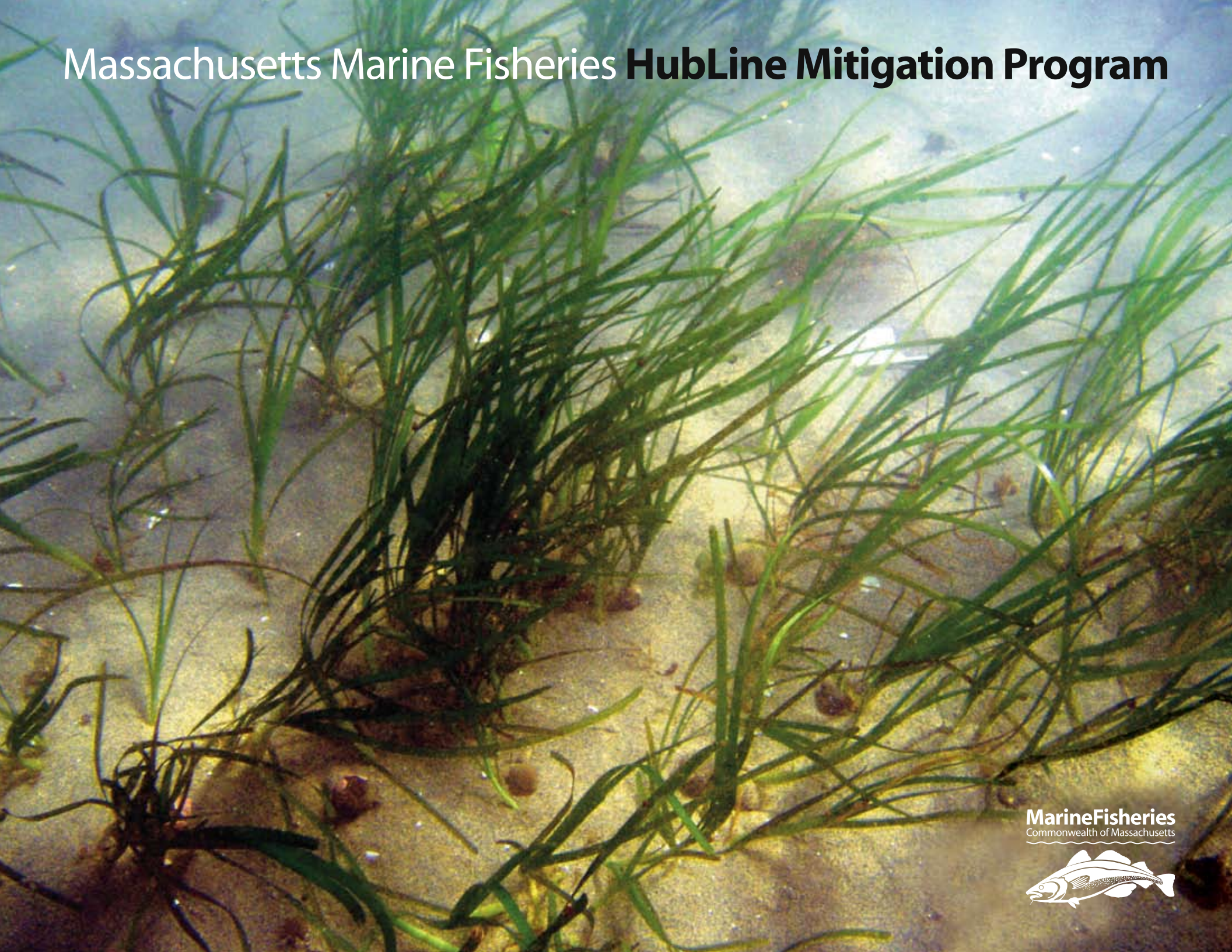
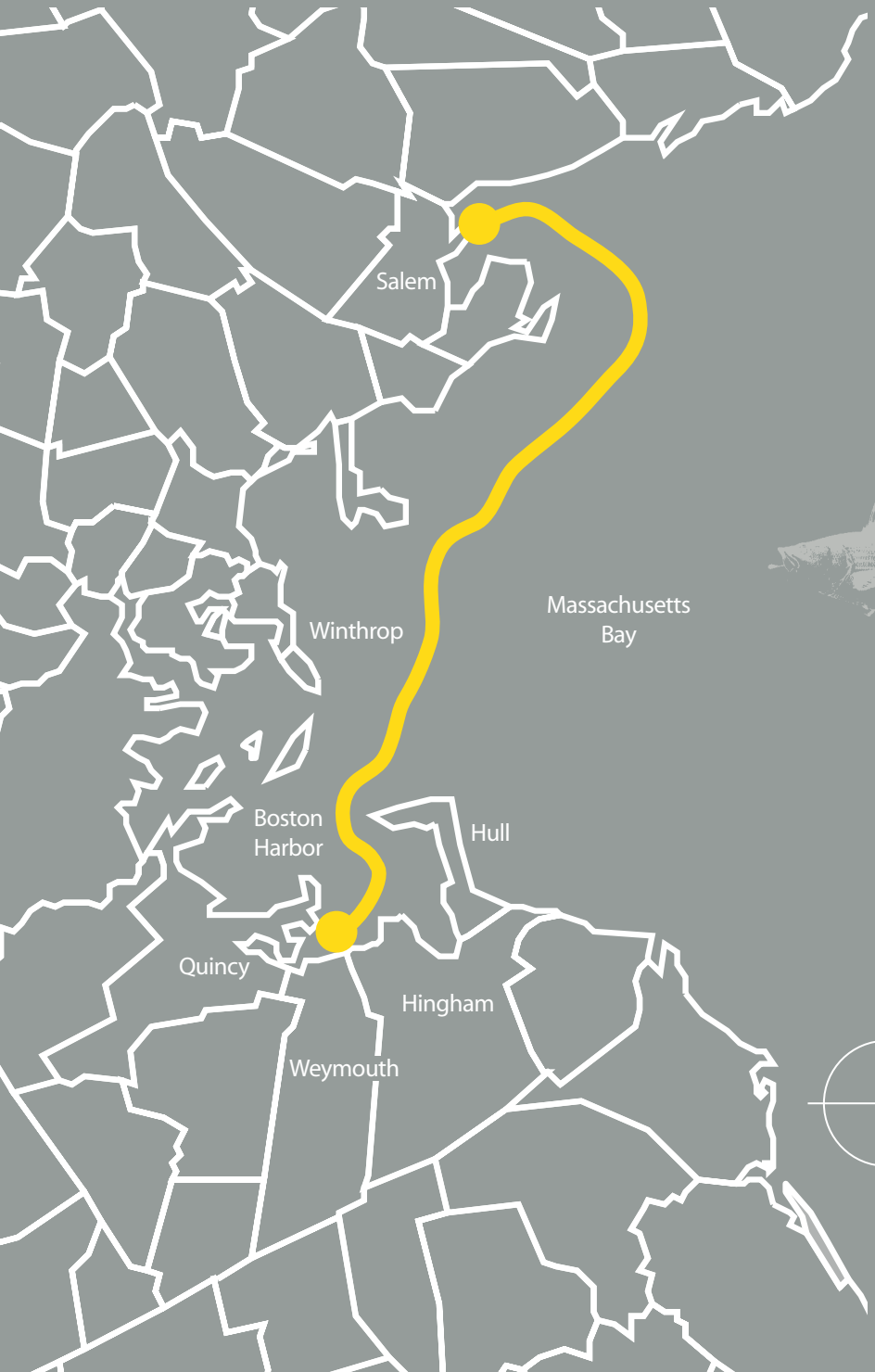
