

Shellfish Propagation Report



Town of Chatham

2014



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Introduction:

The Chatham Shellfish Propagation Program (CSPP) has a long history of growing and distributing shellfish into the waters of Chatham. The CSPP operates under two major goals: a) to ensure a sustainable harvesting resource for both commercial and recreational shell fishermen, and b) to maintain a viable spawning stock to guarantee the future generations of shellfish.

2014 marked the third season of the newly appointed oversight of the CSPP. As with each past year, there are continually new challenges to address from the previous year and throughout the season.

2013 had been one of the best growth years in seed stock in the recent past. That being said, the closures of Oyster Pond and Oyster River, and the greater number of seed from previous years, increased the work load on and left us struggling to keep up at times. All in all, the 2013 season was a learning season and allowed us to figure out how best to streamline some of the growing techniques. These lessons translated into our goals for 2014 and were as follows: 1) Continue to hold more quahogs in the upweller for the full season to minimize net plant out, 2) be more efficient with the oyster grow out.

Going into 2014 we hoped to have some of the issues from the past ironed out. We handled approximately 3 million seed this year, which was more than in the previous 2 years, but by streamlining many processes and with the assistance of volunteers and AmeriCorps we were able to stay on top of the growth and fouling for most of the season. The season started much slower than in the past, as the water took a long time to warm up after the extremely cold winter. It was well into June or July before we really started to see food in the water and seed growth.

By the end of the season water temperatures had averaged out to be roughly the same as in previous years, but it didn't feel like it as the summer felt cool and wet. In 2013 we had 13 days with recorded water temperature was over 25°C, whereas only 8 in 2014. However in comparison, 2012 experienced 38 days with the water temperatures over 25°C at Stage Harbor, though this was prior to the break in South Beach.

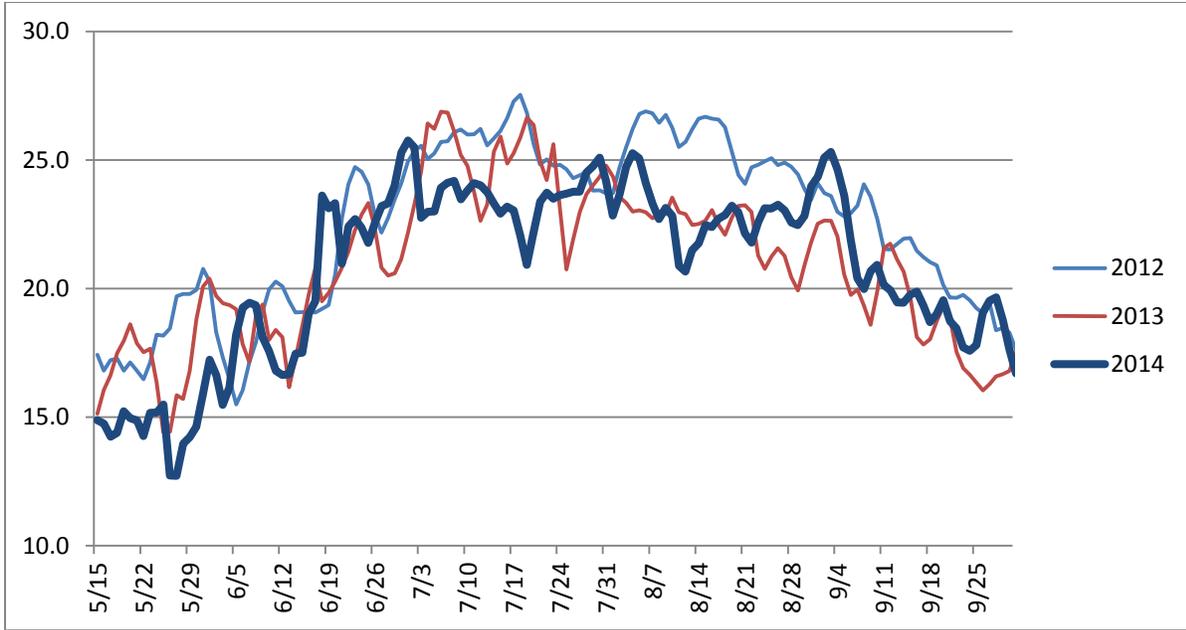


Figure 1 - Water temperature data recorded at Stage Harbor, data provided by Mass DMF

It is believed that cooler summer temperatures of this past season led to a slower growth rate in the seed than in the past years past, however this also lead to less fouling in both the nursery and the field than experienced in past years.

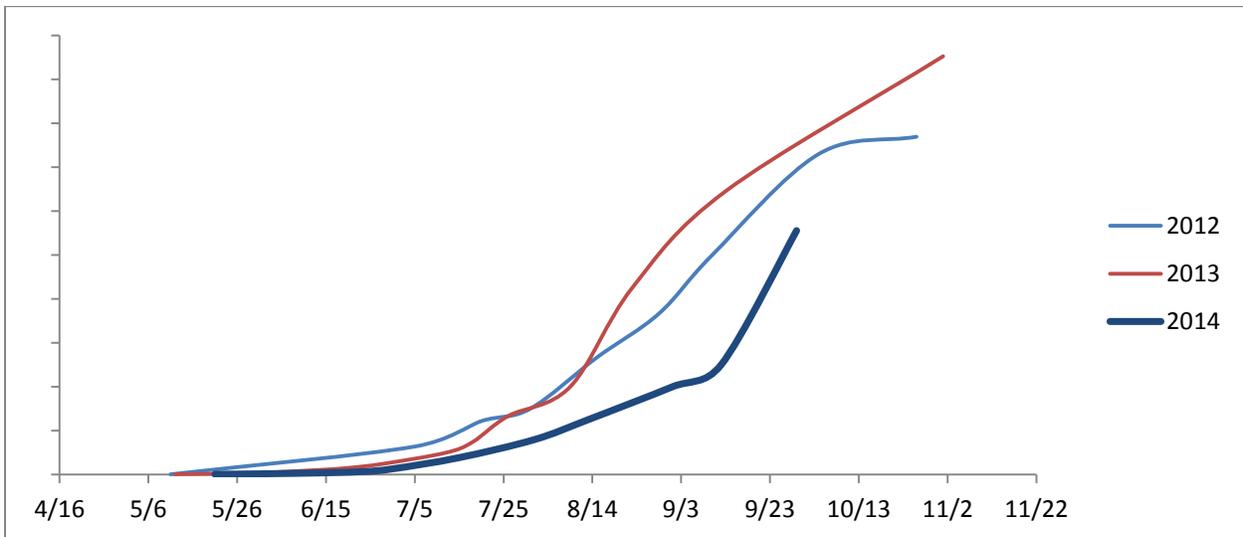


Figure 2 - Relative growth rates between 2012, 2013, and 2014 of quahog seed in the nursery

