Connecticut's 2014 *Vibrio parahaemolyticus* Monitoring Program: Background and Preliminary Results

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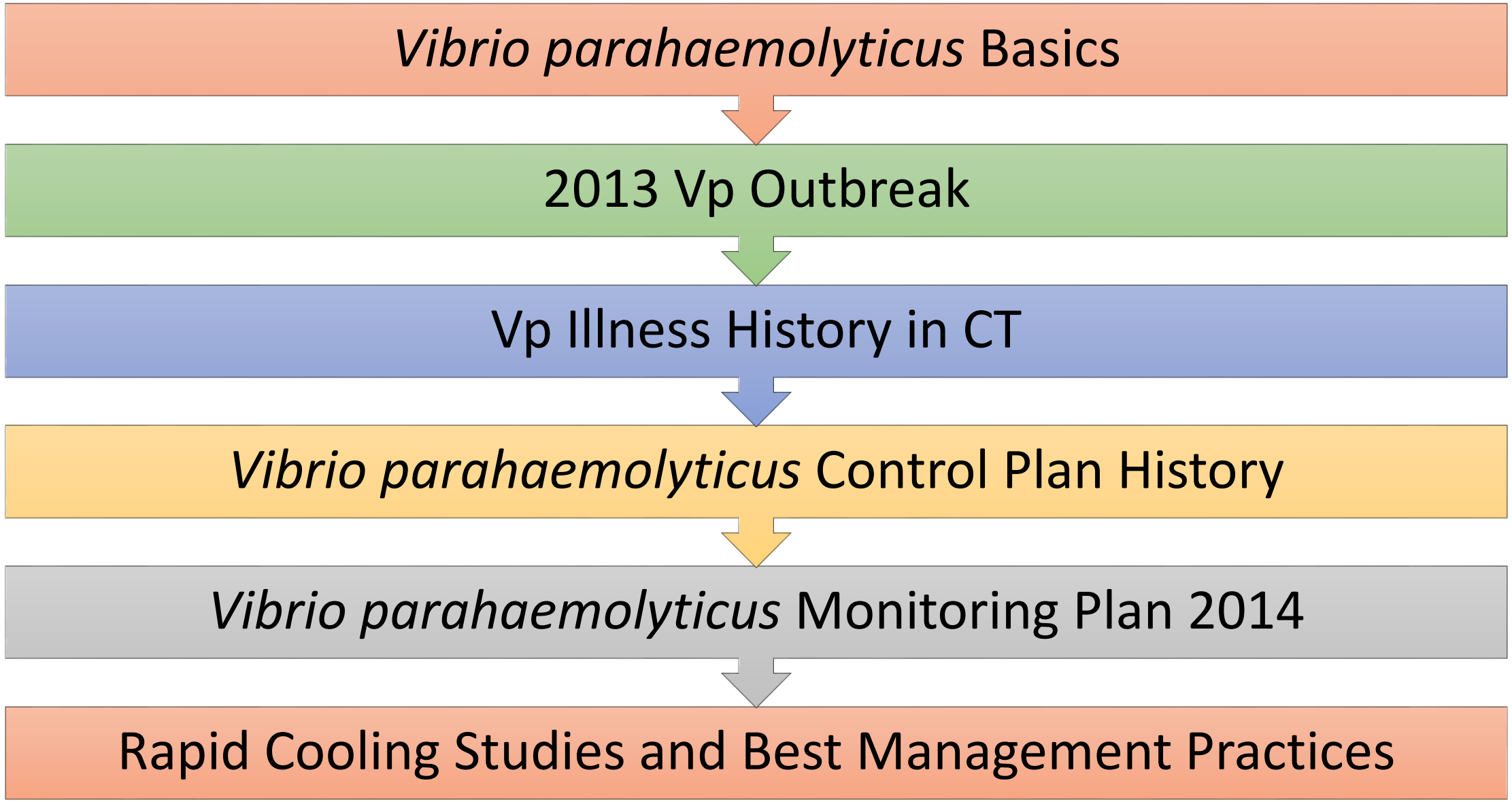
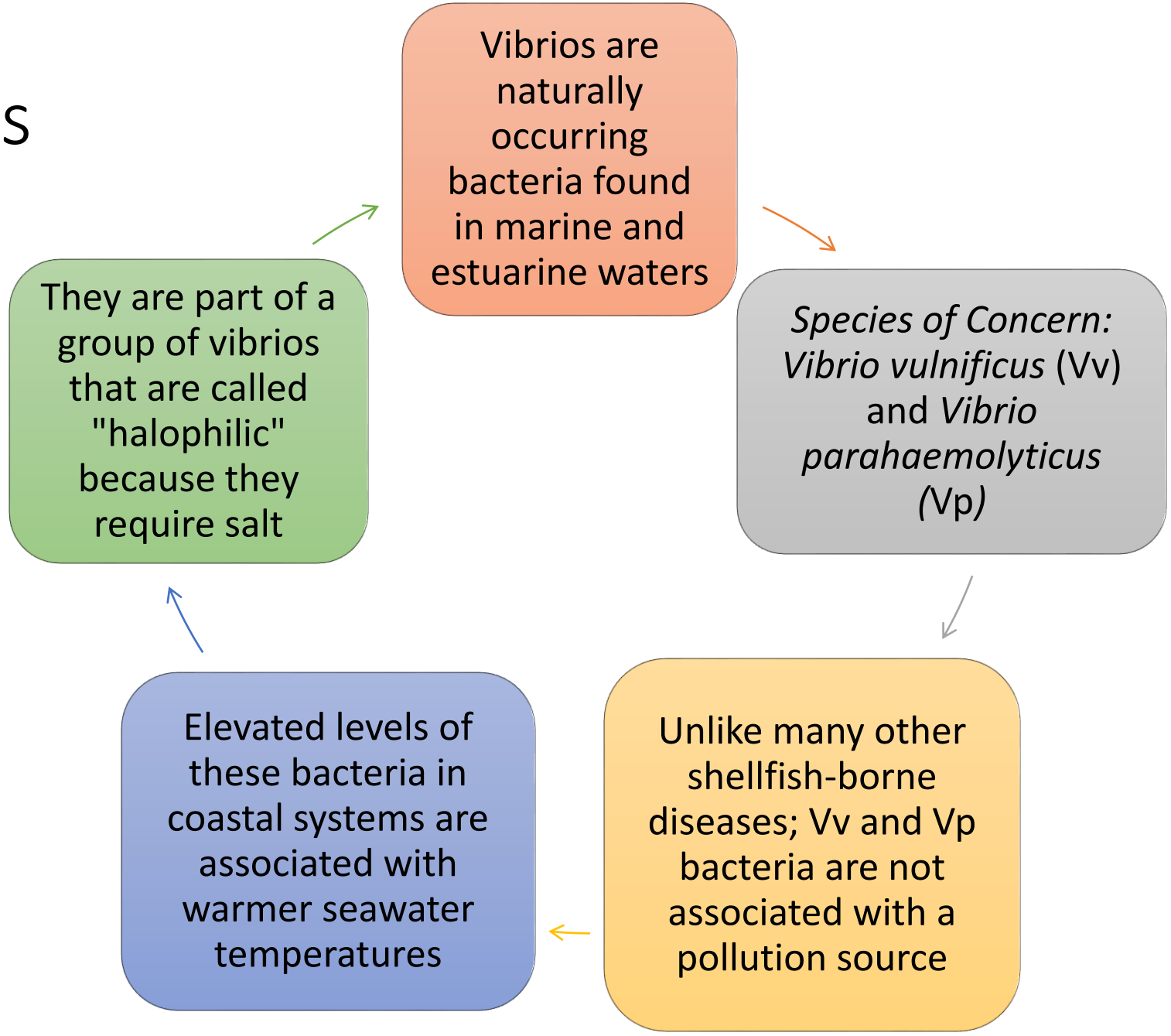

Vibrio parahaemolyticus Basics
2013 Vp Outbreak
Vp Illness History in CT
Vibrio parahaemolyticus Control Plan History
Vibrio parahaemolyticus Monitoring Plan 2014
Rapid Cooling Studies and Best Management Practices

Vibrios



Source http://emedicine.medscape.com/article/232038-overview#a0199

Centers for Disease Controls: Foodborne Illness Rates 1996-2012

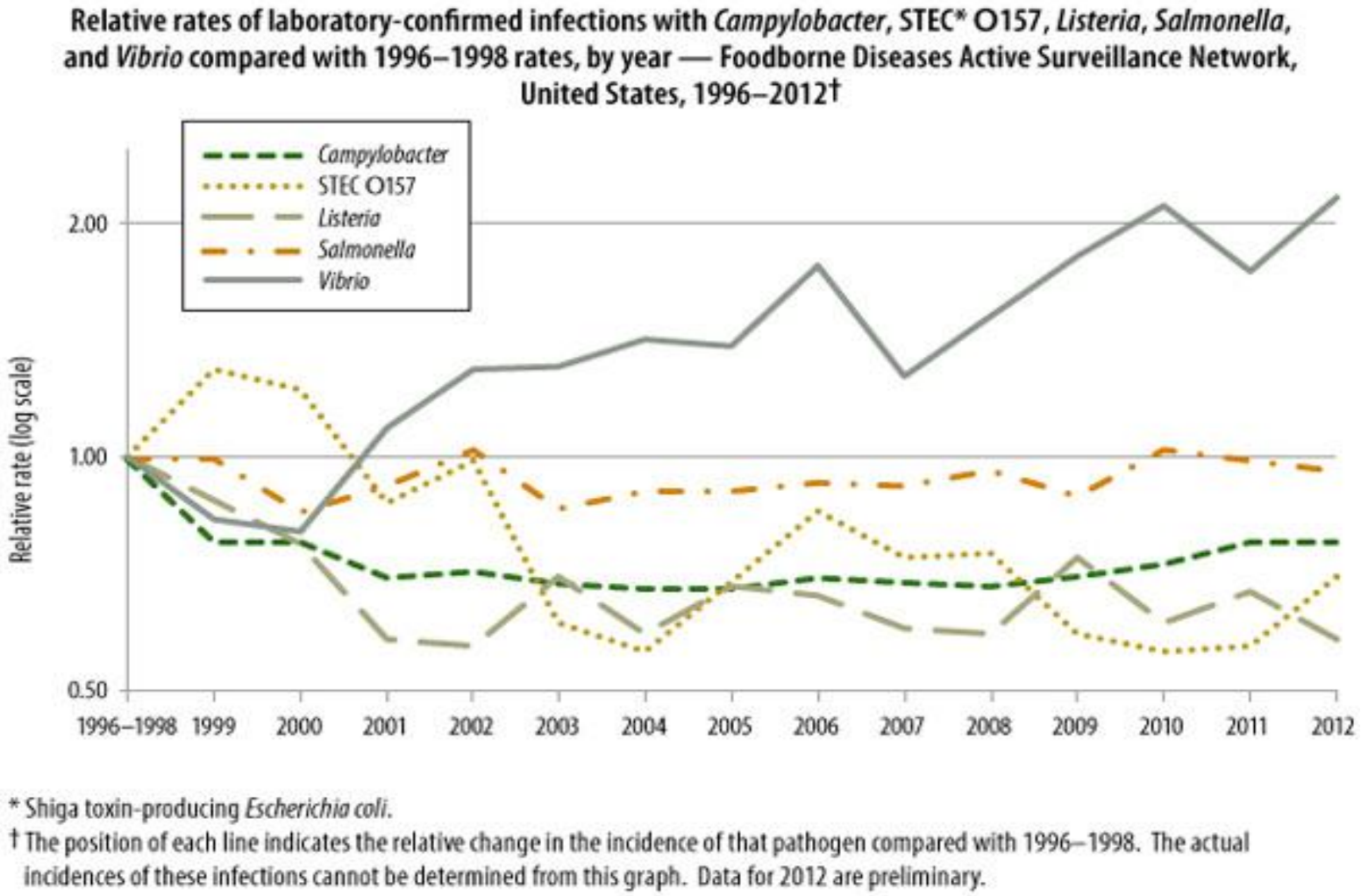


Figure 1. Relative rates of laboratory-confirmed infections with *Campylobacter*, *E. coli* O157, *Listeria*, *Salmonella*, and *Vibrio*, compared with 1996--1998 rates, by year --- Foodborne Diseases Active Surveillance Network, United States, 1996--2012*
http://www.cdc.gov/foodborneburden/trends-in-foodborne-illness.html

