

Flotsam & Jetsam

A Newsletter for Massachusetts Marine Educators

Winter 2003

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President's Message



MME President Howard Dimmick of Stoneham High School and President-Elect Linda McIntosh, Dana Hall School, who will become President at the WHOI Conference this year.

A new year has dawned. Will it be a great year, a troubled year, or just another year? I bring you wishes for a great year. Since my last message, several significant events have occurred.

MME received a grant from the National Marine Education Association to resurrect our **web site** and update its content. The site (www.massmarineeducators.org) went public on January 1, 2003. Doug Cormier, our webmaster has done an excellent job of putting us back on line. Doug is available for designing websites for others by contacting him from our web site. We will keep the site current with changes made on a monthly basis through the year.

The site contains a calendar of activities for MME as well as those of NSTA, MASS and MAST. (MME is an affiliate of MAST). You will also find hot links to many marine, educational, and scientific organizations throughout

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20th High School Marine Studies Symposium



On March 19, 2003, from 8:00 AM to 2:00 PM, MME will hold another great conference for high school students at the University of Massachusetts Dartmouth. The morning session keynote speaker will be Dr. Porter Turnbull, an explorer, ornithologist, doctor, and diver. Dr. Turnbull will talk about the National Geographic/New England Aquarium Joint Expedition on Life at the Bottom of the World.

In addition to two spectacular keynote speakers, the program will include twenty workshops on a wide variety of topics presented by key local and national scientists.

There's space for only 400 students, so please contact Rick Schmidt at 617/287-7666 (rick.schmidt@umb.edu) to register your students. For program information, contact Trina Crowley 508/910-6628 (pcrowley@umassd.edu).

27th Annual Woods Hole Conference!

Ocean Science for Everyone is the theme of our 27th annual Conference that will be held on May 3rd at the Woods Hole Oceanographic Institution. The day's schedule for this popular conference will include speakers, annual meeting, door prizes, raffle, and awards ceremony in the morning, and workshops and field trips in the afternoon.

Watch for the WHOI conference flyer that will include a request for nominees for book awards, Crowley scholarships and teacher grants, and annual awards. Check the Calendar section (page 3) for contact and registration information.

On Friday, May 2, WHOI Sea Grant will hold its third annual teacher workshop at the Exhibit Center (see page 2). This workshop was a great success in past years, so sign up early to reserve your place for this special event.

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- Patricia Crowley.....University of Massachusetts Dartmouth

From the Editor....

Marine Bioinvaders is the subject of the curriculum materials in this issue. Our thanks to Susan Nourse, a professor at Tabor Academy in Marion, MA, who has prepared a fascinating lab/field trip activity on the Japanese Shore Crab (*Hemigrapsus sanguineus*). Sue informs me that the crabs are presently deep in the mud where I hope they can ignore the cold and snow until spring.

**TOPICS IN OCEANOGRAPHY:
 A Workshop for Educators**

Friday, May 2, 2003
 9:30 AM -- 3:00 PM

Coming to the WHOI Conference? Why not come a day early and participate in a great workshop?

WHOI scientists and engineers will present two sessions followed by demos of related classroom activities. Held in the WHOI Exhibit Center, the sessions are limited in size to allow for lots of interaction. Each participant will receive resource binders full of background articles, web links, and classroom activities. Lunch will be provided. PDPs will be given.

If you would like to register or be placed on a list for more information when it is available, please contact Stephanie Murphy, samurphy@whoi.edu, 508/289-2271.

Flotsam & Jetsam

A Newsletter for Massachusetts Marine Educators

website: www.capecod.net/~MME

Flotsam and Jetsam is published three times a year by the Massachusetts Marine Educators, Inc. Please submit items for the calendar, classroom projects, curriculum materials, or other information to the editor. Please submit dates for the calendar at least two months prior to the event or call the editor (617) 484-6961 (email: barbarap@thecia.net).

Publications Officer.....Barbara Passero

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January 31, 2003

Stellwagen Banks Poster/Art Contest Deadline. Information: Anne Smrcina, 781-545-8026 x 204
Anne.Smrcina@noaa.gov

March 12, 2003 - 5:30 PM

MME Board Meeting. Peabody Essex Museum. Information: sonal_bhatt@pem.org.

March 19, 2003 -- 8 AM - 2 PM

20th High School Marine Studies Symposium. University of Massachusetts at Dartmouth. Information: Rick Schmidt, UMass Boston, (617) 283-7666 (rick.schmidt@umb.edu).

March 27-30, 2003

NSTA National Convention. Philadelphia, PA. Information: www.nsta.org/conventions.

May 1-2, 2003

Massachusetts Association of Science Supervisors (MASS) Conference. Holiday Inn, Worcester, MA. Information: pquatromoni@peoplepc.com.

