

STELLWAGEN BANK E-NOTES: *sanctuary news & events* December 2012



Credit: SBNMS file photo by Elliott Hazen. Photo taken under NOAA Fisheries Permit #14245

Bermuda's new Marine Mammal Sanctuary joins Stellwagen's sister sanctuary network



Humpback breach. Credit SBNMS file photo by Elliott Hazen. Photo taken under NOAA Fisheries Permit #14245.

NOAA and the Government of Bermuda have signed a "sister sanctuary" agreement to support the protection of endangered humpback whales that swim through a new marine mammal sanctuary in the territorial waters of Bermuda on their annual migrations between the feeding/nursery ground of Stellwagen Bank National Marine Sanctuary off Massachusetts and breeding/calving grounds in the Caribbean Sea. The agreement became effective on September 21, 2012.

Together, the two marine sanctuaries will collaborate on research, monitoring and outreach programs that could lead to better protection for humpback whales in the North Atlantic Ocean.

Nearly 650 miles east of the North Carolina coast, Bermuda is strategically situated between the humpbacks' southern calving and breeding grounds and their northern feeding/nursery grounds.

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Harbor Seal Visitor

Harbor seals, like this one photographed during the 2012 Whale Tagging Research Cruise, are one of the regular marine mammal visitors to Stellwagen Bank National Marine Sanctuary. Growing populations of gray and harbor seals on Cape Cod beaches account for a growing number of white shark sightings in the region.

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Bermuda *continued from page 1*

“We are pleased to enlarge our network of sister sanctuaries with the inclusion of Bermuda as we share the responsibility of protecting the same population of endangered humpback whales,” said Craig MacDonald, sanctuary superintendent,

In his remarks announcing the new sanctuary and sister sanctuary agreement, Marc A Bean, Bermuda’s Minister of Environment, Planning and Infrastructure Strategy, said: “The area of the new Bermuda Marine Mammal Sanctuary will be more than 170,000 square nautical miles, approximately circular in shape with Bermuda at its centre. Although by no means the biggest Marine Mammal Sanctuary in the world, it is a very substantial size and we hope it will be a great contribution to marine mammal conservation in the Atlantic Ocean.... The establishment of this Marine Mammal Sanctuary and the conclusion of the agreement with Stellwagen Bank National Marine Sanctuary will protect, and assist in the global recovery of these, endangered species; promote and encourage research into and monitoring of this iconic species while consequently promoting Bermuda as an important hot spot for whale watching.”

In August 2011, the Stellwagen Bank sanctuary signed a sister sanctuary agreement with France for the waters around the French Antilles in the Caribbean Sea. Stellwagen’s sister sanctuary program with the Dominican Republic, created in 2006, was the world’s first agreement to protect the same population of marine mammals in its critical habitats at both endpoints of its migratory route.



STELLWAGEN SANCTUARY TRIVIA

In discussing the sanctuary, to what does “The Sliver” refer?

The “sliver” is the portion of the Western Gulf of Maine Closure Area (absence of bottom-impact groundfishing) that overlaps with the sanctuary. Encompassing 22 percent of the sanctuary, this area has become an important asset for habitat studies looking at seafloor recovery from fishing activity.

Where is Sanctuary Hill”?

Sanctuary Hill is located in the extreme northeast corner of the sanctuary. The shallowest depth at Sanctuary Hill is 120 feet; the area includes exposed bedrock.

Dave Wiley gives TEDx talk in New Bedford; watch his program online

The topic is *Social Complexity and Scientific Validity*. The speaker is our own Dr. David Wiley, research coordinator, who participated in this regional program to bring local experts and their ideas before the public. His September 5, 2012 TEDx talk, based on his Ian Axford Fellowship undertaken in New Zealand last year, is available for free viewing online at YouTube. The address is: <http://www.youtube.com/watch?v=OwV07-xR43k&feature=plcp>

According to its website, TEDx is a program of local, self-organized events that bring people together to share a TED-like experience. TED stands for Technology, Entertainment, Design and originated as a means of spreading worthy ideas from acknowledged experts, first at a conference

SBNMS file photo



David Wiley

and now through annual U.S. and United Kingdom conferences and a multitude of short videos. The TED and TEDx videos are released under a Creative Commons license, so they can be freely shared and reposted.