Quahog Enhancement:

As in the past, the CSPP focused the majority of its efforts on propagating quahog seed. The CSPP has been operating since the mid 1970's and has to date distributed over 109 million quahogs into the waters of Chatham. In the commercial industry quahogs are the go to species, as many of the other species are cyclical. This year, the town received 2.5 million quahog seed at size R1.5. The town purchased 2 million seed with moneys from the propagation revolving fund, and received half a million seed through county funding. R1.5 seed is sized to be retained on mesh that has an opening of 1.5 mm on the diagonal. All seed was procured from Aquaculture Research Corporation (ARC) located in Dennis, MA. Seed arrived to the Chatham Nursery on May 21st 2014 and May 27th 2014.



Figure 3 - 2.5 million quahogs on arrival at the nursery

Stage 1 Nursery:

The Chatham Nursery, located on Stage Harbor under the Harbormasters Office, consists of six flow-through tanks in which raw seawater is pumped through at a rate of 400gpm. These tanks are set up with bottom screened silos, which allow the tanks to act as upwellers to grow the seed. Silos are lined with different sized mesh, and as the animals grow they are placed on larger and larger mesh to increase water flow. 22 silos can be placed in each tank allowing for a total of 132 silos in the building. Placing the seed in these tanks provide the seed with numerous advantages over growing in the natural environment. First, the seed is protected within the nursery environment safe from predators; secondly, the seed is allowed to feed on nutrient rich water constantly and lastly, we are able to closely monitor and clean the seed regularly allowing for maximum growth with minimal competition and stress. The nursery environment is the most essential component needed to grow large number of seed while achieving maximum growth rates

Upon arrival the 2.5 million quahog seed was placed directly into 22 upweller silos. The seed arrived in 1 5-gallon bucket, and was placed on 750 μ m mesh. When the seed is this small the most accurate way to

size and count it is to use volume measurements, how many animals displace a milliliter of water. These measurements are often represented as quahogs per milliliter (q/ml). When the animals arrived they were 250q/ml, within 3 weeks, by June 9th the animals had grown to 63q/ml and almost quadrupling in size and volume. As the animals grow they are constantly being sieved and thinned. Animals will grow best with other animals of their own size and will grow best when thinned to a low density. The smaller animals cannot compete for food with the larger animals and thus grading the animals is important. What was 22 silos or 1 tank on May 21st quickly became 5 or 6 full tanks by the end of June as the animals continued to double in volume every week or so.



Figure 4 – Quahogs on arrival



Figure 5- Nursery set up with silos

As the tanks began to fill with silos by the end of June or beginning of July two options are available: attempt to keep as many quahogs in the nursery environment as long as possible to accelerate growth, or move quahogs out into the grow-out environment. With the use of stackable trays in the nursery tanks in place of silos we are able to increase the volume of animals that can be kept in the nursery environment. These stackable trays are lined with different sized mesh and as the quahogs get larger they 'graduate' out of silos and on to stackable trays. Although the density of quahogs on each tray is less than that of the animals in the silos, 5 or 6 trays can be stacked allowing for a larger volume of animals to be in each tank.

As the nursery continued to fill by the end of July, some animals began to be moved out into the field and into grow-out cages. These cages allowed for continued protection from predators as well as easy access for continued oversight. We attempt to keep as many animals as possible within the nursery where the greatest growth rate is achieved. Any animals able to reach 20-25 mm by the end of the growing season are directly distributed to the natural environment for final grow-out. If animals do not reach 20-25mm by the end of the growing season, they are placed in grow-out areas with predator protection, such as netting, and within a protected, closed to harvesting area maintained by the CSPP for another season or two.

Stage 2 Grow-Out:

In 2014, as the quahogs were removed from the nursery to make space for the ever growing seed, they were placed in grow-out bags at Stetsons Cove. Stetsons Cove, located in Oyster River at the mouth of Oyster Pond, has been used for many years by the CSPP to grow out both quahogs and oysters. This year, animals left the nursery environment at between 2.5q/ml and 4q/ml, which is approximately 10mm in length; these animals were placed in ADPI plastic floating and non-floating mesh bags. The mesh bags protect the animals from predators and allow for water to flow past the animals at all times. Floating bags float at the top of the water column and can easily be flipped periodically to remove any fouling that might grow on the underside of the bag. Non-floating bags settle on the bottom and sink slightly into the subsurface allowing for the animals to dig into the sediment slightly, but also allowing for easy retrieval. Between July 25th and September 9th approximately 1.1 million quahogs were removed from the nursery environment and placed in bags.

At the end of the growing season, all of these quahogs were moved to secondary grow-out for overwintering. This season two distinct secondary grow-out methods were implemented: Planting under predator netting, and deep water grow bags.



Figure 6 - Float line

Stage 3 Grow-Out – Overwinter:

Predator Netting:

On November 4th, with the assistance of Barnstable County AmeriCorps members, 795,000 quahogs were planted under 5 nets on the backside of Hardings Beach in Oyster River. These nets, which are

30ft*14ft, were planted with approximately 150,000 quahogs under each net. The area where the net will be placed is first systematically raked out to remove any crabs, conchs or moon snails or large quahogs. The quahogs are then spread evenly under the net area, and the net surrounded by weighted line is placed over the animals. Rebar is laid across the nets to hold them in place and keep the animals from all shifting to one side and staples are placed around the edges to keep the sides down so that predators can't bury under the nets.



Figure 7 - Quahogs scattered by AmeriCorps members to be covered by predator control netting

The quahogs under these nets will continue to grow for another season or two before they are dug out and can then be distributed. Since growth rates for quahogs are slower under nets and may take many seasons for optimum broadcast size, the CSPP rotates areas used to plant nets to minimize the bottom taken out of public use. Currently the department is in different stages of grow-out in four areas around South Chatham.