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

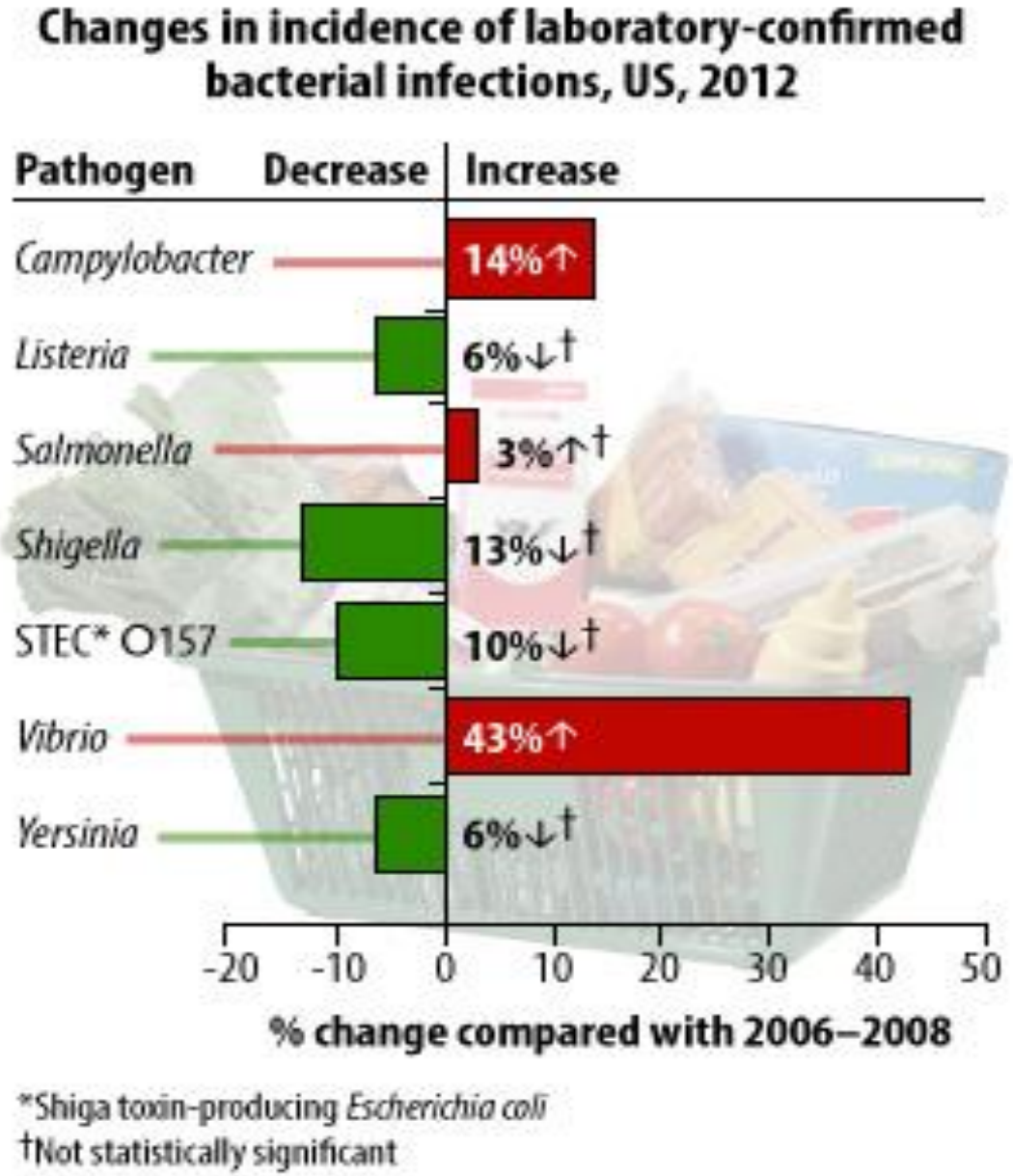
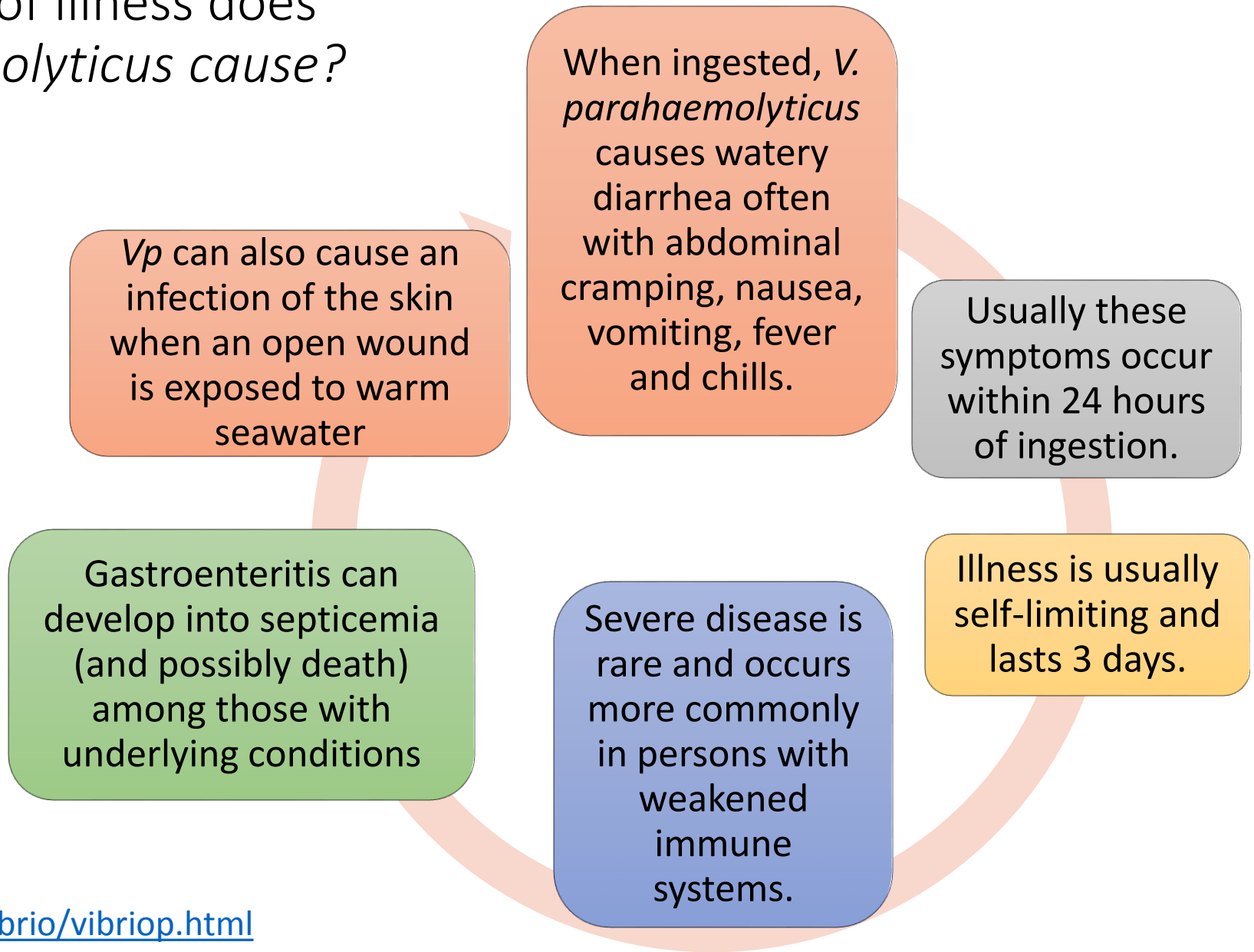
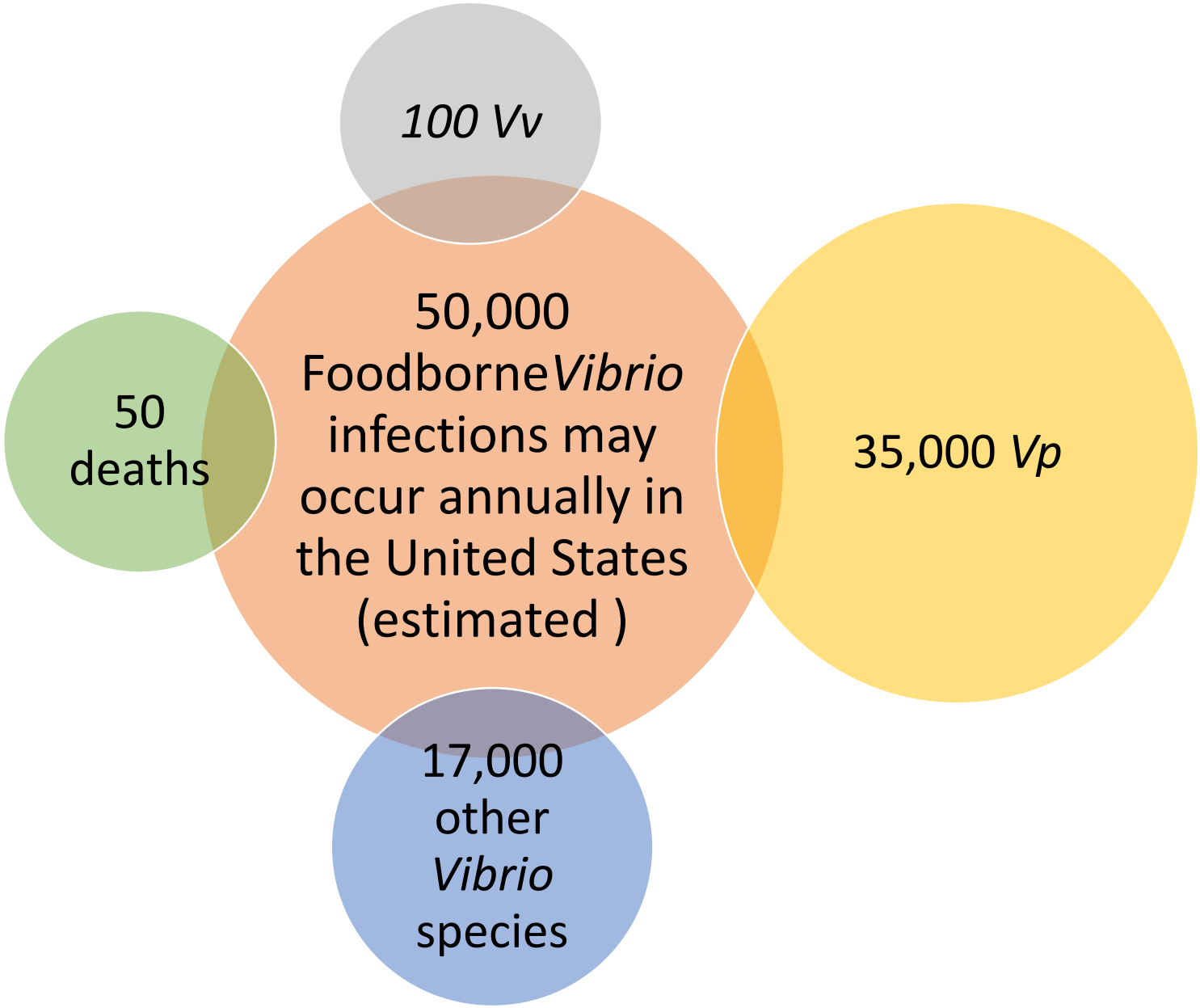


