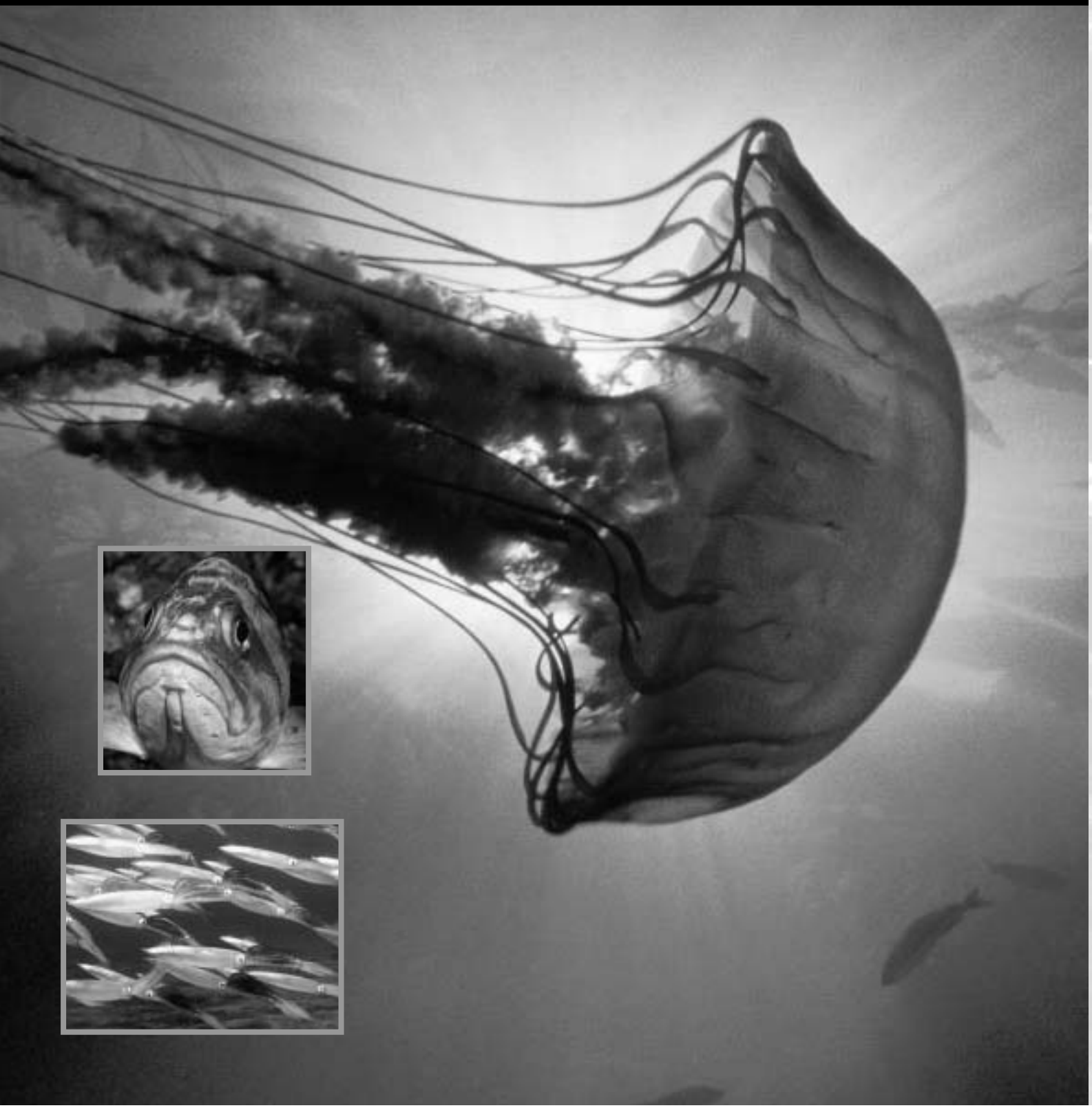
Ecosystem Observations

for the Monterey Bay National Marine Sanctuary

2000



Exploring the Davidson Seamount

Seamounts are volcanoes that rise up from the ocean floor. Their cascading slopes with outcropping cliffs, rocky fragmented bases, and sedimented valleys impinge on the mid-to-upper water column, modifying local current patterns. These factors result in highly-variable environmental conditions for life over the seamount, ranging from sediment-laden areas with few currents to exposed undersea ridgelines swept by strong currents with high densities of suspended material. Consequently, seamounts appear to support a high diversity of life both on their surfaces and in surrounding waters.

Located 120 kilometers to the southwest of Monterey, the Davidson Seamount is forty kilometers long and rises 2,300 meters from the ocean floor, yet is still roughly 1,300 meters below the sea surface. This large geographic feature was the first to be characterized as a "seamount" and was named after George Davidson, a scientist at the Coast and Geodetic Survey – the forerunner to the National Oceanic and Atmospheric Administration's (NOAA) National Ocean Service. In 1978-1979 the U.S. Geological Survey collected the first geological samples, and recent work on these same samples shows the seamount is about 12 million years old.

