

Restoration and Enhancement of Softshell Clam (*Mya arenaria*) Populations in Boston Harbor, Massachusetts

Tom Shields

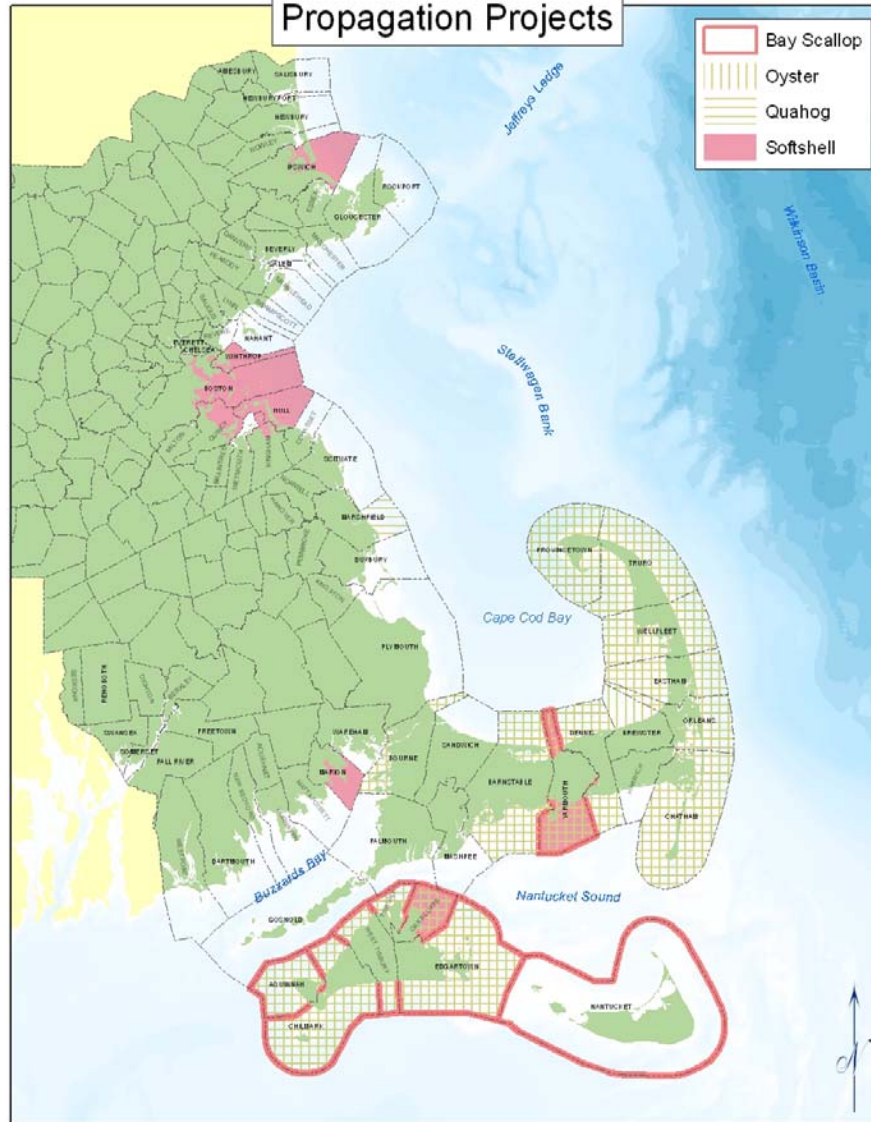
Commonwealth of Massachusetts
Division of Marine Fisheries
Gloucester, MA USA



Shellfish Restoration in Massachusetts

- **Goal:** Increase the abundance and overall biomass of a targeted shellfish population.
- **Home Rule**
 - Individual towns manage nearshore shellfish resources within their jurisdiction.
 - *Marine Fisheries* oversee management strategies, provide technical assistance and maintain high public health standards
- **Municipal/public propagation programs**
 - Majority of shellfish restoration programs in the state are undertaken by individual coastal communities, and are designed to enhance local shellfish resources in support of recreational and commercial shellfisheries within their jurisdictions.
 - Most municipal shellfish programs have two time related functions:
 - Short term stock augmentation
 - Long term propagation
- **Parent Stock**
 - *Marine Fisheries* requires that all introduced shellfish be held as parent stock for at least one spawning seasons prior to exposure to recreational or commercial shellfisheries.

