Integrated oyster and littleneck clam aquaculture to increase seafarm yield

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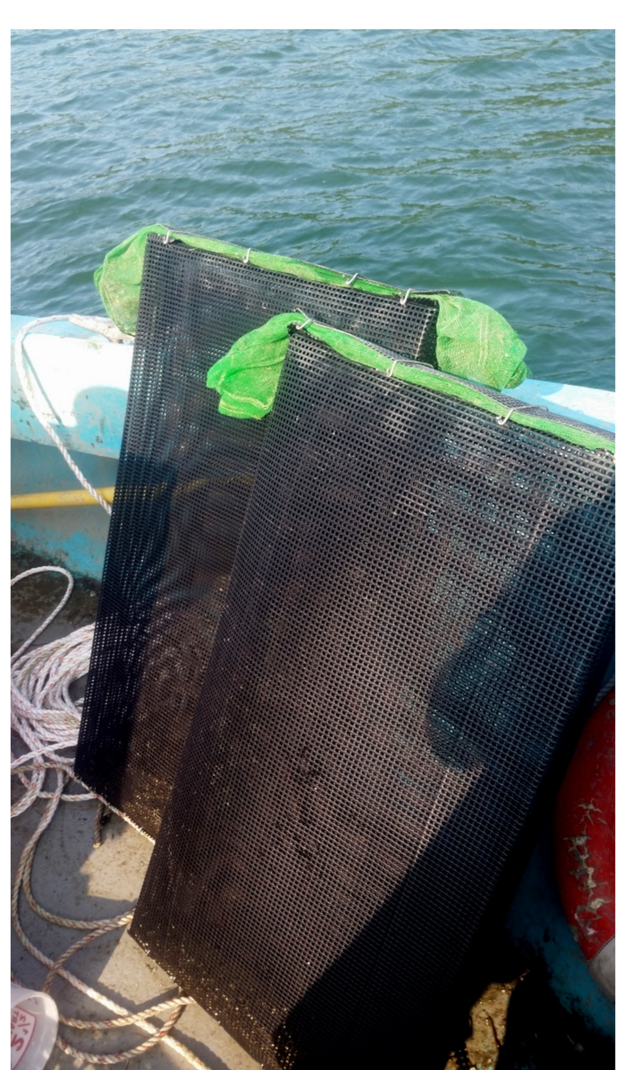
80,000 1mm clam seed

Clam Seed in nursery bag

Nursery bags deployed in floating oyster cages



Bottom-growth bags ready for deployment

Objectives:

This project aimed to test crop diversification on a subtidal oyster farm by introducing littleneck clams (Mercenaria mercenaria) as a secondary crop species. Adding clam culture to an existing oyster farm would utilize different (and otherwise wasted) vertical space within the footprint of an aquaculture lease.

Small, intensive oyster farms (which make up a large proportion of aquaculture leases in the region) use floating equipment to grow oysters in the top few feet of the water column, where strong currents deliver the most suspended plankton. Littleneck clams optimally grow in soft sediments and could be placed on the seafloor below existing oyster farms. In this arrangement the oysters and clams would not compete for food or space. Successful implementation of this design could potentially increase a farm's total shellfish yield.

Subtidal culture of littlenecks would bypass the inherent drawbacks of traditional inter-tidal clam culture (disturbance of wildlife, conflict with wild-harvest fisheries, aesthetic complaints, and co-option of what has traditionally been a commons) and would offer the farmer the benefit of crops with different maturation times and increased resilience to disease and pests. A polyculture of oysters and littlenecks would present farmers with two-high value crop species that can be sold on the specialty half-shell market.

