

The Tidal Exchange



Newsletter of the New York ~ New Jersey Harbor Estuary Program

Summer 2010, Issue No. 25

THIS ISSUE

HARBOR ESTUARY NEWS

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Special Issue Dedicated To The Eastern Oyster

(Crassostrea virginica)

Introduction

Oysters were once a very abundant and cherished resource of the NY-NJ Harbor estuary. An account published in 1887 says “Oysters once grew naturally all along the Brooklyn shore, and in the East River; all around Manhattan Island; up the Hudson as far as Sing Sing; out to the Jersey shore from that point to Keyport, N. J., and in Keyport, Raritan, Newark, and Hackensack Rivers; all around Staten Island, and on many reefs and wide areas of bottom between Robyn’s Reef and Jersey City.” By the early 20th century, sediment and water pollution and over harvesting had all but eliminated these once-dominant features. While no known reefs and only a handful of individuals remain today, water and sediment

quality has improved dramatically and the restoration of the Eastern Oyster to the Estuary may now be possible. The promise of their restoration has captured the interest of scientists, policy makers, and the general public, all recognizing the importance of the oyster as a key biological component of the Estuary, a symbol of environmental improvements, and as a means of further connecting people to the estuary.

Value and need for restoration

The oyster’s contributions to overall estuary function are numerous. Oysters are “ecosystem engineers” and shape their environment into complex three dimensional structures which support not only themselves but a host

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Workers stand on the docks of the lower Manhattan waterfront on West Street Looking North from Charles Street holding baskets for unloading oysters, 1890. Photo by Museum of the City of New York, Byron Co. Collection.



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The Tidal Exchange – Summer 2010

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The Tidal Exchange is a publication of the New York – New Jersey Harbor Estuary Program (HEP), a partnership of federal, state and local governments, scientists and citizens working together to protect and restore the natural resources of the estuary. The purpose of the newsletter is to promote an informative dialog on issues related to the Harbor Estuary Program.

The HEP is sponsored by the States of New York and New Jersey and the US Environmental Protection Agency. The HEP Management Committee consists of representatives from the US EPA, NJ DEP, NYS DEC, NY and NJ local governments, US ACE, US DOI, NOAA, Port Authority of NY & NJ, Interstate Environmental Commission, NJ Harbor Dischargers Group, NYS DOS, Science & Technical Advisory Committee and Citizens Advisory Committee.

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Public Health, Enforcement Capability and Habitat Alteration

NY State Department of Environmental Conservation

The restoration of oysters in the Harbor Estuary also faces regulatory challenges because this area is designated as “uncertified” and closed to shellfish harvesting. Shellfish restoration projects in these areas must be evaluated to determine the public health implications associated with increasing shellfish populations in closed areas and the potential for illegal harvest, enforcement capacity available to patrol these areas as required under federal programs and the accessibility to the public of these shellfish resources. The protection of public health is considered to be one of the most important regulatory concerns that must be addressed in the evaluation of any restoration project regardless of scale. Additionally, the potential for habitat alteration involved with the placement of shell on the bottom for

oyster restoration needs to be carefully considered.

Pilot and demonstration projects should be used to evaluate whether, where and how restoration is feasible by determining the technical, environmental and biological factors that may influence success. These pilot projects will provide the scientific data necessary to guide the development of future restoration in the Harbor Estuary. They can be used to develop risk management strategies to address potential public health concerns and evaluate enforcement capacity needed to adequately monitor sites and prevent illegal harvest. The ecological benefits of oyster restoration need to be balanced against the potential public health risks associated with illegal harvest and shellfish illnesses associated with consumption of tainted shellfish. ❖

Map of the New York-New Jersey Harbor Estuary



Oyster Restoration Research Project (ORRP)

Jim Lodge and Katie Mosher-Smith

Is it possible to have oysters flourishing in the NY-NJ Harbor again? Can the ambitious goals for oyster restoration laid out in the Hudson-Raritan Estuary Comprehensive Restoration Plan be met? The answer today is: we really don't know. But the good news is that a science-based strategy coupled with a new partnership of organizations is now in place to address these questions.

Last year, the Hudson River Foundation convened a panel of oyster restoration experts from around the country to review ongoing local oyster research and pilot projects, and to make recommendations for a path forward. The group advised that while studies of the survivability of introduced oysters in caged experiments were positive, it was now necessary to have a fuller understanding of whether oysters will survive in more natural settings. The expert panel recommended the creation of a number of small experimental reefs in the NY-NJ Harbor Estuary. These underwater laboratories would be used to evaluate survivability and development of the oysters, to see how oysters are affected by natural forces, and how the surrounding environment is affected by the oysters themselves. The project will answer these and other important scientific research questions and complete several critical next steps necessary toward achieving the restoration targets outlined in the Comprehensive Restoration Plan.

A partnership of not-for-profit organizations, federal, state and city agencies, citizens, and scientists have come together to complete this ambitious project. This collaborative effort grew from recognition by all involved partners that only a coordinated and integrated effort could achieve the shared project goals. The experimental oyster reefs



Baykeeper assists Harbor School with aquaculture activities. These oyster shells are being placed in setting tanks on Governor's Island where they will be "set" with oyster larvae to produce live spat-on shell for the project. Over 200,000 oysters are being produced in preparation for reef building activities this year.

constructed under this project are envisioned as the base research platform for all current and future partners. By working together, joining financial and human resources and coordinating the research efforts, we can achieve more, in less time, for less money. The partnership aims to foster a collaborative scientific dialogue and will encourage researchers to use the project's experimental reefs and the project's data to answer questions specific to the proposed oyster restoration efforts as well as related research questions. The experimental reefs will also provide numerous education and

outreach opportunities and can be a focal point for engaging the public in the oyster restoration effort and the overall ecosystem restoration agenda.

