2018 Accomplishments

Brooding Deep-sea Octopuses Discovered

In October, staff joined Ocean Exploration Trust and the Office of National Marine Sanctuaries aboard the Exploration Vessel (E/V) *Nautilus* for a deep-sea expedition to Davidson Seamount Management Zone. Using remotely operated vehicles (ROVs) to survey depths up to 3,600 meters, scientists collected biological and geological samples, and revealed a rarely-seen "Dumbo" octopus. Scientists also discovered huge aggregations of over 1,000 brooding deep-sea octopuses aligned near rock fissures with shimmering seawater, typically associated with fluid seeps caused by temperature, hydrocarbons (methane), or salinity differences in the surrounding water. This phenomenon has only been observed in one other location worldwide, and was the largest cluster of brooding deep-sea octopuses ever discovered.

Brooding deep-sea octopuses *(Muusoctopus robustus)*.

E/V *Nautilus* Live Interactions

In support of the E/V *Nautilus* expedition to Davidson Seamount Management Zone, staff offered education programs to highlight the science and exploration taking place. Sanctuary Exploration Center hosted remotely operated vehicle (ROV) building, viewed the E/V *Nautilus* real-time ROV video feed, and engaged with scientists aboard during live ship-to-shore interactions. Staff visited school classrooms and presented activities about deep-sea environments. Over 200 students learned about ocean exploration, marine biodiversity at the seamount, and conducted pressure experiments. These activities served to inspire students to seek careers in science, technology, engineering, and mathematics and become the next generation of ocean explorers.

Proposed Essential Fish Habitat Modifications Accepted

The Pacific Fishery Management Council (PFMC) issued a final decision to accept all 15 proposed boundary modifications to Essential Fish Habitat Conservation Areas (EFH CAs) where groundfish bottom trawl gear is prohibited west coast wide. During the PFMC's 5-year review process, staff lead a Collaborative Monterey Bay proposal submitted in 2013 to modify EFH CAs trawl boundaries within the sanctuary. The proposal uniquely considered new protections for EFH CAs from trawling impacts, coupled with opportunities for fishermen to access valuable fishing grounds by opening portions that are less environmentally sensitive. The MBNMS proposal served as a model for the Coastwide Collaborative, and included Monterey Bay trawl fishermen, City of Monterey, Oceana, Natural Resources Defense Council, Ocean Conservancy, The Nature Conservancy, CA Groundfish Collective, and Environmental Defense Fund.

Team OCEAN on the Water Engagement

Team OCEAN program puts trained volunteer naturalists in sanctuary kayaks to act as on-the-water interpretive docents to promote respectful wildlife viewing guidelines. Coastal wildlife, such as shorebirds, seals, and sea otters, are impacted by increasing numbers of ocean recreational kayakers. In 2018, volunteers donated 774 hours and engaged 9,003 people on the water in Elkhorn Slough in Moss Landing and off Cannery Row in Monterey. Since 2000, Team OCEAN volunteers have educated more than 100,000 people. The program's unique blend of interpretive enforcement has been recognized as a model program in the National Marine Sanctuary System.

Team OCEAN interpretive docents in the sanctuary.

Sanctuary staff present 2018 Volunteer Service Award.

Outstanding Volunteer Service Award

Scott Benson and Karin Forney received MBNMS' 2018 Volunteer Service Award for their contributions to the Beach COMBERS program. Scott developed the training course and methods for Beach COMBERS in 1997 with significant science and agency application advice from Karin. They have been monitoring the same three mile stretch of beach, monthly for 21 years, documenting beach cast birds and marine mammals. Both Scott and Karin show a dedication to MBNMS and regularly contribute to annual volunteer appreciation and training events, sharing their scientific insights. Beach COMBERS program has resulted in 185 volunteers contributing to more than 31,000 hours, and is a collaboration among MBNMS, Moss Landing Marine Laboratories, U.S. Fish and Wildlife Service, CA Department of Fish and Wildlife, U.S. Geological Survey, and Save The Earth.

Recreation and Tourism Initiatives

Staff joined with local partners in the Monterey Bay Eco-tourism Region Initiative, which brings together policy makers, public officials, hospitality leaders, and recreation, tourism, and wellness providers. This Initiative focuses on developing key sustainability best practices that promote Monterey Bay peninsula as a world eco-tourism destination. MBNMS collaborated with CA State University Monterey Bay's Sustainable Hospitality Management Program to draft a sanctuary business recognition program, with the goal to raise sanctuary awareness and encourage sustainable green business practices that support a healthy ocean and a Blue Economy.

