Baseline Highlights from California's South Coast Subtidal Remotely Operated Vehicle Surveys

Monitoring Life in the Deep

About This Snapshot Report

This report highlights some key scientific findings from the subtidal remotely operated vehicle (ROV) monitoring project, one of ten baseline projects in California's South Coast region.[1] This project characterized mid-depth rock, subtidal soft-bottom, and deep and canyon ecosystems at selected locations around the time of marine protected area (MPA) implementation. Facts and figures are derived from the project's peer-reviewed technical report,[2] which can be found, along with the related data, at OceanSpaces.org.

97.5 HOURS OF VIDEO

102 ROV TRANSECTS

93 fish species or species groups observed

12,810 PHOTOS

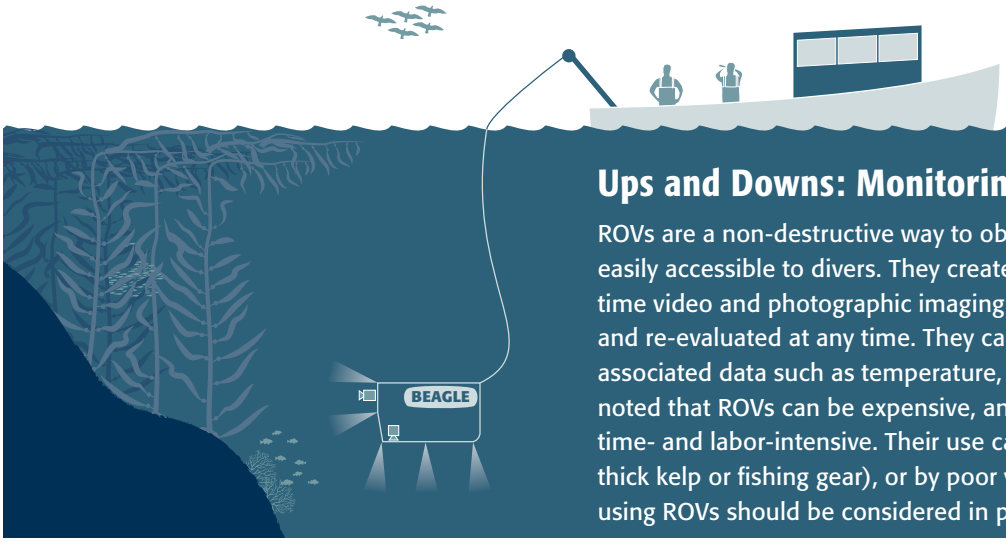
51,192 FISH observed

LIFE IN THE DEEP

The ROV project surveyed South Coast ecosystem types that exist below depths that scuba divers can efficiently survey. Mid-depth rock ecosystems exist between 30 and 100 meters (m), while subtidal soft-bottom ecosystems extend from 0 to 100m, and deep and canyon ecosystems occur below 100m and can have either rocky or soft substrates. These ecosystems are home to many commercially and ecologically important species. Rockfishes and Lingcod can be found over rocky substrate, and flatfishes and ridgeback prawns can be found over the more abundant soft substrate. Species that inhabit these dark waters, especially on rocky substrate, tend to be long-lived and slow-growing, including habitat-forming sessile invertebrates such as sea fans and corals that are especially sensitive to physical disturbance. We have only begun to explore and grow our understanding of these deep, dark ecosystems off the California coast.

A Collaborative Effort

This project represents a successful collaboration between academic scientists at the Institute for Applied Marine Ecology (IfAME),[3] scientists and engineers at the non-profit organization Marine Applied Research and Exploration (MARE),[4] and members of the commercial fishing community (F/V Donna Kathleen and her crew). Together, researchers collected video and still imagery using an ROV at four locations representing the biogeographic zones across the South Coast. By combining these images with map products from the California Seafloor and Coastal Mapping Project funded by the Ocean Protection Council (OPC), researchers described the ecological characteristics inside and outside of selected State Marine Reserves (SMRs) and State Marine Conservation Areas (SMCAs) at the time of South Coast MPA implementation.



