



# MARTHA'S VINEYARD SHELLFISH GROUP

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## Edgartown Great Pond Oyster Restoration Program

Year 13 Annual Report  
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Respectfully submitted by:

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## **Project Summary**

Oysters have become a renaissance species. They play a vital role in habitat restoration with the growing understanding that oyster reefs clean the waters in which they live and create preferred habitats for commercial and recreational fish species. Oyster reefs feed denitrifying microbial communities, help stabilize shorelines and mitigate some of the impacts of sea level rise while fighting the effects of ocean acidification. Edgartown Great Pond's wild oyster population has been vital to the health of the pond and the sustenance of its community since early tribal times. In 1994, the oyster population suffered a massive mortality event which caused by *Perkinsus marinus*, a single cell parasite which causes Dermo disease. Dermo impacts wild oyster populations from Maine through Texas, and can kill an oyster in a little as 1 year, where the parasite is most virulent.

In 2007, after more than 10 years of selective pressure from Dermo disease, the Martha's Vineyard Shellfish Group initiated an oyster restoration program for Edgartown Great Pond in order to speed the ecological recovery of the estuary. Every season since then, large oysters, which have survived years of Dermo infections and are suspected to be more tolerant or resistant to it, are selected to be the parents of hatchery reared larvae, spat-on-shell seed and single oysters produced by MVSG. Other strategies such as predator control and cultching are also implemented to help the population recover and persist. Cultching is the spreading of clean, recycled shell in the pond. Shell cultching helps to balance the pH of the pond in the face of climate change, eutrophication and the resultant acidic bottom conditions.

From 2008 to 2015, levels of Dermo disease were monitored in the pond by Emma Green-Beach, first as part of her research for her Masters of Science from Rutgers University, funded by the Vineyard Vision Fellowship and then as an initiative from MVSG to keep an eye on the health of the oyster population. Infection levels (weighted prevalence) were relatively low, oscillating between 0.2 and 1.9 (scale of 0-5). During this time the pond started showing signs of recovery: improved water clarity and an increase in the oyster population. The oysters appeared to tolerate the moderate-low disease levels, and mortality was relatively low as well. However, there were very few oysters and very little to no eelgrass in the Great Pond. By 2016, eelgrass beds had noticeably expanded once again. In 2018, we witnessed a massive wild oyster set which covered every surface below the water line with young oysters - a definite sign of a healthy oyster population. However, in the spring of 2019, we received new reports of extensive adult oyster mortalities in particular parts of the Pond. Similar news was reported in Tisbury Great Pond. MVSG responded by re-launching our intensive Dermo monitoring program and adding a new population survey to this Oyster Restoration Program.

The pond's general trend towards recovery is undeniable, but we still face some significant setbacks: filamentous brown algae settling on eelgrass blades, boring sponge (of the genus *Cliona*), opportunistic green macro algae blooms, the presence of toxic jellyfish and occasionally, high oyster mortality. In the winter of 2019, the MVSG team decided to add oyster population distribution and disease monitoring programs to our existing propagation and enhancement program to get a better understanding of why we still see significant mortalities. Unfortunately, we were unable to perform the population surveys in 2020. However, we did collect more valuable data on Dermo disease in both Edgartown and Tisbury Great Ponds.

We like to discuss this project as having three components:

1. Oyster Stock Enhancement (80%)
2. Oyster Population and Dermo Surveys (10%)
3. Shell Recovery and Cultching (10%)

## PART I: OYSTER POPULATION ENHANCEMENT PROGRAM

The map below is a visual summary of the oyster enhancement strategies/activities that were employed in 2020. The following section will refer back to this map and these activities.



### Trapping crabs for predator control

Blue crab, green crabs, and even small mud crabs, are voracious predators of young and weak shellfish. Edgartown Great Pond does not always have a lot of large crabs. Populations of blue crabs, *Callinectes sapidus*, rise and fall in waves, which are dependent on megalop larvae making

their way into the Great Pond at the right time, when the beach is breached to the ocean. In 2017 or so, there was a notable increase in the number of invasive European green crabs, *Carcinus maenas*. The literature indicates that green crabs can survive in salinities as low as 4 ppt, but they rarely persist in our south-shore Great Ponds. This year, very few green crabs were caught in the traps, but many small blue crabs were seen and released. We think that some of the mortality seen this year was from crabs, and was made possible by the terrible boring sponge (*Cliona sp.*) which invades the oyster shell and makes it porous, weak and vulnerable.