New Sanctuaries MBON Research Tools

New tools were developed by the Sanctuaries Marine Biodiversity Observation Network (MBON) demonstration project team to investigate the relationships between the ocean environment and animal communities of the sanctuary, and convey this information to a variety of users. Interactive infographics provide dynamic status and trend information and data-driven storytelling for resources managers, educators, and public constituents of the sanctuaries. For science teams and advisory groups that need additional detail and technical capabilities, MBON is developing curated data views and a data explorer. This suite of tools, available through the MBON Data Portal, improves access to observing data on critical parameters for understanding biodiversity in the sanctuary.

Trained members of the whale disentanglement network practice rescue techniques in the sanctuary.

Minimizing Whale Entanglement Incidents

CA Department of Fish and Wildlife, in partnership with NOAA National Marine Fisheries Service and the California Ocean Protection Council, have prioritized addressing recent spikes in whale entanglements occurring in California waters. In response, a diverse stakeholder working group comprised of commercial and recreational fishermen, environmental organization representatives, members of the whale disentanglement network, and state and federal agency staff, set up to address risk reduction for whale entanglements in Dungeness crab fishing gear. Strategies included the development of a Risk Assessment Framework and exploring gear modification such as ropeless technologies. MBNMS serves as the regional sanctuaries representative and engages in collaborative efforts to reduce threats to sanctuary resources and wildlife.

Taking a sample of bubblegum coral for transplantation experiments at Sur Ridge. (Image courtesy of MBARI)

Deep-sea Coral Transplants at Sur Ridge

During a 2018 research cruise to Sur Ridge led by Monterey Bay Aquarium Research Institute (MBARI), sanctuary scientists assessed the effectiveness of deep-sea coral transplant techniques. In addition, individual corals were studied for age, growth, predation, and feeding mechanisms. The successful coral transplant techniques being developed over the past five years will be useful for wide ranging deep-sea restoration efforts. At a larger scale, ocean currents were measured to characterize this biologically diverse Sanctuary Ecologically Significant Area (SESA) and to address spatial ecosystem management needs.

Monterey Bay National Marine Sanctuary Foundation

A local Monterey Bay Chapter of the National Marine Sanctuary Foundation was created to build awareness and raise funds for sanctuary activities. In 2018, a Chapter director was hired to focus fundraising efforts on supporting Bay Net and Team OCEAN programs for reducing ocean wildlife disturbance, and to support sanctuary partners in whale rescue and disentanglement efforts. The Chapter will grow to serve as a model collaboration between a public agency and a non-profit organization in the years to come.

Expansion of Urban Watch to Salinas

Urban Watch is a dry weather monitoring program conducted by trained volunteers to monitor storm drain outfalls. Volunteers use field kits to test water samples for common pollutants such as detergents, chlorine, orthophosphate, and indicator bacteria. Urban Watch engages local citizens to promote stewardship of urban watersheds while providing real-time data to city staff for tracking discharges into the storm drain system. The program has been funded by the City of Pacific Grove for over 20 years. In 2018, the program expanded to the City of Salinas in three watersheds with highly successful outcomes.

Final EIR/EIS for Monterey Peninsula Water Supply Project

MBNMS and the CA Public Utilities Commission released a jointly prepared Final Environmental Impact Report/Environmental Impact Statement (EIR/EIS) for the Monterey Peninsula Water Supply Project (MPWSP). The MPWSP includes various proposed facilities and improvements including: a subsurface water intake system; a 9.6-million-gallons-per-day reverse osmosis desalination plant; desalinated water storage and conveyance facilities; and expanded Aquifer Storage and Recovery facilities. The Final EIR/EIS identified Alternative 5a (a smaller desal project and the Pure Water Monterey Groundwater Replenishment Project) as the environmentally preferred alternative. Federal, state, and local agencies will use the Final EIR/EIS to consider related permits or other approvals. As federal lead agency under National Environmental Policy Act, MBNMS has the authority and responsibility to ensure the project does not harm or have negative environmental impacts to sanctuary resources.

Special Community Events at Sanctuary Exploration Center

2018 was another successful year for offering public events at the Sanctuary Exploration Center (SEC), located in Santa Cruz. Events included film screenings, Waves and Wildlife photo exhibit, First Friday art events, and hosting the International Global Waves Conference. During World Oceans Day, Leatherback Turtle Day, and Get Into Your Sanctuary Day, attendees from all over the world gained a deeper understanding of the need to protect this special place. Events offered at the SEC, in partnership with other local businesses and non-profit organizations, showcase collaborations in ocean protection and conservation throughout the region.