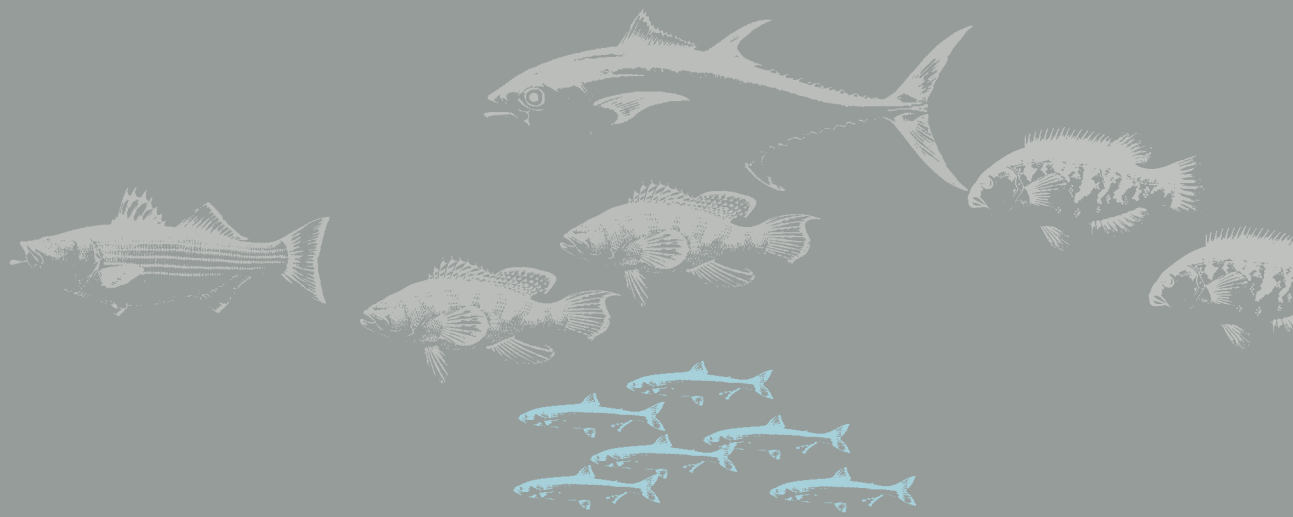
Massachusetts Marine Fisheries **HubLine Mitigation Program**