In May 2000 MBARI began describing biological communities on the crest and flanks of Davidson Seamount using a remotely-operated vehicle. The Monterey Bay National Marine Sanctuary collaborated in this exploration by performing bird and mammal surveys over the seamount during the cruise and compiling oceanographic data taken from MBARI's research vessel, *Western Flyer*. The Sanctuary has since conducted aerial surveys from the NOAA plane *Shrike AeroCommander* to enhance the mammal observation data sets.

Corals, such as this enormous gorgonian, are found on the Davidson Seamount.

In addition to being geologically young and having a unique shape (most seamounts are circular) the Davidson Seamount has remarkable biological communities. Davidson has large, dense patches of sponges and apparently extremely old coral forests with individuals commonly reaching more than three meters in height *(see photo above)*. Moreover, many invertebrate species collected during the cruise were previously unknown to scientists. Perhaps related to the rich life on the seamount, the waters above Davidson Seamount appear to be a productive feeding ground and – as observed at nearby seamounts – are frequented by sperm whales and albatross.

Although samples from the recent exploration of Davidson Seamount have not been analyzed fully and new discoveries concerning Davidson Seamount and similar ocean habitats are expected upon further research, information from this year's sampling efforts have been recognized at the highest levels. On June 12, 2000 President Clinton directed NOAA to work in partnership with marine research institutions and universities to explore four unique sites in the United States, and Davidson Seamount is one of these sites of high research priority.

New technologies are enabling detailed investigations of deep-sea habitats, promising discovery of presently-unknown marine resources. We are planning future expeditions to Davidson Seamount. Greater knowledge of the biodiversity, community patterns, and function of this area will improve our options for management of these unique marine environments for the education, enjoyment, and use of generations to come.

– Andrew De Vogelaere[1], Mario Tamburri[1, 2], David Clague[2], James Barry[2], and Scott Benson[3]

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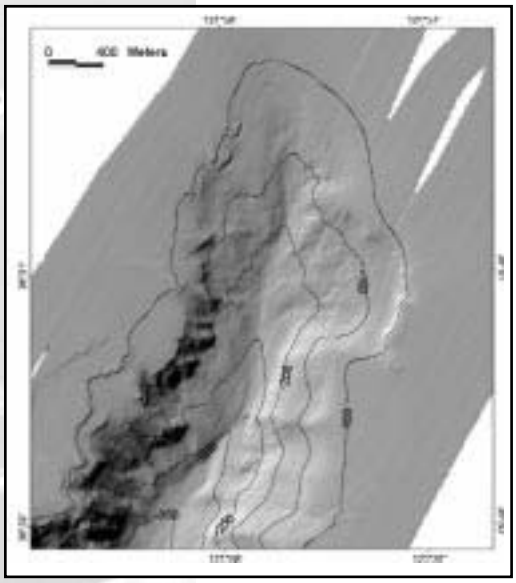
The Physical Environment

Mapping Rockfish Habitats of the Sanctuary

Rockfishes (*Sebastes* sp.; often referred to as red snapper or rock cod in fish markets) have been declining at alarming rates along much of the U.S. West Coast. Concern by sport and commercial fishers, government scientists and managers, and the general public has led to an increased effort to seek solutions for sustaining and conserving these economically important fisheries. Because many rockfish species are commonly associated with high, rugged seafloor relief, it is essential to identify and quantify areas with these characteristics.

Marine benthic habitats are identified and mapped using a suite of geophysical remote sensing tools. Unlike terrestrial habitats, which are defined by flora and fauna in relationship to altitude and climate, deep water (>30 meters) marine benthic habitats initially are defined by substrate type, relief, and depth or by their seafloor morphology as imaged by the various geophysical mapping tools. All of these tools rely on sound to produce the images. Side scan sonographs that exhibit backscatter signals and shadows form an image that looks much like a photograph. Another recently-developed tool is the multibeam echo sounder, which also produces a photographic-like image of the seafloor that can resolve features on the order of one to three meters. Geophysical surveys are followed by on-site examination of the habitats using remotely-operated vehicles (ROVs) and manned submersibles. This approach allows confirmation of interpretations of the geophysical data and observations of rockfish assemblages associated with the habitats.

These modern habitat characterization methodologies have evolved from studies undertaken in the Monterey Bay National Marine Sanctuary. In the early 1990s a multidisciplinary approach to characterizing marine benthic habitats began with biologists and geologists from government, academic, and private scientific agencies and institutes – the National Oceanic and Atmospheric Administration (NOAA)/National Marine Fisheries Service, U.S. Geological Survey, Moss Landing Marine Laboratories (MLML), and Monterey Bay Aquarium Research Institute (MBARI) – applying their respective disciplines to the definition and understanding of these habitats. With the application of new geophysical technologies the Monterey Bay team made considerable contributions in refining habitat



Norman M. Maher © 2000 MBARI

Figure 1: Multibeam bathymetry data, artificially illuminated from the northwest, help scientists differentiate between steep rocky ledges and gentler sedimented slopes in the headward part of Soquel Canyon.

characterizations. Rockfish habitats were mapped first in Monterey Bay, at the head of Soquel Canyon *(Figure 1)*.

