

Research Vessels *Shearwater* and *Shark Cat* Summary of 2018 Accomplishments



NOAA's R/V *Shearwater*. Photo: Carolina Pacheco, *Ocean Mysteries*.



NOAA's R/V *Shark Cat*. Photo: LT Lyndsey Davis, NOAA/CINMS.

NOAA's Office of National Marine Sanctuaries operates a fleet of small boats to support mission-critical programs in sanctuaries. The Research Vessels *Shearwater* and *Shark Cat* are based in Santa Barbara, California, and operated by Channel Islands National Marine Sanctuary (CINMS). The 62' R/V *Shearwater* was launched in 2002 as the first of her class and has proven to be an effective platform for research, maritime heritage, education, and outreach missions in CINMS, as well as a model for other sanctuary vessels that have followed. The 28' R/V *Shark Cat* was acquired by CINMS from Monterey Bay National Marine Sanctuary (MBNMS) in 2010 and has proven to be an effective, lower cost option for several projects.

Summary

- Area of responsibility: 1,470 square miles. Projects supported throughout the Southern California Bight
- Projects supported: 36
- Total days at sea: 112
- R/V *Shearwater* days at sea: 106
- R/V *Shark Cat* days at sea: 6

HISTORY & ACCOMPLISHMENTS OF THE R/V *SHEARWATER*

In March of 2018 The R/V *Shearwater* completed 15 years of service for CINMS out of Santa Barbara. Built in Bellingham, Washington in 2002, she was delivered to CINMS in Santa Barbara in late March of 2003. *Shearwater* has been one of the best tools CINMS has in documenting and gaining knowledge of the sanctuary above and below the water surface for the last 15 years. Here is some of her history and accomplishments over that period, compiled by lead Captain Terrence Shinn:

- A 15 year age for a boat is about 60 years old in human years (she was designed and built for about a 20 year productive life).

- She has travelled about 74,000 nautical miles (same as about 86,000 miles on a car's odometer and the same as going around the world 3.5 times).
- While she can travel at over 20 knots, her average speed has been around 6 knots (research/survey work is usually conducted at slow speeds).
- She has 2,080 days of operation (well over a third of her life) logged in her books, averaging 136 days a year. Her first few years she did well over 200 days a year.
- Her main engines have 13,000 hours on them, the equivalent of running 1.5 years without stopping (that's 53 oil changes).
- Her generators total 27,030 hours (that's another 190 oil changes), which means she has produced her own electricity for the equivalent of over 3 years nonstop which is probably close to her time spent away from the dock.
- Her northernmost operations were conducted offshore of the San Francisco Bay area. Before the *Fulmar* (*Shearwater's* sister ship) was built, *Shearwater* would spend several weeks a year supporting operations for the Monterey Bay, Farrallon Islands, and Cordell Bank National Marine Sanctuaries.
- Her southernmost work has taken her to south of the Mexico land border (the US maritime border extends farther south than the land border).
- On a few occasions she has ventured 100 miles offshore of the Southern California mainland.
- She has spent over 700 nights anchored at all eight of the Channel Islands and she continues to use her original anchor.
- Her longest single journey remains her 1,100 nautical mile delivery from the Seattle, Washington area to Santa Barbara, California.
- Her deepest work occurred in the Catalina Basin where she lowered instruments to 4,000 feet with her oceanographic winch.
- She has supported around 12,000 dives (that is roughly the number of tank fills the dive compressor has logged).
- There have been only 3 instances where she limped back home for repairs (2 steering casualties and 1 transmission problem) and she has never required a tow or assistance. She has only missed approximately between 15 to 20 days of work in 15 years due to unscheduled repairs or "sick leave".
- She has saved 3 vessels (2 yachts and one commercial vessel) from sinking or grounding in the CINMS, and assisted many more.

While her former shiny aluminum appearance has changed through the years and is now closer to a Navy grey, she continues to conduct busy field seasons as a small research vessel often doing a big research vessel's job.

RESEARCH: Highlights aboard R/V *Shearwater* & *Shark Cat*

In response to our annual solicitation, project proposals from 48 interested parties, totaling 180 days at sea, were received for the 2018 calendar-year field season. In spite of budget constraints, we were able to accommodate about 60% of the requested days. The majority of operational days at sea were research missions. 24 different research projects were supported by CINMS vessels in 2018, several of which included outside funding for cost sharing. Most of these projects are multi-year monitoring missions with long-term datasets that address sanctuary management plan needs.

RESEARCH AND MONITORING HIGHLIGHTS

Marine Protected Area Monitoring with the University of California Santa Barbara (UCSB)'s Partnership for Interdisciplinary Studies of Coastal Oceans (PISCO)

2018 marked the twentieth year of monitoring for the PISCO-UCSB program led by Dr. Jenn Caselle in the Santa Barbara Channel. Partnerships with the CINMS and the California Department of Fish and Wildlife, and use of their vessels, greatly expands their capacity for monitoring across the channel. In 2018 they completed a full subtidal rocky reef monitoring survey (fishes, invertebrates, algae, and habitat) at twenty-three sites (each site is comprised of 2 or 3 sides with multiple transects and depth strata), in and out of nine Marine Protected Areas. Use of the R/V *Shearwater* in 2018 was instrumental in this accomplishment as the platform can support a large team of divers, and the overnight capacity allows access to many sites in a relatively short amount of time. Lastly, the R/V *Shearwater* played a crucial role in their ability to train young scientists on how to conduct research and monitoring. More specifically, in 2018 they trained four new science divers and continued the training of five returning students.

