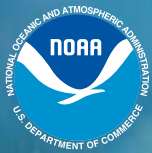


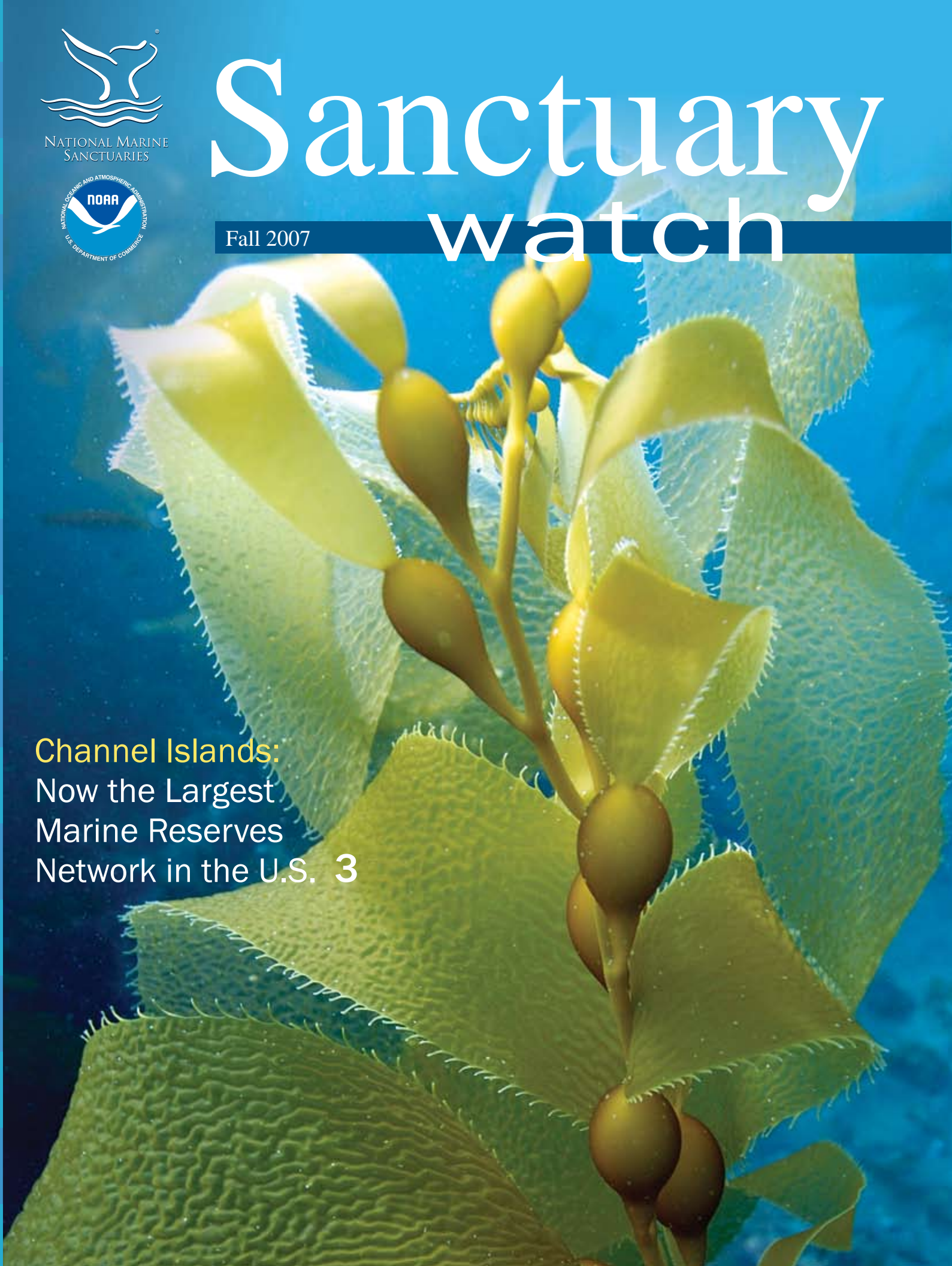
NATIONAL MARINE  
SANCTUARIES



# Sanctuary watch

Fall 2007

**Channel Islands:**  
Now the Largest  
Marine Reserves  
Network in the U.S. 3



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Photo: Claire Fackler

It's amazing what people can accomplish together when they are passionate and dedicated about what they do even when the work seems daunting at times. This issue of *Sanctuary Watch* highlights the terrific work being done by people inside and out of the sanctuary program that is making a major contribution to ocean conservation.

In August, our program reached another conservation milestone. After several years of tireless work by people in the federal government, the state of California, local communities and numerous partners, NOAA designated an additional 110.5 square miles to the existing marine reserves around the Channel Islands. This move extends a network of reserves that now make up the largest no-fishing zone in the continental United States. I cannot emphasize enough what a major step this is for ocean conservation. No-take zones are a rarity — about one percent of the world's oceans are set aside as such — and when communities and government join together for that purpose, there is cause for celebration.

Underscoring this event is the hard work done by our own sanctuary staff, partners and volunteers who through the years have dedicated themselves to protect our marine resources. People like Dave Mattila and Ed Lyman, who risk their own safety to disentangle whales; Volunteer of the Year Brian Diveley, who made major contributions to help preserve and protect the USS *Monitor*; Leda Cunningham of REEF, whose largely volunteer organization has conducted nearly 100,000 fish surveys to date; teachers from around the country who dove the Flower Garden Banks this summer so they can teach others back home about marine life — the sanctuary program could not accomplish its goals without their help. It's people like them and people like you that are making a difference.

