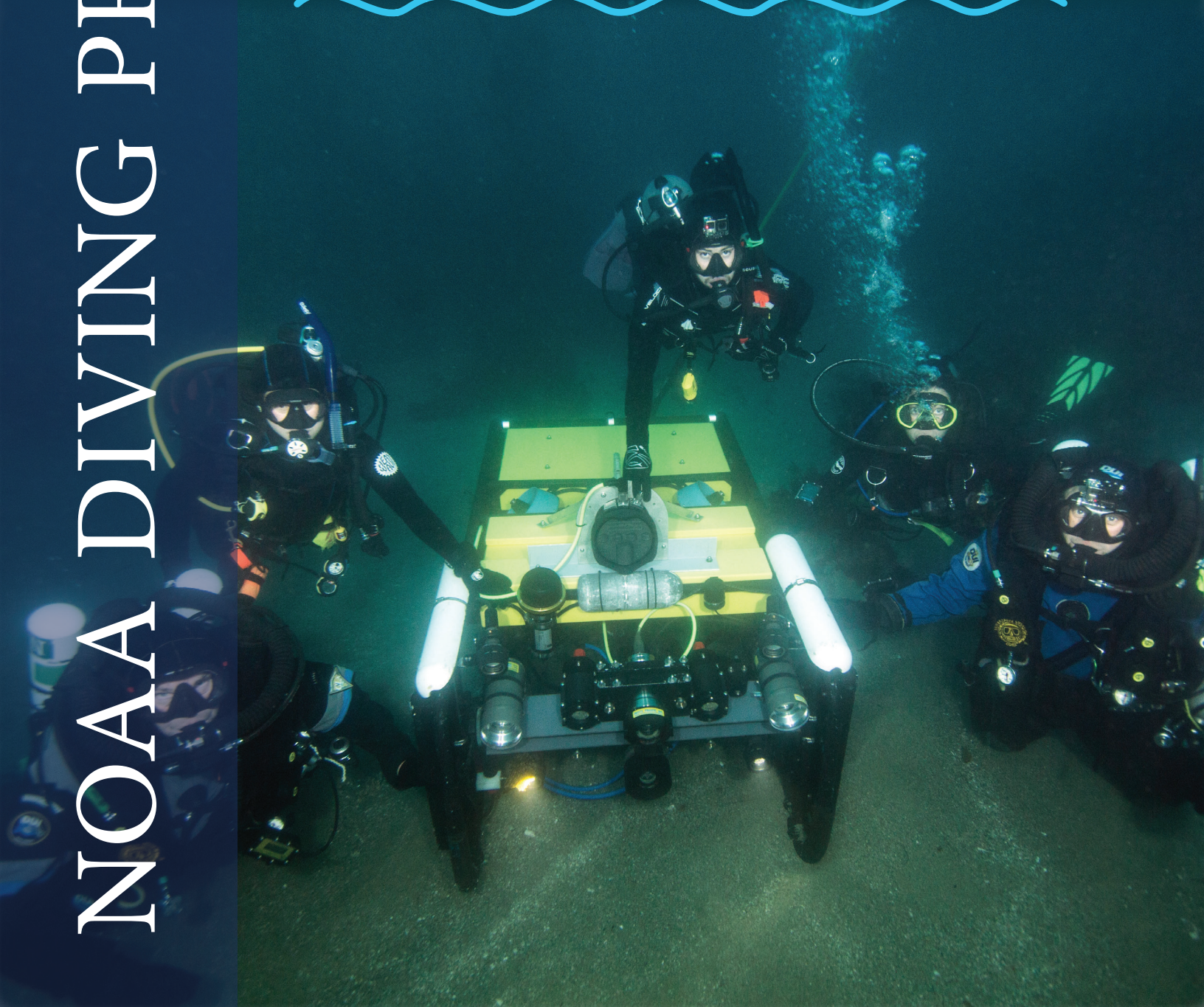


# NOAA DIVING PROGRAM

2 0 1 7  
Annual  
Report



# Unit Diving Supervisors

*The calendar year 2016 achievements of the NDP could not have been possible without the efforts of its UDSs.*

Mark Bailey (NOS/Seattle, WA)  
John Bright (NOS/Alpena, MI)  
Ray Boland (NMFS/Honolulu, HI)  
Julie Bursek (NOS/Santa Barbara, CA)  
Pete Cummiskey (NMFS/Kodiak, AK)  
Andy David (NMFS/Panama City, FL)  
Brian Degan (NOS/Beaufort, NC)  
LTJG James Europe, NOAA (NMFS/Miami, FL)  
Gregg Gitschlag (NMFS/Galveston, TX)  
LT Jared Halonen, NOAA (NOS/Savannah, GA)  
Dominy Hataway (NOS/Pascagoula MS)  
Emma Hickerson (NOS/Galveston, TX)  
Zach Hileman (OMAO/Seattle, WA)  
Joe Hoyt (NOS/Newport News, VA)  
LT Kelsey Jeffers, NOAA (NOS/Key Largo, FL)  
CDR Eric Johnson, NOAA (NOS/Silver Spring, MD)  
LCDR Justin Keese, NOAA (OMAO/Seattle, WA)

LCDR Faith Knighton, NOAA (OMAO/Seattle, WA)  
Matt Lawrence (NOS/Scituate, MA)  
Jason Leonard (NOS/Honolulu, HI)  
Steve Lonhart (NOS/Santa Cruz, CA)  
Andrew Mason (NOS/Silver Spring, MD)  
Scott Mau (NMFS/La Jolla, CA)  
Sean Meehan (NMFS/St. Petersburg, FL)  
Chris Metzger (NOS/Chesapeake, VA)  
Victor Simon (NMFS/Seattle, WA)  
Barry Smith (NMFS/Milford, CT)  
Bob Stone (NMFS/Juneau, AK)  
Mitchell Tartt (NOS/Silver Spring, MD)  
Steve Thomas (NMFS/Santa Rosa, CA)  
Nick Tolimieri (NMFS/Seattle, WA)  
Hans Van Tilburg (NOS/Honolulu, HI)  
David Witting (NMFS/Long Beach, CA)  
Frank Wood (OMAO/Honolulu, HI)

Cover photo: NOAA divers pose with a Remotely Operated Vehicle (ROV) near the Southern California coastline while conducting comparison surveys using Open Circuit SCUBA, Closed Circuit Rebreathers, and the ROV. Adam Obaza/NOAA





# NOAA DIVING PROGRAM

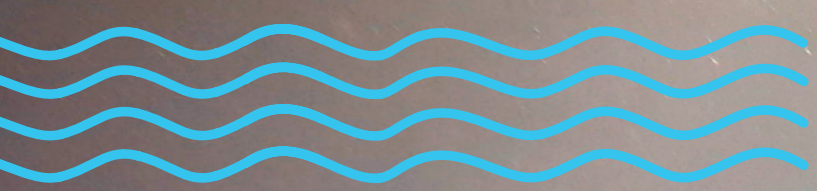


The NOAA Diving Program (NDP) oversees all diving that is performed on behalf of NOAA's scientific research and operations.

The NOAA Diving Program (NDP), is administered by the U.S. Department of Commerce (DOC), National Oceanic and Atmospheric Administration (NOAA), Office of Marine and Aviation Operations (OMAO) and is headquartered at the NOAA Diving Center (NDC) in Seattle, Washington. Its mission is to train, certify and equip scientists, engineers, and technicians, while promoting innovation of effective diving technologies, and safely performing underwater operations.

With 369 active divers, NOAA has the largest complement of divers of any civilian federal agency. The NDP establishes standards and safety procedures for conducting various types of diving in support of NOAA's mission.

The NDP's vision for the future is to lead the nation in the advancement of diving safety, education, training, innovation and execution of underwater operations in support of science, service and stewardship.



# N O

## NMFS

- Auke Bay, Alaska
- Galveston, Texas
- Honolulu, Hawai'i
- Kodiak, Alaska
- La Jolla, California
- Long Beach, California
- Miami, Florida
- Milford, Connecticut
- Newport, Oregon
- Panama City, Florida
- Pascagoula, Mississippi
- Santa Cruz, California
- Santa Rosa, California
- Seattle, Washington
- Silver Spring, Maryland
- St. Petersburg, Florida



## NOS

Center for Operational  
Oceanographic Products and  
Services

Chesapeake, Virginia  
Seattle, Washington

National Centers for Coastal  
Ocean Science

Beaufort, North Carolina  
Silver Spring, Maryland

National Marine Sanctuaries  
& Marine National Monuments

Silver Spring, Maryland  
Channel Islands

Florida Keys  
Flower Garden Banks  
Gray's Reef

Monitor

Monterey Bay

American Samoa

Pacific Islands Region

Papahānaumokuākea

Stellwagen Bank

Thunder Bay



A

A

## OAR

Miami, Florida

## OMAO

NOAA Diving Center

Seattle, Washington

NOAA Ships\*

MOC-A (Norfolk, VA)

*Gordon Gunter* - Pascagoula, MS

*Henry B. Bigelow* - Newport, RI

*Nancy Foster* - Charleston, SC

*Okeanos Explorer* - Kingstown, RI

*Oregon II* - Pascagoula, MS

*Pisces* - Pascagoula, MS

*Ronald H. Brown* - Charleston, SC

MOC-P (Newport, Oregon)

*Bell M. Shimada* - Newport, OR

*Fairweather* - Ketchikan, AK

*Oscar Dyson* - Kodiak, AK

*Rainier* - Newport, OR

*Reuben Lasker* - San Diego, CA

MOC-PI (Honolulu, Hawai'i)

*Hi'ialakai* - Honolulu, HI

*Oscar Elton Sette* - Honolulu, HI

\*Marine Operations Centers are located in the Atlantic (MOC-A), Pacific (MOC-P), and Pacific Islands (MOC-PI)



# UNITS

# 2017



## An update from NDP Manager Greg McFall

### Winter NOAA Diving Class

After a couple of years conducting winter NOAA Diver and Divemaster training in Panama City, FL, NDC will be returning to Key West, FL to conduct training during the next few years. While Key West offers a much better training environment with relatively easy access to pools, confined open water and open water areas, the lodging costs in excess of \$250 per night had become a constraint on class attendance. A move to Panama City, where the lodging rate was \$84 per night, seemed like a sensible cost saving measure.

Recent NDC contacts with the U.S. Navy have opened up additional options to use housing at one of three different bases on Key West at an affordable rate that is lower than housing in Panama City. NDC will continue working with the U.S. Navy and other government partners in the area to continue offering cost savings in the future while maintaining the highest standards of diving training.

### Launch of New OMAO / NDP Website

For approximately 5 years, the NOAA Diving Control and Safety Board (NDCSB) and many divers in the field have been asking for an update to the NDP website to make it more functional, informative and easier to navigate. During this time, a new website for OMAO was in the works with space for an NDP section. Delays with this endeavor required staff to work behind the scenes to prepare content for the site while waiting for the project to be completed.

With help from OMAO headquarters, the tireless efforts of NDP Program Assistant Aitana de la Jara, and under the guidance of OMAO's Public Affairs Officer, David Hall the new NDP website went live in May of 2016. The design is simple and effective and is much easier to update and keep refreshed than the old site. The new website can be found at: <https://www.oma.noaa.gov/ndp>



NDP Manager Greg McFall during an open-circuit decompression dive in the Florida Keys NMS.  
Greg McFall/NOAA

CDR Ben Evans (NOAA) flanked by NDC staff members. From left to right: LT Gary Montgomery (USPHS), Bill Gordon, CDR Ben Evans (NOAA) and CAPT Joel Dulaigh (USPHS). Aitana de la Jara/NOAA



### Combined Safety Manuals

The NDCSB has been working to update the Working Diving Standards and Safety Manual and the Scientific Diving Standards and Safety Manual into a single version that incorporates all of the interim diving policies (0300s). This project was identified as a priority by NDCSB members and Unit Diving Supervisors (UDSs) but the complexity of the revision was such that it has taken two and half years to complete.

After much revision, editing and incorporation of the interim diving policies, the NDCSB approved the final version in August of 2016. The resulting NOAA Diving Standards and Safety Manual (NDSSM) was sent for NOAA legal review and was subsequently cleared by General Counsel (GC) in October of 2016. The NDSSM will have to be cleared by DOC Office of General Counsel (OGC) and then will undergo internal review by staff at OMAO prior to being signed as policy by the Director of OMAO. As soon as the NDSSM is signed, it will be available on the NDP website at: [www.oma.noaa.gov/learn/diving-program/diving/regulations](http://www.oma.noaa.gov/learn/diving-program/diving/regulations)

### NDP Staffing Changes

In February of 2016, CDR Ben Evans (NOAA) from the National Ocean Service (NOS) Pacific Hydrographic Branch stepped in to serve as the Acting NOAA Diving Center Manager (NDCM) to provide for continuity of operations for 6 months. NDP is very thankful to NOS and OMAO for allowing CDR Evans to come in at a crucial time for the NDC. After CDR Evans reported back to NOS in July of 2016, NDC Executive Officer (XO) LCDR Justin Keese (NOAA) served as the Acting NDCM while the Program continued searching for a new Center Manager. LCDR Keese provided an excellent service to the Program while in the position until he rotated out to his next sea tour in December. As of the end of 2016 the NDCM position continues to be vacant.

The new NDC XO, LCDR Faith Knighton (NOAA) reported for duty on August 1st and came to the Center from NOAA Ship *Hi'ialakai* where she

“... the new NDP website went live in May of 2016.”



LCDR Justin Keesee (NOAA) places a new pin on LCDR Faith Knighton's (NOAA) uniform during her promotion ceremony. Greg McFall/NOAA

“ . . . Roger Mays was selected by the Chief of OMAO's SECD for the position and began serving officially as DSO in December of 2016. ”

served as Operations Officer and Acting XO for two different missions.

After serving as the Acting Diving Safety Officer (DSO) for almost a year, Roger Mays was selected by the Chief of OMAO's Safety and Environmental Compliance Division (SECD) for the position and began serving officially as DSO in December of 2016. Roger's primary responsibility as DSO is to coordinate and conduct Diving Unit Safety Assessments (DUSAs) at every diving unit and on every platform on a three year rotational basis. While Roger works directly for SECD, he also serves as an advisory member of the NDCSB.

The Chair of the NDCSB and NOS Line Office Diving Officer (LODO), Kim Roberson accepted a new position in NOAA and had to step down from her NDCSB duties in October after serving as LODO for three years and as Chair for one year. Brian Degan was nominated to take the NOS LODO position by his Line Office and will be replacing her as a new member of the NDCSB. Andrew David was elected as the new Chair of the NDCSB and will remain in the position until elections are conducted at the next annual meeting. Similarly, NOS Deputy LODO (DLODO) Tane Casserley accepted a new position with NOAA and stepped down from the NDCSB to focus on his new responsibilities. Joe Hoyt was selected to the position of DLODO and started serving in that capacity after Tane's departure.

The NDCSB membership as of December 2016:

Chair and NMFS LODO – Andy David  
NMFS DLODO – Ray Boland  
NOS LODO – Brian Degan  
NOS DLODO – Joe Hoyt  
OMAO LODO – Bill Gordon  
OMAO DLODO – LCDR Faith Knighton (NOAA)  
NDP Manager – Greg McFall

(Non-voting members)

NOAA Diving Medical Officer – CAPT Joel Dulaigh (USPHS)  
NOAA Safety – Joe Duran  
NDCM – Vacant  
NOAA DSO – Roger Mays

### **New Edition of the NOAA Diving Manual**

At long last, the NDP was able to make significant progress on the 6th edition of the NOAA Diving Manual. Unlike the NDSSM which is a compendium of NOAA regulations, the NOAA Diving Manual covers the history of diving as well as technical, medical, and instructional material on a variety of diving modes.

This edition will have a fresh look. Significant revisions were made to chapters on Diving Equipment, Physiology, Procedures for Scientific Dives, Rebreathers and Polluted Water Diving. Two new chapters



**“The American Academy of Underwater Sciences continues to be our largest reciprocity partner and their contributions . . . to the mission and mandates of NOAA cannot be understated.”**

on Advanced Platform Support and Underwater Photography and Videography were added to round out the manual. The new edition of the NOAA Diving Manual should be available in the July/August timeframe of 2017. Thanks to the many folks in NOAA who helped with the much-needed changes, revisions and edits of this 772 page document.

### **NOAA Diving Program Partnerships**

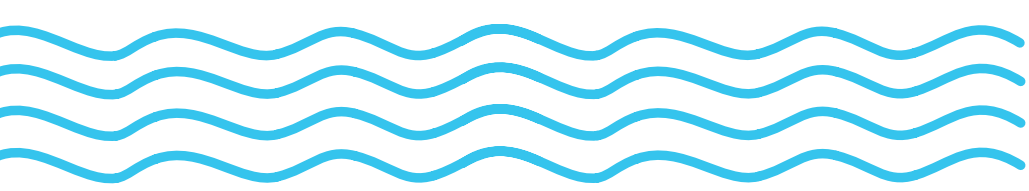
The partnerships that the NDP builds with other sister agencies (other federal programs) continue to serve us well. This year was the first in NDP history that NDC had the opportunity to work with the Department of Energy. One of their divers from the Lawrence Livermore National Laboratory came to audit the NOAA Diver class to see if it would be suitable training for their divers. The diver participated in all of the class activities and left feeling that the course of instruction would suit their people well. Additionally, the U.S. Army Corps of Engineers sent four auditors out to see if NOAA might be able to help train their divers. At the end of their visit they were glad to observe a high level of attention to safety in the NDC's training environment and will discuss the potential for training with their command structure.

The American Academy of Underwater Sciences (AAUS) continues to be our largest reciprocity partner and their contributions to the collection of scientific information that contributes to the mission and mandates of NOAA cannot be understated. New reciprocity partnerships that were added in 2016 included the Miami Dade Department of Environmental Resources Management and the California Department of Parks and Recreation. A complete list of NDP's reciprocity partners can be found on the reciprocity page of the NDP website.

Reciprocity Diver Brady Booton (Florida International University) after replacing a buoy downline at the Florida Keys National Marine Sanctuary.

LT Kelsey Jeffers/NOAA





## BY THE NUMBERS: A quick look at NOAA dives in 2016

“ The overall numbers for 2016 are slightly below previous years, representative of the cyclic nature of many dive operations and the mission needs of the line offices. ”

In 2016, NOAA divers (n=369) supported the missions of all six NOAA Line Offices: Office of Marine & Aviation Operations (OMAO, n=92), National Marine Fisheries Service (NMFS, n=130), National Ocean Service (NOS, n=137), Office of Oceanic and Atmospheric Research (OAR, n=5), National Weather Service (NWS, n=1), and National Environmental Satellite, Data, and Information Service (NESDIS, n=2) (Fig. 1 and 2). Each line office excels in unique mission requirements; OMAO leads in Occupational Safety and Health Administration (OSHA) classified working dives in support of ship husbandry (n=860) (Fig. 3), NOS leads in deepest dive on closed circuit rebreather at 332 feet of sea water, and NMFS leads with 27% of all NOAA dives in data collection and monitoring (Fig. 4).

A total of 9,863 dives were completed with 6,075 hours of logged bottom time (Fig. 5) performing working, scientific and proficiency dives (Fig. 6), breathing air, nitrox or trimix (Fig. 7) using open circuit SCUBA, closed circuit rebreathers and in hyperbaric chambers (Fig. 8). The NOAA diver population is comprised of federal, contract, NOAA Corps, wage mariner, wage grade, volunteer and U.S. Public Health Service employees (Fig. 9) that dive from Alaska to the South Pacific, from the North Atlantic to the Caribbean, and the United States Territories (Fig. 10). Divers enter the water primarily from small boats, the shore and ships (Fig. 11) and perform a variety of tasks to complete their missions, such as data collection, ship husbandry and proficiency dives (Fig. 3). In 2016, NOAA divers dove over 437,000 feet, this is equivalent to diving to the bottom of the Marianas Trench twelve times.

The overall numbers for 2016 are slightly below previous years, representative of the cyclic nature of many dive operations and the mission needs of the line offices. Over the past seven years, the NDP has supported over 82,000 dives and nearly 50,000 hours underwater in support of NOAA's mission and mandates (Fig. 4a). The success and exceptional safety record of the NDP are a reflection of the safety culture and professionalism of NOAA divers, divemasters and unit diving supervisors.

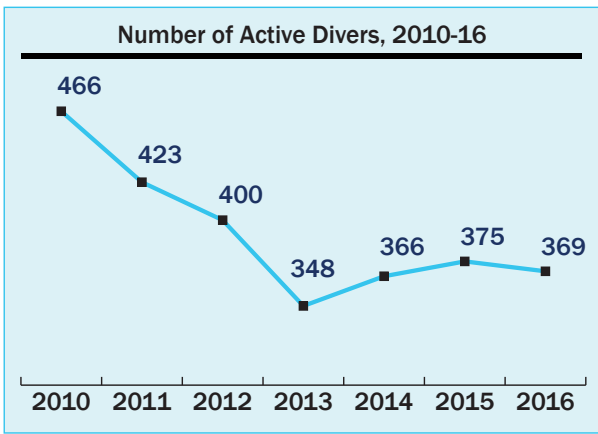


Figure 1. Number of active divers, 2016.

