

Shellfish Disease Status Review



Dr. Lydia M. Bienlien

20th Annual Gathering of Shellfish Commissions

February 3, 2023

Outline



Introduction

Diseases

Shellfish Health

Plans

Questions

Introduction...to me!

- State: Department of Agriculture
 - Bureau of Aquaculture and Laboratory Services
- Title: The State Bivalve Shellfish Pathologist
- Role: All things shellfish health and disease
- Contact:
 - Lydia.Bienlien@ct.gov
 - 203-874-0696 ex: 120



Education



- Morningside College, IA
 - Bachelor of Science - Biology
 - Bachelor of Arts - Chemistry



- William & Mary/Virginia Institute of Marine Science, VA
 - Master of Science - Marine Science
 - Doctor of Philosophy - Marine Science

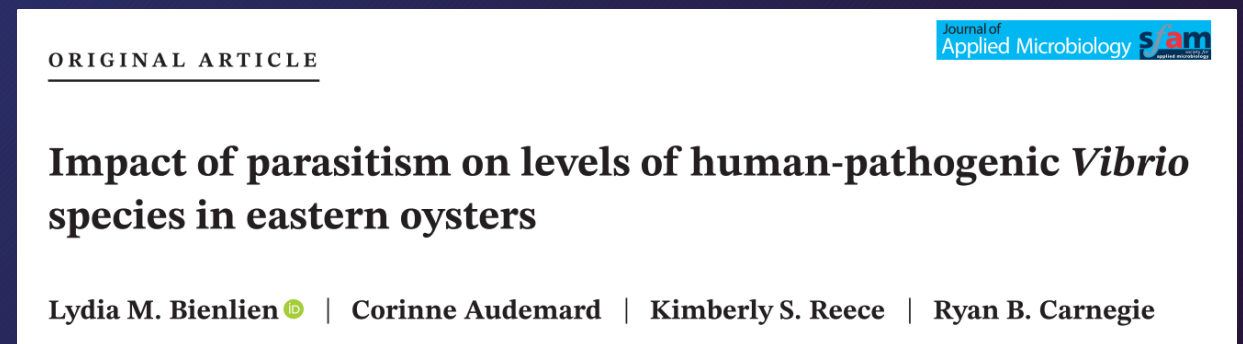
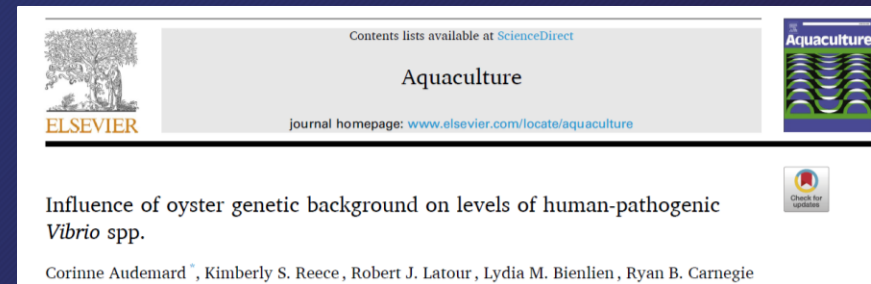
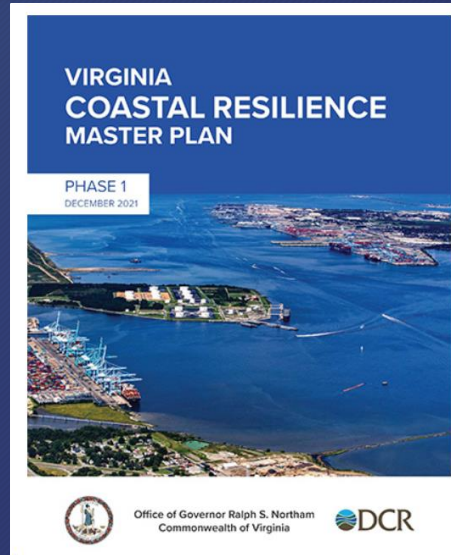


- Research - oyster diseases



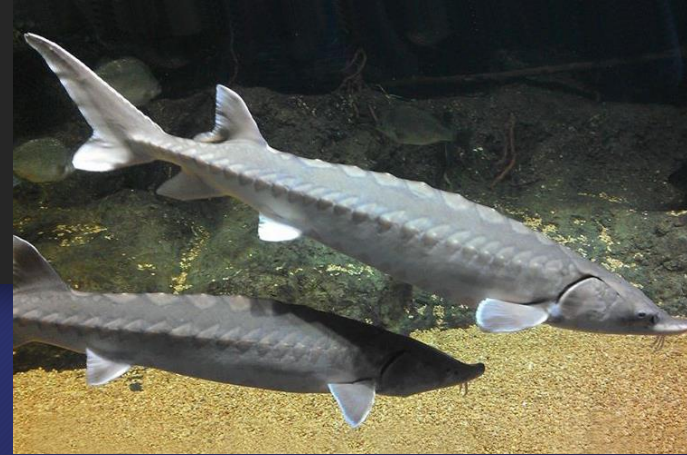
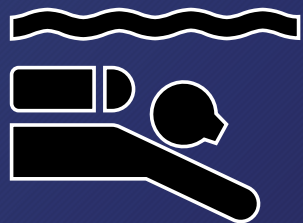
Other Experience

- Flooding
 - Virginia
- Writing
 - Papers and grants
 - Reviewer
- Working
 - East Coast Pathology Working Group
 - Biosecurity



Plus...

- Small projects
 - Sturgeon tracking
 - Cancer and marine genetics
 - HAB monitoring
 - Drones
 - Xploration Awesome Planet
- Scuba



Atlantic sturgeon swimming.
Credit: NOAA Fisheries



Shellfish Diseases



CT.GOV Connecticut's Official State Website

Search Connecticut Government

Language + Settings

Connecticut Department of Agriculture

CT.gov Home / Department of Agriculture / Oyster & Clam Diseases

- Ag Business Development & Assistance >
- Aquaculture >
- Regulatory Services >
- Animals and Animal Health >
- Boards, Councils, and Commissions >
- Farmland Preservation >
- COVID-19 Resources for Farmers >
- Freedom of Information Requests >

Search Department of Agriculture

by Keyword

Oyster and Clam Disease Surveillance and Fact Sheets

Overview

The Department of Agriculture Bureau of Aquaculture (DA/BA) monitors oyster and clam diseases during annual surveys, prepares disease management strategies, develops disease-resistant oyster strains through selective breeding programs, and performs scientific research in collaboration with universities and government laboratories. The eastern oyster (*Crassostrea virginica*) and the northern quahog (hard clam, *Mercenaria mercenaria*) are Connecticut's two major commercially harvested shellfish species. Due to the presence of multiple oyster disease-causing organisms, epizootic MSX outbreaks in 1997 and 1998, and good overall health of hard clam populations, the majority of disease surveillance, disease management, and selective breeding programs in Connecticut have focused on oysters. Research projects have also focused on shellfish that are recreationally harvested in Connecticut, including the soft-shell clam (*Mya arenaria*), the bay scallop (*Argopecten irradians*) and the blue mussel (*Mytilus edulis*).

