Vibrio parahaemolyticus (Vp) Illness in Massachusetts and Impact on the Cape and Island's Shellfish Industry

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Shellfish Aquaculture 2015 Report

22 acre increase in leased area
$3.5M increase in value

Table 11. 2015 Private Shellfish Propagation Permits and Acreage Under Cultivation, by Municipality

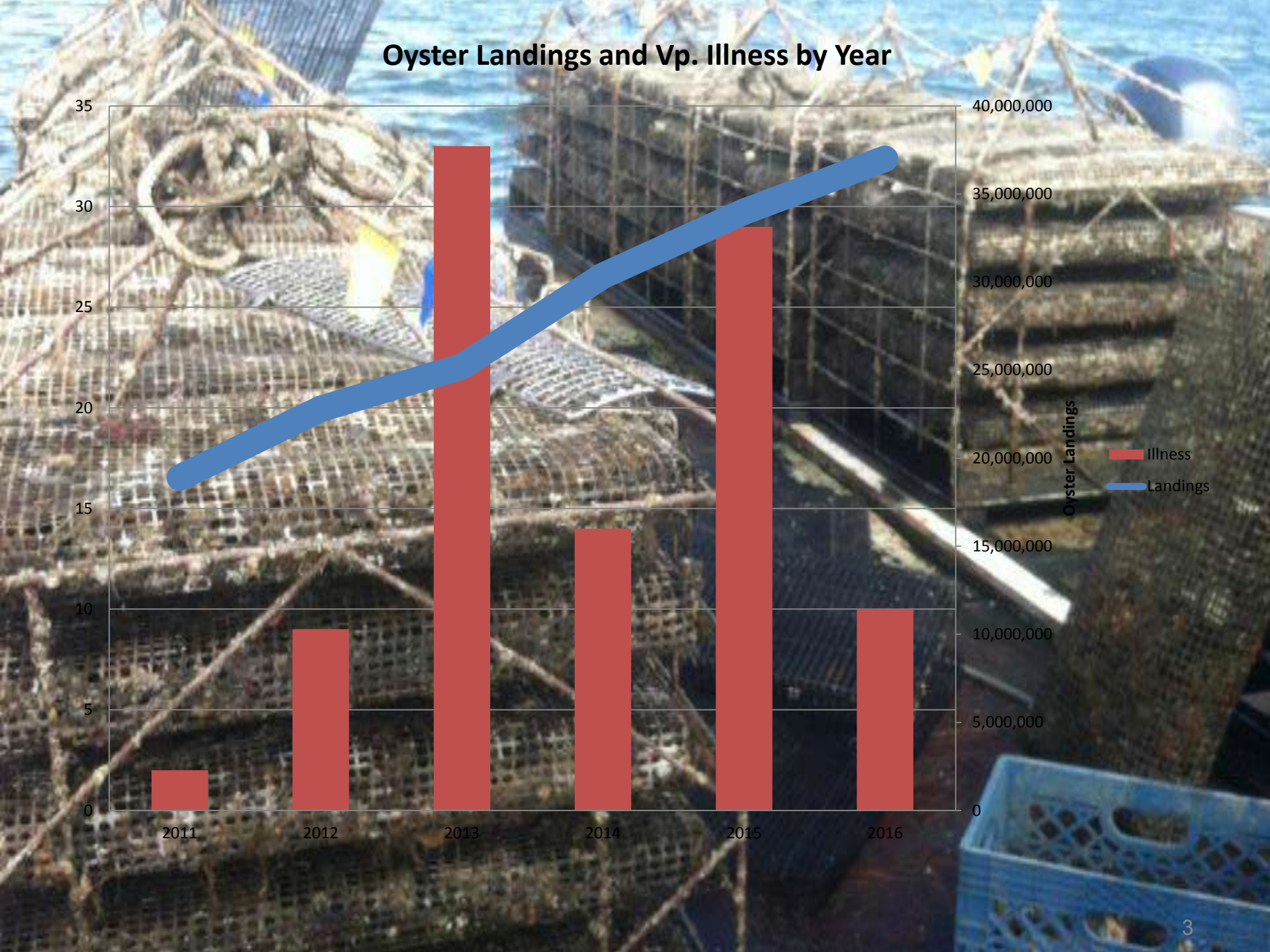
Municipality	# Growers	Total Acres	Species Grown
Aquinnah	1	2.6	Quahog
Barnstable	49	138.76	Oyster, Quahog, Soft Shell Clam
Bourne	2	2.9	Oyster
Brewster	9	8.5	Oyster, Quahog
Chatham	2	8	Oyster, Quahog, Soft Shell Clam, Razor
Chilmark	7	23.06	Oyster, Blue Mussel
Dartmouth	1	0.5	Oyster
Dennis	28	30	Oyster, Quahog, Soft Shell Clam
Duxbury	29	70.66	Oyster, Quahog
Eastham	20	19.47	Oyster, Quahog, Soft Shell Clam, Mussel
Edgartown	12	15.5	Oyster
Fairhaven	2	36	Oyster, Quahog, Bay Scallop
Falmouth	9	40.1	Oyster, Mussel
Gosnold	1	32	Oyster
Ipswich	2	2	SS Clam
Kingston	3	8.5	Oyster
Marion	3	1.5	Oyster
Mashpee	4	13.9	Oyster, Quahog, Soft Shell Clam
Mattapoisett	2	104.9	Oyster, Bay Scallop
Nantucket	8	71	Oyster, Quahog, SS Clam
Oak Bluffs	1	2	Oyster
Orleans	14	23.28	Oyster, Quahog, Mussel, Surf Clam
Plymouth	8	35.37	Oyster, Quahog, Soft Shell Clam
Provincetown	8	14	Oyster, Quahog, Mussel, Surf Clam
Rowley	12	18.5	Oyster, Soft Shell Clam, Razor Clam
Truro	8	19	Oyster
Wareham	7	86.18	Oyster, Quahog
Wellfleet	71	259.1	Oyster, Quahog, Soft Shell Clam, Mussel, Razor Clam
Westport	5	25	Oyster, Quahog
Yarmouth	3	16.5	Oyster, Quahog
Grand Total	**331**	**1,128.78**	

Table 12. 2015 Aquaculture Landings and Value

American Oyster		
Town or Region	Pieces	Reported Value
Duxbury	9,571,229	$5,479,278
Barnstable	7,559,181	$4,492,595
Wellfleet	6,689,444	$3,763,302
Edgartown	2,624,124	$1,602,975
Wareham	1,776,855	$1,031,783
Orleans	1,240,896	$723,483
Dennis	1,220,628	$710,548
Buzzards Bay	1,202,551	$645,698
Falmouth	958,802	$550,585
Brewster	904,650	$534,958
Nantucket & Vineyard Sounds	903,992	$576,502
Plymouth	719,481	$390,095
Eastham	497,079	$275,526
Kingston	319,100	$179,805
Nantucket	283,126	$200,519
Yarmouth	205,778	$112,420
Mashpee	147,471	$84,303
Provincetown/Truro	97,605	$57,288
Marion	69,600	$38,299
Nantucket	17,600	$15,785
Total	**37,009,191**	**$21,465,746**

Quahog		
Town or Region	Pieces	Reported Value
Wellfleet	5,931,686	$1,300,735
Barnstable	389,535	$82,674
Pleasant Bay	135,470	$34,328
Other	54,830	$12,753
Total	**6,511,520**	**$1,430,490**

All Other Aquaculture Species (Soft Shell Clam, Blue Mussel, Bay Scallop)	$198,200
Total Aquaculture Landings Value	**$23,094,437**


Oyster Landings and Vp. Illness by Year
35
30
25
20
15
10
5
0
40,000,000
35,000,000
30,000,000
25,000,000
20,000,000
15,000,000
10,000,000
5,000,000
0
Oyster Landings
Illness
Landings
2011
2012
2013
2014
2015
2016