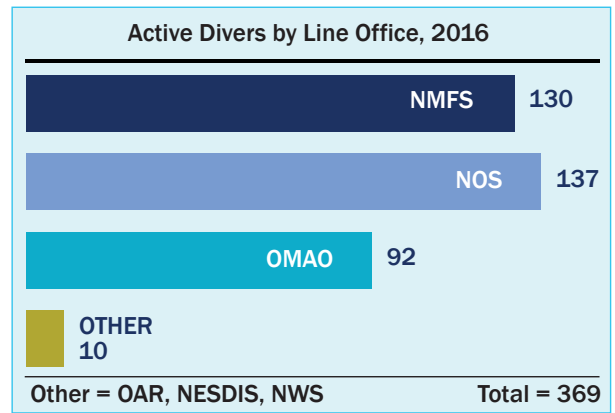


Figure 2. Active divers by line office, 2016.

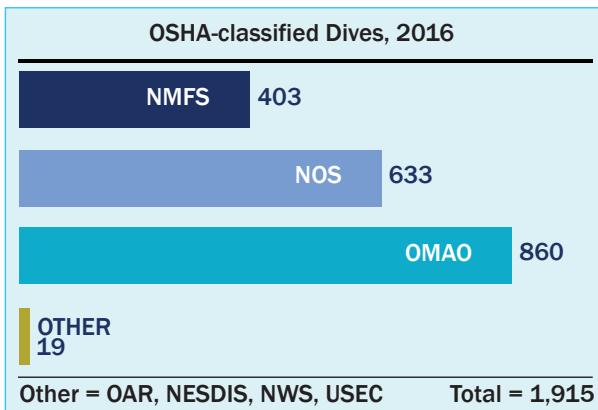


Figure 3. OSHA-classified dives, 2016.

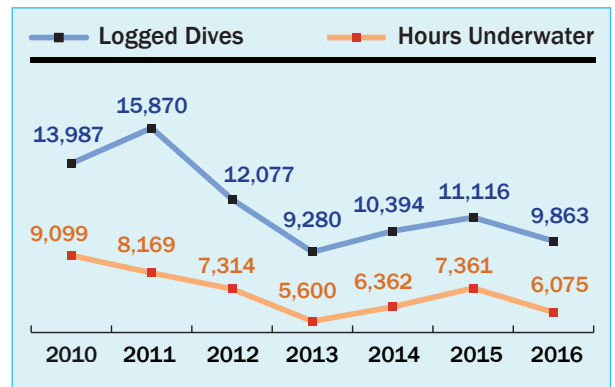


Figure 5. Logged dives and hours underwater, 2016.

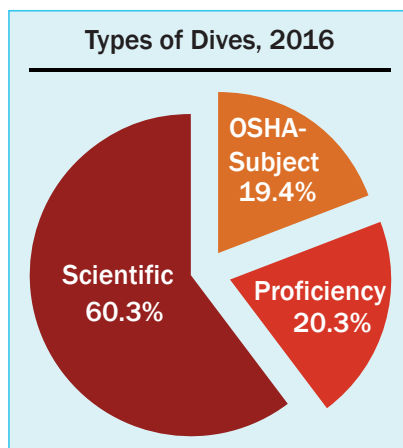


Figure 6. Types of dives, 2016.

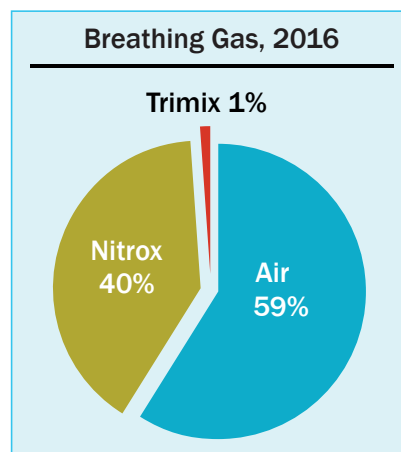


Figure 7. Breathing gas, 2016.



# BY THE NUMBERS

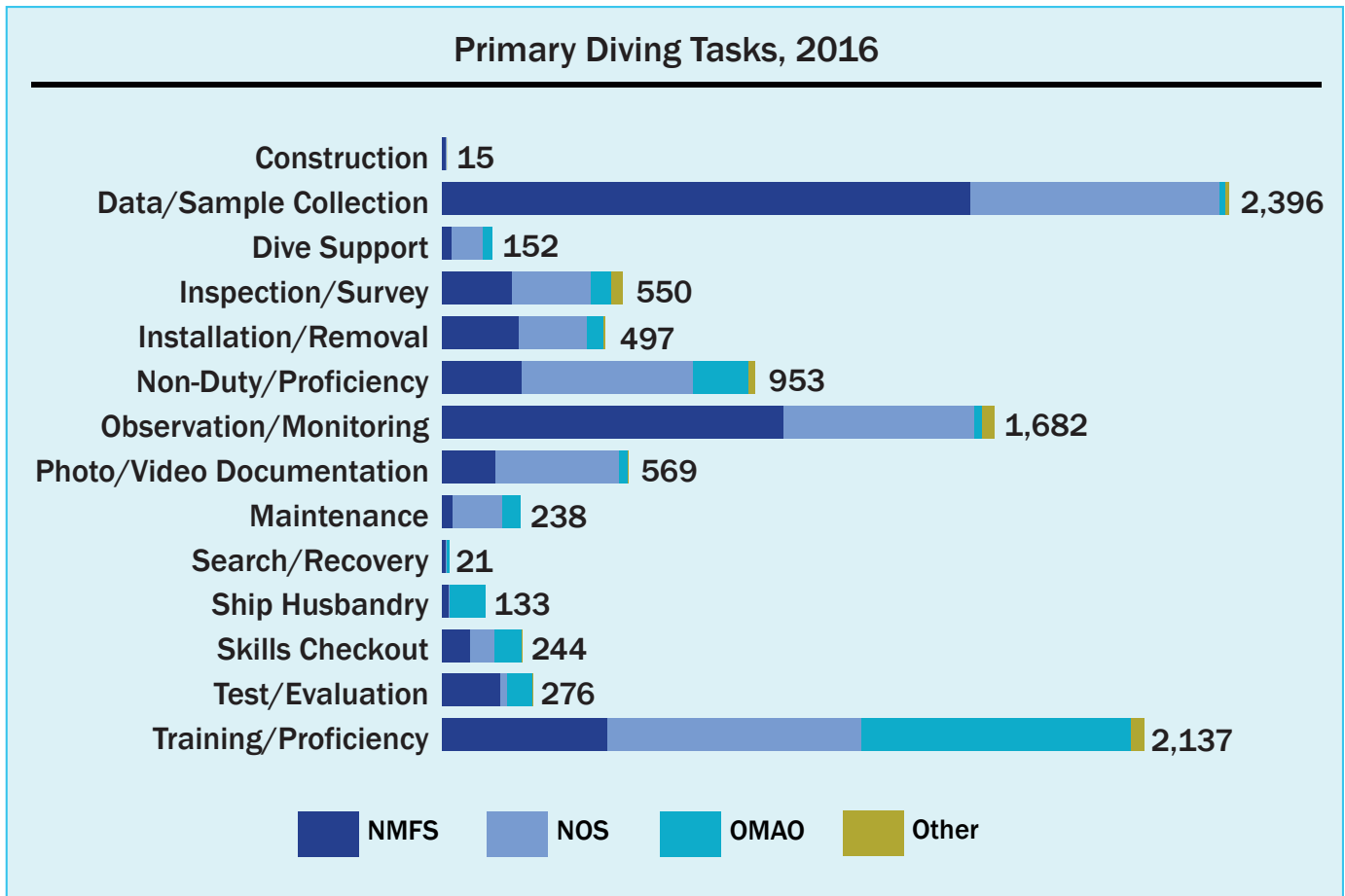


Figure 4. Primary diving tasks, 2016.

### Number of Dives by Diving Mode, 2016

DECO	Decompression	182
	Non-decompression	9,681
MODE	Hyperbaric Chamber	37
	SCUBA	9,826
SCUBA Mode	Open Circuit	9,481
	Closed Circuit Rebreather	341
	Semi-closed Circuit Rebreather	4
Total number of NOAA Dives in 2016 =		9,863

Figure 8. Number of dives by diving mode, 2016.

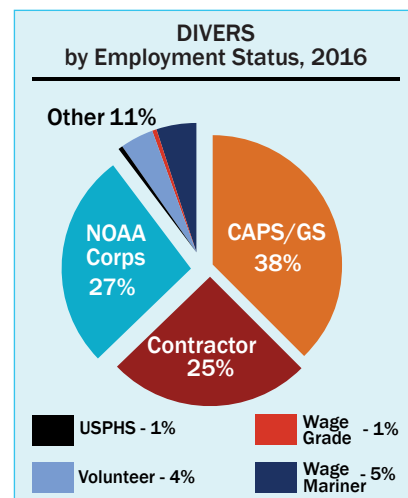


Figure 9. Dives by employment status, 2016.

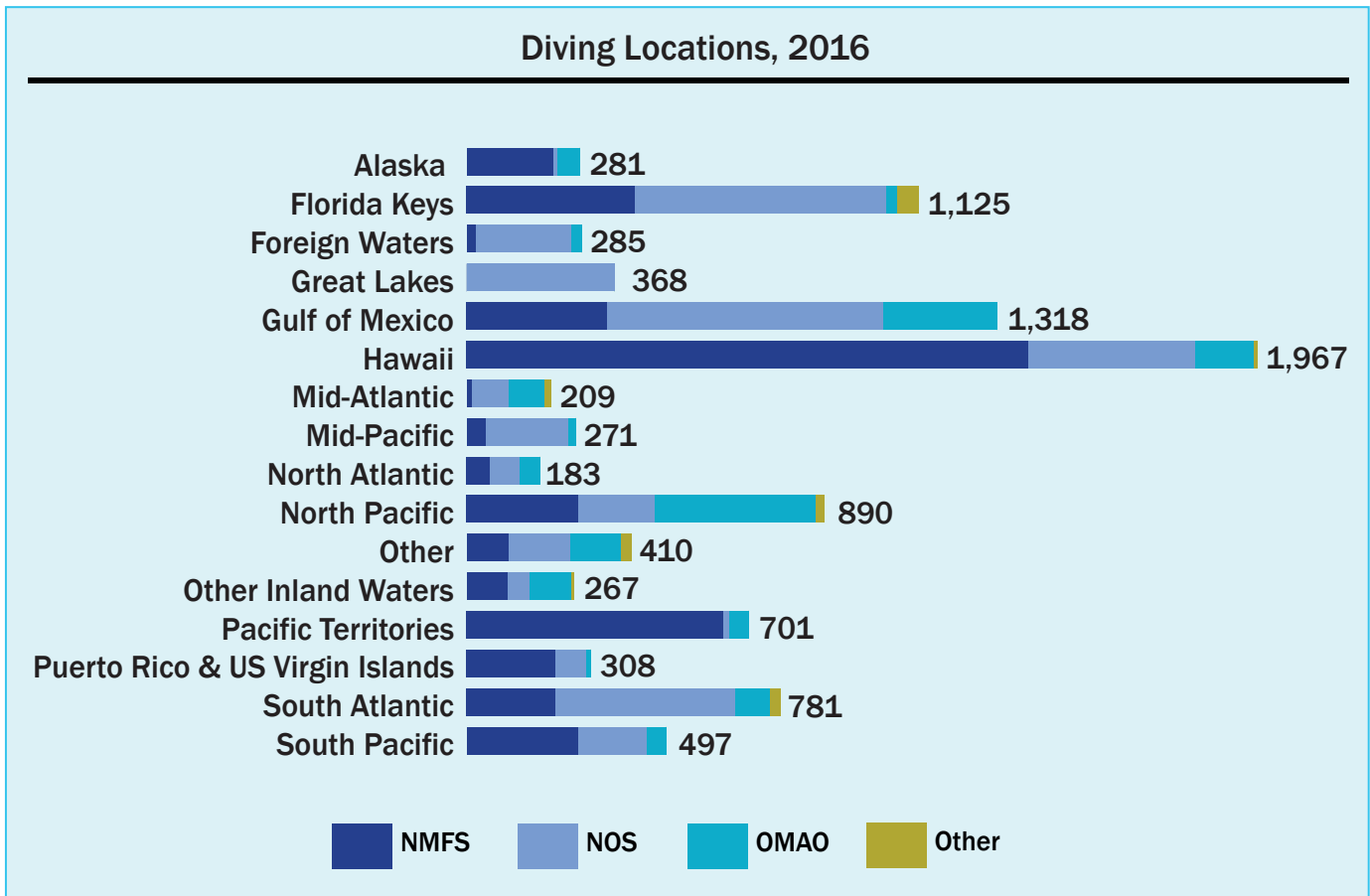


Figure 10. Diving locations, 2016.

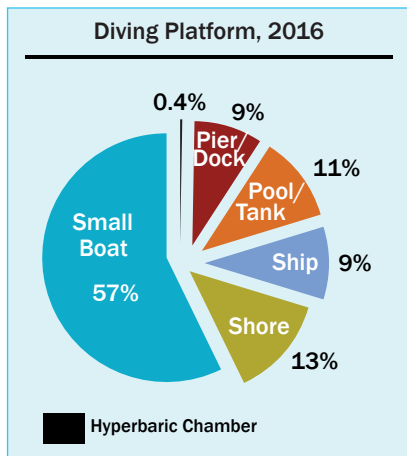


Figure 11. Diving platforms, 2016.

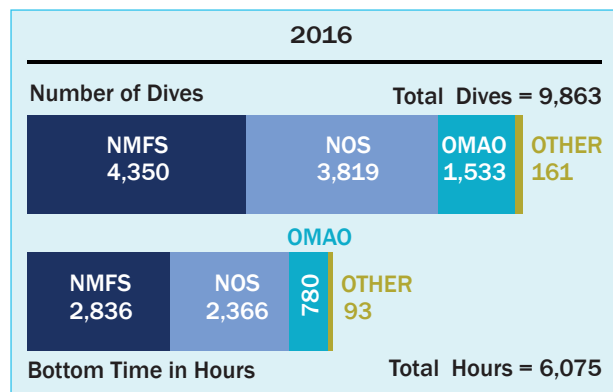


Figure 12. Number of Dives and bottom time, 2016.

# Diving Center

**“ modular training  
...promotes cost  
savings to the  
government by  
allowing greater  
flexibility with  
respect to time  
on official travel”**



ENS Caroline Wilkinson (NOAA) and ENS Jennifer Kraus (NOAA) during a NOAA Diver class.

Greg McFall/NOAA



NOAA Diver students on the NDC boat *Dinsmore*. Greg McFall/NOAA

The NDC in Seattle, Washington serves as the training and support branch to carry out the NDP mission:

“To train, certify, and equip scientists, engineers, and technicians while promoting innovation of effective diving technologies and to safely perform underwater operations.”

NDC provides standardized diver, divemaster, and diving medical technician training to support diving missions. In addition to training, NDC provides hyperbaric chamber support for diving missions, conducts a variety of community outreach programs, and hosts the jointly sponsored NOAA-Undersea and Hyperbaric Medical Society (UHMS) Physicians Training in Diving and Hyperbaric Medicine.

In 2016, NDC conducted three training courses resulting in 56 new divers and 13 divemasters and one Diving Medical Technician (DMT) course resulting in 12 new or recertified DMTs. The line offices continue to respond favorably to the modular training approach as evidenced in diver and divemaster matriculation. The modular training approach promotes cost savings to the government by allowing greater flexibility with respect to time on official travel. Diving units have the option of sending non-divers to an initial week of introduction to diving while experienced and previously certified divers can attend training during weeks two and three to further develop scientific research and OSHA working diver skills. The divemaster course runs concurrently with the last two weeks of the diver course and prepares experienced divers to safely supervise and direct NOAA diving operations at diving units throughout the nation. All divers and divemasters graduate with the standardized competencies to integrate with their dive teams and safely participate in diving missions. The NDP website has more information on training.

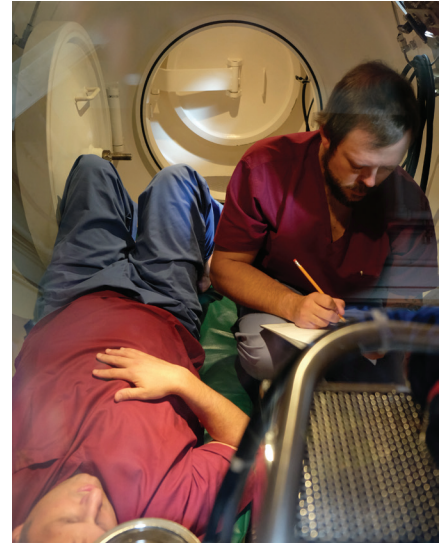
The Diving Center provided operational support to the NOAA Ship *Hi'ialakai* during four missions in 2016 for a total of 97 days at sea. During each mission, a NDC Instructor serves as both Divemaster and Chamber Supervisor, overseeing high tempo technical and SCUBA diving operations for the NOS Papahānaumokuākea Marine National Monument and the NOAA Fisheries Coral Reef Ecosystem Program research missions. The Chamber Supervisor's role is essential to the research missions by supporting the operation of a hyperbaric chamber and compressed air systems that are on loan from NDC to support the safety of diving operations in remote locations. The need for hyperbaric support on the ship was highlighted this year by the successful treatment of a suspected case of decompression illness while underway, allowing research diving operations to continue without interruption. Chamber Supervisors also maintain the air compressors, repair and troubleshoot SCUBA equipment, and conduct diver drills and training with the dive team at sea.

NDC honored a tradition of public outreach and education during 2016. Instructors provided an interactive educational experience to over 100 students during the NOAA Science Camp in July. Students interacted with diving equipment and recompression chambers, observed and communicated with divers demonstrating diving skills in the tower, and discovered how divers use underwater search techniques during a simulated dive. In addition, NDC hosted a number of tours and public outreach events throughout the year to share diving, science, and technology experiences with students.

NDC continued to build partnerships with the diving community. In January, the United States Coast Guard Cold Water Ice Diving unit conducted training at NDC. Their use of the tower, training basin in Lake Washington, tanks, storage area, and classroom took full advantage of our facility while NDC conducted off-site diver training in Florida.

Construction at NDC continued as part of a three-year plan to renovate the facility. In 2016, the second floor office space and the classroom were completed. This coming year, an elevator, kitchenette, and energy efficient lighting installation will complete the construction. Please come by to visit when you are in the area!

In 2016, NDC had several changes to staffing. After nine years of tremendous support to the NOAA Diving community, Jennifer Carriere left NDC for a new job with the U.S. Coast Guard; she'll be sorely missed. Meanwhile, Executive Officer (XO) and OMAO DLODO LCDR Justin Keese (NOAA) rotated to his next assignment as XO aboard the NOAA Ship *Reuben Lasker*. We wish him well on this sea tour and appreciate his contributions to NDC over the past three years! LCDR Faith Knighton (NOAA) took over as XO at NDC and DLODO for OMAO in August.



DMT students practice neurologic exam skills while pressurized to a depth of 60'.  
Joel Dulaigh/NOAA

“The need for hyperbaric support on the ship was highlighted this year by the successful treatment of a suspected case of decompression illness.”



NOAA Diver students enter the water from a boat.  
Greg McFall/NOAA

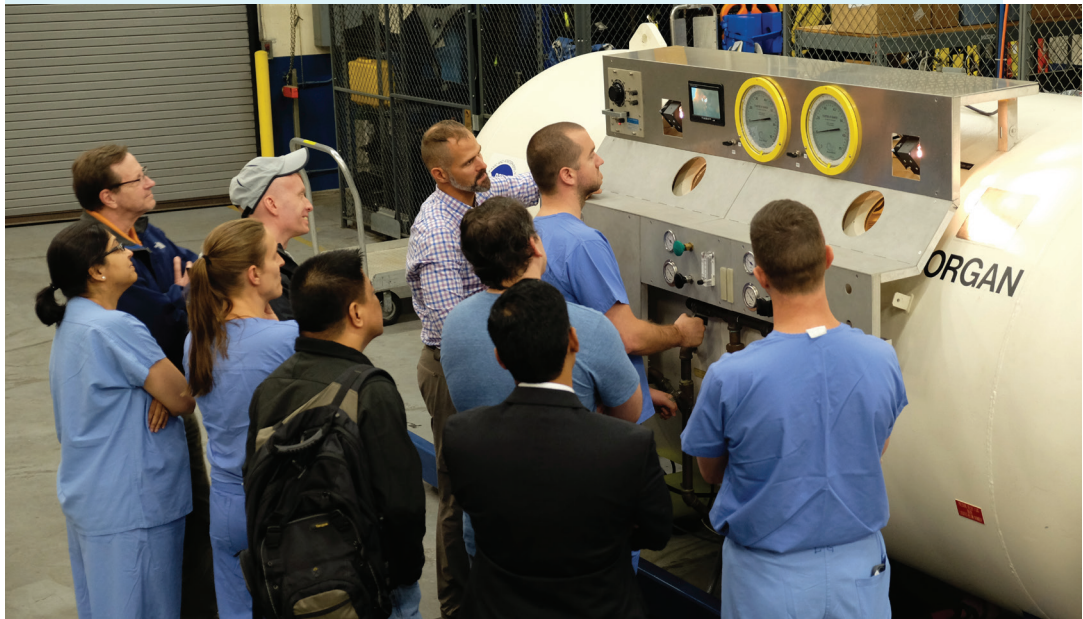
# Medicine

“ In 2016, NOAA Diving Medicine hosted 34 students from seven different countries as well as ... fellows from Undersea and Hyperbaric Medicine [programs] ”



CAPT Joel Dulaigh, USPHS communicates with DMT students inside a hyperbaric chamber.

