LaBanca, F. (2005).
Connecticut Journal of Science Education.
Volume 42, Issue 2, pages 59-63

Fishing for Data in Long Island Sound Salt Marshes

by

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Effective field experiences can be important tools to excite and motivate students in science. Students exposed to hands-on inquiry-based field studies can gain important skills and a great appreciation for the natural world. Coastal Connecticut salt marshes along the Long Island Sound coast provide such an opportunity, and they are in close proximity to almost every Connecticut school. Student exploration and discovery in this natural environment can incite valuable and memorable science explorations.

The Salt Marsh Ecosystem

The salt marsh is an important coastal wetland ecosystem that plays a vital role in the health of Long Island Sound. Salt marshes are important barriers between marine and terrestrial biomes that contain diverse and complex biological interrelationships as well as protectoral geologic boarders. Salt marshes protect terrestrial land from extensive erosion by buffering water action especially from high-energy surges of storms. Terrestrial life is also protected from the osmotic effects of salt water, an unfamiliar and potentially damaging environment to land organisms (Greene, 1998).

In return, marshes protect the water from terrestrial influences. They often act as biogeological filters removing sediment. Fresh water flow (e.g. from a river) decreases, which results in decreased solubility of sediments, which in turn results in deposition of potential toxins. Fertilizer and nutrients settle and can somewhat be eliminated to diminish the effects of algal blooms and subsequent damaging water hypoxia (Sala and LaBanca, 1999).

Salt marshes, although important to both terrestrial and marine environments, are unique and complex ecological regions unto themselves. They contain extensive and diverse flora and fauna. They act as nursery grounds for many fish, planktonic larvae, crustaceans, and mollusks. The complex interrelationships make the salt marsh one of the most productive ecosystems per square meter in the earth's biosphere (Smith and Hallibaugh, 1993). The salt marsh far exceeds even a tropical rain forest in primary productivity per unit area.

The extreme biological diversity in the salt marsh makes it an ideal site for field study. Many Connecticut teachers are in close proximity to a Long Island Sound salt marsh, thus making a trip practical and convenient. This article suggests strategies for planning a trip to a Connecticut salt marsh and offers several suggestions for exciting, simple, and inexpensive experiments that can be conducted to allow students a first-hand experience in a coastal ecosystem.

Planning the Trip

It is best to plan a trip to the salt marsh at low tide. More of the marsh will be exposed and will provide students with a much better opportunity to successfully collect and study different organisms. The National Oceanic and Atmospheric Association/ National Ocean Service provide a web site that allows individuals to check the tide predictions on a tide table. The link *http://coops.nos.noaa.gov/tides03/ tab2ec2a.html#16* connects to the Long Island Sound region for tidal predictions. As a pre-trip activity, students can make graphs depicting cyclical tide predictions and determine optimal dates and times for trips.

Trips are best taken in the fall when species diversity is greatest and healthiest. The spring often results in underdeveloped and/or a minimal number of specimens available for examination. Some excellent, representative, and easily accessible Connecticut salt marshes are depicted in Figure 1. Driving directions are provided at the end of this article.

Several resource books are ideal for a trip to the marsh and can be used as reference material for students as they examine different elements of the ecosystem including Gosner (1978), Ingle *et al.* (2001), and Weiss (1995).

The possibilities for activities at the marsh are endless. Teachers should select activities that are meaningful and representative of their own individual expertise.

Find Interesting Items

One of the simplest activities to conduct would be to ask students to find "interesting" items as they search the area. Using the word interesting leaves an open-ended perspective for students; interesting has

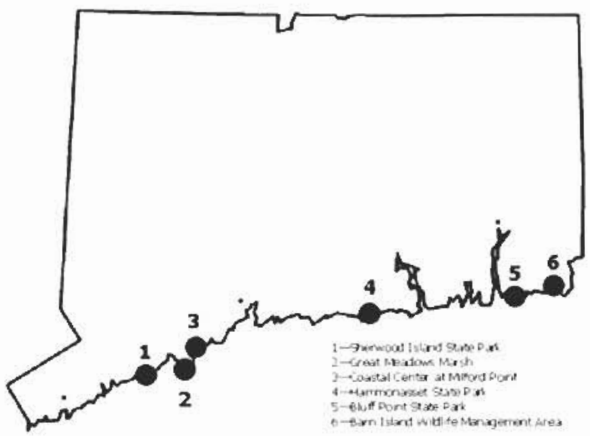

Figure 1. Easily Accessible Connecticut Salt Marshes

different meanings for different people. When the students present their items, there often is a range of biological and environmental discussions that can take place. Students often collect a variety of items from mollusk shells to garbage.

