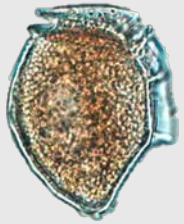
2022 CONNECTICUT SHELLFISH COMMISSION GATHERING

CONNECTICUT DEPARTMENT OF AGRICULTURE, BUREAU OF AQUACULTURE

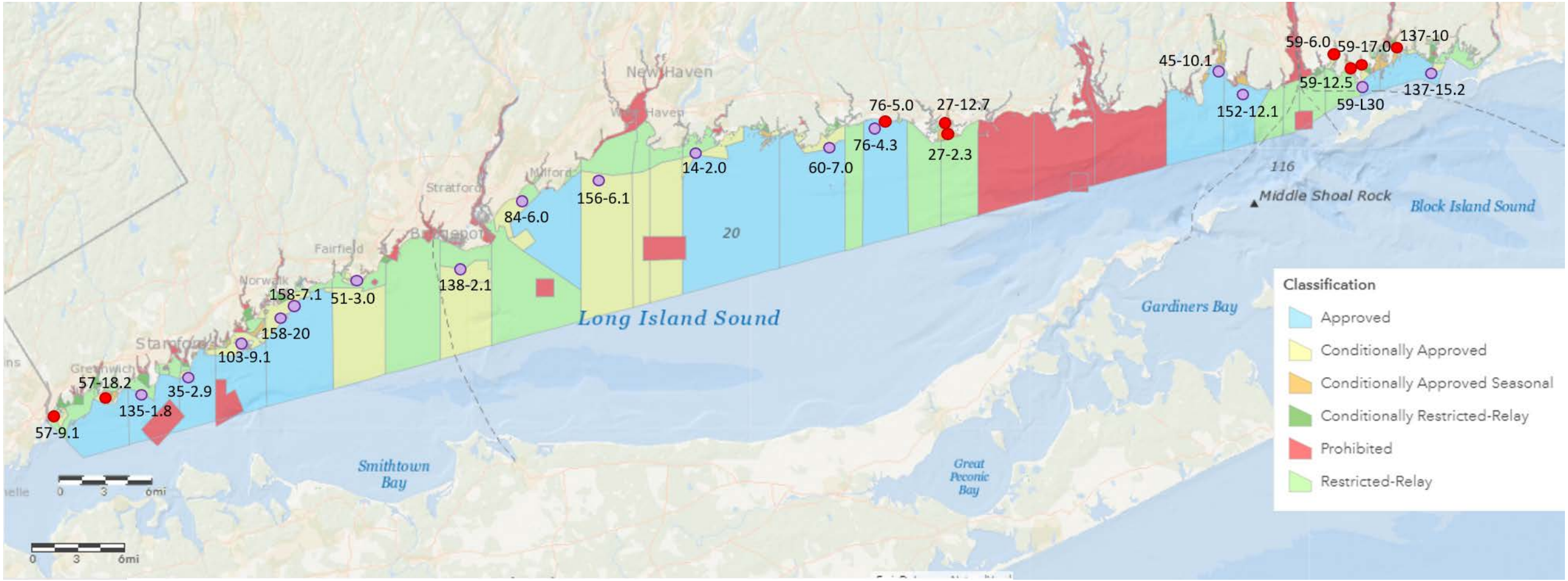
EMILY MARQUIS, FISHERIES BIOLOGIST I

OVERVIEW OF PRESENTATION

- Harmful Algal Bloom Update
- Statewide Shellfish Disease Update
- Per- and Polyfluoroalkyl Substances (PFAS) Update
- Vibrio Update

HAB genus	Toxin	Syndrome	Potential effects
Alexandrium 	Saxitoxin **Potentially lethal**	Paralytic Shellfish Poisoning (PSP)	Tingling, numbness, burning in extremities or mouth; lack of coordination/staggering; drowsiness; fever; rash; **respiratory difficulty and/or arrest; death** -Gastrointestinal: Nausea, vomiting, diarrhea
Pseudo-nitzschia 	Domoic acid **Potentially lethal**	Amnesic Shellfish Poisoning (ASP)	-Dizziness; headache; disorientation; short-term memory loss; **seizures**; **respiratory difficulty; coma; long-term neurological damage, including memory defects and weakening/death muscles in extremities; death** -Gastroenteritis usually develops within 24 hours of consumption – nausea, vomiting, abdominal cramps, diarrhea
Dinophysis 	Okadaic acid	Diarrhetic Shellfish Poisoning (DSP)	-Gastrointestinal onset within 30 mins-few hours of consumption: Incapacitating diarrhea, nausea, vomiting, abdominal pain; recovery typically within 3 days -Potential association with cancer (long-term exposure)
Prorocentrum 			

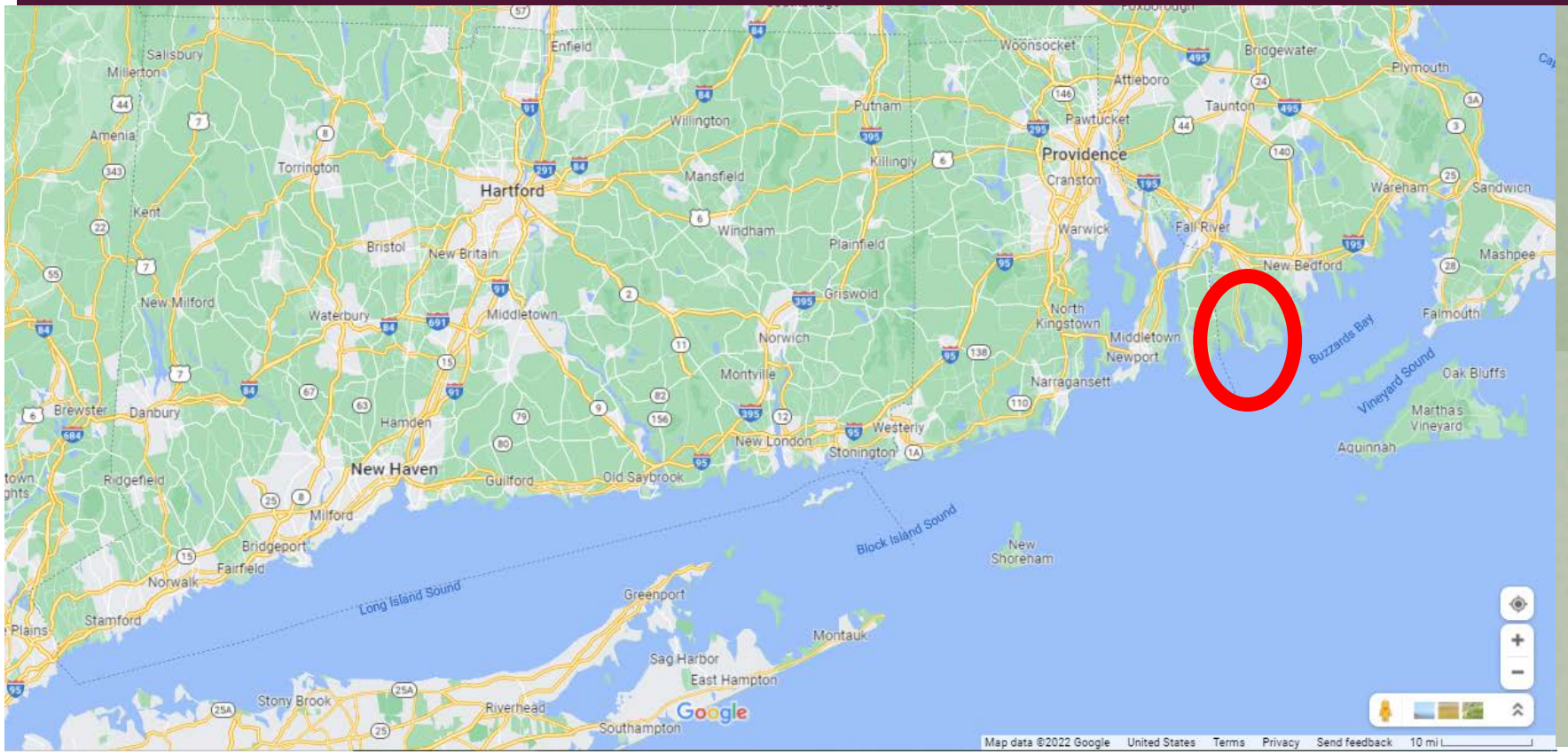
HAB MONITORING STATIONS (RECREATIONAL SHOWN IN RED)



ANNUAL NUMBER OF HAB SAMPLES

Year	2019	2020	2021
Recreational HAB samples	14	56	83
Total HAB samples	179	226	244

TROPICAL HAB IN MASSACHUSETTS (OCTOBER 11&13, 2021)



Karenia papilionacea

*Images not to scale

Karenia mikimotoi

Karenia brevis

K. papilionacea was detected in Massachusetts and does produce brevetoxins, which are regulated by the FDA; however, *K. papilionacea* produces lower concentrations of brevetoxin than *K. brevis*. *K. brevis* is the most common *Karenia* species that causes red tide in Florida, which is associated with shellfish closures and animal kills. *K. mikimotoi* does not produce brevetoxins, but does cause large blooms in Maine and Massachusetts now and has been associated with fish kills due to hypoxia.

TROPICAL HAB IN MASSACHUSETTS (OCTOBER 11&13, 2021)

Sample Type	Sampled Volume (L)	Concentrated Volume (ml)	Sample Growing Area	Cell Count (K.p. cells/L)	Date Collected	Water Temp (°F)	Salinity (psu)
Hard Clam (~20 animals various size)	N/A	N/A	BB3	100	10/13/2021	66.3	31
Oyster (15 animals)	N/A	N/A	BB1	1150	10/13/2021	66.7	32
Whole Water	1	N/A	BB1	1150	10/13/2021	66.7	32
Water Concentrate #1	14	40	BB1	1150	10/13/2021	66.7	32
Water Concentrate #2	15	40	BB3		10/13/2021	67.2	31
Lugol's Preserved Concentrate	1	23	BB3	5460	10/11/2021	65	32

Brevetoxin was not detected in shellfish or water samples in Massachusetts during this event.

Information provided by Massachusetts Division of Marine Fisheries, Shellfish Sanitation and Management Program

NO TROPICAL HABS IN CONNECTICUT

Collected	Station	Town	Surface Temp (°C)	Surface Temp (°F)	Surface Salinity
10/6/2021	59-25.0	Groton	19.3	66.7	31.9
10/6/2021	45-11.1	East Lyme	20.2	68.4	31.1
10/6/2021	59-6.0	Groton	19.2	66.6	25.6
10/6/2021	137-8.0	Stonington	19.1	66.4	31.6
10/6/2021	45-8.1	East Lyme	20	68	30.7
10/12/2021	84-6.0	Milford	19.9	67.8	27.6
10/12/2021	51-3.0	Fairfield	19.4	66.9	26
10/13/2021	156-6.1	West Haven	19.8		27.5
10/13/2021	014-5.2	Branford	20		27.9
10/25/2021	103-9.1	Norwalk	18.2	64.8	27.6
10/25/2021	35-2.9	Darien	18.6		27.8
10/25/2021	158-11.0	Westport	17.9	64.2	27.7
10/28/2021	27-12.7	Clinton			
10/28/2021	27-2.3	Clinton			

