East Hampton Town
Shellfish Hatchery

The 2015 Crew, left to right: Kate, Pete, Carissa, Shelby, and Barley

2015 Annual Report
and
2016 Operating Plan

Prepared by Kate Rossi-Snook
Edited by Barley Dunne

East Hampton Town Shellfish Hatchery

The skiff loaded for seeding in Lake Montauk

Annual Report of Operations

Mission Statement

With a hatchery on Fort Pond Bay, a nursery on Three Mile Harbor, and a floating raft field growout system in Napeague Harbor, the East Hampton Town Shellfish Hatchery produces large quantities of oyster (*Crassostrea virginica*), clam (*Mercenaria mercenaria*), and bay scallop (*Argopecten irradians*) seed to enhance valuable shellfish stocks in local waterways. Shellfish are available for harvest by all permitted town residents.

Cooperative research and experimentation concerning shellfish culture, the subsequent success of seed in the wild, and the status of the resource is undertaken and reported upon regularly, often funded and validated by scientific research grants. Educational opportunities afforded by the work include school group and open house tours and educational displays at community functions.

Annual reporting includes production statistics and values, seed dissemination information, results of research initiatives, a summary of outreach efforts, the status of current and developing infrastructure, and a plan for the following year's operations.

2015

Full-time Staff
John "Barley" Dunne – Director
Kate Rossi-Snook – Hatchery Manager
Pete Topping – Algae Culturist

Part-time and Contractual
Carissa Maurin – Environmental Aide
Shelby Joyce – Environmental Aide (summer)
Adam Younes – Environmental Aide (fall)
Jeremy Gould – Maintenance Mechanic

Volunteers
Romy Macari
Christopher Fox-Strauss

Carissa and Pete unloading OysterGros

Special Thanks to:

Barnaby Friedman for producing our annual seeding maps.

The East Hampton Town Board and East Hampton Trustees for their continued support.

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2015 Season Summary

Due to weather and harmful ubiquitous bacteria, this year was wrought with a few challenges for our shellfish crop.

Oysters: In an effort to condense the Hatchery season, we delayed our first oyster spawn until March 3rd. We recorded slower growth rates and a slightly reduced set success from last year (48% from 52%). This may have been due to cooler water temps in the hatchery as a result of a malfunctioning heater. In all, we moved just under 7 million oysters from the hatchery to upwelling at the nursery, and nearly 5 million to field growout.

Around early – mid July we noticed relatively slow growth in the oysters at the nursery. By August 6th we experienced a significant die-off of oysters at both the field and nursery. After checking old forgotten notes and conferring with some of our colleagues, Gregg Rivara, Dale Leavitt, and Rick Karney, we confirmed that Roseovarius Oyster Disease (ROD)/Juvenile Oyster Disease (JOD) was the cause. Telltale signs were apparent: reduced growth overall, die-off of many individuals under about 25mm, conchiolin layer in the shell, exaggerated cup shape to the left/bottom valve. We then moved field runts back to the nursery for increased water flow and quicker growth in an attempt to combat the disease. We also cancelled the impending sale (a first) of some of the oysters that were still at the nursery. After a week, we moved the oysters that continued to grow back to the field. Those that didn't grow were culled and discarded.

More than 3 million nursery and field culls, and 1.3 million seed oysters were disseminated. The total market value of our 2015 oyster production was $292,570.

In an effort to combat the recurrence of the disease during 2016 we will spawn some of the survivors from 2015. This should create a resistant strain and put us back on track toward robust and rewarding oyster culture.

Clams: After several consecutive years of no clam die-offs in the hatchery and numbers around 20 million per annum, we have decided to shift our efforts back to producing larger seed clams, more of a quality vs. quantity approach. For instance, compared to 2014, far fewer clams than usual were moved to the nursery upwelling system (11.5 million vs. 25.8 million), thus we were able to produce more seed-sized clams this year than last (2.3 million vs. 1.8 million). This number would have been even higher, were we not hit by a Nor'easter in early October during which we lost approximately 1.7 million clams and sustained significant damage to gear.

The total market value of distributed clams in 2015 was $199,233.

Scallops: Due to an extremely cold winter and prolonged ice conditions at the overwintering pond, the overwintered scallops sustained a significant die-off. Of the 267,000 stocked in Pond of Pines, only about 25,500 were retrieved and seeded. We suspect that the inlet to the pond may have frozen, eliminating or much reducing the tidal flushing and compromising the water quality.

On the other hand we had a very successful season with our 2015 spawned and reared scallops. After a few lackluster spawns, most likely due to the prolonged winter conditions which may have delayed their natural conditioning, we achieved some excellent spawns in mid-June. In all, we moved approximately 920,000 juvenile scallops to the downwelling system at the nursery, and 400,000 to field growout; our best numbers in five years.

In an attempt to mitigate a repeat of last winter's losses, we made some changes to our scallop overwintering regime. We seeded nearly three quarters of our crop (~290,000) in the fall among most of the Towns harbors (all except Three Mile and Napeague Harbor). The remaining, ~118,000, were overwintered in Pond of Pines and will be seeded to Three Mile and Napeague Harbors in the spring.

The total value of distributed scallops in 2015 was $23,766.

In all, over 39 million shellfish (valued at $507,537) were disseminated in 2015.

Staffing: Barley, Kate, and Pete continued as the full-time Hatchery team, and Jeremy Gould served another year as part-time seasonal Maintenance Mechanic. Carissa Maurin continued to fill the position of Environmental Aide for the full season, while Shelby Joyce returned for her fifth summer. In the fall we hired Adam Younes as an additional Environmental Aide.

Gear: Because the scallop overwintering blocks are considerably more labor intensive, we decided to try overwintering half of our scallops in lighter-stocked pearl nets, and half in the blocks. If growth and survival prove to be the same or better when we pull them in the spring, we will most likely switch to using all pearl nets for scallop overwintering.

The barge from Lazy Point this winter

2016 Operating Plan

Pete and Adam prepare to seed oysters

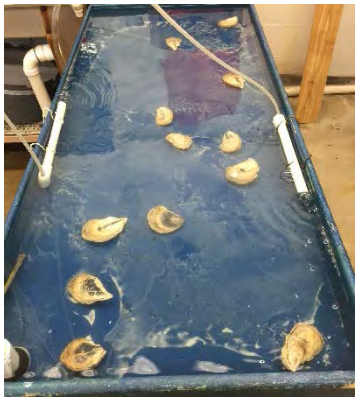
Target Species:	Eastern Oyster (*Crassostrea virginica*) Hard Clam (*Mercenaria mercenaria*) Bay Scallop (*Argopecten irradians*)
Projected Seed/ Overwintering Production:	Oysters: 6-8 million, Spawns: 2/23, 3/8, 3/22 Clams: 5-6 million, Spawns: 4/7, 4/21, 5/5 Scallops: 300,000, Spawns: as natural conditioning permits
Grant Projects:	No grants have been received for the 2016 season
Permit Status:	All East Hampton Shellfish Hatchery marine hatchery and off bottom grow-out permits are in place for the 2016 season
Additional Operations/ Goals:	Overcome oyster disease issue of 2015 Resume enumeration of the efficacy of seeding via surveys, especially for clams. Increase yields on clam growout by transitioning into soft bottom bags. Start oyster gardening pilot program in Three Mile Harbor Request fourth full-time staff member