MarineFisheries
Commonwealth of Massachusetts

HubLine Pipeline





Program Overview

29.4 Mile Long Pipeline
During 2002-2003, a natural gas pipeline was constructed by Algonquin Gas Transmission Company across Massachusetts Bay. This 29.4 mile long, 24" to 30" diameter pipe, known as the HubLine, runs from Salem/Beverly to Weymouth and in most areas is buried at a minimum depth of 3 ft. Horizontal directional drilling, conventional dredging, jetting, plowing, and blasting were all part of the construction process and collectively, they were assumed to have exerted an impact on the marine environment and living resources. Pipeline construction which occurred outside of recommended time-of-year work windows, resulted in compensation to the Commonwealth of Massachusetts by Algonquin Gas Transmission Company for mitigation to damages to marine resources and habitat.

Comprehensive Effort
This program is the first, large-scale, comprehensive effort by the Massachusetts Division of Marine Fisheries (*MarineFisheries*) to assess and mitigate for impacts from a major marine construction project in Massachusetts coastal waters.

Response to Assumed Impacts
The Massachusetts Division of Marine Fisheries conducted monitoring, impact assessment, and mitigation activities during 2003-2008 in response to assumed impacts from pipeline construction.

Work Conducted in Four Areas
Mitigation work was conducted in four areas: eelgrass restoration, habitat enhancement, anadromous fish restoration, and shellfish propagation.

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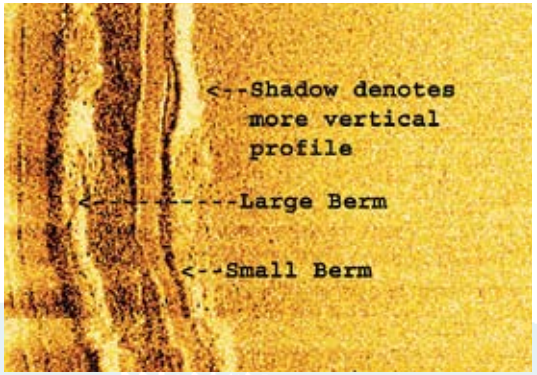

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1. Pipeline construction and deployment
2. Unburied pipe on bottom
3. Sonar image of back-filled pipeline trench defined by elevated berms
4. Diver transplanting eelgrass
5. Shad fry stocking in the Charles River

Eelgrass Restoration

The primary goal of the Eelgrass Restoration Project was to re-establish eelgrass in Boston Harbor as partial mitigation for the HubLine pipeline construction. Eelgrass habitat provides shelter, food, and has the potential to positively affect abundance of a number of finfish and invertebrate species.

