

Abstract

The Monterey Bay National Marine Sanctuary (Sanctuary) and the California Coastal Commission are working closely with the California Department of Transportation (CalTrans) and several other local, state, and federal agencies to develop a Corridor Management Plan along the Big Sur Coast. Highway 1 in Big Sur is often subject to delays and closures due to storms, washouts, and landslides. The purpose of the Big Sur Coast Highway Management Plan (CHMP) is to develop sustainable strategies that ensure the safe and efficient operation of the highway while protecting the unique qualities and sensitive terrestrial and marine resources of this remarkable coastline.

As one part of the CHMP, this project has been designed to survey intertidal and nearshore subtidal areas along the Big Sur coast. The surveys will focus on areas of coastline known or with the greatest potential to be affected by highway repairs from landslides or other storm-related events. Data collected will include species lists, population densities, and presence of economically important, particularly sensitive, and/or endangered species. The results will be placed into multiple GIS data layers and maps for resource managers and the public.

Study Objectives

Researchers from the Partnership for Interdisciplinary Studies of Coastal Oceans (PISCO) at UC Santa Cruz and SANCTUARY staff scientists are working together to survey six subtidal sites and adjacent intertidal sites. In particular, they collect data to:

1. Characterize geological substrate types at selected sites according to 5-10 categories, such as granite, boulder, sand.
2. Identify physical factors at these sites which may affect the sensitivity of marine biota to disposal activities, such as wave energy, relative exposure and aspect, presence of protective offshore rocks, etc., and qualitatively rank each site by physical exposure categories which could affect disposed material.
3. Characterize biological assemblages at these sites. Identify and note the abundance of those species that may be particularly susceptible to disposal activities, such as the sea palm, and owl limpet.
4. Rank critical and/or disposal-sensitive habitats using indices such as location, size, and quality in order of most critical to least critical; consider species assemblages' degree of tolerance to sediment disposal (i.e., burial, scour, turbidity) and physical factors.

Methods

The initial site selection process focused on three issues: recent landslide activity at a site, its geology, and proximity of a similar site with no or reduced effects due to landslide material. In consultation with geologists from the

California Geologic Survey, CalTrans staff, and a representative of the State Water Resources Control Board, Sanctuary staff identified 14 candidate sites. Several sites were similar to one another and many were considered alternatives; it was never planned to survey all 14 sites.

The R/V *Shearwater*, a 62-foot catamaran from the Channel Islands National Marine Sanctuary, served as the research platform from September 12-27, 2003. This vessel was able to transit quickly from Monterey to Ragged Point at speeds of up to 20 knots, support up to 10 live-aboard researchers and two crew, anchor overnight at remote sites, fill SCUBA tanks, and quickly deploy inflatable boats and kayaks used by subtidal and intertidal researchers, respectively. Its high maneuverability and state-of-the-art technology often allowed the crew to place the vessel immediately adjacent to the study sites.



Divers (from left to right): Mark Carr (UCSC) Tim Tregoning (USCG), Steve Lonhart (SIMoN), and Mark Readdie (UCSC).

An experienced dive team and an intertidal crew qualitatively surveyed 9 of the 14 sites over a three day period, then used this information to select six sites for full quantitative surveys (only six could be surveyed due to logistical constraints). Qualitative diver sampling at each site involved three divers descending to 20 m depth and swimming as shallow as possible. Divers recorded all fishes, invertebrates, and algae encountered during the course of an entire dive, and also noted topography and substrate types (e.g., sand, cobble, boulders, reef). Four rocky shore researchers used kayaks and wetsuits to access intertidal sites. Once upon the shore, or in some cases from the kayak, they filled out a species checklist while viewing the shore at locations on either side of a slide (if one was present). They also evaluated the sites for their suitability to collect quantitative data.

