

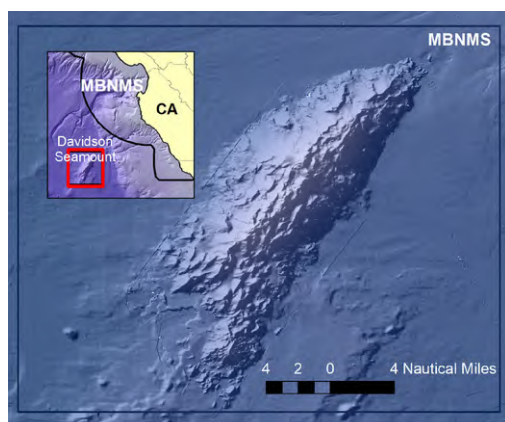
## 2019 Accomplishments



Credit: Amity Wood/NOAA

### Explorations at Davidson Seamount

After the discovery of the deep-sea octopus garden in 2018, sanctuary scientists returned to Davidson Seamount in 2019 with Woods Hole Oceanographic Institution (WHOI) aboard the submersible *Alvin* and with Ocean Exploration Trust (OET) aboard the *E/V Nautilus*. The dives further characterized the octopus nursery area and determined the temperature of warm water seeps on the seafloor. The WHOI expedition was highlighted during the BBC's live television broadcast of "Blue Planet Live." During a dive with OET, transects were conducted to estimate octopus population size, and the long-term placement of temperature and dissolved oxygen loggers was completed. A small volcanic cone approximately six miles northeast of the octopus garden was found to be hosting more brooding octopuses.



Davidson Seamount Mapped Features. Credit: Chad King/NOAA

### Seafloor Protections Expanded

MBNMS staff led a stakeholder process to develop a collaborative Monterey Bay proposal with local trawl fishermen and conservation organizations for Essential Fish Habitat Conservation Area modifications in 2013, which was approved by the Pacific Fishery Management Council in 2018. The final rule changes bottom trawl fishing closures to minimize adverse effects of fishing to Pacific Coast groundfish essential fish habitat and re-opens historically important fishing grounds to groundfish bottom trawling. As part of the rule, the amendments will protect deep-sea habitats beyond 11,483 feet (3,500 meters) below the ocean surface by prohibiting all commercial bottom-contact fishing gear. The collaborative approach served as a model and a similar process was implemented along the entire west coast.

### Dive Into Ocean Exploration

In support of the *E/V Nautilus* deep-sea expedition to Davidson Seamount, MBNMS staff hosted classroom presentations with local 4th grade students. During field trips to the Sanctuary Exploration Center, 90 students engaged in deep-sea coral lessons, ROV building activities, and experienced live ship-to-shore interactions with scientists at sea. The "Dive Into Ocean Exploration" program serves to excite and inspire students to seek careers in science, technology, engineering, and mathematics and to become the next generation of explorers.

### Management Plan Review Process

After the NOAA Office of National Marine Sanctuaries internal review process, the MBNMS draft management plan, draft proposed rule, and draft environmental assessment enters into a formal clearance process through the Department of Commerce. Issuance of the documents will occur in early 2020 with public notice through the federal register, including public hearings and 60 day public comment period.

### Fishermen in the Classroom

Fishermen in the Classroom education program, presented by MBNMS staff alongside local fishermen, provides students a hands-on learning experience of a "day in the life" of a fisherman and focuses on the local fishing industry and rich history in the sanctuary. Four fishermen from Monterey, Santa Cruz, and Moss Landing harbors delivered 21 presentations reaching 508 students throughout Santa Cruz and Monterey Counties during the 2018-19 school-year.