Last year, Papahānaumokuākea Marine National Monument was established in the Northwestern Hawaiian Islands, making it the largest protected marine area in the world. This year, the Channel Islands received added protection in sanctuary waters. The difficult job of management plan review — the sanctuary program's participatory public process — is underway and moving towards conclusion. Yes, great things do happen when people put their hearts and minds into it. Now let's get back to work!

Sincerely,

Daniel J. Basta, Director

NOAA National Marine Sanctuary Program

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**Cover:** California kelp. Photo: Robert Schwemmer

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## “Thank You Ocean” Campaign Selected for Award

The California “Thank You Ocean” campaign and team are the recipients of a 2007 Coastal America Partnership Award, one of eight in the country, for outstanding efforts to restore and protect the coastal environment. The award recognizes the team’s efforts to instill in Californians a sense of personal connection and responsibility to their ocean and coast. It acknowledges that the campaign’s approach to communicating the challenges facing ocean and coastal environments is unique and exemplifies a holistic, aquatic approach to ecosystem restoration.

Coastal America is a partnership of federal, state and local governments, and private groups to address environmental and coastal problems. In 1997, Coastal America



Photo Courtesy of the U.S. Coast Guard

More than 300 grade school students gathered at Dockweiler Beach in Los Angeles to spell out “Thank You Ocean”. The June event was in response to Gov. Arnold Schwarzenegger’s declaration of California’s “Thank You Ocean Day.”

established an awards program to recognize outstanding team efforts to restore and protect the coastal environment.

The Thank You Ocean Campaign is a statewide public awareness campaign designed by the NOAA National Marine Sanctuary Program and the State of California Resources Agency. It is supported by the California Ocean Communicators Alliance, a network of more than 150 ocean-related businesses, agencies and organizations who promote ocean messages to Californians. The alliance is also coordinated by the sanctuary program.

Recently, the campaign developed television PSAs produced by cinematographer Bob Talbot, along with posters and a Web site.

For more information, visit [thankyouocean.org](http://thankyouocean.org).

## Monterey Bay Sanctuary Celebrates 15 Years of Stewardship

Monterey Bay National Marine Sanctuary turned 15 on Sept. 18, 2007. Over the years, sanctuary staff have built a strong program to understand and protect the natural and cultural resources of the central California Coast. Following the mandates of resource protection, research and education, staff have developed a wide variety of programs and products in addition to building the infrastructure needed to successfully manage one of America’s ocean treasures.

Some of the highlights of the past 15 years include: implementing a water quality protection program addressing urban runoff, harbors and agriculture; creating Sanctuary Integrated Monitoring Network also known as SIMoN; launching an innovative multicultural program (MERITO); commissioning a state-of-the-art research vessel — R/V *Fulmar*; opening two new visitor centers, and creating a new management plan with unprecedented public input.

## Teachers Learn About Coral Reefs in Gulf of Mexico

Flower Garden Banks National Marine Sanctuary staff invited educators from around the country to get out of their classrooms and into the Gulf of Mexico for two five-day underwater exploration workshops in July.

Known as Down Under, Out Yonder, the workshops offer teachers first-hand experience with exploration and research. The teachers get hands-on training, and they get to interact with educators from around the country, exchanging ideas that can result in new classroom dynamics.

This popular annual event is sponsored by the Gulf of Mexico Foundation in partnership with sanctuary staff. During a classroom session the participants were given a crash course in coral reef biology and ecology. While underwater, the teachers counted fish and other animals and made general observations of the coral reef environment.

The most valuable part of this workshop is the curriculum the educators will develop based upon what they learn.

## Diveley Selected as Volunteer of the Year

Brian Diveley, a resident of Bellevue, Wash., has been named the 2007 Volunteer of the Year by the National Marine Sanctuary Foundation for his work as lead member of an archaeological team excavating artifacts from the wreck of the Civil War ironclad USS *Monitor* during the summer of 2006.

Diveley, a graduate student at East Carolina University, spent countless hours last summer working with the staff of *Monitor* National Marine Sanctuary and conservators from The Mariners’ Museum in Newport News, Va., using his technical skills to create a photo-mosaic of the interior and exterior walls of the USS *Monitor* by piecing together thousands of high-resolution digital images that are used to monitor the condition of the 144-year-old sunken ironclad ship.

The Volunteer of the Year Award was presented by the National Marine Sanctuary Foundation at its annual Leadership Awards Dinner on June 5 during Capitol Hill Ocean Week in Washington, D.C.



Photo: David Alberg

NOAA  
Establishes  
**Largest  
Marine  
Reserves  
Network**  
in Continental U.S.

Marine conservation in U.S. waters received an added boost in July when NOAA expanded protected areas within Channel Islands National Marine Sanctuary.

The move permanently bans fishing from nearly 111 square miles around the Channel Islands, extending a network of marine reserves that now make up the largest area of no-fishing zones in the continental United States. NOAA's action complements an existing network of marine zones established in the waters of the sanctuary by the state of California in 2003.

Combined with the state marine reserves of the sanctuary, the protected area is more than 300 square miles. The move further protects fishes, invertebrates and habitats by prohibiting extractive activities, such as fishing, in sanctuary waters.

Photo: Robert Schwemmer



Above: Diver and sheephead in Channel Islands.  
Below: Smuggler's Cove, Santa Cruz Island.

Photo: Keith Berson





Photo: Robert Schwemmer

Diver in kelp.