After the initial four days of qualitative sampling, six sites were selected and quantitatively sampled. However, due to poor tides, only subtidal data were collected. The intertidal sampling was postponed until November/December 2003. Each of the six sites was subdivided into two areas (upcoast and

downcoast). Within each area one pair of divers collected data on fishes while a second pair of divers collected data on invertebrates and algae using two 30 m long belt transects at different depths (e.g., 20, 15, and 10 m). At each site, divers collecting fish data completed a total of 24 transects, while divers collecting invertebrate and algae data completed a total of 18 transects. Fishes were counted and total length of individuals was estimated. Mobile invertebrates were counted, and estimated percent cover of sessile organisms and algae was done using uniform point contacts. Divers also counted all stipitate understory algae and counted the stipes of giant kelp *Macrocystis pyrifera* and bull kelp *Nereocystis luetkeana*.

Findings

Of the 14 sites originally identified, four (Hurricane Point, Pitkins Curve, Grey Slip, and south of Salmon Creek) were not qualitatively surveyed and subsequently omitted from the sampling program. These four sites presented either hazardous diving conditions or logistical constraints that made them unsuitable. Divers qualitatively sampled the remaining 10 sites, and six of those were quantitatively sampled (Partington Cove, McWay slide, north of Salmon Creek, Duck Ponds slide, Wild Cattle Creek, and Lucia).

The following results are preliminary; the six sites will be revisited in spring 2004 and a final report is not expected until summer/fall 2004. In general, areas at or near the base of a slide site were not strikingly different from the more distant area within the same site. Between sites there was much more variation in both the type of terrain and the relative abundances of species. For example, the deeper sections of some sites were dominated by high vertical relief and high densities of sessile invertebrates, but were dominated by stipitate algae at shallow depths. From site to site the relief and substrate type (e.g., boulders, cobble, gravel or sand) would vary as would the density of sessile invertebrates and algae. However, the list of species at all of these sites was fairly consistent.

Relevance to Resource Management

This project is being undertaken as part of the Big Sur Coast Highway Management Plan. The California Department of Transportation (CalTrans) received a grant to develop most of the management plan; however, it lacks adequate funds for an essential component of the plan—a survey of marine resources along typical landslide areas and sites where CalTrans may seek to dispose of rock and soil debris on the shoreline and into the ocean. Highway management and repair strategies, even with objectives to minimize earthwork impacts and overall disturbances, may continue to require suitable locations for depositing excess material. The handling of material at a landslide site or exporting to a suitable disposal site continues to raise concern about the potential for impacts to shoreline habitats. Evaluating shoreline habitats for sensitivity to these activities will be an essential component to determining the effects of landslide material being deposited or redistributed on or near the

shoreline. The data collected during the course of this project will directly address these issues and serve as a baseline to detect changes in the future.

Fish and Invertebrate Surveys, Geological Habitat Characterization, and Shipwreck Reconnaissance: *Delta* Submersible Cruise

