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)

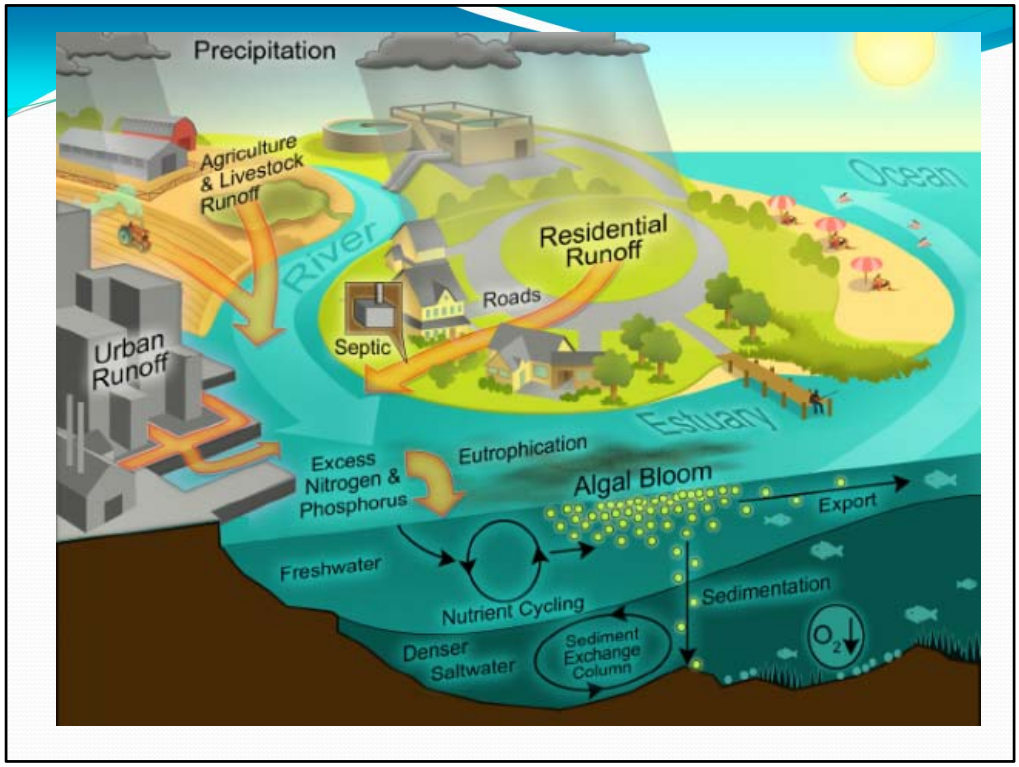
NSSP – Model Ordinance

- 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”


Precipitation
Agriculture & Livestock Runoff
River
Residential Runoff
Roads
Septic
Urban Runoff
Ocean
Estuary
Excess Nitrogen & Phosphorus
Eutrophication
Algal Bloom
Export
Freshwater
Nutrient Cycling
Sedimentation
Denser Saltwater
Sediment Exchange Column
O2

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

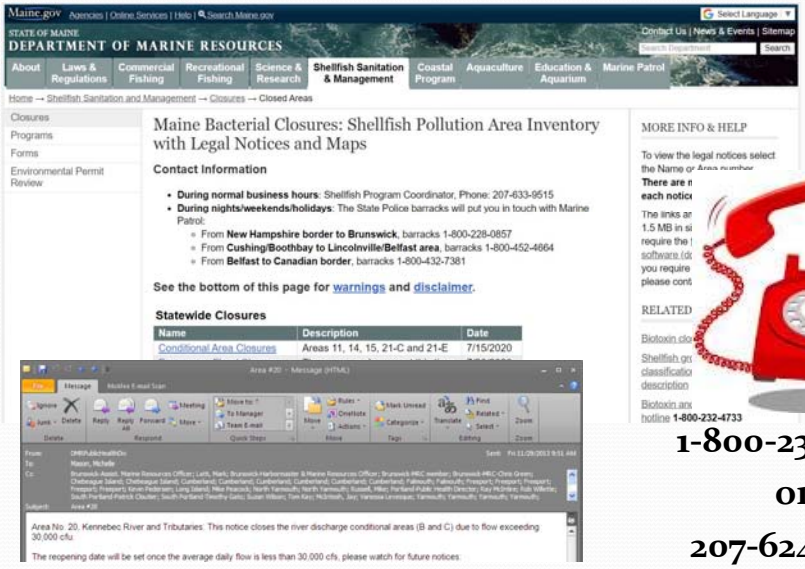
- You must have a MSD available
- Can be a 5 gal bucket with a tight fitting lid labeled "human waste only"
- DO NOT put waste overboard; fecal material and vomitus can contaminate your shellfish and cause illnesses.