May 2, 2003 -- 11 AM - 5 PM

Topics in Oceanography: Educators Training Workshop. WHOI's Exhibit Center. Information: Stephanie Murphy (samurphy@whoi.edu) (508) 289-2271 or Tracey Crago (tcrago@whoi.edu) (508) 289-2665.

May 3, 2003 -- 8:30 AM - 6 PM

Ocean Science for Everyone: MME's 27th Annual Marine Science Conference and Meeting. Woods Hole, MA. Cost \$40.00. Information: Linda McIntosh (email: ljm_mme@danahall.org). Contact Rick Schmidt (617) 287-7666, (rick.schmidt@umb.edu) for registration questions.

May 14-June 5, 2003

Dive and Discover Expedition. Information: www.divediscover.whoi.edu.

July 21-25, 2003

National Marine Education Association (NMEA) Conference. Wilmington, NC. Information: <http://www.marined.org/>.

August 10-15, 2003

Fourth Professional Education Program at the Coast Guard Station, Eastham, MA. Information: Gail Brookings, gbrookings@juno.com.

October 4-5, 2003

Boston Harbor Educators Conference. South Boston High School, Boston, MA. Information: Peg Collins, Ccndpcllns@aol.com.

In fall 2002, the National Science Foundation funded a partnership formed by the New England Aquarium, the University of Massachusetts, and the Woods Hole Oceanographic Institution to create a **New England Regional Center for Ocean Sciences Education Excellence** (COSEE). One of a group of seven centers around the country created to promote knowledge and awareness of the oceans, the New England Regional COSEE will strengthen New England's ocean science education capacity and effectiveness by forging strong regional collaborations to facilitate collaboration between scientists and informal and formal educators. The Center will provide educators with multiple tools to create programs that convey current and evolving knowledge of the oceans and provide researchers with the means and training to be effectively involved in formal and informal education. For more information, please contact Dr. Carolyn Levi, Director, New England Regional COSEE, at clevi@neaq.org.

In addition to visiting the New England Aquarium, did you know that you can call (617-973-5206) to book your kids into vacation camp and other family programs or to set up classroom outreach bringing Aquarium educators, traveling exhibits and (in some cases) live animals out to your school? This is also the number to call for booking group visits and to sign up for Explorer classes at the Aquarium. The Aquarium invites you to take part in our programming to enhance your existing curriculum plans and to provide students and teachers with in-depth field experiences for learning and fun in the summer and all year around. To arrange a date to observe an upcoming program and see for yourself, call 617/973-0280.

The New England Aquarium anticipates several upcoming summer institutes including the **Museum Institute for Teaching Science** (MITS), from July 7-18, for gr. K-8 teachers in partnership with three other Boston area museums (MIT, Children's, and U.S. Constitution). The focus will be on using each museum's content to integrate science with other subjects across the curriculum.

The Aquarium is in the planning stages for a gr. 6-12 institute in which participants construct underwater remotely operated vehicles toward the goal of establishing a New England regional **ROV competition**.

We anticipate a repeat of our extremely popular Massachusetts Department of Education-funded middle school content institute, "**On the Waterfront**," emphasizing mathematics and language arts connections to science through coastal field studies around Boston Harbor.

The Aquarium is also planning for two, weeklong K-12 institutes focusing on the **Boston Harbor Islands** that will have strong interdisciplinary field studies components.

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MARINE BIOINVASERS

Asian Shore Crab

Hemigrapsus sanguineus

by Sue Nourse, Tabor Academy

Other marine bioinvasers: Orange striped sea anemone (*Idiadumeneae lineata*), European oyster (*Ostrea edulis*), European periwinkle (*Littorina littorea*), Asian Shore Crab, (*Hemigrapsus sanguineus*), Green crab (*Carcinus maenus*), Stalked sea squirt (*Styela clava*), Dead man's fingers (*Codium fragile*), Pacific Colonial tunicate, *Botrylloides dieyensis*

Asian Shore Crab. Courtesy of Susan Nourse. Tabor Academy.

I. Overview:

You may recognize some of the organisms listed above as you wade through the shallow intertidal zones of local beaches. But they all look quite different; some are animals, while others are plants. This group is comprised of mostly nuisance organisms known as exotic species. Exotic species, also known as introduced species, invasive species, and non-indigenous species, are examples of organisms that inhabit areas outside of their natural geographic range. They are of significant interest to marine biologists and ecologists because of their possible influence on the natural ecology of the area(s) that they inhabit. Introduced species sometimes force native or indigenous species from their well developed niches. Multiplying rapidly in their new homes, introduced species alter gene pools which, in turn, may simplify ecosystems. In fact, research has shown that most harm done to ecosystems by introduced species occurs as a result of a reduction in biodiversity. Biodiversity, as you may recall from biology class, is the variation and variety of genes, organisms and species found in an ecosystem. As biodiversity declines in an ecosystem, the ecosystem may become more vulnerable to disease and pests.