V. Parahaemolyticus (Vp.)

-Naturally inhabits coastal waters

-Halophilic

-Present in higher concentrations during summer

-One of the fastest growth rates of all known bacteria

-Pathogenic strains small percentage of the total *Vp.*

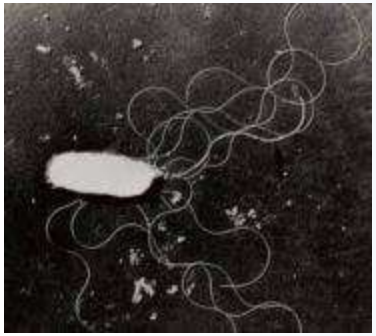
-When ingested Vp. can cause GI distress

-Infective dose not known

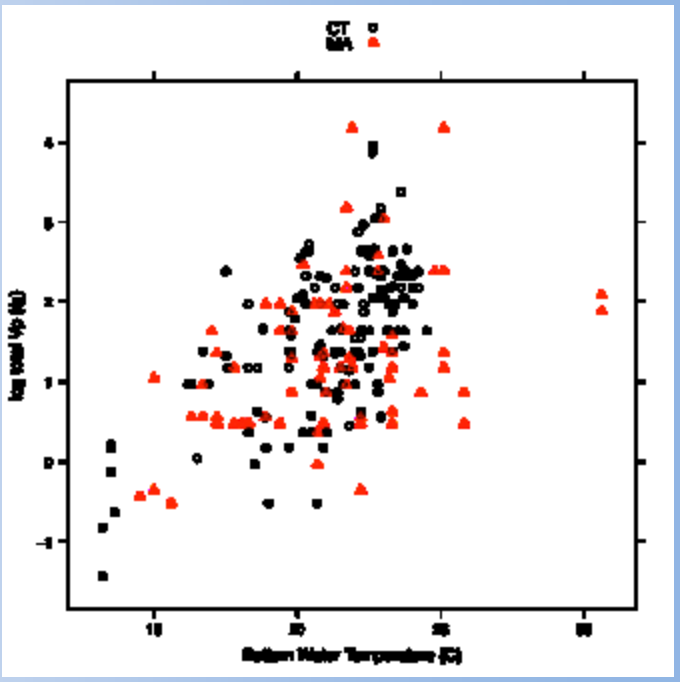
-Onset -24-72hrs

Oyster Temp (° F)	Growth Rate (logs/hr)	Doubling Time (hours)
50	0.008	35.8
70	0.100	3.01
90	0.292	1.03
100	0.426	0.71

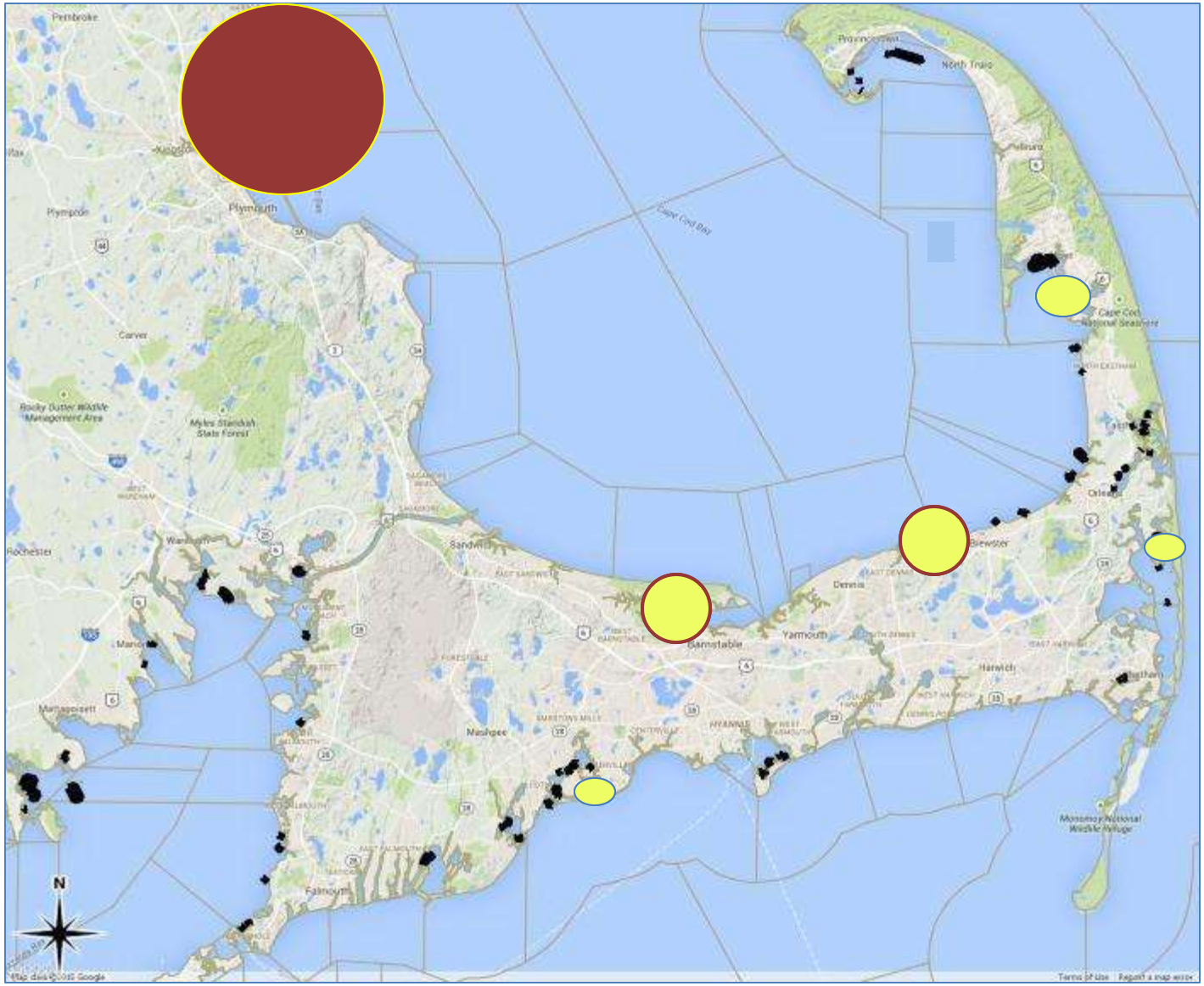
USFDA

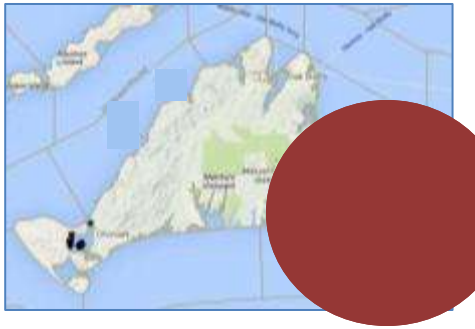


Kozo Makino *et al*.



