

Augmenting the lobster catch: Oyster aquaculture in modified lobster traps

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Capture fisheries globally are imperiled with many traditional stocks fully or over-exploited (Schiermeler 2002, FAO 2004, NMFS 2003). Regulations that restrict commercial harvest and entry into fisheries are growing and have reached a point where the livelihood and lifestyle of many fishers have been compromised. An important fishing vocation and tradition is threatened.

If explored and implemented in a manner that provides comfort and confidence in commercial fishers, aquaculture can serve as a conduit and alternative option to keep fishermen on the water, working in an environment and pursuing a vocation consistent with their experience and preference. Perhaps the best way to encourage acceptance of aquaculture and to provide the training that commercial fishermen need to pursue aquaculture successfully is through hands-on experiences that build upon activities with which fishers are familiar.

The American lobster (*Homarus americanus*) supports an important and lucrative fishery in coastal waters of the northwestern Atlantic (NMFS 2003, Corson 2004, Boston Globe 2005). In New England, lobsters are routinely captured in baited traps fished on the bottom and secured in position by bricks serving as ballast (Figure 1). Traps are fished for several days, hoisted, harvested and cleaned before being re-baited and returned to the water. Handling procedures are reminiscent of techniques commonly employed in tray culture of the American or eastern oyster (*Crassostrea virginica*; Mattiessen 2001, Wallace 2001). Replacement of brick ballast by living oysters could integrate oyster culture into fished lobster traps thereby linking aquaculture with an existing practice, while providing exposure and nurturing receptivity in commercial fishers. Coincidentally, the process encourages regulators to reassess preconceptions that segregate fish culture from capture fisheries. Are lobster traps with brick ballast replaced by living and growing oysters a fishing device, an aquaculture technique or something else?

To assess the efficacy of integrating small-scale oyster culture in lobster traps, a two year study was initiated that enlisted the cooperation of eleven commercial lobstermen from Massachusetts (USA); six lobstermen trapped lobsters



Fig. 1. Lobster traps being loaded on boat. (Photo by J. Buttner)

in waters north of Boston and four trapped in waters south of Boston. Critical considerations, beyond permit acquisition, included oyster survival and growth, lobster capture rate, and time required to process modified vs. traditional traps. If successful, the approach would increase receptivity to aquaculture and would provide supplemental income for lobstermen in coastal waters of Massachusetts as well as facilitating application of the lobster trap/oyster culture technology elsewhere.

Study Methods

Initially conceptualized in 1999, more than a year of networking was required to enlist support and cooperation among regulatory, commercial and extension people. In spring 2001, Salem State College's Aquaculture Permit was amended by the Massachusetts Division of Marine Fisheries (DMF) to allow for the experimental culture of American oysters (*Crassostrea virginica*) in fished lobster traps. Modified lobster traps designed with input from collaborating lobstermen were manufactured by Friendship Trap⁴ (Figure 2). Ten lobster traps (122 cm x 61 cm x 41

cm) that were modified to hold a stack of five plastic coated wire trays (61 cm x 30 cm x 5 cm) were distributed to each participating lobsterman. Concurrently, lobstermen were instructed on record keeping in a provided logbook and on oyster maintenance.

In mid-August 2001, Island Creek Shellfish Farm, Duxbury, Massachusetts, provided approximately 10,000 juvenile oysters (~40 mm shell length [SL]) previously inspected and found to be disease-free by Dr. Roxanna Smolowitz of the Marine Biological Laboratory, Woods Hole, Massachusetts. In 2002, the study was repeated, with refinement. Number and size of oysters used was increased; 20,000 oysters (~50 mm SL) were obtained from Fishers Island Oyster Farm, Fishers Island, New York. Prior to their arrival on 16 May 2002, oysters had been inspected by Dr. Inke Sunila, State of Connecticut, Department of Agriculture, Milford, Connecticut and interstate importation approved by the Massachusetts DMF. Each participating lobsterman also received a new logbook.

By late August 2001 and between late May and mid-June 2002, each participating lobsterman received 900 or 1,800 oysters, respectively (Table 1 and 2). The top tray in each of 10 modified lobster traps was stocked with 90 oysters in 2001. In 2002, the four top trays of each modified lobster trap, 10 traps total, received 45 oysters. In 2002, each participating lobsterman received one temperature sensor⁵ programmed to record temperatures once every four hours. Temperature sensors were secured in a modified trap and temperature data were recorded for the duration of the study. Modified traps with oysters were fished in the same manner and location as traditional traps. Collaborating lobstermen set traps in one trawl line of 10 traps, five modified and five traditional, or in lines of five modified and five traditional traps fished near each other (Figure 3).

