EASTERN OYSTERS (*Crassostrea virginica*) IN NEW HAMPSHIRE: THEIR DEMISE AND RESTORATION

Jennifer Greene
Senior Laboratory Technician
University of New Hampshire
jenn.greene@unh.edu
lab website: http://marine.unh.edu/jel/faculty/grizzle/grizzle.html

Zoology Department
Spaulding Hall, Rm.G47
38 College Road
Durham, NH 03824
(603) 862-1244 office
(603) 862-3784 fax

About the author: Jennifer Greene is a research technician in the Zoology Department at the University of New Hampshire. She is the senior technician in a benthic invertebrate ecology laboratory and has been conducting shellfish restoration projects for 5 years. She has a M.S. in Zoology and a B.S. in Environmental Conservation.

He was a bold man that first eat an oyster.
Jonathan Swift, POLITE CONVERSATION (1738)

One might imagine that the first person that decided to attempt breaking into an oyster must have been extremely hungry. The task of cracking open an oyster is extremely difficult. You must have the right tool and if the knife is not placed in exactly the right place, you could risk cutting off a digit. When the first oyster was finally opened, this hungry person would have come across a disheartening sight. Could this possibly be edible? In that half shell sat a slimy, cold blob – an unappetizing display. Somehow, the oyster has become a national treasure and culinary delicacy in many parts of the world.

Oysters are sessile, reef-forming bivalves that live in estuarine habitats and are important indicators of the overall health of these sensitive ecosystems (Figure 1). They live in the

intertidal zone to a depth of 40 feet (12 m) and range from Canada to Mexico, along both the Atlantic and Gulf Coasts. Oysters filter water for food and improve water quality by removing

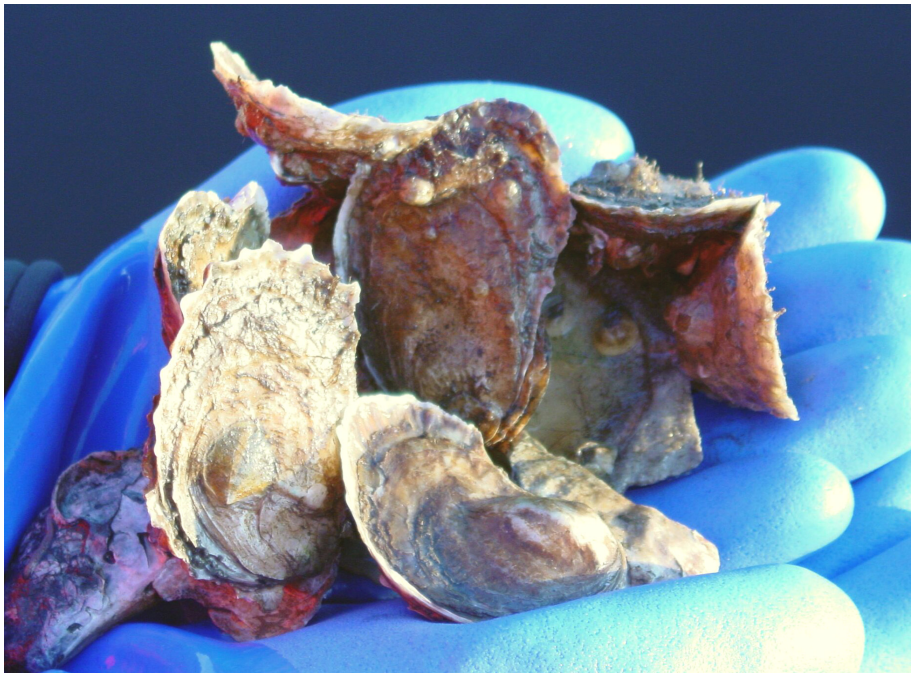

Figure 1. Eastern oysters (*Crassostrea virginica*)

phytoplankton and other organic particles. An adult oyster can filter approximately 20 gallons of water per day, contributing greatly to the overall water quality. Oyster reefs also provide important habitat for other marine creatures (Luckenbach et al. 1999). Since the 1950's, two oyster infectious and fatal diseases caused by parasitic protozoans, MSX (*Haplosporidium nelsoni*) and Dermo (*Perkinsus marinus*), have been plaguing Gulf Coast and mid-Atlantic regions and have been steadily moving north since that time. In 1957, MSX caused the die-off of 90-95% of the population of oysters in lower Delaware Bay and was detected as far up as the Damariscotta River, Maine by 1984 (Ford and Tripp 1996).