Water Chemistry

Quality of water can be analyzed using a wide range of materials. Certainly, sophisticated probe systems can be purchased, but many science suppliers have kits that are available for water quality. Although these kits may not be as accurate as a meter, students have the opportunity to have a more hands-on experience where they will be required to either measure, titrate, or observe. Suggestions for water chemistry tests include dissolved oxygen, pH, salinity, and temperature. More sophisticated analysis can be determined with nitrates, phosphates, carbon dioxide, hardness, or turbidity.

Ideally, students will practice using the test kits in the classroom before they are used in the field. Students may even design classroom experiments beforehand to test different problems that may actually reveal the nature of different water quality factors.

Fish Sampling

Marshes generally have large populations of minnowfish. To sample the fish, a minnow trap (Figure 2) can be purchased at local bait shops or large discount retailers. The trap should be set in an area where grass and water meet. Since these species of fish prefer a carbohydrate diet, the trap should be baited with a firm roll or bun. The trap can sit from 10 minutes to an hour depending on sampling and population sizes as well as time available for the trip. Alternatively, students can sample with a seine net.

After collection, students can examine the fish and take measurements. Common measurements to take include length and mass. If balances are not available for a field experience, just length can be collected.

The most commonly found fish are *Fundulus heteroclitus*, the mummichog, *Fundulus majalis*, the killifish, and *Menidia menidia*, the silverside (Figure 3). The Fundulus spp. fish are extremely hardy and tolerant to stress. They endure handling well during observation and can be returned to the water after examination. Silversides are more sensitive to handling and should be treated with care.

Other Ideas

Water quality, plant biology, organism collection with key identification, or perhaps field geology experiments can take place concurrently. Teachers should make plans that focus on their particular interests, strengths or curricular requirements. Weiss and Dorsey (1999) suggest many other practical, student-centered and tested experiments that may be applicable to specific teacher or course needs.

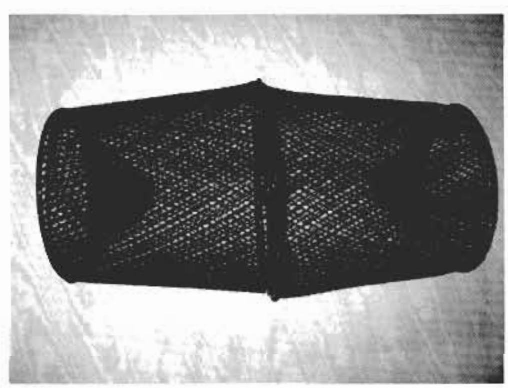

Figure 2. A minnow trap. Available at bait shops and large discount retailers

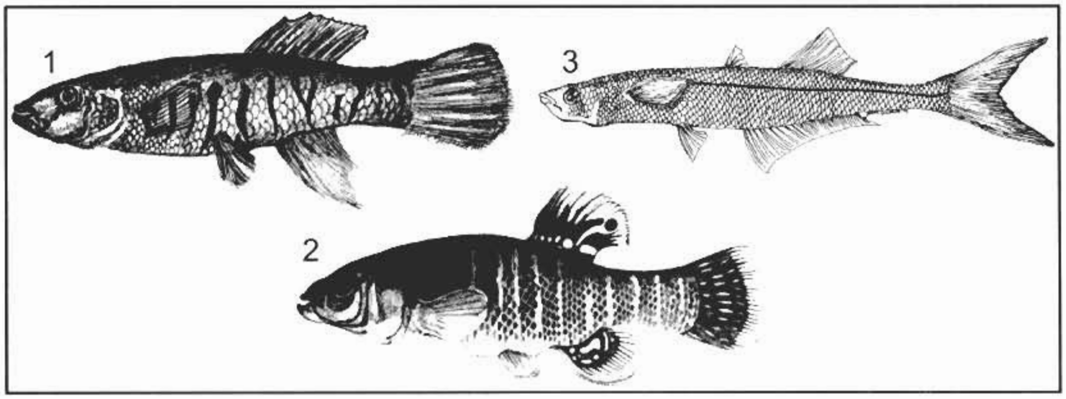

Figure 3. Common marsh minnowfish: 1. Killifish, 2. Mummichog, 3. Silverside.