Study Design

The overall approach is to characterize reef development (survival and growth of the oysters themselves) and reef performance (ecosystem services provided by the reefs) over a 2-year period at locations throughout the estuary. This summer (2010) the project will construct small-scale reef

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Oyster Restoration Research Project Partners

Hudson River Foundation, NY/NJ Baykeeper, U.S Army Corps of Engineers, The Port Authority of New York & New Jersey, The Urban Assembly New York Harbor School, The Harbor Foundation, Governors Island Preservation and Education Corporation, NY-NJ Harbor Estuary Program, NY City Department of Parks and Recreation, NY City Department of Environmental Protection, U.S Environmental Protection Agency, New York State Department of Environmental Conservation - Hudson River Program, Hudson River Park Trust, NOAA Restoration Center, Bart Chezar (Bay Ridge Flats Oyster Project), Rocking the Boat. ❖

of other organisms. In a typical oyster reef, the conglomeration of shell and sediment is overlaid by a layer of live oysters and other small organisms. Crevices formed by the stacking oyster shells create microhabitats for species such as grass shrimp, small clams, crabs, and worms to hide from larger predators. The oyster shells themselves are known to attract small invertebrate species such as sponges, hydroids, barnacles and mussels as well as their predators (starfish, crabs and flatworms). Some species of fish use oyster reefs as spawning sites and for foraging including one that is named after them, the oyster toadfish. The fishes that are attracted to the reef provide a forage base for higher level predators, such as birds and game fish.

In certain areas, subtidal oyster reefs (i.e. those that remain under water even during low tides) can alter current flows helping to create or expand shallow water habitat by trapping sediments. Reefs can also help preserve and expand salt marshes by protecting them from waves.

Oysters and other shellfish are filter feeders, which means they pump large amounts of water through their systems to capture phytoplankton for nourishment, while also removing suspended solids from the water column. The filtering service provided by oysters has the potential to increase water clarity

and the likelihood for submerged aquatic vegetation such as eelgrass to become established. Unfortunately, while filtering water, oysters also accumulate contaminants (including bacteria) that can lead to disease in humans when the shellfish are consumed. For this reason, most areas in our Estuary are currently closed for shellfish harvest (even though some shellfish beds remain) and our oyster restoration efforts are focused on restoring oysters and oyster reefs for their ecological value and not to support a fishery.

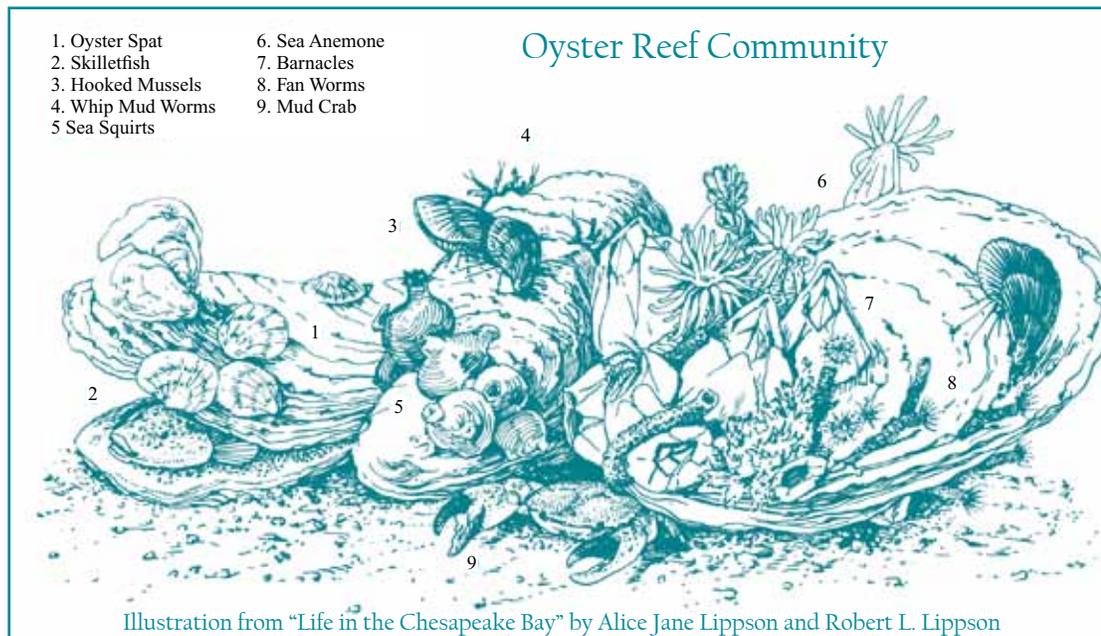
An Ecosystem Restoration Master Plan

The U.S. Army Corps of Engineers released the draft Hudson-Raritan Estuary Comprehensive Restoration Plan (CRP) in March 2009. This challenging effort built off the NY-NJ Harbor Estuary Program's Comprehensive Conservation and Management Plan and the work of other HEP partners and Estuary stakeholders. The release of the Plan and its endorsement by the NY-NJ Harbor Estuary Program's Policy Committee last year has added much needed impetus and focus to our region's ecosystem restoration efforts, serving as the master plan to move habitat restoration forward in our Estuary (see www.thewatersweshare.org). The Plan utilizes eleven target ecosystem characteristics (TECs) —including oyster reefs—that were developed by a team of scientists with the goal of creating “a mosaic of habitats that provide society with new and increased benefits from the estuary

environment.” Oyster reefs are seen as an important part of improving and restoring habitat within the Estuary. The Comprehensive Restoration Plan sets a goal of restoring 500 acres of oyster reef by 2015 and 5,000 acres by 2050.