“The Channel Islands have been the focal point of the national debate about marine reserves for the past eight or nine years,” said Daniel J. Basta, director of the National Marine Sanctuary Program. “A lot of people were losing faith that it could ever work. It’s a marvelous achievement that justifies all of the efforts and hopes of people involved.”

The federal action adds nine new marine zones, eight of which are no-take marine reserves and one limited-take marine conservation area. The marine reserves prohibit all extractive activities and injury to sanctuary resources. The marine conservation area allows commercial and recreational lobster fishing and recreational fishing for pelagic species — all other resource extraction and injury is prohibited.

The expansion comes after more than eight years of study and debate over expanding a cluster of already protected areas in state waters, which extend three miles from the islands, into federal waters.

“It was the vision of an old recreational fisherman, Jim Donlan, who helped get the effort started,” said Sean Hastings, ocean policy analyst for the sanctuary program. “Mr. Donlan told me, ‘I’ve been fishing out there for 50 years, Sean, and it’s not what it used to be. We need to set some areas aside.’”

Researchers are monitoring how marine reserves in the Channel Islands affect the marine environment and ocean users alike. The abundance, size, biomass and diversity of fished species are expected to increase within the reserves as compared to areas outside. Habitats supporting marine populations are expected to benefit through reduced disturbance as well.

The Channel Islands sanctuary staff, National Park Service, state of California, university partners and the sanctuary advisory council have been working together on biological and economic monitoring, outreach and enforcement programs.

“To see an old man’s vision realized, after years of community process and partnership between the state of California and NOAA, has been the highlight of my career,” Hastings said. “More importantly, the sanctuary’s globally unique marine ecosystem will benefit for generations to come.”

Home to a rich diversity of marine life and habitats, the Channel Islands sanctuary was established in 1980 to protect marine resources surrounding San Miguel, Santa Rosa, Santa Cruz, Anacapa and Santa Barbara islands. The sanctuary spans just under 1,500 square miles from the island shorelines to six miles offshore. For more information, visit the sanctuary Web site at [channelislands.noaa.gov](http://channelislands.noaa.gov).

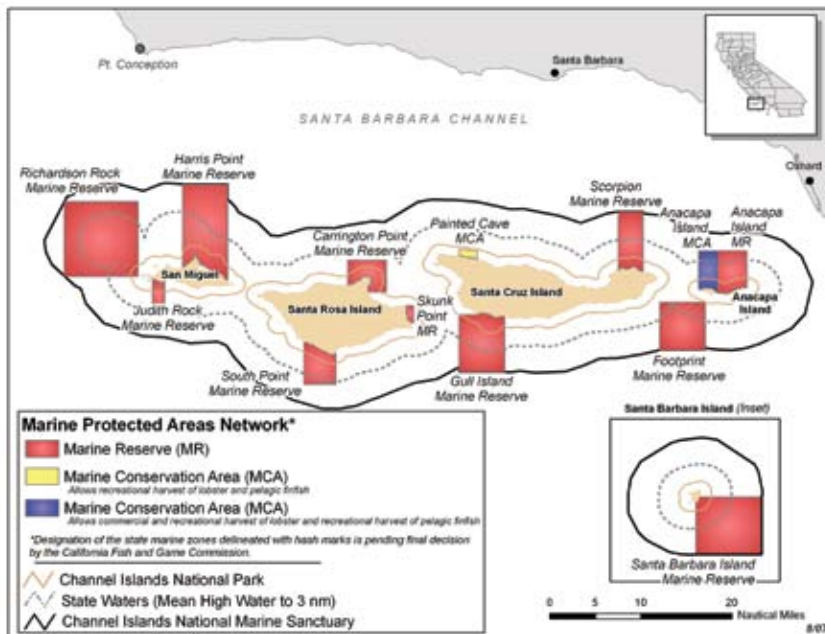


Photo: Natalie Senyk



Photo: Robert Schwemmer

Red gorgonian.

# Seagrasses Critical to Marine Habitats

**S**waying rhythmically with the passing waves, the vast seagrass beds of the Florida Keys may not look like much at first glance. The green meadows don't have the vibrant color and beauty of coral reefs, or the mystique of tangled mangrove forests. But what they lack in aesthetic appeal, these flowering plants more than make up for in ecological significance.

Found in shallow coastal waters around the world, seagrasses are the driving force behind many thriving marine ecosystems, providing critical food and habitat for countless species of fish and invertebrates. There are about 60 species of seagrasses worldwide, which range from tropical to temperate regions and from the intertidal zone to depths of 40 meters (130 feet).

In Florida Keys National Marine Sanctuary, where seagrass beds cover an estimated 80 percent of the seafloor, they act as nursery habitat for juvenile snapper and grouper, sheltering young fish until they grow large enough to migrate into mangrove-root environments or fend for themselves on coral reefs. Important species like queen conch and spiny lobster also find refuge within the dense blades of seagrass meadows while sea turtles and a variety of reef fish stop by to browse the leafy buffet.

Brian Keller, research coordinator for the Florida Keys sanctuary, said seagrass beds are one of the most productive plant systems on Earth. "Seagrasses are very important to ecosystem function in the Keys," he explained. In addition to their rapid growth, seagrass leaves provide growing surfaces for epiphytic algae and invertebrates.

Habitat and food source aren't the only roles seagrasses play in maintaining the marine environment — their roots stabilize the sediment of the seafloor, reducing erosion and keeping water clarity high so habitats like Florida Keys' coral reefs can flourish. Jim Fourqurean, the lead scientist on a seagrass monitoring project conducted by Florida International University, explained that without them, more silt would cloud the coastal waters and severely harm both coral ecosystems and the area's natural beauty.