ABSTRACT for Dave Wiley's TEDx Talk

Environmental problem-solving in the 21st century has moved away from the technological approach that dominated past decision-making and management. Modern decision-making is increasingly viewed as deliberative and participatory, characterized by socially complex multi-stakeholder processes. Information provided to stakeholders for decision-making contains both social and technical components and these present different, but formidable challenges to scientists.

Traditionally, scientists have focused on the technical aspects of problem-solving and counted on confidence in the scientific process to eliminate social concerns, such as research bias or the vested interests of scientists affecting their results or the communication of their findings. However, social aspects of research are a high-order concern among stakeholders and invariably used by them to invalidate information that is counter to their preconceptions or desires. Therefore, research that ignores social complexity has substantially reduced impact on problem-solving and decision-making.

The question becomes, how can scientists conduct research that has social as well as scientific power?

The traditional perception that science provides credible and unbiased information because research is conducted in isolation from those most impacted by its results (i.e., stakeholders) is not valid. Such research contributes to stakeholder entrenchment by allowing stakeholders to construct myriad reasons to reject it, rather than contributing to problem-solving by providing agreed upon information for decisions. Research that is inclusive, balanced by a diversity of interest and demonstrates a full set of problem definitions and potential solutions, as identified by those impacted by them, provides results that are seen as more credible and more likely to be accepted by stakeholders for consensus decisions.

Attention to such aspects of research will increase the social power of results and help scientists achieve the scientific ideal of producing information that is judged unbiased and defensible. Ultimately, increasing the social power of scientific research will increase its efficacy as a cost effective problem-solving tool, thereby increasing its ability to conserve biodiversity and protect the resources and economies on which we depend.

BUMP ups its sanctuary courses



Boston University students participate in on-the-water research from the sanctuary's research vessel *Auk*. Photo: Evelyn Ganson/SBNMS

After a month of immersion in marine science using Stellwagen Bank sanctuary as their living laboratory, undergraduate students in Boston University's Marine Program (BUMP) come away from their course with a pretty good idea of whether marine science is for them.

The first BUMP course in the sanctuary occurred five years ago after BUMP's long-time field site in Woods Hole was disbanded. Since then the program has evolved and grown, serving more than 90 students to date. This year an additional offering in physical oceanography joined marine biology in the course catalog and both were fully enrolled.

Students participate in from four to eight day-long trips out into the sanctuary, studying whale and seabird foraging behaviors or taking measurements of water column characteristics. They then synthesize what they've learned and produce a research paper which they have to present orally to their peers.

NATIONAL MARINE SANCTUARIES TRIVIA

What sanctuary just grew from the smallest to the largest?

Fagatele Bay National Marine Sanctuary, once listed as the smallest site in the system at ¼ square mile, has expanded and been renamed. The new National Marine Sanctuary of American Samoa now stretches around the entire coast of this U.S. territory in the South Pacific and covers more than 13,500 square miles. Five distinct units were added, including Rose Atoll.

Ocean Odyssey and the Sanctuary

In celebration of the sanctuary's 20th anniversary, the Conservation Law Foundation (CLF) is posting a series of essays on its *Ocean Odyssey* site related to sanctuary conservation and science. The first of these blogs (on Nov. 6) was from Priscilla Brooks of CLF, who serves on the Sanctuary Advisory Council (with photos by famed wildlife photographer Brian Skerry). Contributions by sanctuary researchers David Wiley, Leila Hatch and Matthew Lawrence will also be posted during November. To learn more about CLF's *Ocean Odyssey: A Journey Beneath New England's Waves* and to view the blogs go to www.newenglandoceanodyssey.org/about. The purpose of this five-year web-based project is to reveal the mysteries and beauty of New England waters.