II. Bioinvasion of New Species - Ballast waters and bottoms of boats are primary culprits:

Within the last few decades, global trade has exploded, and along with it, the international shipping industry. Many marine species are introduced to new geographic regions through the release of ballast water from these globally wandering ships. Large cargo ships carry water in tanks known as ballast tanks. These tanks help to steady empty ships as they travel until they pick up new cargo. Tens of thousands of gallons of water fill ballast tanks from their port of departure, later to be released in their ports of destination. Many organisms hitch rides in these ballast waters, traveling thousands of miles from their homeport to new locations around the world.

It is estimated that there are at least 25,000 ships currently traveling in the world's oceans. Stowed away in their ballast water, scientists estimate, are approximately 3,000 different exotic species. Discharged into new ecosystems with few natural predators, they quickly disrupt native trophic systems and subsequently establish themselves.

The zebra mussel (*Mnemiopsis leidyi*) is a classic example of an exotic that was transported in ballast water and has subsequently wreaked havoc in native North American freshwater aquatic ecosystems. Zebra mussels were first introduced during the mid 1980s, arriving via ballast water from Europe. Zebra mussels were discharged into the Great Lakes from ships carrying cargo. Without predators, the zebra mussel rapidly established itself in this new ecosystem. Prolific breeders, the resulting rapid population growth in the mussels have caused numerous negative effects including clogging of water and drain pipes of the municipal water supply system. Additionally, these mussels have displaced native freshwater mussels, causing disruption of the natural food chain. These prolific breeders have also depended on abundant plankton for nourishment. Because the bioinvader strips the water in its hungry attempt to feed itself, the water is left barren of nutrients for native mussels and other plankton feeders. To date, the United States has spent \$5 billion in an attempt to control and eradicate this nuisance organism. So far, these efforts have not been successful, and the organism continues to spread.

Possible solutions:

Scientists have arrived at several possible strategies to slow the spread of marine exotic species. Ships, for example, could be required to dump their ballast 200 miles offshore where the species would have little chance of survival. Other possibilities include filtering all incoming ballast water or using ultraviolet radiation and engine heat to destroy exotic organisms before they can be discharged into new waters.

INTRODUCED SPECIES ARE CAPABLE OF ALTERING ECOSYSTEMS AS A RESULT OF TWO FORCES:

1. Introduced species frequently disrupt existing food webs. Predator prey relationships are changed causing an alteration in the natural trophic structure of the ecosystem.
2. Because many invasive species have no natural predators, they successfully compete for space.

In Sippican Harbor and its surrounding marshes, bioinvasive representatives from many of the invertebrate phyla and some from the plant kingdom are found. Within a short walking distance from the location of the Tabor lab, approximately half a dozen invasive species impact our local marine ecosystems.

III. INVESTIGATION OF THE ASIAN SHORE CRAB (*Hemigrapsus sanguineus*)

Hemigrapsus sanguineus, better known as the Asian Shore Crab, was introduced to the eastern U.S. coast in 1988. This feisty, aggressive little crab was first documented in New Jersey waters and has subsequently spread as far north as Penobscott Bay, Maine, and south into North Carolina coastal areas. Scientists have determined that most likely the Asian Shore Crab arrived via ballast waters from the Pacific.

Anatomy and Physiology of *Hemigrapsus sanguineus*

Directions:

In this part of the lab, you will be making observations of a living Asian Shore Crab. As you closely observe this invertebrate, respond to the following questions and directives.

Part I. External Anatomy

Note: If you are located near an intertidal zone you may collect a few crabs to bring back to your classroom/lab. As you collect these crabs, note the habitat in which these crabs live.

Label the ventral and dorsal diagrams below as you proceed through the crab observation with your teacher.

Ventral Surface

Dorsal Surface

Based on your observations, answer the following questions.

1. What are the identifying characteristics of the external anatomy of the Asian Shore Crab?
2. Is this a male or female crab?
3. How did you determine the sex of this crab?
4. Describe how the crab takes in oxygen for respiration.
5. What is the crab's prey?
6. How does the crab feed? What appendages does it use for feeding?
7. List some of the crab's predators.

The following questions can be responded to during an in-class discussion or may be assigned for homework.

1. Describe the crab's habitat.
2. How might the crab's morphology enable it to successfully survive in this environment?
3. Describe several characteristics of this crab (besides predator/prey relationships) that have enabled it to invade our coastal areas so successfully.