Unfortunately, Fourqurean said, this important habitat is also disap-

pearing at a faster rate than both rainforests and coral reefs alike. Areas like Florida Bay, which underwent a massive die-off of seagrass in 1987, and other parts of the Gulf of Mexico have experienced losses of 20-100% of seagrass cover over the past several decades.

The situation isn't quite as grim within the waters of the marine sanctuary, Keller said, although the shallow seagrass meadows are still vulnerable to disruption from storms and boats that run aground. "The distribution and abundance of seagrasses in the sanctuary are generally pretty stable, with the exception of damage from storms as well as boat propellers and groundings."

National Marine Sanctuary Program scientists have devised an innovative technique for repairing damaged areas in the seagrass beds. Based on observations of lush patches of seagrasses below pilings where seabirds commonly perch around the Florida Keys, sanctuary personnel began planting stakes in seagrass meadows encouraging cormorants and others to land there and "do their business" — an all-natural fertilization technique that has been proven to speed seagrass recovery.

While seagrass populations in the Florida Keys sanctuary appear to be in no immediate danger, Fourqurean said researchers have observed

some signs that eutrophication — increased nutrient levels in the water, often due to runoff from land — is causing changes in the relative abundance of seagrass species in some parts of the sanctuary.

"We've been conducting long-term monitoring of the seagrass resources in the Florida Keys since 1995, and in those 12 years we've seen troubling signs," Fourqurean cautioned. "Eutrophication of near-shore waters as human populations have increased was identified as the primary threat to seagrasses, and we are continuing to watch that trend very closely."


Keller said Fourqurean's research has been extremely beneficial to the management of the Florida Keys sanctuary, and this issue is an excellent example of the value of similar long-term monitoring programs that are being conducted throughout the National Marine Sanctuary System. 



Photo: NOAA COMA Biogeography Team



Photo: Jeff Drazen and John Yeh

## Deep Sea Explored in Monument Mission

**C**onsidering what a large area the Papahānaumokuākea Marine National Monument covers in the Northwestern Hawaiian Islands, one would expect to see a broad spectrum of marine life — Hawaiian monk seals, Laysan albatrosses, even tiger sharks. But before researchers on a 25-day expedition to the monument began to review their photos of rarely explored deep-sea environments, no one knew what they would find.

In July, scientists from NOAA's National Marine Sanctuary Program and the University of Hawaii, on board the NOAA ship *Hi'ialakai*,



## NOAA Team Surveys *Hassler*

The ocean and Great Lakes are littered with the remains of ships that represent a storied and sometimes infamous maritime past. Many of these wrecks lie within the boundaries of national marine sanctuaries while others rest in state waters or at extreme ocean depths. Part of the sanctuary program's mission is to document historical shipwrecks and find ways to protect these important sites and cultural resources that tell a story of our collective past.

One such story is unfolding in Alaska, where NOAA archaeologists are looking at the remains of the *Hassler*. Built in 1871 at a Camden, N.J., shipyard, the *Hassler* was the first Coast Survey vessel constructed from iron, and the most technologically advanced science vessel in the United States Coast Survey fleet. After a long career, the *Hassler* was decommissioned by the U.S. government, sold and renamed *Clara Nevada*. The 151-foot ship came to a tragic end on Feb. 8, 1898, when it slammed into an uncharted rock in southeastern Alaska and sank, killing everyone on board. Its remains now rest in 30 feet of water.

"At the time, the *Hassler* represented innovation in iron shipbuilding," said John Jensen, project lead. "The vessel was powered by an innovative compound steam engine and equipped with deep-sea dredging equipment." Jensen, a nautical archaeologist and historian, is a professor of maritime studies at the Sea Education Association at Woods Hole.

The 2007 *Hassler* expedition, which followed a 2006 NOAA-funded expedition to survey shipwrecks in southeastern Alaska, accomplished several of its goals. "We are determining the extent of the wreck site," said Tane Casserley, a maritime archaeologist with the sanctuary program and a member of the survey team, "and assessing the site's stability, documenting the archaeological details through still and video photography and manual sketching."

Casserley added, "We are also compiling sufficient data to nominate the wreck to the National Register of Historic Places."

The study of the wreck and of the *Hassler's* history provides an important look at a transitional era in American shipbuilding and illuminates the U.S. Coast Survey's role in promoting ocean science.

An innovative ship with a rich history as a science and survey vessel, the *Hassler* was an ideal target for the expedition, which coincided with the 200th anniversary of the founding of the U.S. Coast Survey. The *Hassler's* significance was also commemorated in June 2007 with the laying of the keel for the *Ferdinand R. Hassler*,

conducted research in monument waters on coral health, apex predator movement and genetic connectivity, in addition to exploring life on the ocean floor nearly 2.5 miles below the surface. Using a time-lapse camera to get a glimpse of life in these uncharted environments, scientists were able to document deep-sea organisms that have never before been photographed.

"Throughout the world, the deep sea is the single largest living space," explained Jeff Drazen, a researcher at the University of Hawaii-Manoa's oceanography department who was the lead for this project. "The deep sea is the largest environment in the monument but it is the least explored." Photos from depths of 1,500 to 2,500 meters were taken of sleeper sharks, a species that is normally found in shallow water off Alaska, deep water off Japan and Southern



Photo: Dave McMahon



Photo: NOAA Photo Library

Top: NOAA archaeologist Hans Van Tilburg documents the *Hassler's* boiler face. Bottom: U.S. Coast Survey ship *Hassler* in 1893.

the newest and most advanced survey vessel in NOAA's fleet. Like its predecessor, the new twin-hulled coastal mapping vessel takes its name from the U.S. Coast Survey's first superintendent, and it is considered among the world's most technologically advanced research vessels.