Figure 2. Changes in incidence of laboratory-confirmed bacterial infections, United States, 2010 compared with 1996–1998
http://www.cdc.gov/foodborneburden/trends-in-foodborne-illness.html

What type of illness does *V. parahaemolyticus cause?*

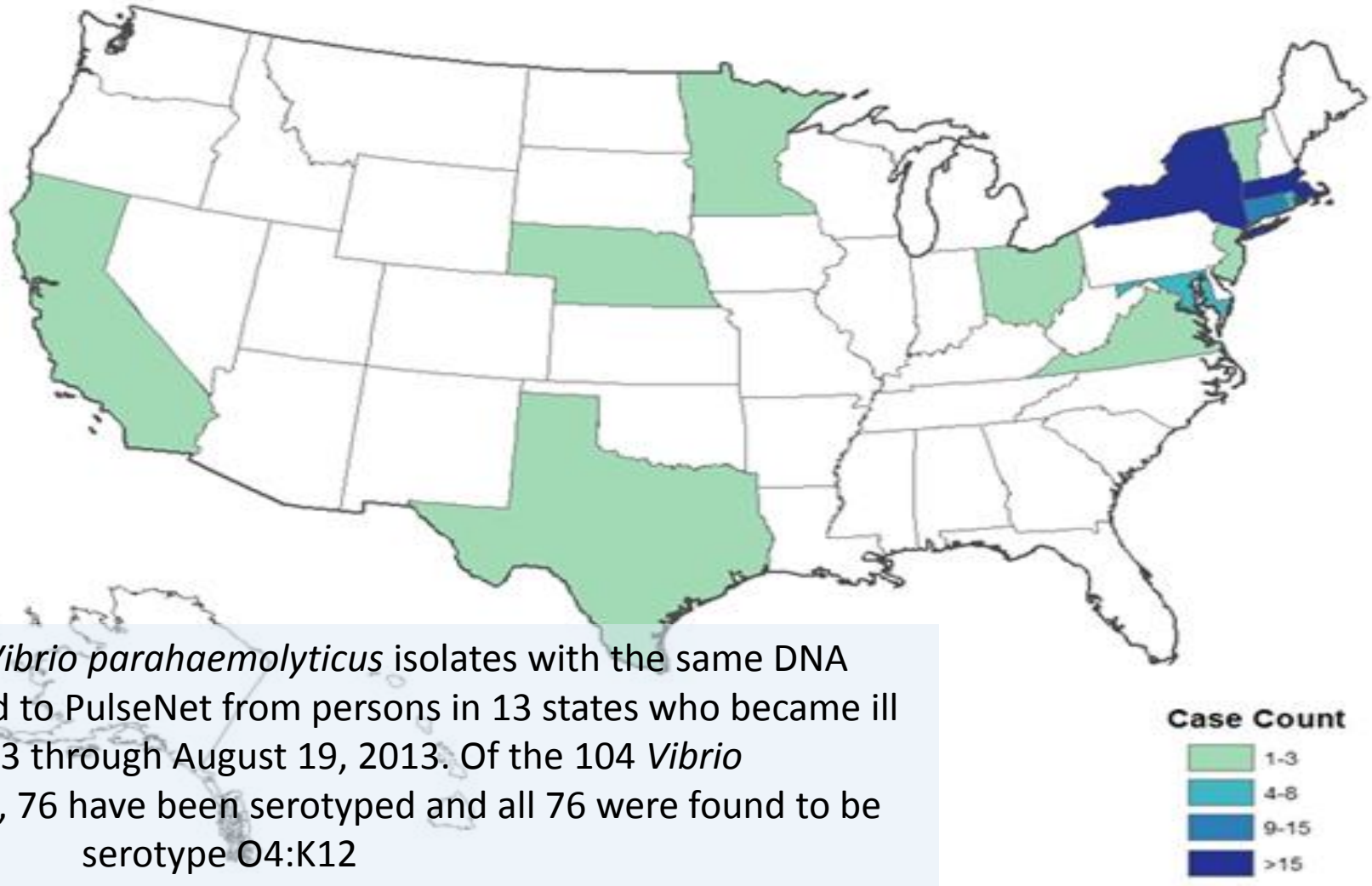


http://www.cdc.gov/vibrio/vibriop.html
http://www.fda.gov/downloads/Food/FoodScienceResearch/UCM196914.pdf



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.

Vp Outbreak Strain 2013 (O4:K12)



One hundred and four *Vibrio parahaemolyticus* isolates with the same DNA "fingerprint" were reported to PulseNet from persons in 13 states who became ill from May 12, 2013 through August 19, 2013. Of the 104 *Vibrio parahaemolyticus* isolates, 76 have been serotyped and all 76 were found to be serotype O4:K12

http://www.cdc.gov/vibrio/investigations/vibriop-09-13/map.html

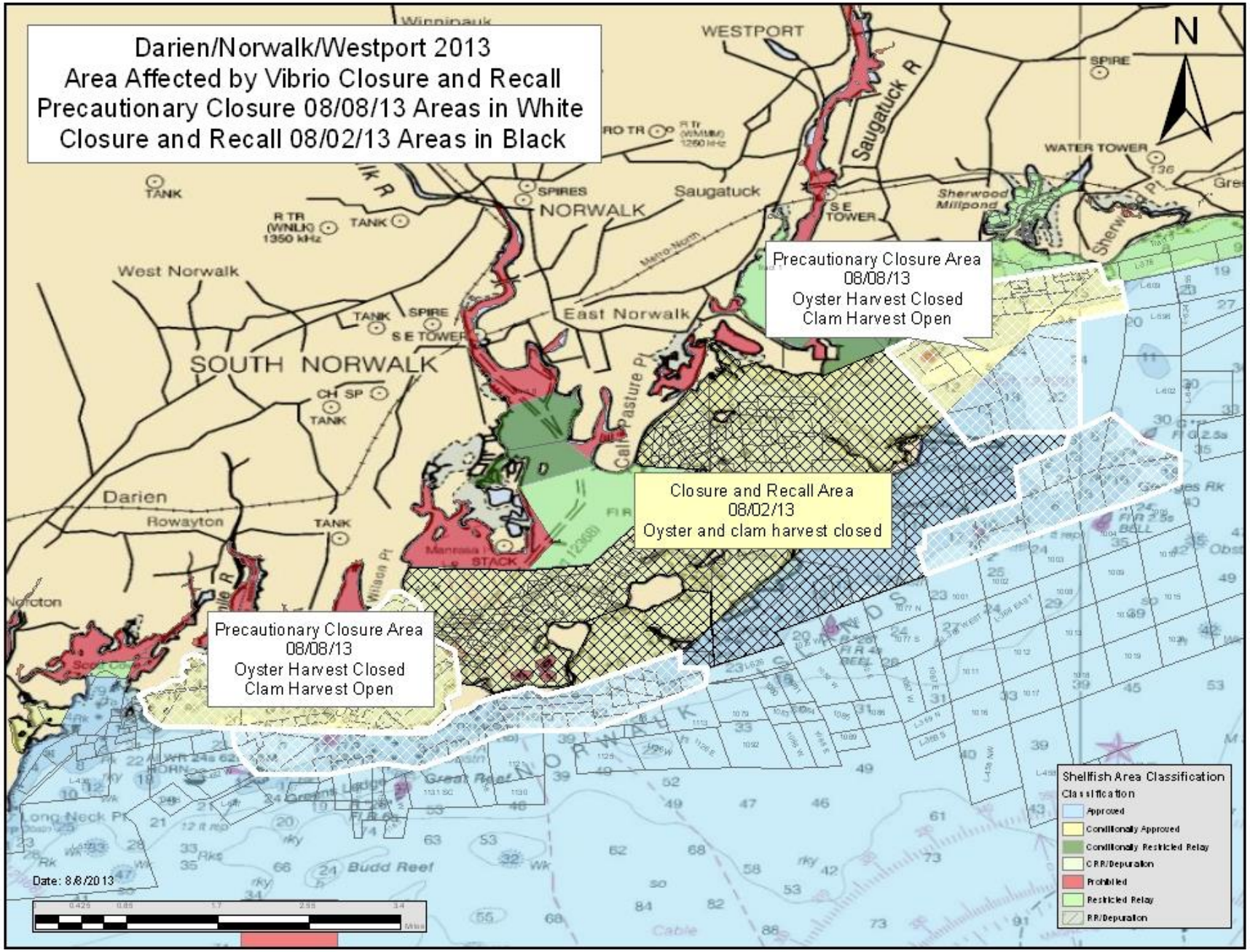
2013 Vp Outbreak Strain (O4:K12)

- Serotype O4:K12
- More virulent than other pathogenic Vp strains
- **Infectious at lower doses** than native strains typically found on the East Coast
- First identified in 1988
- Caused large outbreaks in 1997 and 2004
- First identified outside of Pacific NW in 2012 (Oyster Bay, NY)
- During 2013, at least 76 of the 104 isolates collected by CDC were determined to be O4: K12

2013 Vp Outbreak Strain (O4:K12)

What can we do?

- Strain is naturally occurring
- Difficult to ID in environment
- Research collaboration into genotyping of strains (CT DA/BA and CT DPH are working with UNH and FDA)
- Post-harvest controls for Vp (time-temperature controls and practices to keep Vp levels from increasing during production)
- STILL PRESENT IN 2014 in the Northeast!!!


