



Aquaculture Education: Shellfish Sanitation

Bureau of Public Health

Why the concern?

- Bivalve shellfish are filter feeders and pose a unique risk to consumers
- Potentially vectors of illness due to raw or lightly cooked consumption
- Can transmit viruses, vibrio and biotoxins
- Clean water = clean bivalve shellfish
- Prevention of post-harvest contamination = bivalve shellfish remain clean



The premise of the NSSP is that clean water (pollution or biotoxins) means the shellfish are safe to eat

Bivalve Shellfish Filter Feeding



Don't panic, it takes about 5 seconds for the video to start

Shellfish and public health

- In the late 1800's and early 1900's public health officials noticed large numbers of illnesses associated with consumption of raw bivalve shellfish
- 1924 there was a widespread typhoid fever outbreak
- Surgeon General developed the first control measures to ensure a safe shellfish supply



National Shellfish Sanitation Program

- State/federal/industry cooperative program recognized by the U.S. Food and Drug Administration (FDA) and the Interstate Shellfish Sanitation Conference (ISSC)



NSSP – Model Ordinance

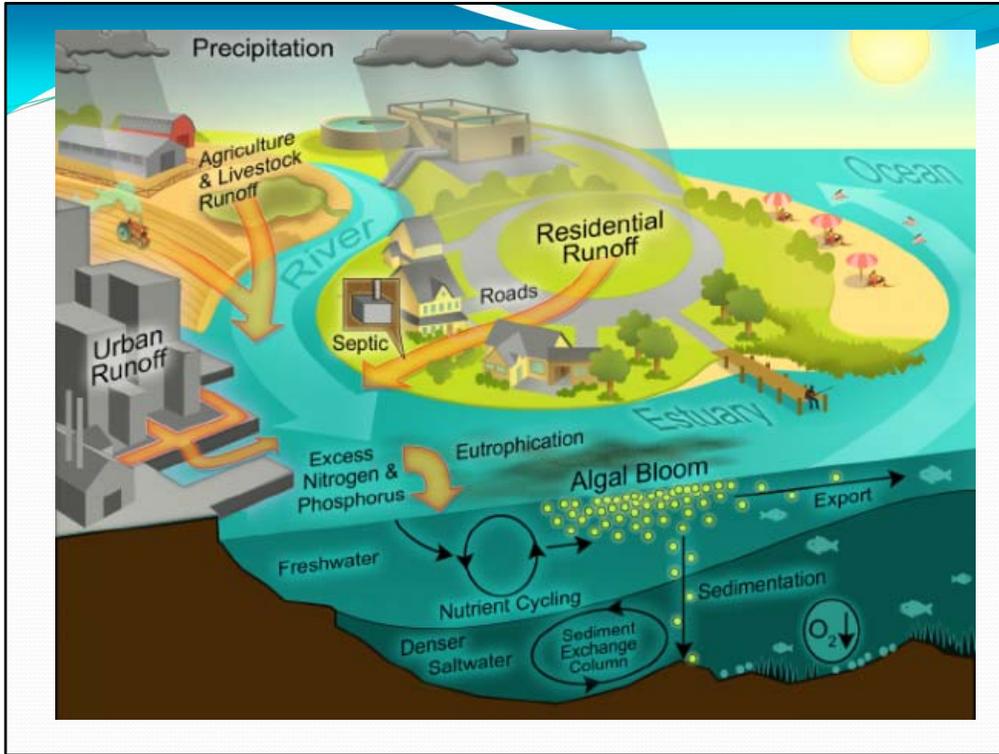
- Growing Area Classification
- Establishes water quality standards
- Establishes biotoxin limits
- Establishes safe handling and trace-back capability



What is “clean water” with regard to bivalve shellfish sanitation

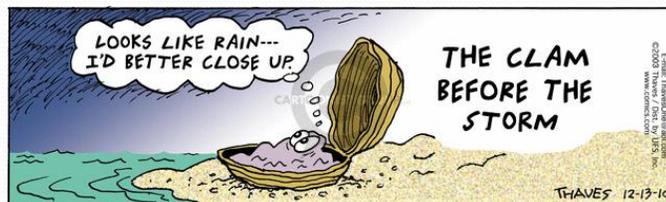
- Evidence it is not contaminated by fecal material (from any animal, doesn't matter)
- Evidence biotoxins are not present (PSP, ASP, DSP)
- Not contaminated by “other deleterious substances”





Growing Area Classifications

- Approved – direct to market
- Conditionally Approved – predictable conditions (rainfall, river flow, marinas, seasonal use)
- Restricted – product must be depurated or relayed
- Conditionally Restricted - predictable conditions, product must be depurated or relayed
- Prohibited – nothing but seed harvest



Marine Sanitation Devices

- You must have a MSD available
- Can be a 5 gal bucket with a tight fitting lid labeled “human waste only”
- DO NOT put waste overboard; fecal material and vomitus can contaminate your shellfish and cause illnesses.



