



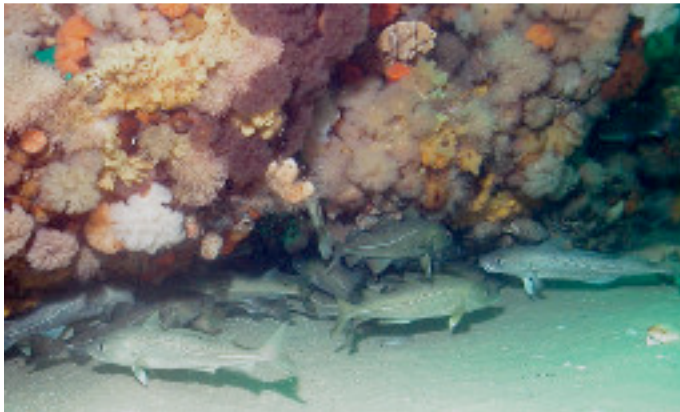
Biodiversity

Biodiversity Explained

(adapted from **Stellwagen Bank National Marine sanctuary Final Management Plan**)

The ocean is the cradle of biological diversity as life began in the sea. A liter of ocean water contains over 100 million micro-organisms. In fact, micro-organisms represent over 50% of the biomass in the sea. Some micro-organisms produce their own food using sunlight while others are predators, hunting for microbial prey in a fluid and turbid environment. The ocean also contains larger multi-cellular plants, including encrusting species that produce calcareous “skeletons” as well as large fast growing kelps that can produce dense forests rivaling those in tropical jungles. Unlike the land and freshwater realms of our planet, the ocean contains representatives of every major type of animal group (phyla) on earth, from sponges to mammals. Although animals are but a single branch of the tree of life, they are the group with which we are most familiar.

Biological diversity is, simply stated, the variety of life on earth; it is the variability in all living things at all levels of examination (United Nations, 1992). It is inclusive of the millions of plants, animals and microbes; the genes they contain; and the ecosystems they build into the living environment. The definition of “biological diversity” or “biodiversity” deserves some discussion as it can mean different things to different people. The most common meaning refers simply to “species diversity,” which is all of the species in a defined area or on earth as a whole, including bacteria, protists, and fungi as well as the multi-cellular organisms (plants, animals).



Cod on Stellwagen Bank (NOAA picture by SBNMS)

Species Diversity – Local Case Study – Demersal Fishes
 Fish are a vital component of the sanctuary’s biological diversity and also one of its strongest links to the human population. The groundfish community
(Explained - cont on page 10)

Inside This Issue

Biodiversity Explained	Page 1
MME Calendar	Page 2
President’s Message	Page 3
From the Editor’s Desk	Page 4
In Memoriam	Page 5
The Closer We Look	Page 6
Boston Harbor Educators Conference	Page 12
How Rare or Abundant is a Species	Page 13
Biodiversity Coldspot	Page 14
Gulf of Main Large Marine Ecosystem	Page 15
Blue Lobster Bowl	Page 16
HSMSS	Page 17
WHOI 2010 Report	Page 18
WHOI 2010 Abstracts	Page 19
MME Awards	Page 20
T-Shirts	Page 21
Art Contest Winners	Page 22

To access this journal on line, use the information on the back of your membership card. If you have difficulty, contact the editor at dimmick@esteacher.org



ISSN 1948-1004

Next Issue of F&J will be posted on the website September 12



Massachusetts Marine Educators
 c/o Bob Rocha
 New Bedford Whaling Museum
 18 Johnny Cake Hill
 New Bedford, MA 02740

www.massmarineeducators.org

<u>Officers:</u>		
President	Bob Rocha	New Bedford Whaling Museum
President-Elect	William Andrade	Swampscott High School
Past-President	Pat Harcourt	Waquoit Bay NERR
Treasurer	Gail Brookings	Educational Consultant
Assistant Treasurer	Linda McIntosh	Swampscott High School
Secretary	Joe LaPointe	Retired
Executive Director	Jack Crowley	Educational Consultant
Editor-in-Chief	Howard Dimmick dimmick@esteacher.org	Science Education Consultants
Managing Editor	Doug Corwine	webmaster@massmarineeducators.org
<u>Board of Directors:</u>		
Lydia Breen		Stoneham High School
Margaret Brumsted		Dartmouth High School
Lee Anne Campbell		Educational Consultant
Peg Collins		Educational Consultant
Howard Dimmick		Educational Consultant
Sarah Hammond		MIT Sea Grant
Erin Hobbs		Stoneham High School
Jayshree Oberoi		New England Aquarium
Dr. Joel Rubin		Stoughton Public Schools
Carolyn Sheild		Clarke Middle School, Lexington
Kathleen Streck		Educational Consultant
Anne I. Smrcina		Stellwagen Bank National Marine Sanctuary
Sue Wieber Nourse		CEO Cape Cod Consultants
<u>Directors Emeritus:</u>		
Alfred Benbenek		Retired
Elizabeth Edwards-Cabana		Retired
Katherine Callahan		Educational Consultant
George Duane		Educational Consultant
Marge Inness		Educational Consultant
Frank Taylor		Educational Consultant
Barbara Waters		Educational Consultant
Calendar Summer 2010		
September 8, 2010		Swampscott Middle School
MME Board Meeting		(Tentative Location)
Saturday October 2, 2010		UMass Boston
Boston Harbor Educators Conference		Ccndpclns@aol.com
Contact: Peg Collins		
Wednesday March 16, 2011		UMass Dartmouth
High School Marine Science Symposium		mbrumsted@dartmouthps.org
Contact: Margaret Brumsted		
Saturday April 30, 2011		Woods Hole Oceanographic Institution
35 th Annual Meeting and Conference		billandrake@hotmail.com
Contact: Bill Andrade		

To access this journal on line, use the information on the back of your membership card. If you have difficulty, contact the editor at dimmick@esteacher.org



President's Message

MME held its 34th annual meeting and conference at Woods Hole Oceanographic Institution (WHOI) on May 1. This day of impressive presentations by WHOI scientists, workshops, field trips, exhibits, chowder, awards and collegiality is a critically important event in the MME calendar. It's one of those days that allows us to connect with the membership, learn from our colleagues, and renew our dedication to marine education. This opportunity to affirm each other's passion for this field grows more important as educators have to get more creative, or even defiant, in order to weave marine topics into classroom mandates.

High praise goes out to President-elect Bill Andrade for coordinating a successful conference. Same goes to fellow Board member, Erin Hobbs, for creating the *Mnemiopsis* design that went onto this year's shirts. There may be some bizarre divisiveness in our country at the moment, but there's none in the crew that makes our conference happen. As overused as the phrase may be, it really does take teamwork to make this conference happen.

I know that Bill would agree with me that we are grateful for the dedicated members who attend these annual gatherings as often as they possibly can. We enjoy seeing each of you and take pride in the fact that you want to keep coming back. We also extend a thank you to those who joined us at the conference for the first time. The feedback all of you provide is welcome and necessary and guides us as we organize future conferences. We hope to see all of you again, whether it's at an MME event or at a professional development workshop somewhere around the state.

It was with great honor that we dedicated the MME meeting to two former Board members who passed away recently, Gordon Estabrooks and Paul King. Both men were leaders in their field and dedicated to delivering quality education for a variety of audiences. Both were inductees of the Massachusetts Hall of Fame of Science Educators. It is worth noting that no less than 14 of the inductees of MHFSE are current or former MME Board members.

While on the topic of conferences, a couple of notes about the National Marine Educators Association conference we're hosting at Northeastern University in Boston next summer. As strong as our current committees are, we hope you will strongly consider getting involved as a volunteer as we pull this major event together. Providing an excellent experience for 400-450 people may seem modest in comparison to the numbers that show up at NSTA, but to us, it is no less important. We want our guests to know the breadth of research and knowledge that happens in MA, we want them to learn from us and from each other, and maybe most importantly, we want them to have a good time. It's our chance to puff up our chests with pride and show off Massachusetts.

You'll notice the 2011 conference logo on page 17. The theme "Cape to Cape: In the Hub of Marine Education" summarizes nicely how much research and sharing of that knowledge happens along our coastline. Earlier today, we did some filming for the NMEA 2011 promotional video in the Hub city, Boston. We have a bit more filming to do later this week and then the editing begins. Dartmouth High School's videography class has taken on this project. Their reputation is excellent, so we go into this with high expectations for a professional finished product. We'll be premiering the video at the NMEA conference in Gatlinburg, TN in July and expect to make it available via the MME website later this summer.