2015 Oyster Production

Oyster Spawn and Culture Summary

	O1 Cohort		O2 Cohort		O3 Cohort	
	Dates	# Oysters ($x10^6$)	Dates	# Oysters ($x10^6$)	Dates	# Oysters ($x10^6$)
Spawn	3/3	239.00	3/17	27.00	4/2	230.00
Set Tanks	3/20-3/23	4.10	4/3	6.42	4/20	5.26
Downwelling - Hatchery	3/31	1.70	4/16-4/17	2.90	5/7	2.97
Set Success	42%		45%		57%	
Upwelling - Nursery	4/22	1.664	5/4-5/5	2.522	5/11-5/15	2.714

	All Cohorts	
	Dates	# Oysters ($x10^6$)
Total to Upwelling	4/22-5/15	**6.90**
to Field Growout	6/10-8/21	**4.77**
Seeded Culls (<30mm)	6/10-10/13	3.34
Seed (30+mm)	8/17-11/17	1.31
	2015 Total Culled/Seeded:	**4.64**



Female oysters and their eggs at the end of a spawn

Oyster Discards and Culls

Hatchery Discards		
Sieve Number	**Approximate Size**	**Total Discards**
325	>45um	34,950,000
270	>53um	328,600,000
230	>63um	76,520,000
200	>75um	67,000,000
170	>90um	49,950,000
140	>106um	1,490,000
120	>125um	4,400,000
100	>150um	35,750,000
80	*>180um*	*14,360,000*
70	*>212um*	*3,295,000*
60	*>250um*	*0*
	TOTAL:	**616,315,000**
	Marketable Total:	***17,655,000***

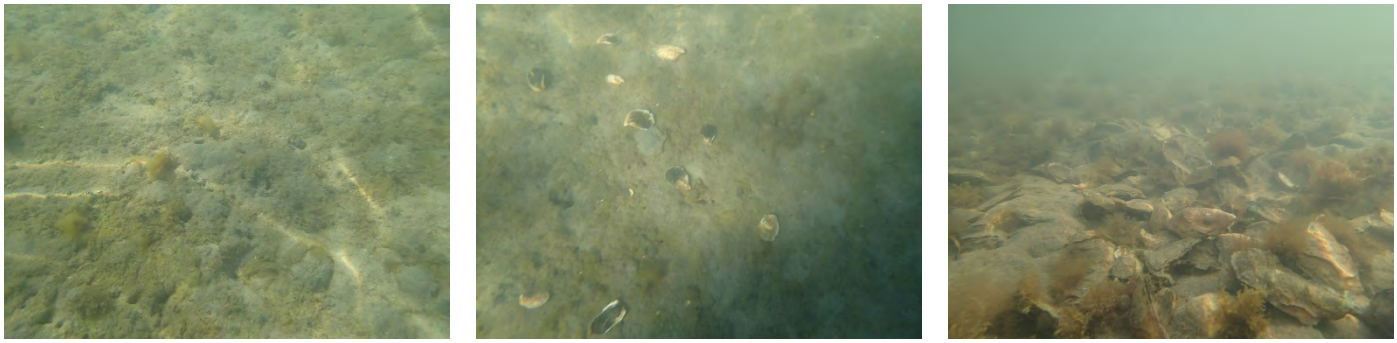
Nursery and Field Culls	
Sieve Size	**Total Culls**
≤#20	450,000
≤2.0mm	450,000
≤2.4mm	1,000
≤3.4mm	210,000
≤5/16"	2,703,535
<5/8"	193,277
TOTAL:	**4,007,812**

Cornell Cooperative Extension received a donation of 71,400,000 #230 (few day old culls) oyster larvae from the hatchery phase and 660,000 nursery culls. Stony Brook Southampton received 1,000 nursery culls and 10,456 field culls. The total value of our oyster donations this year was $6,774.

Oyster Distribution

		Nursery Culls	Field Culls	Seed	from 2014 Cohort	Totals	Sizes (mm)	
							Average	Range
Accabonac Harbor		0	341,520	276,086	18,128	**635,734**	48.8	9 - 86
Hog Creek		0	0	38,760	0	**38,760**	49.0	20 - 70
Lake Montauk		0	0	223,360	0	**223,360**	45.9	24 - 69
Napeague Harbor		0	656,020	266,508	18,128	**940,656**	46.3	6 - 86
Three Mile Harbor		450,000	1,888,816	364,205	0	**2,703,021**	35.9	<1 - 75
Northwest Creek		0	0	136,509	0	**136,509**	44.4	22 - 72
Donations/Research		661,000	10,456	0	0	**671,456**	---	<2 - 35
Totals		**1,111,000**	**2,896,812**	**1,305,428**	**36,256**	**5,349,496**		
Sizes (mm)	Average	---	15.4	44.4	60.2			
	Range	<1 - <3.4	6 - 29	21 - 86	44 - 86			

Please refer to Appendix I (page 20) for the 2015 Harbor Seeding Maps.



Northwest Creek (left to right): unseeded area; immediately after seeding (2015); one year after seeding (2014)

Oyster Overwintering

Overwintering Stocking and Retrieval	
Napeague Oyster Gro: Stocked 11/5/14	44,800
average size (mm)	40.3
Seeded 7/24/15*	36,256
average size (mm)	60.2
Percent survival	81%
Percent growth	49%

* Transferred from cove to field 6/24

Due to the large losses we experienced as a result of ROD/JOD, we did not have extra oysters to overwinter this year.

Oyster Market Values

	2015 Oyster Production Market Value				
	Size (mm)	**Value/1000**	**Quantity**	**Value**	**Total Value**
Discards	>180um	$3.66	17,655,000	$64,661.44	**$64,661**
Nursery and Field Culls	0.5-1.0	$5.50	450,000	$2,475.00	**$91,245**
	1.1-4.0	$9.75	661,000	$6,444.75	
	8.1-12.0	$22.64	1,321,275	$29,912.20	
	12.1-16.0	$32.70	1,391,284	$45,494.99	
	16.1-25.0	$37.50	183,488	$6,880.80	
	25.1-30.0	$48.75	765	$37.29	
Seed	30.1-35.0	$53.40	11,416	$609.61	**$121,895**
	35.1-40.0	$79.67	398,903	$31,779.27	
	40.1-45.0	$86.33	423,267	$36,542.05	
	45.1-60.0	$112.25	471,842	$52,964.26	
2 Year Old Seed (2014 Cohort)	45.1-60.0	$112.25	36,256	$4,069.74	**$4,070**
Seeding & Handling	1.0-57.0	$2.00	5,349,496	$10,698.99	**$10,699**
	TOTAL OYSTER VALUE: $292,570				

