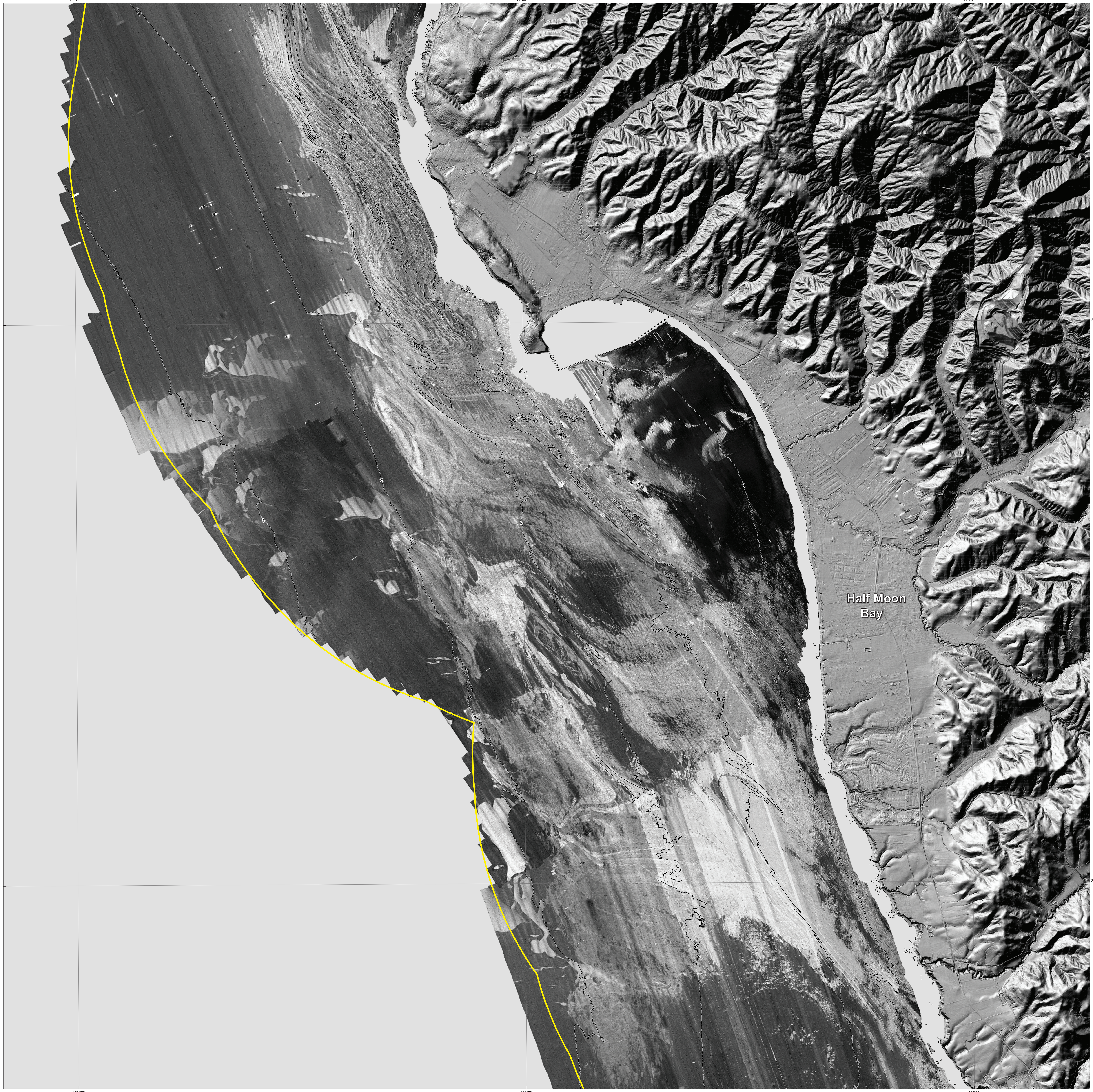
U.S. Department of the Interior
U.S. Geological Survey

Open-File Report 2014–1214
Sheet 3 of 10
Pamphlet accompanies map



Onshore elevation data collected by Photoscience in 2005 for U.S. Geological Survey and County of San Mateo. California's State Waters limit from NOAA Office of Coast Survey

Universal Transverse Mercator projection, Zone 10N

NOT INTENDED FOR NAVIGATIONAL USE

14°
TRUE NORTH
MAGNETIC NORTH
APPROXIMATE MEAN DECLINATION, 2014

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 INTERVAL 10 METERS

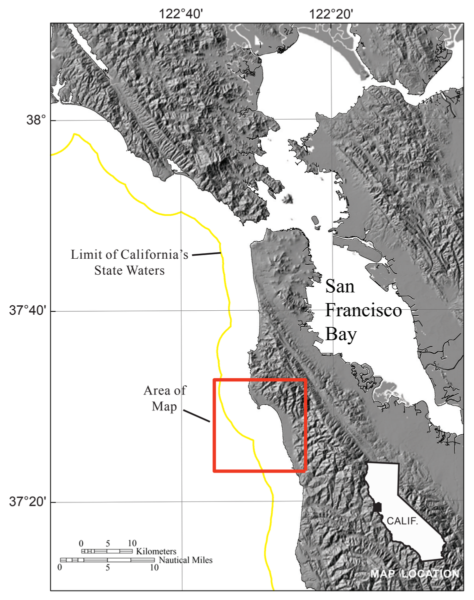
ONE MILE = 0.869 NAUTICAL MILES

CALIF.
MAP LOCATION

Acoustic-backscatter imagery by Peter Dartnell, 2012 (data collected by Fugro Pelagos in 2006 and 2007 and by California State University, Monterey Bay, Seafloor Mapping Lab in 2007). Bathymetric contours by Carrie K. Bretz, 2008

