National Marine Sanctuaries
National Oceanic and Atmospheric Administration
STELLWAGEN BANK NATIONAL MARINE SANCTUARY

SPRING/SUMMER 2011

News from
Gerry E. Studds
Stellwagen Bank
National Marine Sanctuary

Stellwagen Banknotes

Currents

Copies of Management Plan Available

The sanctuary's *Final Management Plan and Environmental Assessment* was published in June 2010 and released in various formats for public distribution. The 400+ page document provides detailed information about sanctuary resources, research and management issues, and provides action plans for 11 priority areas. The plan, which includes hundreds of full-color photographs, maps and diagrams, can be accessed from the sanctuary's website at http://stellwagen.noaa.gov. Electronic CD versions of the document can be obtained from the sanctuary by e-mailing stellwagen@noaa.gov.

Charles W. Morgan *under repair. Photo: Courtesy of Mystic Seaport*

Plans Underway for Historic Whaler to Visit Sanctuary

The nation's last surviving wooden whaleship is scheduled to make a sanctuary visit in 2014 after a major restoration is completed. The *Charles W. Morgan*, a National Historic Landmark and crown jewel among exhibits at Mystic Seaport, made 37 voyages between 1841 and 1921 when she was retired. The overhaul will assure the seaworthiness of the *Morgan* to visit some of the region's historic whaling ports as well as allow her to make the transition from "whaling to watching" in a visit to the sanctuary. A goal of the seaport and the sanctuary system is to heighten awareness of the nation's connections to the sea and its resources. For more information about the *Charles W. Morgan's* voyage, visit www.mysticseaport.org.

Sanctuary archaeologist Matthew Lawrence captures underwater video of an unidentified trawler now marked with a mooring buoy. Photo: Heather Knowles, Northern Atlantic Dive Expeditions, Inc.

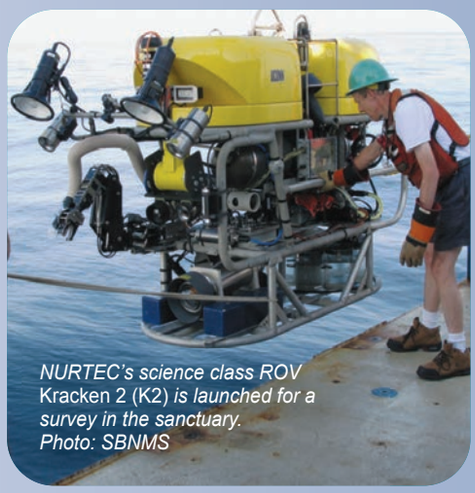
Dive Mooring Deployed on Wreck

Divers will now have easier and safer access to a sanctuary dive site. The unidentified trawler, located in 100 feet of water on Stellwagen Bank, now hosts a mooring block that provides a secure tie-off point for dive boats. The mooring installation was part of a pilot project to assess the feasibility and effectiveness of dive moorings in the sanctuary and follows similar installations at other sanctuaries around the country. Sanctuary archaeologists and Sanctuary Advisory Council diving representative Heather Knowles of Northern Atlantic Dive Expeditions, Inc. received a grant from PADI'S *Project Aware* to initiate the mooring system. Anyone with information about this shipwreck's identify should contact the sanctuary's maritime archaeology team at 781-545-8026 ext. 213.

Derelict fishing gear retrieved from the seafloor. *Photo: NOAA*

Documentary Details Project to Remove Derelict Fishing Gear

When government, non-profit organizations and fishermen collaborate to solve a problem, there can be positive impacts on the ocean. This is the message of a new documentary that looks at the issue of lost or derelict fishing gear that can present a threat to marine wildlife and to fishermen whose own active gear can get snagged in the lost lines, nets and traps. *Stellwagen Sweep: Restoring Stellwagen Bank National Marine Sanctuary*, a ten minute video, looks at one creative project in which fishermen work with marine conservationists and sanctuary staff to improve the marine environment. The documentary was produced by Stellwagen Bank National Marine Sanctuary and Stellwagen Alive: Friends of the National Marine Sanctuary through a grant from the NOAA Marine Debris Program. A link to the video is available on the sanctuary's website http://stellwagen.noaa.gov.



NURTEC's science class ROV Kracken 2 (K2) *is launched for a survey in the sanctuary. Photo: SBNMS*

Maritime Heritage Sleuths Investigate Shipwrecks

Last year, during a two-day August cruise, sanctuary maritime archaeologists along with researchers from the University of Connecticut visited seven historic shipwrecks and gathered high definition still and video imagery with a remotely operated vehicle. The shipwrecks ranged from fishing vessels to wooden-hulled sailing vessels with cargoes of coal or stone. Several shipwrecks lacked obvious cargoes and date to the early 19th century based on artifacts and vessel construction. This was the sixth Stellwagen Bank sanctuary maritime heritage ROV cruise with the Northeast Undersea Research Technology and Education Center at UConn (NURTEC) since 2002. The partnership has successfully investigated 28 shipwreck sites to date.

Contact the sanctuary for information about receiving copies of our publications.

STELLWAGEN Banknotes
Spring/Summer 2011

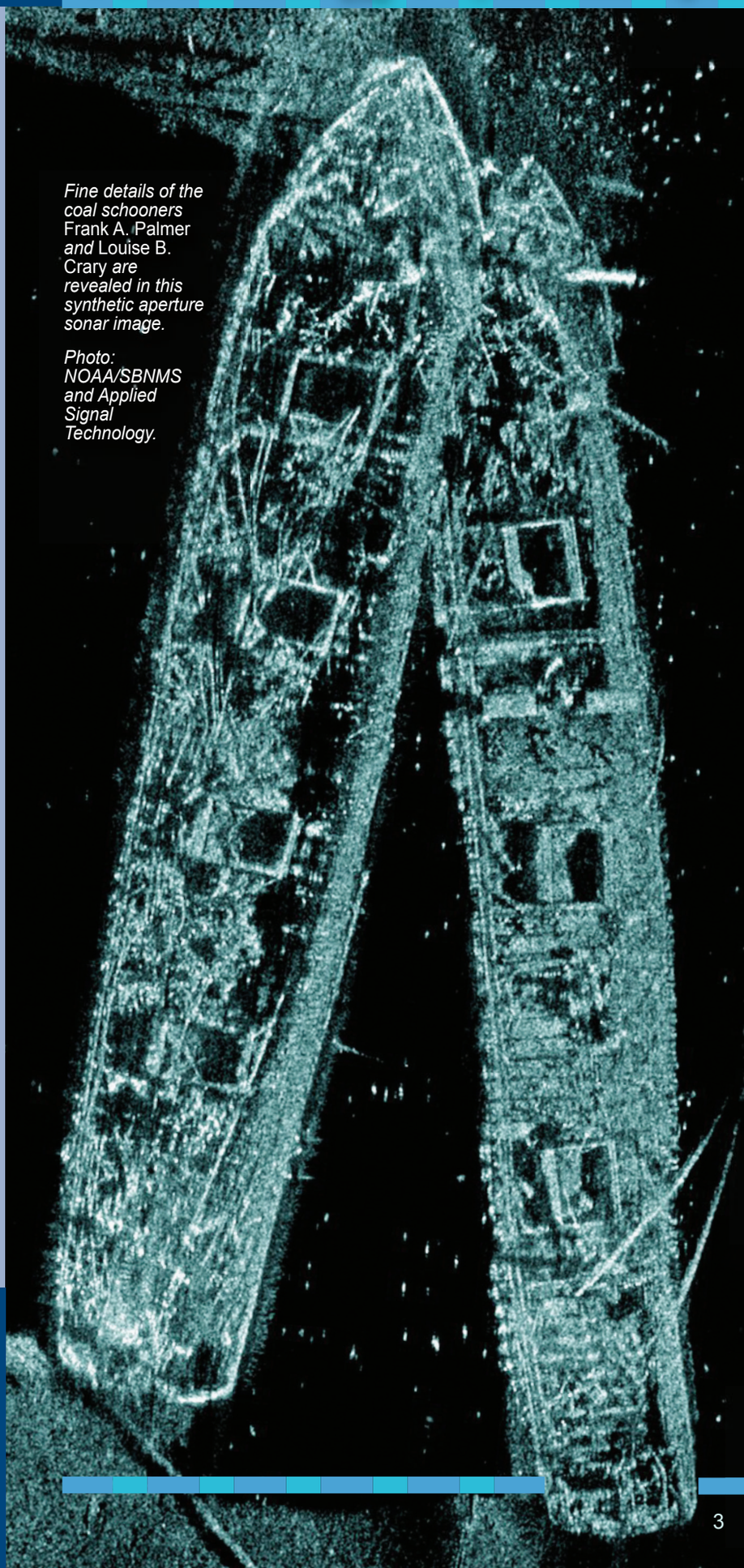
Cover photo: ***Sculpin on the sanctuary seafloor*** by Ben Cowie-Haskell, SBNMS

Editor: Anne I. Smrcina
Graphic Designer: Dennis Huston, Creative Resources Group
Contributors: Anne-Marie Runfola, Deborah Marx, Matthew Lawrence

Gerry E. Studds Stellwagen Bank National Marine Sanctuary
175 Edward Foster Road, Scituate, MA 02066
Telephone: 781-545-8026 Fax: 781-545-8036
General E-Mail: stellwagen@noaa.gov
Web Site: http://stellwagen.noaa.gov

National Marine Sanctuaries

Technology: Synthetic Aperture Sonar



Fine details of the coal schooners Frank A. Palmer *and* Louise B. Crary *are revealed in this synthetic aperture sonar image.*

Photo: NOAA/SBNMS and Applied Signal Technology.