As progress in habitat characterization and mapping advanced, the team expanded to keep pace with the demand for delineating benthic fish habitats. In the mid-1990s the Center for Habitat Studies at MLML was formed. Seafloor mapping continued, with funds from Monterey Bay National Marine Sanctuary, UC California Sea Grant, and California Department of Fish and Game (CDFG), in the vicinity of the Big Creek Ecological Reserve. Techniques developed in the Sanctuary were used to map marine benthic habitats in Southeastern Alaska. In the late 1990s, the Monterey Bay team organized and participated in several national and international workshops to classify and characterize marine habitats, reporting on the success of their mapping activities. The Seafloor Mapping Laboratory of CSU Monterey Bay (CSUMB) was formed and convened a regional workshop on marine benthic habitat characterization and mapping in 1999, which was supported by CDFG and NOAA Special Projects.

Most recently the team, supported by CDFG and the National Sea Grant Program, has been actively involved in digitally compiling offshore geological information and recently-released industry geophysical data for the construction of marine benthic habitat maps, not only within the Sanctuary but throughout offshore California. CSUMB's Seafloor Mapping Lab used grants from the U.S. Department of Defense and CDFG to purchase a 27-foot boat with technologically-advanced multibeam and ROV systems that are being used to map benthic habitats in the Sanctuary. In addition, the excellent deep-water multibeam data collected by MBARI are being used to define deeper water habitats.

In the past year we have identified many areas within the Sanctuary that are probable deep-water rockfish habitats. Potential rockfish habitats exist at the heads of submarine canyons and on the continental shelf where eroded granitic and sedimentary rocks are exposed. During the past year extensive marine benthic habitat maps have been produced through the conversion of the California Continental Margins Geological Map series, published by the California Division of Mines and Geology, into geographical information systems (GIS).

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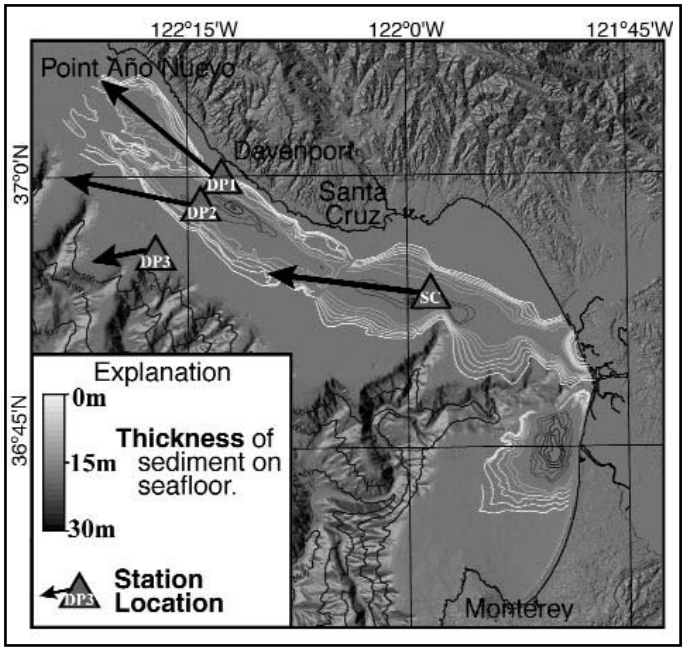
Where Does the Mud Go?

Mud and sand covering the continental shelf underlying the Monterey Bay National Marine Sanctuary are relatively young, geologically speaking. During the glacial age, ending about 18,000 years ago, the level of the oceans was much lower due to the amount of water locked up in continental ice sheets, and a large portion of today's Sanctuary was dry land. As the glaciers melted, the level of the oceans began to rise and sand and mud carried offshore from rivers began to accumulate on the continental shelf, filling in depressions and covering the once-dry surface. The process of land erosion and transport to the Sanctuary environment continues today, and recent studies are shedding light on where the mud is coming from and where it is accumulating.

The Sanctuary floor north of the Monterey Peninsula today is covered at water depths between about forty and ninety meters by a nearly continuous blanket of mud as much as thirty meters thick. The shape of this mud deposit is like a long stretched-out pancake from central Monterey Bay toward the northwest; although it may reach a maximum thickness of thirty meters, it thins both toward the land and farther offshore to thicknesses of a few meters or less. Past calculations of sediment erosion rates and river discharges by researchers at UC Santa Cruz have shown that the offshore muds may be explained by the three rivers that empty into Monterey Bay: the Salinas, Pajaro, and San Lorenzo. The amount of sediment contributed annually from sediment washed out of eroding cliffs and from gullies of smaller streams and creeks is minor in comparison.



With shaded relief as background, the mudbelt thickness is shown by contours and suspended mud transport directions are shown at four locations, as measured by current meters and turbidity sensors that recorded for one year.

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Unless specifically stated, the views expressed in this issue do not necessarily reflect the opinions of the Monterey Bay National Marine Sanctuary, the National Marine Sanctuary Program, or NOAA.

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