Currently the major objectives of the monitoring program are: 1) tracking kelp forest community change associated with changes in environmental conditions using data collected at core long-term monitoring sites; 2) assessment of the responses of kelp forest communities to protection from fishing, within and outside of Marine Protected Areas (MPA); 3) documentation of community-level responses to disturbances (e.g., invasive species, disease). For example, they have been tracking the arrival and spread of the invasive brown alga *Sargassum horneri* in the Channel Islands and recently published a paper describing a pattern of abundance that correlates with MPA status indicating that a well-established MPA was resilient to invasion by non-native species through trophic dynamics. They have widely communicated this story of MPA resilience at scientific meetings, in the popular press, and through lectures to the community.

This monitoring data continues to be used by a number of academic researchers and agency partners. CINMS uses this monitoring data to assess status and trends in kelp forest ecosystems for their Sanctuary condition reports. The California Department of Fish and Wildlife uses the data in some fisheries management plans and also to evaluate the effectiveness of the MPAs.

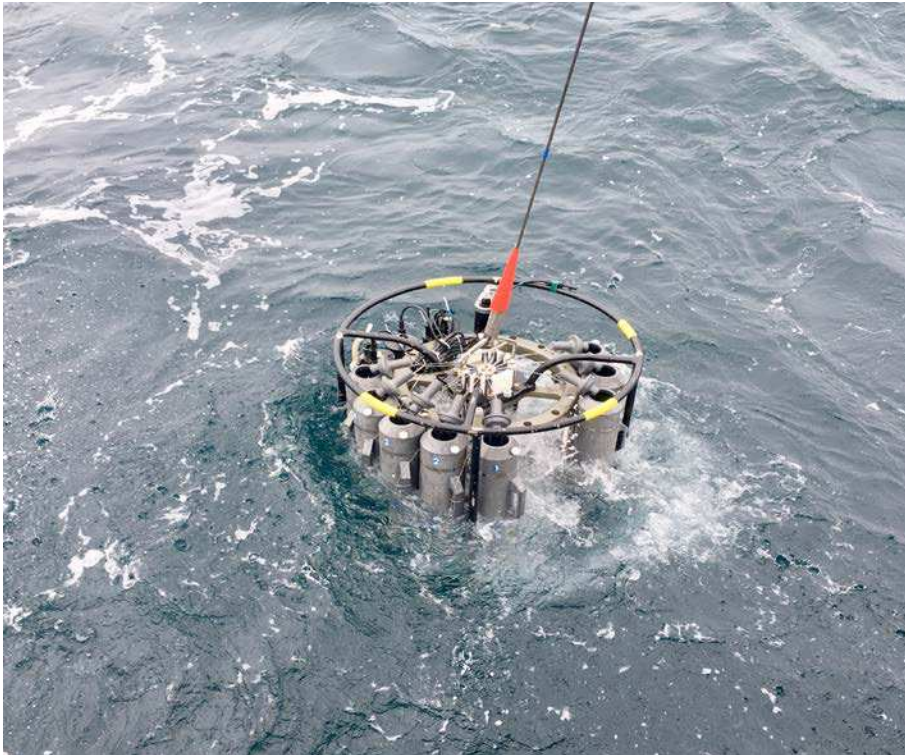


Map of the 2018 PISCO UCSB long-term monitoring sites. Ten of the twenty-three sites were at least partially completed from the R/V *Shearwater*.

Plumes and Blooms

From February to November 2018, the R/V *Shearwater* conducted 7 research cruises across the Santa Barbara Channel to support the Plumes and Blooms Project (PnB) led by Dr. David Siegel, UCSB. Plumes and Blooms is a long-term monitoring project of bio-optical properties in coastal waters, supported by NASA and developed at the Earth Research Institute of UC Santa Barbara. The goal of the PnB project is to characterize ocean color variability in an optically complex ecosystem in order to calibrate and validate ocean color observations from space. In particular, the data collected during the PnB cruises are used to develop numerical algorithms to quantify remotely-sensed quantities such as sediment plumes and phytoplankton blooms in the coastal marine environment of the Santa Barbara Channel. These *in-situ* measurements also provide valuable information on seasonal and inter-annual changes of ocean color under various concentrations of dissolved and particulate matter. This year, a total of 47 physical and optical profile data were collected at 7 stations from CTD/rosette and spectro-radiometric casts. Along with the optical properties, a total of 89 discrete water samples were collected at surface and depth for the analysis of phytoplankton biomass (chlorophyll) and composition (HPLC), dissolved inorganic nutrient concentrations, dissolved and particulate light absorption, particulate organic carbon and particulate silica concentrations. These long-term environmental observations, initiated in 1996, provide a unique spatial and temporal assessment of the ecosystem variability on

different time scales, and are available to the public.



CTD and water sampling rosette deployment.

The R/V *Shearwater* also enabled the routine collection of samples for other investigators as part of the PnB sampling. Dissolved organic carbon (DOC) sampling and analysis have been done for Dr. Craig Carlson (UC Santa Barbara). Dissolved inorganic carbon (DIC) and alkalinity sampling and analysis are performed by the Iglesias-Rodriguez lab (UC Santa Barbara), as well as coccolithophore population assessment. These data will give us the ability to close the carbon budget in the Santa Barbara Channel and to relate changes in the total carbon stocks to ocean optical properties.

The PnB project also provides an oceanographic context and access to the sea for graduate student research. Several dissertation projects have been completed or are ongoing which leverage the field program and the existence of the long-term time record of PnB. This year, nine graduate and undergraduate students, professors, engineers, and lab technicians, participated in multiple PnB cruises either to collect scientific material or to familiarize themselves with the operation of various instruments and the work at sea in general.

