Use of “Conservation Moorings” as a Component of Eelgrass Restoration in two Massachusetts Harbors

Massachusetts Bays Program
Division of Marine Fisheries

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The Seagrass Picture in Massachusetts and Cape Cod Bay

- Dominant species is eelgrass (*Zostera marina*)
- Temperate species that ranges in North America from the Canadian Maritimes to Southeastern U.S.
- Ecosystem services range from nursery and forage habitat to sediment stabilization and shoreline protection
- Once abundant to the point of navigational nuisance, now declining at an alarming rate*
- Sensitivity to changes in water quality and other stressors have made it a sentinel of coastal environmental change
MassDEP Seagrass Monitoring Program

- Began as a comprehensive mapping effort in 1995
- Delineate seagrass beds (Zostera and Rupia) in embayments and nearshore waters from 1:20,000 true color aerial photos
- Repeated flyovers in 2000 and 2006 to provide a 12 year picture of status and trends in eelgrass over the time period

MassDEP Seagrass Monitoring Program

<table>
<thead>
<tr>
<th>Region</th>
<th>Median decline 1995-2006 (% y(^{-1}))</th>
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</thead>
<tbody>
<tr>
<td>Massachusetts Bay</td>
<td>-2.39</td>
</tr>
<tr>
<td>South Cape Cod</td>
<td>-3.39</td>
</tr>
<tr>
<td>Buzzards Bay</td>
<td>-3.51</td>
</tr>
<tr>
<td>The Islands</td>
<td>-2.21</td>
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From Costello, C.T. and W.J. Kenworthy. 2010
<table>
<thead>
<tr>
<th>Location</th>
<th>1995</th>
<th>2000</th>
<th>2006</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gloucester Harbor</td>
<td>18.55</td>
<td>15.03 (-4.21)</td>
<td>21.12 (9.46)</td>
</tr>
<tr>
<td>Salem Harbor</td>
<td>41.93</td>
<td>7.71 (-33.86)</td>
<td>12.55 (9.73)</td>
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<td>Lynn Harbor</td>
<td>289.42</td>
<td>259.20 (-2.21)</td>
<td>272.01 (0.97)</td>
</tr>
<tr>
<td>Boston Harbor</td>
<td>81.48</td>
<td>26.97 (-22.11)</td>
<td>47.04 (29.22)</td>
</tr>
<tr>
<td>Cohasset Harbor</td>
<td>45.61</td>
<td>47.35 (0.75)</td>
<td>45.32 (-0.88)</td>
</tr>
<tr>
<td>Scituate Harbor</td>
<td>4.84</td>
<td>4.18 (-2.97)</td>
<td>4.17 (-0.04)</td>
</tr>
<tr>
<td>Duxbury/Plymouth H.</td>
<td>910.27</td>
<td>792.4 (-2.77)</td>
<td>772.76 (-0.50)</td>
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-3.59%/yr \(-0.5%/yr\)

From Costello, C.T. and W.J. Kenworthy. 2010
## MassDEP Seagrass Monitoring Program

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<tr>
<th>Location</th>
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<th>Area Mapped (ha)</th>
<th>POTW Upgrades</th>
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<td></td>
<td>Location</td>
<td>1995 (ha)</td>
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- **Note:** The table includes data on the area mapped for seagrass in various locations along the Massachusetts coastline, with changes in area and years of POTW upgrades noted.
Extent vs. Condition

- DEP mapping effort is the resource for tracking areal extent
- Large scale changes (the literal 20,000 foot view) documented through this mapping effort say little about patchiness, integrity, and condition
- Impacts documented by MA DEP are associated primarily with water quality
- There are many other localized but important impacts to eelgrass beds
  - CSO mitigation
  - Coastal development
  - Boating infrastructure (navigational channels, markers, and moorings)
Notes on Moorings

- Traditional moorings constructed with a block and chain
- Chain provides scope and play and allows the vessel to swing with changing tides and wind patterns
- Block anchors the system to the substrate
- Chain drags a large circular scar in the eelgrass, creating a denuded zone, resuspending sediment, and creating a sink for detritus
- Block itself creates bottom shear stress and a scour area around its perimeter.
Notes on Moorings
Intersection of Eelgrass Meadows and Mooring Fields