Read/download the 2021 Statewide Shellfish Disease Report here.

The Bureau is contributing to the ongoing NOAA project focusing on understanding the health of Long Island Sound's oyster beds.

The following economically-important infectious oyster diseases are present in CT: MSX (Multinucleated Sphere Unknown, due to *Haplosporidium nelsoni*), SSO (Seaside Organism, due to *Haplosporidium costale*), Dermo (due to *Perkinsus marinus*) and ROD (Roseovarius Oyster Disease, due to *Roseovarius*

STATE OF CONNECTICUT
DEPARTMENT OF AGRICULTURE
Bureau of Aquaculture & Laboratory Services

Bryan P. Hurlburt
Commissioner

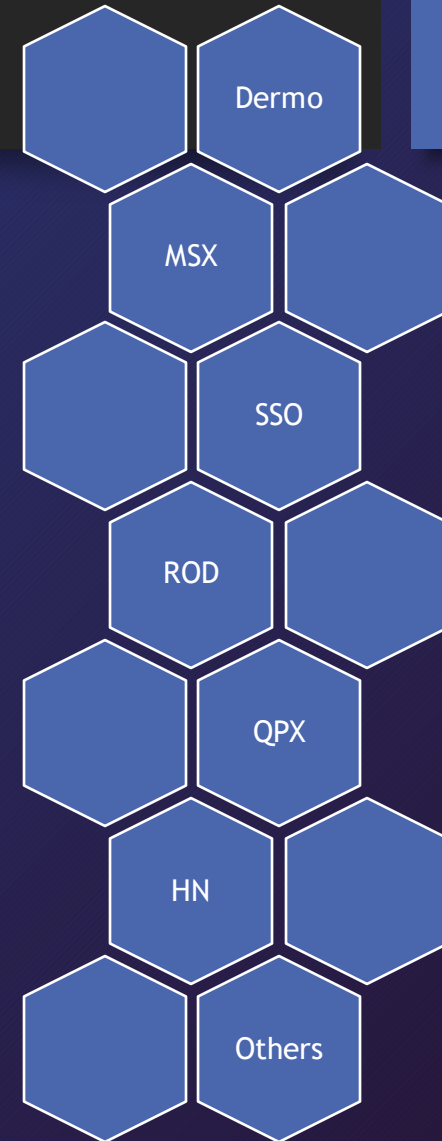
CONNECTICUT GROWN
A Way of Life
David H. Carey
Director

2021 Statewide Shellfish Disease Update

Shellfish health is a critical factor in maintaining viable wild and cultivated populations, which support a robust aquaculture industry. The Connecticut Department of Agriculture, Bureau of Aquaculture (DABA) has monitored shellfish health since 1997. This report provides recent oyster and hard clam disease data with historic context.

Contents

- History of Oyster Diseases in Connecticut1
- History of Hard Clam Diseases in Connecticut.....2
- Methodology3
- 1997-2021 Oyster Disease Trends4
- 2019-2021 Oyster Disease Surveillance Results7
- 2019-2021 Wild & Hatchery Oyster Comparative Results.....10
- 2020-2021 Hard Clam Disease Surveillance Results13
- Discussion13
- Conclusions16
- Guidelines for Oyster Disease Management in Connecticut17
- Guidelines for Hard Clam Disease Management in Connecticut17

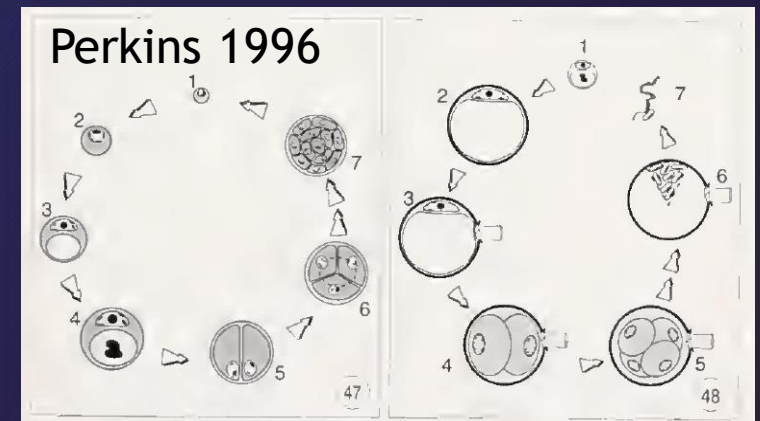
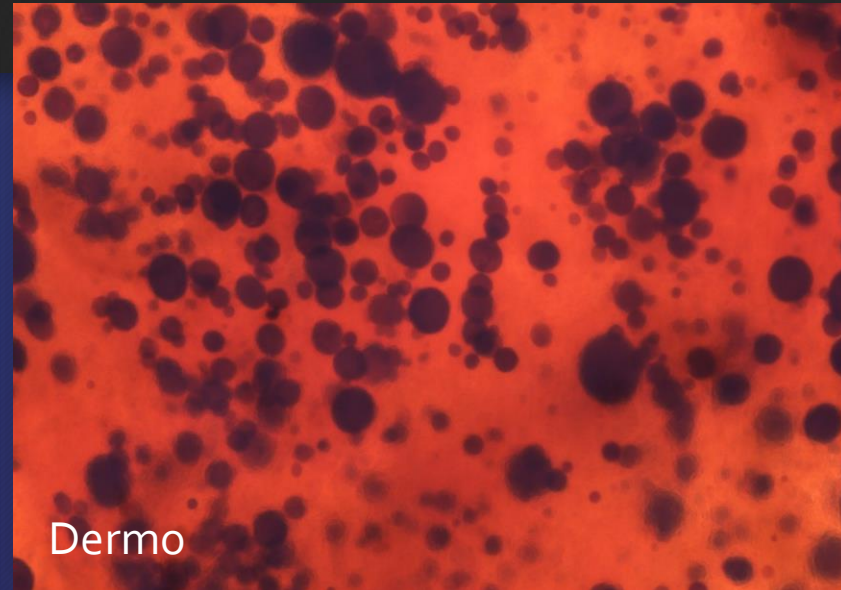


- <https://portal.ct.gov/DOAG/Aquaculture1/Aquaculture/Oyster-and-Clam-Diseases>
- 2021 Statewide Shellfish Disease Update

