CT Bureau of Aquaculture

Vibrio Control Plans 2013

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Department of Agriculture/Bureau of Aquaculture

What we will be covering

CDC Foodborne Illness Rates

2013 Connecticut Vibrio Risk Assessment

Vibrio Illness Summary CT 2009-2012

2012 *Vibrio* Sample Results

2013 Vibrio Parahaemolyticus Control Plan

Foodborne Illness Rates 1996-2012

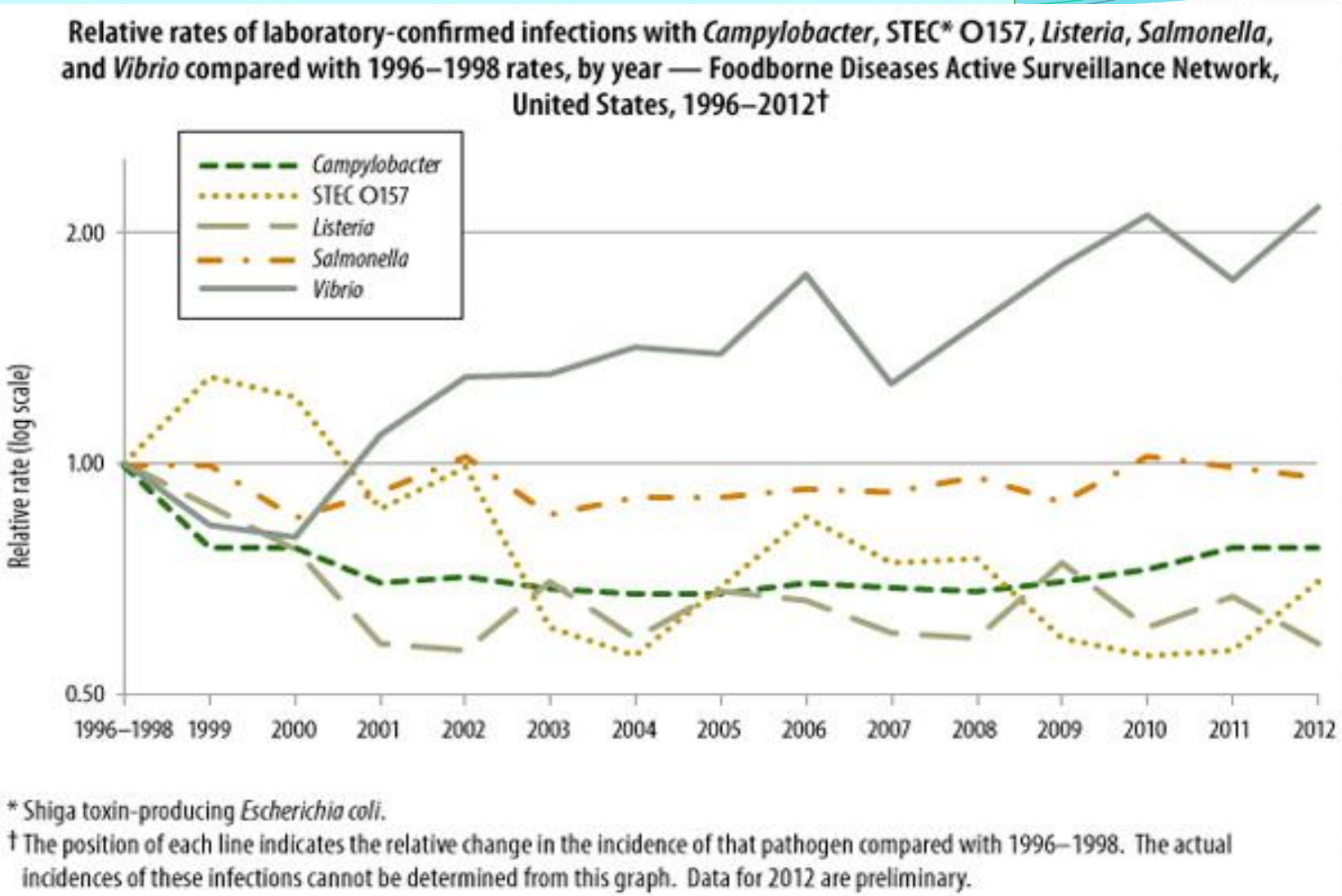


Figure 1. FIGURE 2. Relative rates of laboratory-confirmed infections with *Campylobacter*, *STEC* O157, Listeria, Salmonella, and Vibrio compared with* 1996–1998 rates, by year — Foodborne Diseases Active Surveillance Network, United States, 1996–2012† http://www.cdc.gov/features/dsfoodnet2012/dsfoodnet2012_c600px.jpg

