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MARINE EXTENSION BULLETIN

Field nursery options as alternatives to upwelling for small oyster seed

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SUMMARY

Small oyster seed is often assumed to have poor nursery performance. Many growers therefore either use an upweller, or if that's not an option, purchase larger (more costly) oyster seed. While juvenile shellfish are most vulnerable to predation and the elements, there are some functional options for small seed oyster culture at the farm site. This bulletin discusses potential options for growing and maintaining smaller-sized oyster seed in nursery culture on farms as an intermediate step between the shellfish hatchery and typical on-farm grow out of oysters. Some specific trials that compare field nursery culture bags to seed in floating upwellers are described as demonstration of the potential, and examples of gear in use as oyster nursery options on Massachusetts oyster farms are also described.

BACKGROUND

Seed size

Procuring seed is a necessary first step for any shellfish farm or propagation operation. Few areas in Massachusetts have enough natural juvenile oyster production to allow for consistent wild "spat" collection, so hatchery seed purchases have become routine for most shellfish growers. Buying shellfish seed is regulated by the Massachusetts Division of Marine Fisheries (DMF) and limited to those who have an active propagation permit. To prevent introduction of shellfish diseases, DMF also provides oversight on the sources of seed available for sale in Massachusetts. The list of approved sources is updated annually and posted to their website (www.mass.gov/info-details/find-an-approved-shellfish-seed-hatchery).

Field nursery culture can be done in commercially available spat bags or lined baskets, custom window screen bags or floating structures – there are several options.

Left to right: Two millimeter seed with coins and pencil for scale. A land-based upweller with round bins. Upwellers use pumps to continuously move water through the shellfish seed.

For growers starting their operation, seed size is an important initial consideration. Most hatcheries can provide oyster seed at numerous sizes. Larger oyster seed (>6mm or ¼") is generally easier to handle and hardier than smaller seed and has decent expected survival rates. Beginner growers often buy the largest seed possible, as it can be put in grow-out gear immediately, eliminating the need to use nursery gear. Starting with big seed has drawbacks though, namely it can be expensive. In recent years, advertised prices of 12mm (½") oyster seed were roughly triple the cost of 3-4mm (~ 1/8") seed, and even larger sizes of 19-25mm (¾"-1") can be four to five times the price of smaller 3-4mm seed. While the expense may be justified for some operations to circumvent the nursery phase, buying quantities of larger size seed can become costly.

Obtaining supplies of large seed can sometimes be an issue. Space is limited at commercial suppliers, so there is an incentive for them to sell smaller seed. In addition, nursery systems can experience failures, bringing in more risk in supply failure.

Upwellers, whether floating or land based, have become somewhat of a standard in nursery culture of oysters in the Massachusetts region. There is good reason for increased reliance on this technology as they allow for easier handling of large numbers of seed in a small area while ensuring adequate food for the high density of actively growing shellfish. Upwellers too have challenges associated with their use. Initial capital cost, lack and/or cost of permittable space to use one, or lack of a power source – despite some advances in tidal and solar power, most upwellers are still connected to grid power – are a few of the reasons an upweller may not be suited to every oyster production scenario.

Upwellers have become so standard that small oyster seed is often assumed to have poor nursery performance unless an upweller is used. While juvenile shellfish are most vulnerable to predation and the elements, there are some functional options for oyster nursery culture at the farm site. Several local trials[1] and research from Auburn University in Alabama[2] also indicated transferring seed to nursery bags at small sizes can improve growth without sacrificing survival of the seed.

SOME ALTERNATIVES TO UPWELLERS

Field culture in nursery bags

As tested by the authors here, nursery bags, or grow bags with a finer mesh, are often the simplest way to start with field nursery culture. These can be commercially made "spat" bags of various mesh sizes or custom-made bags made out of materials like window screen with a mesh size of roughly 1mm. Deploying these finer mesh bags within a standard HDPE (high density polyethylene) oyster grow bag provides more structure for the fine mesh bag and allows the bags to be deployed in standard aquaculture gear.

As a side note: One needs to be careful about mesh size and size of oysters, making sure oysters are big enough to be retained by the mesh. Good success is usually ensured by stepping down a mesh size, i.e., deploying 2mm seed (sometimes listed as R1.5 or retained on 1.5mm mesh) on 1mm mesh bags. Likewise, not all mesh is made the same,

1. Reitsma, J., Archer, A., Murphy, D., Booth, H. 2022. Experiments with Small Oyster Seed in Nursery Bags as an Alternative to Upwelling. Technical Report. Cape Cod Cooperative Extension, Woods Hole Sea Grant, and SEMAC.
2. Landry, K., Rikard, F.S., Myers, T., and W.C. Walton. 2013. Performance of Upweller Vs. Field Bag Nursery Systems For Oyster Seed Crassostrea virginica. Proceedings of Aquaculture 2013, Nashville, TN.

some 2mm mesh bags are actually roughly 2mm x 3mm, and may allow the seed to fall through. Always double check before you deploy.