California, and a rare species of hagfish that had not been previously photographed in the Northwestern Hawaiian Islands.

"All of the research conducted on this cruise will continue to help monument managers better understand the important ecosystems that make up the Northwestern Hawaiian Islands environments," said Randy Kosaki, program research coordinator for the monument, who was chief scientist on the expedition. "We continue to find amazing diversity as we push beyond coral reefs into deeper waters."



Opposite: Creatures from 1,500 meters below one of the islands include king crabs, deep-sea shrimp, and rattail. This image was taken with a drop camera lowered from the research vessel.

# Whales Get a Helping Hand

There are certain jobs for which only a handful of people in the world are qualified. Astronaut comes to mind. Deep wreck diving is another. One job that is dangerous and left to a small group of highly trained people is rescuing whales from harmful entanglements. Few do it worldwide. Two of them are with NOAA's Hawaiian Islands Humpback Whale National Marine Sanctuary.

To understand why freeing whales from entanglement is such a specialized endeavor, one needs to get a picture of their work environment. A typical scenario: after receiving a call from a passing vessel about a whale ensnared in lines or floating nets, whale rescuers generally leave the safety of a larger support boat, enter a much smaller inflatable-type vessel, and approach an animal the size of a city bus. Once in position, the rescuers have to figure out a way to set the animal free without hurting themselves or the whale.

For Ed Lyman and David Mattila, this was their calling. These whale rescue experts have dedicated much of their adult lives to cutting whales free. Why? Globally, entanglement in fishing gear and marine debris is a pervasive problem for the animals and the fishermen. Along with ship strikes, entanglement is one of the largest causes of human-induced mortality of many large whales. Getting caught in fishing gear often injures and kills whales and other marine mammals. So, Lyman and Mattila decided to do something about the problem.

Working with state and federal agencies, scientists, fishermen and others from the marine community, Mattila and Lyman have helped free more than 75 large whales over the years. Mattila, a New London, Conn., native, was one of the early whale disentangles, working with the Provincetown Center for Coastal Studies, a whale research and rescue organization located on Cape Cod, Mass. The organization began cutting whales free along the East Coast in 1984. At that time, Mattila, who attended the University of Washington, had been studying the whales for over a decade and had seen firsthand the potential threat of entanglement for even the largest whales.

"When you have had the opportunity to work so closely with these animals like I have, and see the issues that threaten the whales and how it affects the fishermen, you want to do something about it — to alleviate the threats to the best of your ability," Mattila said.

Lyman, who was born in Millville, N.J., noted, "The primary threat of entanglement to large whales is not drowning. Their large size usually means they can pull the gear to the surface to breathe. Instead, entanglement may cause physical trauma, prevent feeding, lead to disease or infection, and render them susceptible to other threats, like ship-strikes. In any event, for the large whales it is typically a slow death."

Mattila's experiences and NOAA's desire to address the issue led them to work with the state of Hawaii's Department of Land and Natural Resources and others to form the Hawaiian Islands Disentan-



Photo: NOAA Permit #932-1489

glement Network, a community-based network that responds to entangled whales around the Hawaiian Islands. Lyman assisted Mattila early on and in 2005 joined Mattila and the Humpback Whale sanctuary in their efforts. They and the network are authorized to carry out rescue efforts under NOAA Fisheries' Marine Mammal Health and Stranding Response Program (NOAA permit #932-1489).

The network had a successful 2006-2007 whale season. They responded to 14 reports of entangled whales and cut free four of the six whales confirmed entangled. According to Lyman, most of the entanglements were reported by commercial operations like dive charters, whale watching cruises and tour boats.

"In many ways they made the difference in what really is a community-based response network," Lyman added.

"Still, what we do in helping rescue whales is like putting a Band-Aid on a very large wound,"

Mattila noted. "In the bigger picture, the real solution is to stop turning the world's oceans into a dumping ground. Stop fouling waters with marine debris, chemicals and derelict fishing gear that has too often become a deathtrap for marine animals."

The National Marine Sanctuary Program, NOAA Fisheries Marine Mammal Health and Stranding Response Program, Hawaii's Department of Land and Natural Resources, the U.S. Coast Guard, and Mattila and Lyman are leading the way in rescuing whales, but more needs to be done to address significant threats to some of the world's most majestic creatures.



Photo: NOAA # 932-1489-08

Above: During a recent rescue response, rescuers photographed this humpback whale entangled in king crab gear that had floated down from Alaska. Lines continue to trail another 40-50 feet with two polyballs attached. One of the polyballs, which is the fisherman's marker buoy, is visible in the image.

Below: Ed Lyman (left) and David Mattila come to the rescue of an entangled whale.





# American Sand Lance

*It's not easy being a little fish in a big ocean.*

That pretty much describes the life of a sand lance, a little fish that plays a large role in marine ecosystems around the world. Unfortunately for the sand lance, that role is usually dinner – for other fish, seabirds, seals, even whales.

The sand lance gets its name from its slender body and snout, which is pointed like a medieval lance. These small fish are also sometimes called “sand eels” due to their appearance, although they are not actually related to true eels.