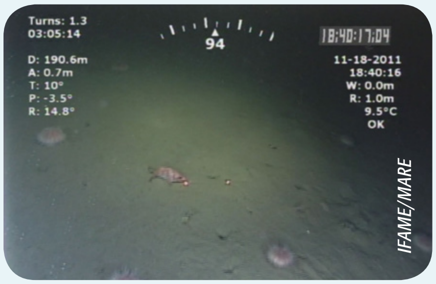
Ups and Downs: Monitoring with ROVs

ROVs are a non-destructive way to observe species and communities at depths not easily accessible to divers. They create a permanent data archive through their real time video and photographic imaging and recording systems, which can be verified and re-evaluated at any time. They can also be outfitted with sensors to record associated data such as temperature, depth, and dissolved oxygen. Researchers noted that ROVs can be expensive, and the deployment and analysis of footage is time- and labor-intensive. Their use can be complicated by entanglement risk (e.g., thick kelp or fishing gear), or by poor visibility. Both the strengths and challenges of using ROVs should be considered in planning for long-term monitoring.

The ROV used in this study, the Beagle, is outfitted with numerous video and still cameras and various sensors. It was controlled by human operators onboard the F/V Donna Kathleen. Researchers "flew" the Beagle at an approximate speed of 1ft/sec roughly 3ft above the seafloor.

Transects Explained

Three types of transects were conducted during this study: normal, vertical, and elevator. During normal transects, the Beagle was flown along a section of the seafloor with a constant depth for the duration of the transect. Data collected from normal transects were summarized by study site. Vertical transects were similar to normal transects, except the Beagle was flown up-slope from the edge of the continental shelf. Vertical transects were also conducted at all four study sites, but they were analyzed separately from the normal transects. In order to explore the walls of La Jolla Canyon, researchers developed a new "elevator" protocol in which the Beagle was flown straight up the canyon wall. Elevator transects were analyzed separately from all other transects. **Multiple transects were conducted at each study site, and while transect length depended on local conditions, they were usually longer than 1km.**



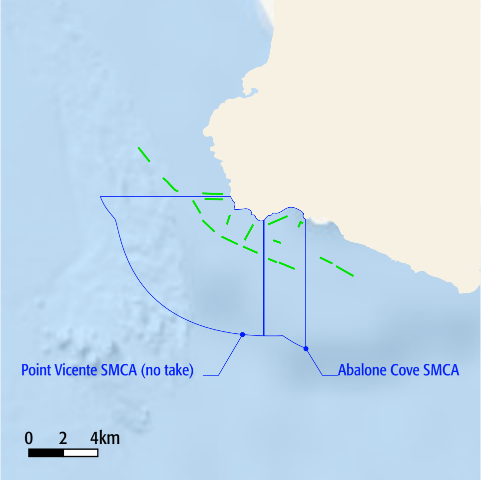
The above display is seen by operators when the ROV is in use, and this video footage is later watched by researchers who collect data on the species and habitats observed. The data is stored in a database, and the footage is archived for later use.

Characterizing Deep Ecosystems: Transects at Four Key Sites

Point Vicente

Depth range surveyed: **10 – 175m**

Substrate: **primarily soft**



Fish species/species groups identified:

37

Individual fish identified:

15,892

Most abundant fish species:

Halfbanded Rockfish (83% of identified fish)

Other abundant fish:

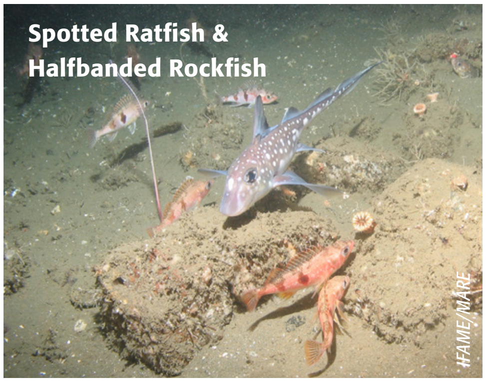
Flatfish, Combfish

Commonly observed invertebrates:

Ridgeback prawns, Octopuses, Sea cucumbers, Sea pens/whips

Fish species only identified at this site:

Sebastolobus spp., English Sole, Bearded Eelpout, Spotted Ratfish

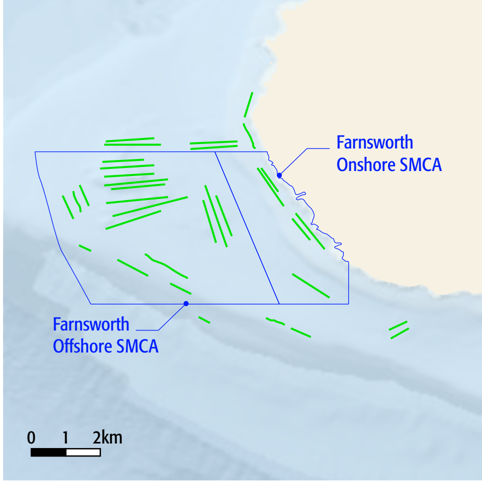


Spotted Ratfish & Halfbanded Rockfish

Santa Catalina Island

Depth range surveyed: **13 – 229m**

Substrate: **soft, hard, mixed**



Fish species/species groups identified:

52

Individual fish identified:

11,898

Most abundant fish species:

Blacksmith (28% of identified fish)

Other abundant fish:

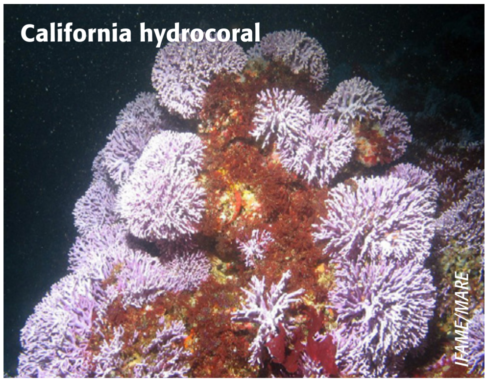
Squarespot Rockfish, Flatfish

Commonly observed invertebrates:

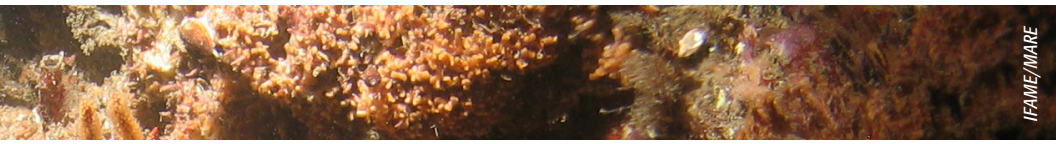
Sea cucumbers, Hydrocoral, Gorgonians, Octopuses

Fish species only identified at this site:

Rockfish (11 species), Clinids (kelpfishes), Cabezon, Ocean Whitefish, 3 species of sharks and skates



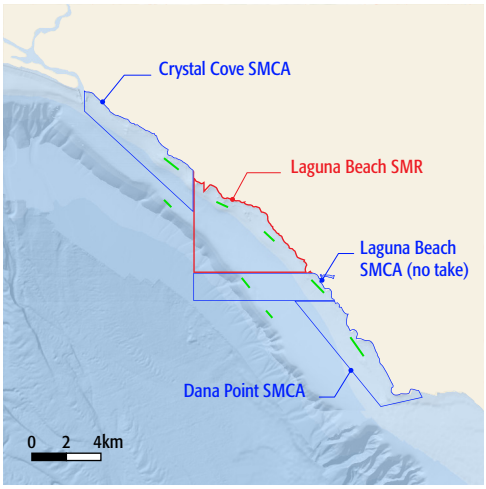
California hydrocoral



Laguna Beach

Depth range surveyed: **10 – 107m**

Substrate: **soft, hard, mixed**



Fish species/species groups identified:

21

Individual fish identified:

973

Most abundant fish species:

Blacksmith (50% of identified fish)

Other abundant fish:

Garibaldi
Flatfish

Commonly observed invertebrates:

Gorgonians
Anemones
Crabs
Octopuses

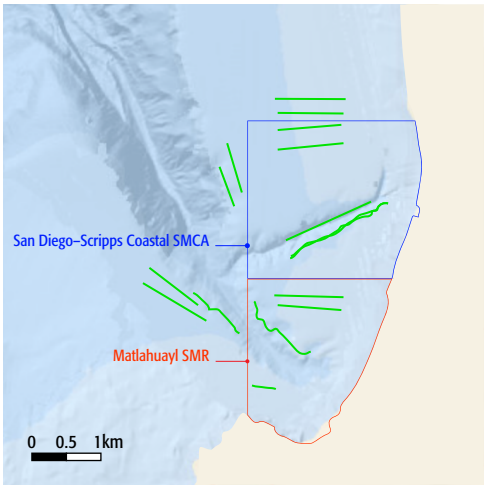
Fish species only identified at this site:

California Tonguefish
Barred Sand Bass

La Jolla

Depth range surveyed: **10 – 252m**

Substrate: **soft, hard, mixed**



Fish species/species groups identified:

40

Individual fish identified:

15,010

Most abundant fish species:

Halfbanded Rockfish (83% of identified fish)

Other abundant fish:

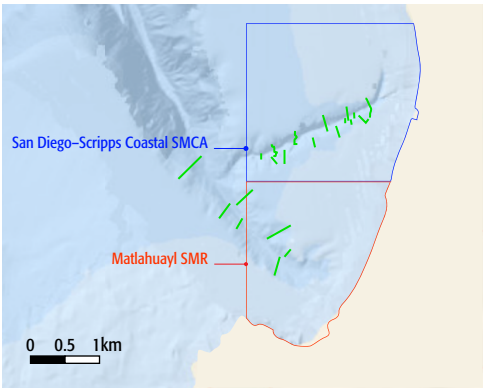
California Lizardfish
Shortbelly Rockfish

Commonly observed invertebrates:

Crabs
Ridgeback prawns
Spot prawns
Octopuses

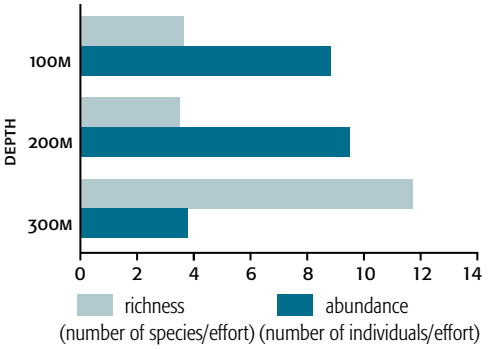
Fish species only identified at this site:

Brown Rockfish
Pipefish
Chilipepper Rockfish
Rock Wrasse
Fantail Sole



Exploring La Jolla Canyon with Elevator Transects

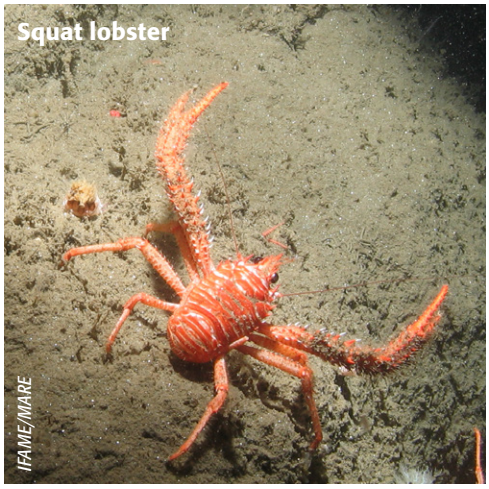
La Jolla Canyon is a key feature of the La Jolla Study Area. Researchers identified 37 fish species or species groups, including 15 rockfish species. They analyzed the data to see which physical factors were the best predictors of species richness and abundance. Depth is the most important predictor of species richness, while slope and rugosity (roughness) of the canyon walls were the best predictors of abundance. For example, the deepest portions of the canyon transects, which were over 200m below the surface, had the greatest species richness but the lowest overall abundance. Some species were evenly distributed across depth ranges, such as Halfbanded Rockfish and California Lizardfish, while some were only observed at the greatest depths, such as Hundred Fathom Codling.