Feel free to contact me marinebiobob65@juno.com or co-Chair, Tracy Hajduk, t.hajduk@noaa.gov if you'd like to know more about getting involved. The conference is from June 29-July 3, 2011.

Lastly, this issue's topic, biodiversity, is a fairly young topic in the realm of science. World-famous scientist E.O. Wilson is credited with coining the term back in the late 80s. He then started Biodiversity Days in 1998 as a fun but useful attempt to catalog 1000 species in 24 hours. He and the volunteers that joined him nearly doubled that number by the time they were finished.

I can remember participating in Biodiversity Days training, led by naturalist and writer Peter Alden, in the early part of the decade and subsequently leading guided walks in search of as many species as possible. As much as I enjoyed making the lists of what we had identified, the better part of this activity was getting the participants, especially the kids, to look more closely at what was around them. They used magnifying glasses, collected small organisms in 'bug boxes', and leafed through field guides in search of a match for what they'd found. We all learned together and were impressed by the variety we had found in our little town of Acushnet.

(President - cont on page 4)

What we did during those walks barely scratched the surface of understanding the entirety of species in our town. Getting to know all of the species in town would take dozens more walks with a variety of naturalists over the course of a few seasons. Putting together all of those 'pieces' would be fun.

Two good sources for recent study of life on earth are The Census of Marine Life and the Encyclopedia of Life. If you are interested in the contextual underpinnings of biodiversity you can check out The Convention on Biological Diversity.

Bob Rocha

President, Massachusetts Marine Educators

From the Editors Desk

As another school year marches to its conclusion, many thoughts have passed through my mind in preparing this column. The WHOI Conference and its theme Alien Invaders is a starting point. We are all keenly aware of the ease in which an area is disrupted by the introduction of a non-native species. The Asian Carp is heading closer toward Lake Michigan and the potential destruction of native lake fish. Pythons growing too big to be pets end up in the Florida Everglades eating many native animals of the marsh. Kudzu Vine introduced into the south to cover bare ground, only to find that it can grow up to 60 feet a year, and cover and strangle all other plants. Zebra Mussels arriving here in the ballast water of ships have clogged many of the outlet pipes in our lakes. The Alien Invaders on the conference program were additional examples of how unwanted species introduced in a foreign environment with no natural predators are causing major changes to the ecosystem of the world.

During the conference, many were concerned with the Gulf Oil Disaster. I found it very disheartening to hear references by premier news reporters being made to the potential damage to the environment once the oil reaches the marshes and the coastal beaches. HELLO!!! The Gulf of Mexico is just as important an environment as are the marshes and beaches. A body of water is as valuable a habitat as are the shore regions. A full 5 - 7% of the seafood of the US is harvested in the Gulf Region. Crabs, oysters, tarpon, tuna, or red snapper, and don't forget the endangered turtles, and hundreds of species of birds, both native and transient, all are impacted by this spill, or will be as it goes on. It seems that the oil industry does not take into consideration that all these creatures are or will be effected before this disaster is over.

It is not what is happening, now, but more what will happen in the months and years ahead as the area is damaged and then slowly tries to recover from this disaster. I have a special affinity for parts of the Gulf, as I was involved, after Hurricane Katrina in helping some NASA Explorer schools in Bay St. Louis, and Pass Christian MS reestablish themselves and get back on their feet. I returned to the area in March 2009 after the NSTA Meeting in New Orleans to see that although the area is slowly getting back to "normal" much work still needed to be done. Now many of these areas are in the path of the oncoming oil rampage, as beaches, marshland, bird nesting areas, as well as the plankton needed at the bottom of the food chain are being irreparably destroyed. And, still ahead, is a predicted higher than normal occurrence of hurricanes in a season that is just underway. These areas have seen three strikes against them, and who knows how much more damage before the oil is stopped and cleaned up.

Someone needs to spread the word that the time is NOW, not next week, or two weeks from now or into August before the oil flow is stopped and cleanup begins. In the spring of 1993, the Mississippi River upstream of St Louis was hit by a major flood, bringing tons of sand and silt down the Mississippi river and out into the Gulf. There was so much dissolved sediment that NASA photographs off the Atlantic Coast in the late summer showed the plume off the North Carolina Coast. Big business seems to not care about major, possibly permanent, damage to the entire ecosystem of this planet. We all should be willing to take part of the blame, as we demand more petroleum and petroleum-based products making more oil drilling in pristine fragile locations necessary. If you wish to have a good classroom activity to show the demands we have for oil, have students research where oil is used and for what it is used. The throw away water bottle you use and discard is petroleum based plastic. How about using a refillable container instead of another bottle.

Howard Dimmick
Editor

Gone Home

In the past two months MME has lost two devoted members of our Association. We are deeply saddened at their passing on. Below, we have some thoughts on each which were supplied by our members. Peg Collins helped with the information for Gordon Estabrooks and John Banister-Marx for Paul King. Thanks to them for their efforts in preparing this page.

Gordon Estabrooks

It is with tears and smiles that we remember our long time member, Gordon Estabrooks. We have tears at his recent passing, but smiles when we think of his presence at all of our events. He was our friend, colleague, and mentor who supported us with his generosity of time, talent and contributions.

His dedication to his profession and his love of science and children were evident in his lifetime career at Boston Latin School and his founding and commitment to his beloved K.E.L.P. (Kennebunk Enrichment Learning Program). He provided so many rich and challenging experiences for children while fostering a love and value for the world in which they live. He did the same for his colleagues by honoring fellow teachers with K.E.L.P. awards every year at MME's Annual Meeting in Woods Hole.

Gordon's love of teaching and fostering environmental awareness continued through his work with the Paul Center for Learning and Recreation in his home town of Chelmsford. To quote from their web page, "The Paul Center is what it is today because of Gordon's forty years of leadership, vision, and unrelenting commitment to children and young adults with special needs".

Despite health difficulties during the past few years, he usually made it to MME's annual conference, clearly delighted to see his colleagues and friends to support the work of the organization. Those of us in MME will sorely miss him, a very giving, kind and gentle soul. Rest in peace, our friend.

Paul King

If you were ever lucky enough to spend some time with Paul King, you soon found out that he was the steady and gracious type of friend. As one of Paul's skiing buddies during the last dozen years, I fondly recall our dramatically different styles on the slopes, a reflection of our distinctly different personalities. While I went down the slope at a fool's speed, often ending up with skis askew and covered with snow, my buddy Paul cruised his favorite slopes at Wildcat at a dignified pace, all the better to take in the beauty of the mountain scenery of Mt. Washington & Tuckerman's Ravine that he so deeply cherished. Warm-up runs were always down Polecat, a long, smooth run symbolic of his human form & demeanor.

Paul was the kind of person who thought deeply about his profession and about the condition of others, and often put his mind to the task of making things better, whether as an educational reformer, social philosopher, or teacher/mentor. You knew Paul put a lot of intellectual capital into things that really mattered, and to him, helping young people "get it right" was way up on the list. His recent reading and passionate recollection of Ken Bain's "What the Best College Teachers Do" was a sign that Paul lived his life always thinking how to communicate more clearly and inspire more fully those he would teach. He was truly dedicated to the art and science of teaching. He was a man of great integrity, one of those marvelously honest and wholesome guys whom you imagine even enjoys a tall glass of milk with meals, and as you might have guessed, he most certainly did.

Paul served for several years on the MME Board and was very active in the MA Association of Biology Teachers and the National Biology Teachers Association. He thoroughly enjoyed connecting with other teachers at conferences and workshops. He was a Biology Teacher at Randolph High school from 1968 to 2001 and taught at Massasoit Community College from 2004 to 2009. Paul was inducted into the Massachusetts Hall of Fame for Science Educators in 2003. We are saddened by his loss, especially at such a young age. Paul battled an illness that many of our members were not aware of.

