

CRUISE REPORT
RE-DISCOVERING CORDELL BANK: DIVE EXPEDITION 30 YEARS LATER



Photo credit: Joe Hoyt/NOAA

CRUISE DATES: October 6-11, 2010

CBNMS CRUISE NUMBER: 2010_7

VESSEL: R/V FULMAR

NOAA
CORDELL BANK NATIONAL MARINE SANCTUARY
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OVERVIEW OF OPERATIONS:

For the first time since the designation of the Cordell Bank National Marine Sanctuary (CBNMS) in 1989, and thirty years after the initial exploration of Cordell Bank by SCUBA divers from the non-profit group Cordell Expeditions, technical scientific SCUBA divers revisited the shallowest parts of Cordell Bank's reef crest (123-193ft) on October 7-9th, 2010, deploying off of the NOAA research vessel *Fulmar*. Cordell Bank National Marine Sanctuary staff, Office of National Marine Sanctuary (ONMS) technical divers, University of North Carolina-Wilmington, NOAA's Cooperative Institute for Ocean Exploration, Research and Technology (CIOERT), University of California-Davis Bodega Marine Laboratory, California Academy of Sciences, and Cordell Expeditions collaborated to put SCUBA divers on Cordell Bank and test the feasibility of using technical divers for accomplishing scientific tasks. Six technical dives were completed in rigorous conditions at five sites on Cordell Bank, with the dive teams successfully accomplishing all of the project's science and outreach objectives. Diving was not possible on three of the planned days due to high winds and large seas that prevented the boat from arriving in Bodega Bay for the start of the cruise and prevented dives from taking place on the last two days of the cruise. Divers collected samples to be archived and identified by the California Academy of Sciences and photos/videos were collected to document and characterize the habitat and communities of the upper reaches of the Bank. Data collected during this mission will be used to compare the invertebrate and fish communities to historical conditions, using photos/video from 30 years ago, and will serve as a baseline upon which to measure future change.

ITINERARY:

October 5 – Due to high winds and seas, the vessel did not come north to Bodega Bay on October 4th, as originally planned.

October 6 – Vessel arrived at Spud Point Marina at 1300. Additional supplies were loaded onto the vessel and diver safety drills were completed.

October 7 – At 0735, departed Bodega Harbor for Cordell Bank. At 10:15, first dive team in the water at Northern East Ridges site. At 1235, second dive team in the water at Northern East Ridges site. Completed two successful dives. Arrived back in Bodega Harbor at 1600.

October 8 – At 0745, departed Bodega Harbor for Cordell Bank. At 1045, first dive team in the water at Craine's Point site. At 1315, second dive team in the water at Northern West Ridge site. Completed two successful dives. Arrived back in Bodega Harbor at 1655.

October 9 – At 0745, departed Bodega Harbor for Cordell Bank. At 1045, first dive team in the water at Middle Ridge site. At 1330, second dive team in the water at South Central Plateau site. Completed two successful dives. Arrived back in Bodega Harbor at 1600.

October 10 – At 0745, departed Bodega Harbor for Cordell Bank. At 0845, a decision was made to cancel operations and return to Bodega Harbor due to high winds and seas. Weather for the next two days was predicted to get worse, so the rest of the cruise was cancelled. Finished demobilization at 1400.

October 11 – Operations cancelled due to weather. Spent morning cleaning the vessel.

October 12 – Operations cancelled due to weather. Vessel transited south.

SCIENTIFIC GOALS AND OBJECTIVES:

1. Collect data of invertebrate distribution and abundance to assess spatial variability in density, species composition, and species richness and determine habitat associations.
2. Collect invertebrate specimens to: a) obtain representatives of target taxa for archival at California Academy of Sciences (CAS); b) photo-document samples in situ for potential field identification guide based on laboratory identifications; c) target tunicates for identifying a potential invasive species; c) target hydrocoral (*Stylaster sp.*) for identification (genetic & morphological) and reproductive analyses, target sponges for species identification.
3. Revisit sampling sites of Cordell Expeditions from the 1970s and 1980s and collect data and specimens to assess qualitative changes in community composition over time and to compare samples with historic collection archived at CAS.
4. Collect high definition video and still images for general site characterization of the habitats and species composition of the reef crest environment.

EDUCATION/OUTREACH GOALS AND OBJECTIVES:

1. Collect high definition video and still images for education/outreach: a) habitats and species composition of reef crest environment; b) divers working on Cordell Bank.
2. To incorporate information and images into outreach and education materials to increase the awareness and appreciation for the habitat and resources protected by CBNMS.
3. To create an Office of National Marine Sanctuaries (ONMS) expedition web site.