The life cycle and transmission of MSX has remained a scientific mystery. When tissue from infected oysters was first examined, the protozoan was not yet identified and called "MSX" or "Multinucleated Sphere X". Later, it was identified as *Haplosporidium nelsoni*, a single-celled parasite. The disease proliferates during periods of high salinity and temperature between the months of May and September, depending on geographic location. Oysters pump water through a filter in the gill chamber, where early infections are found, and scientists have concluded that the infective stage of this parasite is water-borne. Interestingly, the infective stage has not been determined and laboratory transmission of MSX from infected oyster to uninfected oyster has never been accomplished (Ewart and Tripp 1996). Because of the severity of the problem, scientists from various institutions, like Rutgers University and the Virginia Institute of Marine Science, have been searching for answers about the connections between the two parasites and oysters.

The eastern oyster probably flourished in the Great Bay/Piscataqua River system in New Hampshire for thousands of years (Figure 2). It was a seasonal food source for the earliest Native American inhabitants as well as the first European settlers, who arrived in the early 17th century. As the human population expanded, significant pressures were placed upon oysters, stemming from problems like overharvesting, water pollution from sewage discharges into estuaries, and heavy sedimentation from the mill industry.

Oyster populations in New Hampshire took their first big hit in 1874 when a survey team mapping the waterways in Great Bay reported flourishing, unexploited oyster reefs. Residents in the coastal towns surrounding the Bay responded to these reports with excitement and oystermen began harvesting for commercial purposes, both manually with oyster tongs and with specialized

schooners. During the winter season, oystermen cut gaping holes in the ice and methodically stripped oyster reefs with horse-drawn dredges. Within five years, the unabashed exploitation of