Oysters - *Perkinsus marinus*



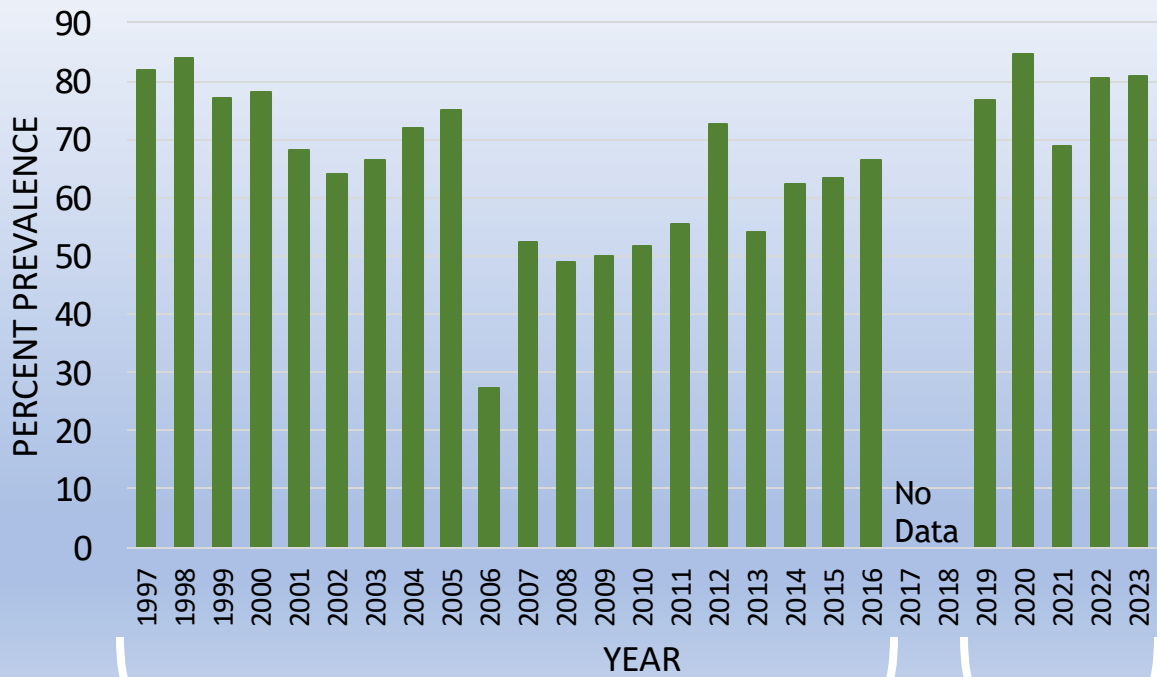
- Aka Dermo aka Perkinsosis aka Pmar
 - Wasting disease
- Protozoan parasite
- Tiny
- Fun life cycle
- East Coast and Gulf of Mexico - native
- High prevalence
 - Quick note...



Oysters - *Perkinsus marinus*



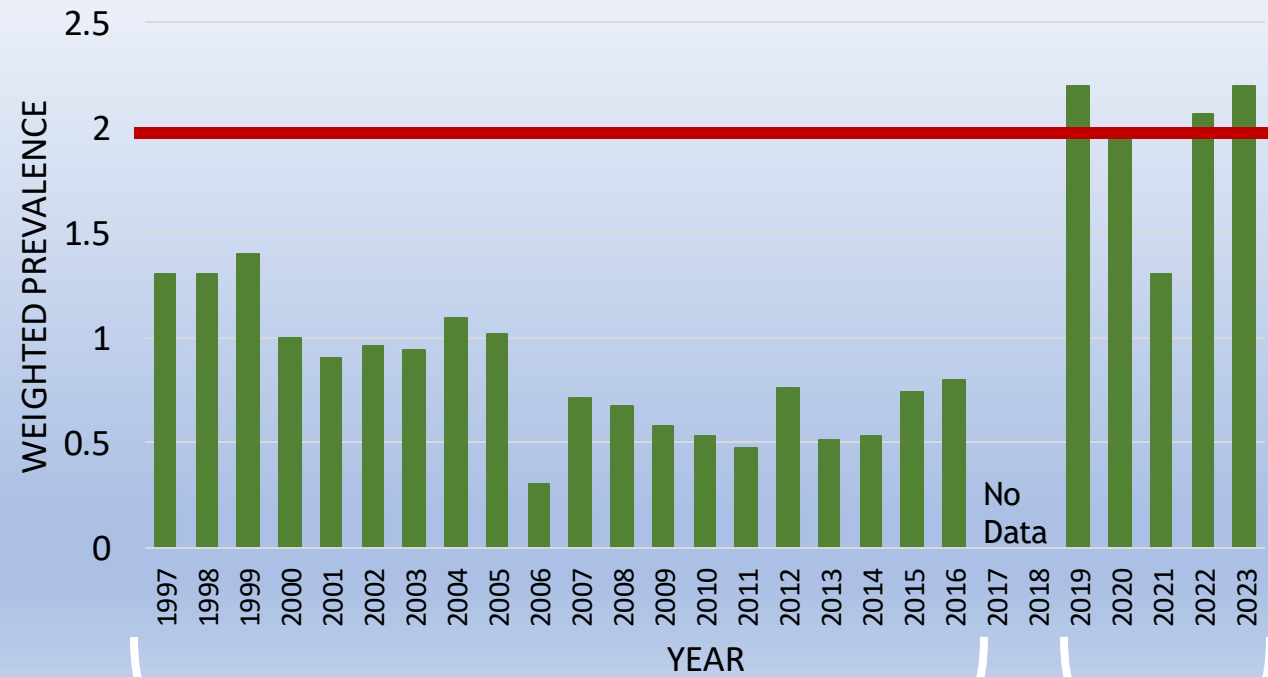
Dermo Prevalence



RFTM

qPCR

Dermo Weighted Prevalence



RFTM

qPCR

Quick note on terms



Examples

- Prevalence
 - Proportion of infect individuals in a sample
- Intensity
 - Number of pathogens in an infected individual
- Weighted Prevalence
 - Combines prevalence and intensity

$$\frac{7 \text{ infected individuals}}{30 \text{ total individuals in the sample}}$$

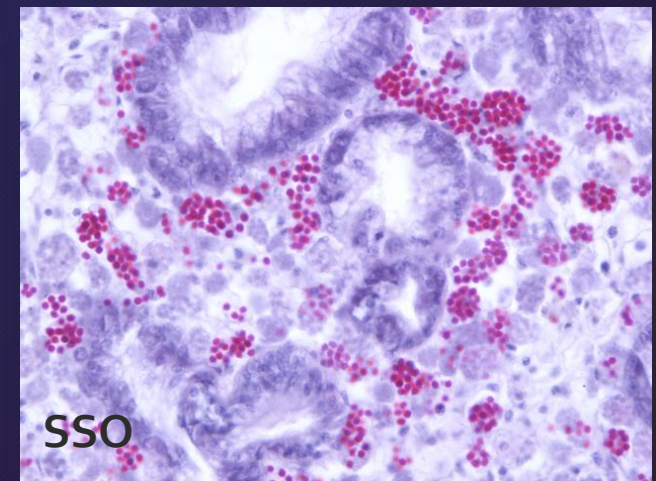
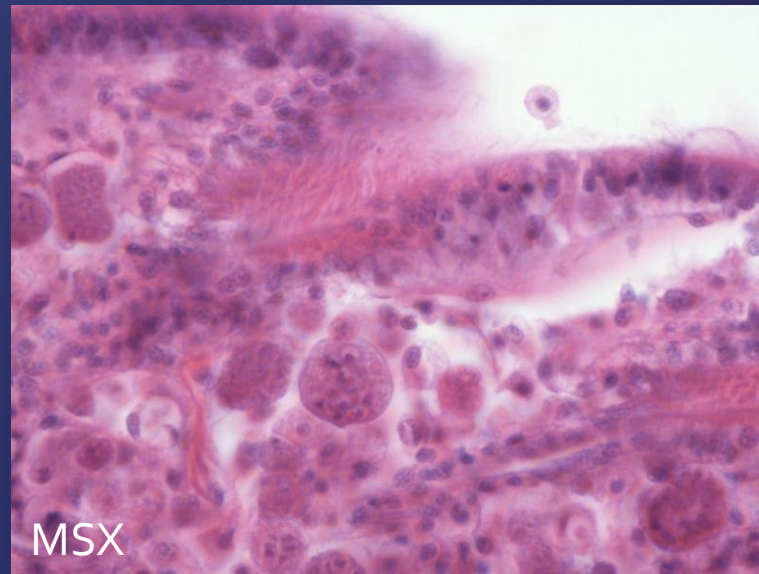
3 individuals had lots of pathogens (ranked 5)
8 individuals had some pathogens (ranked 3)
19 individuals had no pathogens (ranked 0)