*The oysters that are placed into overwintering are not accounted for in our production market values until they are seeded the following year

2015 Hard Clam Production

Hard Clam Spawn and Culture Summary

	C1 Cohort		C2 Cohort		C3 Cohort	
	Dates	# Clams ($x10^6$)	Dates	# Clams ($x10^6$)	Dates	# Clams ($x10^6$)
Spawn	4/21	90.30	5/5	42.00	5/19	10.60
Set Tanks	5/8-5/11	4.31	5/22	2.97	6/3	1.21
Transition Tanks - Hatchery	5/18-5/22	9.02	6/1-6/10	5.65	6/11	1.78
Upwelling - Nursery	5/22*-6/8	7.07	6/10*-6/16	4.47	6/16**	

	All Cohorts	
	Dates	# Clams ($x10^6$)
Total to Upwelling	5/22-6/16	**11.54**
Field Growout	7/9-7/24	**5.39**
Seeded Culls (<10mm)	6/8-11/4	10.65
Overwintering	10/27	1.03
Seed (10+mm)	10/29-11/4	1.26
	2015 Total Culled/Seeded/Overwintered:	**12.95**

*brought directly to nursery from hatchery

**sieved with remaining C2 at nursery

Hard Clam Discards and Culls

Hatchery Discards		
Sieve Number	**Approximate Size**	**Total Discards**
230	>63um	600,000
200	>75um	26,000,000
170	>90um	47,700,000
140	>106um	1,600,000
120	>125um	8,220,000
100	>150um	12,275,000
80	*>180um*	*678,000*
70	*>212um*	*92,500*
60	*>250um*	*475,875*
50	*>300um*	*1,385,000*
40	*>425um*	*811,250*
	TOTAL:	**99,837,625**
	Marketable Total:	***3,442,625***

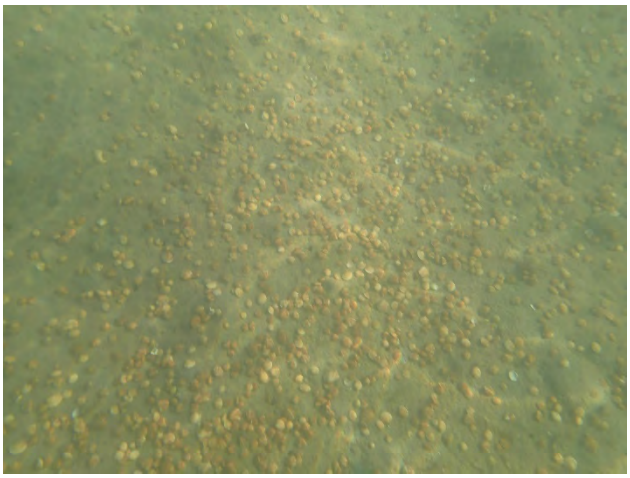
Nursery and Field Culls	
Sieve Size	**Total Culls**
≤#20	5,524,900
≤1.7mm	2,250,000
≤2.0mm	389,000
≤2.4mm	280,000
≤3/16"	2,212,995
TOTAL:	**10,656,895**

We did not donate any hatchery discards this year. However, approximately 10 million viable juvenile clam discards, sizes #100 – #40, were seeded just south of the Nursery. Stony Brook Southampton received 3,435 field culled clams.

Hard Clam Distribution

	Nursery Culls	Field Culls	Seed	from 2013 Cohort	from 2014 Cohort	Totals	Sizes (mm)	
							Average	Range
Accabonac Harbor	2,530,000	480,960	251,520	0	120,960	**3,383,440**	11.7	<1.7 - 22
Hog Creek	0	0	0	3,552	30,240	**33,792**	16.8	13 - 21
Lake Montauk	0	417,664	251,208	0	116,400	**785,272**	12.2	4 - 21
Napeague Harbor	389,000	604,944	251,520	0	90,288	**1,335,752**	11.4	<2 - 24
Three Mile Harbor	5,520,000	435,384	209,376	0	120,960	**6,285,720**	11.2	<1 - 21
Northwest Creek	0	270,608	298,872	0	0	**569,480**	9.4	4 - 17
Northwest Creek Overwintering	0	0	1,034,830	0	0	**1,034,830**	13.0	9 - 18
Donations/Research	4,900	3,435	0	0	0	**8,335**	5.1	3 - 6
Totals	**8,443,900**	**2,212,995**	**2,297,326**	**3,552**	**478,848**	**13,436,621**		
Sizes (mm) Average	---	7.3	13.6	17.8	14.6			
Sizes (mm) Range	<1 - <2.4	3 - 15	8 - 22	13 - 21	11 - 24			

Please refer to Appendix I (page 20) for the 2015 Harbor Seeding Maps.



Clams seeded in Northwest Creek

Clam blocks damaged in Nor'easter Joaquine

Hard Clam Overwintering

In 2014 we decided to leave approximately 25,000 clams (10 bags) from the 2013 overwintered cohort for an additional year to see how the clams would do with an extra year of overwintering. Unfortunately, survival among the 3 year old clams plummeted to 14% from the 73% that was exhibited in the 2 year olds of the 2013 cohort the previous year. Growth was better in the 3 year olds (31% from 8%), but considering the loss, it doesn't appear to be advantageous to overwinter clams for an additional year.

Overwintering Stocking and Retrieval	
Northwest Creek: Stocked 9/13/13-10/16/13*	25,000
average size (mm)	13.5
Seeded 10/21/15	3,552
average size (mm)	17.8
Percent survival	14%
Percent growth	31%
Northwest Creek: Stocked 10/1/14-10/28/14	967,240
average size (mm)	11.5
Seeded 10/21/15-10/22/15	478,848
average size (mm)	14.6
Percent survival	50%
Percent growth	27%

*10 bags (~25,000 clams) from 2013 left for additional year of overwintering

2015 Overwintering Stocking	
Northwest Creek: Stocked 10/27/15	1,034,830
average size (mm)	13.0

The 2014 overwintered clams experienced average growth and survival, 27% and 50% respectively. We pulled the bags out of the mud again this year in July hoping to enhance growth and survival, but it may have been too late in the season to make much of a difference.

The 2015 overwintered clams were stocked in 370 bags at 1.2L (~2,500 clams) per bag on 4 strings.