Bring It Back to the Classroom/Data Analysis

Field experiences become even more meaningful when the experience continues in the classroom laboratory. Consider bringing samples back to the classroom to establish a Long Island Sound aquarium. It is not necessary to fuss over making salt water. Have students bring 2-liter soda bottles and fill them with water from the Sound. Empty mollusk shells can be used for a ground cover.

A good day of field data collection can lead to extensive analysis. For example, if students conduct a fish study of mass versus length the students might construct histograms and/or scatter plots comparing length to mass. Generally, the larger the data sample the more meaningful and pattern sensitive it will be.

Histograms can be created of groupings of mass or data (sample, Figure 4). For the more sophisticated students, length can be plotted against width to examine trends. (sample, Figure 5) To add a mathematics component, from the length/width graphs, a linear regression can be determined along with the correlation coefficient, r. Length/mass comparisons traditionally and consistently produce very high correlations. The data presented in this paper has been actually collected and analyzed by students.

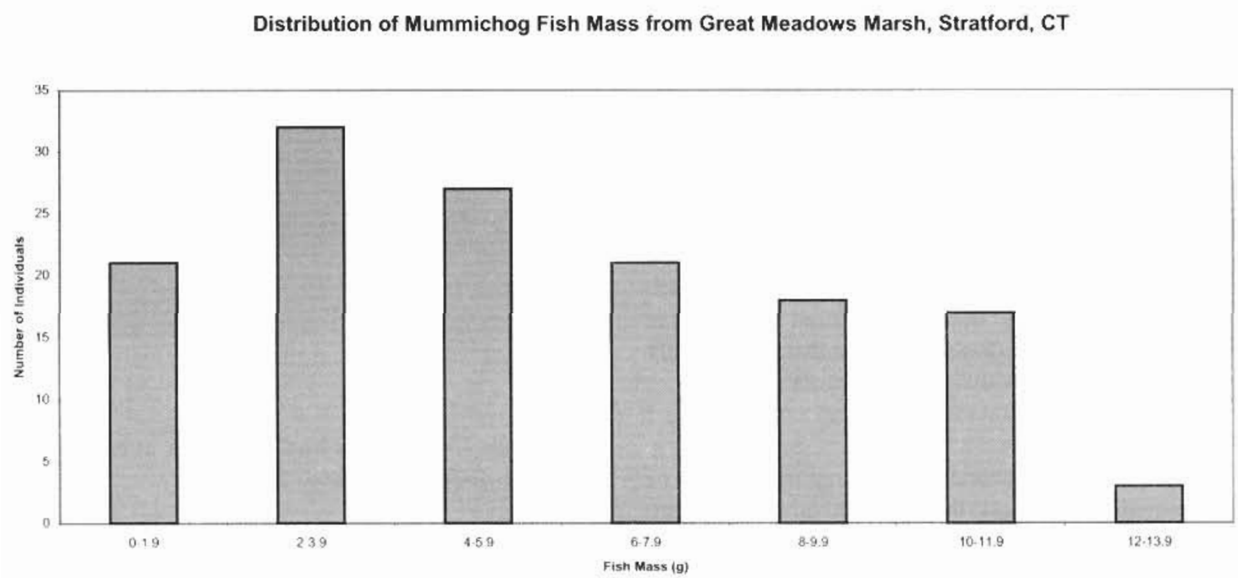

Figure 4. Data for Mass of Fish

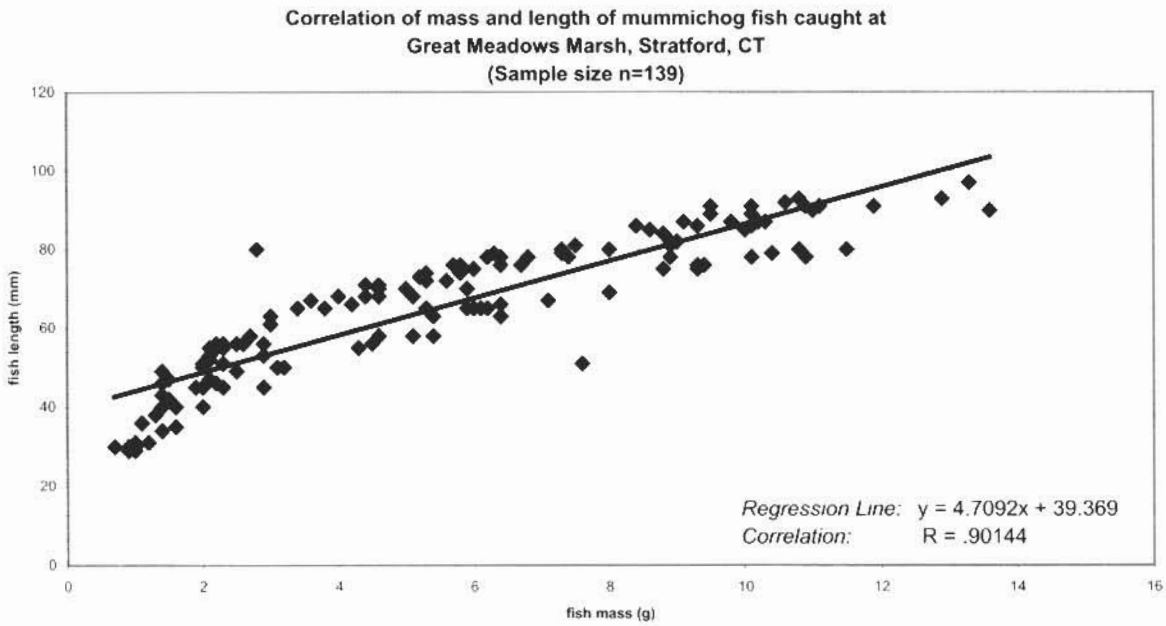

Figure 5. Correlation of Mass and Length of Mummichog Fish

If a trip to the marsh becomes an annual event, the data saved from year to year becomes excellent cross-reference material. Students can determine if regular annual patterns occur and may even be able to explain certain trends.

Implications

Meaningful field experiences are important in science because they excite and energize students, not to mention the benefits of authentic data collection in the natural world. Coastal studies are true interdisciplinary classrooms: Students can conduct *biology, chemistry, physics, or geology experiments.* They can photograph and draw. They can listen and observe and respond in poetry. Most important, they can appreciate. Perhaps the best gift we can give our students is respect and appreciation for the environment. Protection of assets like the Long Island Sound ecosystem comes from greater understanding and knowledge from local citizens. We need to strive to make our students these informed citizens.