Sanctuary Exploration Center in Santa Cruz.

NOAA Fisheries Research Vessel *Bell M. Shimada* heading out to the Davidson Seamount Management Zone for sanctuary researchers to conduct oceanographic and biological surveys.

Oceanographic and Biological Surveys above Davidson Seamount

On board the NOAA Fisheries Research Vessel *Bell M. Shimada*, sanctuary scientists teamed with Point Blue Conservation Science and Applied Marine Sciences to conduct regional characterization and monitoring of ocean ecosystems at the Davidson Seamount Management Zone. Surveys included plankton tows, midwater krill trawls, echosounder data collection, marine mammal and seabird observations, sea surface collection of micro-plastics, and water sampling for persistent organic pollutants and harmful algal blooms. Long-term data sets will help relate spatial patterns of bird and mammal distribution with prey and oceanographic patterns, and identify resources at risk from human threats.

Healthy Soils Program

As part of the Healthy Soils Program, sanctuary staff implemented best practice workshops with 193 farmers and ranchers in Monterey County to improve soil health and carbon sequestration on agricultural lands adjacent to the sanctuary. Adoption of the practices will remove an estimated 60 tons of carbon dioxide (CO_2) from the atmosphere per year, putting it into long-term storage in soils. This can produce other on-farm advantages such as drought resistance, increased plant yields, and less runoff. Storing carbon on agricultural lands is one strategy to help remove CO_2 from the atmosphere, thereby benefiting marine ecosystems by potentially slowing ocean temperature increases and chemistry changes that can contribute to ocean acidification.

Get Into Your Sanctuary

On July 29th, staff kicked off the 5th annual Get Into Your Sanctuary (GIYS) events by connecting 30 military veterans to MBNMS aboard the NOAA Research Vessel *Fulmar.* Joined by Rep. Jimmy Panetta (CA-20), veterans experienced a day of wildlife watching, plankton sampling, and listening to underwater sounds. On August 4th, the Coastal Discovery Center and the Sanctuary Exploration Center hosted public events for GIYS to promote ocean recreation and responsible wildlife viewing. Staff hosted "virtual wildlife tour" presentations, equipment demonstrations, and distributed information on local recreation providers in the area. The nation-wide GIYS campaign helps heighten sanctuary awareness and the significance of these special underwater places as recreational destinations.

Veterans join staff and Congressman Jimmy Panetta for Get Into Your Sanctuary day aboard the R/V *Fulmar*.

19th Annual Snapshot Day

Snapshot Day was first held in 2000 when a small group of volunteers collected water samples from sanctuary watersheds to measure temperature, dissolved oxygen, turbidity, pH, conductivity, and for nitrate and bacteria testing. Fast forward to 2018 when 134 volunteers collected water samples and field measurements from 123 sites in four counties: San Mateo, Santa Cruz, Monterey, and San Luis Obispo. Data collected during Snapshot Day is entered into the CA Environmental Data Exchange Network (CEDEN) where it is available for state, local, and federal resource managers as well as the public. The Coastal Watershed Council and the San Mateo County Resource Conservation District also partner with MBNMS to mark one of the longest, single-day water quality monitoring programs in California.

First Flush volunteers collect water samples at storm drains that flow into the sanctuary.

19th Annual First Flush

First Flush utilizes trained volunteers to collect water samples at storm drain outfalls during the first major rainstorm of the winter season. In 2018, 30 First Flush volunteers were mobilized mid-morning on November 23rd, marking the latest First Flush event on record. Volunteers were able to collect water samples at all 15 storm drain outfall sites and two receiving water sites that flow into the sanctuary. Data gathered for First Flush is used by local storm water managers to understand and manage urban runoff water quality while identifying watersheds that require further investigation or best management practice implementation.

10th Ocean Fair in San Simeon

In the sanctuary's southern region, staff organized the 10th Ocean Fair at the Coastal Discovery Center in San Simeon, celebrating coastal and ocean resources with over 20 agency and non-profit partners. An estimated 600 attendees engaged in conservation activities, including interactive games and crafts. Participants built remotely operated vehicles, learned proper fishing and wildlife etiquette, and experienced rescued animals. Demonstrations were provided on oil spill clean up techniques. With support from 30 volunteers, CA State Parks, San Simeon Chamber of Commerce, Seabird Protection Network, and the Cambria Community Council, the Ocean Fair highlighted partnerships in conservation and wildlife protection in MBNMS throughout Monterey and San Luis Obispo counties.

