Bottom gear and floating gear

A Comparison of Bottom, Hanging and Floating Gear for Growing Eastern Oysters

(Crassostrea virginica) in the Broadkill River, Delaware

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OYSTER GROW-OUT METHODS

BACKGROUND

Shellfish culture shows great promise in providing a sustainable solution to some environmental issues in Delaware. Because of the regional importance of the aquatic environment and the potential for aquaculture development, the primary goals of the Natural Resources Program at Delaware State University are to promote sustainable solutions to the growing demands and needs, support public interests, and become a steward of the environment in the state.

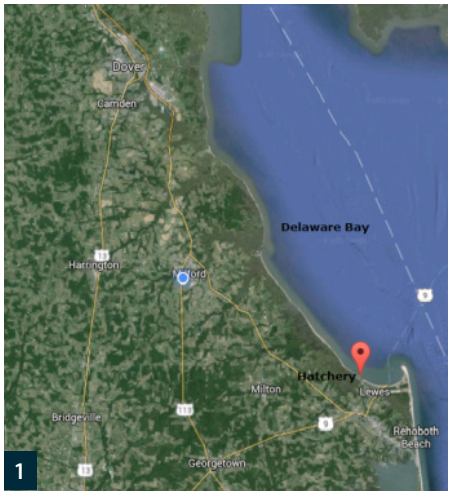
The objective of this 2-year research project was to compare the growth of hatchery-raised oysters housed in various oyster culture gears to determine which gear better was suited for commercial aquaculture practices in Delaware.

Site Location

This study was conducted at the University of Delaware (UD) oyster hatchery pier, near the mouth of the Broadkill River in Lewes, Delaware.

1. Location of UD Oyster Hatchery, Lewes, DE

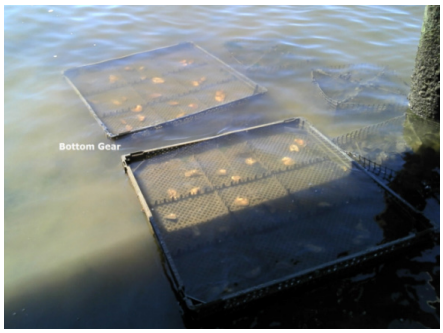
2. Location of pier and gear types



(maps.google.com)

Gear Type

In 2014, bottom gear (weighted aquaculture trays) and hanging gear (baskets) suspended at the end of the pier were used.



Bottom gear – 2014

Hanging gear – 2014

In 2015, similar bottom gear (weighted aquaculture trays) and baskets contained inside a Taylor float were suspended near the end of the pier. A Taylor float holds baskets of oysters approximately 31cm below the surface of the water.

Bottom gear and Floating gear – 2015

Gear Construction

Construction of a basket housed in a Taylor float

Bottom gear consisted of plastic aquaculture trays that were weighted with bricks.

Previously constructed hanging baskets (35.6 cm x 35.6 cm x 15.2 cm) were made of vinyl-coated 14-gauge wire (2.5 cm square) with rope tied diagonally across at the corners.

After the loss of oysters during the first week of this study due to strong tides causing the baskets to "tip," the top of each basket was covered with plastic mesh.

The baskets housed inside the Taylor float (56 cm x 23 cm x 23 cm) were also constructed of vinyl-coated 14-gauge wire.

Construction of bottom gear

Hanging basket

Basket inside Taylor float

Hanging gear with mesh top

Experimental Set-up

180 oysters ranging less than 100mm shell height were haphazardly selected from the hatchery stock. Six groups of 30 oysters were then selected from these 180 oysters. In 2014, each group of 30 oysters were then randomly assigned to and placed in either a hanging basket (n=3) or a weighted aquaculture tray /bottom gear (n=3). In 2015, they were assigned to either a basket housed in a Taylor float "floating basket") (n=3) or a weighted aquaculture tray/ bottom gear (n=3).

In 2015, oysters were assigned individual numbers (1-180) in order to better track their growth. These numbers were applied with white nail polish and a red Sharpie. (In 2014, the study was set up to just track the average growth of all oysters grown in either bottom gear or floating gear. It was possible, however, to determine the growth of each individual oyster after spending many hours analyzing the data).

In 2014, oysters in both gear types were exposed to the air twice daily during low tide. In 2015, only oysters in bottom gear were exposed to the air — oysters in the Taylor float remained suspended in the water.

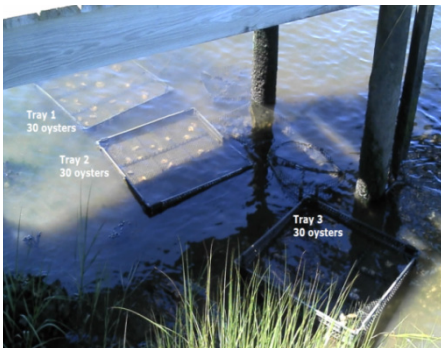
Numbered oysters – tray

Numbered oysters – basket

Grow-out Gear Deployment

In 2014, each group of 30 oysters were placed in either a hanging basket (n=3) and hung from the pier, or a weighted grow-out tray/bottom gear (n=3) and placed in the intertidal benthic area under the pier close to shore.

