OFFSHORE MUSSEL FARMING:

INTRODUCTION and CONTEXT for SOUTHERN NEW ENGLAND
PROGRESS ON NEW STRATEGIES FOR MUSSEL FARMING IN SOUTHERN NEW ENGLAND

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Overview

• Summary of global mussel production
  – Examples from other countries
  – US imports and production

• Summary of production methods
  – On bottom
  – Under rafts
  – Submerged longlines

• MBL mussel research in Southern New England
International context for mussel aquaculture

• 2 million metric tonnes of annual production (live wt of 6 spp.)
  – Equivalent to billion pounds of meat (roughly equivalent to beef)

• Largest producers are New Zealand and Atlantic Canada
  – NZ = 12,000 acres leased, 190 Million pounds/yr, 75% export = $185 M
  – PEI = 10,000 acres, 38 Million pounds/yr, $23M value
  – Other Canadian Provinces expanding (carrying capacity reached in PEI)
  – Imports to US worth $80 million per year
PEI mussel landings and values from 1980 to 2008 reached biological and social carrying capacity.
International mussel aquaculture

- NZ and PEI mostly use surface reference lines in protected waters.

Lines and harvest in NZ

Harvesting PEI mussels through the ice
International mussel aquaculture

- Traditional European mussel culture in nearshore waters –
  - On bottom in Holland
  - On poles and suspended lines in France, Spain and Portugal

- 30 year “young” Maine mussel farms – mostly surface rafts
  - 10 farms on 228 acres
  - 800K lbs worth $1M in 2009
  - U.S. production – 3.4 M lbs
  - U.S. imports – 57 M lbs

- Crowded coastlines and competing uses encourage mussel farming to go offshore
Background to Offshore Mussel Farming

- First tried by WHOI at Buoy Farm – successful 1998 pilot project
  - problems getting enough seed and high capital costs
  - worries about peacrab infestation rates (20%) and markets

UNH conducted similar trials near Isle of Shoals in 2000 - 2008
- successfully installed 6 lines and transferred to commercial operation
Advantages of So. New England mussel culture

- Tremendous market potential for U.S. mussel production vs. imports
- Growth advantage to market- 10 months in So. New England vs. 20 in PEI
- Lower transportation costs to major markets and centers of distribution
- Better meat yield in prime summer months than PEI
- Low risk of closure due to harmful algae blooms

AND CHALLENGES
- Can typical fishing boats do the work of deploying and managing lines?
- What are the capital and operating costs and risks?
- Can we avoid peacrabs and will the market accept product?
Pea crabs

- Mussel farms north of Cape Cod have no pea crabs
- Mussels on southern New England shores may be infested with pea crabs (*Tumidotheres maculatus*)
- Market acceptability <5% infestation
- Can mussels grown offshore/off-bottom escape p-crab?
Background on research project

- NOAA / NMAI funded collaboration between fishermen/farmers, processor and research institutions (MBL lead institution):

  - YR1: 2008/’09 pilot tests – monitor for pea crabs and growth
  - YR 2: 2009/’10 pilot commercial scale grow-out
METHODS – Year 1

• Seed collected in late August 2008
  – Rhode Island
  – Massachusetts

• Experimental 2m long socks on buoys
  – At 2 depths; 6m and 20m deep

• Set at 12 potential grow-out sites

• Monitored growth and pea crab abundance
Highest measured pea crab abundance at a single sample
RESULTS YEAR 1

NUMBER OF MUSSELS ANALYZED

MV / RI 14,549

PEA CRABS PREVALENCE

MV 0.4%
Narragansett 0.75%
RI 1.1%

Growth Rates
- MV (Sept – May ‘09) 2.8 mm/month
- RI (Sept – June ‘09) 3.0 mm/month
METHODS – 2009 (Year 2)