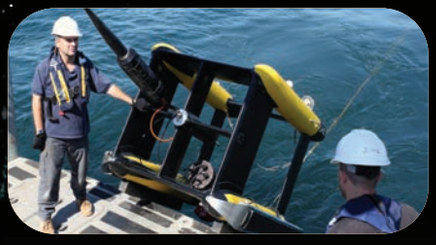
High Tech Gear Reveals Sanctuary Secrets

Deep, dark and cold, the sanctuary's depths hide much from human observation. Fortunately, technological advances are sweeping aside the ocean's opaque veil.

In the summer of 2010, sanctuary archaeologist Matthew Lawrence deployed a new variety of acoustic imaging system to map the sanctuary's seafloor in search of maritime heritage resources. Synthetic aperture sonar uses numerous acoustic pings to create images similar to conventional side scan sonar; however, the images have a much higher resolution making fine detail more apparent. Features as small as three centimeters squared (half a square inch) can be distinguished on the seafloor of the sanctuary at depths of hundreds of feet. The equipment, supplied by Applied Signal Technology, was deployed from the 85-foot *SRVx* (small research vessel experimental), the newest addition to the National Marine Sanctuaries East Coast fleet.

This was the first application of synthetic aperture sonar technology for shipwreck investigations in the national marine sanctuary system. The equipment's primary use has been in homeland security, particularly anti-submarine warfare, as well as remote sensing and mapping.

Over the course of the 24-hour-a-day, seven-day mission, the sonar mapped more than 169 square kilometers (approximately 65 square miles) or about 1/13th of the sanctuary. The goal was to locate archaeological resources, assess derelict fishing gear concentrations, and characterize seafloor habitats. More than 10 sonar targets believed to be possible shipwrecks, were located during the survey. The team also re-imaged the wreck sites of the steamship *Portland* and the schooners *Frank A. Palmer* and *Louise B. Crary*; both sites are listed on the National Register of Historic Places. NOAA's Office of Ocean Exploration and Research and the Office of National Marine Sanctuaries Maritime Heritage Program provided project funding



Synthetic aperture sonar uses a dynamically controlled towfish deployed from a research vessel. Photo: NOAA/SBNMS and Applied Signal Technology

The Office of National Marine Sanctuaries small experimental research vessel SRVx *was the platform for the sonar survey. Photo: Evelyn Ganson, SBNMS*

Shipping Compliance

Notices Educate Shippers about Right Whale Rule

In 2008, NOAA issued speed restrictions for waters off the Massachusetts coast to protect critically endangered North Atlantic right whales. Two Seasonal Management Areas (SMAs) were established – Cape Cod SMA for January 1 - May 15 and Off Race Point SMA for March 1 - April 30. Parts of both SMAs overlap the sanctuary. Although a 10-knot speed limit was set, the question remained of whether ships would comply with the restriction – and would NOAA be able to assess compliance despite the vast expanse of ocean and the scarcity of manpower?

Sanctuary researchers have found a definitive and supportable means of determining the speeds of large ships in the sanctuary's portion of the SMAs. The answer is AIS – the Automatic Identification System. AIS is an international system that monitors large vessel traffic to ensure greater safety at sea. With that information in hand, the team is now implementing an education and evaluation program.

In the United States, the U.S. Coast Guard administers the AIS program. Here in Massachusetts, the sanctuary was instrumental in assisting the Coast Guard in setting up the local network. Sanctuary researchers have also become a major force in using AIS data for conservation purposes.

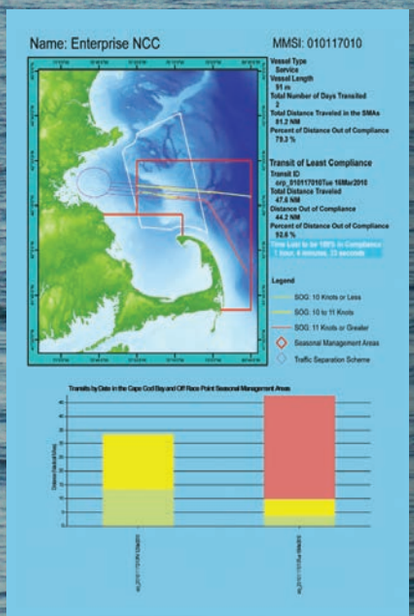
AIS-equipped ships (a requirement on vessels of 300 gross tons or more) transmit messages every two seconds that include ship name, call sign, position, speed, heading, size of ship, cargo and other information. AIS ship track data were used in past years to provide supporting evidence to move the Boston shipping lanes to areas with fewer historic whale sightings. Most recently, with high capacity number-crunching computers, the team has been able to record exact speeds along track lines. The resulting maps provide a visible record of compliance or non-compliance with SMA regulations.

"Co-signing with the International Fund for Animal Welfare, we have recently sent out 227 letters to vessel owners whose ships were tracked in one or both of the local Seasonal Management Areas for Right Whale Ship Strike Reduction," said Craig MacDonald, sanctuary superintendent. "The letters explain SMAs, the 10-knot rule and how we gathered and analyzed the data to determine the compliance levels of the companies' individual vessels."

Along with the letters, the ship owners were sent a personalized fact sheet for each of their vessels that transited a SMA. A key portion of each fact sheet is a map of the transit or transits (some ships have made multiple trips through the SMAs) as well as an estimated time cost to be in compliance for those vessels that exceeded the 10-knot speed limit. "In many cases, the revised speed would be only minutes or an hour or so more than the non-compliant time," said sanctuary Geographic Information System Analyst Michael Thompson.

"We have already heard from numerous owners who have received these letters and who are reminding their captains about the rule," said MacDonald. Through constant monitoring, the research team will determine future compliance rates with the SMA speed limit and evaluate the effectiveness of the education program. "This is not an enforcement action," notes MacDonald, "but a way to build awareness of the rule, educate the operators and, hopefully, reduce the number of lethal ship strikes on right whales."

The project is made possible by support from the International Fund for Animal Welfare and NOAA Office of National Marine Sanctuaries working together with NOAA Fisheries Office of Protected Resources, NOAA Office of Law Enforcement and the U.S. Coast Guard.



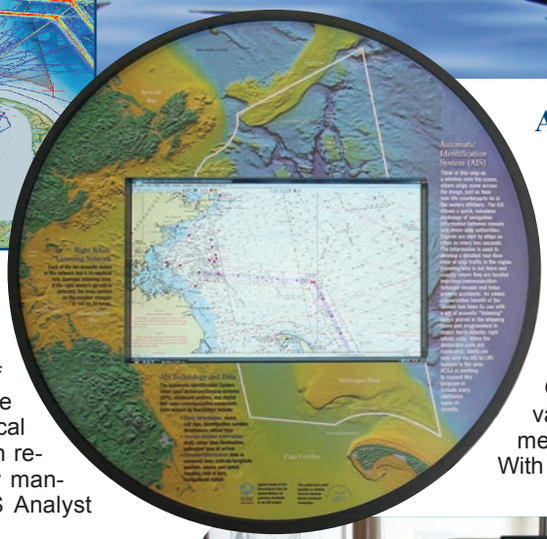
Ship Tracks and SMA Speed Compliance

This sample fact sheet shows the track of a fictional vessel, Enterprise NCC, as it transits into and out of the sanctuary and the Off-Race-Point Seasonal Management Area. Information included in the fact sheet includes the distance traveled in the SMA, the exact track and the speed category (10 knots or less, 10-11 knots, 11 knots or greater), the percent of distance out of compliance, and the time lost to be 100 percent in compliance. In many cases, this time difference is negligible in comparison to the length of time for the entire voyage.

A whale swims near a tanker off the Massachusetts coast. Photo: Anne smrcina, SBNMS

Right whales skim feed on plankton patches. This year, an estimated 200 animals visited Cape Cod Bay and Stellwagen Bank National Marine Sanctuary in April. Photo: Susan Parks, Penn State Univ. Photo taken under NOAA Fisheries Permit.

