

**DESCRIPTION OF MAP UNITS**

**UNCONSOLIDATED CONTINENTAL SHELF SEDIMENTS**

- Ss(s)\_ru Soft, unconsolidated sediment (sand), predominantly rippled
- Ss(s)g7\_l\_u Soft, unconsolidated sediment (sand or gravel); inferred
- Ss(s)g\_l\_hu Soft, unconsolidated, hummocky sediment (sand and gravel)
- Ss(s)g\_hrw\_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**

- Sms(b)\_cu Mixed habitat of boulders or pinnacles and cobbles with soft, unconsolidated sediment
- Sme\_cu Mixed habitat of soft, unconsolidated sediment, locally overlying hard, consolidated sedimentary bedrock

**HARD SUBSTRATE ON CONTINENTAL SHELF**

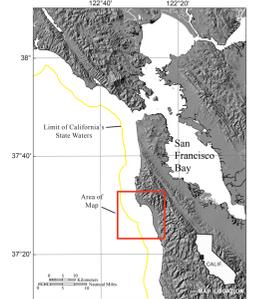
- Shs\_g Hard, granitic rock exposure; may contain unconsolidated sediment (sand) in crevices and cracks
- Shd\_cd Hard, deformed, and differentially eroded sedimentary-bedrock outcrop
- Shd\_f\_cd Hard, flat, deformed, and differentially eroded sedimentary-bedrock outcrop

**ANTHROPOGENIC FEATURES**

- Ss\_a-dm? Soft, unconsolidated, anthropogenically deposited sediment (possible dredge spoils); inferred
- 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 3-nautical-mile limit of California's State Waters were not mapped as part of California Seafloor Mapping Program
- 3-nautical-mile limit of California's State Waters
- Bathymetric contour (in meters)—Derived from modified 2-m-resolution bathymetry grid. Contour interval: 10 m



**DISCUSSION**

This map shows "potential" marine benthic habitats in the Offshore of Half Moon Bay 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 Half Moon Bay 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 uSABED bottom sampling compilation by Reid and others (2006). The combination of remotely observed data (for example, multibeam bathymetry and backscatter, seismic-reflection profiles) and directly 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-swath 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 "mixes" (indicated in other sheets, containing both rock and sediment). Broad, generally smooth areas of 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.

The Offshore of Half Moon Bay map area includes Half Moon Bay and the continental shelf to the north, west, and south of it. Delineated on the map area are 11 potential marine benthic habitat types, all of which are located on the continental shelf ("shelf" megahabitat); two of these potential habitats are anthropogenic, found near the entrance to Pillar Point Harbor. The meso- and macrohabitats include deformed sedimentary-rock outcrops, flat, hard bedrock exposures, rugged, fractured granitic rock, and dynamic features such as mobile sand sheets, sand waves, and associated scour depressions. Backscatter data show that over one-half of the area is covered with "soft" sediment, although the highly deformed and differentially eroded bedrock outcrops and their seafloor relief present the most spectacular backscatter imagery in this map area.

Although the map area is located on the relatively flat, eroded continental shelf, the differentially eroded bedrock forms local relief and rugosity that make promising potential habitats for rockfish (*Sebastes* spp.). Sediment transport is primarily to the southeast, and sedimentary processes are quite active in the area, producing the dynamic bedforms that may be habitats for forage fish such as Pacific sand lance (*Ammodytes leucopneustes*). In addition, erosion through shelf sediments down to a coarser lag has produced sediment-filled scour depressions that resemble "ripple scour depressions" of Cacchione and others (1984) and Phillips and others (2007), found mainly on the shelf in the northwestern and central parts of the map area.

Of the 126.8 km<sup>2</sup> in the map area, 26.25 km<sup>2</sup> (44.4 percent) is exposed hard bedrock, and 7.73 km<sup>2</sup> (6.1 percent) consists of sediment-covered bedrock, which is of the mixed hard-soft indication class. Soft, unconsolidated sediment covers a total of 70.5 km<sup>2</sup> (55.6 percent), and 62.77 km<sup>2</sup> (49.5 percent) consists of mobile sand sheets, ripple scour depressions, and gravels. Anthropogenic habitats cover 0.05 km<sup>2</sup> (0.04 percent) and are located in the vicinity of Pillar Point Harbor.

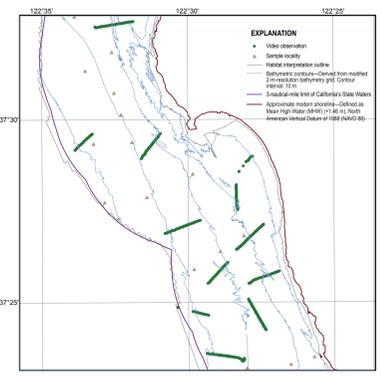


Figure 1. Map showing video observation locations and sample localities for Offshore of Half Moon Bay map area.

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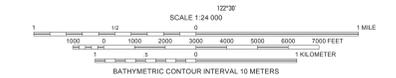
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Potential marine benthic habitats mapped by Bryan E. Dieter and H. Gary Greene, 2011. Bathymetric contours by Chris A. Endris, 2009. GIS database and digital cartography by Charles A. Endris and Mercedes D. Erley. Manuscript approved for publication October 2, 2014.

**Potential Marine Benthic Habitats, Offshore of Half Moon Bay Map Area, California**  
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