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



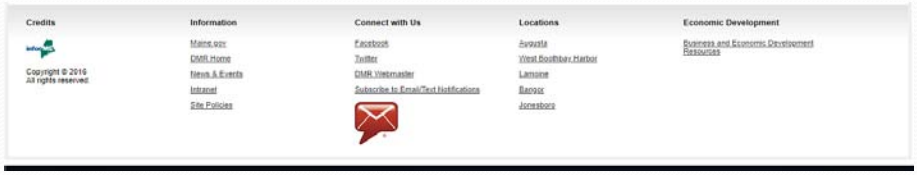
1-800-232-4733

or

207-624-7727

Website, hotline and email

GovDelivery



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

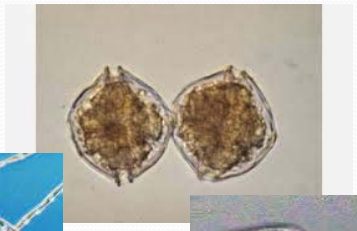
Marine Biotoxins

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

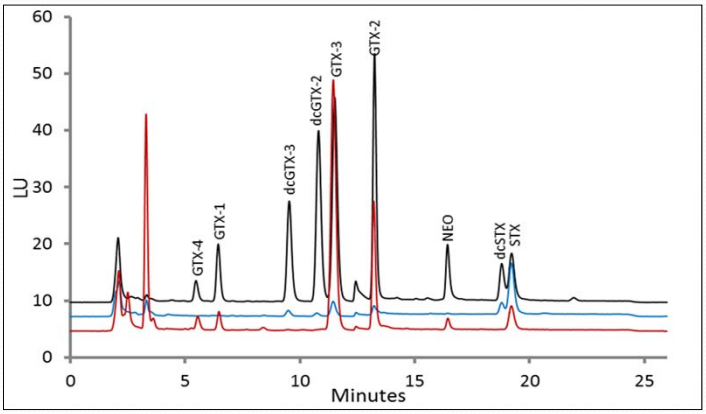
What are marine biotoxins

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



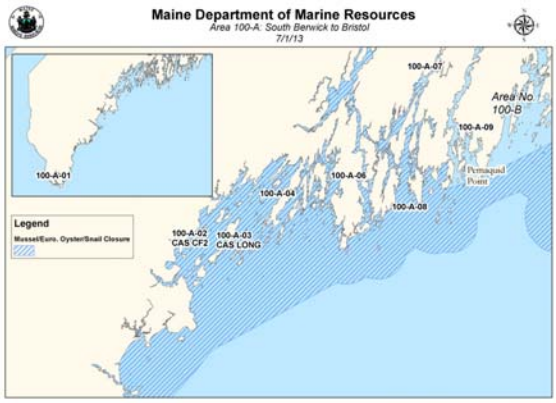
Biotoxin Sample Processing

- 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 anther closed area likely making them more toxic

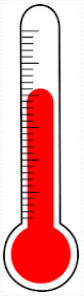
Vibrio Bacteria

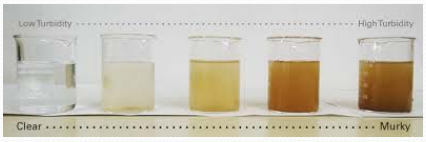
Vibrio spp.

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

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

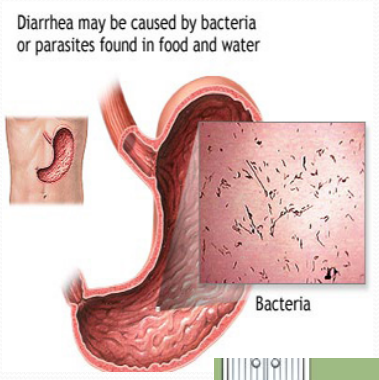
- Wound infections can occur through infection of a pre-existing wound or one obtained during coastal water-related activities
- 24% cases involved wound infections
- Debridement or amputation are common treatments

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%

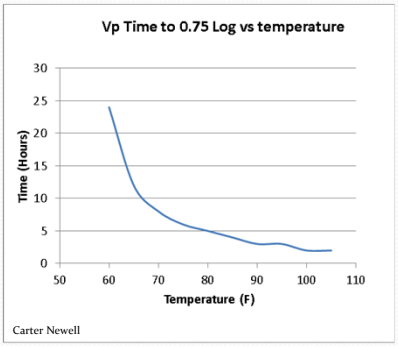
Vibrios and human health-gastroenteritis

- 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



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?