Over the past decade, the NY-NJ Harbor Estuary Program's Habitat Work Group (recently reorganized as the Restoration Work Group) has played a lead role in coordinating our region's restoration efforts. Recognizing the myriad challenges to restoring oysters to the Estuary, an Oyster Subcommittee was formed under the HEP, which includes organizations that have been involved in oyster gardening, conducted scientific research, or have otherwise promoted oyster restoration efforts. This newly formed subcommittee will provide the perfect venue for the partners to coordinate and discuss the efforts to advance the restoration of oyster reefs within the Estuary. The articles in this newsletter feature a handful of ongoing projects, which are providing crucial information and tools in the quest of bringing oysters back to our waters. All of these activities have helped to cultivate the public's interest in oysters, promoted education and stewardship of the Estuary and developed new scientific insights about the potential for reintroducing oysters. Adding to these earlier efforts, many of these same partners are now collaborating in the Oyster Research Restoration Project, an effort designed to determine the feasibility of achieving the oyster restoration targets of the Comprehensive Restoration Plan.

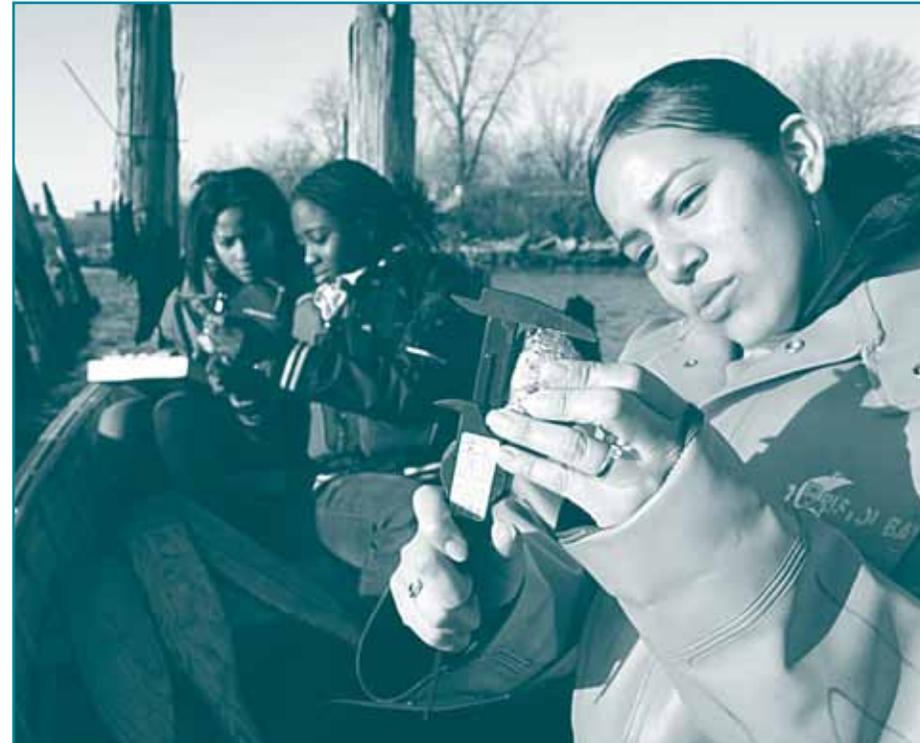
No oyster reefs exist today in our estuary. Achieving the goal of re-establishing sustainable oyster reefs is an exciting yet daunting proposition and numerous technical and policy challenges remain. The projects and experiments highlighted in the articles of this newsletter are the critical first steps towards achieving our goals. The Harbor Estuary Program and all of the associated partners are firmly committed to this vision. ❖



Oyster Gardening in the Hudson-Raritan Estuary

Katie Mosher-Smith

Oyster gardening is the practice of growing oysters inside a net or cage that protects them from predators and keeps them off the bottom, away from smothering silt and sediment. Oyster gardening makes it



Students on the Bronx River measure Rocking the Boat's oysters. Photo by Alex Kudryatsev, Rocking the Boat

easier to obtain big, healthy, mature oysters that can then be “planted” in reefs for restoration purposes. Oyster reefs or beds are large communities of clustered generations of oysters attached to the estuary bottom or to various objects such as rocks, pilings, and shipwrecks. Oysters might be kept in a garden for one or two years—and sometimes much longer—before they are moved to a reef.

In 1999, NY/NJ Baykeeper launched its Oyster Gardening Program with nets suspended in New York City waters. Since then, the program has grown to nearly one hundred ‘oyster gardens’ at over sixty locations in New York and New Jersey. School groups, youth clubs, environmental educators, retirees, and boating clubs make up most of the ranks of Baykeeper’s participants. From the Brooklyn high school students who take the subway to garden alongside the FDR to the retired businessman living along the shores of the Navesink River in Red Bank, NJ all share a common love of the Estuary and take delight in each raising of their net.

Many oyster gardening programs on the east coast share the goals of promoting marine stewardship and conservation. Gardeners spend several hours a month at the water with their nets. Through observation and the hands-on activities of measuring and

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Shellfish Gardening and Restoration in New Jersey

New Jersey Department of Environmental Protection

As per recent New Jersey Department of Environmental Protection (NJDEP) bans, restoration and gardening of shellfish in New Jersey waters using commercially important species like oysters and clams can only be done in approved waters (see NJDEP press release of June 7, 2010 http://www.state.nj.us/dep/newsrel/2010/10_0053.htm). This is to protect public health and the economic value of the state’s nationally significant shellfish industry.

New Jersey has a \$790 million-a-year shellfish industry*, which is number one in the U.S. in shellfish yield and second only to Massachusetts in its economic value. This industry could be severely damaged if oysters from gardening or restoration projects in contaminated waters are illegally harvested and consumed, leading to an illness outbreak. In addition, the state must ensure compliance with U.S. Food and Drug Administration regulations pertaining to protection of public health from consumption of shellfish.

The NJDEP fully supports educational and environmental projects and will be developing new rules that could offer alternatives and give direction to these types of programs on how to undertake such projects in a safe and responsible manner. The department believes that the goals of these programs relative to habitat and ecological improvements, water quality and stewardship of our water resources can be achieved by using non-commercial species such as ribbed mussels.

