

Gauging Social and Economic Benefits of Oyster Gardening Restoration in Delaware Inland Bays USA



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YSI Multiparameter Handheld, DE Application Note A604

Coastal areas are home to a wealth of natural and economic resources and are frequently the most developed areas. This narrow fringe, comprising 17 percent of the contiguous U.S. land area, is home to more than half of the nation's population (NOS, 2011). Considering these numbers, it is crucial that consideration is given to human impact on the coastal ecosystems as well as efforts to improve these same watersheds. Environmental problems include high levels of nitrogen and phosphorus. Two major areas of concern have been identified as critical issues for Delaware's Inland Bays – eutrophication and habitat loss (EPA, 2011). To this end, for the past nine years, oyster gardening continues to be a part of the restoration of the Inland Bays in Delaware. Around the 32 square miles of surface area of the Inland Bays (Martin 1996), 200 volunteers living in the local communities surrounding the watershed place floating baskets of oysters at the ends of their docks to allow the filter-feeders a safe haven to grow from small, young spat into thriving adult oysters. Among scholars, there is a general consensus that the current rates of resource depletion and environmental degradation cannot be sustained over a long period of time (Thanawala, 2001). These gardeners' actions are important in their ability to offer this habitat essential revitalization.



Taylor floats tied to the end of volunteer's docks hold small 0.25 inch spat attached to old oyster shells offer a better chance of survival.

Oyster Gardening

Oyster gardening is the nursery culture of small, hatchery-produced oysters, called seed or spat to a larger juvenile size. This larger size is preferred for stocking artificial oyster reefs and for other shellfish restoration projects. In addition, larger oysters generally have better predator survival rates. The Delaware Oyster Gardening Program, initiated during the summer of 2003, is a cooperative effort among the Delaware Center for the Inland Bays (CIB), the Delaware Sea Grant Marine Advisory Program, Delaware State University (joined in 2005) and citizen volunteers living along the waterfront on one of Delaware's three coastal or Inland Bays: Rehoboth, Indian River and the Little Assawoman. Volunteer gardeners support the program by caring for small 0.25 inch spat attached to old oyster shells by holding them in baskets tied to their docks called Taylor floats. The

gardeners keep the oyster spat clean and protected from predators. Oysters held off the bottom have better conditions for growth - increased water flow and greater access to particulate food - so they reach a planting size of 1-2 inches much more rapidly than oysters on the bottom (Ewart, 2008).

These oyster gardeners are participating in small-scale aquaculture. Most aquaculture is for the consumption of the livestock. However, in this case, the oysters are being grown for re-entry back into the ecosystem, by being placed in strategic locations throughout the Delaware Inland Bays. In this way, the oyster populations of the Inland Bays are being restored in a small yet crucial way.

Citizen Monitoring

Also included in the community, are a dedicated group of volunteers who keep records of the local water quality, by participating in the Citizen Monitoring Program. Since 1991, the group of Citizen Monitoring volunteers have been taking



The Delaware Bay is comprised of 782 square miles (2,030 km²).

water sample data in Delaware Inland Bays with the volunteer oyster gardeners who have committed to daily monitoring of the water quality since 2007 using handheld YSI multiparameter instrument, to measure a broad range of important water quality characteristics. The data Citizen Monitoring volunteers have gathered

provides scientists and resource managers with a clearer picture of the estuary's health and the trend information needed to understand and manage the ecosystem (UDEL, 2011). Data gathered by the volunteer oyster gardeners

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have provided important baseline information for the student projects and selection of ideal locations for oyster gardening. Popular YSI multiparameter handhelds include the YSI Model 556 and YSI Model Professional Plus for water quality monitoring.

Volunteerism

The volunteers who participate in the monitoring of water quality and oyster aquaculture have noticed an increased awareness to protect the water and its biota. They have also gained an appreciation for the Eastern oyster species, *Crassostrea virginica*, and the efforts of its restoration. The data obtained from the gardeners can then be used in research to determine the best location to place the oysters for continued growth after their two seasons in the Taylor floats.



A volunteer uses the YSI 556 multiparameter instrument to measure several water quality parameters at once off the docks.

Information Gathering

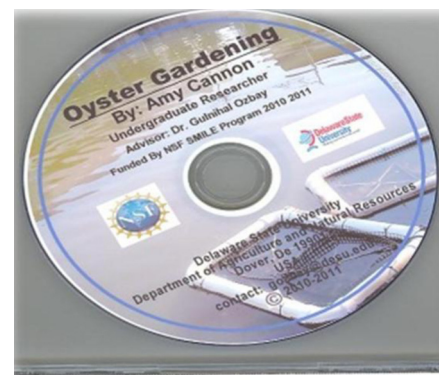
Oyster culture has a potential to lessen pressure on natural overexploited populations and to generate income for coastal communities (Buitrago, 2005). This current study was performed to show the social and economic benefits of oyster gardening in their local habitats in relation to watershed improvements. Oyster gardeners were surveyed by Delaware State University undergraduate research assistant, Amy Cannon, as part of the information gathering. An email was sent to all gardeners with an online link to reply to the survey.