West Coast Observations

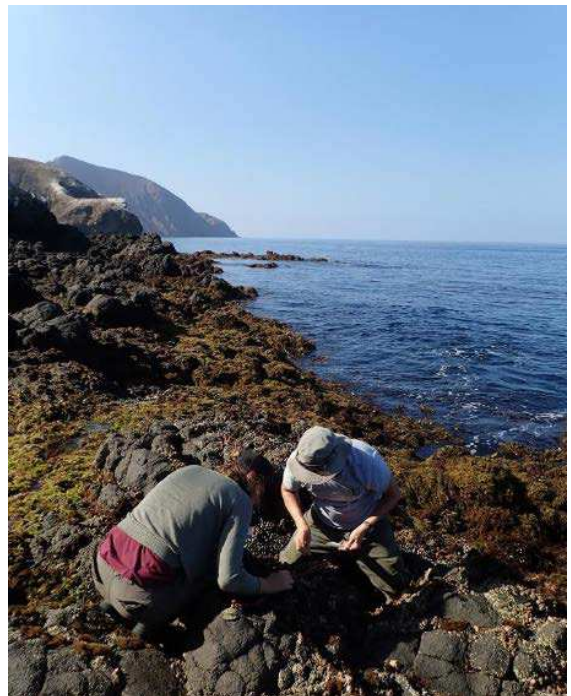
Since 1999, there have been 14 sub-surface moorings deployed around the Channel Islands where researchers collect data using environmental monitoring equipment and acoustic telemetry receivers. Twice a year CINMS divers swap out the receivers and download the data collected. West Coast Observations is a part of the Southern California Acoustic Telemetry Tracking Network (SCATTN), a collaborative group of researchers who use acoustic telemetry to study the behavior of several species of highly mobile large predator fishes that have been tagged in and around southern California. The continuation of this long-term dataset is dependent on *Shearwater* support and the ongoing investment by ONMS ensures that researchers and partners have access to this critical data.

Over the last few years, the methods have been improved to include smaller configurations and more accurate GPS coordinates, which has resulted in increased efficiency swapping out equipment and ultimately fewer boat days required. In 2018, West Coast Observations included 4 days in late winter/early spring and 4 days in the fall to swap out all of the receivers, including boat days that were able to be piggy backed on other projects in the region.

CINMS Field Support for Channel Islands National Park Programs

During January 27-30, 2018, CINMS partnered with Channel Islands National Park (CINP), and provided use of the sanctuary's R/V *Shearwater*, as well as sanctuary staff time, to support several long term CINP monitoring programs. This included seabird monitoring and restoration activities, intertidal monitoring, and kelp forest monitoring at Anacapa Island. Over the course of the two full field days on the 27th and 30th (weathered out on two days), we were able to access sites across all three Anacapa islets, and conduct a variety of monitoring tasks. Staff from the CINP Intertidal Monitoring Program were able to complete remaining field work for their 2017-18 field season. As part of this work, a team of taxonomists were transported to intertidal monitoring sites where they were able to positively identify organisms for genetic fingerprinting and documentation. The CINP Seabird Monitoring Program team was also able to access sites across all three islets, and conducted a variety of monitoring tasks for this breeding season. This included assessing evidence of 2017 breeding effort of Scripp's murrelets, mapping cave and other sites to assess overall condition and expansion of murrelet nesting locations, and the discovery of a new breeding location for Ashy Storm petrels.

From November 6-8, 2018, the R/V *Shearwater* provided support to conduct surveys for both the CINP Kelp Forest Monitoring Program as well as the CINP Rocky Intertidal Monitoring Program (RIMP). The work was conducted at all three Anacapa Island islets, known to be logistically difficult to sample, over the course of three full days of vessel time. The CINP Kelp Forest Monitoring Program team was able to conduct surveys, with the support of CINMS divers, for the newly invasive algal species *Undaria pinnatifida* in order to better document distribution, as well as retrieve and deploy several subtidal acoustic loggers which will assist in determining if ambient biological sounds can be used as an indicator of kelp forest ecosystem health. Specimens for genetic work



Researchers conduct intertidal monitoring at Anacapa Island.

were also collected to determine which harbor was the source population for this invasive species. The CINP Rocky Intertidal Monitoring Program (RIMP) utilized the R/V *Shearwater* to access several permanent survey sites on Middle and West Anacapa Islands. In recent years, with budget cuts, CINP has relied heavily on CINMS for vessel time on the R/V *Shearwater* to access rocky intertidal sites on Anacapa and Santa Cruz Islands. Lastly, during this cruise, staff from the CINP's Division of Interpretation were able to gather audio/visual material for intertidal zone curriculum development. CINP was also able to accommodate other work projects that greatly needed field support, which included kelp forest acoustics monitoring and specimen collections for a study being conducted at the University of California, Los Angeles.