Credit: Ali Wolman/NOAA

### Outstanding Volunteer Service

Marj Sewell received the MBNMS 2019 Volunteer Service Award for her contributions at the Coastal Discovery Center. She was in the first docent training class in 2006, and has contributed more than 1,700 hours of her time to education and interpretation of the sanctuary. Marj contributed content to the Center's local history program and whaling exhibit. As a retired teacher, she teaches hundreds of students who come to the Center each year and inspires people of all ages with her endless enthusiasm for the sanctuary.

## Vessel Causality Responses

MBNMS staff coordinated the salvage operations of nine vessel groundings, which can pose immediate threats to sanctuary resources by crushing marine habitat and organisms, releasing hazardous chemicals, and discharging nets, hooks, and other harmful debris. A coordinated emergency response conducted in an environmentally sound manner between federal and state agencies, harbor masters, and other local partners is critical to protecting natural resources. MBNMS staff assisted the NOAA Office of Law Enforcement during incident investigations, and as part of on-going clean-up efforts, assessed habitat damage and promoted actions to help restore impacted resources.

## Salmonscape Exhibit

In collaboration with the National Marine Fisheries Service, a new salmonscape traveling exhibit was created by MBNMS staff, consisting of three interactive panels, focusing on the salmon life cycle, threats to California populations, recreational fishing, salmon research, and highlights what people can do in their daily lives to help protect salmon. A final panel is under development in partnership with U.S. Forest Service (USFS) highlighting the connection of salmon migrations throughout California watersheds, and why land and sea resource protections from MBNMS and USFS are vital to salmon lifecycles.

## Cruise Ship Compliance Monitoring

As part of the cruise ship regulatory compliance program, MBNMS staff coordinated joint inspections with U.S. Coast Guard for several cruise ships transiting through the sanctuary during ports of call. Each year, the team conducts random inspections of cruise ships visiting Monterey to verify adherence with sanctuary and Coast Guard regulations. Inspectors review ship logs, interview crew members, and physically inspect engine rooms, waste management, and other areas to ensure regulatory compliance of environmental safeguards and practices. In response to growing public interest over potential impacts from cruise ships visiting Monterey Bay, MBNMS and the City of Monterey staff hosted a public information session in June with a representative panel of multiple agencies over cruise ship regulations. The session, which was video recorded for a local cable television access channel, served to provide factual information on regulatory authority and addressed public questions on cruise ships.



Credit: Ocean Exploration Trust/NOAA

## Whale Fall Encountered

During a second ROV dive aboard the E/V *Nautilus*, sanctuary scientists encountered the carcass of a recently deceased baleen whale around 10,500 feet deep on the seafloor. The whale fall was in the middle stages of decomposition, covered in scavengers including cusk eels, grenadiers, octopus, and crustaceans. Valuable samples of bones, a newly identified species of the bone-eating worm *Osedax*, water, eDNA, and sediment were collected for further research of a rarely studied ecological phenomena. The public followed along in real time during the live-streaming broadcast of the remarkable discovery, and social media of the event experienced over four million views with dozens of media stories published, including NPR, CNN, and The Washington Post.

## Essential Fish Habitats Surveyed

The NOAA Ship *Reuben Lasker* surveyed deep-sea habitats within MBNMS including Cabrillo Canyon, west of Carmel Canyon, and Sur Canyon Slot Canyons. As part of a 29-day expedition within four national marine sanctuaries along the west coast, the research focused on Essential Fish Habitat Conservation Areas proposed for modification under the Pacific Fishery Management Council's draft Amendment 28, surveying potential sites for offshore wind energy, and assessing previously unexplored habitats. The research cruise was a multi-institution effort as part of EXPRESS (Expanding Pacific Research and Exploration of Submerged Systems) and Deep-sea Coral Research and Technology Program's West Coast Deep-sea Coral Initiative efforts. The surveys provide a better understanding of deep-sea communities in anticipation of fisheries management decisions.