Aitana de la Jara/NOAA



Students participating in the NOAA/UHMS Physicians Training in Diving Medicine course learn how to operate a 60” hyperbaric chamber. Aitana de la Jara/NOAA

The NOAA Diving Medicine office is staffed by Commissioned Corps officers from the United States Public Health Service (USPHS) who serve as NOAA’s Diving Medical Officers (DMOs).

The office is physically located at NDP’s headquarters office at the NDC in Seattle, WA. The primary responsibility of the DMOs is monitoring the health and wellbeing of all NOAA divers. This is achieved through on-site or virtual clinical assistance, reviewing periodic physicals for all NOAA divers, teaching diving medicine and emergency first aid classes, and assisting divers during emergencies through the 24 hour NOAA diving emergency hotline.

There are currently two DMOs on duty. The Senior DMO is Captain Joel Dulaigh (USPHS), an Acute Care Nurse Practitioner that has served as a DMO for NOAA since 2009. Lieutenant Gary Montgomery (USPHS) is a Physician Assistant and has served as a DMO since 2015. Like all officers in the USPHS, CAPT Dulaigh and LT Montgomery have a dual role in serving the agency to which they are assigned and serving the USPHS. In their capacity as NOAA DMOs, they provide a service to NOAA by providing medical surveillance, education and training, diving emergency medical management, and direct medical care. As USPHS officers they are also called to protect promote, and advance the health and safety of our Nation and can be deployed to fulfill this mission at any time of crisis. CAPT Dulaigh and LT Montgomery have been assigned



to Tier I response teams with the Assistant Secretary for Preparedness and Response.

2016 was the first full year with two full time diving medical officers assigned to the program. This resulted in the office's increased ability to support the field and provide better customer service. As an example, this year, LT Montgomery, USPHS, was able to provide diving medical coverage on board the NOAA Ship *Hi'ialakai* during the month of August for the Reef Assessment and Monitoring Program mission.

Thanks to this year's increase in staff, NOAA Diving Medicine expanded the current curriculum and offered more educational opportunities. In 2016, the annual DMT course offered students the opportunity to become certified nationally (with the National Board of Diving and Hyperbaric Medical Technology), or to obtain NOAA certification. The NOAA DMT certification was recently developed in-house and allows NOAA DMTs to focus on skills that are specific to the NOAA mission and to the type of diving casualties more likely to occur during diving operations at NOAA. This year's course was attended by NOAA employees as well as members of the U.S. Army and the U.S. Air Force. The course will continue to be offered at least annually to NOAA divers and personnel from NOAA units that desire to improve the safety of their divers by staffing DMTs at their diving sites.

The other flagship course of NOAA Diving Medicine is the Physicians Training in Diving Medicine course. It is co-sponsored by UHMS. This course is known worldwide and has the reputation of being one of the best diving medicine courses in the world. In 2016, NOAA Diving Medicine hosted 34 students from seven different countries as well as the fellows from Undersea and Hyperbaric Medicine fellowships from Duke University, Louisiana State University, University of California San Diego, Hennepin County Medical Center, United States Air Force, and University of Pennsylvania. The NOAA/UHMS course is the only such course in North America recognized by the Diving Medical Advisory Committee.

In addition to the primary function of the NOAA Diving Medicine office, both medical officers are Basic Life Support instructors through the American Heart Association and provide CPR training upon request. They are also Divers Alert Network (DAN) instructors, providing an array of training that includes Diving First Aid for Professional Divers. One or both of the DMOs is onsite and available during all diving and divemaster courses taught through NDC to provide instruction and medical support.

NOAA Diving Medicine is also responsible for supplying Oxygen, AED, or first aid kits to the field and resupplying expired items as requested.

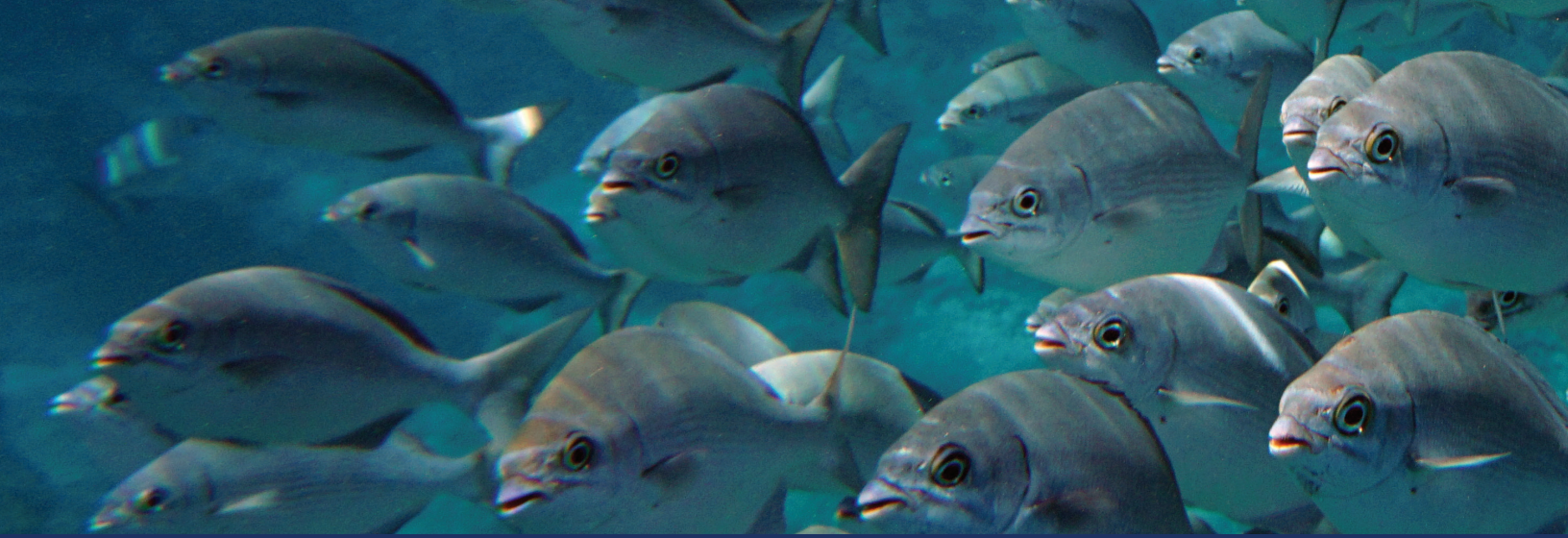


A student from the Physicians course gets a feel for the type of work his patients may be performing. Greg McFall/NOAA

“ The NOAA DMT certification was recently developed in-house and allows NOAA DMTs to focus on skills that are specific to the NOAA mission ”



A combined AED/O2 kit in use during a NOAA Diver class. Greg McFall/NOAA



# N M F S

Andrew David  
Line Office Diving Officer

“NMFS continues to log more dives and accrue more bottom time than any other line office within NOAA”

## National Marine Fisheries Service (NMFS)

The 16 diving units with divers from the National Marine Fisheries Service (NMFS) had an active year in 2016. Diving units are supported in all regions of the country; however the highest operational tempo continues to remain in the Pacific Islands and Southeast Fisheries Science Centers. NMFS continues to log more dives and accrue more bottom time than any other line office within NOAA although the National Ocean Service (NOS) has more divers. NMFS had 130 divers logging dives in 2016, which is a decrease of 5 (3.7%) from 2015 and represents 35% of the total number of NOAA divers. A total of 4,350 dives were completed by NMFS divers this year, 44.1% of the 9,863 dives executed in the NDP. This is a decrease of 899 dives (17.1%) compared to the 5,249 dives completed by NMFS in 2015. The bottom time accumulated by NMFS divers decreased from 3,696 hours in 2015 to 2,836 hours in 2016, a decrease of 23.2%. The bottom time logged by NMFS divers was just under half (46.7%) of the time logged by all divers within the Program. The vast majority of NMFS dives were scientific (85.2%) compared to working (9.2%) or non-duty (5.6%). Nitrox was the most used breathing mixture (50.6%) for NMFS divers compared to air (49.4%). This is a higher percentage usage of nitrox than found in the overall NDP where air is the dominant breathing gas (59% air, 40% nitrox and 1% trimix). Direct observation and sample collection, habitat restoration, collection of telemetry data, and safety/training were the dominant categories of activities conducted this year. Our level of training remains high and is exemplified by diving skills training, rescue drills, fitness tests and check-out dives for new equipment and techniques.

Once again, 2016 was a year without any significant diving injuries to NMFS divers. There was only one reportable diving incident within NMFS in 2015; an out-of-air situation which did not result in any injuries, due in large part to the safety training described above.

The use of nitrox as the breathing gas continues at a high rate, with the majority of NMFS dives (50.6%) using this mixture. The use of nitrox allows extended bottom times at common research depths compared to



School of chubs (*kyphosus sp.*) Andrew Purves/NOAA

air. Alternatively, if the air bottom time limits are used, nitrox provides a greater safety margin against decompression illness (aka ‘the bends’) as less nitrogen is dissolved into the blood than would occur in the same amount of time breathing air.

The only in-house rebreather training program in the NDP continued in 2016 under Ray Boland, the DLODO and UDS for the Honolulu Unit. Ray intends to expand the use of Closed Circuit Rebreathers (CCRs) for research in the Pacific Islands. Two other NMFS Units, Long Beach and La Jolla, completed training in the use of Innerspace Systems Corporation’s Megalodon rebreathers and used them extensively for white abalone research in southern California. Unit Diving Supervisors Dave Witting and Scott Mau will undertake air and normoxic trimix decompression training with their Megalodon CCRs in 2017.

The DUSA program continues to evolve and prove beneficial to our safety record. Nearly all the NMFS Units have now been inspected twice (inspections occur every three years) and the deficiencies found have decreased considerably in number and severity.

The largest number of NMFS dives continued to be in support of the Coral Reef Conservation Program (CRCP). Habitat conservation, fishery independent monitoring, and coral restoration also remain as significant beneficiaries of diving activities. An abbreviated list of the species studied includes: several species of abalone, conch, staghorn and elkhorn coral, hake, lingcod, mutton snapper, red king crab, several species of rockfish, lionfish (invasive on east coast), scallop, sturgeon, several salmon species and several grouper species.

Eleven peer reviewed publications and numerous presentations at national and international scientific meetings were made possible by data collected by NOAA NMFS divers.



**“The largest number of NMFS dives continued to be in support of the Coral Reef Conservation Program”**

# N M F S



NOAA divers from the Auke Bay unit help each other with their equipment during a December 2016 dive. [Dave Csepp/NOAA](#)

## Diving Units by Location

### Auke Bay, Alaska

Divers completed a major field expedition to Tracy Arm fjord, near Juneau, Alaska, to continue collection of coral colony snips for a project on the effects of ocean acidification on the physiology of corals. This project was conducted with operational diver support from the NDC. Coordination continued with the U.S. Fish and Wildlife Service and U.S. Army Corps of Engineers on habitat assessments to provide permits under Section 404 of the federal Clean Water Act and Section 10 of the Rivers and Harbors Act. Divers also participated in Seaweeek, an outreach project designed to educate the public, particularly children, about the oceans and living marine resources. Diving operations also supported several important research and habitat assessment projects. Several peer-reviewed scientific publications are currently in press or preparation.

In addition, the availability of trained divers at the unit to conduct maintenance on laboratory aquaculture facilities resulted in considerable cost savings to the government, since divers would have otherwise been contracted out at a much higher cost to complete this job.

### Galveston, Texas

The U.S. Caribbean area was the focus of research activity for this Texas unit in 2016. One project consisted of locating and documenting goliath grouper spawning aggregations off the northeast coast of Puerto Rico which has been designated as NOAA's Caribbean Habitat Focus Area.

NOAA Reciprocity  
Diver Kosta Stamoulis  
(University of Hawai'i)  
conducting a Stand  
Point Count (SPC)  
fish survey at Rose  
Atoll during a survey  
comparison study using  
CCRs and open circuit  
SCUBA. The visibility on  
this dive was in excess  
of 30 meters.

Ray Boland/NOAA



For this project divers conducted visual surveys and deployed sound recorders (on buoyed and weighted lines) to listen for goliath grouper sounds produced during courtship and spawning. The work being done on goliath grouper will contribute to the efforts to increase the numbers of this species which is listed as critically endangered throughout its range under the International Union for Conservation of Nature.

NOAA is also collaborating with the National Park Service on a continuing project at the Buck Island Reef National Monument in St. Croix, U.S. Virgin Islands. The focal animal for this study is queen conch. In 2016, NOAA divers tagged more than 20 conch with acoustic transmitters. Divers have already deployed an array of 144 acoustic receivers to track the approximate movements of the tagged conch, including seasonal reproductive migrations. This work will contribute to the understanding of this threatened species which is listed under the Convention of International Trade in Endangered Species. Other diving partners for this project are tagging sea turtles, sharks, and various species of reef fish to collect more behavioral information. This study will assist the National Monument with future management plans.

### **Honolulu, Hawai'i**

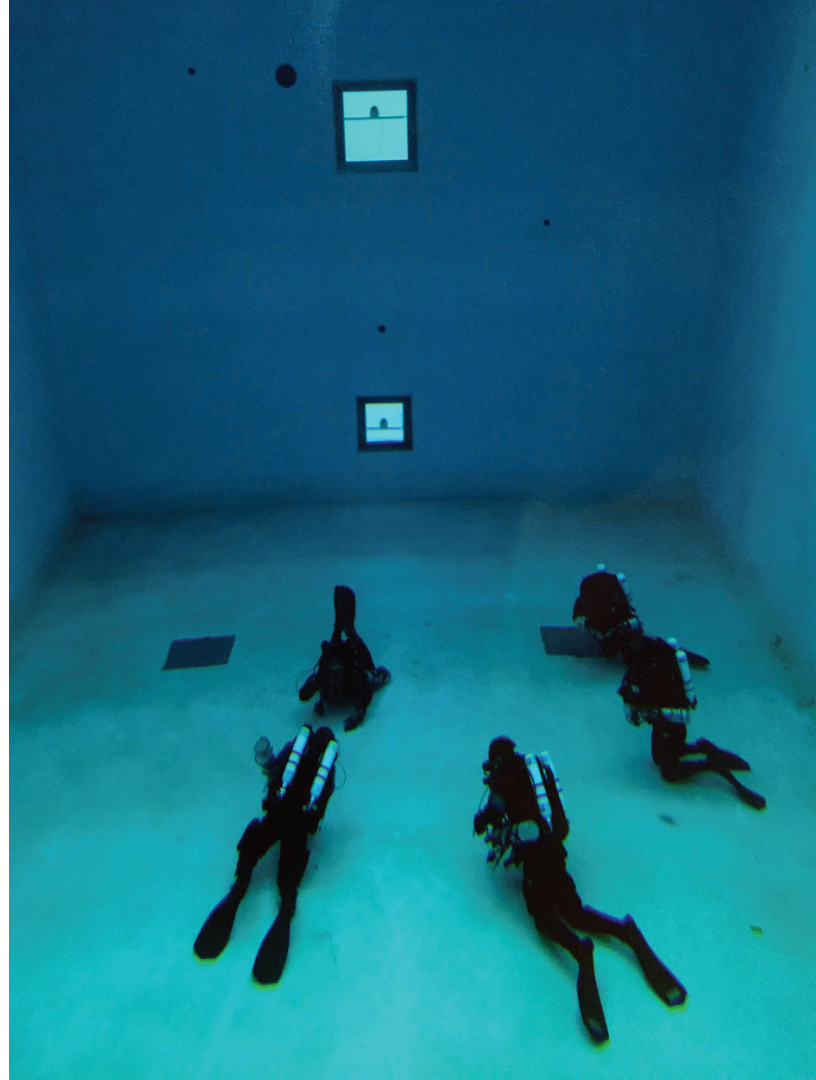
The largest unit in the NDP was extremely active again in 2016. Unit divers conducted scientific dives in the Main Hawaiian Islands, the Northwestern Hawaiian Islands, Rose and Kwajalein Atolls, Jarvis Island and four islands of American Samoa. Divers completed biological surveys to investigate the impact of El Niño at Jarvis Island which had been detected the previous year. A special project utilizing CCRs and open circuit SCUBA equipment was also conducted to determine the effects on fish behavior between the two diving modes when researchers conduct fish surveys.

“ [NOAA divers from the Galveston Unit] conducted visual surveys and deployed sound recorders (on buoyed and weighted lines) to listen for goliath grouper sounds produced during courtship and spawning. ”

# N M F S

NOAA Unit Diving Supervisors Scott Mau and David Witting received training on the Megalodon CCR at the La Jolla Unit's Ocean Technology Test Tank in 2016. They used CCRs to support surveys and outplanting of endangered abalone.

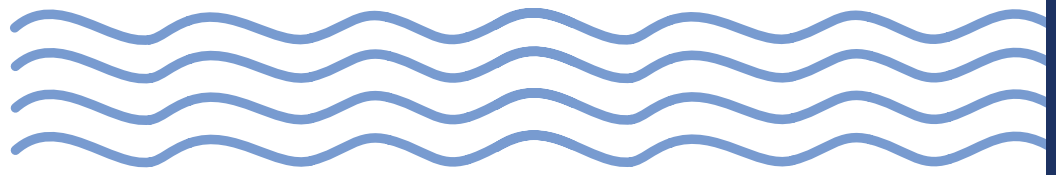
Dale Sweetnam/  
NOAA



NOAA divers also completed inventories of the biological communities in lagoon and ocean-side reef areas at Kwajalein Atoll, including coral, fish, macroinvertebrates and algae in support of Environmental Standards and Procedures biennial inventory requirements and NMFS protected species consultations. Five peer reviewed publications were published in 2016 based upon data collected by NOAA divers based in Honolulu.

### **Kodiak, Alaska**

In 2016, this Alaska unit completed a project seeking to identify major predators of first year red king crab in nearshore waters to better understand how to maximize the survival rates of hatchery raised individuals currently being released to rebuild local stocks. Divers used GoPro and cabled infrared capable cameras to monitor juvenile red kings crabs attached to tethers at 13 experimental stations at depths of about 20 ft. (8 stations) and 50 ft. (5 stations). Unusually warm conditions over the 2016 summer are likely to have driven some predator species to deeper, cooler waters, biasing results in comparison to what might be expected under more normal conditions, but preliminary results suggest that hermit crabs and sculpins are likely to be the most



important predators of juvenile red king crabs. Arctic shannies and juvenile kelp greenlings were also observed to attack the tethered crabs, though at much reduced rates relative to the aforementioned species. The importance of this work stems from the fact that the Alaska commercial red king crab fishery has been below threshold and closed since 2006.

NMFS divers continued to provide dive support to the Alaska Department of Fish and Game in recovery efforts of remote temperature monitors. The unit divers also provide marine organisms for other researchers at the NMFS lab and its public aquarium, as well as for other agencies. Another important project that was again undertaken in 2016 monitors local waters for sea star wasting disease which is spreading throughout the Pacific Northwest and Alaska waters.

### **La Jolla, California**

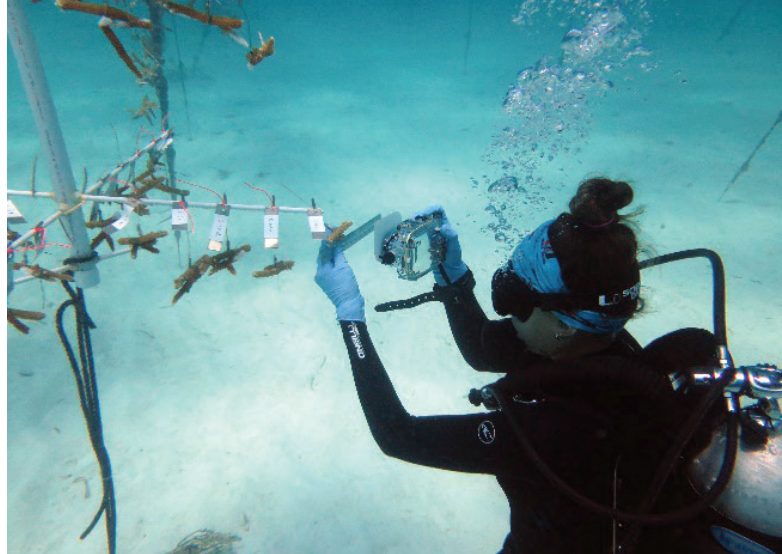
Diving projects in 2016 focused research on pinto and the Endangered Species Act-listed white abalone. Two dozen pinto abalones were marked with acoustic tags in a kelp bed 7000 m<sup>2</sup> in an area off Point Loma in San Diego to monitor their movements with a hydrophone array. The goal was to determine if the animals aggregate for spawning. Near Palos Verdes Peninsula, in Los Angeles County, a white abalone was collected to add to breeding stock at the California Department of Fish and Wildlife's (CDFW) Bodega Bay Laboratory. This was the first collection of wild white abalone in 12 years and was conducted in collaboration with CDFW divers. In order to survey abalone around 8 hectares off San Nicolas Island in the Channel Islands, NOAA divers collaborated again with the CDFW and also with the U.S. Navy, National Park Service, University of California at Davis, Scripps Institute of Oceanography, Southern California Institute of Marine Science, and California State University at Fullerton. During this survey, thirty-seven red, green, and pink abalone were found along with the shells of several white abalone.