The Other Carbon Dioxide Issue: Ocean Acidification

Too much carbon dioxide in the atmosphere causes two major problems—one we hear a lot about and one we don't. We hear a lot about the warming of the planet due to the greenhouse effect. What we hear little about is that one quarter of the carbon dioxide in the atmosphere gets absorbed by the oceans. Carbon dioxide increases the acidity of oceans causing disruptions in the food web and organisms' ability to grow.

To increase our knowledge of this problem, the sanctuary teamed up with researchers at the University of New Hampshire, UMass-Dartmouth and the Northeast Fisheries Science Center in late 2011 and deployed a suite of calibrated instruments designed to measure CO₂, pH, oxygen, temperature, salinity and beam attenuation (light penetration) for six months on an experimental passive acoustic right whale monitoring mooring emplaced by the Woods Hole Oceanographic Institution in the sanctuary at a depth of 85 meters (280 ft).

Results show high CO₂ and correspondingly low calcite saturation throughout much of the December 2011-June 2012 deployment period. Low calcite saturation is important because it affects how well organisms can convert calcium carbonate in the water to the production of shells or other structures they need for survival. Most remarkably, in the spring we observed an apparent coupling in time between surface and near-bottom CO₂. These results suggest that strongly enhanced acidification near the ocean bottom may be closely coupled to the downward movement of particulate organic matter from phytoplankton blooms at the surface. This biochemical coupling may have important implications for bottom dwelling organisms, particularly for the organisms that require calcium carbonate to build their exoskeletons such as echinoderms, cold-water corals and mollusks.

These unanticipated findings and the success of our pilot equipment placement strategy using the long-term right whale monitoring infrastructure highlight both the scientific importance and a potential baseline observational system for Stellwagen Bank sanctuary climate impact investigations.

SCIENCE FACT: *Decreases in pH and the calcite mineral saturation state of the surface oceans and subsurface waters are larger at higher latitudes, due in large part to colder seawater temperatures. It is expected that the saturation state of surface waters off the coast of New England will decline sooner than other areas of the Northeast, especially during the winter months.*

In order to bring sound, interdisciplinary science to bear on fish and shellfish management, the sanctuary research team intends to establish a baseline of conditions and measure processes affecting acidification in the sanctuary.

In particular, we seek a clearer understanding of the dynamic coupling between surface carbon production, deep-water remineralization and near-bottom ocean acidification. We propose an enhanced sensor deployment for one-to-two years and a variety of studies to measure conditions here and compared to other coastal monitoring sites in the western Gulf of Maine.

As part of the NOAA Ocean and Great Lakes Acidification Research Plan, Stellwagen Bank National Marine Sanctuary has been designated as a sentinel site for ocean acidification research in the northeast region.

Article contributed by Ben Cowie-Haskell

Return to *Helgoland*

In the fall of 1975, an underwater habitat, named *Helgoland*, hosted science teams on Jeffreys Ledge to study the ecology of spawning herring and other fisheries-related projects. After its three month deployment, the ungainly housing was removed (it now resides on land at a German museum), but other structural elements were left behind. Following the pinpointing of the *Helgoland* site in July 2010, sanctuary researchers have sought to reveal more of the story behind this pioneering scientific diving project (see Spring/Summer 2011 *Banknotes* for an extensive story on the mission). http://stellwagen.noaa.gov/library/pdfs/banknotes_sprsum2011.pdf