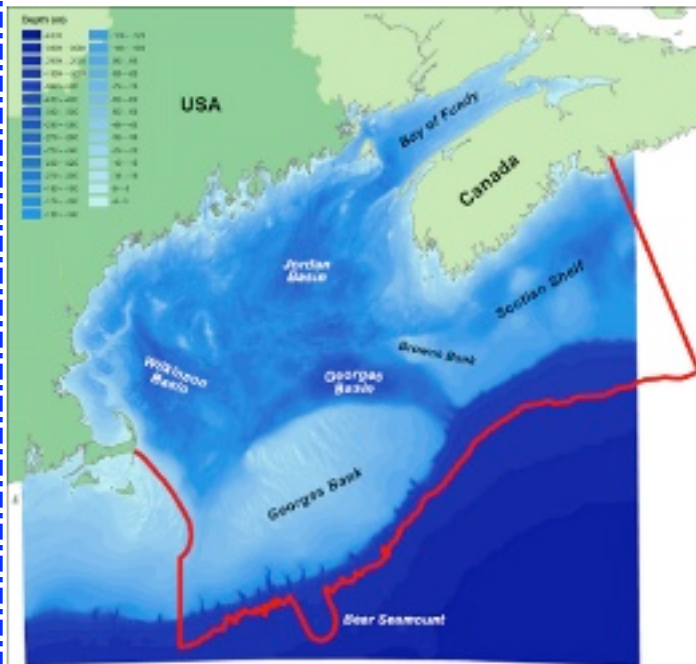
It's easy to see why Paul earned so many accolades and won so many awards as a science educator. He was innovative, compassionate and endlessly eager to do whatever it took to motivate students. In his roughly three decades of teaching I figure he directly touched over 3,000 lives with his great intellectual and charismatic gifts. I would have enjoyed the opportunity to be a student in one of those classes and watch him work his magic. His laughter alone was enough to leave your cheek muscles begging for a rest. Paul King always had the best interest of others at heart, and it is here in ours where he will be fondly remembered and revered.

The closer we look, the more we see

The known diversity of marine life in the Gulf of Maine region continues to grow.

Susan Ryan, Gulf of Maine Research Institute
Species data courtesy of Nick Wolff, USM

The year 2010 – named the *Year of Biodiversity* by the United Nations – will bring focus to the diversity of life on land and sea, and the changes that are occurring around the globe due to human impacts. In October, scientists from eighty nations will gather at the Royal Society in London to share their findings from the *Census of Marine Life* – a 10-year study to assess and explain the abundance, distribution and diversity of life in the world’s ocean. As part of this effort, researchers in the Gulf of Maine have worked together to understand biodiversity in the region and the vital role it plays in ecosystem processes and function. To begin to understand that role, scientists first began by identifying the known species in a



Study Area: The Gulf of Maine is home to over 4,000 species.
Image: GoMA Census

comprehensive database, and linking the species records to information on location and abundance.

The Gulf of Maine Program of the Census of Marine Life, based at the University of Southern Maine and the Centre for Marine Biodiversity in Dartmouth, Nova Scotia, worked with collaborators at the Huntsman Marine Science Center of St. Andrews, New Brunswick to build the authoritative list of known marine species in the Gulf of Maine region. The list is called the Gulf of Maine Register of Marine Species, and it presently contains over 3,100 species that live here year-round or occur here seasonally. The Census has recently identified more than 1,400 additional species that are awaiting validation and entry to the Register. Thus our current estimate of known species in the region is around 4,500. Most of these potential additions come from analyses of databases and special lists, such as intertidal invertebrates and marine phytoplankton, assembled by researchers over the course of their careers. (The most diverse groups—bacteria,

archaea and viruses—are being dealt with separately by a special expert group, since the usual definition of “species” does not apply to these organisms.)

“I recall an early planning meeting of scientists discussing species diversity in the Gulf of Maine, and at the time, our best estimates were closer to 1,500 or 2,000 named species in total,” said Lewis Incze, chief scientist with the Gulf of Maine Census at the University of Southern Maine. “By establishing a species register, and a process for adding to this database, we now have compiled a list of marine species in the Gulf of Maine that is double, to triple, our original estimate.”

The searchable register for the Gulf of Maine and neighboring deep sea waters includes a wide scope of life forms ranging from microscopic plants to marine mammals in waters from the lower intertidal to the deep sea. Researchers at Huntsman, led by curators Lou Van Guelpen and Gerhard Pohle, mined literature dating back 100 years for species records and assured that the list is presented using standard species classifications. Though still in preliminary form, the register is a tremendously useful resource to investigators of biodiversity in the Gulf of Maine. When investigators collect organisms, they can now easily check to see if they have been reported here before, and find descriptions and links to other information.



Megaptera novaeangliae, or humpback whale. A mom and calf traveled hundreds of miles to feed in the krill-laden waters near Platts Bank in the Gulf of Maine. Image: GoMA Census

(Closer - cont on page 7)

The register also provides a source of information against which scientists can monitor future losses or introductions of species in the region as a result of climate change or other events, whether natural or induced by humans. Because the Gulf of Maine lies in an area that transitions from subpolar to temperate conditions, it and its creatures may serve as a sentinel for climate change. And, by providing a more complete picture of the marine web of life, it is another step toward managing the Gulf of Maine as an ecosystem – one of the primary goals of fisheries management in the U.S. and Canada.



Solaster endeca, or sunstar. One of the many intertidal species found in Cobscook Bay, Bay of Fundy. Image: GoMA Census

Incze emphasizes that, while the register is the region's most comprehensive, authoritative list of known species, it is still a work in progress that must be maintained with updated entries and changing taxonomies, and it requires a rigorous process of validation. In addition, new species are still being discovered. For example, just outside of the Gulf of Maine proper, seaward of Georges Bank, scientists exploring a chain of extinct, undersea volcanoes known as the New England Seamounts have found both species that are new to science and species whose existence has been known elsewhere but never seen before in the Gulf of Maine region. They have also collected many more specimens that have not yet been examined.

"The closer we look, the more we see," says Incze. "There are likely thousands more species throughout the Gulf of Maine not yet identified.

These include small worms and other organisms living in the soft sediments that cover much of the sea floor, in addition to the likely hundreds of thousands of different microscopic bacteria and viruses that live throughout the ecosystem. While most are invisible to the human eye, they are collectively major players in the web of ocean life."

Dr. Peter Lawton, Incze's counterpart at the Centre for Marine Biodiversity, agrees: "Even in the well-studied Gulf of Maine Area there are many species that have yet to be recorded, including new records for the area and new species to science. During the Census years, just a few benthic samples in Jordan Basin revealed numerous new regional records, and expeditions to the less explored areas such as the slope and seamounts identified new species."

While the Register is an important record of all species found in the region, additional information on distribution and abundance is important to understand roles of species in the ecosystem and to follow changes through time. One of the ways that the Census has helped to make species lists valuable is by linking them to location and how many are found in a given area. The Ocean Biogeographic Information Systems or OBIS is the first global database of marine life that includes spatial information in every part of the world's ocean, including the North Atlantic. This database, along with the analysis of the trends in diversity, abundance and distribution of marine life – past, present and future – will be one of the many legacies of the global Census of Marine Life (www.coml.org).

Some interesting facts about organisms listed in the Gulf of Maine Register of Marine Species:

Mammals, birds, fishes and more

- * Marine species in the Gulf of Maine range from miniscule, like the diatoms, to gigantic, the largest being the blue whale. The smallest species, like the phytoplanktonic diatoms and dinoflagellates, number in the billions, while the larger species can be rare, such as the right whale, of which there are only four hundred in the Gulf of Maine.
- * Like summer tourists, at least 18 species of marine mammals spend only part of the year in the Gulf of Maine. One of the more famous is the humpback whale, whose Latin name *Megaptera novaeangliae* means "big-winged New Englander." Whales migrate to colder waters for feeding in the summer, and to tropical waters to give birth in the winter.

- * Mammals like the humpback whale are at the top of the marine food web and depend on multiple species lower in the web. For example, a humpback whale may need to eat a ton of herring (about 5,000 fish). Each herring has fed on hundreds of zooplankton (animals that float with the currents), such as shrimp-like species called krill. And each krill has fed on as many as 130,000 diatoms. Therefore, one meal for a humpback may represent more than 400 billion diatoms. (Cerullo, M., 1999, Sea Soup).
- * Of the chordates (animals with a backbone or nerve cord) there are 577 fishes, 182 birds, 27 mammals and 2 sea turtles, the leatherback and loggerhead, that call the Gulf of Maine their home. Two listed species, the flightless Great Auk and the Sea Mink, have been extinct for over a century.