- Total hectares of eelgrass (2001) in MA Bay: 3,191 ha
- Total ha of mooring field located in eelgrass in MA Bay: 67 ha
- Total hectares of eelgrass (2001) in all of Massachusetts: 12,005 ha
- Total ha of mooring field located in eelgrass in all of Massachusetts: 312 ha

- Eelgrass beds containing moorings in Massachusetts Bay ≈ 2.1%
- Number of moorings in eelgrass beds in Massachusetts Bay ≈ 402
- Eelgrass beds containing moorings in Massachusetts ≈ 2.6%
- Number of moorings in eelgrass beds in Massachusetts ≈ 1872
Does Technology Hold the Key? Conservation Moorings

- Chain is replaced with a floating elastic rode that provides play but eliminates contact with the substrate and eliminates scour.
- Block is replaced with a helical anchor, which reduces the footprint from square meters to square centimeters.
- Manufacturers claim:
  - Increased holding power
  - Reduced maintenance costs
  - Reduced wear and tear on vessels
Is it Legal to Site Mooring in Eelgrass Beds?

- Harbor masters have an exemption from the Army Corps of Engineers permitting process to place moorings, but this does not apply to eelgrass beds.
- Private marinas must file for a Category 2 ACOE general permit for all mooring facilities.
- ACOE requires mitigation for blocks and chains located within an eelgrass bed.
- ACOE provides an escape route. If placed within a mooring scar, private boat owners can replace their traditional mooring with a conservation mooring under category 1 (non-reporting).
Objectives of Our Study

1) Assess the impact of conservation moorings (or lack of impact) on eelgrass beds in comparison to traditional moorings
2) Determine whether additional restoration activities (eelgrass transplants) are necessary for recolonization of mooring scars
3) Demonstrate the use of conservation moorings to boat owners, harbormasters and marina operators in Massachusetts
4) Make appropriate policy recommendations
Methods

1) Replace 7 traditional moorings with conservation moorings in two distinct Massachusetts Harbors (Manchester and Provincetown)

2) Transplant eelgrass into a subset of the scars

3) Monitor the recovery
   1) Diver surveys
   2) Video transects
   3) Water quality monitoring
   4) Aerial photos

4) Document boater experience with the mooring systems
Treatments

a) Traditional block and chain moorings and associated scars (3)
b) Mooring scars with conservation moorings installed (3)
c) Mooring scars with conservation moorings installed and eelgrass transplants (4)
d) Reference natural sand patch surrounded by eelgrass (1)
e) Reference natural eelgrass meadow (1)
Monitoring

Diver Surveys

- (all ten moorings and sand patch) Establish transects in four cardinal directions (% cover, shoot density, canopy height). Includes measuring distance to the edge of the bed
- (Transplanted scars) assess survival of transplanted shoots
- (Reference bed) Drop 12 random quadrats in reference bed measuring parameters listed above
Monitoring

• Volunteer Monitoring
  ➢ Underwater video surveys
  ➢ Secchi disk
• Semiannual over-flights (LightHawk volunteer aviators)
• Periodic boater surveys
Preliminary Results

Eight Conservation Moorings installed in Manchester-by-the-Sea

Pre-restoration monitoring completed in Manchester Harbor October, 2010
- Average diameter of mooring scars N-S = 6.6 m
- Average diameter of mooring scars E-W = 7.9 m
- Average area roughly 41 m²

Going back to our estimate of 1872 moorings, mooring scars may account for 77,000 m² of direct impacts
Time Zero Monitoring

- Mohee
- Arie
- Austin
- Sayce
- Landmark
- Crockers
- Bidner
“Time 0” Flyovers
Considerations/Reflections

• Extremely difficult to get boat owners to participate in the program
  ➢ lack of faith in the newfangled technology
  ➢ liability concerns

• Permitting through the ACOE was a major hurdle

• Offer of free gear seemed to serve as little incentive for private boat owners

• Gear is expensive for private businesses

• I became a conservation mooring salesmen

• Monitoring needs to be kept relatively simple
Thanks to Our Funders!

- Association of National Estuary Programs / NOAA Community Based Restoration Partnership
- The Nature Conservancy
Thanks to Our Many Partners!

- Massachusetts Division of Marine Fisheries
- Environmental Protection Agency
- Town of Manchester
- Town of Provincetown
- Salem Sound Coastwatch
- Association to Preserve Cape Cod
- Provincetown Center for Coastal Studies
- LightHawk