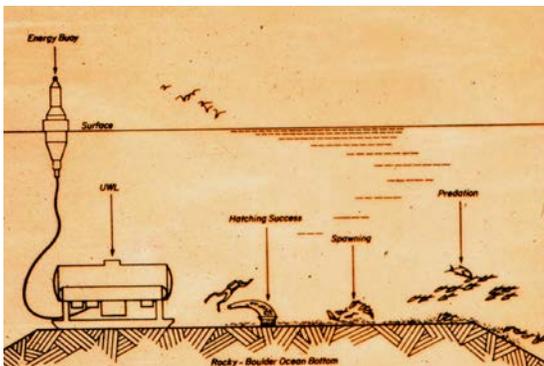


University of Connecticut scientists at the Northeast Underwater Research Technology and Education Center (NURTEC-UConn) have digitized hundreds of images taken during the mission and have compiled logs and mission notes into a project archive. Unfortunately, the passing of Principal Investigator Richard Cooper limited one avenue of research into the fisheries science project, but served as the impetus for a return to the site. Sanctuary staff and UConn scientists set in motion a plan to commemorate Cooper's and the research team's achievements through the placement of a plaque. Sanctuary staff determined that the ideal location for this commemorative signage was adjacent to a pair of the large Danforth anchors, found serendipitously during the July 2010 dive that once held the power and compressor buoy for the saturation habitat.

In preparation of placing the plaque, sanctuary archaeologists headed to the shallowest portion of Jeffreys Ledge onboard the R/V *Auk* to relocate the anchors with the sanctuary's small remotely operated vehicle (ROV). Following several hours of ROV transects over the site, the archaeologists found much more of the *Helgoland*'s infrastructure than was originally thought possible, including components from the research project (FISSHH – First International Saturation Study of Herring and Hydroacoustics). Numerous rope guidelines still cross the rocky bottom, connecting three-foot-cubed concrete blocks that once served as reference points for the research or as weights for underwater “telephone booths” (where divers could remove their masks and speak to each other without surfacing). Most surprisingly, the survey located a second pair of Danforth anchors that worked in concert with the others to keep the power buoy located directly above the habitat. All of these man-made structures are proving to be ideal homes for sanctuary wildlife. Images revealed a cusk living under one such concrete block, an unusual sighting in such shallow water (approximately 120 feet).

Once the anchors' position was accurately determined, sanctuary and UConn divers traveled to Jeffreys Ledge on the R/V *Auk* and dove the site to install the plaque and conduct a marine life survey. Richard Cooper's son, Chris Cooper who is a researcher at UConn, joined the dive team and assisted with the plaque's installation. The mission's success encouraged the dive team to consider future ecological research at the *Helgoland* site. Sanctuary archaeologists plan to develop interpretive information on the FISSHH project and the *Helgoland* habitat for divers and the non-diving public.

– Article contributed by Matthew Lawrence



Photos: (top left) Sanctuary and UConn researchers prepare for a dive to the *Helgoland* site; (top right) Chris Cooper inspects the plaque commemorating the 1975 mission; (far left) schematic shows placement of underwater habitat and study area; (left) *Helgoland* habitat is lifted during maintenance work before the mission. Credit: SBNMS and NURTEC-UConn.

Stellwagen sanctuary's maritime archaeologist leads mission in Florida Keys

NOAA's Office of National Marine Sanctuaries has identified the remains of an early 20th century shipwreck in Florida Keys National Marine Sanctuary to be those of the British steamship *Hannah M. Bell*. Information gathered by sanctuary staff and volunteers from the National Association of Black Scuba Divers during a September 2012 field survey enabled maritime archaeologists to confirm the wreck's origins.

"Similar to the way detectives use forensic information to solve a crime, we compared the dimensions and construction characteristics of the shipwreck known locally as 'Mike's Wreck' with historic shipping records in order to solve this mystery," said Matthew Lawrence, Stellwagen Bank sanctuary's maritime archaeologist and this project's principal investigator. "Measurements of the shipwreck and the records for *Hannah M. Bell* were virtually identical, as were the reported sinking location and the actual location of the wreck."

No lives were lost when the *Hannah M. Bell* grounded on the shallow reef known today as Elbow Reef, located about six miles offshore of Key Largo, Fla., on April 4, 1911. The ship was loaded with coal bound for Vera Cruz, Mexico. With the ship's engine room flooded and holds filled with water, salvagers abandoned their efforts days after grounding, and by May heavy weather had torn the ship apart.

