Northeast Sustainable Agriculture Research and Education Program
Farmer / Grower Grant Final Report

1. **Project name and contact information**: "Development of an Intertidal Upweller Nursery for Shellfish Aquaculture", Grant. No. FNE04-535. Sunken Treasures Shellfish Company (now known as Target Ship Oyster Company), 15 Linda Lane, Eastham, MA 02642 508-934-9753 tsoc@targetshipoysters.com

2. **Project Goals**: We proposed to develop an intertidal upweller for small shellfish seed. This type of nursery system is usually used where the upweller can remain submerged in the water constantly, since this is how the young shellfish seed usually grow. While in it, the small shellfish are receiving a constant flow of seawater thereby giving them food and oxygen consistently. However, most shellfish farms in Massachusetts are located in the intertidal zone thereby making it unfeasible to hold shellfish seed in the traditional type of upwelling system. By developing a novel intertidal upweller, this would allow small shellfish farmers to maximize their profit by purchasing smaller shellfish seed at a lower price and growing them to a larger size in an upweller on their farm site.

3. **Farm Profile:** Sunken Treasures Shellfish Company (now known as Target Ship Oyster Company) is a small shellfish farm located off of First Encounter Beach in Eastham, MA in Cape Cod Bay. Currently, the farm is 2.0 acres in the intertidal area.. Annual production of oysters was originally estimated at about 100,000 per year but it will probably actually yield about 60,000 – 70,000 oysters in subsequent years.

4. **Participants:** This project is a collaboration between Target Ship Oyster Company in Eastham, MA (owned and operated part-time by Bethany Walton) and Sweet Neck Farm in Edgartown, MA (owned and operated full-time by Jack Blake). See (http://home.earthlink.net/~jblake321/).

Mr. Blake has provided the design and technical expertise to modify his original larger scale tidal upweller system for use on a smaller scale in the intertidal zone for this project. Ms. Walton then deployed the upweller units on her shellfish farm, purchased small shellfish seed, and subsequently monitored growth of the seed over the course of the season. Other observations were made on the environmental conditions that the upweller units were exposed to, including flow rate and wave action.

5. **Project activities:** The activities that were accomplished for this project include the design and construction of the upweller units by Mr. Blake. Ms. Walton picked up and transported the disassembled units from Edgartown to Eastham, where they were then fully assembled. Only two of the ten upweller units were actually deployed on the shellfish grant and used; the other eight remained onshore and were never utilized for this study due to the severe loss of seed from the two original units.

We planned to deploy these upwellers at the same location during the 2005 season.

6. **Results:** During the 2004 season, we were able to record some limited growth data on the oyster seed before losing the equipment due to severe wave action on the gear. We would have liked to have recorded more extensive growth data and raised the seed to the originally proposed size of 25 mm. We were also hoping to deploy these units again in 2005, but recognized that that our shellfish growing area was far too dynamic to gain meaningful results. Therefore, we did not deploy any upweller units or seed for the 2005 season.

7. **Conditions:** We underestimated the effect that wind and wave action would have on our shellfish aquaculture site and on these intertidal upwellers. We also should have spread out our seed more – we were not anticipating such severe loss of seed in a short time. Due to these severe conditions, we determined that we would not deploy any upweller units or seed for the 2005 season.

8. **Economics:** In addition to the equipment expenses covered by the SARE funding, we paid out of pocket for the cost of shellfish seed to initiate the project (100,000 seed @ $20 / 1000 seed), and additional shellfish seed later on in the season to try to replenish the seed lost (another 50,000 seed). We also had to pay for modifications to the upweller units to try to make them more secure (plywood pieces, PVC pipe, etc.)

9. **Assessment:** The results thus far from our project have demonstrated the need to either (A) find a drastically different method of securing the intertidal upweller units at a dynamic site and / or (B) deploy these upweller units in more protected and calmer locations to observe these functioning in the field and gather meaningful growth data on shellfish seed. This would be a good next step to assess the feasibility of these upwellers for use by shellfish farmers in different parts of the state. Modifications and improvements to these units can also be made after holding a roundtable discussion with growers throughout the state. There have already been requests by other growers in other parts of the state for plans for these upweller units so that they may try them out on their own farms.