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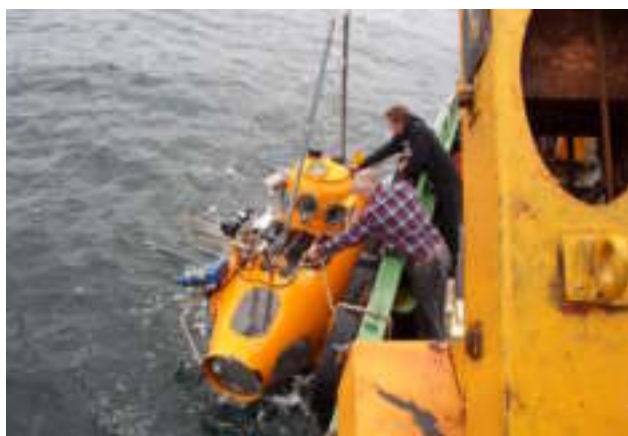
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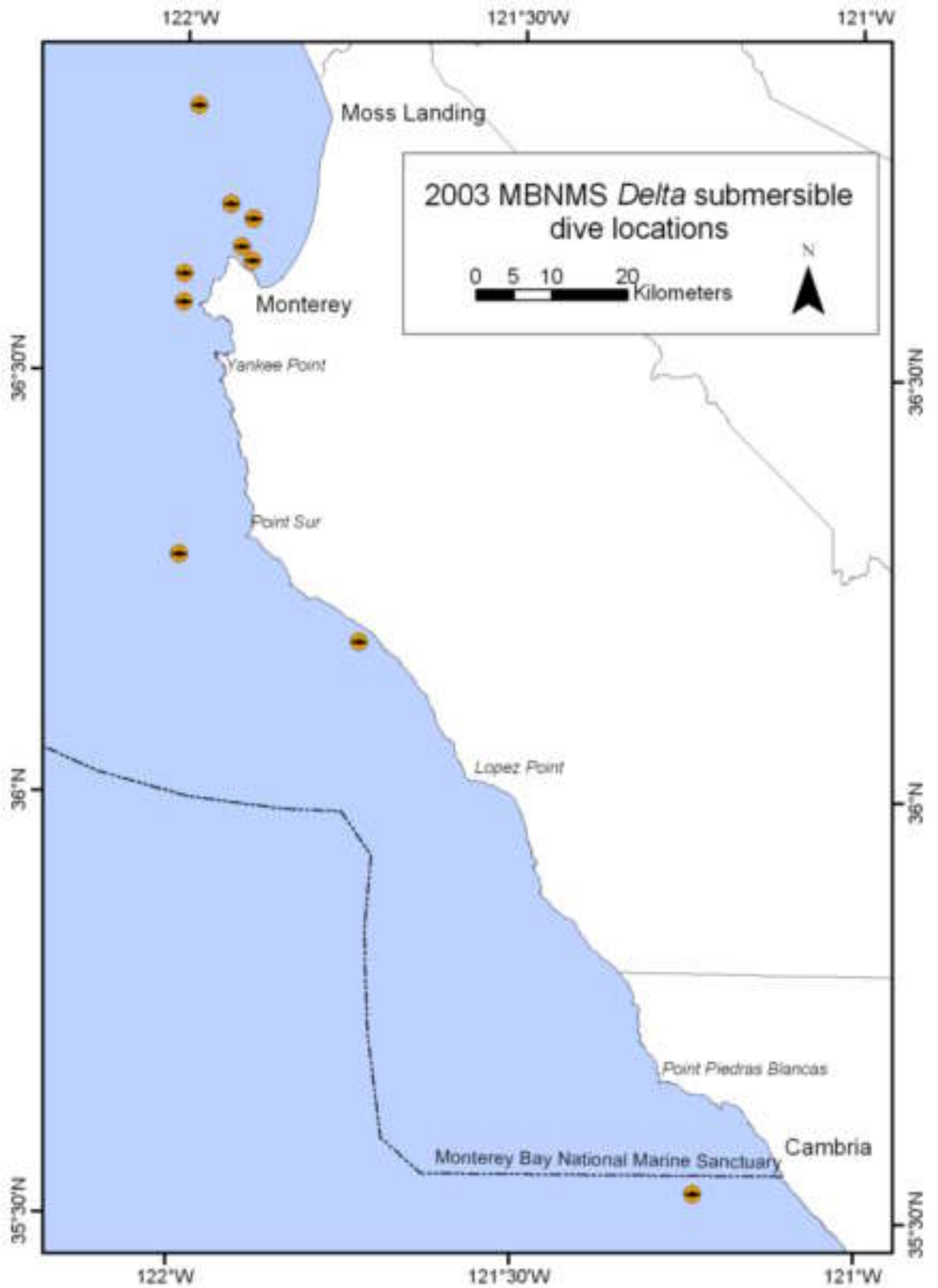
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Recovery of *Delta* submersible on RV *Velero IV*. Photo: MBNMS/NOAA.



Map of *Delta* submersible survey locations.