Prior to its demise, the ship made frequent transatlantic trips between European ports, the U.S. East and Gulf coasts, and Caribbean and South American ports transporting a variety of bulk cargos, including cotton, sugar and coal.



NOAA science divers from the national marine sanctuary system, including Stellwagen Bank sanctuary, and National Association of Black Scuba Divers work to confirm the identity of a shipwreck six miles off Key Largo at Elbow Reef. Credit: NOAA

For more information visit:
[Florida Keys National Marine Sanctuary](http://FloridaKeysNationalMarineSanctuary.gov).

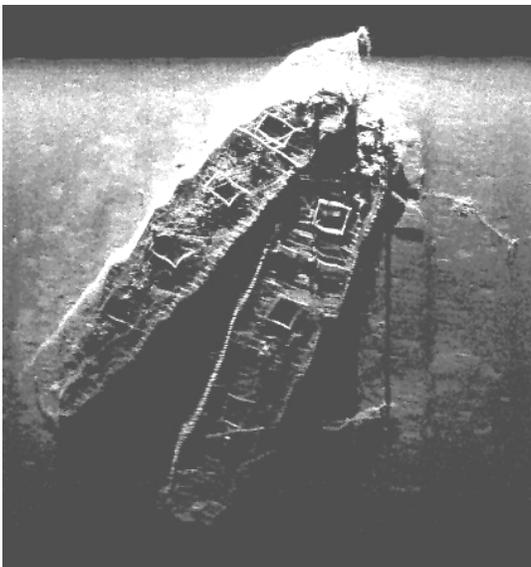
[NOAA Maritime Heritage Program](http://NOAAMaritimeHeritageProgram.gov).

[National Association of Black Scuba Divers](http://NationalAssociationofBlackScubaDivers.org)

STELLWAGEN SANCTUARY TRIVIA

What was the first Stellwagen sanctuary resource to be listed on the National Register of Historic Places?

The coastal steamship *Portland* was officially placed on this list of historically significant sites in 2005. The *Palmer-Crary* site was similarly listed in 2006.



110th anniversary of *Palmer-Crary* loss

This year marks the 110th anniversary of the sinking of the *Frank A. Palmer* and *Louise B. Crary*, two coal schooners that collided and sank on Dec. 17, 1902. Their connected remains lie in the deep waters of the sanctuary. The two Maine-built vessels represent some of the largest 19th century coastal trading vessels – in fact, the *Frank A. Palmer* was the longest four-masted schooner ever built. Each vessel is still loaded with 3,000 tons of Virginia coal.

In 2002, the sanctuary and researchers from the National Undersea Research Center, now the National Undersea Research, Technology and Education Center at the University of Connecticut (NURTEC-UConn), located the ships with side scan sonar using information provided by shipwreck researchers Arnold Carr and John Fish.

For more information about the *Palmer-Crary* shipwrecks, visit the sanctuary's web page at <http://stellwagen.noaa.gov/maritime/crarypotter.html>. The website includes a new article providing insights from the family of the *Louise B. Crary's* captain.

Photo: SBNMS and NURTEC-UConn



Two new NOAA Ocean Today videos highlight sanctuary education programs

NOAA *Ocean Today* video kiosks at the Smithsonian Institution and numerous museums and visitor centers around the country are featuring two new programs that highlight sanctuary co-sponsored education/outreach programs. The goal of both videos is to raise awareness about safe whale watching.

Whale SENSE discusses a collaborative, voluntary program recognizing commercial whale watching operations along the northeast U.S. committed to a higher standard of conservation and education.

Watch Out for Spouts provides tips on how to be a more aware recreational boater in waters where whales are present. The video is based on the “See A Spout” education program.