Their scientific name, *Ammodytes*, means “sand burrower”, referring to their tendency to burrow to a depth of several inches into the sandy seafloor to hide from predators or to avoid tidal currents. Some species of sand lance in coastal areas frequently bury themselves in sand or gravel beaches that are submerged during high tide, leaving them high and dry when the water recedes. Despite this peculiar habit, the fish are able to survive such exposure, sometimes for hours at a time.

About 18 species of sand lance — the exact number is a matter of debate — can be found in coastal areas throughout the world’s oceans. Sand lances are particularly common in temperate regions like the northwest Atlantic, where their abundant larvae provide an important food source for cod, salmon and other commercially important species.

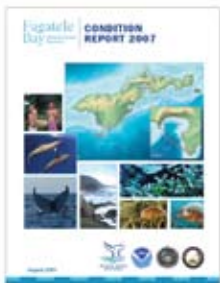
Fish aren’t the only creatures that eat sand lances. In a recent study at Stellwagen Bank National Marine Sanctuary, NOAA scientists confirmed the link between the distribution of humpback whales and certain “ecological hot-spots” containing high concentrations of sand lance — one of the whales’ favorite foods. Seabirds like puffins, auks and cormorants all feast on large schools of adult sand lances. So, while sand lances may be small, they are a major link in many ocean ecosystems, including your national marine sanctuaries.



**Common Name:** American sand lance  
**Scientific Name:** *Ammodytes americanus*  
**Distribution:** Temperate and tropical oceans worldwide

**Status:** Stable  
**Max. length:** 20-25 cm.  
**Diet:** Plankton, copepods

Photo: Dick Barker



## Fagatele Bay Condition Report Released

The National Marine Sanctuary Program released a status report evaluating the health of Fagatele Bay National Marine Sanctuary, home to coral reefs that may have the highest marine life diversity in the sanctuary system. This report provides a summary of resources in the sanctuary, pressures on those re-

sources, and management responses to the pressures that threaten the marine environment. Topping the list of concerns are threats like blast fishing and other harmful, prohibited fishing practices, as well as an increasing number of coral bleaching events due to elevated surface water temperatures. However, the report also states that habitat and

water quality in the sanctuary are in very good condition. The release of the report is the first step to engaging Samoans and their cultural connections to the sea in determining the future role of the sanctuary program in American Samoa’s stewardship of its ocean ecosystems.

Similar reports from all sanctuaries are underway. These reports provide a wealth of information about the complex marine resources and archaeological treasures found in sanctuary waters in straightforward, easily understandable documents. The reports will help set the stage for management plan reviews at each site and help sanctuary staff identify monitoring, and research priorities for day-to-day management needs and new threats to the sanctuaries. The Fagatele Bay condition report is available at [sanctuaries.noaa.gov](http://sanctuaries.noaa.gov).



## One Survey at a Time



One hundred thousand is a big number. You can easily picture a city population of a hundred thousand or a car that's gone as many miles. But counting to 100,000? Not likely. Well, imagine having to count fish, species by species, to produce just *one* of 100,000 volunteer-generated fish surveys.

Yet that is what the REEF Volunteer Fish Survey Project has done. REEF (the Reef Environmental Education Foundation) first opened its doors in Key Largo, Fla., in 1993, when Florida Keys National Marine Sanctuary was just

beginning to monitor its coral reefs and other offshore resources. REEF volunteers were instrumental in collecting baseline data on fish populations for sanctuary managers. Since then, the project has grown.

To date, volunteers have conducted more than 100,000 fish surveys throughout the coastal Americas, the Caribbean and the Hawaiian Islands. More than one-third of these surveys happened in places like Flower Garden Banks, Monterey Bay, Gray's Reef, Olympic Coast and Channel Islands national marine sanctuaries. Volunteer by volunteer, survey by survey, the REEF data set has grown into the largest living marine life database in the world.

But REEF data are one piece of the puzzle for sanctuary managers working to understand and protect the living marine resources under their charge. Equally importantly, REEF provides hands-on science activities that engage an important sanctuary constituency — volunteers. They have been instrumental in identifying new species, morphological variants of known species, and in documenting previously unrecorded range extensions of other fish species. REEF information has been used by researchers to assess the status of a reef fish species that is experiencing significant declines. Divers and

snorkelers are in a unique position to observe and document many valuable and vulnerable living marine resources. With the limited number of scientists and grant money available to survey fishes of the world, REEF volunteers contribute data that scientists wouldn't otherwise be able to collect.

The power of this information is in its volume and ability to transform a recreational diver into a citizen scientist. REEF volunteers are more knowledgeable and aware of marine ecosystems, leading to a stronger sense of stewardship and support for effective management of local resources. Surveys can also yield pleasant surprises — two new species of goby were discovered by REEF surveyors while diving the waters of Veracruz Marine Park in Mexico in 2003.

REEF programs teach people who enjoy the ocean for sport how to ensure it remains a thriving place for future generations. In the end, we will conserve only what we love, we will love only what we understand, we will understand only what we are taught.

To learn more about how to be a REEF volunteer, visit [reef.org](http://reef.org). 



Photo: Paul Humann

Each year, REEF volunteers devote hours surveying fish in and around national marine sanctuaries.

