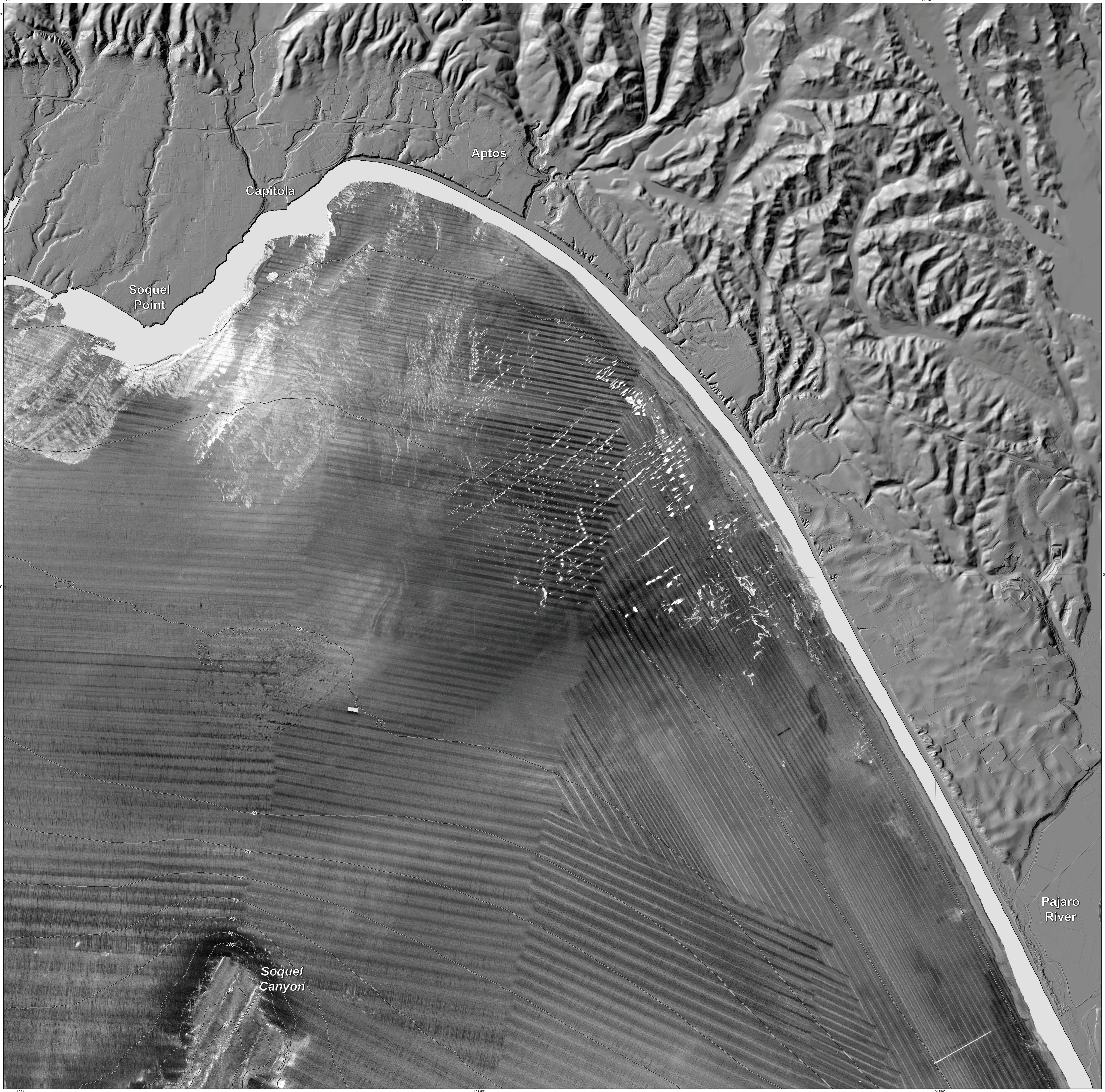
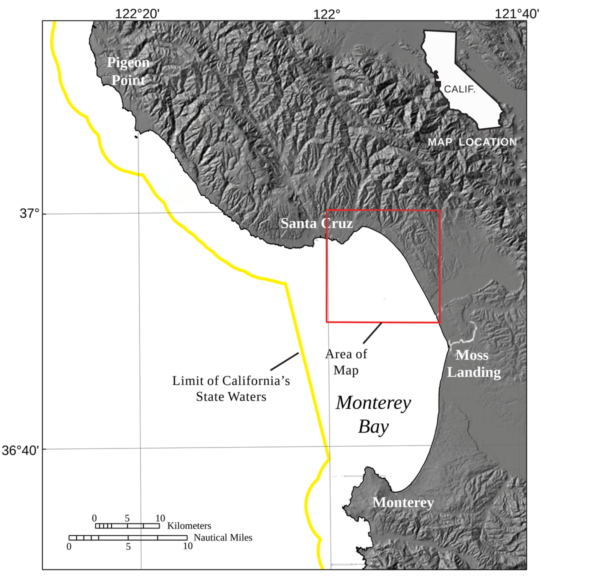
Open-File Report 2016–1025
Sheet 3 of 10
Pamphlet accompanies map





