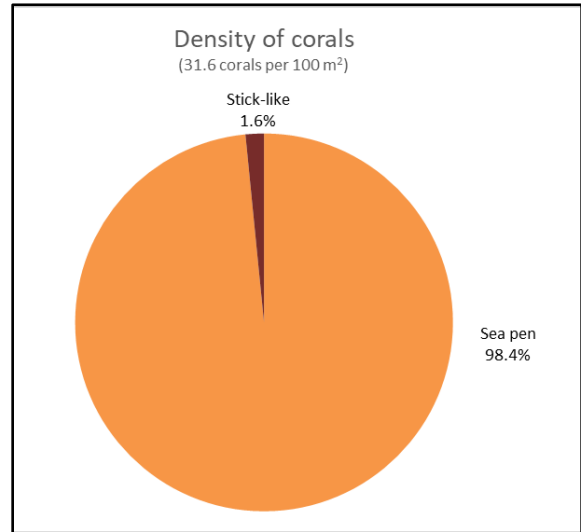
In total, 1,426 m² of seafloor were surveyed during 3 quantitative transects conducted during Dive 0025 at Northeast Santa Cruz Island off southern California. Soft sediment (100% of total area surveyed) was the only habitat type classified, which consisted entirely of mud.



No shipboard CTD cast was deployed at this location.

BIOLOGICAL ENVIRONMENT: CORALS (NE Santa Cruz Island)

A total of 445 individual coral colonies, comprising at least 4 taxa, were enumerated from 3 quantitative transects conducted during Dive 0025 at northeast Santa Cruz Island off southern California. Coral densities were 31.6 corals per 100 m² of seafloor. Sea pens dominated the coral assemblage in this soft sediment covered site (98.4%). Seven *Swiftia*-type sticks attached to small cobbles were also observed (1.6%).



Colors in the pie diagram match colors in the list of coral taxa (below).

Scientific name	Common name	Number
<i>Pennatula phosphorea</i>	phosphorescent sea pen	5
Pennatulacea #1	sea pen (thin)	424
Plexauridae #1	<i>Swiftia</i> type (red w/ white polyps)	7
<i>Ptilosarcus</i> sp.	orange sea pen	9

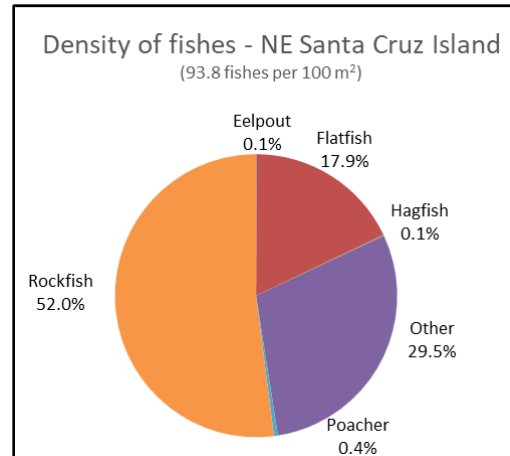
No coral specimens were collected during dives at northeast Santa Cruz Island.

BIOLOGICAL ENVIRONMENT: SPONGES (NE Santa Cruz Island)

No sponges were enumerated from 3 quantitative transects conducted during Dive 0025 at northeast Santa Cruz Island off southern California.

BIOLOGICAL ENVIRONMENT: FISHES (NE Santa Cruz Island)

At least 26 taxa of fishes were identified from 3 quantitative transects conducted during Dive 0025 at Northeast Santa Cruz Island off southern California. A total of 345 individual fishes were enumerated. The overall density of 93.8 fishes per 100 m² of seafloor was the highest calculated during the cruise. Rockfishes (*Sebastes* spp.) were the dominant taxa with over 50% of all fishes (52.0%). The Other fish category (29.5%) included combfishes (*Zaniolepis* spp., 201 individuals), spotted cusk-eels (*Chilara taylori*, 126 individuals) and plainfin midshipman (*Porichthys notatus*, 32 individuals). The remaining taxa included the flatfishes (17.9%), poachers (0.4%), hagfishes (0.1%), and eelpouts (0.1%).



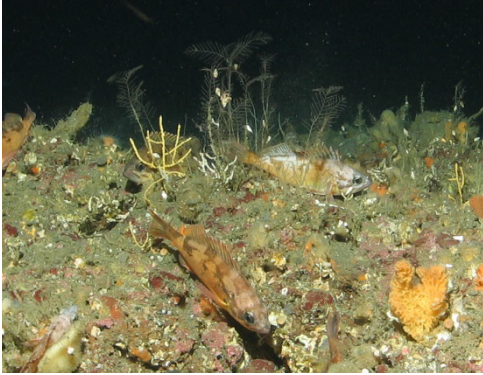
Colors in the pie diagram match colors in the list of fish taxa (below).

One sea pen of the 445 corals (0.2%) had a fish association (halfbanded rockfish, *S. semicinctus*) within one body length.

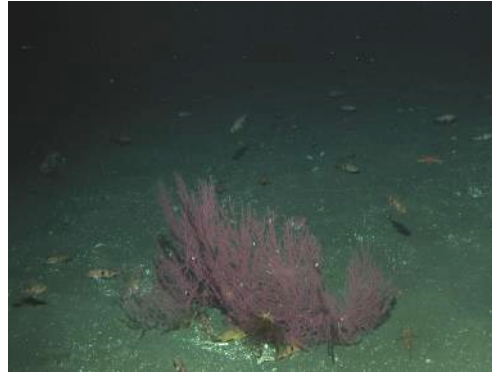
Scientific name	Common name	Number
<i>Argentina sialis</i>	Pacific argentine	2
<i>Chilara taylori</i>	spotted cusk-eel	126
<i>Citharichthys</i> spp.	unidentified sanddab	44
<i>Enophrys taurina</i>	bull sculpin	2
<i>Eptatretus</i> spp.	unidentified hagfish	1
<i>Hydrolagus colliei</i>	spotted ratfish	3
<i>Icelinus filamentosus</i>	threadfin sculpin	1
<i>Icelinus tenuis</i>	spotfin sculpin	1
<i>Lycodes cortezianus</i>	bigfin eelpout	1
<i>Merluccius productus</i>	Pacific hake	8
<i>Microstomus pacificus</i>	Dover sole	19
<i>Parophrys vetulus</i>	English sole	4
Pleuronectiformes	unidentified flatfishes	168
<i>Pleuronichthys</i> spp.	unidentified turbot	4
<i>Porichthys notatus</i>	plainfin midshipman	32
<i>Raja stellulata</i>	starry skate	1
<i>Sebastes chlorostictus</i>	greenspotted rockfish	3
<i>Sebastes goodei</i>	chilipepper	2
<i>Sebastes jordani</i>	shortbelly rockfish	40
<i>Sebastes levis</i>	cowcod	1
<i>Sebastes saxicola</i>	stripetail rockfish	2
<i>Sebastes semicinctus</i>	halfbanded rockfish	645
<i>Sebastomus</i>	unidentified <i>Sebastomus</i>	1
<i>Xeneretmus triacanthus</i>	bluespotted poacher	6
<i>Zalembius rosaceus</i>	pink seaperch	20
<i>Zaniolepis frenata</i>	shortspine combfish	197
<i>Zaniolepis latipinnis</i>	longspine combfish	4

IMAGE GALLERY (NE Santa Cruz Island)

A newly described coral, *Chromoplexaura cordellbankensis* and halfbanded rockfish at 87 m.



A purple gorgonian, *Eugorgia rubens*, at 88 m.



A school of halfbanded rockfish at 88 m.



A sea pen at 86 m.



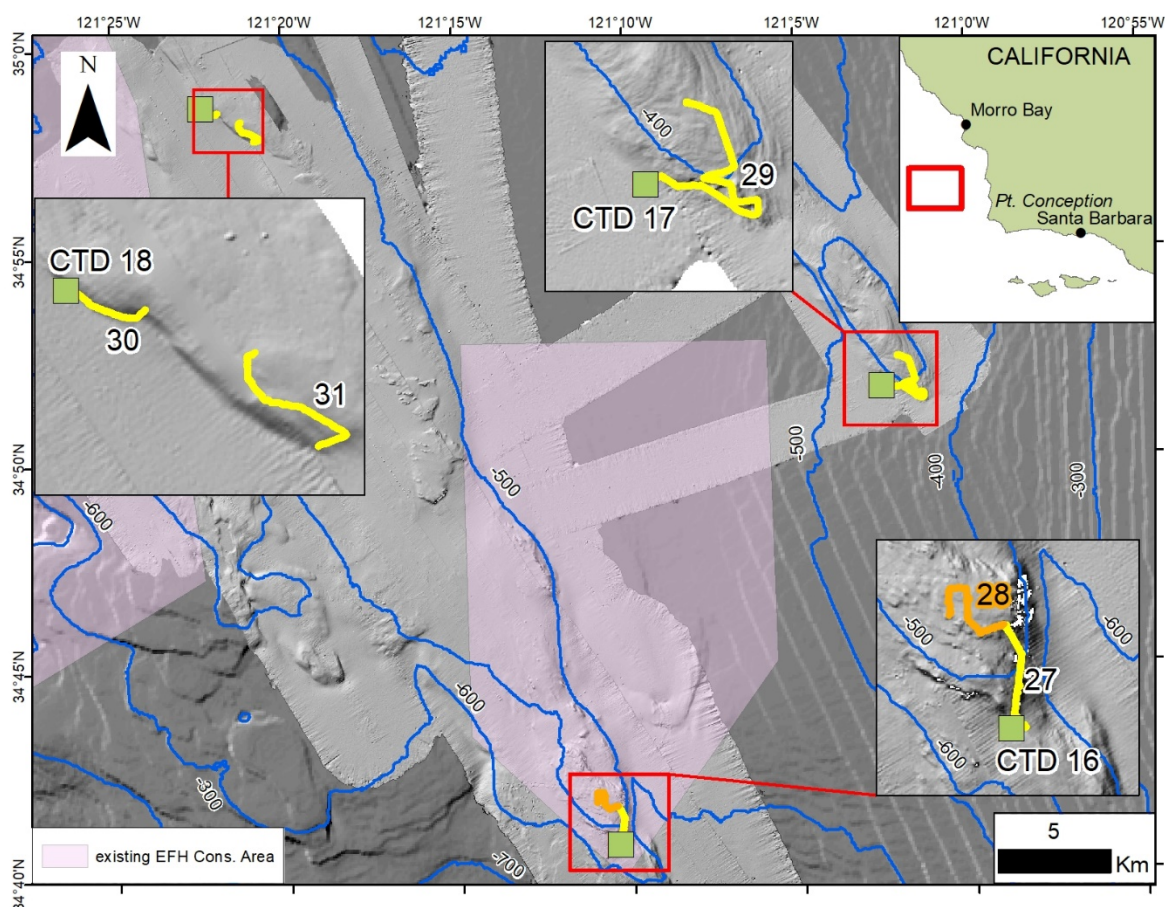
ADDITIONAL COMMENTS (NE Santa Cruz Island)

No anthropogenic debris items were documented during dives at northeast Santa Cruz Island.