## Milestones in Water Quality Monitoring

2019 marks the 20th year of Snapshot Day and First Flush, and the 23rd year of Urban Watch water quality monitoring programs. First Flush collects water samples from storm drains during the first rain of winter, and Urban Watch is a dry weather monitoring program for the detection of urban pollutants within storm drains flowing into the sanctuary. During the first Saturday in May, Snapshot Day collects water samples and field measurements from over 250 creeks and rivers within four counties that drain into MBNMS. Throughout the past 23 years, over 5,000 trained volunteers and coordination among many partners have resulted in the successful long-term monitoring, reducing, and preventing contaminants from impacting the sanctuary's water quality.



Credit: R.Chow

## Team OCEAN's 20th Season

Team OCEAN is a unique program that puts trained, knowledgeable volunteer naturalists on the water in sanctuary kayaks to interact with ocean users such as kayakers, paddleboarders and boaters, directly influencing whether users disturb sensitive marine wildlife such as sea otters or harbor seals. This year, Team OCEAN engaged with 4,244 people in Elkhorn Slough and 1,585 people along Cannery Row in Monterey. These seasonal totals bring the program totals to over 113,000 people contacted since the program started in 2000. After 20 years on the water, Team OCEAN continues to be a critical program, vital for the protection of federally protected, sensitive wildlife such as harbor seals and the endangered Southern sea otter.

## New Indicator Portfolios for Sanctuary Condition Reports

In order to identify and prioritize quantitative, habitat-based indicators of ecosystem state for sanctuary condition reports, NOAA Office of National Marine Sanctuaries' and NOAA Fisheries' scientists within the California Current Integrated Ecosystem Assessment team collaborated on "[Developing Science-Based Indicator Portfolios For National Marine Sanctuary Condition Reports](#)." Using MBNMS as the focal sanctuary, the report describes a process used to compile, categorize, and screen indicators, resulting in indicator portfolios and conceptual models for each of the sanctuary's eight major habitat categories. This indicator development process will aid in ecosystem-based management by promoting a more consistent approach to documenting the status and trends of driving forces, pressures, and resources in MBNMS.

## Annotated Checklist of Fishes

Along with the California Academy of Sciences, sanctuary scientists published "[Annotated checklist of fishes from Monterey Bay National Marine Sanctuary with notes on extralimital species](#)." Extensive ichthyological research, field surveys, and analyses of collections at museums, literature, and visual records were essential in creating the first annotated checklist of fishes. This inventory provides evidence of occurrence for 507 fishes and an additional 18 species considered to be extralimital (derived from outside sanctuary boundaries). Establishing a comprehensive inventory of diverse fish fauna is a crucial first step to further identify species that are endemic, threatened, introduced, or socio-economically important, information which is very useful for resource management.



Credit: Nick Ingram/NOAA

## New Sounds in the Sanctuary Exhibit

A joint project between MBNMS and Monterey Bay Aquarium Research Institute (MBARI) staff to create an underwater sound exhibit was completed at the Sanctuary Exploration Center. The "Sounds in the Sanctuary" exhibit highlights 10 different sounds recorded with MBARI's hydrophone at 3,000 feet deep in the sanctuary. With activation of exhibit buttons, visitors hear a sound and then see a corresponding message about the sound source. The exhibit plays both natural and anthropogenic sounds, such as underwater earthquakes, container ships, and blue, sperm, and humpback whales and dolphins, to engage the public in ocean acoustics and research to characterize the sanctuary soundscape.

## Fishing Gear Demonstration Day

To inform the efforts of the California Dungeness Crab Fishing Gear Working Group, the California Department of Fish and Wildlife and national marine sanctuaries hosted a gear innovation demonstration day. Fisherman, gear designers, and fishery and resource managers learned about different gear types that may help reduce the risk of whale and sea turtle entanglements in commercial Dungeness crab fishing gear. Participants explored the use of "pop-up" gear technology, long soaker systems, and weak link lines designed to release when an animal puts pressure on the line to reduce entanglements.