Legal Notice for Pollution Closures

- <https://www.maine.gov/dmr/>
- <https://www.maine.gov/dmr/shellfish-sanitation-management/index.html>
- <https://www.maine.gov/dmr/shellfish-sanitation-management/closures/pollution.html>
- <https://www.maine.gov/dmr/shellfish-sanitation-management/closures/documents/14.pdf>

Just shows an example map and text legal notice

Closure Notifications

The screenshot displays the Maine Department of Marine Resources website. The main heading is "Closure Notifications". The page is divided into several sections:

- Navigation:** Includes "Maine.gov", "Agencies | Online Services | Help | Search Maine.gov", and a search bar.
- Department of Marine Resources:** Features a navigation menu with categories like "About", "Laws & Regulations", "Commercial Fishing", "Recreational Fishing", "Science & Research", "Shellfish Sanitation & Management", "Coastal Program", "Aquaculture", "Education & Aquarium", and "Marine Patrol".
- Home:** Shows the breadcrumb trail: "Home -- Shellfish Sanitation and Management -- Closures -- Closed Areas".
- Left Sidebar:** Lists "Closures", "Programs", "Forms", and "Environmental Permit Review".
- Main Content:**
 - Section:** "Maine Bacterial Closures: Shellfish Pollution Area Inventory with Legal Notices and Maps".
 - Contact Information:**
 - During normal business hours:** Shellfish Program Coordinator, Phone: 207-633-9515
 - During nights/weekends/holidays:** The State Police barracks will put you in touch with Marine Patrol.
 - From **New Hampshire border to Brunswick**, barracks 1-800-228-0857
 - From **Cushing/Boothbay to Lincolnville/Belfast area**, barracks 1-800-452-4864
 - From **Belfast to Canadian border**, barracks 1-800-432-7381
 - See the bottom of this page for [warnings](#) and [disclaimer](#).**
- Statewide Closures Table:**

Name	Description	Date
Conditional Area Closures	Areas 11, 14, 15, 21-C and 21-E	7/15/2020

- Right Sidebar:**
- MORE INFO & HELP:** "To view the legal notices select the Name or Area number. There are 11 notices. The links are 1.5 MB in size. If you require the software (if you require please contact...)"
- RELATED:** "Biotoxin closures", "Shellfish geographic classification", "description".
- Biotoxin hotline:** 1-800-232-4733
- Phone Icon:** A red rotary phone icon is positioned next to the hotline information.
- Bottom Section:** A screenshot of an email client showing a message from "Maine, Nicole" with the subject "Area #20 - Kennebec River and Tributaries". The email content states: "This notice closes the river discharge conditional areas (B and C) due to flow exceeding 30,000 cfs. The reopening date will be set once the average daily flow is less than 30,000 cfs, please watch for future notices."

Website, hotline and email

GovDelivery

Credits	Information	Connect with Us	Locations	Economic Development
 Copyright © 2016 All rights reserved	Home DMR Home News & Events Contact Site Policies	Facebook Twitter DMR YouTube Subscribe to Email/Text Notifications 	Avon Westborough/Hatfield Lansing Roxbury Jonestown	Business and Economic Development Resources

<https://public.govdelivery.com/accounts/MEDMR/subscriber/new>

Emergency Closures

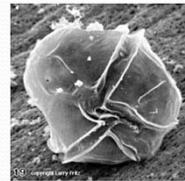
- Biotoxin
- Flood
- Oil spill
- Dead whales
- Anything that will adversely impact water quality and shellfish sanitation



Marine Biotoxins

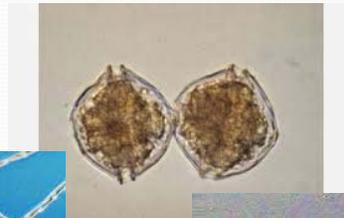
Biotoxin

- Paralytic shellfish poisoning (PSP) is common in Maine
- ASP and DSP are emerging issues in the Gulf of Maine
- Caused by species of phytoplankton
- DMR monitors phytoplankton and toxin in shellfish
- People do get ill from biotoxins
- You can't see it in the water
- It can kill people
- It is not cooked out of shellfish
- Shellfish taste normal



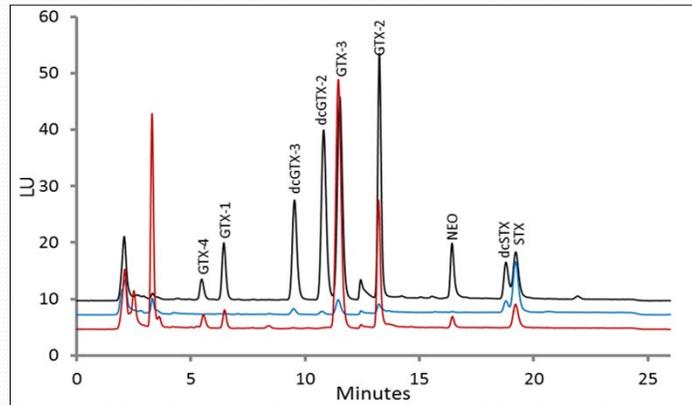
What are marine biotoxins

- Caused by some species of marine phytoplankton
- Species of concern in the Gulf of Maine:
 - *Alexandrium*
 - *Pseudo nitzschia*
 - *Dinophysis*
 - ????