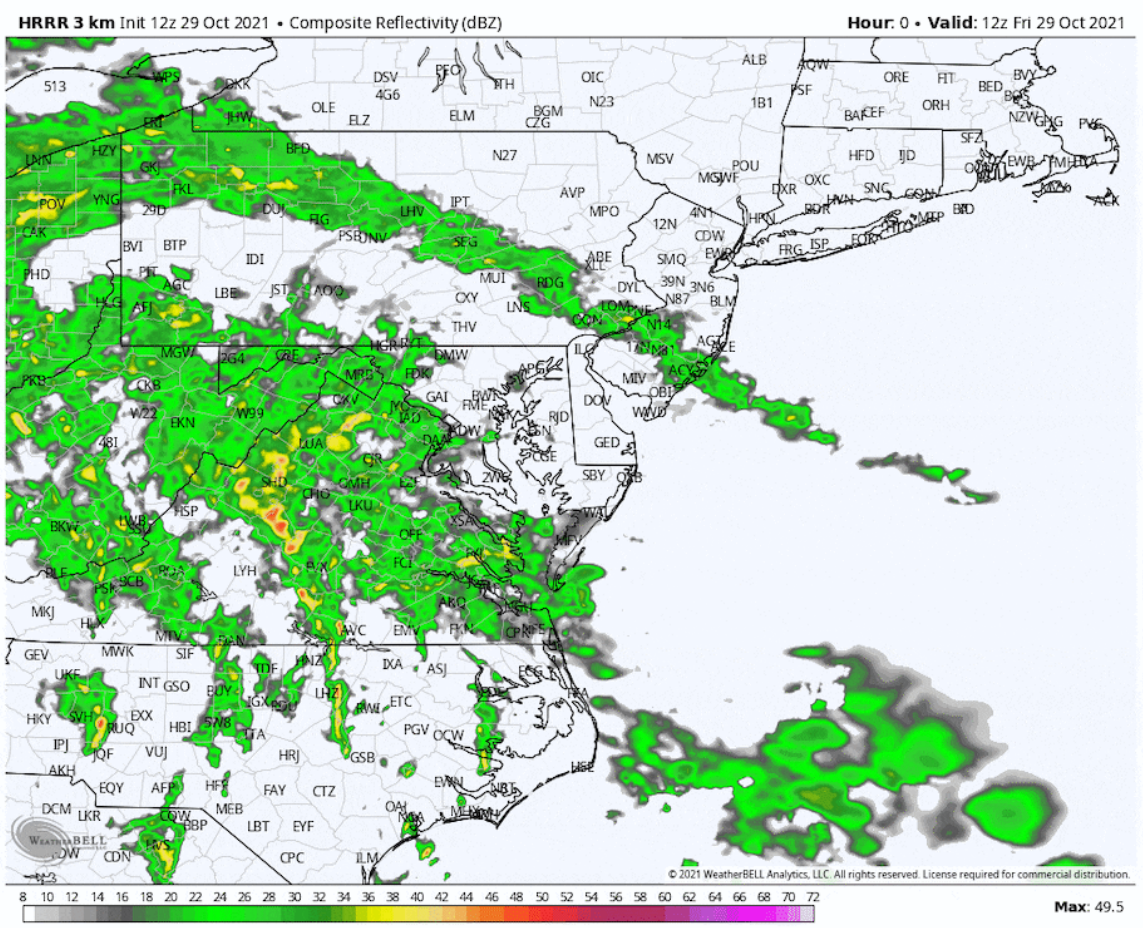
TROPICAL HABS IN CONNECTICUT

Collected	Station	Town	Surface Temp (°C)	Surface Temp (°F)	Surface Salinity
10/6/2021	59-25.0	Groton	19.3	66.7	31.9
10/6/2021	59-6.0	Groton	19.2	66.6	25.6
10/28/2021	27-12.7	Clinton			
10/28/2021	27-2.3	Clinton			
11/2/2021	57-18.2	Greenwich			
11/2/2021	14-5.2	Branford	16.4	16.4	28.1
11/2/2021	57-9.1	Greenwich			
11/3/2021	27-2.3	Clinton*			
11/3/2021	27-12.7	Clinton			
11/3/2021	59-12.5	Groton*			
11/8/2021	137-10.0	Stonington			
11/14/2021	57-18.2	Greenwich			
11/14/2021	57-9.1	Greenwich			

Karenia papilionacea @ 133 cells/L

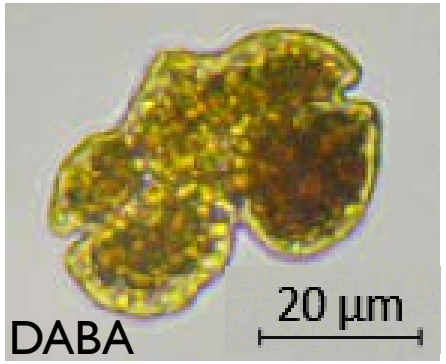
Ostreopsis @ 33,373 cells/L

"EAST COAST STORM BRINGING WORST COASTAL FLOODING SINCE 2003 TO PARTS OF MID-ATLANTIC"



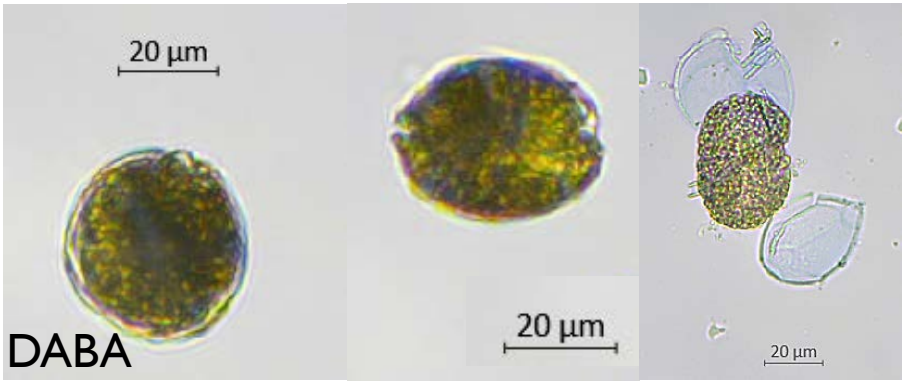
...and with it, tropical HABs!

Karenia papilionacea (133 cells/L)



Representative image

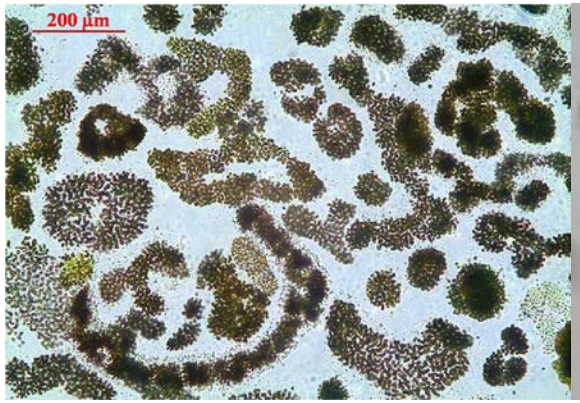
Ostreopsis sp. (33,373 cells/L) Representative image

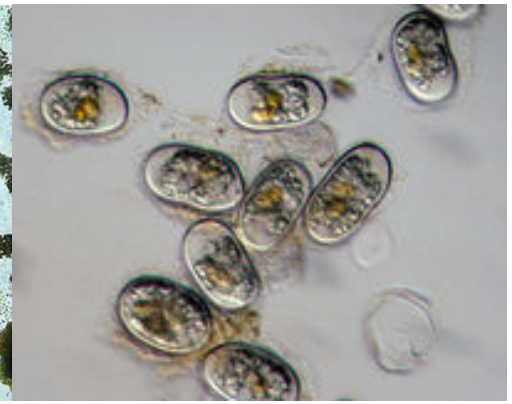


RESEARCH TO DIRECT MANAGEMENT

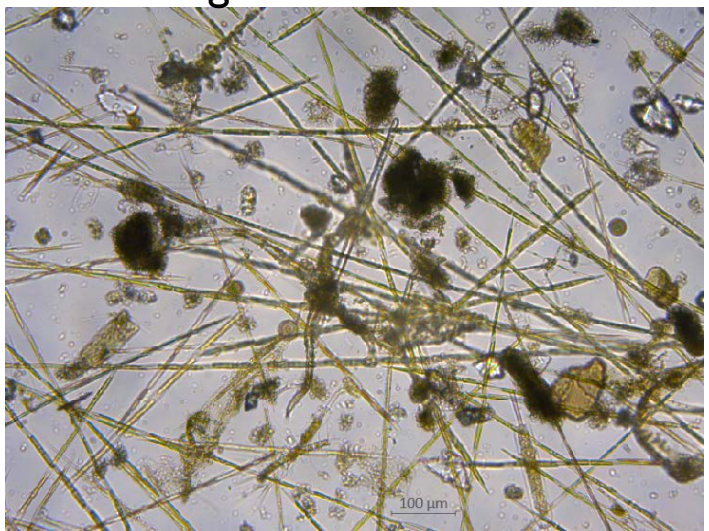
- Funded 2022-2023: Transport of microcystin into Greenwich shellfish growing areas
- Future funding (2023-2025?): *Alexandrium* cyst surveys
- Future funding (2023-2025?): *Pseudo-nitzschia* species assemblage and domoic acid monitoring (statewide)