Both programs are co-sponsored by Stellwagen Bank National Marine Sanctuary, NOAA Fisheries-Office of Protected Resources, and Whale and Dolphin Conservation (a nonprofit conservation organization). You can also view the videos with your computer at the following links:

[Watch Out for Spouts](http://oceanoday.noaa.gov/watchoutforspouts/) <http://oceanoday.noaa.gov/watchoutforspouts/>

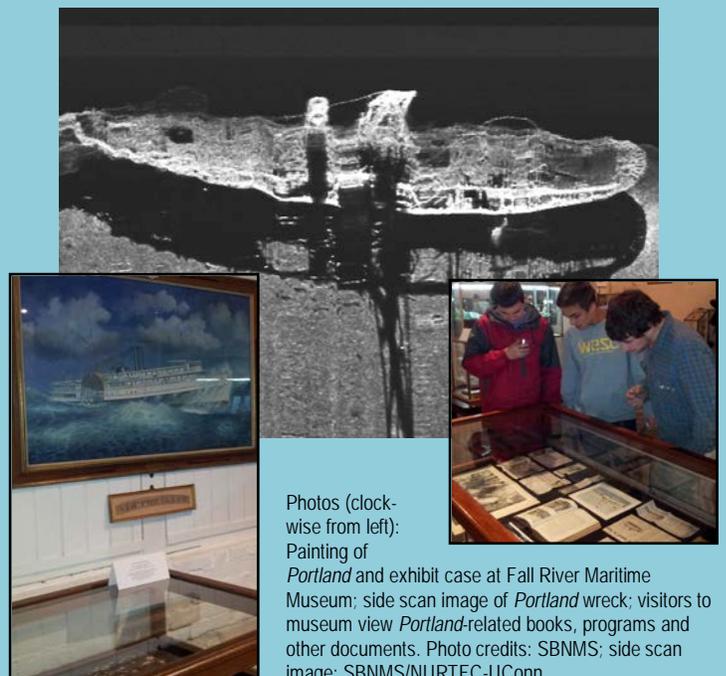
[Whale SENSE](http://oceanoday.noaa.gov/whalesense/) <http://oceanoday.noaa.gov/whalesense/>

Animals without Passports exhibit closes soon

A sanctuary-sponsored exhibit at the Cape Cod Museum of Natural History will end its run there on Dec. 31. A portion of that exhibit will be loaned to the Provincetown Center for Coastal Studies for an extended stay. A traveling version of the exhibit will begin its tour at the Mystic Aquarium in April 2013.

Fall River Maritime Museum opens exhibit about *Portland* shipwreck

Exactly 114 years to the hour that US Life Saving Service surfmen began to find wreckage from the *Portland* washing ashore on the Outer Cape Cod beaches, sanctuary archaeologist Matthew Lawrence began relating the *Portland*'s dramatic story to attendees at an event to commemorate the steamship's loss hosted by the Fall River Maritime Museum. The museum recently opened an exhibit featuring *Portland* artifacts and documents. The Stellwagen Bank sanctuary provided historical and underwater imagery of the steamship to highlight the archaeological research on the site. Former sanctuary advisory council diving alternate, Robert Foster, also presented at the event on his team's dangerous scuba dives to the *Portland* shipwreck, the first ever made. Following the presentation, those in attendance read aloud a contemporary poem written about the disaster in remembrance of all those who lost their lives on the steamship.



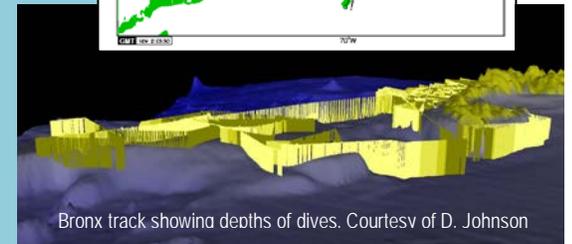
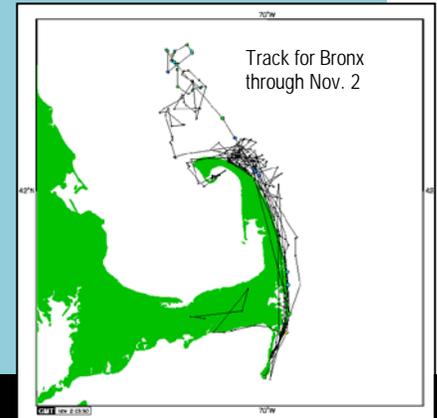
Photos (clock-wise from left): Painting of *Portland* and exhibit case at Fall River Maritime Museum; side scan image of *Portland* wreck; visitors to museum view *Portland*-related books, programs and other documents. Photo credits: SBNMS; side scan image: SBNMS/NURTEC-UConn