### **Spawning cages and wild spat collectors**

During the months of May through July, three surface-floating oyster spawning cages were deployed around the pond, each containing 300 adult oysters. This strategy is effective for several reasons:

1. The top several inches of water most often have far superior algal food resources compared to the bottom of the pond, and thus providing the best nutrition.
2. Surfaces waters heat and cool more rapidly which helps to induce the oysters to spawn.
3. By holding so many oysters in a small space, the females are more likely to be triggered by spawning males, thus increasing fertilization efficiency.

Unfortunately, we saw a very sparse set of wild oysters in the pond this year. The last year there was an ample set was in 2018. It is not unusual for recruitment to vary in waves or cycles. We did not hang bags of clean shell from the spawning sanctuaries to collect wild spat, as we usually do. This year we experimented with a new piece of technology called a Zapco Spat Trap (<https://www.zapcoaquaculture.com/equipment/spat-catchers>). One piece was put into the remote-set tanks on Kanomika Point, two were hung in Slough Cove and one was hung south of Swan Neck. The collector that was placed in the tank with cultured larvae (from the hatchery) collected roughly 20,000 oyster spat and the three other collectors trapped about 5,000 spat in total. All of which fell off the collectors easily and are being grown in floating cages with the other singles produced in the hatchery.



Field Manager Jason holding new spat catcher.



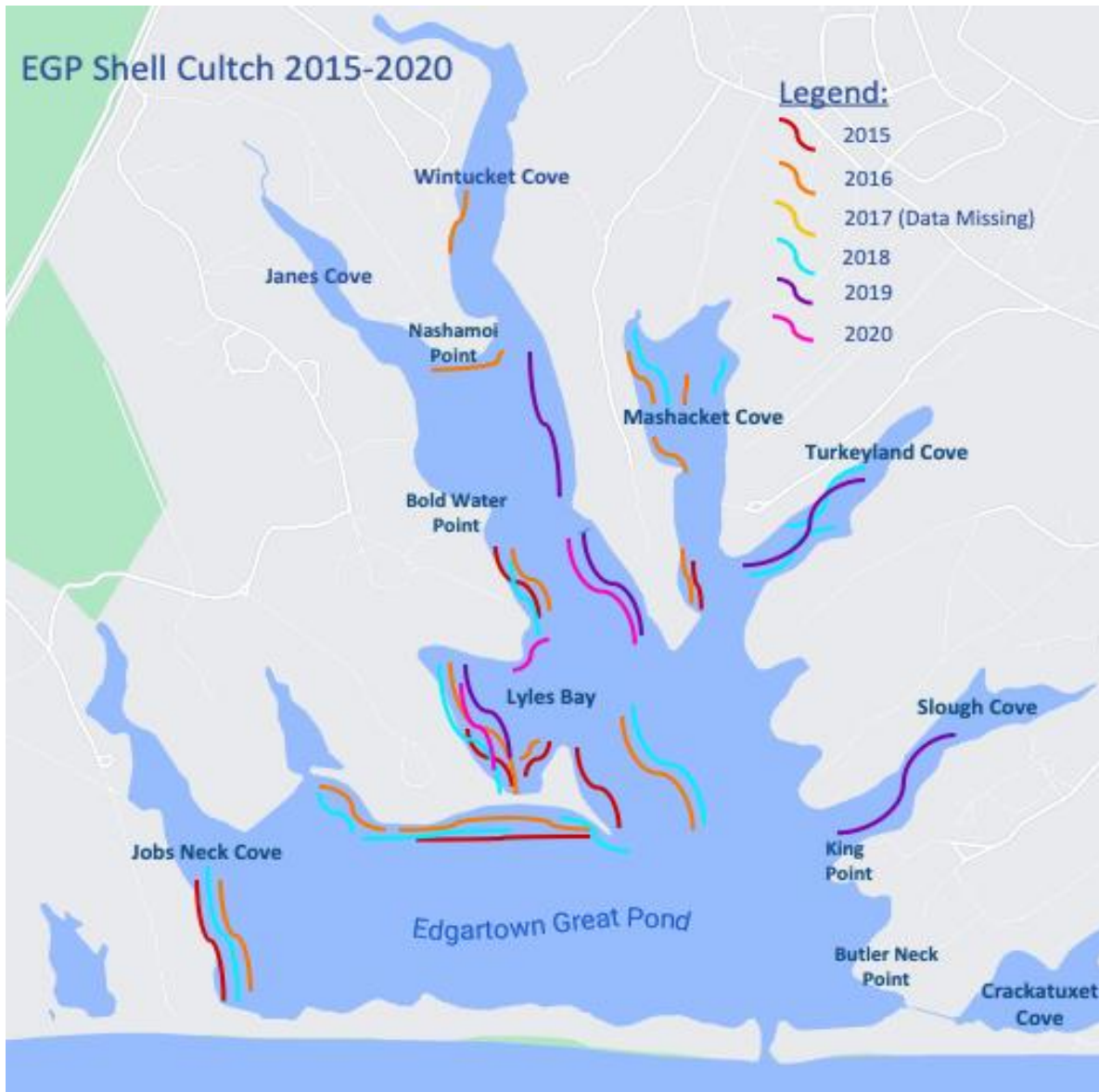
Preparing to spread shell cultch into the pond using the Edgartown Shellfish Department's skiff.

