



## Siemens We Can Change The World Challenge

### Stewards of the Pamlico Sound's Application Details

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#### • Step 1: Choose It!

Hatteras Island is a small community located off the coast of North Carolina. Our coastal economy is dependent upon tourism and fishing. In the past several years, the fishing industry has been declining steadily. Our community has been experiencing this decrease for many years, and it seems that Hurricane Isabel in September of 2003 exacerbated the problem. The storm swept away much of the substrate in the Pamlico Sound. This habitat loss in turn effected the oyster populations due to the fact that there was nothing for the oyster larvae to attach to during the crucial pediveliger stage of their development. Since oysters play an important part in maintaining water quality, the declining populations of oysters has added to the decline of the water quality of Pamlico Sound. In the past twenty years many factors have influenced the degradation of the water quality of the Pamlico Sound, which in turn has influenced the decline of the oyster populations.

This issue is important to us as it plays a major role in many aspects of our everyday lives. Our island culture is one that developed due to the community's reliance on the waters of the Atlantic Ocean and the Pamlico Sound. It is imperative to us as well as our community that we work together in an effort to help replenish the oyster populations, which will in turn help in the restoration of the quality of the water of the Pamlico Sound.

#### • Step 2: Research It!

As a team we had been noticing a decrease in oyster populations since Hurricane Isabel, and we wanted to know why this was happening. In order to do so, we knew that we had to draw upon every possible resource.

Our team ventured into the community to discuss how the waters of the Pamlico Sound had changed over the years. The elders of our community gave us vital information with regard to the Pamlico Sound in the past. They told us that at one time there were oyster reefs that were so large that they were navigational hazards. Many of them told us that they thought that there would always be more than enough oysters in the water, and they were shocked by the sharp decrease in the oyster populations. We quickly realized that this meant there was a serious problem within our estuary system. This information only reinforced the fact that we had to continue to gather more information. We soon began talking with scientists from the Coastal Studies Institute and other scientists from the university system. We told them of our endeavor to become stewards of the Pamlico Sound and asked them for help gathering important information and determining how we could help. The declining oyster population was a serious issue that needed to be addressed.

As part of our research we spent our first two years in middle school learning about the Pamlico estuary system and the importance of oysters. We quickly learned that oysters are considered a "keystone species", meaning that it is an organism that helps to keep the estuary system healthy. John McCord of the Coastal Studies Institute came to our school two days a month to help educate us about the importance of oysters, the oyster life cycle, and the role they play in a healthy estuary system. We also learned how important it is to be proactive about our environment if we want to help to restore our waters.

By the first spring we were donning waders and exploring the Pamlico Sound behind the school. We spent many hours seining and collecting various organisms that lived in the shallow waters. We set up tanks trying to replicate the shallows of the Pamlico as much as possible and observed the behaviors of the many different organisms. As we waded through the water, we were also trying to locate oyster reefs so that we could observe the ecosystem of an oyster reef and also to keep a record of any reefs that we could find. The sad reality of this endeavor was that we never found a natural reef in the areas that we explored. This reinforced our thoughts that we needed to do something about the decrease in oyster reefs in the waters of our island.

While researching the reasons for the decline in the oyster populations in the Pamlico Sound we found that most scientists agreed that there were many factors involved. As James Mackenzie of NOAA has said, some of the most prevalent factors, "... are biological and physical damage to the oysters and their beds (predation, siltation, severe storms, channel dredging, and harvesting by dredges)." After reading that statement we discussed the fact that Hatteras Island, a barrier island off the coast of North Carolina, is in the path of many storms throughout the year. The more we read, the better we understood that oysters need substrate in order to thrive. The oyster during the pediveliger stage (footed stage) of development will not survive without substrate.

As a group we became more determined to help restore the oyster populations in the Pamlico Sound. John McCord, Coastal Studies Institute, became our primary consultant. When he visited our school, there was a group of students who talked with him about what could be done about the oyster populations. We would also email him and at times even call him when we had an "urgent" question that needed to be answered. He told us about the oyster shell recycling program with the Division of Marine Fisheries. This organization has a statewide oyster shell recycling program with a motto of, "Oyster Shell Recycling – Trash to Treasure". As we continued to read about and discuss the declining oyster populations, the common thread weaving through the story of our oysters was one of substantial substrate loss.

### • Step 3: Plan It!

After many discussions with scientists from the Coastal Studies Center and Division of Marine Fisheries and with our goal of helping to increase the oyster populations in mind, we felt that building an artificial oyster reef would be the most successful avenue for restoring oyster populations. We quickly learned that there were many steps to take before we could build the actual reef. The first thing we needed to do was to create a protected research sanctuary behind the school in the Pamlico Sound. Mr. McCord helped us with that by contacting state authorities who were very prompt in allowing us to delineate the area for research. Once the area was established, we then needed to determine what size reef we would build and what material to use for the reef. The DMF could provide us with either recycled oyster shells or marl (a rock-like sediment) with which to build our reef. We decided to use oyster shell versus marl because we thought that oyster shell was the more natural way to help the environment.

We then contacted DMF and arranged for them to drop off the oyster shell and bagging material. That's when the hard work began. As a team we had to bag a dump truck load of oyster shell into bags. We bagged roughly 1,000 bags before the end of the school year. Despite our best efforts we were unable to finish creating our reef before the last day of school, so we had to dedicate several of our summer days to complete the job. The next step in the process was loading; at first we had planned on simply laying the bags down on the bottom one after the other, but Mr. McCord advised us otherwise. Some of us loaded the bags into a skiff and took them out into the Pamlico Sound behind the school, while the rest of us waded into the Pamlico to direct the boat to the correct spot. We began stacking the bags three high, each layer going down perpendicular to the one prior to it. The process continued with the skiff making several trips back to the docks to get more oyster bags. At the end of the day, there was a 16.77 square meter artificial oyster reef behind our school.