All corals or sponges were healthy with no damaged or knocked over specimens observed on transect.

SITE AREA: Santa Lucia Bank DIVE NUMBER: ROV 0027-0031

GENERAL LOCATION AND DIVE TRACK



STATION OVERVIEW (Santa Lucia Bank)

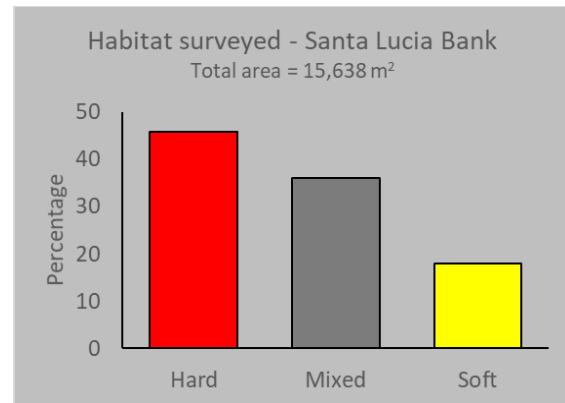
Project	EXPRESS 2018
Chief Scientists	T. Laidig, E. Clarke, C. Caldw
Contact Information	NMFS, SWFSC, tom.laidig@noaa.gov
Purpose	Survey deep-sea coral communities along the U.S. West Coast
Vessel and Survey Vehicle	NOAA Ship <i>Bell M. Shimada</i> ; ROV <i>Beagle</i> (MARE)
Science Observers	Tom Laidig, Meredith Everett, Lisa Krigsman
Digital Video	19.7
Digital Still Photos	7,153 images
Positioning System	Ship: GPS; ROV: USBL
CTD Sensors	Yes
O₂ Sensor	Yes
pH Sensor	No
Specimens collected	21
Water sample	3 eDNA; 21 water chemistry
Other	Logbook, Relational database
Report Analyst	Tom Laidig
Date Compiled	07 July 2021

DIVE DATA (Santa Lucia Bank)

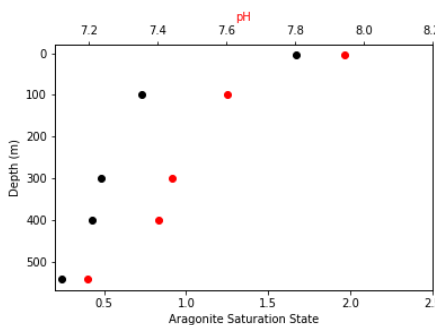
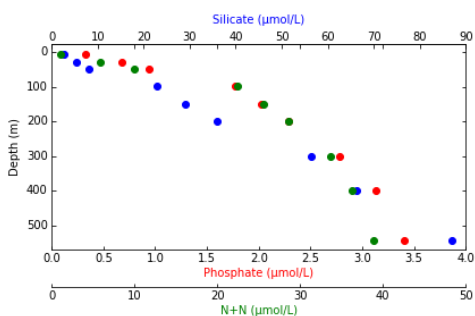
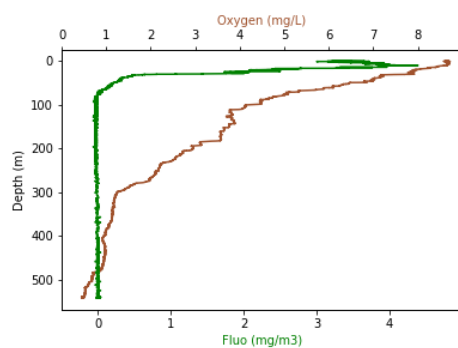
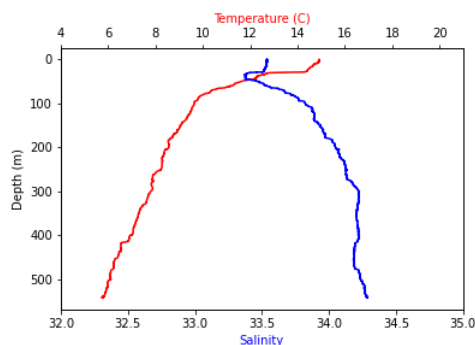
Date	31 Oct- 2 Nov 2018	Starting Latitude (N)	34° 40.733'
Minimum Bottom Depth (m)	354	Starting Longitude (W)	121° 10.283'
Maximum Bottom Depth (m)	505	Ending Latitude (N)	34° 58.262'
Start Bottom Time (UTC)	01:41:48	Ending Longitude (W)	121° 21.192'
End Bottom Time (UTC)	09:44:26	Number of Dives	5
Number 15-min Transects	24		

PHYSICAL ENVIRONMENT (Santa Lucia Bank)

In total, 15,638 m² of seafloor were surveyed during 24 quantitative transects conducted during Dive 0027-0031 on Santa Lucia Bank off central California. Habitat types were classified as (1) Hard (46% of the total area surveyed), which included only bedrock outcrops, rock with a thin mud veneer, flat rock, boulders, and cobble; (2) Mixed (36% of the total area surveyed), including a combination of mud with boulder, cobbles, flat rock, or rock outcrops; and (3) Soft (18% of the total area surveyed), which consisted entirely of mud.

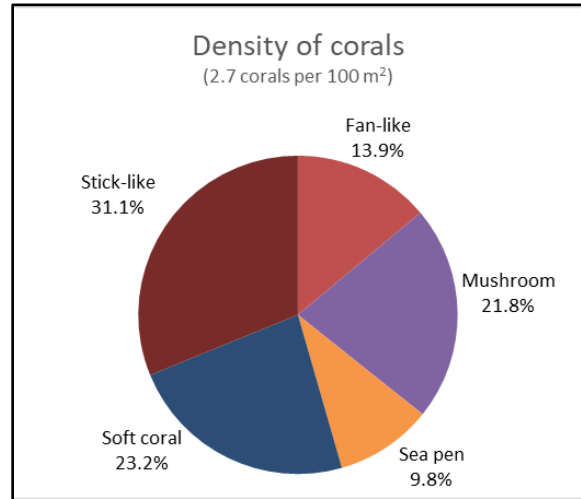


Temperature (as measured from the shipboard CTD) decreased quickly until 90 m and gradually after that. Salinity increased with depth, except for a slight decrease at 40 m. Oxygen decreased gradually with depth. Fluorescence peaked near the surface (~20 m) and reduced to zero near 100 m. Nutrient load (phosphate, silicate, and ammonia and N+N) increased with depth. pH and aragonite saturation state decreased quickly until approximately 100 m, and gradually after that.



BIOLOGICAL ENVIRONMENT: CORALS (Santa Lucia Bank)

A total of 417 individual coral colonies, comprising at least 11 taxa, were enumerated from 24 quantitative transects conducted during Dive 0027-0031 on Santa Lucia Bank off central California. Coral densities were 2.7 corals per 100 m² of seafloor. Stick-like (31.1%), soft (23.2%), and mushroom (21.8%) corals were the dominant taxa. Mushroom corals (34.1%) were also abundant. Fan-like corals (13.9%) and sea pens (9.8%) were also observed.



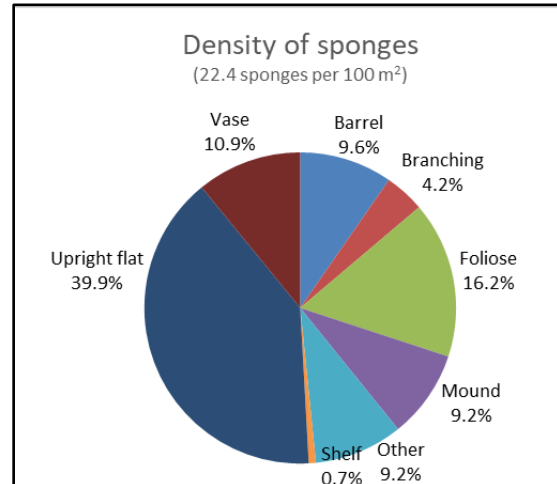
Colors in the pie diagram match colors in the list of coral taxa (below).

Scientific name	Common name	Number
<i>Anthoptilum grandiflorum</i>	feather boa sea pen	8
<i>Clavularia</i> spp.	soft coral	97
<i>Heteropolypus ritteri</i>	mushroom coral	91
<i>Paragorgia</i> spp.	sea fan (white with red polyps)	8
<i>Parastenella ramosa</i>	primnoid	13
Pennatulacea #1	sea pen (thin)	24
Pennatulidae	sea pen (thick)	8
Plexauridae #1	<i>Swiftia</i> type (red w/ white polyps)	133
<i>Plumarella longispina</i>	primnoid	4
<i>Swiftia pacifica</i>	sea fan (red with yellow polyps)	30
<i>Virgularia</i> spp.	sea pen	1

Three coral specimens were collected during dives at Santa Lucia Bank and sent to experts for identification. Shipboard identifications were *Swiftia pacifica* (1 specimen), *Paragorgia* spp. (1 specimen), and *Plumarella longispina* (1 specimen). Verified identifications from experts are still pending.

BIOLOGICAL ENVIRONMENT: SPONGES (Santa Lucia Bank)

A total of 3,507 individual sponges from at least 20 different taxa were enumerated from 24 quantitative transects conducted during Dive 0027-0031 on Santa Lucia Bank off central California. An overall density of 22.4 sponges per 100 m² of seafloor was calculated. Upright flat (*Mycale* spp.; 39.9 %) was the most abundant taxa. Foliose (16.2%), barrel (9.6%), and mound (9.2%) were also somewhat abundant. Although two different species of *Asbestopluma* were observed in the sponge category (9.2%), the pipecleaner type was the dominant species of this genus.



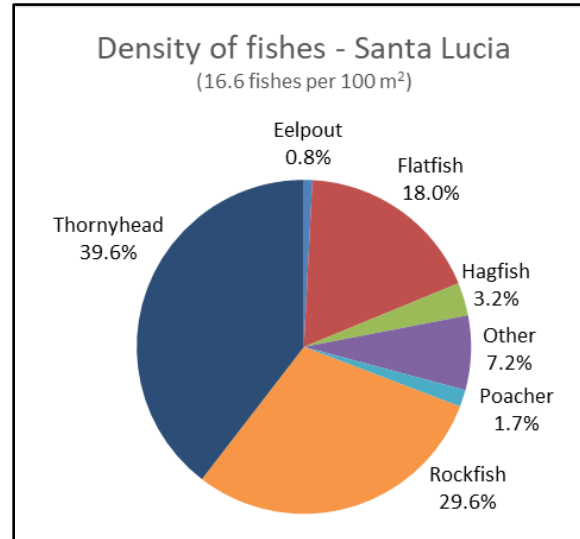
Colors in the pie diagram match colors in the list of sponge taxa (below).