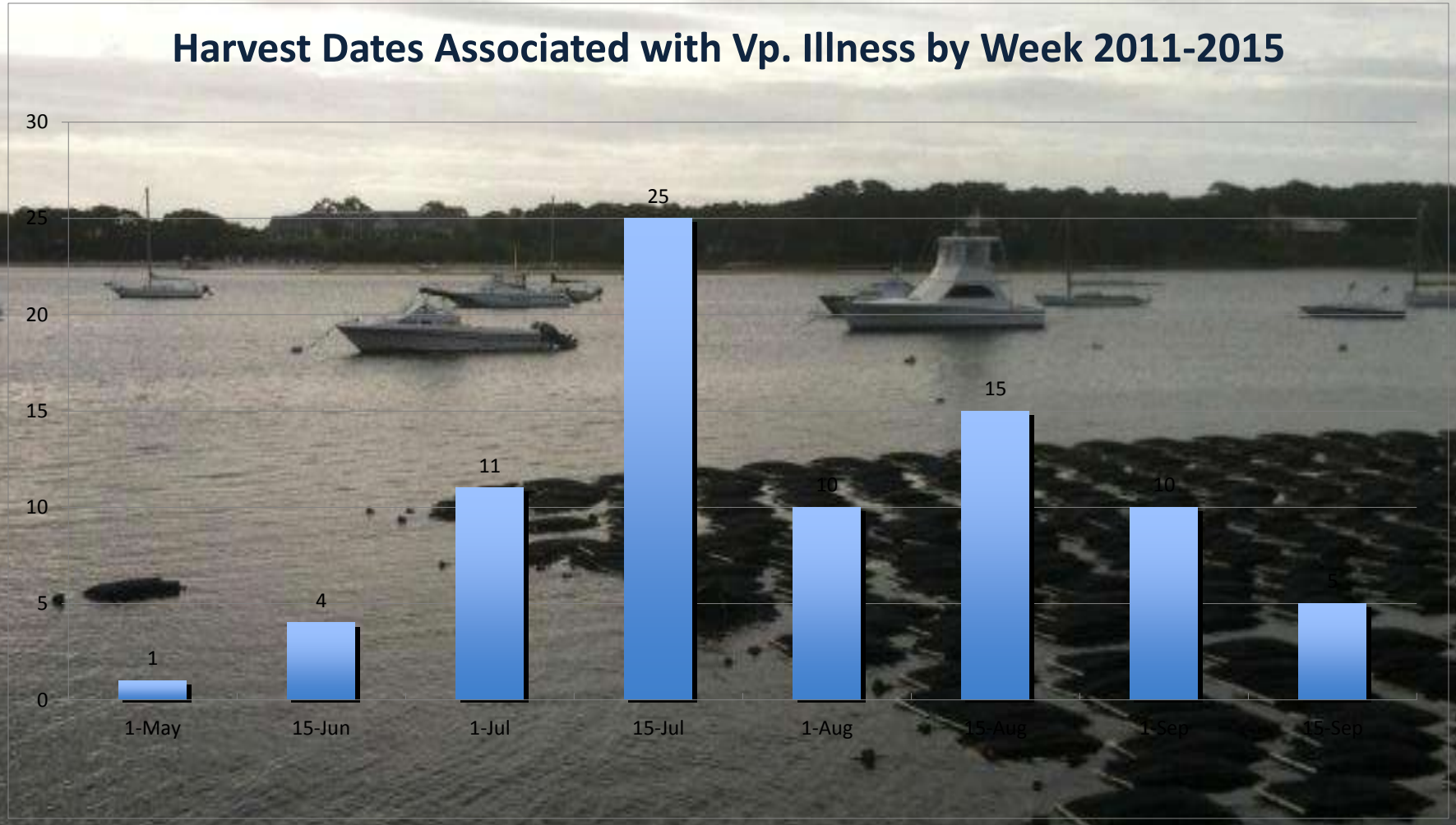
Primary Massachusetts Oyster Harvest Areas implicated in Vp. Illness





"Sporadic"

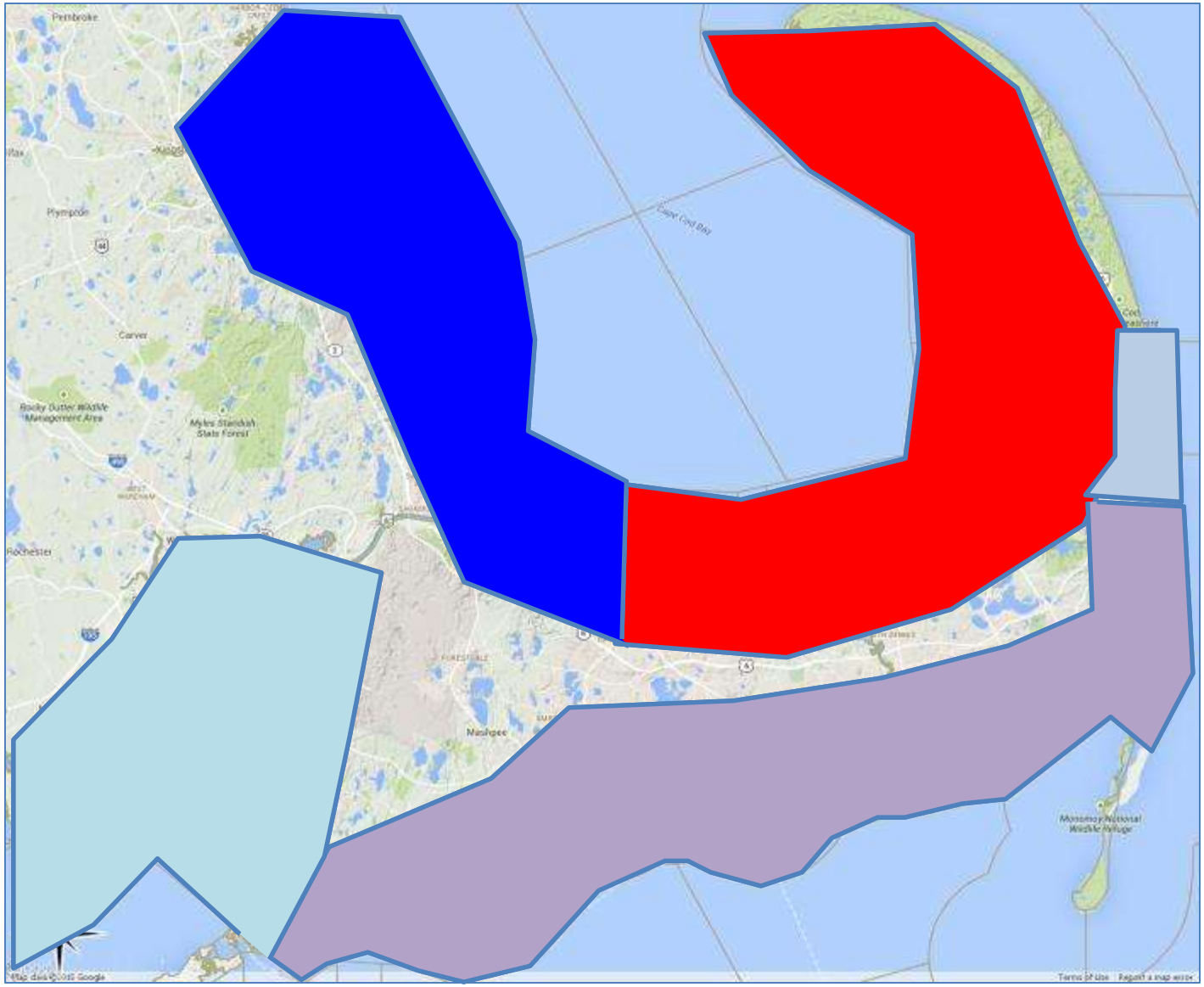
"Outbreak"


Harvest Dates Associated with Vp. Illness by Week 2011-2015
30
25
20
15
10
5
0
1
4
11
25
10
15
10
5
1-May
15-Jun
1-Jul
15-Jul
1-Aug
15-Aug
1-Sep
15-Sep

Why is Vp. an Issue in Massachusetts Now?