2009 Town Shellfish Propagation Projects



Status of the Softshell Clam Fishery in Boston Harbor

- Landings have dropped drastically over the last decade
 - 1997 Landings = ~ 2.48 million lbs.
 - 2008 Landings = ~ 0.47 million lbs.
- Today, there are approximately 100 commercially-licensed clam diggers in Boston Harbor
- Softshell clam resource are depleted due to:
 - Over fishing
 - Habitat loss
 - Poor recruitment





Greater Boston Harbor

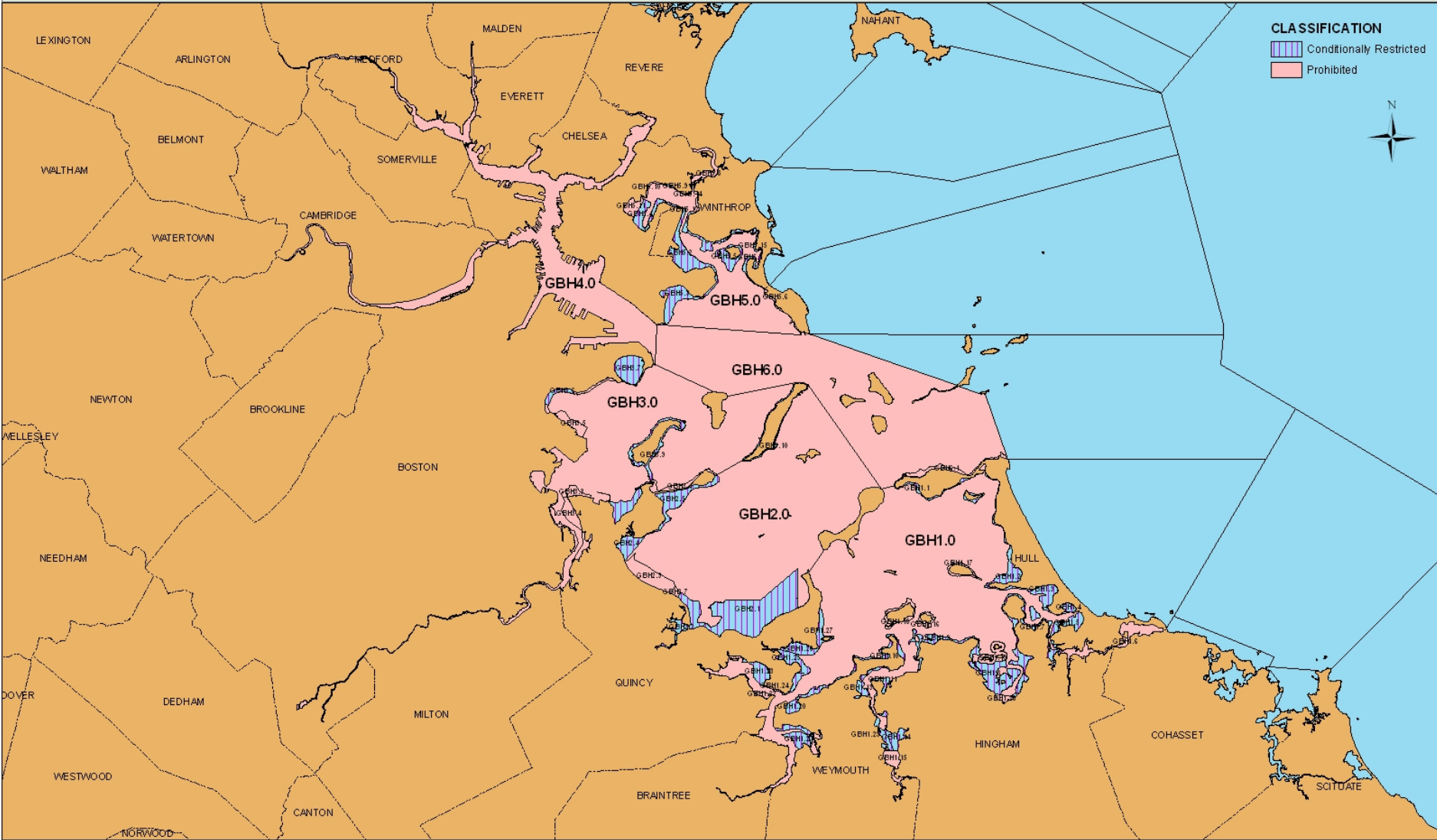


BOSTON HARBOR SHELLFISH CLASSIFICATION AREAS

Produced
October 8, 2009

CLASSIFICATION

- Conditionally Restricted
- Prohibited



Program Overview

■ APPROACH:

- Establish a collaborative network of stakeholders and state resources in order to develop municipal propagation methodologies appropriate for the region.

■ PARTICIPANTS

- Shellfish Constables from Boston Harbor communities
- Regional commercial shellfishers
- Massachusetts state resources
 - Marine Fisheries* - project financing, management and oversight.
 - Salem State College* - provision of hatchery seed (NEMAC)
 - biological and sediment sampling .

■ DESIGN:

- Begin on a pilot scale, and gradually expand as successful methodologies and techniques are developed and realized.