Darien/Norwalk/Westport 2013
Area Affected by Vibrio Closure and Recall
Precautionary Closure 08/08/13 Areas in White
Closure and Recall 08/02/13 Areas in Black
N
WESTPORT
Saugatuck R
SPIRE
WATER TOWER
Sherwood Millpond
S E TOWER
SPIRES
NORWALK
Saugatuck
TANK
R TR (WNLK) 1350 kHz
West Norwalk
East Norwalk
Metro-North
SOUTH NORWALK
CH SP
Cat Pasture Pt
Darien
Rowayton
Wilson Pt
Norton
Budd Reef
Great Reef
Long Neck Pt
Precautionary Closure Area
08/08/13
Oyster Harvest Closed
Clam Harvest Open
Closure and Recall Area
08/02/13
Oyster and clam harvest closed
Precautionary Closure Area
08/08/13
Oyster Harvest Closed
Clam Harvest Open
Date: 8/8/2013
Shellfish Area Classification
Classification
Approved
Conditionally Approved
Conditionally Restricted Relay
CRR/Depuration
Prohibited
Restricted Relay
RR/Depuration

Illness History in Connecticut: 2009 to 2014 Illness Summary

Year	Confirmed Cases Linked to CT Shellfish	Multi-State Shellfish Cases Including CT Source
2009	1	2
2010	1	2
2011	1	2
2012	1*	3
2013	23**	11
2014	1	2

*2012 Closure of Westport/Norwalk growing area from 7/15/12 through 9/19/12

** 2013 Closure of Westport/Norwalk growing area from 8/2/13 through 9/16/13

Illness History in Connecticut: 2009 to 2014 Vp Control Plan Summary

Year	VPCP Required?	Closure?	Hrs to TC	Hrs to 50°F
2009	NO	NO	NA	NA
2010	NO	NO	NA	NA
2011	NO	NO	NA	NA
2012	Voluntary/Mandatory	YES	5	10
2013	Mandatory	YES	5	Mandatory 10 Voluntary 5
2014	Mandatory (2 VPCPs)	NO	5/Rapid Cooling	5/Rapid Cooling

Illness History in Connecticut: 2014 Illness Summary

Confirmed Vp Illness Linked to CT Shellfish (1 & 2)		1
Traceback Code		Number of Cases
1	CT Confirmed Single Source	0
2	CT Confirmed (Milford 7/15 or Westport 7/14)	1
3	CT Product Plus Out-of-State	2

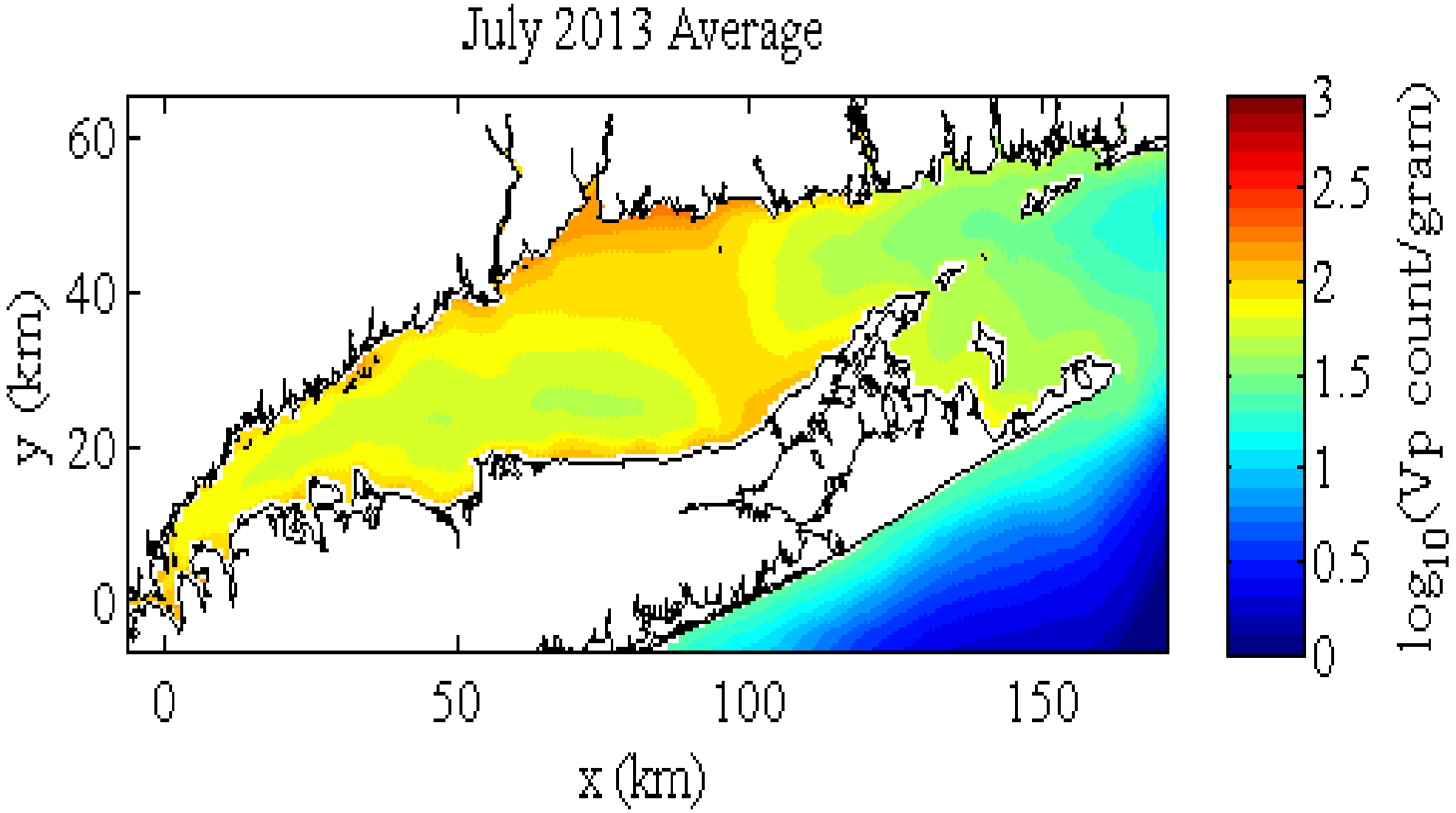
Connecticut's 2014 *Vibrio parahaemolyticus* Research Projects and Partners

- ***Analysis of Pathogenic Lineages of Vibrio parahaemolyticus in the Northeast*:** University of New Hampshire
- ***Vibrio parahaemolyticus Levels in Atlantic Coast Shellfish 2014***: FDA
- **Connecticut Sea Grant Funded: *Modeling Vibrio parahaemolyticus Outbreaks in Commercial Shellfish Areas in Western Long Island Sound: Research Linking Local Environmental Factors and Uptake by Oysters.*** UCONN partners Michael Whitney, Evan Ward, and Tessa Getchis
- **ISSC Funded: *Techniques and Practices for Vibrio Reduction: Study effectiveness of rapid cooling in reducing Vp levels with CT Industry***

Connecticut DA/BA Accomplishments to Date

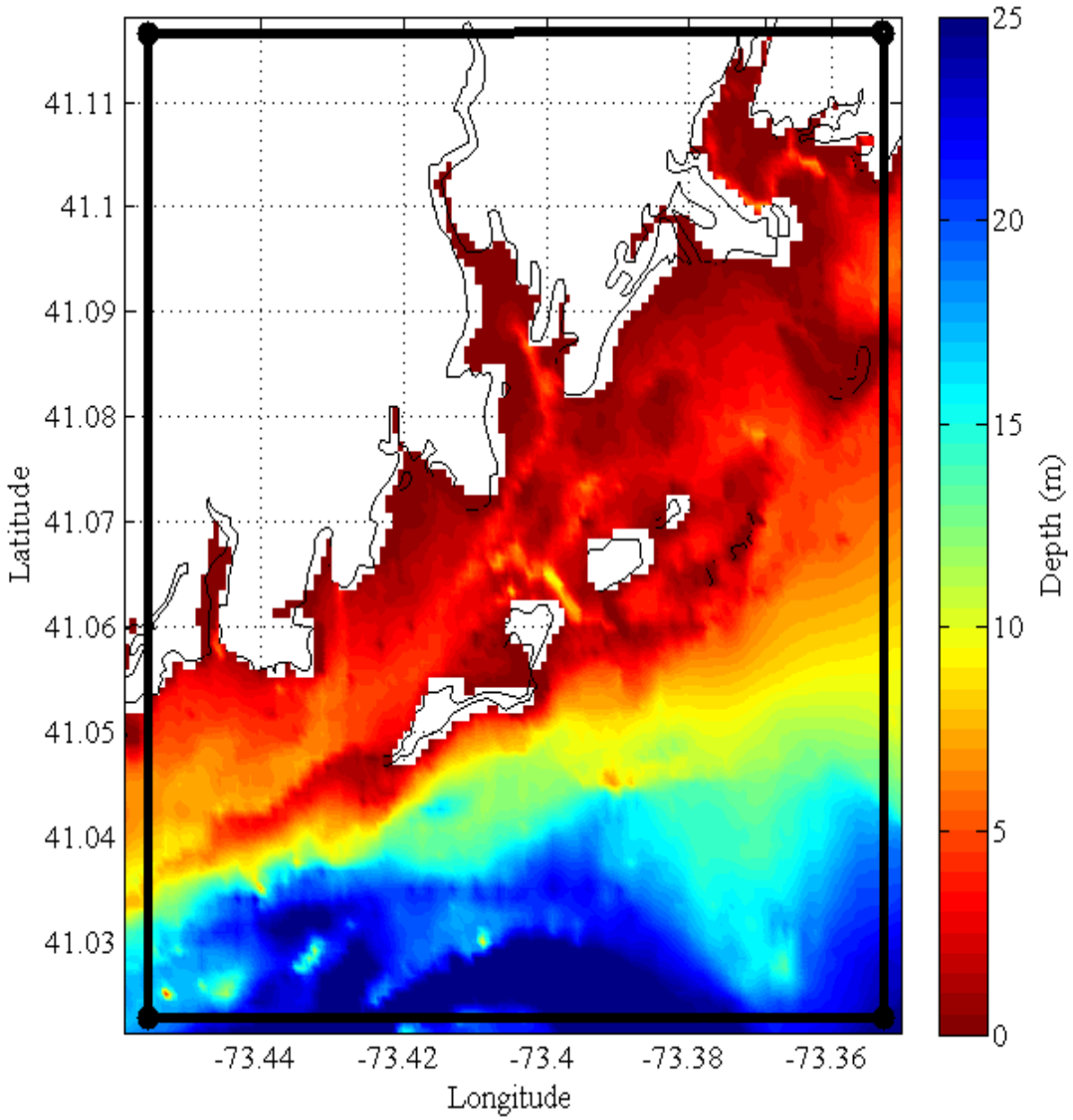
- DA/BA awarded FDA Partnership Funds: Covered purchase of Smart Button and Hobo Temperature Data Loggers for 2014 Monitoring
- DA/BA Awarded ISSC Funds: *Techniques and Practices for Vibrio Reduction: evaluate the effectiveness of rapid cooling in reducing Vp levels in partnership with CT Industry*
- DA/BA laboratory successfully implemented PCR analysis for Total Vp, tdh and trh pathogenic indicators
- 85 Samples were run by the DA/BA lab during 2014
- Effectiveness of industry controls was evaluated during field observations and using Smart Button data loggers
- 16 Hobo data loggers and 6 Star-Oddi CTDs were deployed to monitor water temperatures, salinity and depth in growing areas used for oyster production