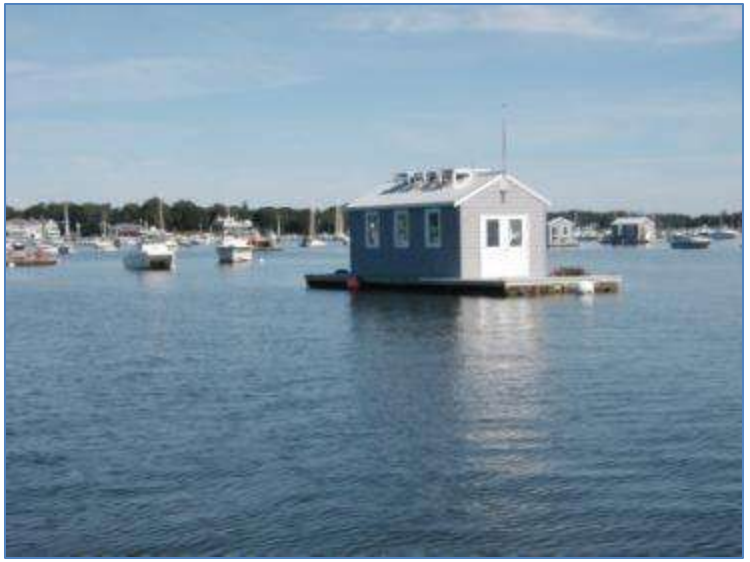
- Increased oyster production?
- Increased oyster consumption during high risk periods?
- Increased air and water temperatures?
- Increased surveillance and mandatory reporting?
- Introduction of cold water tolerant and more virulent O4:K12 strain type?

Primary Massachusetts Oyster Harvest Areas



Intertidal Oyster Harvest

Sub-tidal Oyster Harvest



Shellfish Management Structure

ISSC

-Governing body that sets standards for shellfish in commerce

-Sets criteria that determines if a member state is required to enact a Vp. Control Plan.

- Outlines minimum Vp. controls required by member states

- Sets criteria for the response to outbreaks of shellfish-related illnesses

- Requires changes if plan is found to be ineffective

Massachusetts

-ISSC member state

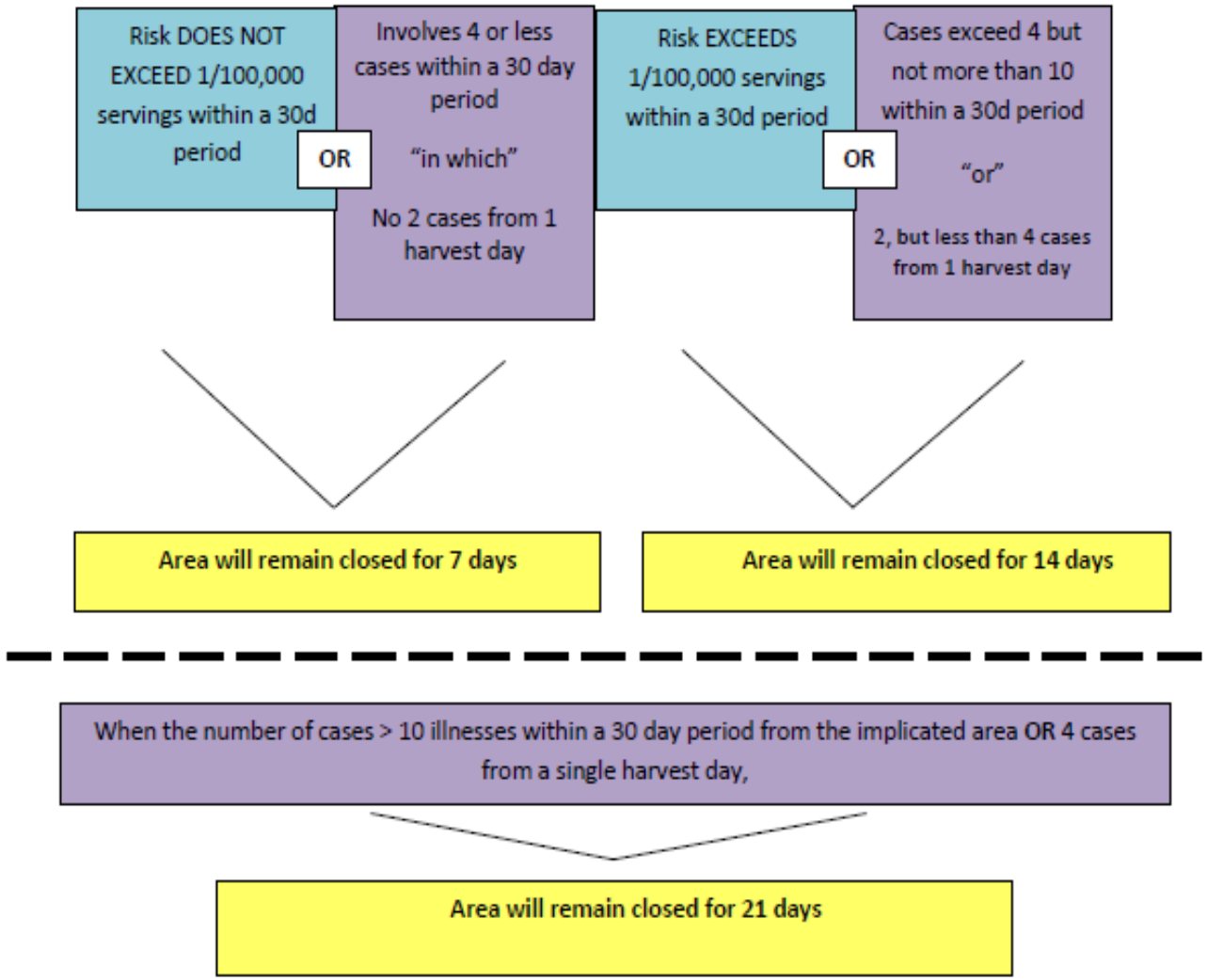
-MA DPH and MA DMF Joint State Shellfish Control Authorities