METHODS and RESULTS:

Six technical dives were completed in rigorous conditions on Cordell Bank with the dive teams successfully accomplishing all of the science and outreach objectives. Diving was not possible on three of the planned days due to high winds and large seas that prevented the boat from arriving in Bodega Bay for the start of the cruise and prevented dives from taking place on the last two days of the cruise.

Dives were completed on Cordell Bank using a team of six technical divers and four safety support divers. Each dive included two science divers and one safety diver on the bottom, as well as two mid-water science support divers who assisted in gear transfer during decompression drifts. Technical divers breathed a trimix of gases during their time on the bottom, and switched to nitrox and oxygen during decompression stages.

Dives were conducted at five sites – one site (Northern East Ridges) was surveyed on two dives conducted by two dive teams, while all other sites were only surveyed with one dive conducted by a single dive team (Table 1). Three of the dive locations (Northern East Ridges, Craine's Point, Northern West Ridge) represented historic Cordell Expedition dive locations (1980s), while two of the dive locations (Middle Ridge, South Central Plateau) represented locations where Delta submersible dives have taken place (2002-2005) (Figure 1). Depths of the dive sites

ranged from 123-193 feet. Bottom time ranged between 20 and 30 minutes, while total dive time (including decompression drift) ranged between 56 and 73 minutes. Bottom currents were estimated at 0.5 to 2 knots and visibility ranged from 30 to over 100 feet at the different dive sites.

Dive sites were located and marked using a combination of waypoints, assessment of benthic habitat layers in real-time (using GNAV software with a GPS feed of the vessel's position), and assessment of fathometer readings. A grappling anchor with a line and surface float were deployed on the up-current and deeper side of the desired waypoint. As a result, the divers were able to follow the line down and reach the shallow targeted waypoint. Overall, the divers felt that it was fairly easy to land on the targeted location using this method. Upon reaching the bottom, divers carried out their respective tasks, which included video and still image documentation and biological specimen collection. In general, the dives included ten minutes of photo quadrat image collection, ten minutes of biological specimen collection, and ten minutes of general documentation of the habitats and communities.

The benthic community and habitat were sampled by taking digital photographs of a 0.25m x 0.25m PVC quadrat frame that was haphazardly placed on the substrate (Appendix 1). Photo quadrat images were taken approximately 2-3 m apart. Between zero and eleven photo quadrats were photographed at each site (Table 1). Macro photos were taken on the second dive of October 9th at South Central Plateau in lieu of quadrat photos. Photo quadrat images will be analyzed to assess presence of species/taxa and to determine invertebrate species composition.

Video footage was acquired throughout the dives and fulfilled the objectives of assessing the reef top community and habitats as well as documenting technical divers carrying out tasks on the Bank. In addition, divers collected one 360 degree panoramic video shot to capture the overall scene of each of the dive locations. Video footage will be used to characterize the benthic community and make qualitative comparisons with past video footage. It will also be used for general sanctuary products, including education and outreach materials.

Biological specimens collected at each of the sites included a variety of invertebrates as well as algae (Appendix 2). Divers were instructed to collect representative invertebrates and algae that they encountered. Collection methods included hand, trowel, and knife techniques. Originally there was an attempt to photograph samples in situ alongside a numbered bag for reference. This became too cumbersome and time-intensive, and still photos of the specimens in situ were no longer taken. Instead, a video image was taken by the second diver while the first diver worked on the specimen collection. Originally, the divers were instructed to place individual specimens in separate bags, and this was carried out on October 7th dives. This method also proved to be too cumbersome and time-intensive, and the method was revised to scoop up clumps of organisms and place the whole lot in a collection bag together. Sponges were still kept in separate bags to prevent co-mingling of spicules that would make identification difficult. Photos were taken of the biological samples during the processing steps before they were preserved in the field. Samples will be identified and catalogued at California Academy of Sciences. One sediment sample was collected at the Craine's Point site and was sent to Mary McGann (USGS) for analysis of past benthic communities.

For each of the dives, divers filled out a series of debrief questions regarding their dive experience and their overall impressions of the natural history of the Bank. These responses will be compiled along with follow-up information from the divers to complete the additional project objective of testing the feasibility of using technical divers for accomplishing science missions on Cordell Bank. The general impression from the technical divers was that SCUBA is a feasible tool for accomplishing some science missions on Cordell Bank.

