

## Sanctuary Ecologically Significant Area (SESA)

### SESA 7: Eastern Smooth Ridge & MARS cable

#### Description

SESA 7 covers a range of deep benthic habitats (700-1,600 m) including a mix of hard (9%) and soft bottom on the south-eastern side of Smooth Ridge and fairly steep habitat along the western wall of Monterey Canyon. This SESA has intermediate levels of habitat diversity (index =3.52) and habitat richness (7 habitats). The benthic habitats and communities have been repeatedly surveyed (MBARI ROV) around the MARS observatory and associated submerged cable (western side of the SESA). Structure-forming invertebrates observed during these surveys include chemosynthetic communities, soft corals and gorgonians, crinoids, and brachiopods. Richness and diversity of the benthic fish fauna appears to be medium-high on Smooth Ridge based on benthic trawl surveys; however trawl survey effort in the SESA is low. The water over this SESA is highly productive, a hotspot for krill, and a foraging hotspot for Sooty Shearwater and marine mammals (e.g., Dall's porpoise, dolphins, sea lions, blue whale, humpback whale). This SESA is located within MBNMS, and research activities may require a permit

([http://montereybay.noaa.gov/resourcepro/permit/permits\\_need.html](http://montereybay.noaa.gov/resourcepro/permit/permits_need.html)).

#### Resource Management Issues

SESA 7 has been heavily used as commercial fishing grounds. Fishing methods with footprints include bottom trawling, bottom longline, pot/trap, and hook-and-line gear.

- Commercial benthic fixed gear
- Commercial bottom trawl
- Essential Fish Habitat (EFH) Conservation Area
- Recreational fishing
- Wildlife viewing
- Leatherback sea turtle critical habitat
- MBARI cable node

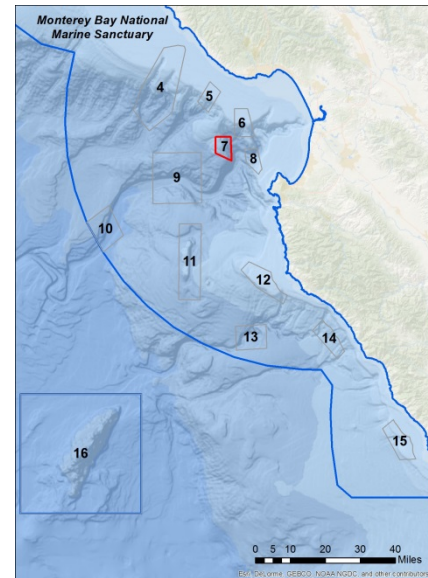


Figure 1. The location of SESA 7 and twelve additional SESAs in Monterey Bay National Marine Sanctuary. Credit: Chad King/MBNMS.



Figure 2. Close-up map of SESA 7. Grey border=SESA boundary; light orange border=EFH Conservation Area; orange=commercial benthic fixed gear dominant use. Source: SESAs Interactive Map, <http://sanctuarymonitoring.org/maps/sesa/>.

## Living Marine Resources & Uses

Table 1. Species known to occur within SESA 7: Eastern Smooth Ridge & MARS Cable.

