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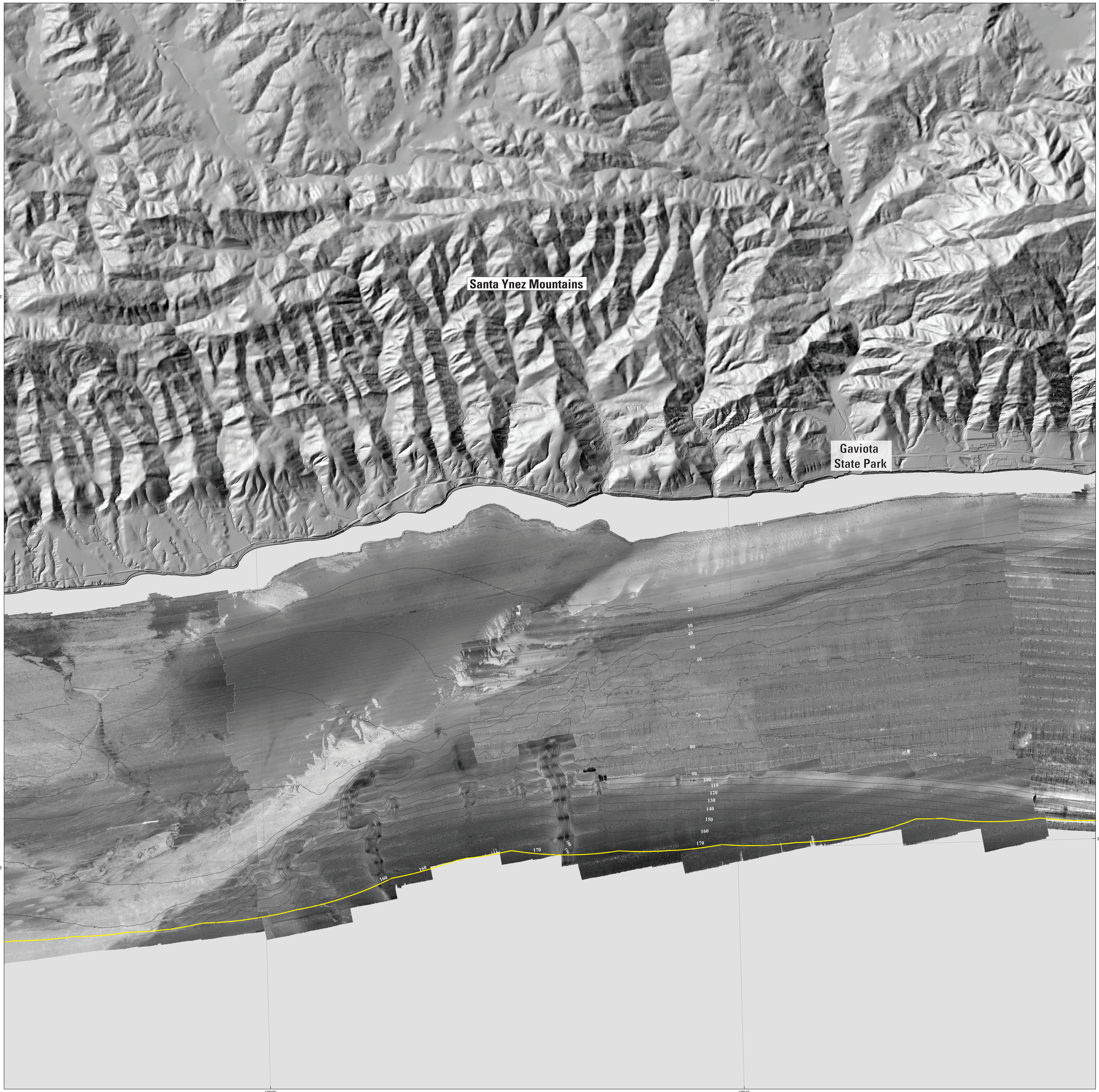
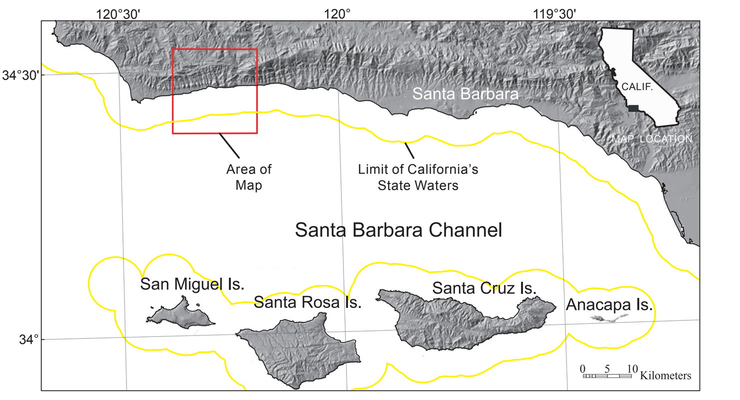
U.S. Department of the Interior
U.S. Geological Survey