Between late August and late October-mid December 2001 and late May-early June and late October-early December 2002 all traps were managed and cleaned, oysters monitored and lobster catch recorded by lobstermen. In both years, the same general areas were fished by the lobstermen; at a depth of 8-24 m and 6-16 m on sites north and south of Boston, respectively. Visits by the co-principal investigators answered questions and helped standardize handling/recording practices, although quality of data reported varied among participants. Surviving oysters and completed logbooks were returned to the co-principal investigators between late October-mid December of each year for analyses of oyster survival, oyster growth, and trap fishability. Number of living oysters and length of each oyster were determined for each trap.

During both 2001 and 2002, control sites were established north of Boston (Smith Pool, Cat Cove Marine Laboratory, Salem; 42°31.80'N, 70°52.32'W) and south of Boston (Massachusetts Maritime Academy, Buzzards Bay; 41°44.20'N, 70°37.36'W). Oysters were placed in one modified lobster trap at each control site as well as in trays suspended in the water at the Smith Pool site. In 2002, a temperature sensor was secured to traps at both control sites. Traps and oysters were monitored throughout the study period. Number of



Fig. 2. Lobster traps were modified to hold five trays of oysters integrating suggestions provided by commercial lobstermen. (Photo by J. Buttner)



Fig. 3. Modified lobster traps were fished and maintained by lobstermen. (Photo by J. Buttner)

living oysters and length of oysters were determined for each trap at harvest.

Study Results

Because environmental conditions differed at sites located south of Boston, data are reported separately for Cape and Islands, and the South Shore. Cape and Island sites were located south of the Cape Cod peninsula, while South Shore sites were located north of the peninsula between Boston and Cape Cod.

Data collected in 2001 indicate that oysters survived in modified lobster pots, but survival varied among and within sites (Table 1). Mortalities were commonly associated with starfish invasion or occlusion of mesh by algae or other bio-

Table 1. Survival and growth of American oysters maintained in lobster traps fished in coastal waters of Massachusetts between August and December 2001. Lobster catch (Traditional trap : Modified trap) is also indicated. NA indicates not applicable.

Site	Stock Date	Harvest Date	Survival (%)	Growth (mm)	Lobster catch (T:M)
Control (2)	22-24 Aug	14 Jan - 14 Feb	85-92	0 - 17	NA
North Shore (6)	17-22 Aug	30 Oct - 22 Dec	<1 - 90	0 - 6	1.5 : 1
South Shore (2)	21-31 Aug	11 Nov - 1 Dec	6 - 51	4 - 6	2.3 : 1
Cape and Islands (2)	23 Aug	16 Oct - 11 Dec	98 - 99	9 - 19	1.8 : 1

Table 2. Survival and growth of American oysters maintained in lobster traps fished in coastal waters of Massachusetts between May and December 2002. Lobster catch and effort to process traps (Traditional trap : Modified trap) is also indicated. NA indicates not applicable.

Site	Stock Date	Harvest Date	Survival (%)	Growth (mm)	Lobster catch (T:M)
Control (2)	22 May -17 Jun	20 Nov	82 - 100	7 - 8	NA
North Shore (6)	30 May - 17 Jun	22 Oct - 4 Nov	50 - 100	0 - 13	Same ¹
South Shore (2)	28 May	7 Oct - 3 Dec	-----	10 - 15	More
Cape and Islands (2)	26 - 30 May	12 Oct - 3 Nov	83 - 98	31 - 35	-----

¹Effort was characterized the same by five of six fishers, one characterized effort as more for modified traps.

fouling organisms. Oysters on the North Shore (~42.5°N, 70.5°W) grew poorly or not at all, while those maintained in traps fished on the South Shore (~42°N; 70°W) exhibited modest growth during the abbreviated growing season (essentially September and October; Table 1). Oysters maintained in traps fished in waters south of Cape Cod (~41.2°N, 70.5°W) exhibited better growth as did oysters maintained in Smith Pool, Cat Cove Marine Laboratory (42°31.80'N, 70°52.32'W; Table 1). Growth was probably affected by temperature; waters south of Cape Cod were influenced by the Gulf Stream and the shallow, protected waters of Smith Pool were warmer than the open waters of Massachusetts' North and South Shores, which were influenced by the Labrador Current. Lobster catch in modified traps was consistently less than in unmodified traps (Table 1); however, time handling traps was similar after lobstermen became more familiar and competent with the procedure.

In 2002, oyster survival generally exceeded 80 percent for sites reporting data and growth ranged from negligible to over 30 mm SL (Table 2). Handling time for trap cleaning/processing was similar for modified and traditional traps, while lobster catch rate approached parity as evidenced by numeric and observational data provided (Table 2). Experience gained during 2001, especially on the removal of biofouling organisms and selection of sites with few starfish, and the longer culture season in 2002 (May into October or later) lead to better management of oysters in modified lobster traps. Warmer temperatures encountered by oysters cultured at control sites and sites south of Cape Cod also

influenced growth; where average daily temperatures greater than 18°C were more frequently observed at these locations (Figure 4).