Ocean Fair brings together partners to highlight coastal and ocean protection in the sanctuary.

Advisory Council Meetings

MBNMS Advisory Council met six times in 2018, and received updates including: Management Plan Review progress, ocean acidification, acoustic research, adapting to sea level rise, marine plastics, a pilot project on trawl gear, agriculture water quality, joint MBNMS and U.S. Coast Guard cruise ships inspections, Elkhorn Slough National Estuarine Research Reserve activities, CA State Marine Protected Area Monitoring Action Plan, sea star wasting disease, and the recovery effort of black abalone at Mud Creek. The Council sent a comment letter on the draft proposed Five-Year Outer Continental Shelf Offshore Oil and Gas Leasing Program, and approved a resolution recommending MBNMS staff coordinate with resource agency partners on research and management projects involving purple sea urchins in Monterey and Santa Cruz counties.

Partnership with National Forests

MBNMS joined the U.S. Forest Service's Fall Fish Fest in South Lake Tahoe to help build awareness of land and sea connections. Located more than 300 miles inland, the annual event hosted over 5,000 attendees. Staff engaged with participants to highlight national marine sanctuaries to inland communities and the vital connections through watersheds, climate, and wildlife. National marine sanctuaries and national forests have many common management approaches, such as supporting natural and cultural resource conservation, recreation, and promoting compatible human activities.

Ed Ricketts Award and Lecture

On April 10th, Dr. Steven Haddock of Monterey Bay Aquarium Research Institute was presented the Ed Ricketts Memorial Award and provided a captivating talk, "*Beneath Pacific Tides: The wondrous glowing realm of deep-sea biodiversity*" to members of the public and scientific community. Dr. Haddock described his early career, and how his interests developed in the fields of midwater ecology, biology, and bioluminescence. His research and scientific papers have advanced our knowledge of these bioluminescent and gelatinous animals. Distinguished recipients are selected by the Monterey Bay National Marine Sanctuary Research Activity Panel members each year.

New Research Publications

MBNMS research team collaborated with scientists to publish three new technical reports. One study, "Non-native Species Colonization of Highly Diverse, Wave Swept Outer Coast Habitats in Central CA," suggests the coastal study areas are still relatively uninvaded by non-native species, but the success of an invasive bryzoan underscores the potential vulnerability of high-value open-coast systems to invasions. The second, "Temperature Induced Range Expansion of a Subtropical Crab Along the CA Coast," included documentation of the range expansion and first occurrence of a subtropical crab in northern California during 2016. Lastly, "Fished Species Uniformly Reduced Escape Behaviors in Response to Protection" reported on the effects of protection on the behavioral traits of a marine fish assemblage of nine targeted kelp forest species across 16 California Marine Protected Areas (MPAs) varying in age, protection level, and diver visitation.

Volunteers educate thousands of sanctuary visitors.

Bay Net Shoreline Interpretation

Bay Net volunteer naturalists engage the public through a unique blend of interpretation and enforcement, providing shoreline visitors with a resource for local marine wildlife. In 2018, Bay Net volunteers donated over 1,700 hours and contacted 31,360 people along the shores of the sanctuary between Santa Cruz and Pebble Beach. The 2018 engagements bring Bay Net's total contacts to 452,450 people since 1995. Bay Net volunteers can be found along the shore all year round, but are especially instrumental in protecting harbor seals and pups during their spring time pupping at local beaches in MBNMS.

Nearshore Ecosystem Surveys

Sanctuary research divers teamed up with CA Department of Fish and Wildlife to conduct nearshore surveys along Sonoma County coastline. Due to several co-occurring natural phenomena (e.g., warm water events, high urchin recruitment, a loss of sea stars that consume small urchins), subtidal waters have transformed from one dominated by bull kelp to one dominated by purple sea urchins, having cascading effects on the red abalone fishery. Data collected supports state and sanctuary management approaches, and contributed to an assessment of the status and trends of marine resources within Greater Farallones National Marine Sanctuary.

8th Annual Whalefest

Drawing over 10,000 visitors, the 8th annual Whalefest took place on January 26th & 27th in Monterey. Staff collaborated on organizing this free, fun, and educational interactive family event celebrating gray whale migrations in MBNMS. Superintendent Paul Michel presented on the latest scientific happenings in the sanctuary, including the black abalone relocation project in Big Sur, and highlighted the valuable research, resource protection, and education partnerships that support MBNMS management goals.