Areas planted in 2012 are currently in the process of being dug out from Mill Creek and Stetsons Cove. Nets planted in 2013 at the Causeway and Mill Creek were removed this fall and dig out will begin next spring. The nets on the 2014 seed will stay in place until next fall when they will be removed and the animals assessed to see when dig out can occur.

Once the quahogs under the netting have reached a distribution size 25mm+ they are manually dug out with large quahog rakes and distributed around to suitable habitat. The process of extracting this seed is time and labor intensive and often requires many people and many hours. We have been fortunate to have assistance by both Barnstable County AmeriCorps members as well as a number of volunteer commercial shell fishermen.



Figure 8 - Predator Control netting over quahog beds

Deep Water Bags:

This season the department experimented with ADPI mesh bags for additional grow-out after the nursery phase. Approximately 53,000 quahogs were placed in these bags in the deeper waters around Stetson's Cove. The deep water bags allow the quahogs to dig into the substrate while providing protection from predators and winter ice. The quahogs are being held over in the mesh bags throughout the winter. If successful, meaning low mortality, employing this technique would greatly reduce time and labor costs. Utilizing deep water bags could replace the planting and later extracting phase of growing quahogs. Deep-water bags would simply need to be hauled and emptied in order to distribute throughout town waters.

We will update on the success or failure of this new technique.

Stage 4 Seed Distribution:

Approximately 2.5 million quahog seed was distributed in shellfish growing areas throughout Chatham waters. These animals ranged in size from 20mm to legal sized animals. The seed distributed was a combination of 2014 seed stock raised in the nursery, as well as seed extracted from grow-out sites. Seed extracted from the grow-out sites were from 2010 through 2013 year classes.

Seed that was growing in the nursery environment and had reached the 20mm-25mm range was distributed directly into the waters on October 28th and November 6th. The industry standard for the minimum size seed for distribution is based on the seed's ability to survive the natural environment and, primarily, predators. Even though some of the animals had reached 20-25mm earlier in the season, they were held in the nursery until the fall when the water temperature began to drop. Since shellfish predators are more active in warmer waters, water temperature is also taken into consideration when broadcasting seed quahogs. It is believed that at water temperatures between 55°F and 50°F the crab activity has begun to decrease, but the quahogs are still active and will dig into the sediment quickly. Above that temperature, there is too much crab activity and below that temperature quahogs are slowing down and will not dig into the sediment as quickly. Seed was also dug out from: Stetsons Cove, Mill Creek, and the Causeway this season and distributed to appropriate habitat. Dig-outs occurred

with the assistance of Barnstable County AmeriCorps members as well as a number of Commercial Shellfishermen. These dig-outs would not be possible without the assistance of these individuals.

We also held two Commercial Digs during the season, one in the spring and one in the fall, to allow commercial diggers the opportunity to come into our grow-out areas and assist us by thinning the areas out. The diggers were able to keep all of the legal sized animals that they dug and we asked that they provided us with the seed so that we could redistribute it. These two opportunities were well received by the industry with over 30 diggers participating and approximately 250 bushels removed and sold. This is approximately 150,000 animals at a value of around \$30,000 directly back to the industry.



Figure 9 - Commercial Dig, and seed ready for distribution

Conclusion:

2014 was a decent year for the quahog enhancement side of the CSPP, though the growth of the animals was not what we had seen in the previous years. However, after a few years of experience, we are refining protocols and growing techniques and continue to develop our goals of improving and expanding the enhancement program. We are making an attempt to limit the number of quahogs that are planted under predator netting and increase the number of animals that are distributed directly from the nursery. This can be done by both increasing the capacity of the nursery, as well as coming up with alternative grow-out methods, like deep-water bags, in order to minimize nets. Although the nets are successful in growing animals to a legal size, the extra labor involved, as well as the extra time involved, doesn't make it the most efficient way for a propagation program to operate. Since our goal is to grow quahogs to distribution size, and not legal size, there are alternative methods for us to consider. We will continue to explore these options in the coming years.

Scallop Enhancement:

The CSPP also purchased bay scallop seed to raise and distribute into Stage Harbor. The scallop enhancement program has been ongoing since at least 1999. The program has had varying success with distributed over 4.5 million scallop seed into the Stage Harbor ecosystem. This season we purchased 200,000 (R2) scallops from ARC, which arrived on August 22nd. As always, the scallops are the last species to arrive in the nursery and are arriving just as many of the other animals are leaving. In addition to the purchased scallops, approximately 100,000 small scallops were donated to the CSPP by ARC on September 5th.

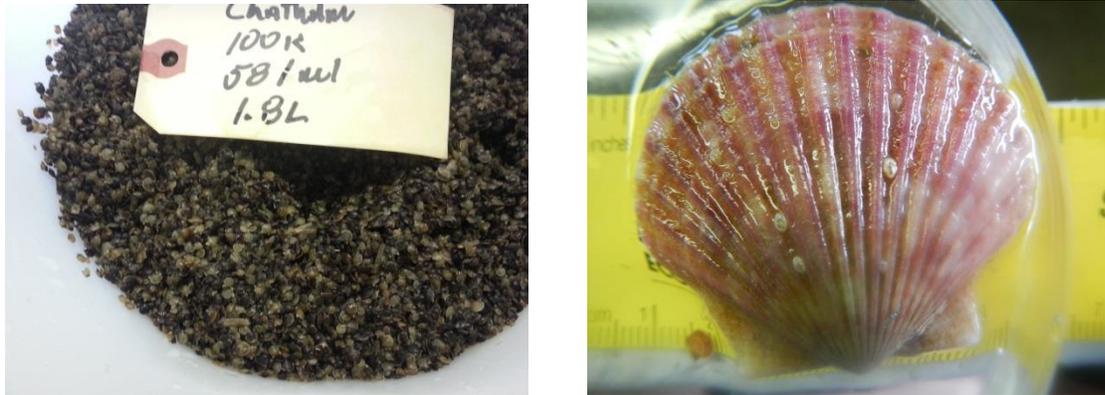


Figure 10 - Scallops on arrival at the nursery

Like the quahogs before them, the scallops start their journey in the upweller silos. However, unlike the quahogs, which are happy to sit on the screens and feed, the scallops need space to swim around and will attach themselves to every surface of the silos. Due to the fact that scallops swim, they also have a tendency to swim out of the tank. As a result, screens must be put in place to keep scallops in the silos. These screens, along with the ever growing scallops, often result in restricted water flow in the scallop silos. Once the scallops are large enough, they are allowed to free swim in the tanks. This allows the scallops more room to swim and grow. The resultant tanks are also easier to handle as they do not need to be cleaned on a daily basis like the silos.

