USA: Massachusetts: Boston Harbor Eelgrass Restoration

Overview

An eelgrass restoration program implemented by the Massachusetts Division of Marine Fisheries is underway in Boston Harbor as a partial mitigation for assumed impacts to marine resources resulting from the HubLine gas pipeline construction which transits the Harbor. The restoration is intended to provide important shallow-water eelgrass habitat to juvenile crustaceans, shellfish, and finfish which commonly inhabit sea grass meadows. Water quality improvements from the secondary treatment and redirection of treated sewage outfalls to an offshore site have resulted in a measurable reversal of environmental degradation within the Harbor. These conditions decrease nutrient loading, particularly nitrogen levels, and thus decrease epiphytic growth and algal blooms, which shade out newly developing eelgrass shoots. Therefore the Boston Harbor environment, with its improved water quality, is a prime candidate for eelgrass restoration. Under the auspices of this project, transplanting and seeding activities were conducted at several sites around the harbor.

Project Details

Lead Entity:

Massachusetts Division of Marine Fisheries

Lead entity types:

- Subnational Government

Adaptive management

Describe adaptive management processes and mid-course corrections taken to address unforeseen challenges and improve outcomes in each of the following categories:

Other:

Shoots were planted successfully by hand and also with PVC/jute frames to which shoots had been tied. However, the jute attracted macroalgae over the winter. The frames were removed in early spring along with as much algae as possible from the plots. The growth at these plots was subsequently comparable to hand-planted plots and consequently, hand planting has become the mainstay of transplant operations. That being said, frame planting does provide opportunities for valuable community outreach and involvement, as shore-side volunteers (i.e. non-divers) can participate in and learn about the project.

State of Progress:

- Closed/completed, no further follow-up

Project Start:

2004-06-05

Project End:

2007-12-05

Total budgeted expenses:

- USD 500,000-1 million

Global Regions:

- Northern America
- Americas
- World

Countries:

- United States of America

Ecosystem Functional Groups / Biomes:

- Brackish tidal biome

Ecosystems:

- Coastal saltmarshes and reedbeds

Extent of project:

- Other

Extent of restoration:

- Other

Degradations:

- Other industrial and urban development

Description:

Loss of eelgrass habitat due to anthropogenic impacts on the Massachusetts coastal marine ecosystem has been extensive. Coastal development, severe organic loading, and siltation in many areas of the inner and outer Harbor have resulted in loss of eelgrass meadows.

Planning and Review

Goals and Objectives

Was a baseline assessment conducted:

UNSURE

Was a reference model used:

UNSURE

were_goals_identified:

YES

Goals and objectives:

- Other

Goals Description::

This project is intended to restore eelgrass habitat to Boston Harbor in order to improve the abundance of juvenile marine resources and larger forage species.

Stakeholder Engagement

Were Stakeholders engaged?:

unsure

Description of Stakeholder Involvement:

The Eelgrass Restoration Project has worked closely with many local agencies and federal entities in the implementation of this restoration effort. The Town Conservation Commissions, the Army Corps of Engineers, the Massachusetts Historical Commission, and the Board of Underwater Archaeological Resources were all involved in the permitting process. Project coordinators have also conducted public outreach initiatives in order to stimulate interest in the project and secure the volunteer assistance upon which it relies. Participation and support has been drawn from such diverse groups as the National Park Service, the New England Aquarium, several Boston area high schools, Earthwatch Institute, and members of the local business community. This volunteer participation, along with educational programs developed for community activities, ensures that the project will enhance public awareness of important local issues and promote stewardship into the future.

Ecosystem Activities and Approaches

General Activities: The task of selecting potential transplant areas in Boston Harbor involved the collation and evaluation of available Boston area environmental data and the augmentation of these data with in situ environmental monitoring. Each of the four existing eelgrass beds in Boston Harbor was examined for depth, salinity, water temperature, light attenuation, and sediment type. The potential project sites were then