The new NJDEP shellfish rules will be developed in cooperation with a variety of stakeholders, including volunteer organizations, the New Jersey oyster industry and the FDA.

** Based on 2008 data (the latest available) from the National Marine Fisheries Service, the total landing of all molluscan shellfish (excluding squid) in NJ was slightly over 67 million lbs, with a dockside value of approximately \$130 million. The Department of Agriculture estimates the total value to the economy (including processors, shellfish dealers and distributors, and restaurants) as six times the dockside value. ❖*

EXPERIMENTAL OYSTER REEF DESIGN

Hudson River Foundation
November 20, 2009



Reef Design Elements

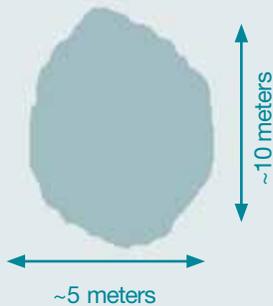
- Veneer Layer:** live oyster spat on shell
- Top Layer:** 5cm mollusk shell
- Base Material:** rock and/or mollusk shell

50 m² areal coverage
Average 20 - 50cm vertical height



Plan View

Irregular shape (from circular to rectangular)



Research and Monitoring Program

Assess reef development

Document timing of important changes such as time of reproduction, significant die-offs and influxes of predators.

- Observations of relative abundances of all potential predators, locations and amounts of sediment accumulation, and occurrence of fouling organisms
- Excavate six haphazardly placed quadrats – identify, count and measure (shell height or length to nearest mm) all live mollusks
- Measure accumulated sediment on the surface of the reef adjacent
- Sacrifice 20 oysters each year at each reef for disease (MSX and Dermo) testing

Assess reef performance (ecosystem services)

Develop quantitative data that describe the ecological value of oyster reefs

- Excavate six haphazardly placed quadrats – identify count and measure the resident flora and fauna
- Sample with some combination of seines, drop nets, and/or gill nets to assess fish utilization
- Sample water flowing over the reef, upstream, and downstream to estimate the short term effect of bivalve feeding on water quality conditions

General environmental monitoring

Develop quantitative data on major environmental variables.

- Near-continuous record of temperature, salinity, dissolved oxygen and chlorophyll
- Measure mid-depth water current speed upstream and downstream of each reef

Illustration: Katie Mosher-Smith

ORRP

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experiments at 7 sites (see map on page 2). The experimental reefs will be approximately 5m x 10 m in size and are designed to mimic natural reefs as much as possible. The chosen reef design to be constructed by the U.S. Army Corps of Engineers provides: (1) a stable base for reef development, (2) surface features that promote spat survival and larval settlement, and (3) live oyster spat-on-shell that can grow and sustain the reef until it becomes self-sustaining through natural recruitment. The reef structure consists of 6 -18 inches of rock material, overlaid by a thin veneer of clam shells, followed by remotely set spat-on-shell (oyster larvae that has been cultured and allowed to settle onto oyster shells). Project partners from the Urban Assembly New York Harbor School in New York and NY/NJ Baykeeper in NJ will grow and remotely set over 300,000 oyster spat for the project.

Data on environmental conditions such as temperature, salinity and dissolved oxygen will be collected to help interpret

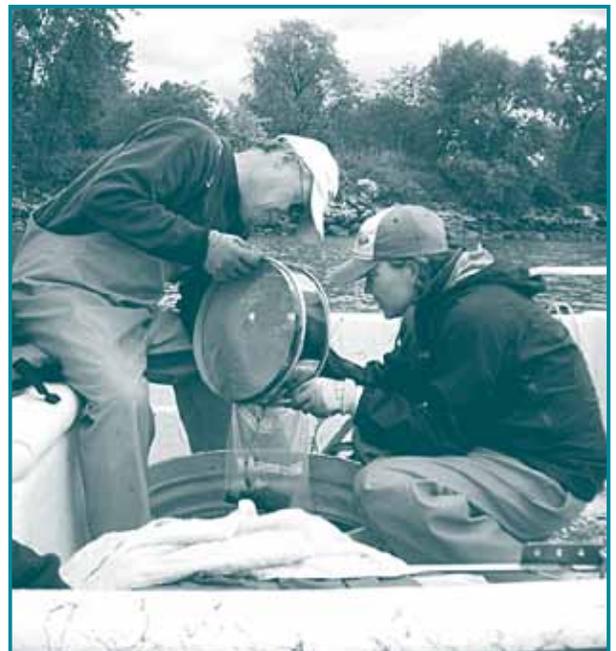
the reef development and reef performance measurements. Because water quality conditions can change dramatically over short time periods, our project will utilize continuous recording sensors at many of the sites.

Assessment of Reef Development

Starting in the fall of 2010 and continuing through the fall of 2012, the project will regularly collect data on oyster survival and growth by counting and measuring several samples from each reef. These data will be used to document the rate

of growth and the timing of important changes such as reproduction, significant

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ORRP Scientists collecting grab samples to characterize existing benthic habitat

Bringing Back the Oyster!

Meredith Comi

Oysters not only represent an important cultural heritage in our region, but are also a vehicle for improving water quality and ecological habitat, which is critical not only to safe enjoyment of the Estuary, but also for the health of the entire ecosystem. It is well accepted that the presence of living oyster reefs within an Estuary can help improve water clarity and quality, provide refuge for a diverse community of marine organisms, provide shoreline stability, provide foraging habitat for shore birds inhabiting adjacent open space, and help to restore submerged sea grasses.