### **Cultching: Spreading shell into the pond**

On June 20, 2002, with the help of the Edgartown Highway Department and David Merry and Sons Inc., about 15 yards of shell were put back into the Pond in order to neutralize acidic water and provide substrate for the oyster larvae to cement to. MVSG interns and our field manager spread shell in Lyles Bay and around Kanomika Point. Cultching, or “shell pushing”, as it has been affectionately nicknamed, is important, even when

there is very little wild set. We are satisfied with spreading 15-20 cubic yards per year, and hope to do a larger amount (40-50 cubic yards) ever few years. Shell-pushing is very labor intensive.

Thanks to the Shell Recovery project and the wild scallop fishery, the shell was entirely local this year, with no imported clam shell from off-island.



In the seasons of 2021 through 2023 we will focus more shelling in Janes Cove (or perhaps upper Meshacket Cove). The water quality in Janes Cove is prone to higher dissolved nitrogen thus lower pH and greater ecological degradation. The hope is that after leaving a large volume of shell in the cove we can build a self-recruiting oyster reef. Those oysters will filter the water to increase water clarity and will remove nitrogen through protein synthesis (i.e. yummy oyster meat) and microbe-mediated denitrification in the sediment.

## Producing oyster larvae

Oysters were spawned on June 26<sup>th</sup> and on July 1<sup>st</sup> in the Richard C. Karney Solar Hatchery in Vineyard Haven which produced over 159 million fertilized eggs. The oyster larvae were grown for 2 weeks in larval tanks both at the Richard C. Karney Hatchery in Vineyard Haven and the Hughes Hatchery in Oak Bluffs – both on Lagoon Pond. Larvae were drained every other day, graded, counted and fed every day with custom micro algae grown at both facilities.

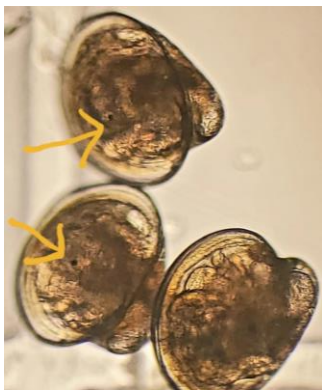


Chris and Alley spawning oysters in the Richard C. Karney Solar Hatchery.



Oyster larvae were rinsed, separated by size and prepared for the remote-set tanks. Larvae were grown at both our Vineyard Haven and Oak Bluffs facilities. Each bundle on the right held 1,100,000 larvae that are ready to stop swimming and cement themselves onto shells.

## Setting the oyster larvae on recycled shell on Kanomika Point



The dark eye spots indicate that the larvae are ready to cement themselves onto shells. The larvae are added to the tanks full of shell, and a few weeks later, they are ¼" long!

