Annual Report

NOAA Diving Program

2009

This report highlights some of the significant events and achievements accomplished by NOAA divers throughout the world during fiscal year 2009. Statistically FY09 was a very safe and productive year for the NOAA Diving Program (NDP). A total of 13,430 dives were conducted by 486 divers, accumulating 8,149 hours of dive time with only two minor dive-related injuries requiring basic first aid and no cases of decompression sickness.

Diving operations were conducted by NOAA divers and reciprocity partners across the globe, from the Red Sea to Alaska, Rhode Island to Wake Island, the Gulf of Mexico to the Gulf of California, and the Caribbean to Puget Sound. Numerous technical reports, peer-reviewed publications and presentations at national and international scientific meetings were made possible by data collected during these operations.

FY09 was a year of change for the NDP with the implementation of many new standards, policies and procedures that ultimately resulted in a safer, more compliant diving program that will set the standard for other programs to follow.

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National Marine Fisheries Service

The 17 diving units within National Marine Fisheries Service (NMFS) supported a wide range of projects in all regions of the country during FY09. The largest number of dives were conducted in the Pacific Islands and Southeast Fisheries Science Centers; however critical projects were completed in all other regions as well.

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

The pace of diving operations increased over FY08 levels. The sharpest increase was in training dives as a semi-annual requirement was initiated for basic diving skills and rescue drills. Numerous divers received training in the new Reserve Air Supply System (RASS). Increases to manning requirements created challenges for many units and necessitated increased reliance on intra-agency cooperation and reciprocity partners for support of NMFS diving activities.

A brief synopsis of each diving unit's activities follows:

The **Auke Bay** unit began a project evaluating growth and survival of shallow corals after trawl disturbance and continued several projects on life history (corals and sponges), mapping (eelgrass), and stock enhancement (salmon post-release behavior). The majority of the **Galveston** Unit's diving was focused in the Caribbean with projects on the recovery of conch populations in the U.S. Virgin Islands (USVI), and productivity and disease in Acropora corals in the northern Caribbean. A cooperative project at the Flower Garden Banks National Marine Sanctuary was also conducted with Texas A&M.

Honolulu dive operations continued at a high level in 2009. Rapid Reef Assessment and Monitoring Program cruises were completed to Wake Island, Guam, the Northern Mariana Islands, and the Northwestern Hawaiian Islands (NWHI). 80,000 lbs of marine debris was removed from the NWHI. Deep (200+ feet) surveys were completed on mesophotic coral reefs in the NWHI, Kauai, and Maui. Closed circuit rebreather evaluation dives were also conducted. Data collected from many of these surveys were published in a variety of peer reviewed scientific journals.

Kodiak began the second year of a settlement study on red king crab as a prelude to a possible stock enhancement program. General research on life history and habitat use of red king and tanner crab continues.

The **La Jolla** unit completed the Point Loma Gastropod density and movement survey, as well as a temporal dynamics study of giant seabass and other indigenous fishes survey in the La Jolla Ecological Reserve (the latter in collaboration with Scripps Oceanographic Institute). Significant efforts were also made in the Gulf of California on grouper spawning aggregations.

Long Beach continued to support habitat conservation related activities through monitoring of seagrass, kelp and rocky reef habitats. Results of seagrass surveys, which were shared with the Morro Bay National Estuary Program and the US Army Corps of Engineers, helped support Quality Analysis/Quality Control determinations of mitigation efforts.

Projects at the **Miami** laboratory utilized data from over 3,600 dives in 2009. Roughly 1,500 of these dives were conducted by NOAA divers with the remainder completed by reciprocity divers from a variety

of academic and governmental agencies. The majority of projects were conducted in the Florida Keys (including the Dry Tortugas), however a significant project was also completed off Navassa Island in the Caribbean. Fishery independent surveys of reef fishes and studies of all aspects of coral biology were the primary goals. Five peer reviewed publications and two technical memoranda resulted from diving supported activities.