In 2015, each group of 30 numbered oysters were placed in either a basket (n=3), placed in a Taylor float, and attached to the pier near the end, or a weighted grow-out tray/bottom gear (n=3) and placed in the intertidal benthic area under the pier close to shore.



Above and below: Bottom gear under pier

Hanging gear at end of pier (basket 3 not shown)

One of three baskets of oysters housed in Taylor float

Taylor float attached to pier

Data Collection

Initial shell height (length) and live weights of each oyster was measured to the nearest 0.1mm with digital calipers (Mitutoyo) and 0.001g with a digital balance (Ohaus Scout Pro), respectively. Epifauna were scrubbed off oysters and they were dried before weighing. Field work was performed weekly at low tide. Oyster growth was measured and mortality count was determined and documented. By week three of the study it was determined that the oyster shells were chipping and losing length, so collecting this measurement ceased. In 2014, data collection occurred for 15 weeks, while in 2015, data were collected for 12 weeks. Research was suspended and gear retrieved from the water due to a Nor'easter and the effects of Hurricane Joaquin.

Measuring shell height (length) of oyster

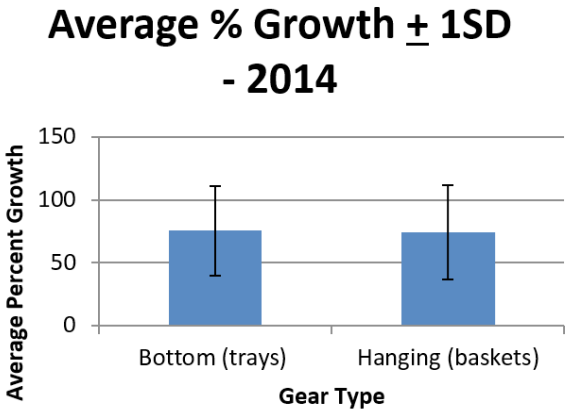
Measuring weight of oyster

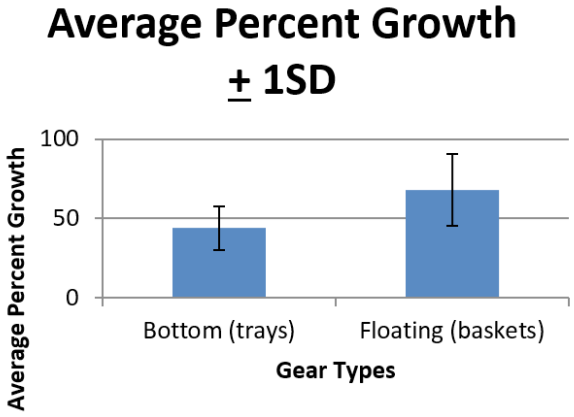
Calculations

The percent growth of each oyster was calculated using the following steps:

- The overall increase in weight of each oyster = Final weight – initial weight
- The % growth for each oyster = Overall increase in weight/initial weight X 100

RESULTS





In 2014, there was no significant difference found in the percent growth of oysters between those grown in the hanging gear and those grown in the bottom gear.

The same was true in 2015 — no significant difference in the average percent growth of oysters when comparing oysters grown in floating gear and those grown in the bottom gear; however, oysters in the floating gear showed an average of 24.2% greater growth than those in the bottom gears.

Discussion

It is not possible to compare the average percent growth of oysters in 2014 to 2015 because the same environmental factors (pH, salinity, food, weather, etc.) did not exist. The study in 2015 was also shortened by 3 weeks due to a Nor'easter and the effects Hurricane Joaquin causing strong winds, current, and excessive high tides. It was necessary to remove the gear and suspend data collection so that gear and oysters were not lost.

Average percent growth of oysters during a single year can be compared between gear types. In 2014, while there was no significant difference in oyster growth between the two gear types, the use of hanging baskets required continual watch to ensure that the rope that was suspending the baskets in the water didn't become wound around the pier pilings and cause the oysters to remain out of the water during high tide.

It was necessary to collect data at low tide due to the use of bottom gear. This can lead to very early mornings or late evenings due to the timing of the low tides in conjunction with data collection days. The baskets in the Taylor float were also sampled at the low tide in order to reduce variables in this study; however, Taylor floats can able to be sampled at any tide, which would make them more convenient to sample.

The weight of the bottom gear made it necessary to first move the oysters to a bucket in order to transfer them to the weighing station, and then return them to the trays. This required climbing down a ladder to access them in the intertidal region. Oysters also required transferring to a bucket with the hanging baskets, due to the manner in which the ropes that suspended them were attached to the pier. Both of these gear types were more labor intensive than the use of the baskets in the Taylor float. Those baskets were removed from the float with a boat hook, and taken to the weighing station. After weighing, the baskets were returned to the float. This method was less labor intensive, and involved less handling of the oysters.

Further Research

Further research on various aquaculture gears will be conducted in the Delaware Inland Bays to assess their suitability and performance to optimize oyster growth and survival, in order to help potential oyster growers successfully raise oysters.

The economics using the various gear types will further help the potential oyster farmers to determine which gear type/ technique would work best for their aquaculture operation location.

More Information

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Photo credits to Laurieann Phalen

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