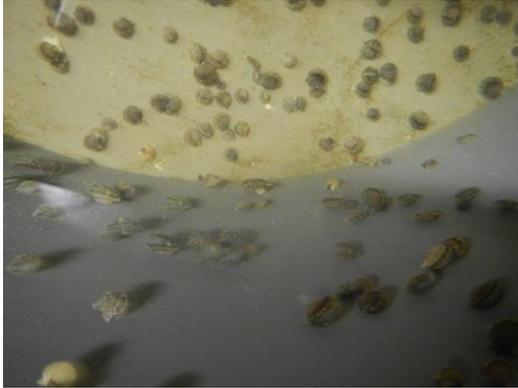


Figure 11 - Scallops clinging to the side of the nursery silo

The scallops are maintained in the nursery environment until the end of the growing season and then they are distributed directly into the ecosystem. As always we wait until the pressure on the resource by the commercial scallop fleet has decreased. This season we waited until November 18th and broadcast scallops to Battlefield, Sears Point and Oyster River, all areas that the commercial fleet had been having success this season.



Figure 12 - Legal scallop harvested in 2014

Oyster Program

Arguably our most popular recreational fishery is the oyster program that has been running since around 2004. Since that time approximately 2.3 million oysters have been distributed into the waters around Chatham for the recreational fishery. The oyster fishery is a seasonal fishery, opening September 1 and lasting until the end of April. Many recreational and commercial fishermen look forward all season long until the much anticipated opening to oyster season. It should be noted that commercial permit holders are only allowed the recreational limit of one 12qt pail per week and are prohibited from selling oysters. This year, with the help of the Community Preservation Committee funding, the oyster program was able to continue as in previous years. With decreasing funding in the revolving fund, the program was in danger of being cut. With the CPC funding, the CSPP was able to purchase 100,000 oyster seed as well as begin the multi-year process of replacing and upgrade old and dilapidated gear. In order to produce the oyster product that people have grown to expect, time and effort must be put into the oyster growing process; our oyster process is an 18 months growth cycle.

Stage 1 Nursery:

Similar to other species, oyster seed starts off in the nursery. This year our seed arrived on May 27th and went directly into silos. In a change from previous year, we requested our oyster seed as early as possible so that we could move it out of the nursery as quickly as possible to allow space for the quahogs to grow. We were lucky to have made that decision as a problem with the hatchery delayed the availability of seed oysters until well into the fall.

We felt that with the earlier seed arrival we would be able to grow the oysters to a larger size for the winter and would thus be a hardier product to make it through the winter. By July 8th, these animals were large enough to move into the field grow-out.



Figure 13 -Oyster Seed on arrival at the nursery

Stage 2 Grow-out:

The majority of our oyster grow-out takes place in floating gear at Stetsons Cove in Oyster River. This area provides the animals with almost constant water flow and plenty of food. It is also protected from most weather events over the summer months. Once the oysters are large enough to leave the nursery environment (1/4 inch), they are placed in floating ADPI bags. These strings of float bags are tied together in rows and provide the oysters with almost constant water flow. The bags can be flipped biweekly to kill off any fouling organisms growing on them.

This season's oysters joined the 2013 stock in the grow-out field at Stetson's Cove. The 2013 oysters had been over-wintered in large rebar cages and sunk in deep water to protect them from ice. In mid-April, these oysters were pulled out and replaced into floating bags for the growing season. The 2013 stock were the oysters large enough to distribute throughout the fall months.

Before being distributed into the public domain, oysters take time and attention to get them to harvestable size. Again this year, we went through the labor intensive process of tumbling all of our oysters. Along with grading the oysters by size, tumbling not only cleans the oysters but breaks the edge of the shell off allowing the oysters to grow a nice deep cup which produces the deep cupped oysters that our harvesters have grown to love. This process is labor intensive and takes approximately 200 man hours to complete the 100,000 oysters. The 200 float bags were all brought on land and emptied so that they could be run through our tumbler. The bags were power washed and the freshly tumbled oysters were thinned and returned to 400 float bags. The seaweed, crabs, sponges, and dead shell were graded out by the tumbler. This year with the assistance of the entire AmeriCorps Wellfleet House, 17 individuals were able to grade, tumble and return 100,000 oysters to the water in one day. This saved us an entire month of labor over the previous season.



Figure 14- Oyster Growth Rates



Figure 15- Barnstable County AmeriCorps assisting with oyster tumbling

Stage 3 Grow-out – Overwinter:

In December all of the 2014 seed oysters, along with any oysters that had not reached 3 inches, were placed in over-winter cages, and sunk in deep water in Oyster Pond. This area should be out of the reach of winter ice, and protected from storms. As a result of CPC funding we were able to start replacing old gear with new and hopefully better gear. The new gear was purchased from Ketcham Trap in New Bedford in July 2014 and was slowly integrated out into the field as the season progressed. The new gear uses a smaller footprint so less area is taken out of the public domain. The most convenient aspect of the new gear is its ability to be used as both floating gear in the summer and sunk gear in the winter, meaning, less gear to achieve the same goals. The cages will be refloated in the early spring and returned to Stetsons Cove for the next growing season

Stage 4 Oyster Distribution:

One of the high points of the CSPP oyster program is the oyster distribution. Many recreational permit holders anxiously await oyster season in order to harvest a basket of fresh Chatham Oysters. During the 2014 season, we distributed oysters 7 times from September to December. In total we distributed approximately 100,000 oysters to the waters of Stage Harbor and Mill Creek. There were many times that we noticed people intently watching us distribute oysters and then we watched them impatiently wait for the tide to drop so that they could venture out and retrieve their bounty. On multiple occasions we returned from distribution to immediately start checking catches of people who were harvesting the coveted oysters. Many people enjoyed multiple batches of oysters including Thanksgiving and Christmas oysters. Despite the harvesting effort, we believe that there is still a bounty of oysters available for hardy souls to find well into the winter months.



