

Best Management Practices for Shellfish Restoration

Prepared for the ISSC Shellfish Restoration
Committee

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Executive Summary

The objectives of the Best Practices for Shellfish Restoration (BMPs) project are to establish methods which include protocols for educational programs and safeguards to ensure that shellfish grown in unapproved areas do not reach the market. The project was recommended by the Shellfish Restoration Committee of the Interstate Shellfish Sanitation Conference (ISSC) at their biennial meeting in 2009. The Nature Conservancy (TNC), through a National Partnership with the NOAA Restoration Center, is working with ISSC on this project to guide future shellfish restoration projects that incorporate educational components designed to protect public health.

The project was designed around seven workshops at regional ISSC and other professional shellfish management meetings, drawing together stakeholders representing state regulatory agencies and public health officials, extension specialists, shellfish industry, non-government organizations, representatives of shellfish gardening programs and other appropriate parties to identify critical issues and solutions.

The workshops brought together those who had, at times, differing views to agree upon best practices for restoration to restore critical shellfish areas while protecting public health. The goal was to use workshop results to provide guidelines that address the needs of stakeholders while establishing protocols for the biosecurity of restoration projects, including educational outreach, and to encourage consistency from state to state. The results of the workshops were incorporated in the report that was recommended for incorporation into the NSSP at the 2011 meeting of the Committee.

The BMPs recommended by workshop participants are grouped under 5 headings:

- protect public health while restoring the environment;
- define goals and objectives of restoration projects;
- expand communication and education;

- expand community-wide restoration and,
- when practical, use noncommercial species in restoration efforts.

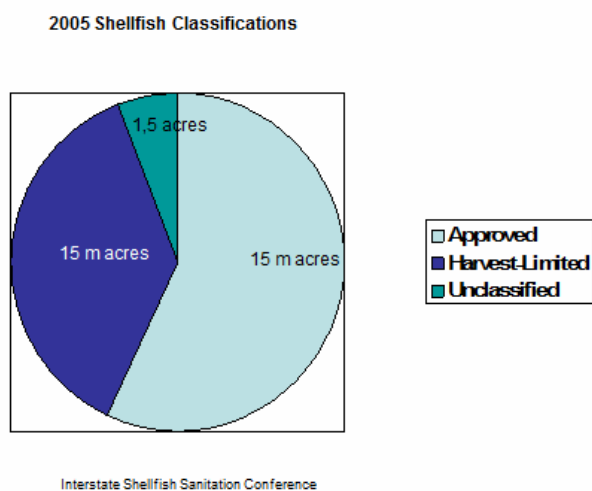
A theme identified throughout the workshop sessions was the need for better planning and earlier communication among all parties. Participants suggested forming partnerships among restoration proposers, regulators, funding agencies, academic institutions and non-government organizations to promote restoration of native shellfish and ecosystem services and to conserve and restore coastal water quality. Although most regulators preferred that restoration activities were only sited in approved waters it was agreed that activities could occur in unapproved waters but would require additional plans for the biosecurity of projects and an education component (biology, growing methods, pests competitors, diseases and public health) for restoration programs using volunteers .

Many of the current and planned projects encourage restoration in community associations where people can work together to improve the environment in their own back yard often by growing shellfish on their own property or in community “plots”. The community volunteers help shellfish control agencies conduct water sampling, provide education and protect the security of the site. They often share knowledge through lectures, written articles, and as guest speakers at civic association meetings and other community events. These local education efforts start shell recycling programs, expand the understanding of the local environment and form a cadre of individuals who protect and ensure the security of the restoration site. Emerging are more efforts to use noncommercial species in restoration efforts, particularly if biosecurity of the sites are a major concern.

Recommendations for Best Management Practices for Shellfish Restoration

1. Protect public health while restoring the environment

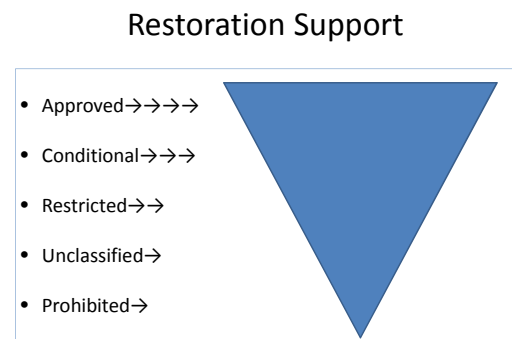
Restoration of shellfish should be conducted in approved waters if possible. The information presented in this report indicates that there is sufficient acreage to conduct numerous restoration



projects without using waters that have not been surveyed, or areas that are restricted or prohibited for shellfish harvest. However, in some projects the objective is to “clean up” the body of water. Although often interpreted as reducing fecal coliform levels the goal may be quite different. For example, drawing attention to a compromised body of water will encourage the community to identify and clean up

sources of pollution. In other cases, the job of the shellfish is to filter the system providing more clarity for submerged aquatic vegetation. The restoration specialists should recognize that the shellfish control officers are charged with protecting public health and preventing illness. They are responding to an industry that wants to protect their reputation for providing safe and wholesome shellfish to the public.

One of the major objections to shellfish restoration is the fear that bootlegging may take place allowing uncertified product to reach the consumer. If one person falls ill from consuming shellfish consumer confidence may be eroded, which can cause economic damage to the industry. A plan for biosecurity needs to be included in each project proposal and, if possible, part of the final funding package. Projects may need to hire security personnel – local sheriff’s office personnel or private security. Enforcement options can include the use of surveillance cameras, employing retired health inspectors, web cams, and on-board GPS systems and incorporating technological equipment used by other law enforcement agents to prevent poaching or catch and arrest those involved in illegal harvesting. In some states it will be necessary to increase fines and penalties.



On the other hand, the regulators need to work closely with the restoration community. Every effort should be made to upgrade classifications of shellfish waters including additional surveys and sampling of growing waters and expanding monitoring and enforcement. Early planning by the restoration community and regulators can greatly expand restoration efforts while protecting public health and the environment.

BMPs

- Form partnerships among restoration proposers, regulators, funding agencies, academic institutions and non-government organizations to promote restoration of native shellfish and ecosystem services, and to conserve and restore coastal water quality.
- Conduct restoration projects in open waters and those historically suitable for shellfish whenever possible.
- Submit additional plans for biosecurity of projects in non-approved waters working closely with enforcement officials and, when suitable, include funding for security efforts in project cost.

- Submit restoration project information to state resource managers, to provide centralized records and data bases.

Define goals and objectives of restoration projects

There is a need to clearly define goals and objectives for oyster restoration, whether the objective is habitat restoration, resource enhancement or production of shellfish for human consumption. The design of the project, funding level and source, required permits, monitoring of results and keeping track of all the elements of the project are critical to eventual success. Using shellfish for water quality improvement could mean different things depending on the program objectives— nutrient reduction, bacterial reduction or sometimes both. Needed are concurrent programs that trace the pollution sources and apply corrective measures. However, in most recent restoration projects, the goal has been the habitat value of oyster reefs and the ecosystem services provided by filtering shellfish.

BMPs

- Define goals and objectives in project proposals, actions to achieve them, methods to track project results and responsibilities of partners in the project.
- Establish criteria to define project success for: ecological services; harvest – who, when, how much; sanctuary - how long; relay - size, security, harvest requirements; reef-building - structural/ecological stability.

Expand Communication and Education

Early communication should occur between state fisheries agencies/public health officials and project proponents, and universities. Regulators need to make certain that the requirements of NSSP are clearly understood and restoration specialists need to provide key information that the requirements of NSSP will be incorporated into their program. Advance planning and early communication can be the key to a successful restoration project. In some projects such as the Lynnhaven River in Virginia, upgrades in classification are a result of the restoration programs and are successful because they were a collaborative effort from the beginning. Adding the

dimension of agri-tourism can be beneficial as well as community education. Education should include potential disease transmission and destructive invasive species and the risks involved.

BMPs

- Prior to applications and funding, meet with state resource managers to discuss potential issues; include location, participants, duration, project goals, methods, species of shellfish, potential harvest or relay requirements, site maintenance and security measures.
- Discuss shellfish gardening locations and plan for oversight by resource managers.
- Provide education component (biology, growing methods, pests, competitors, diseases and public health aspects of shellfish) for restoration programs using volunteers.
- Demonstrate to health officials that plans to educate volunteers will ensure that shellfish grown in unapproved waters will not be consumed.
- Use project to educate public about estuaries, growing shellfish and the importance of shellfish in maintaining biological health of an estuary.

Expand community-wide restoration

We need to engage the broader community in restoration efforts. These can include master oyster gardening, annual workshops, tours, speakers' bureaus, kiosks, monthly newsletters and websites. Education should include high school teacher training programs. Keeping volunteers motivated is a challenging aspect of long-term projects. There is often a high turnover and a need to bring new people in, broadening the education of the community.

Many community-based programs begin with the training of volunteers to conduct water quality monitoring augmenting "official" samples. Training by professionals and continued surveillance provides education and expands surveillance. Accuracy could be checked by dual sampling with certified techniques. Volunteers are usually reliable, and feel committed to the maintenance of environmental quality. In some communities a school or private laboratory can allow for the tracking of rain events or find source contamination in the neighborhood that can be later

checked by a certified lab. With volunteers taking water samples and monitoring waters, there are more “eyes on the water” to observe what is going on.

BMPs

- Encourage restoration in community associations where people can work together to improve the environment in their own back yard.
- Share knowledge through lectures, written articles, and as guest speakers at civic association meetings and other community events.
- Start shell recycling programs.
- Provide volunteers to help shellfish control agencies conduct water sampling, provide education and security of the site. State agencies should solicit and accept volunteer help when appropriate.

Use noncommercial species in restoration efforts

The use of alternative noncommercial species is a possible approach to expand opportunities in certain habitats and waters that are not approved. There are many species that may be appropriate for restoration but recognizing the problems associated with the zebra mussel in the Great Lakes, the selected species should be native to the system being restored.

BMPs

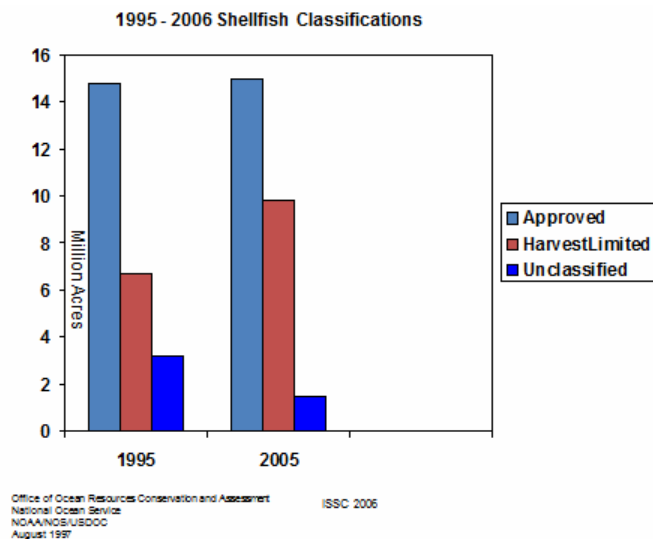
- Use commercially important species as a first choice but if biosecurity of commercial species is a concern, consider alternative native species for their filtering capacity and beneficial role in the ecosystem.

Introduction

Molluscan shellfish populations throughout the nation have declined significantly with a precipitous decline occurring during the last half of the 20th century.

http://www.st.nmfs.noaa.gov/st1/commercial/landings/annual_landings.html. Shellfish are a highly valuable resource providing a healthy food source, an economic boon to local economies through commercial and recreational harvesting and numerous ecosystem services such as improvements to water quality, habitat for numerous estuarine species and erosion control through reef building (Coen et al., 2007). The combination of the serious population declines and importance of shellfish to coastal states have led to shellfish restoration programs designed to improve the current situation. Most often these programs fall within the requirements of the National Shellfish Sanitation Program (NSSP).

The NSSP requires that the state shellfish control agency classify shellfish growing areas into



one of five classifications: approved, conditionally approved, restricted, conditionally restricted and prohibited.

A growing area in the approved classification is always in the open status except for an emergency situation such as conditions following a significant rain event or hurricane when a growing area in the approved classification may be placed temporarily in the closed status.

The remaining four growing area classifications all place some type of restriction on shellstock harvesting such as a harvest prohibition for a specified duration or until test results show appreciable improvement in the water quality. For more information concerning the enforcement of these restrictions, see the NSSP Guidance Document, *Growing Area Patrol and Enforcement of Growing Area Restrictions* (ISSC/FDA, 2002).

Project Description

The project to develop best practices for shellfish restoration was recommended by the Shellfish Restoration Committee of the ISSC, (*Shellfish Restoration Committee Report 2009*, Appendix A). The Interstate Shellfish Sanitation Conference (ISSC) was formed in 1982 to foster and promote shellfish sanitation through the cooperation of state and federal control agencies, the shellfish industry, and the academic community. The ISSC promotes cooperation and trust among shellfish control agencies, the shellfish industry, and consumers of shellfish; and ensures the safety of shellfish products consumed in the United States. Article II, Section 1 of the ISSC Constitution states the objective of the Conference shall be to foster and improve the sanitation of shellfish in this country and to encourage restoration of shellfish growing areas.

The charge to the Shellfish Restoration Standing Committee is to review restoration information that could impact shellfish sanitation and the National Shellfish Sanitation Program (NSSP) and to identify proactive efforts in which Conference involvement would encourage restoration of shellfish growing areas. In October, 2009, the Shellfish Restoration Committee, with the approval of the Executive Board, made the following recommendation: “ISSC consider working with restoration practitioners to develop a set of best practices to guide restoration efforts and provide public health education .” (Appendix A).

The decline of shellfish abundance, coupled with compromised water quality, has spurred the interest in shellfish restoration. While most restoration efforts have also centered on the American oyster, other species such as the native Olympia oyster (*Ostreola conchila*), hard clams (*Mercenaria mercenaria*), soft clams (*Mya arenaria*), mussels (*Mytilus edulis*) and scallops (*Argopecten irradians*) have also received attention of shellfish restoration efforts.

The objectives of the project are to establish best management practices which include protocols for educational programs and safeguards to ensure that shellfish raised in unapproved areas do not reach the market.

The first task was to determine what Best Management Practices are and how they can be applied to shellfish restoration. Wikipedia defines **Best Practices** as generally-accepted, informally-standardized techniques, methods or processes that have proven themselves over time

to accomplish given tasks. Often based upon common sense, these practices are commonly used where no specific formal methodology is in place or the existing methodology does not sufficiently address the issue. The idea is that with proper processes, checks and testing, a desired outcome can be delivered more effectively with fewer problems and unforeseen complications. In addition, a "best" practice can evolve and become more effective as improvements are discovered. Although there are examples in environmental management the closest comparison to best management in shellfish restoration is BMPs for aquaculture.

The Nature Conservancy is working with ISSC on this project to open more opportunities for shellfish restoration while developing education programs that protect public health. The project was designed to organize and facilitate workshops at regional ISSC and other professional meetings, drawing together stakeholders representing state regulators and public health officials, extension specialists, non-government organizations, representatives of shellfish gardening programs and other appropriate parties to identify critical issues and solutions. Handouts (Appendix B) were prepared for each meeting and PowerPoint presentations (Appendix C) used to guide discussions.

This project brought together many differing opinions to agree upon best practices for restoration that restore critical shellfish areas while protecting public health. It was hoped that restoration best practices could provide guidelines to address the needs of stakeholders while establishing consistent education guidelines and protocols for the biosecurity of restoration projects that can be used in all states.

Background

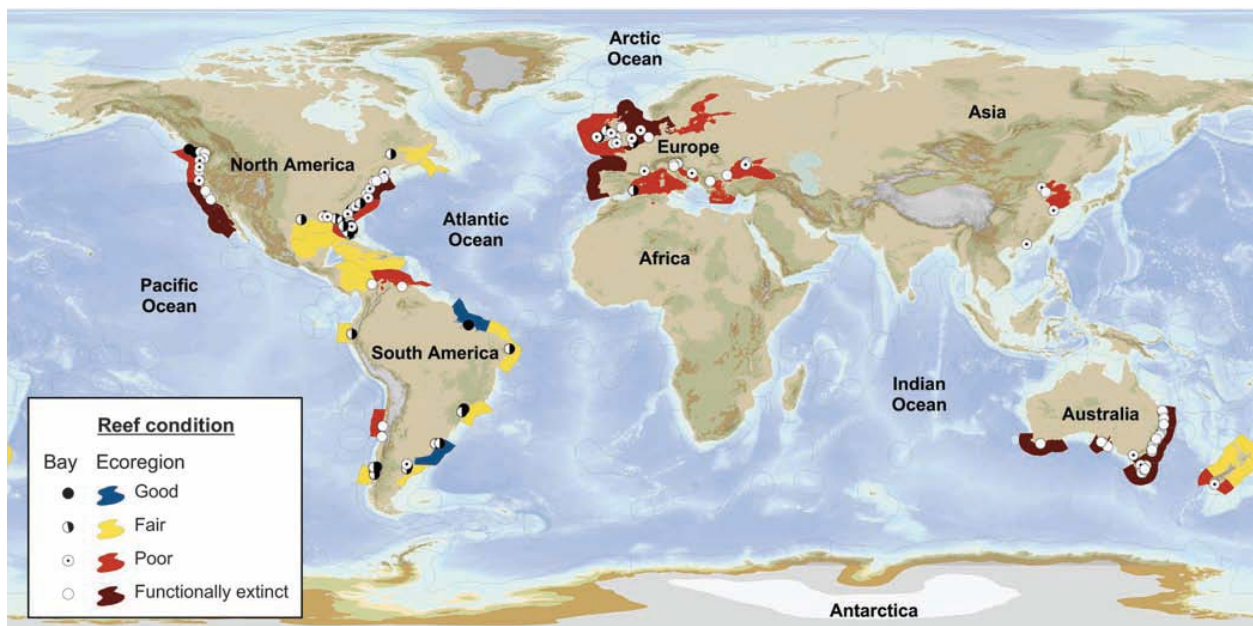
The Nature Conservancy, in partnership with NOAA Restoration Center produced the publication: [A Practitioners Guide to the Design and Monitoring of Shellfish Restoration Projects](#)

http://www.nmfs.noaa.gov/habitat/restoration/publications/TNCNOAAshellfish_hotlinks_final.pdf which describes shellfish restoration programs and their practitioners. The publication also

stresses the need for national best practices for shellfish restoration projects. The Nature Conservancy recently produced another report , [Shellfish Reefs at Risk](#),

<http://conserveonline.org/library/shellfish-reefs-at-risk-report/@@view.html> from an article in

BioScience, *Oyster reefs at risk and recommendations for conservation, restoration and management*. (Beck et al., 2011). The authors point out that 85% of reefs have been lost globally and of the remaining, in most bays and ecoregions, the majority is classified as at less than 10% of “prior abundance”, and that in many areas of North America, Europe and Australia, reefs are presently considered functionally extinct, lacking the ability to be sustainable.