Open-File Report 2018–1023
Sheet 3 of 9
Pamphlet accompanies map





DISCUSSION

This acoustic-backscatter map of the Offshore of Gaviota map area in southern California was generated from acoustic-backscatter data collected by the U.S. Geological Survey (USGS) and by Fugro Pelagos (fig. 1) in 2007 and 2008, using a combination of 400-kHz Reson 7125, 240-kHz Reson 8101, and 100-kHz Reson 8111 multibeam echosounders, as well as a 234-kHz SEA SWATHplus bathymetric sidescan-sonar system. These mapping missions combined to collect acoustic-backscatter data from about the 10-m isobath to beyond the 3-nautical-mile limit of California's State Waters.

During the USGS mapping missions, GPS data with real-time-kinematic corrections were combined with measurements of vessel motion (heave, pitch, and roll) in a CodaOctopus F190 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 (backscatter intensity) from unintended targets in the water column. The backscatter data were postprocessed in 2016 using SonarWiz software 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 data were exported in Imagine format, imported into a geographic information system (GIS), and converted to a GRID at 2-m resolution.

During the Fugro Pelagos mapping missions, an Applanix POS-MV (Position and Orientation System for Marine Vessels) was used to accurately position the vessels during data collection, and it also accounted for vessel motion such as heave, pitch, and roll, with navigational input from GPS receivers. Smoothed Best Estimated Trajectory (SBET) files were postprocessed from logged POS-MV files. Sound-velocity profiles were collected with an Applied Microsystems (AM) SVPlus sound velocimeter. Soundings were corrected for vessel motion using the Applanix POS-MV data, for variations in water-column sound velocity using the AM SVPlus data, and for variations in water height (tides) and heave using the postprocessed SBET data (California State University, Monterey Bay, Seafloor Mapping Lab, 2016). The Reson backscatter data were postprocessed using Geocoder software. The backscatter intensities were radiometrically corrected (including despeckling and angle-varying gain adjustments), and the position of each acoustic sample was geometrically corrected for slant range on a line-by-line basis. After the lines were corrected, they were mosaicked into 0.5-m resolution images (California State University, Monterey Bay, Seafloor Mapping Lab, 2016). The mosaics were then exported as georeferenced TIFF images, imported into a GIS, and converted to GRIDs at 2-m resolution.

The acoustic-backscatter imagery from each different mapping system and processing method were merged into their own individual grids. These individual grids, which cover different areas, were displayed in a GIS to create this composite acoustic-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). Ripple patterns and straight lines in some parts of the map area are data-collection and -processing artifacts.

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 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/).

REFERENCE CITED

California State University, Monterey Bay, Seafloor Mapping Lab, 2016, Southern California 2008 CSMP surveys: California State University, Monterey Bay, Seafloor Mapping Lab Data Library, accessed October 2016 at http://seafloor.otterlabs.org/SFMLwebDATA_SURVEYMAP.htm.