FDA

- Evaluates State compliance w/ NSSP guidelines and federal regulations

- Reviews State Vp. control plans and ability to enforce plan

ISSC Vp. Illness- Response Guidance

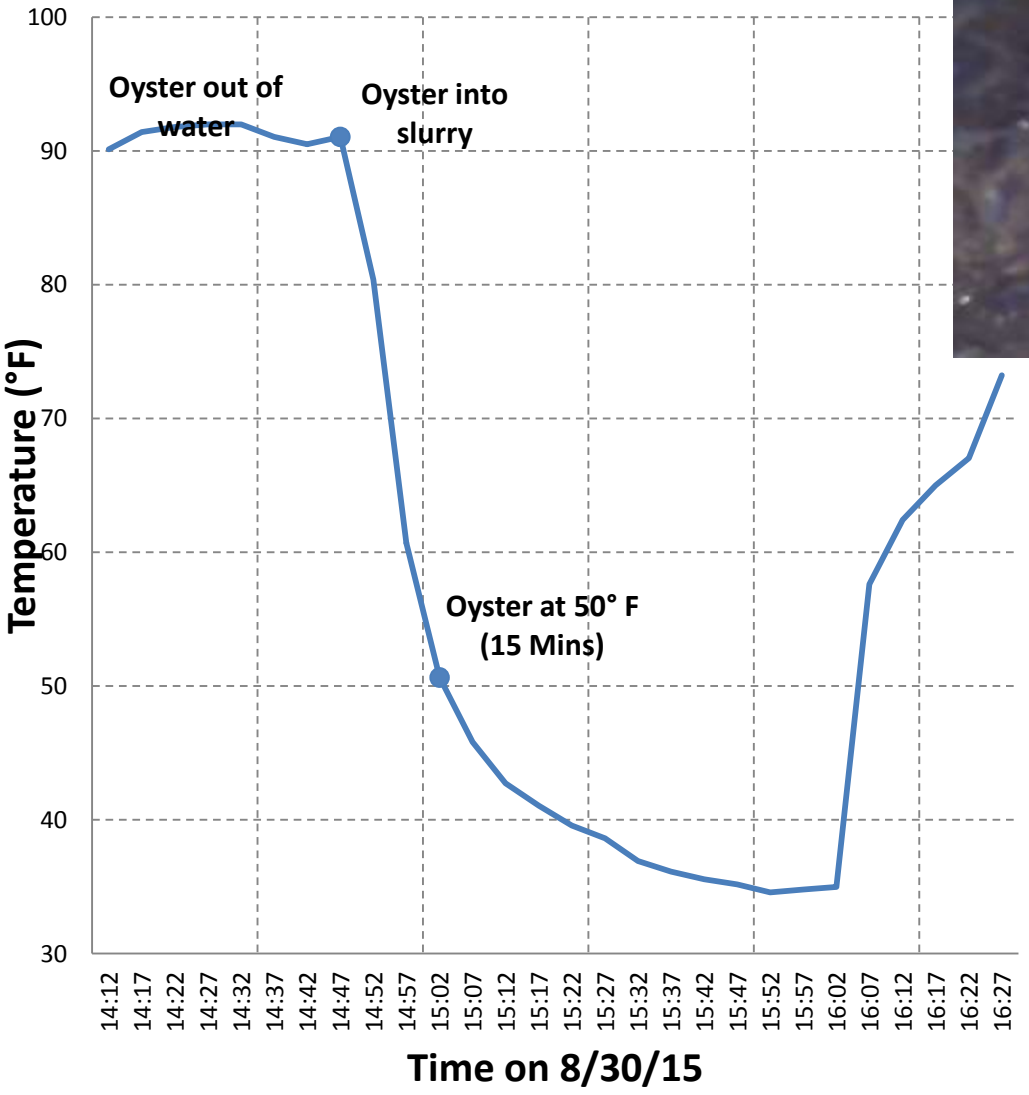


MA Plan- Shading

Oyster Temp (° F)	Growth Rate (logs/hr)	Doubling Time (hours)
50	0.008	35.8
70	0.100	3.01
90	0.292	1.03
100	0.426	0.71

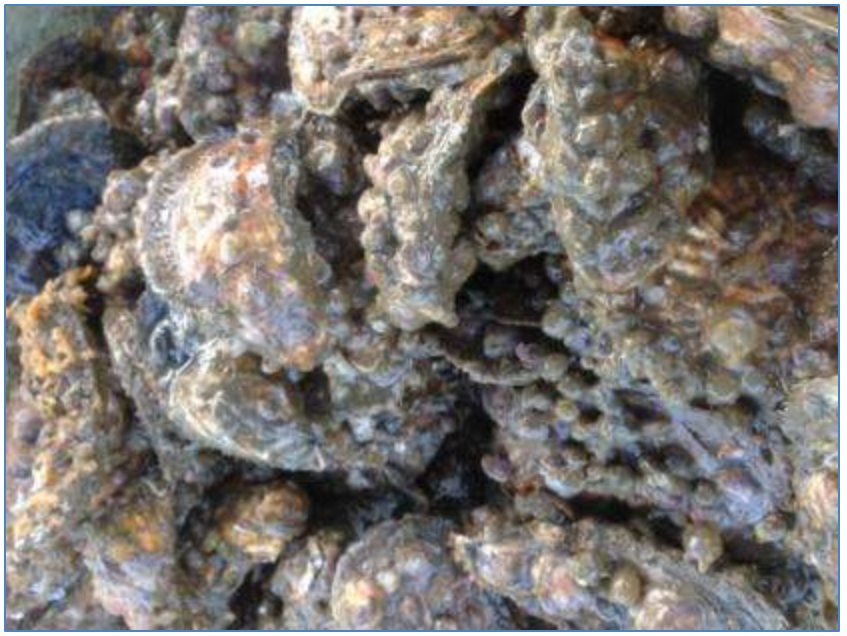
MA Plan- Rapid Cooling (Icing)

Ice Slurry Cooling Time



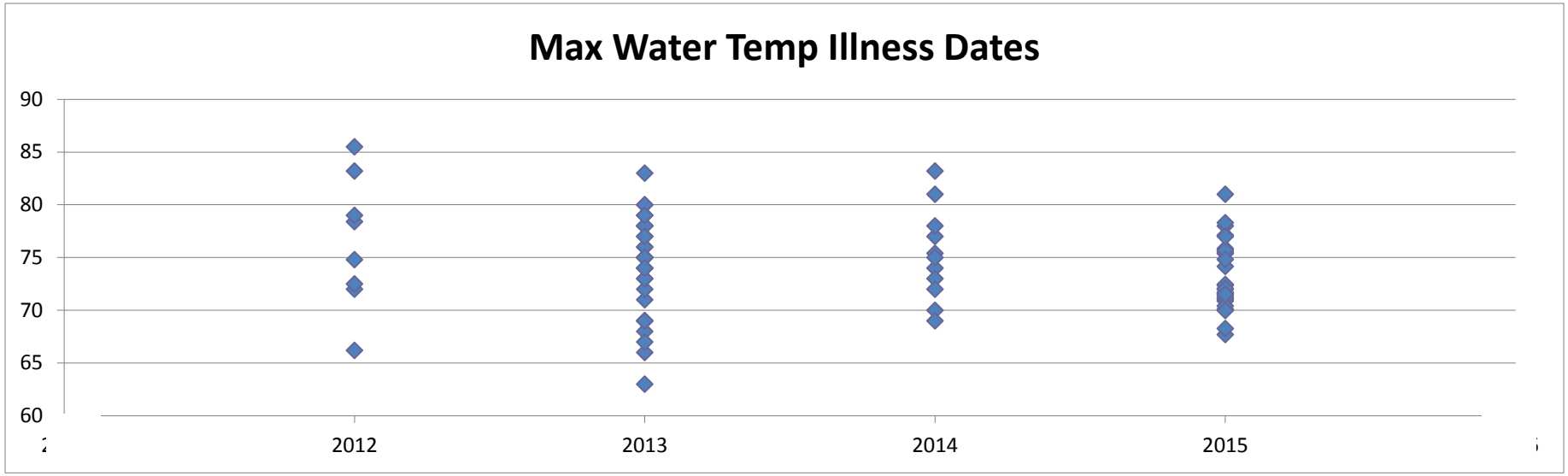
Direct Ice Cooling Time

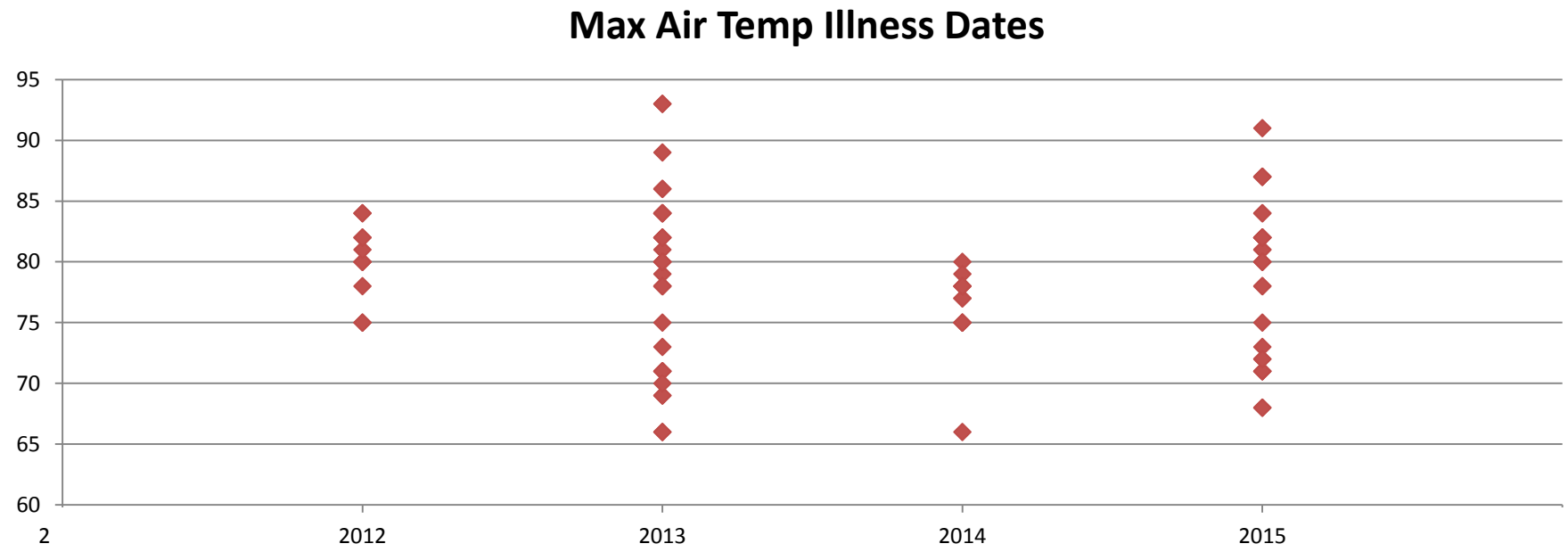
MA Plan- Culling, Sorting, Air Drying and Re-submergence



