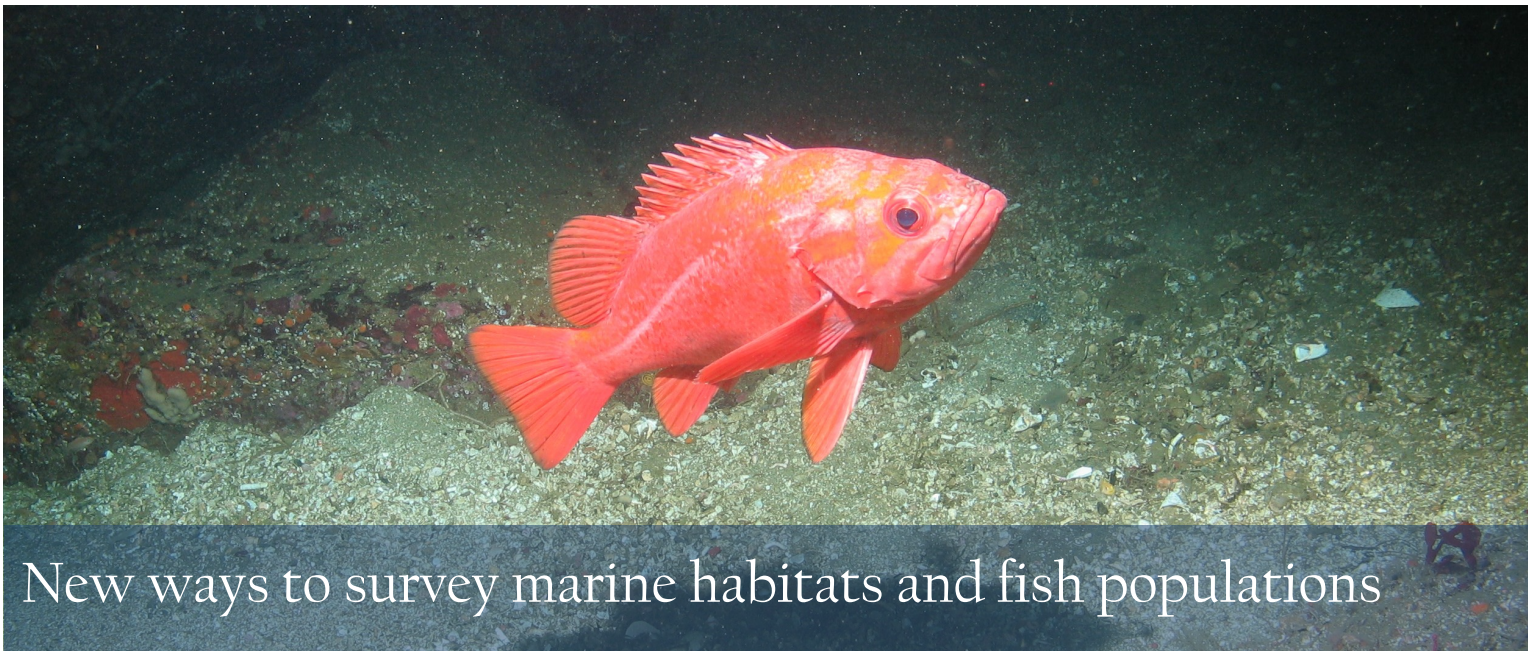


New ways to survey marine habitats and fish populations

Scientists, engineers, fishery managers, and fishermen are working together to better understand threatened populations of fish species and the habitats they depend on off the U.S. West Coast

We need new and better information to inform ocean management decisions, especially in the face of changing ocean conditions. For decades, fishermen in California, Oregon, and Washington have relied upon year-round opportunities to fish for groundfish and sustain local economies. Many important groundfish species are long-lived rockfish (e.g. Bocaccio, Chilipepper, Cowcod and Yelloweye Rockfish) that inhabit rocky seafloor habitats in the 50–500 meter depth zone. Overfishing in the late 1980s and through the 1990s led to greatly reduced harvest levels and large area closures at the turn of the century, however, in recent years most of the previously overfished populations have been rebuilt. To be effective at sustaining populations and fishing into the future, fishery managers need better information to understand the status of rockfish populations, the role of marine protected areas in rebuilding fish populations, and to adaptively manage where and how many fish can be caught each year.