Once the larvae reached the eyed stage and were ready to undergo metamorphosis, they were transferred to our remote set tanks on Kanomika Point. The tanks were filled with mesh bags of recycled shell from Island restaurants and inoculated with a total of 1.81 eyed larvae from the hatchery. The tanks were drained and refilled every day, and fed a mixture of live algae from the hatchery, and a suspension of conveniently concentrated, preserved algae from Reed Mariculture, Inc. Very soon after metamorphosis, the tiny oysters eat so much microalgae that we are unable to transport enough live food to satisfy them. After a week, the bags holding shell and newly cemented juvenile oysters were removed from the tanks and placed in our floating nursery cages in the rich surface water of the pond. The oysters then grow very quickly, and are still protected from predators.

### **Releasing the remote set oyster seed**

Clumps of juvenile oyster were removed the floating cages on several dates August - October and seeded into the pond in areas with hard bottoms and areas targeted during the shelling. The timing of this planting always varies, and depends on the growth rate of the oyster spat. The goal is always to let the spat grow as large as possible before they grow through the mesh of the bags. This year the wild set was very poor which makes our input of hatchery cultured oysters that much more vital to the health of the oyster population and pond in general.



This year we tried something new, which we will become part of our general practices. We chose six out of the ~24 large bags of spat-on-shell and instead of planting them out before the spat grow into the bags, those six bags for spat-on-shell were split into 12 bags and put back into the cages to grow bigger. We will do more of this next year.

### **Producing Single Oysters**

Every season the Shellfish Group grows a small amount of “singles” for Edgartown Great Pond. Singles are oysters set on small (<0.8mm) pieces of shell instead of a large shell, producing an individual oyster instead of a clump of oysters. These oysters have better market value but are more sensitive to predation and have to be protected in bags until the next season. This year 129,400 singles were grown in the pond using our floating cages and survived beautifully. In November, the cages will be sunk to the bottom of Mashacket Cove for the winter.



This year we purchased two replicates of a new system designed to produce single oysters. The goal of this system is to more easily produce single oysters, compared to the traditional method of setting larvae on crushed poultry shell, which is very labor intensive. Each system had two halves. Two of these halves were hung in Slough Cove and one half south of Swan Neck, with the hopes of catching wild oyster spat. The remaining one half of the system was placed in one of the remote set tanks. An additional 5,000 oysters were collected from the wild, a single oysters.

## PART II: POPULATION DISTRIBUTION AND DISEASE MONITORING PROGRAM

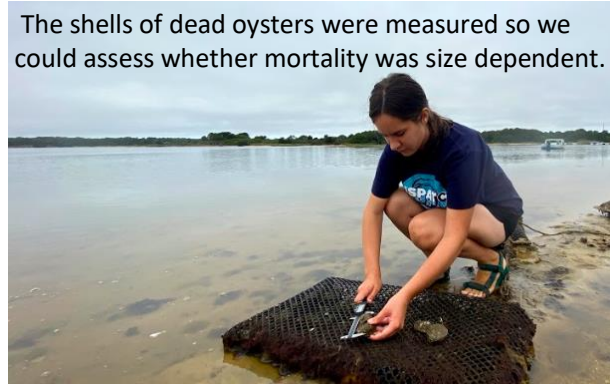
### Size distribution and abundance of the oyster population

*Due to a sudden and significant change in staffing, this population monitoring was not done in 2020. We will resume in 2021 and hopefully add sites in TGP for comparison.*

### Mortality and disease monitoring

This year we achieved three out of four goals that we set for ourselves in 2019:

1. Attach temperature loggers to survival cages from which we take samples  
✓ *Graph of water temperatures below*
2. Measure salinity at every sampling and monitoring event  
✓ *Salinity was about 15ppt all summer in EGP, and 15-20ppt in TGP*
3. Record water depth at every sampling event  
✓ *The EGP cage was in 0.4m less water than in TGP.*
4. Collect a Dermo sample in June before the water reaches 20C  
✗ *The first Dermo sample was collected when the water was almost 25C*



The shells of dead oysters were measured so we could assess whether mortality was size dependent.

To monitor mortality and Dermo infection levels, a test cage filled with 200-300 adult oysters was placed on the bottom in Turkeyland Cove. Mesh bags were also deployed on the bottom at Sepiessa Point in Tisbury Great Pond. The cage was monitored with live/dead counts and live oysters from the cages were sent 5 times during the season to Rutgers University for Dermo analysis.