Milford and several associated sub-units conducted operations in support of NOAA's mission this year, including bay scallop collections in cooperation with the U.S. EPA and the Stonington, CT Shellfish Warden. Other dive operations included aquaculture support, search and recovery of lost gear, installation and maintenance of acoustic arrays in Narragansett, RI and ship husbandry on several vessels.

The **Panama City** unit supported fishery research into sub-adult reef fish in the northern Gulf of Mexico and snapper spawning aggregations near the Dry Tortugas. Significant cost savings were achieved via underwater maintenance of an aquaculture facility and ship husbandry projects. Support was also given to U.S. Navy collaborative projects.

Gear testing and evaluation were the focus of most diving activities by the **Pascagoula** unit. Bycatch reduction in trawls, turtle escapement, gill net designs, and an evaluation of hook guards on bottom longline gear were the most significant projects.

Sandy Hook divers fulfilled three primary missions in 2009: support of fisheries research programs, ship husbandry on laboratory vessels and maintenance of aquaculture facilities and public outreach.

The **Santa Cruz** unit completed several community assessments and the 26th consecutive annual recruitment survey of rockfish off central California. This survey resulted in a presentation at an international meeting and publications in peer-reviewed literature. Cooperation with academic and volunteer Reef Environmental Education Foundation (REEF) partners helped fill gaps in surveys caused by the new manning requirements.

The **Santa Rosa** unit documented conditions in riverine and estuarine habitat and evaluated structures which may negatively affect adult or juvenile salmonids and sturgeon. The unit also completed a survey of invasive kelp (Undaria) in San Francisco Bay.

The **Seattle Sandpoint** unit continued its fisheries and marine mammal research support. A lack of project funding curtailed dive support and most diving activities were conducted for rescue and training purposes.

The **Seattle Montlake** unit focused on three research areas in 2009: a lingcod movement study, analysis of sixgill shark movement; and installation of an antennae array to track PIT tagged salmon. Significant ship husbandry, aquaculture maintenance and specimen collection for outreach activities were also completed. NOAA Diving projects were essential to five scientific publications this year.

With assistance from divers from other NOAA line offices, the **Silver Spring National Marine Fisheries Service unit** conducted a wide variety of operations this year. These included coral assessments in Puerto Rico, Hawaii, and the Red Sea, oyster restoration in the Chesapeake Bay, buoy recovery, and underwater filming for a recruitment video for the Office of Marine and Aviation Operations (OMAO).

The **St. Petersburg** Unit's mission was primarily emergency response and restoration for ship groundings in the southeast U.S. and the Caribbean. Mapping restoration needs at the Magara Site, coral damage triage in San Juan and site designation and inspection for coral nursery projects in the Florida Keys and US Virgin Islands were also completed.

During FY09, 197 NMFS divers conducted 7,301 dives (Table 1).

Table 1: FY09 NOAA Diving Activity

	Divers	*Dives*	*Bottom Time (hours)*
NMFS	197	7301	4980
OAR	12	157	74
NOS	171	4538	2446
OMAO	106	1434	649
TOTALS	**486**	**13430**	**8149**

Ocean 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 towards 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.

Pacific Marine Environmental Laboratory (PMEL) and **Atlantic Oceanographic and Meteorological Laboratory** (AOML) units provide diver services as a collateral duty to their scientific and administrative assignments.

The PMEL unit conducted dive support for moored autonomous pCO_2 ($MapCO_2$) systems; Ocean-Acidification mooring in Australia; Deep-Ocean Assessment and Reporting of Tsunamis (DART) buoy development, testing, inspection and mounting of line mounted current meters, implementation and testing of new diver rescue system aboard R/V *HAYES*; inspection of Western Region Center (WRC) moorings, recovery of lost equipment from WRC piers, NOAA Diving Center (NDC) tower cleaning, line tending training and RASS familiarization. PMEL divers also supported other offices on the Western Regional Center campus and assisted with NDC classes.