Credit: SBNMS



Millions of Data Points Illustrate Shipping Patterns

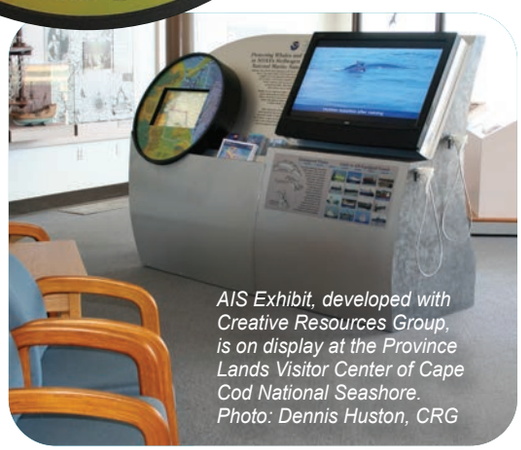
The Automatic Identification System or AIS has become a treasure trove of data for the sanctuary. "Daily, we're collecting thousands of facts about local ship traffic. We are using their data in remarkable ways to address sanctuary management issues" said sanctuary GIS Analyst Michael Thompson.

Over the past few years, AIS data have been used to help shift the Boston shipping lanes to an area less threatening to whale feeding grounds, to match types of ships with their distinctive sounds as recorded on acoustic buoys, and to better understand ship traffic patterns in the sanctuary.

Sanctuary researchers plotted 2010 AIS data, consisting of more than half a billion records, to get this image of ship traffic in the sanctuary region. Notice the heavy density of ship tracks at the liquid natural gas (LNG) ports (dense red masses) just west of the sanctuary boundary. Other areas with high traffic include the Boston shipping lanes that go east-west through Massachusetts Bay and the north-south Cape Cod Canal to Boston route.

AIS Exhibits Open in Provincetown and Rockport

Want to learn about the Automatic Identification System (AIS)? This real-time program providing information about ship traffic in local waters is part of a new sanctuary exhibit, with one unit installed at the Province Lands Visitor Center of Cape Cod National Seashore and another at the Halibut Point State Park in Rockport, Mass. Although AIS is administered by the U.S. Coast Guard in this nation, the sanctuary recognized its value for research early in the program's development and helped set up the local coverage zone. With antennae receiver stations (for AIS transmissions) in Scituate, Rockport and Provincetown, the Boston-area AIS network covers the entire sanctuary along with the Cape Cod Canal and waters off Cape Ann and Cape Cod. In exchange for using the visitor centers as bases for the antennae, the sanctuary designed and installed the new, high-tech exhibits. The exhibits, which feature a real-time display of ship tracks and videos about AIS and how it is being used for whale conservation, are free and open seasonally. Check with the individual parks for dates and times.



AIS Exhibit, developed with Creative Resources Group, is on display at the Province Lands Visitor Center of Cape Cod National Seashore. Photo: Dennis Huston, CRG

Biodiversity Conservation

Sanctuary Seafloor Shows Signs of Recovery

You can't see the border at the water's surface. The boundary line appears only on written maps. But in some respects the zone that demarcates the Western Gulf of Maine Closure Area where it overlaps Stellwagen Bank National Marine Sanctuary is becoming recognizable to researchers who visit this underwater world.

Colorful anemones now cling to boulders while young sea stars and short fingers of sponge are becoming more prevalent over gravel. Marine life is growing up in this section of the sanctuary that was once actively fished but is now closed to fishing gear that impacts groundfish habitat. But the recovery has been slow, and, in some areas, far from stable.

"We can clearly see effects of the closure on the different responses of the seafloor community inside and outside the closure area," said Peter Auster, research professor of marine sciences at the University of Connecticut. "It's good news that the closure is beginning to work in terms of habitat protection but recovery is at an early interim stage and is still ongoing, even after 12 years."

Before the closure went into effect persistent bottom-impact fishing activity, including seafloor dragging of trawl nets and clam and scallop dredges, removed much of the marine life that grew there. Sponges, anemones, tunicates and other relatively stationary and commercially unimportant but ecologically significant species, were incidentally removed or chronically damaged.

"These creatures establish biological communities that provide three-dimensional structure on the seafloor, just as trees do on land," said Craig MacDonald, sanctuary superintendent. "When the structures are removed, other animals, such as juvenile fish or crustaceans, have fewer places to hide from predators, reducing the functional utility of the associated habitats."

Scientists note that species within these benthic marine communities are closely associated with one another, and an understanding of these relationships can assist in understanding the overall health of the environment. In protected areas of the sanctuary unhampered by the chronic impacts of bottom-impact fishing gear, it appears that communities have begun to recover and regulate themselves based on local interactions between species such as predation and competition. This is evidence of a return to the status of a more fully functioning ecosystem. But compared to studies conducted elsewhere, seafloor habitat recovery at Stellwagen Bank sanctuary sites has not progressed as anticipated, according to a new report in the National Marine Sanctuaries Conservation Series.

"Most people assume that once we stop impacting an area with fishing gear, that it will rapidly recover to a stable community, like the recovery of old farm fields in New England ultimately shifting to mature forests," said Alison Tamsett, a University of Connecticut biologist and principal author of the study "Dynamics of Hard Substratum Communities Inside and Outside of a Fisheries Habitat Closed Area in Stellwagen Bank National Marine Sanctuary." "We now realize there is much more complexity to the recovery process in the seafloor ecosystem than was previously known."

The closure area was established by NOAA's Fisheries Service and the New England Fishery Management Council in 1998 to aid in the recovery of groundfish. In so doing, they created a living laboratory for the assessment of closed areas as conservation tools for managing biological diversity. All bottom-tending gear that could affect groundfish habitat was prohibited in the closure area, although lobster traps, recreational hook-and-line, and mid-water trawls were, and still are, allowed. Over the past dozen years, a team of scientists has looked at recovery rates of representative habitat types in the sanctuary, half in the closed area and half in areas with active fishing.

The Conservation Series report concludes that seafloor communities inside the closure area are recovering from fishing gear impacts but they haven't yet returned to a state of ecological stability. The authors caution that their observations "neither support nor reject" the assumption that cessation or reduction of fishing will allow populations and communities to fully recover. They recommend continued monitoring, over a larger number of sites and a longer period of time within the sanctuary, to determine how seafloor communities there respond to various human uses.

The report, written by Alison Tamsett, Kari Heinonen and Peter Auster of the University of Connecticut and James Lindholm of California State University, San Diego, is available online at http://sanctuaries.noaa.gov/science/conservation.

Photographing the Seafloor at Six Frames a Second

Every second, six images are snapped. Through the magic of computer processing, those images are pieced together into a mosaic, creating a continuous image ribbon. Those pictures have been revealing the status of the seafloor – from habitat changes, to the spread of invasive species and the presence of marine debris. HabCam or HABitat mapping CAMera system provides a unique glimpse of the seafloor through optical imaging. Developed by the HabCam Group, based at the Woods Hole Oceanographic Institution and funded through a variety of public and private sources, the technology has become an important tool for government, academia and industry. The camera system has been used to watch ecosystem changes in several portions of the continental shelf off the northeastern United States, including sections of Georges Bank, Nantucket Shoals, the Mid-Atlantic Bight and Stellwagen Bank sanctuary. Part of the project involved assessing the extent and threat of the invasive tunicate *Didemnum vexillum*, which has seen explosive growth on Georges Bank and has now been seen in parts of the sanctuary. The vast array of images has also provided researchers with information about the types and amount of marine debris on the seafloor. Ben Cowie-Haskell, sanctuary deputy superintendent, was a co-author of a paper entitled "Detecting derelict fishing gear in Stellwagen Bank National Marine Sanctuary using HabCam" presented at the Fifth International Marine Debris Conference in Hawaii this past winter. To find out more about HabCam and to view seafloor images, go to http://habcam.whoi.edu.

HabCam images are spliced together to produce a mosaic of the seafloor, including this track in the sanctuary. Photo: HabCam Group

Northern red anemones provide cover for shrimp in a section of the sanctuary incorporated in the Western Gulf of Maine Closure Area. Photo: NURTEC - UConn

Individual HabCam images capture scenes of marine life and marine debris on the seafloor.

Top to bottom :
Lobster,eating fish;
Northern cerianthid;
Derelict net;
Sea star;
Cusk and sponge;
Northern red anemone
Photos: HabCam Group

Special Feature

Helgoland Mission to the Seafloor

Herring, Hydroacoustics and Exploration in Inner Space

Helgoland became a case study on the difficulties of working in the ocean. The lessons learned here helped guide future undersea exploration."

Wes Pratt, NOAA science diver for the Helgoland project.