A bit of the Bronx in the sanctuary

Data tags that connect to cell phone networks show that Bronx, a juvenile gray seal, started to explore the sanctuary in late October. After rescue and rehabilitation from a fisheries interaction, the animal was released at West Dennis Beach on Cape Cod with the tag glued to the animal's fur. Dr. Dave Johnston, a researcher at Duke University Marine Laboratory and leader of the tracking project, reports that the tag incorporates a Global Positioning System (GPS) receiver with a thermistor (temperature) and depth sensor to capture information about the seal's movements and the environment. When the seal hauls out (comes on shore), the tag links into the local cellular network and downloads its data for analysis. The process for tracking Bronx, who Johnston calls his first "iSeal," is similar to how people use the "Find My Friends" feature on iPhones.

Several groups have contributed to this effort, including the International Fund for Animal Welfare, Mystic Aquarium, the Provincetown Center for Coastal Studies and the Riverhead Foundation.

To view Bronx's up-to-date track or for more information on the project, go to <http://superpod.ml.duke.edu/johnston/latest-tracks-bronx/>



Humpback calf disentangled

On October 25, the calf of a regular sanctuary visitor, the humpback whale Tornado, was rescued from a potentially deadly entanglement. The case of this still dependent calf (which means it was still nursing) was first reported by Cape Ann Whale Watch two days earlier.

Intensive searches by NOAA Fisheries, the Coast Guard the Provincetown Center for Coastal Studies' Marine Animal Entanglement Response (MAER) team could not initially locate the animal. On Thursday, however, the MAER team spotted the mother/calf pair off the northern tip of Stellwagen Bank. According to the Center, the calf was towing buoys and more than 500 feet of line that was wrapped around its left flipper. After several hours of intense effort, the team was able to remove all the gear from the animal near the Tillies Bank area of the sanctuary.

"This was a remarkably difficult disentangling" said Scott Landry, Director of the MAER program. "The calf was travelling very fast in an attempt to keep up with its mother, so we had to work while being towed at high speed." Despite its speed and mobility, the calf suffered extensive lacerations across its body as a result of the entanglement. At last sighting the two whales were swimming calmly together. For more information on this case and other disentangling efforts this year, visit <http://www.coastalstudies.org/>



Reigning in Spain

Stellwagen Bank sanctuary research drew attention at an international conference in Spain this past October. Dave Wiley, sanctuary research coordinator, was an invited participant to the International Workshop on Maritime Transport and Biodiversity Conservation in Santa Cruz de Tenerife. The program's objective was to identify ways to develop an international outreach and training program to help mariners protect whales and other protected species and their habitats.

Dave presented information on "Whale Alert" – a free mobile app for iPads and iPhones that provides static and dynamic information to ships at sea to reduce the risk of collisions with right whales. He also reviewed the sanctuary's outreach and education program to the maritime industry that provides "Report Cards" and speed maps relating to ship compliance with speed limits in right whale seasonal management areas in the northeast that overlap the sanctuary.