FIELD OBSERVATION

Hemigrapsus sanguineus

I. Research Questions: What are the current populations of *Hemigrapsus sanguineus* in local ecosystems and where are they located?

II. Research Objectives: To determine the current populations of *Hemigrapsus sanguineus* in the coastal areas of Marion, Massachusetts.

III. Research Materials: Quadrats: 1 meter² or ¼ meter² – pvc piping

▪10 meter transect tape ▪field notebook ▪computer ▪field guide ▪refractometer ▪thermometer ▪dissolved oxygen kit

VI. Research Methods

1. Proceed to study area at low tide.
2. Run a 10-meter transect line perpendicular to shore.
3. Mark site or a boulder with spray paint to identify site if possible.
4. Place 1m² quadrats or ¼ meter² quadrats randomly along transect line, alternating left, right.
5. Sample populations at high intertidal, middle intertidal, and low intertidal zones.
6. Each quadrat area should be sampled by turning over rocks and digging into the sediment to a two-inch depth.
7. All crabs, once counted, should be removed from quadrat sampling site and placed in a bucket while the remaining crabs are being counted.
8. Measure carapace of each collected crab.
9. Determine sex of each crab.
10. Note green crab populations and other invertebrates in study site.
11. Temperature, salinity, and dissolved oxygen should be taken at each sampling site.
12. To track crabs for future observation, place dots of nail polish on carapace.

Various locations will be studied including Aucoot Cove, Planting Island, Moore Property, Schaefer lab, Silvershell Beach, Hammett's Cove, Converse Point, Kitannsett.

V. Data Processing

1. Place in Excel file.
2. Compare data from each study site.

VI. Analysis of data: Compare the populations of *Hemigrapsus* from each location. How do they compare?

VII. Conclusion: Write a summary of your observations. In your summary address the initial research questions and objective.

Extension activities:

- Create a "wanted poster" identifying the *Hemigrapsus*. The poster should explain how its appearance has disrupted the ecosystem (i.e., altered the food web, reduced biodiversity, changed habitat conditions).
- Research current control systems for exotic species

Related Web sites: Sea Grant Non-Indigenous Species (SGNIS) Web site: <http://www.sgnis.org>

FACT SHEET *Hemigrapsus sanguineus*

- **Geographic range:** North – Maine Penobscot Bay. South – North Carolina.
- **Distinctive features:** Asian Shore Crabs — small, brownish-black, striped legs, square-shaped carapace, three spines on each side of shell. Adults, 2-3 inches.
- **Reproduction:** 3-4 clutches of eggs per year in warm weather months (March – October). In contrast, native species only have 1-2 clutches per summer. Females Asian Shore Crabs carry more than 52,000 eggs.
- **Habitat:** Rocky, intertidal zone (under rocks). Between high-tide line and one or two feet below low-tide line. Asian Shore Crabs exploit different, but overlapping habitats with the green crab (*Carcinus maenas*).
- **Prey:** Omnivorous, including macroalgae, salt marsh grass, amphipods, gastropods, bivalves, barnacles, and polychaetes (*north – Maine). South Massachusetts – mussels, clams periwinkles, and European green crab. Research (lab studies) has shown that *H. sanguineus* consumes three species of commercial shellfish, *Mytilus edulis*, *Mya arenaria*, and *Crassostrea virginica*.
- **Predators:** Tautog (*Tautoga onitis*), mummichogs (*Fundulus heteroclitus*)
- **Potential Impact:** Due to its broad omnivorous diet, aggressive behavior, three plus clutches, tolerance to a range of salinities, and temperatures, *H. sanguineus* has the potential to affect numerous populations of resident species.

Membership Application

May 1, 2002 - April 30, 2003



Please send this application and your check made out to MME to:

Joseph La Pointe
67 Maple Street
West Roxbury, MA 02132
jglapointe@aol.com

I wish to become a member of MME New Renewal in the following category:

- | | | | |
|--------------------------------------------------|----------|-------------------------------------------------------|----------|
| <input type="checkbox"/> Active member (1 year) | \$ 20.00 | <input type="checkbox"/> Organization member (1 year) | \$100.00 |
| <input type="checkbox"/> Active member (5 years) | \$ 80.00 | <input type="checkbox"/> Student member (1 year) | \$ 11.00 |
| <input type="checkbox"/> Life member | \$400.00 | | |

MAILING ADDRESS (please print)

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Title _____
Organization _____
Address _____
City _____
State _____ Zipcode _____
Telephone _____
Email address _____

Grades and subjects _____

Fax number (work or home?) _____

- Please check here if you **DO NOT** wish to have your home information published in our membership booklet.

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