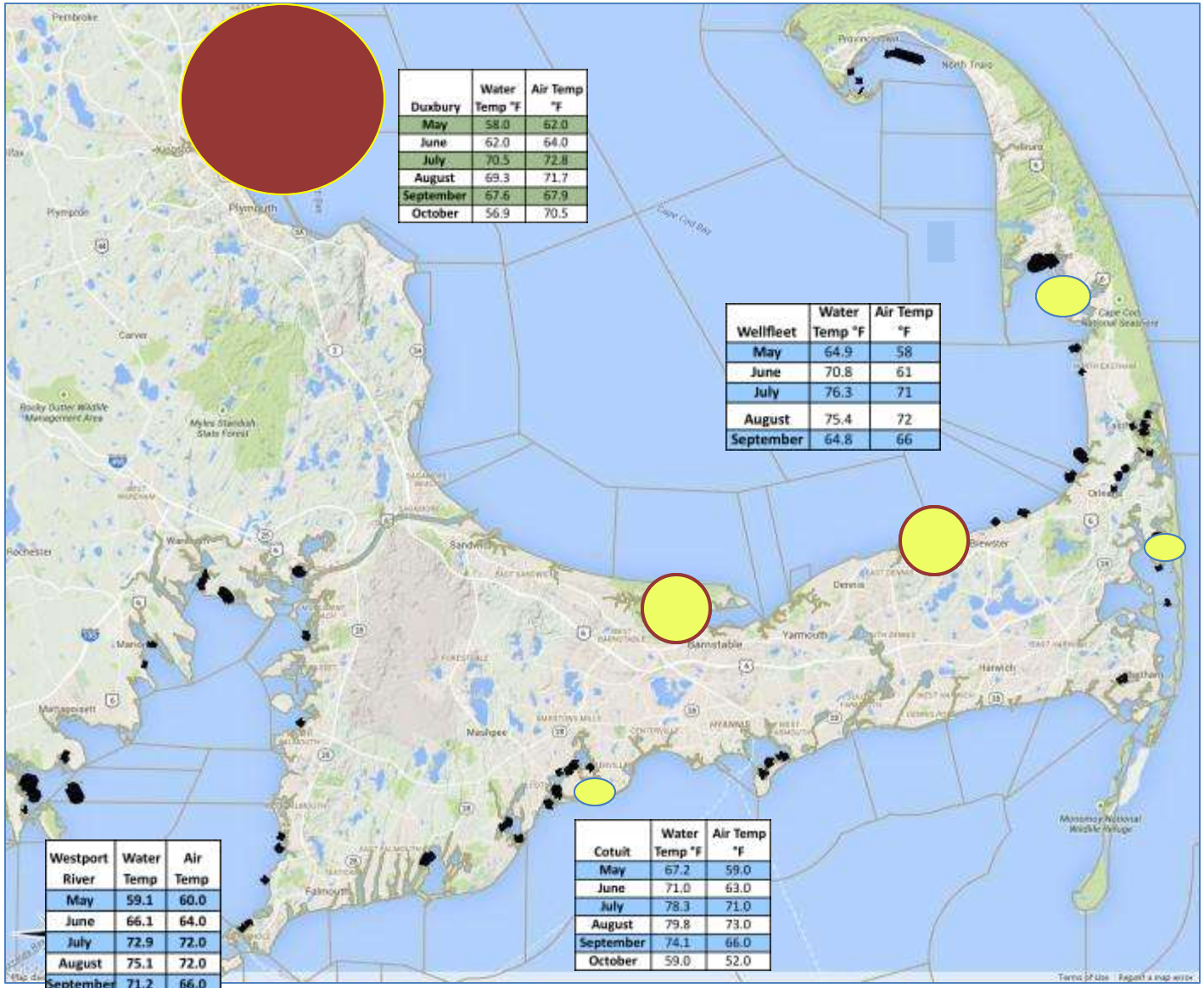
VIBRIO GROWTH AND RISK OF ILLNESS
In these circumstances, harvesters are required
to re-submerge oysters prior to harvest

OYSTER PROCESSING AND RE-SUBMERGENCE
If more than 2 hours from time of exposure, oysters must
be re-submerged for a minimum of 14 days prior to harvest


Max Water Temp Illness Dates
90
85
80
75
70
65
60
2012
2013
2014
2015


Max Air Temp Illness Dates
95
90
85
80
75
70
65
60
2
2012
2013
2014
2015

Primary Massachusetts Oyster Harvest Areas implicated in Vp. Illness



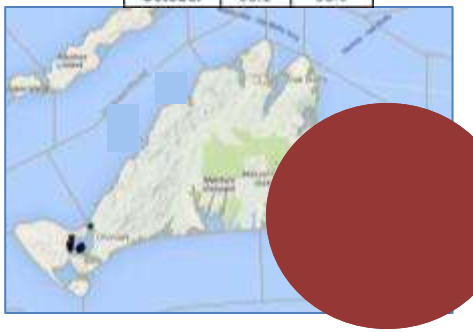
Duxbury	Water Temp °F	Air Temp °F
May	58.0	62.0
June	62.0	64.0
July	70.5	72.8
August	69.3	71.7
September	67.6	67.9
October	56.9	70.5

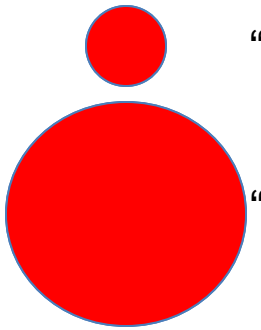
Wellfleet	Water Temp °F	Air Temp °F
May	64.9	58
June	70.8	61
July	76.3	71
August	75.4	72
September	64.8	66

Westport River	Water Temp	Air Temp
May	59.1	60.0
June	66.1	64.0
July	72.9	72.0
August	75.1	72.0
September	71.2	66.0
October	60.3	52.0

Cotuit	Water Temp °F	Air Temp °F
May	67.2	59.0
June	71.0	63.0
July	78.3	71.0
August	79.8	73.0
September	74.1	66.0
October	59.0	52.0

Katama	Water Temp °F	Air Temp °F
May	54.7	57.0
June	63.6	62.0
July	76.6	73.4
August	78.1	74.4
September	72.7	70.1
October	60.1	58.6