Figure 16 - Oysters ready for distribution

Community Preservation Funding

This year we were fortunate to receive support for the oyster program with help from the CPC funding. The funds will span over four years of the oyster program and will help support the continuation of this popular recreational activity. We are lucky to be able to use this money to replace ageing gear as well as purchase seed and hire labor to help maintain the seed.

With the timely monies from the CPC to upgrade and replace gear, we will be able to streamline the oyster-grow process and aim towards our goal of producing more oysters for this recreational fishery.

Razor Clam Experiment:

As part of a larger experiment through Barnstable County Cooperative Extension (BCCE) and Woods Hole Seagrant, we were fortunate to receive some razor clam seed. Razor clams are becoming a new and emerging 'alternative' aquaculture species and the BCCE is looking to help aquaculturists develop a method for production.

One hundred thousand razor clams arrived in the nursery on August 5th and were immediately placed into a silo. Like scallops these animals are active and swim around, so a screen was needed to keep the animals in the silo. These animals, much like steamers, do not have strong abductor muscles and need pressure exerted on them in order to help keep their shells closed. As a result we needed to either keep the animals in sediment so they could dig in, or keep them dense enough in the silo that they would all hold each other closed.

Razor clams are extremely fragile and need to be handled with extreme care, therefore an effort was made to handle them as gently and infrequently as possible. After a few weeks in silos, we decided that the razor clams needed to be in the sand, and as we were not ready to put them in the field, sand trays were created. These sand trays were built from plastic buckets filled with finely sieved sand with holes drilled around them to allow for some water flow. The trays were covered with a fine screen mesh to allow water flow at the top.

The razor clams were introduced to the sand trays, and almost immediately dug into the sand. We did have a mishap with a few of the trays not having enough water flow through them resulting in some mortality. However, the clams that survived grew well and at the end of October were transplanted out into the field. The razor clams were transplanted under buckets with a screened top. The buckets are approximately 18 inches deep and should exclude predators while keeping the razor clams in place.

We will check on the clams in the spring time, and hopefully they will have survived the winter and will have grown.



Figure 17 - Razor clams on arrival, and in sand trays



Figure 18 - Sand trays with razor clams holes, - Razor clams in the field under buckets

ShORE:

Each year as part of the Shellfish Officers Research and Education (ShORE), the Cape Cod Cooperative extension provides interested towns with seed and gear to participate in some ongoing research to determine and test growing conditions in different locations.

Each year we receive enough gear to deploy one unit per location. In each location a PVC frame is located holding 75 oyster seed. These seed stay in the water for approximately 60 days before they are collected. At the end of this time the county analyzes the oysters for: % survival, shell length and growth rate.

Three years ago in 2012 we only deployed gear to Stetsons Cove, but each year since we have added a location, Mill Creek (2013), Causeway (2014). As a result we are building a year to year comparison of growth rates across different locations around Chatham.

2014 saw the lowest average growth rate since we started collecting information, which ties in and agrees with our growth rate information from the nursery.

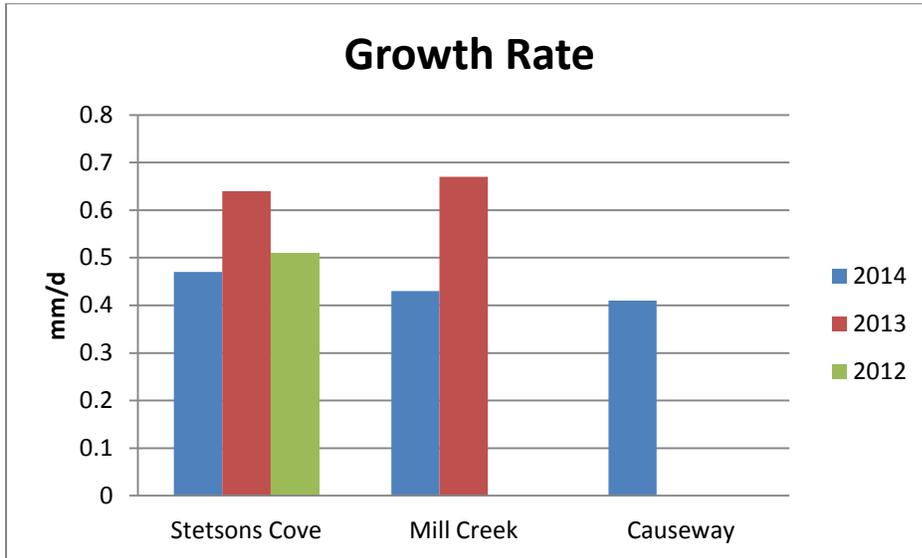


Figure 19 - Growth Rate of Oysters in mm/d

Shellfish Survey:

Shellfish surveys assess the population of shellfish in a given area at a given time. These studies are rarely long-term and provide only a snap-shot of a location's shellfish population. Such surveys do not take into account the potential effect of different environmental conditions on a resident population. In conjunction with a Cape Cod AmeriCorps placement, the department developed a long-term project to assess local shellfish populations. This project examines potential influences of population fluctuations by conducting monthly population surveys in three locations over the course of three years.

Environmental conditions such as air temperature, water temperature and barometric pressure are recorded along with the monthly population counts. This data will be correlated over time. The information gained will hopefully allow us to more accurately assess shellfish populations given specific environmental conditions in order to better understand shellfish behavior and identify viable shellfish habitat.

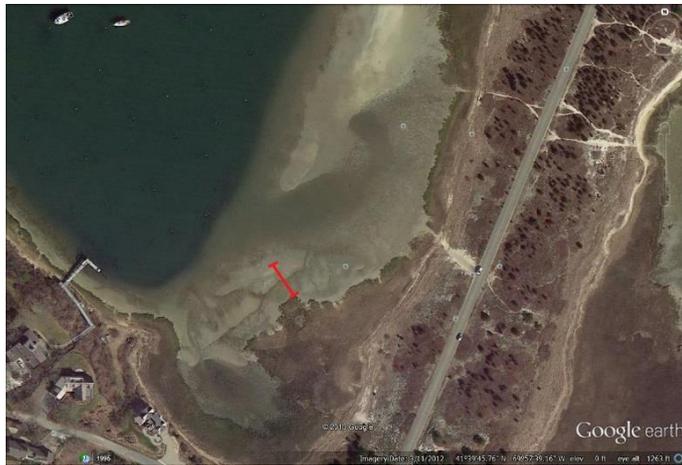


Figure 20- Stage Harbor Causeway; an area only open to recreational shellfishermen.