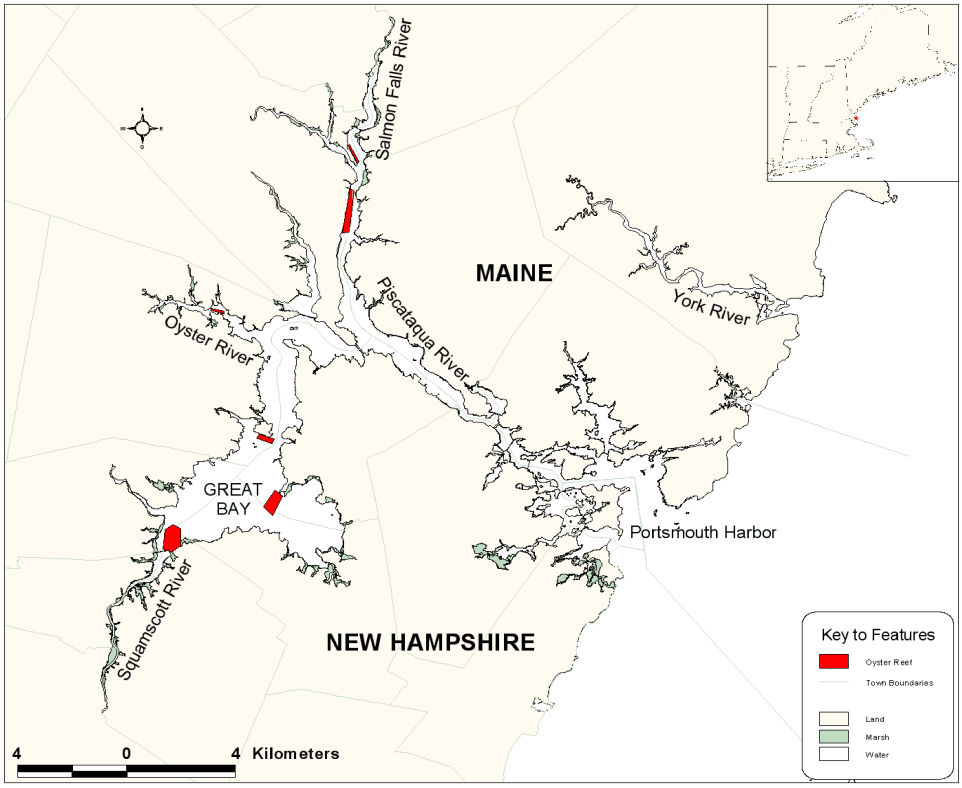

Figure 2. Great Bay/Piscataqua River System oyster reefs

oysters in Great Bay caused the resource to be near depletion. State regulations had been imposed by 1879, but the resource and commercial fishery has never returned (Bolster 2001). Today, oysters are only harvested recreationally, remaining an important social and cultural resource for New Hampshire's citizens.

Resource managers have been particularly concerned over the population decline of oysters in the Great Bay/Piscataqua River estuarine system. In similar fashion to other regions, MSX killed 90-95% of the remaining oyster population in 1995. This die-off has left less than 10 reefs in the estuarine system, with the largest reef totaling approximately 35 acres (0.14 km^2). In

2000, the New Hampshire Estuaries Project published a management plan for Great Bay that included maintaining healthy shellfish populations and habitats as a high priority. This also included the ambitious goal of restoring 20 acres (~2 km^2) of oyster reefs by the year 2010. Research on restoration of oyster habitat in the Great Bay/Piscataqua River has centered upon several research projects, with the common goal of determining the most effective restoration techniques, including reseeding known reef areas with young oysters. Oysters for these projects are grown on a substrate called cultch (usually oyster shells) in mesh bags in large setting tanks at UNH's Jackson Estuarine Laboratory (Figure 3). Projects have included transplanting oysters grown from disease-resistant larvae from Rutgers University as well as fast-growth, native larvae

Figure 3. Remote setting tanks used to grow oysters for restoration at the Jackson Lab.

that are spawned from Maine oysters that have not succumbed to disease. Additionally, native oysters have been collected and transplanted to depleted reef areas. Projects have also focused on

testing different types of cultch in Great Bay to use for reef restoration. The newest experiments examine how oyster reef size affects the success of the reefs and natural larvae settlement on and among the experimental reefs.

Overall, local restoration projects haves been met with both successes and stumbling blocks. A percentage of oysters from all projects have already been affected by disease, while others remain healthy. Oyster reefs that have been constructed previously will continue to be monitored each year for survival and disease. We are continuing to learn more about the most effective restoration techniques for the Great Bay/Piscataqua River system with each project and will continue reseeding efforts with two new projects beginning this summer. Oysters are a valuable ecological resource and important cultural component of life in the seacoast region of New Hampshire. Protecting this treasured natural resource with sustainable recreational harvesting and sound environmental practices will ensure that oysters remain a fundamental part of the local ecosystem.

References:

Bolster, W. J. 2002. Oystering on the Bay. In: W. J. Bolster, Ed. Cross-grained and Wily Waters: A Guide to the Piscataqua Maritime Region. Peter E. Randall Publisher. Portsmouth, NH. 214 pp.

Ford, S.F and M.R. Tripp. 1996. Disease and Defense Mechanisms. In: Kennedy, V.S., R.I.E Newell, and A.F. Eble, Eds. The Eastern Oyster: *Crassostrea virginica*. Maryland Sea Grant College, University of Maryland System, College Park, MD.

Luckenbach, M.W., R. Mann, and J. Wesson, Eds. 1999. Oyster Reef Habitat Restoration: A Synopsis and Synthesis of Approaches. Virginia Institute of Marine Science, Gloucester Point, VA.

New Hampshire Estuaries Project. 2000. New Hampshire Estuaries Project Management Plan. Office of State Planning, Portsmouth, NH.