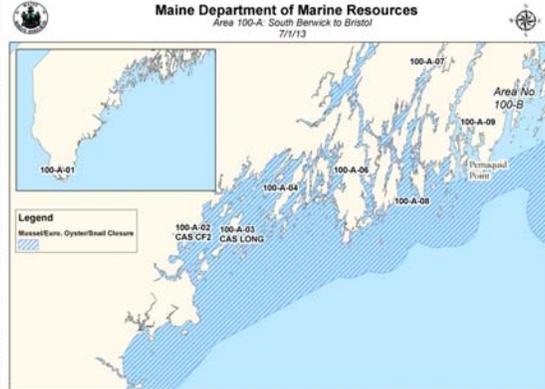
Biotoxin Sample Processing

- Collect 12+ animals per station, transport to lab
- Shuck, puree
- HPLC PCOX for PSP; HPLC UV for ASP; LC-MS/MS for DSP



Results

- PSP: >80 micrograms of toxin/100 grams of shellfish tissue = CLOSURE
- ASP: >20 µg/100g
- DSP: >16 µg/100g
- Reopen after 2 clean samples at least 7 days apart
- Species specific: mussels, soft shelled clams, hard clams, surf clams, oysters, quahogs, scallops



High Risk Species

- Scallops whole or roe on pose high risk to consumers as do surf and razor clams
- Store toxins for long periods (>1 year)
- Transform less toxic compounds into more toxic compounds
- Different tissues have different levels of toxin (e.g. meat = 0; roe = minimal; mantel = very high)

High Risk Species Continued

- Whole or roe on scallops are no longer allowed on LPAs
- LPAs can not have MOUs for biotoxin testing
- Species like European oysters, surf clams and razor clams are closed and reopened with the regional mussel closure (May-August approximately)
- American oysters are closed based on regional sampling of known hot spots

Biotoxin Illnesses

- Jonesport 2007: fisherman found floating barrel with mussels, four family members hospitalized, area was closed
- Cutler 2008: resident harvested mussels from a floating fish pen, three family members hospitalized, area was closed
- Swans Island 2009: resident harvested clams from a closed area and then purged them in another closed area likely making them more toxic

Vibrio Bacteria

Vibrio spp.

- Naturally occurring marine bacteria
- Pathogenic strains include:
 - *Vibrio parahaemolyticus*
 - *Vibrio vulnificus*
 - *Vibrio cholerae*
 - *Vibrio fluvialis*
 - *Vibrio metoecus*.....

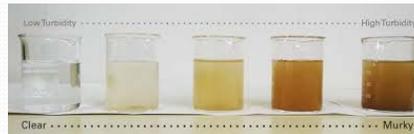
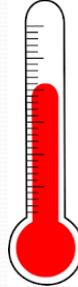


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Vibrio ecology

- Factors that can affect Vibrio populations and distribution:

- Temperature
- Salinity
- Turbidity
- Dissolved oxygen
- Phosphorus
- Nitrogen



Temperature is the most important factor

Vibrios and human health-wounds

- Wound infections can occur through infection of a pre-existing wound or one obtained during coastal water-related activities
- 24% cases involved wound infections
- Debridement or amputation are common treatments



Vibrios and human health-septicemia

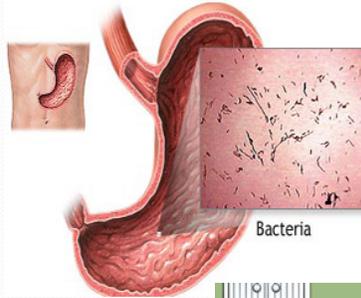
- Primary septicemia involves fever, shock, diarrhea, vomiting, abdominal cramps and skin lesions
- Typically caused by raw shellfish consumption
- The fatality rate is up to 75%



Vibrios and human health-gastroenteritis

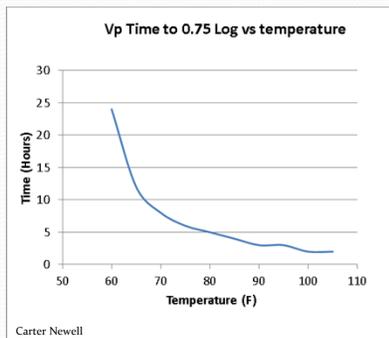
- Gastroenteritis is characterized as illness with vomiting or diarrhea, abdominal cramps
- Can be caused by ingestion of raw seafood
- Underreported due to relatively mild symptoms that quickly dissipate in healthy adults

Diarrhea may be caused by bacteria or parasites found in food and water



Closures for Vp

- Triggered by an outbreak, 2 or more illnesses from a single growing area
- Reopening basically depends on declining water temperatures



Control Plans: Where? When? What?

