NOAA Diving Program

2011 Annual Report

31 December 2011

NOAA Diving Center
7600 Sand Point Way NE
Seattle, WA 98115

Summary

For over 40 years, NOAA divers have safely, efficiently, and cost-effectively collected data and performed tasks underwater in support of NOAA goals and objectives. Fiscal year 2011 was no exception.

FY11 continued to be a year of change and transition for the NOAA Diving Program (NDP) with the implementation of new standards, policies and procedures designed to increase safety and ensure compliance with federal regulations. Nine new policies were implemented, a new Working Diving standards and safety manual was adopted, and a new Diving Unit Safety Assessment (DUSA) program was initiated. This year, when compared to FY 2010, the Program experienced a 09% (44) decrease in the number of divers, a 01% (130) decrease in the number of dives performed, and a 05% (471) decrease in the total hours of bottom time logged by NOAA divers. These data do not include dives conducted by reciprocity partners which would have significantly impacted the totals in each category.

Of the total number of dives recorded (13,859), 71% (9,845) were classified as 'scientific,' 14% (1,971) were 'working,' and 26% (3,550) were 'training or proficiency' (see Chart 1). These data represent almost no change in the number of scientific dives, a 12% decrease in working dives compared to FY10, and a 09% decrease in training and proficiency dives. Should the proposed alternate diving standards, currently under review by OSHA, be approved, the Program may see an increase in the number of working dives performed each year due to the lessening of restrictions on Nitrox breathing mixtures and the ability to conduct working dives without a chamber on site.

From a safety standpoint, a total of five (5) diving-related incidents were recorded via the SECO on-line accident/incident reporting system. Of these, one involved oxygen toxicity and arterial gas embolism, two involved decompression sickness, one was a trauma (bite) from a marine animal, and there was one near-miss (reciprocity diver regulator hose failure). Fortunately, all incidents were managed effectively with divers suffering no permanent signs or symptoms. The incident-free dive rate for FY11 was 99.97%, matching that of FY10.

None of the aforementioned diving incidents were the result of missing or faulty diving equipment. Much of the credit for this statistic goes to the maintenance performed on all diver-worn gear issued by the Program's Standardized [Diving] Equipment Program. All 'life-support' components are serviced on an annual basis by certified technicians. This excellent equipment safety record is even more impressive considering over 1,100 pieces of gear are serviced annually.

The training of NOAA divers continues to be one of the hallmarks of the NDP. The three-week 'Working Diver' course continues to set the standard for the training of occupational divers as seen by the continuous requests to attend this training by other federal, state, and local government agencies.

Presented in this report are highlights of some significant events and achievements accomplished by NOAA divers during fiscal year 2011.

Table 1: FY11 Line Office Diving Summary

Line/Staff Office	Divers	Dives	Bottom Time (Hours)
NMFS	167	7,339	4,689.1
NOS	151	4,855	2,701.7
OMAO	95	1,603	738.1
OAR	9	59	38.8
OOC*	1	3	1.1
TOTALS	**423**	**13,859**	**8,168.8**

* NOAA's Office of Communication employs a public relations diver who supports all other Line Offices

National Marine Fisheries Service (NMFS)

The National Marine Fisheries Service (NMFS) supports 17 diving units across all regions of the country. As in previous years, the Pacific Islands and Southeast Fisheries Science Centers had the highest tempo of diving activity, although critical projects were completed in all regions. NMFS continued to lead other Line Offices (LOs) in the number of divers (167), the number of dives (7339) and the amount of bottom time (4689 hours) (Table 1). Scientific dives outnumbered working dives nearly two to one. Direct observation and sample collection, habitat restoration, collection of telemetry data, ship husbandry, public outreach, and safety training were some of the categories under which diving activities were conducted this year. A heightened awareness of, and attention to, safety exemplified by diving skills training, rescue drills, fitness tests and check-out dives for new equipment and techniques were important factors contributing to a year without any significant diving injuries to NMFS divers.

Administrative task loading on Unit Diving Supervisors (UDSs) continues to increase with this trend likely to persist in FY 2012 as the Dive Unit Safety Assessment (DUSA) inspection program becomes fully operational. Two NMFS units served as test beds for the DUSA with inspections in 2011. The lessons learned during these inspections helped improve the functionality of the DUSA program. Several NMFS UDSs participated in the Scientific Diver Trainer program for certifying new scientific divers. This will ensure all future locally trained divers have a standardized skill set and level of training. The establishment of a LODO budget by NMFS HQ in FY2010 has allowed units to request and receive upgrades of safety equipment and most requests were met in FY2011. It is hoped the FY2012 budget will allow the completion of the safety upgrades.

The largest number of NMFS dives was in support of the Coral Reef Conservation Program (CRCP). Habitat conservation, fishery independent monitoring, and coral restoration were other significant beneficiaries of diving activities.