Fortune and fate led to a recent discovery that adds a new chapter in the history of underwater exploration in the sanctuary. In the early years of the man-in-the-sea program, when divers and scientists were pushing the boundaries of the inner-space frontier, an underwater habitat was placed on Jeffreys Ledge. Although only a short-term experiment in underwatr living, evidence of the project still remains on the seafloor -- the name associated with the find is "Helgoland."

Helgoland was an ungainly-looking structure – a bright orange-yellow mix of tubes and tunnels and tanks. This massive metal invention of German engineering had seen service in the North and Baltic Seas. In September of 1975 it came to the United States for a three-month mission dedicated to fisheries biology through NOAA's Manned Undersea Science and Technology Program. From September to November Helfoland divers experienced challenges from severe storms and a hurricane to uncooperative study subjects (herring), but their experiences added to the growing body of knowledge about saturation diving and the use of underwater habitats.

The multi-national team included habitat technical specialists from Germany, U.S. scientists and support divers, and researchers from Poland and the Soviet Union. It showcased the spirit of "glasnost" or "openness" and peaceful cooperation a decade before Russian premier Mikhail Gorbachev introduced the policy more formally. Just as with the International Space Station today, Helgoland brought individuals together in an extreme environment where survival and scientific cooperation took precedence over the philosophical differences in the political arena.

The modern part of this story starts on July 19, 2010. Chris Cooper, a NOAA science diver, had agreed to join a sanctuary team planning on scouting the shallowest portion of Jeffreys Ledge, This area offered the potential for interesting seafloor features but was not often targeted by local divers.

Cooper, in preparing for the day trip north from his Connecticut home, contacted his father, Dick Cooper, to cancel a previous engagement and mentioned his upcoming assignment.

"My jaw dropped when my dad said he was pretty sure he had been to that spot, and that it had been with the Helgoland underwater habitat," he said. "Dad's Helgoland stories had fascinated me when I was a child. Now, 35 years later, I would be diving on the very spot where my father had been science director for that undersea mission," said Cooper.

At the time of the Helgoland project, Dick Cooper was a biologist for the National Marine Fisheries Service where he led NOAA's Manned Undersea Research and Technology group. He was based out of Woods Hole, Mass.

"Dad said there were only two areas on Jeffreys Ledge that were shallow enough for diving and had been considered for the Helgoland deployment," noted Cooper. "The coordinates for my upcoming dive were on the south flank of the ledge and right where he figured the Helgoland had been stationed."

Dick Cooper described a boulder strewn area. He mentioned that the habitat crew used large cube-like cement blocks to weigh down the structure. A large buoy had been anchored at the site to provide power for the habitat.

continued on page 9

Helgoland art courtesy of NURTEC - UConn

continued from page 8

"When I met up with the team the following morning it was hard to contain my excitement. I shared my father's stories about the Helgoland with the other team members as we traveled out to the site on the sanctuary's research vessel Auk," said Cooper. While aware than an underwater habitat had been used on Jeffreys Ledge, the team had not suspected that their intended dive spot might be the actual location of the Helgoland habitat.

Upon arrival at the dive coordinates, the first two divers swam down on a shot line set on the shallowest part of Jeffreys Ledge.

Within 50 feet of that location the divers found an anchor chain; and, in following the chain, they discovered two large Danforth anchors used to anchor the habitat's surface support buoy. The dive team had found the exact location of the Helgoland project.

Man in Space and Sea

In the 1970s, as astronauts proved man could walk on the moon and perform scientific experiments in an orbiting space laboratory, another brave group of adventurers were exploring an equally dangerous environment. These explorers also left Terra Firma, but instead of going up, they went down – into the sea. The ocean offered aquanauts challenges that rivaled space travel, from the dangers of living in a hostile environment to the difficulties of organizing complex missions with new technologies. One of those missions happened right here off the Massachusetts coast in what is now Stellwagen Bank National Marine Sanctuary with the Helgoland undersea habitat.

The Helgoland habitat measured 14 meters (46 feet) long, seven meters (23 feet) wide and seven meters (23 feet) high. Four-person dive teams spent week-long rotations in its damp, cramped spaces, which included a kitchen/dining area, bunks and laboratory space in the central compartment. A "moon pool" and "suiting up" area with egress to the ocean were located at one end, and the decompression chamber at the other.

The principle feature of this type of underwater habitat is that the pressure inside the habitat is equal to the pressure at depth. This allows divers to enter and exit the habitat through a downward facing "moon pool" (a two-meter wide hatch) to the ocean. Once inside, dry suits (preferable to wet suits due to cold water temperatures) could be removed and normal clothing worn for non-dive operations in the habitat. If, by accident, the air pressure inside the habitat were to drop precipitously, water could rush inside and flood the living spaces.

As part of the Helgoland mission, all divers had to be experienced in saturation diving, a relatively new technique at that time, which allows humans to work for long periods of time at depth. In traditional diving, the deeper a diver goes below 33 feet, the shorter the allowable dive time. With deeper depths, there is more pressure, and the gases breathed into the body are compressed. When sufacing, divers must breathe out the compressed gasses – primarily nitrogen – or risk suffering a condition called decompression sickness or "the bends." In most dives, decompression time is based on depth and length of dive.

In saturation diving it was found that there is a certain point in time during a deep dive (and habitat stay) where the body's tissues get filled to capacity with the pressurized gas. After a stay of a day or a week or more, divers only have to decompress once, although that session can be quite lengthy. With Helgoland, the decompression period was 50 hours.

At the end of the mission in some types of habitats, divers enter pressurized capsules, return to the surface for recovery, and decompress on board the ship or on shore. In the Helgoland project, decompression occurred in the habitat's compact chamber. When fully decompressed, the divers would quickly be returned to the 115 foot pressure (as if they were undertaking a traditional dive), don their drysuits and exit the habitat. Their ascent would include a normal, short

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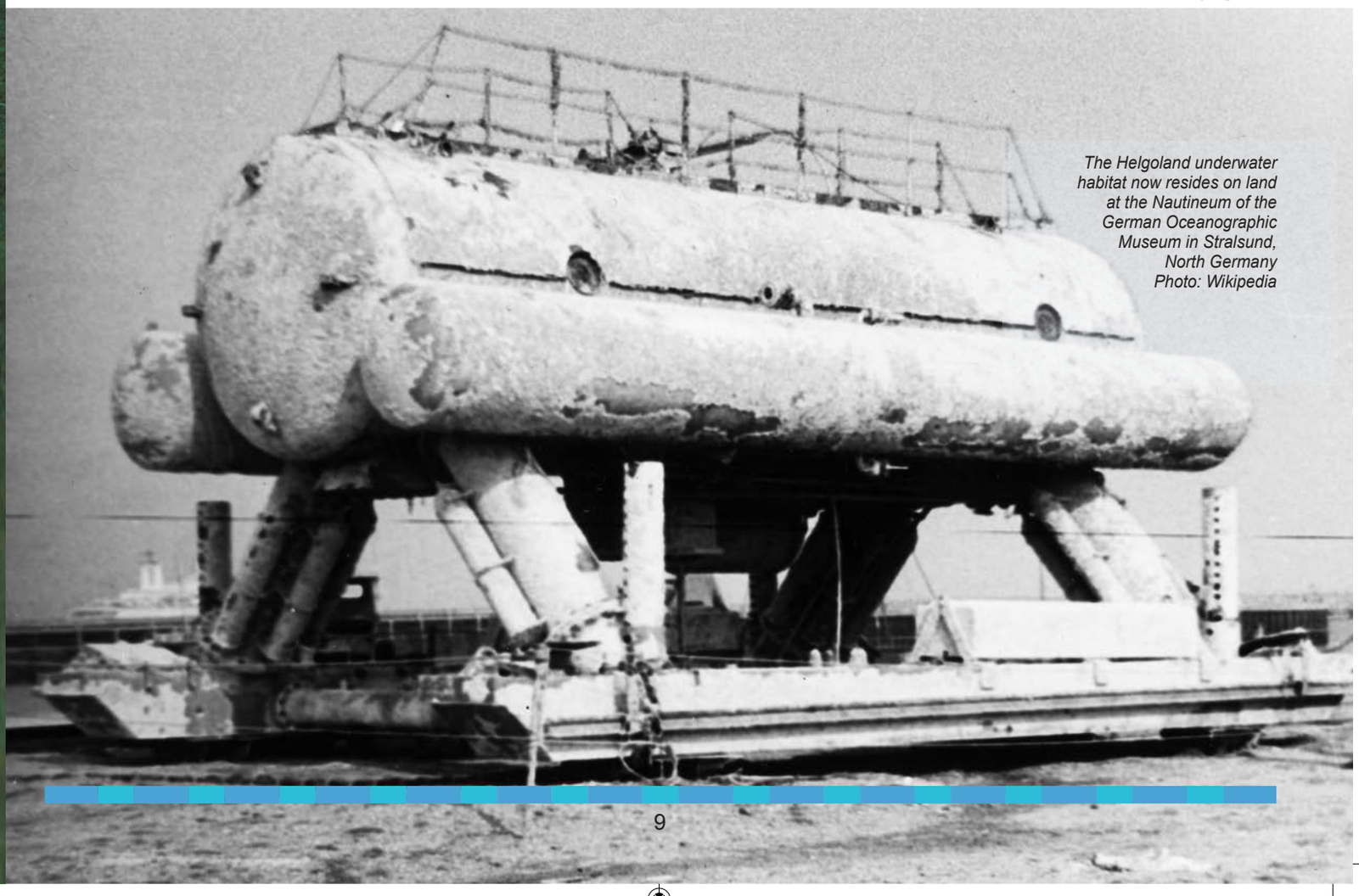


The Helgoland underwater habitat now resides on land at the Nautineum of the German Oceanographic Museum in Stralsund, North Germany
Photo: Wikipedia

Special Feature

continued from page 9

decompression stop at 10 feet before surfacing and recovery for the bumpy ride back to shore. These tedious hours of decompression and life in tight quarters required a cadre of physically and psychologically fit divers.