Microcystis aeruginosa bloom | *Alexandrium catenella* cysts

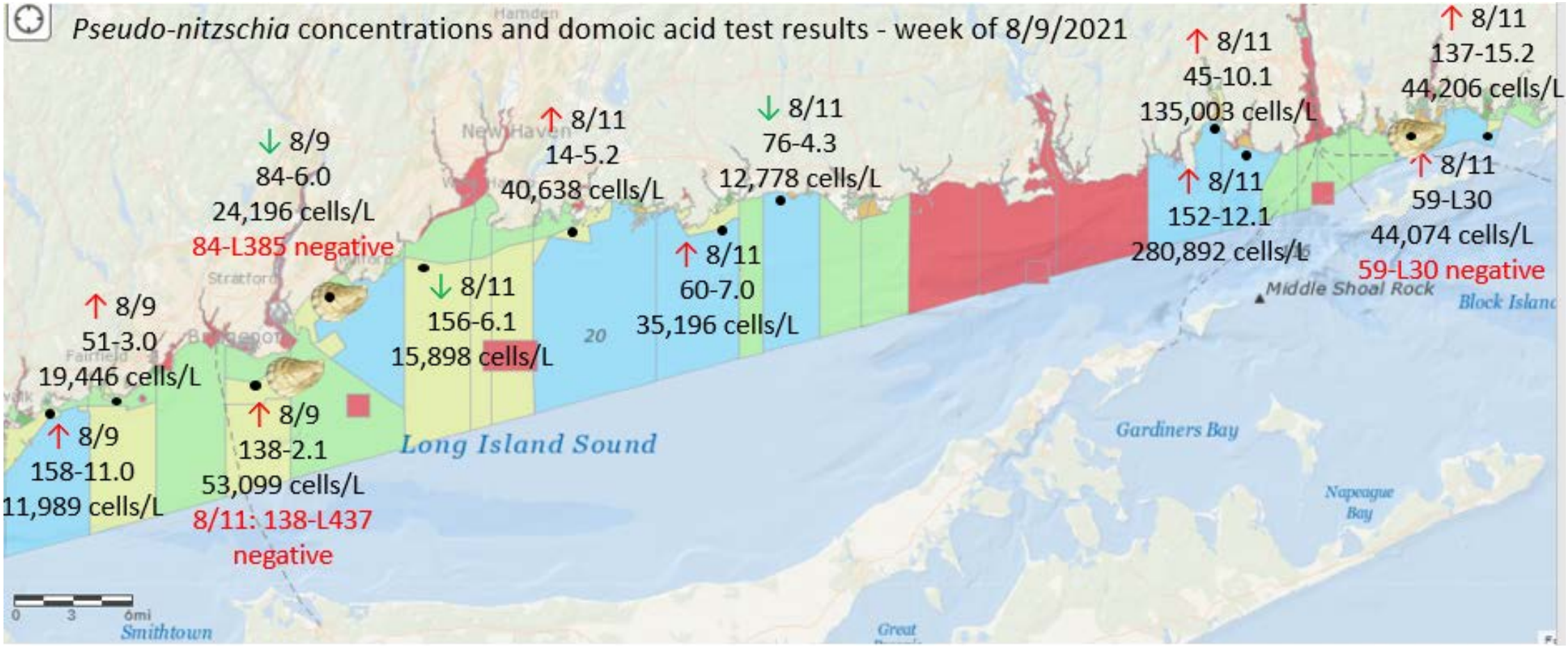




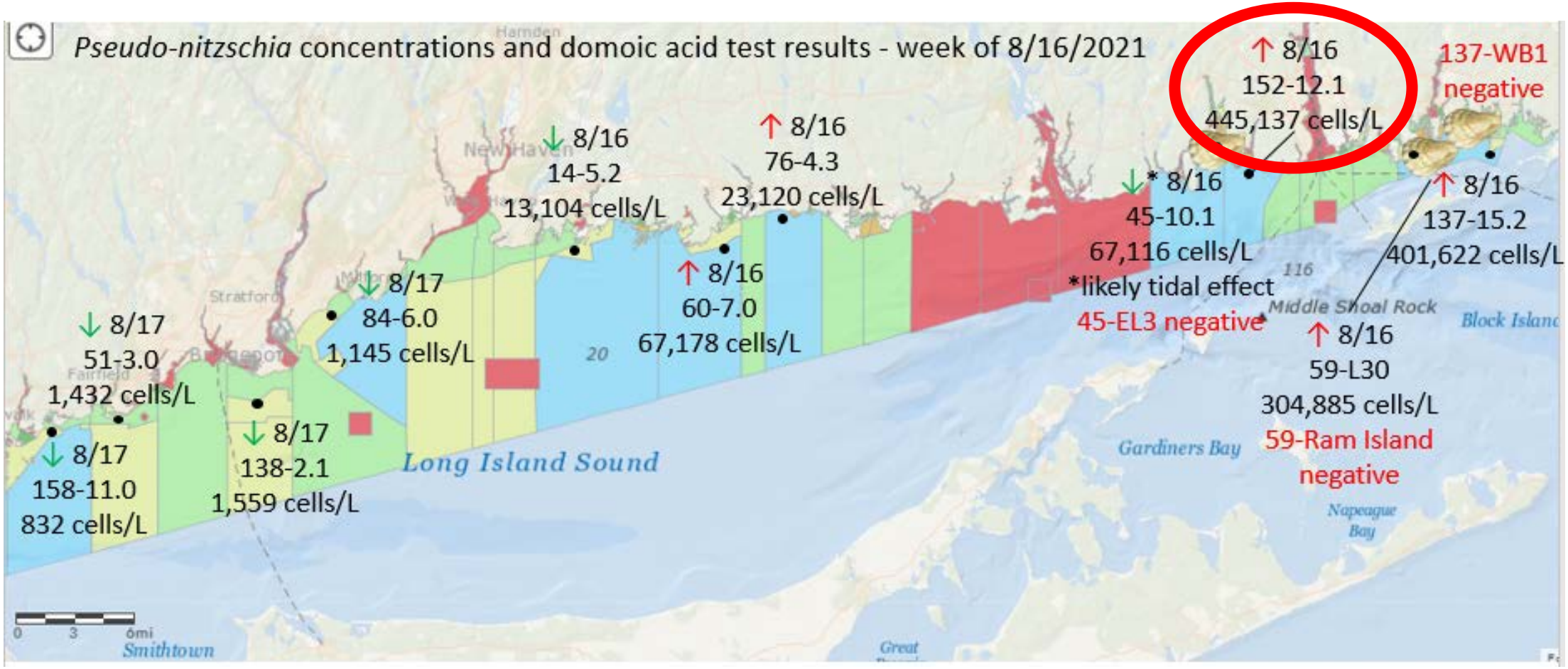
Connecticut August 2022 *Pseudo-nitzschia* bloom



AUGUST *PSEUDO-NITZSCHIA* BLOOM



AUGUST *PSEUDO-NITZSCHIA* BLOOM



Highest *Pseudo-nitzschia* concentration recorded yet

ANNUAL HAB REPORTS

Bryan P. Hurlburt
Commissioner

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

David H. Carey
Director

2020 Connecticut Harmful Algal Bloom Report

Table of Contents

https://portal.ct.gov/-/media/DOAG/Aquaculture/HABs/2020-Connecticut-HAB-Report.pdf

WE NEED YOUR HELP TO COVER CT'S COASTLINE...

Please report discolored water, strange marine animal behavior and/or animal kills!

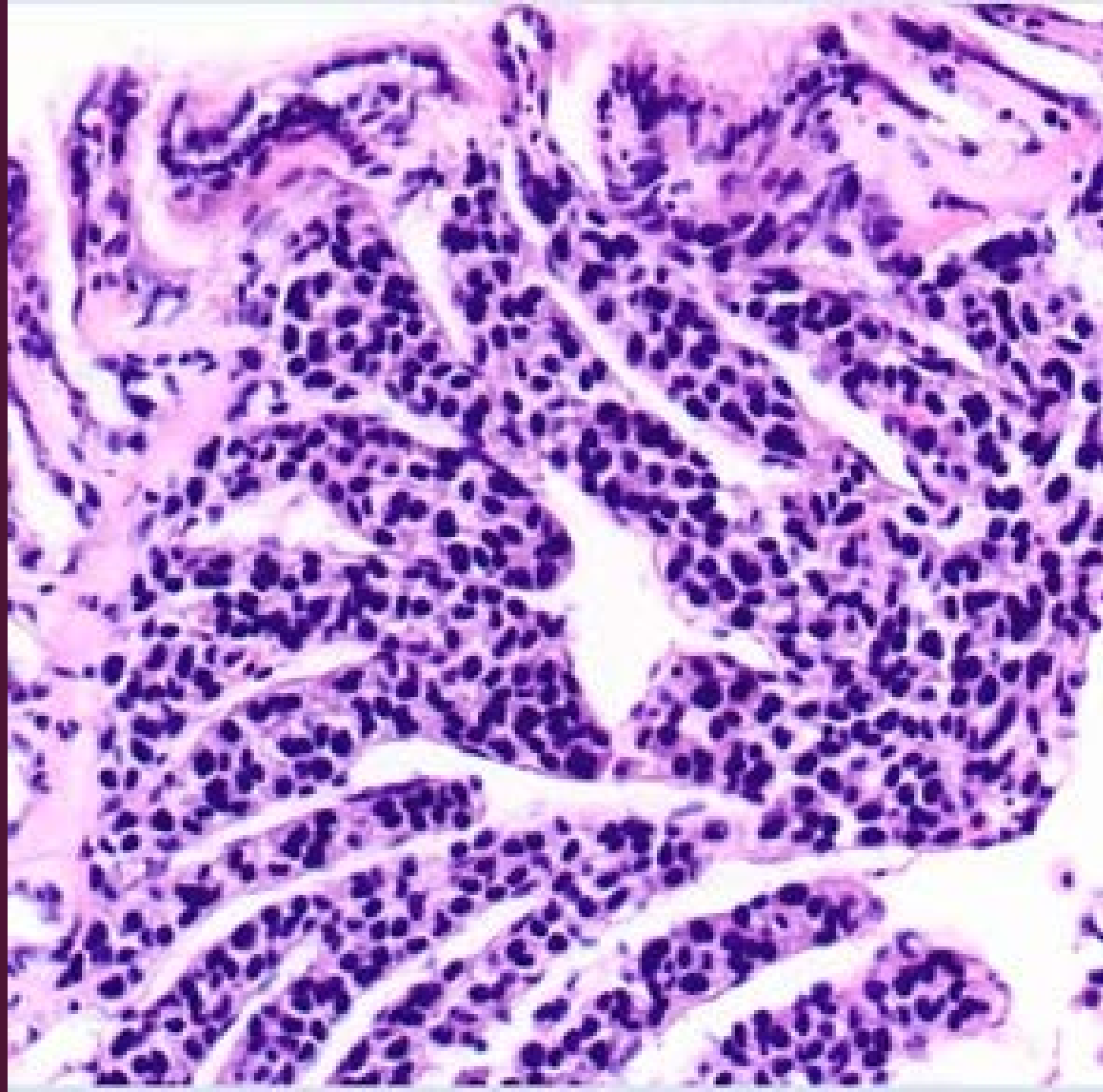
1) Take a sample; 2) take a photo; 3) call DA/BA



NEW FDA REQUIREMENT FOR HAB MONITORING

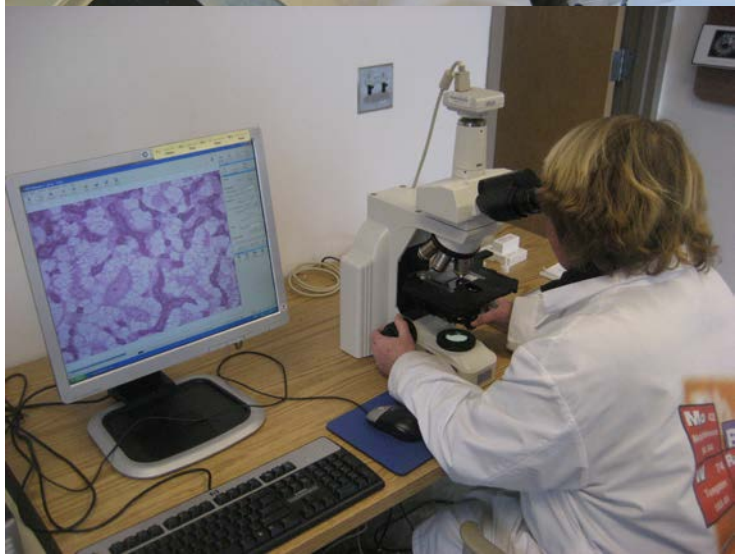
- In addition to the water quality (results and frequency) and shellfish testing and sanitary survey requirements...
- To open new growing areas where historic HAB data is not available for a hydrographically linked waterbody, the DABA will comply with the newly required 36 samples over 3 years.