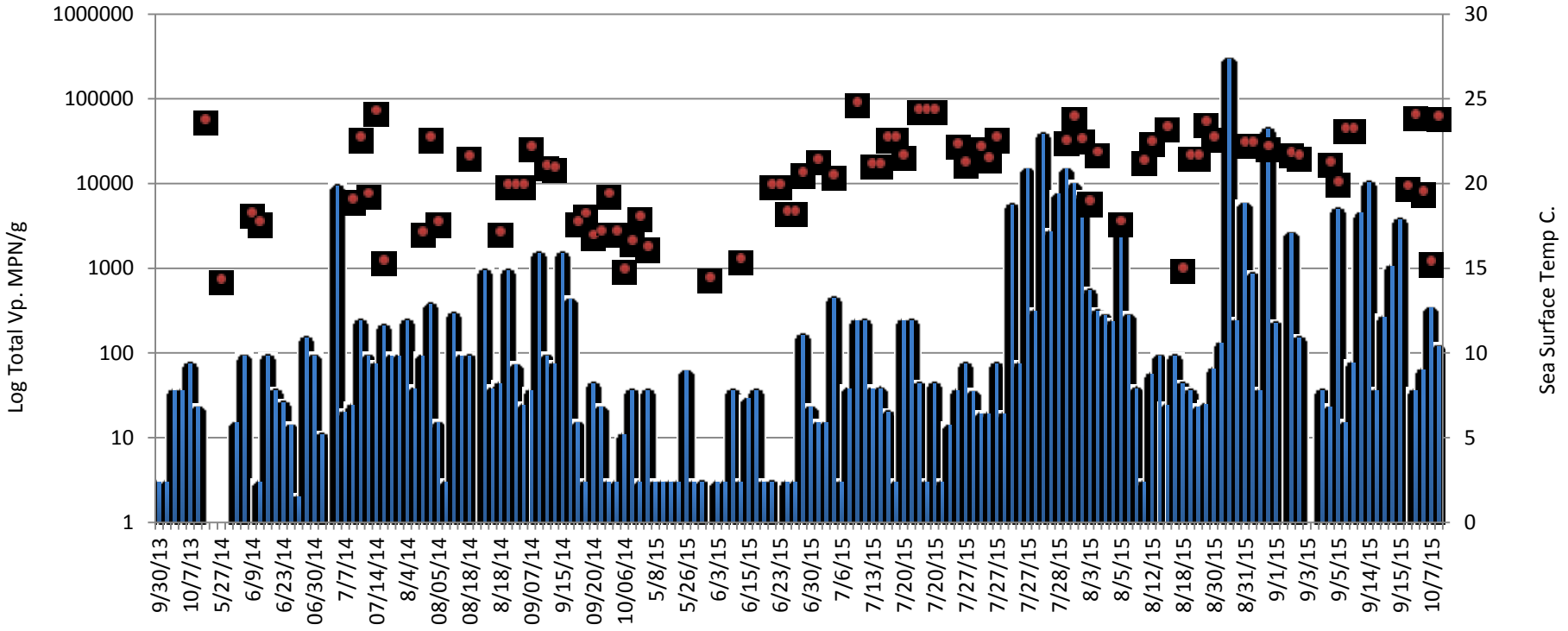




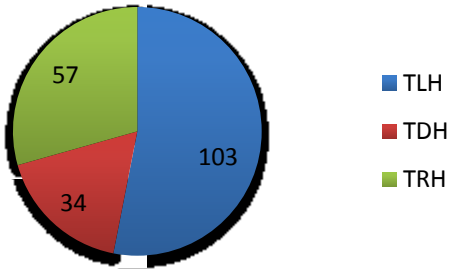
"Sporadic"

"Outbreak"

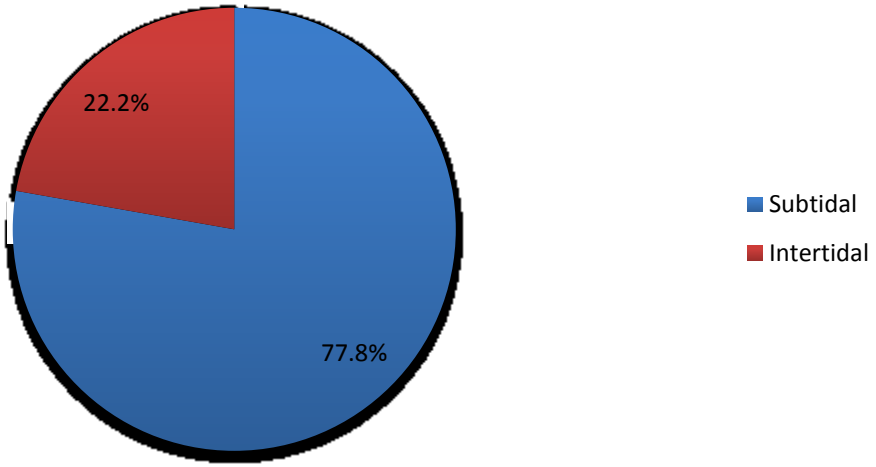
Total Vp and Water Temperature



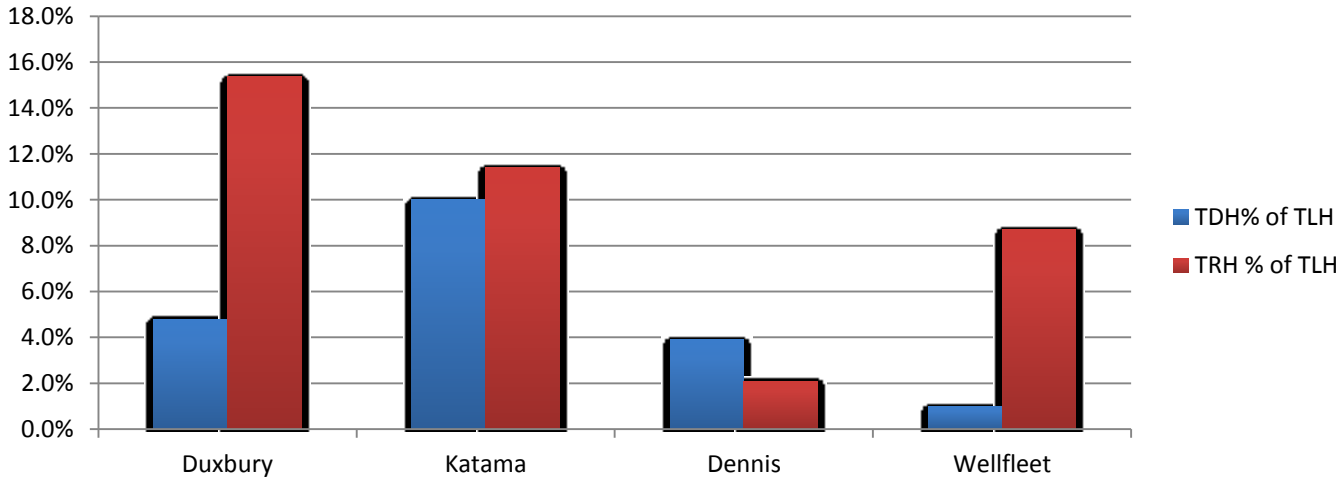
2015 MA Environmental Samples Gene Occurrence n=138