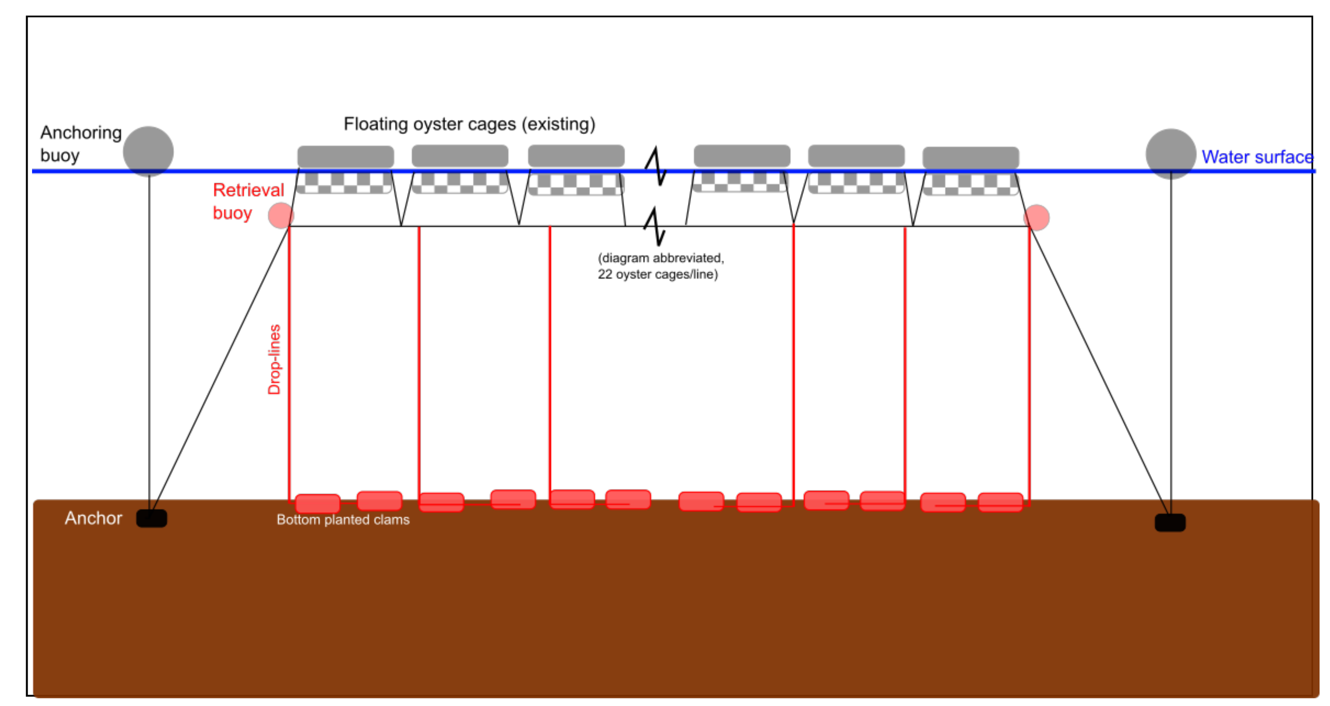
Methods:

80,000 1mm littleneck clam seeds were procured in mid June 2017. The seed was placed in 0.7mm soft mesh nursery bags which were deployed in lantern nets and floating oyster cages. Mesh bags were swapped out weekly to avoid excessive algal fouling.

Seed was sieved in August. Individuals that were large enough to be retained by 4mm ridged mesh were selected for the growout phase of the experiment. These individuals were split into three different groups. Two of the groups were deployed in bottom-planting bags. These bags consisted of commercially available ridged-mesh oyster bags, strengthened with stainless steel hog-rings and weighed down with rebar. These bags were lowered with ropes to the soft substrate below the farm at opposite ends of the farm. The remaining group of clams was retained in surface gear similar to the nursery equipment. This treatment was included to gauge the optimal time to switch from nursery equipment to bottom-planting.