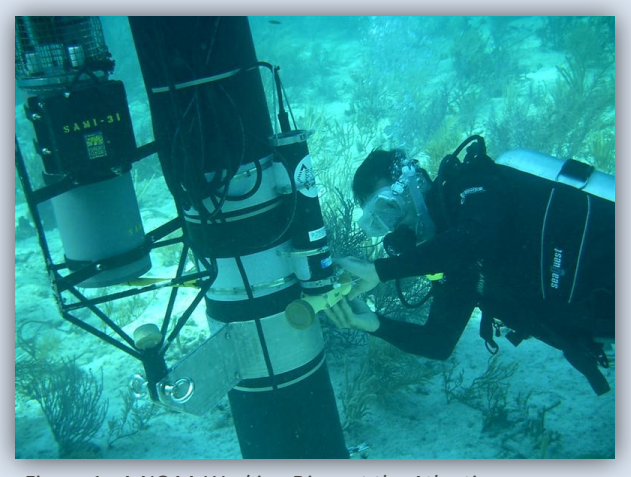

Figure 1: A NOAA Working Diver at the Atlantic Oceanographic and Meteorological Laboratory adjusts a fluorometer at a CREWS station.

PMEL scientists and engineers conducted inspections and testing of various underwater systems. Current meter testing revealed a previously unknown defect in the instrument firmware. Dive support

for MapCO2, Ocean-Acidification mooring in Australia was performed at the request of the Australia Institute of Marine Sciences (AIMS) to oversee/advise on the installation of a coastal coral reef monitoring buoy. This oversight allowed AIMS and University of Queensland divers to maintain the mooring on their own.

The AOML unit installed oceanographic and meteorological equipment on the Coral Reef Early Warning Systems (CREWS) pylon in Little Cayman (see Figure 1), installed an Acoustic Doppler Curent Profiler (ADCP) sensor package in Port Everglades channel to measure current flow, deployed a moored autonomous pCO2 (MapCO2) buoy at La Parguera, PR to monitor/assess effects of ocean acidification on coral reefs (with PMEL, Coral Reef Watch Program and University of Puerto Rico). The AOML unit also assisted Southeast Fisheries Science Center with Florida Keys reef fish monitoring, and recovered two ADCP instruments and stands.

During FY09, 12 OAR divers conducted 157 dives (Table 1).

National Ocean Service

The 14 sites across the National Ocean Service (NOS) conducted a variety of activities this year. Divers from the National Centers for Coastal Ocean Science (NCCOS) accomplished a wide variety of tasks. The mission of the Center for Sponsored Coastal Ocean Research (CSCOR) is to provide the highest quality research in support of coastal management decisions through competitive, peer-reviewed research and holistic ecosystem studies. Among the activities in which CSCOR engaged this year were the Hawaii Coral Reef Initiative Research Program, National Coral Reef Institute (NCRI), Coral Reef Ecosystem Studies/Caribbean, Coral Reef Ecosystem Studies/Micronesia, Caribbean Coral Reef Institute (CCRI) and Deep Coral Reef Ecosystem Studies (Deep-CRES).

The goal of the Center for **Coastal Monitoring and Assessment** (CCMA) is to assess and forecast coastal and marine ecosystem conditions through research and monitoring. This year CMMA divers engaged in coral reef ecosystem monitoring missions with National Park Service, USVI Department of Planning and Natural Resources (DPNR) in St. Croix, coral reef ecosystem monitoring missions with University of Puerto Rico at La Parguera and an initial biological monitoring mission coupled with contaminant sampling in Jobos Bay, PR. CCMA divers also worked in St. John, USVI on an ongoing acoustic fish tagging and tracking project and a coral reef ecosystem monitoring mission with National Park Service, US Geological Survey, and DPNR. Additionally, they participated in a collaborative project monitoring marine debris and investigating fish movement with acoustic tagging technology at Gray's Reef National Marine Sanctuary in Savannah, GA.