Looking for Herring, Listening for Fish

The Helgoland science mission promised to provide important data for the region's fishing industry, in particular, a better understanding of predation on herring eggs.

"We believed the Helgoland site was a prime spawning area and we planned to make the area a living laboratory," said Wes Pratt, a NOAA benthic biologist with a solid understanding of Gulf of Maine species and an interest in underwater photography. "We intended to observe the spawning grounds and then record the types of predators attracted to the eggs."

Sea stars, spiny dogfish and other fish gobble up this treat much as humans consume caviar. The researchers also planned to cover selected patches of eggs and determine survival rates. If, through this research, techniques for protecting eggs could be developed, the resulting increased herring population might benefit the regional fishing industry, which, at that time, included major canneries in Maine and the Canadian Maritime Provinces.

A secondary goal of the Helgoland project involved capturing and securing particular species of groundfish to the seafloor to determine if active sonars could detect distinctive "acoustic signatures" or sounds for each species. "We believed we could produce identifiable sonograms of cod, haddock and other species based on sonar reflections from their swim bladders," said Pratt. One possible outgrowth of this research might be more selective fishing and less bycatch.

To support dive operations, cables were set out on the seafloor from the habitat to orient divers to various compass directions and to provide guidelines for return to the habitat. The research team also established a series of outposts – bell-like structures that held air pockets allowing divers to remove their masks to have a quick discussion. Bottled air was bled into the hemispheric bowls to replenish the gases in these conversation stations.

With great enthusiasm and hopeful determination, the project was entitled the First International Saturation Study of Herring and Hydroacoustics or FISSHH.

Unfortunately for the Helgoland team, Murphy's Law – "If something can go wrong, it will!" was certainly in effect during the mission. The projected herring spawning did not happen at the chosen location during that Fall, although herring did spawn nearby in the Gulf of Maine, noted Pratt. "We know they spawned on a nearby knoll. Who knows; we might have spooked the fish with our physical presence. They are quite likely very sensitive to environmental perturbations of sound and light." The secondary mission of detecting and identifying fish through acoustics also failed due to flooded electronic equipment.

With no herring and hydroacoustics the FISSHH acronym lost some of its meaning. In the end, the two H's could have stood for the dangers of hurricanes and the hazards of open water diving.

Troubled Waters

"In addition to the science dilemmas, we were plagued by a series of other troubles," said Kevin McCarthy, a young support diver during the mission who was inspired by Dick Cooper during this time and later went on to work in the New England marine technology industry. The project offered a challenging job and break from schooling, placing him among a group of professional divers, each with 15 or so years of experience.

"Weather was our greatest challenge," said McCarthy. "Diving in New England is never easy, and fall projects can be overset with numerous inherent dangers. Sea state can change radically in a short time, and we were often confronted with rough seas."

For the support divers who delivered supplies and provided escort to and from the habitat and for the aquanauts who spent days in the close confines of the habitat, cold was an ever present problem. "The water in the Gulf of Maine never gets warm," said McCarthy, "and at depth, you're living in temperatures close to freezing." He noted that despite drysuits for in-the-water operations, and simple electric heaters in the habitat, the body never warmed up. "We were constantly eating to take in enough calories to compensate for the cold and the strenuous diving activities – the energy expenditures were enormous," he said.

What made Helgoland so different from any of the earlier U.S. underwater habitat biology missions were the depth of the seabase facility, the temperature of the water and the distance from shore. Prior projects, and most subsequent programs, focused on more tropical ecosystems in the Virgin Islands or Florida Keys and shallower depths. Elsewhere, several U.S. Navy projects reached greater depths and seafloor stays, but with missions dedicated primarily to the study of saturation diving with military crews. But even these missions had more sheltered environments for their habitats.

"Although Helgoland had previously been stationed in a relatively deep area in the North Sea, it had probably never been subjected to the ocean forces we experience here," noted McCarthy. "Out on Jeffreys Ledge we were open to the power of New England storms and seas. Wind could hit the surface waters from any direction, and it often did. We had a series of storm fronts come through that subjected us to heavy seas for a good portion of the mission."

The power of the ocean was most dramatically illustrated when the outer edges of a hurricane clipped the Helgoland study area. "My dad reported that at one point he heard the most unnerving scraping from outside the habitat," said Cooper, in reminiscing

about his father's stories of Helgoland. "A two-person team went out to investigate and it looked like the ground was moving. What was happening was that heavy swells were pushing Helgoland over the ground. It was not supposed to do that; they thought it was securely anchored. If Helgoland continued to move, it might possibly slide down into considerably deeper water."

In another incident, the habitat crew heard an explosion from outside. Concerned that part of the structure or the life-support system was compromised, two divers left the Helgoland. Luckily, they found that the sound was caused by the implosion of a glass flotation ball on the cable linking the surface energy buoy to the habitat. The high seas and changing pressures had pushed the capabilities of that product.

Helgoland's energy buoy. Photo: NOAA

Death at Sea

Heavy seas were also probably a factor in the most tragic aspect of the mission – the death of one of the German divers. In a journal entry from that day, the mission's chief medical officer, Dr. George Bond, wrote: "At some terrible point in time, he must have breathed deeply at the precise moment that the top-side buoy rose abruptly with a sharp wave crest. Hanging tight on the line [at his 10-foot decompression stop,

continued on page 11

continued from page 10

he] was raised about four meters toward the surface."

After recovery at the surface, heroic efforts were made to revive him, including CPR on the transport vessel and use of a decompression chamber on shore, but to no avail.

Despite this setback early in the project, the full schedule of dives was attempted. With days growing shorter as the project rolled on, severe limitations with the surface vessels' capabilities for deployment and recovery of the divers in heavy seas, and the problems of supplying adequate stocks of gas and food in the Helgoland, logistics became an ever-present concern. Dr. Bond's task of calculating safe decompression times for all return dives, including many weather-delayed ascents, was probably the most critical element in terms of personnel safety.

Dr. Bond, known widely in the dive community as "Pappy" or "Poppa Topside," was the most famous member of the team, although he remained shoreside for the entire mission. This U.S. Navy medical officer, considered the "father of saturation diving," was closing out a long and much honored military career with Helgoland as his final detail. His knowledge of saturation diving and capabilities in calculating decompression times, were well tested in this mission.

Problems and Progress

Dr. Bond, whose background included an English major in college, kept journals throughout his career including his time with the Helgoland project. In some of his final thoughts about the mission he wrote: "In all truth, I must admit that the FISSH project [he used this acronym rather than FISSHH because there were no herring] has also had as many hairy moments as I can recall in a similar span of time. By Navy standards, far too many of our operations were only marginally safe, and some downright unsafe. And yet, though all major goals were not reached, it sure as hell wasn't for lack of effort. The work will go on, in other times and places, and men will learn a little more about this undersea game with each successive probe."

Wes Pratt, in summarizing the project, said "We had a lot of bad breaks on this mission. It was dominated by technical problems, from quirky carbon dioxide scrubbers, to language barriers, a mal-functioning energy buoy, inadequate supplies, and, most importantly, rough seas. We miscalculated the time and location of the arrival of the herring. But we learned a lot about the techniques for doing science in cold water and we furthered the cause of benthic biology studies. I can't think of another saturation diving program, before or after this one, that was as challenging and scientifically focused. In some cases it showed us what not to do. But we have to keep trying, even if we don't always succeed."

