

# Use of Conservation Moorings in Eelgrass (*Zostera marina*) Meadows in two Massachusetts Harbors

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## INTRODUCTION

Eelgrass (*Zostera marina*) is declining at an alarming rate in Massachusetts due to a variety of anthropogenic stressors. Water quality impairment is the most commonly cited cause of this decline. However, boating impacts, such as damage from traditional mooring systems, also play a role in the loss of eelgrass extent. Traditional block and chain moorings can create large circular scars in eelgrass beds due to the large footprint of the block and the scouring action of the chain as it drags along the substrate. For at least the past two decades impacts from mooring blocks and chain have been reported in the literature in seagrass systems around the globe (Walker et al 1989; Hastings et al 1995). More recently there has been a call to transition toward "seagrass friendly" moorings (Montefalcone et al. 2008), systems designed to minimize scour of seagrass beds with a helical anchor and floating, flexible rode. In Massachusetts, use of "Seagrass friendly" or "conservation moorings" are rare and traditional moorings are still the norm.



Winter flounder in eelgrass meadow, Manchester, MA

We aim to demonstrate the use of "conservation moorings" in two harbors in Massachusetts with a strong emphasis on outreach to boat owners and harbormasters. The primary objective of the study is to assess the ability of eelgrass to grow back into the scars left by traditional moorings after tackle is replaced with a "conservation mooring" system. After mooring tackle is replaced, the study will compare the rates of recovery in scars with and without eelgrass transplants.

The results of this project will have immediate management implications. Resource agencies are already recommending the use of "conservation moorings" and permitting agencies including the Army Corp of Engineers are re-writing mooring regulations with an emphasis on the use of this emerging technology.

## TRADITIONAL MOORINGS

The vast majority of recreational boat moorings in Massachusetts are constructed of a large block or mushroom style weight that anchors the mooring and a heavy chain that adds additional weight and drag and allows for changing tidal heights and wind and current direction (Figure 1). The block itself causes a loss of eelgrass due to its large surface area and can cause scour resulting from bottom shear stress. The chain, which is designed to drag on the substrate, often carves a circular pattern into the eelgrass bed as the boat swings on the mooring, ripping up plants and increasing the exposed edge of the eelgrass meadow while providing a sink for detritus.

The combined effect of the block and chain may also increase sediment resuspension within the eelgrass bed, diminishing water and light quality on the edge of the scar, and further degrading the eelgrass habitat.

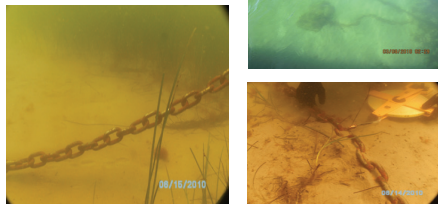


Figure 1. clockwise: diagram of a traditional mooring; block and chain with surrounding scar as seen from the water surface in Provincetown; chain scouring eelgrass in Manchester; underwater view of chain and edge of scar in Manchester

## RESTORATION SITES

Two different restoration sites, Manchester Harbor, on the Massachusetts North Shore, and Provincetown Harbor at the tip of Cape Cod (Figure 2), will be included in the study, enabling a comparison of the rates of recovery in two different systems with differences in water quality, substrate, and hydrologic conditions.

Eight Conservation Moorings were installed in Manchester Harbor in October 2010, and seven more will be installed in Provincetown harbor later this fall. Sites were selected due to the overlap of extensive eelgrass beds and mooring fields, and due to the presence of visible mooring scars documented in aerial photography including images displayed in Google Earth as well as low altitude flights over the restoration sites in fall 2010.