Divers from the **Center for Coastal Fisheries and Habitat Research** (CCFHR) in Beaufort, NC continued their work in habitat characterization, the assessment of human impacts on coastal resources, assessment of invasive species on coastal and ocean habitat and ecology and ecosystem recovery modeling. This year they conducted dives to characterize, monitor and restore sea grass beds, create new sea grass habitat, evaluate damage to sea grass habitat from small boat and ship damage and evaluate methods to reestablish sea grass beds to their former ranges. Dives were also conducted to monitor and characterize coral reef habitats, evaluate damage to coral reef habitats from small boats and ships and environmental factors and to evaluate health of coral reef and sea grass habitats after establishment of marine protected areas. Ongoing investigations were furthered this year to characterize changes in reef community structures from invasive indo-pacific lionfish in coastal waters from North Carolina to the Caribbean and to document the effects of marine protected areas on fish

populations, fishery diversity, spawning success and protection of threatened marine species. Scientific dives were also made to collect sediment and algae to identify species and mechanisms that result in toxic reactions like ciguatera and to deploy and collect data from acoustic arrays to track movements of fish species in situ.

The **Office of National Marine Sanctuaries** (ONMS) conducts diving to: better understand living marine resources and the ecosystems to which they belong, assist resource managers in making sound decisions that ensure the protection of sanctuary resources, discover, characterize and protect submerged cultural resources to further understanding of our nation's maritime heritage and provide education on all these activities with outreach to the public at large.

Dives conducted at **Thunder Bay National Marine Sanctuary** (TBNMS) in Lake Huron supported redeployment of mooring buoys and annual monitoring dives at 19 popular shipwreck sites, phase two archaeological documentation of the 300-foot long steamer *GRECIAN*, and sampling at the Middle Island and various other sites in support of the NOAA Great Lakes Environmental Research Lab. Divers from TBNMS and **Monitor National Marine Sanctuary** supported ongoing efforts to characterize two German U-boats off the coast of North Carolina and investigate other shipwrecks in a mission dubbed "Battle of the Atlantic."

At **Stellwagen Bank National Marine Sanctuary**, divers documented the historic shipwreck Paul Palmer and other wreck sites.

At **Gray's Reef National Marine Sanctuary** in Savannah, GA, divers engaged in a variety of activities in support of acoustic fish tagging, CO_2 monitoring, invertebrate characterization and collection of invasive species including the indo-Pacific lionfish.

In the **Florida Keys National Marine Sanctuary (FKNMS)**, diving was conducted in support of maintenance for sanctuary vessels, damage assessment and restoration of seagrass beds and coral reefs, submerged cultural resource management, mooring buoy installations and maintenance of mooring systems, videography and photography for educational programs, relocation of near shore corals endangered by construction activities and collection of coral spawn and coral nursery monitoring, heritage awareness diving seminars and Nautical Archaeology Society training for FKNMS staff and members of the National Association of Black Scuba Divers.

At the **Flower Gardens Banks National Marine Sanctuary**, dives were made in support of hurricane impact assessments, collection of repetitive photographs, quadrate transects, technical diving to conduct marine debris surveys, water quality instrument and acoustic receiver equipment recovery and re-deployment, and fish, lobster and spiny sea urchin surveys.

On the west coast, **Channel Islands National Marine Sanctuary** (CINMS) conducted dives to survey shipwrecks in support of regional cultural heritage, supported partners of the Partnership for Inter-Disciplinary Studies of Coastal Oceans (PISCO) and Bight '08 kelp forest monitoring, REEF and the University of California – Santa Barbara, monitoring of living marine resources and habitats, and conducted experimental work on ecosystem responses to Marine Protected Areas within CINMS.

At **Monterey Bay National Marine Sanctuary**, divers supported PISCO partners for the quantitative characterization of algae, invertebrates, fishes and habitats, dove from the R/V *Fulmar* for maintenance and support of the West Coast Observatory moorings and worked with partners at the California Department of Fish and Game to characterize the diversity and abundance of rockfish, as well as location of previously tagged fish.

In the Pacific, divers of the **Papahānaumokuākea Marine National Monument** supported investigations to determine movements of top predators, study coral genetics, survey maritime heritage resources and study the population genetics of reef fishes and invertebrates. Cruises were conducted to track the movements of top fish predators and to support 111 technical dives to look for alien invasive algae and to conduct surveys of black coral and the collection of fish for population genetics investigations.

