Final Report

Establishing an Oyster Shell Recycling Program in New Hampshire

UNH OYSTER SHELL RECYCLING PROGRAM

1. Identify Your Shell: NH Wild Harvest Restaurant Grocery Store/Seafood Market
2. Place Oyster Shell in Marked Recycling Container
3. Latch Recycling Container Lid
4. Fill Out Log Book

Questions/Concerns Call: Jenn Greene 603.862.1244 www.oyster.unh.edu

Submitted to: University of New Hampshire VPR/PS Office

Date: September 28, 2006
Project Title: Establishing an Oyster Shell Recycling Program in New Hampshire

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Summary

A major obstacle for oyster restoration projects is the shortage of native oyster shell, or culch, that can be used for remote setting of hatchery-reared larvae. There are potential shell resources outside of NH but introducing shell from outside NH waters may represent a significant exotic species introduction risk. To address the limited availability of oyster shell, during the summer of 2006 an Oyster Shell Recycling Program was initiated for the Great Bay Estuary region. To minimize the risk of introducing non-native species and/or pathogens adhered to collected shell, into the estuarine system a HACCP based preventative mitigation strategy was developed project investigators and approved by the NH Fish and Game Department. The HACCP program was used to identify potential hazards or critical control points during the shell donation process, and assign preventative measures that would stop the introduction of shellfish pathogens or exotic species to NH estuaries. In little more than three weeks, 13 bushels of oyster shell have been donated by community participants. Abstracts have been submitted to highlight the program as well as discuss the HACCP approach to disease/exotics importation mitigation, to both the International Conference on Shellfish Restoration and the World Aquaculture Society/National Shellfisheries Association Annual Meeting.

Rationale

Populations of the eastern oyster (Crassostrea virginica) have been in long-term decline throughout much of its range, including New Hampshire. Once abundant populations in the Piscataqua River and Great Bay Estuary were virtually eliminated in the mid 1990s from an epizootic of the shellfish pathogen MSX. Following the mass mortality event individual efforts by UNH, NH Fish and Game, and private shellfish processors in Southern Maine have worked to understand the underlying causes of oyster disease outbreaks, and to rebuild the once abundance oyster resource with native and disease resistant strains.

A major obstacle for these resource restoration projects is the shortage of native oyster shell that can be used for remote setting of hatchery-reared larvae. Remote setting is a process in which oyster larvae “set” or cement themselves on a clean shell source, or culch under controlled conditions. After “setting” larvae undergo a metamorphosis into their adult form. Seeded shell can then be transferred to historically active oyster beds in an effort to rebuild the native resource. There are potential shell resources outside of NH but the science and regulatory communities have learned that introducing shell from outside NH waters represents a significant exotic species introduction risk.

The overall goal of the project was to supply Great Bay Estuary oyster restoration projects with a continual source of native oyster shell, by implementing a shell recycling program. The scholarly objectives were to continue oyster restoration projects within the Great Bay Estuary with the acquired native shell source and present restoration project results to coastal communities within NH and Southern Maine in an effort to increase public awareness and support of local shellfish resources.
Project Objectives and Results

Specific Project Objectives

The specific objectives required to implement a shell recycling program were as follows;

1- Obtain a trailer and construct a bin to be used for collection and transport of shell,
2- Determine appropriate locations for shell return, storage, and final processing,
3- Develop a protocol that insures no introduction of undesirable materials to State waters in conjunction with the NH Fish and Game Department,
4- Create a public outreach and awareness campaign (flyers, signage, etc.), involve NH oyster harvesters in all aspects of the program,
5- Initiate the program (install trailer, prepare holding facilities and processing area)
6- Develop a plan for long-term funding of the program

Objective 1 (obtain trailer) was accomplished by direct purchase from a local supplier with added costs of some modifications to construct appropriate bin for holding shells.

A Pequea utility trailer (model 610R) was purchased for $1600 from The Trailer Place of New England in Kingston, NH. The trailer was modified slightly by the company to accommodate the needs of this project by adding a higher railing. Eight 48-gallon industrial trash bins were purchased and loaded onto the trailer to hold the different types of shell. Bins were clearly labeled as NH/Great Bay Wild Harvest, Grocery/Seafood Market, and Restaurant. (See Fig 1.).
Objective 2 (Determine appropriate locations) Working with NH Fish & Game and the NH Estuaries Project potential sites were discussed for shell collection, storage and final processing. This task was a joint effort by Dr. Raymond Grizzle (UNH/JEL, Zoology Dept.), Jennifer Greene (UNH Research Assistant), Bruce Smith (NH Fish & Game), and Jennifer Hunter (NHEP).

The oyster shell recycling center is located on NH Fish and Game property near Jackson Estuarine Laboratory. It is in an easily accessible parking lot near the public boat launch (see Fig 2.). Additional fish totes have been labeled and placed at the end of the JEL causeway to accommodate harvesters who arrive with NH/Great Bay oyster shell by boat. After donation, oyster shell will be stored and quarantined at UNH's Kingman Farm in conjunction with the recycling and composting area already in place. The area is currently being fenced into labeled sections for depositing the different types of shell.

