Safety in Shellfish Farming

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Safety…

- …on the job
- …on the water
- …in handling a food product

Fundamentals of Shellfish Farming
Safe Shellfish Handling  19 April  2018
The work of shellfish aquaculture

- Physically demanding job
  - Lift & carry (&wear) heavy gear
  - Working in/on water
  - Sharp edges gear/oysters
  - Inclement weather
    - Rain, snow, wind
    - Temperature extremes
    - Biting/blood-sucking insects
Reality of Place

WEATHER IN OTHER STATES

ARIZONA

WISCONSIN

WASHINGTON

NEBRASKA

WEATHER IN MASSACHUSETTS

THURSDAY
The work of shellfish aquaculture

- SEMAC Mini-Grant in 2011
  - John Milliken - awardee
    - online survey to collect responses on the work, species grown, length of time in the aquaculture business, equipment used and injuries or general disabilities resulting from the work.

![Pie chart showing years in the aquaculture business]
Workplace
On-the-job injuries

- Interesting to note
  - majority of responding growers not directly hurt on the job
  - though a relatively dangerous business – heavy materials and sharp implements, chances of crush injuries, etc.
Injuries – a closer look

- Of the actual on-the-job injuries:
  - Most had cuts, sprains, other joint injuries and similar
  - Surprisingly, no crush injuries were reported
    - This may reflect the respondents more than the industry as a whole
Long term injuries & disabilities

- In the long run, **everybody** has aches, pains and similar

- **Lower back problems are universal**
  - shoulders close behind – leg and shoulder problems account for at least half

- Frequent heavy lifting contributes to this physically demanding business

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**Graph:**

*We all know this is a tough business, and in the long run we all wear out to some extent. Have you had-

- **Upper back problems including neck problems**: 100.0% (6)
- **Leg problems, knees, hips, ankles, feet**: 86.7% (4)
- **Elbow, hand or wrist joint problems**: 50.0% (3)

Categories include:
- Lower back problems
- Shoulder problems, including rotator cuff
- Elbow, hand or wrist joint problems
- None, you lucky devil
What is the worst part of the work?

Typical survey responses:

- “Repetition with the hands during culling. During culling if you put one foot up on a milk crate, that helps with back issues. I also have my younger employees do more of the lifting.”
  - As time goes on, we develop several ongoing issues, like hand pain, arm pain and the like while culling. We also develop strategies to cope with them. But ways to prevent it in the first place are important.

- “If I were 30 years younger, all would be well!”
  - Survey design did not include a question on ‘Age’. However, in general, many if not most growers on Cape Cod are in their forties or older, and that has its own set of problems, including more easily damaged joints and muscles and slower recovery.

- “Lifting trays of oysters up over my shoulders. I have not found a way to do this better and yet be time efficient.”
  - While this may seem to be one response to one situation, the response itself is telling: we accept injuries and strains in order to produce, to get the job done. Solutions to prevent or postpone injuries don’t get used often because they’re not time-efficient or cost-effective in the short run.
I. Arrive home safely at the end of each day
   - Boating and water safety

II. Do no Harm
   - Safe handling and awareness
Boating Safety

Know your boat

- Every boat is a compromise
- Ability to handle waves/weather
- Speed
- Carrying capacity
- Reliability

Is your boat maintained?
Boating Safety

Some of the basics:

- Registration
- **Life Jackets**
- Anchor & rope
- Compass
- Fire extinguisher
- Paddle
- Visual Distress Signals
- Sound Producing Device
- Communication device
<table>
<thead>
<tr>
<th>Equipment</th>
<th>Requirement</th>
<th>Vessel Length (in feet)</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Certificate of Number</strong></td>
<td>All undocumented vessels equipped with propulsion machinery must be state registered. Certificate of Number must be on board when the vessel is in use. Note that some states require all vessels to be registered.</td>
<td>X  X  X  X</td>
<td>5</td>
</tr>
<tr>
<td><strong>State Numbering</strong></td>
<td>(a) Plain block letters/numbers, not less than 3 inches in height, must be affixed on each side of the forward half of the vessel, in a contrasting color to the background, and read from left to right. (b) State validation sticker(s) must be affixed within 6 inches of the registration number. Note: check with your local boating agency for specific state requirements.</td>
<td>X  X  X  X</td>
<td>5</td>
</tr>
<tr>
<td><strong>Certificate of Documentation</strong></td>
<td>Applies only to “Documented” vessels: (a) Original and current certificate must be on board. (b) Vessel name/heading port must be marked on exterior part of hull in letters not less than 4 inches in height. (c) Official Number must be permanently affixed on exterior structure in numbers not less than 3 inches in height.</td>
<td>X  X  X  X</td>
<td>6</td>
</tr>
<tr>
<td><strong>Life Jackets</strong></td>
<td>(a) One Type I, II, III, or IV wearable life jacket for each person on board. Must be U.S. Coast Guard-approved. (b) In addition, must carry one Type IV throwable device.</td>
<td>X  X  X  X</td>
<td>9</td>
</tr>
<tr>
<td><strong>Visual Distress Signals</strong></td>
<td>(a) One electric distress light, or three combination day/night red flares. Note: only required to be carried on board when the vessel is operating between sunset and sunrise. (b) Three combination day/night red flares — hand-held, meteor, or parachute-type, or one orange distress flag, or one electric distress light, or three hand-held or floating orange smoke signals and one electric distress light.</td>
<td>X  X  X</td>
<td>17</td>
</tr>
<tr>
<td><strong>Fire Extinguishers</strong></td>
<td>(a) One B-I (when enclosed compartment). (b) One B-II or two B-I. Note: fixed system equals one B-I. (c) One B-II and one B-I, or three B-I. Note: fixed system equals one B-I.</td>
<td>X  X  X</td>
<td>21</td>
</tr>
<tr>
<td><strong>Ventilation</strong></td>
<td>(a) All vessels built after April 25, 1940 that are gasoline-fueled with enclosed engine and/or fuel tank compartments must have natural ventilation (at least two ducts fitted with cowls). (b) In addition, a vessel built after July 31, 1980 must have a rated power exhaust blower.</td>
<td>X  X  X</td>
<td>23</td>
</tr>
<tr>
<td><strong>Sound Producing Devices</strong></td>
<td>(a) A vessel of less than 39.4 feet (12 meters) must, at a minimum, have some means of making an efficient sound signal — i.e., hand-held air horn, athletic whistle. A human voice/sound is not acceptable. (b) A vessel 39.4 feet (12 meters) or greater, must have a sound-signaling appliance capable of producing an efficient sound signal, audible for 1/2 mile, with a 4- to 6-second duration.</td>
<td>X  X</td>
<td>25</td>
</tr>
<tr>
<td><strong>Backfire Flame Arrestor</strong></td>
<td>Required on gasoline engines installed after April 25, 1940, except outboard motors.</td>
<td>X  X  X</td>
<td>25</td>
</tr>
<tr>
<td><strong>Navigational Lights</strong></td>
<td>Required to be displayed from sunset to sunrise and in areas of restricted visibility.</td>
<td>X  X  X</td>
<td>27</td>
</tr>
<tr>
<td><strong>Oil Pollution Placard</strong></td>
<td>(a) Placard must be at least 5 by 8 inches and made of durable material. (b) Placard must be posted in each machinery space or at the bilge control station.</td>
<td>X  X</td>
<td>32</td>
</tr>
<tr>
<td><strong>Garbage Placard</strong></td>
<td>(a) Placard must be at least 4 by 9 inches and made of durable material. (b) Displayed in a conspicuous place notifying all on board of the discharge restrictions.</td>
<td>X  X</td>
<td>34</td>
</tr>
<tr>
<td><strong>Marine Sanitation Devices</strong></td>
<td>If there is an installed toilet, the vessel must have an operable MSD Type I, II, or III.</td>
<td>X  X  X</td>
<td>35</td>
</tr>
<tr>
<td><strong>Navigation Rules</strong> (Inland Only)**</td>
<td>The operator of a vessel 39.4 feet (12 meters) or greater while operating on U.S. inland waters must have on board a copy of these rules.</td>
<td>X  X</td>
<td>36</td>
</tr>
</tbody>
</table>
Other important stuff to have