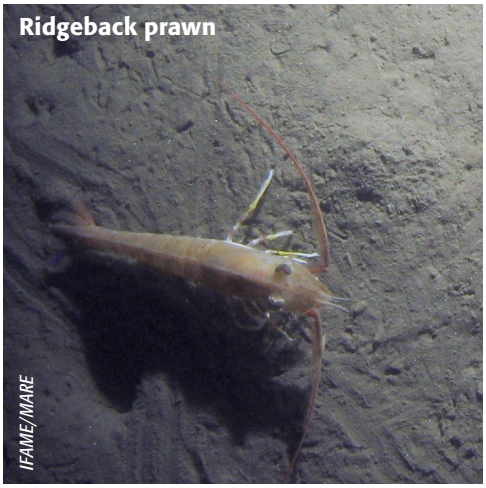


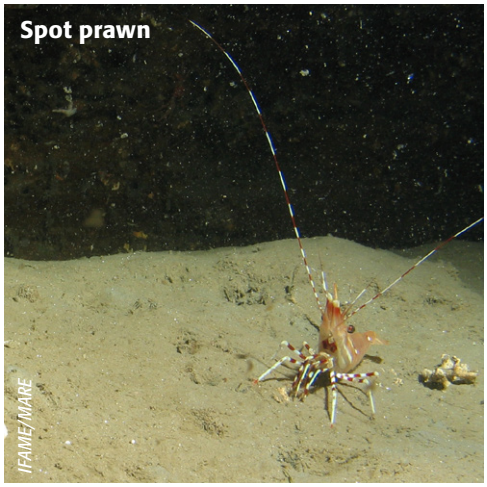
The number of species increased below 200m (greater richness), but there were fewer total fish (lower abundance).

Examining Depth Distributions with Vertical Transects

To explore the distribution of fishes and invertebrates across depths, additional "vertical" transects were conducted at all four study sites. Survey depths ranged from 50–400m. Some fish were most common at the deepest parts of the transects, such as Aurora/Splitnose Rockfish and Dogface Witch-eel, which were observed at their greatest density between 300 and 400m. Other fish were more common in the shallower portions of the transects, such as Halfbanded Rockfish, which had their greatest density at 50m. Mobile invertebrates most commonly observed on the vertical transects included squat lobsters, octopuses, and prawns. Squat lobsters reached their peak density at 260m and were observed over a relatively narrow depth range, while octopuses were observed across the entire depth range but at low densities.







Prawn Distributions: Steep and Deep

Spot prawns and ridgeback prawns are commercially important species. Researchers analyzed the distribution of prawns across all four study sites to characterize their habitat preferences. Ridgeback prawns were most commonly observed at depths of 140–200m and at slopes of 10–20°. Spot prawns seemed to prefer deeper and steeper conditions, and were most commonly observed at depths of 160–220m and slopes of 25–45°.

About South Coast MPA Baseline Monitoring

California Ocean Science Trust, California Department of Fish and Wildlife (CDFW), California Ocean Protection Council (OPC), and California Sea Grant coordinated and collaborated in the implementation of baseline monitoring, which was funded by OPC. Results from this work will inform CDFW management recommendations to the California Fish and Game Commission from the first five years of MPA implementation in the region, anticipated in 2017. MPA monitoring results can also inform the management of fisheries, water quality, coastal development, and climate change.

Footnotes

1. http://oceanspaces.org/sc-deep
2. James Lindholm, Ashley Knight, Dirk Rosen, Andy Lauermann, Flower Moye, Alli N. Cramer, Joshua Smith, Heather Bolton, Michael Esgro, Sarah Finstad, Rhiannon McCollough, and Molly Fredle. 2015. Baseline Characterization of Mid-Depth Rocky and Soft-Bottom Ecosystems (20-350m). California Sea Grant. San Diego, CA. 118 pp. goo.gl/mno1HT
3. http://oceanspaces.org/ifame
4. http://oceanspaces.org/mare

CALIFORNIA OCEAN SCIENCE TRUST
CALIFORNIA OCEAN PROTECTION COUNCIL
Sea Grant California
CALIFORNIA DEPARTMENT OF FISH & WILDLIFE
oceanSPACES