$$WP = [5*(\# \text{ Heavy}) + 3*(\# \text{ Moderate}) + 1*(\# \text{ Light and Rare})] / \text{Sample Size.}$$

Oysters - *Haplosporidium nelsoni*



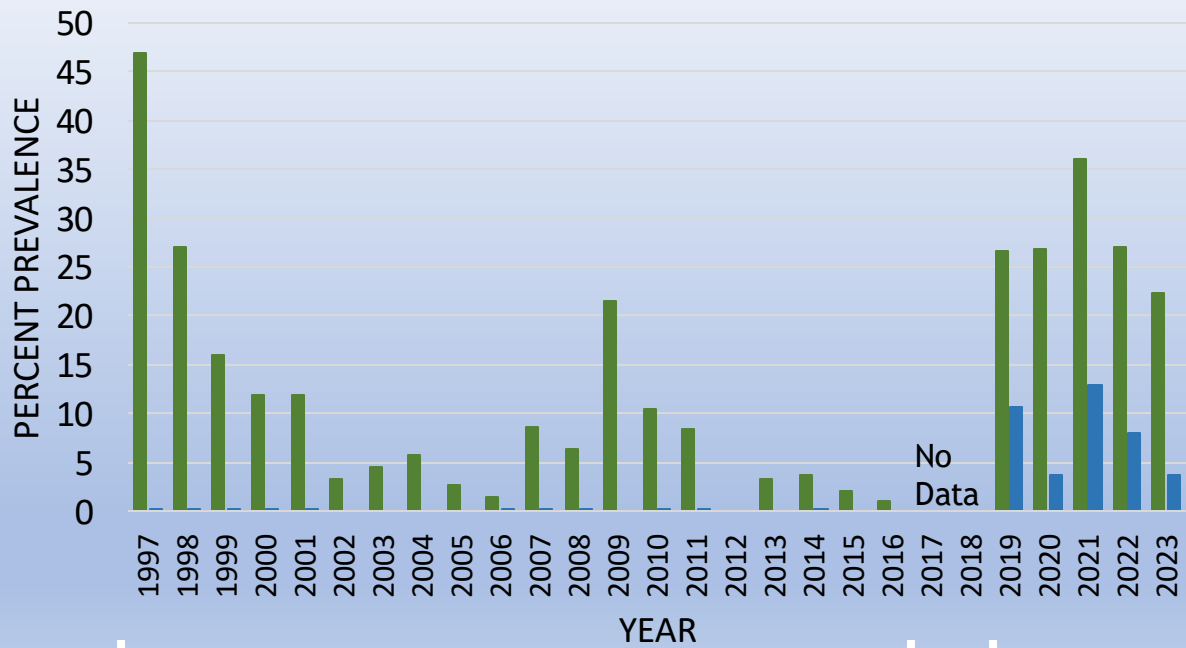
- Aka MSX
 - Quick mortalities
- Protozoan parasite
- Tiny
- Life cycle???
- East Coast - introduced
- Low prevalence
- Also, *Haplosporidium costale* aka SSO