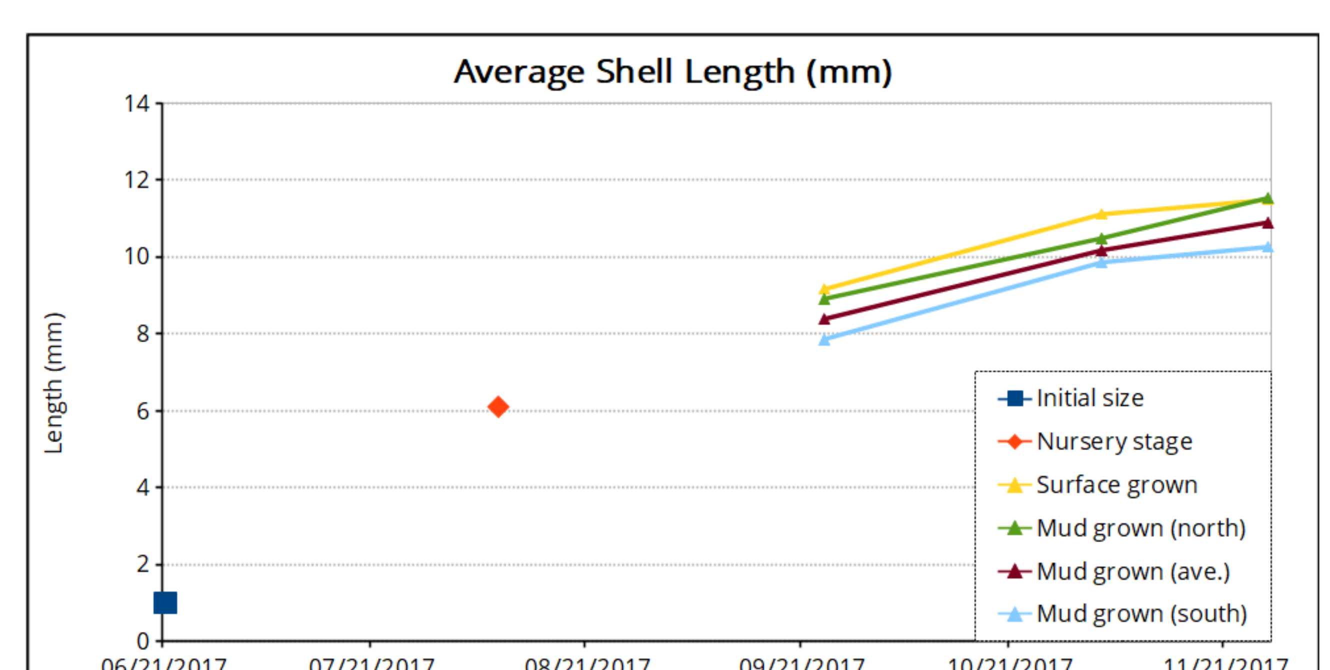
Bottom planted bags were hauled to the surface weekly to check for fouling and to prevent them from sinking too deep into the sediments. Surface/nursery bags were rotated between sun and shade on a weekly schedule to avoid buildup of algae. Length, volume, fouling, predator presence, and mortality measurements were taken on a monthly schedule until the end of November.

Oysters growing in floating cages at Winnegance Oyster Farm



Site plan of longlines - Experimental equipment shown in red

Bottom grown clams during November 2017 measurements



Results:

Nursery phase-

Clams grew at a very high rate during the nursery-phase. Shell length grew over 6x (on average) in the time between June 21 and Aug. 8, despite highly unusual severe red-tide conditions that stunted oyster growth during the same period.

The mesh nursery bags picked up a small amount of algal fouling. This was easily mitigated by rotating sun-facing bags into the shade and switching fouled bags with fresh bags on a weekly basis. Bags were never fouled enough to inhibit water flow and feeding. Predation was not an issue in the contained system of the nursery. No predators were observed within the nursery bags. Mechanical loss (wave-action sifting) was very high, with just over 60% of seed lost during nursery growth.

Growout Phase-

During the growout phase, shell lengths grew in both surface and sediment treatments by significant margins, but differences between treatments fell within standard error. The trends seen in shell lengths were mirrored by shell volume measurements and suggest clams grown on the surface grew the fastest until late October, while sediment-grown clams grew faster in the final month of the experiment. On average, the surface-treatment clams reached a length of 11.5mm by the end of November and sediment-grown clams reached a length of 10.9mm. In both treatments, individuals were observed measuring as long as 17mm.

Surface-grown clams picked up a very small amount of blue-mussel fouling in November (ave. 6 individuals/bag). For all practical purposes this is negligible. Sediment-grown clams were free of fouling organisms. Fouling across the farm was exceptionally light in 2017 compared to other seasons. These results may reflect that trend. Rock crabs were also observed in the bottom-planted bags, though predation was inconsequential.

Conclusions:

This project demonstrated that littleneck clams can be grown in the same footprint as eastern oysters, adding an additional crop species to an existing farm without sacrificing lease-space. Both the floating nursery and sinking grow-out bags were technically viable methods for growing hardshell clams and were compatible with existing oyster farm practices. Growth rates were excellent in all treatments. Fouling, depredation, and other mortality was negligible during the grow-out phase. Though seed loss was high during the nursery phase, this problem could be mitigated by purchasing larger seed or by using a more rigid fine-mesh in nursery bags.

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