### • Step 4: Do It!

We had built the artificial oyster reef in the Pamlico Sound in June and knew that we had to allow some time before we began collecting data about oyster recruitment. During the summer, occasionally someone from the group would venture behind the school to visually check the reef and make sure no bags had washed ashore. We were also happy that we did not have any strong hurricanes during the summer that could have damaged our reef.

When we returned to school in August, we were anxious to get into the water to check our reef to see if any oyster spat had been recruited. One of the first things we did upon our return to school was to set a date when we (teachers and students) and the scientists from the Coastal Studies Institute could collect quantitative data from the reef. On August 27, 2008 we put on our swimsuits, life jackets, and goggles, gathered our equipment, and spent the afternoon laying down a transect line and using a PVC half meter quadrat to section off the reef, so we could count the number of oyster spat that had been recruited in the  $2\frac{1}{2}$  months since we built the reef. We would count the oyster spat in each quadrat and report the information to the adult data collector. At the end of the day, we knew we needed to collect more data before we could sit down and analyze our findings. The next data collection took place on September 4, 2008 when we again laid down a transect line and using half meter quadrats counted the oyster spat. Each time we collected data, one of the scientists filmed us collecting data and took footage of natural activity on the reef.

When all the data was collected, we came inside to examine the findings of our research. Our team also took our field notes and entered the data into Excel; data consolidation allowed us to track the progress of our reef electronically. In doing so, we were also able to see the information graphically.

Although we wanted to collect data later in September, we were unable to get back into the Pamlico due to poor weather conditions. We did put on our waders a number of times, though, and trek out into the water to check the reef to make sure it was still intact. Recently local surfers donated some used wetsuits so that we can venture into the Pamlico Sound during the early spring to collect data about the growth rate of the oyster spat that was recruited. During the late spring and early summer we will again lay a transect line and use our half meter quadrats to count any newly recruited spat. We are hoping that as our reef behind the school continues to thrive, and we share our good news, island residents will want to become involved in our oyster recruitment project.

### • Step 5: Analyze It!

Upon the completion of our reef, we could not collect data until about two months later, because school had not started yet and we were enjoying our summer vacation. When summer ended and we came back to school we suited up and went out into the sound to collect quantitative data. Our findings were astounding and better than we could have ever imagined!

In just over two months, the reef had shown an amazing amount of growth. Our data indicated that 43% of the reef showed oyster

spat recruitment. When we shared our initial data with the scientists from the Coastal Studies Institute, they were impressed with the amount of recruitment in three months. We also sat and analyzed the video footage and were very excited to see the numbers of sheepshead, pinfish, pigfish, blue crabs, and other animals that had made the reef their new home. Not only was our artificial reef succeeding in recruiting oyster spat it had also created new habitat for a number of other marine organisms. Best of all, the people studying the reef began to notice constant change in the clarity of the water. We had tangible success.

The results of our reef showed a vast number of new oyster spat. From June to September, we had around 2000 new oysters living on our reef. At this rate we can expect approximately 2500–3000 new oysters on the reef next spring. After closely scoping our reef, we concluded that the main reason that it showed such great results was the location. Any closer and we might not have had such great results.

We plan to continue this project and expand upon what we have already begun. This spring we hope to collect more data by snorkeling on and around the reef as well as enlarging our experimental project. As part of the expansion of our research, we will be building two new reefs using the two different materials: marl and recycled oyster shells. Although these reefs will be substantially smaller than our first reef, they will be beneficial in helping us determine which material returns the best oyster spat recruitment. This new information will also aid us in creating other productive artificial oyster reefs in the waters behind our island communities on a larger scale.

## • Step 6: Share It!

As a group we were so excited about the amazing recruitment rate on our artificial oyster reef we knew we had to share our success and information with members of our community. As a group we created a PowerPoint slideshow that displayed all of the information we gathered, including photos and video of our success. We then took our slideshow and presented it at a community event (Day at the Docks). We showed community members and visitors our achievement. Several people were extremely excited about our success and wanted to know more.

Due to this new found interest our project, we made the decision to make more presentations, and educate interested community members. We formed a group that made several presentations to several groups and to some of the villages. Our team presented to the Kiwanis, the New Schools Project, the Dare County Board of Commissioners, and Hatteras Village. We also plan to present to the several other island towns. They were all interested in our cause and what we were doing to give back to the environment. They also wanted to be involved in the continuation of our projects and were looking forward to the impact that this will have on our surrounding area in the coming years.

Several people of the many that we presented to wanted to become involved in the expansion of our vision. There are an increasing number of people who are eager to volunteer their time and supplies. Due to this, we decided to make several other reefs in other villages along the island. As a result of our efforts, Hatteras village has recently made the decision to step up and create their own reef in their waters. If we were to do so, the oysters growing on these reefs would be harvestable in two years. In order to complete this process and reach our goal we will need:

- Oyster shell and marl donated from Division of Marine Fisheries
- Bagging material
- PVC pipe
- Shovels
- Boat
- Manpower
- Gloves

This project will hopefully never truly end; we see it continuing and expanding long into the future. We also hope that other communities will follow in their footsteps and make reefs similar to ours. This would be an accomplishment that takes us much closer to our initial goal of restoring oyster populations to their historic levels.