• Deployed 4 longlines - 2 in MA, 2 in RI

• Used embedding plow anchors for deployment from fishing boats

• Seed collected in Oct. and Nov.
  – From cleaning RI oyster cages

• Used Canadian socking equipment
  – (Cotton Bisected) Square Mesh Socking

• Monitored growth and pea crabs
Scenes of longline equipment and deployment
Scenes of seed grading, socking and harvest
Results in Year 2

Massachusetts - < 1 year to harvest

- 3.5mm per month growth rate from 24 to 59mm
- 0% to 5% pea crabs per market-size mussels
- 30% to 20% steamed meat yield (June vs. August)
- Overset produced half the seed for next 1 year cycle
CONCLUSIONS and future investigation

With 3 to 3.5 mm per month average growth rates we can reach market size with 15 to 20mm seed in about 1 year.

Peachcrabs have not been as prevalent as expected, and when present even in 5% of samples, they have not been noticeable to consumers.

Current means of collecting and socking seed works on a small scale. We can retrieve half the seed necessary for re-seeding the longlines as over-set on market sized mussels.

New seed sources must be exploited and may require removing invasive tunicates.

Need to improve the yield of mussels per foot of sock; this is likely function of:
Seed size and density to start
Sock type – try NZ continuous vs. Canadian discrete socks
Sock spacing along the headrope and length of socks
CONCLUSIONS and future investigation

Managing buoyancy takes experience.
- Try intermediate anchors along headrope to balance floats
- Most traditional effective anchors are too expensive to buy and deploy – need to develop driven anchors at 1/10\textsuperscript{th} the cost

Preliminary economic analysis (Kite-Powell, WHOI)
6 year payback of investment including vessel and longlines at 5\% interest based on a farm gate price of $0.40/lb
## The future of mussel farming??

### Offshore Mussel Farming Examples Worldwide

<table>
<thead>
<tr>
<th>Where</th>
<th>Who</th>
<th>Lease</th>
<th>No. of lines</th>
</tr>
</thead>
<tbody>
<tr>
<td>England</td>
<td>John Holmyard</td>
<td>3,805 acres</td>
<td>800 lines planned</td>
</tr>
<tr>
<td>NZ</td>
<td>Cawthron/industry</td>
<td>19,768 acres</td>
<td>“several” lines</td>
</tr>
<tr>
<td>Iceland</td>
<td>Vidir Bjornsson</td>
<td>19,768 acres</td>
<td>172 lines</td>
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<tr>
<td>Quebec</td>
<td>Rejean Allard</td>
<td>19,768 acres</td>
<td>130 lines</td>
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<tr>
<td>Newfoundland</td>
<td>Terry Mills</td>
<td>250 acres</td>
<td>10 lines</td>
</tr>
<tr>
<td>NH, USA</td>
<td>1 fisherman</td>
<td>10 acres pending</td>
<td>2 lines (10 pending)</td>
</tr>
<tr>
<td>RI, USA</td>
<td>2 fishermen</td>
<td>10 acres pending</td>
<td>2 lines (10 pending)</td>
</tr>
<tr>
<td>MA, USA</td>
<td>2 fishermen</td>
<td>250 acres</td>
<td>10 lines</td>
</tr>
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ACKNOWLEDGEMENTS

• NOAA Marine Aquaculture Program

• Rob Reynolds – Zephyr Marine

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The market results of our hard work

Nutritional value of mussels - as much protein as beef

- Per 1.0 lb. Mussels (100g cooked meat)

  Amount per serving
  Calories: **100**  
  Protein: **16g.**

- Fat: **2.0g**  
  Saturated: **0g.**
  Trans: **0g.**
  Cholesterol: **40mg.**
  Sodium: **200mg.**
  Carbohydrate: **6g.**
  Fiber: **0g.**
  Sugars: **0g.**
  Vitamin A: **4%**  
  Vitamin C: **0%**  
  Calcium: **2%**  
  Iron: **25%**

% Daily Values

- 3%
- 13%
- 11%
- 2%
Continuous socking machinery