Invertebrates

- * The oldest described species in the register is from 1753, a green alga called *Ulva lactuca*, commonly known as sea lettuce. Recent explorations of the New England Seamounts have discovered several new species of fish and corals.
- * Many of us associate corals with warm tropical waters rather than the cold Gulf of Maine. But the Gulf of Maine region hosts 14 known species of deepwater coral, some of which have only recently been found by Census researchers.
- * Species of animals without backbones (invertebrates), including sponges, jellyfish, worms, mollusks, echinoderms such as starfish, sea urchins and sand dollars, and crustaceans, outnumber those with backbones, such as fishes, birds, and mammals, almost 2-to-1 (2645 invertebrate v. 789 vertebrate species).
- * Nearly one-fifth of all known species – 870 in all -- in the Gulf of Maine region are plants (aquatic, photosynthetic organisms, ranging from single-celled forms to kelp, that are the base of the marine food web). One teaspoon of seawater can hold more than a million phytoplankton (tiny plants that float with currents). Most are invisible to the naked eye, but en masse, phytoplankton also are the species that give otherwise blue oceans (reflecting the color of the sky) their varying colors, such as the greenish-hued waters of the Gulf of Maine.
- * Two of the microscopic plant species are of the genus *Alexandrium* and are the source of the paralytic shellfish poisoning known as "red tide." A major red tide swept the New England coast in 2005, shutting down the clamming industry for weeks. For more on red tide, see <http://www.whoi.edu/page.do?pid=11913>
- * There are 116 species of echinoderms, which includes seastars and sea urchins, but only one species of sand dollar in the Gulf of Maine, the *Echinarachnius parma*.

Commercially-fished species

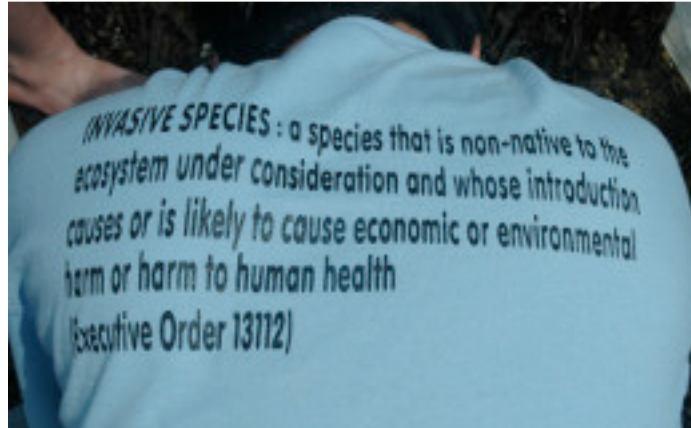


Homarus americanus, the iconic American lobster in its natural benthic habitat. Image courtesy of Strong/Buzeta.

- * What New Englanders call the "steamer," "long-neck," "squirt clam," or "belly clam" – or simply "the clam" -- is a species formally known as *Mya arenaria* and commonly known as the soft-shelled clam. It is one of 167 known species of bivalves in the Gulf of Maine region, a class of species that also includes mussels, quahogs, and scallops.
- * One of the Gulf of Maine's tastiest delights, *Homarus americanus*, the American lobster, is just one species among 812 species known as arthropods – creatures with jointed appendages and hard outer shells. While the human species loves lobster, other mammalian species, in particular whales, depend on different arthropods, such as the tiny crustaceans called copepods and krill.
- * Less than thirteen percent of known marine species in the Gulf of Maine register – a total of 577 -- are fishes. Of these, fewer than 5 percent are fished commercially. For an animated map that shows the decline of some of the best known of these, such as Atlantic cod, see <http://research.usm.maine.edu/gulfofmaine-census/data-mapping/visualizations>.

Invasives

- * Some species are recently arrived as the result of human activities, such as shipping, and are unwelcome invaders that are altering local ecosystems. These include the invasive algae known as deadman's fingers and the European green crab, a small shore crab that is an efficient colonizer and predator.
- * At least 44 species are considered invasives to the Gulf of Maine; see <http://research.usm.maine.edu/gulfofmaine-census/education/tools-resources/overviews/invasives>



Invasives definition: An educator finds ways to teach behind his back. Image: S. Ryan, USM

###

WEB SITES:

Gulf of Maine Census, with Gulf of Maine Register of Marine Species: www.usm.maine.edu/gulfofmaine-census (click on "Biodiversity of the Gulf" and then on "Taxonomic lists")
Huntsman Marine Science Centre, with Register and background information:
<http://www.marinebiodiversity.ca/nonNARMS/index.jsp> (click on "Classification" and then "Gulf of Maine Register of Marine Species")
Census of Marine Life: www.coml.org

CONTACTS

Susan Ryan, Education and Outreach Coordinator, Gulf of Maine Census of Marine Life, University of Southern Maine, 207-228-1680, e-mail: sryan@usm.maine.edu
Dr. Lew Incze, Chief Scientist, Gulf of Maine Census of Marine Life, University of Southern Maine, 207-228-1676, e-mail: lincze@gmail.com
Dr. Peter Lawton, Director, Centre for Marine Biodiversity, and Department of Fisheries & Oceans – Canada, email: LawtonP@mar.dfo-mpo.gc.ca
Lou Van Guelpen, Curator of Fishes, Atlantic Reference Centre, Huntsman Marine Science Centre, and Dr. Gerhard Pohle, Curator of Invertebrates, Atlantic Reference Centre, Associate Director, Huntsman Marine Science Centre, 506-529-1203, email: arc@mar.dfo-mpo.gc.ca



Nearshore sampling: A Census researcher in the intertidal zone looks out at the support boat for the underwater sampling team in Cobscook Bay. Image: S. Ryan, USM

in the sanctuary, made up of fishes such as cod, haddock, whiting (silver hake) and various flatfish, has been sought for food from the earliest European settlements to the present. The fish species found in the sanctuary are generally representative of fish assemblages in the Gulf of Maine region. Of the known 652 Gulf of Maine fish species, more than 80 species of fish exist in the sanctuary. While that number may seem small when compared to the total count for similarly sized regions within the Gulf of Maine, species richness varied, but was consistently high in the sanctuary for both the spring and fall.

The genetic variation within species, both among geographically separate populations and among individuals within single populations is termed “genetic diversity.” While species diversity by definition includes all of the species, or particular groups of species in an area, genetic diversity refers to the variation within single species. The level of genetic diversity within a population is an indication of the ability of the population to respond to and persist in the face of environmental change.

Genetic Diversity – Local Case Study – North Atlantic right whale



Feeding Humpback Whale with several species of gulls
(pix by Anne Smrcina, SBNMS)

The North Atlantic right whale is an interesting example for the topic of genetic diversity. Recently, NOAA, along with most of the scientific community, reclassified the northern right whale into two separate species – the North Atlantic right whale (*Eubalaena glacialis*) and the North Pacific right whale (*Eubalaena japonica*) based on geographic and genetic isolation. The southern right whale (*Eubalaena australis*) had long been considered a separate species. Researchers believe behavioral and genetic differences now provide evidence for classification into three separate species. For the endangered North Atlantic right whales, with an estimated population of about 400 individuals, recovery to more robust population may be problematic due to the small initial numbers and

threat of inbreeding through low genetic diversity.

At the highest levels of complexity, “community diversity” and “ecosystem diversity” refer to the different biological communities and their associations with the physical environment (i.e., the ecosystem) that occur within an area, geographic region or the earth as a whole. The diversity of communities and ecosystems within a region is an indication of the range of evolutionary forces that have influenced species distributions. The range of organisms supported at particular sites provides a benchmark to understand both natural and human-induced change.

Species richness, quantified simply as the number of species in a particular area, is one of the most straightforward means of characterizing biodiversity. Using this measure, there are more than 575 species in the Stellwagen Bank National Marine Sanctuary. A preliminary list of those species is presented in the upcoming Final Management Plan (expected June 2010), and available at the sanctuary’s website at <http://stellwagen.noaa.gov>.

Community Diversity – Local Case Study – Muddy Basins and a Diversity of Sanctuary Communities

Stellwagen Bank National Marine Sanctuary, in its 842-square-miles contains a rich mix of habitats, including open ocean, muddy basins, sand waves, pebble gravel, boulder ridges and rocky ledges. Although muddy basins have been often compared to deserts, with the implication that living resources are sparse, the exact opposite may be the case. These important habitats may contain some of the more diverse arrays of animals, including various species of worms, mollusks and other creatures living within the sediments and the highest numbers of fish species among sanctuary habitats. Studies are showing that these mud habitats are also very sensitive, and may take the most time (possibly decades) to recover from the effects of seafloor disturbance, such as fishing.

Functional Relevance:

Over-exploitation (overharvest, bycatch and indirect effects of fishing) and habitat loss are considered the top threats to marine biodiversity. Habitat loss can be attributed to both destruction of marine areas due to development and the introduction of pollutants that make the area unhealthy to marine life. Yet managing ecosystems to promote biodiversity can have important practical, utilitarian benefits by maintaining multiple ecosystem services over time in the face of change. Ecosystem services include provisioning services (e.g. fish and seafood), regulating services (i.e. climate), recreational services (e.g. fishing, diving and boating), cultural services (e.g. aesthetic and spiritual values), and supporting services (e.g. nutrient cycling and primary production).