- First Aid kit
- Sunscreen
- Bug spray
- Drinking water
- Basic tools
  - Be able to do battery cables, hose clamps, etc.
- Manual pump or bailer
- Spare prop & wrench, pins?
- Duct tape and zip ties
Boating Safety

Be a prudent mariner
- Observe weather conditions and forecast
- A lightning strike can ruin your day
  - Loss of life
- Ice sinks boats
- Carry enough fuel
Boating Safety

Safe Operations

- Situational Awareness
- Carrying Capacity for the boat and sea conditions
- Is the load secured?
- Speed – “reasonable and proper”
- Wake – watch out for smaller vessels
  - Who is responsible??
- Don’t forget to use your anchor……
- Take a class if uncomfortable
Trailering Safety

- Practice, practice…
  - “ramp buzzards” - elevate stress

- Equipment
  - Metal and seawater don’t mix
    - Then there’s electricity and seawater
  - A little maintenance can go a long way
  - Capacity – weight adds up
**General Water Safety**

**Avoiding Darwin Awards**

- Waders make fabulous sinkers
- Stranding crew members
- Hypothermia
- Heat Exhaustion
- Getting stuck in muck
- **ALWAYS** Carry plenty of drinking water
- **NO** alcohol

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20-30#
Have a plan for extremes

- What if a hurricane comes?
- What is the plan for winter?
- How much time do you need?
  - When do you need to make the call?
Is it a safe work environment?

- Not all days are workable at every site
- What conditions are not workable
- Is there an alternative?
  - Work floats
  - Off-site culling
    - More recordkeeping
      - Vibrio related concerns
    - More control of conditions
    - Less rushed
Product Handling Safety

- Basic food safety & temperature control
- Over 95% of MA cultured shellfish are consumed raw
  - Vibrio
  - Vp Control Plan
Regulating Shellfish Sanitation

**Federal:**
National Shellfish Sanitation Program (NSSP)
Guide for the Control of Molluscan Shellfish, “Model Ordinance”, 2017 Revision

**State:**
Food Protection Program
105 CMR 533.000 Fish and Fishery Products

Courtesy of Eric Hickey MA DPH
ISSC and NSSP

What is the ISSC?

Interstate Shellfish Sanitation Conference

- A federal cooperative body which manages the National Shellfish Sanitation Program. It was formed in 1982 to foster and promote the sanitation of shellfish through the cooperation of state and federal control agencies, the shellfish industry, and the academic community.

- The ISSC manages three task forces: the Growing Areas task force, the Processing and Distribution task force, and Administration task force. Committees are often appointed to assist task forces in developing recommendations. Delegates from each state shellfish control agency vote on recommendations submitted by the task forces.

Regulation by committee, oversight of FDA
NSSP – National Shellfish Sanitation Program

Guide for the Control of Molluscan Shellfish updated March 2018

- NSSP is the federal/state cooperative program recognized by the FDA and the ISSC (Interstate Shellfish Sanitation Conference) for the sanitary control of shellfish produced and sold for human consumption.

- Purpose of the NSSP is to promote and improve the sanitation of shellfish moving in interstate commerce through federal/state cooperation & uniformity of State shellfish programs.

- Participants in the NSSP include agencies from shellfish-producing and non-producing states, FDA, EPA, NOAA and the shellfish industry.