Earth Day drifters – their final locations



On Earth Day, April 17, two drifters tracking sea surface currents were released in the sanctuary with the help of Dr. Kathryn Sullivan, NOAA Deputy Administrator. The NOAA drifter, which also measured sea surface temperature, ended up circling Georges Bank before going silent in mid-August. The student-built drifter followed a similar early track, but only lasted until late April. To view these tracks and follow other student-built drifters, visit NOAA Oceanographer Dr. Jim Manning's website at <http://www.nefsc.noaa.gov/drifter>. Dr. Manning plans to offer teacher workshops on drifter-building and ocean current classroom activities in January and March 2013.

20th Anniversary Calendar

- Nov. 4 Official 20th Anniversary of Gerry E. Studts Stellwagen Bank National Marine Sanctuary
- Dec. 14-Jan. 5 Christmas Bird Count with Massachusetts Audubon Day TBD based on wind and sea conditions
- Apr. 25 Deadline Annual Marine Art Contest for students in grades K-12 Sponsored by Massachusetts Marine Educators and others. Theme: *Amazing Ocean Creatures of Stellwagen Bank Sanctuary*

Shellfish and Red Tide information available from Mass Fisheries

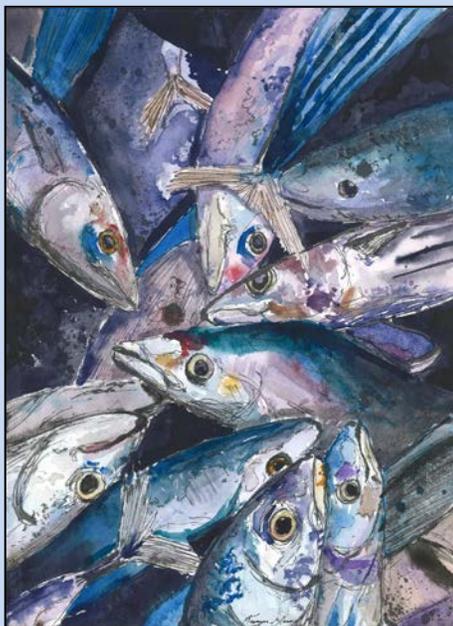
The Massachusetts Division of Marine Fisheries has recently released a new brochure and a poster detailing local shellfish and red tide issues. The materials were produced with support from a NOAA grant and are being made available to the public free of charge at various marine education centers throughout the state. The materials can also be viewed at the DMF website www.mass.gov/dfwele/dmf/publications/informational.htm.

Did you know that red tide is the name loosely used to describe a bloom in marine waters of single-celled microscopic algae that contain both red pigments and harmful neurotoxins that can contaminate many types of shellfish that we eat?

Did you know that cooking will NOT rid the shellfish of the red tide toxin?

For more information about this important health issue and answers to questions about shellfish and red tide go to the DMF website.

Marine art exhibit begins tour



The annual student marine art touring exhibit started its 2012-2013 tour at the Provincetown Center for Coastal Studies this summer. The exhibit showcases winners from the 2012 contest sponsored by Mass. Marine Educators; theme was "Amazing Ocean Creatures of Stellwagen Bank Sanctuary." The schedule now continues with the following dates and locations:

Nov. 28 – Dec. 31
Cape Cod National Seashore, Eastham

Jan. 15 – Feb. 26
J.F.K. Federal Building, Boston

March 1 – March 31
Salem National Historic Site Visitor Ctr.

April
TBD

May 15 – June 10
NOAA Fisheries NE Office, Gloucester

Artwork: (left) *Herring Catch* by Keegan Gilmore, grade 10, Nauset Regional High School; (right) *Whale Tail* by Joey Kennedy, grade 11, Old Colony Regional Vocational Technical High School. View all winning art and honorable mentions at <http://stellwagen.noaa.gov/gallery/contest2012.html>



NATIONAL MARINE SANCTUARY SYSTEM



Scale varies in this perspective. Adapted from National Geographic Maps.

National Marine Sanctuaries
1972-2012: Celebrating 40 Years

Gerry E. Studts
Stellwagen Bank
National Marine Sanctuary
1992-2012: Celebrating 20 Years



<http://stellwagen.noaa.gov/>