Driving Directions to Salt Marsh Sites

Sherwood Island State Park: I-95 to exit 18. At the end of the ramp turn south. Travel 1 mile on the Sherwood Island Connector into the park.

Great Meadows Marsh: I-95 north to Exit 30. Go straight on to Lordship Boulevard/Route 113. Travel 1 mile to fork and bear right (still Lordship Boulevard). Travel 1.25 miles passing Sikorsky Airport on the left. At stop sign turn right on Oak Bluff Road. Travel 0.3 miles into Long Beach Park. *OR* take I-95 south to Exit 30. At the end of the ramp turn left on to Surf Avenue. At the light, turn left on to Lordship Boulevard. Travel 1 mile to fork and bear right (still Lordship Boulevard). Travel 1.25 miles passing Sikorsky Airport on the left. At stop sign turn right on Oak Bluff Road. Travel 0.3 miles into Long Beach Park.

Coastal Center at Milford Point: I-95 to Exit 34. Turn right at the end of the ramp and go 0.5 mile to the third light (Naugatuck Avenue). Turn left on Naugatuck Avenue and go 0.8 mile, passing tennis courts on right and small wildlife sanctuary (at 1.1 miles) to stop sign at Seaview Avenue. Turn right, go 0.4 mile. At the fork bear right into parking area. The Coastal Center is a division of the Audubon Society. There is a building with displays for student viewing.

Hammonasset State Park: I-95 to Exit 62. At the end of ramp turn south. Travel 1 mile on the Hammonasset Connector into the park. Follow signs to Meigs Point.

Bluff Point State Park: I-95 to Exit 88. Head south through 2 lights to Route 1. Turn right on Route 1 and left at the first light (Depot Road). Continue to the park.

Barn Island Wildlife Management Area: I-95 to Exit 91. Proceed south to Route 1. Turn left on Route 1, go several miles, and turn right on Greenhaven Road (at stop light). Make an immediate right on to Palmer Neck Road and proceed to the end.

Acknowledgements

Special thanks to Drs. Lisa Kaplan (Teikyo Post University), Joseph Crivello (University of Connecticut), Ralph Yulo (Eastern Connecticut State University *Emeritus*) and Mickey Weiss (Project Oceanology) for their stimulating discussions, ideas, and inspiration. Scientific drawings are by Jack Gutbrod and Virgnina Zimmerman.

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