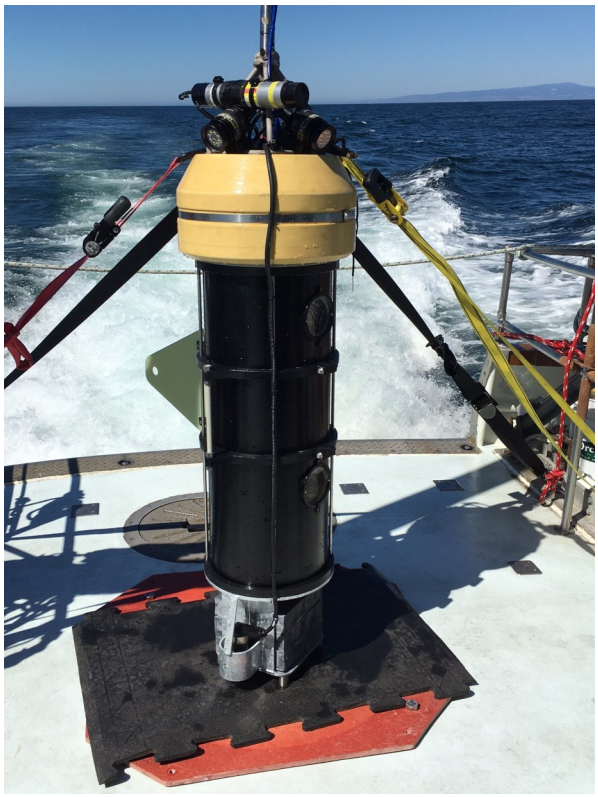
New visual tools to inform management

One of the primary methods for estimating abundance has been trawl surveys, in which researchers use trawl nets to catch and count fish. While this approach works well for fish that live in sand and mud habitats, it is less effective for many species of rockfish that live in rocky habitats, as trawl nets cannot be used in the high-relief rocky areas where they live. Visual survey methods offer a better way to survey such habitats, and one such approach involves lowering camera systems down to the seafloor and recording video of fishes in rocky habitats. Early "video landers" demonstrated that good data on size and density of rockfish could be collected in this manner, but there were significant engineering and design challenges that needed to be overcome to ensure the tool could be deployed rapidly and repeatedly over large stretches of the U.S. West Coast to survey the habitats where these fishes live.

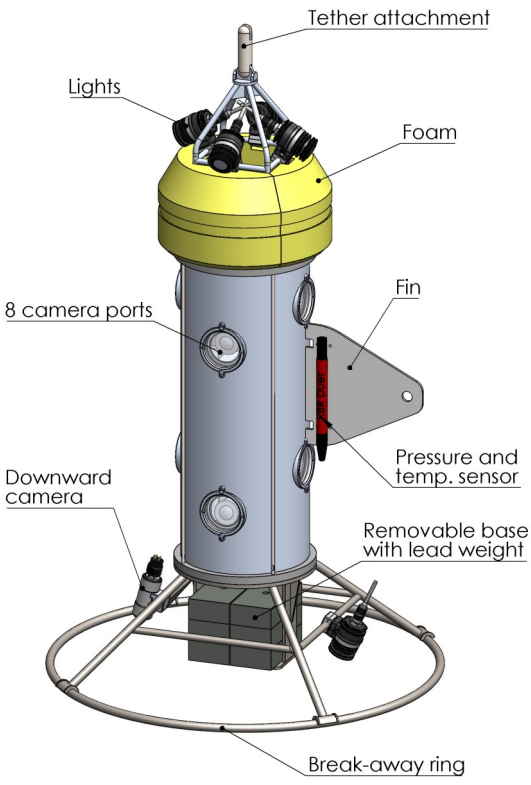
Unique collaboration to design, build, and test innovative technology

The Nature Conservancy (TNC), Monterey Bay Aquarium Research Institute (MBARI), Moss Landing Marine Laboratories (MLML), National Marine Fisheries Service (NMFS), Marine Applied Research and Exploration (MARE), and local fishermen are partnering to design, build, and test a new camera system that can be used to accurately count and size rockfish in deep-water habitats. Scientists, managers, engineers, and fishermen worked together to develop the scientific and operational requirements that form the foundation for the engineering design of the new visual tool.

The Nature Conservancy MBARI Moss Landing Marine Laboratories MARE NOAA FISHERIES



A two-camera prototype of the Benthic Observation Survey System on a research vessel in Monterey Bay. Image: Chad Kecy © 2017 MBARI



This illustration shows the main components proposed for the 8-camera Benthic Observation Survey System, to be built in 2018. Image: Chad Kecy © 2017 MBARI

Designing and Building the Benthic Observation Survey System

MBARI is leading the engineering process to design and build the Benthic Observation Survey System (BOSS) - a stereo video lander that can collect visual data on the size and abundance of fish populations in deep rocky habitats from a variety of types of vessels. The BOSS can be lowered down to the bottom relatively quickly from a ship on a cable that provides power for the lights and cameras, and carries video back to the surface. The system has a weighted bottom and floatation on top that makes it a stable platform on uneven terrain, as well as a downward-looking camera that that allows the BOSS to be landed carefully. High-definition video cameras record video in all directions, after which the system is lifted off the bottom and moved to a new location. Special software is used to stitch these images together to create stereo images, which are used to identify, count, and determine the sizes of fish.

Progress to date and next steps

Leveraging prior work, in 2017 the team build a two-camera prototype BOSS and participated in a NMFS-led experiment in the California Channel Islands to evaluate fish behavioral responses to underwater vehicles. Field tests showed that BOSS is stable on rocky habitats, can be set down within a 5m radius of a specific coordinate, and can collect robust data on fish density and size. Field and pool tests have demonstrated that fish can be identified and measured out to 4 m from the lander, with a sizing error of < 2%.

In 2018, the research team is building a more advanced system that uses eight cameras to provide near 360-degree stereo views of the seafloor, has more sophisticated camera controls, and will allow researchers to record and store video onboard the ship instead of inside the lander. The system will be tested at sea at numerous sites off California to demonstrate how visual data can be collected at large spatial scales along the West Coast. After refinement of the final design, MBARI engineers will transfer the technology to external partners with the technical expertise to operate, maintain, and use this system.

New data collection systems such as BOSS will enable rapid data collection within deep rocky habitats and marine protected areas that have, to date, been challenging to survey. This innovative, state-of-the-art technology has the potential to help inform better management that could increase fishing opportunities while protecting critical habitat areas and fish populations into the future.

Acknowledgements

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