Hard Clam Market Values

	2015 Clam Production Market Value				
	Size (mm)	**Value/1000**	**Quantity**	**Value**	**Total Value**
Discards	>180um	$2.00	3,442,625	$6,885.25	**$6,885**
Culls	0.5-1.0	$4.50	5,524,900	$24,862.05	**$100,453**
	1.1-2.0	$7.70	2,639,000	$20,320.30	
	2.1-3.0	$12.70	280,000	$3,556.00	
	3.1-6.0	$16.45	127,419	$2,096.62	
	6.1-8.0	$21.40	1,261,312	$26,992.08	
	8.1-10.0	$27.45	824,264	$22,626.05	
Seed	10.1-16.0	$33.86	1,262,496	$42,749.52	**$42,750**
2 Year Old Seed (2014 Cohort)	10.1-16.0	$33.86	478,848	$16,214.33	**$16,214**
3 Year Old Seed (2013 Cohort)	16.1-25.0	$35.75	3,552	$126.98	**$127**
Seeding & Handling	0.5-25.0	$2.00	12,401,791	$24,803.58	**$24,804**
	TOTAL CLAM VALUE: $191,233				

*The clams that are placed into overwintering are not accounted for in our production market values until they are seeded the following year

2015 Bay Scallop Production

Bay Scallop Spawn and Culture Summary

A ripe scallop ready for spawning

Spawns			
S1 Cohort		S2 Cohort	
Date	# Scallops (x10^6)	Date	# Scallops (x10^6)
6/9	12.10	6/11	10.80
S3 Cohort		S4 Cohort	
Date	# Scallops (x10^6)	Date	# Scallops (x10^6)
6/17	3.80	6/18	35.60

All Cohorts		
	Dates	# Scallops (x10^6)
Set Tanks	6/22-6/26	**0.85**
Downwelling - Nursery	6/26-6/29	**0.92**
Upwelling - Nursery	7/2-7/9	**0.52**
Field Growout	7/27-7/29	**0.40**
Seeded Culls (<20mm)	8/21	0.02
Seed (20+mm)	9/10-10/20	0.29
Overwintering	11/17-11/18	0.12
2015 Total Culled/Seeded/Overwintered:		**0.43**

Bay Scallop Discards and Culls

Hatchery Discards		
Sieve Number	Approximate Size	Total Discards
325	>45um	380,000
270	>53um	1,500,000
230	>63um	0
200	>75um	0
170	>90um	0
140	>106um	363,000
120	>125um	45,000
100	>150um	72,000
80	*>180um*	*0*
70	*>212um*	*0*
60	*>250um*	*0*
50	*>300um*	*20,000*
40	*>425um*	*110,000*
	TOTAL:	**2,490,000**
	Marketable Total:	***130,000***

Nursery and Field Culls	
Sieve Size	Total Culls
≤2.4mm	4,500
<20mm	79,104
TOTAL:	**83,604**

We seeded 20,000 viable juvenile (#50) scallops from our hatchery discards and Cornell Cooperative Extension received 110,000 donated hatchery discards valuing approximately $1,200. Stony Brook Southampton received a total of 6,732 nursery and field culls. We also donated 51,912 field culls (a value of almost $1,870) to The Nature Conservancy for them to grow and potentially return half back to us next year.

Bay Scallop Distribution

		Nursery Culls	Field Culls	Seed	from 2014 Cohort	Totals	Sizes (mm)	
							Average	Range
Accabonac Harbor		0	0	97,524	5,775	**103,299**	30.6	13 - 41
Hog Creek		0	0	39,072	0	**39,072**	29.1	25 - 34
Lake Montauk		0	24,960	106,965	0	**131,925**	22.5	7 - 41
Napeague Harbor		0	0	7,784	19,740	**27,524**	33.5	20 - 41
Three Mile Harbor		0	0	0	0	**0**	---	---
Northwest Creek		0	0	39,270	0	**39,270**	28.6	20 - 34
Pond of Pines Overwintering		0	0	117,520	0	**117,520**	29.2	20 - 38
Donations/Research		4,500	54,144	0	50	**58,694**	15.2	<2.4 - 43
Totals		**4,500**	**79,104**	**408,135**	**25,565**	**517,304**		
Sizes (mm)	Average	<2.4	11.1	27.7	36.5			
	Range	---	7 - 15	13 - 41	31 - 41			

Please refer to Appendix I (page 20) for the 2015 Harbor Seeding Maps.

In addition to the nursery and field culls mentioned above, we donated 50 overwintered scallops from the 2014 cohort to the South Fork Natural History Museum.

Bay Scallop Overwintering

Overwintering Stocking and Retrieval	
Pond of Pines: Stocked 10/23/14-11/5/14	267,000
average size (mm)	30.4
Seeded 5/12/15-5/27/15	25,515
average size (mm)	36.5
Percent survival	10%
Percent growth	20%

2015 Overwintering Stocking	
Pond of Pines: Total Stocked	117,520
Pearl Nets: 10/19/15	59,600
average size (mm)	28.6
Blocks: 10/20/15	57,920
average size (mm)	29.8

Scallop bugs in pearl nets

Bay Scallop Market Values

	2015 Scallop Production Market Value				
	Size (mm)	**Value/1000**	**Quantity**	**Value**	**Total Value**
Discards	>180um	$11.00	130,000	$1,430.00	**$1,430**
Culls	1.5-2.4	$16.50	4,500	$74.25	**$2,922**
	10.1-14.0	$36.00	79,104	$2,847.74	
Seed	20.0-45.0	$58.33	290,615	$16,952.54	**$16,953**
2 Year Old Seed (2014 Cohort)	30.0-45.0	$65.00	25,565	$1,661.73	**$1,662**
Seeding & Handling	1.5-45.0	$2.00	399,784	$799.57	**$800**
	TOTAL SCALLOP VALUE: $23,766				

*The scallops that are placed into overwintering are not accounted for in our production market values until they are seeded the following year

2015 Grants and Cooperative Research

Development of small, local shellfish hatcheries and increasing hatchery production methods for existing hatcheries culturing the Eastern Oyster, *Crassostrea virginica*

Participants
Kim Tetrault, Cornell Cooperative Extension of Suffolk County
Gregg Rivara, Cornell Cooperative Extension of Suffolk County
Karen Rivara, Aeros Cultured Oyster Company
Josh Belury, Conscience Point Shellfish Hatchery

Abstract
The Suffolk County Marine Environmental Learning Center, a facility of Cornell Cooperative Extension of Suffolk County, New York, has operated a shellfish hatchery on Long Island since 1991, with two additional hatcheries being added in later years. Over the past two decades, many inquiries have been made by commercial enterprises regarding shellfish culture methods. In an attempt to make hatchery techniques and protocol more accessible to prospective ventures, CCE-Suffolk has secured a research grant with New York Sea Grant to examine the use of algae paste as a sole food source for larval rearing and to evaluate high-density larval culture for eastern oysters. One goal is to determine the viability of small-scale "pocket" hatcheries and their ability to produce eyed pediveligers without using expensive resources such as live cultured micro-algae and large volumes of heather seawater.

Results: preliminary

East Hampton Shellfish Hatchery's role: provided oyster larvae

Shellfish Growout Program at Mashomack Preserve

Participants
Adam Starke, The Nature Conservancy

Program Description
The Shellfish Growout Program at Mashomack Preserve was established over a decade ago with the intention of increasing the spawning stock of bay scallops. The program was established with the help of Cornell Cooperative's Marine Extension and follows much of the same methodology as used in their systems. The program is largely run by volunteers who meet weekly through the growing season to clean cages, move scallops around, and track how they are surviving. In recent years, the program took a shift and used scallop spat collectors (graciously donated by the Town of East Hampton) to gather seed through the summer and fall. These scallops were over-wintered at Mashomack's Log Cabin Creek and returned to the waters they were collected from just prior to their spawning. Another recent addition to the program was the expansion of this work into Great South Bay. In coordination with the Town of Brookhaven, a portion of the scallops acquired from the Town of East Hampton will be planted in areas that have rebounding eelgrass meadows adjacent to the Wilderness Breach spring 2016.