### **Long Beach, California**

The Long Beach unit worked jointly with the La Jolla unit on all the abalone research described above, including an outplanting of 5,000 juvenile red abalone off Palos Verdes Peninsula. The incorporation of CCRs into the Long Beach and La Jolla units has greatly enhanced their ability to execute the abalone projects, largely due to the enhanced bottom times afforded by the rebreather units. As an example, the Endangered Species Act-listed white abalone is extremely rare, and in order to find them, divers must conduct time-consuming transect-based surveys that cover large areas. With CCR units, divers are able to stay in the water for longer periods of time, reducing the overall time and number of

“ [Kodiak divers] completed a project seeking to identify major predators of first year red king crab in nearshore waters [in support of efforts] ... to rebuild local stocks. ”

NOAA Reciprocity Diver E. Pontes (University of Miami) collecting monitoring photos of coral disease resistance assays at a coral nursery. NOAA



dives that would be necessary if conducting these operations solely with open circuit SCUBA diving. In fact, rebreather divers and Unit Diving Supervisors Scott Mau (La Jolla) and David Witting (Long Beach) were able to use their extended bottom times during this project to set up the sites and complete transect surveys, while their open circuit colleagues used their more limited time to support the study in more efficient ways.

### Miami, Florida

This unit has two primary groups, the Fisheries Ecology Unit (FEU) and the Benthic Ecosystem Assessment & Research (BEAR) Unit. The FEU divers participate in and coordinate a reef fish visual census through the entire 560 kilometer (348 mile) Florida reef tract, which runs from Martin County to Dry Tortugas National Park (west of the Florida Keys). This group is part of the National Coral Reef Monitoring Program (NCRMP) with shared monitoring responsibilities with Flower Garden Banks National Marine Sanctuary, in Southeast Florida and the Florida Keys (to the Dry Tortugas), Puerto Rico, and the U.S. Virgin Islands. FEU divers have completed fishery independent stock assessments for commercially important species in the snapper-grouper complex in the Florida Keys and Dry Tortugas that have proven to be invaluable for management purposes.

BEAR divers conduct coral and reef benthic assessments in the Florida Keys and U.S. Virgin Islands, primarily through demographic monitoring and recovery-related research of coral designated by the Endangered Species Act (ESA) as Threatened. Working with many collaborating partners, the BEAR team facilitated and conducted many individual studies related to coral spawning and larval biology in 2016. These studies included:

1. Characterizing larval longevity and timing of settlement competency, cryo-archiving DNA/sperm samples from two ESA-listed species (in collaboration with the Smithsonian Institution);
2. Characterizing effects of nutrients and contaminants on fertilization and larval stages (in collaboration with NOAA's



Coral disease assay in which disease condition has transmitted from a diseased staghorn coral inoculate to a susceptible elkhorn coral fragment. NOAA



NOAA Diver Jerry Prezioso looking for alewives swimming upstream to spawn in the pond behind the Gilbert Stuart Museum in North Kingstown, Rhode Island. James Turek / NOAA



- National Centers for Coastal Ocean Science (NCCOS)), and;
3. Improving the settlement and growth of larval recruits for population enhancement (in collaboration with the Mote Tropical Marine Lab).

In 2016, BEAR divers also worked on a new project that developed and implemented a standard protocol to evaluate relative disease resistance among cultured coral stocks that are being used in population enhancement. A total of 16 genotypes of staghorn coral and 6 genotypes of elkhorn coral were tested.

During the course of the year, the Miami unit collaborated with the University of Miami/Rosenstiel School of Marine and Atmospheric Science, Florida Fish and Wildlife Research Institute, National Park Service, Nova Southeastern University, Florida International University, Pennsylvania State University, University of Buffalo, Florida Department of Environmental Protection, Mote Marine Laboratory, Florida Aquarium, Florida Department of Environmental Resource Management, and the Florida Keys Community College.

### **Milford, Connecticut**

Northeastern diving in 2016 was centered on scientific surveys, ship husbandry, maintenance of seawater intakes and training. Support dives were made for hull and running gear maintenance on several NOAA vessels, inspection of intake pipes, cage recovery, data logger removal and installation, and the installation and servicing of acoustic arrays in Narragansett, Rhode Island. Unit Diving Supervisor Barry Smith continued work with the U.S. Coast Guard to establish a NOAA Diving Unit at the Coast Guard Academy. NOAA Diver Jerry Prezioso gave an invited outreach presentation at the University of Rhode Island entitled: “Diving as a Tool to Aid Research and Operations at the Northeast Fisheries Science Center Over the Years”.

### **Newport, Oregon**

The primary mission of the Newport diving unit is ship husbandry

“[NOAA Divers] have completed fishery independent stock assessments for commercially important species in the snapper-grouper complex in the Florida Keys and Dry Tortugas that have proven to be invaluable for management purposes.”

# N M F S



NDC used the facilities and vessels at the Panama City Lab during their winter training and received diving and training support from the unit's divers. [Greg McFall/NOAA](#)

in support of the West Coast Groundfish Bottom Trawl Survey. The Survey covers the entire west coast of the continental U.S.A, with depths ranging from 55 to 1280 meters and provides an index of abundance for 40 commercially and recreational harvested species. The data are used to help manage and monitor these valuable fisheries. In 2016, unit divers installed and removed transducer/sensor arrays on four of these commercial vessels, saving NOAA approximately \$64,000 had the vessels been dry docked for the installations and removals. Newport unit divers also assisted Seattle unit divers in changing out echolocation receivers in Puget Sound.

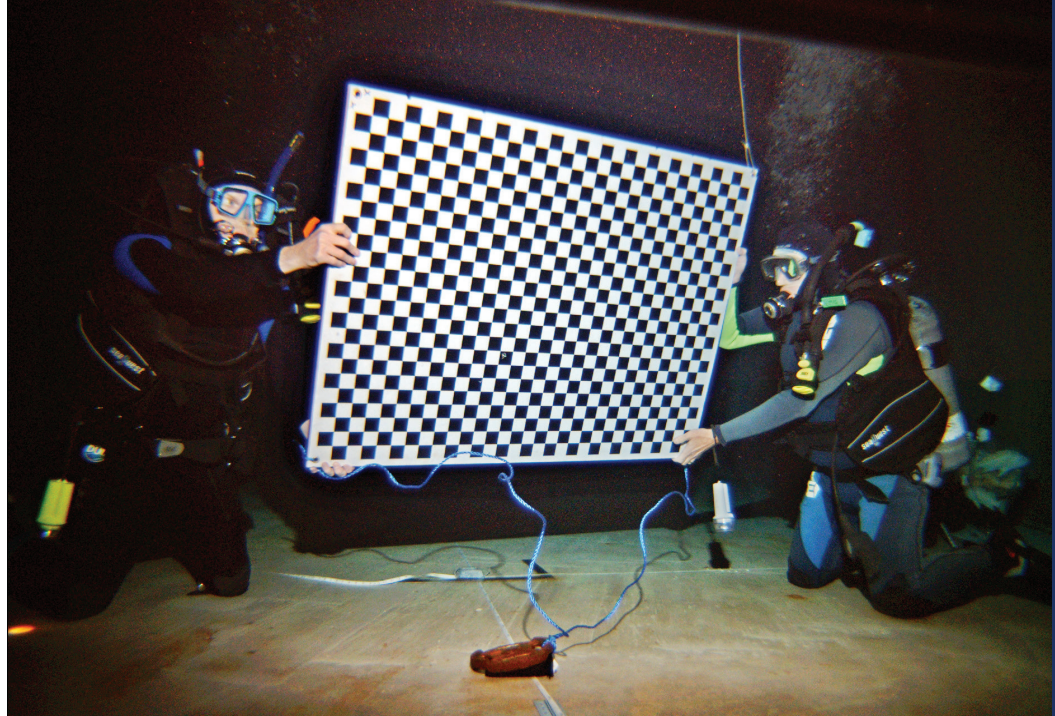
## **Panama City, Florida**

Diving activities in northern Florida focused on scientific support, aquaculture maintenance, and training. Maintenance of aquaculture systems and installation/removal of sea turtle holding pens benefited NOAA programs while producing cost savings.

Unit divers assisted during portions of the NOAA Diver and Divemaster training courses which were held in Panama City for the second time in January of 2016. The training courses were improved over 2015 as staff became more familiar with diving sites and logistics in Panama City.

## **Pascagoula, Mississippi**

The Mississippi unit develops and evaluates fisheries conservation and utilization gear, in particular as it pertains to impacts on threatened and endangered species collected as bycatch in commercial fishing operations. The two most commonly caught ESA-listed species of sea



NOAA Divers Curt Whitmire and Tom Laidig holding up a calibration board to test an underwater stereo camera and Dual Frequency Identification Sonar (DIDSON) system at the Monterey Bay Aquarium Research Institute. NOAA

turtles are the endangered Kemp's Ridley and the threatened Loggerhead. In 2016, certification tests for Turtle Excluder Devices (TEDs) were focused on certifying types of TEDs that will be slated for use in the commercial skimmer trawl fishery which targets nearshore penaeid shrimp. This fishery uses relatively small nets that impact sea turtles located in nearshore waters. These smaller sea turtles have weaker swimming abilities and may not be excluded from standard otter trawl style TEDs. In order to determine which TEDs are more effective in excluding these smaller turtles, one year old loggerhead sea turtles were used in tests using various TED designs by NOAA divers.

In a continuing international collaboration, unit divers assisted the Mexico Instituto Nacional de la Pesca in evaluating several fishing gear types, including stow nets which are designed to target shrimp in channels with good tidal flow. NOAA divers from this unit conduct some of the most physically demanding dives in the NDP due to the difficulty of working on operating trawls at speeds approaching 3 knots.

### **Santa Cruz, California**

This northern California unit focuses on recruitment surveys of rockfish (*Sebastes* species) in central California reefs, particularly those along the south edge of Monterey Bay. Monitoring of the juvenile rockfish population is used to help predict the number of adults available to the fishery in future years. Survey results are compared with other studies on juvenile rockfish abundance to determine timing of settlement and overall health of the populations. In 2016, Santa Cruz Lead Diver Tom Laidig worked with members of two different organizations of recreational

“Unit divers [in Newport] installed and removed transducer/sensor arrays [that support groundfish surveys] on four ... commercial vessels, saving NOAA approximately \$64,000”



NOAA Diver David White, an engineer at the Santa Rosa unit, inspects a fish screen on a municipal water intake for the City of Redding on the Sacramento River. [Steve Thomas/NOAA](#)

divers: Reef Environmental Education Foundation (REEF), and Bay Area Underwater Explorers to teach them how to identify juvenile rockfish in order to involve them in the data collection process. Many of these groups have already provided valuable information on rockfish and their distribution. Other collaborators on the juvenile rockfish surveys include University of California (UC) Santa Barbara, UC Santa Cruz, California State University Monterey Bay, NOAA's Office of National Marine Sanctuaries, and California Department of Fish and Wildlife. Another 2016 project involved calibration of a stereo camera and Dual Frequency Identification Sonar (DIDSON) system to be used during NOAA's Untrawable Habitat Strategic Initiative (UHSI). The purpose of the UHSI is to determine the reaction of fishes to underwater survey vehicles such as ROVs, Autonomous Underwater Vehicles (AUVs), towed cameras, and manned submersibles.

### **Santa Rosa, California**

The Santa Rosa unit supports northern California NMFS field offices by documenting existing conditions of riverine and estuarine habitat and by evaluating in-river structures that may negatively affect adult of juvenile salmonids and sturgeon on the Sacramento and San Joaquin Rivers, their tributaries, and in the Sacramento/San Joaquin River Delta. In 2016, NOAA divers recorded fish habitat and fish behavior data near fish screens via visual observations and video or still photography, and deployed and retrieved fish monitoring equipment. Diving operations were conducted to investigate the condition of fish screens to ensure they function as designed, to protect fish from entrainment and loss

as water is drawn from the rivers for agricultural use. Pacific salmon, a commercially viable and economically important species, is the primary design target for the fish screens, although other commercially important species also benefit, including white sturgeon, American shad, and striped bass. Several ESA-listed species are also protected by the screens, including Sacramento split tail, green sturgeon, Delta smelt, four runs of Chinook salmon, and steelhead.

### Seattle, Washington

The majority of diving conducted at the Northwest Fisheries Science Center supports research through direct data collection or installation and maintenance of equipment. In 2016, these projects included evaluation of the ecological effects of introduced eelgrass in Puget Sound, the potential use of eelgrass as nursery habitat for rockfish, the prevalence of eelgrass wasting disease in Puget Sound in relation to urbanization, the movement and spatial distribution of porpoises within Puget Sound, and the placement of settlement plates and collection of specimens for genetic mapping of marine invertebrates in Puget Sound and the Olympic coast. Significant cost savings to NOAA are made possible by the maintenance of the saltwater intake system at the Mukilteo Field Station. In collaboration with the Olympic Coast National Marine Sanctuary (OCNMS), unit divers monitored kelp forest habitats in the OCNMS to examine the role of sea otter recovery on benthic habitats. Divers conducted surveys to collect data on fish abundance, macro invertebrates, and kelp density.

### Silver Spring, Maryland

This unit has divers from multiple NOAA line offices (NMFS, NOS, Office of Exploration and Research, OMAO, NESDIS, and the NOAA Office of Communications) and while each has varying missions and tasks, there are consistent themes of observations and monitoring, sampling and photo documentation which require dive support. In 2016, divers from the unit identified navigation hazards and recovered gear

“In 2016,  
[research]  
projects included  
. . . the potential  
use of eelgrass  
as nursery  
habitat for  
rockfish”

NOAA divers in the Seattle unit conducted research on herring spawning in 2016.

Paul Hillman/NOAA



# N M F S



From left to right, Unit Diving Supervisor CDR Eric Johnson (NOAA) with CDR Jeff Shoup (NOAA) and LTJG Rachel Pryor (NOAA) conducting proficiency training at Walter Reed National Military Medical Center. [Andrew Mason/NOAA](#)

with the University of New Hampshire, assisted the NOAA Chesapeake Bay Office with oyster transect monitoring in Chesapeake Bay, and conducted joint training with U.S. Secret Service divers in a quarry and pool. In an excellent example of cross-line office cooperation, the unit continued to combine diving opportunities with the two other Silver Spring-based units for required annual training sessions that consist of classroom refresher training, underwater checkout skills, physical fitness, and swimming tests. Monthly training sessions are jointly scheduled to maximize opportunities for unit divers.

## St. Petersburg, Florida

During 2016, NOAA's Restoration Center and its partners outplanted approximately 35,000 ESA-listed corals from coral nurseries in Florida, Puerto Rico, and the U.S. Virgin Islands to help restore populations of these species and restore impacted and degraded reefs. After Hurricane Matthew was found to have impacted elkhorn thickets, *Acropora palmata*, on the south coast of Puerto Rico, the Restoration Center deployed a diving team to save approximately 8,000 coral fragments that otherwise would have perished after the storm. Surveys of potential coral impacts from dredging in the Miami shipping channel were continued in 2016. The St. Petersburg unit continues to support scientific research efforts from partners throughout the region conducting fish counts throughout the Florida Keys/Dry Tortugas area and with ongoing goliath grouper research on the East coast of Florida.

“the Restoration Center deployed a diving team to save approximately 8,000 coral fragments that would have otherwise perished after [Hurricane Matthew].”

NOAA divers from the Pacific Islands Fisheries Science Center used CCRs to conduct comparison studies of reef fish surveys (CCR vs. Open Circuit SCUBA) in American Samoa. Ray Boland/NOAA.





# N O S

Brian Degan  
Line Office Diving Officer

## National Ocean Service (NOS)

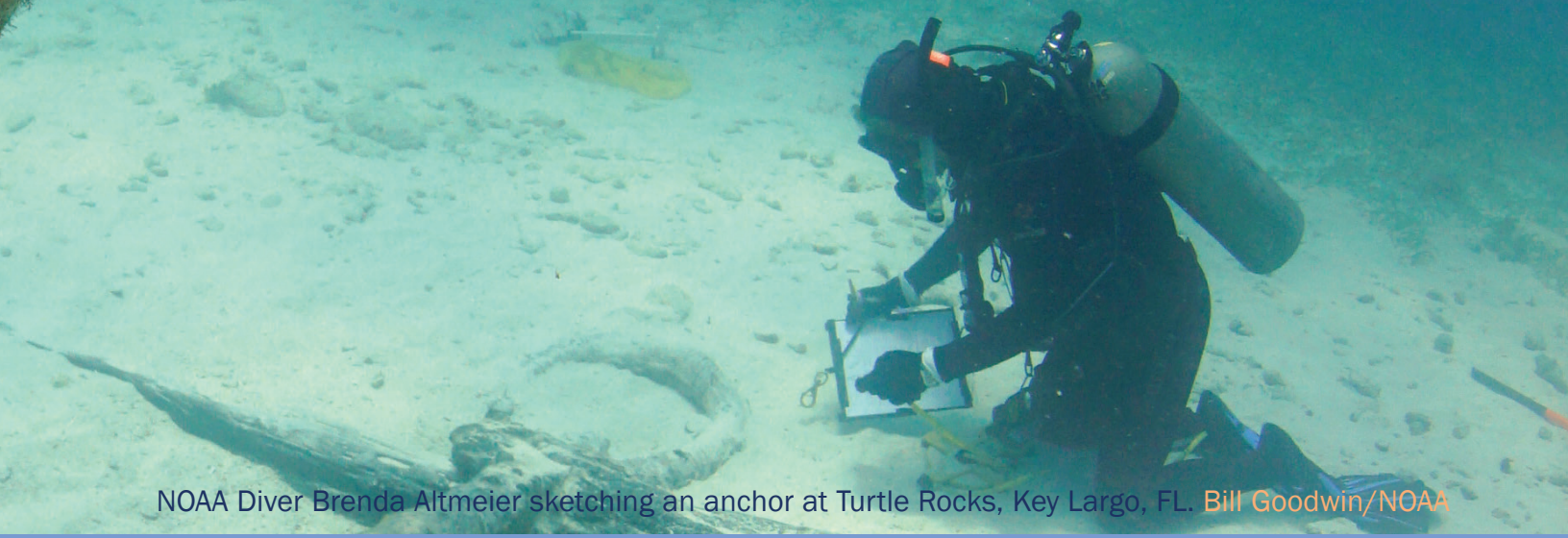
NOS supports 16 diving units located within three program offices. The Center for Operational Products and Services (CO-OPS), NCCOS, and the Office of National Marine Sanctuaries (ONMS) all utilize NOS divers to help support NOAA's mission. In 2016, NOS's 137 divers completed 3,819 dives for a total of 2,366 hours of bottom time, all slight decreases from 2015. A majority of NOS dives (63%) occurred to a maximum depth of 60 feet, 30% occurred between 61 and 99 feet, 4% occurred between 100 and 130 feet, and 3% occurred between 131 and 330 feet. The 330 feet depth was a milestone for the NDP, surpassing last year's mark of 300 feet. The vast majority of NOS dives were scientific (60%) compared to working (17%) and non-duty (23%). Sample collection, observation, monitoring, photo/video documentation, and safety/training were the primary activities conducted during NOS diving operations this year.

NOS offices with diving units have a wide variety of missions that span from a focus on oceanic instrument installation and maintenance (CO-OPS) to research monitoring, resource protection, and outreach and education (NCCOS and ONMS). NOS divers participate in research missions that include biological monitoring and sampling, invasive species studies, climate change, damage assessment, restoration and monitoring of coral and sea grass habitats, and maritime archaeological surveys. Many of the NOS diving units seek to actively engage the public in NOAA's mission through live dive broadcasts, documentary films, research opportunities for volunteer divers, and the installation of mooring buoys that allow safe access to diving sites and protect habitats and resources. NOS divers and their respective offices work in collaboration with many partners to accomplish their missions including Federal and State agencies, universities, and non-profit organizations.

While divers incurred no significant injuries in 2016, there was one diving incident within NOS. For this out-of-air incident, deficiencies were identified and corrected, and lessons learned were disseminated throughout the program. The annual training conducted by NOS divers

**“The 330 feet depth was a milestone for the NOAA Diving Program, surpassing last year’s mark of 300 feet.”**





NOAA Diver Brenda Altmeier sketching an anchor at Turtle Rocks, Key Largo, FL. Bill Goodwin/NOAA

helped mitigate the incident, and can be directly correlated to why significant diver injuries were not incurred.

2016 was a big year for leadership changes in diving within the line office. Both of the NOS representatives at the NDCSB stepped down from their positions. Kim Roberson was the LODO for NOS since 2013, and served as the Board Chair from 2015 until she stepped down from her position in August 31, 2016. Tane Casserley was the DLODO from 2014 until September 30, 2016. Kim was the first woman to be elected Chair of the Board and was an important advocate for increasing the number of diving trainers in the field. Tane pushed the program further in the adoption of new diving technologies and improvement of safety protocols for CCRs. His many contributions included facilitating the transfer of a cache of CCR equipment from the FBI that saved NOAA thousands of dollars. They both decided to step down to concentrate on new work assignments, but still remain active members of the NOAA diving community. Brian Degan became the NOS LODO on September 1 and Joe Hoyt became the DLODO on October 1, 2016.


### Diving Units by Program Office and Location

#### Center for Operational Oceanographic Products and Services (CO-OPS)

CO-OPS provides the national infrastructure, science, and technical expertise to monitor, assess, and distribute tide, current, water level, and other coastal oceanographic products and services that support NOAA's mission of environmental stewardship and environmental assessment and prediction. Divers install, maintain, and remove underwater components for tidal and current measurement stations.

#### Atlantic Operations Branch (AOB), Chesapeake, Virginia

AOB divers install and maintain underwater components of the National Water Level Observation Network (NWLON) and the Physical



“[Former DLODO Tane Casserley’s] many contributions included facilitating the transfer of a cache of CCR equipment from the FBI that saved NOAA thousands of dollars.”