DISCUSSION

This acoustic-backscatter map of the Offshore of Aptos map area in central California was generated from acoustic-backscatter data collected by the Monterey Bay Aquarium Research Institute (MBARI) and the U.S. Geological Survey (USGS) (fig. 1). Mapping was completed in 1998 and 2009, using a combination of a 30-kHz Simrad EM-300 multibeam echosounder and a 234-kHz SEA SWATHplus phase-differencing sidescan-sonar system. Theses mapping missions combined to collect acoustic backscatter data in all of the Offshore of Aptos map area deeper than about 10 m.

During the MBARI mapping mission an Applied Analytic POS MV (Position and Orientation System for Marine Vessels) was used to accurately position the vessel during data collection and account for vessel motion with navigational input from a kinematic differential global positioning system (DGPS). Soundings were corrected for variations in water-column sound velocity using data from SeaBird CTD (conductivity, temperature, and depth) and Sippican T5 expendable bathythermographs(National Centers for Environmental Information, 2015). The USGS downloaded the original MBARI survey line files from the National Centers for Environmental Information on-line bathymetry server (National Centers for Environmental Information, 2015). Using MB-Systems, a freeware software package for processing and displaying backscatter data (Caress and others, 2015), amplitude values were extracted from the lines at 5-m spatial resolution and exported as one XYZ file. The XYZ file was gridded in Fledermaus® software (QPS), converted to an ASCII raster file, and imported into a geographic information system (GIS).

During the USGS mapping mission, GPS data with real-time-kinematic corrections were combined with measurements of vessel motion (heave, pitch, and roll) in a CodaOctopus F180 attitude-and-position system to produce a high-precision vessel-attitude packet. This packet was transmitted to the acquisition software in real time and combined with instantaneous sound-velocity measurements at the transducer head before each ping. The returned samples were projected to the seafloor using a ray-tracing algorithm that works with previously measured sound-velocity profiles. Statistical filters were applied to discriminate seafloor returns (soundings and backscatter intensity) from unintended targets in the water column (Ritchie and others, 2010). The backscatter data were postprocessed using USGS software (D.P. Finlayson, written commun., 2011) that normalizes for time-varying signal loss and beam-directivity differences. Thus, the raw 16-bit backscatter data were gain-normalized to enhance the backscatter of the SWATHplus system. The resulting normalized-amplitude values were rescaled to 16-bit and gridded into GeoJPEGs using GRID Processor Software, then imported into a GIS and converted to GRIDs.

The acoustic-backscatter imagery from each different mapping system and processing method (MBARI and USGS) were merged into their own individual grids. These individual grids, which cover different areas, were displayed in a GIS to create the composite backscatter map. On the map, brighter tones indicate higher backscatter intensity, and darker tones indicate lower backscatter intensity. The intensity represents a complex interaction between the acoustic pulse and the seafloor, as well as characteristics within the shallow subsurface, providing a general indication of seafloor texture and composition. Backscatter intensity depends on the acoustic source level; the frequency used to image the seafloor; the grazing angle; the composition and character of the seafloor, including grain size, water content, bulk density, and seafloor roughness; and some biological cover. Harder and rougher bottom types such as rocky outcrops or coarse sediment typically return stronger intensities (high backscatter, lighter tones), whereas softer bottom types such as fine sediment return weaker intensities (low backscatter, darker tones). Note that the parallel lines of higher backscatter intensity throughout the map area are data-collection and -processing artifacts.

Bathymetric contours were generated at 10-m intervals for water depths shallower than 100 m and at 50-m intervals for water depths deeper than 100 m from the merged 2-m- and 3-m-resolution bathymetric surfaces. The merged surfaces were smoothed using the Focal Mean tool in ArcGIS and a circular neighborhood that has a radius of between 20 and 30 m (depending on the location). The contours were generated from these smoothed surfaces using the Spatial Analyst Contour tool in ArcGIS. The most continuous contour segments were preserved; smaller segments and isolated island polygons were excluded from the final output. The contours were then clipped to the boundary of the map area.

The onshore-area image was generated by applying an illumination having an azimuth of 300° and from 45° above the horizon to 2-m-resolution topographic-lidar data from National Oceanic and Atmospheric Administration (NOAA) Office for Coastal Management's Digital Coast (available at http://www.csc.noaa.gov/digitalcoast/data/coastallidar/) and to 10-m-resolution topographic-lidar data from the U.S. Geological Survey's National Elevation Dataset (available at http://ned.usgs.gov/).