Overall, the most striking observation from the series of dives on the shallower sections of Cordell Bank was the overall abundance of juvenile rockfish (Appendix 3). Often it was difficult for the divers to obtain a clear shot of the bottom for the photo quadrat images due to the abundance of fish in the field of view. Divers were amazed by the pristine condition and overall abundance, diversity, and color palette of life on and near the seafloor of Cordell Bank.

Minimal evidence of human impact was observed on the dives to the upper reef crest. The only evidence of derelict fishing gear was one lead fishing weight. Another item of interest included a potentially human-created hole with a metal pipe in its center at the Northern East Ridges site. These holes were originally noted and described by Cordell Expeditions. The pipe was left in the hole 30 years ago by Cordell Expedition divers.

In addition to the abundance of life noted on the bottom, there were a large number of marine mammals as well as seabirds observed during the duration of the cruise. For example, on October 8th, there were at least ten humpback whales, two blue whales, and a group of sea lions noted in the vicinity of the vessel while at one station. Even though humpback whales were seen swimming very close to the boat during the dives (i.e., within 100m), divers did not see them sub-surface during the dive. In general, humpback whales were very active on the surface, performing multiple feeding lunges. Swarms of krill and small fish were observed just below the surface.

Information on Cordell Bank and the daily activities of the cruise were posted to an Office of National Marine Sanctuaries (ONMS) expedition web site:

<http://sanctuaries.noaa.gov/missions/2010reefcrest/welcome.html>

High definition video was collected both sub-surface and topside for creating a thirty minute film piece documenting the history of SCUBA exploration of Cordell Bank, the amazing Bank community, as well as the results of the current mission. A three minute film has been produced that provides a concept piece for a longer film.

SCIENTIFIC PERSONNEL:

<u>Name</u>	<u>Position</u>	<u>Organization</u>
Dan Howard	Chief Scientist	Cordell Bank National Marine Sanctuary
Kaitlin Graiff	Biologist	Cordell Bank National Marine Sanctuary
Dale Roberts	Biologist	Cordell Bank National Marine Sanctuary
Lisa Etherington	Biologist	Cordell Bank National Marine Sanctuary
Bob van Syoc	Biologist	California Academy of Sciences
Dana Carrison	Biologist	California Academy of Sciences
Greg McFall	Technical Diver/ NOS Diving Officer	Gray's Reef National Marine Sanctuary
Joe Hoyt	Technical Diver	Monitor National Marine Sanctuary
Tane Casserly	Technical Diver	Office of National Marine Sanctuaries
Russ Green	Technical Diver	Thunder Bay National Marine Sanctuary
Doug Kesling	Technical Diver/ Diving Supervisor	Cooperative Institute for Ocean Exploration, Research and Technology
Thor Dunmire	Technical Diver	Cooperative Institute for Ocean Exploration, Research and Technology
Robert Schwemmer	Science Support Diver	Office National Marine Sanctuaries
David Dann	Science Support Diver	University of California-Davis
Matt Robart	Science Support Diver	University of California-Davis
David McGuire	Science Support Diver/Filmmaker	Sea Stewards
Lou Douros	Filmmaker	

DISPOSITION OF DATA:

Video tapes, still images, and physical data from the cruise are stored at the Cordell Bank National Marine Sanctuary office, 1 Bear Valley Road, Point Reyes Station, CA 94956. Specimens are housed at California Academy of Sciences.

Table 1. Summary of dives conducted on Cordell Bank.

Date	Dive #	Site	Bottom depth (ft.)	Latitude	Longitude	Science diver 1 (still camera & specimens)	Science diver 2 (video camera)	Bottom safety diver	# Photo quadrats	Photo quality	Video quality	Specimens collected?
2010_1007	1	Northern East Ridges	142	38°01.821' N	123°25.101' W	Joe Hoyt	Russ Green	Thor Dunmire	11	good	good	yes
2010_1007	2	Northern East Ridges	130	38°01.821' N	123°25.101' W	Greg McFall	Tane Casserley	Doug Kesling	8	good	good	yes
2010_1008	1	Craine's Point	175	37°59.01' N	123°25.631' W	Joe Hoyt	Russ Green	Thor Dunmire	9	good	good	yes
2010_1008	2	Northern West Ridge	139	38°01.230' N	123°27.100' W	Greg McFall	Tane Casserley	Doug Kesling	8	good	good	yes
2010_1009	1	Middle Ridge	185	38°01.375' N	123°25.578' W	Joe Hoyt	Russ Green	Thor Dunmire	11	fuzzy	no lights	yes
2010_1009	2	South Central Plateau	193	37°59.533' N	123°24.965' W	Greg McFall	Tane Casserley	Doug Kesling	0	good-macro	good	yes