When using nursery bags, seed growth can be comparable to that seen in an upweller, with seed reaching roughly a ½" (~13mm) in just 2-4 weeks. Density is an important consideration; 1000-2000 seed per bag (0.6-1.2 oysters per cm^2) achieved similar results to an upweller system, while 4000 per bag showed slower growth. Periodically handling the bags to keep the small oysters moving around is crucial to prevent clumping and to keep fouling at bay. Handling time can be reduced, however, if small mesh bags of seed are planted during months with maximal growth potential (often late May and June in Massachusetts). Based on the testing we did, survival or yield from the number of seeds planted can lag behind in field culture but, in good growth conditions, can be in the range of 80-100%, though lower where predators pose challenges or growth is more variable or limiting.

Baskets and line-based grow out tumblers

While not part of our study, some other options available for grow out are hanging baskets with finer mesh lining and larger tube-type "grow out" tumblers. Both of these options seem to work best at intertidal locations where they can be hung from lines stretched just off the bottom or from other gear, allowing wind and waves to generate some natural tumbling action. This also reduces the amount of time and effort needed for handling the containers to keep the seed dispersed. The tube type tumblers often come equipped with a float that allows the tube to move up and down with the tide, providing further tumbling action. While routine handling isn't as critical if natural tumbling action occurs, take care in the case of very exposed sites to avoid line chaffing and potential gear loss or damage.

Floating options

There are floating options for nursery culture as well. If floating is permitted within the growing area, it allows the seed to grow near the surface where the water is well oxygenated and food – phytoplankton – is most plentiful. Floating can also take advantage of surface wave action to tumble the rapidly growing seed but, again, care should be taken to avoid wave action that is too aggressive.

Besides oyster grow bags lined with finer mesh, some custom-made floating trays or structures lined with fine mesh have been used with success. To manage fouling, it

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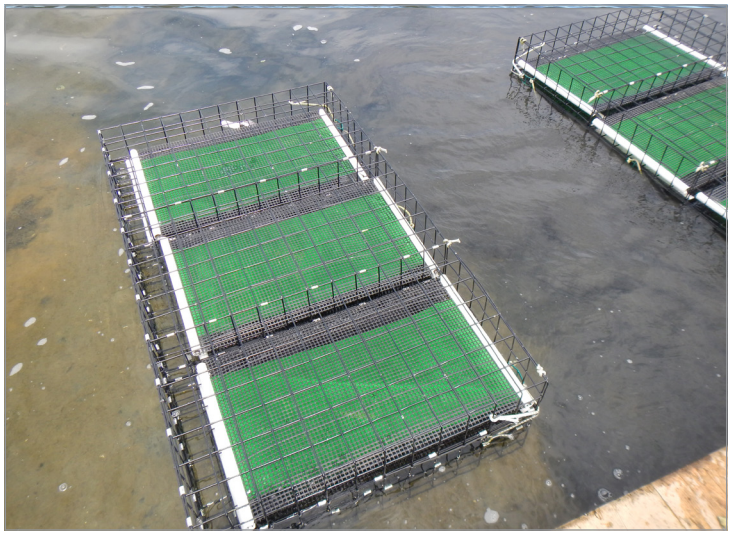
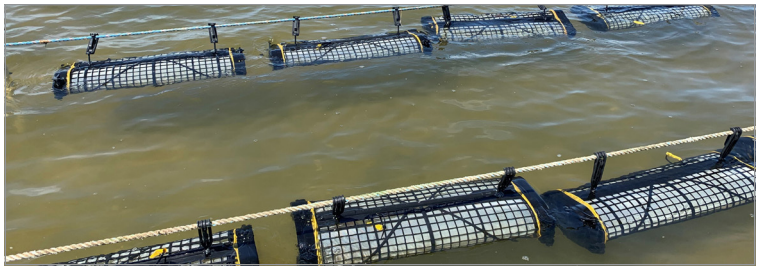
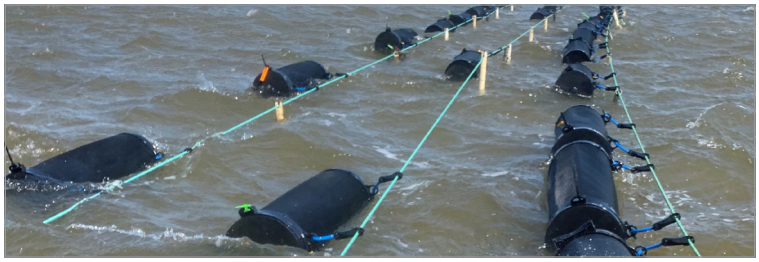
Left to right: Green mesh spat bags with a mesh of 0.75mm stretched flat inside an oyster grow bag with PVC sliders at either end. These can then be deployed in standard grow gear like the cage pictured here. Hanging baskets (top) and oyster grow out tumblers (bottom) on long line system. Photo credit: Mark Begley







can be good to have an option to flip the floating system to allow periodic air drying or cleaning of the mesh, though access to seed can become an issue in mesh enclosed scenarios.