The relationship between biodiversity and ecosystem functioning (and services) has emerged as a central issue in ecological and environmental sciences during the last decade. Compelling evidence has accumulated from marine systems to suggest that sustainable ecosystem services depend upon a diverse biota (Palumbi *et al.*, 2009). It is now generally understood that conserving biodiversity should be a goal of ecosystem-based management.

Biodiversity can act as biological insurance for local ecosystems. A management system that conserves biodiversity will help to accrue more “eco-service capital” for human use and will maintain a hedge against unanticipated ecosystem changes from natural and anthropogenic causes.

Resource of interest:

Palumbi, S.R., P.A. Sandifer, J. D. Allan, M.W. Beck, D.G. Fautin, M.J. Fogarty, et al., 2009. Managing for ocean biodiversity to sustain marine ecosystem services. *Frontiers in Ecology*, 7, 204-211.

International Year of Biodiversity



The United Nations declared 2010 the International Year of Biodiversity (IYB). Throughout the year countless initiatives will be organized to disseminate information, promote the protection of biodiversity and encourage organizations, institutions, companies and individuals to take direct action to reduce the constant loss of biological diversity worldwide. The celebrations for the International Year of Biodiversity are led by the [Secretariat of the Convention on Biological Diversity \(CBD\)](#). Countdown 2010 is a partner of the CBD for the IYB.

In only a few years of activity, Countdown 2010 has been able to mobilize an increasing number of actors ranging from local authorities and businesses to civil society organizations. With a powerful network of [nearly 1,000 partners](#), Countdown 2010 is one of the leading initiatives mobilizing action for the 2010 target. Through its wide and well-established network, Countdown 2010 will be a key global actor for IYB in Europe and around the world. Countdown 2010 and its partners will provide one of the main information channels and will be a major vehicle for reaching target groups worldwide.

MME is featuring the International Year of Biodiversity in its summer Journal. The lead article as well as the articles [Biodiversity Cold Spot](#), [How Rare or Abundant is a Species](#), and [Gulf of Maine Large Marine Ecosystems](#) are a collaborative effort of the Staff at Stellwagen Bank National Marine Sanctuary. Our thanks go to Superintendent Craig MacDonald and his staff for their efforts, and to Anne Smrcina who was responsible for pulling the articles together.

<http://www.countdown2010.net/year-biodiversity>



Boston Harbor Educators Conference

Saturday
October 2
2010

Fee \$40

Visit the MME Web site at: www.massmarineeducators.org



Sponsors:
 Massachusetts Marine Educators
 Massachusetts Water Resources Authority
 Boston Harbor Islands National Park Area
 UMass Boston/Marine Operations
 Stellwagen Bank National Marine Sanctuary

SAVE THIS DATE: OCTOBER 2, 2010

“Connecting Communities to Boston Harbor”

Boston Harbor: it's a name that generates many reactions. Whether one is interested in politics and government, maritime history, marine biology, coastal geology, water quality, art or popular music, the harbor provides a setting for inspiration, reflection or study. Our conference this year will focus on the Inner Harbor -- a fascinating and ever-changing marine hub that connects communities to the sea.

LOCATION: UMass Boston -- McCormack Hall
 Registration begins at 8am; workshops start at 9am;
 a guided Inner Harbor field trip on the R/V *Columbia Point* is scheduled from 1:30-4pm.

Program fee covers all workshops, keynote presentation, field trip and lunch.

--- For more information or to register---

Mail to: Gail Brookings, 184 Highland St., Taunton, MA 02780 or visit the MME Web site at: www.massmarineeducators.org

Name _____
 Address _____
 City _____ State _____ Zip _____
 Telephone _____ E-Mail _____

[] send more information (circle) email mail [] I want to preregister, my payment is enclosed.



How Rare or Abundant is a Species

Ecological rarity is defined in a variety of different ways, but usually based on population numbers of a species compared to other more abundant organisms. The concept is especially important in management programs focused on biodiversity conservation. Notably, rare species most often are not targeted for economic gain but are impacted as a consequence of activities directed at the exploitation of more abundant species.

Most species in the Gulf of Maine might be considered rare based on the relative abundance of their numbers that occur in samples. For example, over a 30-year period (1975-2005), 90% of the numerical abundance of the fish community came from 7-10 species out of a total of 77 species sampled during NOAA Fisheries Service research trawls. The remaining 67-70 species made up only 10% of the numerical abundance and, therefore, would be considered to have some degree of rarity in the community.

Analysis of such sample data leads to questions about the distribution and abundance of rare species within Stellwagen Bank National Marine Sanctuary. For example, are species rare due to human-caused disturbance or are they naturally rare in their associated communities? Answers to this question lead to discussions of the necessity of management and the need for listing under provisions of the Endangered Species Act. Another question that arises is focused on whether rare species are distributed sparsely and evenly through particular habitats or are they rare in most places and have dense concentrations at limited locations? Answers to this question may indicate the need to manage impacts in centers of species abundance and to insure that potential source populations continue their ecological function.

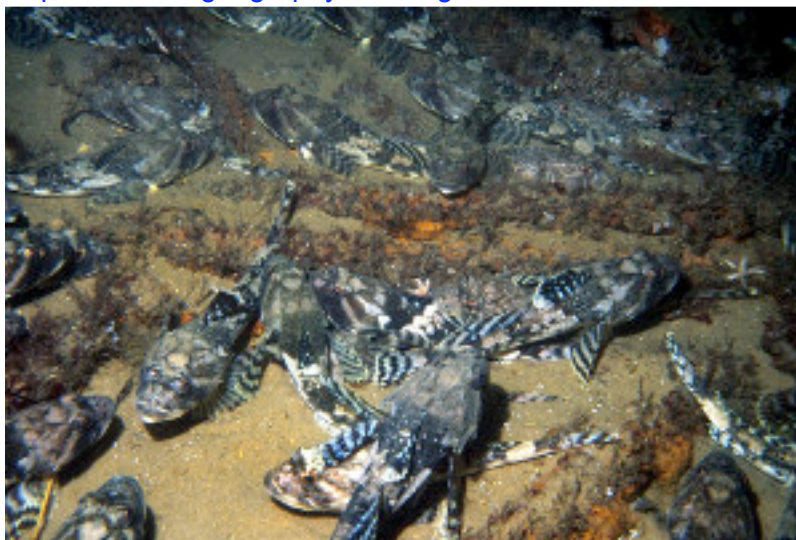
(adapted from Stellwagen Bank National Marine sanctuary Final Management Plan)

Resource of interest:

* Auster, P.J., R. Clark, and R.E.S. Reed, 2006. Marine Fishes. In: An Ecological Characterization of Stellwagen Bank National Marine Sanctuary Region (Chapter 3). National Center for Coastal Ocean Science, NOAA Technical Memorandum, Silver Spring, MD.

The complete report is available on-line at

<http://ccma.nos.noaa.gov/products/biogeography/stellwagen/welcome.html>



A school of Sculpin at Stellwagen Bank Credit Mark Dixon, Paul Palmer, NOAA

Biodiversity Coldspot

Biodiversity “hotspots” are regions of the world with unusually high concentrations of endemic species (species that are found nowhere else on Earth) and that, by the original definition (Myers, 1988), also suffer severe habitat destruction. Today the term is more loosely applied to areas having the perceived biological quality of high species richness. The term is used in practice to identify areas of the world that should be managed to protect biodiversity.

By this definition, hotspots occur almost exclusively at lower latitudes in tropical and subtropical climates. Temperate places in the world that may be relatively species poor can also have high biological value, when those values are defined differently. Such places are considered to be biodiversity “coldspots.” Coldspots take on particular and unique importance when they can be linked in additive fashion to become part of a regional network that fully characterizes and effectively maintains functioning ecosystems.

Stellwagen Bank National Marine Sanctuary is an important biodiversity coldspot. The sanctuary area is one of thirty priority sites for networked marine ecosystem conservation in New England and Maritime Canada that were identified through an extensive science-based approach. That study by Crawford and Smith (2006) is the foundation for a systematic effort to conserve and network high-quality and enduring examples representative of the full range of communities, habitats, environmental gradients and ecological processes in the Gulf of Maine and northeast continental shelf. The sanctuary was a particularly important contributor for demersal fish, marine mammals, benthic habitats and seascapes.