<p>Invertebrates</p>	<ul style="list-style-type: none"> <li>-anemones (Actiniaria)</li> <li>-soft corals† (Alcyonacea), e.g., <i>Heteropolypus ritteri</i></li> <li>-sea pens† (Pennatulacea), e.g., <i>Anthoptilum grandiflorum</i>, <i>Halipteris californica</i>, <i>Funiculina</i> sp., <i>Pennatula californica</i>, <i>Umbellula lindahli</i>, also Virgulariidae</li> <li>-sea slugs (Nudibranchia), e.g., <i>Tritonia diomedea</i></li> <li>-sea snails (Gastropoda)</li> <li>-crabs (Decapoda), e.g., longhorn decorator crab (<i>Chorilia longipes</i>), grooved tanner crab (<i>Chionoecetes tanneri</i>)</li> <li>-brachiopods† (Brachiopoda)</li> <li>-sea lilies (Crinoidea)</li> <li>-brittle stars (Ophiuroidea), e.g., <i>Asteronyx</i> sp.</li> </ul> <p>(MBARI VARS imagery; NMFS West Coast Bottom Trawl Groundfish Survey)</p>
<p>Fishes</p>	<ul style="list-style-type: none"> <li>-Pacific Hagfish (<i>Eptatretus stoutii</i>)</li> <li>-Filetail Cat Shark (<i>Parmaturus xaniurus</i>)</li> <li>-California Slickhead (<i>Alepocephalus tenebrosus</i>)</li> <li>-Pacific Flatnose (<i>Antimora microlepis</i>)</li> <li>-Hundred-fathom Codling (<i>Physiculus rastrelliger</i>)</li> <li>-Longspine Thornyhead (<i>Sebastobus altvelis</i>)</li> <li>-Blacktail Snailfish (<i>Careproctus melanurus</i>)</li> <li>-Twoline Eelpout (<i>Bothrocara brunneum</i>)</li> <li>-eelpout (<i>Lycenchelys</i> sp.)</li> </ul> <p>(MBARI VARS imagery)</p> <p><i>Found nearby:</i></p> <ul style="list-style-type: none"> <li>-Sablefish (<i>Anoplopoma fimbria</i>)</li> <li>-Dover Sole (<i>Microstomus pacificus</i>)</li> </ul> <p>(MBNMS 2013; Vetter et al. 1994)</p>
<p>Marine birds</p>	<ul style="list-style-type: none"> <li>-Pacific Loon (<i>Gavia pacifica</i>)</li> <li>-Black-footed Albatross<sup>3</sup> (<i>Phoebastria nigripes</i>)</li> <li>-Northern Fulmar (<i>Fulmarus glacialis</i>)</li> <li>-Buller's Shearwater (<i>Puffinus bulleri</i>), Pink-footed Shearwater<sup>3</sup> (<i>P. creatopus</i>), Sooty Shearwater (<i>P. griseus</i>)</li> <li>-California Brown Pelican (<i>Pelecanus occidentalis californicus</i>)</li> <li>-Red Phalarope (<i>Phalaropus fulicarius</i>)</li> <li>-California Gull (<i>Larus californicus</i>), Heermann's Gull (<i>L. heermanni</i>), Western Gull (<i>L. occidentalis</i>)</li> <li>-Black-legged Kittiwake (<i>Rissa tridactyla</i>)</li> <li>-Common Murre (<i>Uria aalge</i>)</li> <li>-Rhinceros Auklet (<i>Cerorhinea monocerata</i>)</li> <li>-Cassin's Auklet<sup>3</sup> (<i>Ptychoramphus aleuticus</i>)</li> </ul> <p>(Ainley et al. 2012)</p>

Marine mammals	-blue whale <sup>1</sup> ( <i>Balaenoptera musculus</i> ) -humpback whale <sup>1</sup> ( <i>Megaptera novaeangliae</i> ) -gray whale ( <i>Eschrichtius robustus</i> ) -dolphins (Odontoceti), e.g., Northern right-whale dolphin ( <i>Lissodelphis borealis</i> ), Risso's dolphin ( <i>Grampus griseus</i> ), Pacific white-sided dolphin ( <i>Lagenorhynchus obliquidens</i> ), Dall's porpoise ( <i>Phocoenoides dalli</i> ) -seals (Phocidae), e.g., harbor seal ( <i>Phoca vitulina</i> ), Northern elephant seal ( <i>Mirounga angustirostris</i> ) -sea lions (Otariinae), e.g., Steller sea lion <sup>2</sup> ( <i>Eumetopias jubatus</i> ), California sea lion ( <i>Zalophus californianus</i> ) (NOAA, 2003)
Marine reptiles	-leatherback sea turtle <sup>1</sup> ( <i>Dermochelys coriacea</i> ) (NOAA, 2003)