Oysters - *Haplosporidium nelsoni* and *H. costale*



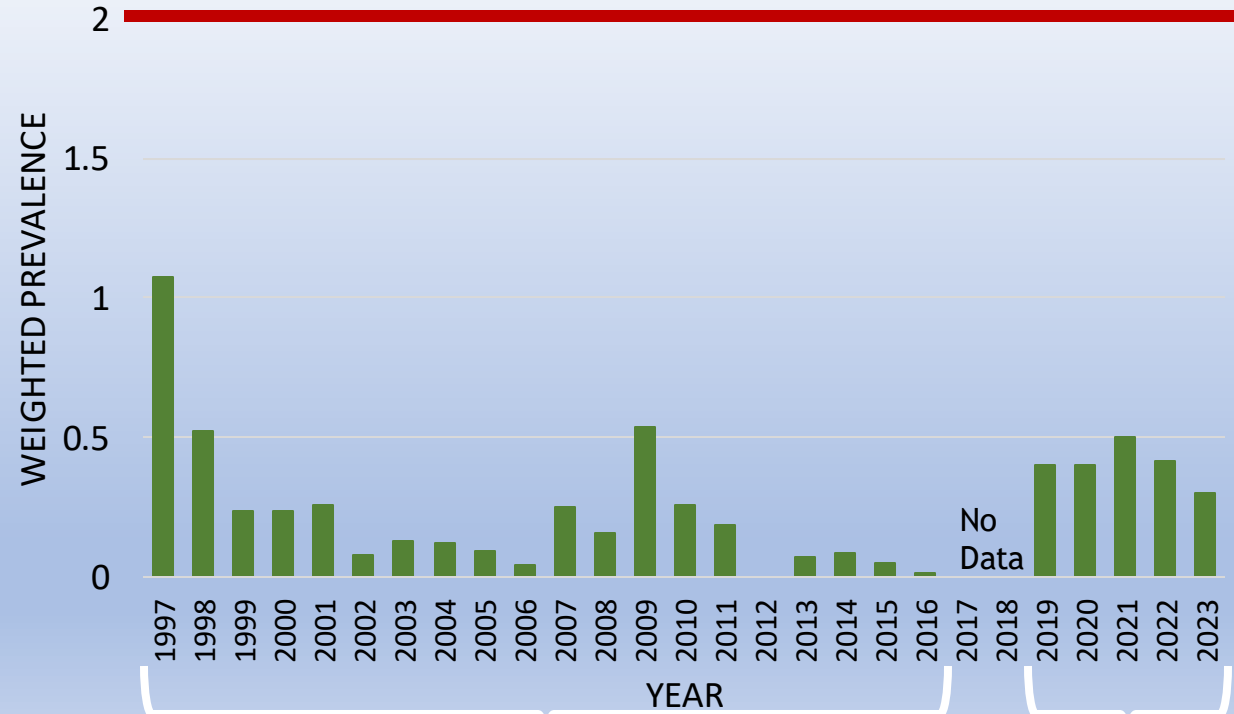
Haplosporidium spp. Prevalence



Histology

qPCR

MSX Weighted Prevalence



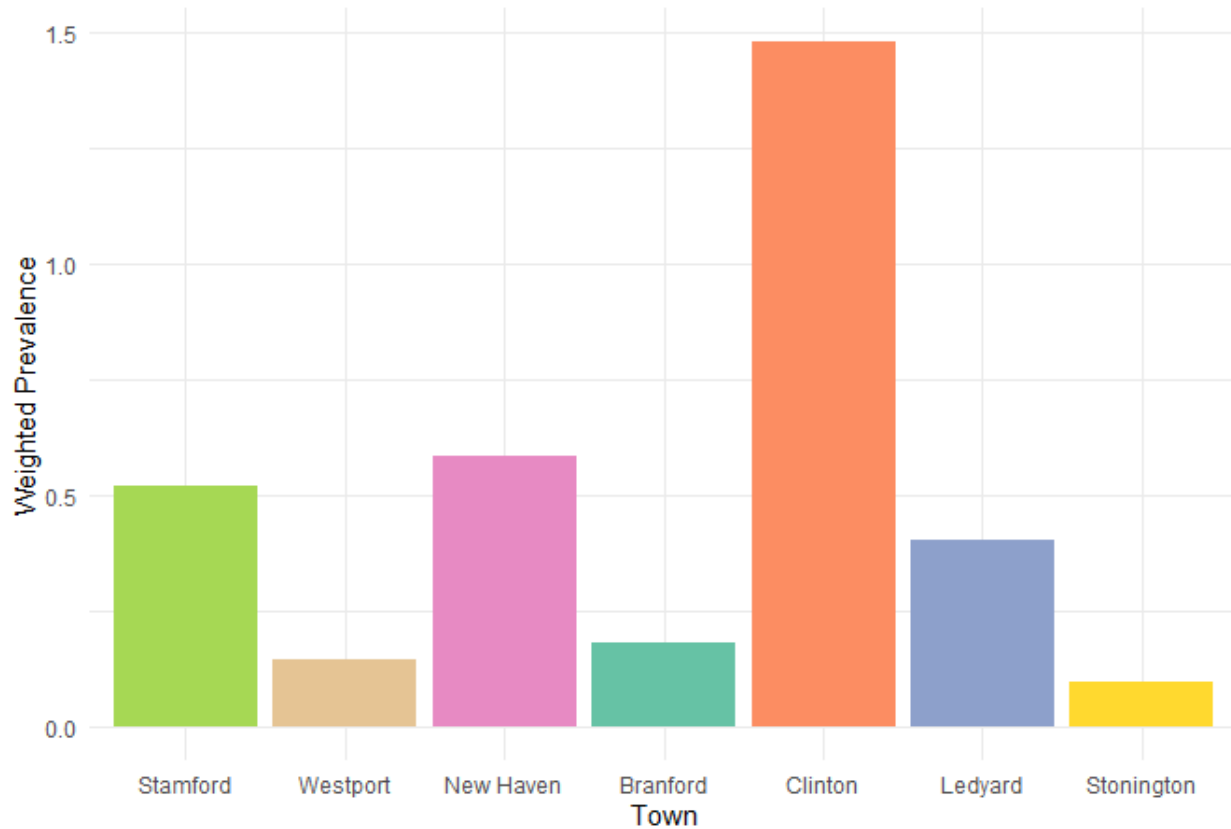
Histology

qPCR

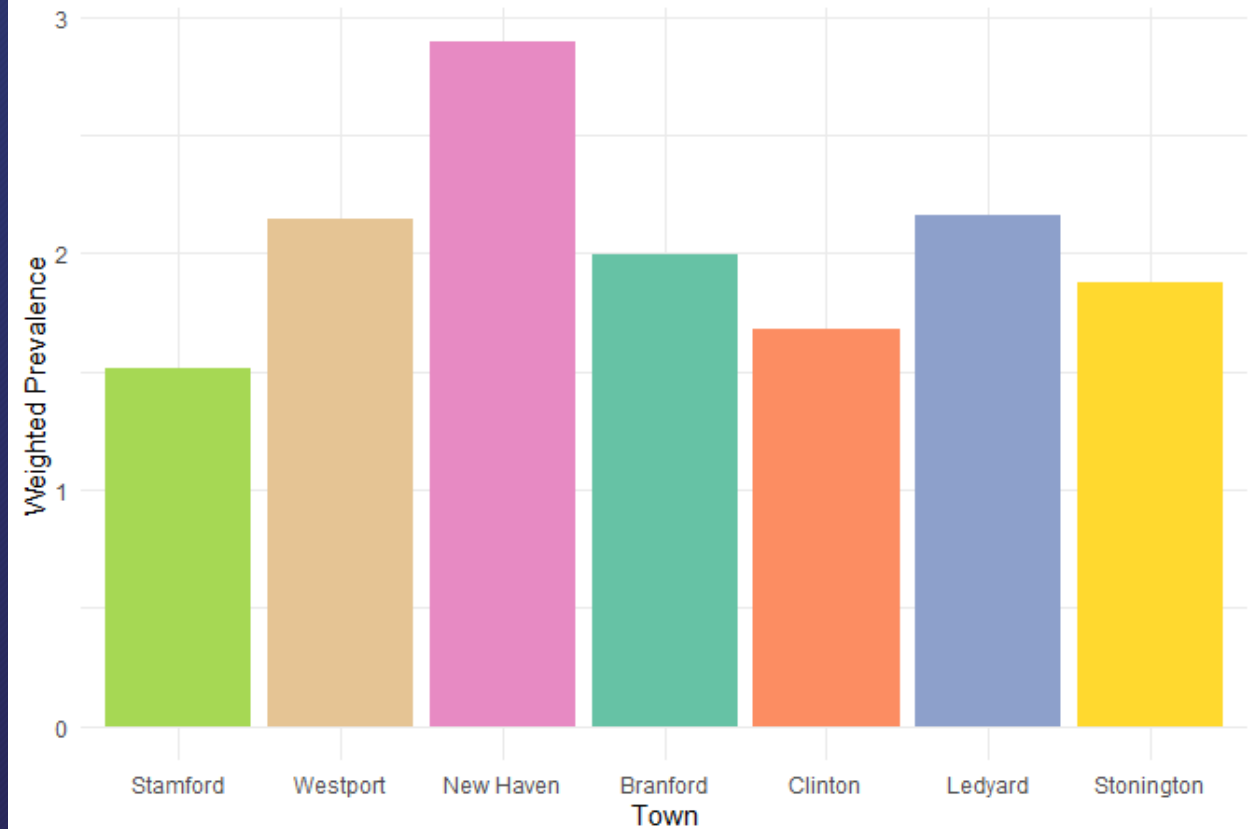
qPCR Data: Weighted Prevalence



MSX

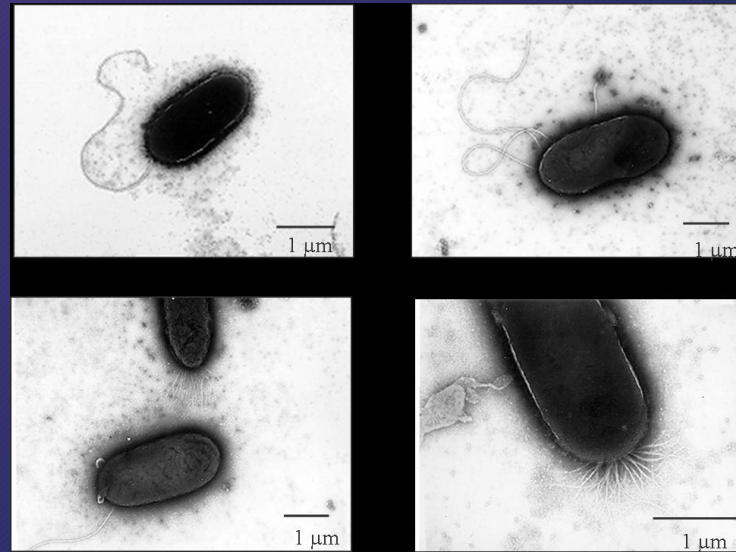


Dermo



Oysters - *Roseovarius crassostrea*

- Aka ROD aka JOD
- Bacteria
- Hatchery seed
- East Coast
- Sporadic