# NOSS



NOAA Diver Aliya Jamil, from the CO-OPS Pacific Operations Branch, cleaning an acoustic sensor in Nawiliwili, on the island of Kaua'i, in Hawai'i. [Eric White/NOAA](#)

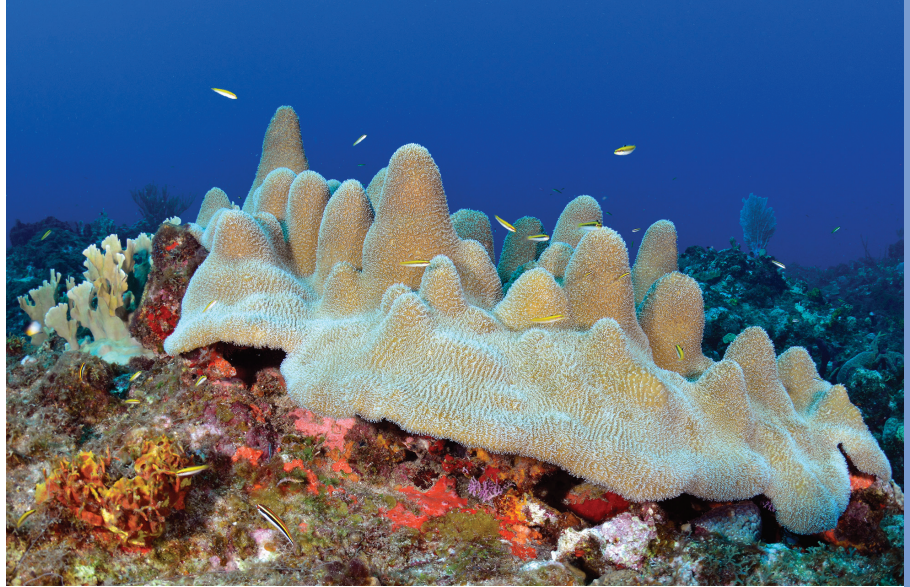
Oceanographic Real Time Systems (PORTS®) on the East and Gulf Coasts, Caribbean, and all five Great Lakes. Diving operations are critical to the CO-OPS mission of providing accurate and reliable water level data to the public. The services provide support for safe navigation, sound ecosystem stewardship, coastal hazard preparedness and response, and the understanding of climate change.

The Mona Island Project was one of the highlights in their busy 2016 season. Divers maintain a Tsunami warning station at Mona Island in Puerto Rico that provides water level data for safe navigation and serves as their westernmost Tsunami warning station. AOB divers sample and measure annually the growth rates of biological fouling located on the sensors of the station, then remove it to preserve the quality of data coming from the sensors. This location is unique compared to most other stations maintained by this unit due to the excellent visibility. This level of clarity gives AOB divers the opportunity to actually see how the warning system operates underwater, something that they cannot do while diving in the murky harbor waters where most of their instruments are installed.

### **Pacific Operations Branch (POB), Seattle, Washington**

POB divers are in charge of the installation, maintenance, and removal of underwater components for tidal and current measurement stations.

A reef structure photographed during NCRMP activities near Desecheo Island in Puerto Rico by divers from the Coastal Monitoring and Assessment (CCMA) unit. NOAA



They service primarily the NWLON system and the National Current Observation Program, including PORTS, hydrography, and special projects.

The stations that provide data to these networks and systems have been collecting water level data for well over 150 years, and the maintenance work performed by NOAA divers has been critical to their reliability. Dives involve inspection, assessment, and maintenance of stilling wells, pressure orifices, their mounts, and occasional installation or removal of new or obsolete stations. The PORTS is used to deliver water level, current speed, direction, and meteorological data via phone, radio and internet to the maritime community.

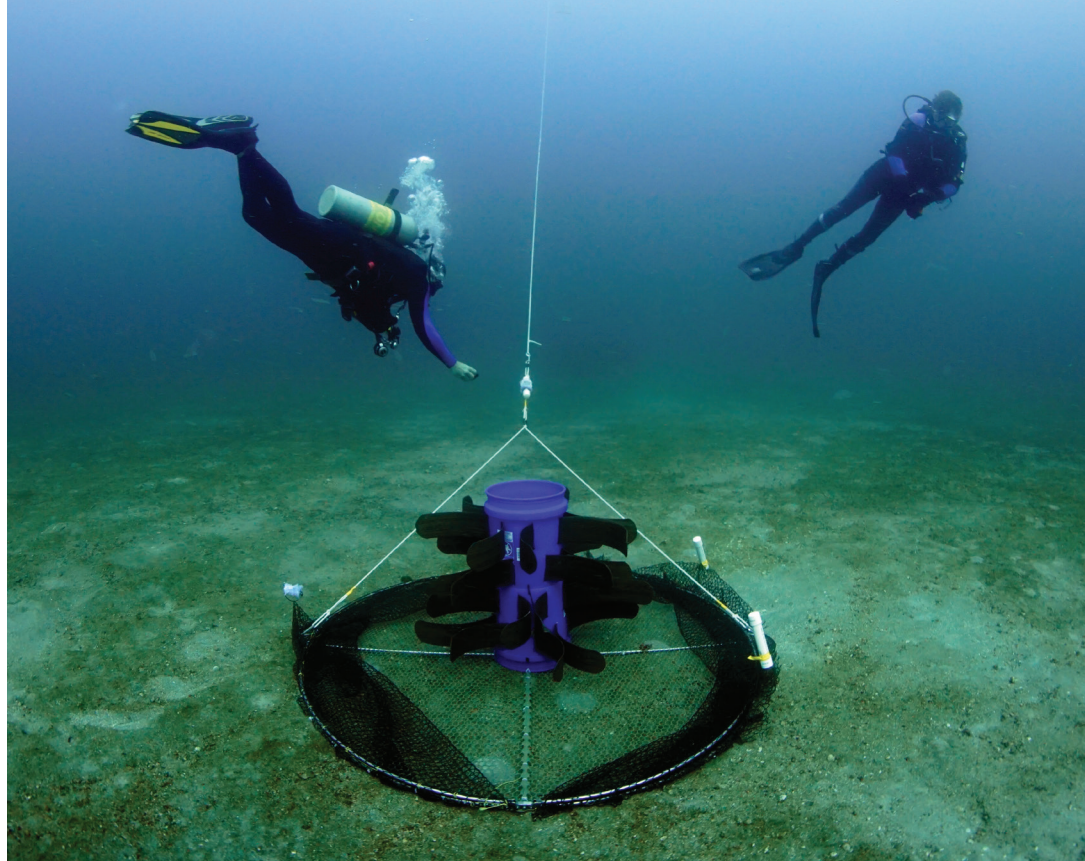
### **National Centers for Coastal Ocean Science (NCCOS)**

NCCOS is the nation's leader in observing, measuring, assessing, protecting, and managing coastal, ocean, and Great Lakes areas. NCCOS provides research, scientific information and tools to help balance the nation's ecological, social and economic goals. The research and tools NCCOS provides are central to addressing coastal issues raised in legislation and as part of NOAA's priorities.

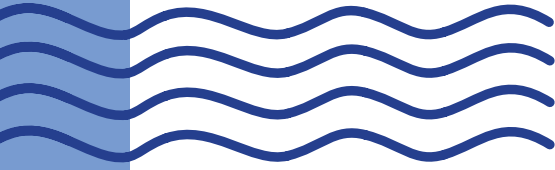
### **Center for Coastal Fisheries and Habitat Research (CCFHR) and Southeast Fisheries Science Center (SEFSC), Beaufort, North Carolina**

The NOS (CCFHR) and NMFS (SEFSC) sub-units making up the Beaufort diving unit focus on monitoring reef fishes, coral and hard-bottom substrates, fish spawning aggregations, and conducting baseline biological assessments. Research is conducted in close collaboration with the Office of National Marine Sanctuaries, specifically Florida Keys, Gray's Reef, Flower Garden Banks, and Monitor National Marine Sanctuaries. Other collaborators in 2016 included University of North Carolina at Chapel Hill and the Environmental Protection Agency (EPA). Local school events and the continued support of the Coastal Carolina

**“ Divers maintain a Tsunami warning station at Mona Island in Puerto Rico that provides water level data for safe navigation and serves as their westernmost Tsunami warning station. ”**



NOAA divers testing a prototype trap for lionfish that does not attract other types of fish. [Mitchell Tartt/NOAA](#)



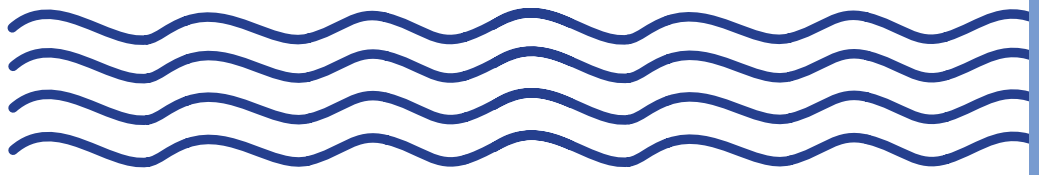
Scientific Diver Symposium highlight the units broad community outreach efforts.

CCFHR co-leads biological monitoring missions with SEFSC to gather data on fish populations and coral reef communities in the U.S. Caribbean, Florida, and the Gulf of Mexico. Each year, unit divers work closely with the CRCP and local partners to collect biological data from thousands of strategically selected sites. Divers also collect data, coral reef images, and other products that give fellow scientists, managers, decision makers and the public a better understanding of a region's resources and how they are changing over time. Data, reports, and all products are available online to the public.

### **Center for Coastal Monitoring and Assessment (CCMA), Silver Spring, Maryland**

CCMA's mission is to assess and forecast coastal and marine ecosystem conditions through research and monitoring. CCMA conducts field observations on regional and national scales. Most of this unit's diving is scientific and occurs at partner sites that include the U.S. Virgin Islands, Puerto Rico, and the Great Lakes. Diving occurs from shore, small boats, and NOAA ships.

The Great Lakes Restoration Initiative is part of a multi-partner, multi-year collaborative effort to characterize and assess Areas of Concern in



the Great Lakes region. This year's efforts focused on the Maumee River in Toledo, Ohio and the Detroit River in Detroit, Michigan. Diving operations for the project included collection of zebra mussels and sediments and locating sample mooring devices. CCMA divers safely completed 20 dives for this mission, and provided sufficient sample material for the success of the project. Results from this study will provide essential information to local, state, and federal managers to make better informed management decisions for protecting, restoring, and conserving the Great Lakes environment.

### Office of National Marine Sanctuaries (ONMS)

The mission of the National Marine Sanctuaries is to conserve, protect and enhance the biodiversity, ecological integrity and cultural legacy of these special underwater places.

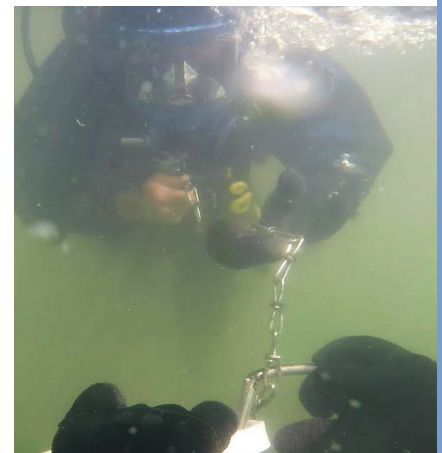
### ONMS Headquarters, Silver Spring, Maryland

2016 was the second year of an effort that included ONMS divers to survey lionfish and other fish populations at Flower Garden Banks National Marine Sanctuary, and to remove lionfish in specific areas of the banks in order to test control strategies for this invasive species. Lionfish population control is a major concern for the Atlantic, Gulf of Mexico, and Caribbean regions of the United States and this has led the Silver Spring unit to start development of trap technologies to assist with this task. Work conducted in 2016 included testing a prototype device that attracts lionfish without attracting other types of fish, eliminating a by-catch problem and ensuring that it will not "ghost-fish" if lost. Initial tests have shown promising results, with no by-catch and high attraction and capture rates for lionfish.

The ONMS diving team also made several collections of zebra mussels and then collected gobies in Lake Erie, near the Toledo Lighthouse, Ohio using snare traps to facilitate later tissue analysis for various scientific projects. The zebra mussels were put in minnow cages and then deployed in numerous locations in the Maumee and Ottawa Rivers in Toledo.

The Grouper Moon Project is a continuation of over a decade of work with REEF and Scripps Institute of Oceanography monitoring and studying a Nassau grouper spawning aggregation on the west end of Little Cayman Island. The work involves tagging and surveying fish populations, deploying and tracking drifter buoys, recording spawning behaviors, deploying hydrophones, mapping, and engaging in underwater education efforts.

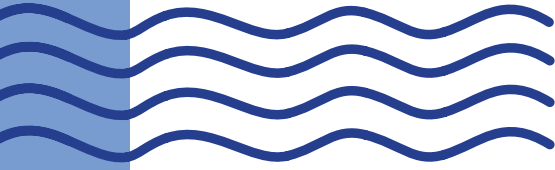
**“ [NCCOS] divers ... collect data, coral reef images, and other products that give fellow scientists, managers, decision makers and the public a better understanding of a region’s resources.”**



NOAA divers attach a float to a sample mooring during a dive in support of NOAA's Mussel Watch Program in Lake Erie. Ed Johnson/NOAA



Students participating in the newly launched Ocean Guardian Dive Club, a program designed to strengthen youth involvement in diving and ocean conservation. *Katie O’Hara/Lynnhaven Dive Center*



Operations to collect documentary images and video were also conducted in 2016, including 360° virtual reality images from Florida Keys and Gray’s Reef National Marine Sanctuaries and HD video documenting key aspects of sanctuary operations in Florida Keys and Olympic Coast National Marine Sanctuaries. The 360° images are viewable online “streetview” style or in virtual reality viewers. All of these images will be available at [www/sanctuaries.noaa.gov/vr](http://www/sanctuaries.noaa.gov/vr). Some video materials can currently be found at [www.sanctuaries.noaa.gov/stories](http://www.sanctuaries.noaa.gov/stories).

As part of outreach efforts, ONMS facilitated introductory dives for the 2016 Nancy Foster Scholarship Program scholars at Gray’s Reef National Marine Sanctuary. This scholarship helps to create a diverse network of scientists who understand the importance of communicating their science to the general public and support the National Marine Sanctuary System’s mission. ONMS also partnered with the National Marine Sanctuary Foundation and dive shops around the country to organize and promote the Ocean Guardian Dive Club. This pool-based diving program is designed to strengthen youth involvement in diving and ocean conservation. Elementary and middle school students are introduced to the National Marine Sanctuary system at dive shops through academic and in-water curriculum designed by ONMS. After initial training, participants conduct an annual stewardship project to increase the health of their local watershed. 2016 was the first year of this pilot program.

Channel Islands NMS Unit Diving Supervisor Julie Bursek winds up the transect tape at the end of an eelgrass survey at Scorpion State Marine Protected Area, Santa Cruz Island, California.

Jessica Alstatt/NOAA

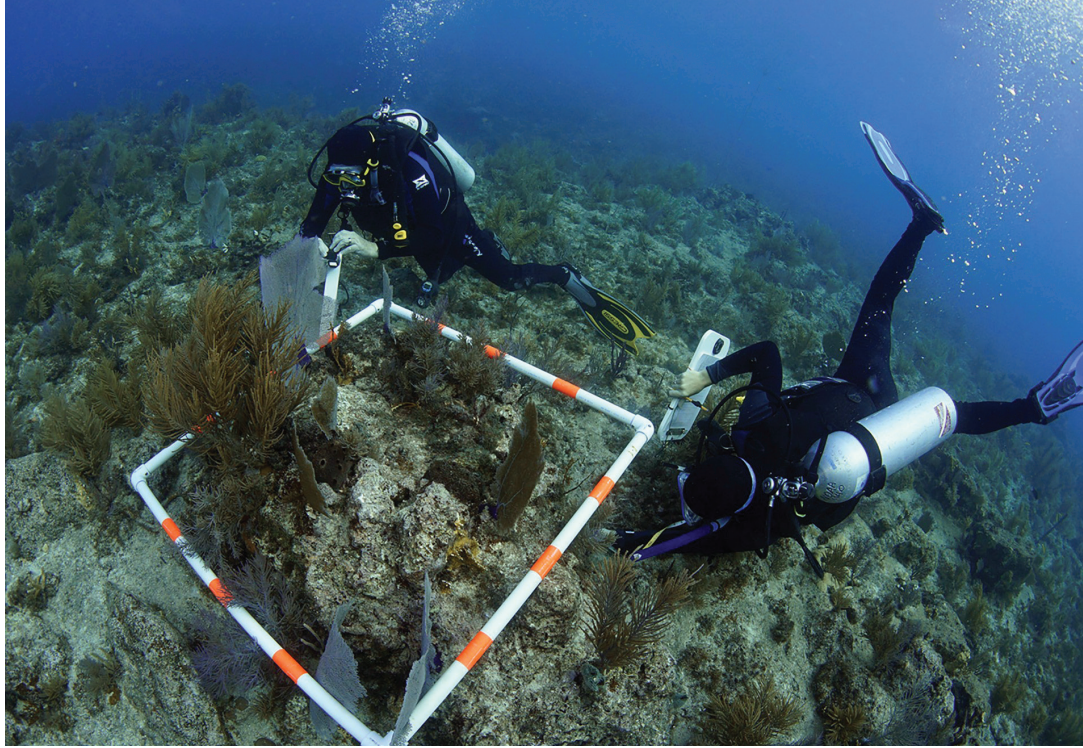


### Channel Islands National Marine Sanctuary (CINMS)

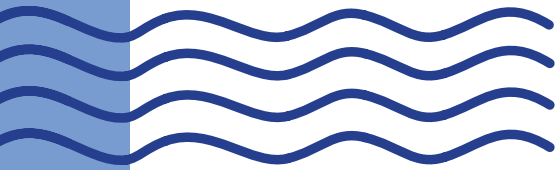
Diving operations conducted at CINMS support the sanctuary's mission to better understand living marine resources and their ecosystems, assist resource managers in making sound decisions that build sustainable fisheries, recover ESA-listed endangered and threatened species, and sustain healthy coasts. Large-scale objectives within that mission include assessments and communication of ecosystem and climate characteristics, effectiveness of Marine Protected Areas (MPAs), human caused stress/risk, recovery of endangered marine species, and development of innovative support technologies. Unit divers specifically contribute to studies of behavioral ecology of fish that include monitoring of fish movement patterns, fish abundance, habitat characterization and fish/habitat associations.

At the forefront of the numerous diving operations supporting CINMS's biological mission in 2016 were maintenance of west coast ocean observatories moorings (temperature loggers and Vemco VR2 acoustic receivers) and eelgrass surveys to characterize eelgrass bed habitats and that of associated species. Divers at the ONMS regional maritime heritage coordinator's office also participate in annual archaeological surveys to locate probable submerged sites, systematically record established sites to create maps, and document sites through still photography and videography. In 2016, CINMS divers continued to collaborate with NMFS divers on surveys around San Nicolas Island to characterize the habitat of white abalone. The project's goal is to identify suitable habitat for the reintroduction of ESA-listed endangered white abalone.

**“ Operations to collect documentary images and video were also conducted in 2016, including 360° virtual reality images ... and HD video documenting key aspects of sanctuary operations.”**



NOAA Divers Bill Goodwin and LT Kelsey Jeffers (NOAA) conduct a coral survey of a restoration “module” at the site where the freighter *Wellwood* ran aground on Molasses Reef within Florida Keys National Marine Sanctuary. [Brenda Altmeier/NOAA](#)



The unit also supported non-NOAA diving reciprocity projects including:

1. Kellet’s Whelk surveys with Cal Poly San Luis Obispo, marine benthic visual surveys of Partnership for Interdisciplinary Studies in Coastal Oceans MPAs conducted along rocky reefs with U.C. Santa Barbara’s Marine Science Institute, and
2. Coral reef fish recruitment surveys, monitoring instrument retrieval, and underwater camera and mooring deployments in Palmyra Atoll with the Nature Conservancy.

### **Florida Keys National Marine Sanctuary (FKNMS)**

Divers in this unit support the FKNMS management plan with scientific research (biological & maritime heritage), maintenance of an extensive mooring buoy program, and ensuring continuation of operations. FKNMS divers conduct biological and structural damage assessments, restoration, and monitoring projects at vessel grounding sites located in coral and seagrass habitats within the sanctuary. The purpose of the coral restoration monitoring program is to evaluate the success of achieving restoration goals. Archeological surveys conducted within FKNMS support ONMS’s mission of conservation and protection of extraordinary sanctuary resources. Maritime heritage resources found in sanctuary waters not only tell the story of discovery and colonization and the struggle of our nation’s development, but also of NOAA’s own development. NOAA’s predecessor agency, the Coast Survey was established in 1807 for the purpose of surveying the coastline and to create accurate nautical charts. Reminders of the Coast Survey’s





involvement in marking the Florida Keys can be seen along the islands in the remains of 15 historic navigation beacons installed in the 1800s. The beacons were discontinued in the 1920s and forgotten as new navigation aids were installed. Since 2014, FKNMS and visiting NOAA divers have collected and documented evidence of these “Totten Beacons” in various locations throughout the FKNMS.