For Dick Cooper, the lure of underwater exploration never faded. He eventually left the National Marine Fisheries Service and headed up the National Undersea Research

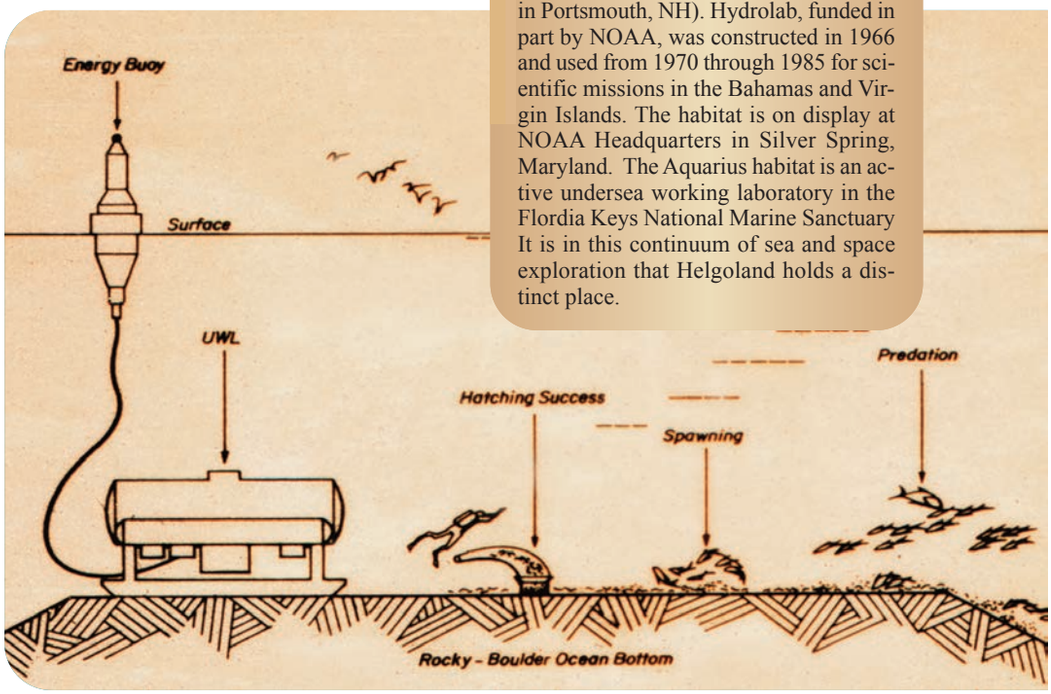
continued on page 12

Helgoland's Wes Pratt and the other divers had to live and work within the confined quarters of the underwater habitat. Photo: NOAA

Missions to Inner and Outer Space

Helgoland came to the United States just after several space and sea programs had gained popular interest. NASA's Apollo program had landed men on the moon from the late 60s through 1972. Skylab, the U.S.'s first space station, hosted three manned missions during 1973 and 1974. In the sea, the U.S. Navy's SEALAB I off Bermuda was commanded by Captain "Poppa Topside" Bond in 1964 and a year later SEALAB II was launched off the California coast with goals of advancing saturation diving procedures and understanding the levels of human endurance to the psychological and physiological strains of living underwater in isolation. Aquanaut/astronaut Scott Carpenter spent a record 30 days in that habitat. The Tektite I and II missions of 1969 and 1970 off the U.S. Virgin Islands were funded by NASA, the Office of Naval Research and the Department of the Interior.

These missions were the first to focus on science, and included the first all-female aquanaut team led by Dr. Sylvia Earle, an internationally renowned ocean explorer and advocate, who piloted a one-person submersible in Stellwagen Bank sanctuary during National Geographic's Sustainable Seas program in 1999. EDALHAB was a student-built project from the University of New Hampshire that was deployed off the Isles of Shoals and later off Florida in the early 1970s (it's now on display at the Seacoast Science Center at Ordione Point State Park in Portsmouth, NH). Hydrolab, funded in part by NOAA, was constructed in 1966 and used from 1970 through 1985 for scientific missions in the Bahamas and Virgin Islands. The habitat is on display at NOAA Headquarters in Silver Spring, Maryland. The Aquarius habitat is an active undersea working laboratory in the Flordia Keys National Marine Sanctuary It is in this continuum of sea and space exploration that Helgoland holds a distinct place.



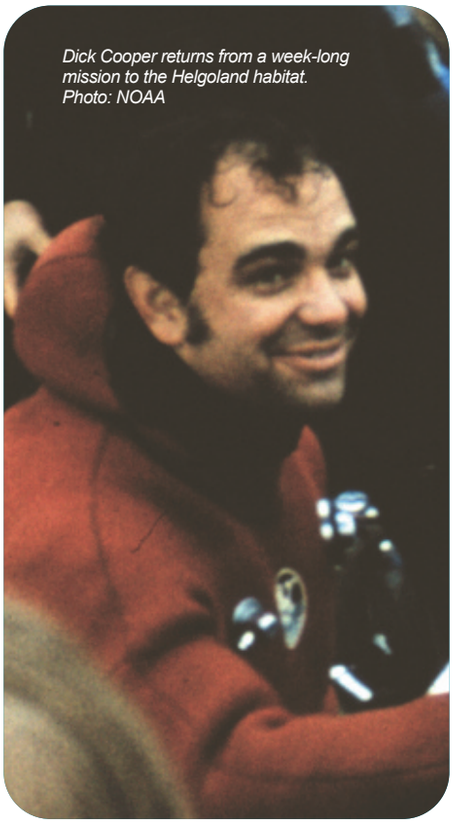
The Helgoland expedition was well orchestrated and as carefully planned as a mission in space. Conditions aboard the station were slightly more roomy than aboard a space capsule, but not by much. The sketch above shows a rendering of one of the scientific missions focused on herring spawning. Photo: NOAA

Special Feature

continued from page 11

Center at the University of Connecticut. He made use of manned submersibles, remotely operated vehicles (ROVs), autonomous underwater vehicles (AUVs) and camera sleds, often in the Stellwagen Bank sanctuary. Although he never again used an anchored underwater habitat in the Gulf of Maine, he suggested that the use of smaller, portable habitats or bells would be a better solution for environments where weather is unstable and scientific study areas may be widely dispersed. And his interests in underwater habitats never flagged. At the time of his passing, he was a founder of the Seabase1 Corporation, a project to build an underwater habitat for research, education and ecotourism off Belize with a mission to increase environmental stewardship and build public fascination for the ocean.

Dr. Richard Cooper passed away suddenly in February (see associated article). A short interview with this article's author was held shortly before his passing and a longer interview had been planned. The sanctuary offers its condolences to his family and recognizes Dick Cooper's lifetime achievements in better understanding the sanctuary area, the Gulf of Maine and in supporting efforts to explore the undersea world.



Dick Cooper returns from a week-long mission to the Helgoland habitat. Photo: NOAA

Article by Anne Smrcina, SBNMS Education and Outreach Coordinator

Dick Cooper proudly displays a model of SeaBase1. Photo courtesy of Chris Cooper

In Memoriam – Dick Cooper

"He was a fan of the Stellwagen Bank region before it ever had a national designation. He encouraged students to study the area's diverse species. And he personally explored its depths through scuba diving, submersibles and imaging systems. It is with great sadness that the sanctuary reports the passing of Dr. Richard "Dick" Cooper on Jan. 28, 2011.

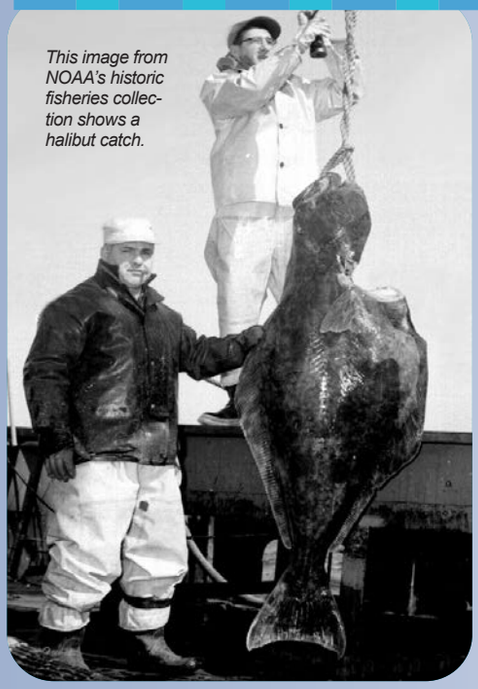
Dick Cooper was a professor emeritus at the University of Connecticut. A former director of the National Undersea Research Center, Dick implemented research programs using underwater vehicles across New England, the Great Lakes, and in places around the world like Russia, Taiwan, Israel and the rift lakes of east Africa. He was a former director of the Marine Sciences & Technology Center and was instrumental in acquiring UConn's flagship research vessel *Connecticut* and the new Marine Sciences Building. His research focused on the use of research submersibles and he used that technology as he became expert in the ecology of submarine canyons and the Gulf of Maine. Dick taught courses that culminated in submersible dives where students obtained first-hand undersea experiences. He founded the High School Aquanaut Program that fostered interest in science and stewardship for the oceans for hundreds of high school teachers and students. Many of these participants experienced Stellwagen Bank close-up and personal as they sampled and photographed the sanctuary's seafloor.