REFERENCES CITED

Caress, D.W., Chayes, D.N., and Ferreira, C.D.S., 2015, MB-System seafloor mapping software, available at http://www.ldeo.columbia.edu/res/pi/MB-System/.

Ritchie, A.C., Finlayson, D.P., and Logan, J.B., 2010, Swath bathymetry surveys of the Monterey Bay area from Point Año Nuevo to Moss Landing, San Mateo, Santa Cruz, and Monterey Counties, California: U.S. Geological Survey Data Series 514, available at http://pubs.usgs.gov/ds/514/.

National Centers for Environmental Information, 2015, Bathymetric data viewer and database, accessed October 10, 2015, at http://www.ngdc.noaa.gov/maps/bathymetry.

EXPLANATION

Backscatter Intensity

High

Low

Area of "no data"—Areas near shoreline not mapped owing to insufficient high-resolution seafloor mapping data

20 **Bathymetric contour (in meters)**—Derived from modified 2-m- and 3-m-resolution bathymetry grids. Contour intervals: 1–100 m water depth, 10 m; >100 m water depth, 50 m

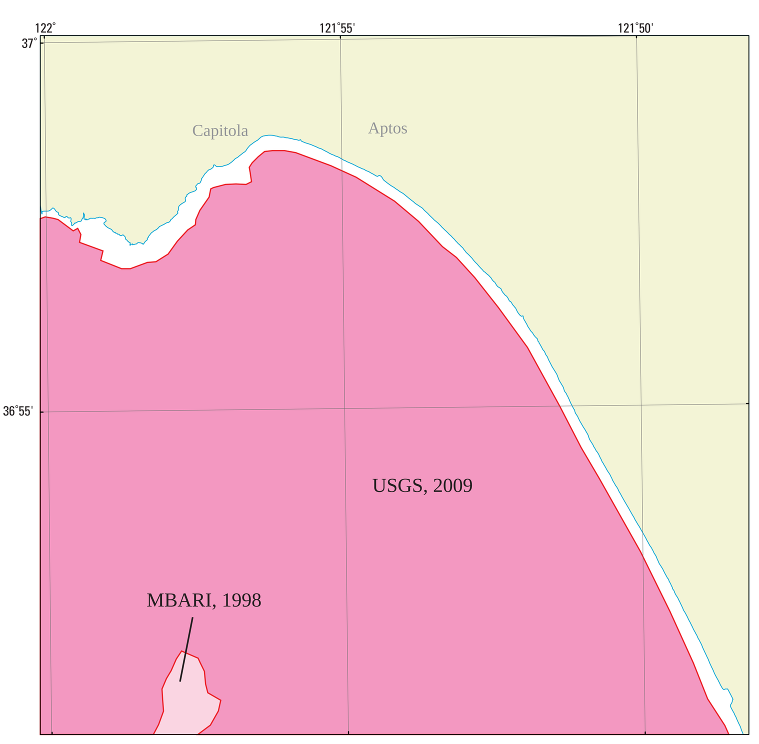


Figure 1. Map showing areas of multibeam echosounder and bathymetric side-scan surveys (pink shading) and onshore topographic data (yellow shading). Also shown are data-collecting agencies (MBARI, Monterey Bay Aquarium Research Institute; USGS, U.S. Geological Survey) and year of surveys if known.

Onshore elevation data from National Oceanic and Atmospheric Administration (NOAA) Office for Coastal Management's Digital Coast (available at http://www.csc.noaa.gov/digitalcoast/data/coastallidar/) and from U.S. Geological Survey's National Elevation Dataset (available at http://ned.usgs.gov/)

Universal Transverse Mercator projection, Zone 10N

NOT INTENDED FOR NAVIGATIONAL USE

13½°
TRUE NORTH
MAGNETIC NORTH
APPROXIMATE MEAN DECLINATION, 2016

SCALE 1:24 000
1 1/2 0 1 MILE
1000 0 1000 2000 3000 4000 5000 6000 7000 FEET
1 .5 0 1 KILOMETER
BATHYMETRIC CONTOUR INTERVALS 10 METERS AND 50 METERS
ONE MILE = 0.869 NAUTICAL MILES

Acoustic-backscatter imagery by Pete Dartnell, 2014 (data collected by Monterey Bay Aquarium Research Insitute in 1998 and by U.S. Geological Survey in 2014). Bathymetric contours by Mercedes D. Erdey, 2014

GIS database and digital cartography by Nadine E. Golden and Susan A. Cochran, 2014

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Acoustic Backscatter, Offshore of Aptos Map Area, California

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