10. **Outreach:** As originally proposed, we plan to develop a bulletin that will describe in detail how to construct one of these intertidal upweller units and what the cost associated with maintaining it are. We also plan to present our results and finders to other shellfish growers at an industry type of meeting. We plan to do all of these things with the help of our local marine extension agent.

Figure 1. A fully assembled intertidal Upweller unit.

Figure 2. Close up of how upweller screen Fits into upweller unit.

Figure 3. Unpacking oyster seed in the field.

Figure 4. 100,000 small (5 mm) oyster seed On arrival. Knife is for scale.

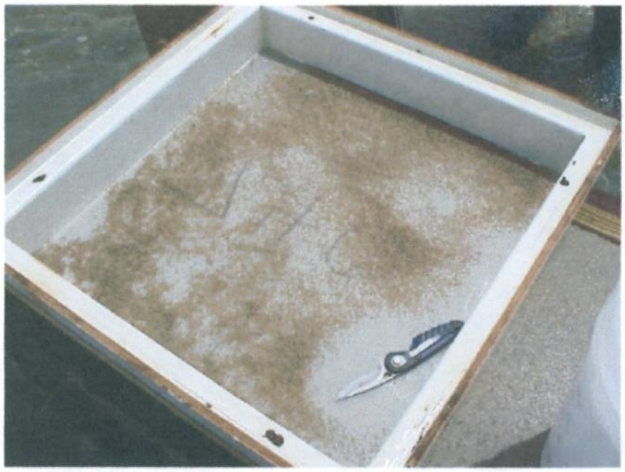


Figure 5. Oyster seed situated in their upweller tray.

Figure 6. Securing the cover on upweller tray to help keep them moist.

Figure 7. Modifications to secure upweller unit including wooden strapping on top of patio blocks and plywood anchor sheet attached to bottom of unit.

Figure 8. Modifications to secure upweller unit include these PVC pipes that were drilled through and attached directly to the upweller.

Figure 9. The remaining 25,000 oyster seed.

Figure 10. The seed after sieving and grading them.

Figure 11. Tending to the upweller screens.

Figure 11. The upweller units Deployed in the field.

SARE Addendum

Project name and contact information: "Development of an Intertidal Upweller Nursery for Shellfish Aquaculture", Grant. No. FNE04-535. Sunken Treasures Shellfish Company (now known as Target Ship Oyster Company), formerly 15 Linda Lane, (now located at 95A South Eastham Street) Eastham, MA 02642 508-934-9753 tsoc@targetshipoysters.com

The growth data that was obtained was an initial measurement of the oyster seed and number of seed per size group; they were separated into groups. One group was those animals that were 2 mm or greater in total length, the other group was less than 2 mm in total length. (please see Narrative below). We lost over 95% of our seed in about three weeks due to the entire upweller being dislodged from high winds and being blown up on the beach. The small oysters that were left in the sieves that were in the units were stressed from being out of water for too long, and therefore died. The remaining seed were then lost due to more severe wave action dislodging one of the sieves (although the upweller unit remained in place – see Narrative below).

June

8,9 We deployed 2 upwellers and set up with rebar and patio blocks

11 We received 100,000 oyster seed from Muscongus Bay Aquaculture in Maine (~5 mm) and placed them all into a 710 um sieve.

165 total mls. X 955 oysters / ml = 157,575 total oysters

12 We checked seed and added lathe to keep patio blocks in place, keep rebar down, tie units together, and keep sieves in slots. Bungee them in possibly?

Noted rebar raised up out of sediments and trays popped up a bit from spaces – motion of waves trying to knock them up and out?

17 One upweller became dislodged and washed up on beach after some high winds. Possible scouring around unit caused rebar to come up and got carried in to shore with wind. One sieve left (with seed) and put back out into other upweller unit. Lost 1 patio block, 3 rebar pieces lost.

Need to pump in PVC and bolt units to it? Make solid bottom for units?

26 Graded seed and counted – all were caught on 1 mm mesh, only 32,550 left from 157, 575. Mortality from stress of being out of water when blown up on shore?