Increase in Confirmed *Vibrio* Bacterial Infections 2006-2008 vs. 2012

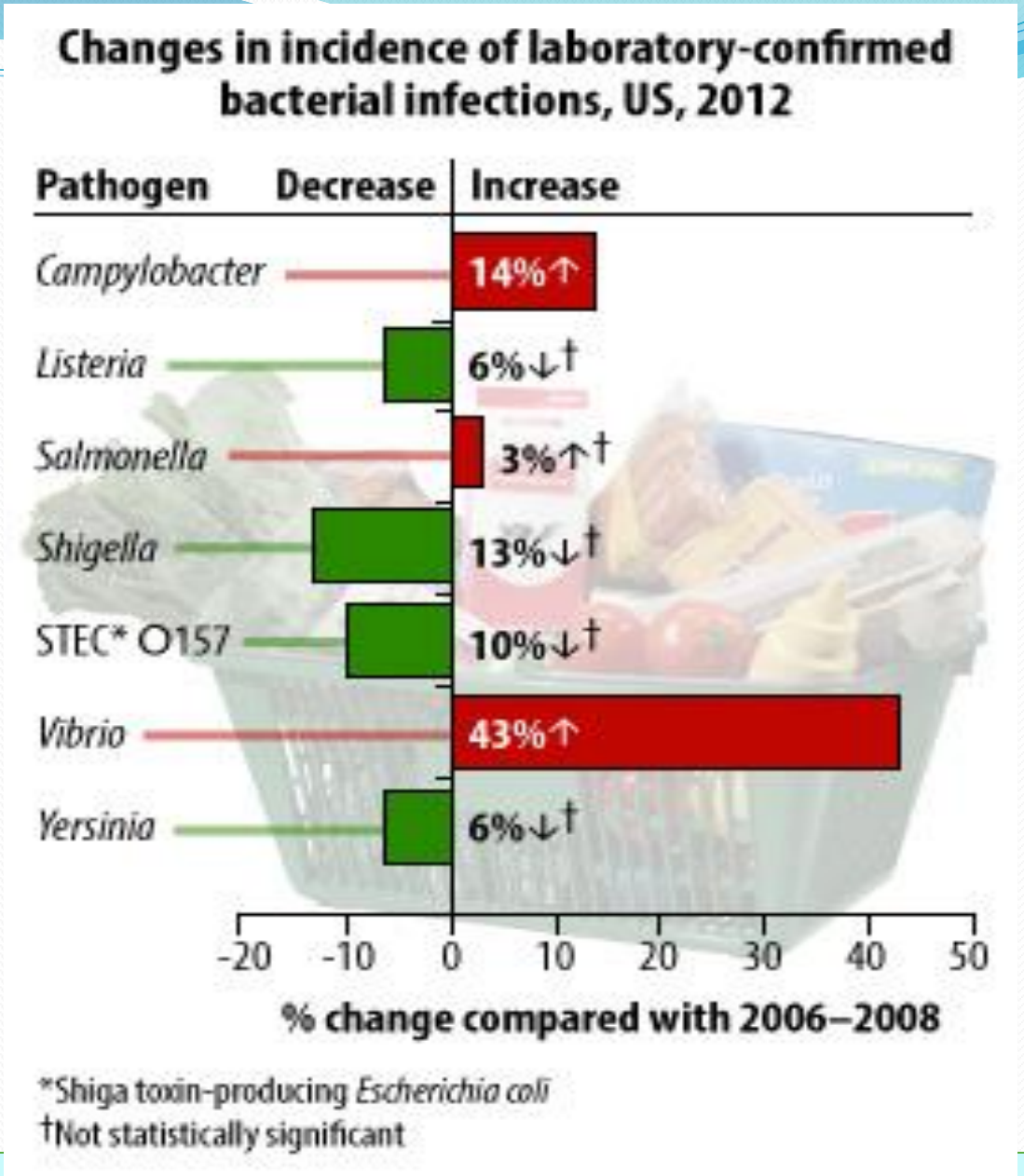


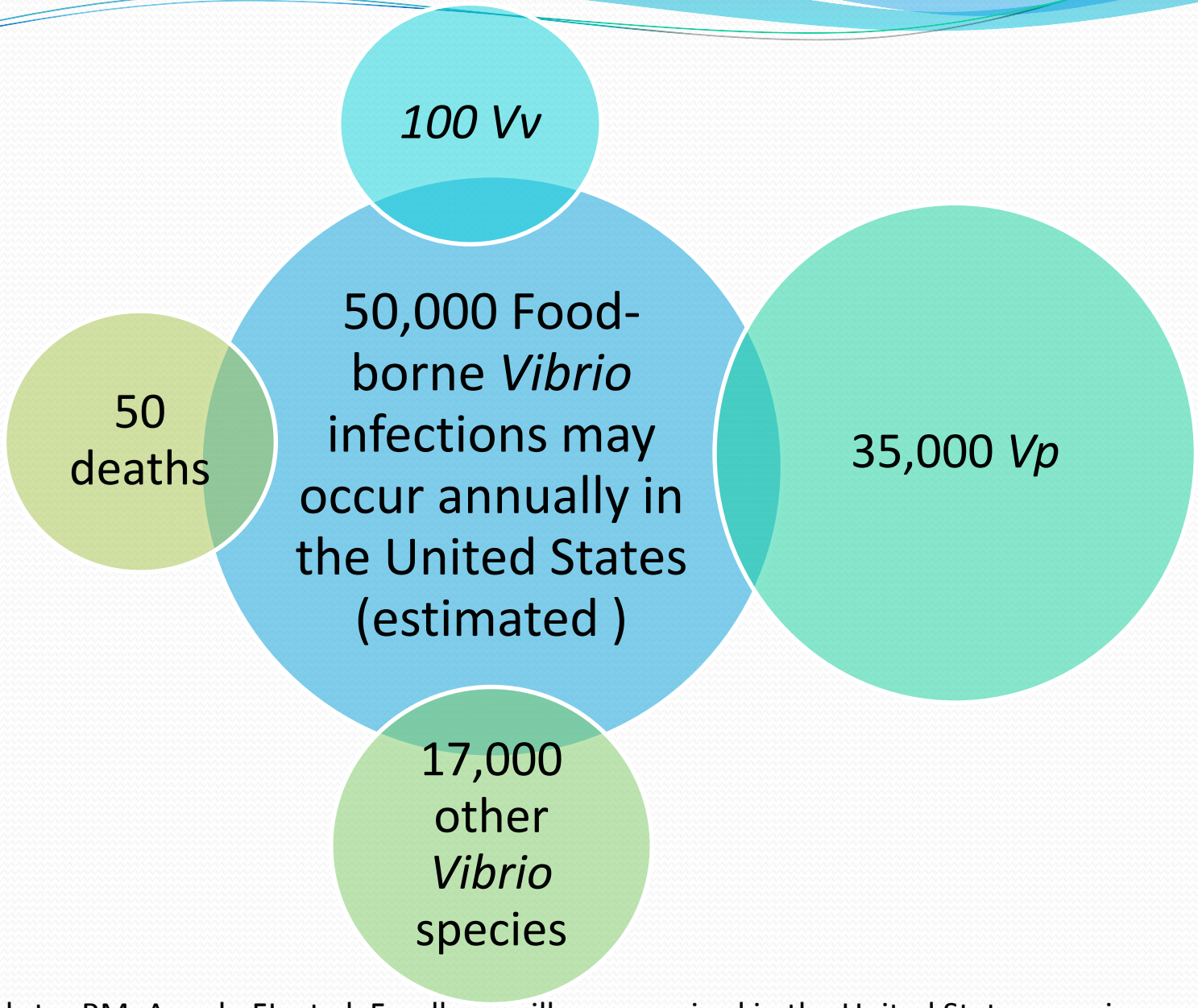
Figure 2. Changes in incidence of laboratory-confirmed bacterial infections, United States, 2012 compared with 2006-2008
http://www.cdc.gov/foodborneburden/trends-in-foodborne-illness.html

Number of Vibrio cases—

Foodborne Diseases Active Surveillance Network, United States, 2012

- *Cases = 193*
- *Hospitalizations = 55*
- *Deaths = 6*

Incidence and Trends of Infection with Pathogens Transmitted Commonly Through Food — Foodborne Diseases Active Surveillance Network, 10 U.S. Sites,1996–2012*Weekly* **April 19, 2013 / 62(15);283-287.**



Scallan E, Hoekstra RM, Angulo FJ, et al. Foodborne illness acquired in the United States – major pathogens. Emerg Infect Dis. 2011 Jan;17(1):7-15.

2013 Connecticut Vibrio Risk Assessment

A. *Vibrio parahaemolyticus* Risk Evaluation.

Every State from which oysters are harvested shall conduct a *Vibrio parahaemolyticus* risk evaluation annually. The evaluation shall consider each of the following factors, including seasonal variations in the factors, in determining whether the risk of *Vibrio parahaemolyticus* infection from the consumption of oysters harvested from an area (hydrological, geographical, or growing) is reasonably likely to occur:

(For the purposes of this section, "reasonably likely to occur" shall mean that the risk constitutes an annual occurrence)

2013 Connecticut Vibrio Risk Assessment

(1) The number of *Vibrio parahaemolyticus* cases epidemiologically linked to the consumption of oysters commercially harvested from the State; and

(2) Levels of total and tdh+ *Vibrio parahaemolyticus* in the area, to the extent that such data exists; and