An abbreviated list of the species studied includes: pinto 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. Over 20 peer reviewed publications and numerous presentations at national and international scientific meetings were made possible by data collected by NMFS divers.

Near Juneau, AK, divers at the **Auke Bay** diving unit supported two major coral-related projects: the continuation of a growth and survival study on shallow water gorgonians which have been subjected to simulated trawl disturbance; and a new project on the reproductive ecology of deep-sea red tree corals in glacial fjords. Visiting divers from the NOS/Channel Islands National Marine Sanctuary (NMS), the University of Maine, and the University of Hawaii participated in these projects which resulted in several reports that were published in peer-reviewed scientific publications. Dive support was given to outreach projects designed to educate the public, particularly children, about the oceans and living marine resources.

Divers in the **Galveston, TX** unit primarily operated in the US Caribbean supporting conch, reef fish, and coral projects. One project involved tag-and-recapture studies and sonic tracking of conch; another examined fish behavior in and escapement from fish traps; and a third determined productivity of staghorn coral (*Acropora cervicornis*) habitat and impacts from natural and human disturbance. There were cooperative research projects with the University of the Virgin Islands and the St. Thomas Fishermen's Association that will result in contributions to NOAA Fisheries Southeast Regional Office (SERO) and Caribbean Fishery Management Council (CFMC) stock assessments and will form the basis for scientific publications.

The largest unit in the NOAA Diving Program is located in **Honolulu, HI**. NOAA divers in this unit completed numerous projects in 2011. Dive supported Rapid Assessment and Monitoring Program (RAMP) cruises were completed at Wake Island, Guam, Northern Marianas Islands, and the Northwestern Hawaiian Islands. The marine debris removal program removed 10,000 lbs. of debris in the Northwestern Hawaiian Islands. In Guam and the Northern Marianas Islands, NOAA divers cooperated with local government divers along with the US Fish and Wildlife Service (USFWS) on surveys of Apra Harbor and surrounding areas in preparation for the US military relocation from Okinawa. Assistance was provided in the training of technical divers for the Papahānaumokuākea National Marine Monument. Data collected from additional surveys and instruments have been published in a variety of peer reviewed scientific journals and are utilized by local governments to make management decisions.

The NMFS diving unit located in **Kodiak, AK** continued to study red king crab habitat use and other aspects of crab behavior by utilizing acoustic tags, an array of remote acoustic receivers, and diver observations. A larval settlement study required divers to recover 80 collectors deployed in four local bays. In addition, two crab habitat surveys were conducted in remote bays in conjunction with a multi-agency crab enhancement effort. Divers also collected marine organisms for other researchers and the laboratory's interpretive displays, which had over 12,000 visitors in 2011. Dive support was also

provided to the Alaska Department of Fish and Game in recovery of remote acoustic receivers and temperature monitors.

The dive team in **La Jolla, CA** focused on outreach, gear testing and training this year. Divers volunteered at the Birch Aquarium educating the public on kelp forest communities, provided safety divers for an underwater camera testing project and conducted biannual checkout dives and rescue training.

The **Miami, FL** Unit is supported by reciprocity divers from Rosenstiel School of Marine and Atmospheric Science (RSMAS), Cooperative Institute for Marine and Atmospheric Studies (CIMAS), Florida Fish and Wildlife Conservation Commission's Fish and Wildlife Research Institute (FWRI), National Park Service (NPS), and other American Academy of Underwater Sciences (AAUS) organizations. Approximately 3000 dives were completed in support of seven major projects in the south Florida area in 2011. NOAA divers from the NMFS lab in Miami made 1427 of these dives. These figures clearly illustrate the importance of reciprocity diving to the NOAA Diving Program. The collection of data from diving is critical to monitoring reef fish populations and for coral and habitat assessment. Fishery independent stock assessments for commercially important species, such as the snapper-grouper complex, and endangered species research on staghorn and elkhorn coral have proven to be invaluable for management purposes including status assessment, recovery planning, and critical habitat designation. Seven peer-reviewed scientific publications and numerous technical memos, reports, and presentations resulted directly from diving activities.

NOAA Divers from the Fisheries dive unit in Miami participate in a joint NOAA / U.S. Coast Guard diver rescue drill. Photo courtesy of the U.S. Coast Guard.

Diving conducted out of the **Milford, CT** unit is centered on scientific surveys, ship husbandry, maintenance, and training. An ongoing bay scallop project was continued in conjunction with the Stonington, CT Shellfish Warden, visual census dives for nutrient studies were conducted in Great Bay, NH (in cooperation with US EPA), and eelgrass monitoring dives were made in Gloucester, MA. Samples were also collected for an ongoing dinoflagellate cyst survival experiment. Support dives were also 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, RI.

Diving activities conducted by the **Panama City** unit in northern Florida focused on gear testing, scientific support, and ship husbandry.