The US continues to have one of the richest natural oyster resources in the world – the Gulf of Mexico – still productive despite significant declines in numerous bays. The authors state that they believe “despite the continued decline of oyster reefs, their condition may be improved through conservation, restoration, and management of fisheries and nonnative species”. They suggest that innovation is needed for oyster reef management for fisheries production, and for providing ecosystem services. They suggest that opportunities exist for restoration in areas of poor water quality but incentives and cooperation and partnerships with managers and other stakeholders are necessary.

Project Process

Why did we use this approach?

We used the process described below because we knew that it had been successfully used for the shellfish aquaculture industry. Both the Pacific Coast Shellfish Growers Association and the East Coast Shellfish Growers Association developed Best Management Practices to address stakeholder concerns. Within the last decade, the shellfish aquaculture industry recognized that differences in growing methods, equipment handling, and the visibility of the industry to the public required that protocols be developed to ensure wise stewardship of coastal waters. Restoration programs have no equivalent set of standards. Their purpose, design, and execution are highly variable, signaling a need for best management practices.

The East Coast Shellfish Growers Association-sponsored project held workshops throughout the East Coast, inviting stakeholders to convene and discuss concerns relative to their particular perspective. Team members presented a short introductory program identifying issues known to be problematic to some sectors and describing what BMPs were. Participants were asked to comment on those issues or others they thought germane to the task at hand. Results were analyzed and through the process, the team identified specific actions related to issues that were, in fact, best practices. The process used for the ECSGA project, the number of people participating and the results suggested that a similar format was appropriate for the shellfish restoration project

The shellfish restoration project team organized and facilitated six well-attended meetings in conjunction with three annual regional ISSC meetings – PacRim, Gulf and South Atlantic Shellfish Sanitation Conference (GSASSC), and Northeast Shellfish Sanitation Association (NESSA), the International Conference on Shellfish Restoration (ICSR), the Pacific Coast Shellfish Growers Association/National Shellfisheries Association West Coast Chapter and the Milford Aquaculture Seminar. A total of 320 people attended these workshops. Brief descriptions of these meetings follow and the original notes can be found in Appendix D.

Workshop Locations and Key Discussion Points

PacRim: The regional PacRim shellfish sanitation meeting held in Stevenson, Washington was selected as our first workshop venue (Appendix D1). Representation from Alaska to California and Hawaii included regulators, Sea Grant, and Cooperative Extension agents and industry. About 40 participants made recommendations on a broad set of issues including: water quality and land use mitigation, private ownership of tidelands; Native American tribal rights and the amount of classified growing waters relative to entire shoreline.

GSASSC: The second meeting, Gulf and South Atlantic Shellfish Sanitation Conference (GSASSC), took place in Orange Beach, Alabama, (Appendix D2) in the Gulf of Mexico/South Atlantic region with a similar mix of people as PacRim. Although regional differences were evident, the 50 attendees addressed similar issues: the fact that states use different approaches to restoration; inter-agency regulatory conflict, for example the Endangered Species Act and the need for better education for oyster gardeners.

PCSGA/NSA: The Pacific Coast Shellfish Growers Association (PCSGA) and West Coast Section of the National Shellfisheries Association (NSA) (Appendix D3) invited us to hold a workshop at their annual meeting in Tacoma, WA. This meeting was attended by 50 people, predominantly industry representatives and scientists with very few regulators. Discussion was lively with the identification of issues including: the cautionary tale of the NJ Baykeeper

program; the use of sophisticated surveillance techniques; the possible inclusion of enforcement in restoration funding and the need for and advisability of advance planning for restoration projects.

ICSR: The International Conference on Shellfish Restoration, held in Charleston, SC (Appendix D4) attracted 50 restoration specialists with fewer industry and regulatory representatives. Issues identified by the attendees included: the possible need for a risk assessment and whether there was an actual risk with restoration in closed areas; the difference between unclassified and unapproved areas; the filtration capacity of shellfish to clean up a system and the number of shellfish required to do so and harvest versus sanctuaries.

MAS: The Milford Aquaculture Seminar is a meeting sponsored by the NOAA Milford Laboratory, Milford, CT (Appendix D5), reflecting the joint interests of scientists, managers, industry and some regulators from the Northeast states. It has been held annually for over 30 years. Fifty people discussed two main themes of restoration including the use of alternative species and education. Issues included: the difference between New Jersey and New York restoration programs in closed waters; programs using alternative species such as *Geukensia demissa*, ribbed mussel ; what elements of an education program were most needed for public programs such as shellfish gardening; why there was a perceived difference in the way regulators treated the enforcement of naturally productive closed areas and restoration projects; whether spawning stock in sanctuaries promote disease resistance or disease and subsistence harvest in closed areas.

NESSA: Our sixth and last meeting in Portsmouth, New Hampshire (Appendix D6) presented new challenges to the workshop format as three states, New Jersey, New York and Connecticut could only participate through teleconferencing. Altogether nearly 60 people participated in the workshop providing the greatest mix of regulators and restorers in the same room. As a result, the discussion provided an opportunity for a lively exchange of viewpoints, especially with respect to restoration in closed areas. Issues discussed were:

- 1) The inability of states to manage the number of people and locations of individual efforts such as gardening and therefore their reticence to approve such programs
- 2) The desire to promote commercial aquaculture and avoid permitting of projects that might jeopardize the industry
- 3) The difference in educational levels of restoration practitioners and volunteers
- 4) Inadequate funding of marine patrols to provide surveillance for the extensive amount of shoreline they are responsible for
- 5) The need to rank habitat projects based on importance of services they provide
- 6) The differences in water quality mitigation between reduction of nutrients and reduction of bacteria.

We were unable to address issues in the Mid-Atlantic region as there was no room on the agenda of the annual Interstate Seafood Seminar held in Ocean City, MD. We attended the meeting, discussing restoration issues on a one-to-one basis.

For those interested in a summary of each workshops and original notes from the workshops, please see Appendix D.

General Workshop Themes:

- Restoration practitioners felt that shellfish restoration was a method to improve water quality, increase habitat, provide shoreline stability, increase diversity and generally improve the estuarine environment. Many felt that projects could be sufficiently planned and executed to prevent consumption of shellfish raised in prohibited waters but acknowledged that surveillance was a must. Identifying appropriate persons for surveillance was a discussion point.
- Shellfish gardening in prohibited areas was seen as a small enough endeavor, especially where shellfish was contained, that harvest would not be an issue but they acknowledged that education was a key ingredient for any successful program.

- Industry, for the most part, was disinclined to favor restoration programs in prohibited waters for fear of shellfish from unapproved areas reaching the consumer one way or another, sometimes resulting in bad press; a situation that is difficult to recover from. However, industry was in favor of restoration in all other waters for the beneficial aspects of restoration programs that positively affect the entire industry. (See additional information on a change to industry responses/perspectives, p. 23)
- Shellfish managers were not overly enthusiastic about restoration programs, especially in prohibited waters, because of enforcement, lack of oversight in locating projects, the number of individuals participating (especially with shellfish gardening), lack of communication with practitioners and lack of funds and personnel to keep track of the projects. However they were cognizant of the potential positive attributes to some of the programs especially with respect to ecosystem services provided and welcomed an opportunity to seek solutions.
- Enforcement was a key issue. Shellfish restoration projects could require additional surveillance and enforcement capabilities currently stretched thin in all states. Prohibited areas already present challenges to enforcement personnel without adding restoration projects. Classifying areas currently unclassified will require additional enforcement personnel and an on-going program in areas that are classified as less than approved to maintain compliance with the NSSP.
- Communication was seen as a key ingredient for all restoration projects and it was emphasized that communication should start early in the process to avoid potential problems once a program is underway. Educating the public about the problems of estuaries in general and the specifics of individual species culture can go a long way toward improving the health of estuaries. It was felt among most participants that an educational component should be required of all restoration programs prior to implementation.
- Private land ownership in Washington provided specific challenges that are not experienced elsewhere.

- The use of alternative non-commercial species may help with water quality but it was seen as an impractical approach from a funding point of view when commercial species can do “double duty” as mitigating water quality issues and then, if safe, as a food item.

Results

The focus on shellfish restoration has increased steadily over the last decade. Shellfish reefs and beds are now recognized as a priority habitat type within NOAA, NFWF and the EPA because of the ecosystem services they provide, including their classification as Essential Fish Habitat. There is also increasing use of oyster reef as a ‘Natural Engineering’ alternative for shoreline protection, sometimes referred to as “living Shorelines”. The scale of shellfish restoration projects has increased in parallel with the recognition of the importance of shellfish habitat in the marine environment.

However, shellfish restoration is not determined by shellfish habitat alone. As described in the definitions listed in Appendix E, there are many types of shellfish restoration and many different groups conducting shellfish restoration programs. Restoration can be practiced as a bioremediation of nutrient loading to estuaries, it can provide ecosystem services not readily attainable by other means, it can provide food, jobs and recreation, and a valuable though incalculable means of educating the public about estuaries.

Types of shellfish restoration include:

- Repletion: adding stocks and/or addressing habitat issues to try to get shellfish populations more in line with historic abundance;
- Reclamation: reclaiming an area that has changed over time such as creating hard bottom from soft organic muds;
- Enhancement: addition of shellfish to existing populations;
- Mitigation: improving a situation produced by disturbance by land uses (stormwater, wastewater, agricultural runoff) or marine disturbances (dredging or oil spills);

- Aquaculture: commercial rearing of shellfish species, both on and off-bottom;
- Return of native species: Olympia oyster as an example;
- Elimination of invasive species, diseases, exotics, predators, fouling organisms.

Groups involved in shellfish restoration include the following examples:

- Federal agencies: research (NOAA Milford Laboratory), funding and regulations (see Appendix F for Regulatory Landscape) (NOAA, FWS,USCOE, USDA), education/outreach (Sea Grant, Extension);
- States: Departments of Natural Resources (resource management, law enforcement, permitting), Departments of Public Health;
- Non-Government Organizations/Groups: TNC, NFWF, Regional Environmental Groups, Audubon, Community Action Groups, Native American tribes;
- Education: Universities, Public Schools, Vocational High Schools.

Special Categories of Groups

Shellfish Gardening/Community Action: Shellfish gardening and community action programs may involve many types of restoration and numerous groups as described above. In its most basic form, shellfish gardening includes a cadre of individuals who grow shellfish in small batches – cages or bags floating under docks in front of their house, bottom plots along the shore, or “garden plots” where individuals “tend” their crop and are responsible for the nursery culture of shellfish. In these programs that vary widely in their approach, there is usually a state extension agent or state natural resources official who oversees the volunteer programs and coordinates their activities. Shellfish gardeners obtain the seed shellfish from publicly-run hatcheries or from commercial hatcheries contracted by the organizing entity to supply the seed. An essential element of these programs is an initial education component to introduce participants to the goals of the program, the biological requirements of the shellfish and the local regulations. In Virginia, a portion of the program was developed for water quality mitigation where individuals grew oysters but not for human consumption. In New York, half of the oysters grown can be for the grower’s consumption while the other half is returned to the community for restocking. In each case, participants enroll in a training program prior to participating in the restoration effort. Also in both cases, there is logistical support for the

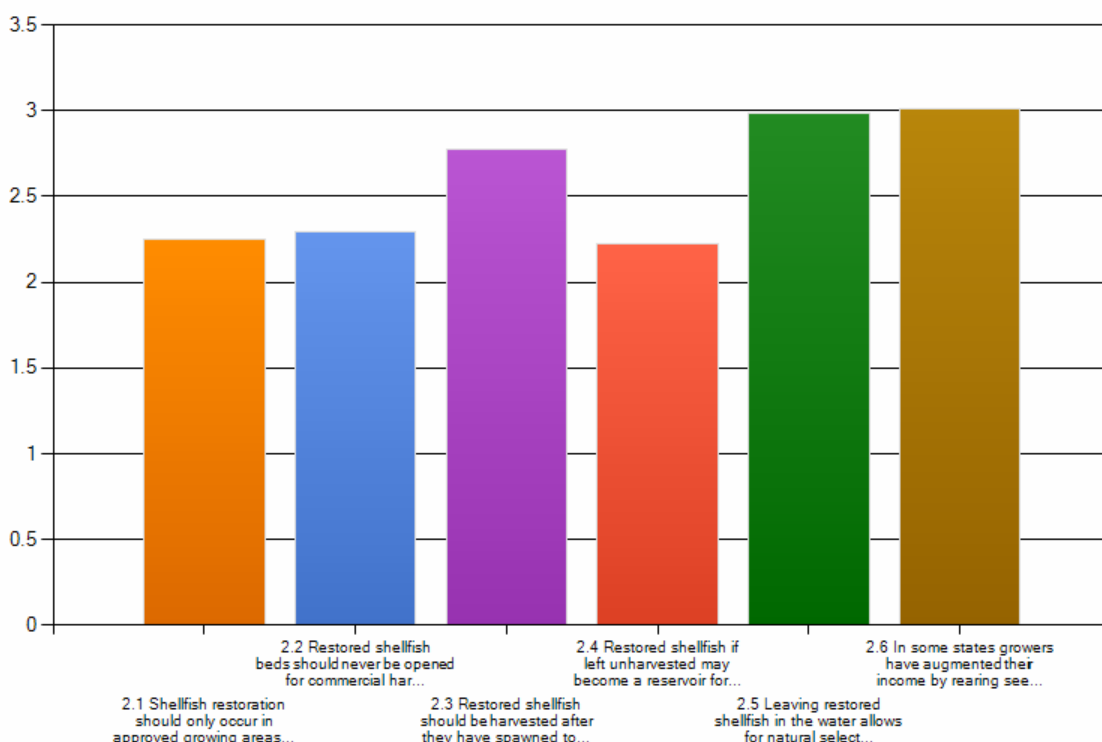
education and training through Sea Grant and Cooperative Extension offices. Individuals engaged in shellfish gardening often become stewards of their region, “spreading the word” about shellfish and the associated benefits to the area of shellfish culture. They often participate in other community action programs aimed at improving water quality, participating in habitat restoration or educating others.

Industry Perspective: Although the perception is that industry is opposed to shellfish restoration, recent policies and survey by the East Coast Shellfish Growers points to a more balanced attitude (http://www.ecsga.org/Pages/News/ECSGAnewsletters/ECSGA_NL_v3-11.pdf). The survey indicates that they are in favor of efforts aimed at improving water quality and programs aimed at educating the public about both water quality and the role of shellfish in estuarine health. Industry must have clean water to grow shellfish to sell shellfish in interstate commerce. With shellfish aquaculture emerging as a growth industry, those involved are cognizant of the larger issues involved and of the requirements of the NSSP.

However, many participants expressed the same concerns of resource managers when restoration programs involving shellfish stock were conducted in prohibited waters. Any illness traced back to shellfish harvested from prohibited waters would have severe rippling effects on the entire industry. Yet, despite the concerns, in a post-workshop survey (see below), a majority of respondents wanted restoration efforts to continue in prohibited waters.

In an effort to help frame NOAA’s aquaculture policy, the East Coast Shellfish Growers Association sent an electronic request for completion of a short survey. Eighty individuals split evenly between growers and related fields (dealers, extension, and research) completed the survey.

2. Shellfish restoration One of NOAA's mandates is to restore coastal ecosystems. Shellfish restoration is likely to be included in their Shellfish Initiative, and we have an opportunity to guide that work. Our industry has a wide range of opinions on the issue and we need yours.



High ranking priorities of actions to document ecological benefits, research ecological concerns, implement BMPs, establish marine spatial planning and pre-permitting zoning. Of medium priority was supporting oyster gardening.

Most respondents (67%) felt that efforts in closed waters should continue; about one third felt that restored beds should never be harvested; 68% did not fear sanctuaries as disease reservoirs while 86% believed that sanctuaries led to disease resistance. Growers (80%) wanted to be active participants in restoration programs.

Additional questions in the survey concerned marketing, post-harvest treatment especially as it related to cost of doing business, NOAA's role in preserving working waterfronts and conducting outreach on the ecological benefits off shellfish aquaculture. While of interest, they were not applicable to this project. However, there was a final section dealing with ecological questions. (Survey results compiled by Robert Rheault, Executive Director ECSGA).

Growers and restorers also differed in their approach to the harvest of shellfish in restored areas. If an area is “restored”, at what point does the restoration project signal that it is time to harvest the shellfish? If an area is set aside as a spawning sanctuary, is it considered part of a restoration project or the primary reason for restoration? For the spawning sanctuary to continue to produce seed in adjacent waters or throughout an embayment it may not be advisable to harvest at all within the sanctuary. However some states require harvest after a specified amount of time. At some point, a decision has to be made about harvest and it would be wise to set the bar early in the process. The goal of any restoration program should be defined in the beginning to avoid harvesting conflicts after a program has gotten off the ground.

Concerns Expressed at the Workshops

The following concerns (**bold underlined**) voiced at discussions will be dealt with individually and may include subtopics (***bold Italics***) and a case study where the concern has been addressed and a positive outcome occurred.

Protect public health while restoring the environment

Among the most controversial issues identified in the workshops was the use of prohibited areas for any type of shellfish restoration program. Concern that shellfish grown in unapproved areas may enter the open market worried both regulators and industry. The potential threat of illness from shellfish harvested from unapproved waters could prevent a state from participating in interstate commerce and possibly cause severe economic damage to the entire industry.

Shellfish managers were clear on their responsibility to protect the public health. As a result, there is the need to develop safeguards to prevent shellfish grown under those conditions from reaching the market.

However, the marketplace was not the only concern. There was also a strong desire to ensure that individuals do not consume shellfish grown in unapproved areas. Shellfish grown under private docks or on private property fit that category as does subsistence harvest. If an illness

occurs and can be traced back to a restoration program, that illness will also devastate both the industry and the future of restoration programs.

Case Study: Soft shell clam project in Boston Harbor. In this particular case the State of Massachusetts is involved in a restoration project in conditionally restricted waters. The soft shell clam enhancement program began in 2006 as a remediation project. There had been major disruptions to native softshell clam (*Mya arenaria*) populations in Boston Harbor resulting from installation and operation of the HUB natural gas line. All the subsequent planting activities continue to be coordinated with local municipal authorities and the harvest of soft shell clams within Boston Harbor is tightly regulated by Massachusetts Marine Fisheries, MA Environmental Police and participating municipal shellfish departments. All commercially harvested soft shell clams must be harvested by a certified Master or Subordinate Digger, and all of the clams must be delivered to the State Shellfish Depuration Plant in Newburyport via a pre-described route. Recreational shellfishing is not permitted within Boston Harbor. There are numerous restoration sites in Boston Harbor as shown in this graphic.



Define goals and objectives of restoration projects

A lack of consistency in how restoration programs are developed, implemented and monitored was brought out in almost all workshops. In many cases, public funds are used for the programs but metrics to evaluate the effectiveness of the programs have been lacking. Evaluations based

on harvest statistics fail to take into consideration ecosystem services or public education benefits, both of which can be difficult to accurately measure.