visited and evaluated for their suitability. Sites deemed appropriate for transplanting were then planted with test plots. Test transplants were accomplished by first harvesting eelgrass shoots from donor sites in Revere and Nahant, north of the harbor. Wire mesh "cages"□ called TERFsâ„¢ (24"□ square) were used to plant shoots. Twenty-five pairs of shoots were tied to each TERFâ„¢, and four TERFsâ„¢ were deployed in a square pattern at each of the twelve sites. These sites were monitored and evaluated for survival rates. In addition, shoot density counts were taken along transects in harvested beds off Revere and Nahant, and in unharvested control sites in order to ensure that harvesting was not negatively impacting the existing beds. The twelve test transplant sites were monitored for survival and general health, and the four best sites were selected for further planting. The chosen sites are off of Long Island and Peddocks Island, and in Lower Neck Cove in Weymouth. In 2005, a total of about 21,000 shoots were planted with the help of volunteers from around the community. A new planting technique was also developed using a lighter, modified version of the TERFâ„¢. In lieu of wiremesh, our modified TERFâ„¢ is a 1/4 m square, 3/4 " PVC pipe frame holding stretched jute (landscape) mesh to which shoots are tied. The PVC frames are anchored to the bottom with 10"□ spikes driven through holes drilled in the corners. Upon deployment and rooting of attached shoots, the jute can be easily cut from the inside of the frame, leaving it to biodegrade while the frames are retrieved for reuse. We used only PVC frames at the Weymouth site, where hand planting would reduce visibility by stirring up soft sediment. Hand planting was also used exclusively at Peddocks Island, where gravel prevents frames from lying flat against the bottom. Both methods were used at Long Island where the sediment is sandy. A checkerboard pattern of transplanting was used at the Peddocks and Long Island sites, whereby we alternated 18 planted 1/4 m2 quadrats with 18 unplanted quadrats. This pattern, adapted from a restoration technique used by Save the Bay, Rhode Island, is designed to cover more ground than continuous planting of shoots, while providing voids for eelgrass to fill naturally. The Long Island site contains 8 of these grids, 4 each along two 150 m transects, bounding approximately one acre. The Peddocks site contains 4 grids, and encompasses a little under half an acre. At all of these sites, additional plots were added in 2006. Two additional sites, one off of Long Island and the one off of Peddocks Island, were also added in 2006, and another additional site will be added off of Peddocks Island later this year.

Categories of ecosystem restoration activities and approaches utilized:

- Ecological restoration

Specific type of rehabilitation and/or restoration approach implemented:

- Assisted natural recovery with planting, seeding, or faunal introductions (e.g. enrichment planting or seeding; farmer assisted natural regeneration; rewilding)

Project Outcomes

Eliminate existing threats to the ecosystem: The Long and Peddocks Island sites looked very healthy with vigorous new growth following the winter of 2005. However, the Weymouth bed gradually deteriorated and was eliminated from future plantings. Shoots there appear unhealthy, and it is possibly the result of unsuitable sediment and light attenuation caused by silt resuspension. By July 2006, the checkerboard planting pattern at the Peddocks site had filled in to the point where it was no longer possible to distinguish the original squares. Biological monitoring was conducted to determine whether our transplanted beds provided similar habitat value to naturally occurring beds. Several indices were used to compare areas transplanted in 2005 and 2006 with a nearby unvegetated Control site, an existing but declining bed in Boston Harbor (Hull), and a healthy existing bed off Nahant. Benthic infauna have not yet been analyzed, but, based on all other measures, our 2005 transplanted beds compared favorably to the Hull bed, and exceeded even the Nahant bed in epifaunal and demersal species richness. As one may expect, 2006 transplant sites have not yet achieved the habitat value of a natural bed based on these indices. However, eelgrass beds planted to date have exhibited significant growth and sufficient density to attract a number of organisms. Among faunal sightings are spider crabs (Libinia emarginata), grubbies (Myxocephalus aeneus), rock crabs (Cancer irroratus), Jonah crabs (Cancer borealis), juvenile winter flounders (Pseudopleuronectes americanus), cunner (Tautogolabrus adspersus), lumpfish, lobsters, pipefish, green crabs, hermit crabs, and small invertebrates such as mysid shrimp. Seeds planted during the fall of 2005 at the Southwest Long Island (LIS) and Southeast Peddocks sites had a low initial germination rate (<1%) when first checked in the spring of 2006. However, further germination and spreading continued through the spring, and have generated extensive eelgrass beds. The bed at LI S in particular is thriving, and covers over 175 square meters, a far larger area than our shoot-transplanted plots. In addition, the plots we planted with shoots in fall 2005 produced seed shoots by summer 2006, which will help to expand those beds. The entire area between planted plots at LIS is now dotted with tufts of eelgrass shoots that have apparently been seeded from last year's transplants. The seed bed at LIS now covers 3100 m2, about 500 m2 of which is quite dense. Shoot density and areal coverage at the plots transplanted in 2006 have increased between 200 and 300%. Factors limiting recovery of the ecosystem: Initially, project practitioners had hoped to nurture a transplant site along the mainland. At this point, however, the Boston Harbor mainland perimeter has been largely eliminated due to its poor potential for supporting eelgrass. This is primarily due to the presence of black, anoxic sediment and/or fine-grained silty sediment, which likely resulted from extensive pre-outfall organic loading. In general, the sediment surrounding some of the islands is more promising for eelgrass transplantation.

Monitoring and Data Sharing

Does the project have a defined monitoring plan?:

NO

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Long Term Management

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