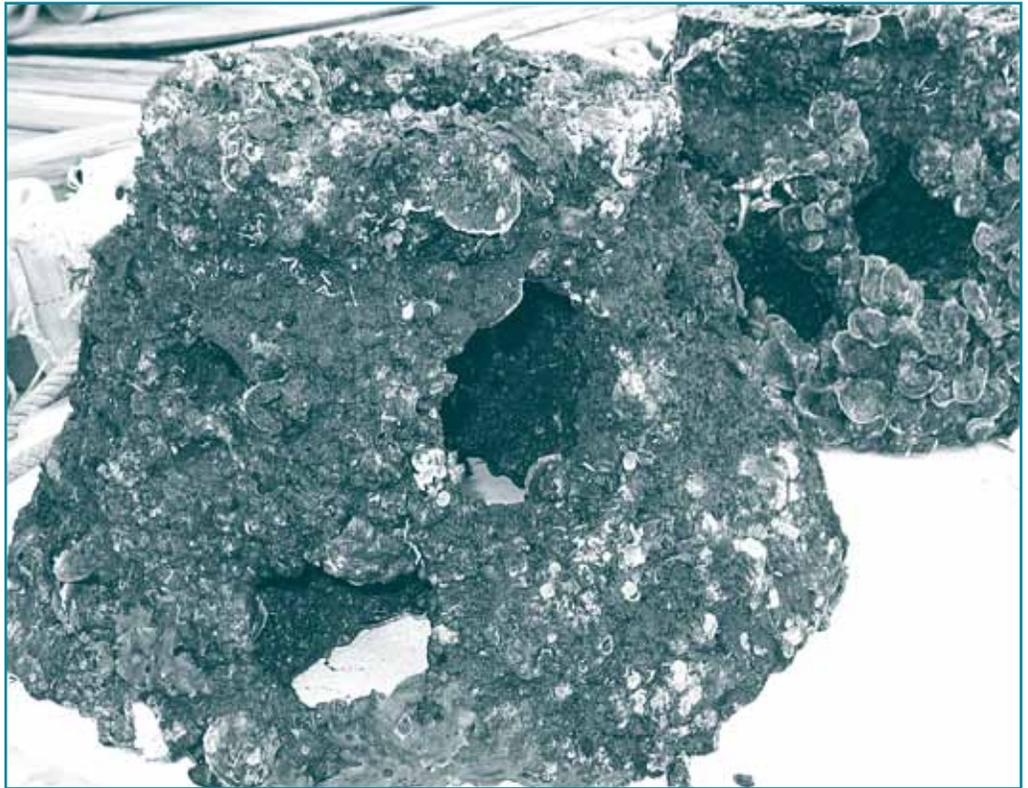
NY/NJ Baykeeper has been working for ten years with a diverse group of partners to restore oysters in our Estuary, focusing on the unique challenges of an urban

environment. Baykeeper's Oyster Restoration Program seeks to identify sites where it may be possible to restore a significant oyster population and habitat type. Baykeeper partners include other non-profits, academic institutions,

watermen, agencies, and various community members.

Baykeeper has conducted several pilot studies establishing small oyster reefs at Liberty Flats, Keyport Harbor

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Reefballs with oysters set on them before deployment at the Keyport site. Photo by NY/NJ Baykeeper

Response to Recent Bans of Shellfish Gardening and Restoration in New Jersey by NJ DEP

Meredith Comi, Oyster Program Director, NY/NJ Baykeeper

Baykeeper has always agreed with the New Jersey Department of Environmental Protection (NJDEP) about the need for controlled and carefully monitored oyster research and education projects that would eliminate the attractive nuisance component and reduce the ease of poaching. To that end, a main criterion when developing the Keyport Reef Project was to establish an experimental design that would be exceedingly difficult to poach. The oysters are always below the waterline, in a non-publically disclosed location, are affixed to a permanent structure and not readily removable if found, and provide would-be poachers with no reward because the oysters are so small as to be inedible. Based on the degree of difficulty to locate and remove the oysters and their sub market size, Baykeeper and partners believe the Keyport project poses no imminent human health danger, and that any conclusion that the oysters do pose a near-term threat to public health is unfounded and likely based on a misunderstanding of the program.

The root cause of human health danger are the elevated fecal coliform levels found in the Raritan Bay and other New Jersey waters as a result of discharges from sewage treatment plants and Combined Sewer Overflows (CSOs). Until these discharges are eliminated, oysters and other shellfish will continue to be unsuitable for consumption. The ban of oyster reef projects hinders progress in achieving key restoration goals for the Estuary and eliminates important education and stewardship opportunities in New Jersey. Furthermore, these bans do not eliminate the risk of poaching other shellfish species that grow naturally in our Estuary. Rather than an outright ban on all oyster research and gardening projects, Baykeeper believes that it is possible to design these projects with enough safeguards (as in the Keyport reef) to virtually eliminate the risk of illegal harvesting and consumption of oysters. This approach would be vastly more beneficial as it would render poaching extremely unlikely while allowing our region to move closer to achieving the numerous benefits of oyster restoration.

Baykeeper urges NJDEP to visit the Keyport research site and is confident that by doing so their public health concerns relating to this project would be allayed. Baykeeper looks forward to dialoguing with the regulatory community to find common ground so controlled and monitored research and education projects can continue in all waters of this Estuary. ❖

die-offs, and influxes of predators. We will also monitor the location and amounts of sediment accumulation, occurrence of fouling organisms (such as barnacles and bryozoans), and other changes relevant to reef development.

Assessment of Reef Performance

Oyster reefs provide three major ecosystem services: 1) habitat for other species, 2) augmented fish production, and 3) water quality improvements. Measuring these ecosystem services is difficult and there are no “standard methods” available. For this reason, the Project (through the Hudson River Foundation) will request proposals from the scientific community to seek innovative, effective and reliable means to assess the ecosystem benefits provided by and affected by the reefs. Responding investigators will have access to all the project’s data, access to the experimental reefs during monitoring events, support from the New York Harbor School’s scientific diving team to conduct additional measurements, and logistical support including access to research boats where needed.