Southern California Bight Regional Monitoring Program

CINMS staff recently partnered with the Southern California Coastal Water Research Project (SCCWRP) to help with field operations within the sanctuary to support the sixth cycle of the Southern California Bight Regional Monitoring Program (Bight '18). The Southern California Bight stretches from Point Conception in Santa Barbara County to Punta Colonet in Mexico, where more than 22 million people engage in a wide variety of industrial, military, and recreational activities along the coastline. Bight '18, which takes place every 5 years, is an ongoing study that involves the collaboration of nearly 100 local organizations combining their knowledge and resources in order to examine the impacts of human activities affecting the ecological health. The study analyzes sediment quality, infaunal benthic species, seawater chemistry, presence and accumulation of harmful algae, and contaminant levels in order to examine how the Bight is changing over space and time. From July 15-19, 2018, a team of SCCWRP and CINMS researchers, aboard the R/V *Shearwater*, sampled sediments within the sanctuary at 15 established monitoring sites with depths ranging from 30ft to nearly 1,500ft. At each station, a Van-Veen grab was used to collect benthic sediment samples to analyze the representative sediment chemistry, composition, and infaunal organisms within that particular stratum. A 25ft Otter-Trawl was also utilized at each sample station to collect and analyze the larger benthic community organisms. The R/V *Shearwater* crew, mechanics, equipment, deck space, and wet lab areas were essential for these extensive sampling efforts. Furthermore, slope and basin sites in the western Santa Barbara Channel were new to the survey and allowed the vessel to experiment with extending its capabilities. Also, the survey was able to fill missing field efforts on the mainland side of the Santa Barbara Channel. Samples taken around some of the oil platforms will help the Bureau of Ocean Energy Management (BOEM) with needed chemical and biological information. Lastly, teaming up with NOAA's Mussel Watch Program, mussels were collected at long-term monitoring locations on Santa Cruz Island and Anacapa Island to test for the bioaccumulation of contaminants of emerging concern. The research cruise also served as a learning opportunity for the sanctuary's two California State

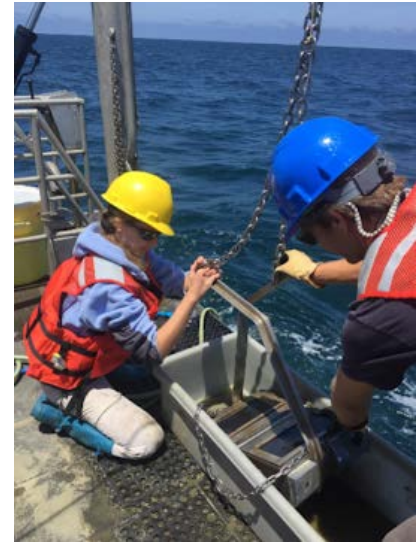
University Council on Ocean Affairs, Science & Technology (CSU COAST) summer interns, who provided field support.



CSU COSAT intern Jolene Bertetto collects mussels at a long-term monitoring location on Anacapa Island for the NOAA Mussel Watch Program



A seafloor sediment sample, which will be analyzed for infaunal species.



CA Sea Grant Fellow Nicole Hack and R/V Shearwater crew member Zac Montgomery bring up a seafloor sediment sample.

Passive Acoustic Mooring Deployment in CINMS

On January 17, 2018, NOAA's R/V *Shearwater* re-deployed an Ocean Noise Reference Station (NRS) in the CINMS. Impacts of ocean noise on living marine resources is a growing concern for National Marine Sanctuaries, as current and projected levels of anthropogenic noise are unprecedented. NOAA is interested in how ocean noise impacts species that rely on acoustic communication to forage, socialize, and navigate, such as marine mammals and some fish and invertebrates. Remote sensing of the underwater environment via passive acoustic monitoring is a cost-effective and non-invasive way to improve our understanding of regional soundscapes, and to quantify the presence and extent of particular noise sources. In 2014, NOAA began deploying a network of twelve NRS across U.S. waters, four of which are within sanctuaries. CINMS' NRS (NRS05) is moored at ~900 meters within a deep channel on the south side of Santa Cruz Island. NRS05 has been in place since October 2014 and the January 2018 re-deployment was part of the regular maintenance of this station. Data collected by NRS05 facilitates characterization of the sanctuary soundscape and understanding of the various noise pressures to living marine resources, under the guidance of NOAA's Ocean Noise Strategy Roadmap. Human activities in the CINMS region that produce noise include shipping, naval sonar and testing, commercial and recreational fishing, oil extraction, tourism, and research. Potential reprieves from noise within CINMS include marine protected areas, the absence of ship traffic apart from in the far northeast corner, and the prohibition of oil and gas exploration. NRS05 and other complimentary acoustic monitoring in or near the CINMS offer valuable insights to better understand how noise varies across

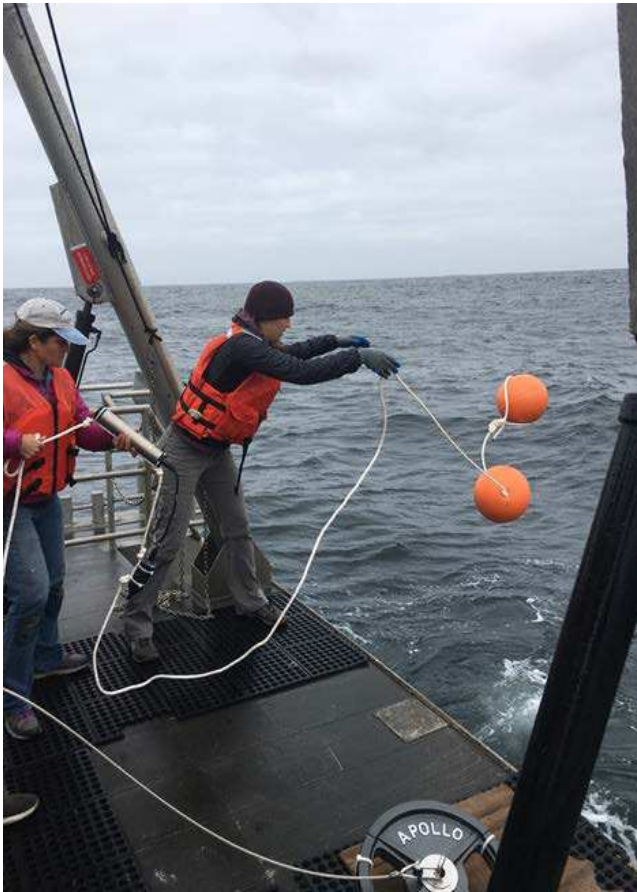
sanctuary habitats, and if and how the sanctuary provides protection to living marine resources from noise impacts.