### **Mortality Results**

Oyster mortality in EGP was much higher than in TGP and higher than it was in 2019. However, a few other factors besides Dermo disease added to this mortality, and/or confound the results. Despite these confounding factors, we still conclude that mortality was substantially higher in EGP than in TGP, despite similar temperature and salinity conditions.

#### **1. Boring sponge**

Various species in the genus *Cliona* are destructive sponges which invade the calcium carbonate shells of oysters and other organisms. As they spread throughout the shell, the oyster exerts a lot of energy to create more calcium matrix to keep the sponge at bay. This energy cost can reduce the growth, condition, reproduction, and disease-fighting ability of the oyster.

Boring sponge is a major problem in Edgartown Great Pond, more so than in TGP. We often find oysters that can be crushed with a strong hand. Boring sponge is worse in some parts of the pond than in others.

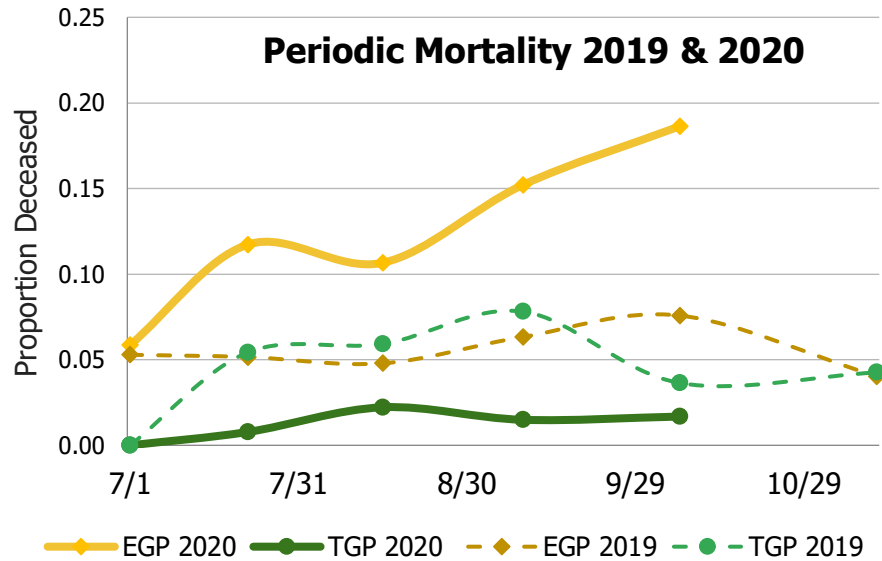


## 2. Blue, green and mud crabs

Young oysters, and those that have weak shells from boring sponge. Most of the oysters we plant are in the form of spat-on-shell as a means to help protect them from crabs.

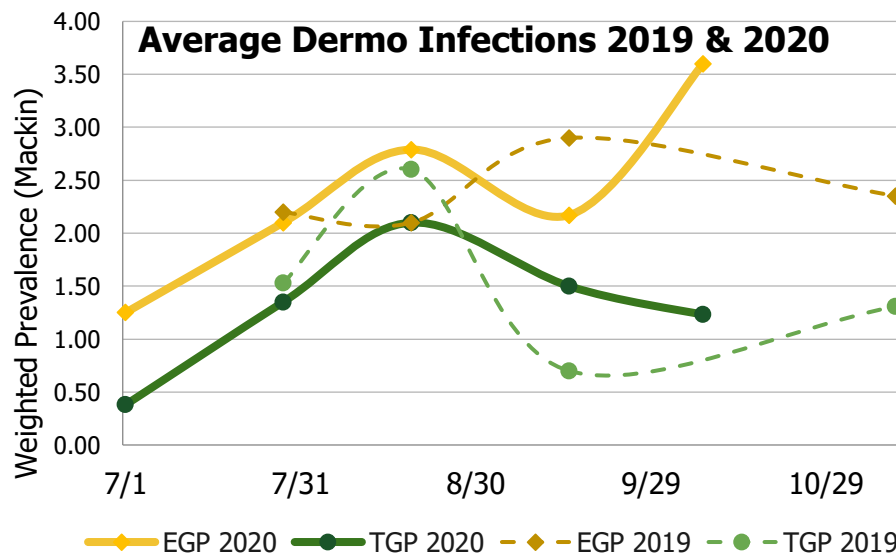
## 3. Theft!