So while the Gulf of Maine region is not a global hotspot of biological diversity, it does contain species endemic to the region, species which are the products of evolutionary forces that act selectively within the region. Hence the Gulf of Maine Large Marine Ecosystem contains a unique fauna based on a number of species occurring nowhere else, some having a distinct genetic composition if they are a subset of a wider ranging species, and others occurring within unique communities or habitats and having a unique ecological role when compared to other regions.

(adapted from Stellwagen Bank National Marine Sanctuary Final Management Plan June 2010)

Resources of interest:

- * Crawford, J.D., and J. Smith, 2006. Marine Ecosystem Conservation for New England and Maritime Canada: A Science-Based Approach to Identifying Priority Areas for Conservation. Conservation Law Foundation and World Wildlife Foundation-Canada. Halifax, NS, Canada. 200 pp.
- * Kareiva, P., and M. Marvier, 2003. Conserving biodiversity coldspots. *American Scientist*, 91, 344-351.
- * Myers, N., 1988. Threatened biotas: “Hotspots” in tropical forests. *The Environmentalist*, 8, 187-208.
- * Myers, N., R.A. Mittermeier, C.G. Mittermeier, G.A.B. da Fonseca, and J. Kent, 2000. Biodiversity hotspots for conservation priorities. *Nature*, 403, 853-858.



School of Cod on Stellwagen Picture Credit NOAA- SBNMS

Gulf of Maine Large Marine Ecosystem

The Gulf of Maine (GoM) Large Marine Ecosystem (LME) forms a distinctive sub-region of the North American continental shelf in the northwest Atlantic Ocean, based not only on topography and circulation but on the communities of organisms that inhabit the area. The GoM LME is located at the southerly end of the Acadian biogeographic province, which also includes the Bay of Fundy and the Scotian Shelf. Stellwagen Bank National Marine Sanctuary is the only national marine sanctuary in the Acadian biogeographic province.

Georges Bank is included in the Acadian biogeographic province by some scientists but in the Virginian biogeographic province to the south by others. The affinity to one or the other biogeographic province is based on differences in the distributions of major groups of organism, patterns of endemism or oceanographic features. Many scientists view Georges Bank, as well as the southern New England Shelf and mid-Atlantic Bight, as a broad transition zone with no unique biogeographic characteristics.

The Stellwagen Bank sanctuary is located in the southwest part of the GoM LME and has depths that range from 20 to greater than 200 m. The shallower parts of the sanctuary support species that are primarily coastal in origin while the deeper waters support species more characteristic of northern and deeper marine communities. Seafloor topography in the western GoM blocks the flow of Maine deep water from the north and east, thereby excluding species that reside in conditions characteristic of Maine deep water environments from sanctuary waters.

The diversity of organisms that occur in the Stellwagen Bank sanctuary is a subset of the species that occur within the larger GoM LME. While not all species found in the GoM LME occur within its boundaries, the sanctuary contains a representative sample of many of the species in the region. Because of the wide range of depths (that cross major water column boundaries) and the high diversity of habitat types (e.g., mud, sand, gravel, boulder), the sanctuary exhibits a wide range of communities and species in a relatively small area.

The GoM LME is relatively species poor when compared to other shelf ecosystems in the world ocean. For example, while the GoM has 652 species of fish (GoM Register of Marine Species at <http://research.usm.maine.edu/gulfofmaine-census/about-the-gulf/biodiversity-of-the-gulf/lists/gulf-of-maine-register-of-marine-species/>; 8 August 2006), the tropical seas off northern Australia and Indonesia contain over 2,000 species of fish — a diversity hotspot with the greatest number of fish species on earth.

(adapted from Stellwagen Bank National Marine sanctuary Final Management Plan)

Resource of interest:

* Cook, R. and P.J. Auster, 2006. Developing Alternatives for Optimal Representation of Seafloor Habitats and Associated Communities in Stellwagen Bank National Marine Sanctuary. Marine Sanctuaries Conservation Series ONMS-06-02.

http://sanctuaries.nos.noaa.gov/science/conservation/seafloor_sbnms.html



Sponges and Anemones Credit Deborah Marx, SBNMS



Sand Lance Credit USGS- Woods Hole

Massachusetts Produces More Blue Lobsters

by Brandy Wilbur
MIT Sea Grant College Program



If you knew that this image is what a larval lobster looks like, you can have a seat next to some of the top science students in Massachusetts at the annual Blue Lobster Bowl. This year's event was held at MIT on **Saturday, February 6, 2010**.

The event is one of the 25 regional competitions that are part of The National Ocean Sciences Bowl (NOSB), a program sponsored by the Consortium for Oceanographic Leadership, based in Washington, DC. The NOSB is an annual round robin competition that tests student's knowledge of ocean-related issues and encourages the next generation of marine scientists, policy makers, teachers, explorers, researchers, technicians, environmental advocates and informed citizens. There are approximately 2,000 students from over 300 U.S. high schools that participate annually in NOSB.

In all, 130 students, making up 24 teams from 12 schools competed in this year's Blue Lobster Bowl, which is the largest of all the regional competitions. The Massachusetts high schools represented at the Blue Lobster Bowl included: Bedford High School, Belmont High School, Brookline High School, Cambridge Rindge & Latin School, Chelmsford High School, Lexington High School, Lincoln-Sudbury Regional High School, Newton North High School, Newton South High School, North Andover High School, Philips Academy and Weymouth High School.

Students from **Lincoln-Sudbury Regional High School** took home the first place prize for 2010 which was an all expense paid trip to the NOSB finals in St. Petersburg, FL April 22-25. The second place Blue Lobster Bowl award went to Lexington High School (last year's national champions), with Newton North coming in third.

Lincoln-Sudbury's venture to the nationals, where they competed against 24 other regional winners, landed them in 10th place – a fantastic performance! We are proud for their effort and representation of Massachusetts at the National Ocean Sciences Bowl. The team showed a strong performance in St. Petersburg and proved how strong the Blue Lobster Bowl competitors are.

Congratulations to all of the students and teachers that participated in the 2010 Blue Lobster Bowl. Get your teams together, because we hope to see you all for the next competition on February 5, 2011!!!

This event is co-sponsored by The MIT Sea Grant College Program, The MIT Center for Ocean Engineering, The Woods Hole Oceanographic Institution and Raytheon.

For more information, please visit: <http://bluelobsterbowl.mit.edu/>



The Blue Lobster Bowl Finals are pictured in this illustration.

2010 High School Marine Science Symposium

On a wonderfully warm, spring-like Wednesday, March 17th, over 350 high school students from all corners of Massachusetts (plus one school that ventured to the south coast from Connecticut) converged on the campus of University of Massachusetts Dartmouth for an exciting day of marine science. The students and their courageous teachers were treated to two fascinating keynote addresses and eighteen different workshops ranging from “Flotsametrics: The Science of the Floating World” to “Skills for the Seagoing Scientist”. From the largest ocean inhabitants; “North Atlantic Right Whales: Can We Save Them?” to the smallest; “Plankton: The Good, the Bad and the Ugly”, all of the students were able to select and attend workshops suited to their particular interests.

The first keynote “Floating Islands of Trash and Seaweed? They’re Real!” was delivered by UMass Dartmouth Physics Professor, Amit Tandon. Dr. Tandon wasted no time engaging his audience in his specialty of Fluid Dynamics and Physical Oceanography. After piquing the high schoolers interest by highlighting the gigantic garbage patch in the middle of the Pacific Ocean, Dr. Tandon went on to discuss how he is able to model mixing processes in the upper ocean. Through the use of a rotating tank, several video cameras and dye, Dr. Tandon and his graduate students modeled upwelling and converging currents and discussed how these circulation patterns allow ocean basins to collect trash that persists for decades. The last part of the presentation empowered the students by suggesting how they might become part of the solution to this global problem.

Our second keynote speaker was Kenneth Oliveira a professor in the Biology department at UMass Dartmouth. Dr. Oliveira is an authority on the life-cycle of the American Eel and recently accomplished the first ever spawning and hatching of the American eel. Naturally, the teen age audience was fascinated to learn of the complicated and unusual sex life of this common inhabitant of our local freshwater and estuarine habitats. The students were surprised to learn that many parts of the life history of the American eel remain a mystery. For example, spawning activities in the Sargasso Sea are virtually unknown. Dr. Oliveiri concluded by outlining how the successful culturing of eels may be very useful to researchers conducting toxicology experiments and to provide a source of eels for food.