July

5 Graded seed and counted: >2000 mm, 89 / ml * 235 total mls = 20,915
<2000 mm, 75 / ml * 13 total mls = 984
≤1410 mm, >1000 mm, 45 total mls, no subsamples – all look dead
so, total left = 21,899 oyster seed

157,575 – 21,899 = 135,676 lost in 3 weeks!

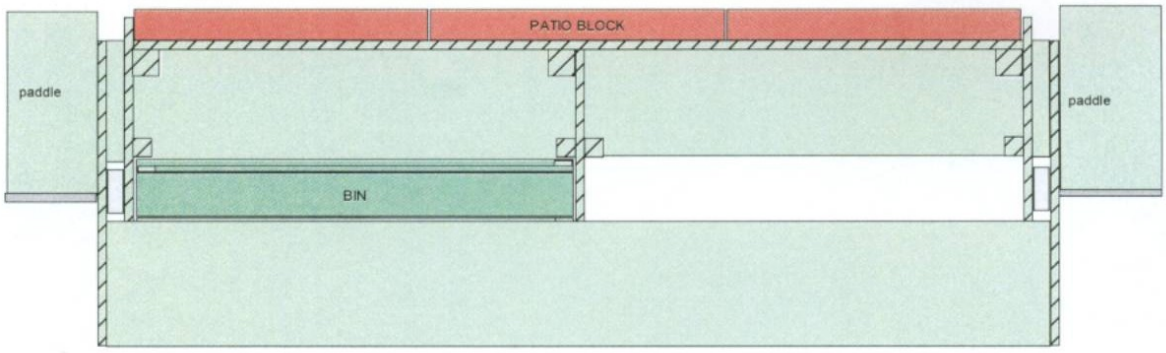
10 We lost another extra sieve – 2000 um, but with no seed in it. Lathe gone too. We had big problems with wave action and sieves being "pushed out" by it. We needed a better securing system. Also added on bottom plywood panel to upweller units to try to minimize scouring an make more stable, but only made the problem worse. Lots of sediment movement.

16, 17 We received 50,000 more oyster seed from Wampanoag Hatchery on Martha's Vineyard (~2.5 mm). Went to deploy seed and noticed that remaining screen with a few original Maine oysters was missing! The screen was "pushed out" and carried away by wind and waves??

These results were very discouraging; ultimately, we put new oyster seed into six small mesh "sleds" and secured in trays. These animals were eventually put into ADPI bags and spat bags and put into Aquatrays with swim noodle floats. We then removed upwellers from the site.

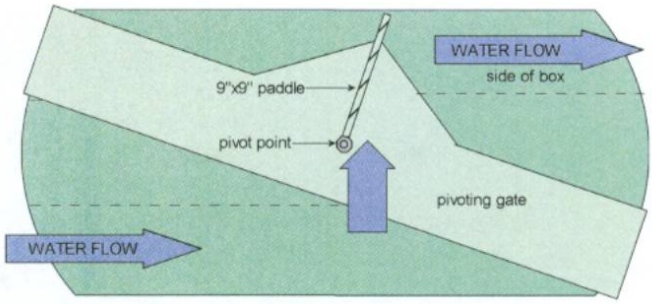
The project only lasted 5-6 weeks! We experienced 100 % seed loss, with scouring from wind and waves posing the biggest problems. This site was too dynamic for the gear. It might work well in a calm area like a salt pond that has low sediment movement; or perhaps in a protected marsh or bay.

FRONT VIEW



NOT TO SCALE

SIDE VIEW



Not to scale

2005 National Shellfisheries Association Meeting

Failures in Shellfish and Aquaculture Research

Gef Flimlin - Why There are no more Shellfish in the Bay

Greg Rivara - "Planting Hard Clams in Iowa"

Joth Davis - Offshore Aquaculture Initiative – How we were slightly ahead of our time

Chris Davis - Ionic Idiocy, or Why I Should Have Paid More Attention in Chemistry Class

Gary Wilckfords - Jury Out on "Low-Cholesterol Oysters" and Other Prosecutable Concepts

Rick Karney – *Vibrio paranoia*

Sandy Macfarlane - "It Seemed Like a Good Idea at the Time"

Dot Leonard –

Bill & Bethany Walton – Intertidal Upwellers: Lessons in Hydrodynamics and Buoyancy