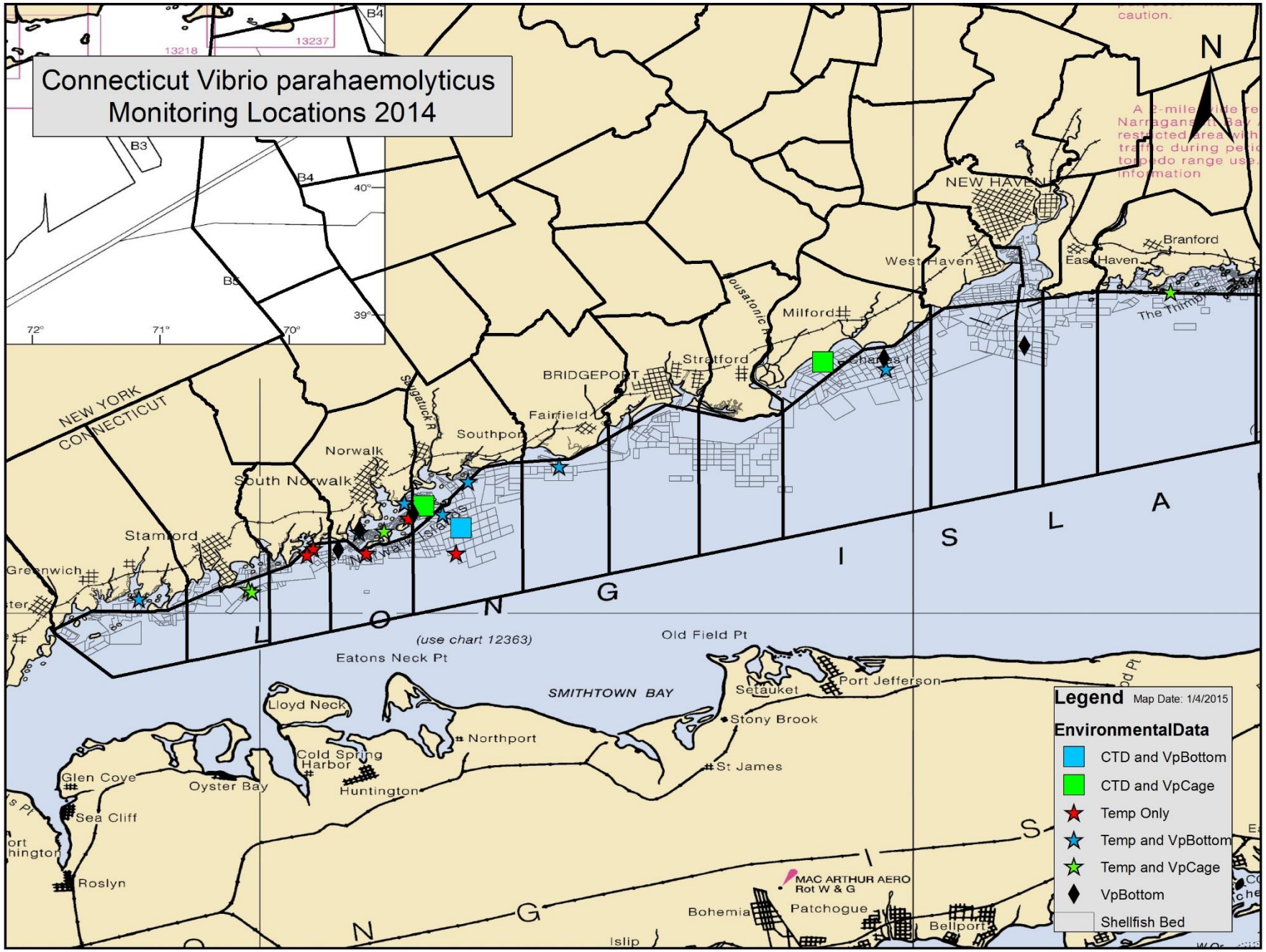
Hydrodynamic Modeling for Vp

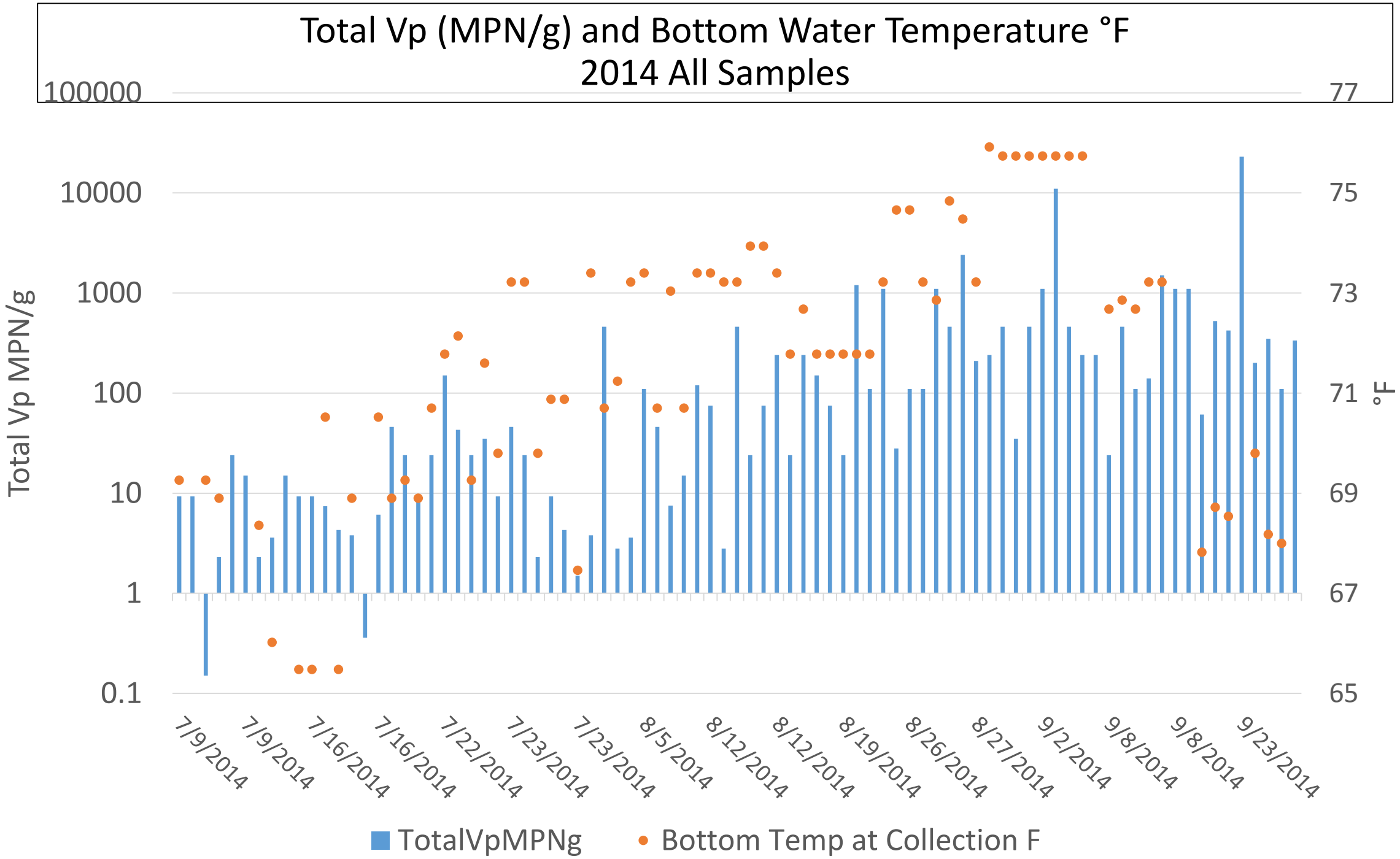


Modeling Project Results

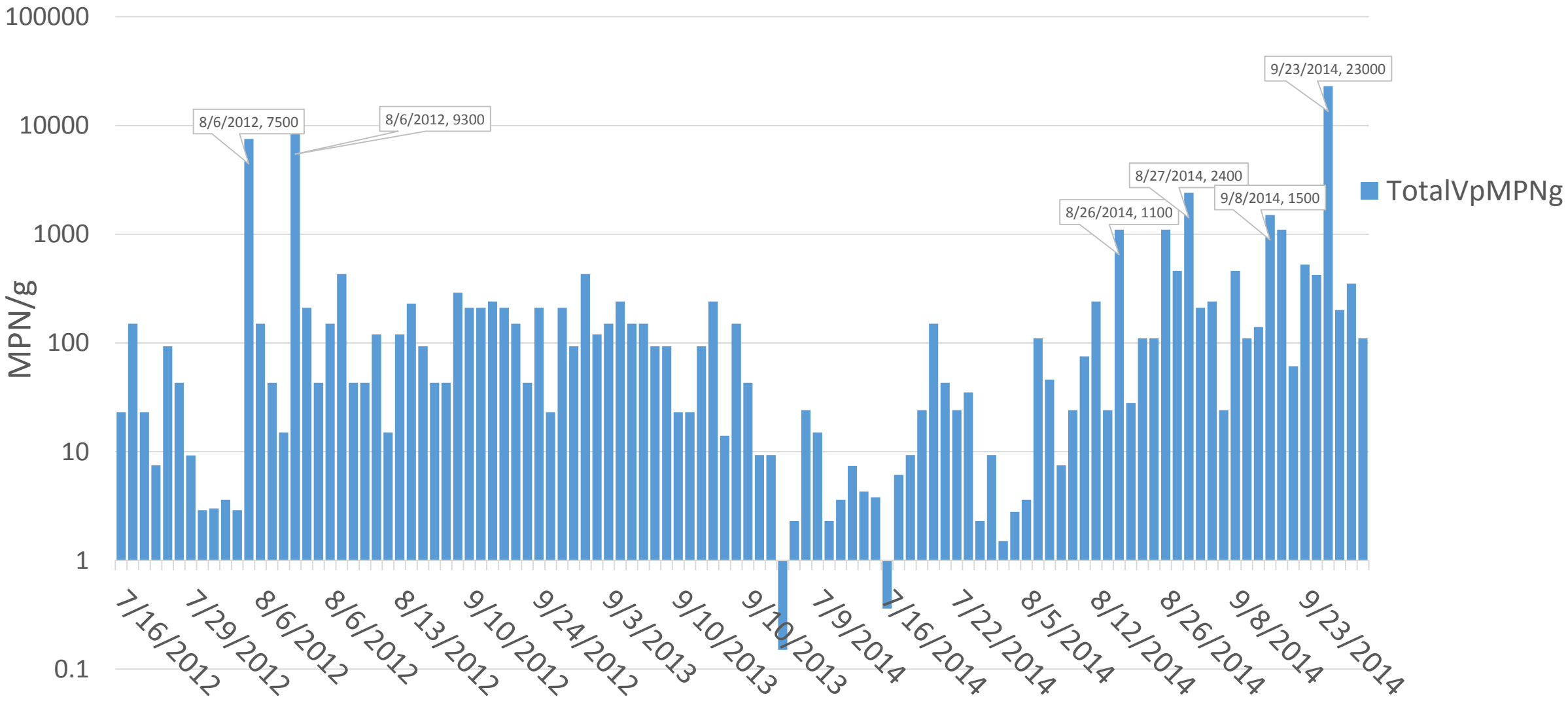
- Link environmental conditions to *Vp* counts in LIS shellfish
- Establish the time-lags between water and shellfish *Vp* counts
- Establishing the environmental forcing scenarios that lead to the 2012 and 2013 *Vp*-related closures
- Creating an operational *Vp* model for LIS will allow managers to anticipate future high *Vp* events
- Identify growing areas most and least susceptible to high-*Vp* events.