Gear testing projects included evaluation of behavior modification of fishes during AUV surveys in conjunction with the SWFSC and trawl survivability of hydrophones for the US Navy. An ongoing reef fish visual census will be expanded in the upcoming year. Ship husbandry diving has provided significant cost and time savings to Panama City and other SEFSC vessels. Maintenance of aquaculture systems and sea turtle holding pens have also benefited NOAA programs while producing cost savings.

The **Pascagoula, MS** unit continued to develop and evaluate prototype Turtle Excluder Devices for shrimp trawl and fish trawl fisheries. The unit expanded their work with by-catch reduction devices for the shrimp trawl fishery and was heavily involved in an international cooperative project evaluating lightweight shrimp trawls for the Mexican shrimp trawl fishery in an effort to reduce dolphin by-catch mortality. Another project involved evaluation of trawl survivability of underwater acoustic sensors for the US Navy. This unit conducts some of the most physically demanding dives in the NOAA Diving Program due to the difficulty of working on operating trawls at speeds approaching 3 knots.

The mission- of the **Sandy Hook, NJ** dive unit is threefold: support of fisheries research projects; maintenance of the research vessel (R/V) *Nauvoo* and the seawater intake system of the James J. Howard Marine Sciences Laboratory; and public outreach and education of the local community.
However, dives were not conducted this year due to a retirement from the dive team which left it short-staffed; a lack of research projects requiring dive support; and dry docking of the R/V *Nauvoo*. Multiple topside training exercises, as well as classroom training activities were conducted and divers gave presentations, on their own time, describing their operations, research goals, and techniques to local dive clubs and a high school class in the New Jersey area. These presentations raised awareness and support of the Sandy Hook Lab and the NOAA Diving Program.

The northern California unit in **Santa Cruz** completed several significant projects in 2011 related to rockfish. The Monterrey rockfish recruitment study monitors juvenile rockfish populations to help predict the number of adults available to the fishery in future years and to determine timing of settlement and overall health of the populations. The UDS recruited several groups of volunteer divers to assist with this project. A rockfish community assessment survey was completed which included enumerating and identifying all habitats, algae, and animals in the transects. Additionally, juvenile rockfish were collected using a mini pole spear and a Benthic Ichthyofauna Net for Kelp Environments (BINKE) for a variety of analyses. Collaborations were made with several civilian diving associations (REEF, BAUE, Central California Diving Council), universities (UC Santa Barbara, UC Santa Cruz, Cal State University-Monterey Bay) and governmental organizations (National Marine Sanctuaries, Cal. Dept. Fish and Game).

The **Santa Rosa** diving 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 and juvenile salmonids and sturgeon. This includes recording fish habitat and behavior data

near fish screens via visual observations and video or still photography, and deployment and retrieval of fish monitoring equipment.

Projects this year focused on the Sacramento and American Rivers. Significant cost savings resulted from these operations as NMFS divers assisted water users by identifying potential problems with their screens helping to prevent damage to the structures and/or pumps, potentially saving water users thousands of dollars. Dive training activities this year included line tending, RASS competency, diver rescue, and basic dive skills exercises.

Most diving conducted by the **Seattle (Montlake), WA** unit was in pursuit of fisheries related research and included fish & habitat surveys, specimen collection, installation, retrieval and replacement of acoustic monitoring equipment, ship inspection, and inspection and maintenance of the water intake system at the Mukilteo lab. Specific projects included six gill and seven gill shark movement behavior; lingcod egg collection, marine mammal research, impact study of introduced eelgrass, pinto abalone restoration, and acoustic tracking technology comparisons. Ship husbandry dives were completed during the Pacific Hake Acoustic Survey and maintenance of the saltwater intake system at the Mukilteo Field Station supported numerous research projects. Three peer-reviewed scientific publications resulted directly from diving projects. All dives were completed by NOAA divers except for the pinto abalone project, which was a collaboration with the Washington State Department of Fish and Wildlife (WDFW).