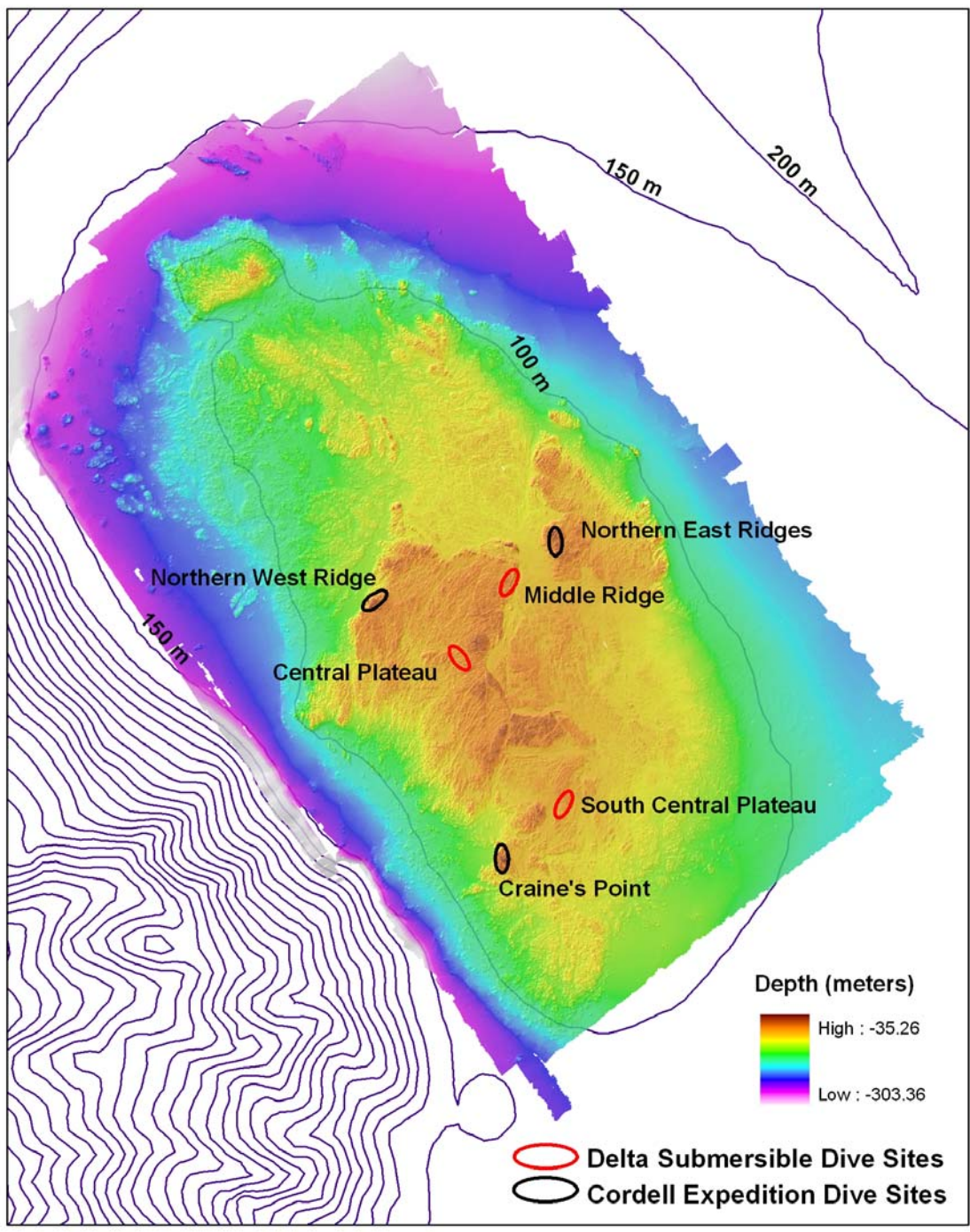


Figure 1. SCUBA dive locations. All sites were sampled except for South Central Plateau. Map created by Lisa Etherington/NOAA

Appendix 1. Representative quadrat photos.



