

**DESCRIPTION OF MAP UNITS**

**UNCONSOLIDATED CONTINENTAL SHELF SEDIMENTS**

- Sa(s)m\_ru: Soft, unconsolidated sediment (fine sand and mud), predominantly rippled
- Sa(s)\_ru: Soft, unconsolidated sediment (sand), predominantly rippled
- Sa(s)g\_ru: Soft, unconsolidated sediment (sand and gravel), predominantly rippled
- Sa(s)g\_hu: Soft, hummocky, unconsolidated sediment (sand and gravel)
- Sa(s)pw\_u: Unconsolidated, dynamic mound of soft sediment (sand)
- Sa(s)pw\_rsu: Soft, mobile sediment window that has unconsolidated and rippled sediment waves, overlying scoured lag pavement of sand and gravel (sorted bedforms)

**MIXED SUBSTRATE ON CONTINENTAL SHELF**

- Sme\_ou: Mixed habitat of soft, unconsolidated sediment, locally overlying hard, consolidated sedimentary bedrock

**HARD SUBSTRATE ON CONTINENTAL SHELF**

- Shd\_ouf: Hard, consolidated sedimentary rock, boulders, or pinnacle
- Shdip\_c: Hard, consolidated boulders or pinnacles of sedimentary rock

**ANTHROPOGENIC FEATURES ON CONTINENTAL SHELF**

- Sh\_a-p: Current-scoured depression in soft, unconsolidated sediment (sand and gravel) adjacent to hard anthropogenic feature (pipeline)
- Sh\_a-p: Hard anthropogenic feature (pipeline)
- Sh\_a-g: Hard anthropogenic feature (groin or jetty)

**EXPLANATION OF MAP SYMBOLS**

- Contact
- Area of "no data"—Areas near shoreline not mapped owing to insufficient high-resolution seafloor mapping data; areas beyond limit of California's State Waters were not mapped as part of California Seafloor Mapping Program
- Limit of California's State Waters
- Bathymetric contour (in meters)—Derived from modified 2-m-resolution bathymetry grids. Contour interval: 10m

**DISCUSSION**

This map shows "potential" marine benthic habitats in the Offshore of Santa Cruz map area. Marine benthic habitats represent a particular type of substrate, geomorphology, seafloor process, or any other attribute that may provide a habitat for a specific species or an assemblage of organisms. Such maps are based largely on seafloor geology, and this map integrates seafloor geology (sheet 10) with information depicted on several other thematic maps of the Offshore of Santa Cruz map area: high-resolution bathymetry (sheet 1), shaded-relief imagery (sheet 2), backscatter (sheet 3), seafloor character (sheet 5), and ground-truth information (sheet 6). This map also uses information from the usSEABED bottom-sampling compilation by Reid and others (2006). The combination of remotely observed data (for example, camera transects, sediment samples) translates to higher confidence in the ability to interpret broad areas of the seafloor (fig. 1).

To avoid any possible misunderstanding of the term "habitat," the term "potential habitat" (as defined by Greene and others, 2005) is used herein to describe a set of distinct seafloor conditions that in the future may qualify as an "actual habitat." Once habitat associations of a species are determined, they can be used to create maps that depict actual habitats, which then need to be confirmed by "ground-truth" surveying using in-situ observations, video, and/or photographic documentation.

Marine benthic habitats are classified using the Benthic Marine Potential Habitat Classification Scheme, a mapping-attribute code developed by Greene and others (1999, 2007). In this map series, habitat-classification codes are based on the deepwater habitat-characterization scheme developed by Greene and others (1999), which was created to not only easily distinguish marine benthic habitats but also to facilitate ease of use and queries within GIS and database programs. The code, which is summarized in chapter 6 in the accompanying pamphlet, is derived from several categories of the Benthic Marine Potential Habitat Classification Scheme (Greene and others, 1999, 2007), and it can be subdivided on the basis of the spatial scale of the data.

High-resolution, multibeam-soundar data, converted to bathymetric depth grids (seafloor digital elevation models; sheet 1), are essential to development of the habitat map, as is shaded-relief imagery (sheet 2), which allows for visualization of seafloor terrain and provides a foundation for interpretation of submarine landforms. Areas of seafloor bedrock exposures are identified by their common sharp edges and high relative relief; these may be contiguous outcrops, isolated parts of outcrop protruding through sediment cover (pinnacles or knobs), or isolated boulders.