Objective 3 (Exotic Species Mitigation Strategy) Develop a protocol that insures no introduction of undesirable materials to State waters in conjunction with the NH Fish and Game Department. This task was the primary responsibility of Dr. La Valley who worked cooperatively with Bob Smith from NH Fish and Game.

Hazard Analysis and Critical Control Points, or HACCP, is a science-based system that examines and isolates possible hazards and sets limits, or critical control points, within which the food is safe and the quality has been maintained. The approach is focused on preventative measures rather than responsive. Resulting from the epizootics of the oyster pathogens MSX and Dermo, inter-state importation requirements have become increasingly conservative.

This conservative regulatory environment has particularly hindered oyster habitat restoration efforts in the Northeast, US. Sources of oyster shell, the preferred settlement structure for juvenile oysters, is difficult to obtain in locations such as New Hampshire, without a commercial oyster industry. We found that the recreational harvesting community was more than willing to collect and donate their shell to support habitat rehabilitation efforts. The critical objective of the project was to develop a preventative
strategy to mitigate exotic species introductions that would be acceptable to NH regulators. Working with NH Fish and Game, Dr. La Valley applied a HACCP based approach to exotic species and pathogen importation mitigation, to design an oyster shell recycling program that would allow recreational fishermen, local seafood markets and restaurants to donate shell for habitat restoration efforts.

The HACCP program was used to identify potential hazards or critical control points during the shell donation process, and assign preventative measures that would stop the introduction of shellfish pathogens or exotic species to NH estuaries. To develop preventative measures in response to significant hazards, critical limits were developed. For example, recent research indicates that quarantine of shell will be quarantined in sea water for categorize, assume “unknown” and air quarantine for 60 days can reduce the risk of spreading Dermo. Such critical limits were used to identify what would be monitored, the procedure for monitoring, and the frequency. Examples included oyster shell source and condition (aged, clean, or organic matter present).

By categorizing the source and condition of shell, mitigation processes (i.e. shell origin reporting, quarantine events, and/or seawater storage) could be performed based on the risk associated with a particular category of shell source (Fig. 3). The Successful implementation of this shell recycling program will have broad impacts on the future of the oyster reef restoration program in NH, as well as connect our restoration efforts to the local community.

Objective 4 (Awareness and Outreach Campaign) was completed by mailing(s) to oyster license holders, posted notices at local stores that sell licenses, and construction of signs placed at shell collection sites. This objective was a cooperative effort between Jennifer Greene from Dr. Grizzle’s lab and Dr. La Valley from NH Sea Grant.

To notify licensed oyster harvesters about this new project, a postcard informational mailing was sent out to over six-hundred people (Figure 4). In addition to the mailing,
Notices were posted at locations where harvesters routinely park or launch their boats. In collaboration with NH Fish and Game, we are currently in the process of making a pamphlet which will be available to people when they apply for their license. Additionally, contact has been made with some influential local oystermen in order to reach individuals who normally may not be targeted by the surveys or mailings.

From July through September several opportunities were available to discuss oyster reef rehabilitation, oyster biology, and to highlight the oyster shell recycling program to community groups in an academic setting and to UNH campus organizations. More than 100 individuals attended these programs and the breakdown of presentations by group, date and attendance is described in Table 1.

<table>
<thead>
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<th>Topic of Discussion</th>
<th>Date</th>
<th>Reason</th>
<th>Number of People</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oyster Shell Recycling</td>
<td>July 3-14, 2006</td>
<td>Site Assessments - Oyster Conservatist Program</td>
<td>20</td>
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<tr>
<td>Oyster Shell Recycling</td>
<td>July 19, 2006</td>
<td>St. Paul's Advanced High School Study Summer Biology Class</td>
<td>15</td>
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<td>Oyster Shell Recycling</td>
<td>July 20, 2006</td>
<td>Training Session - Oyster Conservatist Program</td>
<td>23</td>
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<td>Oyster Shell Recycling</td>
<td>July 24, 2006</td>
<td>Project Smart - high school students/teachers</td>
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<td>Oyster Shell Recycling</td>
<td>July 25, 2007</td>
<td>Great Bay Discovery Cruise</td>
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<td>Oyster Shell Recycling</td>
<td>September 13, 2006</td>
<td>Presentation to UNH counseling service</td>
<td>30</td>
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<tr>
<td><strong>Total Participants</strong></td>
<td></td>
<td></td>
<td><strong>129</strong></td>
</tr>
</tbody>
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Table 1. Outreach/Educational Workshops

Media was also used as a venue to increase regional public awareness of the Shell Recycling Program. For example, the Boston Globe published a feature story in the Globe North section entitled, "Scientists want you to save those shells", which has provided more exposure for the project (see appendix). Presentations are currently scheduled at the International Conference on Shellfish Restoration (outreach focus) and the World Aquaculture Society/National Shellfisheries Association Annual Meeting (technology transfer/HAACP focus). See appendix for attached abstracts.