GIS database and digital cartography by Nadine E. Golden

Manuscript approved for publication October 2, 2014



DISCUSSION

This acoustic-backscatter map of the Offshore of Half Moon Bay map area in northern California was generated from backscatter data collected by Fugro Pelagos and by California State University, Monterey Bay (CSUMB) (fig. 1). Mapping was completed in 2006 and 2007, using a combination of 400-kHz Reson 7125 and 244-kHz Reson 8101 multibeam echosounders. 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 all the 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 (position accuracy, ±2 m; pitch, roll, and heading accuracy, ±0.02°; heave accuracy, ±5%, or 5 cm). To account for tidal-cycle fluctuations, CSUMB used NavCom 2050 GPS receiver (CNAV) data, and Fugro Pelagos used KGPS data (GPS data with real-time kinematic corrections); in addition, 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) using vertical-position data from the KGPS receivers. Backscatter data were postprocessed using Geocoder version 3.2 (Fugro Pelagos modified test release 16). Within Geocoder, 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 a 1-m-resolution image. Overlap between parallel lines was resolved using a priority table whose values were based on the distance of each sample from the ship track, with the samples that were closest to and furthest from the ship track being given the lowest priority. An anti-aliasing algorithm was also applied. The mosaics were then exported as georeferenced TIFF images, imported into a geographic information system (GIS), and converted to GRIDs at 2-m resolution.

The acoustic-backscatter grids were combined in a GIS to create this map, on which 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 an indication of seafloor texture and sediment type. 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).

Bathymetric contours were generated at 10-m intervals from a merged 2-m-resolution bathymetric surface (see sheet 1 of this report). The most continuous contour segments were preserved; smaller segments and isolated island polygons were excluded from the final output. Contours were smoothed using a polynomial approximation with exponential kernel algorithm and a tolerance value of 60 m.

The onshore-area image was generated by applying an illumination having an azimuth of 300° and from 45° above the horizon to 1-m-resolution topographic-lidar data collected by Photoscience in 2005 for the U.S. Geological Survey and the County of San Mateo.

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

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

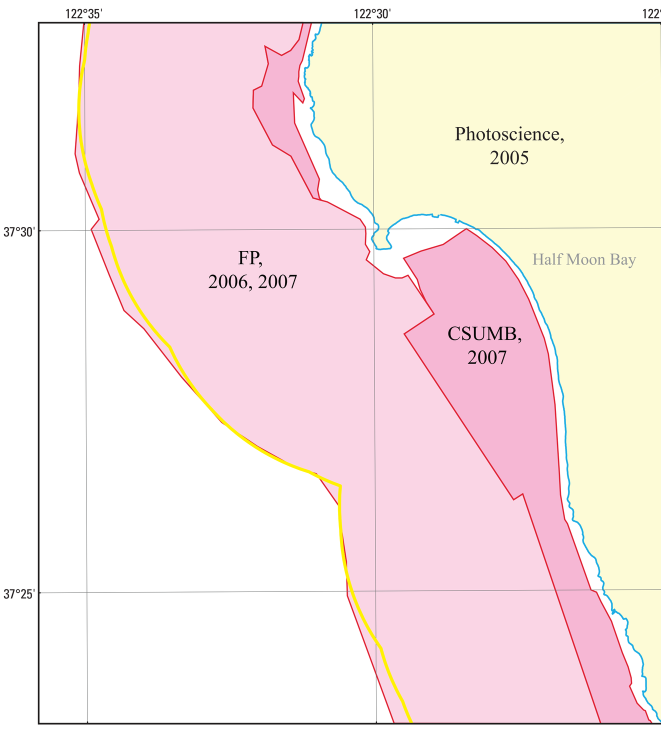


Figure 1. Map showing areas of multibeam-echosounder surveys (pink shading) and onshore topographic-lidar surveys (yellow shading). Also shown are data-collecting agencies (CSUMB, California State University, Monterey Bay, Seafloor Mapping Lab; FP, Fugro Pelagos) and dates of surveys if known.

Acoustic Backscatter, Offshore of Half Moon Bay Map Area, California

By

Carrie K. Bretz,[1] Rikk G. Kvitek,[1] Peter Dartnell,[2] and Eleyne L. Phillips[2]

2014

[1]California State University, Monterey Bay, Seafloor Mapping Lab;
[2]U.S. Geological Survey

ISSN 2331-1258 (online)
http://dx.doi.org/10.3133/ofr20141214

For sale by U.S. Geological Survey, Information Services, Box 25286, Federal Center, Denver, CO 80225, 1–888–ASK–USGS

Digital files available at http://pubs.usgs.gov/of/2014/1214/

Suggested Citation: Bretz, C.K., Kvitek, R.G., Dartnell, P., and Phillips, E.L., 2014, Acoustic backscatter, Offshore of Half Moon Bay map area, California, *sheet 3 in* Cochrane, G.R., Dartnell, P., Greene, H.G., Johnson, S.Y., Golden, N.E., Hartwell, S.R., Dieter, B.E., Manson, M.W., Sliter, R.W., Ross, S.L., Watt, J.T., Endris, C.A., Kvitek, R.G., Phillips, E.L., Erdey, M.D., Chin, J.L., and Bretz, C.K., (G.R. Cochrane and S.A. Cochran, eds.), California State Waters Map Series—Offshore of Half Moon Bay, California: U.S. Geological Survey Open-File Report 2014–1214, pamphlet 37 p., 10 sheets, scale 1:24,000, *http://dx.doi.org/10.3133/ofr20141214*.