2021 SHELLFISH DISEASE UPDATE



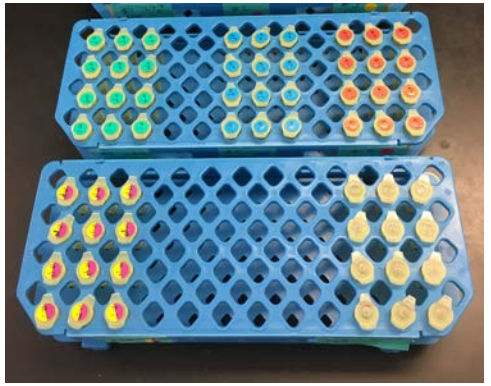
SHELLFISH PATHOLOGY METHODS

1997-2016
Histology



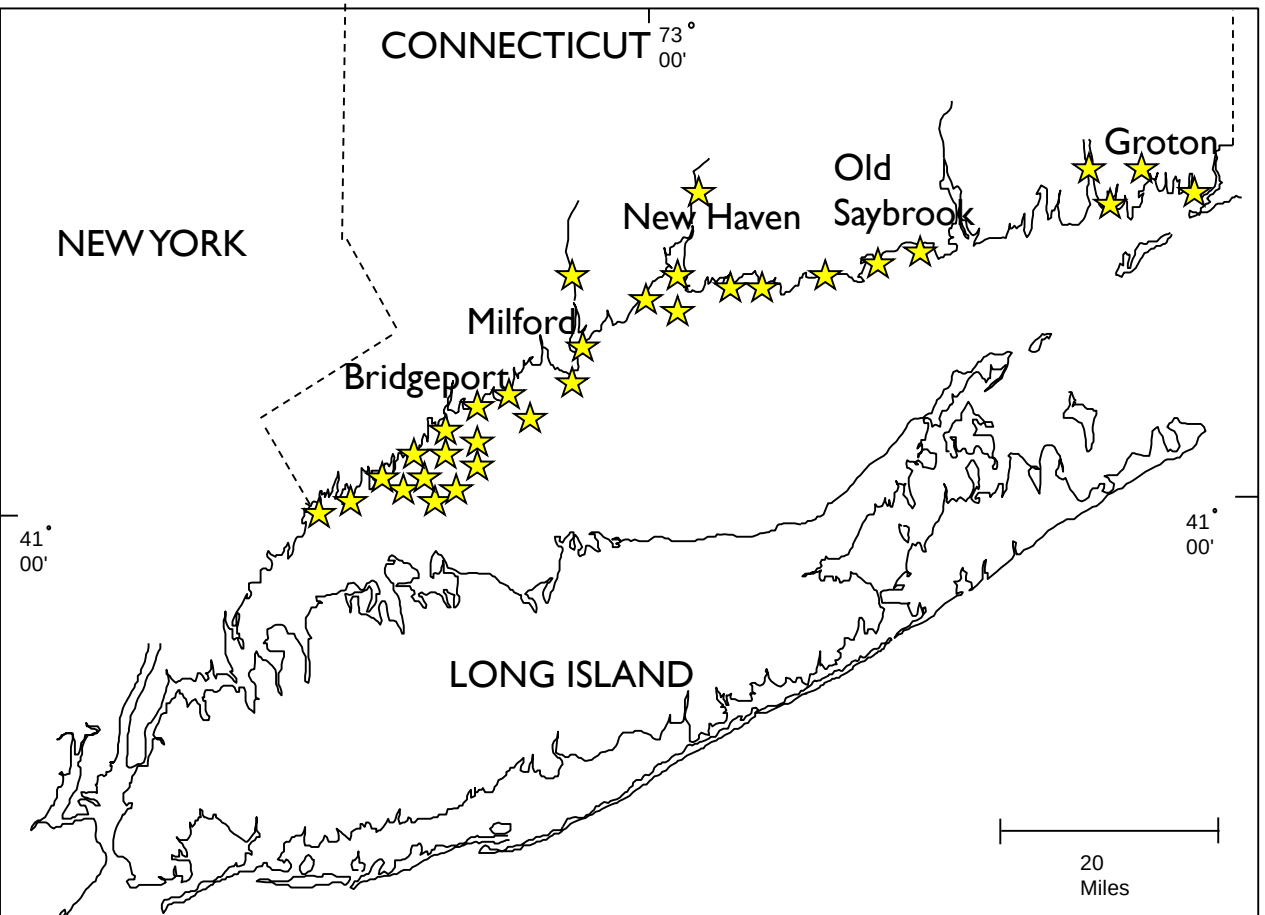
2019-2021
Triplex PCR

Roger Williams University

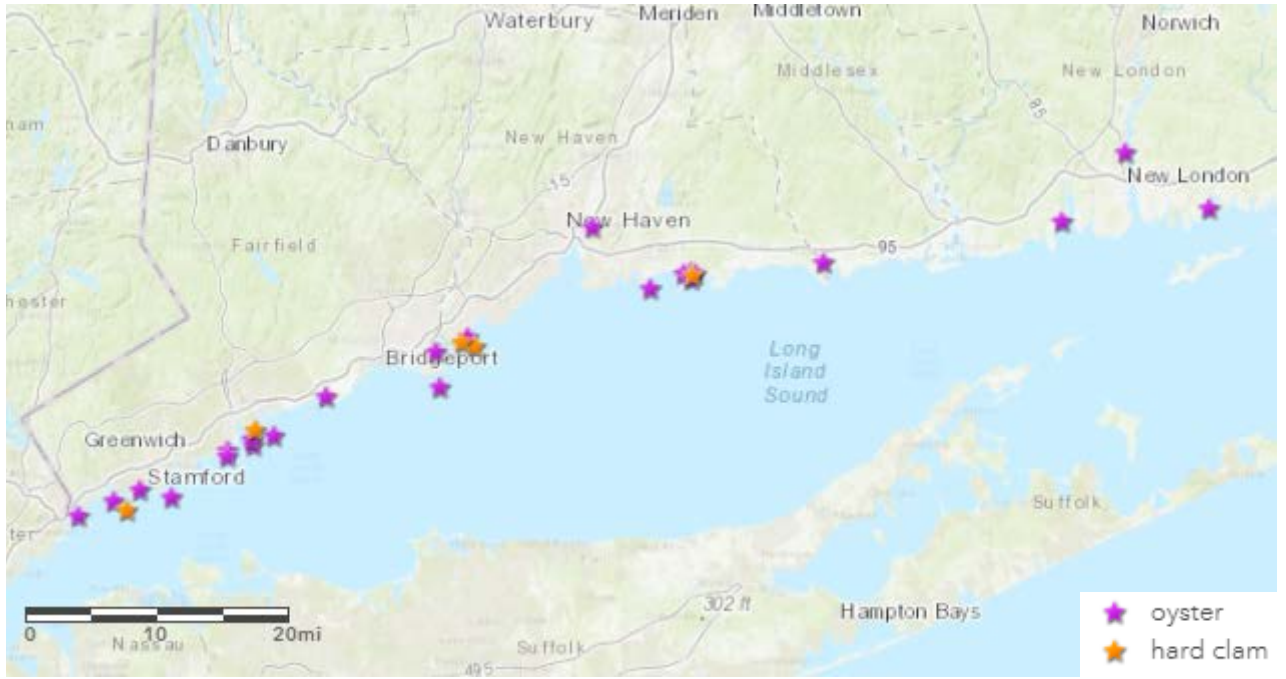


SHELLFISH DISEASE SURVEILLANCE SAMPLING LOCATIONS

1997-2016



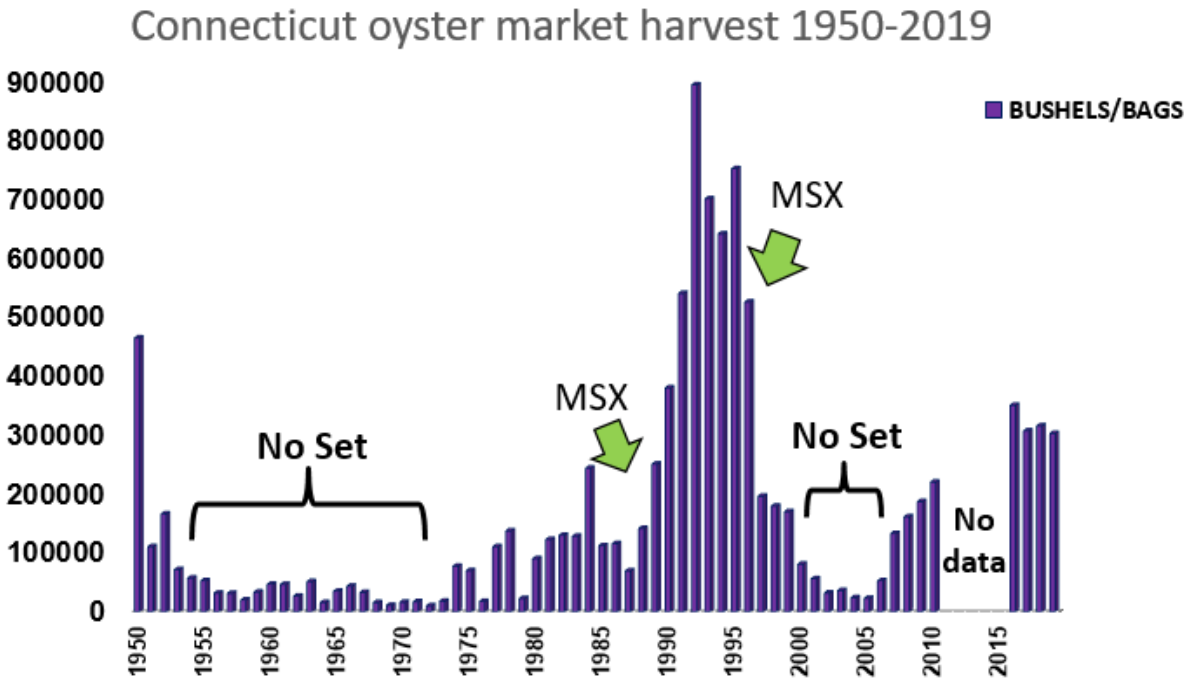
2019-2021



PATHOLOGY DATA INTERPRETATION

- **Prevalence:** percent of animals positive in the population (each sample set was typically 30 shellfish)
- **Weighed Intensity:** total of the scores for each individual animal/total number of animals in the sample set. Weighed intensity is used to report findings from any pathology lab, regardless of the method used to do the evaluation, and provides an overall standardized score to assess the level of infection in each group of oysters by each of the parasites.
  - **Dermo:** Intensity ratings are: 0.5, very light; 1.0, light; 2.0, light to moderate; 3.0, moderate; 4.0, heavy; 5.0, very heavy. **Populations with weighed intensities above 2.0 usually show noticeable mortality.** Populations with intensities above 2.0 can also show sporadic mortality.
  - **MSX and SSO:** Intensity rating are: 1, light; 2.0, moderate; 3.0, severe. **Populations with weighed intensities of 2.0 and greater usually show noticeable mortality.** Populations with MSX or SSO intensities of 1.5 can show sporadic mortality.

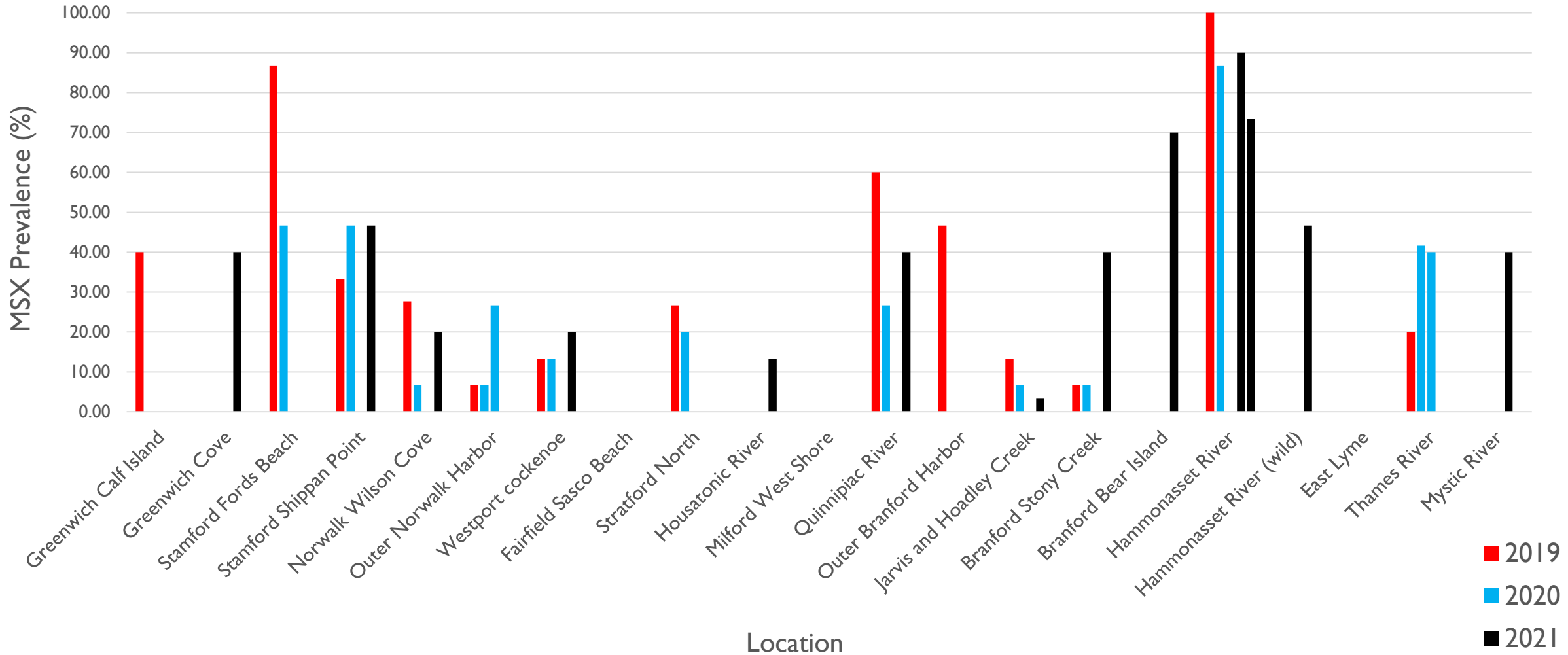
CT OYSTER DISEASE HISTORY: MSX



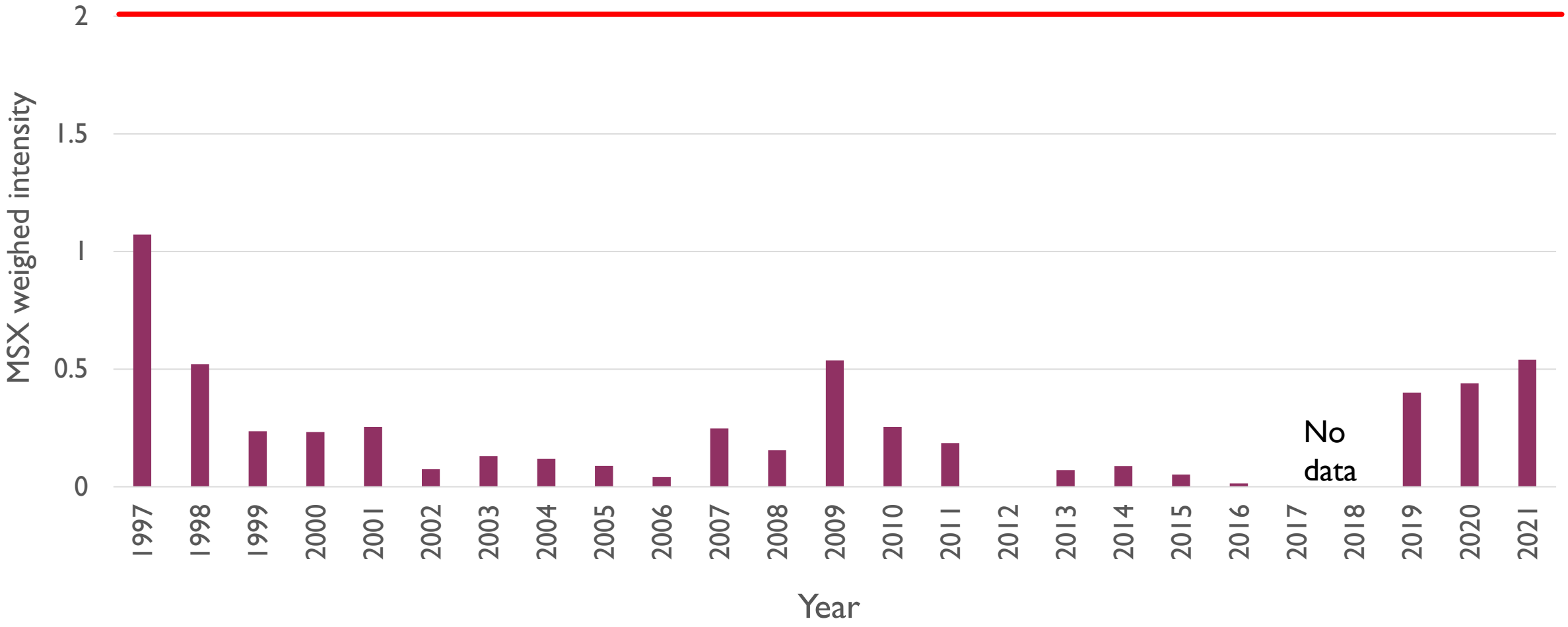
- The 1997 outbreak of MSX infection in market size oysters caused serious economic damage to the oyster industry.
- The following year, infection spread to seed oyster beds and caused devastating mortality.
- Populations began to recover after 2004.
- MSX-prevalence in Connecticut oysters has been in steady decline since the 1998 outbreak.
- MSX occurs in CT as a co-infection with another haplosporidian parasite, SSO.