East Hampton Shellfish Hatchery's role: donated spat collectors and juvenile bay scallops

Response of early life stage bivalves to diurnal changes in carbon dioxide and dissolved oxygen concentrations

Participants
Hannah Clark, Marine Sciences Program, Stony Brook Southampton

Abstract
Highly productive and shallow coastal systems often experience metabolically-driven, diurnal variations in pH and dissolved oxygen (DO) concentrations. It has been suggested that worsening acidification and eutrophication-driven hypoxia will intensify the magnitude of diurnal changes by decreasing baseline pH and DO levels. Few studies, however, have investigated the concurrent effects of low pH and low DO on ecologically and socioeconomically important marine organisms inhabiting coastal ecosystems. My thesis was designed to assess the effects of diurnal patterns in acidification and hypoxia on the survival, growth, and development of the early life stages of three bivalves indigenous to the East Coast of North America: bay scallops (*Argopecten irradians*), hard clams (*Mercenaria mercenaria*), and eastern oysters (*Crassostrea virginica*). Bivalves were exposed to both continuous and diurnal fluctuations in low levels of pH and DO. Continuously acidified conditions reduced survival of juvenile bay scallops as well as larvae of all three species studied, slowed growth of larval bay scallops and eastern oysters, and delayed the development of bay scallop larvae, while continuously hypoxic conditions reduced the survival, growth, and development of larval bay scallops and development of larval hard clams. Though simultaneous exposure to both factors had significantly more negative effects than each factor independently, the effects on survival of bay scallop and hard clam larvae, hard clam development, and eastern oyster growth were antagonistic. The effects of diurnal exposure to acidified and hypoxic conditions were more complex. In some cases, diurnally acidified conditions eliminated or mitigated the negative effects of survival for larval bivalves. These benefits were sometimes lost when both pH and DO varied diurnally suggesting the fluctuations in both factors at the same time were too energetically costly and/or occurred too rapidly for the bivalves to physiologically compensate without experiencing adverse effects. Collectively, this study provides a more accurate representation of the responses of early life stage bivalves to future acidification and hypoxia in shallow, coastal systems and demonstrates that diurnal fluctuations in pH and DO represent a significant threat to the North Atlantic bivalve populations.

Results: Master's Thesis, defended December 2015

East Hampton Shellfish Hatchery's role: provided juvenile bay scallops; clam and oyster eggs and sperm

Understanding the effects of predicted ocean conditions as a result of climate change on juvenile shellfish

Participants
Alexandra Stevens, Marine Sciences Program, Stony Brook Southampton

Summary
Four experiments focused on future climate change risks on shellfish. Each of the four experiments used approximately 500 juveniles each of 4 different shellfish species: Hard Clams, Blue Mussels, Bay Scallops and Eastern Oysters. The shellfish were held in conditions similar to the predicted

climate change and global warming in our local bays and oceans, with each experiment encompassing: an ambient control, low pH, low dissolved oxygen, and both low pH and low dissolved oxygen. The ambient condition represented current ocean/bay conditions (pH: ~7.9-8 & DO: ~6mg/L). Low pH conditions represented future predictions for increasing acidification (lower pH) in our local bays and oceans (pH: ~2 & DO: ~6mg/L). Low dissolved oxygen (DO) represented future predictions on less dissolved oxygen/increasing hypoxia in our local bays and oceans (pH: ~7.9-8 & DO: ~2mg/L). The fourth condition represented both ocean acidification and hypoxia in future waters (pH: ~2 & DO: ~2mg/L). These experiments also placed shellfish under varied temperature conditions: an ambient temperature of 24C and a higher temperature or approximately 30-31C. The shellfish were then placed in buckets (4 replicates of each) for each condition (4 conditions) over a period of time to measure growth rate and survival throughout the experiment. The shellfish were fed daily from our lab's algae and daily measurements of chemistry were taken. Once the data is analyzed the goal of these experiments will be to better understand how juvenile shellfish survive and grow under future ocean conditions.

Results: in progress

East Hampton Shellfish Hatchery's role: provided juvenile oysters and clams

Temperature controls the toxicity of the icthyotoxic dinoflagellate, *Cochlodinium polykrikoides*

Participants
Andrew W. Griffith, Marine Sciences Program, Stony Brook Southampton

Abstract
Blooms of the harmful dinoflagellate, *Cochlodinium polykrikoides*, occur annually within estuaries around the World. These harmful algal blooms have become notorious for lethal impacts on marine life particularly fish and shellfish. To date, however, the role of temperature in altering the growth and toxicity of this alga is unknown. Here we report a laboratory and field-based study of how temperature influences the growth and toxicity of *C. polykrikoides*. Shellfish were deployed at two sites, one with a high likelihood of *C. polyrkikoides* presence and another where blooms of *C. polykrikoides* were likely to be absent. Juvenile bay scallops (*Argopecten irradians*) were deployed in triplicate bags at surface and bottom locations within each site. An additional set of bags with scallops were deployed at surface positions only and co-cultured with local species of macroalgae, previously reported to allelopathically inhibit several species of harmful algae, to investigate potential mitigative effects. Toxicity was significantly increased at the 'exposed site' in surface positions only. Scallops deployed at depth (1.5-2 m) displayed minimal rates of mortality, suggesting the shellfish deployed at bottom positions during bloom events are more likely to survive. In addition, the inclusion of macroalgae with deployed shellfish offered no protective benefits from *C. polykrikoides* blooms. Growth rates of North American *C. polykrikoides* strains increase with temperature to a maximum at ~25°C. In contrast, lethality to larval fish and shellfish decreased as temperatures increased from ~16°C to ~28°C. The underlying mechanism by which *C. polykrikoides*-induced mortality in marine life has not been fully resolved but has been attributed to reactive oxygen species (ROS). Consistent with this hypothesis, we suggest that the toxic principle associated with *C. polykrikoides* is less stable at

higher temperatures. These results suggest blooms in temperate latitudes may be more toxic than those in tropical zones. Conversely, as global temperatures increase, the toxic effects of *C. polykrikoides* blooms may become less severe.