(3) The water temperatures in the area; and

(4) The air temperatures in the area; and

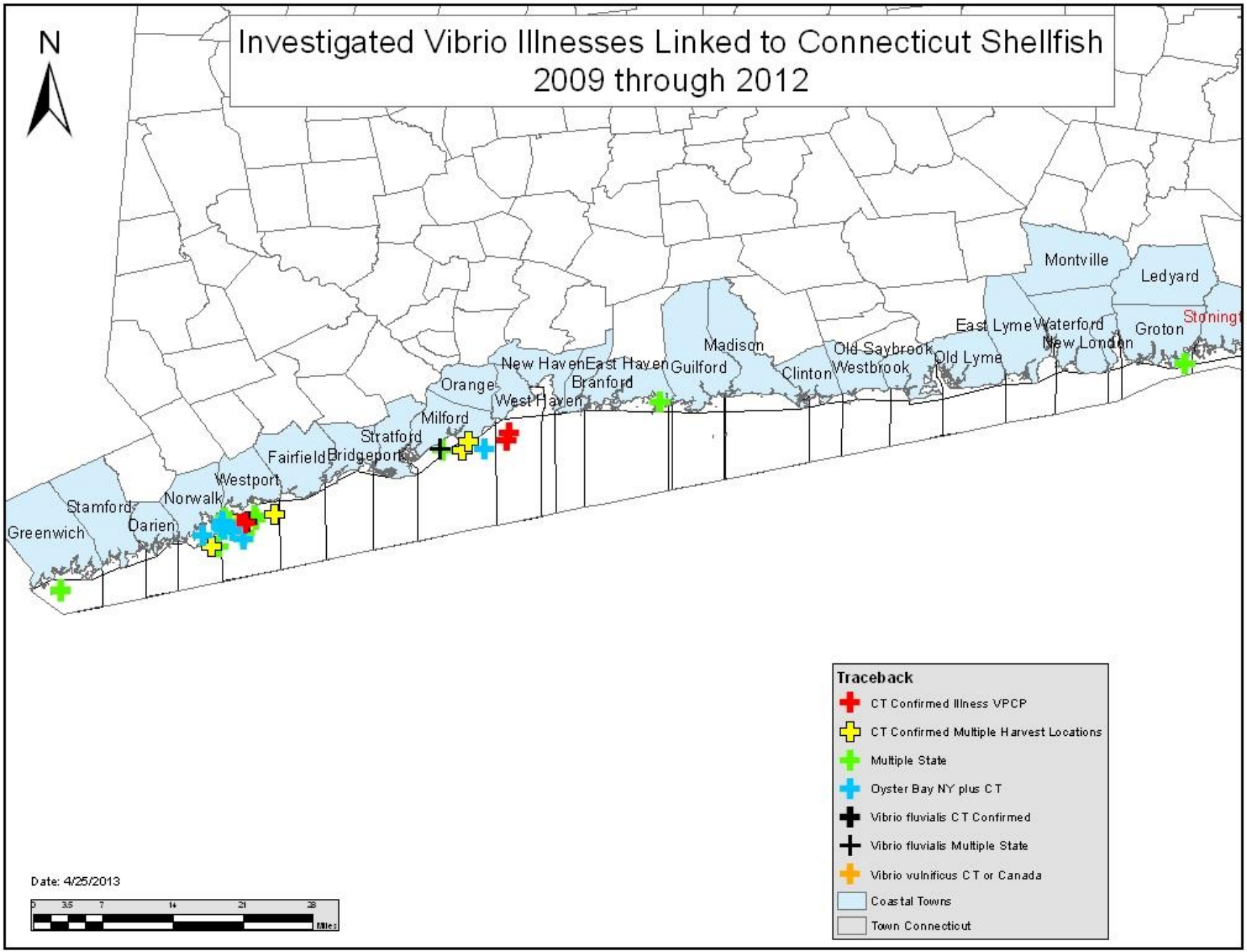
(5) Salinity in the area; and

(6) Harvesting techniques in the area; and

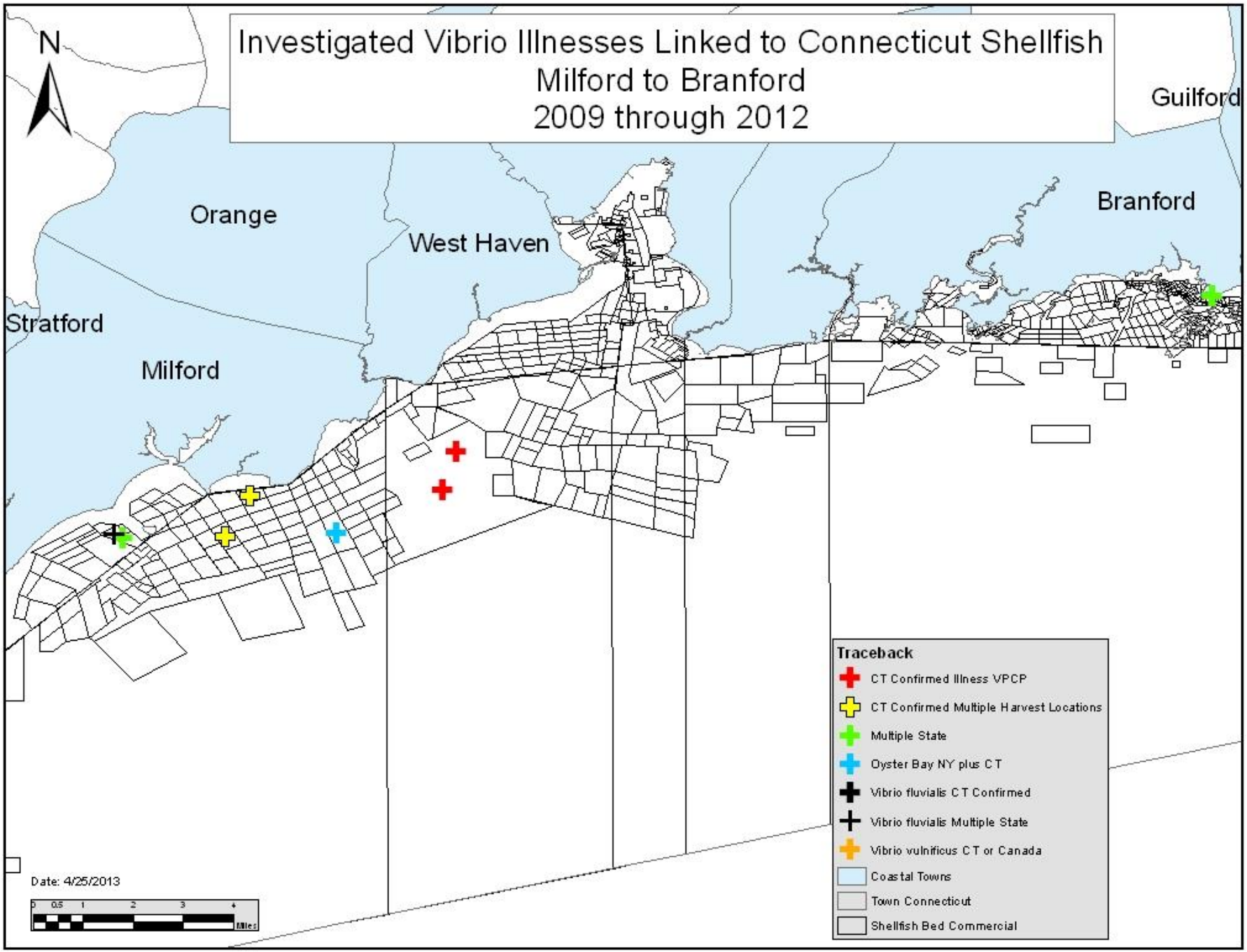
(7) The quantity of harvest from the area and its uses i.e. shucking, halfshell, PHP.

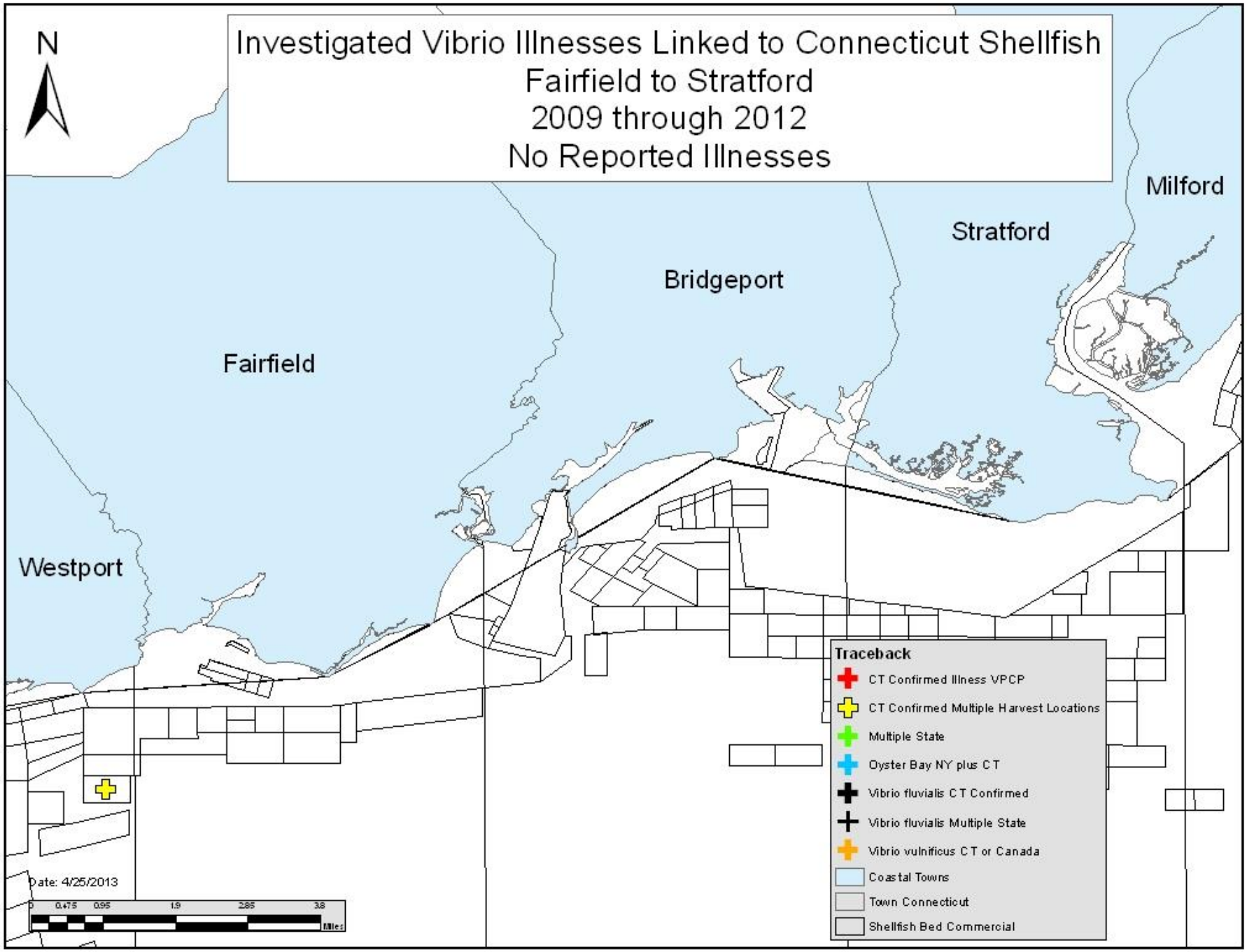
2013 Connecticut Vibrio Risk Assessment

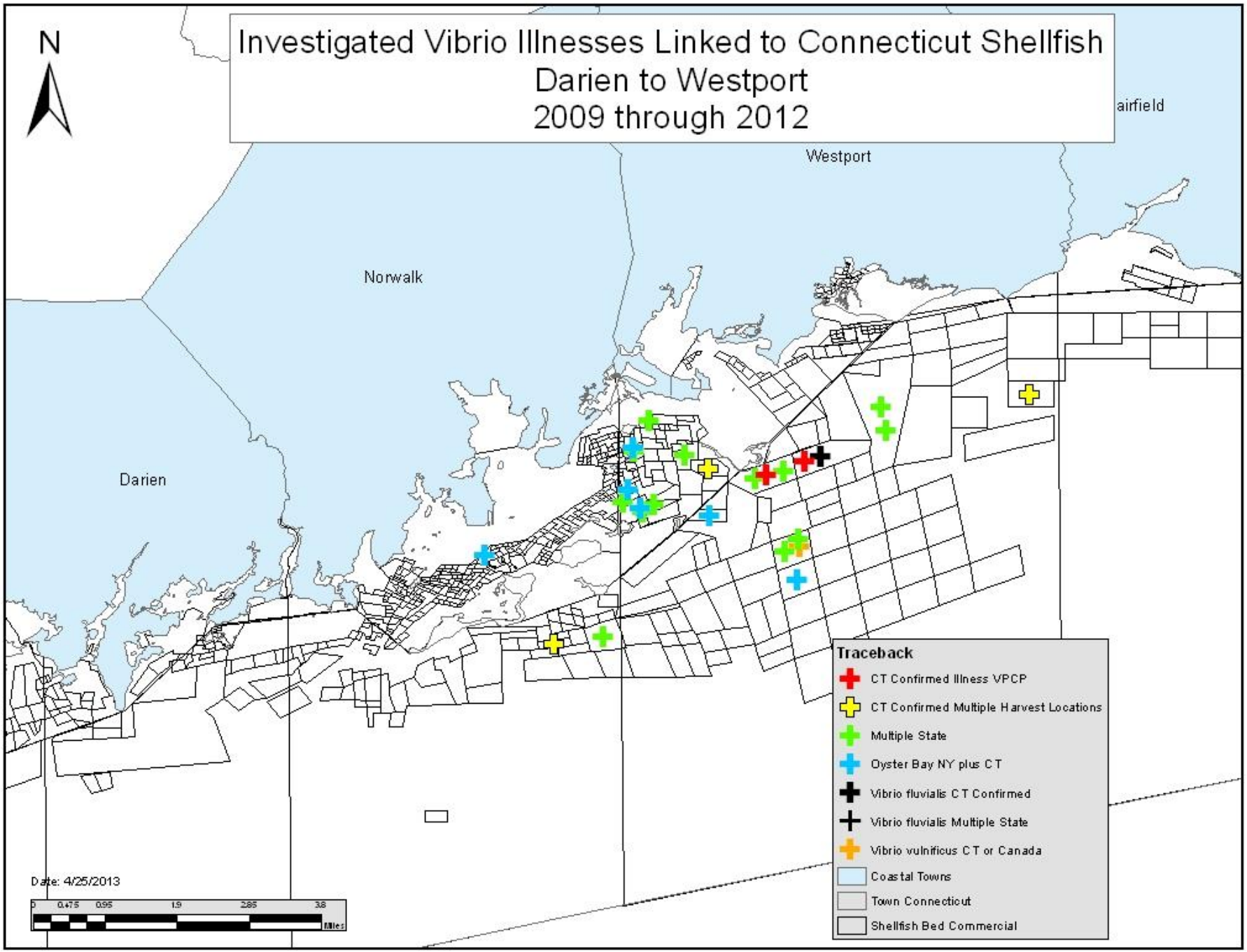
1. The number of Vibrio parahaemolyticus cases epidemiologically linked to the consumption of oysters commercially harvested from the State