Deformed shells of ROD-infected seed oysters. (Inke Sunila)

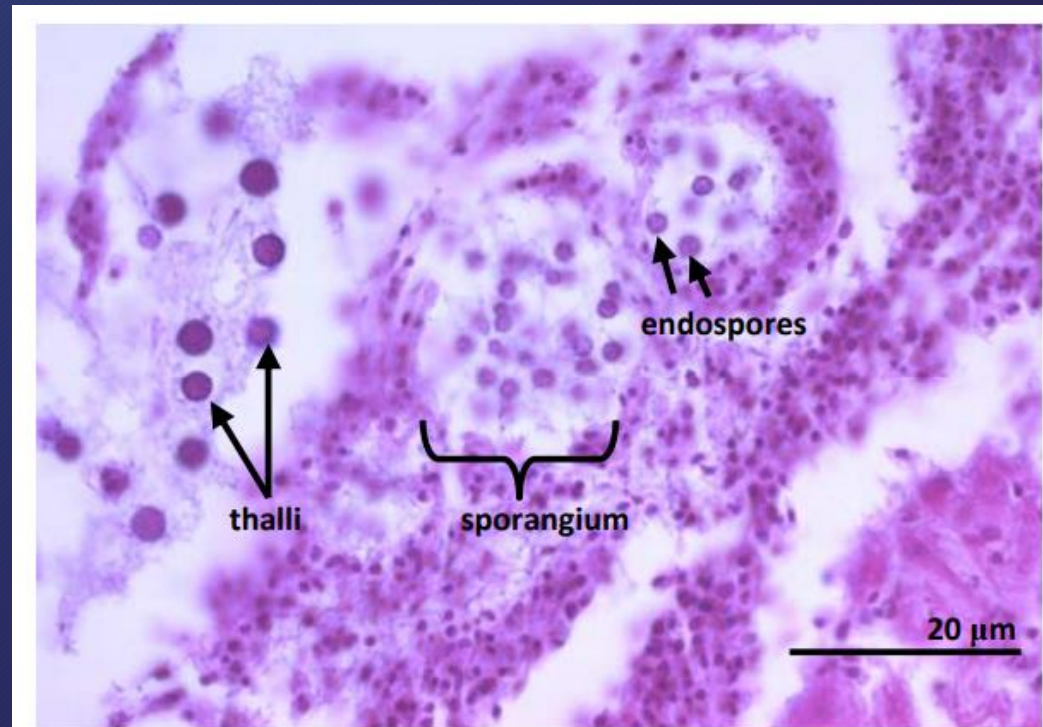


Conchiolin rings on shells of ROD-infected seed oysters. (Inke Sunila)

Clams - *Mucochytrium quahogii*



- Aka QPX
- Marine fungus-like protist
- Facultative parasite
- Tiny
- Difficult life cycle
- Upper East Coast
- Low prevalence



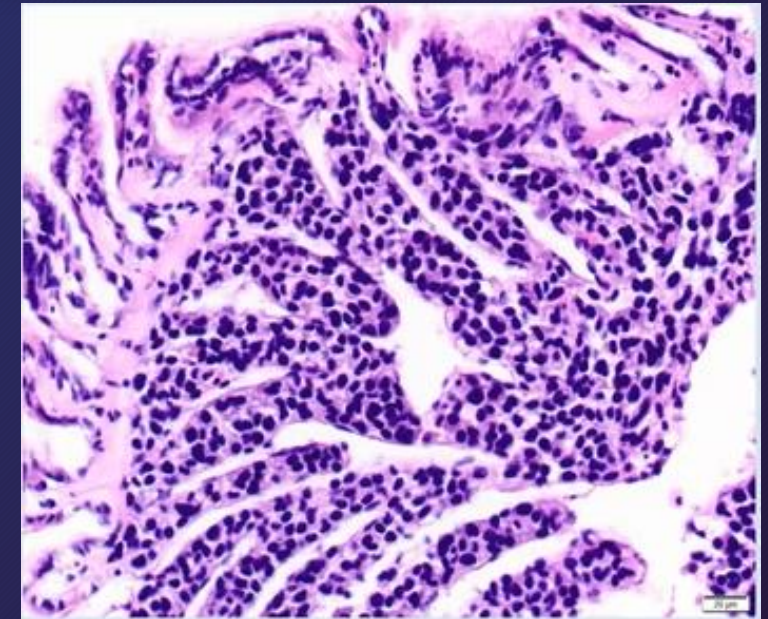
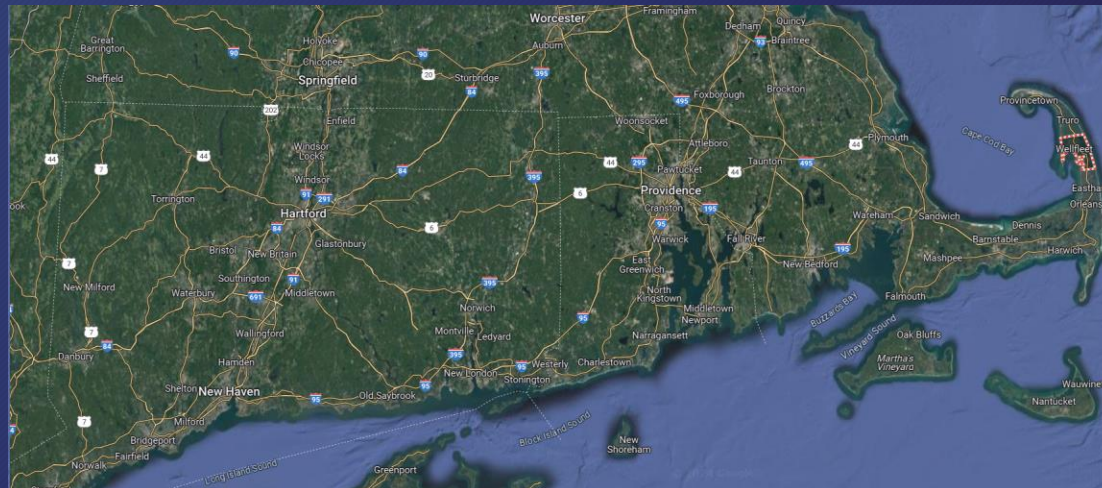
QPX thalli, sporangia and endospores in histological section
(Inke Sunila)

