Oyster Farming

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Chris Linder, chrislinder.com
Class Outline

- Overview of grow-out
- Review of systems
  - Bottom planting
  - Rack and Bag
  - Trays
  - Baskets
  - Floating Bags
- Grading, Splitting and Tumbling
- Fouling
- Disease
- Winter Considerations
- Harvest Methods
- Bag Designs and Construction Techniques
- Guest Speakers
Guest Speakers

- Dave Ryan – Barnstable
  Cape Cod Oyster Company (1993)

- Ed Janiunas – Duxbury
  Sweetheart Creek Oyster Co. (2016)

- Kirsten Friedrich – Orleans
  Skaket Beach Oyster Farm
Field Grow-Out

- Raise oysters to market size
- Attempt to:
  - Keep oysters alive
  - Maximize growth
  - Induce preferred shape (deep cup, fan shape)
- Options:
  - Bottom culture
  - Suspended culture
  - Off-bottom culture
- Threat of ice requires a plan
New England Oyster Growing Cycle

- 18+ months to grow 2018 crop
- 18+ months to grow 2019 crop
- Selling 2017 crop
- Selling 2018 crop

2018 2019

Sold out

Graphic modified from Pangea website
Production Cycle

- **Year One**
  - Nursery of Year One
    - Moved to field
  - Nursery of Year Two
    - Moved to field
  - Field culture of Year One

- **Year Two**
  - Nursery of Year Two
    - Moved to field
  - Field culture of Year One

- **Year Three**
  - Nursery of Year Three
    - Moved to field
  - Field culture of Year Two
  - Field culture of Year One
    - Harvest of Year One

- **Year Four**
  - Nursery of Year Four
    - Moved to field
  - Field culture of Year Three
  - Field culture of Year Two
    - Harvest of Year Two
  - Continued harvest of Year One?
To Raise 100,000 Oysters/Year

- **Year One**
  - Buy & nursery 100,000 2 mm seed
  - End of year, 100 bags of 1,000 Yr 1 seed
    - ~16 racks

- **Year Two**
  - Buy & nursery 100,000 2 mm seed
  - End of year, 100 bags of 1,000 Yr 2 seed
    - ~16 racks
  - In spring, divide Yr 1 seed into 500 bags of 200 oysters each
    - ~84 racks

- **Year Three**
  - Buy & nursery 100,000 2 mm seed
  - End of year, 100 bags of 1,000 Yr 3 seed
    - ~16 racks
  - In spring, divide Yr 2 seed into 500 bags of 200 oysters each
    - ~84 racks
  - Across year, raise Yr 1 seed
    - ~68 racks
  - Harvest as ready
What Would that Cost?

**Year One**
- Buy & nursery 100,000 2 mm seed = $1,200
- End of year, 100 bags of 1,000 Yr 1 seed (assuming 2 size mesh bags) = $840
  - ~16 racks = $2,240

**Year Two**
- Buy & nursery 100,000 2 mm seed = $1,200
- End of year, 100 bags of 1,000 Yr 2 seed (assuming 2 size mesh bags) = Re-use Year One
  - ~16 racks = Re-use Year One
- In spring, divide Yr 1 seed into 500 bags of 200 oysters each = $2,100
  - ~84 racks = $11,760

**Year Three**
- Buy & nursery 100,000 2 mm seed = $1,200
- End of year, 100 bags of 1,000 Yr 3 seed (assuming 2 size mesh bags) = Re-use Year One
  - ~16 racks = Re-use Year One
- In spring, divide Yr 2 seed into 500 bags of 200 oysters each = $2,100
  - ~84 racks = $11,760
- Across year, raise Yr 1 seed
  - Harvest as ready
  - Assume 80% survival
  - Wholesale price of $0.60
  - = +$48,000
- Three Year Net, without labor = ($48,000 – $36,000) = $13,600 or $4,533/yr
## Oysters

<table>
<thead>
<tr>
<th>Number</th>
<th>Seed Price/1000</th>
<th>Yr to maturity</th>
<th>Per Bag</th>
<th>Bags/rack</th>
<th>Bags needed</th>
<th>Racks needed</th>
<th>Bag cost each</th>
<th>Rack cost each</th>
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### Survival Rate
- To Market: 75%
- Gross: $41,250.00
- Net: $25,472.22