Site Selection
Extensive site selection work was conducted to identify areas suitable for eelgrass growth.

Planting
Planting was conducted using a combination of hand- and frame-planting, and seed dispersal; by late 2007, total areal coverage was 5 acres.

Outreach
Outreach was an integral part of our eelgrass restoration effort. We provided a "hands-on" educational experience for members of the community and promoted stewardship of this valuable resource…155 volunteer shore helpers and divers donated a total of 428 hours during our restoration activities.

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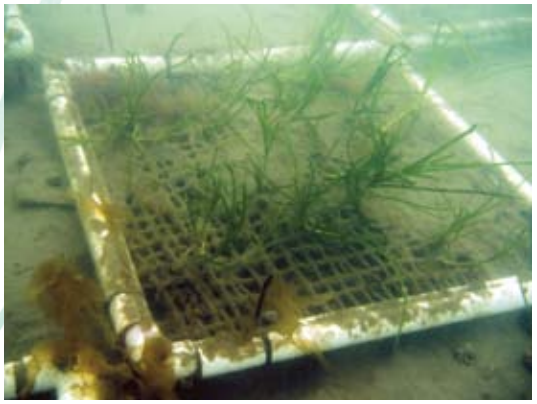

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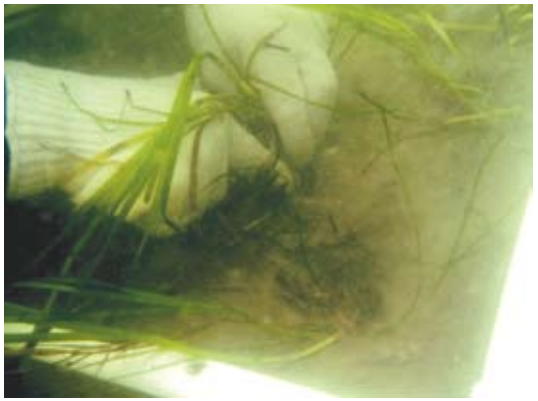

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1. Sediment core analysis
2. Jute planting frame to which eelgrass shoots were tied
3. Hand planting
4. Eelgrass seeds were harvested from flowering shoots and planted
5. Volunteers tying eelgrass to planting frames
6. Volunteer diver deploying a wire mesh planting frame

Habitat Enhancement

In March-April, 2006, *MarineFisheries* constructed a six unit cobble-boulder reef off Boston Harbor in order to provide partial mitigation for the assumed impacts to biological resources and habitat from HubLine construction. This Project enhanced complex substrate in Massachusetts Bay, thereby providing niches for multiple life stages of numerous finfish and invertebrate species. A simple site selection model used seven systematic steps and allowed us to select an optimal location for the reef.

Long-term Monitoring
An intensive, long-term monitoring program was implemented to measure ecological variation on the artificial reef relative to a nearby natural reef and a cobble fill point on the HubLine.

Providing a Habitat
Although the monitoring program is on-going, 2 years after construction, the cobble and boulder artificial reef did provide habitat for the hard-bottom encrusting community, larval settlement occurred in similar densities to adjacent comparison sites, and the abundance of cunner was higher on the artificial reef than the natural reef.