Cooperative relationships help FKNMS divers raise organizational prestige through participation in training and lectures. For nearly a decade the annual Heritage Awareness Diving (HAD) seminar has enlightened divers on the delicate nature of non-renewable historical resources located underwater. NOAA divers participate in this annual jointly sponsored three-day seminar to teach heritage awareness diving to Dive Course Directors and Instructor Trainers. The course provides HAD participants with instruction and materials for training students on how to pro-actively protect shipwrecks, artificial reefs, and other underwater cultural sites. Lectures include history, maritime archaeology, and state and federal laws. The seminar is sponsored by the State of Florida Bureau of Archaeological Research/Florida Public Archaeology Network/NOAA/FKNMS and is accepted as a specialty through the Professional Association of Diving Instructors, the National Association of Underwater Instructors, and Sport Diving Recruiters. The 2016 class visited the Mystery Wreck offshore Marathon, Florida. The construction details of the Mystery Wreck suggest a colonial ship, the dominant feature of which is a large mound of concreted ballast. The Mystery Wreck has been surveyed, photo-documented, and monitored by the FKNMS Maritime Heritage Program since 2005, when NOAA

**“ For nearly a decade the annual Heritage Awareness Diving (HAD) seminar has enlightened divers on the delicate nature of non-renewable historical resources located underwater.”**

NOAA divers collect data from one of the 15 historic navigation beacons installed by the Coast Survey in the 1850’s inside what is now the Florida Keys National Marine Sanctuary. [Corey Malcolm/MFMHS](#)





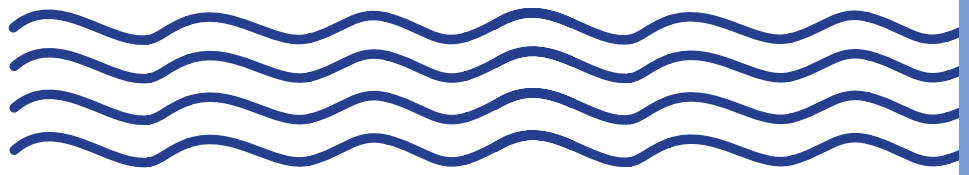
NOAA's Nancy Foster Scholars conducted two dives at Gray's Reef National Marine Sanctuary as part of an orientation to the National Marine Sanctuary system and its mission. [NOAA](#)

divers first mapped the site in response to the growing need for research, documentation, and education on historical resource sites heavily visited by dive shops and residents in FKNMS.

### **Flower Garden Banks National Marine Sanctuary (FGBNMS)**

FGBNMS is one of the most active dive units in the National Marine Sanctuaries system. FGBNMS divers support research, monitoring, response, management, education, and outreach, in and around the National Marine Sanctuary.

Diving operations supported numerous research and monitoring projects during 2016, including the removal of lionfish, continued documentation at repetitive photo-stations, random benthic and fish surveys, video surveys, biological sampling, the annual coral spawning project, installation of mooring buoys to protect reef resources, and maintenance of oceanographic instrumentation. Data collection and long-term monitoring surveys have contributed to a 20 year data set that feeds directly into management decisions in response to activities to review the management plan. The FGBNMS state of the art diving platform, Research Vessel *Manta*, helps supports the work of sanctuary divers and helped with the rapid deployment of divers in response to a coral mortality event on East Flower Garden Bank.



The unit also supported non-NOAA diving reciprocity projects with Texas A & M University Galveston, Moody Garden, and Zara International scientific diving programs.

### **Gray's Reef National Marine Sanctuary (GRNMS)**

The primary mission of diving operations at GRNMS is to support research and monitoring activities in and around the sanctuary. A secondary mission for divers in this unit is to support education and outreach activities.

Utilizing the NOAA Ship *Nancy Foster*, Gray's Reef divers continued the collection of annual data by conducting benthic habitat, fish community, and sessile benthic invertebrate surveys at numerous sites located within and outside the sanctuary research area to establish baselines of benthic habitat characteristics, conspicuous and prey fish communities, and benthic invertebrate populations. Scientists can use these to compare data collected over time to determine differences between managed areas (research versus open). Other prominent diving operations conducted with partner organizations included collecting 360° imagery for virtual dives, research on predator-prey interactions, and assessing the partial pressure of CO<sub>2</sub> fluctuation on *Oculina arbuscula*, and assessing the distribution and abundance of echinoderms living on Gray's Reef. Key partner organizations collaborating with GRNMS in 2016 included the Ocean Agency, ONMS, NCCOS, Mystic Aquarium, University of Connecticut Department of Marine Sciences, Valdosta State University, and Georgia Southern University.

GRNMS depends upon the support of volunteer divers to accomplish all of the activities described above, and they are an essential component to achieving the benefits from diving operations at Gray's Reef. In order to conduct safe diving operations, the volunteers are trained by NOAA and certified as NOAA divers before they are incorporated into the "Team Ocean" program and start assisting sanctuary scientists with data collection.

### **Monitor National Marine Sanctuary (MNMS)**

Divers at MNMS conduct archaeological site assessments of maritime heritage resources off the coast of North Carolina in and around the sanctuary. Activities typically include photo/video documentation, measured drawing with tapes and slates, and recording observations.

In 2016, MNMS and Battle of the Atlantic Research and Expedition Group divers recorded the remains of the wreckage of *F.W. Abrams*, a merchant

**“The FGBNMS state of the art diving platform, R/V *Manta*, ... helped with the rapid deployment of divers in response to a coral mortality event on East Flower Garden Bank.”**



NOAA Diver Chad King (left) captures video of two Sierra Club Service Outing divers collecting sea star specimens at the Monterey Bay NMS.  
 Steve Lonhart/NOAA

ship that was sunk during World War II. Approximately 50% of the site was recorded with baseline offsets. A complete 3D photogrammetric model was also produced of the site. MNMS divers also participated in a survey of wrecks up to 160' deep in Lake Huron in support of research efforts at Thunder Bay National Marine Sanctuary. The goal for this project was to produce 3D photogrammetric models of shipwreck sites in the newly expanded TBNMS. In addition to photogrammetric modeling, video and XL Catlin SVX camera system images were also collected. During another notable project, MNMS conducted a remote sensing survey through a partnership with Bureau of Ocean Energy Management. The sidescan sonar survey focused on locating potential maritime heritage resources in an area under consideration for wind energy development. During the course of the survey several anomalies were located. Divers will then be able to visit these targets to determine what they are and to assess potential significance.

### **Monterey Bay National Marine Sanctuary (MBNMS)**

The MBNMS unit primarily conducts or participates in scientific diving

A NOAA diver in the Florida Keys National Marine Sanctuary.  
NOAA



operations that characterize and monitor the habitats within and adjacent to the sanctuary. Specific projects and operations in 2016 included nearshore characterization of Big Sur, capturing images with the XL Catlin SVX camera system, surveys for sea star wasting syndrome, MPA surveys in central California, and supporting camera testing at Monterey Bay Aquarium Research Institute for fish movement research. MBNMS divers conducted educational outreach to several different organizations including Sierra Club Service Outing volunteers, REEF, Dive Club of Silicon Valley, AAUS, NOAA's Northwest Fisheries Science Center, and recreational divers to teach them invertebrate and algal identification, and survey methodology.

Divers from this unit span several sites, and many of the dives conducted by MBNMS in 2016 supported other sites (Flower Garden Banks, Olympic Coast, Gray's Reef, and Florida Keys National Marine Sanctuaries) and other NOAA divers, such as the CO-OPS team that services the Monterey tide instruments.

#### **National Marine Sanctuary of American Samoa (NMSAS)**

NMSAS supports the greatest diversity of tropical marine life in the sanctuary system, including a wide variety of coral and other invertebrates, fishes, turtles, marine mammals and marine plants. The sanctuary protects extensive coral reefs, along with deep water reefs, hydrothermal vent communities, and rare marine archaeological resources. The sanctuary is also the most remote location within the system and the only unit south of the equator. NMSAS diving activities support research and monitoring objectives contained within the site management plan and divers are instrumental in responding to major natural disasters, such as Crown-of-Thorn outbreaks, hurricanes, coral bleaching, anchoring damage, etc. Divers also collect data that establish resource baselines that allow scientists to understand changes over time in an effort to protect sanctuary resources. Though American Samoa is very remote, the site has benefited from training and unit inspections that have enhanced diving capacity for three NOAA divers.

**“The Pacific Islands Region Unit Diving Supervisor provides training [to NOAA divers in his capacity] as a certified NOAA Trainer and oversees services in support of NOAA diving operations throughout the region.”**



NOAA divers from the Papahānaumokuākea Marine National Monument conducted dives to a maximum depth of 330 feet during scientific surveys. [NOAA](#)

### **Pacific Islands Region (PIR)**

The PIR Unit Diving Supervisor provides training (as a certified NOAA Trainer) and oversees services in support of NOAA diving operations throughout the region. This primary diving mission includes providing NOAA Diver training for employees of the NMS, certification check out dives, observer diver check outs, and bi-annual rescue and in-water skills training, among other skills. The PIR maritime heritage coordinator (archaeologist) also conducts assessment and training dives on submerged cultural resources in support of the Historic Preservation Act and the National Marine Sanctuaries Act, adding to the inventory of NOAA's submerged historic properties and enhancing NOAA's outreach and education efforts for coastal and marine resources.

### **Papahānaumokuākea Marine National Monument (PMNM)**

The PMNM diving unit conducts characterization, monitoring, research, and resource protection of natural and maritime heritage resources in the Northwestern Hawaiian Islands (NWHI) in support of management objectives of the PMNM. Diving operations include both standard SCUBA and technical diving operations using Closed Circuit Rebreathers (CCR) to characterize both shallow (0-130 feet) and deep reef environments (up to 330 feet). Additional diving operations conducted by PMNM divers include resource protection, alien species inspections, dive training, and technical proficiency diving operations both internally and with partner agencies such as the State of Hawai'i, Bishop Museum, University of Hawai'i, and Hawai'i Institute of Marine Biology.



Dr. Sylvia Earle gives President Barack Obama a photograph of *Tosanoides obama* on Midway Atoll, from the film “Sea of Hope: America’s Underwater Treasures” which premiered on the National Geographic Channel. [Brian Skerry/National Geographic](#)

In 2016, PMNM’s rebreather technical dive teams increased their operational diving depths to 330 feet to conduct scientific surveys. Expeditions to PMNM included the survey, collection and documentation of fish, benthic habitats, marine alien species, maritime heritage resources and environmental events. An expedition in collaboration with Bishop Museum and The Association of Marine Exploration in June 2016 led to the description of a new species of coral reef fish that was named after President Barack Obama. The fish, *Tosanoides obama*, recognizes President Obama’s efforts to protect and preserve the natural environment, including the recent expansion of the PMNM. At 582,578 square miles, it is now the largest permanent MPA on earth.

PMNM divers assisted with numerous outreach efforts including University of Hawai’i’s Quantitative Underwater Ecological Survey Techniques field course, which guides students through field surveying techniques and mentors students on career paths in marine science and conservation. PMNM divers also worked with University of Hawai’i’s Marine Option Program to train students to gather data during ship expeditions. Likewise, undergraduate interns from the University of Hawai’i were trained to conduct surveys.

**“A [diving] expedition in collaboration with Bishop Museum and The Association of Marine Exploration in June 2016 led to the description of a new species of coral reef fish that was named after President Barack Obama.”**



Unit Diving Supervisor Matthew Lawrence swims over the wreckage from the steamship *Acorn* on Elbow Reef in Florida Keys NMS.

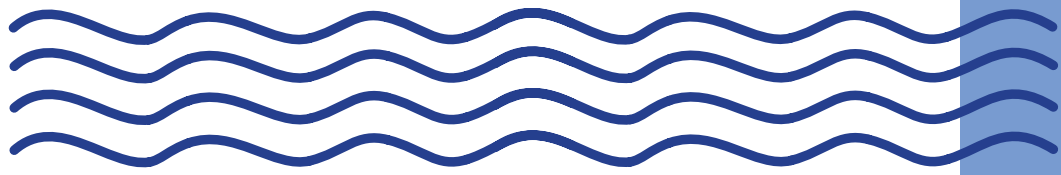
Brenda Altmeier/NOAA

### Stellwagen Bank National Marine Sanctuary (SBNMS)

SBNMS conducts dives to characterize, protect, and interpret the sanctuary's natural and cultural resources under mandates of both the National Marine Sanctuaries Act and the Historic Preservation Act. Shipwreck characterization is a common operation and requires the use of photographic equipment, tape measures, and underwater recording slates. Due to the sanctuary's cold waters, depth, and open ocean conditions, divers utilize drysuits, double tanks with isolation manifolds, and dual regulators to increase the divers' efficiency and safety.

In 2016, SBNMS conducted diving operations to characterize the Elbow Reef Shipwreck near Key Largo in collaboration with FKNMS's diving unit. The project seeks to document the landscape of the wrecking industry by mapping the ships lost and then salvaged on Elbow Reef. The project's partner, Diving With a Purpose (DWP), is an avocational archaeology program which has brought almost 50 volunteer divers to the project since 2012. In 2016, twenty DWP diving volunteers contributed \$25,000 in labor hours to the project. This year the project began mapping a shipwreck on Elbow Reef believed to be the steamship *Acorn* lost in 1885.





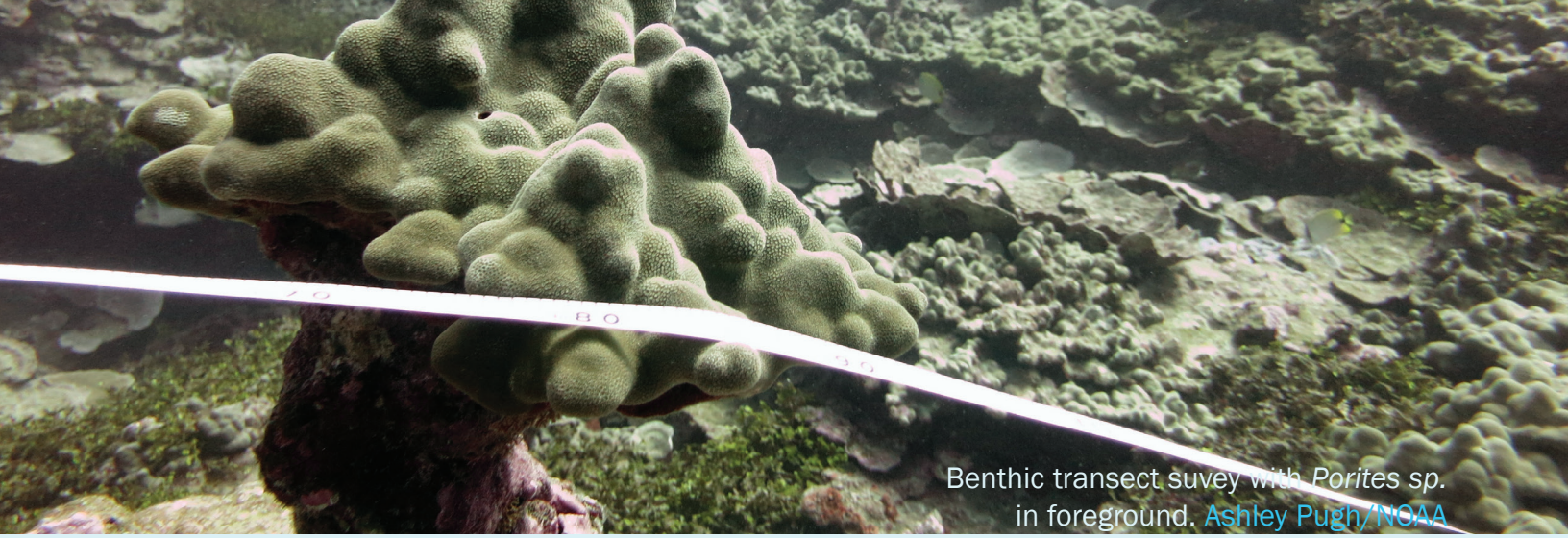
## Thunder Bay National Marine Sanctuary (TBNMS)

TBNMS divers support the ONMS's mission of protecting treasured places in the ocean and Great Lakes by focusing on resource protection in northwestern Lake Huron. While this primarily involves documentation, management, and monitoring of archaeological shipwreck remains, sanctuary divers facilitate a broad range of scientific research activities spanning numerous freshwater research areas including ecology, microbial biology, fisheries management, habitat studies, and hydrology.

In 2016, TBNMS divers completed archaeological mapping of the vessel *W.P. Thew*. Resting in 80 feet of water, the wooden bulk carrier's remains exhibit a very interesting site disposition with respect to structural integrity. While many vessels of similar vintage and in similar depths remain almost completely intact, *W. P. Thew's* remains are disarticulated and scattered over a wide area, presenting a relative challenge during documentation. Utilizing both photogrammetric modeling and traditional hand-mapping, archaeologists completed the documentation through both no-decompression and light decompression diving modes. Throughout, CCRs offered divers increased efficiency during in-water activities.

Another noteworthy TBMNS mission was the deep mooring buoy reconnaissance of vessel *Pewabic*. The original purpose of this project was to facilitate the installation of several deep-water mooring buoy rigs at selected sanctuary-managed shipwreck sites. Proper permitting, however, did not arrive in time for the planned technical diving operations, so focus was shifted to detailed photo and video documentation. Here, 360 degree panoramic imagery and 3D photogrammetric models were generated over a series of tech dives that included selecting the location for the eventual mooring buoy and ground truthing it.

**“ In 2016, twenty DWP diving volunteers contributed \$25,000 in labor hours [to map] a shipwreck on Elbow Reef believed to be the steamship *Acorn* lost in 1885.”**



Benthic transect survey with *Porites* sp. in foreground. [Ashley Pugh/NOAA](#)

# O A R

Andrew David  
Acting Line Office Diving Officer

## Office of Oceanic and Atmospheric Research (OAR)

### Miami, Florida

The primary diving mission of the Atlantic Oceanographic and Meteorological Laboratory (AOML) is to support local and international ocean chemistry and physical oceanography research through scientific diving. AOML's collaborations are quite extensive. Within NOAA these included Pacific Marine Environmental Laboratory, Florida Keys National Marine Sanctuary, and the Southeast Fisheries Science Center. Other government partners outside of NOAA included Florida Fish and Wildlife Commission, U.S. Geological Survey, Department of Environmental Quality, and National Park Service. Academic and Non-Governmental Organization partners included University of the Virgin Islands, Nova Southeastern University, University of Miami/Rosenstiel School of Marine and Atmospheric Science, and University of South Florida.

Projects undertaken in 2016 included site surveys conducted for upcoming installations in the Coral Health and Monitoring Program, deployment of bottom mounted Acoustic Doppler Current Profiler units, site assessments, and oceanographic data collection for the Florida Area Coastal Environment program, water monitoring site data collection South Florida Project, instrumentation deployment, physical oceanographic data collection and instrumentation maintenance for the Western Boundary Time Series, coral reef surveys and sampling in South Florida, the Pacific and the Caribbean for CRCP and Ocean Acidification, and turbidity monitoring due to dredging project surrounding the Miami shipping channel.

“ ... AOML [divers] support local and international ocean chemistry and physical oceanography research ... ”



NOAA Diver Jean de Marignac examines a deadeye, part of the rigging from a sailing ship, from a shipwreck in Greater Farallones National Marine sanctuary. Matthew Lawrence/NOAA.



# OMAO

LCDR Faith Knighton, NOAA  
Deputy Line Office Diving Officer

## Office of Marine and Aviation Operations (OMAO)

OMAO supports 15 diving units aboard NOAA ships and several shore-based diving units at the NDC, Marine Operations Centers, Headquarters, Commissioned Personnel Center, and the NOAA Corps Officer Training Center. OMAO diving operations occur across all regions where NOAA missions take place, from Alaska to the South Pacific, the North Atlantic to the Caribbean and Gulf of Mexico, the United States Territories, and around the world. OMAO divers are primarily NOAA Corps Officers and Wage Mariners, trained in specialized skills to perform working dives.

OMAO ships support diverse hydrographic, oceanographic, fisheries, and atmospheric scientific missions. Ship dives involve hull inspections and de-fouling the hull, propeller, rudder, and bow thruster by removing marine growth, using a variety of tools to ensure the ship runs efficiently and safely. Having divers aboard the ships to perform these critical tasks saves the fleet tens of thousands of dollars per year, as it safeguards ships working in remote locations with the ability to remove derelict gear from the hull, and can prevent the need for emergency dry-docks for maintenance. Divers also conduct scientific instrument installation and inspection dives on the hulls of ships to ensure quality data collection for the line offices they serve during underway missions. In 2016, OMAO divers represented 25% of all NOAA divers (92 out of 369 total divers), performed 45% (860 out of 1,915 total) of OSHA-classified working dives and 15% of NOAA dives (1,533 out of 9,863 total dives), and spent 780 hours (or 32.5 days) underwater. Primary diver tasks include ship husbandry, training, and proficiency.

Ship husbandry dives are often as deep as the draft of a ship, typically less than 20 feet of sea water. What makes these dives unique is that they are in an overhead environment and often involve the use of tools, higher levels of exertion in cold or low-visibility water, and can take several hours or several dives to accomplish the task at hand. Ship hull inspections allow divers to report back to the Command the condition



Black sea bass at Gray's Reef NMS. Steve Lonhart/NOAA

of the hull; without divers there would be no access to this part of the ship. OMAO divers obtain Special Task Endorsements to conduct ship husbandry dives and perform working dives using dry suits and full face masks. OSHA standards for working dives offer additional safety precautions by requiring topside personnel and standby divers to assist in diving operations.