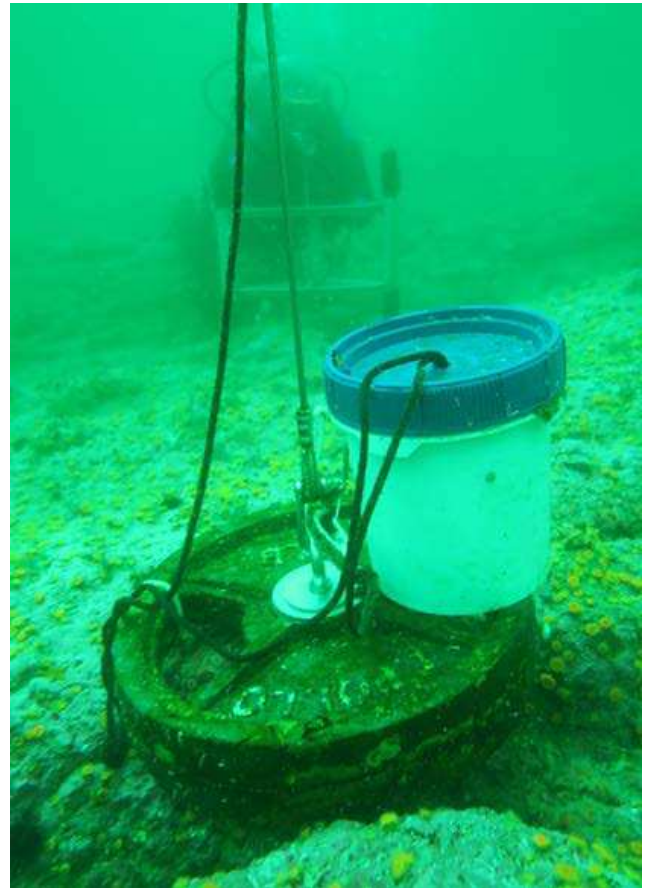
Staging of the CINMS NRS on R/V Shearwater. The hydrophone is the gray cylinder shown on the far left, line and cable are shown in between the hydrophone and the mooring anchor (old railroad wheel), and Nancy Foster Scholar Samara Haver is between the anchor and the sub-surface orange buoy that will sit highest in the water column.

Quantifying Human Drivers of Noise in CINMS

On May 30, 2018, as a part of the new CINMS soundscape monitoring program, research teams from CINMS and NOAA’s Southwest Fisheries Science Center (SWFSC) deployed seafloor hydrophones off San Miguel Island and Santa Rosa Island as part of a collaborative study on the human drivers of noise in the sanctuary, funded by NOAA Science & Technology’s Ocean Acoustics Program. A few months later on August 8 and 9, 2018, researchers from CINMS and SWFSC recovered and re-deployed the hydrophones to the same prior locations. Data from the recovered hydrophones will undergo analysis of the quantification of natural noise (e.g., marine mammals) and anthropogenic noise (e.g., acoustic deterrents used in fisheries). In addition to sound data collection and analysis, this project is testing an anchor recovery system designed by Jay Barlow (SWFSC). CINMS divers took underwater photographs of one of the moorings at ~65 feet, and set up a video camera to record the automatic release and anchor recovery process. The video captured the mechanism successfully bringing a line secured to the weights to the surface, so that after the equipment was onboard, the weights could be hoisted onto the vessel. The trial system is a low-cost setup that has the potential to reduce the number of anchors abandoned in sanctuaries each year during scientific investigations that rely on temporary moorings. This system will continue to be tested in CINMS at dive-able depths, with iterative design and implementation improvements, in hopes to one day use the design for both shallow and deep moorings in an effort to reduce discharge and minimize seafloor disturbance.



Co-PI's Shannon Rankin (left, SWFSC) and Lindsey Peavey Reeves (right, CINMS) deploy a seafloor hydrophone off the R/V Shearwater in CINMS on May 30, 2018.



CINMS diver Ryan Freedman positions an underwater video camera to record the automatic release of the hydrophone mooring in the forefront.

Warty Sea Cucumber Assessment

Marine Applied Research and Exploration (MARE), in partnership with California Department of Fish and Wildlife, completed an expedition around Anacapa Island in the northern Channel Islands using MARE's remotely operated vehicle, the Beagle on board the R/V *Shearwater*. This survey was conducted in an effort to understand the migratory patterns of warty sea cucumbers and the role deeper waters may play in supporting their populations - and by extension efforts to protect them. The ROV Beagle completed 9 dives within 2 study areas over the course of two separate deployments (May and November). Furthermore, during May 2018, MARE in partnership with the Marine Conservation Institute (MCI), NOAA and CINMS, completed an expedition to locate deep-sea corals off the northern Channel Islands. The team visited never-before seen areas off the coast during an 8-day research

expedition aboard the *Shearwater*. MARE's ROV Beagle completed 22 dives in 7 study areas in effort to discover new deep-sea coral habitats.



Warty Sea Cucumber (Parastichopus parvimensis) aggregation.



Andy Lauermann (Director of Science and Operations, MARE) flying the ROV Beagle.