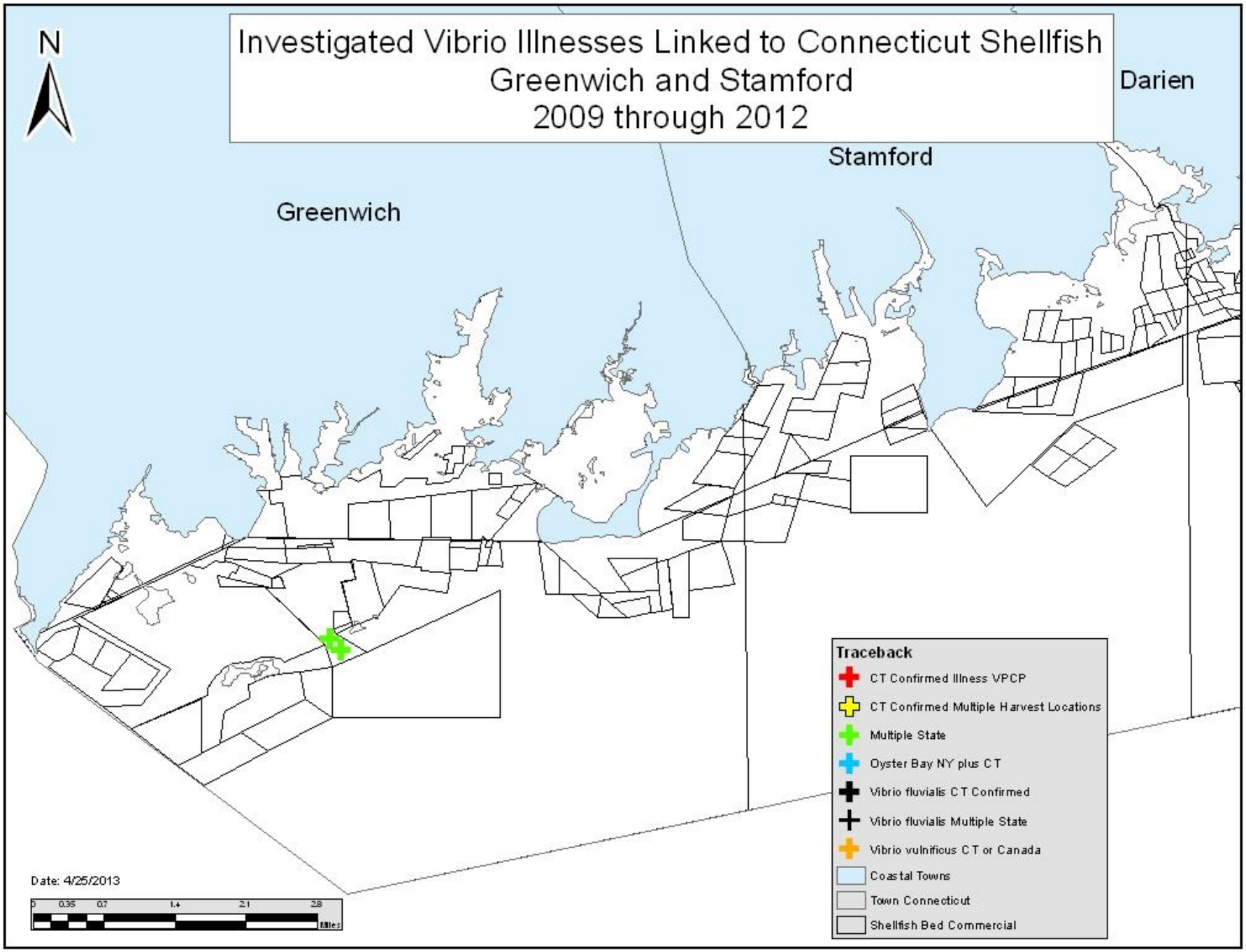

N
Investigated Vibrio Illnesses Linked to Connecticut Shellfish
2009 through 2012
Montville
Ledyard
Stoningt
East Lyme
Waterford
New London
Groton
Madison
Old Saybrook
Westbrook
Old Lyme
Clinton
New Haven
East Haven
Branford
Guilford
Orange
West Haven
Milford
Stratford
Fairfield
Bridgeport
Westport
Norwalk
Stamford
Darien
Greenwich
Traceback
CT Confirmed Illness VPCP
CT Confirmed Multiple Harvest Locations
Multiple State
Oyster Bay NY plus CT
Vibrio fluvialis CT Confirmed
Vibrio fluvialis Multiple State
Vibrio vulnificus CT or Canada
Coastal Towns
Town Connecticut
Date: 4/25/2013
0 3.5 7 14 21 28
Miles

Year	Number of Cases	Source States
2009	7 (1 confirmed CT)	1 MA 1 CT or RI 1 CT or NY 2 Unknown 1 Vv likely CT, 1 definitely CT
2010	5 (1 confirmed CT)	1 ME, MD or VA 1 CT, ME, or WA 1 NY, WA, ME, MA 1 likely CT, 1 Definitely CT
2011	6 (1 confirmed CT)	1 CT, PE, NY 1 Unknown 3 CT (1 Vp/Vf, 1 Vc, 1Vf) 1 CT or WA
2012	8 (1 confirmed CT)	1 RI 1 PE, MA, NY or CT 1 OB NY or CT 1MA 1 OB NY 1 CT or OB NY 1 NY, MA, NB 1CT


Investigated Vibrio Illnesses Linked to Connecticut Shellfish
Milford to Branford
2009 through 2012
N
Guilford
Branford
Orange
West Haven
Stratford
Milford
Traceback
CT Confirmed Illness VPCP
CT Confirmed Multiple Harvest Locations
Multiple State
Oyster Bay NY plus CT
Vibrio fluvialis CT Confirmed
Vibrio fluvialis Multiple State
Vibrio vulnificus CT or Canada
Coastal Towns
Town Connecticut
Shellfish Bed Commercial
Date: 4/25/2013
0 0.5 1 2 3 4
Miles


N
Investigated Vibrio Illnesses Linked to Connecticut Shellfish
Fairfield to Stratford
2009 through 2012
No Reported Illnesses
Milford
Stratford
Bridgeport
Fairfield
Westport
Traceback
CT Confirmed Illness VPCP
CT Confirmed Multiple Harvest Locations
Multiple State
Oyster Bay NY plus CT
Vibrio fluvialis CT Confirmed
Vibrio fluvialis Multiple State
Vibrio vulnificus CT or Canada
Coastal Towns
Town Connecticut
Shellfish Bed Commercial
Date: 4/25/2013
0 0.475 0.95 1.9 2.85 3.8
Miles