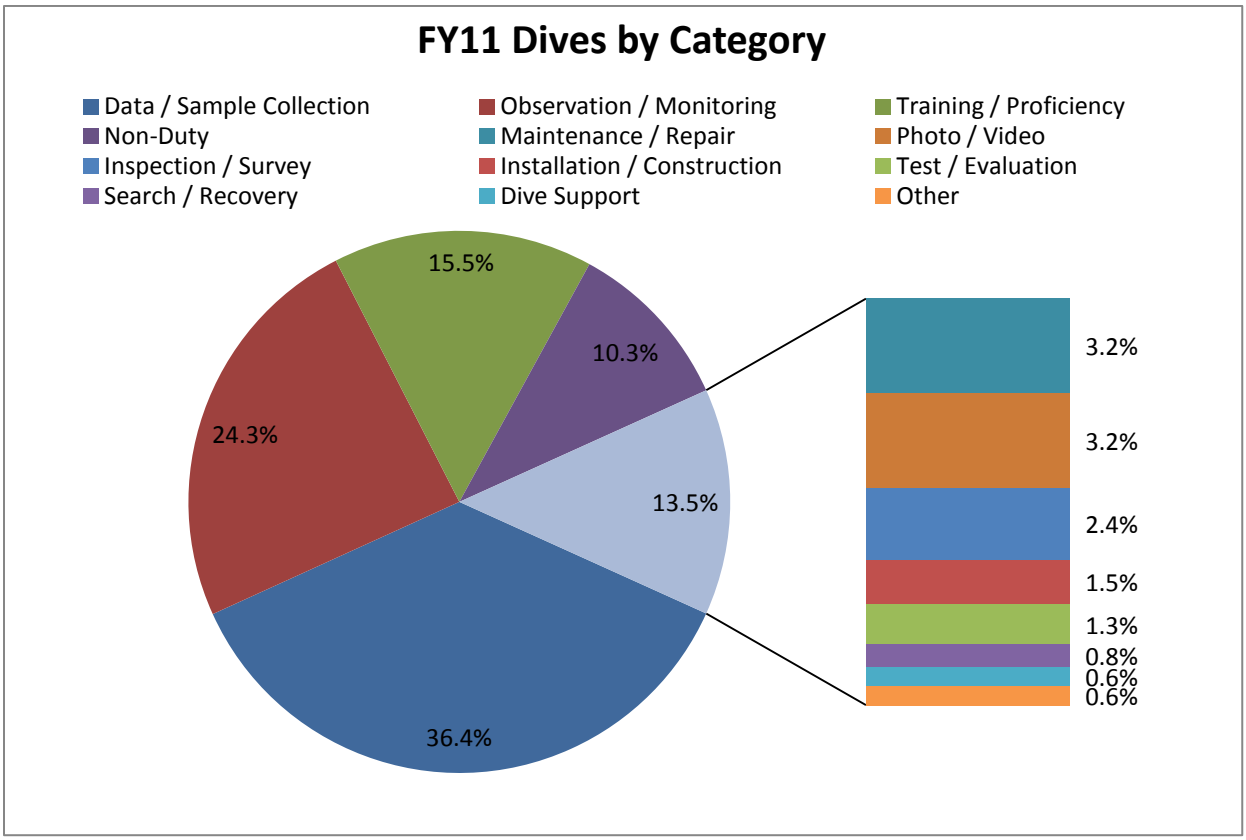


Chart 1 – Fiscal year 2011 dive percentages by category

The NMFS diving unit in **Seattle (Sandpoint), WA** focuses on fisheries and marine mammal research support. There were no projects requiring dive support this year and there was attrition in the diving unit. However, maintaining dive capability is warranted as having to reconstitute a unit would not likely meet the response time needed in the event dive support is required. Training dives were conducted with the NOAA Diving Center, co-located on the campus with this unit.

The **Silver Spring, MD** unit has divers from multiple line offices (Fisheries, NOS, OAR, OMAO, 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 across these line offices. The unit continued to combine divers with two other Silver Spring-based units for the required semi-annual training sessions, consisting of classroom refresher training, underwater checkout skills, and annual watermanship assessments. These training sessions have proved to be very successful bringing the various divers together and have shown to be a useful training tool. Two significant projects involved deploying reef balls to provide oyster habitat and conducting site surveys for an oyster restoration project in the Magothy River, Chesapeake Bay.

The main mission of the central Florida NMFS unit, located in **St. Petersburg**, is to conduct emergency response and restoration using diving in support of Natural Resource Damage Assessment (NRDA) cases such as ship groundings, oil spills, chemical spills and other catastrophic events under the jurisdiction of the Office of Response and Restoration and the Restoration Center. This year, projects included removal of vessel debris from *Cayo Ron* in Cabo Rojo, Puerto Rico, coral recruitment monitoring at Margara and Sperchios grounding sites, post-restoration monitoring at the LNG-C *Matthews* grounding site, expansion of Acropora coral nurseries in PR and the VI, class instruction for Scientific and Scientific Volunteer divers in Puerto Rico, and inspection and survey of marine debris sites on east coast of Florida. The unit has also continued to provide guidance for responders to the Maritime Safety Committee (MSC) 252/ Deep Water Horizon (DWH) Oil Spill and to provide advice and oversight to a variety of Marine Debris Restoration projects in the US Pacific/ Hawaii, as well as guidance for derelict fishing gear and lobster and crab trap removal.

National Ocean Service

This year 151 NOAA divers from the National Ocean Service (NOS) conducted 4,542 dives (see Table 1) in support of NOAA's mission. The NOS diving units exist within three different program offices: the Center for Operational Oceanographic Products and Services (CO-OPS), the National Centers for Coastal Ocean Science (NCCOS), and the Office of National Marine Sanctuaries (ONMS). The diving activities that occurred under these program offices are highlighted below.

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

The mission of CO-OPS is to provide 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.