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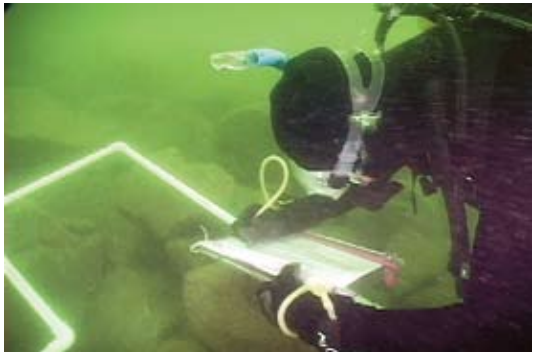

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1. Diver assessing algae and coverage of encrusting invertebrates on reef
2. Larval collectors
3. Fish trapping
4. Some reef occupants

Anadromous Fish Restoration

The objective of the Anadromous Fish Passage Enhancement Project was to enhance and increase spawning habitat for alosid fishes (alewives, *Alosa pseudoharengus*; blueback herring, *Alosa aestivalis*; American shad, *Alosa sapidissima*).

Project Completions

MarineFisheries selected and completed 20 projects in 13 river systems in the HubLine-impacted region of Massachusetts Bay that (a) ranged from minor to major fishway improvements, (b) created new passage for anadromous fish, (c) evaluated the feasibility for restoring anadromous fish populations, (d) restored or enhanced spawning habitat, and (e) developed innovative technology for assessing river herring passage and run size.

Reliable Population Estimates

To improve population assessment of river herring, *MarineFisheries* funded the University of Massachusetts-Amherst to develop technology for an accurate automated digital video system that will count migrating river herring and produce scientifically reliable population estimates. Work on this counting technique is on-going and will continue to be improved and refined.

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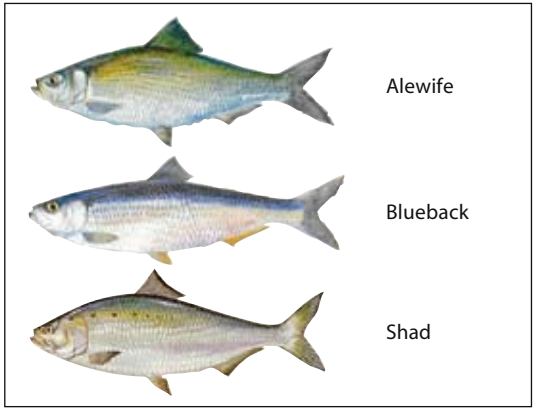

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1. Alosid fishes
2. Successive fish images obtained through video monitoring at set-up in Monument River in Bourne (Mather, MaCFWU, UMASS. Amherst)
3. Video monitoring set-up in Monument River in Bourne (Mather, MaCFWU, UMASS. Amherst)
4. Notching of the Bleachery Dam, Charles River, to allow fish passage

Smelt Restoration

Restoring Smelt Populations
MarineFisheries worked to restore rainbow smelt (Osmerus mordax) populations in several river systems in the Massachusetts Bay area. GOALS: develop smelt culture techniques, achieve high survival of smelt eggs in a hatchery incubation setting, develop otolith marking protocols, and verify restoration success following stocking in a control river.

Fyke Net Sampling
Fyke net sampling stations served as a source for mature smelt for laboratory culture and for re-capturing marked smelt that were stocked in specific rivers. Smelt fyke nets successfully captured smelt at all six stations during 2005-2008 revealing unique population signals of spawning run seasonality, age composition, and size at age. This technique shows promise for tracking age composition and cohort strength.

Stocking the Crane River
Approximately 5.3 million marked smelt larvae were stocked into the Crane River during 2005-2008. The analysis of age-1 smelt otoliths from 2008 fyke net catches at restoration river stations revealed 16% of the Crane River age-1 smelt and 14% of the North River age-1 smelt were stocked as larvae by this project.

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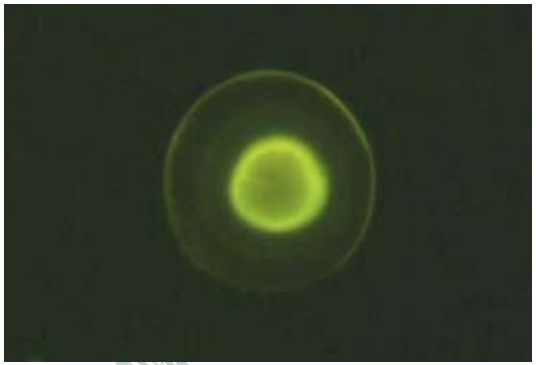

1. Smelt fyke net in the Fore River, Braintree
2. Smelt incubation jars at *MarineFisheries* Laboratory
3. 500 mg/l oxytetracyline mark on larval smelt otolith at 14 days post-hatch indicated by bright ring in center of image.

