Massachusetts *MarineFisheries* Standard Operating Procedure

Using the TERFS (Transplanting Eelgrass Remotely with Frames System) methods to plant eelgrass *(Zostera marina)*

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Point of Contact:
Tay Evans
Massachusetts Division of Marine Fisheries
Annisquam River Marine Fisheries Field Station
30 Emerson Ave.
Gloucester, MA 01930
978-282-0308 x168
Tay.Evans@state.ma.us

I. Objective:

Transplanting eelgrass using the TERFS™ method (Short et al. 1999) and modified TERFS method (Leschen et al. 2010) at restoration sites

II. Gear List:

A. Shore side (preparing TERF frames)
   - TERFS
   - Harvested eelgrass
   - Crepe paper ties

B. Topside/water
   - Dive gear
   - Safety gear, dive float
   - Field notebook

III. METHODS:

A. Planting

In earlier Boston Harbor transplant work (2004), *MarineFisheries* utilized TERFS™ and modified TERFS, among other methods. TERFS methods were created in response to the need for a lower cost sub-tidal planting method that reduces the need for SCUBA work. The frames also protect transplanted eelgrass shoots from organisms that dig under or disturb the newly planted eelgrass. Both methods incorporate an outreach component to the restoration effort, and the only difference between the methods is the material used in the planting unit frame: TERFS™ (Short et al. 2002) utilize a rubber-coated wire frame, while modified TERFS use a PVC frame method.

TERFS™ Method

The TERFS™ method involves attaching 50 eelgrass shoots in pairs (i.e. 25 planting units) to a weighted rubber-coated wire frame with biodegradable paper twine (Photos 1 and 2). This method was created in response to the need for a low cost subtidal planting method. The TERFS methodology avoids SCUBA and the frames protect transplanted eelgrass shoots from organisms that dig under or disturb the newly planted eelgrass. One 60 cm x 60 cm x 15 cm high frame plants 50 eelgrass shoots for a total of 200 shoots/m^2.

TERFS are prepared on shore and then placed on the seafloor by lowering the TERFS from the side of a small boat or by wading into the water and placing the TERFS in the sediment. The TERFS are placed on the ocean floor so the eelgrass roots are in contact with the sediment and the eelgrass leaf blades extend into the water column. Four bricks attached to the frame provide weight to press the eelgrass roots into the top centimeter of sediment. The bricks also ensure the TERFS will remain on the bottom where they are placed. The frame protects the fragile shoots from being uprooted by burrowing animals such as green crabs. The TERFS, with the eelgrass shoots attached, are left on the sediment surface at the transplanting site for 3-5 weeks, enough time for the plants to root into the sediment. The frames are ready to be removed when the plants have rooted securely into the sediment; time can vary depending on your location. The plants may root in less time at a transplant site with warm water compared to a cool water site. If the frames are removed too early, the eelgrass shoots may still be attached to the frames and consequently will be pulled up with the frame. If the frames are left too long, the shoots have time to grow over the frame and the frames can be difficult to remove, or the eelgrass is pulled up with the frame. Three to five weeks is the norm for most sites in the northeastern U.S.; trial and error with close observation can be done to determine the right time period to leave the TERFS in the water at your site. After the TERFS frames are removed from a transplant area, they can be cleaned, stored and re-used in future eelgrass tranplanting projects (Figure 4).

Modified TERFS Method

New TERF™ alternatives constructed with PVC frames were tested (Photos 3 and 4). These were developed as a lighter-weight alternative to the heavier wire mesh TERFs™ which were cumbersome for divers. Pairs of eelgrass shoots were tied at each of 25 junctions of the jute and 10” spikes were driven through pre-drilled holes in the frame corners to anchor the frame in the sediment; metal landscape staples were used to anchor the jute. After the eelgrass has rooted, the jute can be cut away along the inside of frame and left behind to biodegrade; frames and spikes are retrieved for reuse.

Be sure to draw a map of the planted areas and meter markings on your dive slate and transcribe into the field notebook at the surface.

IV. PHOTOS:

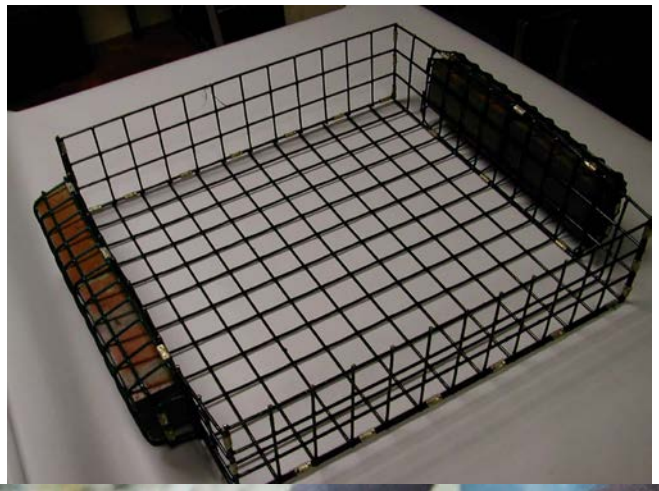

Photo 1. TERFS™frame

Photo 2. Volunteer tying eelgrass shoots to TERFS™frame

Photo 3. Modified TERFS frame

Photo 4. Volunteers tying shoots to modified TERFS frame

V. DATA MANAGEMENT:

Monitoring data are entered and quality-control checked in the spreadsheet titled *HUB3 Monitoring Data* stored here W:\Habitat Project\Habitat Research\Seagrass\HUB3 Eelgrass restoration\Monitoring data

VI. REFERENCES:

Leschen, A.S. K. H. Ford, N.T. Evans. (2010). Successful Eelgrass Restoration in a Formerly Eutrophic Estuary (Boston Harbor) Supports the Use of a Multifaceted Watershed Approach to Mitigating Eelgrass Loss. Estuaries and Coasts. 33:1340-1354.

Short, F. T., C. A. Short, C.L. Burdick-Whitney (2002). A manual for community-based eelgrass restoration. Jackson Estuarine Laboratory. University of New Hampshire, 85 Adams Point Road Durham, New Hampshire.

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