Prior to working at UConn, Dick was a biologist at the National Marine Fisheries Service Laboratory in Woods Hole, Mass., where he led the Manned Undersea Science & Technology group. Early in his career he was involved in many of our nation's first experiments in saturation diving and undersea habitation, where he saw firsthand the potential for using this technology to advance science. He was an aquanaut on the Navy's Sealab III program off California, Tektite in the Virgin Islands, and Helgoland in the Gulf of Maine. The Helgoland underwater habitat was anchored, for three months in 1975, on Jeffreys Ledge in an area that is now the northern part of the sanctuary. Late in his career he returned to these roots, developing the concept of SeaBase, a modern undersea habitat that is intended to promote awareness of ocean issues.

Dick inspired and fostered many careers in marine science and his legacy will live on through the work of his students, former staff and colleagues. Dick formed two foundations to promote the potential for educational and recreational use of saturation diving and was working on these projects to the end. He is survived by his wife of 50 years Paddy Cooper, sons Chris and Jeff, and daughters Cathy and Wendy. His positive gung-ho outlook on life will be sorely missed.

This article was based on material from Peter Auster, science director at NURTEC-UConn and a sanctuary advisory council member.

Biodiversity Conservation



This image from NOAA's historic fisheries collection shows a halibut catch.

Where Have All the Big Fish Gone?

A century ago, fishermen could go out to Stellwagen Bank and consistently find swordfish. Halibut, the most prized and largest of the local flatfish, was a common and economically significant catch.

Today, fishing vessels travel long distances into the North Atlantic in their search for swordfish and halibut are considered commercially extinct.

The numbers of big, top-level predators in Stellwagen Bank National Marine Sanctuary have decreased significantly over what existed 100 years ago, according to a new NOAA National Marine Sanctuaries Conservation Series report. "Stellwagen Bank Marine Historical Ecology Final Report" describes fish populations in the sanctuary that are resilient, but have suffered declines in numbers and species diversity over time.

The report, produced by the Gulf of Maine Cod Project at the University of New Hampshire, presents results of a three-year survey and analysis of historical documents and manuscripts relevant to the marine historical ecology of the sanctuary. The authors, Stefan Claesson and Andrew Rosenberg, former director of NOAA Fisheries Northeast Regional Office, said the report's findings challenge currently established baselines "and should influence the direction of management actions needed to improve overall ecosystem integrity."

Key findings from the research include:
• Halibut, swordfish and other big top predators were overfished to near commercial extinction in the late 19th and early 20th centuries;
• Diversity of bottom-dwelling species in the western Gulf of Maine, including the sanctuary, declined from 1900 to 2000; and
• Maximum annual catch levels of important commercial species declined by nearly 50 percent over a 100 year period.

"Understanding our past is key to managing for the future, and offers critical insights for marine resource managers, the fishing community and environmentalists," said Craig MacDonald, superintendent of Stellwagen Bank National Marine Sanctuary. "Biodiversity conservation is an important management priority for the sanctuary, and a major focus in our new management plan. Big fish are important agents in shaping the composition and complexity of marine communities and their numbers need to be increased."

The waters of Stellwagen Bank National Marine Sanctuary have been fished for nearly 400 years, since European mariners came to the New World well before the Pilgrims. Near-shore fish populations and offshore banks, such as Stellwagen, were already showing declining numbers of fish by the early 1800s, the report notes.

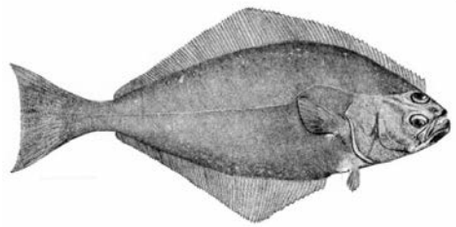
By the late 1800s, fishing interactions with the Stellwagen Bank ecosystem caused dramatic changes to animal populations, according to the report's authors. They attribute the relatively quick ecosystem shifts resulting from these fisheries to the development of new fishing technologies, such as gill nets and trawl gear, which were invented and adopted to improve efficiency and catch levels in an environment of declining numbers of fish caught and increasing market demand for a broader variety of species.

"As managers, industries and the public think about Stellwagen Bank National Marine Sanctuary it is important to understand what used to be there and what can be recovered, not just what we have seen in the last couple of decades," said Andy Rosenberg, one of the report's authors.

The report recommends additional analysis that examines historical trends for fish populations and habitat conditions back to 1800, and identifies socioeconomic and cultural drivers related to shifts in catch levels.

The Marine Sanctuaries Conservation Series Report (ONMS-10-04) is available online at the Office of National Marine Sanctuaries website at http://sanctuaries.noaa.gov/science/conservation/welcome.html or at the Stellwagen Bank sanctuary website at http://stellwagen.noaa.gov.

Swordfishing boats had to travel far out to sea when in-shore stocks were depleted
Photo: NOAA



The Atlantic halibut, the Gulf of Maine's largest flatfish, is now listed as a "Species of Concern" due to overfishing.
Artwork: NOAA

Sanctuary Shipwreck

The bow of the Edna G. *sits upright on the sanctuary seafloor. Photo: SBNMS and NURTEC -UConn*

Eastern Rig Dragger Shipwreck Added to the National Register

It's not the oldest shipwreck on the sanctuary's seafloor, nor does it have the most dramatic history, but the *Edna G.* serves as a link to the sanctuary's commercial fishing heritage.

If one industry can be cited as having built this nation, many would claim that it was fishing. The original New England colonies harvested the bounty of the sea for subsistence and export. Over the centuries, the industry has evolved, as has its role in society, but the fishing boat continues to serve as a cultural icon for the region.

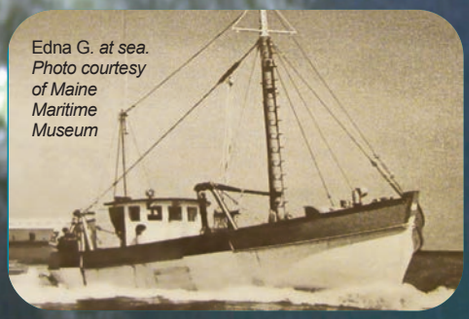
"The sanctuary's seafloor holds a wealth of historic knowledge," said Matthew Lawrence, sanctuary maritime archaeologist. "Each shipwreck provides us with glimpses of the past. The *Edna G.* is part of a continuum that stretches from the earliest sailing vessels to the steel-hulled diesel vessels of today. If we look at the sanctuary as a museum, then the *Edna G.* is an important exhibit in the fishing gallery."

Over the past decade, the sanctuary has been uncovering its maritime heritage through archaeological research "The situation parallels land-based preservation," said Lawrence. "Historic houses in Boston or Salem may not have hosted world-shaking events, but they still deserve protection as representative examples of building styles inhabited by everyday Americans. The same can be said of once commonplace fishing vessels." The wreck of the *Edna G.* has been listed on the National Register of Historic Places, the nation's official list of cultural resources worthy of preservation, as representative of a distinctive regional fishing technique – the eastern rig dragger.

Marine life festoons the Edna G.*'s trawl winch. Photo: SBNMS and NURTEC -UConn*

The eastern rig dragger is categorized as a wooden-hulled, engine-powered fishing vessel that deploys, tows and recovers an otter trawl net or dredge over either the starboard or port side. A single structure at the vessel's stern contains the wheelhouse, captain's bunk and below deck engineering space. The vessel's trawl winch is positioned between the wheelhouse and the fish hold hatch at amidships.

The 54-foot *Edna G.* was launched in 1956 by the Morehead City Shipbuilding Corporation of Morehead City, N.C. From her launch until 1974, the *Edna G.* fished off the North Carolina and Virginia coasts, and in 1974 new owners moved it to New England. The vessel sank on June 30, 1988, off Gloucester, Mass. in what is now the northern part of the sanctuary. As her two-man crew set out its trawl net, a strange noise alerted them to water rapidly filling the vessel's engine room. The fishermen were able to abandon ship and were picked up by another fishing vessel. The exact cause of the sinking was never determined.



Edna G. *at sea. Photo courtesy of Maine Maritime Museum*

"*Edna G.* was listed on the National Register of Historic Places due to its exceptional importance as a remarkably intact example of 20th century fishing technology," said Craig MacDonald, sanctuary superintendent. "The shipwreck represents a rapidly disappearing watercraft variety emblematic of the region's maritime traditions."