This incredible day of marine education could never have happened without the help the incredibly energetic Massachusetts Marine Educator Board member volunteers and all of our speakers and workshop presenters. Hope to see you next year at the High School Marine Science Symposium.



Save the Date!

NMEA 2011
Cape to Cape: In the Hub
of Marine Education

June 29 - July 3, 2011

Northeastern University
Boston, Massachusetts

34th Annual Meeting and Conference at Woods Hole Massachusetts.

May 1st 2010 by Bill Andrade, Conference Chair

The weather could not have been better for our 34th Annual Meeting and Conference at Woods Hole Oceanographic Institution, with its theme of *Alien Invasion*. The warmth and sunshine from the outside seemed to fill the lobby of the Redfield Building as colleagues reunited for what was a great day of speakers, workshops, tours, and exhibits. Dr. Jim Price, Senior Scientist and Assistant Dean at WHOI, welcomed the over seventy participants

Dr. Judy Pederson of M.I.T. Sea Grant's Center for Coastal Resources began our speakers program with an overview of the invasive species problem in New England waters. From invasive bryozoans on our kelp to invasive seaweeds such as *Codium sp.* and *Grateloupia sp.* Judy presented the modes by which species have taken hold in our waters, the risks to our marine ecosystems, and changes to their distribution. We learned methods being used to manage these invasions in other countries as well as ideas for integrating invasive species into the classroom. (See abstract in this issue)

Our annual awards ceremony recognized several members with their service to our organization. Margaret Brumstead from Dartmouth High School received MME's Award of Distinction. Anne Smrcina, Kathleen Streck, Howard Dimmick, and Arthur Dutra were recipients of Nap Buonaparte Service Awards. The awards are summarized later in this issue.

Co-presenters: Dr. Scott Gallager and Amber York from WHOI presented their work using photo-mosaic images from their habitat mapping camera system or "Hab Cam" to study species in benthic habitats off our coast. Their projects include the monitoring of the invasive tunicate *Didendum vexillum* which has spread over surfaces on bottom substrates and threatens scallop beds and benthic fisheries. Amber gave us a preview of how we could access images and data from HabCam surveys with Google Earth. HabCam promises to be a great resource for scientists and educators and can be accessed by going to <http://habcam.whoi.edu>. (See abstract in this issue)

During breaks in our program, members were treated to some wonderful exhibits and displays in the Redfield Lobby. We were given opportunities to network with representatives from these organizations and were provided with valuable resources to enhance our classroom instruction.

A slide show of student art work from MME's Marine Art Contest provided a beautiful back drop during our business meeting. We elected board members and discussed how MME might respond to the perception that the oil spill in the Gulf of Mexico would only be disastrous when it reaches coastal areas.

After lunch with Chef Roland's chowder and Joe LaPoint's three bean soup, Dr. G. Richard Harbison, WHOI Scientist Emeritus, concluded our speakers program with an entertaining story of his journey from basic research to his involvement with the politics of controlling the invasion of *Mnemiopsis leidyi* in the Black Sea. This voracious ctenophore has been responsible for the decline Black Sea fish populations as it feeds on their eggs and larvae as well as many of the invertebrates that provide food for fish species. In the end, Dr. Harbison felt "doing nothing" was the best solution as he returned to basic research. (see abstract in this issue)

Following our annual door prizes MME members enjoyed the excellent weather with Hovey Clifford's WHOI Dock Tour and the Ocean Quest Discovery Cruise. Some of us rejoined Dr. Harbison for a workshop on exotic species while others explored the ocean with Chris Polloni from USGS Using Geowall 3D to Visualize the Sea Floor.

The day concluded with a relaxing reception on the porch of the Madden Center at the Sea Education Association. It was a perfect ending to a busy day. Thanks to all who helped make it a great conference.



WHOI 2010 PRESENTATION ABSTRACTS

Risky Business; Managing or Not? Marine Invasions and their Impacts

Judith Pederson, Ph.D.
MIT Sea Grant College Program

Marine invasions are generally out of sight and out of mind, yet they have significant ecological, economic and human health impacts. Marine species are introduced through a variety of vectors – ballast, hull fouling, aquarium trades, aquaculture, seafood industry and research – that transport organisms from one location of origin to areas outside their native range. If they become established, non-native species may disperse to new locations and may outcompete native species or impact fisheries. Several common seashore species are introduced, including the European green crab, *Carcinus maenas*, the Asian shore crab, *Hemigrapsus sanguineus*, the European Oyster, *Ostrea edulis*, the Japanese green algae, *Codium fragile ssp fragile*, and several sea squirts, especially the compound tunicate *Didemnum vexillum*. Marine invasion scientists need help in documenting changes in distribution and abundance, impacts from these and other introduced species, as well as collection local environmental data. Opportunities for school age students to participate in a marine non-native species monitoring program are available.

A Towed Optical Habitat Mapping System Monitors the Invasive Tunicate Species *Didemnum vexillum* Along the Northeast Continental Shelf

Dr. Scott Gallagher, associate Scientist (Tenured), Biology, and
Ms. Amber York, Research Associate II, Biology,
Woods Hole Oceanographic Institution

The invasive tunicate *Didemnum vexillum* is a colonial ascidian of unknown origin that has spread down the Atlantic Coast since its appearance in Maine during the 1980's. Optical Image surveys conducted with HabCam (Habitat Mapping Camera System) average about 100 nautical miles a day of continuous bottom imagery and have to date revealed that three regions of Georges Bank contain areas of *D. vexillum* growth: the Northern Edge (closed Area II), south of Nantucket Shoals (Nantucket Loghtship Closed Area) and Great South Channel (Closed Area I), the latter two regions being previously not known to contain *D. vexillum*. The population along the Northern Edge spans from outside to inside of an area closed to ground fish and scallop fishing thereby providing a site to study the differences in *D. vexillum* growth under disturbed and undisturbed conditions. Areas of *D. vexillum* growth within Closed Area II were denser than areas outside of Closed Area II based on measurements of percent cover of *D. vexillum* on the bottom. Increasing density of *D. vexillum* was correlated with a decrease in number per m² of sea scallop (*Placopecten magellanicus*), lacy tube worms (*Folograna implexa*), northern Sea Star (*Asterias vulgaris*), mussels, crabs, barnacles, and siphons of infaunal organisms. *D. vexillum* was also found to be limited to substrates containing gravel or more complex structure. Mats of this tunicate were found to overgrow live and dead sea scallops, anemones, sponges, dead shells, other ascidians, barnacles, rock crabs, and skate egg cases. A massive die-back of *D. vexillum* occurred at sites in Closed Area II between cruises in August 2007 and early May 2008, a period during which bottom temperature dropped below 5^o C. However, die-back in the winter of 2009 was less substantial when bottom temperature was warmer than the previous year. This suggests that *D. vexillum* mats on Georges Bank may exhibit the same seasonal fluctuations in density regulated by temperatures as seen on coastal *D. vexillum* populations. However continued year-round sampling is needed to characterize offshore seasonality in detail.

(Abstract - cont on page 20)



Basic Research, Applied Research and Politics: A Chronicle of One Scientist's Attempt to do Something Useful

G Richard Harbison, PH.D.
Scientist Emeritus
Woods Hole Oceanographic Institution

In 1982, a new animal appeared in the Black Sea, the ctenophore, *Mnemiopsis leidyi*. This animal spread rapidly across the Black Sea, and, as it increased in abundance, by 1989, stocks of several commercially valuable fish had crashed. It appeared that the ctenophore, which has formerly been restricted to the east coasts of the Americas, was responsible for their decline in fish stocks, since it feeds on fish eggs and larvae, and many invertebrates that serve as food for fish. In other words, *Mnemiopsis leidyi*, was both a predator and competitor of these species.

Coincidentally, I had been working on the predation by vertebrates and invertebrates of gelatinous zooplankton, and had created a long list of fishes and other animals that feed exclusively on ctenophores and other gelatinous animals. I regarded this serendipitous research as a good start for an attempt to come up with a method for the biological control of, *Mnemiopsis leidyi*. It seemed to me that the best candidate for introduction was our local butterfish, *Peprilus triacanthus*, which is very tasty and feeds preferentially on *M.leidyi*.

In order to bring the idea of using a commercially valuable fish as a biological control agent to fruition, I found myself increasingly involved in a series of meetings and workshops, sponsored by the governmental agencies NOAA, the United Nations Environmental Program, and NATO. In the course of these meetings, I discovered that biological control is quite controversial, at least with regard to the marine environment. While these meetings and workshops were going on, *Mnemiopsis leidyi* was introduced into the Caspian sea, and probably spread on its own into the Mediterranean, the Atlantic coast of Europe, and the North Sea. The difficulties of achieving anything concrete in the current international political environment appeared to be overwhelming, and I ultimately decided that it was better for me to stick with what I like to do best, which is basic research.