Enhancement Strategy

- Apply shellfish propagation techniques developed and used by municipal propagation programs and private aquaculturists in Maine and on Cape Cod and the North Shore
- Working with Shellfish Constables within participating communities, we selected enhancement sites on tidal flats that once supported healthy soft shell clam resource that had since gone fallow.
- Basic approach involves out-planting hatchery-reared juvenile clams and temporarily protecting them from natural predators.
- Soft shell clams reach sexual maturity within 1 ½ to 2 years. It is hoped that the stocking of clams in high densities will improve the chances of successful spawning and reproductive success within the targeted areas.

Hatchery culture protocols are well known
and seed clams are readily available



Site Preparation

- Each enhancement plot (12 ft. by 50 ft.) is raked to roughen the substrate and to remove predators.
- Following delineation of the plot, a 4-6 inch deep trench is dug around the plot perimeter.



Planting Hatchery Seed

- Hatchery-reared juvenile clams are seeded within each experimental plot.
 - Seed density of 25-50 clams/ft²
- Seeding may occur from late June through October.
- Seed Size: 5- 17mm Shell Length (SL)



Predator Exclusion Netting

- Predator exclusion nets are placed over the trenched plots and then backfilled to secure them.
- Nets are removed from the sites prior to ice-up
- All enhancement plot corners are marked with steel re-bar or PVC stakes.



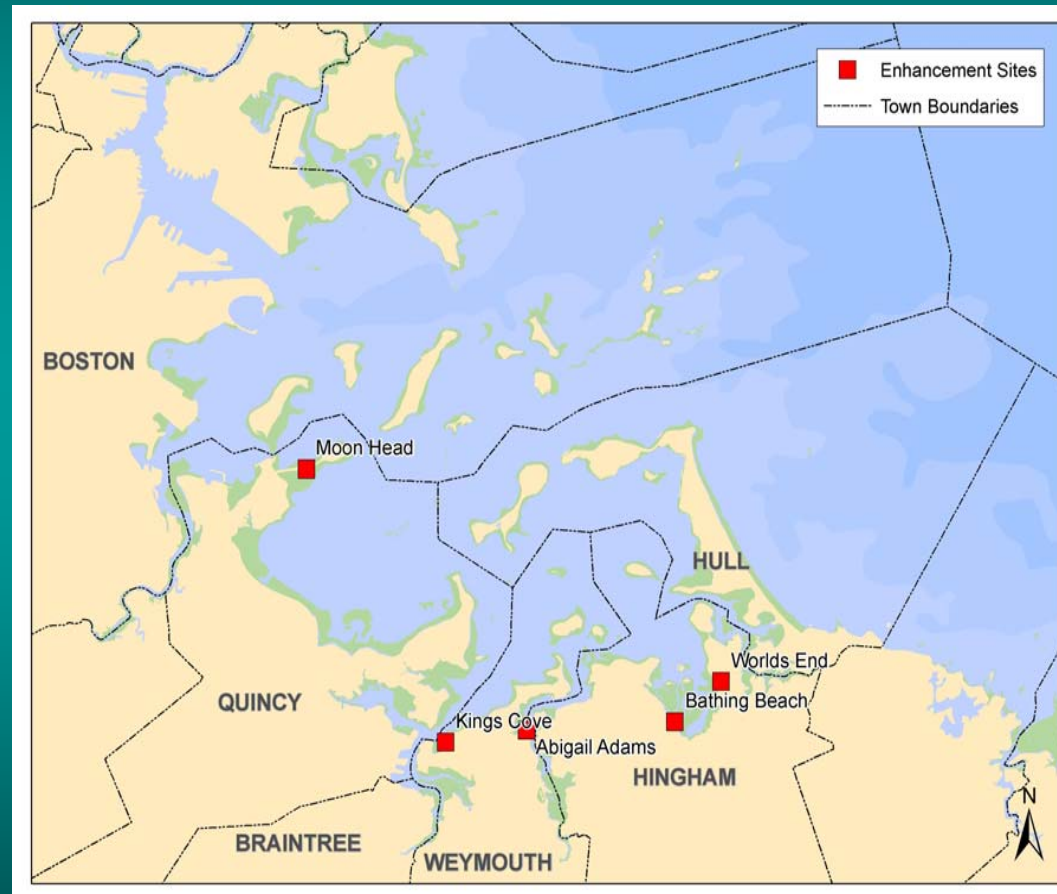
Site Maintenance & Monitoring

- All enhancement plots are monitored and maintained
 - Routinely brushed free of algae
 - Rips and tears were patched
- Biological Monitoring
 - Sites are monitored throughout the year
 - Clams are sampled for growth and survival