To account for the lack of a latch opening, the "Pittsley Gro" system involves an 8-foot-long compartmentalized wooden structure where mesh of various sizes can be secured over the top with bungee straps. The system allows the grower to flip for cleaning and drying. In a rough test comparing the same lot of seed to a nearby upweller, oyster seed growth was similar if densities and mesh size were managed.

GENERAL RECOMMENDATIONS

- Field nursery culture can be done in commercially available spat bags or lined baskets, custom window screen bags or floating structures–there are several options.
- To prevent loss, make sure the mesh size being used is a step down from the size of oysters being deployed.
- Get seed at a time of year when there is sufficient food for maximal growth. Fast growing oysters don't need to be in small mesh for very long, which eases the handling.
- Density is also a critical consideration. While trial and error is inevitable, it is best to err to the side of lower density to maximize growth. A good starting point is 1000 per bag or less than 1/cm^2.
- Flipping and handling bags at least once per week is recommended, especially when in <2mm mesh.
- Shaking oysters manually or with wave action will help prevent clumping and help shape the oysters.

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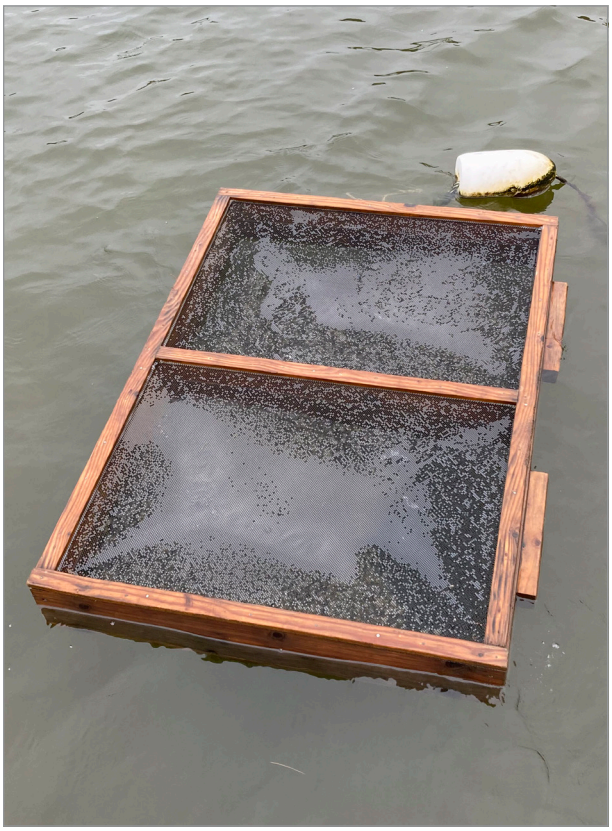

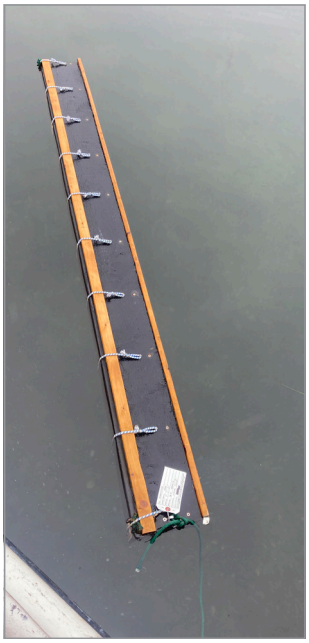

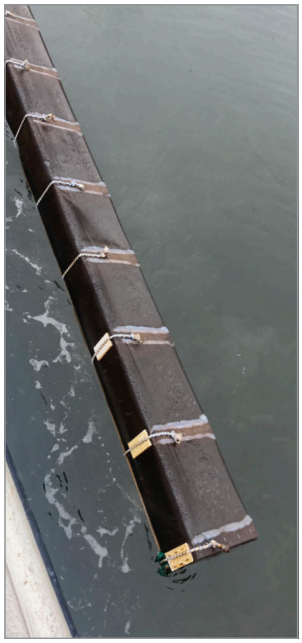

Top to bottom: A floating wooden mesh tray for nursery culture. Pittsley Gro floating in use position and inverted to be cleaned.

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