This year, oysters disappeared from the cage at the rate of about a dozen at a time. We put a sign on the cage but it didn't help. Next year we will put it in deeper water, and somewhere more inconspicuous.



## Dermo Infection Results

Derma infections in EGP were consistently higher than those in TGP, which is partly explanatory to the mortality shown in the graph above. Although the trend was different from 2019, it was relatively similar until the October sample came back from the lab (in late November).



Among Derma researchers, an average infection level of 3.0 (on the Mackin Scale of 0-5) is considered to cause death in a population. A 3.6 average infection level, as seen in the October 2020 EGP sample is extremely high. This explains the mortality rate that was measured in the October sampling (graph above) but we cannot find an explanation for this high infection level. Temperature was decreasing and the salinity was unchanged (16 ppt) from September. It indicates that there were a lot of highly infected, weak individuals which were succumbing to the disease. Our prediction is that there will high mortality this winter.

In 2021, MVSG will initiate a small, long term study with seed-money from the Edey Foundation to study the difference in Derma disease resistance/tolerance of EGP, TGP and the Rutgers University NEH lines of oysters. We will grow all three strains in both Edgartown and

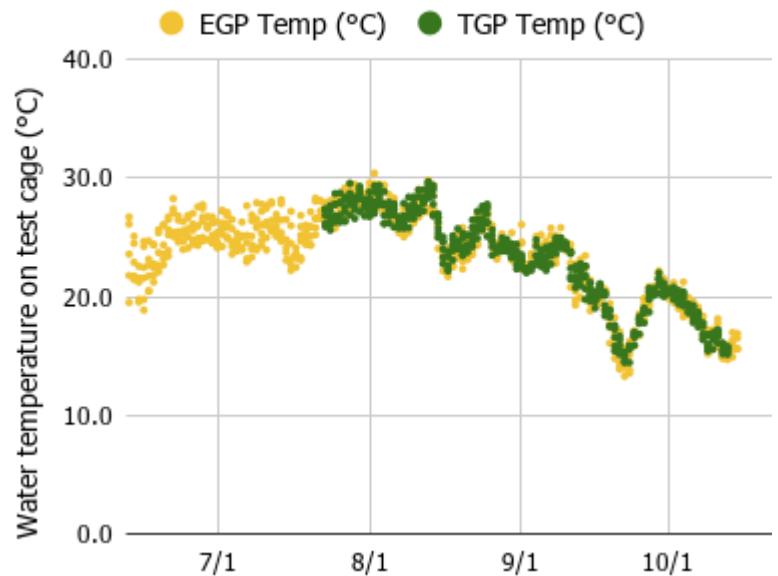
Tisbury Great Ponds, monitoring growth, survival and disease levels, for up to 5 years. The results will inform us of which strain/population we should be using for restoration broodstock.

### **Effects of temperature, salinity and beach openings on Dermo**

Dermo infection levels in oysters are highly correlated to temperature and salinity of the water. In EGP and TGP, which are periodically opened to the ocean, temperature and salinity can drastically rise in a matter of hours/days when water level drops and salty ocean water rushes into the pond. To understand and attempt to explain the infection levels in the oyster population, we need to always consider water depth, temperature and salinity at the sampled sites.

The graph to the right shows that the water temperature in the cages in both ponds were very similar. Salinity was taken at each sampling and monitoring time, and ranged from 14 -16ppt in EGP and 15- 20ppt in TGP. Neither pond was open to the ocean during the monitoring period, this year.

### **Water temperature at cages 2020**



### **The Shell Recovery Partnership**

The Martha's Vineyard Shell Recovery Partnership is a program of the Martha's Vineyard Shellfish Group, Inc. and was created in 2011 under the initiative of former hatchery staff Jessie Holtham. She formulated a shell pick---up program with these goals:

1. Reduce bulk waste from the Island's waste stream
2. Increase buffering capacity of Martha's Vineyard salt ponds
3. Provide a local source of shell for shellfish restoration

Since 2014, the project has been managed by now MVSG's Executive Director Emma Green-Beach. The Shell Recovery program picks up shell waste from 8 - 10 restaurants, from April through October and brings it to a secure outdoor location in Edgartown where the shell is dumped into a pile to age for one year. Since 2011, Martha's Vineyard Shell Recovery Partnership has been funded by various sources including the Vineyard Vision Fellowship, Patagonia, Edey Foundation, Farm Neck Foundation and private donations.