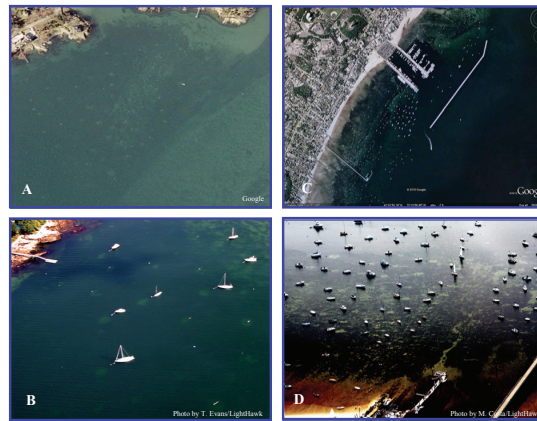


Figure 2. Aerial photo showing scars in the eelgrass meadow at A and B) Outer Manchester Harbor mooring field, and C and D) Provincetown mooring field

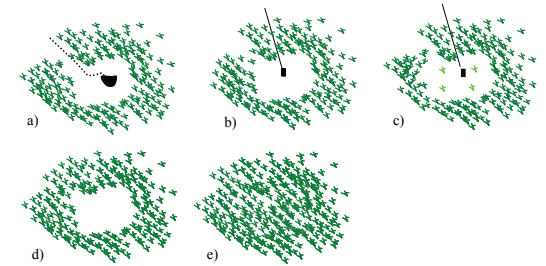
## CONSERVATION MOORINGS



Figure 3. clockwise from left: diagram of a conservation mooring; helical anchors; conservation mooring (helical anchor and flexible rode) ready for installation in Manchester Harbor.

Alternative mooring systems, dubbed "conservation moorings," (Figure 3) replace the block with a helical anchor that is screwed into the substrate. A strong elastic rode fixed to the anchor replaces the chain, and is attached to a float, preventing the rode from dragging on the substrate. If installed correctly, this system will not touch the bottom and therefore may minimize most impacts to eelgrass beds associated with moorings.

## METHODS

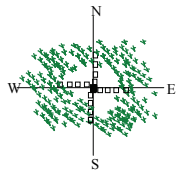


Treatments (see sketches above)

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

Monitoring (pre and post restoration)

- Treatments a-d, divers measure the radius of the scar in all four cardinal directions (see diagram at right). Eelgrass parameters (% cover, shoot density and canopy ht.) are measured in 1m<sup>2</sup> quadrats at 2m intervals out from the center of the mooring along a gradient including the scar and the edge of the grass bed.
- Treatment c, divers will also assess the survival of transplanted shoots in each of the four transplanted plots (N, S, E, W).
- Treatment e, the control eelgrass bed, divers measure 12 quadrats within a vegetated area.



## PRELIMINARY RESULTS

Pre-restoration (time 0) monitoring was completed in Manchester Harbor in October of 2010. The average diameters of measured mooring scars in Manchester Harbor were N:S 6.6m and E:W 7.9m (Figure 4). Time 0 monitoring will be completed in Provincetown Harbor in the spring of 2011. Eelgrass will be transplanted at both sites during the spring of 2011.

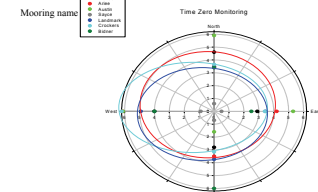


Figure 4. Graphic representation of the measurements of the scar radii at 7 moorings before installation of the "conservation mooring" systems. Distances are measured in meters from the mooring block outward at all four cardinal directions.

## REFERENCES

Hastings K, Hesp P, Kendrick GA (1995) Seagrass loss associated with boat moorings at Rottnest Island, Western Australia. *Ocean and Coastal Management* 26:225-246

Montefalcone M, Chiantore M, Lanzone A, Morri C, Albertelli G, Bianchi CN (2008) BACI design reveals the decline of seagrass *Posidonia oceanica* induced by anchoring. *Marine Pollution Bulletin* 56: 1637-1645

Walker DL, Lukatelich RJ, Bastyan G, McComb AJ (1989) Effect of boat moorings on seagrass beds near Perth, Western Australia. *Aquatic Botany* 36:69-77