The **Field Operations Division (FOD)/Atlantic Region Office (ARO)** divers based out of Norfolk, Virginia maintain the National Water Level Observation Network (NWLON) of tide wells along the entire eastern seaboard and in the Great Lakes region. This year they completed 54 inspections and repairs of wells and intakes, replaced inverted cones, plates and clamps.

Within the Great Lakes region there are a total of 56 stations which required repair and jetting of the underwater intake pipes attached to well sumps. In Puerto Rico, lift bags were used to help install new brass plates to a well in San Juan. In Culebra, divers removed a well from a pier damaged by a hurricane and reinstalled the well and station on a different pier.

Many diving units within NOS, as well as divers from other line offices, made a huge effort to remove invasive lionfish from the waters of the southeast U.S. and the Caribbean during FY 2011. (Photo credit – Brenda Altmeier)

In addition to maintenance of the NWLON infrastructure, the **FOD/ Pacific Region Office (PRO)** divers are responsible for the National Current Observation Program (NCOP), which includes the Physical Oceanographic Real Time Systems (PORTS) and NWS Tsunami Warning Center infrastructure. The NWLON and the NCOP data also provide tidal and current predictions used by the entire maritime community. This unit, based out of Seattle, Washington, installed a special tide and weather station sponsored under an international agreement between the US and Barbuda, and maintained a short term station in Mare Island, CA to support hydrographic surveys being conducted in the area and another in Bolinas Lagoon, CA to support tidal datum determination and sea level trend.

National Centers for Coastal Ocean Science (NCCOS)

The mission of NCCOS is to support achievement of NOAA's coastal missions by providing cutting–edge research, scientific information, and tools that help balance ecological, social, and economic goals.

The **Center for Coastal Monitoring and Assessment (CCMA)** meets NCCOS's goals by assessing and forecasting coastal and marine ecosystem conditions through research and monitoring. By conducting field observations on regional and national scales, the center provides the best available scientific information for resource managers and researchers. This year, CCMA divers based out of Silver Spring, MD conducted research to spatially characterize and monitor the distribution, abundance, and size of both reef fishes and macro-invertebrates relating this information to in-situ fine-scale habitat data and the spatial distribution and diversity of habitat types using benthic habitat maps.

In support of watershed restoration and in collaboration with many partners, dives were conducted in Guanica Bay, Puerto Rico to develop a baseline assessment of biological resources chemical contaminants, nutrients and sedimentation rates, prior to proposed restoration activities. The dive crew had the unusual experience of a 35 lb. king mackerel jumping out of the water, catapulting itself high into the air and landing head first onto the dive boat. They also conducted a baseline assessment of fish and benthic community structure to support an experimental fishery closure at the Flower Garden Banks National Marine Sanctuary.

The responsibilities of the **Center for Coastal Fisheries and Habitat Research (CCFHR)** are to address the impacts of global climate change on ecosystems in the coastal ocean, provide scientific guidance to preserve and restore NOAA trust resources, and implement integrated ecosystem assessments of key and accessible ecosystems of importance to the nation. Divers from the Beaufort, NC CCFHR facility supported Gray's Reef NMS with dives to begin documenting the differences between natural and human-induced changes to the natural communities within the Sanctuary, and by inference, in similar habitats outside the Sanctuary. Data from diver surveys provide a detailed census of live-bottom fish and benthic community structures, offer information on population stability, and also a template for additional comprehensive sampling. Divers conducted fish and habitat community assessments on North Carolina shipwrecks in the "Graveyard of the Atlantic" studying World War II era shipwrecks off the coast of North Carolina. In addition to being cultural resources, these shipwrecks attract a wide diversity of fishes, invertebrates and algal species. Divers conducted fish and benthic community surveys and placed temperature sensors on five shipwrecks. Research teams from the FGBNMS, NCCOS, and the Cooperative Institute for Ocean Exploration Research and Technology (CIOERT) made dives on the Flower Gardens Banks NMS to evaluate the utility of an experimental fishing closure.

NCCOS's **Center for Sponsored Coastal Ocean Research (CSCOR)** is responsible for providing the highest quality research in support of coastal management decisions through competitive, peer-reviewed research and holistic ecosystem studies. CSCOR also participates with other NCCOS centers and other parts of NOAA in collaborative field research activities as appropriate. Though budget constraints severely restricted travel, divers from this group maintained proficiency through regularly scheduled proficiency dives and their continued diving support of the Magothy River Oyster Restoration Program.