Special Status Species: Endangered<sup>1</sup>, Threatened<sup>2</sup>; Birds of Conservation Concern<sup>3</sup>; Biogenic habitat†

#### Diverse or productive communities:

- high primary productivity
- krill hotspot
- marine bird and mammal high diversity

#### Migration, breeding, or foraging areas:

- Dall's porpoise, dolphins, sea lions (ESI, Environmental Sensitivity Index); blue whale and humpback whale (ESI)
- 100% in leatherback sea turtle NMFS critical habitat
- 100% in Sooty Shearwater (IBA, Important Bird Area)

## Research

#### SIMoN projects:

Center for Integrated Marine Technologies: Wind to Whales (1997-2008)

<http://sanctuariesimon.org/projects/100155/center-for-integrated-marine-technologies%3a-wind-to-whales>

CSCAPE: Collaborative Survey of Cetacean Abundance and the Pelagic Ecosystem (2005-07)

<http://sanctuariesimon.org/projects/100273/cscape%3a--collaborative-survey-of-cetacean-abundance-and-the-pelagic-ecosystem>.

MBARI Time Series (MBTS) Program (1992-current)

<http://sanctuariesimon.org/projects/100273/cscape%3a--collaborative-survey-of-cetacean-abundance-and-the-pelagic-ecosystem>.

Midwater Trawl Pre-recruit Survey (1983-current)

<http://sanctuarymonitoring.org/projects/100118/midwater-trawl-pre-recruit-survey>

Monitoring whales by Cascadia Research Collective (1991-current)

<http://sanctuarymonitoring.org/projects/100152/monitoring-whales-by-cascadia-research-collective>

Potential Impacts of the Monterey Accelerated Research System (MARS) Cable on the Seabed and Benthic Faunal Assemblages (2003-current)

<http://sanctuarymonitoring.org/projects/100391/potential-impacts-of-the-monterey-accelerated-research-system-%28mars%29-cable-on-the-seabed-and-benthic-faunal-assemblages>

Sea Turtle Restoration Project: Leatherback Watch Program (2010-current)

<http://sanctuarymonitoring.org/projects/100395/sea-turtle-restoration-project%3a-leatherback-watch-program>

Structure of Populations, Levels of Abundance and Status of Humpbacks (SPLASH) (2004-current)

<http://sanctuarymonitoring.org/projects/100224/structure-of-populations%2c-levels-of-abundance-and-status-of-humpbacks-%28splash%29>

Tagging of Pacific Predators (TOPP) (2000-current)

<http://sanctuarymonitoring.org/projects/100137/tagging-of-pacific-predators-%28topp%29>

Tracking Black-footed Albatross Movements and Conservation (2004-2008)

<http://sanctuariesimon.org/projects/100305/tracking-black-footed-albatross-movements-and-conservation>

Underwater Behavior of Large Whales Using Suction-cup Attached Tags (2000-current)

<http://sanctuarymonitoring.org/projects/100153/underwater-behavior-of-large-whales-using-suction-cup-attached-tags>

usSEABED: A USGS Pacific Coast Offshore Surficial Sediment Data and Mapping Project (2005-current)

<http://sanctuarymonitoring.org/projects/100247/usseabed%3a-a-usgs-pacific-coast-offshore-surficial-sediment-data-and-mapping-project>

Monitoring stations and/or data collection instruments:

- CIMT survey tracklines (historic)
- NMFS West Coast Bottom Trawl Groundfish Survey
- MBARI MARS observatory

Equipment linked to MARS node:

- CTD, seafloor seismometer
- DEIMOS echo sounder
- ORCA Eye-in-the-Sea
- FOCE experiment (ocean acidification)
- benthic rover (deep-sea carbon cycling)
- deep-sea ESP (molecular ID)
- ALOHA mooring (vertical profiles of water column)

MBNMS research:

- CTD profile (NOAA Ship Shimada, 2015)

## Science Needs & Research Questions

Bottom Trawling: Habitat and Species Recovery

[http://sanctuaries.noaa.gov/science/assessment/pdfs/mbnms\\_extraction\\_trawling.pdf](http://sanctuaries.noaa.gov/science/assessment/pdfs/mbnms_extraction_trawling.pdf)

- Which habitats are sensitive to bottom trawling?