Scientific name	Common name	Number
<i>Asbestopluma</i> spp. #1	predatory pipecleaner sponge	233
<i>Asbestopluma</i> spp. #2	predatory sponge (clear)	1
<i>Farrea occa</i>	lace foliose sponge	2
<i>Haliclona</i> (Gellius)	tan vase/trumpet sponge	1
<i>Heterochone calyx</i>	fingered goblet vase sponge	100
<i>Mycale</i> spp.	upright flat sponge (yellow)	1261
Porifera #1	unidentified foliose sponges	464
Porifera #10	unidentified sponge (blue/white)	14
Porifera #12	unidentified sponge	1
Porifera #2	unidentified upright flat sponges	141
Porifera #3	unidentified barrel sponges	338
Porifera #4	unidentified shelf sponges	26
Porifera #5	unidentified vase sponges	231
Porifera #6	unidentified mound sponges	307
Porifera #7	unidentified branching sponge	145
Porifera #8	unidentified tube sponge	87
<i>Rhizaxinella gadus</i>	club sponge	1
<i>Staurocalyptus</i> spp. #1	Picasso sponge	46
<i>Staurocalyptus</i> spp. #2	white vase sponge	4
<i>Thenia muricata</i>	foliose sponge (clear)	104

Nine sponge specimens were collected during dives on Santa Lucia Bank and sent to experts for identification. Shipboard identifications were moldy Swiss cheese sponge (1 specimen), puffball sponge (1 specimen), thick tube sponge (1 specimen), white tube sponge (1 specimen), hedgehog *Heterochone* sponge (2 specimens), purple moon sponge (1 specimen), yellow crumpet sponge (1 specimen), and *Asbestopluma* spp. (1 specimen). Verified identifications from experts are still pending.

BIOLOGICAL ENVIRONMENT: FISHES (Santa Lucia Bank)

At least 37 taxa of fishes were identified from 24 quantitative transects conducted during Dive 0027-0031 on Santa Lucia Bank Island off central California. A total of 2,599 individual fishes were enumerated. An overall density of 16.6 fishes per 100 m² of seafloor was calculated. Thornyheads (*Sebastolobus* spp., 39.6%) and rockfishes (*Sebastes* spp., 29.6%) were the dominant taxa accounting for approximately 70% of all fishes. The remaining taxa were flatfishes (18.0%), Other fishes (7.2%) The remaining taxa included the hagfishes (3.2%), poachers (1.7%), and eelpouts (0.8%). This area is known as a spawning site for petrale sole (*Eopsetta jordani*) and has an abundance of darkblotched rockfish (*S. crameri*). Darkblotched rockfish are a northern species but they are often commonly found in large aggregations here near the southern extent of their range.



Colors in the pie diagram match colors in the list of fish taxa (below).

A total of 22 sponges (0.6%, no corals) of the 1,585 corals and sponges had a fish association within one body length. Vase and barrel sponges were the most common taxa associated with fishes. Blackgill rockfish (10 individuals, *S. melanostomus*) were the most common fish taxa associated with the sponges. Other fish taxa associated with the sponges were thornyheads (5), splitnose rockfish (3), Aurora rockfish (2), hagfish (1), and one catshark egg case was on a sponge.

Scientific name	Common name	Number
Agonidae	unidentified poachers	36
<i>Anoplopoma fimbria</i>	sablefish	7
<i>BathYGONUS pentacanthus</i>	bigeye poacher	3
<i>Bathyrāja interrupta</i>	sandpaper skate	3
<i>Cataetyx rubrirostris</i>	rubynose brotula	28
<i>Embassichthys bathybius</i>	deepsea sole	18
<i>Eopsetta jordani</i>	petrale sole	30
<i>Eptatretus</i> spp.	unidentified hagfish	83
<i>Glyptocephalus zachirus</i>	rex sole	54
<i>Hydrolagus colliei</i>	spotted ratfish	7
<i>Hydrolagus colliei</i> egg case	ratfish egg case	1
<i>Icelinus</i> spp.	<i>Icelinus</i> sculpins	3
<i>Lycodes cortezianus</i>	bigfin eelpout	18
<i>Lycodes diapterus</i>	black eelpout	3
<i>Lyopsetta exilis</i>	slender sole	3
Macrouridae	unidentified grenadier	1
<i>Merluccius productus</i>	Pacific hake	16
<i>Microstomus pacificus</i>	Dover sole	361
Myctophidae	unidentified lanternfish	2
<i>Ophiodon elongatus</i>	lingcod	1
Osteichthyes	unidentified fishes	2
<i>Plectobranchnus evides</i>	bluebarred prickleback	1
Pleuronectiformes	unidentified flatfishes	1

Scientific name	Common name	Number
<i>Raja rhina</i>	longnose skate	33
<i>Raja</i> spp.	unidentified skate	1
Rajiformes egg cases	skate egg cases	8
Scyliorhinidae	unidentified cat shark	61
Scyliorhinidae egg cases	cat shark egg cases	12
<i>Sebastes aurora</i>	aurora rockfish	85
<i>Sebastes crameri</i>	darkblotched rockfish	3
<i>Sebastes diploproa</i>	splitnose rockfish	161
<i>Sebastes helvomaculatus</i>	rosethorn rockfish	1
<i>Sebastes melanostomus</i>	blackgill rockfish	390
<i>Sebastes rufus</i>	bank rockfish	119
<i>Sebastes simulator</i>	pinkrose rockfish	1
<i>Sebastes</i> spp.	unidentified rockfishes	3
<i>Sebastolobus alascanus</i>	shortspine thornyhead	62
<i>Sebastolobus altivelis</i>	longspine thornyhead	86
<i>Sebastolobus</i> spp.	thornyheads	880
<i>Sebastomus</i>	unidentified <i>Sebastomus</i>	7
<i>Xeneretmus leiops</i>	smootheye poacher	4

IMAGE GALLERY (Santa Lucia Bank)

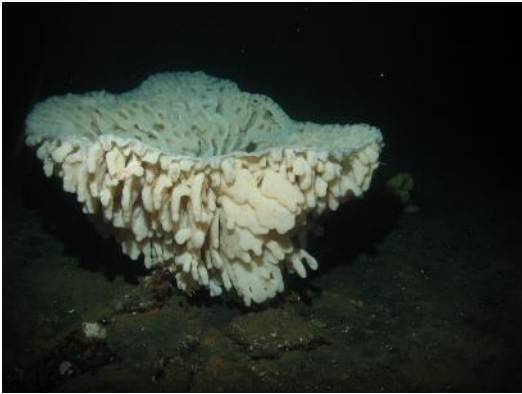
Two large sponges at 505 m.



Sponges and a blackgill rockfish at 427 m.



A massive *Heterochone calyx* at 437 m.



A spawning aggregation of petrale sole at 357 m.



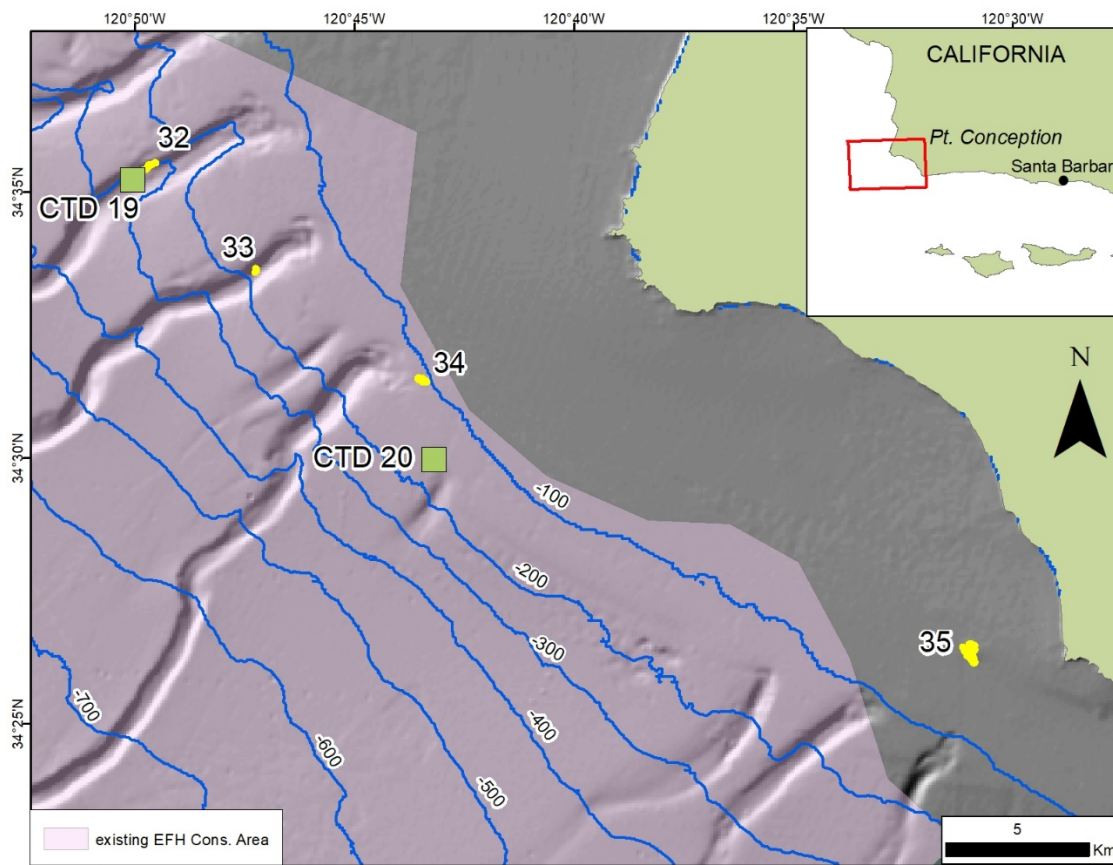
ADDITIONAL COMMENTS (Santa Lucia Bank)

Seven anthropogenic debris items (two glass bottles, one Pepsi can, one cement block, an old cloth tarp, one longline, and a small net wrapped around a rock) were documented during dives at Santa Lucia Bank. All the items were covered in sediment and/or covered with invertebrate growth except the Pepsi can, which appeared freshly deposited on the seafloor. Damage to fauna by these items was not evident.

Two corals (Plexauridae #1) and 11 sponges (1 barrel sponge, 9 *Heterochone calyx*, and 1 *Asbestopluma* spp. #1) had damaged sections. Nine sponges (4 *Heterochone calyx*, 2 barrel, 2 *Asbestopluma* #1, and 1 *Staurocalyptus* spp. #1) and no corals were knocked over. Two corals (Plexauridae #1) appeared dead and seventeen sponges (9 *Heterochone calyx* and 8 various sponges) appeared dead or dying.