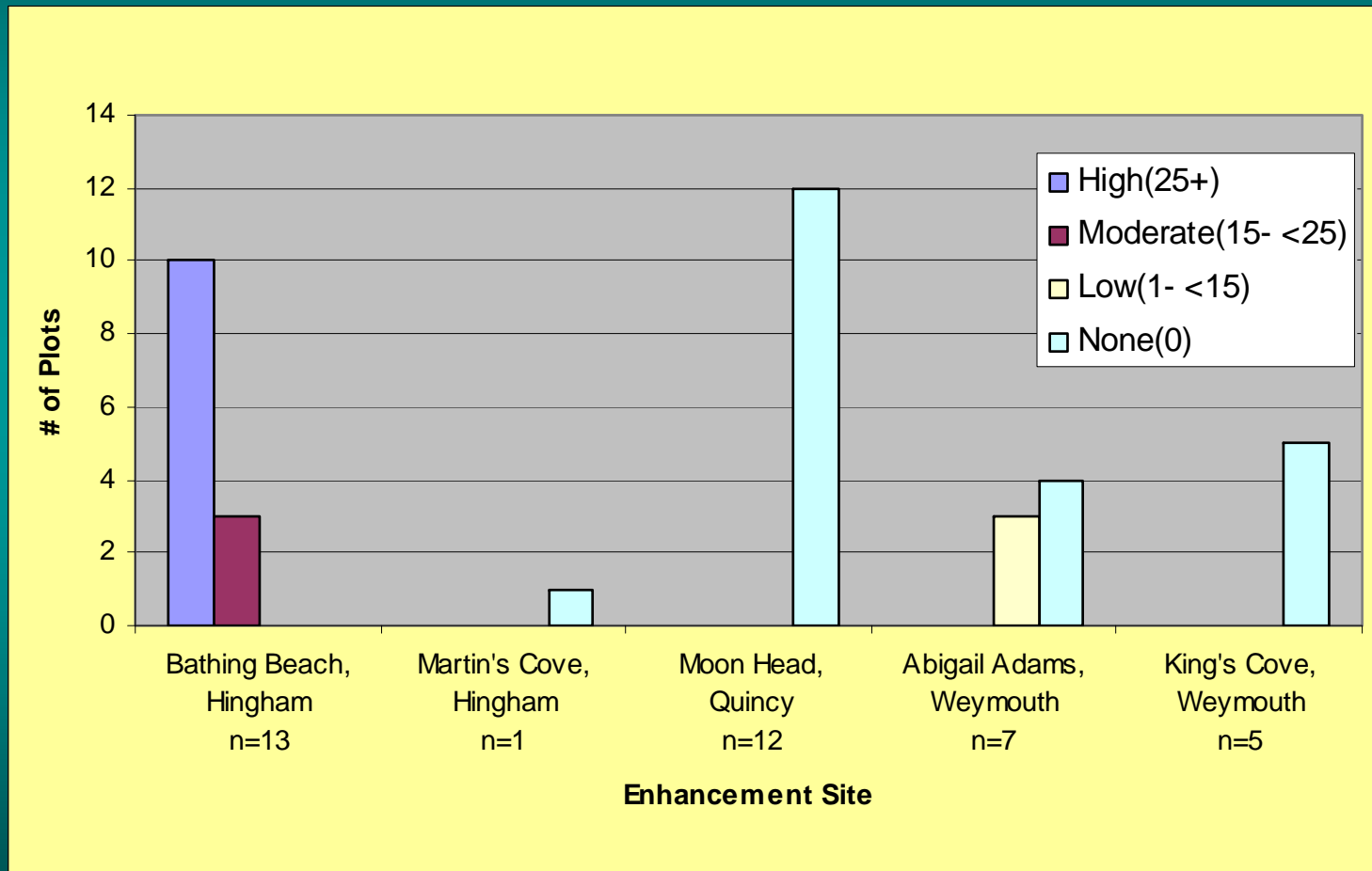


2006 Pilot Enhancement Sites

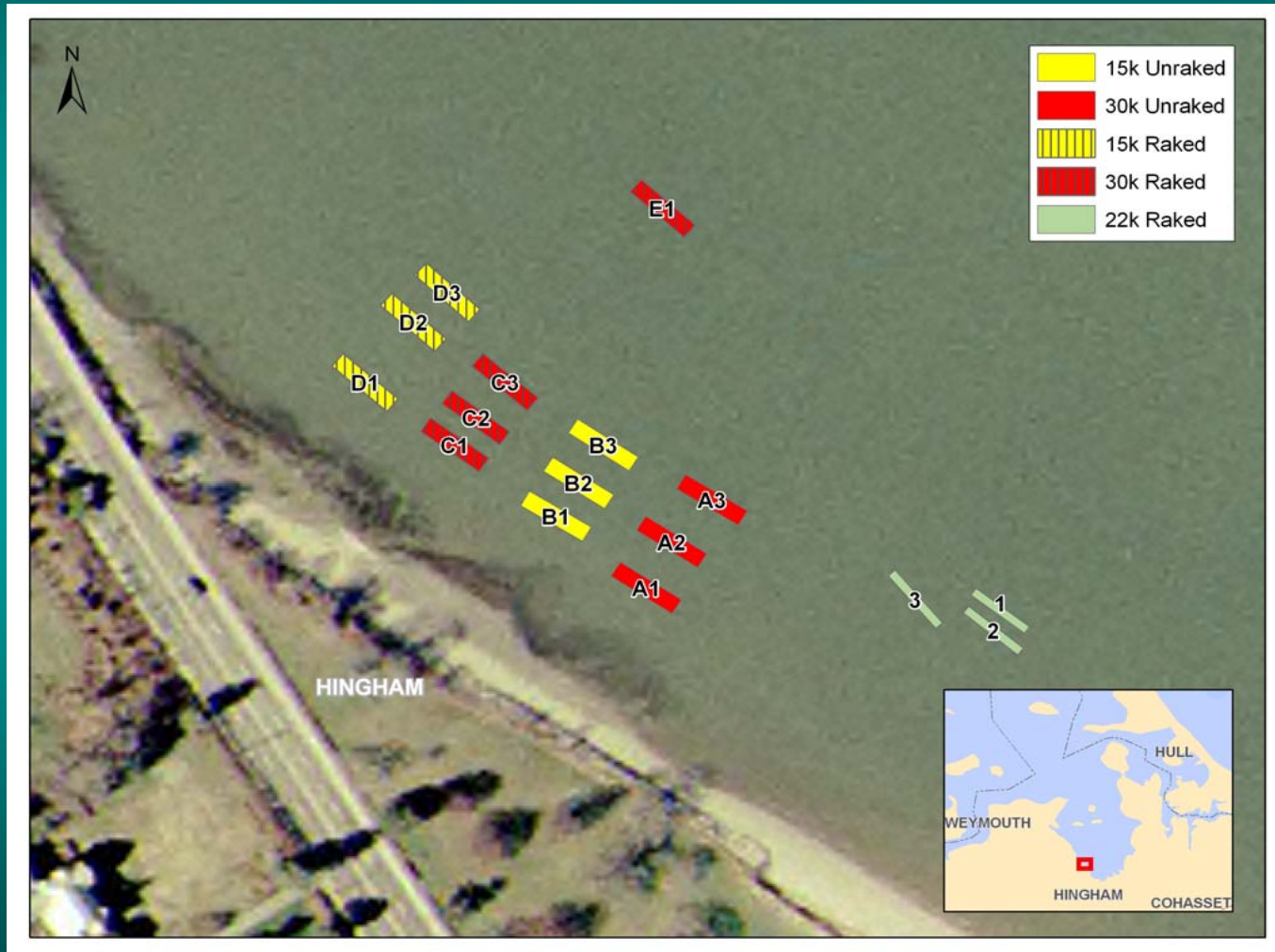
- Participating Towns:
 - Weymouth
 - Hingham
 - Quincy
- Seeded over 1 million clams within 5 enhancement sites
- Total of 38 plots (@600 ft.²)
- Seed Size: 5 -15mm
- Density: 25 – 50 clams/ft²



Clam survival at five 2006 enhancement sites based on field data collected in the fall and winter of 2007.



Arrangement of plots at the 2006 Hingham enhancement Site



Summary of clam lengths within plots receiving two experimental treatments following 1.7 years of growth

Independent-samples t-tests assuming equal variance determined that:

Comparison of Shell Length at Different Seeding Densities			
Treatment	Average Length (mm)	S.D	Number of Clams
25 clams/ft ²	53.2	5.7	400
50 clams /ft ²	49.2	4.8	407

- There was significant difference in shell lengths of clams seeded at two different densities ($p \leq 0.001$)

Comparison of Shell Length Within Raked and Unraked Substrates			
Treatment	Average Length (mm)	S.D	Number of Clams
Raked	52	5.8	386
Unraked	50.5	5.4	421

- There was significant difference in shell lengths of clams planted in raked and unraked substrates ($p \leq 0.001$).