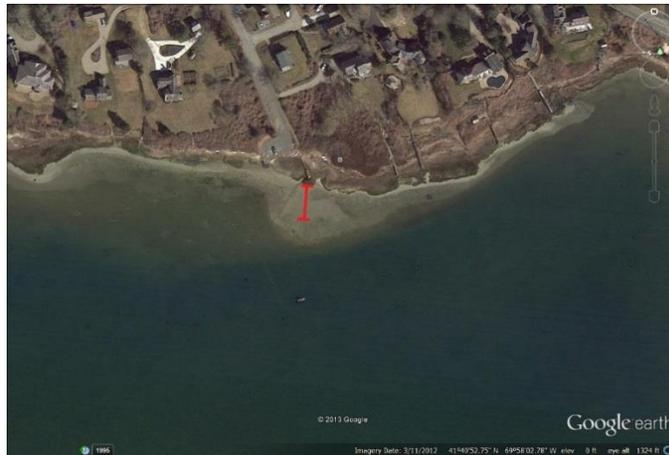


Figure 21- Oyster Pond Furlong; an area closed to both commercial and recreational shellfishermen.

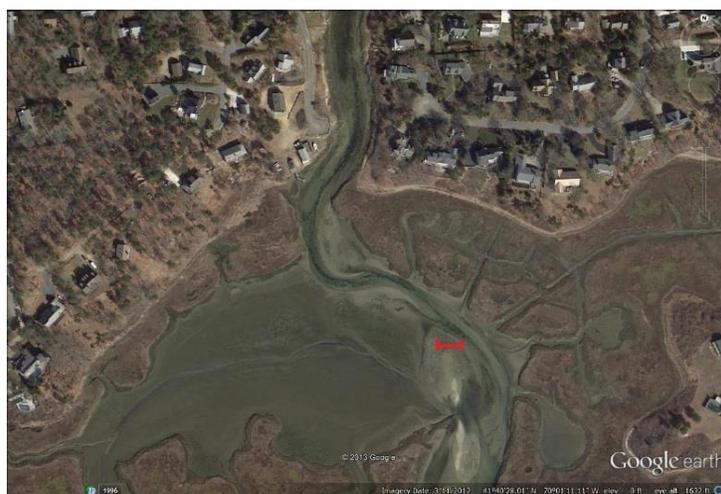


Figure 22- Mill Creek; an area open from December 1st through June 1st, to both commercial and recreational shellfishermen.

At each of these three locations, there is approximately a 100 foot line from which samples are taken within three 1 m² plots. The plots are dug out using a clam rake. The shellfish are collected and rinsed in a sieve then type and length (mm) of all the shellfish is recorded. Also recorded is the type of sediment, air and water temperatures, tide height, wind direction and speed, and moon phase. By recording these variables, our goal is to better understand how shellfish behavior differs from month to month as well as note possible trends occurring throughout the year.

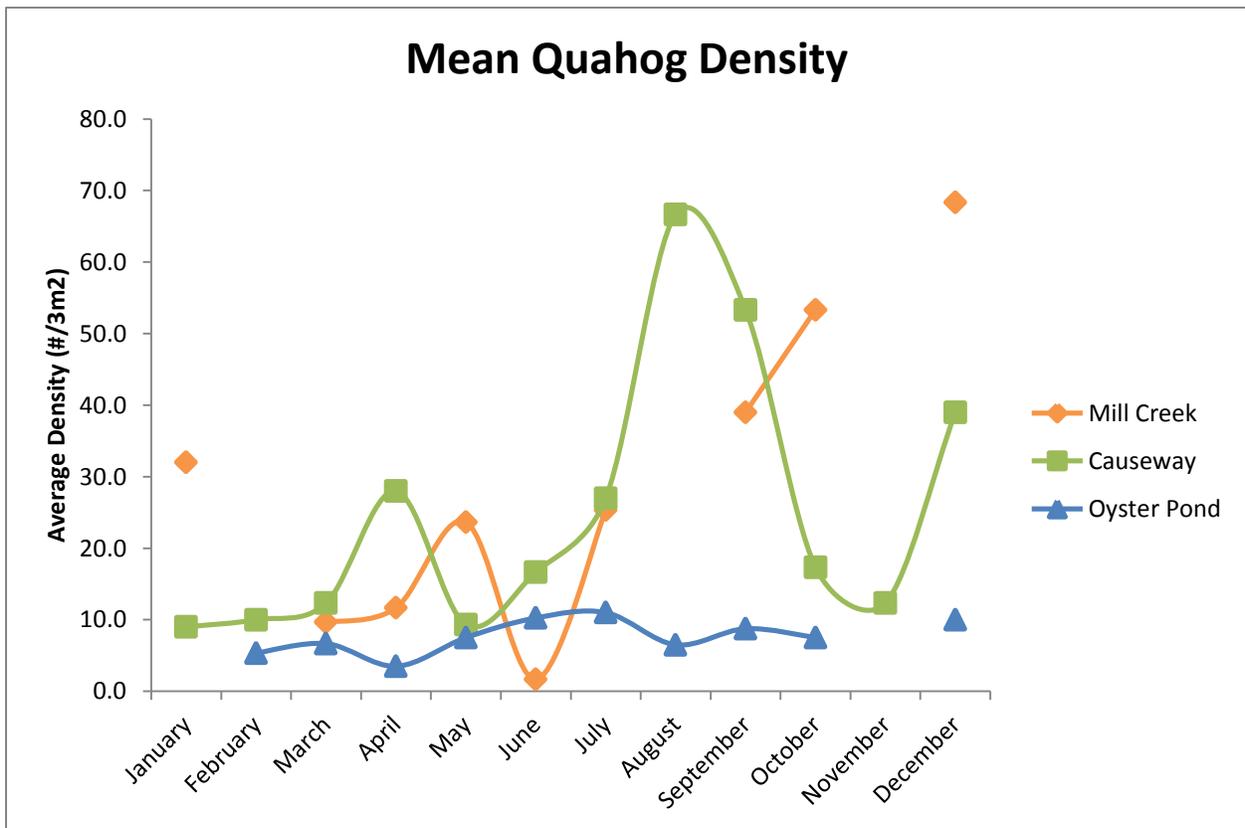


Figure 23- The mean quahog density at the three sample sites from January 2014 through December 2014. Certain months for certain locations are missing data due to poor tides and/or weather.