East Hampton Shellfish Hatchery's role: provided juvenile bay scallops

Exploring trait-mediated effects of finfish on decapod crustaceans and bay scallops in eelgrass ecosystems

Participants
Stephen Heck, Marine Sciences Program, Stony Brook Southampton
Bradley Peterson (Advisor)

Summary
Habitat complexity structures ecological communities by providing refuge from predators to prey (Carroll et al. 2014, Grabowski 2004). Eelgrass (*Zostera marina*) has long been considered important for the survival of juvenile bay scallops (*Argopecten irradians*) since they use the canopy as refuge from predators (Ambrose and Irlandi 1992). Unfortunately, there have been severe declines in eelgrass in Long Island estuaries (NYSTF 2009). A diverse suite of predators prey on bay scallops with varying modes of foraging. In Long Island estuaries, one of the dominant crustacean predators of bay scallops at this size class is the black-fingered mud crab (*Dyspanopeus sayi*) (Tettelbach 1986). Although it is commonly assumed that the height of attachment of bay scallops on eelgrass blades is driven by the presence of predators foraging from the bottom upwards, there is little empirical evidence to support this. In coastal seagrass ecosystems of Long Island, predator-prey dynamics are further complicated by the presence of several species of large, predatory finfish that consume both this dominant predator of juvenile bay scallops, the black-fingered mud crab, as well as small size classes of bay scallops (Adams 1974, Bigelow and Schroeder 1953). Among these fish species are scup (*Stenotomus chrysops*) (Weinstock 2010). This fish species is subject to commercial as well as recreational fishing pressure, which has altered their abundance and will likely continue to do so. Since these fish forage for scallops from the water column, downwards, this could limit the upper limit of the vertical distribution of juvenile bay scallops in the eelgrass canopy. Furthermore, reductions in the abundance of these fish predators may alter the foraging rates of black-fingered mud crabs on scallops. The extent that this species influences the vertical distribution of bay scallops and the consumption rates of black-fingered mud crabs on scallops is unknown. We aimed to explore how the presence of finfish predators influence the foraging rates of crab mesopredators as well as how the occurrence of finfish and crabs influences the height of attachment in the eelgrass canopy of bay scallops. We investigated these questions in large mesocosm tanks at Stony Brook University's Southampton Marine Station during the 2015 field season. We also conducted field experiments to look at whether the height of attachment of bay scallops on eelgrass influenced scallop survival across three different areas of Shinnecock Bay. This was all done with the immense help of the East Hampton Town Shellfish Hatchery which provided us with the scallops for our investigation. Understanding how the presence of finfish predators and eelgrass coverage influence the structure of the community is an important step in developing responsive ecosystem-based management

measures to help enhance the efficacy of bay scallop restoration efforts and rebuild these valuable coastal ecosystems of Long Island, NY.

East Hampton Shellfish Hatchery's role: provided juvenile bay scallops

Determining the effect of size on hard clam and oyster survival in Shinnecock Bay

Participants
Rebecca Kulp, Marine Sciences Program, Stony Brook Southampton

Summary
We selected six sites in Shinnecock Bay for evaluating survival and growth of our two targeted restoration species, hard clams and oysters. The six sites were at Far Pond, Tiana Beach, Tiana Bay, Weesuck Creek, Dockers, and Quantuck Canal (Figure 1). Sites at Far Pond and Tiana Beach were in seagrass beds; sites at Tiana Bay and Weesuck Creek in existing clam sanctuaries; and sites at Dockers and Quantuck Canal in potential oyster reef sanctuary locations. Growth and survival was evaluated for hard clams in the existing clam sanctuaries (Weesuck Creek and Tiana Bay) and oysters in potential oyster reef sanctuaries (Dockers and Quantuck Canal). We additionally evaluated hard clam and oyster survival in and out of seagrass bed habitats at Far Pond and Tiana Beach. In the oyster survival experiment, there was no difference in oyster mortality by size at each site, except in the Tiana Beach seagrass bed (large oysters: 10.3% ± 10.3%; small oysters: 20.8% ± 7.4%; Figure 5). Oyster mortality was highest at the Quantuck Canal (large oysters, 28.4% ± 24.0%; small oysters, 28.8% ± 18.2%). Quantuck Canal was also the only location where complete consumption of oysters occurred on a tile replicate out of all the experimental runs. In the clam survival experiments, there was low consumption across all sites and size classes, except outside of the Far Pond seagrass bed (Figure 6). Here, the large clams had the highest mortality out of all the treatment combinations with a 21.5 % ± 9.2 % mortality. The Far Pond seagrass beds had the next highest values (large: 11.7% ± 12.8%; small: 13.4% ± 8.4%). The remaining sites had consumption less than 10%. Results indicate that generally in western Shinnecock juvenile clams and oysters planted in the smaller size class will have similar predation pressure as larger size class. Given the aquaculture facility costs associated with growing shellfish to larger sizes, shellfish may not need to be grown past mid-teens to have the same predation refuge as individuals grown to the early 30s. The higher predation at Quantuck Canal for oysters suggests that there is a greater predation pressure present at this site than others.

East Hampton Shellfish Hatchery's role: provided juvenile oysters and clams

2015 Public Outreach & Industry Involvement

Outreach & Education

- Greg Metzger and his Southampton high school marine science class came to the hatchery for a tour in February

- The Dunne Family participated in the Montauk St. Patrick's Day Parade with a "float" including one of the hatchery trucks and the Sharpy adorned with signage, gear and candy

- Pete participated in the annual *Sportsman's Expo* where he presented our work and answered questions from the public

- We held an Open House tour and spawning event at the Hatchery with participants from the public, South Fork Natural History Museum and Concerned Citizens of Montauk in May

- We hosted a Project MOST tour/clamming trip with about 40 kids at the nursery in July

Open House visitors awed by a clam spawn

- South Fork Natural History Museum's summer marine program came to the field site for a tour and oyster seeding in August

- The Hatchery team was interviewed by two NYU film students for a class film project about the environmental effects of nutrient loading in harbor waters

- Kate participated in the *East Hampton Town Trustees' Largest Clam Contest* in November where she presented our work and answered questions from the public as well as holding our clam counting contest

Committee Involvement

- Barley is chair of the Long Island Shellfish Managers Group

- Barley serves on the *Peconic Estuary Program's Natural Resources Subcommittee* and *New York State Shellfish Advisory Committee*

Conference Attendance

- In January, Barley attended the Northeast Aquaculture Conference and Exposition (NACE) combined with the Milford Aquaculture Seminar in Portland, ME

2015 Infrastructure Management

Annual Maintenance

- New seals, bearings as necessary, on water pumps
- Trailer lights, winches, straps/chains repaired/replaced
- All motors winterized
- Buoys repainted

The sharpie rafted up to scallop buoy strings

Boats/Trailers

- New Yamaha outboard on 24' Carolina Skiff
- Boats bottom painted
- Hulls patched as necessary

Nursery

- Work table gel-coated
- Downwelling tank repaired
- Fence repaired

Field Growout

- Rotary sieve feed table expanded, new casters installed
- One of the storage/sieve box tops re-glassed and gel coated
- Lexan ice shield installed on barge for overwintering
- Most gear previously stored at the Lazy Point ramp was relocated to Trustee property off Shore Rd. at the Trustees request

Montauk Facility

- Hatchery room reorganized to make access to set tanks easier
- A three-pile dolphin with a pulley system was installed in Fort Pond Bay in order to replace the decrepit pier for fastening our salt water intake system
- Valves installed on broodstock food conical
- Airlines organized and drying rack installed in lab
- 10 new oyster setting downwellers made
- Built larger u.v. hood for algae transfers
- Considerable de-foliating completed at the overgrown Montauk facility in December