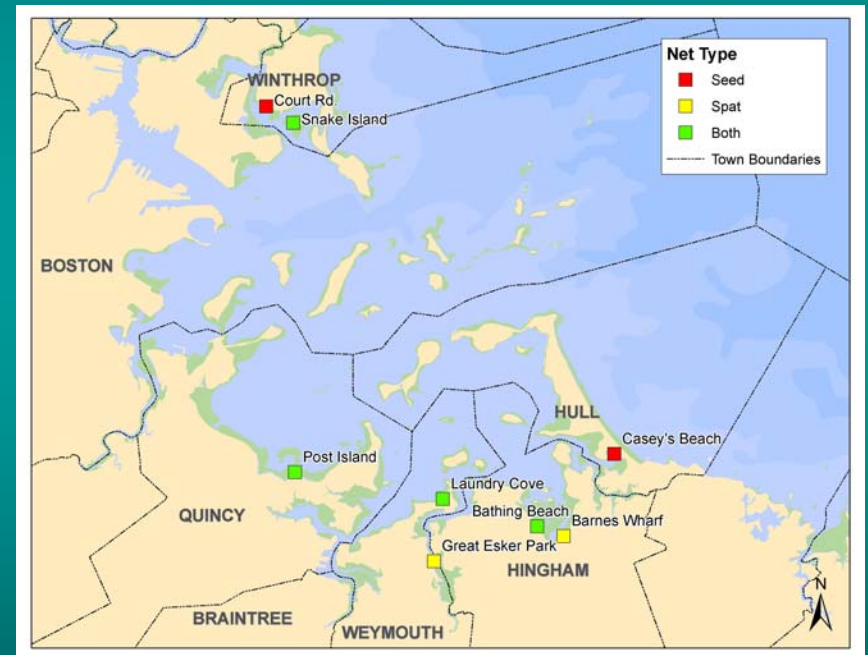
Pilot Project -Lessons Learned

- Better understanding of optimal enhancement site characteristics:
 - substrate
 - tidal current
 - exposure to wind driven waves and vessel wake
 - reduce conflict with public user groups
- Plant larger seed clams
 - minimum size of > 10 mm SL
- Plant clams at densities of 25 – 30 per ft²
- Rake the substrate before planting seed clams



2007 Enhancement Sites

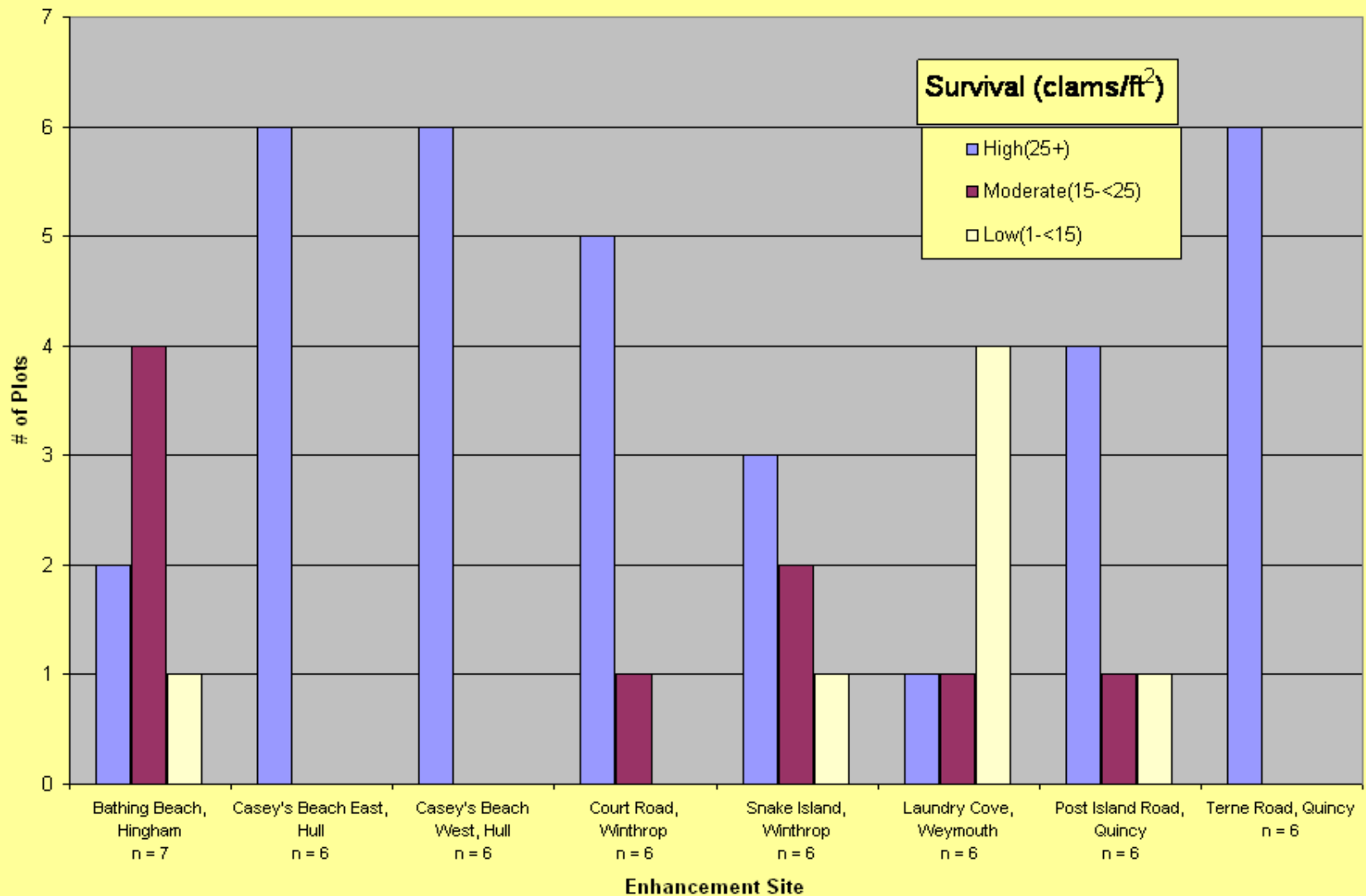
- Participating Towns:
 - Weymouth - Winthrop
 - Hingham - Hull
 - Quincy
- Seeded over 870,000 clams within 8 enhancement sites
- Total of 49 plots (600 ft.²)
- Seed Size: 10 -17mm
- Density: 30 clams/ft²
- Deployed 46 wild spat collectors



