

Photo: basket star, white-plumed anemone, and young-of-year rockfish; DFW/MARE



NORTH COAST REMOTELY OPERATED VEHICLE SURVEYS

Much of the rocky reef habitat offshore of California is at depths that make exploration, monitoring, and research difficult. Traditional SCUBA surveys usually occur shallower than 100 feet (30 meters), which significantly limits direct human observation to a narrow band of habitats near shore. In 2013, the federal Coastal Impact Assistance Program ([CIAP](#)) awarded the California Department of Fish and Wildlife (DFW) a \$1.9 million grant. This enabled researchers to conduct an extensive, three-year survey of habitats inside and outside California's marine protected areas (MPAs)

using robotic technology. This resulted in the first comprehensive statewide survey of deeper rocky habitats within California's state waters. This report presents an overview of key findings from the 2014 North Coast portion of the survey and highlights differences between this region and other areas of the coast. The North Coast MPA region encompasses California's jurisdictional ocean waters (0-3 nautical miles [nm] from shore, including offshore rocks) from the California-Oregon border south to Alder Creek near Point Arena in Mendocino County.



Photo: DFW and MARE crew launch the Beagle ROV; DFW/MARE

DFW collaborated with [Marine Applied Research and Exploration](#) (MARE) to deploy MARE's remotely operated vehicle (ROV) the *Beagle* to survey 138 deep rocky habitat locations between the US-MEX and CA-OR borders. Surveys targeted depths between 20 and 100 meters in addition to four deep submarine canyon sites with depths up to 400 meters.

METHODS

In the summer of 2014, DFW and MARE carried out a joint 25-day expedition in the North Coast MPA region, combining MARE's [baseline funded MPA monitoring surveys](#) with the CIAP grant surveys. Altogether, 40 locations, including seven MPAs, were visited between Point St. George (Del Norte County) and Albion (Mendocino County). By combining resources, DFW and MARE maximized ship time and were able to visit locations not previously explored, especially at remote areas such as Cape Mendocino.

The ROV *Beagle* was “flown” by remote control via its umbilical tether, with the research vessel following using real world GPS positions acquired from an acoustic tracking system (Figure 1). Video swath transects were preplanned using bathymetry maps and then flown by the ROV pilot who navigated using a live mapping computer screen of the acoustic tracking system and shipboard GPS. Sites were chosen within rocky habitat areas identified from seafloor bathymetric mapping data. These sites typically ranged between 20 and 100 meters deep and were spread across the depth range of the rocky reef in a particular area.