Black Coral (Antipathes sp.) with a commensal squat lobster (Munida quadrispina).

Comparison of the Biological Communities of Shipwrecks and Nearby Natural Reefs

A UCSB project led by Mark Page was conducted aboard the R/V *Shearwater* with the goal of surveying the biological communities at selected wreck sites for nonnative and potentially invasive invertebrate (e.g., the byzoan *Watersipora*) and algal species (e.g., the macroalga *Undaria*). The biotic communities on the wrecks were compared to nearby communities on natural rocky substrate. The research addresses a high priority need of CINMS pertaining to the tracking, monitoring, and studying of nonnative and invasive species so that impacts to resources can be assessed and potential management actions, such as eradication, can be evaluated. The work complements a survey of over 60 sites, which includes natural reef and artificial structures on the mainland, Channel Islands, and offshore oil and gas platforms supported by the Bureau of Ocean Energy Management. *Watersipora* is a foliose, encrusting invertebrate capable of outcompeting native species for space. Nonnative species tend to thrive on artificial structure, which can provide initial colonization sites and a source of propagules to surrounding natural habitat. Artificial structure, in general, tends to support different biotic communities than natural substrate, but given the length of time some of these wrecks have been in place, it is unknown to what extent wreck communities differ, if at all, from those of natural habitat.

Sampling of four shipwrecks, one aircraft, and nearby natural reef habitat was conducted using standard methods. SCUBA divers working in pairs swam belt transects, qualitatively searching for *Watersipora* and other nonnative species and photographically sampling plots along the transects for analysis of percent cover of invertebrates and macroalgae. In addition, surveys of fish were conducted along the transects. No non-native species were observed during the qualitative surveys of these wrecks or natural

reef sites. Quantitative analyses of the photographs and fish data are on-going.



Divers surveying invertebrates and fish along transect tapes at the Grumman Guardian Aircraft. Depth: ~60ft



Diver preparing to deploy a transect tape at the wreck of the Aggi off of Santa Rosa Island. Depth: ~30ft

RESOURCE PROTECTION & EMERGING TECHNOLOGIES HIGHLIGHTS

Channel Islands Beach Cleanups

The R/V *Shearwater* supports multiple coastal cleanups within CINMS annually. With funding for all projects provided by the NOAA Marine Debris program, the sanctuary is able to partner with local fisherfolk and help prevent and remove marine debris. One of the shoreline cleanup projects, for example, was in support of International Coastal Cleanup Day where CINMS staff and local partners cleaned up trash along 2 miles of coastline at Chinese Harbor, Santa Cruz Island. Removal of debris from the island was supported by crew of the R/V *Shearwater* as well as two commercial lobster fishermen (Captains Sam Shrout and Chris Voss) aboard their personal vessels. 760 lbs of trash, primarily plastic packaging and lost fishing gear, were removed from the island. The second island shoreline cleanup supported by the R/V *Shearwater* in 2018 was for California Coastal Cleanup Day. The crew and volunteers removed approximately 800 lbs of debris from 2 more miles along Santa Cruz Island coastline. Support was again provided by the same two commercial lobster fishermen and their vessels. On August 3, 2018, in support of the national Get Into Your Sanctuary campaign, the CINMS staff and local partners cleaned up trash from two miles of coastline at Smuggler's Cove, Santa Cruz Island. Crew of the sanctuary's R/V *Shearwater* worked alongside Captain Sam Shrout and his crew to collect nearly two tons of trash, including approximately 75 lobster traps that had washed up on the beach.



Top Left: One of the volunteering fishing vessels filled with traps collected from the beach.

Bottom Left: Volunteers and crew stacking/tying down traps on top of kayaks to then be taken offshore back to the vessels.

Right: Walking smaller pieces of trash back to fill the garbage bags.

Shearwater Hosts Whale Entanglement Response Training

On March 27-28, 2018, crew from CINMS aboard R/V *Shearwater* partnered with participants from NOAA's Large Whale Entanglement Response Network, Channel Islands Marine Wildlife Institute, Island Packers, Condor Express, Vessel Assist, and K2 Unmanned Drone Company for large whale entanglement response training conducted offshore from Santa Barbara, California. An overview of previous entanglements, lessons learned, techniques, assigned roles and responsibilities was discussed in advance of the field training. On the water, personnel practiced tracking a satellite buoy, which in the case of an entanglement would be attached to the whale for tracking purposes, and split into groups in small rigid hull inflatables to practice hooking floats and releasing lines on simulated entangled whales behind a boat.



Participants simulate coming into a tow behind a whale to free it from Marine Debris. Photo: Clayton Hunt

Shearwater Lends Critical Support to Satellite Launches

Shearwater provided critical vessel clearance operational support to Vandenberg Air Force Base.



Mars Insight Launch

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In May *Shearwater* supported the Atlas V Insight launch, which sent a lander to Mars. The InSight mission seeks to uncover how a rocky body forms and evolves to become a planet by investigating the interior structure and composition of Mars. To learn more go here:

<https://mars.nasa.gov/insight/mission/overview/>

The image to the left captures the first six minutes of the launch of the Mars Insight Lander from Vandenberg Air Force Base on an Atlas V rocket, as seen from the Santa Lucia mountains above San Luis Obispo, CA.