Backscatter maps (sheet 3) also are essential for developing potential benthic habitat maps. High backscatter is further indication of "hard" bottom, consistent with interpretation as rock or coarse sediment. In many locations, areas within or around a rocky feature appear to be covered by a thin veneer of sediment, identified on the habitat map as "matted" in other words, containing both rock and sediment). Broad, generally smooth areas of the seafloor that lack sharp and angular edge characteristics are mapped as "sediment" and are further defined by various sedimentary features such as erosional scars and depressions, as well as depositional features such as dunes, mounds, or sand waves. Low backscatter, indicative of a "soft" bottom, also significantly aids identification and classification of sedimentary habitats.

Delineated in the Offshore of Santa Cruz map area are 12 potential marine benthic habitat types, all of which are located on the continental shelf ("shelf" megahabitat). The meso- and macrohabitats on the continental shelf include soft, unconsolidated sediment (habitat types) such as fine sand and mud, sand, and dynamic features such as mobile sand sheets, sediment waves, and rippled sediment depressions; mixed substrate (1 habitat type) such as soft sand and gravels overlying consolidated sedimentary bedrock and also gravel pavement; hard substrate (2 habitat types) such as deformed and differentially eroded bedrock, as well as pinnacles and boulders; and anthropogenic features (3 habitat types) such as jetty and riprap, a pipeline, and scoured depressions next to a pipeline.

Backscatter data (see sheet 3) show that most of the area is underlain by "soft" materials, consistent with the interpretation that unconsolidated sediments dominate habitat in the map area. Sedimentary processes are quite active, especially on the inner shelf from Point Santa Cruz to the San Lorenzo River, and, thus, habitats are highly dynamic, with sediment transport primarily to the east and southeast. An extensive exposure of deformed and differentially eroded bedrock is found as a relatively thin strip in the nearshore that extends from Davenport to Point Santa Cruz, where it forms extensive submarine outcrops offshore, potentially providing good habitat for rockfish (*Sebastes* spp.).

Of the 150 km<sup>2</sup> on the continental shelf in the map area, soft, unconsolidated sediment is the dominant habitat type, covering 134 km<sup>2</sup> (89.4 percent). Hard rock covers 12.25 km<sup>2</sup> (8.2 percent), whereas 3.12 km<sup>2</sup> (2.1 percent) consists of mixed hard-soft substrate. Anthropogenic substrate, although mapped, is insignificant in both area and percentage of habitat coverage.

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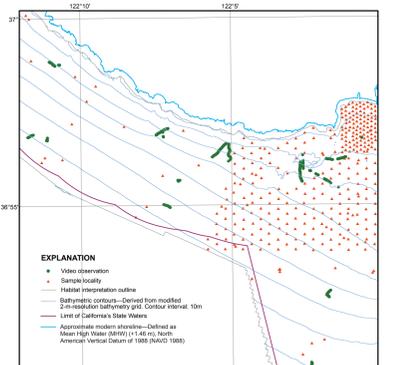
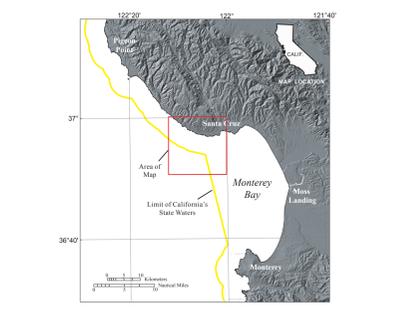
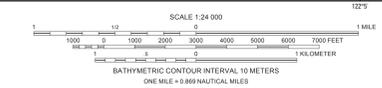


Figure 1. Map showing video-observation locations and sample localities for Offshore of Santa Cruz map area.

Shoreline elevation data from National Oceanic and Atmospheric Administration (NOAA) Office for Coastal Management's Digital Coast. Available at <http://www.noaa.gov/coastalmanagement/digitalcoast/> and from U.S. Geological Survey's National Elevation Dataset. Location of the map area is shown in California's State Waters limit from NOAA Office of Coast Survey. Universal Transverse Mercator projection, Zone 10N. NOT INTENDED FOR NAVIGATIONAL USE.



Potential marine benthic habitats mapped by Bryan E. Dieter, Charles A. Endris, and H. Gary Greene, 2011. Bathymetric contours by Mercedes D. Erdey. GIS database and digital cartography by Mercedes D. Erdey and Bryan E. Dieter. Manuscript approved for publication February 18, 2015.

**Potential Marine Benthic Habitats, Offshore of Santa Cruz Map Area, California**

By  
Bryan E. Dieter,<sup>1</sup> Charles A. Endris,<sup>1</sup> H. Gary Greene,<sup>1</sup> and Mercedes D. Erdey<sup>2</sup>  
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<sup>1</sup> Moss Landing Marine Laboratories, Center for Habitat Studies, U.S. Geological Survey



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