**SITE AREA: Pt. Conception
DIVE NUMBER: ROV 0032-0035**

GENERAL LOCATION AND DIVE TRACK



STATION OVERVIEW (Pt. Conception)

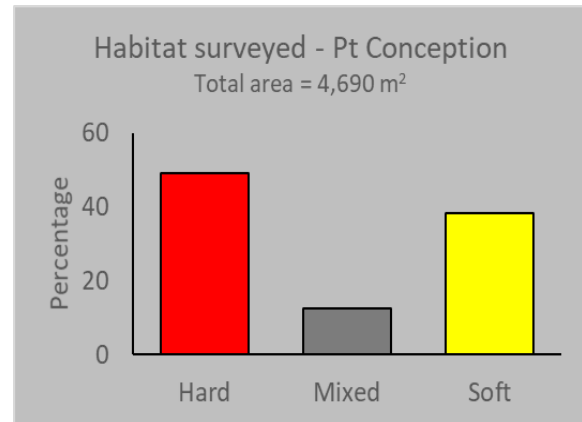
Project	EXPRESS 2018
Chief Scientists	T. Laidig, E. Clarke, C. Caldw
Contact Information	NMFS, SWFSC, tom.laidig@noaa.gov
Purpose	Survey deep-sea coral communities along the U.S. West Coast
Vessel and Survey Vehicle	NOAA Ship <i>Bell M. Shimada</i> ; ROV <i>Beagle</i> (MARE)
Science Observers	Tom Laidig, Meredith Everett, Lisa Krigsman
Digital Video	10.9 hours
Digital Still Photos	3,892 images
Positioning System	Ship: GPS; ROV: USBL
CTD Sensors	Yes
O₂ Sensor	Yes
pH Sensor	No
Specimens collected	2
Water sample	3 eDNA; 9 water chemistry
Other	Logbook, Relational database
Report Analyst	Tom Laidig
Date Compiled	07 July 2021

DIVE DATA (Pt. Conception)

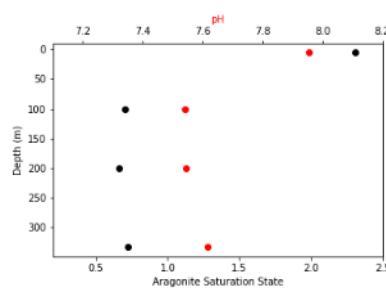
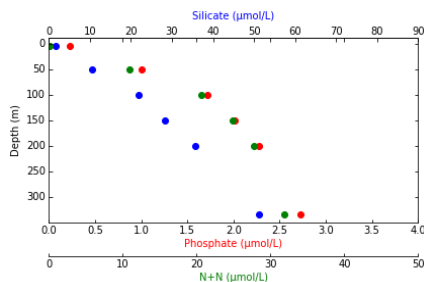
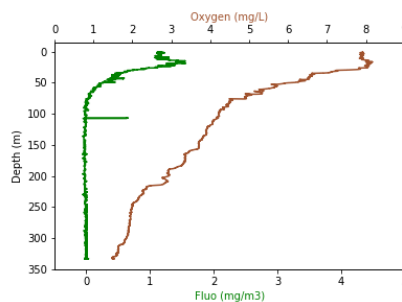
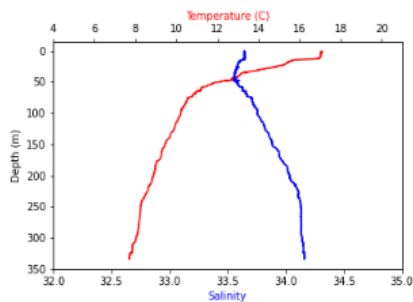
Date	3-4 Nov 2018	Starting Latitude (N)	34° 35.316'
Minimum Bottom Depth (m)	50	Starting Longitude (W)	120° 49.847'
Maximum Bottom Depth (m)	336	Ending Latitude (N)	34° 27.028'
Start Bottom Time (UTC)	03:29:48	Ending Longitude (W)	120° 30.359'
End Bottom Time (UTC)	10:07:30	Number of Dives	4
Number 15-min Transects	10		

PHYSICAL ENVIRONMENT (Pt. Conception)

In total, 4,690 m² of seafloor were surveyed during 10 quantitative transects conducted during Dive 0032-0035 at Pt. Conception off the intersection between central and southern California. Habitat types were classified as (1) Hard (50% of the total area surveyed), which included only bedrock outcrops, flat rock, boulders, and cobble; (2) Mixed (12% of the total area surveyed), including a combination of mud with boulder, cobbles, or rock outcrops; and (3) Soft (38% of the total area surveyed), which consisted of mud in the deeper areas and sand in the shallower.

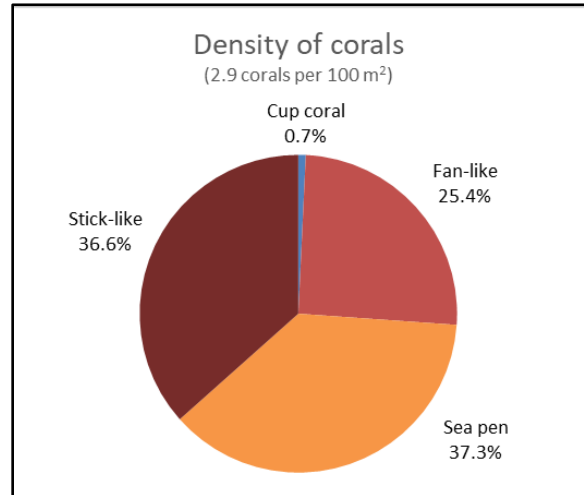


Temperature (as measured from the shipboard CTD) decreased quickly until 50 m and gradually after that. Salinity increased with depth, except for a slight decrease at 40 m. Oxygen decreased gradually with depth. Fluorescence peaked near the surface (~20 m) and reduced to zero near 90 m. Nutrient load (phosphate, silicate, and ammonia and N+N) increased with depth. pH and aragonite saturation state decreased quickly until approximately 100 m.



BIOLOGICAL ENVIRONMENT: CORALS (Pt. Conception)

A total of 134 individual coral colonies, comprising at least 6 taxa, were enumerated from 10 quantitative transects conducted during Dive 0032-0035 at Pt. Conception off the intersection between central and southern California. Overall coral density was 2.9 corals per 100 m² of seafloor. Sea pens (37.3), stick-like (36.6%), and fan-like (25.4%) corals were the dominant taxa. Only one *Desmophyllum pertusum* (formally called *Lophelia pertusa*) was observed.



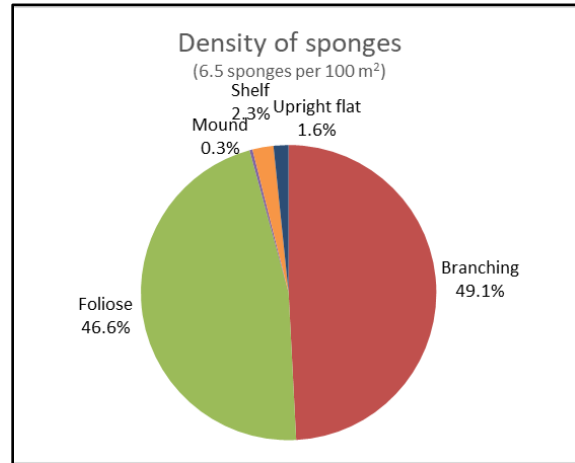
Colors in the pie diagram match colors in the list of coral taxa (below).

Scientific name	Common name	Number
<i>Desmophyllum pertusum</i>	white cup coral	1
<i>Leptogorgia chilensis</i>	red gorgonian	34
Pennatulacea #1	sea pen (thin)	39
Pennatulidae	sea pen (thick)	8
Plexauridae #1	<i>Swiftia</i> type (red w/ white polyps)	49
<i>Ptilosarcus sp.</i>	orange sea pen	3

One coral specimen was collected during dives at Pt. Conception and sent to experts for identification. Shipboard identification of the one specimen was *Swiftia spauldingi*. Verified identification from experts is still pending.

BIOLOGICAL ENVIRONMENT: SPONGES (Pt. Conception)

A total of 305 individual sponges from at least 6 different taxa were enumerated from 10 quantitative transects conducted during Dive 0032-0035 at Pt. Conception off the intersection between central and southern California. An overall density of 6.5 sponges per 100 m² of seafloor was calculated. Branching sponges (49.1%) accounted for almost half of the sponge assemblage, followed closely by foliose sponges (46.6%). Upright flat (1.6%), shelf (2.3%), and mound (0.3%) sponges were also present.



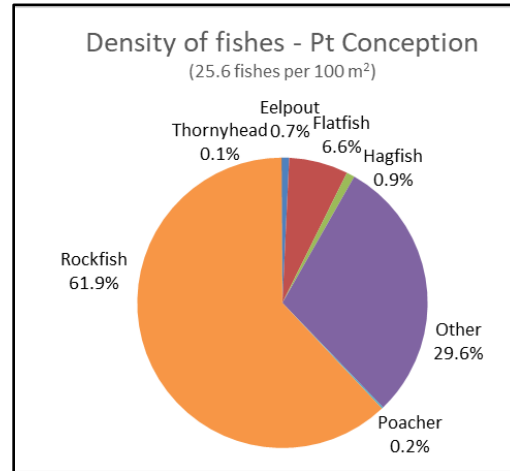
Colors in the pie diagram match colors in the list of sponge taxa (below).

Scientific name	Common name	Number
<i>Farrea occa</i>	lace foliose sponge	1
Porifera #1	unidentified foliose sponges	141
Porifera #2	unidentified upright flat sponges	5
Porifera #4	unidentified shelf sponges	7
Porifera #6	unidentified mound sponges	1
Porifera #7	unidentified branching sponge	150

No sponge specimens were collected on dives at Pt. Conception.

BIOLOGICAL ENVIRONMENT: FISHES (Pt. Conception)

At least 56 taxa of fishes were identified from 10 quantitative transects conducted during Dive 0032-0035 at Pt. Conception off the intersection between central and southern California. A total of 1,201 individual fishes were enumerated. An overall density of 25.6 fishes per 100 m² of seafloor was calculated. Rockfishes (*Sebastes* spp., 61.9%) dominated the fish assemblage. Twenty-two species of rockfishes were observed with the shallow dwelling calico rockfish (*S. dallii*) being the most numerous. Other fishes accounted for 29.6% of all fishes with the spotted cusk-eel as the most abundant (*Chilara taylori*, 105 individuals). The remaining taxa included the flatfishes (6.6%), hagfishes (0.9%), eelpouts (0.7%) and poachers (0.2%).



Colors in the pie diagram match colors in the list of fish taxa (below).

Just 3 individuals (0.7%) of the 439 corals and sponges had a fish association within one body length. Fish associations were with one *Leptogorgia chilensis*, one *Ptilosarcus* spp., and one foliose sponge, and the fish associated were a pink seaperch, a spotted scorpionfish, and a spotted cusk-eel.