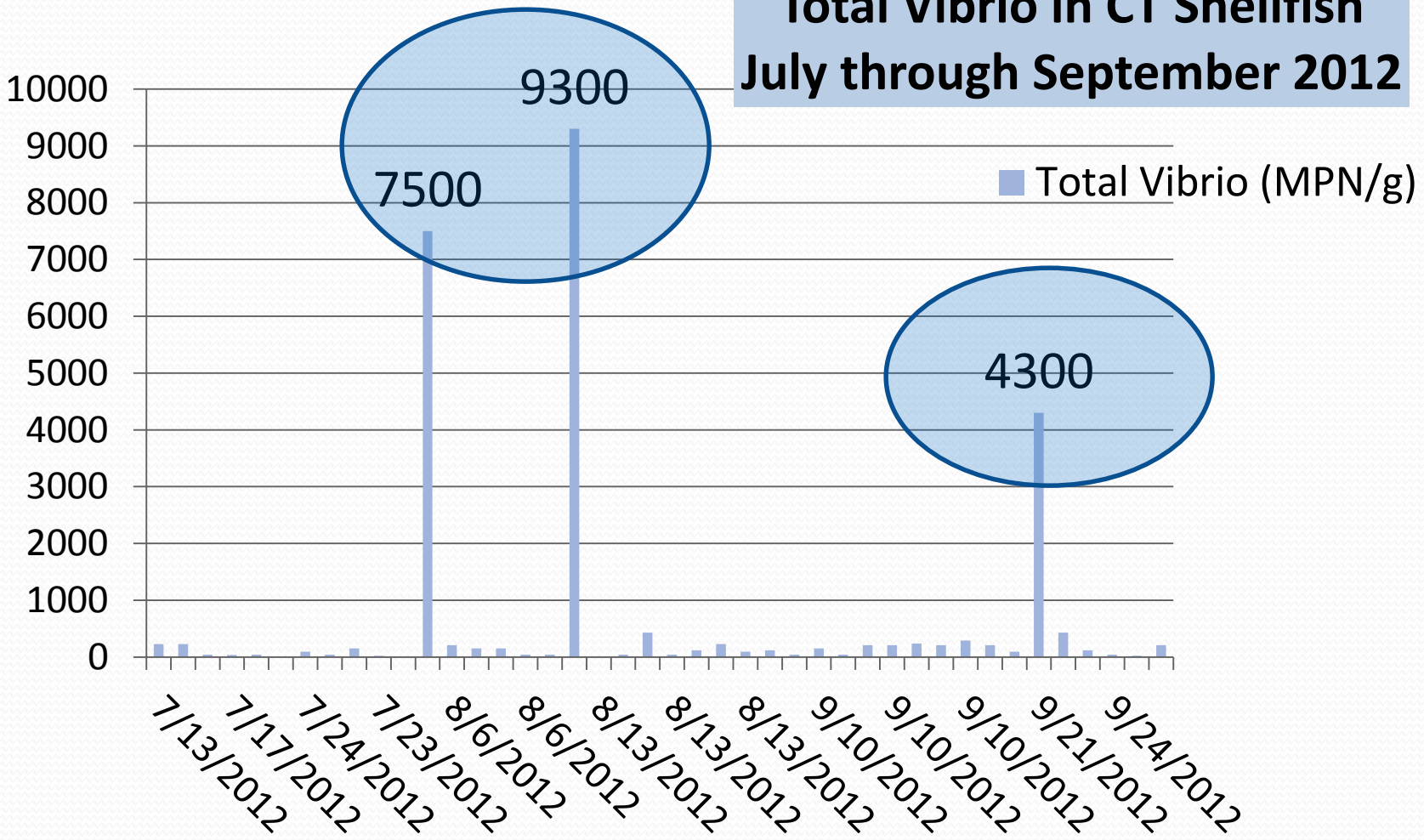

N
Investigated Vibrio Illnesses Linked to Connecticut Shellfish
Darien to Westport
2009 through 2012
airfield
Westport
Norwalk
Darien
Traceback
CT Confirmed Illness VPCP
CT Confirmed Multiple Harvest Locations
Multiple State
Oyster Bay NY plus CT
Vibrio fluvialis CT Confirmed
Vibrio fluvialis Multiple State
Vibrio vulnificus CT or Canada
Coastal Towns
Town Connecticut
Shellfish Bed Commercial
Date: 4/25/2013
0 0.475 0.95 1.9 2.85 3.8
Miles


N
Investigated Vibrio Illnesses Linked to Connecticut Shellfish
Greenwich and Stamford
2009 through 2012
Darien
Stamford
Greenwich
Traceback
CT Confirmed Illness VPCP
CT Confirmed Multiple Harvest Locations
Multiple State
Oyster Bay NY plus CT
Vibrio fluvialis CT Confirmed
Vibrio fluvialis Multiple State
Vibrio vulnificus CT or Canada
Coastal Towns
Town Connecticut
Shellfish Bed Commercial
Date: 4/25/2013
0 0.35 0.7 1.4 2.1 2.8
Miles

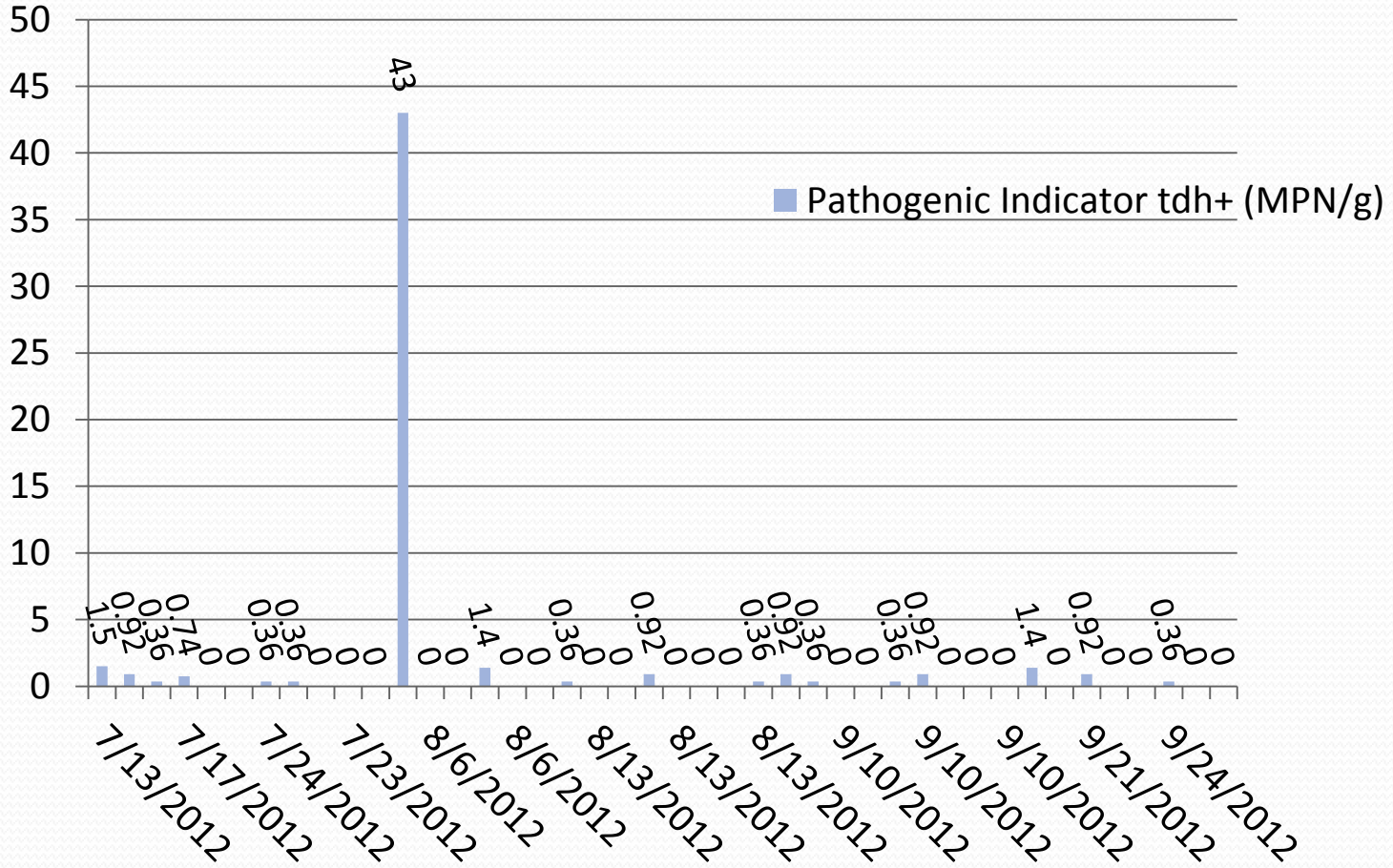
2013 Connecticut Vibrio Risk Assessment

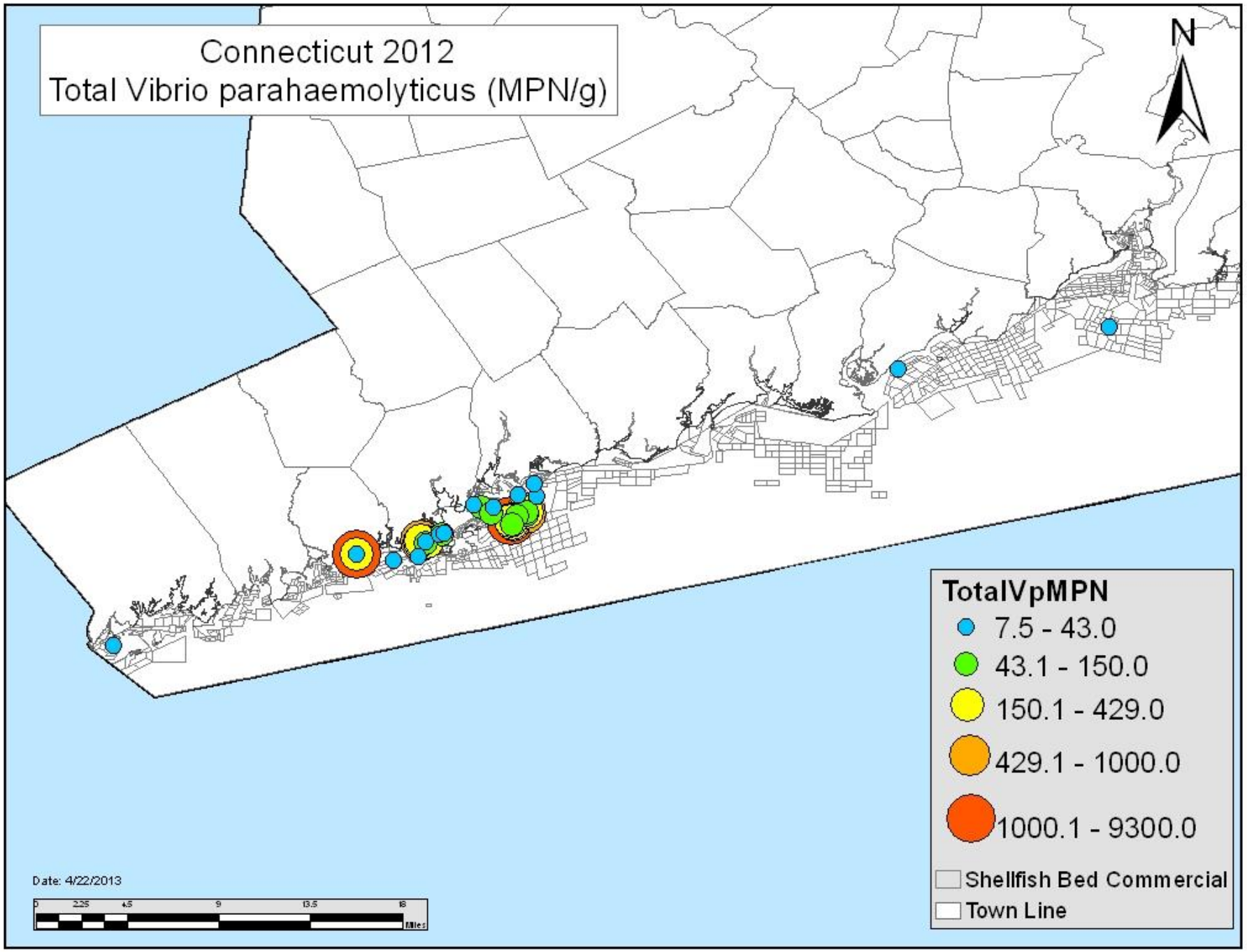
(2) Levels of total and tdh+ Vibrio parahaemolyticus in the area, to the extent that such data exists; and