Office of National Marine Sanctuaries (ONMS)

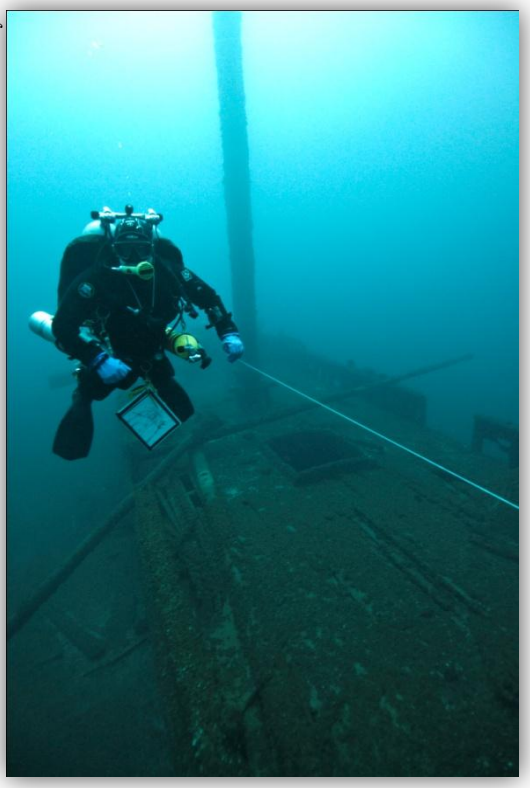
The Office of National Marine Sanctuaries (ONMS) mission is to serve as trustee for the nation's system of marine protected areas and to conserve, protect, and enhance their biodiversity, ecological integrity and cultural legacy. ONMS manages 13 sanctuaries and one marine national monument encompassing more than 150,000 square miles of U.S. oceans and the Great Lakes.

In the Northeast Region of Lake Huron, **Thunder Bay NMS** divers and archaeologists located at Alpena, MI partnered with divers from the University of North Carolina at Wilmington, and University of North Carolina Coastal Studies Institute to conduct decompression Trimix dives to document historic schooners and steamers in 130-220 feet of water in Lake Huron. The intent of these dives was to create photo-mosaics and conduct photo documentation of several shipwrecks sites. Thunder Bay NMS staff

also partnered with members of the National Association of Black SCUBA Divers (NABS) to document the wreck of the *Montana*. The project included a conservation overview and multi-beam remote sensing surveys.

At **Stellwagen Bank NMS** located at the mouth of Massachusetts Bay, dive operations focused on archaeological site investigation and monitoring and habitat studies. Dives were made on the National Register listed shipwreck *Paul Palmer* to further the site's archaeological and biological characterization.

Photo Credit – Tane Casserly



NOAA Divers at Thunder Bay NMS performing a baseline assessment on the 19th Century wreck *Defiance*.

Of particular note at this site was an immense population of longhorn sculpin, Atlantic wolf fish (a species of concern) and monkfish which have not been seen in the sanctuary since 2004. An archaeological remote sensing led lead to an unexpected find and first dive on an unidentified fishing vessel shipwreck. The vessel's wooden hull lays on its starboard side and is separated from its deck gear by a considerable distance. Divers located a large clam dredge at the site and ghost fishing gear was found entangled in the shipwreck's structure.

At the Office of National Marine Sanctuaries (**ONMS) headquarters** in Silver Spring, Maryland, divers from the ONMS hosted a joint research and education mission entitled *Aquarius 2010: If Reefs Could Talk*. The mission, sponsored by AT&T and the National Marine Sanctuary Foundation, brought the underwater world and the science of ocean conservation to the public via live internet broadcasts. Divers from this unit also supported the Muscle Watch Monitoring Program, a long term monitoring program focused on contaminates in bivalve populations around the country and run by NCCOS in the Great Lakes Basin and . This Program is a joint project between NOAA and the US Environmental Protection Agency. The unit also supported efforts to certify several individuals as NOAA Observer divers from partner organizations including the Smithsonian, National Geographic, and the Washington Post, as well as the Administrator of NOAA, Dr. Jane Lubchenco and the Director of Communications, Justin Kenney. It also certified three new volunteer Scientific Divers.

In the Southeast region of the ONMS, divers at **Gray's Reef NMS** in Savannah, GA conducted working dives to replace sensors on the National Data Buoy Center (NDBC) data buoy 41008, conducted dives in support of the ongoing acoustic fish tagging program, gathered critical baseline (time zero) data prior to establishment of the sanctuary's Research Area closure, deployed and recovered seafloor water sampling devices and supported AAUS partner institution scientific diving investigations.

At **Monitor NMS** (MNMS) headquartered in Newport News, VA, divers conducted the "Battle of the Atlantic" archaeological survey with field operations centered on an ongoing project to survey WWII shipwrecks associated with the Battle of the Atlantic. The primary survey sites were the wrecks of the *E.M. Clark* and the German submarine *U-701*, on which divers collected photomosaics, still images and hours of 3D high definition (HD) video. Additionally, five other WWII wrecks were investigated using similar means. MNMS also collaborated with NCCOS-CCFHR Beaufort to conduct baseline biological surveys at selected wreck sites off North Carolina and conducted a wreath-laying ceremony at the site of the *Dixie Arrow*.