### OMAO Diving Units by Location

#### Marine Operations Center - Atlantic (MOC-A) Norfolk, Virginia

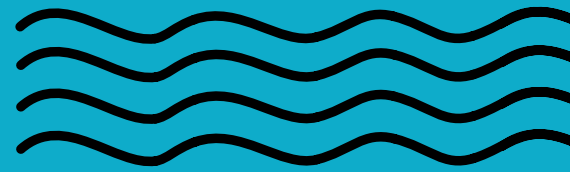
The MOC-A diving unit primarily supports NOAA Ships while in port.

#### NOAA Ship *Gordon Gunter* - Pascagoula, MS

The primary diving missions of the NOAA Ship *Gordon Gunter* are ship husbandry, scientific support and maintaining proficiency. Ship husbandry dives involve inspecting the propellers, any scientific instruments mounted to the hull of the ship, and the hull itself for any signs of fouling or for maintenance. Divers from NOAA Ships *Gordon Gunter* and *Pisces* jointly searched for a mud grab that was lost off Horn Island in Mississippi during a scientific expedition, although the mud grab was not located due to low visibility. Proficiency dives were also conducted to maintain diver skills and safety procedures.

#### NOAA Ship *Henry B. Bigelow* - Newport, RI

In 2016, NOAA Ship *Henry B. Bigelow* divers trained and safely performed underwater operations and ship husbandry dives. At the Newport Naval Base Station in July, the diving team worked in pairs and took turns clearing the propeller of line from fishing gear. They also inspected the hull and intakes, clearing and cleaning transducers, and performed a visual inspection of the bow thruster and rudder before exiting the



“ Having divers aboard the ships to perform these critical tasks saves the fleet tens of thousands of dollars per year ”

# OMAO



NOAA divers from the NOAA Ship *Gordon Gunter* suit up for a dive.  
NOAA

water. The cost of shipboard divers to complete this work is well below industry standards to hire commercial divers. Divers also completed annual skills check-outs, swim tests, training in oxygen administration, rescue techniques and medical evacuation practice drills.

### **NOAA Ship *Nancy Foster* - Charleston, SC**

Diving operations at this ship support the mission of OMAO, NOAA Ship *Nancy Foster*, and other NOAA line offices. This unit conducts monthly hull inspections and performs ship husbandry tasks to ensure vessel readiness in port and while underway. Additionally, the unit supports and participates in a variety of scientific diving operations during projects and is equipped with air and nitrox compressors that provide divers with safe and breathable gas mixtures.

Working dives conducted while the ship was moored included hull inspections, cleaning z-drives, propellers, rudders, sea chests, and installation and removal of transducers, ADCPs, Reson 7125 multibeam and Reson 710 sound velocity probes. The work the divers completed had a direct impact on scientific operations and mission readiness. In March, ship divers replaced the sound velocity probe which ensured quality multibeam data was acquired by the ship. This data is used to make operational decisions that are dependent upon the quality of scientific data collected. Other dives were necessary to ensure mission readiness, such as dives in June to remove fouled gear in the z-drive.

A diver from the NOAA Ship *Henry B. Bigelow* during a hull dive. NOAA



Cost savings occurred when unit divers installed, repaired, cleaned, and inspected the ship's hull and associated equipment when compared to using contractors for these dive tasks.

Shipboard divers also supported scientific dives conducted from small boats launched from the ship in support of research with FKNMS and GRNMS.

#### **NOAA Ship *Okeanos Explorer* - Kingstown, RI**

The primary mission of the divers on NOAA Ship *Okeanos Explorer* is to carry out ship husbandry dives. Members of the dive unit have a unique knowledge of the ship's hull, the sensitive instruments that are mounted to the hull and the proper techniques for maintaining the instruments. Having a functioning diving unit dedicated to the ship avoids having to hire a contract diving company which would incur higher costs to the ship and that may damage sensitive equipment.

In May, the *Okeanos Explorer* was in Saipan Harbor. Shortly after the discovery of a large amount of water in a void space near the hull, it became necessary to activate the ship's diving team. The diving team was able to methodically inspect the hull for any obvious signs of damage or mechanical issues which caused the water to enter the void. After thoroughly inspecting the hull, the diving team collaborated with ship engineers to conclude that the ship was not in immediate danger of additional water ingress in the hull. This gave the command and OMAO sufficient time to determine the best course of action and avoid rushing when attempting to solve a serious issue.

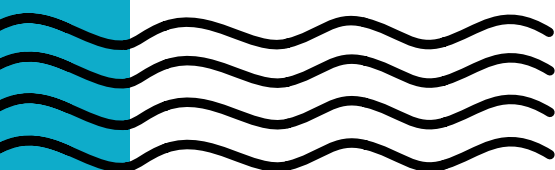
Prior to getting underway during the end of 2016, the *Okeanos Explorer* diving team performed a working dive to inspect the ship's hull and clean the sonar, transducer, and sound velocity probe. This equipment is extremely sensitive and, to maintain it properly, specific tools and

**“ ... divers [from the NOAA Ship *Nancy Foster*] replaced the sound velocity probe which ensured quality multibeam data was acquired by the ship.”**

# O M A O



A NOAA diver from NOAA Ship *Pisces* inspects sensors below a newly deployed buoy in the Gulf of Maine. [NOAA](#)



techniques are required. Cleaning these instruments prior to the start of the field season greatly enhances functionality and data collection. In 2016, the diving team completed several hull inspections and a sonar cleaning, saving the ship an estimated \$8,000 to contract commercial divers.

### **NOAA Ship *Oregon II* - Pascagoula, MS**

The NOAA Ship *Oregon II* conducts diving operations primarily to survey the hull of the vessel while at home port in Pascagoula, Mississippi.

### **NOAA Ship *Pisces* - Pascagoula, MS**

The NOAA Ship *Pisces* diving unit executes ship husbandry and aids scientific missions through equipment retrieval and installation.

The Deepwater Coral project was a unique, exploratory expedition for the *Pisces*. The project did not originally call for diving operations but ended up requiring them when fishing gear became entangled in the propeller on the transit to the first site. Project operations relied on an AUV, so properly functioning propulsion was essential to cruise execution. The ship was anchored in a small cove off Block Island, Rhode Island and divers were deployed to remove the fouled gear. Upon removal, ship operations resumed and the mission was able to be carried out.

The Northeastern Regional Association of Coastal Ocean Observing Systems is a northeast oceanographic data buoy group which maintains



NOAA divers from the NOAA Ship *Okeanos Explorer* conduct a hull dive in low visibility.  
NOAA



and services several Oceanographic Data Acquisition System buoys in the Gulf of Maine. Again, this mission did not originally call for diving operations, but an underway dive was required nonetheless when several lobster pots became entangled in the propeller, restricting propulsion near a newly deployed buoy. Once diving operations to remove the entangled gear were completed, divers were then transported via small boat to conduct another dive near the buoy. The scientists were interested in the sensors that were located 20 feet below the surface to ensure that they were deployed and tending correctly. Divers checked the sensors and photographed them to provide the scientific team with documentation at the surface.

Each month the *Pisces*' diving team conducts a ship husbandry dive to clean the propeller and rudder, which saves the need to hire a contractor, at a savings of an estimated \$3,000.

#### **NOAA Ship *Ronald H. Brown* - Charleston, SC**

The NOAA Ship *Ronald H. Brown* is an OMAO ship that conducts research around the world. In 2016, the *Ronald H. Brown* primarily sailed the Pacific Ocean with numerous foreign port calls and research conducted hundreds of miles out to sea. The ship's diving team is essential for ship surveys and to provide ship maintenance to ensure mission readiness.

While underway offshore Washington, the *Ronald H. Brown* inadvertently picked up two crab pot lines and buoys that caused stress in the port Z-drive. Divers were deployed to remove the lines. This open water dive allowed quick response and eliminated the need to pull into a port and cause delays on a critical West Coast Ocean Acidification project.

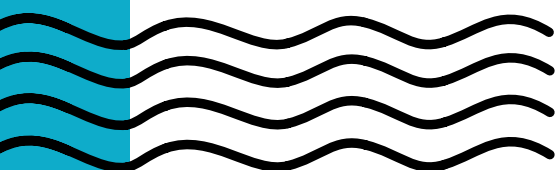
While in Seattle in July, two dives were conducted to install and remove a plug for the port side auxiliary seawater discharge pipe that had failed.

**“ In 2016, the [Okeanos Explorer] diving team completed several hull inspections and a sonar cleaning, saving the ship an estimated \$8,000 to contract commercial divers. ”**

# O M A O



NOAA divers from NOAA Ships *Bell M. Shimada*, *Rainier*, and *Reuben Lasker* volunteer at the Oregon coast Aquarium as reciprocity divers to maintain proficiency in diving skills. [LTJG Nikita Norton/NOAA](#)



The installation of the plug allowed the pipe to be cut out and replaced without the need for an emergency dry dock.

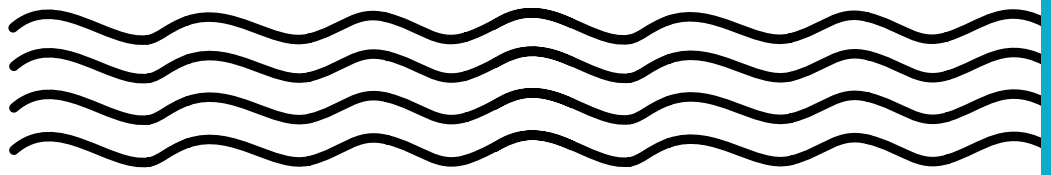
## **Marine Operations Center - Pacific (MOC-P) Newport, Oregon**

The MOC-P diving unit primarily supports NOAA Ships with diving operations while in port. The diving unit also maintains and inspects the facility structures and participates in reciprocity dives with the Oregon Coast Aquarium.

### **NOAA Ship *Bell M. Shimada* - Newport, OR**

Working dives on the NOAA Ship *Bell M. Shimada* hull and underwater equipment are conducted as needed for cleaning and maintenance.

In March, while the ship was in Newport, Oregon, three *Bell M. Shimada* divers worked with one diver from MOC-P to remove fouled line from the propeller over two dives. Removing the lines increased fuel efficiency and ensured clean and accurate acoustic data collection aboard the ship. Other ship husbandry dives conducted throughout the year included inspection of the propeller and rudder for fouling. Divers inspected the centerboard transducers and hull sensors and cleaned them as well as scraped growth out of essential water sampling intakes. Dives also included a familiarization for new *Bell M. Shimada* divers of the ship's hull and notable features.



The ship's divers also volunteer at the Oregon Coast Aquarium as reciprocity divers and to maintain proficiency in diving skills. They assist in aquarium husbandry dives to vacuum, clean, scrub delicate acrylic, and assist aquarists in the habitats. The ship's divers have completed over 30 dives with the aquarium, volunteering over 50 hours. NOAA's presence at the aquarium encouraged fellow non-NOAA divers to come to the NOAA facility for tours and promoted an excitement and interest from the local community in NOAA's operations.

### **NOAA Ship *Fairweather* - Ketchikan, AK**

The primary mission of NOAA Ship *Fairweather*'s diving unit is to support the hydrographic mission of the ship. This includes the installation and removal of the subtidal components of tide gauges, identifying and accurately measuring the minimum depth of potential dangers to navigation, and performing regular hull dives to ensure sonar components are free of growth and that the hull is in good repair.

A hull inspection of *Fairweather* was conducted in April with five ship divers and the help of three NDC divers from Seattle, Washington. Divers completed two evolutions that consisted of a hull inspection, a skills check-out dive to maintain proficiency, and recovery of a small hand tool that had been lost overboard. The inspection of *Fairweather*'s hull revealed no major damage or growth to be removed. Photos and video were taken of all zinc anodes and thru-hulls for official post-dive review.

In May, the *Fairweather* deployed two diving teams working from a small boat to install a tide gauge that will acquire data to aid in the accuracy of survey operations conducted in West Prince of Wales, Alaska.

A hull inspection was conducted in September to inspect and clean all survey equipment and remove debris from the propellers. A survey launch was tied alongside the ship and used as a diving platform. With one team acting as line-tended standby divers, a team of two other divers inspected the hull and reported findings. Each team then switched roles and a second inspection was conducted. The inspection revealed patches of kelp and mono-filament fishing line wrapped around the starboard propeller, isolated patches of barnacle growth on survey equipment, and a 5-inch dent on one port propeller blade. All kelp and fishing line was immediately removed and disposed of aboard the ship.

### **NOAA Ship *Oscar Dyson* - Kodiak, AK**

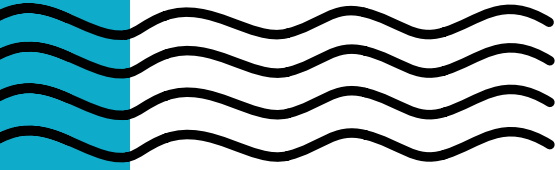
The NOAA Ship *Oscar Dyson*'s primary diving mission is to monitor and maintain the ship's hull through routine inspections and cleaning of

**“ In May, the *Fairweather* deployed two diving teams working from a small boat to install a tide gauge that will acquire data to aid in the accuracy of survey operations conducted in West Prince of Wales, Alaska. ”**

# O M A O



*Pisces* ship divers perform rescue drills as part of their annual refresher training. [NOAA](#)

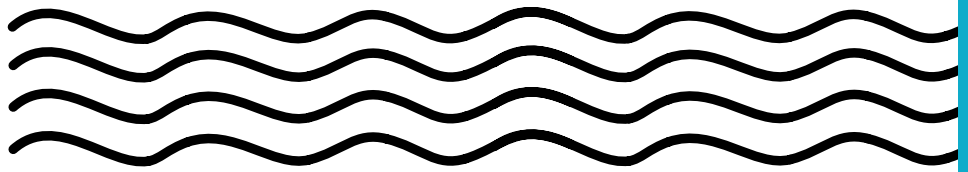


the propeller and rudder. Ship's divers conducted four ship husbandry dives while in port in support of the mission. Inspection results were provided to the NOAA Fisheries Midwater Assessment and Conservation Engineering program personnel to verify the condition of the hull, rudder, propeller, and transducers. Regularly cleaning marine growth minimizes ship impacts to the acoustic signature of data collected.

### **NOAA Ship *Rainier* - Newport, OR**

The primary mission of the *Rainier's* diving unit is to support the hydrographic mission of the ship. This includes the installation and removal of the subtidal components of tide gauges, identifying and accurately measuring the least depth of potential dangers to navigation, and performing regular hull dives to ensure sonar components are free of growth and that the hull is in good repair.

During the 2016 field season, *Rainier* divers conducted hydrographic survey operations in Alaska. *Rainier* provided contemporary surveys to update NOS nautical charting products for North Kodiak Island, Resurrection Bay (Seward), and the George and Carol inlets near Ketchikan. These products support the large fishing fleets and increasing levels of commercial and passenger vessel traffic in these areas. *Rainier's* 2016 hydrographic operations did not require the installation of a tide gauge. Due to the remoteness of the ship's operating area and the high travel time to the nearest hyperbaric chamber, *Rainier* divers only conducted working dives for mission critical purposes.



In 2016, *Rainier* divers contributed to the operational success of the ship's mission by serving as a fast response team during several instances of fouled propellers and freeing a survey launch from entanglement in fishing gear. *Rainier* divers provided support to the engineering department with a repair that required the placement of an external fitting on the hull. *Rainier* divers also conducted monthly hull dives to monitor the material condition of the ship. While in port throughout the field season *Rainier* divers maintained proficiency by conducting several non-OSHA-classified dives to practice their skills.

Having a well-trained and prepared diving team aboard the ship eliminated the need and associated expenses of contracted divers. Furthermore, the fast response of divers to incidents ensured all *Rainier's* survey assets were operational throughout the field season, increasing the unit's productivity.

*Rainier* divers have maintained a strong relationship with the Oregon Coast Aquarium's diving program. While in the ship's home port of Newport Oregon, *Rainier* divers regularly volunteer to help maintain the aquarium's underwater exhibits.

#### **NOAA Ship *Reuben Lasker* - San Diego, CA**

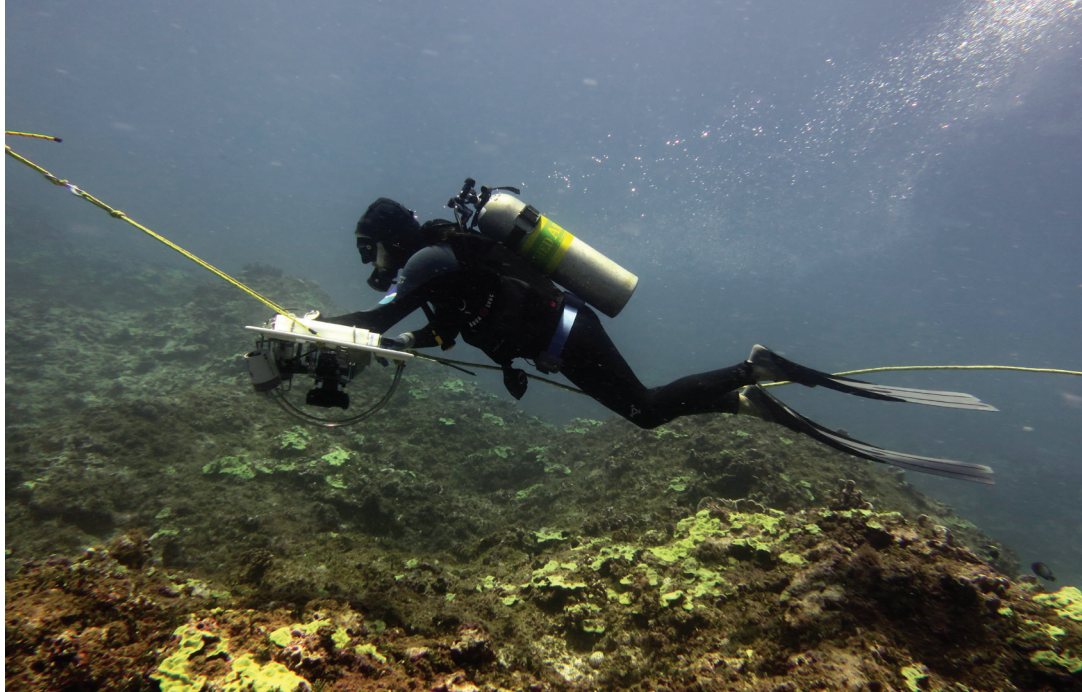
Divers aboard the *Reuben Lasker* support the ship's mission by conducting hull inspections and ship husbandry.

In January 2016, divers conducted hull dives and inspected the propeller and rudder for marine growth and attached a Continuous Underway Fish Egg Sampler (CUFES) scoop to the hull for scientific missions. In June, divers cleaned the propeller and rudder of loose line from the spring-time fishing and cleaned the CUFES scoop. Later in the year, divers conducted hull inspections and cleaned the propeller and rudder of marine growth. Divers also maintain proficiency by conducting scientific dives in California.

Hull maintenance dives on the *Reuben Lasker* saved approximately \$10,000 when compared to the costs to hire commercial divers to do similar work.

**“*Rainier* divers provided support to the engineering department with a repair that required the placement of an external fitting on the hull.”**

# O M A O



NOAA Diver Jao Garriques conducting a benthic towboard survey supported by the NOAA Ship *Hi'ialakai*. [Kaylyn McCoy/NOAA](#)

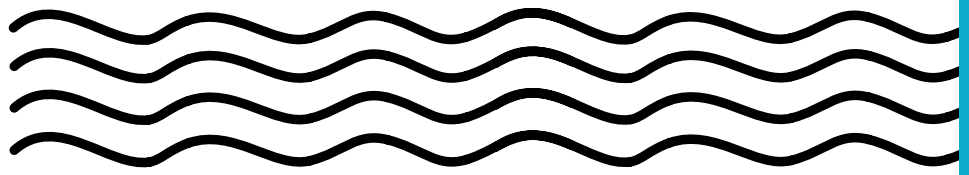
## Marine Operations Center - Pacific Islands (MOC-PI) Honolulu, Hawai'i

### NOAA Ship *Hi'ialakai* - Honolulu, HI

The primary missions of the NOAA Ship *Hi'ialakai's* diving unit are performing ship husbandry and supporting scientific diving missions.

*Hi'ialakai* divers performed husbandry dives on the ship multiple times throughout the year. Divers cleaned the hull, bow thrusters, rudders and propellers using a variety of tools and methods. In addition to general maintenance, divers must remove all marine life from the hull in order to receive an entry permit to work in the Papahānaumokuākea Marine National Monument (PMNM). This year the ship completed several projects in support of research in the Monument, thus maintaining a clean hull required great attention.

Ship divers served as support divers on various Coral Reef Ecosystem Program dives. When space was available and duty permitted, ship divers provided support and assistance to the established scientific diving teams. This resulted in greater efficiency and reduced individual work load across the teams. The perception among the scientific teams was that the ship divers provided relief and added value to their field work. In addition, ship divers were able to step in as substitute divers to maintain continuity of diving operations when program divers required rest days. The ship's ability to provide support divers allowed for no reduction in operational ability and was greatly appreciated by the scientists on board.



A guest diver and writer accompanied the scientific team on a PMNM biogeography project. This individual was not a NOAA diver and additional safety measures were put in place to ensure the safety of everyone on the project. As such, *Hi'ialakai* divers served as escort divers. They supervised underwater operations to allow the Observer Diver to safely observe the natural resources of PMNM and the activity of the scientists.

In August, contract commercial divers were needed to clean the hull due to water quality conditions in Pearl Harbor. The cost was \$4,800. If contract services had been required to conduct necessary hull cleaning for the ship throughout the year, the costs would likely have exceeded \$20,000 annually.