ANNUAL AVERAGE PREVALENCE OF MSX AND SSO (1997-2021)

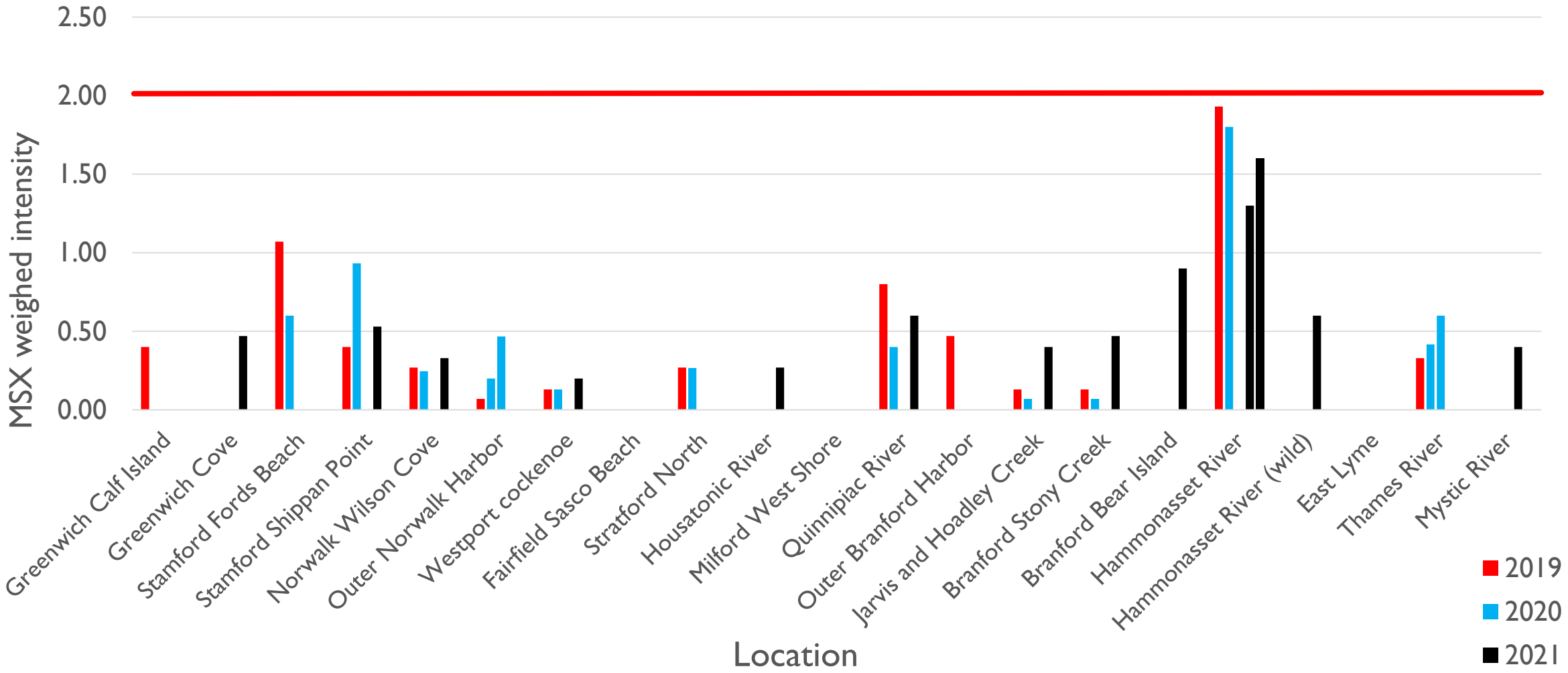
MSX PREVALENCE BY LOCATION (2019-2021)



ANNUAL AVERAGE MSX WEIGHED INTENSITY (1997-2021)

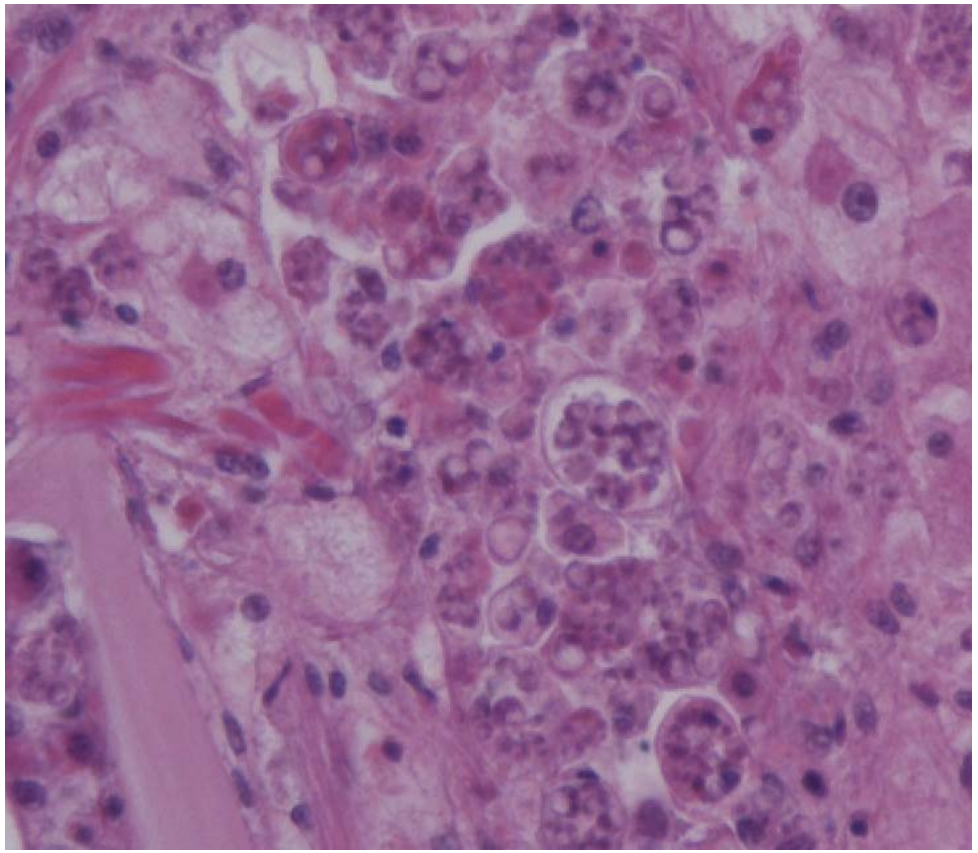


MSX WEIGHED INTENSITY BY LOCATION (2019-2021)