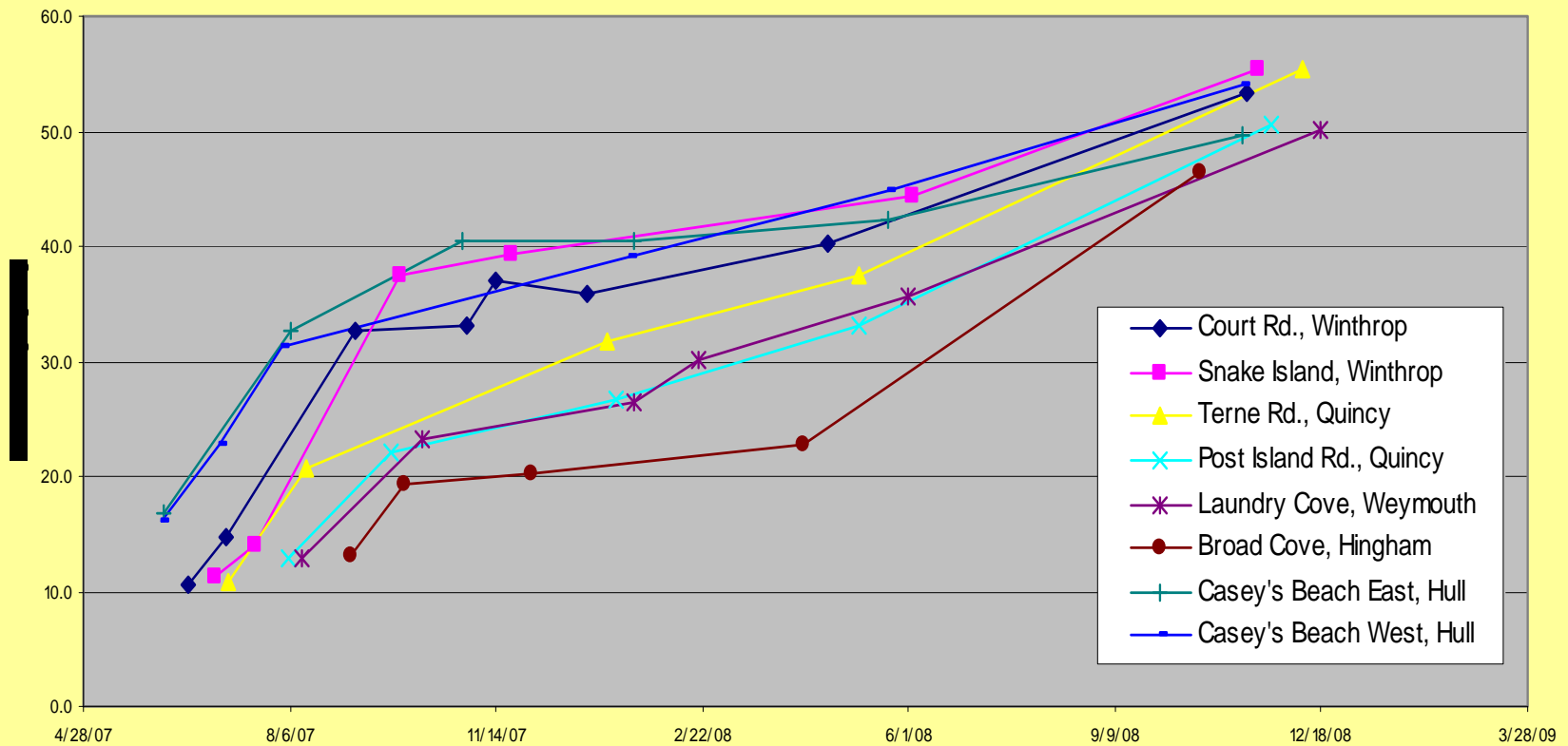
Upper and lower length thresholds of clams seeded in four 2007 Enhancement Sites

Enhancement Site	Sample Month	Lower Threshold (mm)	Upper Threshold (mm)
Court Road	October '07	none	40
	November '07	none	43
	December '07	none	45
	April '08	20	55
	November '08	35	70
Terne Road	August '07	13	35
	January '08	20	45
	May '08	20	55
	December '08	40	70
Post Island Road	September '07	none	35
	January '08	15	40
	May '08	20	55
	November '08	30	65
Laundry Cove	October '07	15	40
	January '08	15	40
	May/June '08	20	50
	December '08	35	65

Clam Survival at Eight 2007 Enhancement Sites during the Winter 2008 Sample Period