Photo credit: Joe Hoyt/NOAA

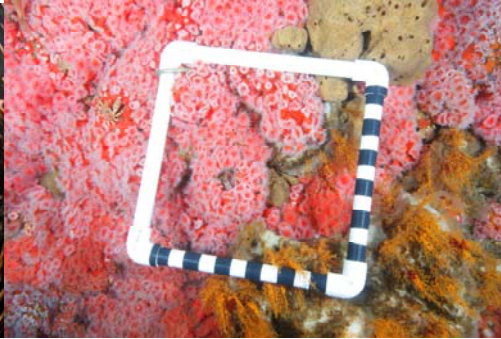


Photo credit: Greg McFall/NOAA



Photo credit: Joe Hoyt/NOAA



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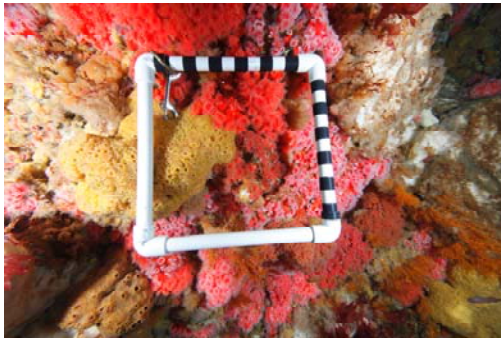


Photo credit: Greg McFall/NOAA



Photo credit: Joe Hoyt/NOAA

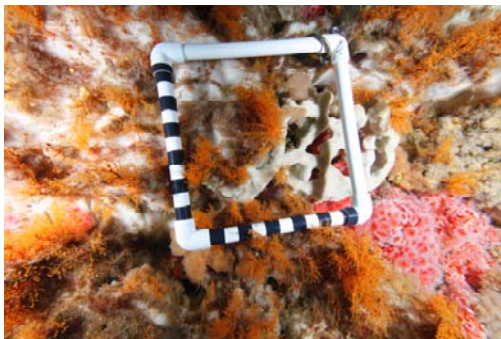


Photo credit: Greg McFall/NOAA

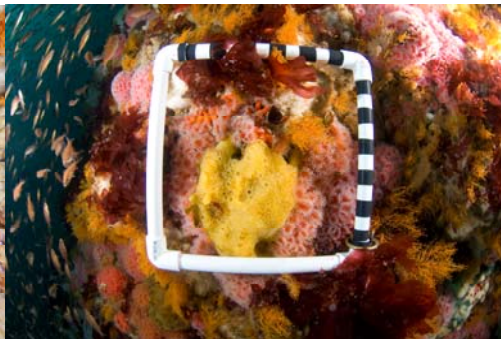


Photo credit: Joe Hoyt/NOAA

Appendix 2. Specimen collections

The following is a general summary of specimens collected on each of the dives. A final list of specimens with verified identifications will be provided at a later date. These specimens will be curated at California Academy of Sciences and will be searchable in their Invertebrate Zoology database.

Oct.7, 2010

Dive #1: Porifera, Decorator crab, hydroid, *Corynactis californica*, *Megabalanus californicus*, *Balanus nubilus*, *Stylaster sp.* (californicus?), lots of amphipods

Dive #2: *Stichopus sp.*?, *Ansidoris nobilus*?, *Corynactis californica*, Porifera (2spp?), hydroid

Oct.8, 2010

Dive #1: *Ansidoris nobilus*? (5), *Corynactis californicus*, *Stichopus sp.*?, Porifera, Hydroid, *Henricia sp.*, *Calliostoma annulatum*, *Calliostoma ligatum*, *Stylaster sp.*, Bryozoan (branching and encrusting), Decorator crab, *Balanus nubilus*, *Megabalanus californicus*, Whelk, Amphipods, Caprellids

Dive #2: Opisthobranch, flat worms, Tunicate, Decorator crab, Porifera, *Megabalanus californicus*, *Balanus nubilus*, Hydroid, Brittle stars, *Calliostoma annulatum*, *Corynactis californica*, Bryozoan, Scallop, Brachiopod, Caprellids, Amphipods

Oct.9, 2010

Dive #1: Scallop (giant), *Stylaster* (2 spp?), crab, Porifera (4 spp?), Brittle star, *Henricia sp.*, Slime star, cookie cutter star, Bryozoan (branching), *Calliostoma annulatum*, *Corynactis californica*, *Pedicularia californica*

Dive #2: *Stichopus sp.*?, baseball sponge, bat star, *Metridium sp.*, large rock, small scallops, keyhole limpet, brachiopod, chitons, encrusting bryozoan, small solitary sponges

Appendix 3. Representative photos of juvenile rockfish observed on Cordell Bank.



Photo credit: Joe Hoyt/NOAA



Photo credit: Greg McFall/NOAA



Photo credit: Greg McFall/NOAA



Photo credit: Greg McFall/NOAA



Photo credit: Joe Hoyt/NOAA