Scientific name	Common name	Number
Agonidae	unidentified poachers	2
<i>Brosmophycis marginata</i>	red brotula	1
<i>Caulolatilus princeps</i>	ocean whitefish	3
<i>Chilara taylori</i>	spotted cusk-eel	105
<i>Citharichthys</i> spp.	unidentified sanddab	45
Cottidae	unidentified sculpin	1
<i>Damalichthys vacca</i>	pile perch	1
Elasmobranchii	shark egg case	1
<i>Enophrys taurina</i>	bull sculpin	25
<i>Eptatretus</i> spp.	unidentified hagfish	11
<i>Glyptocephalus zachirus</i>	rex sole	6
<i>Lycodes cortezianus</i>	bigfin eelpout	1
<i>Lycodes diapterus</i>	black eelpout	1
<i>Lyconema barbatum</i>	bearded eelpout	7
<i>Lyopsetta exilis</i>	slender sole	6
<i>Merluccius productus</i>	Pacific hake	35
<i>Microstomus pacificus</i>	Dover sole	10
<i>Ophiodon elongatus</i>	lingcod	10
<i>Oxylebius pictus</i>	painted greenling	2
<i>Phanerodon furcatus</i>	white seaperch	1
Pleuronectiformes	unidentified flatfishes	4
<i>Pleuronichthys</i> spp.	unidentified turbot	8
<i>Porichthys notatus</i>	plainfin midshipman	23
<i>Raja rhina</i>	longnose skate	3
<i>Raja stellulata</i>	starry skate	1
Rajiformes egg cases	skate egg cases	11

Scientific name	Common name	Number
<i>Rhacochilus toxotes</i>	rubberlip seaperch	3
<i>Scorpaena guttata</i>	spotted scorpionfish	31
Scyliorhinidae	unidentified cat shark	2
<i>Sebastes caurinus</i>	copper rockfish	4
<i>Sebastes chlorostictus</i>	greenspotted rockfish	12
<i>Sebastes constellatus</i>	starry rockfish	11
<i>Sebastes dallii</i>	calico rockfish	281
<i>Sebastes diploproa</i>	splitnose rockfish	109
<i>Sebastes elongatus</i>	greenstriped rockfish	1
<i>Sebastes entomelas</i>	widow rockfish	54
<i>Sebastes flavidus</i>	yellowtail rockfish	3
<i>Sebastes helvomaculatus</i>	rosethorn rockfish	2
<i>Sebastes hopkinsi</i>	squarespot rockfish	45
<i>Sebastes jordani</i>	shortbelly rockfish	17
<i>Sebastes levis</i>	cowcod	1
<i>Sebastes melanostomus</i>	blackgill rockfish	1
<i>Sebastes miniatus</i>	vermilion rockfish	96
<i>Sebastes ovalis</i>	speckled rockfish	5
<i>Sebastes paucispinis</i>	bocaccio	24
<i>Sebastes rosaceus</i>	rosy rockfish	12
<i>Sebastes rosenblatti</i>	greenblotched rockfish	1
<i>Sebastes saxicola</i>	stripetail rockfish	21
<i>Sebastes semicinctus</i>	halfbanded rockfish	4
<i>Sebastes serranoides</i>	olive rockfish	13
<i>Sebastes wilsoni</i>	pygmy rockfish	14
<i>Sebastolobus alascanus</i>	shortspine thornyhead	1
<i>Trachurus symmetricus</i>	jack mackerel	2
<i>Sebastomus</i>	unidentified <i>Sebastomus</i>	13
<i>Zalembius rosaceus</i>	pink seaperch	64
<i>Zaniolepis frenata</i>	shortspine combfish	13
<i>Zaniolepis latipinnis</i>	longspine combfish	17

IMAGE GALLERY (Pt. Conception)

Crabs cover the seafloor at 264 m in Arguello Canyon.



A spotted snake eel at 52 m.



Cup corals, a rock crab, and a calico rockfish at 54 m.



A crab, *Molocha faxoni*, with a sponge next to a red stick Plexauridae at 101 m.



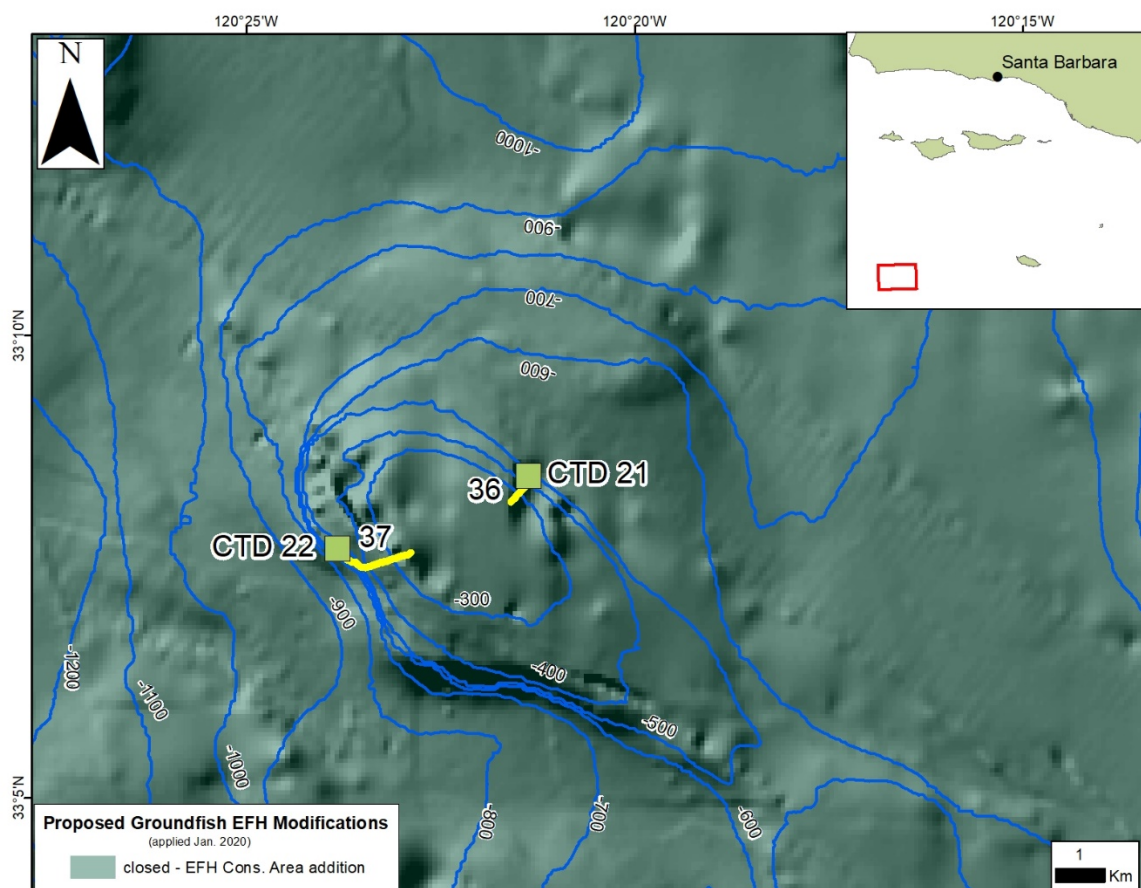
ADDITIONAL COMMENTS (Pt. Conception)

Two anthropogenic debris items (a monofilament fishing line and a longline) were documented during dives at Pt. Conception. Both items were old and covered in sediment and invertebrate growth. Damage to fauna by these items was not evident.

All corals or sponges appeared healthy and none were damaged or knocked over.

SITE AREA: Sverdrup Bank
DIVE NUMBER: ROV 0036-0037

GENERAL LOCATION AND DIVE TRACK



STATION OVERVIEW (Sverdrup Bank)

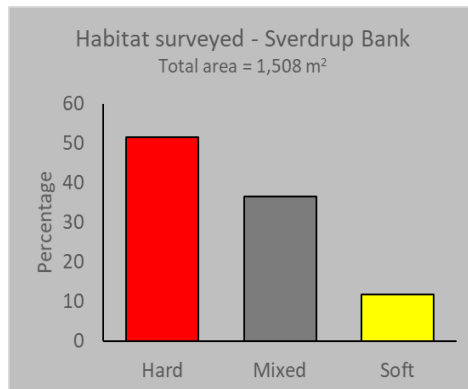
Project	EXPRESS 2018
Chief Scientists	T. Laidig, E. Clarke, C. Caldow
Contact Information	NMFS, SWFSC, tom.laidig@noaa.gov
Purpose	Survey deep-sea coral communities along the U.S. West Coast
Vessel and Survey Vehicle	NOAA Ship <i>Bell M. Shimada</i> ; ROV <i>Beagle</i> (MARE)
Science Observers	Tom Laidig, Meredith Everett, Lisa Krigsman
Digital Video	4.6 hours
Digital Still Photos	1,861 images
Positioning System	Ship: GPS; ROV: USBL
CTD Sensors	Yes
O₂ Sensor	Yes
pH Sensor	No
Specimens collected	7
Water sample	2 eDNA; 16 water chemistry
Other	Logbook, Relational database
Report Analyst	Tom Laidig
Date Compiled	07 July 2021

DIVE DATA (Sverdrup Bank)

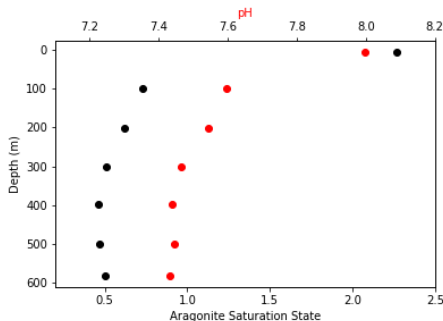
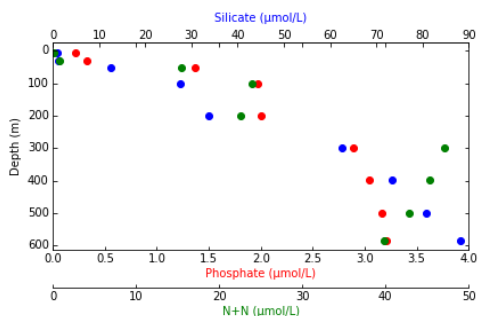
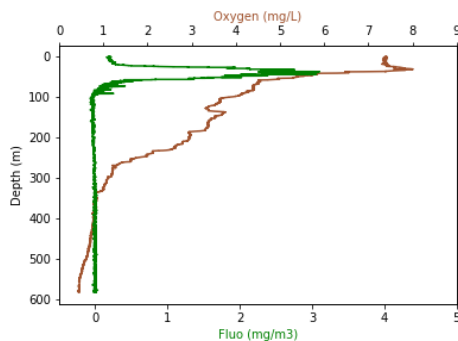
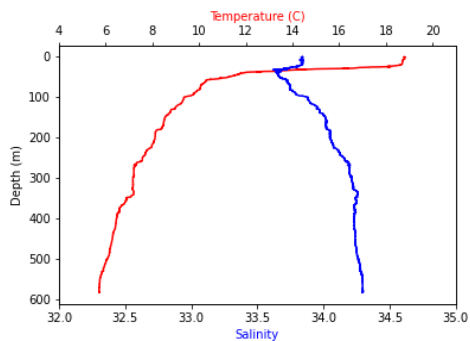
Date	5-6 Nov 2018	Starting Latitude (N)	33° 08.597'
Minimum Bottom Depth (m)	249	Starting Longitude (W)	120° 21.165'
Maximum Bottom Depth (m)	629	Ending Latitude (N)	33° 7.785'
Start Bottom Time (UTC)	07:25:03	Ending Longitude (W)	120° 22.664'
End Bottom Time (UTC)	10:15:26	Number of Dives	2
Number 15-min Transects	6		

PHYSICAL ENVIRONMENT (Sverdrup Bank)

In total, 1,508 m² of seafloor were surveyed during 6 quantitative transects conducted during Dive 0036-0037 on Sverdrup Bank in the Southern California Bight. Habitat types were classified as (1) Hard (51% of the total area surveyed), which included only bedrock outcrops, rock covered in a thin mud veneer, boulders, and cobble; (2) Mixed (37% of the total area surveyed), including a combination of mud with boulder, cobbles, or rock outcrops; and (3) Soft (12% of the total area surveyed), which consisted entirely of mud.