Scientists from NOAA and the University of Connecticut's Northeast Underwater Research Technology and Education Center, or NURTEC, documented the shipwreck site in 2003 with a remotely operated vehicle. The fieldwork recorded the vessel's features including its intact wooden hull, wheelhouse and trawl winch. This information provides insights into vessel construction and gear development.

NOAA and NURTEC scientists have collaboratively located and documented more than three dozen historic shipwrecks in the sanctuary using side scan sonar and underwater robots. *Edna G.* is the sanctuary's fifth shipwreck site to be included on the National Register, which is administered by the U. S. Department of the Interior's National Park Service.

Edna G.'s location within Stellwagen Bank National Marine Sanctuary provides protection unavailable in other federal waters off Massachusetts. Sanctuary regulations prohibit moving, removing, or injuring, or any attempt to move any sanctuary historical resource, including artifacts and pieces from shipwrecks. Anyone violating this regulation is subject to civil penalties.

Currents

Sanctuary volunteer coordinator Anne-Marie Runfola (center) provides guidance during a workshop activity. Photo: SBNMS

New Partnerships Forged through Sister Sanctuary Workshop

The sister sanctuary relationship between Stellwagen Bank National Marine Sanctuary and the Marine Mammal Sanctuary of the Dominican Republic was strengthened this past March with a two-day workshop on volunteering, held in Samaná, gateway to that Caribbean nation's marine sanctuary. The workshop led by sanctuary Volunteer Coordinator Anne-Marie Runfola and Barbara Knoss, director of education and volunteers at the Cape Cod Museum of Natural History, attracted participants from the Samaná Tourism Cluster, the Mayor's Office, The Nature Conservancy, several community development organizations, an eco hotel, and CEBSE, a conservation organization that opened a new whale museum there in February. The workshop focused on developing a youth volunteer corps to educate locals and tourists about the sanctuary and its connections with the Stellwagen Bank sanctuary and the U.S. National Marine Sanctuary System. Dominican students have a community service requirement, which provides a ready-made demographic for potential volunteer programs.

Sanctuary Establishes Volunteer Program

Stellwagen Bank National Marine Sanctuary, which has taken on several volunteers in the past on an informal basis, is now formalizing the process. As sanctuary research, education and resource protection programs expand along with public recognition of the site, the need for additional hands is paramount. Volunteers make a unique and valuable contribution by expanding contact with local communities and building a sense of stewardship for the sanctuary. Volunteer docent events and presentations increase public awareness and support by helping people learn more about the research and conservation efforts of the Stellwagen Bank National Marine Sanctuary team. Other volunteer projects support the sanctuary in many large and small ways. In return, volunteers gain a better understanding of this exciting ocean world and have an opportunity to make a difference.

Stellwagen Ambassadors

Do you like to meet people? Are you interested in spreading the word about the amazing natural and cultural resources off the coast of Massachusetts? The Stellwagen Ambassadors program is a great opportunity to visit festivals, museums, and other venues to talk with the public about the sanctuary and its programs. Ambassadors may staff sanctuary tables at events, give presentations to groups or run educational activities based on their interests. The sanctuary will offer training and support to those who can commit to several events a year. Check the sanctuary website for the dates and times for training sessions.

The 2011 Grand Prize in the Marine Art Contest was awarded to Lucas Cantell for his painting of sanctuary biodiversity

Marine Art Contest Results

Winners of the 2011 K - 12 Marine Art Contest sponsored by Massachusetts Marine Educators and co-sponsored by the sanctuary will be posted on the sanctuary's website http://stellwagen.noaa.gov/pgalllery/kidscorner.html in June 2011. Almost 750 entries were received this year including art from Serbia and France.

A Child's Sanctuary

Newly trained Ambassadors will have the opportunity to participate in an exciting local initiative. The sanctuary is partnering with the Scituate Public Library to produce A Child's Sanctuary, a series of educational events targeting pre-K through upper elementary school students. The first event was held on May 7. Subsequent classes are scheduled for July 9 and August 13, 2011, from 10-11:30 a.m. at the library. The program is designed to connect children and parents to their local sanctuary and offers science, math, art, and language arts content through a real-world context. Members of the Ambassadors program will help present marine-themed activities, highlight library resources, and share information about the sanctuary program. In addition to adult volunteers, the sanctuary will develop a cadre of teen Ambassadors to help run the program by cross-training the library's youth volunteers. If interest exists, the sanctuary will replicate A Child's Sanctuary in other towns with connections to the sanctuary, from Cape Ann to Cape Cod.

You can find information on current volunteer listings and program news at http://stellwagen.noaa.gov/involved/volunteers.html.

Gerry E. Studds Stellwagen Bank
National Marine Sanctuary
175 Edward Foster Road
Scituate, Massachusetts 02066
http://stellwagen.noaa.gov

Sei whales in the sanctuary
Photo: Anne Smrcina, SBNMS

CREATURE FEATURE – SEI WHALES (*Balaenoptera borealis*)

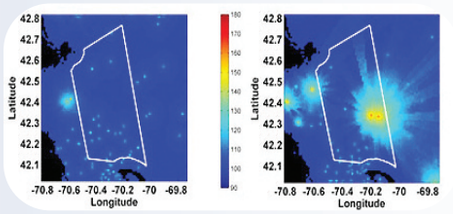
There was a flurry of excitement during an April whale watch into the sanctuary. Not only were critically endangered North Atlantic right whales feeding in the sanctuary, but several rarely seen sei (pronounced "say") whales were there too. This endangered baleen whale species can reach lengths of about 40-60 feet (12-18 meters) and weigh up to 50 tons. Known to feed opportunistically on small schooling fish, plankton or squid, the observed group of about half a dozen whales appeared to be feasting on the same tiny prey as their right whale cousins.

The sei whale has a long, sleek body that is dark bluish-gray to black in color with subtle mottling and pale underneath. It is somewhat similar to a fin whale, but has a uniformly dark head, unlike the fin whale's asymmetric coloration. The whale's blow is shorter and less dense than that of the fin and its dorsal fin is relatively taller, thinner and more deeply hooked. One distinct characteristic is the whale's baleen, which is dark with a fine silky fringe of white bristles. This fine baleen is used for filtering out copepods and other small planktonic prey. The presence of 30-65 relatively short ventral pleats on the throat is an indication that the whale is also capable of gulp feeding on schools of fish. They are considered the fastest swimming cetacean, reaching top speeds of nearly 35 miles per hour.

Sei whales are found throughout the world ocean, but are commonly grouped into two subspecies – one in the Northern Hemisphere (*B.b. borealis*) and another in the Southern Hemisphere (*B.b. schlegellii*). In U.S. waters, sei whales have been divided into four stocks: the Hawaiian Stock, Eastern North Pacific Stock, Nova Scotia Stock and Western North Atlantic Stock. Although the species is believed to migrate toward lower latitudes during the winter and higher latitudes during the summer, the distribution and movement patterns of this species are not well known. During the 19th and 20th centuries, sei whales were greatly depleted by commercial whaling, with an estimated 300,000 animals killed for their meat and oil. Today, scientists estimate that the current worldwide population is about 80,000 individuals.

Student Marine Art Showcased in Traveling Exhibit

Winning artwork from the Massachusetts Marine Educators annual marine art contest has been displayed in a number of venues around Massachusetts this past year. "Amazing Ocean Creatures of Stellwagen Bank National Marine Sanctuary" visited the Provincetown Center for Coastal Studies laboratory during summer 2010, followed by an installation at the J.F.K. Federal Building in Boston in the winter and a spring showing at the Salem National Historic Site visitor center. The 2010 exhibit finished up its tour at the National Marine Fisheries Service Northeast Regional Office in Gloucester. When the 2011 contest winners are selected early this summer, the new artwork will be showcased in the traveling exhibit. A listing of locations for the 2011 art show will be posted on the sanctuary's website.



Sanctuary Noise Mapping Reported in National Geographic Magazine

A collaborative research project to characterize the underwater acoustic (sound) environment of the sanctuary and to examine the effects of noise on resident marine animals was recently covered in National Geographic Magazine. The January issue described cases where the sounds of large vessels may be masking right whale calls. The research team from the sanctuary, the NMFS Northeast Fisheries Science Center, Cornell University's Laboratory of Ornithology's Bioacoustics Research Program and Marine Acoustics, Inc. believes that man-made noise may drastically change marine animal behavior. More information on this research project can be found on the sanctuary's website at http://stellwagen.noaa.gov/science/passive_acoustics_current.html.

Electronic Banknotes

Due to increased costs for printing and mailing and a reduced budget, the sanctuary is forced to suspend publication of Stellwagen Banknotes. Instead, we are looking into the creation of an electronic magazine to be distributed via e-mail and the sanctuary's website. Individuals interested in receiving this electronic posting should send an e-mail to stellwagen@noaa.gov with a subject line of "Subscribe to E-News" and the correct name and e-mail address in the body text.