Clams - Hemocytic neoplasia



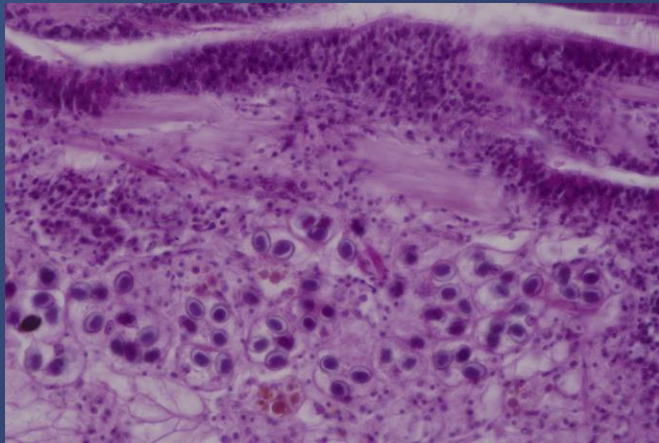
- Aka HN aka disseminated neoplasia aka DN
- Cells
- Wellfleet, MA

- **ONE clam!**
 - Imported

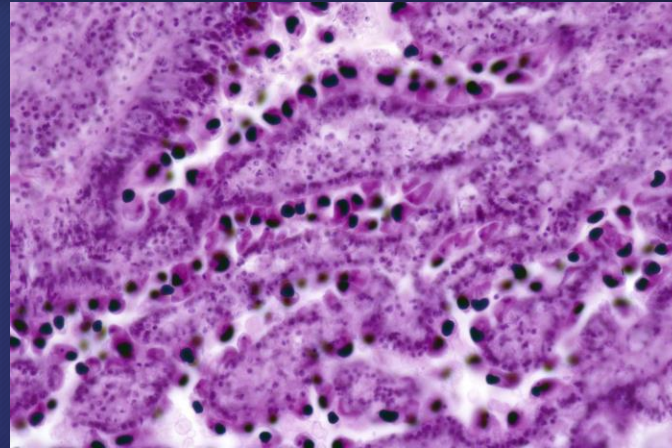


Hemocytic neoplasia in hard clam tissue.
Photo by Dr. Smolowitz (all rights reserved).