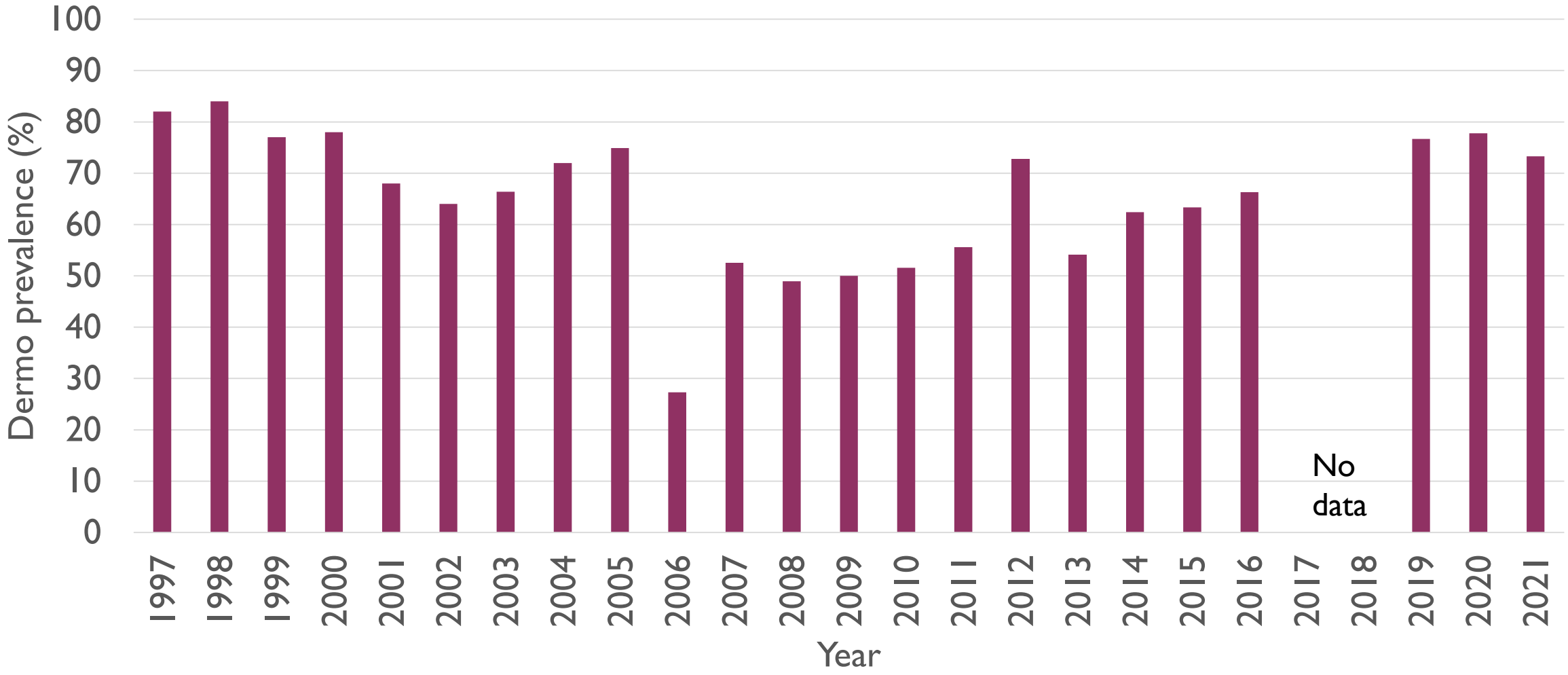


CT OYSTER DISEASE HISTORY: DERMO

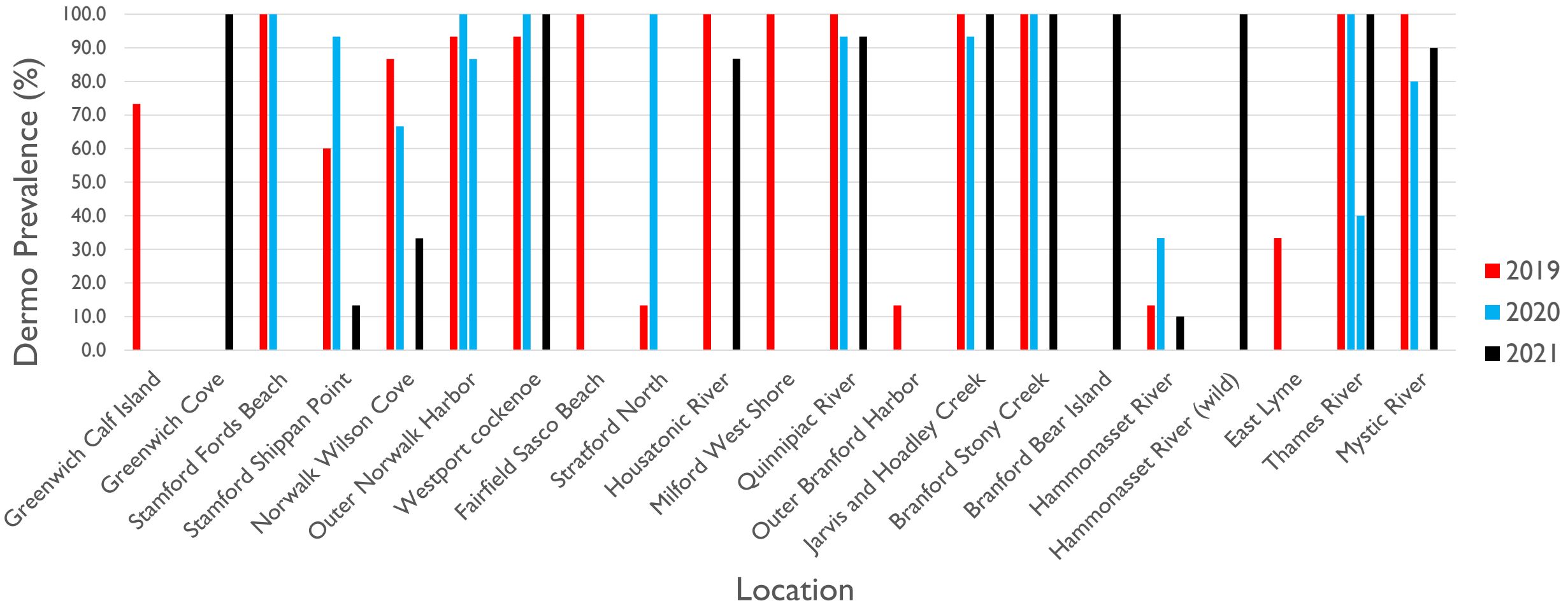
- Dermo is a slow-killing disease.
- It takes up to three years in Connecticut after initial infection for parasite intensities to approach levels high enough to cause death of the oyster.
- Oysters are marketed when they are three to four years old. Consequently, Dermo has not caused significant mortalities in Connecticut's commercial oyster stocks.
- Dermo-associated mortalities have been detected in areas of unusually slow oyster growth or during restoration efforts when oysters are grown indefinitely.



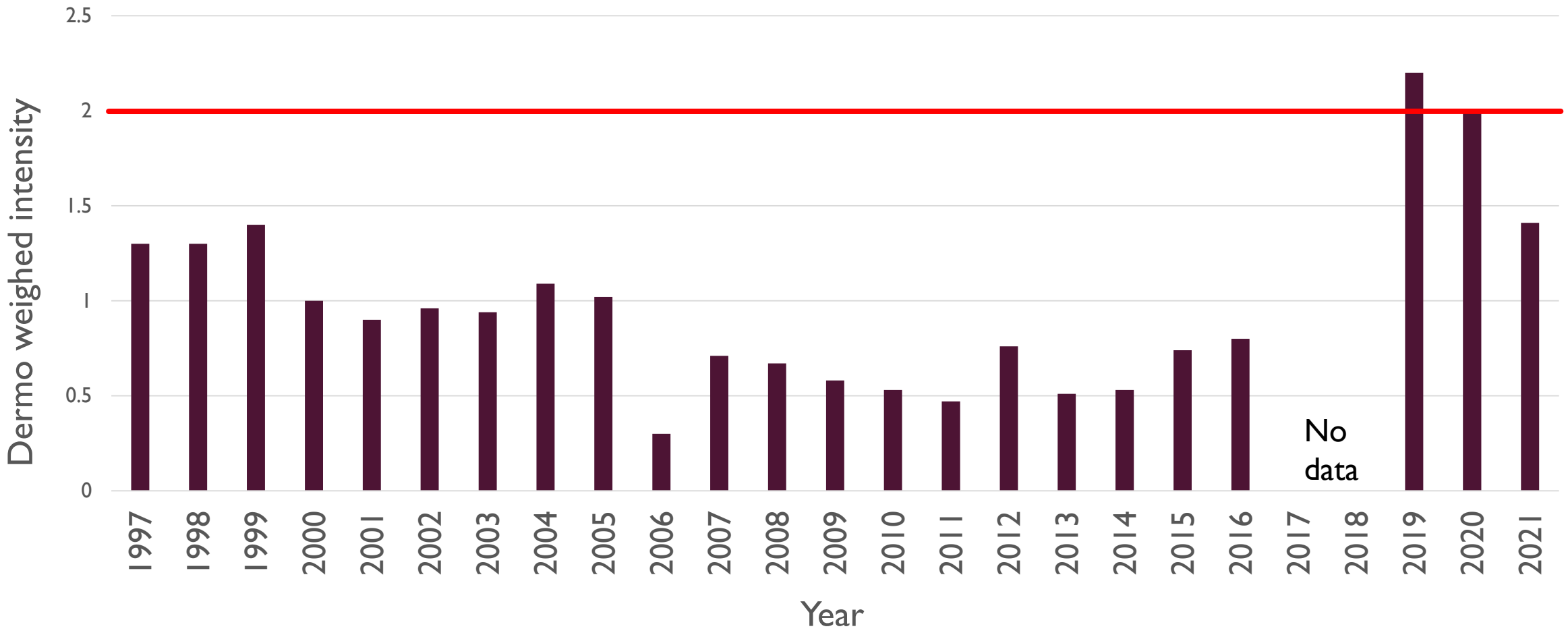
ANNUAL AVERAGE DERMO PREVALENCE IN CT (1997-2021)



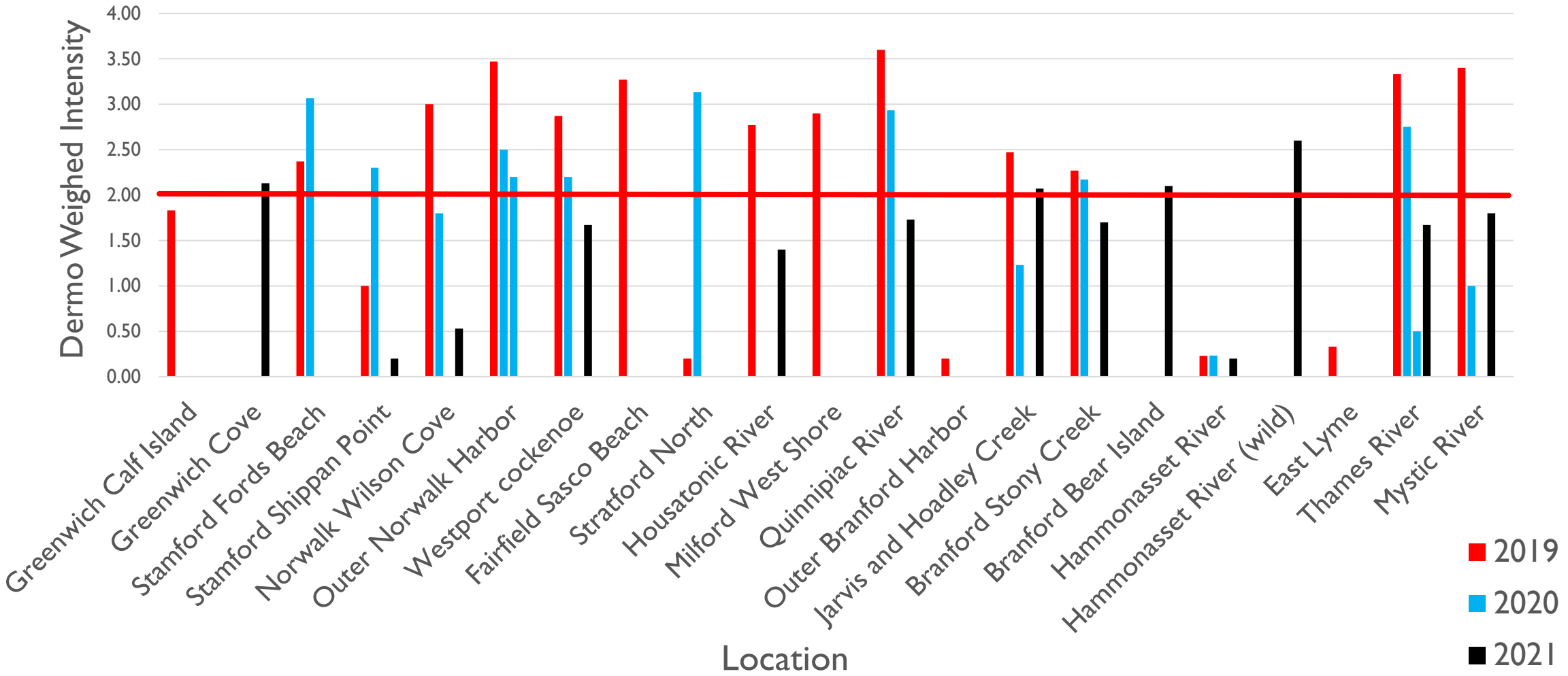
DERMO PREVALENCE BY LOCATION (2019-2021)



ANNUAL AVERAGE DERMO WEIGHED INTENSITY (1997-2021)



DERMO WEIGHED INTENSITY BY LOCATION (2019-2021)



EXPECTED MORTALITY - 2019-2021 SAMPLES

RESULT INTERPRETATION (MORTALITY) PROVIDED BY CONSULTING PATHOLOGIST

Type of expected mortality	2019	2020	2021	Total
Expected Dermo mortality	11 (61.11%)	8 (57.14%)	3 (20%)	22 (47.82%)
	Calf Island, Greenwich; Fords Beach, Stamford; Outer Norwalk Harbor; Wilson Cove, Norwalk; Westport Cockenoe; Sasco Beach, Fairfield; Housatonic River; West Shore, Milford; Quinnipiac River; Jarvis Creek, Branford; Mystic River, Stonington	Fords Beach, Stamford; Outer Norwalk Harbor; Wilson Cove, Norwalk (2 samples); Westport Cockenoe; Stratford North; Quinnipiac River; Stony Creek, Branford	Mystic River, Stonington; Hammonasset River (wild); Greenwich Cove	
Expected MSX mortality	1 (5.56%)	1 (7.14%)	2 (13.33%)	4 (8.7%)
	Hammonasset River	Hammonasset River	Hammonasset River (2 samples)	
Expected Dermo and MSX mortality	1 (5.56%)	1 (7.14%)	2 (13.33%)	4 (8.7%)
	Thames River	Stamford Shippan Point	Bear Island, Branford; Wilson Cove, Norwalk	
Expected Dermo and SSO mortality	1 (5.56%)	0	0	1 (2.17%)
	Stony Creek, Branford			
Total	2019: 14 (77.78%)	2020: 10 (71.43%)	2021: 7 (46.67%)	31 (67.39%)

2019-2021

Commissions who are experiencing noticeable or significant mortality in their growing area(s) should report this finding to the Bureau and seek additional guidance from the consulting pathologist.

Dermo Status

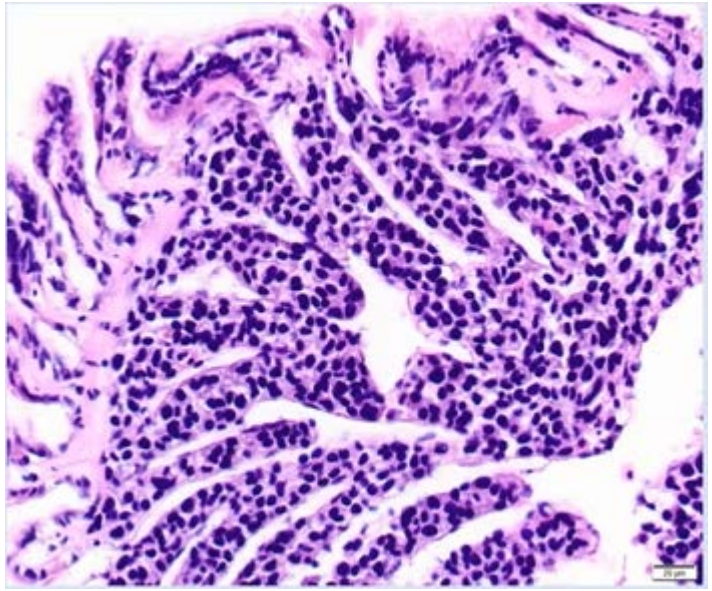
- 97.83% of shellfish samples were infected with Dermo
- 54% of samples exceeded the Dermo weighed intensity of 2
- Dermo prevalence and weighed intensity were significantly higher for wild than hatchery samples
- In Connecticut this level of infection has not historically caused significant mortalities in our commercial oyster stocks.
- Individual reports have not indicated a high level of mortality despite this moderate to high prevalence of disease.