Tiny Krill:

# GIANTS

in the Marine Food Chain

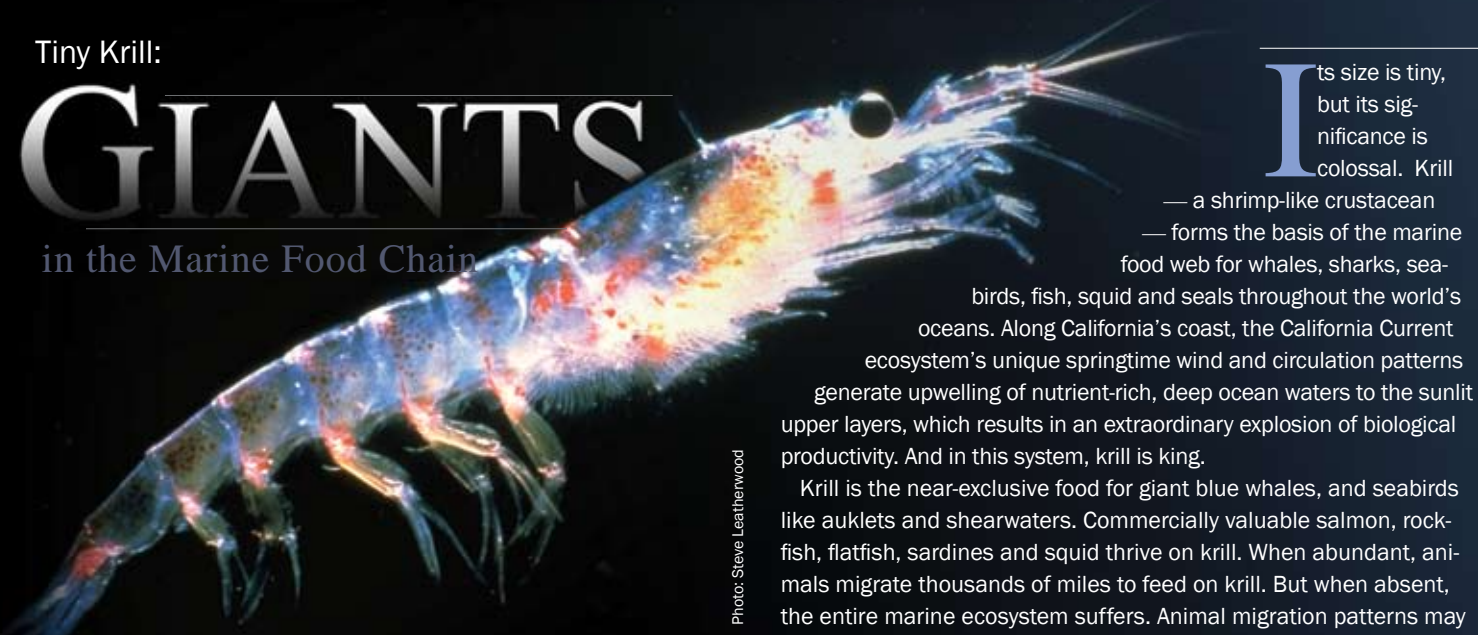


Photo: Steve Leatherwood

Its size is tiny, but its significance is colossal. Krill

— a shrimp-like crustacean — forms the basis of the marine food web for whales, sharks, seabirds, fish, squid and seals throughout the world's oceans. Along California's coast, the California Current ecosystem's unique springtime wind and circulation patterns generate upwelling of nutrient-rich, deep ocean waters to the sunlit upper layers, which results in an extraordinary explosion of biological productivity. And in this system, krill is king.

Krill is the near-exclusive food for giant blue whales, and seabirds like auklets and shearwaters. Commercially valuable salmon, rockfish, flatfish, sardines and squid thrive on krill. When abundant, animals migrate thousands of miles to feed on krill. But when absent, the entire marine ecosystem suffers. Animal migration patterns may



# Ancient Channels Discovered in Gray's Reef Waters

While the NOAA ship *Nancy Foster* plied the waters in and around Gray's Reef National Marine Sanctuary during a June research expedition, all eyes were searching the bottom for new evidence of very old geological action.

Several ancient paleochannels — ancient river and stream beds — were discovered meandering through the sanctuary and nearby live-bottom areas, some cutting down to 20 meters below the seafloor. Divers collected fossil scallop shells from paleochannels near the sanctuary that were estimated to be 32,000 to 38,000 years old. A whale bone fossil, evaluated for later study, was dated to about 35,000 years.

“One of the primary goals of the expedition was to identify and describe the sediment and rock layers found within the sanctuary and surrounding areas to help understand geologic history,” said Paul Gayes of Coastal Carolina University. Gayes was one of several scientists to use the *Nancy Foster* as a platform for scientific investigation during its visit to Grays Reef.

The paleochannels extend across the northern border of the sanctuary and were formed when sea levels were much lower than they are at present. “Several former large tidal inlets are also present as deep, narrow incisions within these channel complexes,” Gayes expanded. “These inlets were drowned and filled with sediment with the rising sea.”

Scientists traced the paleochannels towards the shore, connecting them with the current onshore channels that drain the coastal area today. Using instruments that detailed rock formations, scientists also began mapping the entire sanctuary to fully characterize its geologic strata.

While Gayes and others looked for evidence of ancient waterways, Daniel Gleason and students from Georgia Southern University examined how shifting sediments impact sedentary benthic invertebrates and how the sanctuary is colonized by these animals.

“Our work is part of an on-going effort to completely catalog all of the rich invertebrate life of Gray's Reef,” said Gleason, a researcher from the university. In the process, the university crew discovered three unusual tunicates and two sponges that may be new species.

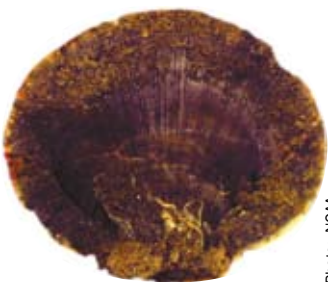


Photo: NOAA

Fossil shell collected on the expedition.