In May of 2011, the Florida Department of Environmental Protection (FDEP) was granted Working Diver Reciprocity with NOAA. This has greatly increased the productivity and efficiency of diving operations within the **Florida Keys NMS** (FKNMS) as the Sanctuary is jointly managed by NOAA and FDEP. Divers from both the upper and the lower regions of the FKNMS surveyed numerous coral reef sites for the Florida Reef Resilience Program (FRRP) collecting valuable data to help biologists illustrate changes in the vitality and health of the Florida reefs over time. Divers also cooperated with the Ministry of Culture of the Government of Spain to examine and document historical Shipwrecks within the FKNMS.

Photo Credit – Bill Goodwin, FKNMS

NOAA and FDEP divers from the Florida Keys NMS install buoys that allow vessels to moor close to sanctuary resources, preventing damage caused by anchoring in sensitive areas.

Further to the West in the Gulf of Mexico, the **Flower Gardens Banks NMS**, Galveston, TX, divers conducted marbled grouper investigations, lionfish assessments, whale shark tagging and surveys, acoustic receiver deployment and recovery, fish and benthic baseline surveys, coral spawning research and marine debris surveys.

In the Western region, divers at **Channel Islands NMS**, located offshore of Santa Barbara, CA, were engaged in annual surveys of shipwrecks in support of regional cultural heritage, studies of behavioral ecology of fish including the monitoring of fish movement patterns, fish abundance, habitat characterization and fish/habitat associations. They also conducted dives for periodic scheduled maintenance and ship husbandry of the R/V *Shearwater*.

Up the coast to **Monterey Bay NMS**, located off the coast of central California, divers performed two research expeditions from the R/V *Fulmar*.

The purpose of these dives was to conduct qualitative subtidal fish, invertebrate, and algae surveys and to document nearshore subtidal habitat near Gorda, California, where a significant landslide, and

subsequent debris deposition by CalTrans, occurred during 2011. They also gathered scientific data from the West Coast Observatory moorings currently installed along the central California coast.

Across the Pacific to Hawaii, the **Papahānaumokuākea Marine National Monument (PMNM)** divers conducted annual expeditions to PMNM to survey, collect and document fish, benthic habitats, marine alien species, maritime heritage resources and environmental events. They also investigated shipwreck sites, performed ecological surveys and outreach/educational events, inspected vessel hulls for alien species, surveyed and collected marine alien species from reef, lagoon and harbor locations.

At the **Pacific Islands Regional Office**, based in Honolulu, HI, the NOAA bi-annual diver skills refresher training and diver rescue training were conducted. Six divers participated in observer diver certification training and six divers completed NOAA science diver certification training. Maritime heritage survey dives were also conducted for the assessment of submerged cultural resources in the main Hawaiian Islands.

NOS Technical Diving Team

NOS technical divers conducted missions in Thunder Bay with archaeologists from Monitor NMS, University of North Carolina at Wilmington, and University of North Carolina Coastal Studies Institute to document historic schooners and steamers in 130-220 feet of water in Lake Huron to create photo-mosaics and conduct photo documentation of several shipwrecks sites. Off the coast of North Carolina, technical diving was conducted for the first time since 2003 on the site of the Monitor in 230fsw. Divers conducted a detailed photo and video survey and documented the condition of the site, which revealed a higher than expected deposition of modern marine debris. Divers from ONMS and NCCOS also conducted photo-mosaics and biological assessments of the wreck of the E.M. Clark and conducted a photo video survey and collected 3D HD video of the German U-boat U-701. In the Flower Garden Banks NMS, divers from NCCOS and the Cooperative Institute for Ocean Exploration Research and Technology (CIOERT) conducted decompression dives to evaluate the utility of an experimental fishing closure. In Hawai'i, four new technical divers were trained and dives were conducted to survey mesophotic corals in the Papahānaumokuākea Marine National Monument.

Office of Oceanic and Atmospheric Research

The mission of the Office of Oceanic and Atmospheric Research (OAR) is to conduct research, develop products, provide scientific understanding and leadership and conduct outreach fostering the evolving environmental and economic mission of NOAA. OAR divers, scientists, engineers and technicians provide critical support in the design, testing, deployment, maintenance, and retrieval of oceanographic monitoring and data collection instrumentation. This includes the field testing of various new and novel underwater data collection systems deployed as primary components of major oceanographic programs.

In 2011, **Pacific Marine Environmental Laboratory (PMEL)**, in Seattle, WA supported the deployment of a MApCO2 O-A Great Barrier Reef monitoring buoy off of Heron Island, Australia. This action included the creation of a training curriculum for the start of an Australian buoy network. In addition PMEL divers: recovered gear for PMEL, the NOAA Diving Center, and various NOAA ships from around the Western Regional Center (WRC) pier; conducted multiple diving drills and training; collected marine debris from Lake Washington as part of Earth Day cleanup; and participated in NOAA Science Camp educating children on NOAA's mission.