- Document represents the Agency's current thinking on the safe and sanitary control of the growing, processing, and shipping of molluscan shellfish for human consumption.

Keys to Keeping Shellfish Safe

- Harvest from **Approved** Source
  - licensed harvester, open and approved area
- Shellstock Identification
  - tags with harvest area and date, etc.
- Shellfish Transactions
  - traceability through transaction slip and tag retention
- Prevention of Adulteration
  - clean vehicles, no pets, etc.
- Time/Temperature Control
  - rapid cooling, minimal exposure to sunlight and other heat sources

Courtesy of Eric Hickey MA DPH
Approved Source

- MA DMF - monitoring
  - Sanitary Survey
  - Fecal coliform sampling
  - Contaminant sampling
  - Follows NSSP guide

- See also MA DMF shellfish planting guidelines
Challenges to shellfish safety

Can cause closures so you want to be aware of what can happen and how to manage risk
Vibrio and the Control Plan

- What is Vibrio?
- Naturally occurring marine bacteria
  - *Vibrio parahaemolyticus* (Vp.)
- Occurs in shellfish
- Can grow rapidly
- Can cause gastro illness
- Control Plan is currently just for oysters
- More on this later…
Harmful Algal Blooms (HABs)

- Red tide – PSP
  - Paralytic Shellfish Poisoning
    - *Alexandrium fundyense*
- Amnesic Shellfish Poisoning (ASP)
  - genus *Pseudo-nitzschia*
  - Domoic Acid
- There are others…
- State does have a monitoring program
Norovirus

- Highly contagious virus
- 2016 closure in Wellfleet
  - 75 people sick
  - Most consumed oysters at wedding raw bars
- Major outbreaks in British Columbia shellfish
- If you’re sick don’t go to work!!!
  - A tiny drop can contaminate a whole growing area
Other causes of closures

- Rainfall
  - Most common
  - Precautionary
- Sewer overflow
  - Operators notify state
- Contaminating events
  - Spills, crashes, fires, etc.
Reducing risk of foodborne illness

- Shellfish must be from an approved source – is the source questionable?

- Bring cooler with adequate ice to immediately begin cooling process
  - Keep product cool/out of direct sun
  - Refrigerate as soon as possible
    - Damp cloth over product to prevent drying out
  - Consume as soon as possible

- **Do not** consume raw shellfish if you are immuno-compromised
  - Includes conditions such as liver disease, diabetes, steroid use, chemotherapy, alcoholism, etc.

- Keep raw foods from touching other raw or cooked foods and surfaces used for cooking and eating
  - Avoid cross-contamination
Cooking is an alternative to raw

- Preparing oysters and other shellfish in the shell
  - **Before** cooking: Discard any with open shells or smell bad
  - **During** cooking: Boil for 3-5 minutes after shells open
  - **After** cooking: Discard any with shells that did not open

- Preparing shucked oysters
  - **Boil** or simmer for at least 3 minutes or until the edges curl
  - **Fry** at 375° Fahrenheit for at least 3 minutes
  - **Broil** 3 inches from heat for 3 minutes
  - **Bake** at 450° Fahrenheit for 10 minutes
Shellfish are nutritious and delicious

- Despite certain risks...
- Low in contaminants

On a per 100g (3.5oz) Serving Size Basis

<table>
<thead>
<tr>
<th>Test</th>
<th>Oysters</th>
<th>Quahogs</th>
<th>Softshell</th>
<th>Mussel</th>
<th>BayScallop</th>
</tr>
</thead>
<tbody>
<tr>
<td># of replicates</td>
<td>4</td>
<td>3</td>
<td>1</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>PAHs (ppb)</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
</tr>
<tr>
<td>PCB Congeners (ppb)</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
</tr>
<tr>
<td>Pesticides (ppb)</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
<td>ND</td>
</tr>
<tr>
<td>Metals (below, in mg/serving)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cadmium (Total in mg)</td>
<td>0.014</td>
<td>0.007</td>
<td>0.002</td>
<td>0.011</td>
<td>0.001</td>
</tr>
<tr>
<td>Lead (Total in mg)</td>
<td>0.005</td>
<td>0.013</td>
<td>0.019</td>
<td>0.012</td>
<td>0.001</td>
</tr>
<tr>
<td>Mercury (Total in mg)</td>
<td>0.001</td>
<td>0.001</td>
<td>ND</td>
<td>0.001</td>
<td>0.001</td>
</tr>
</tbody>
</table>