Photo: NOAA

Paul Gayes and a member of the crew clear cables prior to deploying a sub bottom profiler that details rock formations.

shift, causing starvation for species unable to forage elsewhere; complete breeding failure for some seabird species occurs, and local ecosystems face collapse.

Of the 85 species of krill worldwide, the dominant species in central and northern California are *Thysanoessa spinifera* and *Euphausia pacifica*, both less than an inch long. Grazing on microscopic plants called phytoplankton, krill, a type of zooplankton, transfer energy to larger creatures upward through the food web. From late spring into fall, krill may swarm in swirling bait balls as dense as 100,000 per cubic yard, migrating vertically in the water column.

In California sanctuary waters in a normal summer-fall season, a single blue whale can consume up to four tons of krill each day. Roughly 2,000 blue whales — perhaps a sixth of the global population — generally feed here. But in 2005 and 2006, all that changed.

During those years, researchers theorize, atypical weather patterns produced the wrong rhythm of wind and calm needed for upwelling. Consequently, krill were so sparse that seabird chicks, unable to eat large prey, died of starvation. Nests were abandoned.

Beach Watch coastal surveyors documented the dead seabirds. Blue whales that usually feed off central and northern California hunkered down in lower latitudes where at least some food was available. The outlook was grim, and scientists feared that a third, fourth or even fifth year without krill could have terrible consequences for the entire ecosystem.

In 2007, upwelling in the California Current — albeit late — has finally set in, and preliminary results indicate these important zooplankton are returning. Scientists are guardedly optimistic that krill will rebound.

“Sanctuaries cannot control natural processes that affect krill, but they can prevent human-caused stresses that compound them, such as oil pollution and other kinds of habitat destruction,” said Maria Brown, Gulf of the Farallones National Marine Sanctuary superintendent. “Cumulative stresses could trigger a domino effect, resulting in major ecosystem impacts. With effective regulations and development of a dynamic ocean stewardship ethic, sanctuaries can enhance nature's inherent resiliency to cope with change. Sanctuaries play an ongoing, critical role in the balance of life within our world ocean.”



NATIONAL MARINE  
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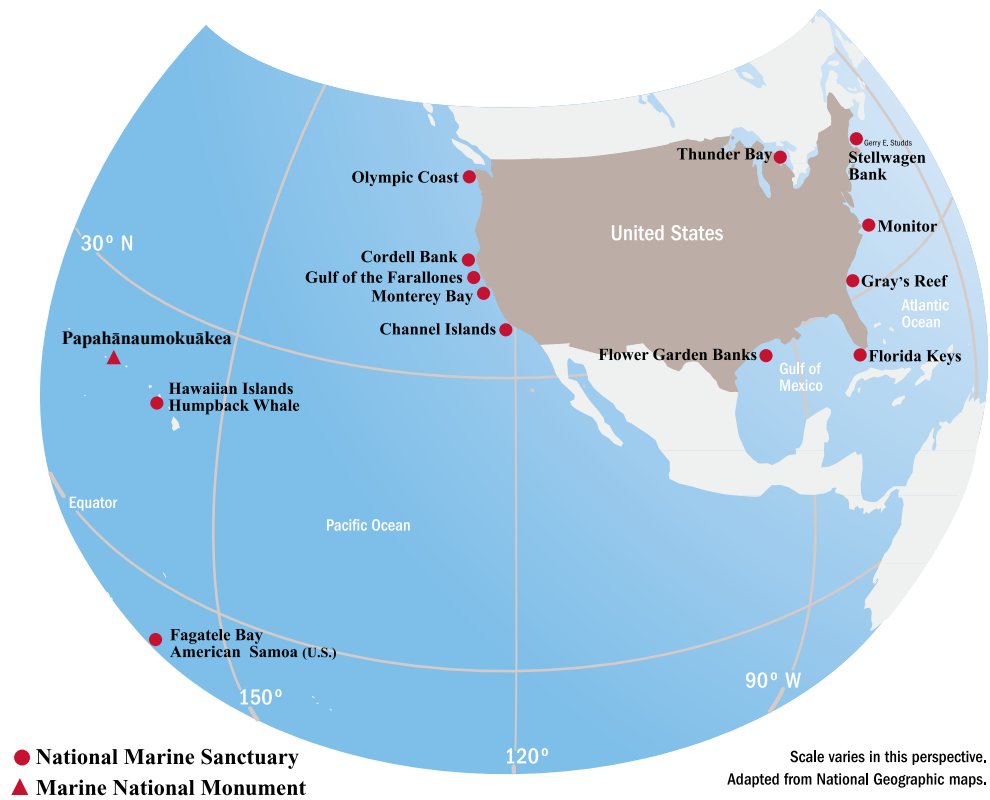
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# National Marine Sanctuary System



The National Marine Sanctuary Program serves as the trustee for a system of 14 marine protected areas, encompassing more than 150,000 square miles of ocean and Great Lakes waters. The system includes 13 national marine sanctuaries and the Papahānaumokuākea Marine National Monument. The sanctuary program is part of the National Oceanic and Atmospheric Administration (NOAA), which manages sanctuaries by working cooperatively with the public to protect sanctuaries while maintaining compatible recreational and commercial activities. The program works to enhance public awareness of our nation's marine resources and maritime heritage through scientific research, monitoring, exploration, educational programs and outreach.



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