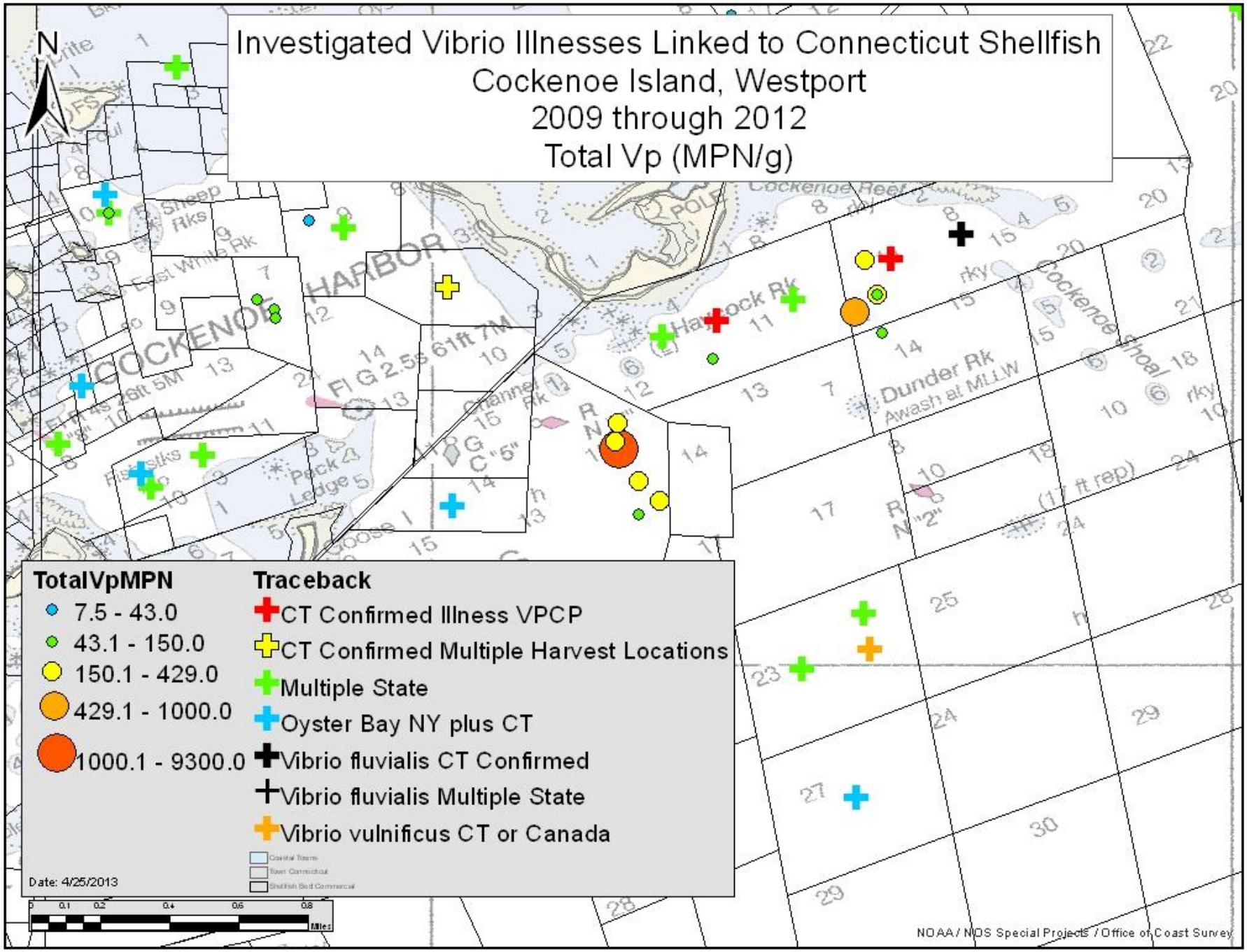
Total Vibrio in CT Shellfish July through September 2012