### Pay rate
- Market Price: $25.00
- Prep and maint: 20 min/K
- Harvest: 20 Min/K

### Year by year, 2 year growth cycle
<table>
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<tr>
<th>Seed</th>
<th>Seed Cost</th>
<th>Prep Labor</th>
<th>Harvest Labor</th>
<th>Harvest</th>
<th>Bags in use</th>
<th>Bags to buy</th>
<th>Racks in use</th>
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### Fixed Costs

| Truck Fuel | $1,715.00 |
| Oil Repairs | $27.00 |
| Maintenance Loan Payments | $655.00 |
| Tires | $185.00 |
| Insurance | $371.00 |
| Parking | $125.00 |
| Total | $1,833.00 |

| Boat Fuel | $177.00 |
| Oil | $22.00 |
| Boat Repairs and maintenance | $275.00 |
| Tires | $85.00 |
| Mooring Fees and maint. Dockage | $150.00 |
| Paint | $125.00 |
| Total | $1,091.50 |

| Boll | $55.00 |
| Oil | $275.00 |
| New Boll | $330.00 |
| Total | $1,091.50 |

| Harvest Gear Rakes | $450.00 |
| Baskets and similar | $110.00 |
| Coolers | $500.00 |
| Total | $1,160.00 |

| Personal Gear Boots | $258.00 |
| Gloves | $110.00 |
| Clothing | $255.00 |
| Foul Weather Gear | $175.00 |
| Total | $788.00 |

| Auxiliary Gear Pumps | $225.00 |
| Repairs and maint. Generators | $90.00 |
| Total | $315.00 |

| Miscellaneous costs Bookkeeping | $650.00 |
| Permits and fees | $435.00 |
| Office expense | $450.00 |
| Total | $1,535.00 |
Production considerations

- 80% survival requires a great deal of attention and time
  - No guarantees, especially with disease

- Time to harvest depends greatly upon location and stock

- Cost of boat, trailer, motor, harvest gear, bags, tags, etc. are not included

- Cost of permits not included

- Don’t forget your labor……
Seed Source: Hatchery

- Hatchery Seed
  - 2 – 20mm range of choices
  - 2mm ($11.25/1,000)
    - 1 million oysters weigh ~4lbs
  - 11 – 16mm (R8) field plant size ($39/1,000)
Natural set...spat on shell or “hats”

- Rely on ‘Mother Nature’
  - she’s often unreliable
  - year-to-year variability
- Cannot select for qualities such as fast growth or disease resistance
- Often clumps or overset instead of singles
Often Start With a Nursery System
Upweller Basics

Inflow

Outflow

Plastic Cylinder

Water Level

Juvenile Shellfish

Micromesh Screening

Fundamentals of Shellfish Farming
Oyster Farming 4 April 2019
Shellfish eat microscopic plants, called phytoplankton, found in the ocean’s waters.

Shellfish farmers tend their crops, but do not add medications or antibiotics.
Bottom Culture

- Oysters are spread out on the seafloor and allowed to grow

David Grossman, gurnetroad.com
Bottom Culture

Photo Credits: peter.hobbs

Chris Linder, chrislinder.com
Bottom Culture

- Harvest often done by dragging
- Nursery gear is retrieved and stored on-shore for the winter
  - Labor-intensive
  - Chance to remove fouling
  - Eliminates ice-damage risk
Bottom Culture

- Inexpensive
- Potential losses to predators and/or burial
- Space inefficient
- Need some form of nursery
- Potentially nicer shaped oysters
- Heavier shells?
  - Slower growth?

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Bottom Culture

- Fences/barriers have been used
  - Intertidal and subtidal
  - Cost-effectiveness increases as enclosed area increases
Bottom Culture – Bags
Off-Bottom: Floating Bags on Sand

- Relatively inexpensive
- Flotation keeps sand out of bags
- Motion should improve shape and overall growth
- Bit hard on the back
- Must keep an eye on the lines and the bags for wear
Floating Bags on Sand
Off-Bottom: Rack & Bag
Rack and Bags

- Typically least expensive off-bottom option
- Require constant handling
- Require attention of leg sinking
- May tip over in high flow or storms
“Off-Bottom”: Rack & Bag
Off-Bottom: Trays

- More expensive than racks
- Units are not as heavy
- Stackable
- Can be stacked high and deployed in deep water
Off-Bottom: Trays - plastic
Trays