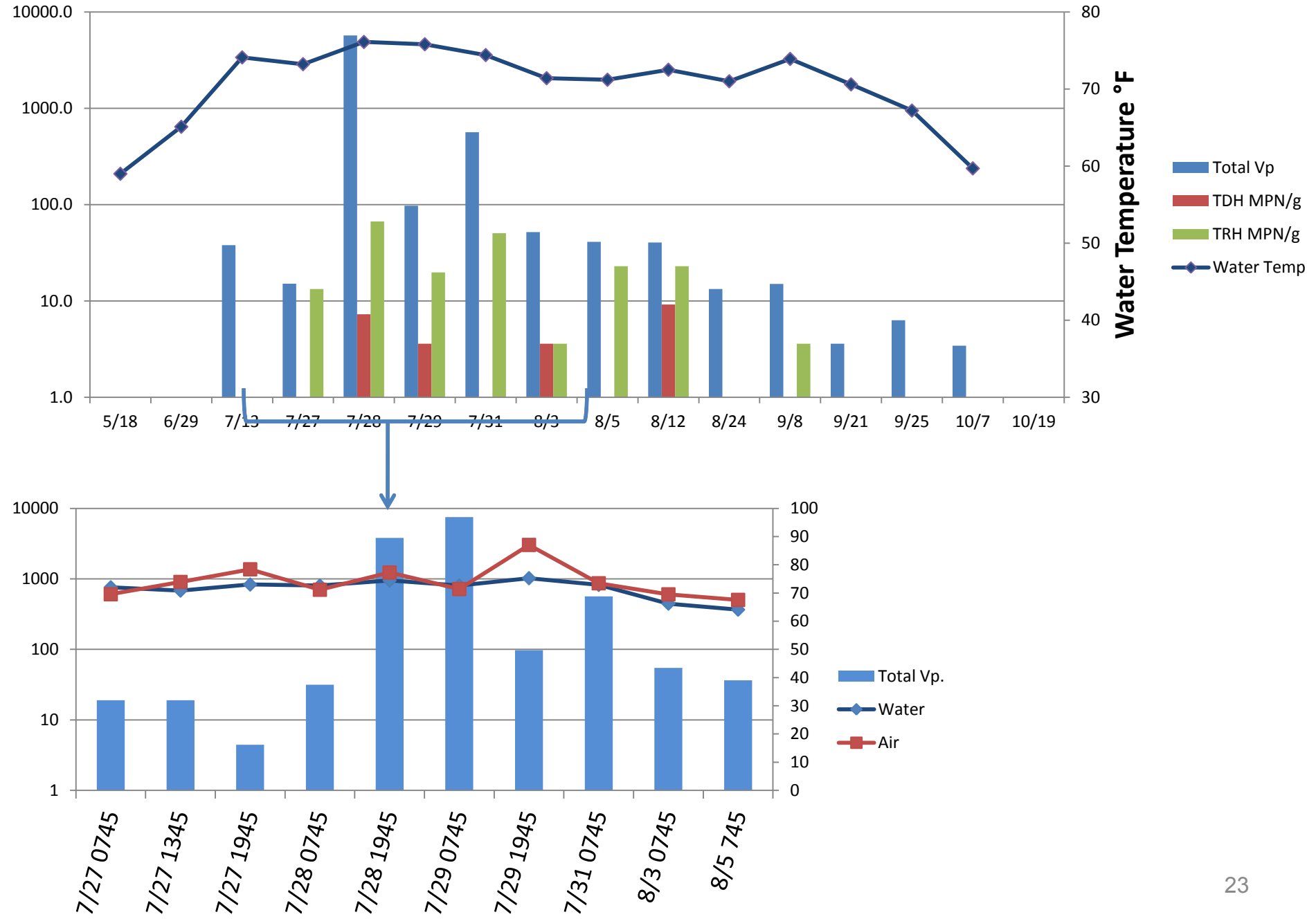
Illness Harvest Area Percent Intertidal vs Subtidal*



trh and tdh relative tlh by area



Duxbury Bay


10000.0
1000.0
100.0
10.0
1.0
80
70
60
50
40
30
Water Temperature °F
5/18
6/29
7/13
7/27
7/28
7/29
7/31
8/3
8/5
8/12
8/24
9/8
9/21
9/25
10/7
10/19
Total Vp
TDH MPN/g
TRH MPN/g
Water Temp
10000
1000
100
10
1
100
90
80
70
60
50
40
30
20
10
0
Total Vp.
Water
Air
7/27 0745
7/27 1345
7/27 1945
7/28 0745
7/28 1945
7/29 0745
7/29 1945
7/31 0745
8/3 0745
8/5 745

Primary Vp. Strain Types Implicated in MA Illnesses

~70%- 04:K12

~90%- 04:K12

~25% 04:K12

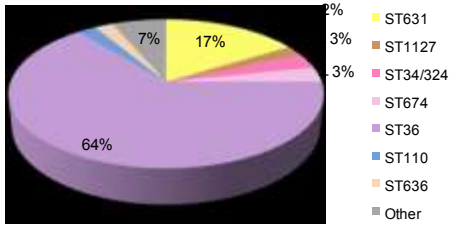
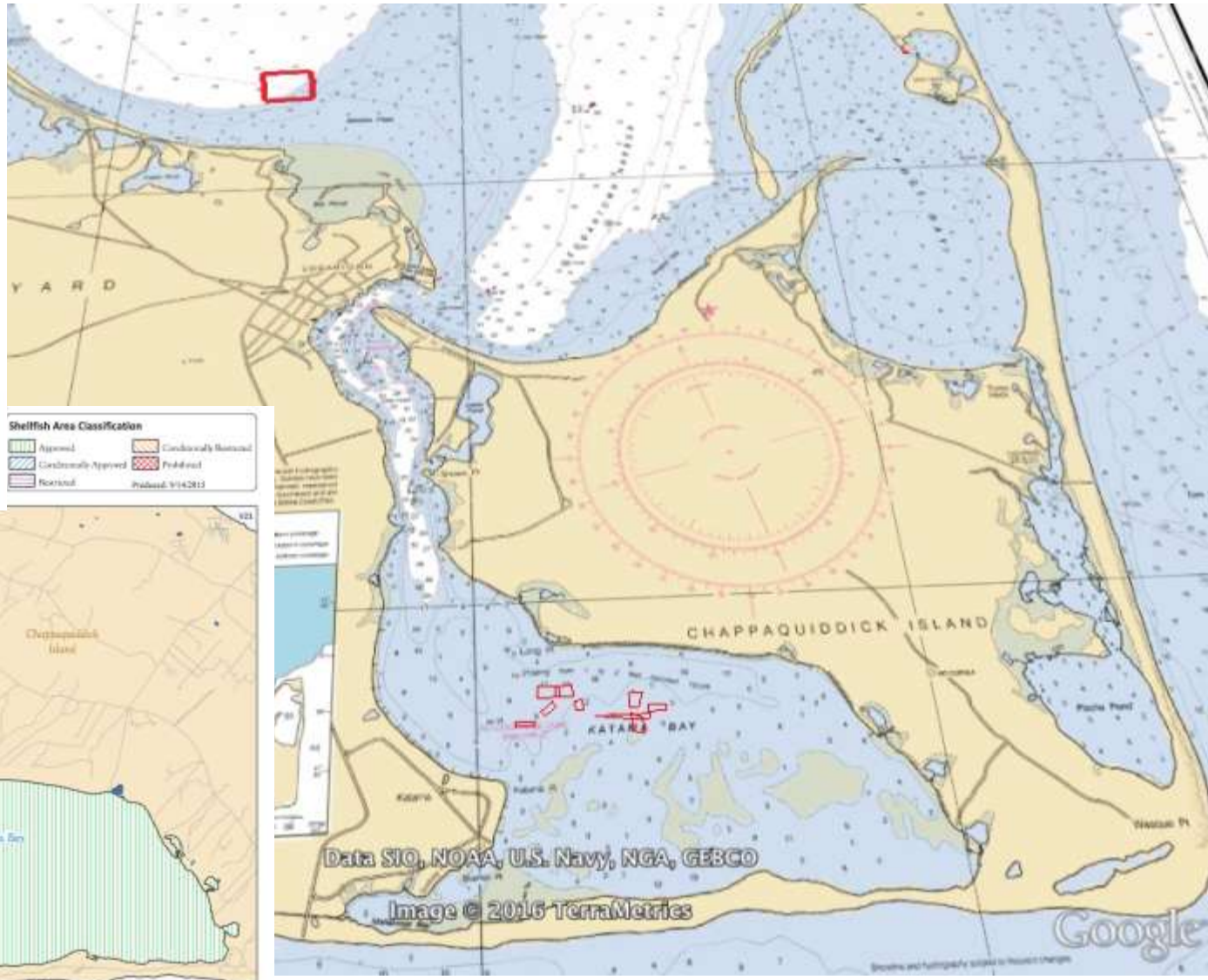


Figure chart showing percent each Strain type has been impicated in a Vp. case Xu et al, 2015

"Sporadic"

"Outbreak"

Summer Pasture



Thank You

Massachusetts Oyster Industry

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