Coordination begins with planning and the onus is on the restoration group. When designing a project in preparation for funding, even if there is a short window of time for proposal preparation, there should be an initial meeting between the proposal principal investigator and the state shellfish management team to lay out the plan. Project goals, methods and location are all necessary ingredients to a successful partnership and can lead to smoother relationships especially if permitting is required. Even if a permit is not required for a restoration project, tacit approval from the regulatory agencies is highly suggested to avoid problems as the project continues through several years.

Requirements and realities of shellfish in the field

Long-term planning is imperative. Shellfish take time to grow, mature, and spawn to produce a sustainable population. As an example, building reefs requires three-dimensional structure, either provided by constructed materials – concrete balls, towers or other similar systems, shell-filled bags, or combinations of substrates. Not only do oysters have to attach to the substrate successfully, they have to attract future generations of oysters to also settle in that particular area. Hard clam restoration often follows a slightly different path because hard clams do not strongly exhibit gregarious setting as oysters do. In that case, large numbers of hard clams are usually produced and planted in “sanctuaries” to encourage fertilization and larval development (Macfarlane, 1998, Kassner and Malouf, 1982,). Hard clams typically, though not always, take longer to grow to maturity than oysters, and the length of time to maturity must be considered. Soft shell clams have certain requirements and challenges that differ from either oysters or hard clams (Beal, 2009, Maine DMR, 2001, Maine/New Hampshire Sea Grant, 1998, Newell and Hidu, 1986, Belding, 1912,). Bay scallops have a short life-span and are more highly susceptible to natural perturbations as a result (Tettelbach and Smith, 2009; Goldberg, 2000, Leavitt and Karney, 2005, Macfarlane, 1999). Mussels, while prolific, can be plagued by pea crabs and by “grit” that turns into tooth-breaking pearls when the mussels are grown on substrate rather than off-bottom. (Newell et al, 1982, Pearce, 1964, 1966).

Harvestability of shellfish from restoration projects

Project proponents need to clearly define goals and objectives for shellfish restoration including such items as harvestability of the stock “down the road”. If the project is primarily aimed at developing habitat, do the project proponents see a time when the habitat will be stable enough to allow harvest and if so, at what level. If it is not to be harvested, who makes that decision and who will enforce the ban on harvesting? Since states have full responsibility for resource management, they may have different perspectives than restoration specialists with respect to fishing a public resource. Funding agencies such as NOAA have agreements with their funding partners that restoration investment should have adequate assurances that the project would be protected through fishery closures. Some states, however, have statutory requirements that require areas be opened for harvest at a future date.

At issue is the timeframe for closures and/or criteria that would satisfy both funders and resource managers – whether or not a restored area could sustain both habitat reclamation and a fishery. Communication between proposal principals and resource managers in advance of funding and implementation could resolve the issue at the beginning of the project.

Harvest is merely one example of the types of issues that surround a project proposal that long-term planning and communication among the parties can resolve beforehand. Successful communication among parties can lead to successful projects where both project proponents and management professionals have a stake in a positive outcome.

Early and continued coordination among all groups in projects

Different types of groups promote and implement restoration projects. Academic institutions, environmental non-government organizations (NGOs), and state/municipal/county entities may all be involved. Academic institutions often do not have much interaction with shellfish regulatory/management personnel. Academic institutions or NGO’s may be looking for a particular set of circumstances or environmental parameters in the field to answer a specific suite of questions without knowing the reason for a particular water quality classification. That knowledge is crucial for a positive outcome. If, for instance, a project is proposed to reduce the nutrient load to a specific area but there are also bacterial issues, using shellfish and the filtering

capacity of shellfish to achieve the goal of nutrient reduction may be modified or prohibited because of the bacterial issues. Early communication and coordination with the regulatory community by the project proponent will alleviate problems later. Academics who are trying to answer specific questions must look beyond their immediate research to potential consequences of their project of which they may be completely unaware.

Case Study: Raritan Bay, a story of planning On August 19, 2010 the headline of the local New Jersey paper, Atlanticville reads, “It’s a sad day for Raritan Bay. An effort to restore the eastern oyster population to the Keyport Harbor officially came to a close on Aug. 9, a day that marked the shutdown of the largest shellfish restoration project in New Jersey and New York.” Under orders from the New Jersey Department of the Environment the NY/NJ Baykeeper removed more than 50,000 oysters from a reef in the Raritan Bay because the commercial sized oysters were located in waters classified as prohibited. The state decision was based on their mandate to protect public health and New Jersey’s \$790 million shellfish industry.

<http://atl.gmnews.com/news/2010-08-19/Front Page/A sad day for Raritan Bay.html>

Fortunately the story does not end there. The headline only one year later, July 29, 2011, in the NY Baykeeper newsletter reads “Baykeeper and Rutgers Complete Historic Raritan Bayshore Mapping Project”. --we are doing valuable alternative research such as this mapping project and identifying a site that DEP considers safe for oyster research....” The U.S. Army Corps of Engineers' Hudson-Raritan Estuary Comprehensive Restoration Plan (CRP) calls for 500 acres of oyster restoration in the Hudson-Raritan Estuary, where “the Eastern oyster is 'ecologically extinct' so reviving its population requires unique and creative approaches that will be guided by this map.” The map is part of a planning process that will identify existing shellfish populations, potential pollution sources and other important environmental factors. If NJ DEP works closely with the organization the result may very likely meet the objectives of the CRP.

http://www.nynjbaykeeper.org/index.php?option=com_content&view=article&id=119%3Abaykeeper-and-rutgers-complete-historic-raritan-bayshore-mapping-project&catid=1%3Alatest-news&Itemid=79

Expand communication and education

The lack of communication between restorers and managers was mentioned at every workshop. Often, the resource manager finds out about a project only when there is a request for a permit or when there is a reported problem as a result of the restoration activity.

The dichotomy between restoration practitioners who propose and execute projects to ameliorate the ecologically damaging effects of habitat degradation from low shellfish abundance, or high nutrient loading and state resource managers who are required to protect the public health by preventing shellfish grown in prohibited waters from reaching the consumer, is an ever-present theme in developing best practices for shellfish restoration. Throughout the workshops, individuals from both sides of the issue commented on the need for broad-based communication and education for all parties involved in either effort. The report mentioned earlier, “Oyster Reefs at Risk” suggests best practices for shellfish restoration to resolve this dichotomy. Usually people involved in shellfish restoration focus on their individual project. Keeping track of all the elements of the project (designing the project, obtaining funding, obtaining permits if required, execution, monitoring results) is critical to the eventual success. Issues may arise during the course of the project that require a change in the execution or may not be feasible for a variety of reasons. Restoration specialists are focused on their restoration goals. Resource managers must focus on the requirements of the National Shellfish Sanitation Program: coordinating efforts of water quality monitoring, classification of growing areas, and enforcement. The workshops illuminated a lack of coordination between the two groups of people.

Need for Central Repository of projects: who, where, what and why

Because there are so many people and entities working in the nation’s bays with many different funding mechanisms, it is almost impossible to know who is doing what where and why. There is no over-arching entity that keeps track of projects and there is no clearinghouse to coordinate all the activities. Academic institutions generally act independently of one another and even within the same institution; departments are often segregated in their research work. Multiple NGO’s and government entities working in the same bay may work independently. Consequently, there is the possibility of duplication of effort, as well as projects that actually may be at cross purposes. State regulators have a responsibility to ensure that shellfish reaching consumers meet the highest health standards and they need to know what projects are taking place within their jurisdiction. If the waters are classified as approved, the conversation should

be rather routine, but as the classifications become more restrictive based on public health, there must be more scrutiny.

Role of volunteers

Another aspect of communication concerns the people involved in the project. Academic institutions, NGO's and government entities all use volunteers to some degree. Communication and education cross boundaries here but one aspect identified in the workshops was the necessity for all people involved in a shellfish restoration project to have some working knowledge of the National Shellfish Sanitation Program (NSSP) and the reason for its importance. Many of the restoration projects already have education programs to train volunteers on techniques. However, shellfish are highly regulated for public health reasons and vigilance by all individuals involved in shellfish restoration in whatever capacity must adhere to the NSSP program for the benefit of the entire industry.

Work in multiple jurisdictions – need for consistency

Because individual states administer the NSSP and Model Ordinance, there is a certain amount of variation, causing problems for practitioners who perform their work in multiple jurisdictions. Workshops identified a need for consistency in interpreting and administering the NSSP and Model Ordinance but short of requiring such consistency, pre-project planning and communication with regulators would again alleviate many of the problems encountered with NSSP interpretation by the states.

Education

Education and communication are intricately linked but there are certain aspects of shellfish restoration that are more specific to the broad topic of education.

Water quality monitoring

Water Quality monitoring requires strict adherence to field and laboratory procedures and protocols. Generally volunteers are trained in the field by qualified personnel from an approved laboratory or agency. They are well versed in the equipment, methods and data entry procedures. Often duplicate samples are taken simultaneously by volunteers and qualified

personnel to ensure accuracy for later samples. When sample results match, there is greater confidence in the results obtained by the volunteers. Sometimes there is a hand-out or series of handouts for reference in the field. Sometimes a group will establish their own laboratory to augment the official certified lab. Such a facility can be enormously useful to track rain events outside normal work-week schedules or to find source contamination that can be later checked by a certified lab. In such cases, the lab can become certified but many are not. Again, duplicate sampling can increase confidence in the non-certified lab results. In both field and laboratory, the education component is straight-forward because protocols have been established and standardized.

Habitat enhancement

SCORE, an example of a successful South Carolina reef-building program, gives volunteers a 15-20 minute orientation on oysters - life cycle, need for substrate, environmental services. They conduct two or more Coastal Discovery Workshops each year which have a longer presentation (PowerPoint) and they have a classroom lesson about habitat and biodiversity which they can do in the schools or at the Department of Natural Resources (DNR) headquarters. They also have a water quality training program and are working towards creating additional lessons.

Shellfish gardening

Shellfish gardening, where individuals grow a relatively small number of seed shellfish on their own property or in a community “plot” requires education to be successful. In most cases, all or a portion of the shellfish grown is returned to the community for restoration projects including those for habitat restoration. One of the benefits of these programs is the information the gardeners gain about oysters and the environment in which they grow. There is no real way to quantify this benefit but the people involved take pride in what they are doing and want to protect their own back yards.

However, the number of people involved in shellfish gardening, while considered a positive aspect among gardening administrators, is considered a negative among resource managers because of a perceived/real lack of oversight and a fear that the gardeners do not fully understand the rigors of the NSSP and the consequences if shellfish is consumed from unapproved waters.

Two programs have been in existence the longest and have been held up as examples of highly motivated groups: SPAT and the VA program. Both have comprehensive educational programs.

Case Study: The SPAT (Southhold [NY] Project in Aquaculture Training) program began in 2000.

The SPAT manual states:

- 500 families have been involved in the program,
- Volunteers logging in excess of 15,000 hours of time each year
- 3 species of shellfish (clams, oysters and scallops) cultured,
- Maintaining a hatchery, nursery and grow out systems that they built, build boats and generally have a rewarding time.
- Members as a vital part of the seaside community

The objective of the program is to encourage members of the community to become stewards of the environment and to restore shellfish in local waters to pre-brown tide levels. Participant fees, federal



grants, corporate sponsorships, county and foundation support finance the SPAT program.

The manual covers oyster biology, (including descriptions of various species and their distribution and moving on to oyster anatomy, growth, reproduction and life cycle, predators, diseases and parasites, and fouling organisms as competitors), hatchery and hatchery techniques, nursery

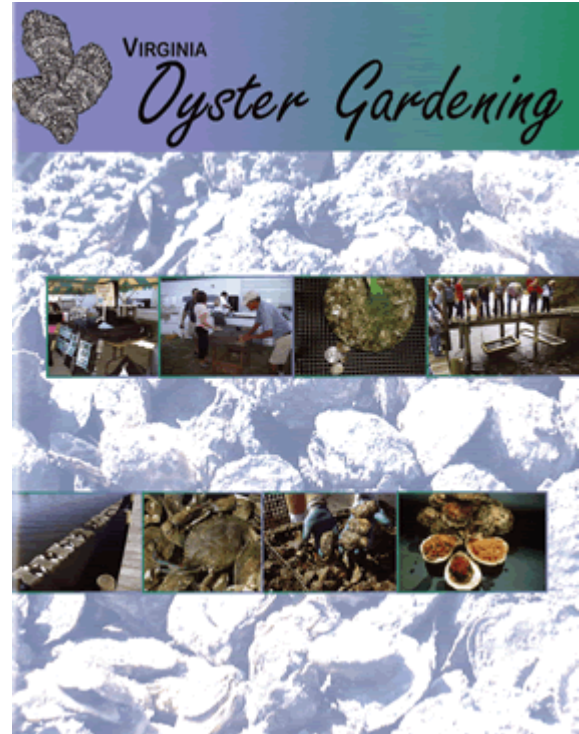
techniques, and grow-out. Kim Tetrault, the program director, points out that there are many ways to grow oysters, several reasons for growing oysters and it is a major component of the program to match the correct method for the appropriate reason. The manual discusses stocking density, culling and sorting, and over-wintering. The manual concludes with appendices including more detailed description of algal food production and nursery methods, triploidy, remote setting, and growing area classification.

The **Virginia** program differs from the SPAT program. Their introduction states up front that the ecological contribution of oysters is through their filtering ability and how oyster gardening can help. They state that there are over 2,000 oyster gardeners “cultivating” oysters in Virginia waters, many of whom are

growing oysters to improve water quality. They state that oysters can filter up to 50 gallons of water daily and the explain the filtering mechanisms involved, either using the filtered water as food or excreting the excess and non-food particles, clarifying the water in the process. They point out that the individual efforts of the gardeners help to improve water quality and biodiversity along the coast. They explain the role of nitrogen in the estuary, causes of excess nutrients and problems in the estuary as a result.

The manual discusses:

- Site selection and its importance for growing oysters
- Important environmental parameters for growing oysters successfully
- Water classification relative to food safety and maps of classified areas
- Seasonality, oyster growing methods and gear
- Purchasing supplies, setting up and maintaining the “garden”
- Pests, parasites and fouling
- Decisions relative to harvesting, vibrios and other considerations
- Oyster diseases, commensals, competitors, pests and predators



There is a special section on schools and oyster gardening that discusses a program called “Schools Restoring Oysters to the Chesapeake. “The program engages 7,250 students from 145 K-12 grade classes each year in a Bay-wide effort to restore the oyster population. As of 2005, 48,500 students have contributed a remarkable 2.7 million oysters to sanctuary reefs in Virginia. This project takes a hands-on approach to education, allows students to execute authentic science, is based on scientifically sound restoration strategies, and meets multiple Virginia Standards of Learning.”

While both programs provide a manual for their gardeners, they differ in approach. A large part of the SPAT program in NY is their hatchery and they devote considerable emphasis to the hatchery process. Both manuals focus on oyster biology and grow-out methods since that is the most important education element for individuals. The Virginia manual describes public health aspects more than the NY version but NY does explain the NSSP classification system.

The workshops revealed that shellfish gardening specifically has several issues causing problems for resource managers.

- The shellfish grown is not considered interstate commerce and therefore does not come under the requirements of the NSSP; the controls are under the jurisdiction of the individual states and the ISSC restoration committee has concurred.
- Some states require gardening only in certified approved waters (NY, NJ) although there was disagreement in New York where some participants said that gardening is allowed in unapproved waters with an educational component but others said that was no longer the case. There are also projects planned or being executed to plant shellfish for water quality improvement in prohibited waters.
- Some states have a good “handle” on where gardening is taking place while other states expressed exasperation with gardening and other restoration projects because they did not have full knowledge of the project or locations and they felt they could not adequately track public health aspects.
- Some states allow shellfish gardening in prohibited waters for seed growth but the shellfish must be relayed to certified waters for eventual harvest. In some states, growers must sign a waiver that they will not consume shellfish grown in unacceptable waters.
- Some states have an educational component similar to the ones described above. Others have a pared-down version or hand-outs and training sessions. One state has attempted to include an educational component but cannot get people to actually attend the sessions.
- Some states do not allow gardening at all because of the difficulty of policing the activity.
- Many states expressed a concern that if an illness occurred from consumption of shellfish from gardening in prohibited waters it would reflect badly on the entire shellfish aquaculture industry.

What seems to be most troublesome is a lack of coordination between gardening administrators and resource managers and a perceived/real lack of oversight. Experience in Virginia and New York (SPAT) programs indicate that education is a key ingredient. The Virginia manual

carefully points out the reasons behind the NSSP, shellfish classification of growing waters and the risks associated with consuming shellfish from unapproved waters. The New York manual mentions these aspects but does not dwell on them; there may be additional information provided at workshops and training sessions. Neither program suggested that there had been a problem with people consuming shellfish grown in unapproved waters. Those individuals who grew shellfish for water quality mitigation were cognizant of the contribution the shellfish made and were aware that the shellfish they were growing was not to be used for consumption. They agreed to grow the shellfish for the benefit of the community rather than for themselves.

Resource managers were clearly uncomfortable discussing shellfish gardening in a public forum. Many knew of and applauded the reason for shellfish gardening but their responsibility to public health was an over-riding consideration. Although the number of participants in these programs is impressive, the numbers just reinforced the reticence by the managers to say with certainty that people in these programs were adhering to public health concerns.

Public Education

Several states had programs in coastal communities where high schools are adding shellfish cultivation and estuarine ecology to their curriculum. Ensuring that these programs also include information on the NSSP is imperative but the schools do not always communicate with the state about their programs and a lack of coordination was again pointed out. However, the fact that schools are paying attention to this topic was viewed as a very positive sign for the future.

Case Study: ReClam the Bay. In New Jersey a group of volunteers led by cooperative extension agents have developed an extremely successful education program. While restoring millions of clams to Barnegat Bay their major impact has been their education and communication activities. “We want to involve the business community and the people who visit their establishments. Our plan is to have business display a ReClam The Bay plaque and to provide simple hand out material telling of the ReClam The Bay activities, the educational programs that we provide, how they can see where the ‘babies’ grow and to visit the web site for more information.” Volunteers attend a variety of festivals and events, take along some of the “babies” and display a story board. The organization has developed class outlines and materials to support their reclaim activities. Volunteers are outfitted with kits of: hands-on activities, visual aids, handout material and simple class projects to supplement a variety of class room, vacation and after school activities. Lesson plans and support materials are available to any group or organization teaching about

marine life. The story board shows, in easy to understand text and graphics, the relationship of shellfish to the environment and what ReClam The Bay is doing to repopulate the bay. The same kind of display is used at the upwellers where the public can observe clam care and feeding. ReClam has established a web site to provide some of the organization's information including water quality and other data that our volunteers monitor as part of the clam care. The information is available in graphical form so that individuals, students and teachers can review it. "Some of the most enthusiastic volunteers feel that they are ensuring a healthy bay for their future." <http://www.reclamthebay.org/>



What we have personally enjoyed is the clam trails, a fun and educational activity to help young and old to understand Barnegat Bay and how they can enjoy and improve it. People who follow the trail will find "clam clews" and "water wisdom" about shellfish, and how they improve the bay. Kids and adults will learn what everybody or anybody can do to help the clams help the bay. The entire clam trail is divided into sub-trails: LBI South, LBI North, Waretown and North, Manahawkin and South.