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Off-Bottom: Trays - wire
Off-Bottom: Wire Cages
Suspended Culture: Baskets

- Expensive
- Swaying motion may improve shape and cup of oysters
- May improve overall growth
- Need to invest in good anchor system
- Need way to keep lines taut as weight increases
- Constant eye on wear and tear
Hanging Baskets
Hanging Baskets – better in areas with more limited wave action
Floating/Surface Culture
Floating/Surface Culture

- **TOP VIEW**
  - Rotational floats
  - Identification floats
  - Spreader bar every 5 bags
  - Suggest 50+50=100 bag grid (or less) for efficiency of handling

- **SIDE VIEW**
  - Water surface
  - Spreader bar
  - OBC bags

- **WINTER or STORM SIDE VIEW**
  - Rotational floats
  - Tension anchor
  - For winter or storm use, attach anchors to one long line only

Images show a floating/surface culture system with diagrams and photos.
Floating Bags
Floating Bags
Suspended Culture

- Higher start up costs
- May increase growth rate
- Fouling can be a problem
- Navigation hazard
- Highly visible
- Allows culture in areas with suboptimal bottom and/or greater depth
Floating Cages

- Considerations
  - Visibility
  - Accessibility
    - boat
  - Lines
    - entanglement risk
  - Depth of water
  - Flipping
    - Re-submergence time?
  - Fouling
Floating Oyster Cages
Floating Oyster Cages
Floating Oyster Culture

- Some systems allow winter deployment at depth

  **Optimum Growth**
  - Maintains level, steady submerged position at the ideal feeding depth.
  - Minimizes shifting to maintain ideal distribution for feeding.

  **Easy Sink**
  - Floats keep oysters off the bottom and out of the mud.
  - Substantially reduces winter mortality rate.
Research Farm Network 2011-2012
Comparison of Floating vs Bottom Cages
Increased growth and survival near the surface
Additional Considerations

- Tumbling, splitting and grading
- Cleaning of fouling organisms and removal of pests
- Staying ahead of disease
- Overwintering – finding a solution
Tumbling

- Removes papery edges
- Promotes deeper cup
- Can also remove barnacles and other fouling organisms
- Many tumblers allow oysters to be graded by size
Splitting

- Volume increases exponentially when the oysters are growing
- To alleviate crowding, oysters must be split
- Opportunity to move up mesh size
- Opportunity to cycle gear
- If gear and time allow, split to final stocking density as soon as possible
Grading

- Grading by size can be done through production cycle
  - Appears to improve overall growth
- Grading before harvest
  - Minimum legal size
  - Opportunity to set a higher standard for market oysters
Mechanical Grading
Cleaning Fouling

- Fouling organisms slow growth and reduce marketability
- Cleaning can be done by hand, dipping or with a power washer
- May also use tidal exposure to reduce fouling
- Catch it early!
Disease

- MSX, Dermo – Mortality tends to increase with age
  - Therefore, harvesting the oyster as soon as it’s legal and marketable should reduce risk

- JOD – Affects first year seed, especially slow growers
  - Therefore, get seed larger sooner (either by purchase or nursery methods)

- Ongoing development of resistant lines of oysters
Overwintering

- Want to avoid ice damage to both oysters and gear
- Overwinter wet or dry?
Dry Winter Storage: Seed ‘Pits’

- Oysters are pitted in ~December (before ice), where they are kept:
  - Cold (~35 F), and
  - Humid (~95% relative humidity).

- Oysters are brought back out to the farm in ~March (after ice) where survival is often over 90%.

- Does not appear to have long term effect on growth

- Survival drops after first winter

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Dry Winter Storage: Seed ‘Pits’

- Eliminates threat of ice to gear and seed
- Kills off some fouling organisms
- May miss a late winter/early spring set of barnacles or mussels
- Can be very labor-intensive
Wet Winter Storage: Deep Water

- Where oysters are threatened by ice, they may be moved to deeper water where ice will not be a problem.
- This may involve extra permitting and require approval from multiple licensing authorities.
- Need to be aware of bottom type and risk of siltation.
Harvest Methods

- Often done by hand or by rake
- Hand selected from bags, baskets, trays
- Sometimes done by drag
Next Week

- Clams!
  - Aka quahogs
- Field Planting,
  - Grow out &
  - Harvest
- Guest Speaker
  - John Milliken