Shad Restoration

The American Shad Propagation Project was a collaborative effort between *MarineFisheries* and the U.S. Fish and Wildlife Service to restore a viable population of shad to the Charles River by establishing a fry-stocking program and improving fish passage in the system.

Fish Passage Improvements
Significant fish passage improvements were made to the Charles River and, despite coincident high water flow events in the Merrimack River that limited broodstock availability at the start of the project, the HubLine American Shad Propagation Project successfully produced and stocked shad fry in the Charles River between 2005 and 2008.

Successful Spawning
From 2006 through 2008, approximately 3000 adult American shad broodstock were captured at the Essex Dam, Merrimack River, injected with hormone and successfully spawned. A total 3.6 million shad fry were immersed in an oxytetracycline bath to mark their otoliths and stocked in the Charles River.

Otolith Marking
Otolith marking allows identification and quantification of hatchery-origin shad in 3-4 years when these fish reach maturity and return to spawn.

Future Success
A successful restoration will be indicated in future years by the presence of a greater number of naturally-spawned individuals as compared to hatchery-spawned individuals.

Outreach Venues
Outreach was conducted in a number of venues, including an exhibit of shad fry at the New England Aquarium, development of an educational kiosk near the Watertown Dam fishway, and multiple presentations.

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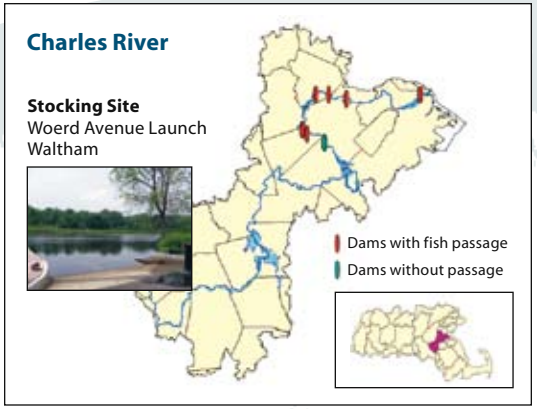

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1. Stocking site in Waltham
2. Hormone injections in adult shad to induce spawning
3. Hatchery-origin juvenile sampled down river 3 months after release
4. Oxytetracycline mark on otolith indicated by bright ring in center of image

Shellfish Restoration

The Shellfish Stock Enhancement Project is restoring/enhancing soft-shell clam (*Mya arenaria*) populations in five Boston Harbor communities Winthrop, Quincy, Weymouth, Hingham and Hull. The soft-shell clam was identified as an impacted species from the construction of the HubLine gas pipeline along near shore areas.

Restoration
Restoration is being conducted through cooperative programs with local municipalities, commercial shellfishers, and Salem State Northeast Massachusetts Aquaculture Center (NEMAC), with funding and technical assistance provided by *MarineFisheries*.

Seed Clams
Between 2006 and 2008, 2.63 million seed clams were planted at enhancement sites in Hull, Winthrop, Quincy, Weymouth and Hingham.

Harvesting
Controlled harvesting of planted plots has been initiated. Legal-sized clams are depurated at the Newburyport plant and later sold by Master diggers. Under-sized clams are replanted within the harvested plots.

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1. Softshell clams
2. Clam seed planting in Hingham

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HubLine Mitigation Program

Bruce T. Estrella, Editor

Commonwealth of Massachusetts
Governor Deval Patrick

Executive Office of Energy and Environmental Affairs
Secretary Ian A. Bowles

Department of Fish and Game
Commissioner Mary B. Griffin

Division of Marine Fisheries
Director Paul J. Diodati

The Massachusetts Marine Fisheries Mission is to manage the Commonwealth's living marine resources and the harvesting of those resources by the commercial and recreational fisheries, while maintaining a diverse number of self-sustaining fish populations at healthy levels of abundance in balance with the ecosystem. Thus, providing wealth and benefits to all citizens of Massachusetts.