Summary

The Oyster Restoration Research Project will further our understanding of the ability of oysters to survive and grow in the Estuary and will provide new insights into the ecosystem services provided by oyster and oyster reefs. Once completed, we will be able to assess the feasibility of restoring oyster reefs at the targeted scales (500 acres by 2015 and 5,000 acres by 2050). If deemed feasible, we will have gained essential and practical experience to initiate full-scale restoration efforts. ❖

Jim Lodge is a Project Manager with the Hudson River Foundation and is the coordinator of the ORRP project.

Katie Mosher-Smith is the NY Oyster Restoration Program Manager with NY/NJ Baykeeper and is the ORRP field project manager.

in Raritan Bay (in partnership with Rutgers University), Oyster Point in the Navesink River (with American Littoral Society and Restore America’s Estuaries), and in the Hackensack River (with Hackensack Riverkeeper, NJ Meadowlands Commission, and Rutgers University). In addition, a developing study directed by Baykeeper Associate Bart Chezar on Bay Ridge Flats in Brooklyn, has given Baykeeper the opportunity to participate in oyster research in New York waters.

Community-based oyster gardening and aquaculture produce the oysters needed to supply the study sites. Monitoring is conducted in conjunction with academic institutions to ensure reliability. Monitoring of oyster growth and the community development of pilot study sites suggests restoration methods used by Baykeeper can re-create healthy functioning habitats, contributing to the overall health of the Estuary.

Due to historic and/or current human activities and contaminant inputs into this estuary, there are important questions to consider with respect to human and ecosystem health when identifying the ideal location(s) for oyster restoration projects in an urban estuary such as the NY-NJ Harbor Estuary. Although naturally occurring beds of clams and mussels still exist,

On Bay Ridge Flats in New York Harbor, there is an oyster restoration research study that was conceived of and is directed by Bart Chezar of Brooklyn, NY. This project, now in its third year, has shown that oysters will thrive in this part of New York Harbor. This project has been supported by countless volunteers, by the Urban Assembly New York Harbor School, NY/NJ Baykeeper, and by the Hudson River Improvement Fund. ❖

the presence of fecal coliform bacteria from outfalls—especially waste water treatment plants—has led to the closure of these beds to shellfish harvest because of the risk of disease transmission. Regulatory agencies generally do not support oyster restoration activities in closed waters due to human health concerns, greatly reducing restoration opportunities in this region.

In 2001, the NJ Department of Environmental Protection permitted a ¼-acre site in Raritan Bay in Keyport Harbor for Baykeeper oyster restoration work. Raritan Bay is a high-energy system, which means it is impacted by intense waves and winds, especially during the winter storm season. This had a negative impact on the success of this restoration effort. Looking for solutions, a study was done in

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Sample bag of spat on shell before deployment onto the Keyport site. Photo by NY/NJ Baykeeper

Bronx River Pilot Oyster Reef

Victoria Ruzicka and Marit Larson

Soundview Park in the Bronx, NY is a 205 acre park located where the Bronx River opens into the East River. Like many parks located along the shoreline of the NY-NJ Harbor Estuary, Soundview Park was once an expansive salt marsh wetland complex that was filled in during the mid-1900s. Landfilling greatly changed the park's shoreline and the wetland ecosystem, and salt marsh, oyster reefs, and eel grass were replaced with construction rubble, tires, and other miscellaneous debris. While today the park provides valuable recreation opportunities with its sports fields, greenway, and views of the water, many groups and individuals are working to restore some of the original ecosystem features, including oysters.

A study conducted in 2004 helped identify locations for a pilot oyster reef restoration project. It all started when researchers from Lehman College discovered a small population of oysters living attached to the debris along the park shoreline. Prompted by this finding and the desire to reestablish oysters to the Bronx River, the New York City Department of Parks & Recreation's Natural Resources Group (NRG) applied for and received funding

through the Wildlife Conservation Society (WCS)-National Oceanic & Atmospheric Administration (NOAA) Lower Bronx River Partnership. NRG was awarded a grant to assess the feasibility of restoring sustainable oyster populations in the Bronx River Estuary as part of a broader effort to restore the Bronx River watershed.

In 2006, NRG, along with several local community groups, constructed its first pilot oyster reef just offshore of Soundview Park. To expand the study area, a second reef was built in 2007. Both reefs are small in size, about 160 square feet, and composed of surf clam shells. Reefs were monitored yearly by NRG and local community groups to determine if they can be productive and self-sustaining by attracting fish, other aquatic species, and enough oyster spat (young oysters that settle on and attach to the reef) to build up the reef.

The reefs are having a positive impact on the species that inhabit the bottom of the water (the benthic community) off the shore of Soundview Park. Since installation, both reefs have attracted oyster spat and a diversity of fish and benthic invertebrates. As the oysters in the reef matured, the number

and size of oysters increased, indicating continued oyster spat settlement and oyster survival year after year. Monitoring also indicated that the reef was used by a diversity of common reef species such as blue crab, winter flounder, northern pipefish, barnacles, polychaete worms, amphipods, grass shrimp, and Atlantic silversides.

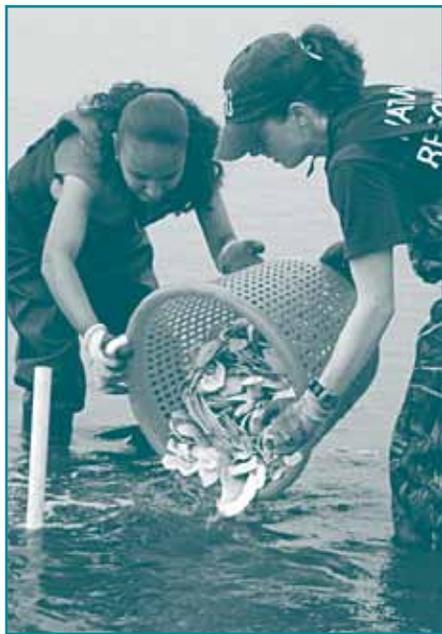
In addition to its environmental benefits, this project has also been a major success in strengthening community partnerships. Community groups assisted at every step in the project, from reef design, construction, and monitoring, to outreach and education. Since 2006, over 100 students, community group members, and volunteers from 11 organizations have spent 2,589 hours working on the project. NRG hopes to expand on this participation in the future.