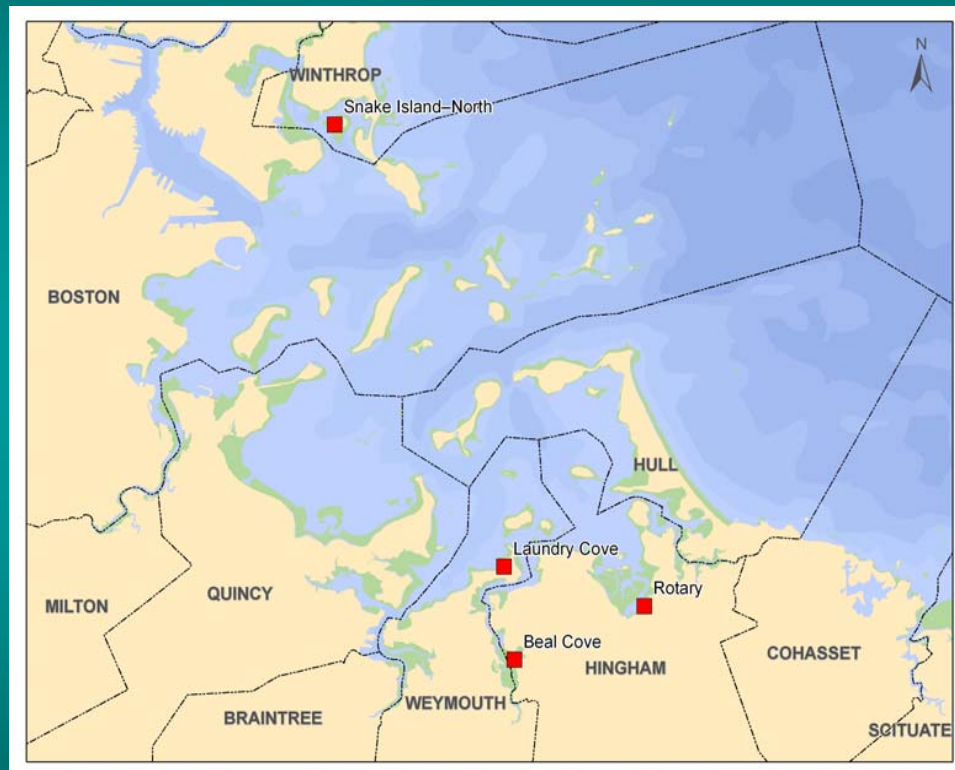


Clam Growth at 2007 Enhancement Sites



2008 Program Overview

- Planned on seeding 1.62 million 10-15mm clams at 6-8 restoration sites
- Successfully seeded 756,000 clams within 42 plots in four sites
- Salem State team sampled 2007 sites for clam growth and survival and collected sediment cores.



Seed Clam Limitations in 2008

- In August 2008, routine pathology test revealed the presence of epibionts on the siphons of the hatchery clams being held in upwellers.
 - One ectoparasite was preliminarily identified as *Boonea* spp – siphon snail
- *Marine Fisheries* temporarily restricted sale of clams from Cat Cove hatchery until a positive ID was secured.
- A positive ID was never verified.
- In 2009, *Marine Fisheries* partially lifted the restrictions, and currently allows Cat Cove to sell clams from their land based facilities which use UV treated and/or filtered sea water

Hatchery Epibiont Mitigation Program

- Hatchery staff are currently investigating epibiont occurrence within the nursery system and developing methods of controlling epibiont growth.
- Investigating the effectiveness of treating clams within their upwellers with fresh water baths
- Monitoring the incidence of epibionts on clam siphons throughout their residence time within the upwellers
- To date, effective protocols have been developed that significantly reduce the incidence of epibionts.
- Inspections of live clams from the upwellers by Dr. Susan Ford at Rutgers University have revealed no gastropods



2009 Program Overview

- Have nearly met our goal of seeding 1.62 million juvenile clams within six restoration sites throughout Boston Harbor.
- Salem State's team of biologists will continue to monitor the 2008 restoration sites. They will be sampling the 2008 restoration sites for:
 - Clam growth and survival
 - Sediment characteristics
- This fall the restoration team will be carrying out a number of controlled harvests of selected plots within some of our 2006 and 2007 enhancement sites.
 - to document the number of clams within the plots
 - To determine the accuracy of our current estimates of clam survival

- The Boston Harbor Shellfish Restoration Program is a work in progress.
- We continue to build and expand the network of local communities, commercial shellfishers and state agencies with the long term goal of enhancing the softshell clam resource within Boston Harbor



Acknowledgements

- Staff and student workers of Salem State's Northeast Massachusetts Aquaculture Center (NEMAC).
- Shellfish Wardens and Harbormasters from the communities of:
Winthrop, Quincy, Weymouth, Hingham & Hull
- Boston Harbor commercial shellfishers

Questions ?