In recent years we have put more emphasis on the connection between shell recovery and the oyster restoration projects we have managed in both Great Ponds for many, many years.

By using local, recycled shell, we have closed the loop for our cultching practices. In 2019 we collected over 30 yards of oyster, clam and mussel shells from restaurants that would have otherwise been thrown away. We used all of that for our oyster restoration programs in 2020. This year, due to the pandemic, we have just a few cubic yards of shell saved for next season. We will rely heavily on the wild scallop shell for our program. This fall, of 2020, MVSG hired a new shell recovery coordinator, Alley McConnell. She is putting in efforts to increase public awareness of the program and establish public drop-off locations for commercial and recreational shellfishers.



New Restoration Coordinator, Alley, dumping shell from restaurants. It will age in this pile for one year before being planted into the pond.

### **Summary and Future Goals**

Our spat-on-shell seed showed fantastic growth and survival, as did the single-set oysters from both 2019 and 2020. The shell cultching efforts put 17 yards of scallop shell back into the pond to provide habitat for the next generation of oysters and fight acidification of water and sediment. We grew 129,400 oyster singles, which are still protected for the winter in bags at the bottom of the pond.

Edgartown Great Pond has seen great improvements since the first outbreak of Dermo decimated the oyster population in the mid-1990s. The increased water clarity, the return of eelgrass meadows and oyster populations are clear signs of the overall good health of the pond. These water quality improvements are made possible, first and foremost, by the upgrades made to the wastewater treatment plan in the mid-1990s. Without the foresight and commitment from the Town of Edgartown, Edgartown Great Pond would not be the clear and beautiful estuary it is today. Improvements are also made possible by the significant dredging, funded by the Great Pond Foundation, until 2020. Since the birth of and made possible by this project, MVSG has planted 15-20 million oysters into EGP. These oysters have restored the ecological balance of the pond by filtering the water, providing habitat for other species and by cycling nutrients within the ecosystem. Mature, wild oysters also provide a source of sustenance for local families in the winter time. Through harvest of mature oysters, additional nitrogen is removed from the pond.



However, we do need to stay vigilant as the pond does show signs of setbacks: filamentous brown algae settling on eelgrass blades, boring sponge, nitrogen-loving macro algae blooms, and continued oyster mortalities which seem to be explained by a recent increase in Dermo infections. This increase is concerning and we feel that more monitoring will be needed next season. Further monitoring will help determine if the oysters can, once more, overcome the disease. If possible, we will continue to use the strategies from 2020, resume the population surveys from 2019, and add a few elements.

### **Stock enhancement goals for 2021:**

1. Use more shell in the remote-set tanks so that each cluster is not so crowded, and to allow each larvae to have greater impact on restoration.
2. Split the large bags of spat-on-shell into 2 bags after 3 weeks in the pond, so we can grow them to a bigger size before releasing, thus improving survival rates.
3. Select a site in one of the coves (Janes or Meshacket) that will become a long-term restoration goal. We will add shell cultch for three years to harden and “sweeten” the bottom, before planting young oysters. This site will be selected to have increased impact on the water quality of the entire pond. A potential site is Jane’s Cove. MV Commission water quality data shows that Jane’s Cove is more impaired by nitrogen than most areas of the pond, and has high chlorophyll levels, which are indicative of microalgae food for the oysters.
4. Obtain a bigger work boat and engine. The 13” Whaler that has been used for several years is not big enough to serve as a proper, safe work boat.

### **Population and disease monitoring goals 2021:**

1. Resume population surveys which were initiated in 2019.
2. Place test cage of oysters in a secure location with predator exclusion to reduce mortality-inducing variables.
3. Start oyster Dermo resistance study, funded by the Edey Foundation.

### **Shell Recovery and cultching goals 2021:**

1. Renew Shell Recovery restaurant membership to 2019 levels, if possible (with respect to COVID-19)
2. Partner with at least two catering/raw bar companies to collect shell
3. Establish two public shell drop-off points
4. Spread at least 25 yards of shell in EGP