The **Atlantic Oceanographic and Meteorological Laboratory (AOML)** in Miami, FL installed an Acoustic Doppler Current Profiler (ADCP) off of Cape Sable, FL. Divers also replaced current transponders and ADCPs in three locations along the west coast of Florida and the Florida Keys; replaced and/or maintained coral reef monitoring instrumentation associated with Coral Reef Early Warning Systems (CREWS) in St. Croix, Puerto Rico, and Little Cayman and turbidity monitoring instrumentation in Biscayne Bay, FL; recovered a thermistor array and conducted site surveys for potential ADCP locations off of Hollywood and Boca, FL associated with Florida Area Coastal Environments (FACE); assisted Southeast Fisheries Science Center with Florida Keys reef fish monitoring; and conducted reef fish surveys in cooperation with the University of Miami and the Florida Fish and Wildlife Service.

Office of Marine and Aviation Operations

NDC Manager Douglas Schleiger helps students communicate with NOAA Diver Zach Hileman during the 2011 NOAA Science Camp. (Photo credit – Celestia Mayasleca)

The **NOAA Diving Center (NDC),** located in Seattle, WA, assists in establishing standards and procedures and investigating and implementing new diving technologies and techniques. The NDC is responsible for training and certifying NOAA divers, providing educational outreach, and supporting field operations with equipment, personnel, and expertise. The majority of dives conducted by NDC divers involved training NOAA and other government agency (EPA, NAVY civilian) divers. NDC divers also conducted surface-supplied and chamber dives in support of the NOAA/UHMS Physician's Training in Diving Medicine course. Other dives included equipment testing (a low SCUBA cylinder pressure warning prototype, a heads-up display facemask, an alternate BCD model that could be used for tethered communications integration) and public outreach via tethered comms diving for NOAA Science Camp.

Finally, NDC divers provided field support to NOAA Ship *Hi'ialakai* as support divers and chamber operators along with supporting five NOS Special Dive Operations with the use of the SOS Hyperlite Hyperbaric Stretcher and Treatment System. They also retrieved two moorings deployed by the Olympic Coast National Marine Sanctuary off the Washington Coast in support of their research which had been fouled in dense sediment. This effort saved tens of thousands of dollars of instrumentation along with recovering a full year worth of recorded data.

Fleet Highlights:

All vessel-based diving units conducted hull inspections and performed ship husbandry tasks (such as sensor and transducer installation and maintenance) to ensure vessel readiness in-port and while underway. These operations allow the Command, crew, and scientific personnel to make direct observations to determine the condition of the hull, propellers, and other underwater hardware at a fraction of the cost of hired commercial diving operations. Additionally, many ships require divers for mission support including sensor calibration for fisheries vessels, object verification, and tide gauge installation/removal for the hydrographic vessels.

A NOAA diver prepares a pneumatic scientific instrument for installation on the sea floor. (Photo credit – Mike Gonsalves)

Divers aboard the NOAA Ship *Okeanos Explorer* were able to replace the ship's Ultra-Short Baseline (USBL) transducer cable, thereby averting the need for the ship to be placed into emergency drydock. The *Okeanos Explorer* crew noticed a slight oil sheen that appeared to be originating from the ship under the waterline. Over the course of multiple dives under the ship, divers were able to isolate the source of the oil leak and facilitated an efficient cessation of the leak. While operating 200 nautical miles northwest of the Galapagos Islands, the ship's fishing gear became entangled in the ship's running gear. Ship divers were deployed and able to clear the entangled gear saving mission time and avoiding costly offshore tug costs in international waters.

While conducting a benthic trawling off of the NOAA Ship *Henry Bigelow*, the trawling gear snagged on the bottom, ripped, and became fouled in the ship's running gear during recovery. The ship was towed into protected waters near Newport, RI where the ship's divers were able to unfoul the fishing gear from ship's propellers allowing the ship to successfully complete the cruise.

The NOAA Ship *Oscar Elton Sette* operates within the borders of the Papahānaumokuākea Marine National Monument. As a condition of attaining the necessary permit to operate there, the ship's hull must be inspected and cleaned on a regular basis by divers. The NOAA divers aboard *Oscar Elton Sette* provide a cost effective alternative to hiring commercial divers to perform this required task.

Divers aboard the NOAA Ship *Rainier* are essential to the hydrographic mission of the ship. They install tide gauges used for the gathering and eventual dissemination of accurate, real-time tide data to mariners. When a potential obstruction is identified using multibeam or sidescan sonar, *Rainier* divers are deployed to investigate the obstruction in order to obtain a more detailed assessment of the situation. This additional data is crucial for the safe navigation of all vessels transiting the area as well as the gear deployment of fishing vessels.

NOAA Divers stationed aboard the NOAA Ship *Rainier* work to install a tide gauge. (Photo Credit – Mike Gonsalves)


NOAA DIVING PROGRAM
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