Although the Bronx River pilot oyster reefs have succeeded in attracting oysters and a variety of other species, and have successfully involved community groups in ecological restoration, data collected in 2009 indicates that the reefs are not sustainable. Both reefs have begun to subside because of accumulating sediments, crushing of clam shells, and low oyster recruitment. The reefs do attract oysters, but the increase in reef height is not enough to offset the subsidence and collapse. In

(continued on page 10)



Students from the community group Rocking the Boat place bags of surf clam shells at a reef site in the Bronx River during reef construction in 2006. Photo by NYCDPR's NRG.



An NRG scientist and a Rocking the Boat student place surf clam shells on top of a reef in the Bronx River during reef construction in 2007. Photo by NYCDPR's NRG.

an attempt to solve this problem, NRG is working with NY/NJ Baykeeper, the Hudson River Foundation, and the other Oyster Restoration Research Project partners (see article on page 12) to install and monitor the performance of an additional reef with a new design that will raise the height of the reefs off the bottom using oyster, clam shell and, potentially, rock. In addition, NRG and partners will apply a top layer of oyster spat-on-shell to both reefs to help jump-start reef growth and attract more oyster spat. With these improvements we hope to increase the long-term sustainability of the structures, so that the reefs can continue to attract oysters and the Bronx community's interest in the health of the Bronx River for years to come. ❖

Victoria Ruzicka was a Project Associate with the NYCDPR's NRG and worked on the WCS/NOAA funded Bronx River Shellfish Habitat Restoration project. She currently is the Natural Areas Manager with the Randall's Island Sports Foundation.

Marit Larson is the Deputy Director of Wetlands and Riparian Restoration at the NYCDPR's NRG. She works on issues relating to the protection, management and restoration of Parks' over 2200 acres of streams, salt marshes and freshwater wetlands

net cleaning, participants become familiar with oysters and other species that inhabit their garden. Gardeners often report the presence of silversides and gobies, eels, mussels, crab, and occasionally seahorses.

Over the course of a year, gardeners develop a familiarity with tidal cycles and seasonal variations in salinity and water temperature. By comparing the growth and survival of oysters in nets from around the estuary, gardeners can study the effects of salinity and depth on oyster growth. Gardeners who visit multiple locations might observe differences between nets placed near soft shorelines, wetlands or open water and nets located near busy marinas, industrial areas or shipping channels.

Countless volunteers help construct nets, tie lines, sort oysters, and teach students each year. In New York City, The Urban Assembly New York Harbor School plays an important role in delivering the program. The NYC Department of Parks and Recreation also plays a valued role providing technical assistance to gardening volunteers in the Bronx, engaging the public through clean water advocacy, and issuing permits to gardens that sit within their park areas.

With the exception of a few oyster gardeners in Shrewsbury, NJ, all of Baykeeper's gardeners work in waterbodies that are classified as 'closed' or 'uncertified', meaning that it is illegal to harvest the oysters for consumption. The NY State Department of Environmental Conservation and the NJ Department of Environmental Protection also determine whether each individual oyster garden will receive a state permit.

Contaminant sources considered in this evaluation include storm water runoff, spills of hazardous material, and persistent contaminants from historical releases. Some locations, including the Kill Van Kull and the Arthur Kill in NY, are restricted from oyster gardening entirely. These persistent shellfish closures highlight the potential benefits of improved water quality in the Estuary.

Many East Coast oyster gardening programs operate in concert with species and habitat restoration efforts. Gardened oysters that have grown past a vulnerable size are planted onto oyster reefs. Strains of fast-growing or disease-resistant oysters can bolster the health of struggling natural populations. Planting gardened oysters allows the community to make a very direct and meaningful contribution to habitat restoration. In New Jersey, gardened oysters are planted on Baykeeper's oyster reefs each year. In New York, we are still working towards establishing a reef for this purpose, but hope to be there soon!

To join the oyster gardening program, email Chrissy Lynn, chrissy@nynjbaykeeper.org, or call NY/NJ Baykeeper at 732-888-9870. ❖

Katie Mosher-Smith coordinated New York's Oyster Gardening Program for several years and is now NY/NJ Baykeeper's Oyster Restoration Program Manager in New York.



Oyster Gardening staff and volunteers sort, count and measure the oysters that will be placed in Oyster Gardens around New York City in July of 2010

partnership with Rutgers University in 2007. The data were used to redesign the Keyport Harbor Pilot Project, which was implemented on the footprint of the previous Keyport Harbor site in summer 2009.

This new experimental design uses innovative and interesting techniques and is the first of its kind in the Estuary. It is hoped this project will provide much needed information about urban systems that can guide future oyster restoration and provide a replicable model for use in high-energy systems. Three structures housing spat-on-shell and oyster seed were placed throughout the site to determine which structure(s) provides the best conditions for oyster growth, survival, new spat settlement, and sediment trapping (accretion). Monitoring results from the 2010 field season will reveal which structure is best adapted to the physical conditions in Raritan Bay.

In response to agency concern, extraordinary steps to address public health have been taken, including enclosing oysters in structures that make it difficult to poach and keeping all reef structures subtidal (so they remain under water at all times and are not easily visible). Before deployment, oysters were secured through the use of different structures: rebar (reinforcing steel rods), mesh bags, and reef balls (concrete structures that attract a variety of sea life). The structures will not only help keep the oysters in place, but will also assist in mitigating the wave energy that dispersed the original Keyport Reef pilot study.