Expand community-wide restoration

A major theme of the workshops was education as it relates to public outreach. People who work in the field of shellfish restoration have varying degrees of knowledge about, or understanding of, shellfish biology and ecology. Principal investigators and program directors are generally well-informed but since shellfish restoration is labor intensive, and since many programs are community efforts, volunteers are often recruited to carry out the programs. Once people get involved in a program, they tend to form an emotional attachment to the environment around them and they begin to understand it. Whether filling bags with shells to build reefs or growing shellfish in individual cages for programs such as shellfish gardening, the result is groups of people with an appreciation of the value of estuaries and the services shellfish provide for all of us. While the benefit of an educated population seems obvious, the true value is really

incalculable, but for resource managers and restoration specialists alike, one of the primary benefits of educational programs is to “spread the word” about shellfish and its role in normalizing conditions of estuaries.

Many community-based programs began with water quality monitoring. Agencies and communities discovered that individuals, properly trained in appropriate techniques, could produce data conducted with quality assurance, saving a tremendous amount of scarce resources. They also found that the volunteers were most often reliable, enjoyed taking the samples and that the monitors felt committed and useful, an aspect difficult to quantify. Once state resource managers gained trust in volunteer water quality monitoring as an augment to their own sampling protocols or as a means to discover causes of water quality degradation, resource managers began to ask for assistance with other projects.

Habitat restoration such as reef-building became a program that beginning modestly, often morphed into larger projects. The statistics for the SC SCORE program (see p.38) are impressive in the number of people involved, the amount of reefs built, and the restorative components of the program, tracked over a decade or more.

Reef building and shellfish gardening are only two examples of activities that utilize volunteers. There are many more. A water quality program that has become a model for communities is the Puget Sound Restoration Fund. Spearheaded by Betsy Peabody, it is a multi-community effort aimed at land-based initiatives to clean up waters or protect waters that are approved for shellfish harvest. A combination program of water quality mitigation and shellfish growing is the Lynnhaven River in VA.

All these examples have several things in common:

- A lead agency or entity to shepherd the project through the funding mechanisms and administer the program;
- An educational institution nearby where Sea Grant Extension, USDA Extension or state DNR offices are involved in the project;

- A dynamic individual or group of individuals who can “marshall the troops” by providing technical expertise and encouragement;
- A clearly identified need and goal articulated to volunteers who develop an “ownership” in the work they do.

Readily apparent through these examples is the diversity of approach and execution of the programs. One of the most impressive programs is the multifaceted SCORE Program mentioned earlier in this report. The South Carolina Department of Natural Resources (SCDNR) is responsible for managing the state's oyster resources. They feel that appropriate management includes the planting of material to provide substrate, known as cultch, for recruitment of juvenile oysters. Unfortunately, there is a nationwide shortage of oyster shell to be used as cultch. That which is available is often not readily accessible because it is spread out in many locations. SCDNR has initiated an effort to encourage the public to recycle oyster shell for use in resource management. Recycling centers have been established along the coast. Consumers are encouraged to deposit clean shell at the recycling centers, which are periodically emptied by SCDNR. The shell generated in this fashion is used for restoration and enhancement of shellfish resources, reducing the costs of these activities. There are two major components to the SCORE program: oyster shell recycling and community-based restoration. By working together, community members and biologists can restore oyster populations while 1) enhancing habitat for fish, shrimp, and crabs, 2) improving water quality of estuarine areas, and 3) informing and educating children, industry, and the general public.

There is also a large community-based restoration element in which more than 8000 volunteers have used more than 500 tons of shell to build 188 reefs at 35 reef sites along the South Carolina coast. <http://score.dnr.sc.gov/deep.php?subject=1>



Case Study: The South Carolina Department of Natural Resources established the South Carolina Oyster Restoration and Enhancement program (SCORE) ten years ago, in late 2000, with the goal of enlisting volunteers to recycle oyster shell and construct oyster reefs. By using volunteers to build the reefs, the SCORE program educates the public on the ecological benefits provided by oysters while also restoring valuable habitat. To date, the SCORE program, working with over 80 community partners, has enlisted over 13,000 volunteers who have contributed 36,000 hours to the project. These volunteers, ranging in age from 8 to 80, have participated in shell recycling, shell bagging, reef building, reef assessments, and water quality monitoring. Over the past 10 years, these volunteers worked to fill over 35,000 mesh bags with 500 tons of recycled oyster shells. Those bags have been deployed to build more than an acre of oyster habitat at 40 sites spanning 200 miles of coastline. Due in part to the stability afforded by the mesh bag and in part to careful site selection, SCORE reefs have a remarkable success rate, with at least 80% of SCORE reefs comparing favorably to natural oyster reefs after only 2-4 years. SCORE reefs have also been demonstrated to stabilize shorelines and foster marsh grass expansion.

Because of the continued support of volunteers and overall success of the program, in 2010, SCORE was able to celebrate its 10th anniversary by undertaking its largest project to date. In just one summer, 174 volunteers contributed 520 hours to deploy 4,310 shell bags at one site on Daniel Island, SC, and have created the largest uninterrupted SCORE reef which covers 6,200 ft² (0.15 acres) of shoreline.

Ensure the security of the restoration site

One of the biggest obstacles for shellfish restoration in unapproved areas is the issue of security. While the ecological services provided by shellfish can certainly help alleviate or lessen nutrient loading to estuaries and possibly reduce bacterial loads as well, a land-use strategy is imperative to truly clean up an estuary. Effort may be better placed in upgrading less severe classifications rather than working in prohibited areas. Virtually all resource managers mentioned lack of funds and personnel resources to adequately address additional shellfish projects. Surveillance takes funds and while technological advances have made remote surveillance a possibility, surveillance also requires “boots on the ground” and “boats in the water”, both of which require ample funds.

Restoration specialists are not enforcement personnel and are generally not trained at all in enforcement. However, if enforcement is necessary to carry out a restoration program, the cost should be paid for by the project proponents or at least shared with them. They should also be required to report any problem they see while out on the water to the proper authorities.

If shellfish gardening takes place in unapproved areas, the project organizers/directors should submit their education protocols to reduce anxiety among resource managers that people growing the shellfish are not consuming them and no one else is either.

Whereas enforcement professionals keep their techniques as closely guarded secrets for obvious reasons, we do not have a case study for ensuring the security of the restoration site.

Encourage volunteer monitoring

Volunteers can provide many eyes on the restoration sites. The successful application of volunteer services to collect and analyze water quality samples is one example of an activity, originally met with skepticism, that has been successful in numerous locations around the country. Agency professionals were skeptical that volunteers could be properly trained to carry out strict protocols on a consistent basis. What surfaced was not only a willingness on the part of volunteers to learn and participate but an enthusiasm to give something back to their community. They saw their actions as one small step in a larger effort to protect water bodies from degradation or to clean up existing problems. Some projects are relatively recent while others have been continuing for several decades, amassing incredible data sets.

While water quality has received the most attention, it is not the only area where volunteers have gotten more involved. Projects have sprung up where people monitor their surroundings for trends – making observations about local conditions such as when certain animals – marine, avian, terrestrial – arrive or leave; tracking weather events; measuring salinity, temperature, tidal heights, and importantly now, pH and other physical parameters. They can identify potential bootleggers and are protective of their sites. Each time someone gets involved, he/she tells someone else and the community education of the population increases, reducing the opportunity for illegal harvest.

Encouraging this type of individual involvement is vitally important for restoration.

Case Study: The Clean Water program of the [University of Maine Cooperative Extension](#) was established in 1988, and provides organizational and technical support to water quality monitoring groups from Kittery to Calais (approximately 1,000 volunteers). The Clean Water program works in partnership with the Maine State Planning Office Partners in Monitoring Program and the

Maine Department of Marine Resources. Water Quality groups study the health of estuarine water by monitoring for dissolved oxygen, temperature, pH, salinity, and fecal coliform bacteria. As a result of successful monitoring efforts in Maine, thousands of acres of clam flats have been opened. High school students have been inspired to go on to study environmental science in universities and to become involved in community conservation efforts. Various watersheds have begun working together, and hundreds of citizens have become active in environmental education and conservation efforts. These efforts, have been integrated into the activities of their local schools.

The Clean Water program builds on the strengths of communities by providing water quality and marine resources and by assisting with environmental issues. Citizens involved in the program are able to make their communities stronger by working collaboratively on marine environment projects. Volunteers increase their knowledge and continue to be stewards of their coastal waters. <http://extension.umaine.edu/programs/natural-resources/marine/maine-shore-stewards/volunteer-opportunities/clean-water/>

Noncommercial species in restoration efforts and transplant

The filtering ability of shellfish is well documented with oysters filtering up to 50 gallons per day. Other species are not as efficient but they still provide a valuable function. If a restoration project is slated to take place in prohibited waters and there is no other acceptable alternative, using noncommercial species may be viable. Presently experiments with *Geukensia demissa*, ribbed mussel, are planned for the Bronx River in NY, a highly compromised area.

There are already serious concerns regarding commercial species in prohibited waters because of the enforcement issues. Enforcement agencies are concerned about their ability to ensure that none of those shellfish reach consumers. One suggestion was to use seed shellfish for their filtering capacity and transplant them to clean waters when they were still sub-legal. The question arises as to when to transplant the shellfish from a restoration project. Some states carry out relay programs under strict state supervision. The shellfish are not harvested until the state gives the clearance and permits to do so. Each step of the process requires surveillance and is therefore an expensive program but the states that use the method suggest that allowing the

shellfish to remain in the approved waters over a spawning period, increases the chances of natural propagation in the transplanted area and is, therefore, a method of restoration.

Some suggested that using alternative species was counterproductive because there would most likely be little public support for a program that used shellfish for ecological services without the benefit of utilizing the shellfish in the foreseeable future. However, shellfish, commercial or noncommercial planted in a prohibited area can not be utilized for human consumption purposes. The only benefit of noncommercial species is the fact that they could be used for their ecological clean up services but would not be consumed. As a relatively new concept, the issue was not resolved.

Case Study: Magothy River Association and the Dark False Mussel: The Magothy River is a tributary of the Chesapeake Bay. For more than fifteen years volunteers from the Magothy River Association, with the help of Team Divers, monitored the ecosystem parameters while they restored oyster populations to historic reefs. In 2004 an explosion of dark false mussels (DFM) or Conrad's mussel followed hurricane Isabel (2003). Team Divers developed a protocol for sampling the mussels and results showed sufficient biomass existed in Cattail Creek to clean the water in 46 hours. In the Magothy River this explosion dropped off to almost nothing at the junction of the creeks with the main portion of the river. Millions of these mussels covered pier pilings and boat bottoms. Since 2005 these mussels have almost disappeared. The mussel is similar in size and looks much like the zebra mussel.

The actual cause for demise of the DFM population is not clear. DFM reportedly survive in salinities 1.4-12 parts per thousand. Occasional minor reoccurrence in creeks tends to indicate significant recruitment has not occurred because salinity levels have recovered or dissolved oxygen is too low and conditions may not be conducive to a spawn. Commercial methods used for spawning and raising blue mussels for consumption are being investigated for collection and to transfer these mussels. This method consists of using fuzzy rope and socks including suitable devices to suspend the mussels. In 2011 there has been a re-emergence of the dark false mussel and this, in combination with enhancement activities may lead to cleaner creeks and an improved Magothy River system.

Concluding Remarks

Comments from the project team:

First, we would like to thank all the participants in this project. Without their willingness to discuss difficult issues and provide candid comments, the project could not have been accomplished. We think that the compilation of ideas and strategies used for shellfish restoration will help resolve differences of opinion of how best to practice shellfish restoration while protecting public health.

Second, some of the suggestions can serve as a starting place for further dialogue. We provided two models of public education (SPAT program and VA Oyster Gardening Program). Participants suggested that Sea Grant and/or Cooperative Extension should develop an education program that can be adapted for specific regional circumstances but still provide the core concepts necessary to understand the restoration environment. We think this is an idea that should be explored.

Third, while there are still expressed differences between managers and restoration practitioners regarding the use of prohibited areas for shellfish restoration and the role of volunteers, the fact that the discussion occurred is a major breakthrough in communication. We believe it is essential that the dialogue continue.

References

- Beal, B. 2006. Biotic and abiotic factors influencing growth and survival of wild and cultured individuals of the softshell clam (*Mya arenaria* L.) In eastern Maine. *Journal of Shellfish Research* 25(2):461-474
- Beck, M.W., R. D. Brumbaugh, L. Airoidi, A. Carranza, L. D. Coen, C. Crawford, O. Defeo, G. J. Edgar, B. Hancock, M. Kay, H. Lenihan, M. W. Luckenbach, C.L. Toropova, G. Zhang, 2011. Oyster reefs at risk and recommendations for conservation, restoration and management 2011. *BioScience* 61: 107-116
- <http://conserveonline.org/library/shellfish-reefs-at-risk-report/@@view.html>
- Coen, L.D., R.D. Brumbaugh, D. Bushek, R. Grizzle, M.W. Lukenbach, M. H. Posey, S.P. Powers and G.S. Toffey, 2007. As We See It: Ecosystem Services Related to Oyster Restoration. *Marine Ecological Progress Series*, 341:303-307.
- Flimlin, G., S. Macfarlane, E. Rhodes, and K. Rhodes, 2010. Best Management Practices for the east coast shellfish aquaculture industry. East Coast Shellfish Growers Association, 77 pp.
- http://www.ecsga.org/Pages/Resources/ECSGA_BMP_Manual.pdf
- Goldberg, R., J. Pereira and P. Clark, 2000. Strategies for enhancement of natural bay scallop, *Argopecten irradians* irradians, populations; A case study in the Niantic River estuary, Connecticut, USA, *Aquaculture International*, 8(2-3):139-158
- Gulf of Maine Aquarium, 2001. Coastal Fishery Research Priorities: Soft-shell clams, Maine Department of Marine Resources.
- http://www.maine.gov/dmr/research/soft_shell_clams.htm
- Kraeuter, J.N., J.M. Klinck, E.N. Powell, E.E. Hoffman, S.C. Buckner, R.E. Grizzle, and V.M. Bricelj, 2008. Effects of the fishery on the northern quahog (=hard clam *Mercenaria mercenaria*) population in Great South Bay, NY: a modeling study. *Journal of Shellfish Research* 27(4) 653-666.
- Kraeuter, J.M., E. N. Powell and S.E. Buckner 2005. A note on spawner-recruit relationship for a heavily exploited bivalve: the case of the northern quahogs (hard clam) *Mercenaria mercenaria* in Great South Bay, NY. *Journal of Shellfish Research* 24:1043-1052.
- Leavitt, D.F. and R. C. Karney, 2005. Cultivation of the bay scallops. Pp. 25-109 in A.M. Kelly and J. Silverstein (eds.) *Aquaculture in the 21st Century*, American Fisheries Symposium 46. Baltimore, MD.
- Macfarlane, S., 1998. The evolution of a municipal quahog (hard clam), *Mercenaria mercenaria* management program, a 20-year history:1975-1995. *Journal of Shellfish Research* 17(4):1015-1036.
- Macfarlane, S., 2001 (unpublished), Review of Codes of Practice and Best Management Practices for the Aquaculture and Related Industries: A Report Prepared for the Maine Aquaculture Innovation Center. 51 pp.
- Maine/New Hampshire Sea Grant College Program, The Clam Handbook, 1998, 77 pp.
- Newell, C.R., and H. Hidu. 1986. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (North Atlantic)-soft shell clam. U.S. Fish Wild. Serv. Biol. Rep. 82(11.53). U.S. Army Corps of Engineers, TR EL-82-4. 17 pp.
- Newell, R.I.E., T.J. Hilbish, R.K. Koehn, and C.J. Newell, 1982. Temporal variation in the reproductive cycle of *Mytilus edulis* L. from localities on the east coast of the U.S. *Biol. Bull.*, 102:299-310.
- Pearce, J.B., 1966. The biology of the mussel crab *Fabia subquadrata* from the waters of the San Juan Archipelago, WA. *Pac. Sci.*, 20: 3-35.
- Pearce, J.B., 1964. On reproduction in *Pinnotheres maculatus*. *Biol. Bull.*, 127:384.
- Tettlback, S. and C. Smith, 2007. Bay scallop restoration in NY. *Ecol. Restor.* 27(1) 20-22.

The Nature Conservancy, [A Practitioners Guide to the Design and Monitoring of Shellfish Restoration Projects](http://www.nmfs.noaa.gov/habitat/restoration/publications/TNCNOAAshellfish_hotlinks_final.pdf)
(http://www.nmfs.noaa.gov/habitat/restoration/publications/TNCNOAAshellfish_hotlinks_final.pdf)

Tucker, C.S. and J.A. Hargreaves (eds.) 2008. Environmental best management practices for aquaculture. Blackwell Publ. Ames Iowa 50014, 592 pp.

Virginia Oyster Gardening Manual: <http://www.coonamesettfarm.com/sitebuildercontent/sitebuilderfiles/vaoystergarden.pdf>

Best Management Practices for Shellfish Restoration

Appendices

- A. Report from the ISSC Shellfish Restoration Committee
- B. NESSA Workshop Handout
- C. NESSA Workshop Presentation
- D. Workshop reports
 - 1. PacRim
 - 2. GSASSC
 - 3. PCSGA/NSA
 - 4. ICSR
 - 5. Milford Aquaculture Seminar
 - 6. NESSA
- E. Definitions
- F. Regulatory Aspects of Shellfish Restoration
- G. Report from the 2011 ISSC Shellfish Restoration Committee Meeting (to be added following 10/2/2011 meeting)

**ISSC 2009 Biennial Meeting
October 17-23, 2009 – Manchester, New Hampshire
Committee Report**

Committee Name :	Shellfish Restoration Committee																																			
Chairperson:	Dot Leonard																																			
Date of Meeting:																																				
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Charge 1:	Review restoration information that could impact shellfish sanitation and the NSSP.
Findings:	<p>The committee heard from <u>Boze Hancock</u>, The Nature Conservancy Global Team of TNC, that globally 85 percent of shellfish reefs have been lost, the most severely impacted marine habitat on the planet. TNC encourages ISSC to address, and possibly encourage shellfish restoration in unapproved waters.</p> <p>Restoration experts presented examples:</p> <p><u>Tom Shields</u>: MA Fisheries, Restoration of softshell clam in Boston Harbor (conditionally restricted waters);</p> <p><u>Bill Taylor</u>: Puget Sound Restoration Fund and Taylor Shellfish, spoke of the industry's commitment to restore the native oyster and their efforts to promote clean water in Puget Sound;</p> <p><u>Ray Grizzle</u>: University of New Hampshire, Addressed the successful oyster restoration and recruitment in Great Bay in both approved and prohibited waters;</p> <p><u>Bob Woolrich</u>, Washington Dept. of Health, outlined the amazing reversal in 30 years from large declines in water quality to numerous upgrades and the legislation such as Shellfish Protection Districts which has forced counties to clean up pollution sources that contribute to declines and close shellfish growing waters;</p> <p><u>Ben Stagg</u>, Virginia Marine Resources Commission, described shellfish restoration in polluted Elizabeth River and the upgrades that have occurred concurrent with shellfish restoration in Lynnhaven Bay.</p>
Conclusions:	Each state approaches shellfish restoration differently, some using closed waters for oyster conservationists/gardeners and restoration activities and others, restricting these activities to approved waters based on concerns about potential bootlegging and illnesses.