The lead oyster gardeners, along with two members of the partnering organizations, Mr. John Ewart, Delaware Sea Grant Program and Mr. EJ Chalabala, Center for Inland Bays and the Project Director at Delaware State University, Dr. Gulnihal Ozbay were all interviewed. A professional

educational video was created and includes footage from these interviews, informative details of oyster gardening and factors of sampling methods presently employed.

Interviewees were asked for perspectives on familiarity within the local community on the growing of oysters. They also looked for responses concerning adjustments in actions of people in regards to renewing shellfish populations.

Oyster gardeners almost unanimously agreed that the float they have at their docks has generated more awareness for the project in the community. When asked for estimated information about the number of people who are now aware of the project simply by asking about the float, it was determined that approximately 4 in every 110 people were not aware of the restoration project. Due to conversations with oyster gardeners, 21,200 new people are now aware of the project. Overwhelming majorities of people interviewed enjoy oyster gardening and are also proud to be a part of the Delaware Inland Bays watershed community.



The average amount of years spent oyster gardening by survey is 4.1 yrs \pm 1.9. Also, 97% of gardeners will grow oysters again next year. Upon asking about new wildlife being seen in the water near their docks since they started gardening, 69.7% of people said they have noticed more wildlife. The average number of new creatures is 4.1 \pm 2.9.

The average number of hours per week spent gardening is 10.5 \pm 14.7. A large majority showed 1.5 hours per week for each Taylor float they keep at their docks.

Key Benefits

When asked about the benefits to people who are fishing for fish or bait for recreational experience, 91.7% of the respondents said yes, they think the project will be a benefit to these folks. This showed how various forms of life that accumulate and thrive near oysters are potential upswings

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to local fishing. As a final synopsis, participants were asked what actions they take now that they did not take before as a result of their participation in the project, the top five answers given were:

- #5 Pay more attention to the various forms of aquatic life and wildlife near surrounding water
- #4 No longer use fertilizers or pesticides on their lawns
- #3 Restoration project has generated a forum for people to discuss the health of the water systems
- #2 Keep excess lawn clippings and tree branches away from water's edge
- #1 Much more aware and careful with local community watersheds

Far Reaching Impacts

In a journal article from Environmental Management, it is said that wetland conservation is an impossible task without promoting the sustainable management of the ecosystems neighboring wetlands. A cardinal issue to this effect is wise use of fertilizers (Tsiouris, 2002). Fertilizer applications, pet waste, and concentration of wildlife activity in residential areas are cited as potential sources of the chlorophyll eutrophication, high levels of bacterial contamination, and presence of antibiotic resistance documented (DeLorenzo, 2011). It has been shown that bivalve suspension feeders serve an important biogeochemical role in coastal ecosystems because N and P from the water column are transferred to the sediments in their biodeposits (Newell, 2005). From this information, it can be determined that the oyster gardeners are taking steps that will lead to improvement with the quality of the local water via observation and quantitatively with the YSI multiparameter instruments over the years.

In a 2002 study, it was shown that mat forming organisms such as algae, but also including sea grasses, diatoms, bivalves, such as oysters, and reef forming organisms, are an intermediate community at the SWI (sediment-water interface) affecting the stability of communities both above and below it (Austen, 2002). When asked about noticing more creatures in the water around their dock since they started gardening, a large majority showed that they had noticed an increase. This information shows that the addition in the number of creatures as an illustration of how the oysters are creating a vast ecosystem brimming with aquatic life. As for economic benefits, the upswings

for local fishing made possible by this project can help to grow an even stronger business in the area, as sport fishing currently generates \$110 million in economic output in the Delaware Inland Bays (Martin, 1996).

The number of oyster gardeners currently involved each have about 200 oysters at their docks. Considering this number, and the fact that each oyster filters approximately 50 gallons of water per day (Paddock, 2010), the oysters currently involved in the program filter about 2 million gallons of water per day in the Inland Bays. The Delaware Inland Bays has a surface area of 32 square miles, with an average depth of 4 feet (Martin et al., 1996). This makes for a total volume of 26.7 billion gallons. In order to filter the volume of water in the Inland Bays once daily, would take at least 533.83 million more oysters. There are currently about 40,000 oysters involved in the Delaware with the Restoration Project. The Restoration Project is a great step forward but large-scale oyster aquaculture will be needed to generate a much larger impact.

Based on discussions with the oyster gardeners, the years spent on this project show the intrinsic value of the actions being taken in the Delaware Bays. Many of these people, volunteers all of them, have spent their lives dedicated to other careers and now choose a commitment to this project. Based on the information gathered, future generations will reap the benefits from this effort in the Delaware.

For information on social survey and oyster habitat assessment, contact Dr. Gulnihal Ozbay at: gozbay@desu.edu

For interest in oyster gardening participation, contact the Delaware Center for the Inland Bays at: www.inlandbays.org.

For information on the Delaware Sea Grant Marina Advisory Program, visit their website at: www.deseagrant.org/outreach.

For information on Citizen Monitoring Program, visit their website at: www.citizen-monitoring.udel.edu.

For information including YSI instrument specifications, visit: www.ysi.com or www.ysi.com/proplus

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