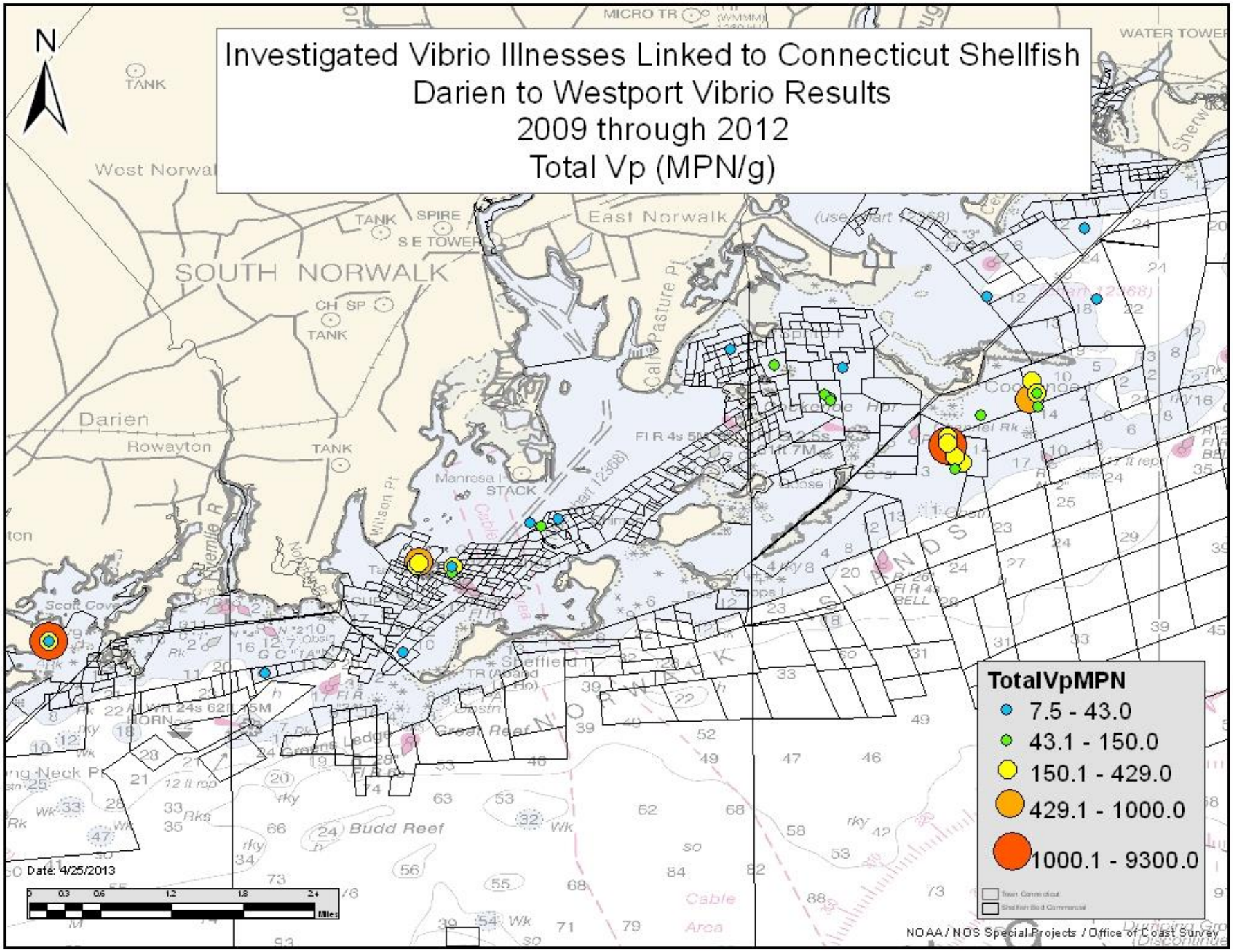


Pathogenic Indicator (tdh+) in CT Shellfish July through September 2012

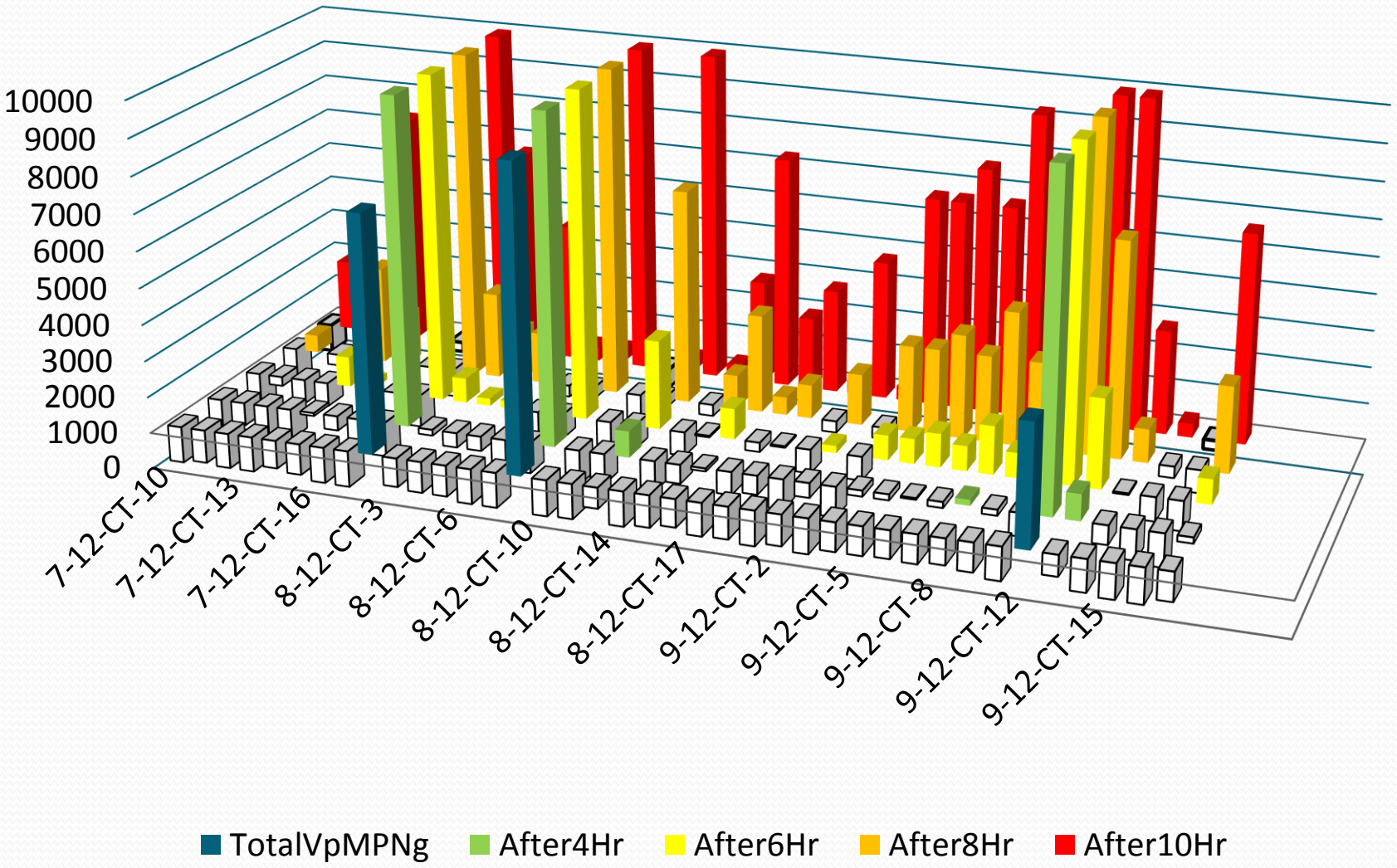



Connecticut 2012
Total Vibrio parahaemolyticus (MPN/g)
N
TotalVpMPN
7.5 - 43.0
43.1 - 150.0
150.1 - 429.0
429.1 - 1000.0
1000.1 - 9300.0
Shellfish Bed Commercial
Town Line
Date: 4/22/2013
0
2.25
4.5
9
13.5
18
Miles


Investigated Vibrio Illnesses Linked to Connecticut Shellfish
Cockenoe Island, Westport
2009 through 2012
Total Vp (MPN/g)
N
TotalVpMPN
7.5 - 43.0
43.1 - 150.0
150.1 - 429.0
429.1 - 1000.0
1000.1 - 9300.0
Traceback
CT Confirmed Illness VPCP
CT Confirmed Multiple Harvest Locations
Multiple State
Oyster Bay NY plus CT
Vibrio fluvialis CT Confirmed
Vibrio fluvialis Multiple State
Vibrio vulnificus CT or Canada
Date: 4/25/2013
Miles
NOAA / NOS Special Projects / Office of Coast Survey


Investigated Vibrio Illnesses Linked to Connecticut Shellfish
Darien to Westport Vibrio Results
2009 through 2012
Total Vp (MPN/g)
N
SOUTH NORWALK
East Norwalk
Darien
Rowayton
Budd Reef
Great Reef
Cable Area
TotalVpMPN
7.5 - 43.0
43.1 - 150.0
150.1 - 429.0
429.1 - 1000.0
1000.1 - 9300.0
Date: 4/25/2013
NOAA / NOS Special Projects / Office of Coast Survey

Estimated Total Vibrio MPN/g with Doubling at 76°F



Note: For better graphic presentation of data, maximum value of vertical axis was set at 10,000. Estimated vibrio levels ranged to 297,600.

Vp Bacteria Doubling Times

Temperature specific Vp Growth rates and Doubling times for calculating cumulative growth based on hourly temperature observations			
Oyster Temperature	Doubling Time	Oyster Temperature	Doubling Time
(degree F)	(hrs)	(degree F)	(hrs)
50	35.8		
55	13.8	80	1.64
60	7.24	85	1.28
65	4.45	90	1.03
70	3.01	95	0.85
75	2.17	100	0.71

From USFDA National Shellfish Sanitation Program 2011 Revision. Section IV. Chapter IV.

Estimated Vp Bacteria Levels Doubling Times at 76°F

FDAID	Total Vp MPNg	After 4Hr	After 6Hr	After 8Hr	After 10Hr
7-12-CT-10	7.5	30	60	120	240
7-12-CT-11	93.0	372	744	1488	2976
7-12-CT-12	43.0	172	344	688	1376
7-12-CT-13	43.0	172	344	688	1376
7-12-CT-14	230.0	920	1840	3680	7360
7-12-CT-15	150.0	600	1200	2400	4800
7-12-CT-16	23.0	92	184	368	736

Estimated Vp Bacteria Doubling Times at 76°F

FDAID	Total Vp MPNg	After 4Hr	After 6Hr	After 8Hr	After 10Hr
8-12-CT-1	15.0	60	120	240	480
8-12-CT-2	7500.0	30000	60000	120000	240000
8-12-CT-3	210.0	840	1680	3360	6720
8-12-CT-4	150.0	600	1200	2400	4800
8-12-CT-5	150.0	600	1200	2400	4800
8-12-CT-6	43.0	172	344	688	1376
8-12-CT-7	43.0	172	344	688	1376
8-12-CT-8	9300.0	37200	74400	148800	297600

Estimated Vp Bacteria Doubling Times at 76°F

FDAID	Total Vp MPNg	After 4Hr	After 6Hr	After 8Hr	After 10Hr
8-12-CT-10	15.0	60	120	240	480
8-12-CT-11	43.0	172	344	688	1376
8-12-CT-13	430.0	1720	3440	6880	13760
8-12-CT-14	43.0	172	344	688	1376
8-12-CT-15	120.0	480	960	1920	3840
8-12-CT-16	230.0	920	1840	3680	7360
8-12-CT-17	93.0	372	744	1488	2976
8-12-CT-12	120.0	480	960	1920	3840

Estimated Vp Bacteria Doubling Times at 76°F

FDAID	Total Vp MPNg	After 4Hr	After 6Hr	After 8Hr	After 10Hr
9-12-CT-1	43.0	172	344	688	1376
9-12-CT-2	150.0	600	1200	2400	4800
9-12-CT-3	43.0	172	344	688	1376
9-12-CT-4	210.0	840	1680	3360	6720
9-12-CT-5	210.0	840	1680	3360	6720
9-12-CT-6	240.0	960	1920	3840	7680
9-12-CT-7	210.0	840	1680	3360	6720
9-12-CT-8	290.0	1160	2320	4640	9280

2013 Connecticut Vibrio Risk Assessment

(3) The water temperatures in the area; and

(4) The air temperatures in the area; and

(5) Salinity in the area; and

Month	Bottom Water Temp Westport (F)	Air Temp (F)	Maximum time to Refrigeration (hr)	VPCP needed?
Jan	45.68	47.99	12	N
Feb	42.44	51.08	12	N
Mar	54.86	66.18	12	N
Apr	59.18	69.30	12	N
May	69.8	73.40	12	N
Jun	75.56	86.17	12	Y
July	79.52	83.35	12	Y
Aug	81.86	80.27	12	Y
Sep	78.62	81.39	12	Y
Oct	69.08	68.99	12	N
Nov	60.26	54.08	12	N
Dec	46.4	54.17	12	N

2013 Connecticut Vibrio Risk Assessment

(5) Salinity:

CT salinity range 22 to 29 ppt in the majority of the growing area

Vp does well over broad salinity range of 10-34ppt

2013 Connecticut Vibrio Risk Assessment

(6) Harvesting techniques in the area;

- Subtidal harvest in CT is less risky than intertidal harvest
- Extended boat trips and long harvest time until refrigeration pose a risk
- Exposure to sun will increase shellstock temps while working unless shade is used
- Large quantities of shellfish harvested in each trip take longer to cool to <50°F allow bacteria to proliferate until temp is reached
- No mechanical refrigeration available on most boats

2013 Connecticut Vibrio Risk Assessment

(7) The quantity of harvest from the area and its uses i.e. shucking, halfshell, PHP.