Appendix B. Best Management Practices for Shellfish Restoration Handout

What is shellfish restoration?

Definition depends on the objective

State –sponsored habitat reclamation

Shell/reef building; “hardening” the bottom; shell collection sites; creating bags of cultch, planting reefs

Seed/spawning stock plantings to increase shellfish populations for commercial/recreational harvest

Community mitigation projects; Oyster gardens; Public/private/NGO (such as TNC) partnerships;

Land-based mitigation...not to be forgotten! Stormwater and agricultural runoff controls; wastewater mitigation

Ecological Services Provided by Shellfish and Programs to Enhance Estuarine Health

Increasing shellfish stock through seeding/planting programs

Nutrient reduction/change through shellfish as bioremediation of eutrophication

Shellfish habitat improvement/restoration through reef building, erosion/sedimentation control, predator control, bottom preparation

Land use programs: wastewater management, watershed zoning, watershed planning and implementation or program resulting in shellfish resources protection or enhancement.

Any program designed to upgrade classified areas to approved or to increase amount of approved acreage.

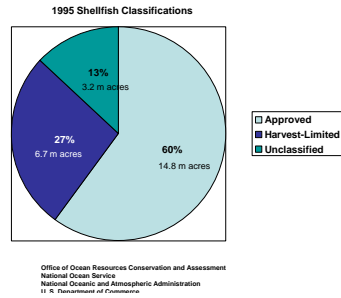
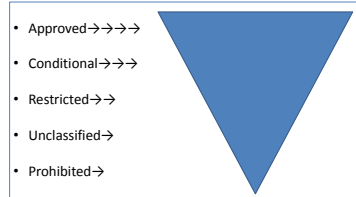
Why Restoration

Substantial decline all shellfish species in all ecoregions of the earth

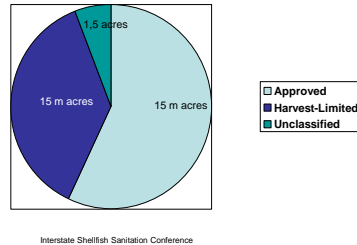
Habitat degradation (globally 85% of oyster reefs are lost)*

Continued development pressures on land leading to degraded water quality

Restoration Support



2005 Shellfish Classifications



Shellfish production and public health protection:

Potential conflict may exist between shellfish restoration programs and shellfish sanitation programs when restoration takes place in compromised growing waters. This may be evident when shellfish is used as bio-remediation for environmental degradation:

Why the conflict? How to resolve the conflict?

Is shellfish restoration allowed in unapproved growing areas if participants go through an education/ training program?

Can people involved in restoration programs harvest shellfish for personal consumption?

What are BMP's?

Set of guiding principles; Specific actions for specific issues

Implemented strategies to preserve environment

Usually voluntary, possible "peer pressure", sometimes regulatory

No verification

Public education of programs for shellfish restoration participants:

What should an education program look like? By Whom?

Will an education program resolve conflict between shellfish restoration and shellfish sanitation/public health issues?

Appendix C. BMPs PowerPoint Presentation

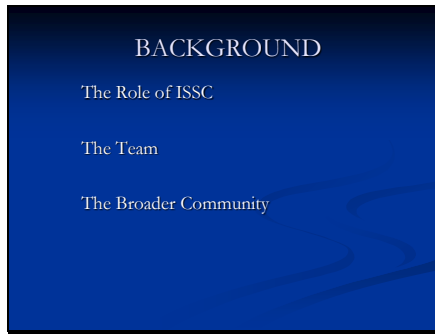
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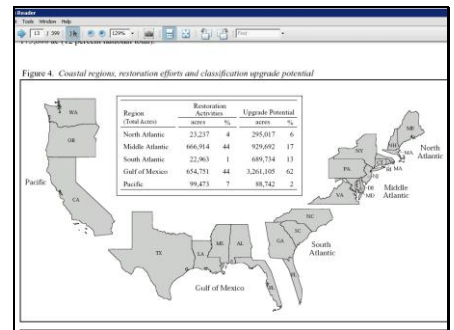
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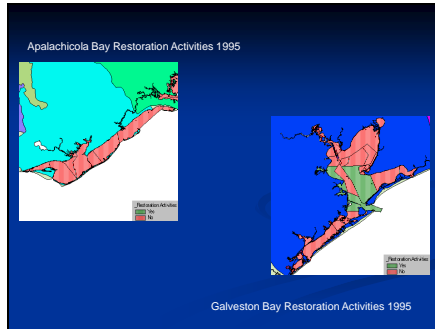
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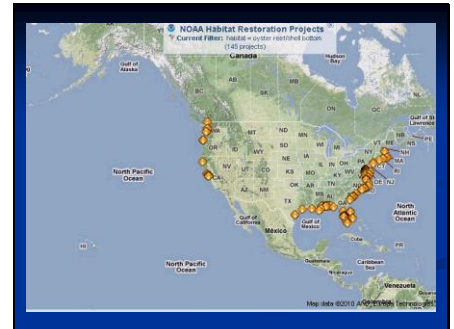
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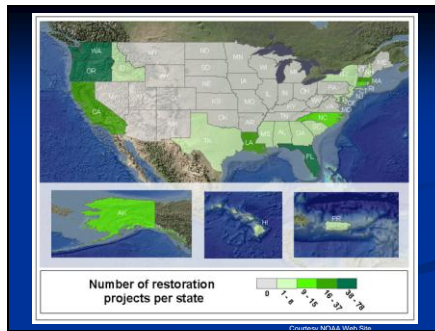
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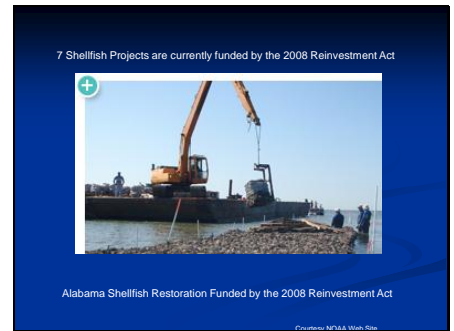
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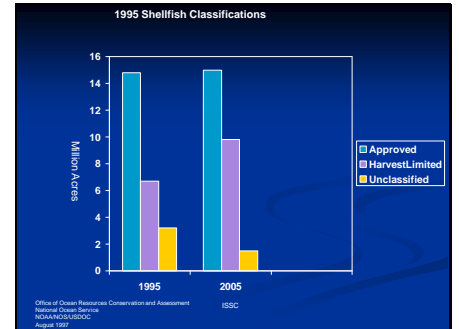
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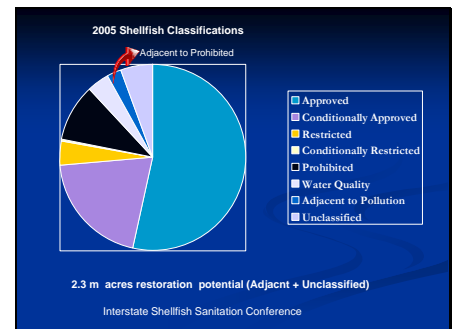
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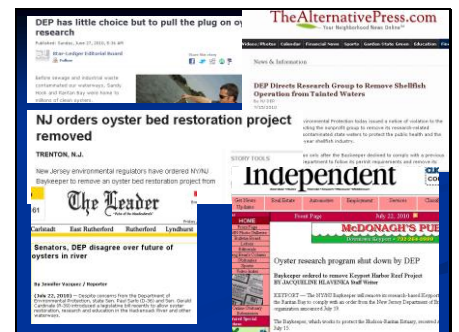
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Slide 18



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TWO SIDES OF THE COIN

- Restoration Benefits
 - Provides ecosystem services
 - Recycling of nutrients
 - Erosion/sedimentation control by reefs
 - Habitat for estuarine species
 - Increased biodiversity
 - Provides opportunities for community action programs
 - Water quality improvements
 - Provides educational programs
 - Expands potential for food production and jobs



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BMP'S

- Set of guiding principles
- Specific actions to address specific issues
- Strategies to preserve environment
- Voluntary, possible "peer pressure" or
- Sometimes regulatory
- No verification

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TWO SIDES OF THE COIN

- Regulatory Issues
 - Some restoration activities take place in unclassified and unapproved areas
 - Potential for harvest of illegal stock/bootlegging
 - Requires increased resources for enforcement
 - Requires surveillance of all planted shellfish
 - To ensure that only commercially approved shellfish reaches market
 - To ensure that shellfish grown in unapproved areas is not directly consumed

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BMP's

- Create bridges and develop constructive dialog
- Identify issues and regional differences
- Identify underlying factors creating the issues
- Identify commonalities, differences and areas of agreement
- Describe potential solutions


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WHY BMPs FOR RESTORATION?

- Currently no guidelines in place
- Diversity of stakeholders
- Different agendas
- States differ in restoration requirements
- In some restoration efforts an educational component is missing
- Potential conflict with NSSP
- Lack of productive communication among participants and regulators

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IS EDUCATION THE ANSWER



Slide 25

EDUCATION PROGRAMS

- What are the educational needs of restoration specialists and oyster gardeners?
 - Should be familiar with relevant regulations/NSSP to understand shellfish sanitation requirements
 - Must know who is responsible and how shellfish water quality is monitored and classified
 - Shellfish biology
 - Shellfish pests/diseases
 - Human diseases



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BMP Process

- **Objective:** Develop guidelines for those who conduct restoration and repletion programs to: mitigate degraded water quality or mitigate diminishing populations of shellfish and habitat loss while protecting public health.
- **WORKSHOP GOALS**
 - Identify issues that could present obstacles to shellfish restoration
 - Open dialogue and suggest solutions that reflect different points of view
 - Have fun while dealing with restoration issues

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Workshops/Presentations

Meeting	Site	Date	Invited
PacRim	Skamania, WA	4/5-8/10	✓
GSASSC	Orange Beach, AL	8/15-19/10	✓
ISS	Ocean City, MD	9/14-16/10	
PCSGA/NSA	Tacoma, WA	9/19-23/10	✓
ICSR	Charleston, SC	11/17-20/10	✓
NESSA	?NH		
ISSC	?	10/2011	✓

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EDUCATION PROGRAMS

- What will they look like?
- Who will provide the education?
- Where do Sea Grant and Cooperative Extension fit into the picture?
- Will education programs satisfy regulators?

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Some of What We Have Heard

- Programs conducted both in approved and unapproved waters
- Opening closed areas is priority; land-based programs with community outreach primary focus
- Shellfish restoration is allowed in unclassified areas in WA; 30% of that is for commercial harvesting and 10% recreational
- Farmers must lease from state-approved waters; restoration is not allowed in unclassified waters
- All unclassified waters prohibited; no private ownership except WA
- Public education for restoration organizations by retired fish and wildlife staff

Slide 33

Supported by





Contact:
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Sandy Macfarlane at 508-255-5618 sandymac@capecod.net

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Restoration Volunteers in Barnegat Bay, NJ



Setting up Upwellers



Counting Clams after Removing from Screens

Courtesy of Barnegat Bay Shellfish Restoration Program

Appendix D1. 2010 Pac Rim Shellfish Sanitation Meeting

Workshop Description

PacRim was the first workshop in this project, held April 6, 2010, in Stevenson, WA, with more public health managers than restoration practitioners - nearly 50 attendees participating - the process of breaking up into small working groups worked well. People who are not used to expressing their own opinions were given the opportunity to do so in small groups. However, it became clear that restoration on the west coast was vastly different from that practiced on the east coast, based on personal knowledge of the authors. There were three reasons for this: first, except for Washington, there are relatively few embayments and neither shellfish harvesting nor shellfish restoration are high priority activities. In Washington, individuals own tidelands. Second, restoration efforts in that state are geared more toward land use mitigation measures than putting more shellfish in the water to increase shellfish habitat. In this regard, community action programs are high visibility programs. However, opening closed areas in Washington is a priority.

Third, the commercial aquaculture industry is large, especially in Washington and increasing shellfish stock through restoration programs is not a high priority given the substantial amount of shellfish already actively cultured. The Washington Department of Fisheries and Wildlife routinely seeds certain public beaches for enhancement but the practice is not widespread throughout the state.

Very few coastal waters are actually classified. Best estimates are: Washington – 30%; Oregon – 10-20%; California– unknown; Alaska– 3%; Hawaii – none because there is no commercial shellfish harvesting and no private ownership.

Public education for restoration projects is a high priority in Washington with many groups involved in the process. When restoration programs are initiated using shellfish or habitat restoration, groups may include Sea Grant, industry, tribes and NGOs, county health programs, university extension, and tideland owners. In Oregon, retired Fish and Wildlife staff often conduct public education programs. The other states reported no educational programs.

Original Notes

As expected, responses depended on experience and expertise of individuals at the table

Most of the programs center in WA

Responses to handout:

Shellfish restoration – shellfish as bioindicator

WA – most programs for water quality improvement vs. habitat and increasing resource; some programs using shellfish for restoration – mussels and oysters;

EPA has funded a program to use shellfish to remove nutrients - structured by volunteers and tideland owners; part of state pollution abatement through Sea Grant; administered by Public Health and tribes

Programs conducted both in approved and unapproved waters

Opening closed areas is priority; land-based programs with community outreach primary focus

Monitoring depends on the program and the location. Some are monitored by tideland owners or leaseholders; others by a public health agency; others by community action groups such as Puget Sound Partnership; Health and Resource Management does some monitoring; in some cases, project implementers monitor for growth in shellfish projects.

There are no transplant programs or depuration prior to consumption; when upgrade is part of restoration and area reclassified, consumption is allowed

Poaching on both recreational and commercial grounds possible with additional programs but does not seem to be much of a problem; enforcement is performed by WDFW when common property but also when tideland owner is involved; however, increased abundance leads to increased risk which leads to increased need for patrols; suggestion not to make it too easy for potential poachers

OR – few programs – some proposed but none initiated

CA – shellfish are sometimes used for fish habitat;

Monitoring done by NOAA and CA Fish and Game in association with interest groups and students

HI – no programs

Shellfish Production and Public Health

WA – entire state is not classified; best estimate is 30% classified but shellfish restoration is allowed in unclassified areas; 30% of that is for commercial harvesting and 10% recreational; all waters unclassified are prohibited

Consumption of shellfish in unclassified areas received conflicting responses – some participants said that it was not allowed while others said it was allowed but part of the dichotomy is that individuals own tidelands and are allowed to consume what is on their own property regardless of classification

Training is provided in some instances but not required

OR – small percentage classified – 10-20%; entire coast and bays are for recreation but approximately 20% also open for commercial harvesting; all unclassified waters are prohibited; no private ownership

Farmers must lease from state-approved waters; restoration is not allowed in unclassified waters

CA – all unclassified waters prohibited; no private ownership

AK – with 30,000 miles of shoreline, only 3% estimated classified

HI – none of the state is classified – no commercial shellfish harvesting; no private ownership

Public education of restoration participants

WA – many groups are involved in public education – local people, government, tribes, growers, public health departments, private groups, non-profits, school systems, counties, restoration groups; shellfish gardeners are stewards of Puget Sound

Governor has initiative to clean up Puget Sound by 2020 and restoration is performance measure

Shellfish programs use both water column and bottom planting

Training programs run by Sea Grant, industry, tribes and NGO's, county health programs, university extension; train tideland landowners; public health is discussed any time volunteers/public involved

OR – public education for restoration organizations by retired fish and wildlife staff

CA – Nothing reported

HI – Nothing reported

AK – Nothing reported

Appendix D2. Gulf and South Atlantic Shellfish Sanitation Conference

Workshop Description

The Gulf and Southeast Atlantic states met in Orange Beach, Alabama with an attendance of almost 50, mostly managers. Each state differed in their approach to restoration. For example, in Alabama there is an active restoration program that includes oyster gardening but all seed oysters are relayed to approved waters. However the state officials were very concerned about patrol needs and the potential of poaching. Both Mississippi and Louisiana have large reef-building programs. In Louisiana these reefs are prized for their ability to attract recreational fish. In both states the industry would oppose any restoration activities in unapproved waters. Texas feels that the key is to expand areas is to increase production but only where waters are approved

The east coast states had varied approaches. Georgia has no restoration in unapproved waters and the volunteers maintain an active shell recycling program. There are government- initiated collaborative projects including environmental and academic organizations. The college organizations reach out to public with education programs. South Carolina has similar programs with an extremely successful shell recycling program located at numerous boat landings.

The attendees identified a list of problems faced in restoration efforts including Interagency /regulatory conflict, some as a result of the Endangered Species Act. The limitation of resources creates patrol problems and it takes time and resources to reclassify areas to an approved status resulting in significant costs for testing and labor. They felt that if approved areas are restored they can then be harvested but that NOAA restoration projects seem to prefer funding projects with restricted harvest. If they ask permission of the public health agency, that creates a liability. Restoration in unapproved areas was referred to as an attractive nuisance and there are major public health concerns regarding any oyster culture near shore. There is a need to generate positive interactions with health programs

The group suggested that restoration practitioners should clearly define goals and objectives for their program - oyster restoration, habitat restoration, resource enhancement or for human consumption. They suggested better communication between state health programs and project proponents, universities, and state fisheries agencies so that the requirements of NSSP are clearly understood. They believed that oyster gardening needs education and enforcement.

On the positive side they spoke extensively about the educational benefits of community restoration citing master oyster gardening, annual workshops, tours, monthly newsletters and websites. Mentioned were the Nature Conservancy, Sea Lab, in North Carolina, Mobile Bay National Estuary Program, - all doing restoration education through talks, newsletters, kiosks. High schools are starting restoration education and programs. The group suggested a high school teacher training program so that teachers can bring students to Dauphin Island and other active sites. The University of South Alabama publishes a "Restoration Brief" – newsletter for general public. Both the departments and cooperative extension staffs have educational programs

Original Notes

The Gulf and Southeast Atlantic states met in Biloxi, Mississippi with an attendance of almost 50. Each state differed in their approach to restoration. For example, in Alabama there is an active restoration program that includes oyster gardening but all seed oysters are relayed to approved waters. However they were very concerned about patrol needs and the potential of poaching. Both Mississippi and Louisiana have large reef-building programs. In Louisiana these reefs are prized for their ability to attract recreational fish. In both states the industry would oppose any restoration activities in unapproved waters. Texas feels that the key is to expand areas is to increase production but only where waters are approved

The east coast states had varied approaches. Georgia has no restoration in unapproved waters and the volunteers maintain an active shell recycling program. There are government- initiated collaborative projects including environmental and academic organizations. The college organizations reach out to public with education programs. South Carolina has similar programs with an extremely successful shell recycling program located at numerous boat landings.