Habitat Characterization of the Continental Slope:

[http://sanctuaries.noaa.gov/science/assessment/pdfs/mbnms\\_characterization\\_slope.pdf](http://sanctuaries.noaa.gov/science/assessment/pdfs/mbnms_characterization_slope.pdf)

- What are the distribution and abundance of organisms and habitats on the continental slope?
- How do corals and chemosynthetic communities on the continental slope provide biogenic habitat for other species?

Human Health - Harmful Algal Blooms

[http://sanctuaries.noaa.gov/science/assessment/pdfs/mbnms\\_habs.pdf](http://sanctuaries.noaa.gov/science/assessment/pdfs/mbnms_habs.pdf)

- How do HABs affect local species populations?

#### Impacts on Whales from Human Uses

[http://sanctuaries.noaa.gov/science/assessment/pdfs/mbnms\\_whale\\_science.pdf](http://sanctuaries.noaa.gov/science/assessment/pdfs/mbnms_whale_science.pdf)

- What are the spatial and temporal patterns of habitat use of large whales throughout sanctuary waters (both inshore and offshore)?

#### Socioeconomics and the Human Dimension

[http://sanctuaries.noaa.gov/science/assessment/pdfs/mbnms\\_socioeconomics.pdf](http://sanctuaries.noaa.gov/science/assessment/pdfs/mbnms_socioeconomics.pdf)

- How do we determine the overall impact of multiple human activities (some with negative and some with positive influence) on Sanctuary resources?

#### Water Quality Integrated Analyses

[http://sanctuaries.noaa.gov/science/assessment/pdfs/mbnms\\_water\\_quality.pdf](http://sanctuaries.noaa.gov/science/assessment/pdfs/mbnms_water_quality.pdf)

- Determine and implement the necessary monitoring to assess the condition of water quality in the Sanctuary.

**SESAs Interactive Map:** <http://sanctuariesimon.org/maps/sesa>

#### Publically Available Imagery

- MBARI ROV: Video Annotation and Reference System (<http://www.mbari.org/products/research-software/video-annotation-and-reference-system-vars/>)
- MARS Observatory Photo Gallery ([http://www3.mbari.org/mars/science/biology\\_photo\\_gallery/MARSPhotoGallery.htm](http://www3.mbari.org/mars/science/biology_photo_gallery/MARSPhotoGallery.htm))
- MBARI ROV: Smooth Ridge soft sediment video transects (<http://www.mbari.org/science/seafloor-processes/biology-and-ecology/faunal-patterns/>)



Figure 3. White-spine sea cucumber, (*Apostichopus leukothele*) at Smooth Ridge. Credit: MBARI (<http://www.mbari.org/benthic-fauna-800m/>).

## SESA Data Layers

Table 2. The 13 SESAs of the MBNMS are comprised of a variety of biological and environmental characteristics that describe unique pelagic and benthic deep sea communities. Listed are a subset of these qualities which include habitat diversity (Shannon-Wiener diversity index); hard substrate area coverage (%); the most common type of habitat; the presence and abundances of corals and sponges, demersal fishes, and marine birds; and the area coverage (%) of upwelling zone within each SESA. Sources: Draft MBNMS report in preparation; SESAs Interactive Map, <http://sanctuarymonitoring.org/maps/sesa/>.