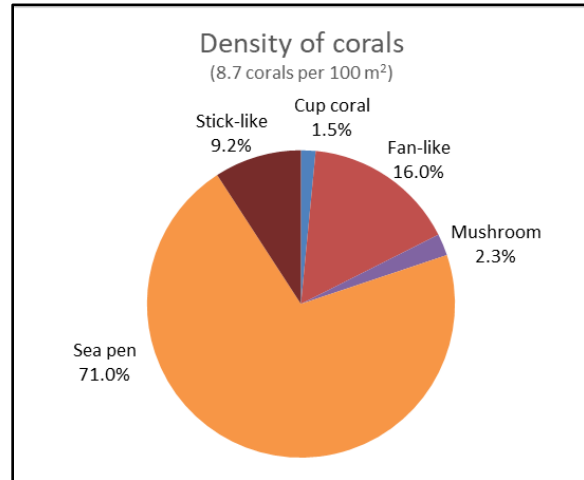


Temperature (as measured from the shipboard CTD) decreased quickly until 50 m and gradually after that. Salinity increased with depth, except for a slight decrease at 40 m. Oxygen decreased rapidly until about 80 m and gradually with depth after that. Fluorescence peaked around 40 m and reduced to zero near 100 m. Nutrient load (phosphate, silicate, and ammonia and N+N) increased with depth. pH and aragonite saturation state decreased quickly until approximately 100 m, and gradually after that.



BIOLOGICAL ENVIRONMENT: CORALS (Sverdrup Bank)

A total of 131 individual coral colonies, comprising at least 12 taxa, were enumerated from 6 quantitative transects conducted during Dive 0036-0037 on Sverdrup Bank in the Southern California Bight. Overall coral density was 8.7 corals per 100 m² of seafloor. Sea pens (at least 4 taxa; 71.0%) dominated the coral assemblage, with most of these (72 individuals) being the feather boa sea pen, *Umbellula lindahli*. Fan-like (16.0%) and stick-like (9.2%) corals were also somewhat abundant.



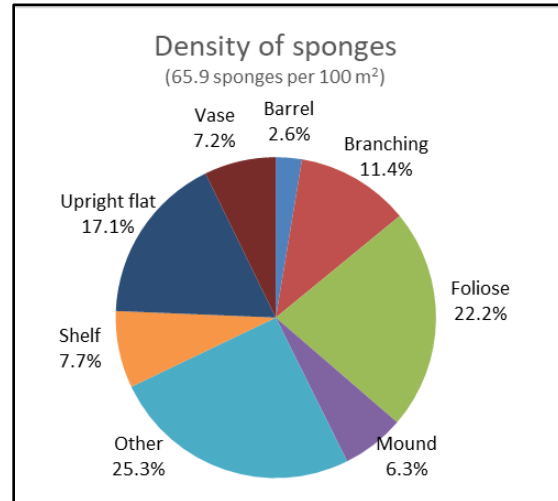
Colors in the pie diagram match colors in the list of coral taxa (below).

Scientific name	Common name	Number
<i>Anthoptilum grandiflorum</i>	feather boa sea pen	12
<i>Chromoplexaura marki</i>	red stick coral	1
<i>Desmophyllum pertusum</i>	white cup coral	2
<i>Halipterus californica</i>	sea pen	5
<i>Heteropolypus ritteri</i>	mushroom coral	3
<i>Paragorgia</i> spp.	sea fan (white with red polyps)	20
<i>Parastenella ramosa</i>	primnoid	1
<i>Pennatula phosphorea</i>	phosphorescent sea pen	1
Pennatulacea #1	sea pen (thin)	3
Plexauridae #1	<i>Swiftia</i> type (red w/ white polyps)	10
Plexauridae #3	<i>Swiftia</i> type (red w/ unknown polyps)	1
<i>Umbellula lindahli</i>	droopy sea pen	72

Two coral specimens were collected during dives at Sverdrup Bank and sent to experts for identification. Shipboard identifications were 1 specimen of Plexauridae and 1 specimen of *Paragorgia* spp. Verified identifications from experts are still pending.

BIOLOGICAL ENVIRONMENT: SPONGES (Sverdrup Bank)

A total of 994 individual sponges from at least 19 different taxa were enumerated from 6 quantitative transects conducted during Dive 0036-0037 on Sverdrup Bank in the Southern California Bight. An overall density of 65.9 sponges per 100 m² of seafloor was calculated. Other sponges were the most abundant taxa consisting of both *Asbestopluma* species, tube sponges and the stalked sponge, *Stylocordyla* spp. Other abundant taxa were foliose (22.2%), upright flat (17.1%), and branching (11.4%) corals.



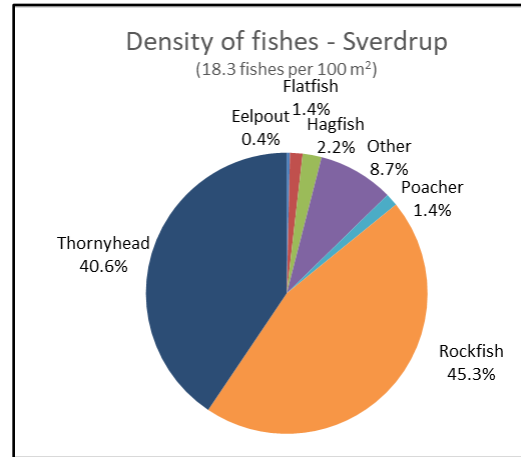
Colors in the pie diagram match colors in the list of sponge taxa (below).

Scientific name	Common name	Number
<i>Asbestopluma</i> spp. #1	predatory pipecleaner sponge	221
<i>Asbestopluma</i> spp. #2	predatory sponge (clear)	2
<i>Farrea occa</i>	lace foliose sponge	4
<i>Heterochone calyx</i>	fingered goblet vase sponge	7
<i>Poecillastra</i> spp.	fringed shelf sponge	17
<i>Polymastia</i> spp. #2	nipple foliose sponge (yellow)	2
Porifera #1	unidentified foliose sponges	189
Porifera #10	unidentified sponge (blue/white)	12
Porifera #2	unidentified upright flat sponges	170
Porifera #3	unidentified barrel sponges	26
Porifera #4	unidentified shelf sponges	60
Porifera #5	unidentified vase sponges	65
Porifera #6	unidentified mound sponges	46
Porifera #7	unidentified branching sponge	69
Porifera #8	unidentified tube sponge	2
Porifera #9	unidentified puffball mound sponge	5
<i>Rhizaxinella gadus</i>	club sponge	45
<i>Stylocordyla</i> spp.	stalked sponge	26
<i>Thenea muricata</i>	foliose sponge (clear)	26

Five sponge specimens were collected during dives on Sverdrup Bank and sent to experts for identification. Shipboard identifications were stalked sponge (1 specimen), yellow ball on small stalk sponge (1 specimen), white pore plate sponge (1 specimen), branched sponge (1 specimen), and hairy barrel sponge (1 specimen). Verified identifications from experts are still pending.

BIOLOGICAL ENVIRONMENT: FISHES (Sverdrup Bank)

At least 22 taxa of fishes were identified from 6 quantitative transects conducted during Dive 0036-0037 on Sverdrup Bank in the Southern California Bight. A total of 276 individual fishes were enumerated. An overall density of 18.3 fishes per 100 m² of seafloor was calculated. Rockfishes (*Sebastes* spp. [mostly blackgill rockfish, *S. melanostomus*], 45.3%) and thornyheads (*Sebastolobus* spp., 40.6%) dominated the fish assemblage. The remaining taxa included Other fishes (mostly *Icelinus* sculpins, 8.7%), hagfishes (2.2%), poachers (1.4%), flatfishes (1.4%) and eelpouts (0.4%). The diversity of fishes appeared lower on this offshore bank.



Colors in the pie diagram match colors in the list of fish taxa (below).

Only 3 sponges (0.3%) of the 1,125 corals and sponges had a fish association within one body length. The sponge taxa were a foliose, upright flat, and a shelf sponge. A blackgill rockfish was associated with each of the three sponge taxa.

Scientific name	Common name	Number
Agonidae	unidentified poachers	1
<i>Cataetyx rubrirostris</i>	rubynose brotula	3
<i>Eptatretus</i> spp.	unidentified hagfish	6
<i>Icelinus</i> spp.	<i>Icelinus</i> sculpins	18
<i>Lycenchelys crotalinus</i>	snakehead eelpout	1
<i>Lyopsetta exilis</i>	slender sole	1
<i>Merluccius productus</i>	Pacific hake	1
<i>Microstomus pacificus</i>	Dover sole	3
<i>Plectobranthus evides</i>	bluebarred prickleback	1
Scyliorhinidae egg cases	cat shark egg cases	1
<i>Sebastes aurora</i>	aurora rockfish	9
<i>Sebastes babcocki</i>	redbanded rockfish	1
<i>Sebastes diploproa</i>	splitnose rockfish	13
<i>Sebastes helvomaculatus</i>	rosethorn rockfish	1
<i>Sebastes melanostomus</i>	blackgill rockfish	49
<i>Sebastes rufus</i>	bank rockfish	9
<i>Sebastes simulator</i>	pinkrose rockfish	1
<i>Sebastes</i> spp.	unidentified rockfishes	7
<i>Sebastes zacentrus</i>	sharpchin rockfish	1
<i>Sebastolobus alascanus</i>	shortspine thornyhead	5
<i>Sebastolobus altivelis</i>	longspine thornyhead	35
<i>Sebastolobus</i> spp.	thornyheads	72
<i>Sebastomus</i>	unidentified <i>Sebastomus</i>	34
<i>Xeneretmus leiops</i>	smootheye poacher	3

IMAGE GALLERY (Sverdrup Bank)

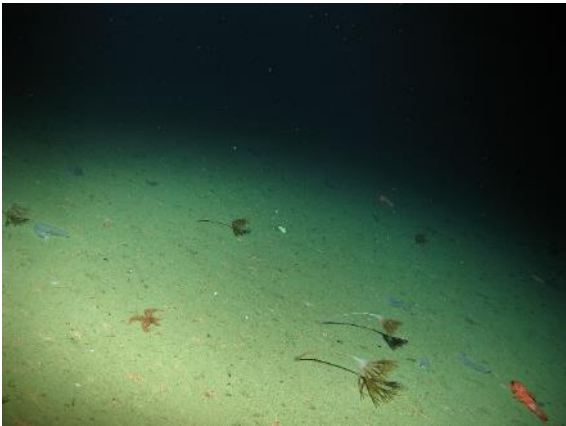
A sponge, *Rhizaxinella gadus*, and a *Rathbunaster californicus* seastar at 311 m.