The attendees identified a list of problems faced in restoration efforts including Interagency /regulatory conflict, some as a result of the Endangered Species Act. The limitation of resources creates patrol problems and it takes time and resources to reclassify areas to an approved status resulting in significant costs for testing and labor. They felt that if approved areas are restored they can then be harvested but that NOAA restoration projects seem to prefer funding projects with restricted harvest. If they ask permission of public health, that creates a liability. Restoration in unapproved areas was referred to as an attractive nuisance and that there are major public health concerns regarding any oyster culture near shore. There is a need to generate positive interactions with health programs

Recommendations included clearly define goals and objectives for oyster restoration: habitat restoration, resource enhancement or for human consumption. They suggested better communication between state health programs and project proponents, universities, and state fisheries agencies so that the requirements of NSSP are clearly understood. Oyster gardening – needs education and enforcement. On the positive side they spoke extensively about the educational benefits of community restoration citing master oyster gardening, annual workshops, tours, monthly newsletters and websites. Mentioned were the Nature Conservancy, Sea Lab, in North Carolina, Mobile Bay National Estuary Program, - all doing restoration education through talks, newsletters, kiosks. High schools are starting

restoration education and programs. The group suggested a high school teacher training program so that teachers can bring students to Dauphin Island and other active sites. The University of South Alabama publishes a “Restoration Brief” – newsletter for general public. Both the departments and cooperative extension staffs have educational programs

Appendix D3. Workshop held in conjunction with Pacific Coast Shellfish Growers Association and Pacific Chapter of NSA

Workshop Description

At the beginning of the workshop on September 23, 2010 in Tacoma, Washington the 50 attendees centered on an incident in New Jersey that had occurred a few weeks prior to the meeting. New Jersey had halted the oyster restoration program being conducted by the NJ/NY Baykeeper in Raritan Bay, in prohibited waters. Although the on-going program had been officially permitted by the state, the program was halted abruptly and the oysters ordered to be destroyed. The news of this action prompted a lively discussion about the purpose of shellfish restoration in general.

Even though Washington restoration centered on land-use mitigation efforts, proponents there pointed out that advance planning and communication were key to success. In many cases, success stories could be documented where areas were upgraded in classification as a result of the restoration programs but that it was a collaborative effort from the beginning of the projects. Keeping volunteers motivated was seen as a challenging aspect of long-term projects but there is usually a small group of committed people who stay with a program long-term.

Enforcement was seen as an issue. One industry representative suggested that biosecurity be included in a project proposal and that it should be part of the funding package. He suggested hiring security personnel – local sheriff's office personnel or private security. He also strongly suggested that a risk assessment be made for any project to clarify how serious a problem associated with a shellfish restoration project could be. Further, he suggested that stock reaching the marketplace from unapproved waters could hurt the entire industry. Schools could be an integral part of the monitoring, providing an educational component and people necessary to actually carry out increased sampling programs. Accuracy could be checked with having dual sampling with certified techniques.

Regulators agreed with industry on that point. They suggested that volunteers could take water samples that could augment "official" samples but could not take the place of certified results in accordance with NSSP protocols. Volunteers could be invaluable to find sources of contamination especially with the lack of funding for agencies to hire personnel. In Washington, if an area is downgraded in classification, a shellfish protection district is established to find the cause and correct it so that the area can be upgraded again.

Some folks suggested it was easier for surveillance in urban areas where there were more "eyes on the water" than rural areas that are more remote. Others felt that subsistence harvest would take place more readily in urban areas because of cultural activities. There was no consensus.

The private property situation of Washington means that people can harvest shellfish on their own property regardless of classification and while this has not seemed to cause a problem thus far of shellfish-related diseases, it is cause for concern. The state sponsors education programs and Shellfish in Your Front Yard workshops to alert people to the potential dangers of shellfish from unapproved areas and about the system of classification to generate awareness among property owners. Everyone

agreed that bad press was an issue and that high-value product bootlegging was an issue everywhere and vigilance was required to ensure product from unapproved areas did not reach consumers.

Original Notes

The BMP workshop was scheduled as the last event of the conference. Approximately 50 people participated. Dot Leonard and Sandy Macfarlane presented a Power Point presentation outlining issues that have been identified with shellfish restoration and shellfish sanitation programs. The presentation included questions aimed at generating a dialog. Following the presentation, the floor was opened to questions and comments facilitated by both Dot and Sandy. With each workshop there have been additional perspectives of regional and national significance and the Pacific Coast workshop contributed greatly to the total project.

A few weeks prior to the PCSGA meeting, NJ halted the Baykeeper Program in Raritan Bay, ordering the removal of all oysters that had been placed in the bay as part of the program. NJ regulators cited that surveillance was the primary issue and that funding for surveillance was lacking. NJ had already been cited by FDA as being out of compliance with NSSP standards. The news of this action has circulated widely among the shellfish community and led to a discussion about the purpose of shellfish restoration, the use of non-approved areas for projects, and the course of action states could take that would be acceptable to the restoration community as well as regulators whose concern is protecting public health. The NJ example brought into focus the need for BMPs for shellfish restoration projects.

Participants began by explaining the need for long-term planning before a restoration project begins, saying that the planning process should include restoration advocates and regulatory personnel. They added that developing a roadmap facilitates the project and allows issues to surface ahead of time, fostering relationships among growers, landowners and regulators. One participant explained the progress made in Puget Sound with restoration projects which resulted in the increase in the amount of approved harvest areas. She also expressed the idea that projects that engage the public become the eyes necessary to watch what happens with the restoration project because they are personally invested. When they see something amiss, they call the appropriate authority. She said that it is sometimes difficult to keep people committed and that volunteers come and go but over the long term, there is usually a cadre of people who continue to be involved and get others involved. These people are an incredibly important group of active individuals: educated about the projects, the issues, and mechanisms to improve shellfish sanitation and get more areas classified for harvest.

A particularly cogent comment was made by a large-scale grower, who suggested that the restoration process required security protection. He said that bio-security should be part of the funding package for a restoration project and as a component of a long-term conservation plan could include hiring security – state security, local Sheriff's office security and private security. In addition, he strongly recommended a Risk Assessment be made for any project to clarify how serious problems associated with a restoration project would be.

The regulatory sector weighed in with concerns about using prohibited areas for shellfish restoration because of issues of shellfish sanitation in the marketplace and the problem of surveillance. He stated

that the workshop introductory presentation presented the problem in a balanced manner. He added that the department often uses volunteers to take water samples as a budgetary benefit for the Department of Health (DOH), stating that the volunteers are trained in paperwork and on-the-ground in the proper technique of water sampling giving the Department confidence in their ability and commitment. There are over 350 acres of shellfish grounds monitored and certified growers are part of the team. Their labs do have the capacity for running the water samples. DOH lacks the necessary people and boats. He said that 90-72, the Shellfish Protection District law mandates the formation of a shellfish protection district whenever water quality classification in a shellfish growing area is downgraded. Each district does things differently, but it is an excellent tool.

One participant mentioned the Northwest Straits Marine Counties Initiative. They are an arm of local government but that local governments had rejected the overall concept of marine sanctuaries. Each of the 7 counties has a Marine Resource Council and the councils appoint representatives to the Marine Resources Commission. The NW Straits now has a foundation. He suggested it as a good model and that eventually they hope to have MRCs in all 12 counties. . Some shellfish growers serve on these committees. The councils could be used to promote native and shellfish gardening concepts and serve as a really good way to connect people in a watershed.

Education was an issue discussed. They now use schools as a source of volunteer monitoring for salmon and habitat restoration. It was suggested that data collected might not be used by the scientists but it can be followed up by the scientists to confirm authenticity. Participants agreed that projects sometimes take on a life of their own and that education was critical to the success of any restoration program. One person described the tidepool displays at events as an approach that worked very well as an education tool.

The role of Sea Grant Extension was explored and the question was raised of what the role should be for extension agents in developing education programs. There was general agreement that Sea Grant Extension was an important component and that perhaps a training manual should be developed by them.

The difference between rural and urban areas was discussed and the suggestion made that urban areas were easier to enforce because there were enough people watching but rural areas were more difficult because prohibited areas may be more difficult to get to and there was the lack of people watching the waters. Participants stated that people who harvested from prohibited waters were doing so illegally and that it was an enforcement issue.

Bad press was perceived as a problem, a concern shared by several participants. They suggested that there was an uneven policy in the way states were dealing with shellfish gardening, mostly because ISSC regulated interstate trade, suggesting that adequate enforcement by the states was needed and agreed that high value product bootlegging was a problem in all areas.

The situation in Washington that is different from most other states where it is not illegal for people to harvest shellfish from their privately-owned property, even if the area is classified as prohibited waters as long as it is not commercial quantity. Washington's private tidelands afford private property owners

the right to harvest. The Shellfish In Your Front Yard workshops that she teaches does not pre-screen participants by growing area classification. Many times this is the first time a homeowner learns that their beach is prohibited. This is a great opportunity for education and clean up of water quality issues. Perhaps the growing area is prohibited because of a series of localized problems (failing onsite sewage system), not something big like a sewage treatment plant that cannot be mitigated. These landowners can do a lot to improve water quality on their own site as well as create peer pressure with their neighbors.

A discussion ensued about whether shellfish should be marked with a fluorescent marker when planted in a prohibited area but the consensus was that it was not needed.

Dot and Sandy thanked the participants for staying for the workshop and for their participation and adding to the opinions of participants from other parts of the country.

Appendix D4. International Conference on Shellfish Restoration

Workshop Description

International Conference on Shellfish Restoration (ICSR) was held in Charleston, South Carolina November 17, 2010. As the name implies, this conference is specifically geared toward shellfish restoration. Managers are welcome and encouraged to attend but the participation is primarily from restoration practitioners. Close to 50 people participated in the workshop that was held in the early evening after the regular meeting.

Early discussion centered on risk assessment with questions about whether there was an actual problem or perceived risk and whether they were actually related and if there was evidence that shellfish restoration had actually caused any illnesses from consumption of cultured stock in restored areas. Subsistence harvest was discussed as more of a problem from an enforcement and risk point of view because of language and cultural issues among subsistence gatherers.

An issue pointed out by a regulator is that there is a vast difference between unclassified and unapproved waters although all unclassified waters are labeled prohibited from an enforcement point of view. It does not mean the waters are unfit for shellfish consumption but rather that the waters have not been tested and do not follow the NSSP protocol and must be off limits.

There was substantial discussion about habitat restoration rather than strictly putting shellfish in the water to augment the natural supply. Habitat restoration is promoted by restoration people because of the ecological services provided by shellfish habitat, most specifically oyster reef building. While there was disagreement over whether oyster reefs can produce enough oysters to eventually clean up an area, there was almost universal agreement that habitat restoration was a positive activity. Further, any program that added land use mitigation programs to reef building had a collaborative approach and usually a measurably positive outcome.

The New Jersey problem was mentioned again as an example of a lack of communication, planning, and funding and as a visible means to point out a state's financial problem. Raritan Bay is an area where hard clam populations exist in prohibited waters and so there was dismay expressed at the destruction of oysters grown in the Baykeeper program, a program that had been properly permitted and in existence for nearly a decade. As a result of the discussion a New Jersey participant suggested that standardization of restoration projects was becoming imperative. Some New Jersey industry folks agreed with the decision of the state to prevent restoration in prohibited waters because they saw it as a potential for contaminated shellfish to reach the market impacting the entire industry.

Enforcement options were discussed including the use of surveillance cameras, using retired health inspectors, and incorporating technological equipment used by other law enforcement agents to prevent poaching or catch and arrest those involved in illegal harvesting. Increasing fines and penalties were also suggested.

The issue of harvest vs. restoration was discussed and deciding when an area is sufficiently restored to allow harvest. There was no consensus as to when this might occur but this could be a starting point for further discussion. Some stated that it was more prudent to target approved waters and ones that do not have regular commercial harvest so the restoration program does not take shellfish out of the public realm.

Communication was the key to resolving issues. Advance planning coupled with communication among the parties was seen as a key ingredient for success. Restoration practitioners should have clearly stated goals and objectives, preferably some that could be measured. Adding the dimension of agri-tourism could be beneficial to a program and add educational benefits. Education should also include invasive species and non-indigenous species and the risks involved with both.

Some suggested that ISSC re-address water classification. Several states petitioned ISSC to regulate shellfish gardening but the response was that gardening was not involved in interstate transfer of shellfish and therefore should be handled by the states, not ISSC. There was a question of whether that issue should be revisited at the ISSC level.

Financial constraints was a theme echoed throughout the workshop – money for water quality monitoring, funds for enforcement of existing classified areas, resources for classifying currently unclassified waters, and funds for education.

Original Notes

Overview: The workshop held in Charleston in conjunction with the Interstate Conference on Shellfish Restoration (ICSR) was the fourth in a series of workshops conducted to develop BMPs for shellfish restoration as recommended by the ISSC Restoration Committee. Following the format of other workshops, the team presented a Power Point program outlining some of the issues involved intended to elicit comments from participants at the workshop that followed the presentation. Close to 50 people participated in the workshop representing not only people from many coastal states but also several of the folks from Canada, Scotland, and Ireland joined the discussion. The team thanked all the people present.

Dot Leonard and Sandy Macfarlane opened the workshop by stating that there are two sides to the issue. Some groups want to restore areas which are not classified as approved. However, some state shellfish control agencies believe that if someone gets ill then it will impact industry and markets. While most of the participants were involved in the restoration efforts in some capacity rather than working for shellfish control agencies, participants were asked to try to put themselves in the shoes of the regulators as they reviewed the issues and sought solutions. They were then asked what could be done to help regulators, who are charged with ensuring safe shellfish for consumption. It is their responsibility to make sure that shellfish are safe for raw consumption.

Early in the discussion, a participant questioned the number of instances of people taking shellfish from restored areas, selling them and folks getting sick from them. Participants pointed out that there is no

risk assessment of this occurring. A primary problem is the cause of classifying areas as conditional, restricted or prohibited and we need to do a better job of regulating pollution.

It was pointed out that people are taking shellfish from unapproved waters for consumption (subsistence harvest) not to market and asked if regulators understood this type of consumption. If more shellfish are planted to go into the water, then more will be taken. There are more people from lower income populations doing this. Regardless where it comes from, if someone gets sick, it impacts the entire industry.

One participant from MS identified himself as a regulator. He commented that shellfish illness has an economic impact. Shellfish Control Agencies are responsible for water classification and resource management. Sometimes high fecal coliform counts are from waterfowl feces. Diseases that waterfowl carry, ie: salmonella, can affect humans. In MS he has tried to dissuade restoration from less than approved waters, and work only in approved waters. They have unclassified (no sanitary survey) waters which are listed as non-approved.

One participant described a program in the Lynnhaven River in Virginia. In Mid 90s Chesapeake Bay Foundation (CBF), working with VA state agency did oyster reef restoration which was mainly about habitat restoration in Lynnhaven River, perfect conditions for getting more oyster recruitment but a completely closed area. Lynnhaven's problem was spat limitation. They needed to stock oysters to get spat fall, and education for gardeners to grow oysters and then put them on a reef. It was a collaborative effort that recognized both the state of VA issues and CBF intent of doing environmental restoration. Citizens of VA Beach worked toward stormwater fixes which improved water quality. The Virginia Marine Resources Commission allowed the establishment of aquaculture in part of the river. Educating the people of the area was important but they recognized that it doesn't affect the PIRATE who can still have a negative impact on the industry. The pirates see bootlegging as a way to make an easy buck. In Lynnhaven people who sampled the area were aware of people working the area illegally and would confront the folks.

The NJ perspective was brought out as it was at the PCSGA meeting where the Baykeeper oyster program in Raritan Bay was forbidden and the oysters destroyed. The Baykeeper was originally approved to put those oysters in closed water then told to take them out. A NJ representative suggested that we need to include standardization in our discussion. Education and continuity of regulation and permitting are necessary. Pre-operational assessment should be done before shellfish go in the water. There should be a reward for doing a good job -for gardeners and for those who turn in poachers. Retired health inspectors could be excellent educators and enforcers.

Enforcement options were discussed. A representative of the TNC explained policing techniques in Alabama. They show a demo of a video surveillance. They put in cameras which were very effective with zooms that were operated from cell phones. Enforcement can quickly see what's going on from a remote location.

Someone asked what the fines were for poaching. The response was that most is under state jurisdiction and each state approaches this from a different manner. There were suggestions that we need more consistency and we should come up with alternative enforcement means and techniques.

In NC volunteers could be helpful, which would expand public involvement. There is a critical mass which needs to be known when planning for restoration projects. One concept most agreed to was that you can't restore shellfish areas without shellfish and removing shellfish from areas is counter productive to restoration programs. But some questioned whether restoration programs will result in more or less closures? It seems prudent to target approved waters and ones that don't have regular commercial harvest, so it doesn't take the available shellfish resource out of the public realm.

One participant from WA State said that there are 327 small growers who police themselves. There is a lot of poaching going on in commercial beds and growers have monitored boats going into illegal areas and have turned them in.

Many participants suggested that communication between proposers and regulators was key and asked if there was opportunity for collaboration between proposers and dialogue with state regulators.

In MS, they are going through something similar from the state side but they have to deal with FDA. State agency has problems addressing same problems and concerns that other groups do.

In NC, they work together and have a good dialogue going but the water quality standards agency has never approved shellfish restoration in unapproved waters.

A representative from RI suggested that in some states there are differences of opinions, for example DEM water resources vs restoration folks.

A participant from NJ questioned why is restoration being done? What is ultimate fate of restoration projects - commerce or just restoration. If restoration will result in commercial harvest somewhere down the road, then rules for NSSP and HACCP need to be followed. That would not be necessary for non-profits and restoration for environmental quality.

One person from NC questioned how restoration compares to agritourism? He wondered if risk aversion or Risk Assessment could be used.

In Scotland oyster reefs are the coral reefs of the north so that the oysters are used for ecological benefits.

What would an educational program look like for a restoration program?

A Canadian colleague suggested to approach this as they do it for invasive species. Sit down with stakeholders and see what type of management works. Stakeholders can be tougher on themselves. Co-development and co-management.

Lynhaven River - used a permit process as a regulatory device.

Aside from water quality issues, folks should be educated about invasive species, non-indigenous, etc.

In NJ some of industry agreed with State of NJ about ban against restoration in non-approved water.

Co-development is finding the best way of managing with optimal results; if top down regulation, it induced stakeholders to try to by-pass regulations; with bottom up development of regulations then everyone abided by the co-developed rules- enabling approach rather than restricting approach.