MSX Status

- 84.78% of shellfish samples were infected with MSX
- 0% of samples exceeded the weighed intensity of 2
- Hatchery populations had higher MSX prevalence and weighed intensity, but not significantly higher than wild oysters
- 26% of samples exceeded the MSX intensity of 1.5
- The current prevalence of MSX may be causing low levels of background mortalities in CT populations (e.g. the Hammonasset River)

HEMOCYTIC NEOPLASIA

- Hemocytic neoplasia (HN) was detected in 1 hard clam, from a New Jersey hatchery source.
- HN has been associated with high mortality rates in Wellfleet, MA, and is an infectious disease that is believed to mainly infect (and sometimes kill) hatchery hard clams.
- Health reports are required prior to importation of shellfish into CT. Ensure health reports have assessed hard clams for HN prior to importation.
- Hard clams that are sitting on the surface should be collected and tested for HN.



Roxanna Smolowitz

IMPORTATION POLICY

https://portal.ct.gov/DOAG/Aquaculture1/Aquaculture/Shellfish-Importation

Northern quahog: The Bureau of Aquaculture will not allow the importation of clams from south of NJ.

Eastern oyster: The Bureau of Aquaculture does not allow the importation of oysters with the exception of hatchery stock from RI and MA, or stock from NY and Long Island Sound.

Bay scallops: The Bureau of Aquaculture does not allow the importation of scallops from outside of Long Island Sound.

Prior to all importations:

Prior to any shellfish importation, the source must be approved by the Bureau of Aquaculture.

The applicant must arrange with Bureau of Aquaculture for a sample of live animals to be tested.

The source of product is not guaranteed to be approved and should be a consideration in any project plans.

ALL INFORMATION PRESENTED IN THE 2021 DISEASE UPDATE REPORT

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

Bryan P. Hurlburt
Commissioner

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.

https://portal.ct.gov/-/media/DOAG/Aquaculture/Pathology/2021-Statewide-Shellfish-Disease-Update.pdf

2021 PFAS UPDATE

WHAT ARE PER- AND POLYFLUOROALKYL SUBSTANCES (PFAS)?

- PFAS are a group of 5,000+ man-made chemicals that are persistent in the environment.
- PFAS were widely used in manufacturing, non-stick products and food packaging, and fire fighting foam, to name a few sources.
- Perfluorooctanoic acid (PFOA) and perfluorooctane sulfonate (PFOS) are 2 of the most widely used and studied PFAS chemicals.
- Scientific studies have demonstrated PFAS have reproductive, developmental, carcinogenic, immune, and hormonal effects on humans.
- The EPA began establishing PFAS health advisories for drinking water in 2016.
- Additional information is available on www.epa.gov/pfas

PFAS HISTORY IN CONNECTICUT

- 2013-15 – EPA-mandated testing confirms that none of Connecticut's large public drinking water systems contain elevated PFAS levels.
- 2016 – DPH adopts the EPA drinking water action level (70 ppt).
- June 2019 – PFAS firefighting foam spill into the Farmington River gains press attention.
- November 2019 – PFAS Action Plan released, listing evaluating food sources, including shellfish, as PFAS exposure pathways as a key recommended action.
- 2020 – DEEP develops GIS map of PFAS sources, and establishes a PFAS takeback program.
- 2021 – Alternative fluorine-free firefighting foam identified.
- Learn more at: https://portal.ct.gov/DEEP/Remediation--Site-Clean-Up/Contaminants-of-Emerging-Concern/Per--and-Polyfluoroalkyl-Substances?msclkid=8f24df2faf8811ecad36d4e0f7989e5f

PFAS ARE DETECTABLE IN FISH AND SHELLFISH

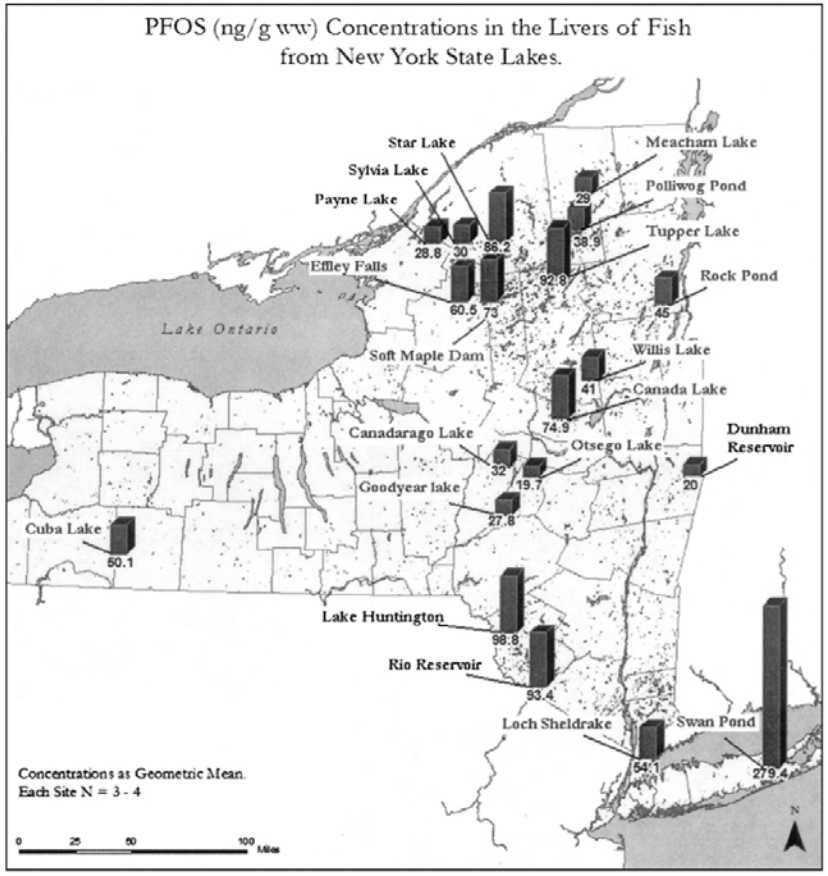


Fig. 2. Map showing liver PFOS concentration (ww; wet weight) in bass (smallmouth and largemouth) from New York State inland lakes

Kannan et al. 2002

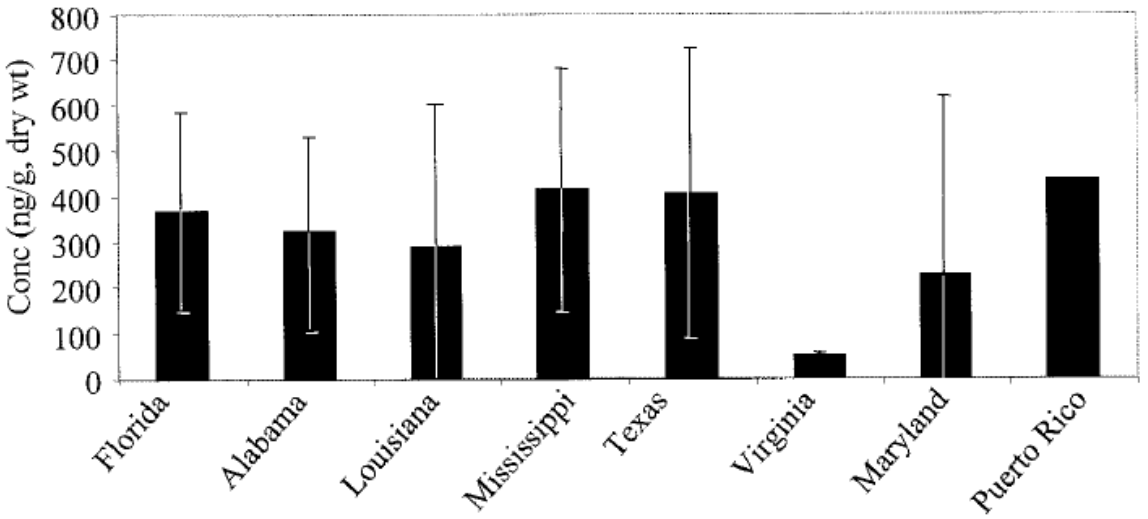


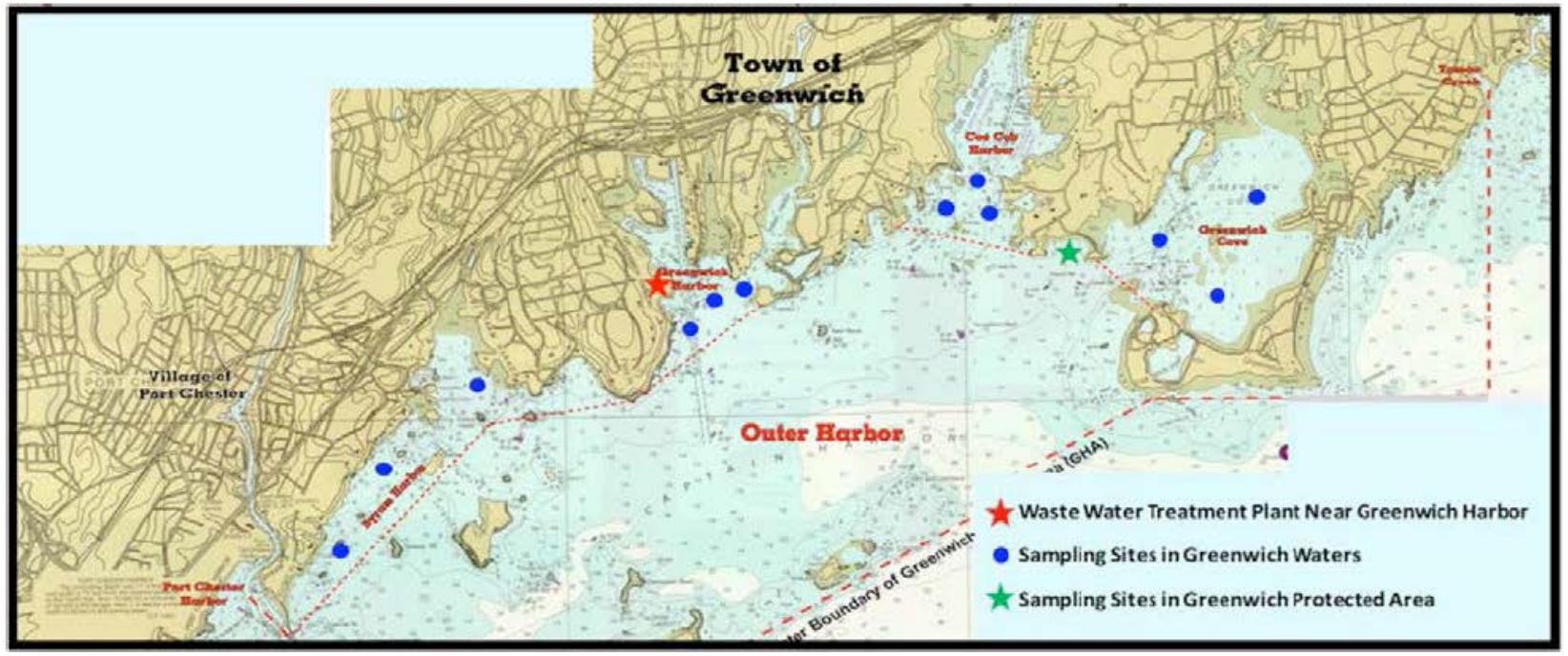
Fig. 3. Concentrations (mean ± SD) of PFOS (ng/g DW) in oyster, *Crassostrea virginica*, from various coastal locations in the Gulf of Mexico and Chesapeake Bay. Concentrations are presented state-wise

Sinclair et al. 2006. This data is not relevant to fish consumption since they analyzed fish liver, but demonstrates PFAS contamination and uptake in NY fish.

GREENWICH 2020
PFAS TESTING IN WATER, SHELLFISH, AND SEDIMENT SAMPLES

All samples were non-detectable for 14 PFAS chemicals!