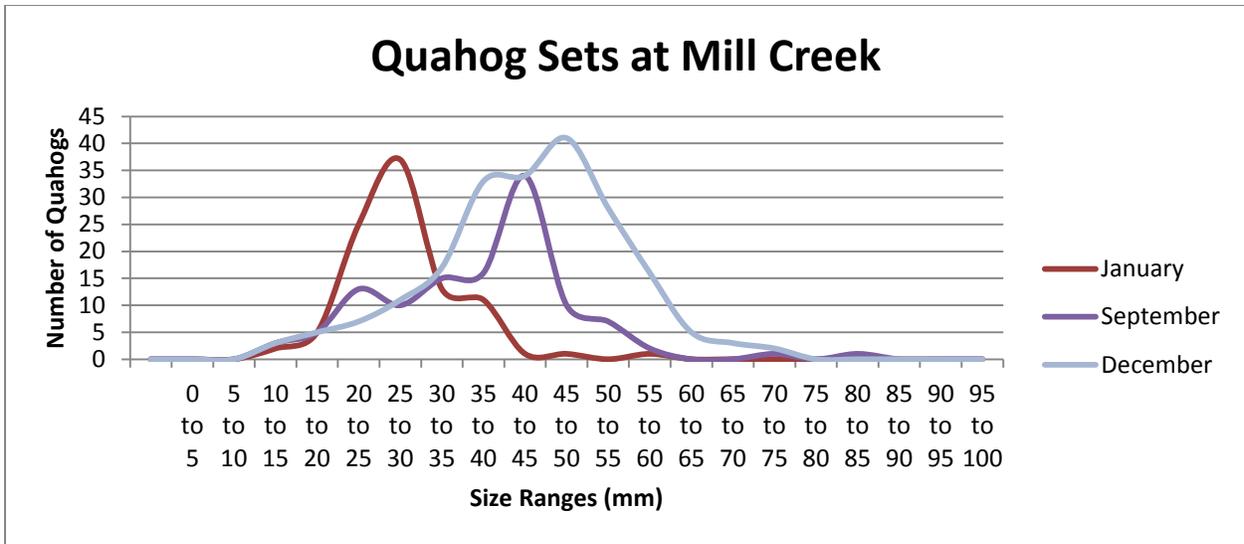


Figure 24- The change in size of quahog sets at Mill Creek. One set is clearly visible, which was planted by the Chatham Shellfish Department in the Fall of 2012. Some months were omitted due to outliers.

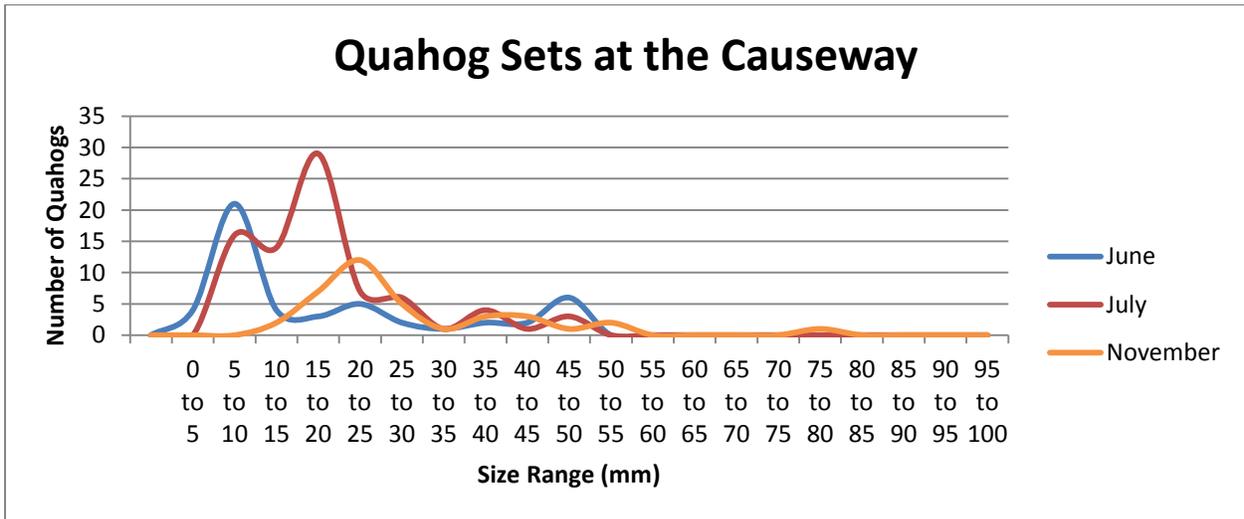


Figure 25- The change in size of quahog sets at the Causeway. One set is clearly visible, which is presumed to be a combination of a wild set and a set planted by the Chatham Shellfish Department. Some months were omitted due to outliers.