Should restorers continue the fight for prohibited areas or give up and only use approved areas?
Question is does it open them up for harvest and if so, for commercial or recreational?

We need a policy for habitat uses and one for closed areas for restoration.

Not all restoration is about water quality benefits. In SE or Gulf, oyster reef restoration can be aaptation for protection against sea level rise.

ISSC has to readdress water classification.

About 4 years ago VA, MD, NJ brought a proposal to the ISSC about prohibiting shellfish gardening and the ISSC Restoration Committee said gardening wasn't about interstate commerce, and controls were up to individual states. ISSC concurred.

In NJ we need to get the state to enforce across the board. We need to get polluters. Most are public entities not private.

In WA state if shellfish classification is downgraded because of water quality , then stakeholders and state are required to put together a plan to rectify the situation and restore classification..

Lack of sampling can be a large issue when it comes to water quality monitoring and classification. MS does call some areas unclassified, hoping to have the money eventually to monitor in the future. When development is about to happen, then new residents would be made aware that they can't allow development to downgrade classification.

While some questions raised at this session could not be answered directly, they brought into focus the need for continued dialogue. The facilitators, Dot and Sandy, thanked the participants for their comments and willingness to share their thoughts in an after-meeting setting.

Appendix D5. Milford Aquaculture Seminar

Workshop Description

The Milford Aquaculture Seminar is a meeting sponsored by the NOAA Milford Laboratory, predicated on the joint interests of scientists, managers and industry. It has been held annually for over 30 years and showcases the work of the Milford Lab. For the past decade or more, it has also showcased the innovative work from two area vocational high schools where students are learning about aquaculture first-hand as part of the curriculum. The BMP workshop was held February 8, 2011, Shelton, Connecticut at the end of the first day of the meeting and was attended by over 60 individuals representing all three of the above groups as well as NGOs and educators.

By the time this meeting occurred, we had conducted several workshops and felt that two major themes needed exploration and that the Milford meeting would be an appropriate venue. The two themes explored at this workshop were the use of alternative species and education. The formal presentations included two that dealt with alternative species for restoration work – one on the use of *Geukensia demissa*, ribbed mussel, in severely compromised waters and one on the use of alternatives without naming specific species. Questions and comments at the workshop centered on both the feasibility of using alternatives and the desirability of such action.

An offshoot conversation centered on comments about areas that were prohibited but were naturally productive and were closed to harvest. The question arose of what was the difference between enforcing regulations dealing with natural populations and restoration projects. A second tangent concerned disease and whether keeping stock in the water as a spawning sanctuary promotes disease or promotes disease resistance. There was disagreement on this point. There was also discussion about using prohibited areas for seed production and transferring the seed for later grow-out in approved waters. A further discussion was required to determine the size limits of this procedure.

For the education component, respondents suggested that gardening program directors needed to make sure that participants understood the classification of the waters in which they were working and what they, as individuals, needed to understand in order to harvest the oysters they were growing. Some states had comprehensive educational programs for shellfish gardeners and others did not. For the managers, it was imperative to have an educational element as part of the program although they did not feel that education alone was enough to prevent consumption of shellfish from questionable areas. Community action programs were seen as a different approach. Any education gained by participants was deemed a positive outcome of the program because the participants became more aware of environmental issues in general and they often became advocates for improving environmental conditions, once educated about the problems.

Some participants felt that public health education belonged at the ISSC level and that there was a need for shellfish restoration and advocates for ISSC compliance to come together and involve enforcement officials. In any event, each group should be more educated about the other group, according to many participants.

Subsistence harvest is a problem especially in urban areas where education may not be enough because of language and cultural barriers. There was no easy solution to this problem but it was felt that it had a bearing on the larger picture of shellfish restoration especially when it is practiced in prohibited waters.

Original Notes

Sandy Macfarlane made the presentation to the approximately 60 people attending the workshop. She began the discussion saying that major issues of shellfish restoration are coupled with potential conflicts between user groups in unapproved waters and asked if we could get beyond the problem. She added that most of the participants in the room were probably aware of the regulatory issues with culturing shellfish in unapproved waters and that communication is key. She then opened the floor for comments.

One of the first comments was that we need to protect public health and educate the public on aquaculture issues.

NJ Baykeeper was represented and suggested that the headlines about the problem with the oyster program in Raritan Bay were misleading. NJ was out of compliance with NSSP regulations and a Rutgers research program, that had been permitted and was an on-going project for 10, years was shut down. This action had much to do with political and regulatory issues specifically related to a change in political administration and climate.

Ms. Macfarlane asked about the possibility of using alternative species, what species might be appropriate, and what the issues may be surrounding that idea. A presentation had been made earlier in the day using *Geukensia demissa*, ribbed mussel, for a project in a compromised area. Ribbed mussels are being considered because they are less desirable as a food product and therefore would not be susceptible to poaching from “dirty” waters. But they grow intertidally and may not grow well in subtidal areas. Most respondents felt it was inadvisable to use that card.

Comments included that it would be absurd if the goal of the restoration is to rebuild the valuable commercial species and the shellfish need to be abundant and commercially attractive. Using alternative species might work for ecological services restoration but in the case of *Geukensia*, it is an intertidal species and likely would not work for large scale subtidal restoration. Substituting non-commercial for commercially important species runs the risk of not getting much support from fishermen or public because it is an unattractive food species. Alternate species might harbor unknown diseases (perhaps partly due to being less well studied). If ribbed mussels could live there (subtidal areas) they’d be there already but they have been naturally selected to be in intertidal areas. It is unlikely that they will perform the ecological task as suggested in subtidal areas. Another species mentioned was *Crepidula* with the question of whether there were any regulations on that species but the question was not answered. Changing species is like replacing automobiles with bicycles. Acres of salt marsh in NYC are now gone. Can we restore the biological functions of ribbed mussels back to the area? Will there be poaching anyway? There was an article where researchers calculated the biomass of mussels (an explosion of a set). They occupy a narrow niche of salinity range and once opened, they were gone in a heartbeat.

The question was raised of what to do with restoration in high risk areas. Comments included that there are areas of naturally-occurring (wild) productive areas that are closed to shellfishing because of water quality. Someone asked, what makes the enforcement and regulation of restoration areas different from that? The argument was made for holistic approaches that incorporates thoughtful land use, water quality and stewardship that is built around the food species. There was an acknowledgement that mammalian and avian e.Coli sources are impacting shellfish harvest and as an indicator species, is using it too conservative?

To restore an area, you are looking to ,make it more valuable. "Seeded" areas are likely to be in less dense areas of shellfish than wild (natural) areas in closed areas. Restoration works if it is done as a commercial venture. The regulations state that the stock has to be harvested when it is young to avoid the likelihood of catching disease. This idea was countered with the comment that removing the oysters when they are young to avoid disease is not necessarily a good idea. The large oysters may be the most resistant to diseases such as Dermo and MSX and their removal might deprive the population of its best chance to evolve in response to the presence of the pathogens. Not all states have the requirement to remove large oysters but in Madison, CT, it is the state policy. In another instance large oysters go back in the population purposely because they are resistant to Dermo.

Ms Macfarlane asked how to handle shellfish restoration in uncertified waters. Many people thought it best to handle shellfish restoration projects under same umbrella that deals with regulation of wild shellfish and said further that poaching may take place in uncertified waters – i.e. enforcement is the issue for both, and probably more of it is needed. Several people spoke of subsistence harvest by people who may not know the language or people whose culture encourages harvest of various shellfish not necessarily sought after by the majority of harvesters, or people who need shellfish for their own table and do not give the closures a thought. It was clear that there are many reasons for subsistence harvest and that enforcement in that regard is extremely difficult in urban areas but is also difficult in rural areas as well.

If you want to restore an area, you are looking to make it more valuable. "Seeded" areas are likely to be in less dense amounts of shellfish than wild (natural) areas in closed areas.

Ms Macfarlane asked about the education component saying that if education was the key to resolving issues, what should the education program look like?

For participants in oyster gardening programs, there is a need to make sure they understand the classification of the waters in which they are doing their oyster gardening; i.e. are they uncertified or conditional, and what they need to do in order to safely harvest them.

Some states require that oyster gardening take place only in certified waters (e.g. NY), but in other states there are no such regulations. Some states have a pretty good idea of where the gardening is taking place (e.g. VA), but in others (e.g. MD) the areas in which gardeners are working are not well known. In RI, commercial growers can raise oysters in upwellers in closed areas, but gardeners can only work in certified areas; no formal training program for oyster gardeners in RI (as there is in NY), but RI requires that oyster gardeners sign papers, including a disclosure of where they are gardening.

We should try to involve schools to educate the kids about restoration. In Madison, CT, there are 60-90 high school students that participate actively in an oyster restoration program in town; coordination of such programs requires a special person who invests a lot of energy. This thought was echoed by another participant who suggested that educational programs should involve the schools. It is food for future generations and that's where the tools for education are housed now. Look at the high schools. It's where it's happening anyway. (The Milford Aquaculture Seminar routinely includes presentations by students at marine vocational high schools in the state).

With Community action projects volunteers become an education program through their participation. SPAT, a program in existence for many years now has a substantial training program for participants. Use of unapproved areas is not longer an option in NY although it was in the early days of SPAT but is now prohibited. However, there are a few research programs, such as the alternative species programs, that are specifically targeting ecological services in unapproved areas.

The VIMS shellfish gardening program is extensive. People are trained through VIMS researchers and utilize unapproved waters for the express reason of the ecological services provided by oysters. Participants are trained that shellfish are not to be consumed and are well aware of the health consequences if they do not adhere to protocol. The question was raised of why it is OK in VA but not in other states where the NSSP is the same for all but the response that the interpretation of NSSP differs in the states. Also, individuals in the VIMS program are not sing huge amounts of shellstock and so harvest is not worth the effort for commercial harvesters so regulators do not seem concerned about the individuals in the program but collectively, there are a lot of people participating – it wi one of the largest gardening programs in the country. Further, through serious education, the oyster gardening people know not to eat the oysters from under their docks, the garden. However as the number of participants increase, managing documents and monitoring becomes more cumbersome.

In RI, aquaculture folks can raise shellfish but not to a harvestable size in prohibited areas. They have to be moved to approved areas in order to be harvested. The state is working on a policy with many of the stakeholders and regulators in a workgroup that has just begun discussions of the issues and develop criteria for siting restoration projects. Right now, Rhode Island gardeners have to sign a paper that said that they aren't supposed to eat what they're growing. In Ct, regulators' focus is on commercial fisheries.

Others felt that the education issues belongs at the ISSC level. Currently, there's a paper trail for holding shellfish to market. All arguments are similarly applied to culturing seed in prohibited areas. Advocates for shellfish restoration + advocates for ISSC compliance should come together Education needs to happen on both sides and enforcement is involved all the time. ISSC conditions are not evenly applied and are interpreted differently in the states. Shellfish aquaculture/restoration work in closed areas should be regulated by the ISSC. Shellfish growers and ISSC regulators need to be educated more about each other, something that could be facilitated by their meeting together (which does not happen very often).

Enforcement personnel need to be involved in order for restoration projects in closed areas to have a better chance of being done without being poached.

People are desiring cheap shellfish almost regardless of the source – take imports for example – where the consumer does not know the origin of the growing area.

In the 1800's, there was precedence for getting clean water. Now, Providence area WW treatment plants aren't always working properly and up to standards.

Ms Macfarlane thanked the audience for their participation and closed the workshop.

Appendix D6. Northeast Shellfish Sanitation Association

Workshop Description

The NESSA meeting was held in Portsmouth, New Hampshire, March 8, 2011. This meeting was unique as teleconferencing was used to facilitate active involvement of states unable to travel to New Hampshire. In total there were 37 participants and several participants from Connecticut, New York and New Jersey whose contributions created lively discussions.

Education of practitioners was mentioned early in the discussion where in some cases, there is training in place and in others there is not. It was suggested that there be a peer-review of the education/training and an evaluation of the programs to determine how the public and stakeholders feel about the projects. Eastern Long Island has a large program with a rigorous educational component and where 50 percent of the stock is raised for personal consumption and 50 percent goes back to the community. All the work takes place in approved waters.

In some states commercial harvest is important for the industry but in New Hampshire, commercial fishing is not part of the equation as currently there is only recreational harvest. However, even with recreational harvest, if someone gets sick, it affects the entire industry.

The issue of marine patrols drew many comments. In Maine, with its very large shoreline, there are only 25 field officers and additional officers would not be feasible because of the cost. Therefore, the state would not approve projects in closed areas because poaching is a potential problem. In terms of opening some currently closed areas by using volunteers the state felt that currently it was satisfactory to use volunteers do water quality testing but there would be reluctance to use volunteers for enforcement or to conduct sanitary surveys.

New York Harbor is uncertified but there are on-going restoration programs. Prohibited areas are not tested. As in many states there is inadequate patrol presence and it is recommended that this be addressed in best management practices for the future. The habitat tradeoffs are a concern. New York is working with the Department of Environmental Protection and Hudson River Foundation for small projects where patrol does not seem to be necessary because of the small size of the programs. Also mentioned was the fact that the NY/NJ baykeepers have inadequate control over the individuals participating in the restoration programs.

It was clearly stated that shellfish gardening is not allowed in New Jersey in waters that are unapproved. New York will allow restoration in unapproved waters if there is an educational component and as long as there is adequate patrol and monitoring where necessary.

Habitat enhancement and habitat ranking were discussed and it was clear there are no criteria to determine if/how one habitat might be preferred over another but there is a need for ranking habitats.

The use of alternative noncommercial species was introduced. Ribbed mussels are being used in New York but other states are not accepting the use of alternative species for restoration programs. There

was a discussion of whether an intertidal species was appropriate for restoration but the proponents pointed out the destruction of marshes in the area and the potential benefit of “marsh mussels” in restoring marsh habitat.

Connecticut was not in favor of any restoration projects because of their commercial industry which is large with substantial populations of oysters and clams that are already filtering water. There is also a concern about transmitting shellfish disease to indigenous populations when the state cannot track where the restoration stock comes from. The state does not want to do anything that would jeopardize the existing industry. Their farming technique since about 1914 is a farm-managed system, not a wild fishery, but they do utilize native seed beds and transplant the seed to leased sites offshore. It is a system that has worked well for generations. They also cultivate the bottom and add shell. Connecticut would rather enhance existing industry practices than do alternative restoration projects. The discussion about the Connecticut system prompted a discussion of “farm” and “wild fishery” semantics and traditional methods compared with more modern methods. Some felt that larvae grown under some sort of controlled conditions constituted farming regardless of whether the larvae/seed came from a hatchery or natural source. With oysters, some felt that the vertical structure afforded by creating reefs was beneficial and constituted restoration.

In Massachusetts, there is no distinction between intra and interstate and no gardening is allowed. However, they have both robust municipal shellfish enhancement programs where commercial and recreational harvesting takes place, and the state has a dynamic aquaculture industry that is in good shape and expanding in approved waters. Massachusetts utilizes a transplant program in which contaminated oysters and hard clams are moved to approved waters. Soft shell clams are harvested in restricted areas and then taken to a state managed depuration plant. In Massachusetts you have to be in an approved area to grow shellfish. Gardening would be hard to police and restoration cannot occur in closed areas because of patrol requirements.

Using shellfish for water quality programs could mean different things depending on the program objectives— nutrient reduction or bacterial reduction or sometimes both. Programs must differentiate between the two so that everyone is clear on the objectives. In response to a comment that Washington State uses shellfish restoration for water quality improvement, some participants said that large shellfish beds will still be polluted; the situation near Sandy Hook was mentioned as an area with a large natural shellfish population and yet the bacterial counts are still high. What is still needed is to

trace the source and correct it. Habitat value of oyster reefs and ecosystem services provided by filtering shellfish was discussed. Dredging can ruin reefs very quickly. Use of alternative species may be appropriate in some situations and should not be discounted.

Participants felt that if patrols/lack of patrols are one of the major problems then maybe we have to think outside the box and use some of the newer technology coming along such as web cams, on-board GPS systems, more rigid forceful penalties (rather than a cost of doing business), and ensuring that enforcement funds are part of a restoration program. Another concern was the possible problem of why there are patrols for a restoration program but not for a wild fishery. When seed is relayed from unapproved sites to approved ones it can be anything from thumbnail size to just sub-legal and it is obviously the latter that can cause problems. There was a major plea for better communication among all practitioners and officials in the planning stages and while project is underway.

Original Notes

The NESSA meeting was held in Portsmouth, NH, March 8, 2011. This meeting was unique as teleconferencing was used to facilitate active involvement of states unable to travel to New Hampshire. In total there were 37 participants.

Education of practitioners was mentioned early in the discussion where in some cases there are projects in place where sometimes there is training and in others there is not. It was suggested that there be a peer-review of the education/training and an evaluation of the programs to determine how the public and stakeholders feel about the projects. Eastern Long Island has a large program with a rigorous educational component and where 50% of the stock is raised for personal consumption and 50% goes back to the community. All the work takes place in approved waters.

In some states, commercial harvest is important for the industry but in New Hampshire, commercial fishing is not part of the equation as currently there is only recreational harvest. However, even with recreational harvest, if someone gets sick, it affects the entire industry.

The issue of marine patrols drew many comments. In Maine, with its very large shoreline, there are only 25 field officers and additional officers would not be feasible because of the cost. Therefore, the state would not approve of projects in closed areas because controlling poaching is a potential problem. In terms of opening some currently closed areas by using volunteers the state felt that currently it was

satisfactory to use volunteers do water quality testing but there would be reluctance to use volunteers for enforcement or to conduct sanitary surveys.

New York Harbor is uncertified but there are on-going restoration programs. Prohibited areas are not tested. As in many states there is inadequate patrol presence and it is recommended that this be addressed in best management practices for the future. The subject of habitat tradeoffs are a concern. NY is working with the DEP and Hudson River Foundation for small projects where patrol does not seem to be necessary because of the small size of the programs. Also mentioned was the fact that the NY/NJ baykeepers have inadequate control over the individuals participating in the restoration programs.

It was clearly stated that shellfish gardening is not allowed in NJ in waters that are un approved. NY will allow restoration in unapproved waters if there is an educational component and as long as there is adequate patrol and monitoring where necessary.

Habitat enhancement and habitat ranking were discussed and it was clear there is no criteria to determine if/how one habitat might be preferred over another but there is a need for ranking habitats.

The use of alternative noncommercial species was introduced. Ribbed mussels are being used in NY but other states are not accepting the use of alternative species for restoration programs.

CT was not in favor of any restoration projects because of their commercial industry which is large with substantial populations of oysters and clams which already are filtering water.. There is also a concern about transmitting shellfish disease to indigenous populations when the state cannot track where the restoration stock comes from. The state does not want to do anything that would jeopardize the existing industry. Their farming technique since about 1914 is a farm-managed system, not a wild fishery, but they do utilize native seed beds and transplant the seed to leased sites offshore. It is a system that has worked well for generations. They also cultivate the bottom and add shell. CT would rather enhance existing industry practices than do alternative restoration projects. The discussion about CT system prompted a discussion of “farm” and “wild fishery” semantics and traditional methods compared with more modern methods. Some felt that larvae grown under some sort of controlled conditions constituted farming regardless of whether the larvae/seed came from a hatchery or natural source. With oysters, some felt that the vertical structure afforded by creating reefs was beneficial and constituted restoration.