In September *Shearwater* supported the Delta II Icesat-2 launch. This mission launched NASA's second Ice, Cloud and land Elevation Satellite, or ICESat-2, environmental spacecraft into a polar orbit to precisely measure the changing height of Earth's ice sheets in unprecedented detail. To learn more go here:

<https://www.ulalaunch.com/missions/archived-launched/delta-ii-icesat-2>

MARITIME HERITAGE HIGHLIGHTS

Chumash Paddlers Make Long-Distance Canoe Journey to Island of Limuw

In a continuing tradition, the annual 20-mile Chumash community tomol crossing from Channel Islands Harbor to Limuw (Santa Cruz Island) took place on September 8, 2018. The tomol named *Muptami*, a traditionally-built plank canoe of indigenous Chumash design, made the journey with three crews of “pullers” on hand to rotate into the 6-person canoe. Senior tomol captains dedicated the paddle to the community's need for healing in the wake of fires, floods and other personal losses. Three escort vessels assisted with the crossing, including the *Shearwater*. Along with sailing vessel *Pendragon* and the RHIB *Argonauta*. Following a pre-launch ceremony at the Channel Islands Boating Center in Oxnard, the tomol departed at 2:53 am, experiencing initially challenging conditions that gave way to mostly smooth seas across the Santa Barbara Channel. *Muptami* reached its destination in 6 hours and 39 minutes, arriving at 9:32 am. Paddlers were greeted by songs and hugs from a large crowd of Chumash family members and friends gathered at the historic village site of Swaxil (Scorpion Valley). Videographers

from the National Marine Sanctuary Foundation conducted filming and interviews for an upcoming “Stories from the Blue” online episode by the Office of National Marine Sanctuaries.



Mupatami pullers, mid-channel enroute to Limuw (Santa Cuz Island). Ahead of the tomol, NOAA/CINMS R/V Shearwater sets course, hosts resting paddlers, and helps protect Mupatami from vessel traffic.

National Geographic “Drain the Oceans” Series Films at CINMS

R/V *Shearwater* supported filming for an episode of National Geographic Channel’s “Drain the Oceans”, focusing on 19th century Gold Rush in California and Klondike. The production company selected the CINMS’ California Gold Rush side-wheel passenger steamer *Winfield Scott*, shipwrecked at Anacapa Island in 1853 with over 500 hundred passengers on board, to be one of their featured stories. The film team worked in collaboration with Dede Marx of SEARCH Inc., an archaeological services company based out of Florida and Robert Schwemmer, NOAA West Coast Regional Maritime Heritage Coordinator. The team filmed artifacts on public display at the Santa Barbara Maritime museum, interviewed Bob and Dede, and then followed on *Shearwater* as Bob and Dede filmed the historic remains of the *Winfield Scott* shipwreck site and conducted an archaeological survey.



National Geographic's film crew recorded Robert Schwemmer and Dede Marx debrief after diving the Winfield Scott wreck site.

EDUCATION AND OUTREACH HIGHLIGHTS

Santa Barbara Unified School District Teachers Experience CINMS as a Learning Laboratory

On September 29th, 2018 CINMS staff coordinated an educational cruise aboard the R/V *Shearwater* for 20 teacher candidates and grade 7-12th science teachers from Santa Barbara Unified School District. The cruise was part of the "*Connecting the Next Generation Science Standards to the natural laboratory of the Santa Barbara Channel and its watershed to provide meaningful training for teachers on ocean acidification and climate change (NGSS-SBC Lab)*" Bay Watershed Education and Training (B-WET) Grant. During the excursion, teachers conducted a plankton tow and viewed plankton under a video microscope, measured ocean pH and salinity, and gained knowledge about research and educational activities in the sanctuary. They also visited Painted Cave on Santa Cruz Island and hiked Cherry Canyon on Santa Rosa Island with a volunteer from the Channel Islands Naturalist Corps.



Left: Teachers learn about plankton on board R/V Shearwater.

Above: Group shot of teachers on Santa Rosa Island.

High School Students & Ocean Acidification Impacts on Calcifying Plankton in Santa Barbara Basin

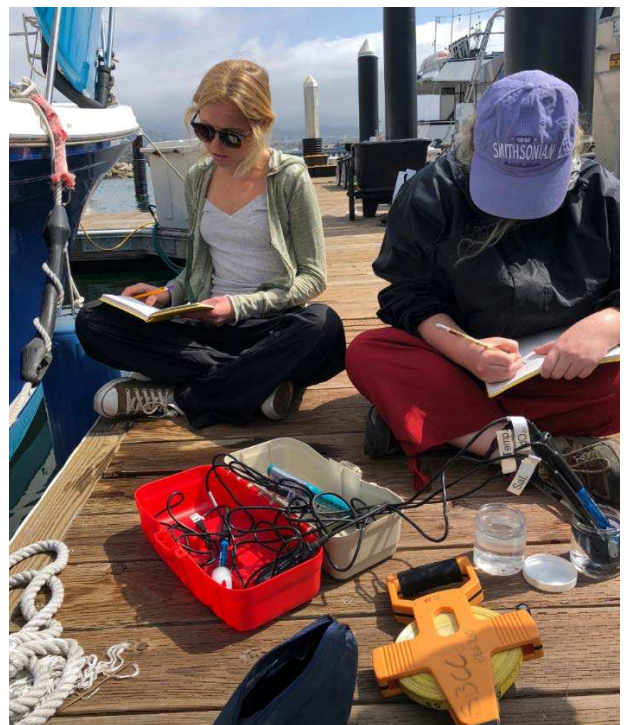
Twice in 2018 (May 25th and November 16th) Ventura high school students from Buena High School's Honor Biology ROP program and Environmental Field Studies program joined Eric Tappa of the University of South Carolina (USC) to retrieve and re-deploy sediment trap arrays from the Santa Barbara Channel and to process sediment samples aboard the R/V *Shearwater*. Two Mark VII automated sediment traps are located at ~200 and 540 m depth in the channel to provide continuous collection of sinking particles. Samples represent two-week sedimentation collection intervals and the traps are recovered and re-deployed every 6 months. This monitoring project's overall objective is to quantify the impact of ocean acidification on calcifying plankton, specifically foraminifers, over the last 300 years. Mr. Tappa invited students to participate in the cruise and served as their mentor, discussing the experimental design of the traps, including the acoustic technologies used in the trap trigger mechanism. Once traps were secured aboard the deck of the R/V *Shearwater*, Mr. Tappa had the students collect the sample bottles from the (2) traps and prepare the traps for re-deployment. Students also had an opportunity to observe sediment and plankton samples under a video microscope.