Office/Administrative

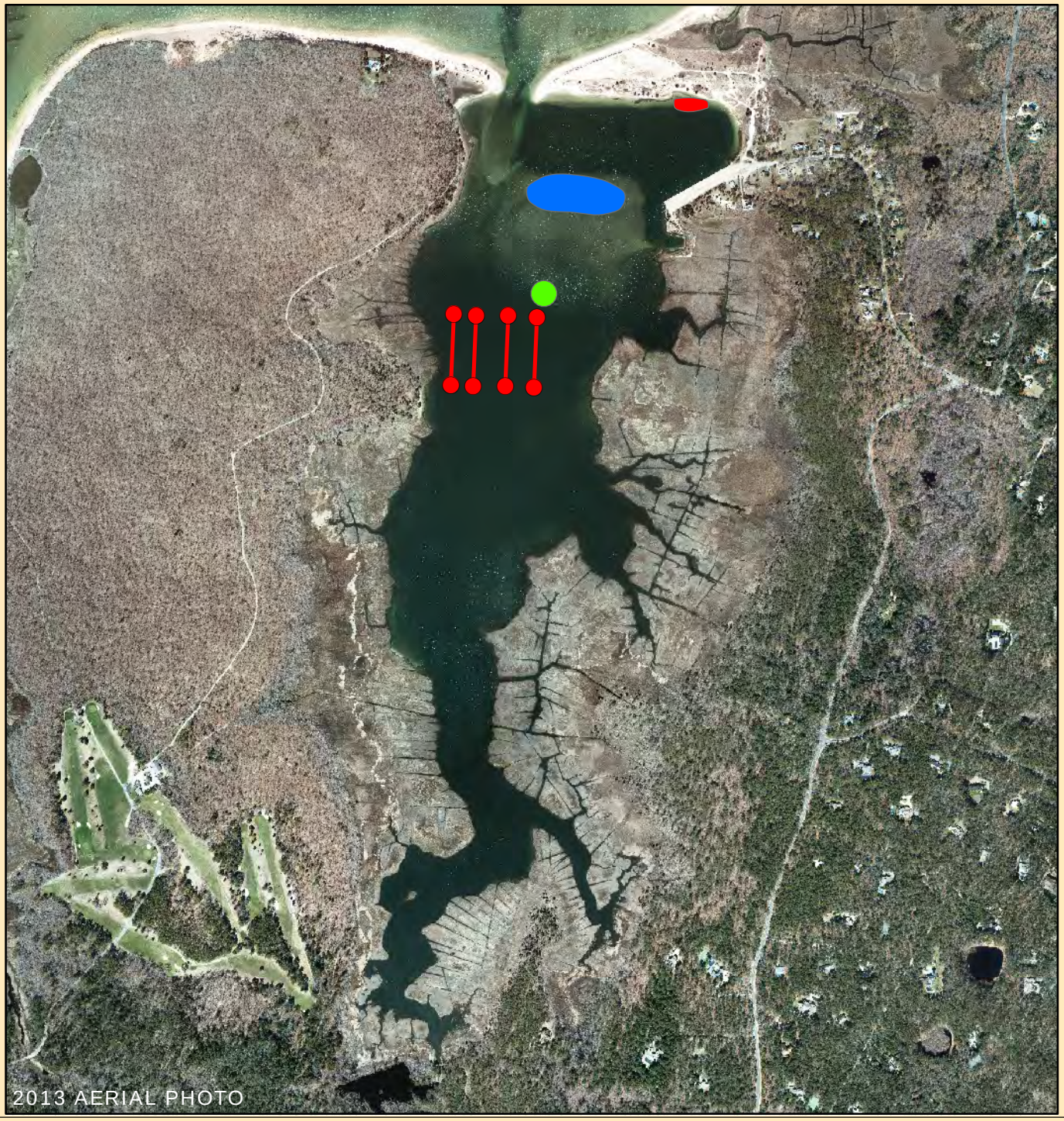
- All hatchery journal articles/papers entered into EndNote program, paper copies filed by author

<u>Appendix I</u>: 2015 Harbor Seeding Maps – All Species

Map 1: Northwest Creek
Map 2: Three Mile Harbor
Map 3: Hog Creek
Map 4: Accabonac Harbor
Map 5: Napeague Harbor
Map 6: Lake Montauk
Map 7: All Harbors

CARTOGRAPHY - BARNABY FRIEDMAN - 1/15/16

NORTHWEST CREEK / 2015 SEEDING



Prepared by
THE TOWN OF EAST HAMPTON
Suffolk County, New York

KEY:

- CLAMS: (1 year old) 569,480 (Avg. Size 9.43 mm)
- OYSTERS: (1 year old) 136,509 (Avg. Size 44.4 mm)
- SCALLOPS: (1 year old) 39,270 (Avg. Size 28.6 mm)
- CLAMS OVERWINTERED: (1 year old) 1,034,830 (Avg. Size 13 mm)

NOT TO SCALE

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CARTOGRAPHY - BARNABY FRIEDMAN - 1/15/16

THREE MILE HARBOR / 2015 SEEDING

Prepared by
THE TOWN OF EAST HAMPTON
Suffolk County, New York

KEY:

CLAMS: (1 year old) 6,164,760 (Avg. Size 6.73 mm)
(2 year old) 120,960 (Avg. Size 15.75 mm)

OYSTERS: (1 year old) 2,703,021 (Avg. Size 35.9 mm)

NOT TO SCALE

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CARTOGRAPHY - BARNABY FRIEDMAN - 1/15/16

HOG CREEK / 2015 SEEDING

Prepared by
THE TOWN OF EAST HAMPTON
Suffolk County, New York

KEY:

CLAMS: (2 year old) 30,240 (Avg. Size 15.75 mm)
(3 year old) 3,552 (Avg. Size 17.8 mm)

OYSTERS: (1 year old) 38,760 (Avg. Size 49.0 mm)

SCALLOPS: (1 year old) 39,072 (Avg. Size 29.1 mm)

NOT TO SCALE

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CARTOGRAPHY - BARNABY FRIEDMAN - 1/15/16

ACCABONAC HARBOR / 2015 SEEDING

Prepared by
THE TOWN OF EAST HAMPTON
Suffolk County, New York

KEY:

CLAMS: (1 year old) 3,262,480 (Avg. Size 7.7 mm)
(2 year old) 120,960 (Avg. Size 15.75 mm)

OYSTERS: (1 year old) 617,606 (Avg. Size 37.5 mm)
(2 year old) 18,128 (Avg. Size 60.2 mm)

SCALLOPS: (1 year old) 97,524 (Avg. Size 24.68 mm)
(2 year old) 5,775 (Avg. Size 36.48 mm)

NOT TO SCALE

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CARTOGRAPHY - BARNABY FRIEDMAN - 1/15/16

NAPEAGUE HARBOR / 2015 SEEDING

Prepared by
THE TOWN OF EAST HAMPTON
Suffolk County, New York

KEY:

CLAMS: (1 year old) 1,245,464 (Avg. Size 8.32 mm)
(2 year old) 90,288 (Avg. Size 14.4 mm)

OYSTERS: (1 year old) 922,528 (Avg. Size 32.4 mm)
(2 year old) 18,128 (Avg. Size 60.2 mm)

SCALLOPS: (1 year old) 7,784 (Avg. Size 29.15 mm)
(2 year old) 19,740 (Avg. Size 36.48 mm)

SCALLOPS OVERWINTERED: 117,520 (Avg. Size 29.2 mm)

NOT TO SCALE

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CARTOGRAPHY - BARNABY FRIEDMAN - 1/15/16

LAKE MONTAUK / 2015 SEEDING

EAST HAMPTON TOWN SHELLFISH HATCHERY

Prepared by
THE TOWN OF EAST HAMPTON
Suffolk County, New York

KEY:

CLAMS: (1 year old) 668,872 (Avg. Size 10.64 mm)
(2 year old) 116,400 (Avg. Size 13.7 mm)

OYSTERS: (1 year old) 223,360 (Avg. Size 45.9 mm)

SCALLOPS: (1 year old) 131,925 (Avg. Size 22.5 mm)

NOT TO SCALE

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2015 SEED PLACEMENT

LEGEND

- CLAMS: 12,393,456
- OYSTERS: 4,678,040
- SCALLOPS: 341,090

Prepared By
THE TOWN OF EAST HAMPTON
Suffolk County, New York

TOWN OF EAST HAMPTON

Suffolk County, New York

SHELLFISH HATCHERY

CARTOGRAPHY - BARNABY FRIEDMAN - 1/16

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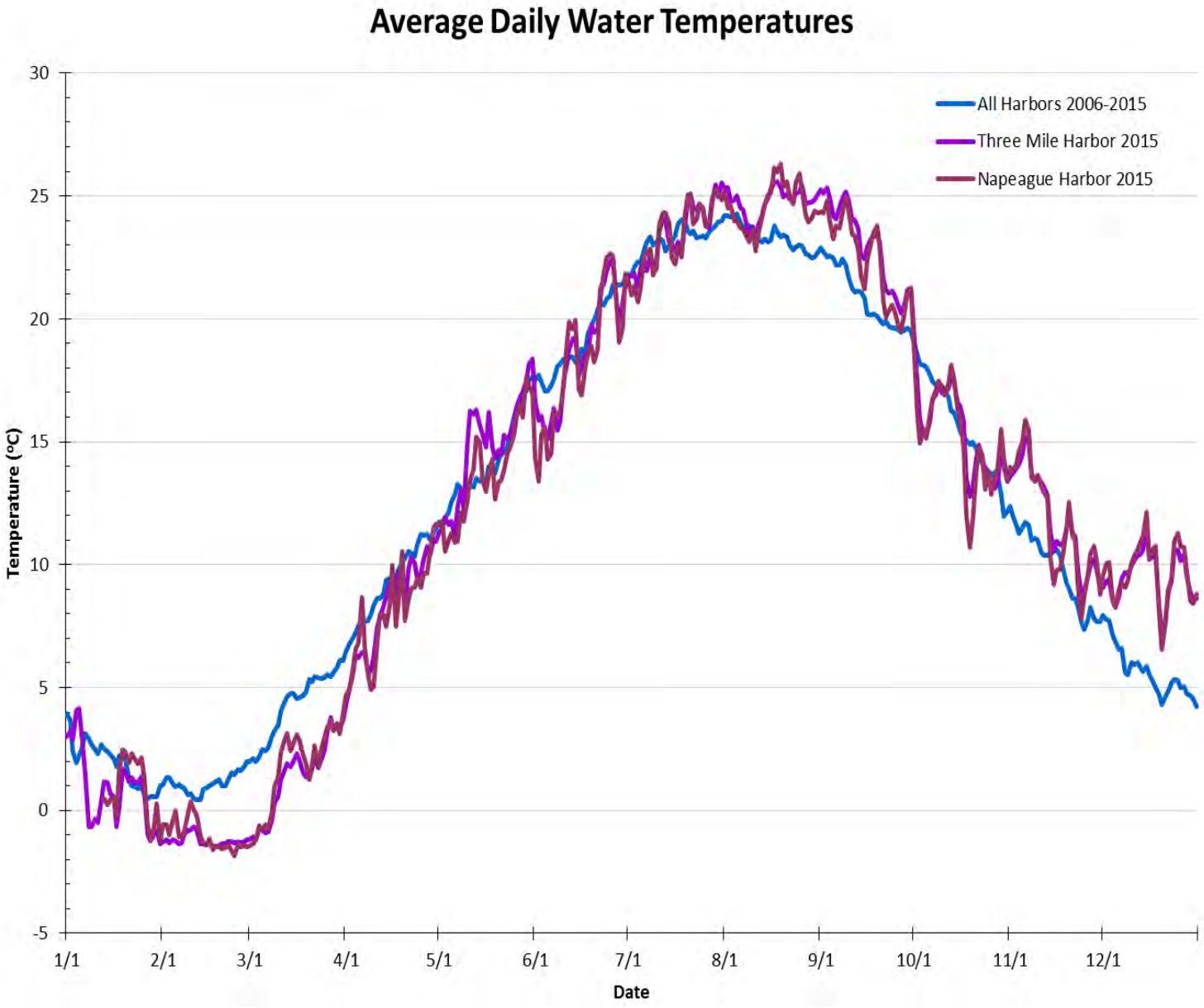
Appendix II: 2015 Harbor Water Temperatures


Average Daily Water Temperatures
All Harbors 2006-2015
Three Mile Harbor 2015
Napeague Harbor 2015
Temperature (ºC)
30
25
20
15
10
5
0
-5
1/1
2/1
3/1
4/1
5/1
6/1
7/1
8/1
9/1
10/1
11/1
12/1
Date

PRESENTING
the Annual East Hampton Town Shellfish Hatchery Open House

In conjunction with the Concerned Citizens of Montauk (CCOM) Earth Day celebration and the South Fork Natural History Museum (SoFo), Hatchery Staff will lead tours through the facility and perform a shellfish spawning demonstration.

typically held the first Saturday in May, from 10am to 12pm
at the Montauk Shellfish Hatchery

Additional events organized by the Hatchery and SoFo are held throughout the year!

specific dates to be announced

Kids and young adults are welcome to participate!
Refreshments will be served & there is no fee for these events!

Don't forget the East Hampton Trustees' Largest Clam Contest
for great chowder and clams on the ½ shell
This event usually occurs around the last weekend in September

Want to schedule your own tour or fieldtrip?...Contact us!

PLEASE E-MAIL: jdunne@ehamptonny.gov CALL THE HATCHERY: (631) 668-4601
OR THE MOBILE PHONE: (631) 816-3082
FOR FURTHER INFORMATION OR TO SIGN UP

These events will go on "rain or shine" – please dress accordingly