SESA	Habitat diversity (H')	Hard substrate (%)	Primary habitat	Corals & sponges	Demersal fishes	Marine birds	Upwelling zone (%)
4	5.43	8%	Slope 2 soft canyon	yes-high	yes-high	yes-high	yes-50%
5	6.13	19%	Slope 1 Soft Canyon	yes- high	yes-med	yes-med	yes-100%
6	6.62	13%	Shelf Break soft	yes-high	yes-low	yes-med	no
7	3.52	9%	Slope 2 soft canyon	yes-med	yes-high	yes-med	no
8	5.32	33%	Slope 2 soft canyon	yes-med	yes-med	yes-high	no
9	2.34	5%	Slope 2 soft canyon	yes-high	yes-high	yes-low	no
10	3.23	1%	Rise soft canyon	yes-med	not sampled	yes-low	no
11	1.56	16%	Slope 2 soft	yes-med	yes-high	yes-low	no
12	4.17	32%	Shelf hard	yes-med	yes-high	yes-med	yes-50%
13	2.00	0%	Slope 2 soft	yes-low	not sampled	yes-low	no
14	2.41	0%	Slope 1 Soft	yes-med	yes-high	yes-med	yes-50%
15	5.31	18%	Shelf Break soft	yes-med	yes-med	yes-med	yes-25%
16	3.12	73%	Slope 2 hard	yes-high	yes-high	yes-low	no

## Selected Publications

Ainley D, Spear L, Casey J, Ford RG, Gill T, et al. 2012. Chapter 3: Biogeography of Marine Birds. A Biogeographic Assessment off North/Central California. Retrieved from Center for Coastal Monitoring and Assessment (NCCOS), National Ocean Service. Available at: <http://ccma.nos.noaa.gov/ecosystems/sanctuaries/california/html/birds/>

Benson SR, Forney KA, Harvey JT, Carretta JV, Dutton PH. 2007. Abundance, Distribution, and Habitat of Leatherback Turtles (*Dermochelys coriacea*) Off California, 1990– 2003. *Fishery Bulletin*, 105(3): 337-347. Available at: [http://aquaticcommons.org/8876/1/benson\\_Fish\\_Bull\\_2007.pdf](http://aquaticcommons.org/8876/1/benson_Fish_Bull_2007.pdf)  
<http://montereybay.noaa.gov/research/techreports/trbenson2007.html>.

Brown JA, EJ Burton, S De Beukelaer. 2013. The Natural Resources of Monterey Bay National Marine Sanctuary: A Focus on Federal Waters. Marine Sanctuaries Conservation Series ONMS-13-05. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Office of National Marine Sanctuaries, Silver Spring, MD. 264 pp. Available at: <http://montereybay.noaa.gov/research/techreports/trbrown2013.html>

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Kirkwood WJ. 2015. Design, Construction, and Operation of an Actively Controlled Deep-Sea CO2 Enrichment Experiment Using a Cabled Observatory System. *Deep-sea research. Oceanographic Research Papers*, 97:1-9.

Kirkwood WJ, Caress DW. 2007. Comparison of MBARI Autonomous Underwater Mapping Results for ORION Monterey Accelerated Research System (MARS) and Neptune Canada. In *Underwater Technology and Workshop on Scientific Use of Submarine Cables and Related Technologies, 2007. Symposium on*: 13-20. IEEE.

Kuhn LA, Barry JP, Buck K, Lovera C, Whaling PJ. 2011. Potential Impacts of the Monterey Accelerated Research System (MARS) Cable on the Seabed and Benthic Faunal Assemblages. *MARS Biological Survey Report, Monterey Bay National Marine Sanctuary*, NOAA: 1-32.

Leeworthy VR, Jerome D, Schueler K. 2014. Economic Impact of the Commercial Fisheries on Local County Economies from Catch in All California National Marine Sanctuaries 2010, 2011 and 2012. Marine Sanctuaries Conservation Series ONMS-14-03. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Office of National Marine Sanctuaries, Silver Spring, MD. 46pp. Available at: <http://montereybay.noaa.gov/research/techreports/trleeworthy2014.html>

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