NOS Center for Operational Oceanographic Product and Services, whose primary responsibility is to install, maintain and remove underwater components for Tidal Measurement/Tsunami Warning Stations, conducted dives this year all over the globe. The Pacific Region Team conducted operations at Physical Oceanographic Real-Time System (PORTS) tide stations in Tacoma, WA, the Colombia River and San Francisco. They also conducted special operations in Bolinas Lagoon, CA, Elkhorn Slough National Estuarine Research Reserve, CA, and in Pago Bay, Guam. The Atlantic Region Team worked in the Great Lakes, the entire East coast and on Mona Island in Puerto Rico. Both units completed training in the use of Tethered Scuba Diving techniques for divers and tenders.

During FY09, 171 NOS divers performed a total of 4,538 dives (Table 1).

Office of Marine and Aviation Operations

The Office of Marine and Aviation Operations (OMAO) has divers in the fleet of NOAA ships, at the two Marine Centers, and at the NDC. Fleet and Marine Center diving support teams consist of both NOAA Corps officers and civilian personnel. Dives by NDC divers were primarily associated with diver training. Marine Center divers played a support role for various projects. Fleet diving activities included ship husbandry tasks such as clearing screws and sea strainers, conducting hull surveys for damage, and installing transducers. Ship divers also installed tide gauges and other data gathering equipment and investigated multi-beam contacts. These activities provided cost savings to the NOAA fleet, enhanced customer service and facilitated self-sufficiency on the seas.

This year's fleet diving highlights are as follows:

NOAA Ship *Hi'ialakai* served as the platform for 3,510 dives in support of a wide range of scientific operations conducted by NMFS and NOS. Of these dives, 125 were conducted at depths between 170-270 feet.

NOAA Ship *McArthur II* benefited from diver hull inspections following a 30-day Ice Seal cruise in the Bering Sea during which there were significant ice flow impacts to the hull.

NOAA Ship *Miller Freeman* divers investigated a gear oil leak from their propeller hub. Their repair actions prevented an emergency dry-docking and preserved valuable operational time during a time-critical research cruise based on seasonal Pacific Hake migration patterns.

NOAA Ship *Nancy Foster* divers conducted 787 dives in support of 5 of 13 projects this field season. To support its dive operations, the ship installed new air and NITROX compressor systems.

NOAA Ship *Oscar Elton Sette* divers performed hull cleanings and provided photos as required to enter the Papahanamokuakea Marine National Monument. The ship realized significant cost savings through the use of the new tethered scuba procedures and equipment.

Two divers from NOAA Ship *Rainier* logged 40 dives each on a two-week project in support of the NMFS Marine Debris Removal Program for a derelict Dungeness Crab pot removal project in Juneau, AK. This collaborative effort was a fine example of the "One NOAA" concept, which NDP strongly supports. It also facilitated crosstalk between Line Offices that provided NMFS personnel additional insight on available NOS bathymetric resources.

All ship dive teams worked hard to maintain diving operational capability and readiness through regular training and drills. Line-tending procedures for standby divers and tenders have been implemented and the use of pony bottles on all ship dives has been standardized. Six ships have acquired new diving equipment that provides voice communication and safety tethers. To date, four ships have sent teams of divers and tenders to train in Tethered Scuba procedures. All ships have received emergency recall systems for their dive lockers.

During FY09, 106 OMAO divers conducted a total of 1,434 dives (Table 1).

NOAA Diving Center

The NOAA Diving Center (NDC), located at the NOAA Western Regional Center in Seattle, Washington, serves as the administrative headquarters for the NOAA Diving Program and primary facility for all NOAA diver training activities and equipment maintenance and distribution. Located within the NDC complex are two operational hyperbaric chambers, offices, classrooms, workshops and gear lockers, air compressors and gas storage facilities and a 30' high x 15' diameter, 40,000 gallon water tower for diver training and equipment testing.

One of the primary missions of the NDC is training. Diver training is conducted at the NDC and in Key West, Florida. This year's training programs included: Working Diver, Divemaster, Diving Medical Technician and Tethered Scuba courses of instruction.