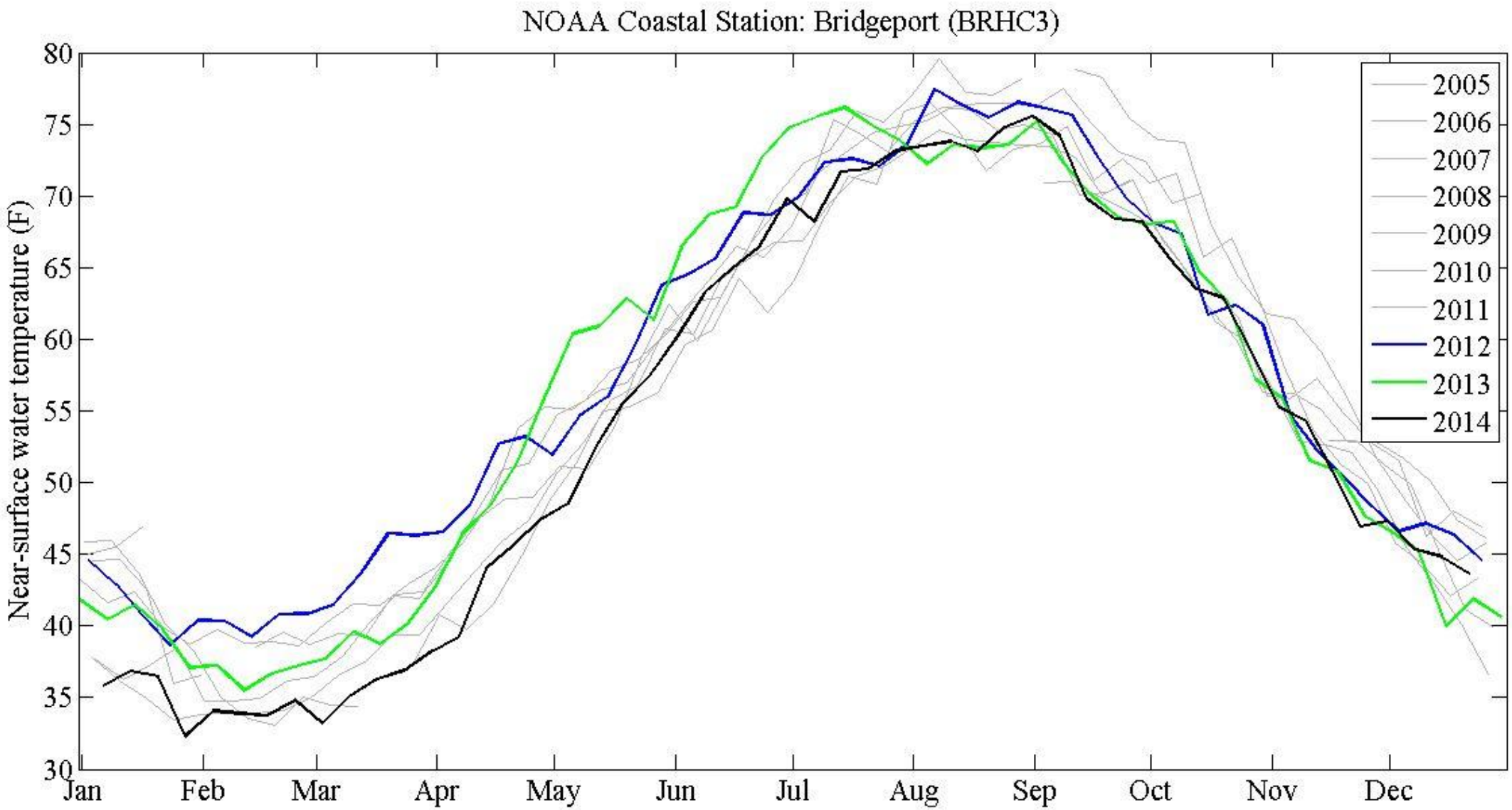


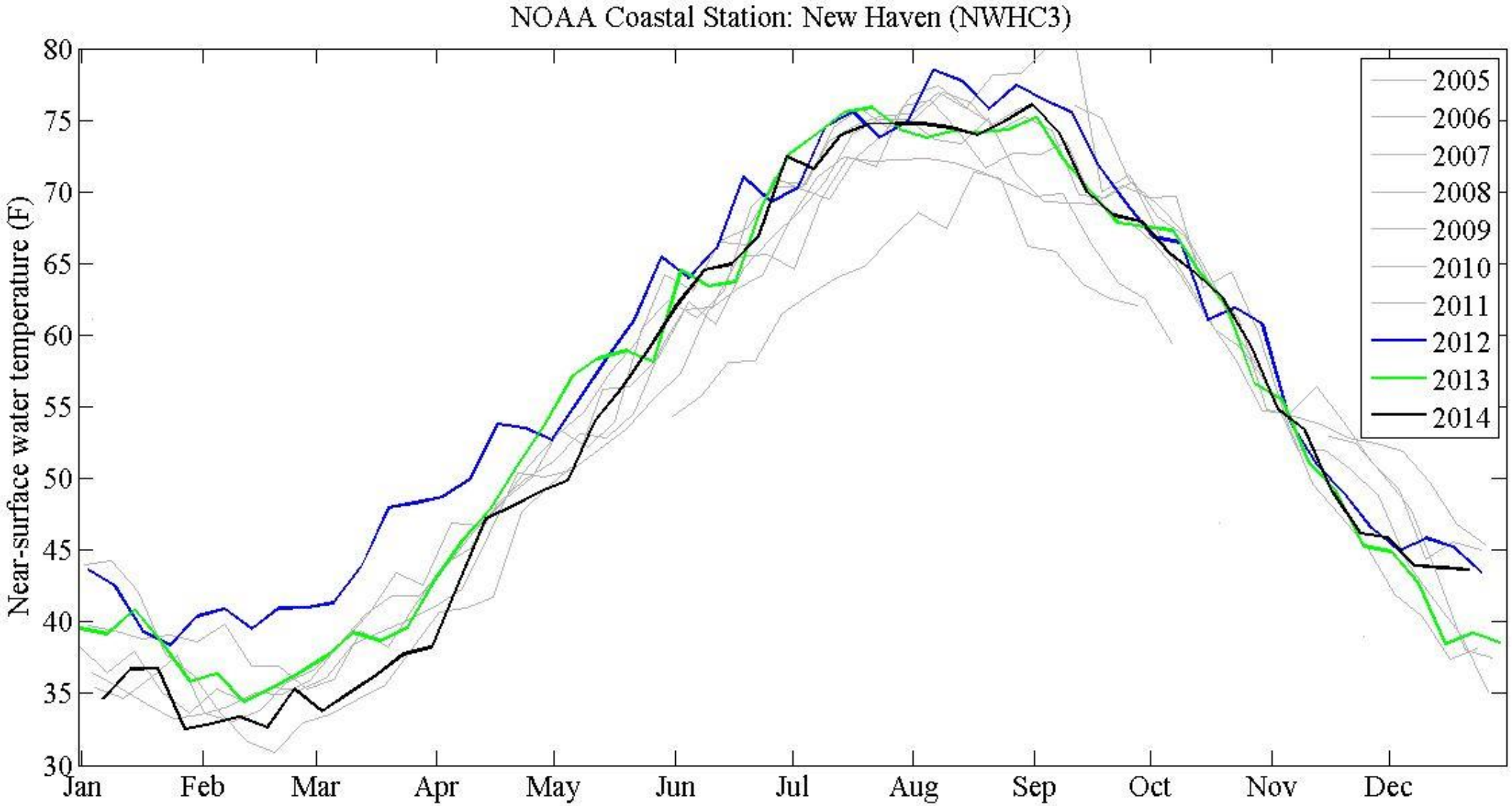

Connecticut Vibrio parahaemolyticus
Monitoring Locations 2014
Legend
Map Date: 1/4/2015
EnvironmentalData
CTD and VpBottom
CTD and VpCage
Temp Only
Temp and VpBottom
Temp and VpCage
VpBottom
Shellfish Bed
NEW YORK
CONNECTICUT
BRIDGEPORT
Stratford
Milford
West Haven
NEW HAVEN
East Haven
Branford
Fairfield
Southport
Norwalk
South Norwalk
Stamford
Greenwich
Saugatuck R.
Housatonic R.
LONG ISLAND
(use chart 12363)
Eatons Neck Pt
Old Field Pt
SMITHTOWN BAY
Port Jefferson
Setauket
Stony Brook
Lloyd Neck
Northport
Cold Spring Harbor
Huntington
St James
Glen Cove
Oyster Bay
Sea Cliff
Roslyn
MAC ARTHUR AERO
Rot W & G
Bohemia
Patchogue
Bellport
Islip
N

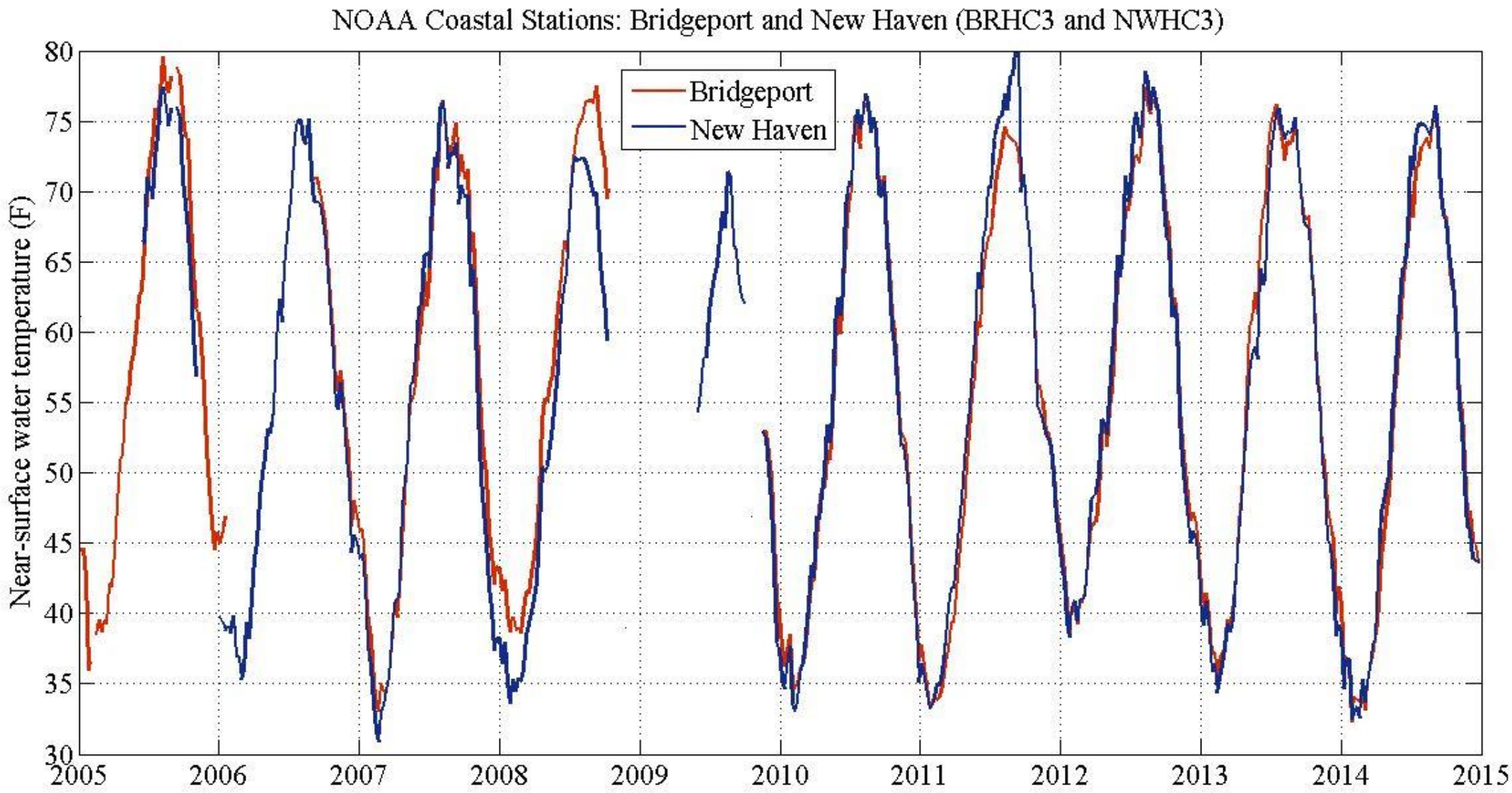

Total Vp (MPN/g) and Bottom Water Temperature °F
2014 All Samples
100000
10000
1000
100
10
1
0.1
Total Vp MPN/g
77
75
73
71
69
67
65
°F
7/9/2014
7/9/2014
7/16/2014
7/16/2014
7/22/2014
7/23/2014
7/23/2014
8/5/2014
8/12/2014
8/12/2014
8/19/2014
8/26/2014
8/27/2014
9/2/2014
9/8/2014
9/8/2014
9/23/2014
TotalVpMPNg
Bottom Temp at Collection F