- Damariscotta and Sheepscot Rivers and New Meadows Lakes
- From May 1 to October 31
- Oysters and hard clams only
- Shading, icing, shorter time to dealers and cooling etc



Best Management Practices

- Vibrio does not grow at 50°F or less
- The faster product is cooled after harvest the less bacteria it will have
- **Get product to 50°F quickly and keep it there!**
- Product at 90°F experiences a doubling of bacteria in one hour
- **Bacteria are not decreased after cooling you can only prevent the initial growth of bacteria**

Post Harvest

Shellfish Tags

- Harvester to Dealer
- Dealer to Dealer
- Dealer to Retail
- Retail retain on file for 90 days
- **Do not have untagged shellfish**



Licensing to Harvest

- You must have an Aquaculture License to harvest and move product
- You must have a vibrio certification to harvest in the Vibrio control areas during the Vibrio control months
- You must also have a commercial shellfish license if you harvest wild product

Allowable sales

- Direct to consumer sales from your house or lease site (not LPAs)
- Sell to an Enhanced Retail Permit holder
- Become a certified shellfish dealer
- Buy a Retail License, sell product to a certified dealer, buy it back and sell from vehicle or fixed location
- Sell to a certified shellfish dealer



Winter Storage on Land

- Must be licensed to harvest
- Must use shellfish tags
- Must use a certified facility
- Size does not matter (e.g. seed)
- Possible option for cold storage at a private site with permission for inspection

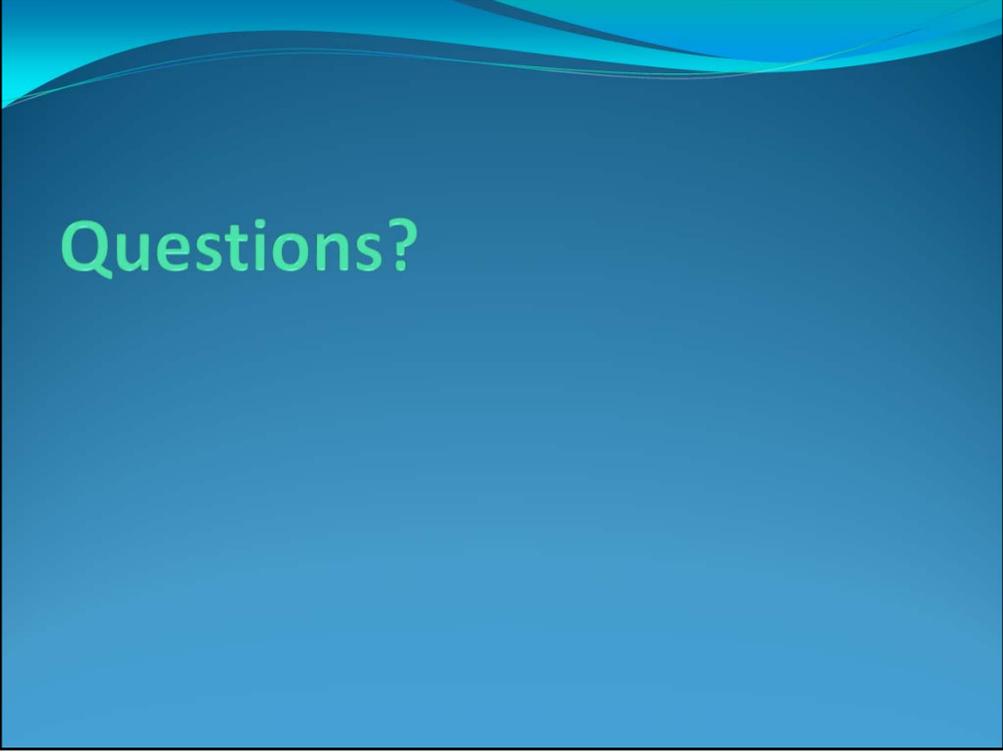


What about seaweed?

Public Health Concerns

- Largely unknown
- Some research on surface bacteria/vibrio etc; significant research on metals contamination
- Impacts of treatments unknown
- Regulation by DACF
- DMR issues LPAs/leases only
- 300:1 EPA toxic mixing zone prohibition





Questions?