- The majority of oysters harvested are intended for raw consumption on the half shell
- Small proportion of shellstock goes to shucking where it would be cooked
- No PHP of any shellstock in CT at this time
- Large quantity of oysters and hard clams are harvested from CT waters, however no landing data is supplied making it difficult to assess the risk of illness

FDA's VPRA Assumptions (Unoffical)

- Meals
  - Serving = 13 oysters (196g)
  - 50% oysters consumed raw
- Illnesses
  - CDC reported oyster-associated illnesses/yr = 137
  - 62% of foodborne cases attributable to oysters
  - VPRA under-reporting factor: 1:20
  - Assuming 100% reporting for purposes of this presentation

FDA US Vp Risk/Serving of Oysters (Unofficial)

- Overall risk/serving (year-round)
  - 41,000,000 US raw oyster servings/yr
  - 137 Vp cases reported/year
  - 0.33 illnesses/100,000
- Spring + Summer (Vp risk season) risk/serving
  - 14,000,000 raw oyster servings
  - O.99 illnesses/100,000

Keep in mind these are the national figures…CT landings are not included in these figures

2012 CT Risk/100,000 Oyster Meals (Unofficial)

- One definitive case associated with CT oysters harvested in Westport
- June + July **partial landings** from the Darien, Norwalk, Westport growing area = 2,096,300 oysters
  - Oyster meals assuming all raw = 161,254
- CT risk/100,000 meals
  - 1 illness/161,254 meals X 100,000 = 0.62
- This figure and associated risk assessment could be calibrated for Connecticut growing areas with additional landings data

FDA Risk Associated with CT Oysters (UNOFFICIAL)

- Observed risk estimate/100,000 servings
  - CT: 0.62
- Pathogenic Vp levels
  - July closest to implicated harvest period
  - CT: ~1/g
- Doubling time at 82F = 1.5h
  - 5h results in maximum of 3.3 doublings or ~10-fold increase
  - 12h results in maximum of 8 doublings or ~250-fold increase
- Estimated maximum pathogenic Vp levels at first refrigeration
  - (Harvest levels) X (Post harvest growth increase)
  - CT: 1/g X 10 = 10/g
  - **Even with low initial pathogenic levels, may be over the limit in 5 hours with doubling times**

2013 Vibrio Parahaemolyticus Control Plan

VPCP Control Measures

a. Post Harvest Processing (PHP).

b. Closing the area to oyster harvest.

c. Restrict oyster harvest to product labeled for shucking by a certified dealer, or other means to allow the hazard to be addressed by further processing.

d. **Limit time from harvest to refrigeration to no more than five (5) hours** or other times based on modeling and sampling in consultation with FDA.

e. Limit time from harvest to refrigeration such that levels of total Vp after completion of cooling to 60 °F do not increase more than 0.75 log from levels at harvest. Calculations for 0.75 log increase can be based on the table as shown below or based on validation studies. The authority may use the FDA Risk Assessment to determine the initial "at harvest" levels.

f. The term refrigeration is storage in a container that is capable of dropping and maintaining ambient air temperature of 45 °F (7.5 °C).

g. Other control measures based on appropriate scientific studies

2013 Vibrio Parahaemolyticus Control Plan

For States required to implement *Vibrio parahaemolyticus* Control Plans, the Plan shall include the administrative procedures and resources necessary to accomplish the following:

(a) Establish one or more triggers for when control measures are needed. These triggers shall be the temperatures in § B. (2) where they apply, or other triggers as determined by the risk evaluation.

Months of June, July, August and September in Connecticut

(b) Implement one or more control measures to reduce the risk of *Vibrio parahaemolyticus* illness at times when it is reasonably likely to occur. The control measures may include:

Limit time from harvest to refrigeration to no more than five hours

2013 Vibrio Parahaemolyticus Control Plan

For States required to implement *Vibrio parahaemolyticus* Control Plans, the Plan shall include the administrative procedures and resources necessary to accomplish the following:

(c) **Require the original dealer to cool oysters to an internal temperature of 50°F (10°C) or below within 10 hours or less as determined by the Authority** after placement into refrigeration during periods when the risk of *Vibrio parahaemolyticus* illness is reasonably likely to occur.

The dealer's HACCP Plan shall include controls necessary to ensure, document and verify that the internal temperature of oysters has reached 50°F (10°C) or below within 10 hours or less as determined by the Authority of being placed into refrigeration.

Oysters without proper HACCP records demonstrating compliance with this cooling requirement shall be diverted to **PHP or labeled "for shucking only",** or other means to allow the hazard to be addressed by further processing

2013 Vibrio Parahaemolyticus Control Plan

For States required to implement *Vibrio parahaemolyticus* Control Plans, the Plan shall include the administrative procedures and resources necessary to accomplish the following:

(d) Evaluate the effectiveness of the Plan.

Evaluate dealer compliance

Field inspections

Cooler process studies

HACCP records review

Testing of shellstock for *Vibrio* levels

(e) Modify the Control Plan when the evaluation shows the Plan is ineffective, or when new information is available or new technology makes this prudent as determined by the Authority

Illness outbreak will require modification of the Plan:

Closure to Shellfish Harvest

2013 Vibrio Parahaemolyticus
Control Plan for Connecticut: Oysters

1. OYSTERS: Limit time from harvest to refrigeration to no more than five hours during the months of June, July and August; 7 hours during September.

Time begins once the first shellstock harvested is no longer submerged.

Dealers may harvest and place shellstock into refrigeration within 5 hours, then make subsequent harvest trips, provided that each trip allows the shellstock to be placed into refrigeration within 5 hours.

2013 Vibrio Parahaemolyticus Control Plan for Connecticut: Oysters

2. Require the original dealer to cool oysters to an internal temperature of 50°F (10°C) or below within 10 hours or less, however the DA/BA **strongly recommends cooling to 50°F within 5 hours.** The 2012 verification studies of dealers cooling practices have demonstrated that cooling to 50 °F takes between 1.5 and 5 hours.

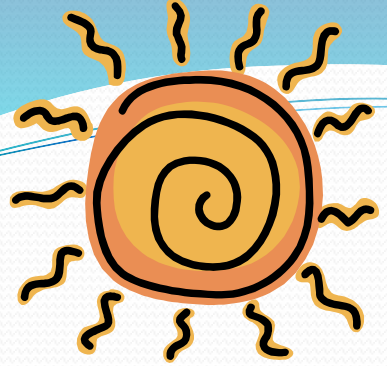
3. All shellstock (clams and oysters) shall be shaded onboard the vessel and as needed at points of transfer to prevent the shellstock from increasing in temperature.

2013 Vibrio Parahaemolyticus Recommendations for Connecticut-Hard Clams

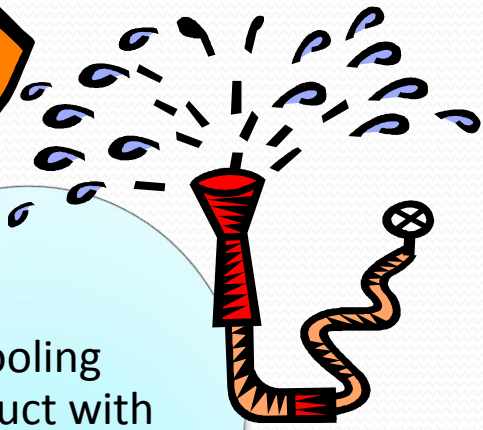
1. Hard Clams: Limit time from harvest to refrigeration to no more than 8 hours during the months of June, July and August.

2. The DA/BA strongly recommends that the original dealer cool hard clams to an internal temperature of 50°F (10°C) or below within 10 hours or less.

3. All shellstock (clams and oysters) shall be shaded onboard the vessel and as needed at points of transfer to prevent the shellstock from increasing in temperature.



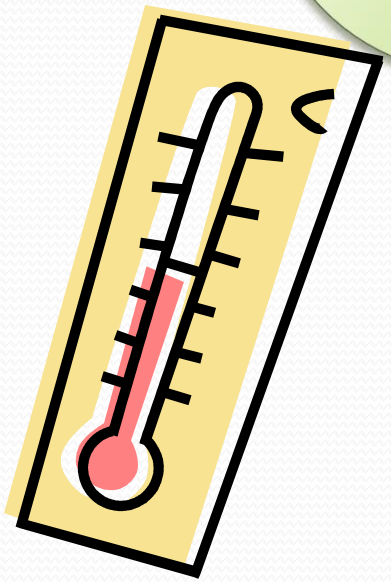
Shading product onboard vessel (can reduce temps by 10°F)



Cooling product with harvest water

Monitor cooling of shellstock to ensure that temperature brought down to 50°F within 10 hours

Vibrio Control Plans Between June and September



Monitor temperatures of shellstock while onboard vessel

5 Hours from harvest to refrigeration (7 in Sept)

Helpful Links

Interstate Shellfish Sanitation Conference *Vibrio* Education

http://www.issc.org/Education/VibrioVulnificus.aspx

CT Department of Agriculture Bureau of Aquaculture *Vibrio* Guidance

http://www.ct.gov/doag/lib/doag/aquaculture/recreational_shellfish_harvesting_and_vibrio.pdf

Questions?