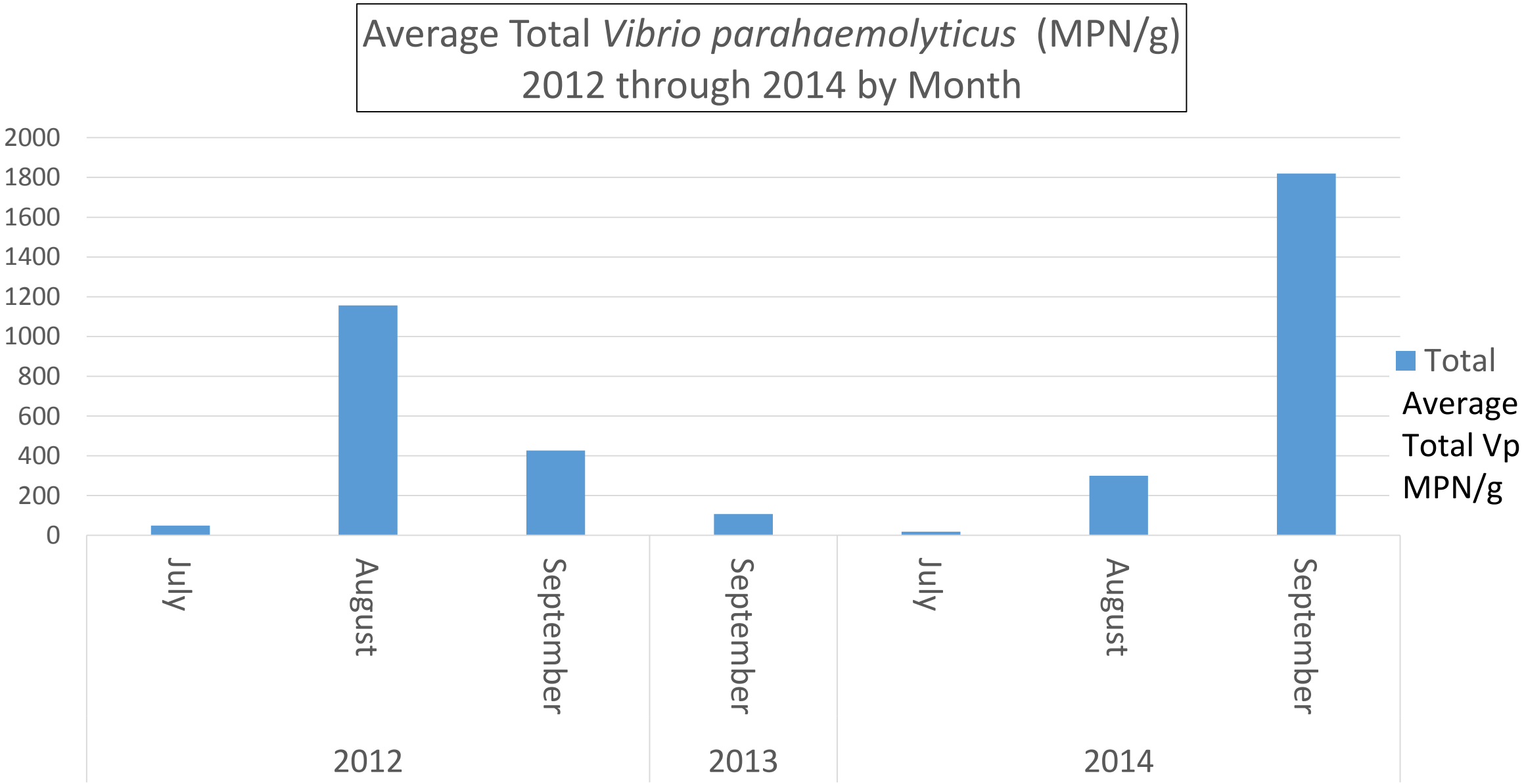
Total Vp (MPN/g) at Time of Harvest 2012 through 2014

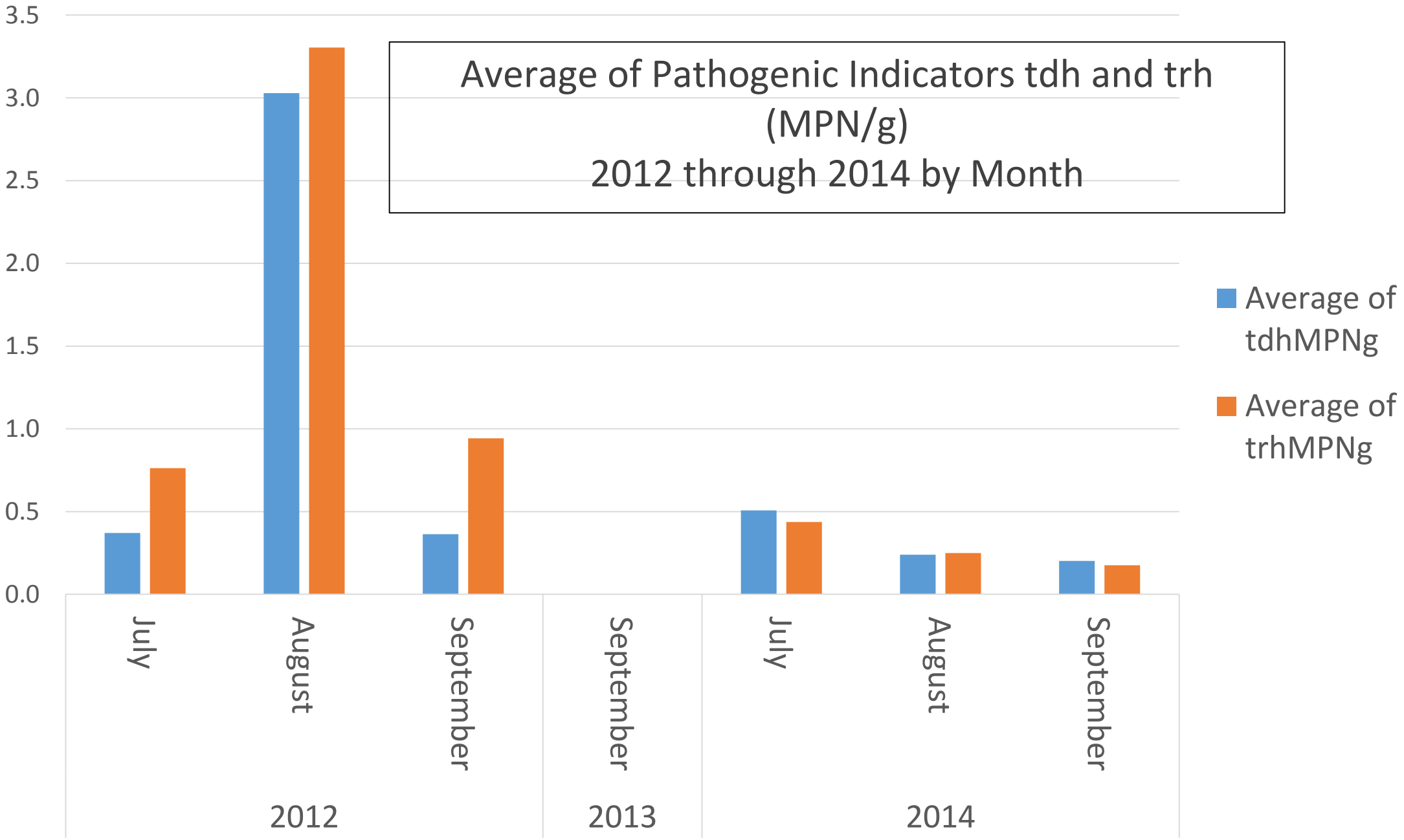



NOAA Coastal Station: Bridgeport (BRHC3)
Near-surface water temperature (F)
80
75
70
65
60
55
50
45
40
35
30
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014


NOAA Coastal Station: New Haven (NWHC3)
Near-surface water temperature (F)
80
75
70
65
60
55
50
45
40
35
30
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014


NOAA Coastal Stations: Bridgeport and New Haven (BRHC3 and NWHC3)
Near-surface water temperature (F)
Bridgeport
New Haven
80
75
70
65
60
55
50
45
40
35
30
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015

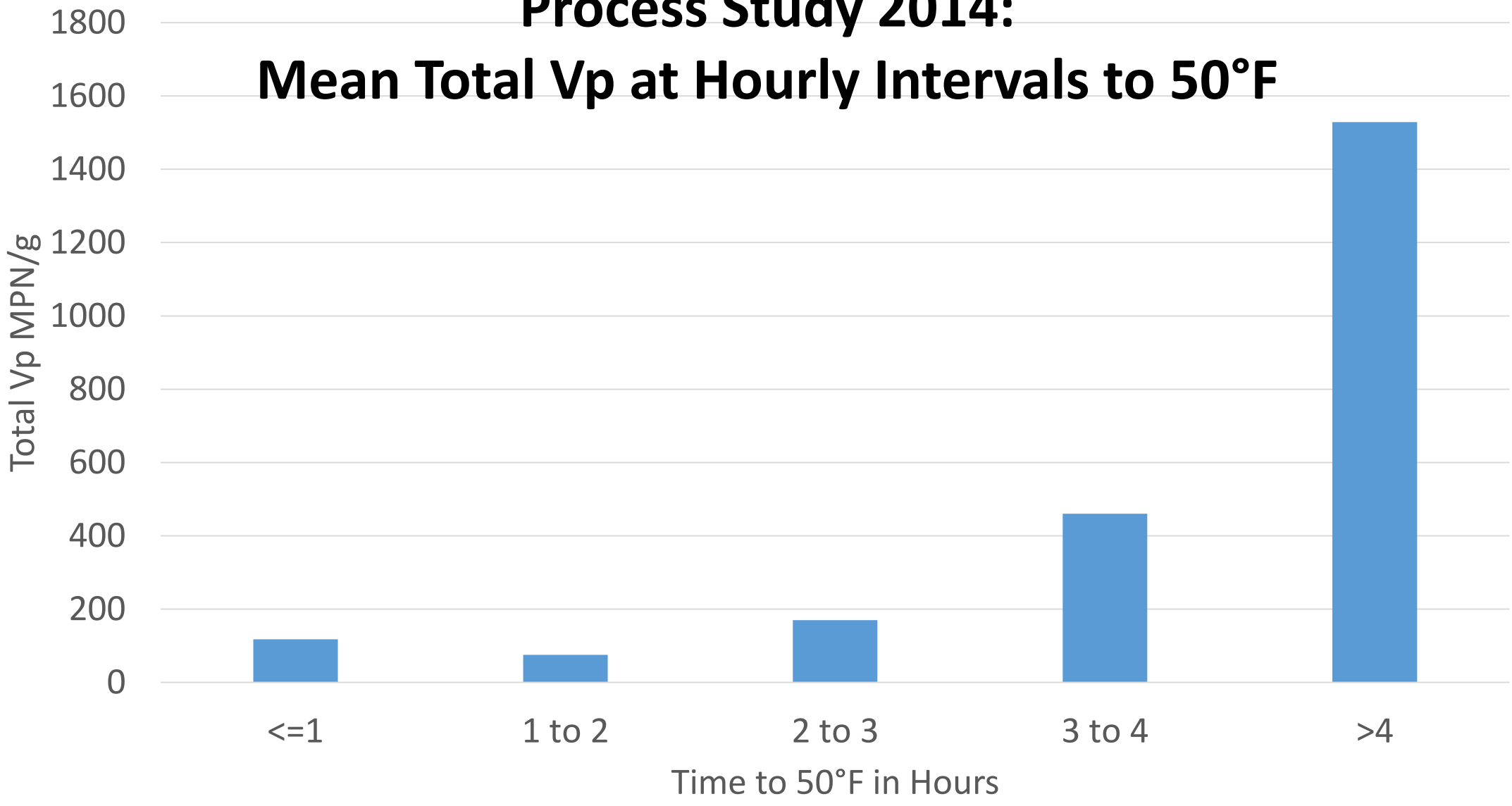

Average Total *Vibrio parahaemolyticus* (MPN/g)
2012 through 2014 by Month
2000
1800
1600
1400
1200
1000
800
600
400
200
0
July
August
September
September
July
August
September
2012
2013
2014
Total Average Total Vp MPN/g