Top Left: Sediment traps were retrieved from Santa Barbara Basin aboard the R/V Shearwater. Top Right: Buena High School students collect sediment sample bottles and process samples from both traps. Bottom left & right: Buena High School students assisting with cleaning of sediment traps before re-deployment.

CINMS Hosts Santa Barbara City College Students for Dockside Field Activities and Excursion on R/V *Shearwater*

On Friday April 27th, 2018 staff from CINMS engaged 20 students and teachers from the Biology 130 Lab and Field Methods Course at Santa Barbara City College (SBCC) in dockside floating lab activities and a coastal excursion aboard R/V *Shearwater*. Students participated in four stations including plankton and Harmful Algal Bloom (HAB) sampling, water quality (pH, salinity, dissolved oxygen, temperature) monitoring, Remotely Operated Vehicle (ROV) technology and invasive seaweed (Sargassum and Undaria) management and monitoring. Following the activity rotations students went out on a short coastal cruise to look for marine mammals and other sea life. The group was able to observe an ocean sunfish (*Mola mola*) and gray whale mom and calf. Students enjoyed talking with the R/V *Shearwater* crew, scientists, and educators as they learned about different career opportunities with NOAA and the University of California Santa Barbara.



Top Left: SBCC students measure dissolved oxygen in the Santa Barbara Harbor.

Top Right: SBCC Students record water quality measurements in the Santa Barbara Harbor.

Left: CINMS Sea Grant Fellow Lindsay Marks talks to SBCC students about invasive algae in the sanctuary.

Public Tours of R/V *Shearwater* during the 17th Annual Santa Barbara Harbor & Seafood Festival

CINMS participated in the 17th Annual Santa Barbara Harbor & Seafood Festival on Saturday, October 13, 2018. The festival raises awareness about the seafood harvested from the Santa Barbara Channel, one of the nation's richest sources of bountiful, sustainable and high-quality seafood — from lobster, ridgback shrimp, rock crab, white sea bass, California halibut, yellowtail, salmon, swordfish, thresher shark, and rockfish to such delicacies as Santa Barbara spot prawns, sea urchin, and sea cucumber. The Harbor & Seafood Festival offered an interactive day for visitors and locals alike, reminding the community that Santa Barbara Harbor is a working harbor where more than 100 fishermen land millions of pounds of seafood each year, adding \$30 million to the local economy and beyond. *R/V Shearwater* offered public dockside tours to share the valuable research operations conducted with a vessel which is also berthed in the harbor. In addition, an information booth was hosted in partnership with Channel Islands National Park to provide information about visiting the sanctuary and park as well as general information about programs and Marine Protected Areas. Over 15,000 people were estimated to have attended the festival.

Vet into your Sanctuary

Twenty central coast veterans got the opportunity to see the Channel Islands National Marine Sanctuary up close on Saturday, July 28, 2018. Aboard the *R/V Shearwater*, NOAA employees and volunteers took the group of veterans on the trip to instill the value of national marine sanctuaries among veterans and highlight the recreational value of the Channel Islands ecosystem through hands-on exploration. Some veterans had never been to the Channel Islands Marine Sanctuary before and were excited to see marine mammals and everything else the sanctuary had to offer. Veterans were also able to get hands-on experience during the trip, including pulling up a submerged net to get a sense of the plastic and plankton in the water.



All veterans, NOAA employees, and NOAA volunteers that attended the Vet into your Sanctuary event.

VESSEL REPAIRS & UPGRADES: Highlights for R/V *Shearwater* & *Shark Cat* **CR/V *Shark Cat* Repairs and Maintenance**

R/V *Shark Cat* received new engines in December 2018 donated from Yamaha. The engines were held up by some paperwork for several months but are now installed and the boat will be ready for the 2019 field season shortly.

Shipyard Repairs and Upgrades Completed for R/V *Shearwater*

R/V *Shearwater* was taken to the boat yard in December 2018 where it received some bottom touch up paint, new prop paint, generator and engine service, science winch maintenance, dive compressor service, hull inspection and strengthening, and repair on several leaks. It also received several safety improvements, including steps to get into the upper bunks in the two staterooms, lights, and upper steering station lock outs. The scheduled maintenance and repairs kept the vessel operating safely and efficiently.

SUCCESSFUL SMALL BOAT PROGRAM

The R/V *Shearwater* and R/V *Shark Cat* were successfully operated and managed by Channel Islands National Marine Sanctuary for 112 mission and training days in 2018. The platforms were vital to maintaining important long-term monitoring projects with partners in addition to meeting the needs of new partners and outreach opportunities. We thank all of our partners, and look forward to another successful year in 2019. For more information, contact us at 805-893-6437 or visit channelislands.noaa.gov/research/vessels.html.



R/V Shearwater at Anacapa Light. Photo: Libby Mackie NOAA/CINMS