Photo: giant Pacific octopus and yelloweye rockfish; DFW/MARE

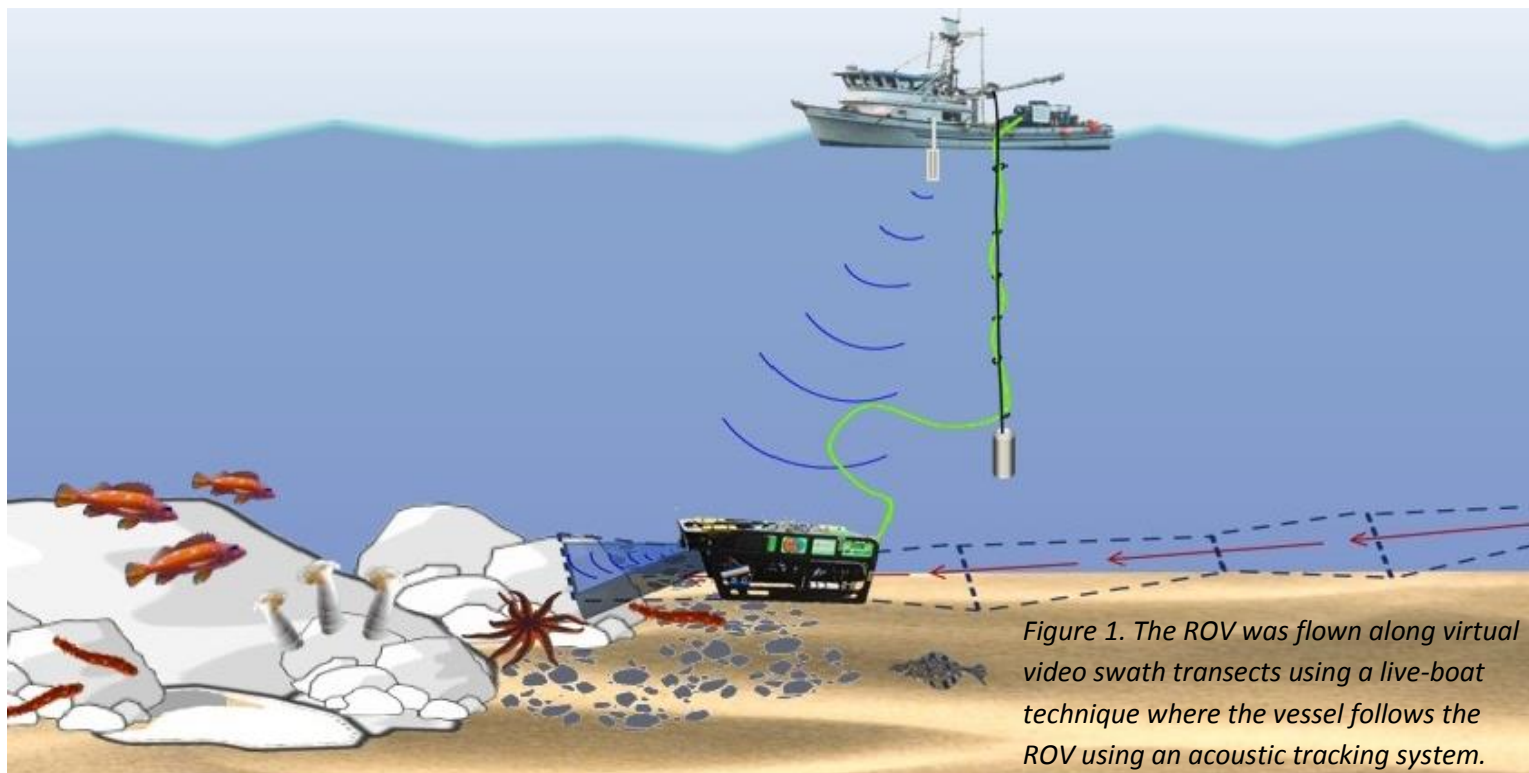


Figure 1. The ROV was flown along virtual video swath transects using a live-boat technique where the vessel follows the ROV using an acoustic tracking system.

RESULTS

The North Coast MPA region ROV surveys completed 60 kilometers (37 miles) of survey lines. Video imagery from 120, 500-meter long (1640 feet), transects was brought back to the lab where MARE's taxonomic experts identified all fish and invertebrates encountered. Tens of thousands of species observations combined with detailed habitat descriptions were compiled in a database with corresponding geographic coordinates of the ROV path to allow analysis of species density, size, and habitat utilization. These surveys will complement the analysis of habitats and species found in all sites surveyed in the statewide study.

Results from the North Coast MPA region video transects analysis shows higher densities and average length of kelp greenling and quillback rockfish when compared to same species in other parts of the state, while vermilion rockfish occurred in lower densities with longer average length (Figure 2). Lingcod sizes were also noticeably larger on the North Coast when compared to statewide averages. The surveys also documented the North Coast's rich and diverse deep-water invertebrate life, with the most abundant invertebrates on rocky habitats the white-plumed anemone and the California sea cucumber.



Photo: lingcod; DFW/MARE

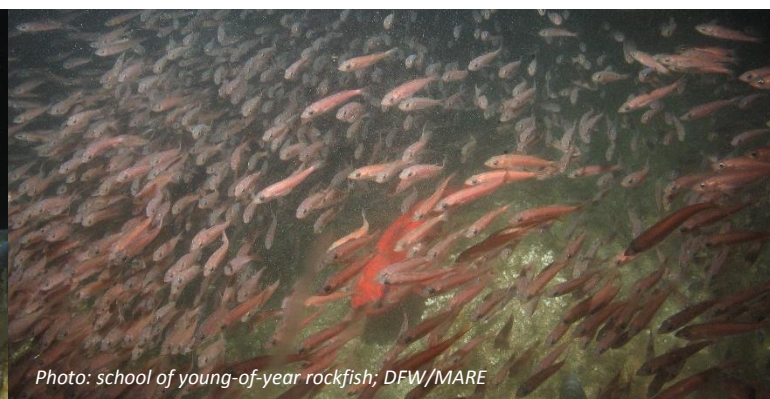


Photo: school of young-of-year rockfish; DFW/MARE

By The Numbers:

34,203	fish observed
81,532	invertebrates
7,500	still images
75	hours of video
60	kilometers surveyed