## Underwater Hydrophones Deployed

As part of acoustic monitoring in MBNMS, NOAA and the U.S. Navy deployed underwater recorders, known as hydrophones, to characterize ambient sound levels, detect species diversity with acoustic signatures, and monitor sounds from geophysical and human activities over time. Eight hydrophones were positioned in stations ranging from 230 to 2,800 feet deep off the Monterey Peninsula, Sunset and Marina State Beaches, Sur Ridge, and in Monterey and Soquel Canyons. Using standardized measurements over the next few years, numerous scientific partners will gather baseline acoustic conditions and better understand long-term changes to sound levels in several national marine sanctuaries.

## Advisory Council Meetings

The advisory council met six times in 2019, and received updates including: Monterey Bay Eco-tourism Initiative, regional soundscape monitoring program, harbor sediment projects, maritime heritage cultural program, shoreline fishing/gear threats to seabirds, whale disentanglement and vessel strikes, new BeachCOMBERS/CenCOOS data portal, balloon marine debris impacts, and microplastics and needles entering the sanctuary. The Council approved a resolution recommending MBNMS staff support a comprehensive approach to plastic pollution mitigation.

## Staff Excellence Award

MBNMS Volunteer Monitoring Coordinator Lisa Emanuelson was awarded the 2019 National Ocean Service's Team Member of the Year for outstanding achievements in education and resource protection. With over 17 years of service to MBNMS, Lisa's leadership has been critical to sustaining our citizen science and outreach programs. She promotes and supports stewardship of sanctuary resources by training and coordinating hundreds of dedicated volunteers in water quality monitoring and wildlife disturbance prevention programs.



Credit: Amity Wood/NOAA

## Get Into Your Sanctuary Celebrations

MBNMS staff held three simultaneous events in August to highlight Get Into Your Sanctuary in three coastal communities. The Coastal Discovery Center hosted local bird and mammal observations and recreational fishing for the public. In Santa Cruz, the Sanctuary Exploration Center offered "Fishy Friday," plankton viewing, and virtual dive experiences. In collaboration with Monterey Bay Kayaks, MBNMS staff hosted an ocean recreation and wildlife festival with partners to promote responsible wildlife viewing. The annual Get Into Your Sanctuary weekend is celebrated throughout the National Marine Sanctuary System.

## Groundwater Replenishment Project

MBNMS finalized the Environmental Assessment and Finding of No Significant Impact Report for the Monterey One Water Regional Wastewater Treatment Plant and Advanced Water Purification Facility project for the purpose of creating a reliable supply of recycled water for agricultural irrigation, diverting polluted surface waters for treatment, and helping to prevent seawater intrusion in the Salinas Valley Groundwater Basin. By doing so, MBNMS ensures sanctuary resources will not be impacted through discharge and drilling into and disturbance of submerged lands.



Credit: Chelsea Prindle/NOAA

## Visitor Center School Programs

School field trips to the Coastal Discovery Center and the Sanctuary Exploration Center reached more than 2,200 students from 32 different schools during the 2018-19 school year. Education programs cover a wide variety of topics and are developed for specific grade levels, such as kelp forest ecology, deep-sea animals, marine debris, oceanography, and identifying plankton. School programs work to educate students about the sanctuary's unique and special coastal and marine environment, fostering stewardship and protection of the sanctuary.

## Sanctuary Agricultural Programs

As part of the Agricultural Water Quality Alliance, MBNMS staff works cooperatively with farmers, ranchers, technical service providers, and resource conservation agencies to protect water quality draining into the sanctuary through a voluntary stewardship approach. Staff organized clean up efforts to remove 300 pounds of abandoned plastic, a point source pollution of microplastics, from agricultural fields near Elkhorn Slough with volunteer students, agricultural professionals, and local conservation organizations. MBNMS staff led Healthy Soils Program workshops on carbon sequestration practices for ranchers and agriculture professionals to help offset greenhouse gas emissions impacting ocean health in a changing climate.