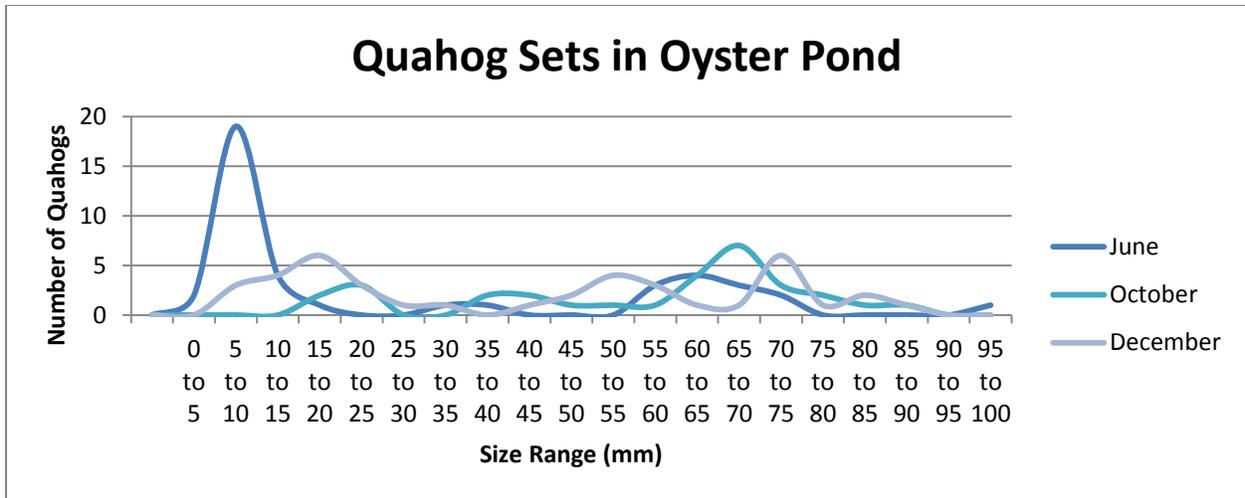


Figure 26- The change in size of quahog sets in Oyster Pond. Two sets are visible, both of which are presumed to be wild sets. Some months were omitted due to outliers.



Figure 27 - Variety of shellfish dug up in one survey location

Funding:

In 1983, Town Meeting voted to create a Shellfish Revolving Fund dedicated to the propagation, cultivation, protection and study of shellfish. From that date forward, seventy-five percent (75%) of commercial permit fees have been deposited into the Shellfish Revolving Fund. In 2001, half of the monies supporting the Town’s initial efforts in defending Chatham’s historic harvesting rights on Monomoy Island were expended from the Shellfish Revolving Fund. Along with the decrease in sales of commercial shellfish permits in recent years, the Fund has diminished and is in need of new revenues.

Concerned about the level of funds in the revolving fund and the increased expenses that the propagation program was facing, this past winter the department applied for additional funds from the

CPC to help offset the cost of the popular oyster program. The department was awarded a \$66,000 grant from the CPC to help with the oyster program for 4 years. This funding helped purchase seed and new gear for the department. Though less money was expended from the revolving fund this year, a decrease in permit sales resulted in less, though continued deficit to the Fund.

In addition, a friends group has formed the “Friends of Chatham Shellfish” and has established a fund which allows people to donate money to be used for shellfish propagation in the future. The department is not involved in this fund, and will apply for money from it when needed.

Conclusion:

2014 was a successful year for the CSPP, we grew and handled over three million animals in the nursery this season, and distributed close to three million animals out into the natural environment to grow out for harvest by shellfishermen.

This year we were able to utilize volunteers and AmeriCorps members to the benefit of the department which allowed us to cut down on much of the labor and time from the prior years. We were able to reach our goals from the previous year of more efficiency in the oyster grow out, as well as holding more quahogs in the nursery to grow out and decrease the number of predator nets planted.

The department will continue to learn from lessons of this past year as we move into the future and look forward to continued efficiency and growth.

Acknowledgments:

The department could not achieve half of what it does without the assistance and support of many individuals. The CSPP summer staff, Suzanne Phillips, Dominic Vitale and Shannon Doane, who worked all summer keeping the nursery clean and running smooth. AmeriCorps Individual Placement members, Brianna Walsh and Natalie Wall, who created and implemented the shellfish survey that is currently being conducted in town. They also offered valuable assistance to the department on any other projects that were needed. In addition, Daniel Campanaro offered time and expert knowledge in everything under the sun. Barnstable County AmeriCorps Cape Cod was also invaluable in offering assistance with many large projects that can only be completed when an army of individuals is available.

Finally we need to thank all the Commercial and Recreational shellfisherman who enjoy fresh local shellfish and are the reason that we work so hard to put product back into the environment.

Appendix A: Seed Arrival

Date	Species	Amount	Size
5/21/2014	Quahogs	2,000,000	R1.5
5/27/2014	Oysters	100,000	R1.5
5/27/2014	Quahogs	517,866	R1.5
6/25/2014	Oysters	6,000	1" - 2" Donation from Steve Wright
8/5/2014	Razor Clams	100,000	38/ml
8/20/2014	Scallops	100,000	63/ml
8/22/2014	Scallops	100,000	58/ml
9/5/2014	Scallops	100,000	Small
	Total	3,023,866	

Appendix B: Quahog Distribution

Date	Location	Amount
5/19/2014	Stage Harbor	30,000
5/20/2014	Stage Harbor	30,000
5/21/2014	Stage Harbor	5,000
6/30/2014	Mill Creek, Stage Harbor	200,000
7/7/2014	Mill Creek	100,000
8/13/2014	Causeway, Stage Harbor	160,000
8/14/2014	Stage Harbor	320,000
8/15/2014	Stage Harbor	112,000
9/29/2014	Bucks Creek	84,098
10/1/2014	Causeway, Stage Harbor, Island Flat, Mitchell River	140,000
10/14/2014	Little Mill Pond	8,000
10/15/2014	Island Flat, 1/2 Circle	12,000
10/16/2014	Oyster Pond	18,000
10/28/2014	Oyster River	4,000
10/28/2014	Island Flat, 1/2 Circle	360,000
10/29/2014	Battlefield, Sears Point	21,000
10/30/2014	Mill Pond, Little Mill Pond	25,000
11/6/2014	Stage Harbor, Mill Pond, Crescent Beach, Battlefield	560,000
11/13/2014	Oyster Pond	7,500
		2,196,598

Appendix C: Oyster Distribution

Date	Broadcast Location	Amount
9/11/2014	Causeway, Stage Harbor, Battlefield	24,000
9/17/2014	Causeway, Stage Harbor, Battlefield	12,000
9/25/2014	Causeway, Stage Harbor, Battlefield	12,000
10/9/2014	Causeway, Stage Harbor, Battlefield	20,000
11/5/2014	Causeway, Stage Harbor, Battlefield	7,000
11/19/2014	Causeway, Stage Harbor, Battlefield	20,000
12/11/2014	Mill Creek	5,000
		100,000