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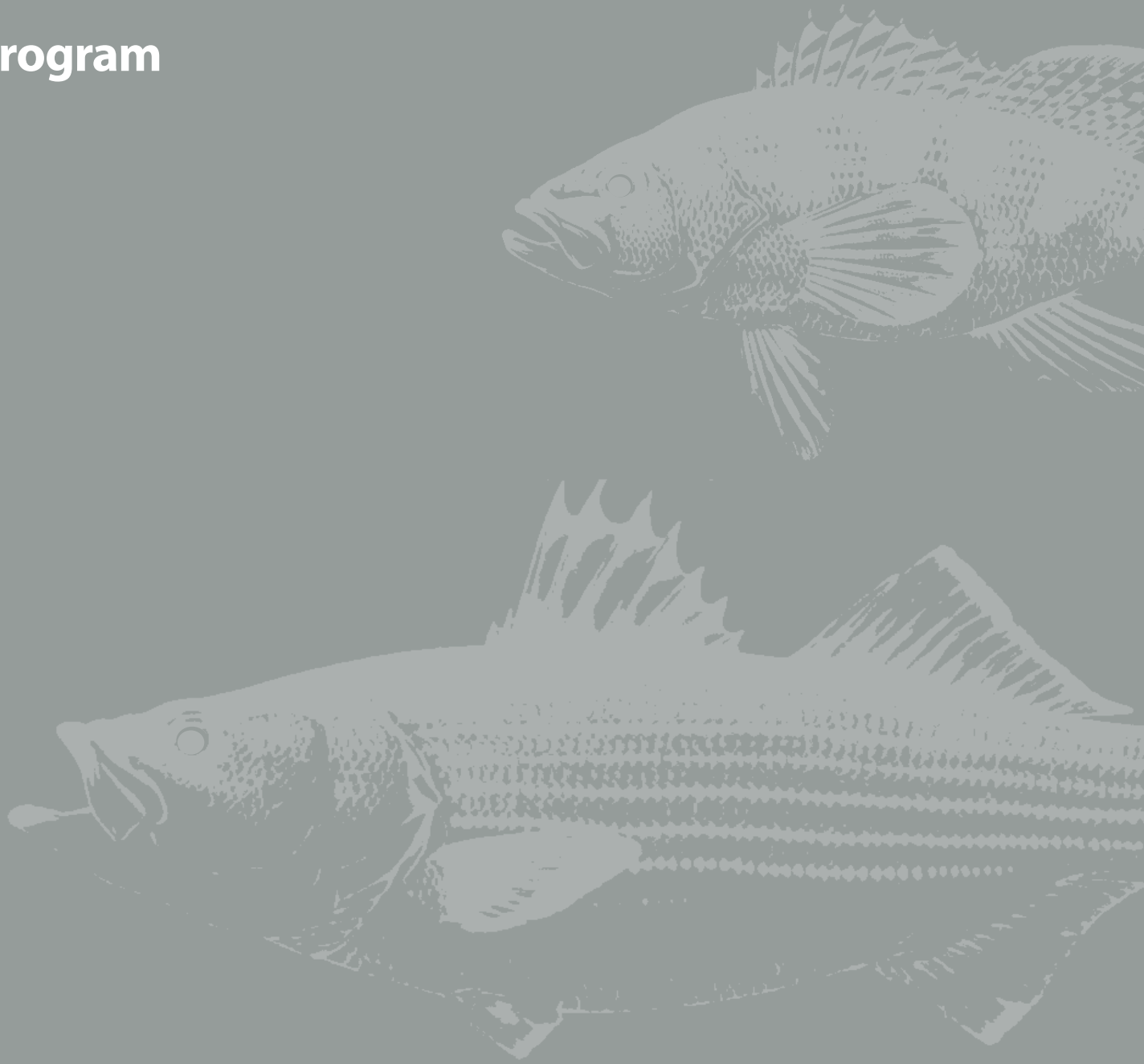
www.mass.gov/dfwele/dmfprogramsandprojects/hubline/hubline.htm#hub



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