Photo: California sea cucumbers and male kelp greenling; DFW/MARE



Photo: basket star and quillback rockfish; DFW/MARE



Photo: big skate; DFW/MARE

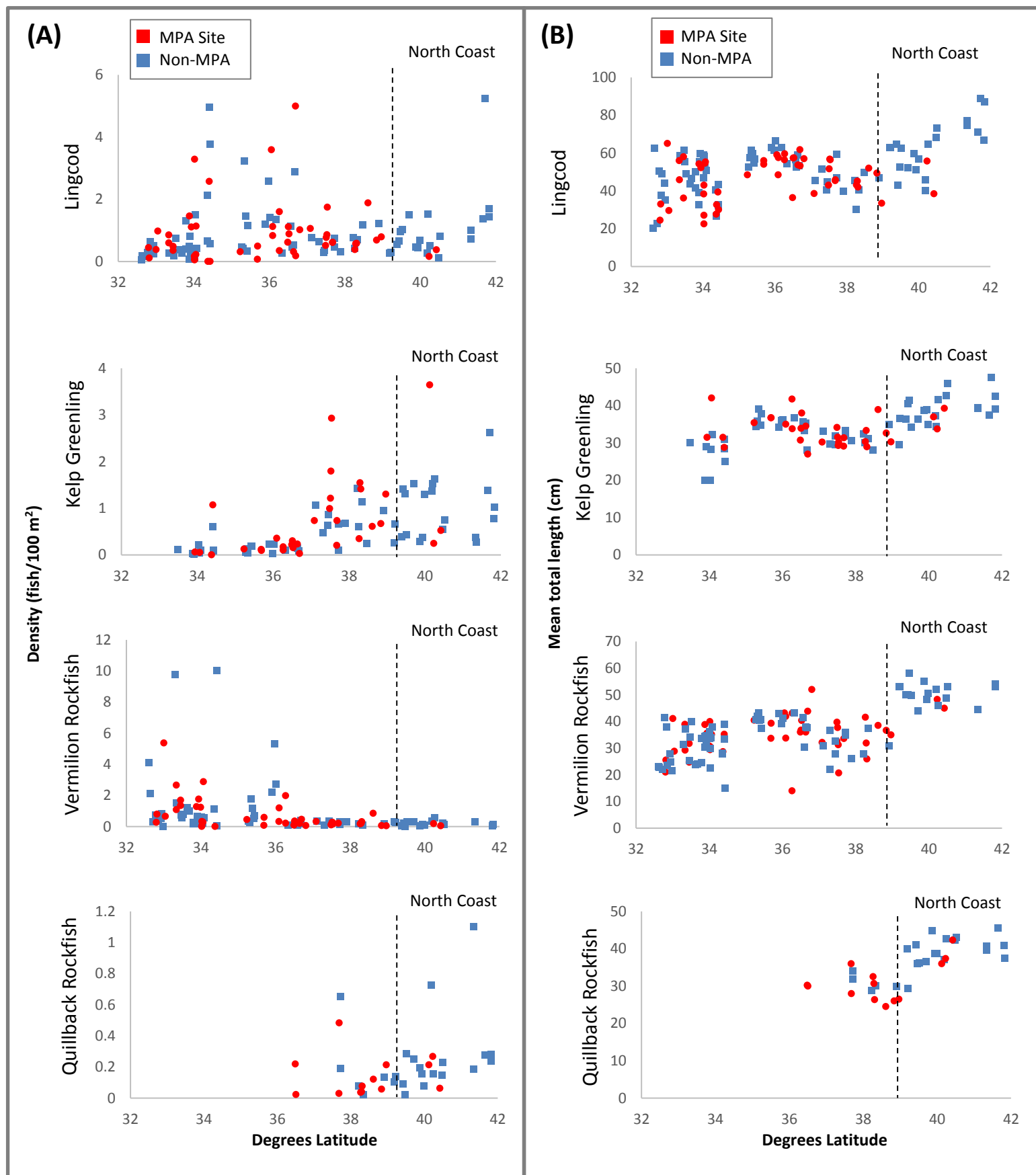


Figure 2. **A)** Mean density and **B)** mean total length of lingcod, kelp greenling, vermilion rockfish, and quillback rockfish plotted against latitude at sites surveyed between 2014 and 2016. Points to the right of the dashed line are within the North Coast MPA region.

NEXT STEPS

An in-depth study is underway exploring the extensive dataset compiled by these surveys. In 2016, DFW—in collaboration with the Ocean Protection Council and the University of California, Davis—hired a post-doctoral researcher tasked with analyzing the entire statewide dataset. This research will focus on modeling

patterns of density and increasing sampling design efficiency for long-term monitoring efforts. The culmination of all ROV statewide survey data will inform the development of long-term monitoring protocols and site selection, as well as provide a baseline for comparison into the future.



Photo: egg-yolk jellyfish, China rockfish, and female kelp greenling; DFW/MARE

Acknowledgements

Author

Michael Prall, DFW, Marine Region
Michael.Prall@wildlife.ca.gov

Document Design

Amanda Van Diggelen, DFW, Marine Region

About this Document

This document provides supplemental information to the [North Coast State of the Region](#) report. The State of the Region report provides a synopsis of the ecological, biological, oceanographic, and socioeconomic conditions in the North Coast MPA region near the time of MPA implementation in December 2012.

Explore California's MPAs at CDFW's MPA webpage
<https://www.wildlife.ca.gov/Conservation/Marine/MPAs>