In addition to a diving team, the *Hi'ialakai* also has trained Diving DMTs on board the ship. This specialized training allows an extra layer of safety for remote diving operations where first line responders play a very important role in recognizing dive-specific injuries and maladies, conducting neurologic exams, and supporting hyperbaric chamber treatments.

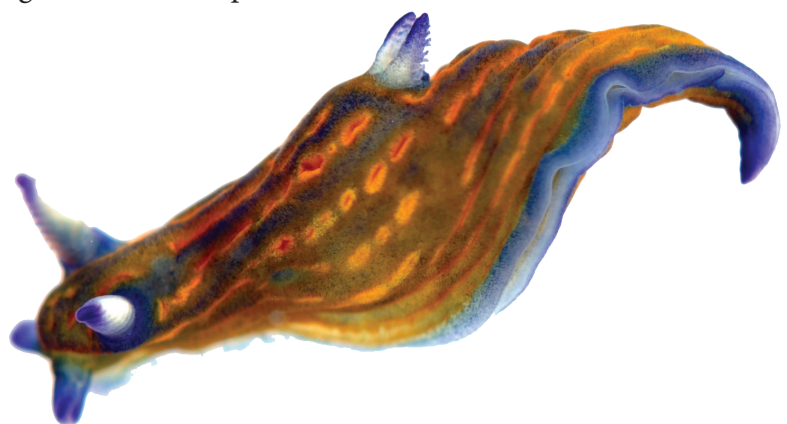
#### **NOAA Ship Oscar *Elton Sette* - Honolulu, HI**

Divers aboard the NOAA Ship *Oscar Elton Sette* perform ship husbandry dives, cleaning the hull while at homeport in Pearl Harbor, Hawai'i and supporting scientific dives.

In 2016, the *Oscar Elton Sette* was on a mission in American and Western Samoa. Divers were necessary to remove derelict Fish Aggregating Devices (FADs) from the ship's running gear. Once, the ship was trying to recover a FAD and it got fouled in the ship's rudder. Another time, the ship ran over a derelict, unlighted FAD in the night and it was discovered the following morning. Shipboard divers prevent additional costs that would have been incurred to remove entangled gear from the ship's hull, especially on remote missions.

**“*Hi'ialakai* divers served as escort divers ... to allow the Observer Diver to safely observe the natural resources of PMNM and the activity of the scientists.”**

A nudibranch found in an Autonomous Reef Monitoring Structure (ARMS) during operations staged from the NOAA Ship *Hi'ialakai*.  
James Morioka/NOAA



# publications



NOAA Diver Tom Oliver identifies invertebrates collected during diving operations. [James Morioka/NOAA](#)

**Scientists published data collected by NOAA divers in 29 peer-reviewed articles, 17 technical memoranda, reports and presentations, 7 magazines and newsletters, and one book.**

## Peer-Reviewed Articles

### NMFS

#### Auke Bay, Alaska

Stone, R. P., Malecha, P. W., & Masuda M. M. (2017). A five-year, in situ growth on shallow-water populations of the gorgonian octocoral (*Calcigorgia spiculifera*) in the Gulf of Alaska. *PLOS ONE*, 12(1), e0169470. <http://dx.doi.org/10.1371/journal.pone.0169470>

#### Honolulu, Hawai'i

Cinner, J. E., Huchery, C., MacNeil, M. A., Graham, N. A. J., McClanahan, T. R., Maina, J., Maire, E., Kittinger, J. N., Hicks, C. C., Mora, C., ... et al. (2016). Bright spots among the world's coral reefs. *Nature*, 535, 416-419. <http://dx.doi.org/10.1038/nature18607>





Karnauskas, K. B., Cohen, A. L., & Gove, J. M. (2016). Mitigation of coral reef warming across the Central Pacific by the equatorial undercurrent: a past and future divide. *Scientific Reports*, 6, article number:21213. <http://dx.doi.org/10.1038/srep21213>

Kelly, E. L. A., Eynaud, Y., Clements, S. M., Gleason, M., Sparks, R. T., Williams, I. D., & Smith, J.E. (2016). Investigating functional redundancy versus complementarity in Hawaiian herbivorous coral reef fishes. *Oecologia*, 182(4), 1151-1163. <http://dx.doi.org/10.1007/s00442-016-3724-0>

Pyle, R. L., Boland, R., Bolick, H., Bowen, B. W., Bradley, C.J., Kane, C., Kosaki R. K., Langston, R., Longenecker, K., Montgomery, A., Parrish, F. A., Popp, B. N., Rooney, J., Smith, C. M., Wagner, D., & Spalding, H. L. (2016). A comprehensive investigation of mesophotic coral ecosystems in the Hawaiian Archipelago. *PeerJ*, 4, e2475. <https://doi.org/10.7717/peerj.2475>

### **Kodiak, Alaska**

Ryer, C. H., Long, W. C., Spencer, M. L., & Iseri, P. (2015). Depth distribution, habitat associations, and differential growth of newly settled southern Tanner crab (*Chionoecetes bairdi*) in embayments around Kodiak Island, Alaska. *Fish. Bull.*, 113 (3), 256–269. <http://fishbull.noaa.gov/1133/ryer.pdf>

### **Miami, Florida**

Bright A. J., Miller, M. W., & Bourque, A.S. (2016). Tracking growth and survival of rescued boulder corals. *Restoration Ecology*, 24, 456-462. <http://dx.doi.org/10.1111/rec.12348>

Cameron, C. M., Pausch, R. E., & Miller, M. W. (2016). Coral recruitment dynamics and substrate mobility in a rubble-dominated back reef habitat. *Bull Mar Sci*, 92(1), 123-136. <https://doi.org/10.5343/bms.2015.1030>

Miller, M. W., Williams, D. E., & Fisch, J. (2016). Genet-specific spawning patterns in *Acropora palmata*. *Coral Reefs*, 35(4), 1393-1398. <http://dx.doi.org/10.1007/s00338-016-1472-6>

Miller, M. W., Williams, D. E., Huntington, B. E., Piniak, G. A., & Vermeij, M. J. A. (2016). Decadal comparison of a diminishing coral community: a case study using demographics to advance inferences of community status. *PeerJ*, 4, e1643. <http://dx.doi.org/10.7717/peerj.1643>

Holotype of *Tosanooides obama* shortly after collection, alive in a holding tank aboard the NOAA Ship *Hi'ialakai*.  
[Richard Pyle/Bishop Museum](#)



# publications



A NOAA diver surfaces during a December dive in Auke Bay, AK. Dave Csepp/NOAA



## NOS

### Florida Keys National Marine Sanctuary

FKNMS has not directly produced any publications during CY16 using data collected on SCUBA. However, FKNMS divers contribute to collection of scientific biological data (mostly coral) that is used by various other agencies in databases and reports that eventually contributes to publications. For example: Florida Reef Resilience Program, BleachWatch, Mote Marine Lab, UNCW Coral Reef Monitoring and Assessment, NMFS/SEFSC, and various other programs that produce periodic condition reports, quick report/quick-look one-pagers, or data analysis on coral spawning, disease, and bleaching.

### Flower Garden Banks National Marine Sanctuary

Johnson, J. E., Bird, C. E., Johnston, M. A., Fogg, A. Q., & Hogan, J. D. (2016). Regional genetic structure and genetic founder effects in the invasive lionfish: comparing the Gulf of Mexico, Caribbean and North Atlantic. *Marine Biology*, 163, 216. <http://dx.doi.org/10.1007/s00227-016-2981-0>

Johnston M. A., Embesi, J. A. Eckert, R. J., Nuttall, M. F., Hickerson, E. L., & Schmahl G. P. (2016) Persistence of coral assemblages at East and West Flower Garden Banks, Gulf of Mexico. *Coral Reefs*, 35, 821. <https://doi.org/10.1007/s00338-016-1452-x>

Johnston, M. A., Nuttall, M. F., Eckert, R. J., Embesi, J. A., Sterne, T. K., Hickerson, E. L., & Schmahl, G.P. (2016) Rapid invasion of Indo-Pacific lionfishes *Pterois volitans* (Linnaeus, 1758) and *P. miles* (Bennett, 1828) in Flower Garden Banks National Marine Sanctuary, Gulf of Mexico, documented in multiple data sets. *BioInvasions Records*, 5(2), 115-122. <http://dx.doi.org/10.3391/bir.2016.5.2.09>

### Papahānaumokuākea Marine National Monument

Bridge, T. C. L., Luiz, O. J., Coleman, R. R., Kane, C. N., & Kosaki, R. K. (2016). Ecological and morphological traits predict depth-generalist fishes on coral reefs. *Proceedings of the Royal Society B*. <http://dx.doi.org/10.1098/rspb.2015.2332>

Friedlander, A. M., Wagner, D., Gaymar, C. F., Wilhelm, A., Lewis, N., Brooke, S., & Varmer, O. (2016). Cooperation between large-scale MPAs: successful experiences from the Pacific Ocean. *Aquatic Conservation: Marine and Freshwater Ecosystems*, 26(2), 126-141. <https://doi.org/10.1002/aqc.2645>

Fukunaga, A., Kosaki, R., Wagner, D., & Kane, C. (2016). Structure of mesophotic reef fish assemblages in the Northwestern Hawaiian Islands. *PLoS ONE*, 11(7), e0157861. <https://doi.org/10.1371/journal.pone.0157861>

Gjerde, K. M., Reeve, L. L. N., Harden-Davies, H., Ardon, J., Dolan, R., Durussel, C., Earle, S., Jimenez, J. A., Kalas, P., Laffoley, D., Oral, N., Page, R., Ribeiro, M. C., Rochette, J., Spadone, A., Thiele, T., Thomas, H. L., Wagner, D., Warner, R., Wilhelm, A. & Wright, G. (2016). Protecting Earth's last conservation frontier: scientific, management and legal priorities for MPAs beyond national jurisdiction. *Aquatic Conservation: Marine and Freshwater Ecosystems*, 26(2), 45-60. <https://doi.org/10.1002/aqc.2646>

Kealoha, A. K., Kahng, S. S., Mackenzie, F. T., Alin, S. R., Kosaki, R. K., Brainard, R. E., & Winn, C. W. (2015). Latitudinal trends and drivers in the CO<sub>2</sub>-carbonic acid system of the Papahānaumokuākea Marine National Monument. *Aquatic Geochemistry*, 21(6), 535–553. <https://doi.org/10.1007/s10498-015-9273-z>

Kelley, C., France, S., Parrish, F., Wagner, D., Gerringer, M., & Garcia, M. (2016). CAPSTONE's first year – 2015 Hohonu Moana: exploring the deep waters off Hawai'i. *Oceanography*, 29(1, Supplement), 68-73. <https://doi.org/10.5670/oceanog.2016.supplement.01>

Kosaki, R. K., Pyle, R. L., Leonard, J. C., Hauk, B. B., Whitton, R. K., & Wagner, D. (2016). 100% endemism in mesophotic fish assemblages of Kure Atoll, Hawaiian Archipelago. *Marine Biodiversity*. <https://doi.org/10.1007/s12526-016-0510-5>

Laverick, J. H., Andradi-Brown, D. A., Exton, D. A., Bongaerts, P., Bridge, T. C. L., Lesser, M. P., Pyle, R. P., Slattery, M., Wagner, D., & Rodgers, A. D. (2016). To what extent do mesophotic coral ecosystems and shallow reefs share species of conservation interest? *Environmental Evidence*, 5, 16. <https://doi.org/10.1186/s13750-016-0068-5>

Pyle, R. L., Boland, R., Bolick, H., Bowen, B. W., Bradley, C. J., Kane, C., Kosaki, R. K., Langston, R., Longenecker, K., Montgomery, A. D., Parrish, F. A., Popp, B. N., Rooney, J., Smith, C. M., Wagner, D., & Spalding, H. L. (2016). A comprehensive investigation of mesophotic coral ecosystems in the Hawaiian Archipelago. *PeerJ*, 4, e2475. <https://doi.org/10.7717/peerj.2475>

Pyle, R. L., & Kosaki, R. K. (2016). *Prognathodes basabei*, a new species of butterflyfish (Perciformes: Chaetodontidae) from the Hawaiian Archipelago. *ZooKeys*, 614, 137-152. <https://doi.org/10.3897/zookeys.614.10200>

Waldrop, E., Hobbs, J. A., Randall, J. E., DiBattista, J. D., Rocha, L. A., Kosaki, R. K., & Bowen, B. W. (2016). Phylogeography, population structure, and evolution of coral-eating butterflyfishes (Family



A crab (*Epiactaea nodulosa*) collected by NOAA divers from an ARMS.

[James Morioka/NOAA](#)



Polyps of the coral *Montipora* sp. Evan Barba/NOAA



Chaetodontidae, genus *Chaetodon*, subgenus *Corallochaetodon*). *Journal of Biogeography*, 43(6), 1116–1129. <https://doi.org/10.1111/jbi.12680>

Wagner, D., & Kelley, C. D. (2016). The largest sponge in the world? *Marine Biodiversity*. <https://doi.org/10.1007/s12526-016-0508-z>

### National Centers for Coastal Ocean Science

Kendall, M. S., Monaco, M. E., & Winship, A. (2016). Baffling telemetry detections can be useful: an acoustic receiver design to monitor organisms along reserve boundaries and ecotones. *Animal Biotelemetry*, 4(2). <https://doi.org/10.1186/s40317-015-0095-y>

### Thunder Bay National Marine Sanctuary

Biddanda, B. A., McMillan, A. C., Long, S. A., Snider, M. J., & Weinke, A. D. (2015). Seeking sunlight: rapid phototactic motility of filamentous mat-forming cyanobacteria optimize photosynthesis and enhance carbon burial in Lake Huron's submerged sinkholes. *Frontiers in Microbiology*, 6, 930. <https://doi.org/10.3389/fmicb.2015.00930>

Voorhies, A. A., Eisenlord, S. D., Marcus, D. N., Duhaime, M. B., Cavalcoli, J. D., Biddanda, B. B., & Dick, G. J. (2016). Ecological and genetic interactions between cyanobacteria and viruses in a low-O<sub>2</sub> mat community inferred through metagenomics and metatranscriptomics. *Environmental Microbiology*, 18(2), 358–371. <https://doi.org/10.1111/1462-2920.12756>

### OAR

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## Technical Memoranda, Reports, and Presentations

### NMFS

#### Honolulu, Hawai'i

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## Milford, Connecticut

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### Florida Keys National Marine Sanctuary

FKNMS produced six internal reports for its Damage Assessment and Restoration Program using data collected on SCUBA during CY16. These included three initial Injury Assessment Reports: structural & biological assessments of coral damage from vessel groundings, three monitoring reports, and one coral restoration plan. These internal reports are added into case packages along with photos/videos and provided to NOAA general council to be used as evidence in prosecution cases for vessel groundings.

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NOAA Diver Julie Bursek takes a giant stride off the R/V *Shearwater* to swap out scientific instruments off Santa Cruz Island.

Jessica Alstatt/NOAA

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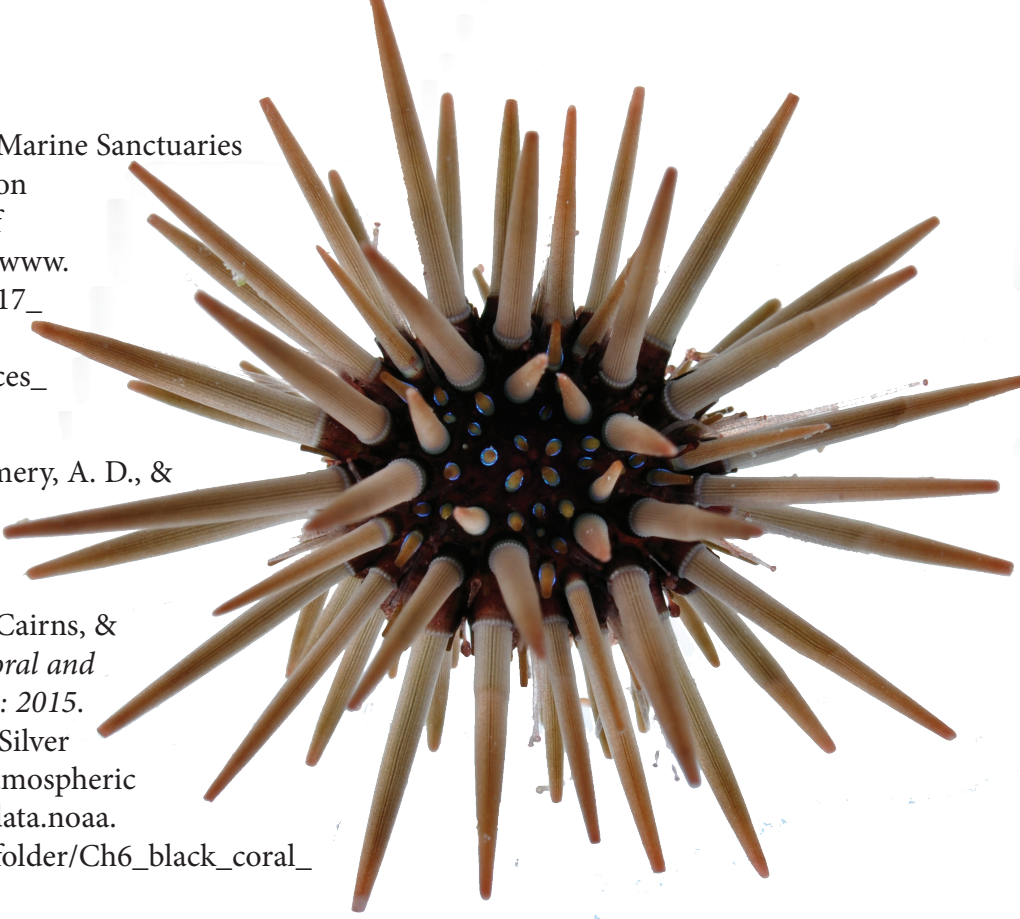
A juvenile horn shark observed during eelgrass surveys at Anacapa Island State Marine Protected Area, Santa Cruz Island. [Jessica Alstatt/NOAA](#)



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Pale rock-boring urchin (*Echinometra Mathaei*) collected by NOAA divers from an ARMS.  
Evan Barba/NOAA

## Magazines and Newsletters

### NOS

#### Gray's Reef National Marine Sanctuary

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Juvenile cubbyu  
(*Pareques umbrosus*).  
Greg McFall/NOAA





# Acronyms

ADCP: Acoustic Doppler Current Profiler

AAUS: American Academy of Underwater Sciences

ARMS: Autonomous Reef Monitoring Structure

AUV: Autonomous Underwater Vehicle

CCFHR: Center for Coastal Fisheries and Habitat Research

CCMA: Center for Coastal Monitoring and Assessment

CCR: Closed Circuit Rebreather

CINMS: Channel Islands National Marine Sanctuary

CO-OPS: Center for Operational Oceanographic Products and Services

CRCP: Coral Reef Conservation Program

DAN: Divers Alert Network

DOC: Department of Commerce

DLODO: Deputy Line Office Diving Officer

DMO: Diving Medical Officer

DMT: Diving Medical Technician

DOC: Department of Commerce

DSO: Diving Safety Officer

DUSA: Diving Unit Safety Assessment

EPA: Environmental Protection Agency

ESA: Endangered Species Act

FBI: Federal Bureau of Investigation

FGBNMS: Flower Garden Banks National Marine Sanctuary

FKNMS: Florida Keys National Marine Sanctuary

GC: General Counsel

GRNMS: Gray's Reef National Marine Sanctuary

LODO: Line Office Diving Officer

MBNMS: Monterey Bay National Marine Sanctuary

MNMS: Monitor National Marine Sanctuary

MOC: Marine Operations Center

MPA: Marine Protected Area

NCCOS: National Centers for Coastal Ocean Science

NCRMP: National Coral Reef Monitoring Program

NDC: NOAA Diving Center

NDCSB: NOAA Diving Control and Safety Board

NDCM: NOAA Diving Center Manager

NDP: NOAA Diving Program

NDSSM: NOAA Diving Standards and Safety Manual

NESDIS: National Environmental Satellite, Data, and Information Service

NMFS: National Marine Fisheries Service

NMS: National Marine Sanctuary

NMSAS: National Marine Sanctuary of American Samoa

NOAA: National Oceanographic and Atmospheric Administration

NOS: National Ocean Service

NWLON: National Water Level Observation Network

OAR: Office of Oceanic and Atmospheric Research

OGC: Office of General Counsel

OMAO: Office of Marine and Aviation Operations

ONMS: Office of National Marine Sanctuaries

PISCO: Partnership for Interdisciplinary Study of Coastal Oceans

PMNM: Papahānaumokuākea Marine National Monument

PORTS: Physical Oceanographic Real Time System

REEF: Reef Environmental Education Foundation

ROV: Remotely Operated Vehicle

SBNMS: Stellwagen Bank National Marine Sanctuary

SECD: Safety and Environmental Compliance Division

SEFSC: Southeast Fisheries Science Center

SCUBA: Self-Contained Underwater Breathing Apparatus

TBNMS: Thunder Bay National Marine Sanctuary

TED: Turtle Excluder Device

UDS: Unit Diving Supervisor

UHMS: Undersea and Hyperbaric Medical Society

USPHS: U.S. Public Health Service



# NOAA DIVING PROGRAM

Diving for Science and Technology



Unit Locations



<http://www.oma.noaa.gov/ndp>

 <https://www.facebook.com/NOAADivingProgram>