Massachusetts Marine Educators 2010 Awards

MME Award of Distinction

For outstanding leadership and tireless dedication to organizer of MME's High school Marine science Symposium

Margaret Brumstead, Dartmouth High School

Nap Buonaparte Service Awards

For service to MME in coordinating the Art contest and help with the Harbor Education Conference

Anne Smrcina, Stellwagen Bank National Marine Sanctuary

For service to MME as assistant to organizer for the High school Marine science Symposium

Kathleen Streck, Framingham Public Schools

For service to MME as editor of Flotsam and Jetsam, exhibiting "stupendous effort"

Howard Dimmick, Science Education Consultant

For service to MME over the years and special efforts with New Bedford's Ocean Explorium Sea Lab Program, New Bedford Public Schools

Arthur Dutra

John Patrick Crowley Memorial Scholarship Awards

George Hampson, Emeritus Oceanographer, WHOI and Education Consultant for sea Lab, New Bedford Public Schools

Eddie Henderson, New Bedford High school, and Ocean Explorium, New Bedford



2010 MME T-Shirt Design

Mnemiopsis leidyi

by Erin Hobbs



Taxonomy

Phylum: Ctenophora

Class: Tentaculata

Order: Lobata

Family: Mnemiidae

Genus species: *Mnemiopsis leidyi* (A.Agassiz) 1965

Mnemiopsis leidyi is a clear Ctenophore that can grow up to 10 cm long. Like all Ctenophores, *M. leidyi* lack stinging tentacles. When it is disturbed it produces a blue-green bioluminescent glow. In New England it can be found from Cape Cod south and typically appears from August to early fall. *M. leidyi* is carnivorous with a diet consisting mainly of zooplankton and fish larvae.

As an invasive species

Mnemiopsis leidyi was introduced in the Black Sea in the 1980's. The most likely cause of its introduction was accidental by merchant ships' ballast water. Its presence has caused a dramatic drop in fish populations, by competing for the same food sources and eating the young and eggs.

In 1999 the species was introduced in the Caspian Sea. The result was that 75% of the zooplankton was depleted, thereby affecting the entire food chain of the sea. Since then, the species has apparently spread throughout the Mediterranean basin and can also be found in the North Sea and Baltic Sea.

How do you get one?

These T-shirts are available from Bill Andrade.

Shirts are black with the emblem similar to that above.

Long Sleeve Shirts - Sizes M, L, XL, 2XL - \$25.00 including shipping costs

Short Sleeve Shirts - Sizes S, M, L, XL, 2XL - \$20.00 including shipping costs

For more information or for ordering directions, contact Bill at billandrake@hotmail.com

Bill also has some shirts in past years designs available in limited sizes. [Contact Bill](#) for more information about previous years shirts.

Art Contest Winners

The Annual MME Art Contest is over and the judges have picked the winners. This year's contest theme was "The Amazing Creatures of Stellwagen Bank National Marine Sanctuary and the Gulf of Maine". There were 370 entries for this year's contest and the winners are listed below and displayed in this issue.

Elementary School First Place - Mako Shark

Kolbe Correia, Home School Student, Grade 4, Acushnet, MA.

Middle School First Place - White sided Dolphin

Supriya Goel, Sharon Middle School, Grade 7, Sharon, MA

High School First Place - Lobster

Hailey Creed, Plymouth South High School, Grade 12, Plymouth, MA.

Scientific Illustration First Place - Octopus

Lucas Cantwell, Plymouth South High School, Grade 11, Plymouth, MA.



Monday, May 10, 2010 12:28pm PDT

Gray whale off Israel called 'most amazing sighting in history of whales'

By: Pete Thomas, GrindTV.com

The discovery Saturday of a gray whale swimming in the Mediterranean Sea off Israel has been labeled by Robert Brownell, a prominent cetacean researcher, "the most amazing sighting in the history of whales."

Alisa Schulman-Janiger, who runs a gray whale census and behavior project in Southern California for the American Cetacean Society, said the sighting was "the equivalent "of finding a dinosaur in your backyard--it was that unbelievable."



To be sure, scientists are perplexed as to how the gray whale might have traveled from the Pacific to the North Atlantic--the most likely entry point to the Mediterranean--where the species is believed to have been extinct for about 300 years.

Among questions being asked is whether--if other gray whales also have gained or will in the coming years gain access to the Atlantic--this could mark the beginning of a re-population effort by a species not encountered in the region since the late 17th or early 18th centuries.

Brownell, who works for the National Oceanic and Atmospheric Administration, believes it could if the consensus among scientists is accurate that a diminished ice cover in recent years in the Arctic region, where the eastern North Pacific stock of gray whales feeds during the summer, has provided pathways to the Atlantic.

"We've had other strange sightings, like narwhals from the U.K. or Japan, but those are still within the same ocean basin that they're known to occur in," Brownell said of Saturday's sighting. "So they're unusual but not as unusual as something showing where it had once gone extinct."

The 40-foot whale was spotted more than a mile beyond Israel's Herzliya Marina, close to Tel Aviv, and followed and photographed for two hours by scientists from the Israel Marine Mammal Research & Assistance Center. They initially assumed it was a sperm whale because, like gray whales, it lacked a dorsal fin. But the mammal was later positively identified as a gray whale.

While the news has not yet been widely reported, it has generated a buzz of excitement among scientists and conservation groups.

Erich Hoyt of the Whale and Dolphin Conservation Society blogged on Monday: "Discounting the possibility of the Panama or Suez canals, I suggest that the Northwest Passage is the most likely entry route. In August, 2007, it was announced that the Northwest Passage was nearly ice-free for the first time and these conditions continued into the summer of 2008."

To be sure, gray whales could not have survived in the North Atlantic unnoticed for 300 years, so it's universally agreed that this particular whale hails from the eastern North Pacific stock--the only viable population of gray whales, numbering about 19,000 animals.

These whales are renowned travelers; they feed during the summer in the Bering and Chukchi seas, and migrate each winter more than 5,000 miles to mating and calving grounds off Baja California, Mexico.

To reach the Atlantic by means other than an Arctic route, they'd have to either swim through the

(Israel - cont on page 24)



Panama Canal or continue another 8,000 miles to the south and round Cape Horn at the bottom of South America. Scientists have discounted both possibilities. That leaves the Arctic route, either an easterly Northwest Passage journey across the top of North America, or a much longer westerly voyage across the top of Russia.

Brownell agrees the former journey represents the most likely scenario and adds that gray whales in the Atlantic might have historically come from the Pacific stock.

Historically there were three distinct populations of gray whales--the eastern North Pacific stock; the North Atlantic stock, and the Korean or western Pacific stock. The western Pacific stock is critically endangered and might number fewer than 100 animals. The North Atlantic population probably became extinct in large part because of hunting during the whaling era. Fossil records have shown that gray whales utilized both sides of the Atlantic. They probably shared a common northern feeding ground and fossils have been found as far south as Florida.

It is not known what the whale was doing in the Mediterranean, when it entered the Atlantic or whether it was the only gray whale to have strayed into that ocean. But from now on, scientists will be on the look out for more of the same species.

--Copyrighted images of gray whale spotted Saturday off Israel courtesy of Israel Marine Mammal Research & Assistance Center

Year of Biodiversity Stamps



The United Nations Postal administration released four stamps on April 15 for the International Year of Biodiversity. Designs are from Ernst Heinrich Haeckel's Art Forms from Nature, published in sections between 1899 and 1904.

The United Nations declared 2010 to be the International Year of Biodiversity as a celebration of the richness and variety of life, a promotion of its importance and a call to safeguard it. The four stamps are for use from the UNPA post offices in Geneva, Switzerland and Vienna, Austria. Similar stamps for use from the post office at UN Headquarters in New York will be issued October 18.



The images are:

- € 0,05 A species of Hydrodictyaceae (colonial algae)
- € 0,20 A species of Boxfish (Ostraciudae)
- F.s. 1,60 A species of arachnid
- F.s. 1,90 A species of starfish

Each stamp measures 32 millimeters by 26 millimeters and the stamps are issued in sheets of 20. For ordering information, write to NPA, Box 5900, Grand Central Station New York, NY 10163-5900; e-mail unpanyinquiries@un.org