EXPLANATION

Backscatter intensity

High

Low

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

20 **Bathymetric contour (in meters)**—Derived from modified 2-m-resolution bathymetry grid. Contour interval: 10 m

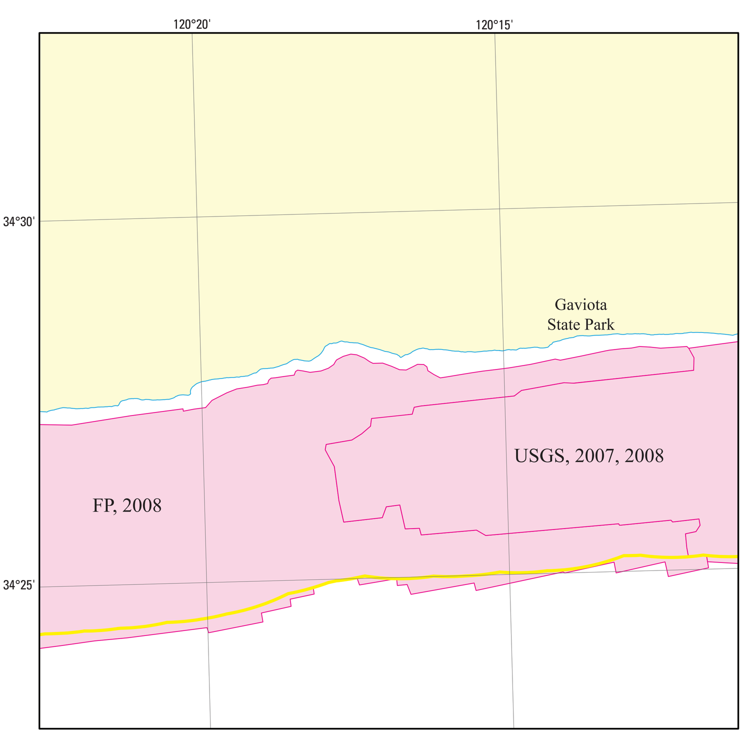


Figure 1. Map showing areas of multibeam-echosounder and bathymetric-sidescan surveys (pink shading) and publicly available onshore topographic-lidar data (yellow shading). Also shown are data-collecting agencies (FP, Fugro Pelagos; USGS, U.S. Geological Survey) and dates of surveys if known.

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/). California's State Waters limit from NOAA Office of Coast Survey

Universal Transverse Mercator projection, Zone 10N

NOT INTENDED FOR NAVIGATIONAL USE

$12\frac{1}{2}°$
TRUE NORTH
MAGNETIC NORTH
APPROXIMATE MEAN DECLINATION, 2018

SCALE 1:24 000
1 ½ 0 1 MILE
1000 0 1000 2000 3000 4000 5000 6000 7000 FEET
1 .5 0 1 KILOMETER
BATHYMETRIC CONTOUR INTERVAL 10 METERS
ONE MILE = 0.869 NAUTICAL MILES

MAP LOCATION

Acoustic-backscatter imagery by Peter Dartnell, 2016 (data collected by U.S. Geological Survey in 2007 and 2008 and by Fugro Pelagos in 2008). Bathymetric contours by Peter Dartnell, 2016

GIS database and digital cartography by Nadine E. Golden and Stephen R. Hartwell

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Acoustic Backscatter, Offshore of Gaviota Map Area, California

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Suggested Dartnell, P., and Kvitek, R.G., 2018, Acoustic backscatter, Offshore of Gaviota map area, California, *sheet 3 in* Johnson, S.Y., Dartnell, P., Cochrane, G.R., Hartwell, S.R., Golden, N.E., Kvitek, R.G., and Davenport, C.W. (S.Y. Johnson and S.A. Cochran, eds.), California State Waters Map Series—Offshore of Gaviota, California: U.S. Geological Survey Open-File Report 2018–1023, pamphlet 41 p., 9 sheets, scale 1:24,000, https://doi.org/10.3133/ofr20181023.