And good for you!
<table>
<thead>
<tr>
<th>Type of shellfish:</th>
<th>Quahog</th>
<th>Oyster</th>
<th>Mussel</th>
<th>Soft-shell Clams</th>
<th>Bay Scallops</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number in a 100g serving</td>
<td>10-12</td>
<td>6-8</td>
<td>14-18</td>
<td>12-16</td>
<td>8-16</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Nutrition Facts</th>
<th>Unit</th>
<th>Amount Per 100g (3.5oz.) Serving (raw)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calories</td>
<td>Calorie</td>
<td>63.6</td>
</tr>
<tr>
<td>Protein</td>
<td>g</td>
<td>11.1</td>
</tr>
<tr>
<td>Carbohydrates</td>
<td>g</td>
<td>3.9</td>
</tr>
<tr>
<td>Fat</td>
<td>g</td>
<td>0.4</td>
</tr>
<tr>
<td>Cholesterol</td>
<td>mg</td>
<td>41.4</td>
</tr>
<tr>
<td>Total Omega-3</td>
<td>mg</td>
<td>107.5</td>
</tr>
<tr>
<td>Saturated fats</td>
<td>mg</td>
<td>58.8</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Minerals</th>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>Calcium</td>
<td>mg</td>
<td>147.5</td>
</tr>
<tr>
<td>Magnesium</td>
<td>mg</td>
<td>77.1</td>
</tr>
<tr>
<td>Iron</td>
<td>mg</td>
<td>3.7</td>
</tr>
<tr>
<td>Zinc</td>
<td>mg</td>
<td>1.4</td>
</tr>
<tr>
<td>Potassium</td>
<td>mg</td>
<td>243.5</td>
</tr>
<tr>
<td>Iodine</td>
<td>ug</td>
<td>55.4</td>
</tr>
<tr>
<td>Selenium</td>
<td>ug</td>
<td>35.9</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Vitamins</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Vitamin A</td>
<td>IU</td>
<td>71.9</td>
</tr>
<tr>
<td>Riboflavin</td>
<td>mg</td>
<td>0.7</td>
</tr>
<tr>
<td>Vitamin C</td>
<td>mg</td>
<td>8.8</td>
</tr>
<tr>
<td>Niacin (B3)</td>
<td>mg</td>
<td>1.9</td>
</tr>
<tr>
<td>Folic Acid</td>
<td>ug</td>
<td>23.6</td>
</tr>
<tr>
<td>B12</td>
<td>ug</td>
<td>33.4</td>
</tr>
</tbody>
</table>
Next up:
Vibrio and the Control Plan

Stand up and STRETCH
Vibrio Control Plan

- Control measures began for oysters in 2012 after 2 illnesses in 2011
- FDA has threatened mandating post harvest processing to control Vibrio or no harvest of oysters – mainly in more southern waters
- Several closures over the years
- Not fully understood and not going away
Its been a challenge

- Added significant burden to industry in icing of product for time to temperature control
  - Weight of harvest can be doubled or tripled
- But...an unsafe product has no value in the market...one bad harvest can shut down an entire area
Vibrio Control Plan

Training videos
https://www.mass.gov/service-details/watch-vibrio-training-videos

Tools for proactive risk management
https://products.coastalscience.noaa.gov/vibrioforecast/northeast/default.aspx#MS

Current Water Temperature
https://v2.wqdataalive.com/public/103