Average of Pathogenic Indicators tdh and trh (MPN/g)
2012 through 2014 by Month
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
July
August
September
September
July
August
September
2012
2013
2014
Average of tdhMPNg
Average of trhMPNg

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

Process Study 2014:
Mean Total Vp at Hourly Intervals to 50°F



Rapid Cooling:
Recommendations from the 1st Year

Ice Slurry: Is It Worth It?

Cost of ice per week:	$360
Oyster Sales per 5 day work week	
(250 bags per day @$45/bag):	$56,250

What is the cost of Closure (in sales only)?

Length of Closure during 2013:	6 weeks
Loss of Gross Sales during 6 week Closure:	-$337,500
Cost of ice for comparable 6 week period:	$2160

2014 Rapid Cooling VPCP

- Cooling times were similar between ice slurry or direct ice on loose oysters
- On-vessel cooling studies: times to 50°F internal temp varied between 6 minutes to 30+ minutes
- It is more difficult to reach the 1 hour to 50°F limit using only on-vessel mechanical refrigeration
- Once oyster have been rapidly cooled, need to hold on ice in insulated containers
- Once oysters are cooled, it does not take as much ice to keep them cold
- Don’t forget shading is still a requirement of CT VPCP!

Ice Slurry versus Direct Ice

- If using direct ice, need to ice loose oysters prior to bagging…bagged oysters will not cool as rapidly due to insulation of oysters
- Use of direct ice requires ensuring all oysters have surface contact with ice
- Ice slurry is more effective when oysters are loosely bagged
- Ice slurry is better choice if you are bagging prior to cooling
- Harvesters who tried both methods have switched to the ice slurry
- Time to 50°F varies greatly, need to monitor internal temps throughout the day each harvest day to ensure that 50°F limit is reached within 1 hour from the time of harvest
- Check ice to water ratio throughout the harvest day to ensure adequate cooling

Taking Accurate Internal Temperatures:

- Use a calibrated probe thermometer
- Infrared thermometers were found to vary greatly from the actual internal temperature as taken with a probe thermometer
- Wet oysters coming out of the slurry were reading 10°F higher with infrared than with the probe thermometer
- Inaccurate temperatures can result in oyster mortality or failure to meet cooling requirements
- Shuck oyster only enough to insert tip of probe into meat of shellfish
- Don’t let probe touch shell
- Minimize direct hand contact to avoid warming oyster
- Oyster temps will rise rapidly once removed from slurry

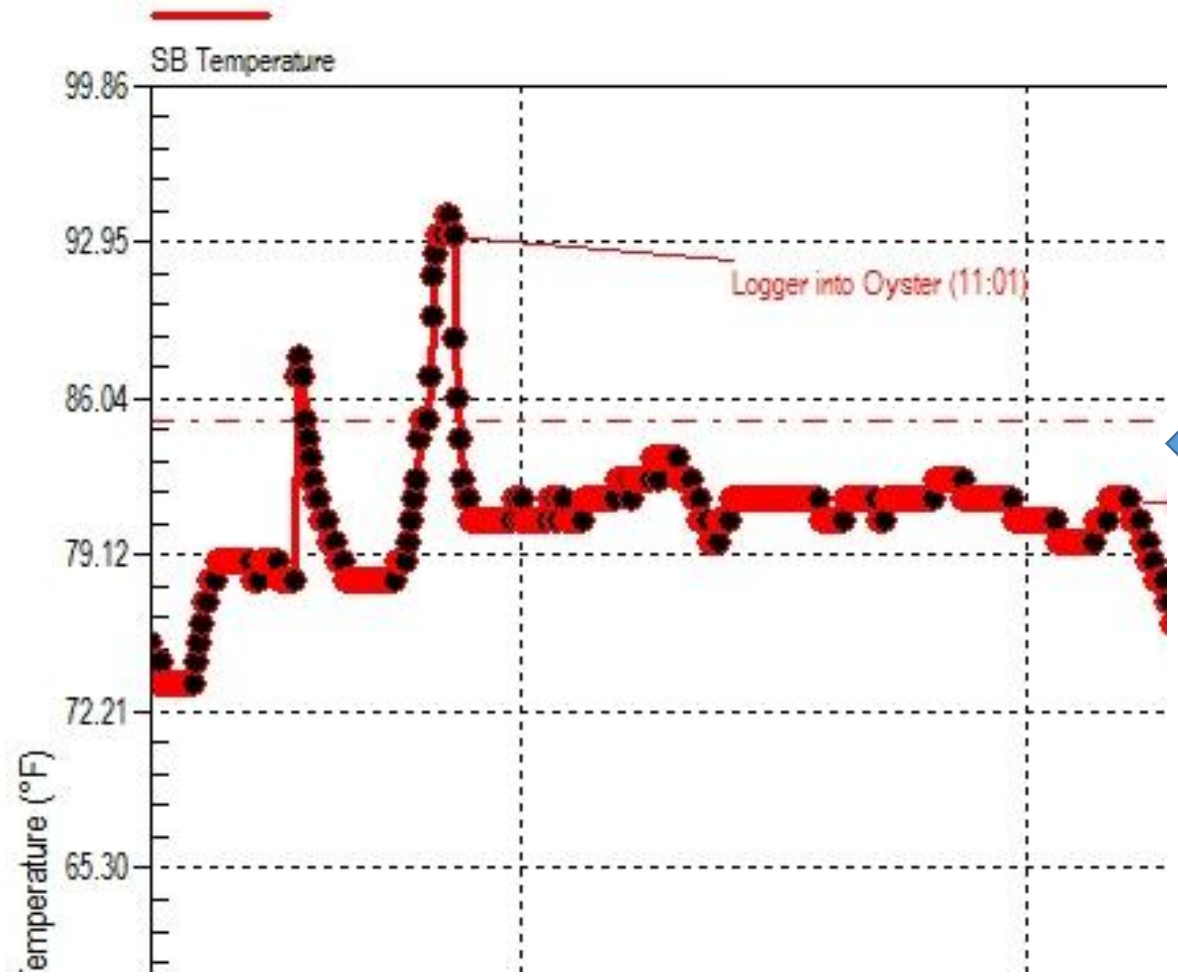
Cooling Profiles: Ice Slurry

Cooling Studies: Direct Ice

Oyster into ice at 3:50

To 50°F at 3:57

Cooling Profiles: 5 Hours on Deck

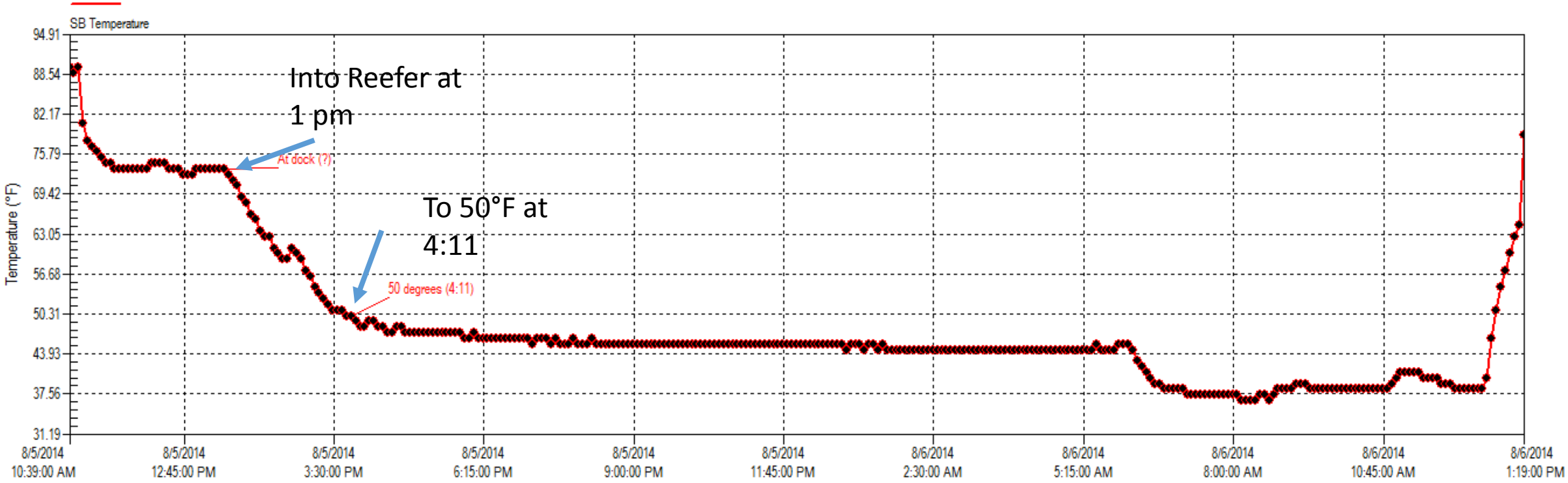


Internal temps of oysters on deck between 80 and 84°F equates to 1.5 hour doubling times!

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

Cooling Profile: Refrigerated Truck



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- CT Industry Partners and Captains: Norm Bloom & Son, Hillard Bloom Shellfish, Doug Stabell, Hemlock Oyster, H & H Shellfish, Charles Island Shellfish, Sam's Seafood, Pramer Oyster
- FDA Partners: Andy DePaola, Jessica Jones, John Bowers, Amy Fitzpatrick, Don Ullstrom
- Anna Newton, CDC
- Academic Partners: UCONN Mike Whitney and Evan Ward, CT Sea Grant's Tessa Getchis, Nancy Balcom, Anoushka Concepcion, Sylvain De Guise
- CT DPH Partners: Quyen Phan, Meghan Maloney, Tracey Weeks, Christine Applewhite, Rhonda Wisniewski, Laurn Mank, Diane Aye, Diane Barden
- Commissioner Reviczky and Department of Agriculture Staff