Others



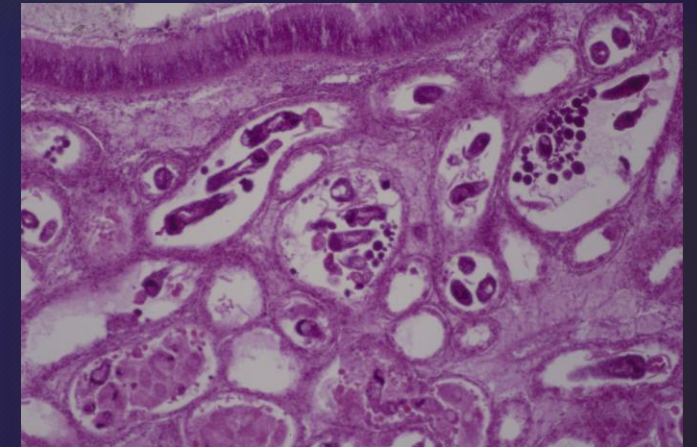
Nematopsis



Ciliates



Turbellaria

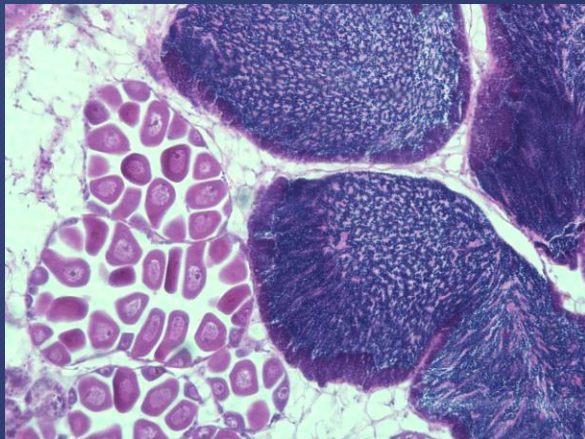


Trematoda

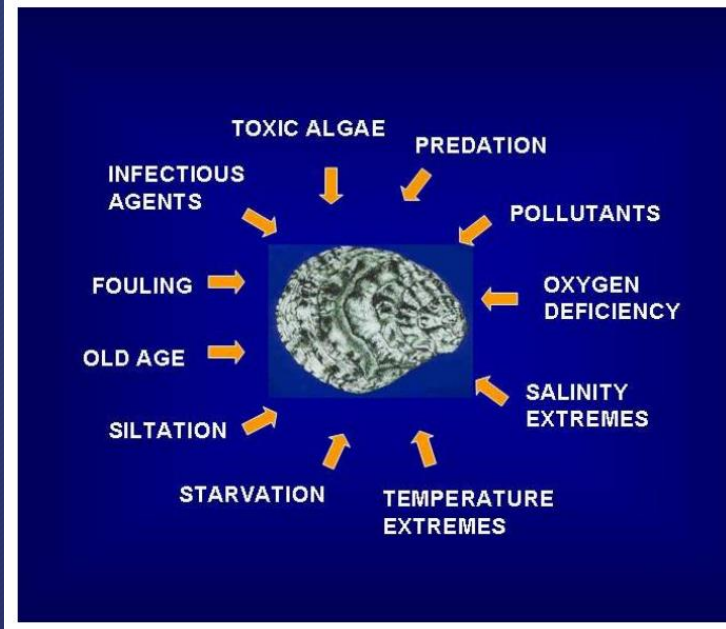
Health



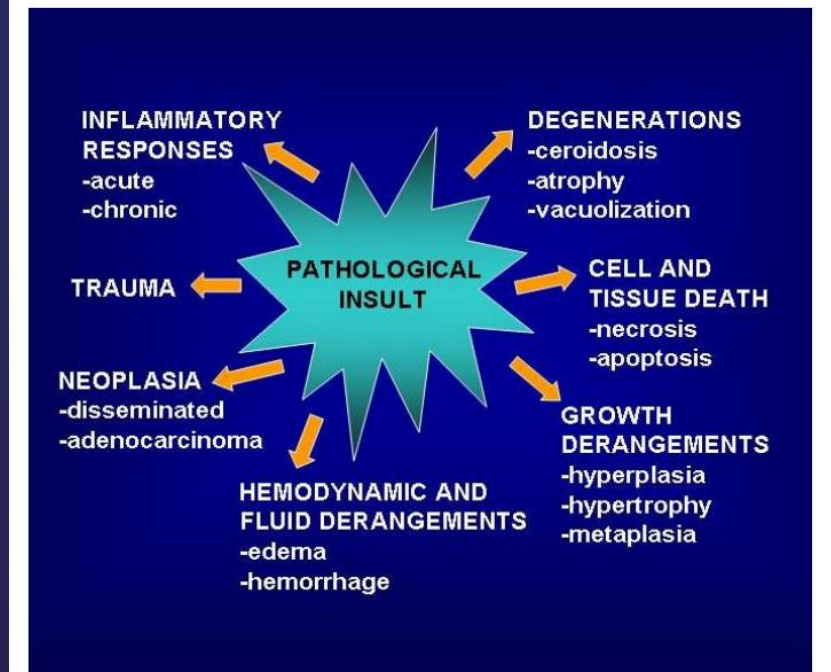
- Pathology
 - Causes
 - Responses
- Food
- Reproduction



FACTORS CAUSING PATHOLOGICAL CHANGES IN OYSTERS



CATEGORIES OF BIVALVE PATHOLOGY



Samples - Collection

- Collection Date/Collector
- Species
- Background/Origin
- Location
 - Specific as possible
 - Temperature
 - Salinity
- Transport
 - In cooler
 - On ice
 - Separated from ice
- More information is better!

STATE OF CONNECTICUT FINALIZED _____
DEPARTMENT OF AGRICULTURE
BUREAU OF AQUACULTURE AND LABORATORY

SAMPLE PROCESSING REQUEST

PRE-SAMPLE

SAMPLE CODE _____ REQUESTOR/DATE _____
PROJECT/REASON FOR REQUEST _____
SOURCE/GROWER _____ EMAIL/PHONE _____

SAMPLING

COLLECTION DATE _____ COLLECTOR _____
SPECIES _____ SAMPLE SIZE _____
BACKGROUND:(PLOIDY/STRAIN/RELAYED/MORTALITIES/OTHER?) _____

ORIGIN: 1. WILD 2. HATCHERY 3. OTHER _____

SAMPLE SITE/LOT/COORDINATES _____
TOWN _____
SURFACE TEMPERATURE _____ SURFACE SALINITY _____
DEPTH OF COLLECTION _____ WEATHER _____

POST-SAMPLE

SAMPLE CONDITION: 1. LIVE 2. FIXED WITH _____ 3. OTHER _____

LIVE SAMPLE HOLDING: 1. REFRIGERATED 2. CAGE 3. FLOW-THRU
4. PROCESSED IMMEDIATELY

PROCEDURES REQUESTED (ID numbers, total quantity for each procedure, etc.)

GROSS MACRO EXAM _____

HISTOLOGY _____ OTHER _____
Fixative _____
Process _____
Embed _____
cut _____
stain(s) _____
microscope _____

COMMENTS: _____

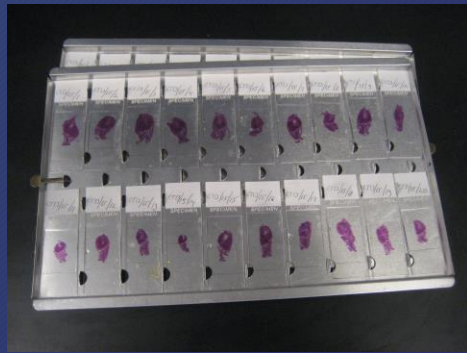


Samples - Tests

- Histology



- RFTM



- qPCR
 - future



Future

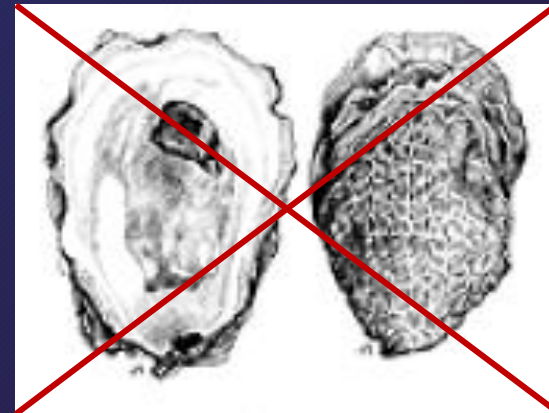
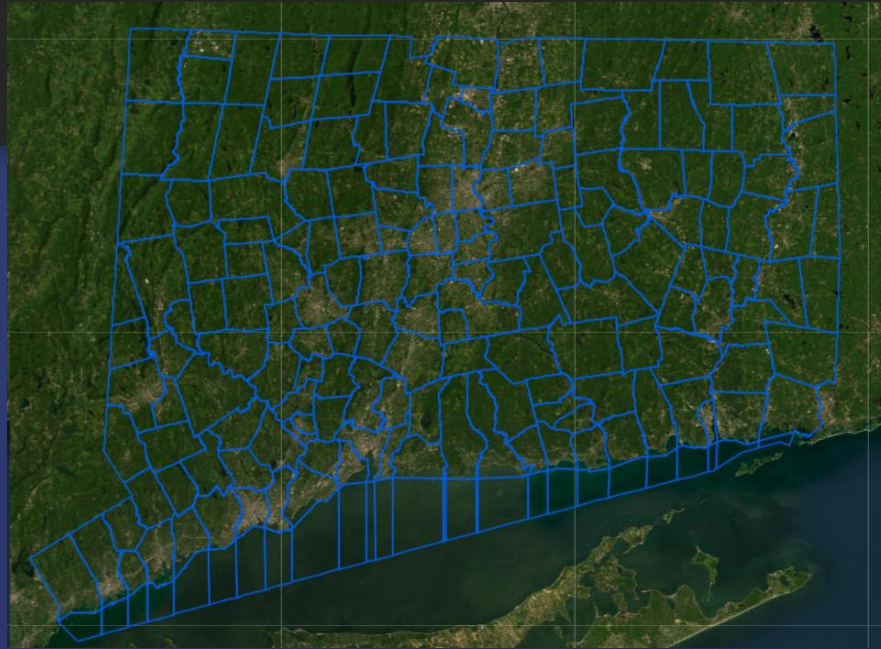


- Collaboration
 - Getting access to sites

- Training



- Emerging disease



Question?



- Website:
<https://portal.ct.gov/DOAG/Aquaculture1/Aquaculture/Aquaculture-Home-Page>
- Contact:
 - Lydia.Bienlien@ct.gov
 - 203-874-0696 ex: 120
 - Business cards