## New Research Publications

MBNMS staff collaborated with scientists to publish three peer-reviewed science articles: "[Shifts in the Distribution and Abundance of Coastal Marine Species Along the Eastern Pacific Ocean During Marine Heatwaves from 2013 to 2018](#)" reports on short- and long-term ecological changes in response to recent marine heatwaves. "[Human-induced Reductions in Fish Predator Boldness Decrease Their Predation Rates in Kelp Forests](#)" compared behavioral traits and predation rates by predatory fishes on squid prey in protected areas of different protection levels and ages, and "[Humpback Whale Song Occurrence Reflects Ecosystem Variability in Feeding and Migratory Habitat of the Northeast Pacific](#)" which examined the occurrence of humpback whale song in the northeast Pacific from three years of continuous recordings off central California.

## Deep-sea Coral Work Continues

Along with partners from Monterey Bay Aquarium Research Institute and UC Santa Cruz, sanctuary scientists continued their long-term research at Sur Ridge, expanding on restoration methods for multiple deep-sea coral species by transplanting live fragments and measuring survival rates. Coral transplants were evaluated for growth, feeding mechanisms, and food availability. The study includes monitoring coral predation at MBARI's Deep-sea Coral Observatory. Findings were presented at the 7th International Symposium on Deep-sea Corals, and the results were published in [Frontiers in Marine Science](#). This work supports applied research priorities for NOAA's West Coast Deep-sea Coral Initiative and has been anticipated for broader restoration efforts following the 2010 Deepwater Horizon oil spill in the Gulf of Mexico.

## BeachCOMBERS Data Published

Twenty years of monitoring data, collected from citizen scientists of the BeachCOMBERS (Coastal Ocean Mammal and Bird Education and Research Surveys) program, have been published in [Marine Pollution Bulletin](#). Trained volunteers, surveying beached marine birds and mammals monthly at selected sections of beaches, reported 357 cases of entanglements among 65,604 carcasses. Twenty-six seabird species (97%), three marine mammal species (3%), and three non-marine birds were affected. Seabirds were primarily entangled in monofilament fishing line. The on-going BeachCOMBERS program has the specific goal of using deposition of beach cast carcasses as an index of the health of the sanctuary.



Credit: Andrew DeVogelaere/NOAA

## Ed Ricketts Memorial Award

The 2019 Ed Ricketts Memorial Award was presented to Dr. James Harvey (*above, right*), director of Moss Landing Marine Laboratories. Dr. Harvey's talk, "[Research, Teaching, and Mentoring: Musings of a Generalist Optimist](#)" highlighted his work on the foraging ecology of harbor seals, humpback whales, and leatherback turtles, and was attended by 60 people as well as live streamed via Facebook Live. The Ed Ricketts Memorial Award and Lecture was created to honor scientists who have exhibited exemplary work throughout their career and advanced the status of knowledge in the field of marine science. The first award was presented in 1986. Recipients are selected by the MBNMS Research Activity Panel members each year.

## Extensive Dive Operations

The Monterey Bay diving unit, which consists of nine divers within NOAA's Diving Program, completed 190 dives in 2019 in support of monitoring and research projects in multiple sanctuaries on the west coast. Projects included Marine Protected Area monitoring with partners, assessments of kelp and urchin populations with state agencies in Greater Farallones National Marine Sanctuary, and monitoring of kelp forest communities within Olympic Coast National Marine Sanctuary in collaboration with divers from National Marine Fisheries Service. Since 2015, these NOAA divers averaged 159 dives per year in support of the Office of National Marine Sanctuaries mission.

## World Ocean Day Celebration

In June, the Sanctuary Exploration Center hosted an art exhibit, "From Ocean Trash to Ocean Conservation," which featured artwork and lectures from local artists transforming ocean trash into unique art pieces to bring awareness of plastic pollution prevention in the sanctuary.