During FY 09 a total of 13,430 dives were conducted by 486 divers, accumulating 8,149 hours of dive time with only two minor dive-related injuries requiring basic first aid and no cases of decompression sickness. (See Figure 2)

Figure 2: FY09 Dives by Category

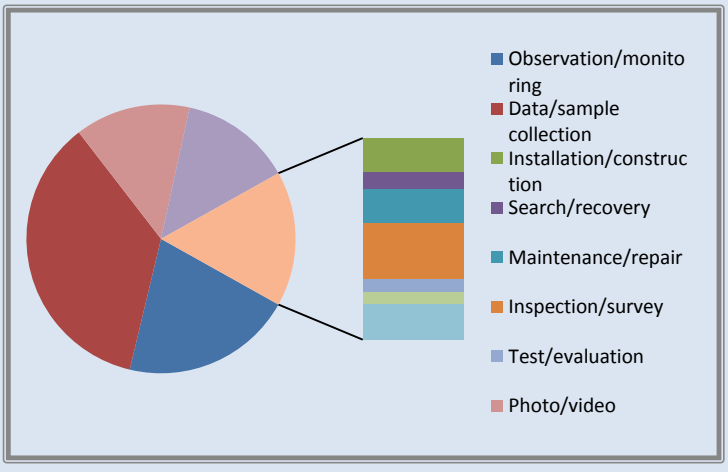

Figure 3: NOAA divers receiving instruction in Tethered Scuba Diving equipment and procedures at the NOAA Diving Center.

During FY09, 36 Working Divers and 17 Divemasters were trained and certified by NDC and 32 scientific divers were certified at the unit level. Five Tethered Scuba classes were held this year, three at the NDC, one in Chesapeake, VA and one in Honolulu, HI. (See Figure 3). The new Tethered Scuba Course graduated 37 people (25 divers, 12 tenders).

Employees from other federal, state and municipal agencies frequently enroll in NDC courses on a space available basis. In FY09, one diver from the US Army Corps of Engineers graduated from a Divemaster class.

During the week of March 23-27, NOAA Unit Diving Supervisors came together under one roof to discuss current issues. The event was hosted by NDC and held off-site at the Hotel Nexus in Seattle. Valuable input from the units led to several positive changes in NDP policies and regulations. The conference also afforded participants the opportunity to meet their peers from the other Line Offices and strengthen existing or create new partnerships for future cooperative efforts.

FY09 also saw the inclusion of diving activities in the performance plans for all Divemasters and Unit Diving Supervisors and the management of the NDC and the NDP separated into two positions: NDC manager, Douglas R. Schleiger and NDP manager, David A. Dinsmore.

In April of this year, a NOAA Diving Safety Officer (NDSO) was hired to develop and oversee a NOAA diving unit inspection program. In addition to the unit inspection program, the NDSO is also responsible for advising the NOAA Diving Control and Safety Board, the Director, OMAO and other NOAA managers on safety concerns and recommendations to mitigate those concerns. During the last half of FY09, the NDSO focused efforts on identifying the various components needed to establish and implement the inspection program.

The Standardized Equipment Program (SEP) is a comprehensive diving equipment maintenance and distribution program utilized by the NOAA Diving Program. Under the SEP, all NOAA divers are supplied with a full set of diving equipment upon certification. That gear is then serviced, maintained or replaced as needed for as long as that diver remains active. All SEP equipment is stored, issued, maintained, and tracked through the Standardized Program Equipment Office located at the NOAA Diving Center. In FY09 the SEP outfitted 53 new, returning, and scientific divers and serviced 851 regulators.

Personnel from the NOAA Diving Center participated in a variety of outreach activities for NOAA Line Offices, state and local government agencies, educational institutions, and the general public. These outreach efforts consisted of technical guidance, operational support, and educational service including participation in NOAA's Science Camp and a facility tour for Dr. Jane Lubchenco, Undersecretary of Commerce for Oceans and Atmosphere and NOAA Administrator, and her staff.

ACKNOWLEDGEMENTS

The science and work conducted by NDP divers are essential to accomplishment of NOAA missions. The NDP thanks all divers for their continuing safe practices, hard work, dedication and contributions.