The implementation of the Keyport Harbor Pilot Project is the result of years of hard work by Baykeeper staff, partners, supporters, funders, and the community and is a testament to a shared desire for clean water. ❖

Meredith Comi directs NY/NJ Baykeeper's Oyster Restoration Program. She manages a small New Jersey aquaculture facility and supervises an assistant, a field technician, and a NY project coordinator as well as a team of volunteers, watermen, and academic partners. She manages reef building and reef monitoring activities, as well as the successful oyster gardening program.

Our results bring new hope for restoring oysters to Jamaica Bay. Of course, for the foreseeable future we cannot expect to eat these oysters. So what is the value of restoring them? Oysters can remove substantial amounts of algae from the water, especially in shallow areas. These algae are the food that fuels the growth of oysters living in reefs, which would attract many species of marine invertebrates and fishes. Oysters also enhance nitrogen cycling in estuaries, which indirectly can improve water quality.

This of course raises a troubling question: If oysters grow so well in Jamaica Bay, why are they hard to find? Is there a missing factor that just kills them at some stage of their life cycle? So far, we do know from our experiments last summer that oyster larvae are likely absent from the bay. This past summer, we got no recruitment of newly settled juveniles to shells suspended in 5 localities the bay. There may be other impediments to larval survival that we don't understand.

To sustain oyster populations in the bay we need oysters to grow,

reproduce and have larvae that are retained in the bay, rather than being washed out to sea during the 3-week larval swimming stage. We also need to know if predators and disease will be a major impediment to restoration. Our next steps involve collaborations with a number of partners, including the



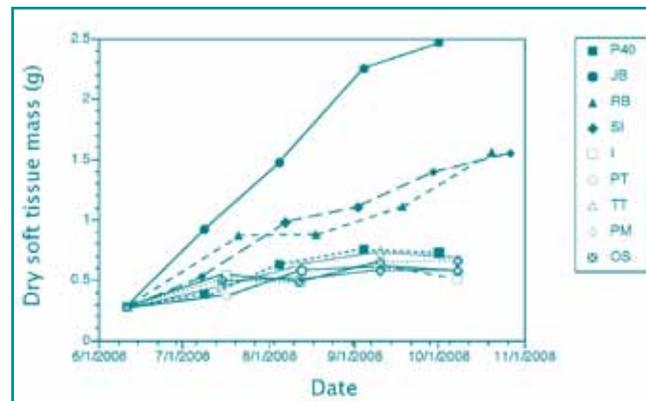
Adam Starke (left) and Dan Mundy Jr. (right) placing cages in Jamaica Bay to study oyster larval settlement.

Hudson River Foundation, HydroQual, Inc., the National Parks Service, and researchers working in conjunction with the New York City Department of Environmental Protection. We are also very lucky to have a number of intelligent citizen observers and activists, who are pushing the cleanup of the Bay forward. In particular, we would like to thank and acknowledge the incredible efforts and support of Dan Mundy Sr. and Jr. of the Jamaica Bay Ecowatchers, and Don Riepe of the American Littoral Society. We also want to thank William and Jerry Scanlon for their invaluable

hospitality over the past 2 years that has helped make our work possible. ❖

Jeffrey Levinton is Distinguished Professor of Ecology and Evolution, Stony Brook University.

Michael Doall is a marine biologist researcher, working in the Department of Ecology and Evolution, Stony Brook University.



Growth through the summer and fall of oyster soft tissue of mature oysters placed in nine localities in the New York-New Jersey region in June 2008. (P40: Pier 40, Lower Manhattan; JB: Broad Channel, Jamaica Bay; RB: western Raritan Bay; SI: Shelter Island; I: Irvington, Tappan Zee; PT: Piermont, Tappan Zee, west side of Hudson; TT: Tarrytown; PM: Philipse Manor; OS: Ossining, Haverstraw Bay.)

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An Oyster Grows in Queens: Can We Bring Them Back?

Jeffrey Levinton and Michael Doall

Last November we received a phone call that would be positively boring most anywhere else along our eastern coastline. A family living at waterside in Jamaica Bay, in Broad Channel, Queens, had found a live oyster that settled in their bait-holding tank. This was amazing, since we had not seen a live oyster in most parts of Jamaica Bay for years. We rushed to the dock, and found a lovely oyster that had managed to escape notice of several dozen green crabs that shared the tank! This lonely oyster may have developed from a swimming larva from a nearby experiment of ours, since it had the characteristic stripe of oysters from a hatchery.

This find is significant in the context of the near disappearance of oysters from our Estuary, discussed in the Introduction to this issue. Four sewage treatment plants, channelization, soft muddy black sediments, and other environmental insults now stand in the way of the oysters returning to Jamaica Bay and other areas of the Estuary.

Or do they? We embarked on a study to compare oyster survival and growth in Jamaica Bay and 8 other sites, ranging from Haverstraw Bay in the Lower Hudson to Raritan Bay, NJ

to the pristine waters of Shelter Island on the east end of Long Island. Would transplanted oysters survive and grow in Jamaica Bay, even though we had only found one lonely oyster? The velvet green color of the water (from algae fueled by a barrage of treated and untreated wastewater discharges) was not encouraging, nor was a feeling

that dissolved oxygen might be a real problem, as the algae grew and decomposed.

The results were, to say the least, startling. We placed juvenile and sexually mature oysters in floating cages and found that they survived well and grew faster than anywhere in the region, including lovely Shelter Island and impacted western Raritan Bay. Both juveniles and mature oysters grew well, and the mature oysters appeared to spawn vigorously through July and August, which may have given us our newfound oyster on the dock in late fall.

(continued on page 11)



Jeff Levinton (left) explaining oyster restoration in Jamaica Bay to Congressman Anthony Weiner.