Study performed by UConn CESE (Willig, Perkins, and Provatas)



SAMPLING LOCATIONS IN GREENWICH WATERS OF LONG ISLAND SOUND							
	Byram Harbor	Cos Cob Harbor	Greenwich Harbor	Greenwich Cove	Protected Area	Trip Blank	Total
Water samples per site	3	3	2+1 dup	3	1	1	13+1 dup
Sediment samples per site	3	2	2+1 dup	3	0	0	10+1 dup
Oyster samples per site	1	3	3+1 dup	4*	1	0	11+1 dup
Total number of samples	7	8	7+3 dups	10	2	1	38
Note: * a separate oyster and hard shelled clam sample was collected and anlayzed from the Greenwich Cove 2 site							

FUTURE PFAS WORK

- The Greenwich 2020 study authors are conducting a study in Groton this year.
- We are currently waiting to see if we receive funding from the legislature for shellfish PFAS testing along the coastline.
- FDA is currently working on establishing PFAS regulations for shellfish.

2021 VIBRIO UPDATE

WHAT ARE *VIBRIO*?

- *Vibrio* are naturally-occurring brackish-salt water bacteria that can be pathogenic.
- Exposure to *Vibrio* can occur through consumption of raw seafood or direct wound contact with seawater.
- Globally, *Vibrio parahaemolyticus* is the leading cause of seafood-associated gastroenteritis.
- *Vibrio vulnificus* can cause life-threatening illness, including sepsis, through seafood consumption or wound infection (salt water contact). Commonly sensationalized by the media as "flesh-eating bacteria."
- *Vibrio cholerae* causes cholera, which is rare in the US and other industrialized nations. Cholera can be life-threatening but is easily prevented and treated.

PREDISPOSED RISKS

- Keep in mind that some people are at greater risk for foodborne illness, and should not eat raw or partially cooked fish or shellfish.
- Susceptible groups include:
  - Pregnant women
  - Young children
  - Older adults
  - Persons whose immune systems are compromised
  - Persons who have decreased stomach acidity
  - Persons who have chronic liver disease or reduced liver function
- If you are unsure, ASK YOUR HEALTHCARE PROVIDER

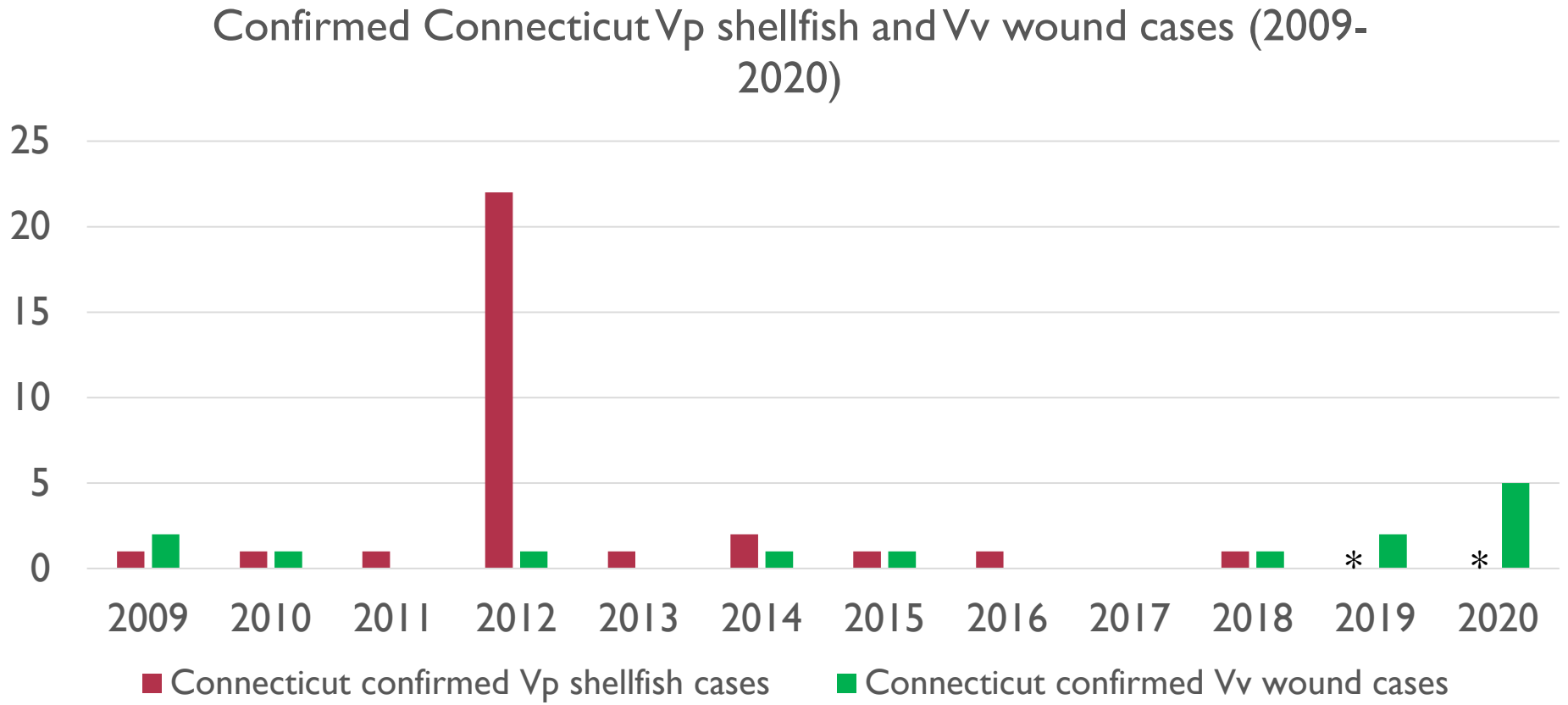
HOW TO AVOID VIBRIO

- Do not expose wounds to seawater during the summer-fall.
  - If you cut yourself in the field, immediately wash the wound and apply antibiotic ointment and a waterproof Band-Aid.
- Harvest shellfish as soon as the tide goes out. Properly ice and shade shellfish immediately after collection.
- Properly refrigerate shellfish. Immediately discard dead shellfish. Consume shellfish within recommended timeframes. Do not consume shellfish that do not open during cooking.
- For enhanced protection, thoroughly cook shellfish during the summer-fall.

VIBRIO OUTBREAK IN CONNECTICUT & MANAGEMENT RESPONSE

- New *Vibrio parahaemolyticus* strain moved into New England area in 2012, causing multi-state outbreaks.
- Cases predominantly impacted Darien-Westport.
- Implemented a statewide *Vibrio parahaemolyticus* Control Plan and rapid cooling requirements to internally cool shellfish to below 50°F within 3-5 hours of harvest.

CONFIRMED CONNECTICUT *VIBRIO PARAHAEMOLYTICUS* SHELLFISH ILLNESSES (DABA) AND *VIBRIO VULNIFICUS* WOUND INFECTIONS (DPH)

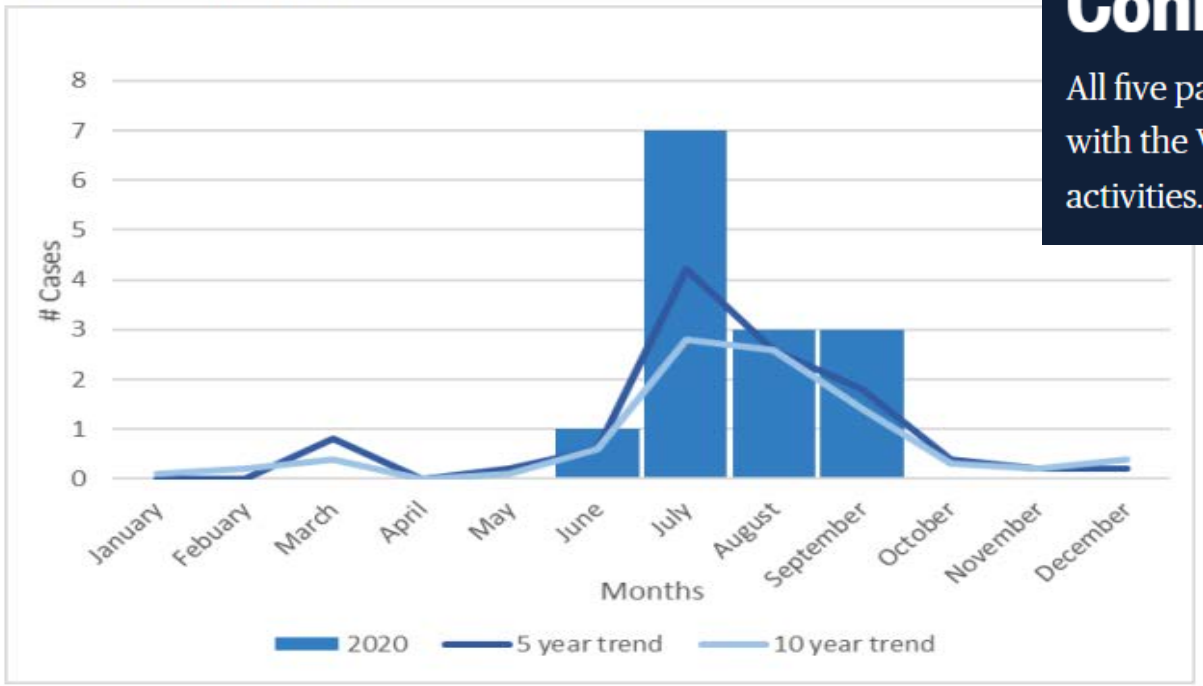


*Shellfish Vp cases for 2019 and 2020 not yet available, but were similar to 2013-2018 range, with low to very few annual confirmed cases

Vv wound cases provided by Connecticut Department of Public Health

VIBRIO VULNIFICUS MAKES HEADLINES IN SUMMER 2020

Figure 1. Vibriosis wound infection cases by month - Connecticut, 2020



https://portal.ct.gov/DPH/Epidemiology-and-Emerging-Infections/CTEPI/Volumes/41/No4/a1

Potentially deadly bacteria sickens 5 along Connecticut shoreline, prompting warning

All five patients had pre-existing wounds or sustained new wounds when they were infected with the Vibrio vulnificus bacteria while swimming, crabbing or engaging in other water activities.

Health officials said there has been an unusually high number of infections caused by bacteria in the salt or brackish water (a mix of salt and fresh water) along Long Island Sound.

WEBSITE RESOURCES

Welcome to the Bureau of Aquaculture

David H. Carey, Bureau Director

Staff & Contact Us

Follow us on Instagram: @aquaculture_ct | Read about CT Aquaculture in the News

General information about the Bureau

Shellfish Sanitation Program
Laboratory Services
Shellfish Area Classifications and Maps
Harmful Algal Bloom Monitoring

General Information about Connecticut Shellfish Aquaculture

Environmental Benefits of Shellfish & Shellfish Aquaculture
Oyster & Clam Disease Fact Sheets
Shellfish Handling and Guidance
Importation Policy
Related Links | Definitions and FAQs

Recreational Shellfishing

Recreational Shellfishing and Shellfish Handling Guidance
Recreational Shellfish Growing Area Contacts, Hotlines, and Maps
Shellfish Commission Guidance Documents

2020 Guidance for Recreational Shellfish Harvesting in Connecticut

STATE OF CONNECTICUT

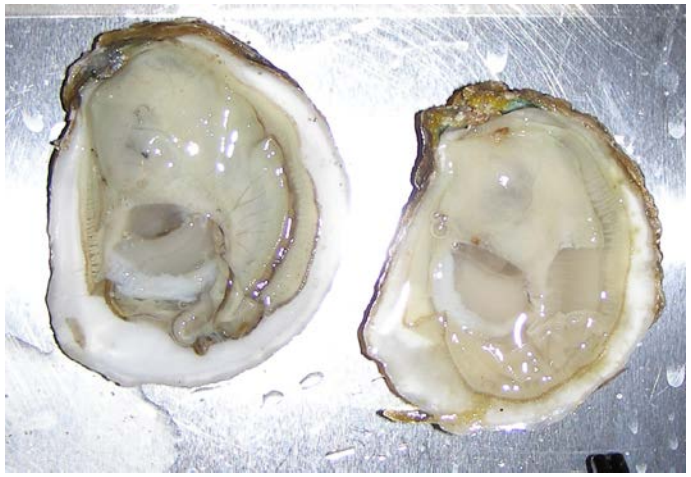
DEPARTMENT OF AGRICULTURE
BUREAU OF AQUACULTURE & LABORATORY

CONNECTICUT GROWN
THE LOCAL FLAVOR.

Recreational Shellfish Harvesting and Vibrio:
***Vibrio parahaemolyticus* Background and Summer Harvest Precautions**

https://portal.ct.gov/DOAG/Aquaculture1/Aquaculture/Aquaculture-Home-Page

QUESTIONS?



THANK YOU

Roger Williams University

USDA

CONNECTICUT GROWN

A Way of Life