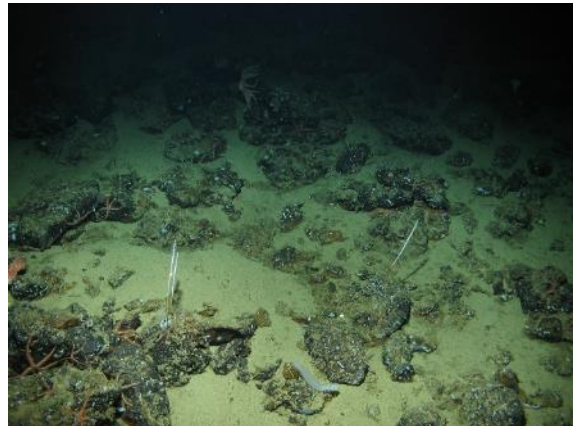
A basketstar, *Gorgonocephalus eucnemis*, on a dead vase sponge at 262 m.



Several *Umbellula lindahli* on a soft sediment seafloor at 621 m.



Predatory sponges, *Asbestopluma* spp., on a cobble seafloor at 402 m.



ADDITIONAL COMMENTS (Sverdrup Bank)

No anthropogenic debris items were documented during dives at Sverdrup Bank.

No corals and 7 sponges (3 *Heterochone calyx*, 1 upright flat, 2 barrels, and 1 vase sponge) had broken areas. Four sponges (2 *Heterochone calyx* and 2 vase sponges) and no corals were knocked over. Eight dead or dying sponges and 1 coral were observed at Sverdrup Bank.

CONCLUSIONS AND NEXT STEPS

The large number of partners and expertise involved in this cruise made it possible to successfully collect an enormous amount of data that will be used to address a variety of critical research and management priorities across multiple agencies. Of this 31-day survey, only one day was completely lost to poor weather. Surveying from central Oregon to southern California provided a unique opportunity to examine the distribution of DSCS and fishes along roughly 1,000 miles of coastline. This 2018 EXPRESS mission is a great example of what can be accomplished when resources, technology, and expertise are strategically leveraged.

Deep-Sea Corals and Sponges

One of the most impressive finds of the cruise were the coral gardens (as defined by Henry and Roberts, 2014) at Mendocino Ridge. Overall coral density was 612.5 corals per 100 m² with >29,000 corals counted in 9 quantitative transects (Table 5). Two sponge gardens were also observed, one at Daisy Bank and the other at Mendocino Ridge. Densities at each location were a little over 100 sponges per 100 m². These coral and sponge garden areas were rare; most surveys during this mission showed much lower densities including Delgada Canyon with only 20 sea pens and northeast Santa Cruz Island with zero sponges observed (Table 5).

Table 5. Overall coral, sponge, and fish densities and the proportion of fish associations with corals and sponges per each site on the 2018 EXPRESS cruise.

Site	Density (#/100m ²)			
	Coral	Sponge	Fish	Fish associations
Daisy Bank	15.3	102	47.5	16.1
Heceta Bank	17.2	14.2	15.9	5.0
Bandon High Spot	13.2	1.9	29.1	6.0
Brush Patch	10.4	0.9	9.5	4.0
Eel River Canyon	5.8	2	14.6	6.0
Mendocino Ridge	612.5	103.4	6.7	2.0
Delgada Canyon	1	0.3	29.3	0.0
Pt. Arena Biogenic Area	4.6	11.5	21.9	0.2
Sur Slot Canyons	102.2	9.2	87.9	0.4
La Cruz Canyon	1.9	12	18.3	1.8
Gull Island (SCI)	8.1	22.4	13.3	0.4
NE Santa Cruz Island	31.6	0	93.8	0.2
Santa Lucia Bank	2.7	22.4	16.6	0.6
Pt. Conception	2.9	6.5	25.6	0.7
Sverdrup Bank	8.7	65.9	18.3	0.3
Average	55.873	24.973	29.89	2.9

Range Observations and Range Extensions

Many species of corals were observed near the edge of their known ranges, with some noted range extensions. The northern species of *Primnoa pacifica* and *Stylaster parageus* were found south to Mendocino Ridge and were the first observations in California waters (the previous southern limit was Washington; Meredith Everett, Pers. Comm.). *Calcigorgia cf japonica* was observed as far south as southern Oregon (Bandon High Spot) which was a range extension with a previous southern limit of Washington (Meredith Everett, Pers. Comm.). Some species of corals were only observed south of Point Conception, CA, including *Acanthogorgia* spp., *Antipathes dendrochristos* (only observed off transect), *Eugorgia rubens* (only observed off transect), *Leptogorgia chilensis*, and *Adelogorgia phyllosclera* (only observed off transect). Both *E. rubens* and *L. chilensis* have been observed north of

Pt. Conception on other expeditions (Starr and Yoklavich 2008, Whitmire et al., 2017). Depth may have played a role in not observing these species during the current study because in general we sampled deeper north of Pt. Conception (minimum depth 86 m at La Cruz Canyon) than south with a minimum depth of 50 m at Pt. Conception. A newly described species of a small, yellow branching coral (*Chromoplexaura cordellbankensis*) was observed at La Cruz Canyon and Anacapa Island in southern California. Most sponge taxa were observed coastwide; however, some taxa were only observed in the southernmost portion of our study area, including the moldy Swiss cheese sponge (only as far north as Santa Lucia Bank), purple moon sponge, and brown ruffled sponge. Although these sponges appear to be present only in the lower latitudes of our surveys, their distribution may be confounded by depth because relatively shallow dives were only at southern study sites. Further analysis is needed to assess the distributional pattern of some sponges.

Fishes

Similar to the corals and sponges, some fishes showed latitudinal variation, with some species observed at the limit of their range, although no range extensions were observed. Four species were observed at the edge of their latitudinal range. Aleutian skates and blackfin poachers were observed near the southern end of their ranges (Pt. Arena Biogenic Area and Eel River Canyon, respectively), while greenblotched and chameleon rockfishes were both seen near the northern edge of their ranges (Delgada Canyon and Pt. Arena Biogenic Area, respectively; Love and Passarelli, 2020). Two notable fish observations occurred at Santa Lucia Bank. First, numerous darkblotched rockfish were observed often congregating in groups of 4-5 individuals, which is an unusually high number of fish to find near the southern edge of their distribution. Second, petrale sole were also found in high numbers and often appeared in what could have been small spawning aggregations, suggesting that this bank may be an important spawning area.

EFH Surveys

Baseline surveys were conducted on DSCS and fish to assess densities, condition, and distribution in 10 EFH areas that underwent fishing regulation changes as part of Amendment 28, implemented 01 January 2020 (5 EFH areas were closed to bottom contact fishing gear and 5 were reopened to bottom contact fishing gear). This baseline information will allow researchers to track potential changes to benthic communities over time and will help resource managers better manage these important areas. In particular, the baseline information collected in newly closed EFH areas, like Mendocino Ridge, can be compared to future surveys and provide data on the potential recovery speed of corals and sponges.

Sverdrup Bank

Previously unexplored Sverdrup Bank had populations of corals, sponges, and fishes that appeared healthy, but the number of taxa were relatively lower than areas nearer to the coast. A lower species count is potentially due to the distance from shore and other banks, which may preclude the dispersal of species with short larval periods. It could also mean that the area is not as productive as sites closer to shore. Sverdrup Bank appeared to be less impacted by marine debris than other sites as no anthropogenic debris was observed, and there were few broken or knocked over corals.

Coral, Sponge, and Fish Associations

Fishes appeared to be more often associated with corals and sponges in the northern portion of our study area than in the south (Table 5). The highest proportion of associations occurred at Daisy Bank where 16% of the corals and sponges had fish-associates, while less than 1% of corals and sponges at each site south of Mendocino Ridge had fish-associates (range of 0.0 - 0.7%). One exception was La Cruz Canyon where 1.8% of corals and sponges had fish-associates. The reasons for these differences are not clear but it is likely that areas with higher densities of fishes and DSCS have a higher probability of associations, or the fish species in the north may seek out DSCS for structure or for feeding purposes. More studies are needed to determine the probable causes for these associations.

Observations of Marine Debris

Low numbers (35 pieces) of anthropogenic debris were found throughout the survey area. Most of the debris consisted of fishing gear (60%) and the rest was trash (mostly glass bottles and cans). Perhaps the reason that the amount of debris was low is due to the depths we surveyed, which were generally

below recreational fishing depths. Also, these areas were far from port and not in areas where pleasure boaters would frequent.

Management Implications

Coastwise surveys like those conducted on this 31-day EXPRESS cruise provide opportunity to conduct distribution and population connectivity studies on DSCS across the West Coast. Visual surveys, eDNA samples, and biological samples of the same or similar species were collected over depths ranging from 50 – 645 m and covering 1,000 mi of coastline for the study area. DSCS, fish, and habitat records generated from the visual survey data will be submitted to the Deep-Sea Coral Research and Technology Program’s National Database (<https://www.ncei.noaa.gov/maps/deep-sea-corals/mapSites.htm>), a publicly accessible and global inventory of DSCS records made for researchers and resource managers. Once analyses are complete, the data will improve our understanding of these valuable and vulnerable DSCS communities and identify areas in need of further research and protection. For example, this information collected in areas currently under evaluation for offshore wind energy development will help guide decisions made by BOEM as to where seabed construction would disturb important DSCS assemblages and habitat the least, if at all. NMFS may also be able to use these data to evaluate the effectiveness of regulatory actions, such as closing areas to bottom trawling through EFH regulations (Amendment 28), for protecting DSCS habitats and supporting commercially fished species that need healthy DSCS habitats. Survey results will also contribute to the understanding of how species distributions change over large latitudinal and depth gradients and can provide insight as to how species ranges may shift in response to environmental changes, such as climate change and ocean acidification. Data such as these are important for NMFS’s ecosystem based approach to management. In addition, West Coast NMS benefit from these data as much of the deeper portions of the sanctuaries visited have yet to be explored or characterized. NMS are mandated to characterize and monitor the status and health of living resources within their boundaries, including DSCS habitats. Thus, this work is, and will continue to be, critical for the ability of sanctuaries to fulfill their Congressional mandates and generate periodic condition reports that track changes to deep-sea benthic communities and evaluate the extent to which sanctuaries provide necessary protection.