In MA, there is no distinction between intra and interstate; no gardening allowed. However, they have robust municipal shellfish enhancement programs. Commercial and recreational harvesting takes place, and they are handled similarly. The state has a robust aquaculture industry that is in good shape and expanding in approved waters. MA utilizes a transplant program in which contaminated oysters are moved to approved waters. Some approved growers and municipalities have utilized the program as well for quahaugs. Soft shell clams are harvested in restricted areas and then taken to a state managed depuration plant. In Massachusetts you have to be in an approved area to grow shellfish. Gardening would be hard to police and restoration cannot occur in closed areas because of patrol requirements.

Using shellfish for water quality programs could mean different things depending on the program objectives— nutrient reduction or bacterial reduction or sometimes both. Programs must differentiate between the two so that everyone is clear on the objectives. In response to a comment that WA state uses shellfish restoration for water quality improvement some participants said that large shellfish beds will still be polluted; the situation near Sand Hook was mentioned as an area with a large natural shellfish population and yet the bacterial counts are still high. What is still needed is to trace the source and correct it. Habitat value of oyster reefs and ecosystem services provided by filtering shellfish was discussed. Dredging can ruin reefs very quickly. Use of alternative species may be appropriate in some situations and should not be discounted.

If patrols/lack of patrols are one of the major problems then maybe we have to think outside the box and use some of the newer technology coming along such as web cams, on-board GPS systems, more rigid forceful penalties (rather than a cost of doing business), and ensuring that enforcement funds are part of a restoration program. Another concern was the possible problem of why there are patrols for a restoration program but not for a wild fishery. When seed is relayed from unapproved sites to approved ones it can be anything from thumbnail size to just sub-legal and it is obviously the latter that can cause problems. There was a major plea for better communication among all practitioners and officials in the planning stages and while project is underway.

Appendix E. Definitions

One of the first questions asked in a discussion about shellfish restoration is **“What exactly do you mean by shellfish restoration?”** The definition depends on the objective of the restoration project.

- Public/private habitat reclamation: using shell or alternate material to harden the bottom or for reef building;
- Shellfish seed plantings to increase shellfish populations for commercial and recreational harvest;
- Community restoration projects which involve shell collection sites, creating bags of cultch, remote setting and using resulting seed to plant reefs;
- Public/private partnerships, for example oyster gardens and other community-based projects which may involve NOAA, The Nature Conservancy, river organizations and marine extension programs; and
- Land-based mitigation - stormwater and agricultural runoff controls, livestock controls and wastewater mitigation which focus on “correcting” human activities that affect shellfish growing waters.

The term “restoration” is problematic because of the many interpretations. For example, restoration could be used interchangeably with repletion when the oyster reef is being restored to its fullness or original state. In the case of reclamation, restoration can mean repairing shellfish reefs or beds using materials such as shells or alternative hard surfaces. Reclamation could also mean restoring mangroves for oysters or sandy bottom for clams.

The term “shellfish enhancement” is a management tool used by agencies to increase opportunities for shellfish harvest and may also be called “propagation”, “mariculture” or “aquaculture”. The Washington Department of Fish and Wildlife uses shellfish enhancement to expand recreational harvest on certain public beaches by adding to the clam and oyster resource. Their technique is to “seed” suitable beaches with juvenile clam and oysters. In Massachusetts, where each municipality manages their own shellfish under state guidelines, enhancement programs, termed “propagation”, can be widespread in scope, species, harvest beneficiaries, and area covered. Alaskan agencies define “mariculture” as “shellfish enhancement”.

In a brochure developed by the East Coast Shellfish Growers Association aquaculture is described as a restoration tool because “shellfish clean the water by filter feeding”, removing microscopic particles from the water. Shellfish remove problematic sediments and phytoplankton and their associated nutrients. “Some of the nitrogen is incorporated into protein and the rest is deposited on the bottom,

where it can be consumed by worms and other organisms.” The brochure ends by pointing out that “as both water clarity and light penetration are improved, the eelgrass is able to recover in waters that have not supported sea grasses for decades. Clearly shellfish aquaculture should be an element of any eelgrass restoration project”. <http://www.ecsga.org/Pages/Sustainability/BenefitsBrochure.pdf>

The “return of native species” such as the Olympia oyster to Puget Sound and San Francisco Bay and the “control of invasive species” are also a part of the broad term for shellfish restoration. Mitigation can be required when a coastal permit is issued in a shellfish area as in New Jersey state laws:

<http://www.state.nj.us/dep/landuse/announce.html>, states that “monetary contribution shall be provided to the dedicated account for Shellfish Habitat Mitigation.” The contribution is based upon “the area of shellfish habitat condemned due to coverage by the structure and boat moorings, the documented shellfish density on the property, and the commercial value of the shellfish resource.” In cases of oil spills, Exxon Valdez, or more recently the Deepwater Horizon in the Gulf of Mexico, mitigation includes the restoration of shellfish and their habitat. In these cases mitigation required as a result of coastal development or of catastrophic events can be considered restoration.

Appendix F. Regulatory Aspects of Shellfish Restoration

Habitat restoration projects often affect the public—they can impact water quality, endangered and threatened species, historic properties, and navigation. Numerous federal and state regulations are in place to ensure adequate environmental protection. Any organization planning a restoration project needs to obtain guidance from the relevant state agency to ensure that they comply with all state and Federal requirements. In our recent discussions with restoration experts and regulators their major concerns are with the National Shellfish Sanitation Program. However there are many other regulations that may need to be addressed.

National Environmental Policy Act of 1969 - Implementing Agency: Any federal action agency

The National Environmental Policy Act of 1969 (NEPA), as amended (42 USC §§ 4321, et seq., 40 CFR Parts 1500-1508) applies to any federal agency actions that have the potential to affect the quality of the human environment. Federal agencies begin the NEPA planning process by preparing an Environmental Assessment (EA) to determine whether an action will have a significant effect on the quality of the human environment (40 CFR 1508.27; NAO 216-6, 6.01b). If an impact is likely to be significant, an environmental impact statement is prepared.

Clean Water Act: Section 404: US Army Corps of Engineers (USACE) and EPA

Section 404 of the Clean Water Act requires prior approval for any discharge of dredged or fill material into the waters of the United States. A Section 404 permit is required for any restoration project that undertakes one of the following activities: (1) discharging fill or dredged material, including shell, in U.S. waters, (2) site development fill for residential, commercial, or recreational developments; (3) construction of revetments, groins, breakwaters, levees, dams, dikes, and weirs; and (4) placement of riprap and road fills.

Clean Water Act: Section 401 - Implementing Agency: State / EPA

Under [Section 401](#), **States and Tribes who have received delegated authority can review and approve, condition, or deny all Federal permits** or licenses that might result in a discharge to state or tribal waters. The major federal licenses and permits subject to Section 401 are Section 402 and 404 permits (in nondelegated States), Federal Energy Regulatory Commission (FERC) hydropower licenses, and Rivers and Harbors Act Section 9 and 10 permits. States and tribes make their decisions to deny, certify, or condition Section 401 permits or licenses primarily by ensuring the activity will comply with state water quality standards.

Rivers and Harbors Act of 1899: Section 10 - Implementing Agency: USACE

The Rivers and Harbors Act of 1899 requires approval prior to the accomplishment of any **work in, over, or under navigable waters of the United States**, or which affects the course, location, condition, or capacity of such waters. A [Section 10 permit](#) is required for any restoration project that undertakes one of the following activities: (1) construction of piers, breakwaters, bulkheads, jetties, weirs, and intake

structures; (2) work such as dredging or disposal of dredged material; and (3) excavation, filling, or other modifications to navigable waters of the United States.

Endangered Species Act - Implementing Agencies: National Marine Fisheries Service (NMFS) and US Fish & Wildlife

The Endangered Species Act (ESA) provides for the conservation of species that are endangered or threatened with extinction throughout all or a significant portion of their range, and the conservation of the ecosystems on which they depend. The National Marine Fisheries Service (NMFS) and the U.S. Fish and Wildlife Service (FWS) share responsibility for implementing the ESA, with FWS managing land and freshwater species and NMFS managing marine species. There are currently 1,855 listings (endangered and threatened) under the ESA, with NMFS having jurisdiction over 61 listed species. Among those are shellfish, the black abalone (*Haliotis cracherodii*) and white abalone (*Haliotis sorenseni*). Federal action agencies are required to consult with NMFS and/or USFWS on any action authorized, funded, or undertaken that might affect endangered or threatened species.

Magnuson-Stevens Fishery Conservation and Management Act: Essential Fish Habitat - Implementing Agency: NMFS

The Magnuson-Stevens Fishery Conservation and Management Act (MSA) mandates that fishery management plans (FMPs) be developed by the Regional Fishery Management Councils (with review by the Secretary of Commerce) to prevent overfishing and rebuild overfished fisheries. FMPs must include language written by the Councils that identifies Essential Fish Habitat (EFH) for managed species and identifies measures to conserve and enhance the habitat necessary to fish to carry out their life cycles. Essential Fish Habitat is defined as those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity. Federal action agencies are required to consult with NMFS on any action authorized, funded, or undertaken that may adversely affect EFH.

Coastal Zone Management Act - Implementing Agency: NOAA and State

The Coastal Zone Management Act requires federal license or permit activities and federal financial assistance activities that have reasonably foreseeable coastal effects must be fully consistent with the enforceable policies of state coastal zone management programs.

National Historic Preservation Act: Section 106 - Implementing Agency: State Historic Preservation Office (SHPO)

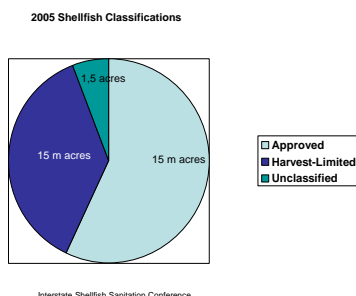
The National Historic Preservation Act (NHPA), amended in 1992, requires that responsible federal agencies taking action that potentially affects any property with historic, architectural, archeological, or cultural value that is listed on or eligible for listing on the National Register of Historic Places (NRHP) comply with the procedures for consultation and comment issued by the Advisory Council on Historic Preservation.

The National Shellfish Sanitation Program: Implementation by States and FDA

Growing Water Classification

The classification of shellfish-growing waters is based on the National Shellfish Sanitation Program (NSSP), a cooperative effort involving states, the shellfish industry, and the FDA. Since 1983, it has been administered through the Interstate Shellfish Sanitation Conference (ISSC). The ISSC was formed to promote shellfish sanitation, adopt uniform procedures and develop comprehensive guidelines (*NSSP Manual of Operations Parts 1 & 2*) to regulate the harvesting, processing, and shipment of shellfish. The NSSP guidelines require each state to classify shellfish growing waters by conducting sanitary surveys that: (1) identify actual and potential pollution sources; (2) evaluate hydrology and meteorology affecting pollutant transport; and (3) assess the results of water samples taken for bacteriological and other contaminants. The sanitary survey is the administrative document upon which growing-water classifications are based.

Growing Water Classifications



Approved Waters - Growing waters from which shellfish may be harvested for direct marketing. Fecal coliform median or geometric mean most probable number (MPN) does not exceed 14 per 100 ml, and not more than 10 percent of the samples exceed an MPN of 43 per 100 ml.

Conditionally Approved Waters - Growing waters meeting approved classification standards under predictable conditions. These waters are open to harvest when water quality standards are met, and are closed at other times. Fecal coliform standards are the same as for Approved (see above).

Restricted Waters - Growing waters from which shellfish may be harvested only if they are relayed or depurated before direct marketing. Fecal coliform median or geometric mean MPN does not exceed 88 per 100 ml, and not more than 10 percent of the samples exceed an MPN of 260 per 100 ml.

Conditionally Restricted - Growing waters do not meet the criteria for restricted waters if subjected to intermittent microbiological pollution, but may be harvested if shellfish are

subjected to a suitable purification process. Fecal coliform standards are the same as for Restricted Waters (see above).

Prohibited Waters - Growing waters from which shellfish may not be harvested for marketing under any conditions.

Unclassified Waters - Growing waters that are part of a state's shellfish program but are inactive, i.e., there is no harvesting, and the state does not conduct any water quality monitoring or maintain a sanitary survey.

Report from the 2011 ISSC Shellfish Restoration Committee Meeting

ISSC 2011 Biennial Meeting October 1-7, 2011 – Seattle, Washington Committee Report

Committee Name : Shellfish Restoration Committee

Chairperson: Dot Leonard

Date of Meeting: October 2, 2011

Roster:

<input checked="" type="checkbox"/> Dot Leonard	<input type="checkbox"/> Bill Dewey
<input type="checkbox"/> Jim Bloom	<input checked="" type="checkbox"/> William Beatty
<input type="checkbox"/> Thomas Foca	<input checked="" type="checkbox"/> Gordon LeBlanc
<input type="checkbox"/> Kathy Brohawn	<input checked="" type="checkbox"/> Walt Canzonier
<input type="checkbox"/> Shannon Jenkins	<input checked="" type="checkbox"/> Joe Migliore
<input checked="" type="checkbox"/> Jeff Kennedy	<input checked="" type="checkbox"/> AJ Erskine
<input checked="" type="checkbox"/> Steve Fleetwood	<input type="checkbox"/> Steve Murphey
<input type="checkbox"/> Robert Goodwin	<input checked="" type="checkbox"/> Scott Gordon
<input checked="" type="checkbox"/> Randy Hatch	<input type="checkbox"/> Bill Hastback
<input type="checkbox"/> Mike Hickey	<input type="checkbox"/> Harold Knudson
<input type="checkbox"/> Elaine McKnight	<input type="checkbox"/> Virginia Olsen
<input type="checkbox"/> Kris Phelps	<input type="checkbox"/> Robert Rheault
<input checked="" type="checkbox"/> Ben Stagg	<input checked="" type="checkbox"/> Bill Taylor
<input type="checkbox"/> Debbie Rouse	<input checked="" type="checkbox"/> Bob Woolrich
<input type="checkbox"/> Bill Kramer	<input checked="" type="checkbox"/> Paul Comar
<input checked="" type="checkbox"/> Greg Gobllick	<input type="checkbox"/> Debra Scoville
<input type="checkbox"/> Tommy Ward	<input checked="" type="checkbox"/> Richard Young

Charge 1:	Review restoration information that could impact shellfish sanitation and the NSSP.
Findings:	<p>Jeff Kennedy (Massachusetts Marine Fisheries) gave a presentation (available as separate PowerPoint) on Massachusetts Shellfish Planting Guidelines (final will be provided to the committee within the next year). These have been developed during listening sessions throughout coastal Massachusetts and include all planting activities: Restoration, Enhancement, Mitigation and Research, other than aquaculture. Ben Stagg (Virginia Marine Resources Commission) gave a presentation (available as separate PowerPoint) on Aquaculture Impacts and Conflicts in Virginia). Virginia statistics include 924 oyster gardening permits (>3000 gardeners exist), 4,322 oyster ground leases covering 95 thousand acres and 858 riparian ground leases covering 440 acres.. Virginia also has >300,000 acres of public shellfish grounds that cannot be leased. Richard Young From Canadian Department of Fisheries and Oceans gave a presentation (available as a separate PowerPoint) on Integrated Multi Trophic Aquaculture also known as polyculture. Installations in British Columbia, New Brunswick and Nova Scotia include salmon pens, mussel socks and kelp longlines. According to the CFIA and Environment Canada there have been no water quality issues. Mussel harvest only takes place during winter months when they are not affected by HABs.</p>
Conclusions:	
Recommendations :	
Charge 2:	Identify proactive efforts in which Conference involvement would encourage restoration of shellfish growing areas.
Findings:	In response to a recommendation by the Shellfish Restoration Committee in the 2009 meeting a series of regional workshops were held to develop the following Best Management Practices for Shellfish Restoration:

1. Protect public health while restoring the environment

- ② Form partnerships among restoration proposers, regulators, funding agencies, academic institutions and non-government organizations to promote restoration of native shellfish and ecosystem services, and to conserve and restore coastal water quality.
- ② Conduct restoration projects in open waters and those historically suitable for shellfish whenever possible.
- ② Submit additional plans for biosecurity of projects in non-approved waters working closely with enforcement officials and, when suitable, include funding for security efforts in project cost.
- ② Submit restoration project information to state resource managers, to provide centralized records and data bases.

2. Define goals and objectives of restoration projects

- ② Define goals and objectives in project proposals, actions to achieve them, methods to track project results and responsibilities of partners in the project.
- ② Establish criteria to define project success for: ecological services; harvest – who, when, how much; sanctuary - how long; relay - size, security, harvest requirements; reef-building - structural/ecological stability.

3. Expand Communication and Education

- ② Prior to applications and funding, meet with state resource managers to discuss potential issues; include location, participants, duration, project goals, methods, species of shellfish, potential harvest or relay requirements, site maintenance and security measures.
- ② Discuss shellfish gardening locations and plan for oversight by resource managers .
- ② Provide education component (biology, growing methods, pests, competitors, diseases and public health aspects of shellfish) for restoration programs using volunteers.
- ② Demonstrate to health officials that plans to educate volunteers will ensure

	<p>that shellfish grown in unapproved waters will not be consumed.</p> <ul style="list-style-type: none"> ☐ Use project to educate public about estuaries, growing shellfish and the importance of shellfish in maintaining biological health of an estuary. <p>4. Expand community-wide restoration</p> <ul style="list-style-type: none"> ☐ Encourage restoration in community associations where people can work together to improve the environment in their own back yard. ☐ Share knowledge through lectures, written articles, and as guest speakers at civic association meetings and other community events. ☐ Start shell recycling programs. ☐ Provide volunteers to help shellfish control agencies conduct water sampling, provide education and security of the site. State agencies should solicit and accept volunteer help when appropriate. <p>5. Use noncommercial species in restoration efforts</p> <ul style="list-style-type: none"> ☐ Use commercially important species as a first choice but if biosecurity of commercial species is a concern, consider alternative native species for their filtering capacity and beneficial role in the ecosystem.
Conclusions:	<p>The Best Mangement Practices as separated from the full report should be included in the NSSP as a guidance document. Before inclusion in the NSSP as guidance the BMPs should be reviewed and edited to follow the NSSP format.</p>
Recommendations	<ol style="list-style-type: none"> 1. Motion carried to separate BMPs from full document for recommendation to Executive Board. 2. Motion carried to request that the BMPs as listed in "Findings" be included in the NSSP as a guidance document. 3. Motion carried to request that the Executive Board provide \$1,000 sponsorship of the 2012 International Conference on Shellfish Restoration" to be held in Charleston, SC from November 14-17, 2012.