Objective 5 (Initiate Program) was accomplished by making final arrangements for collection and storage of shell, and installation of trailer at collection facility. This objective was a team effort between all participants and managed by Jennifer Greene.

As of September 1, 2006, the shell recycling area is open and is receiving oyster shells. After only 3 weeks, approximately 13 bushels of Great Bay oyster shell have been collected and we anticipate increased participation as time goes on. Additionally, a log book has been attached to the trailer for oystermen/women to record the amount of shell donated, origin of shell, and location that...
the shells were harvested from in Great Bay. This provides NH Fish and Game with further information about which areas are harvested routinely and complies with the HACCP species introduction mitigation program.

Objective 6 (Long-term Funding) will be secured initially by incorporation of the costs into existing grants that already have funds for obtaining shell. Longer-term needs will be written into grant proposals that are in progress or planned. Continued external funding efforts will be cooperatively pursued by both Dr. Grizzle and Dr. La Valley.

Development funds ($5.3K) were secured from NH Sea Grant to cover costs for combining the shell recycling program with a recently initiated "oyster conservationist" program that relies on citizen volunteers. The recycled shell will eventually be used to provide the cultch material for the juvenile oysters that are raised by the oyster conservationists. Together, the two programs represent important outreach components in the overall oyster restoration program. Additional proposals will be prepared as opportunities arise to secure and increase funding for the shell recycling (and oyster conservationist) program. Even at this early stage, the present project has generated an extraordinary amount of interest from the public.
Appendix
APPLYING HACCP TECHNOLOGIES TO EASTERN OYSTER *Crassostrea virginica* HABITAT RESTORATION IN NEW HAMPSHIRE

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**Figure 1. Overview of HACCP plan for oyster shell recycling**

- **HAZARD**
  - Shell Source
  - Residual Organic Matter on Shell
  - Unknown Shell Source

- **CRITICAL LIMIT**
  - Air quarantine for minimum 60 days
  - Shell free from residual organic matter
  - Shell source will be categorized by staff

- **CORRECTIVE ACTION**
  - Shell will be air quarantined until 60 days can be documented
  - Quarantined in sea water for 10 days prior to air storage
  - If unable to categorize, assume “unknown” and air quarantine for 60 days

- **VERIFICATION**
  - Record review (2x/wk) and monthly report to NH F&G
  - Record review (2x/wk) and monthly report to NH F&G
  - Weekly review and monthly report to NH F&G

World Aquaculture Society/National Shellfisheries Association Annual Meeting
February 26 - March 7, 2007
San Antonio, TX
DEVELOPING PARTNERSHIPS WITH LOCAL COMMUNITY MEMBERS TO ENCOURAGE PARTICIPATION IN OYSTER RESTORATION PROJECTS

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The eastern oyster (Crassostrea virginica) plays an important economic and ecological role in the Great Bay estuary (NH). There have been dramatic declines in oyster densities and reef acreage since mid-1990s, when the first MSX epizootic occurred. While UNH researchers and federal regulatory agencies are actively involved with the resource, local community members have had little chance for participation. Therefore, in combination with our ongoing reef restoration projects, we have instituted two new community outreach programs involving oyster reef restoration in New Hampshire: oyster shell recycling and an “oyster conservationist” program. Recreational harvesters are allowed to remove a bushel of oysters per day in New Hampshire. The oyster shell recycling program allows harvesters to return their shell to a central location for use in remote setting of native oyster larvae. This will allow us to use local shell as substrate for future reef restoration projects and minimize the amount of shell going to local landfills. The oyster conservationist program involves providing local dock owners with naturally set oyster spat in cages and allowing them to care for the oysters until they are ready for transplant at one of our restoration sites. Volunteers at 16 sites around Great Bay and its tributaries monitor the growth of the oyster spat and provide helpful observations from areas not usually sampled. Overall, both projects connect the local community with a marine resource that many people utilize and allow them to become an active participant in the restoration process.

International Conference on Shellfish Restoration
November 15-19, 2006
Charleston, SC
Scientists want you to save those oyster shells
UNH program is using discards to help regenerate population in Great Bay

By Tim Wacker
GLOBE CORRESPONDENT

DURHAM, N.H. — Along with plastic, cardboard, glass, and paper, area residents can now add oyster shells to their list of recyclables.

The shells are being collected for reuse in a program involving citizens and scientists interested in returning oysters to the Great Bay. Since 1993 the area’s oyster population has declined by 95 percent, so the University of New Hampshire and the state chapter of the Nature Conservancy this summer sought out public help to bring the mollusks back.

Residents, commercial shellfishermen, restaurants, and seafood markets are being asked to bring in any discarded shells they may have to the state’s first oyster shell recycling center, which opened Labor Day weekend outside the university’s Jackson Estuarine Laboratory in Durham.

"In the past a lot of these shells were just brought to the dump, which is not good," said Jenn Greene, who runs the recycling program. "It’s very important that we use the recycled shells as a substrate to grow the baby oyster on at the lab. . . . That’s what they attach to normally."

The discarded shells literally form the base of a program to rebuild the oyster population in the Great Bay to what it once was centu-
Scientists want your discarded oyster shells

...