Discussion

Oysters survived and grew in functional lobster traps, with the best growth being observed for oysters cultured in the warmer waters (>18°C) south of Cape Cod. Additionally, modified traps captured lobsters effectively, although at a rate somewhat less than realized by traditional traps, and did not require inordinate effort to process. These findings suggest that commercial lobstermen can augment their income by replacing the nonliving ballast typically used to anchor traps with one or more bags of oysters. If 100 premium grade oysters are harvested per modified trap, the additional revenue of US\$50 per trap provides substantial supplemental income, even if the catch rate in modified traps is slightly less than that realized in traditional traps. Applicability of oyster culture in fished lobster traps appears economically viable and acceptable to at least some lobstermen.

The financial and logistic benefits of integrating oyster culture into fished lobster traps have not gone unappreciated. The technique has been embraced by two participating lobstermen south of Cape Cod as well as other lobstermen not involved in this study that became aware of its findings. Working closely with the Massachusetts Division of Marine Fisheries to ensure modified lobster traps are fished in waters approved for bivalve culture and that product qual-

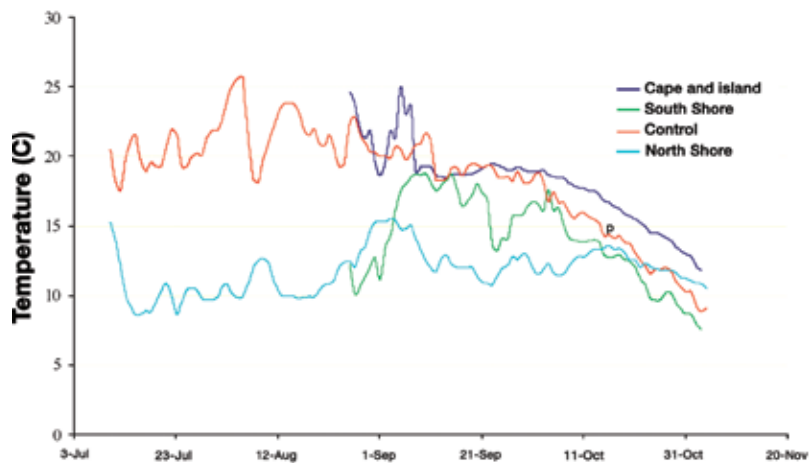


Fig. 4. Average temperature for Control, North Shore, Cape and Island, and South Shore sites for dates when data were collected in lobster traps when oysters were fished.

ity is maintained, integration of oyster culture into fished lobster traps continues beyond this study and is moving toward commercial viability. Integration of oyster culture into fished lobster traps appears to have its greatest commercial potential in the warmer waters south of Cape Cod, although the approach may work in the cooler waters if a suitable alternate mollusc is employed.

While biologically feasible and economically attractive, perhaps the greatest value of integrating oyster culture into lobster traps is the resultant blurring of perceived and real differences between fishing and aquaculture. Lobstermen, scientists and regulators have pooled their resources and talents proactively to help secure an important fishing tradition in Massachusetts to the benefit of fishers, consumers and the environment. Given the dismal status of too many commercial fisheries, the ever-expanding human population, and increasing demands upon aquatic resources, we must think and act by plural vs. singular pronouns to identify, create and realize new opportunities.

Notes

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⁴Friendship, ME.

⁵HOBO, Onset Computer Corporation, Bourne, MA

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References

- Boston Globe. 2005. New England Lobster Prices Soar. 5 July 2005.
- Corson, T. 2004. The secret life of lobsters: how fishermen and scientists are unraveling the mysteries of our favorite crustacean. Harper Collins, New York, NY. USA
- FAO (Food and Agriculture Organization of the United Nations). 2004. The State of World Fisheries and Aquaculture 2004. Food and Agriculture Organization of the United Nations, Rome, Italy.
- Matthiessen, G.C. 2001. Oyster Culture. Fishing News Books, London, England.
- NMFS (National Marine Fisheries Service). 2003. NMFS Landings. http://www.st.nmfs.gov/st1/commercial/landings/annual_landings.html (October, 2005)
- Schiermeler, Q. 2002. How Many More Fish in the Sea? Nature 419: 662-665.
- Wallace, R.K. 2001. Cultivating the Eastern Oyster, *Crassostrea virginica*. Southern Regional Aquaculture Center, SRCA Publication 432, Mississippi State University, Stoneville, MS. USA.