Ultimately, restrictions on laboratory use as a result of the COVID-19 pandemic has caused delay in many of the lab-based analyses. Once restrictions ease, results from eDNA, genetics, and population connectivity studies are anticipated to become available soon thereafter.

Data disposition

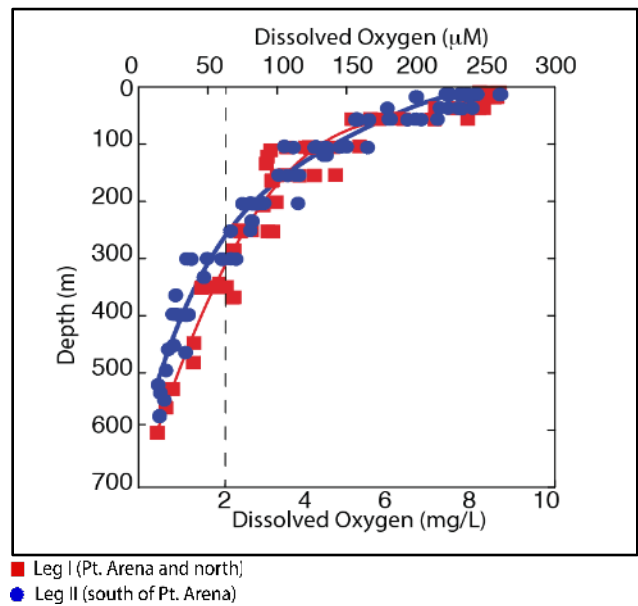
Disposition and contact information for data collected during this expedition.

Data type	Contact	Institution	Email
fish/coral/sponge counts	Tom Laidig	NMFS - SWFSC	tom.laidig@noaa.gov
Water chemistry and CTD	Nancy Prouty	USGS	nprouty@usgs.gov
Transect and mapping	Diana Watters	NMFS - SWFSC	diana.watters@noaa.gov
DNA/eDNA	Meredith Everett	NMFS - NWFSC	meredith.everett@noaa.gov

Latitudinal changes in oceanographic variables

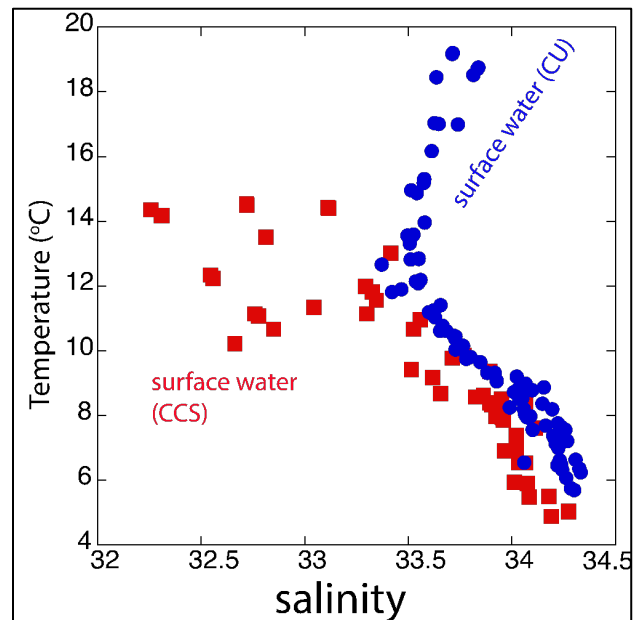
Dissolved oxygen

Dissolved oxygen (DO) concentrations decreased with depth. Corals observed at depths greater than 300 m are living within the oxygen minimum zone (OMZ, < 2 mg/L). Dissolved oxygen levels were generally lower at depths below 200 m in the northern half of the survey compared to the southern half. Our dives were limited to ~600 m.



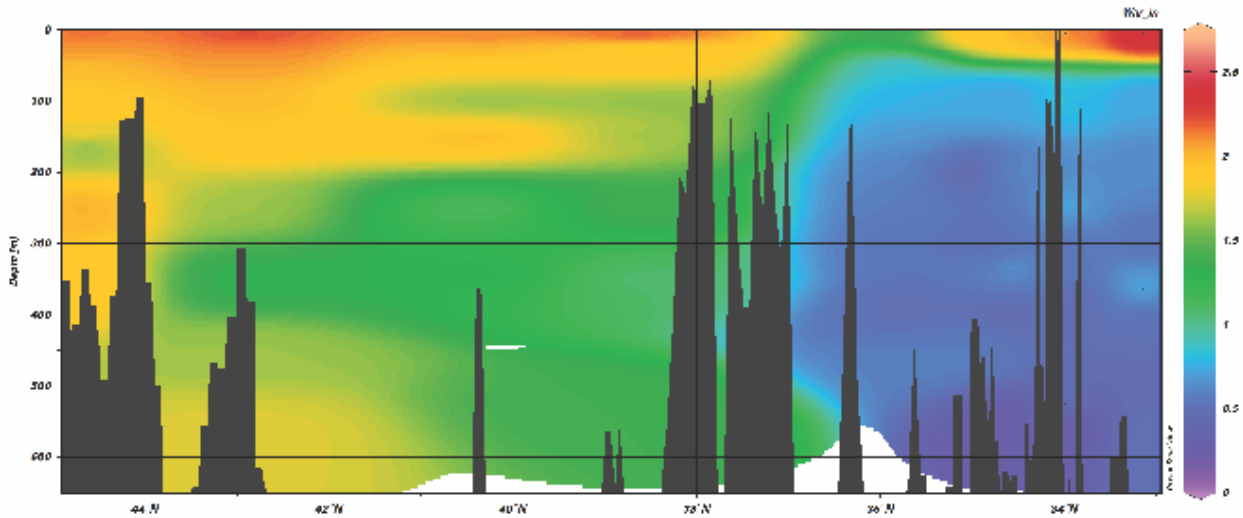
Temperature and Salinity

Surface water (<100 m) characteristics differ between Leg I and Leg II, with cooler, fresher water to the north and more saline, warmer surface water to the south. Surface waters to the north were also depleted in radiocarbon ($\Delta^{14}\text{C}$), potentially reflecting stronger upwelling drivers by equatorward flowing California Current System (CCS) compared to the poleward flowing California Undercurrent (CU) in the south that is more saline and warmer.



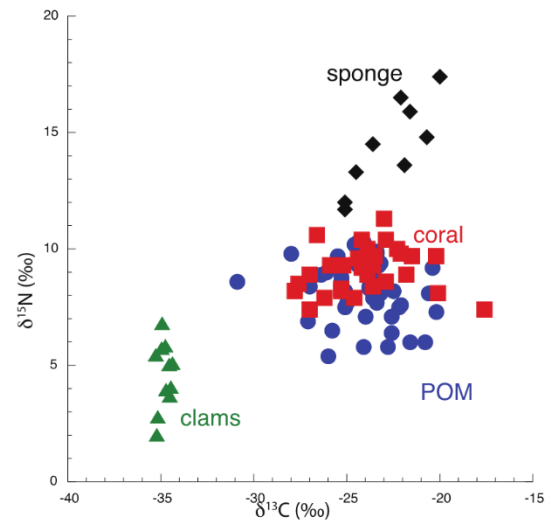
Aragonite Saturation levels

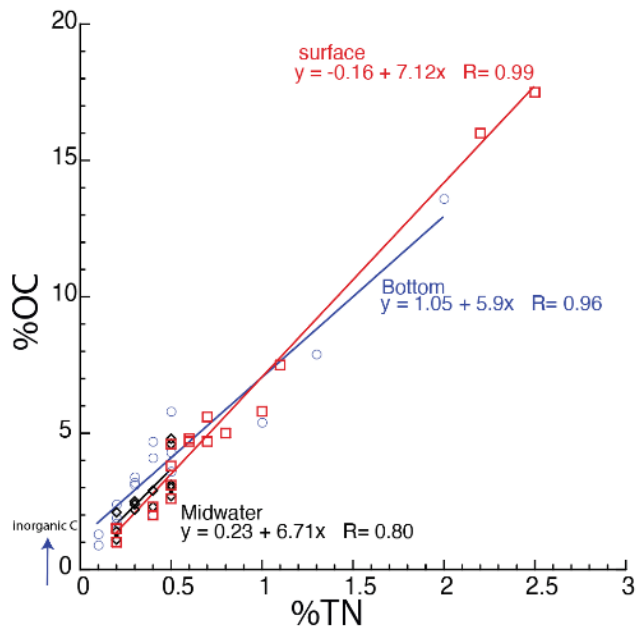
Along the coast of California and Oregon, surface waters are saturated, with aragonite saturation state greater than 1 ($\Omega_{\text{arag}} > 1$). At depth, carbonate chemistry parameters are favorable for calcifying organisms north of Pt. Arena (38.9°N) where pH varied between 7.8 and 8.1. However, conditions south of Pt. Arena suggest that scleractinian corals are exposed to undersaturated seawater, inhibiting the formation of aragonite and favoring dissolution with pH values between 7.2 and 8.1. Therefore, the shallow aragonite saturation horizon (ASH) south of Pt. Arena has potential impacts to deep-sea ecosystems, such as decreased calcification rates (e.g., Gomez et al., 2018).



Stable carbon and nitrogen

Stable carbon ($\delta^{13}\text{C}$) and nitrogen ($\delta^{15}\text{N}$) results indicate isotopically distinct feeding groups, comprising at least two trophic levels (clams, coral, and sponges). Analysis of variance (ANOVA) was used to determine differences in isotope composition and post-hoc Tukey tests used to assess significance in means between species. Chemosynthetic clams occupy a distinct isotopic niche, consistent with dependency on carbon fixed via their chemoautotrophic endosymbionts, whereas photosynthetically fixed carbon dominates the carbon pool for corals and sponges. The POM ($\delta^{13}\text{C}$) values suggest that the corals are feeding on POM that is primarily derived from marine phytoplankton and bacterioplankton OM sources (Hansman and Sessions, 2016). The ^{15}N -enriched sponge values suggest potential particle selection (Rau et al., 1990) via active resuspension. In comparison, the ^{15}N -depleted values from the vesicomyid clams indicates uptake of a local nitrogen source rather than particulate organic nitrogen.





Particulate Organic Matter

Plot of POM percent total nitrogen (%TN) versus percent organic carbon (% OC) shows near zero intercepts, indicating that the majority of nitrogen is organic. However, the positive %OC intercept of the bottom water POM samples suggest input from inorganic carbon sources.

For Further Study

Further explorations at the coral garden at Mendocino Ridge would help determine the extent of coverage of this unique area with the highest densities of corals recorded on the United States West Coast to date. Surveys could be extended deeper and to the north and south of the ridge to better understand the extent of this area of high coral abundance. Now that the essential fish habitats (EFH) modifications are in place, new surveys conducted within and around these modified EFH areas will enable monitoring for changes related to increased fishing pressure or to examine the potential and rate of recovery of coral and sponge species in newly closed areas. Further studies include examining the relationship between seep-related structures (such as authigenic carbonates) and the distribution of deep-sea coral and sponge (DSCS) habitats.

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