

Natural Barriers to Storm Surges

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Introduction

Do you remember Super Storm Sandy? In October of 2012, as a hurricane and a post-tropical cyclone, Super Storm Sandy resulted in at least 186 deaths in the United States, Canada and the Caribbean. In preparation, states of emergencies were declared all along the east coast even before she hit and still people did not heed the warnings. People went without electricity for over two weeks and gasoline was rationed in parts of New Jersey and New York for days following the storm. The right to vote in the Presidential election was in jeopardy for many due to no electricity and voting locations swept away in the waves of the storm. The fear is that with global warming and sea levels rising, we are in for more “super storms” in the future. (In fact, this seems to be coming a reality as waves of “super typhoons” have hammered Japan and S.E. Asia.)

The idea for my unit came from an article presented during our DTI seminar with Dr. Bartley. It was about how a man was wishing for oysters while he was waiting for Super Storm Sandy to hit. It was one of those articles that sparked my curiosity because I had no idea why he would be wishing for oysters. As I continued to read I learned that oysters, besides being tasty mollusks, are actually vital to the coastline because they can slow down wave action. Unfortunately for New Jersey and many other coastal states, oysters have been overharvested in much of the region. Not only have we demolished these natural breakwaters that could protect our shorelines but we have also removed one of the most efficient water filtration organisms. My curriculum unit really started to come together when I started to realize how much coral reefs and oyster reefs had in common. Coral reefs are a critical part of the ocean ecosystem as well, teeming with sea life that relies on them for survival. They are important to the economy, providing millions of people around the globe with food, coastal storm protection, and jobs. Coastal protection was the key. The more research I did the more the two had in common and the more I could see my sixth grade students making connections between these two marvels of the sea. The ultimate goal is to spark their interest by showing them how eating oysters could cause severe storm damage. It will involve teaching them about the unintended

consequence of overharvesting and the pollution of our most precious resource, water. I plan to have them create a video, tri-fold or radio announcement to encourage activism.

Rationale

In the State of Delaware, the Department of Education has created thematic lessons that are recommended for each grade level in Social Studies. The issue is that the syllabus calls for 32 weeks of instruction and due to semester scheduling I only have 18 weeks of instruction. My goal is to create a lesson that will create a bridge between the Delaware Recommended Curriculum (DRC) Units called “Reasons for Regions” and “Humans Interact with the Environment.” These two units have been created around the Delaware content standards to ensure rigor in the classroom discussions, activities and assessments in achieving the standards; however, I feel I can combine the two standards into one unit and more efficiently teach the essential questions in a shorter timeframe. The state standards I intend to cover with my unit are from the 6th to 8th grade level and they include:

1. “Students will understand the processes affecting the location of economic activities in different world regions”

2. “Students will apply a knowledge of the major processes shaping natural environments to understand how different peoples have changed and been affected by, physical environments in the world's sub-regions.”

The essential questions for these standards are,

- “To what degree are economic regions specialized?”
- “What’s “special” about a given region and how could it change?”
- “Under what conditions should human cultures attempt to change the processes that shape the natural environment?”

For my unit of study, I will focus on what makes a region a region? How are coastal areas around the world similar? And, how does what we do have unintended consequences? I want my students to realize that there are all kinds of regions in the world and there are many aspects that can make an area a region. They should also be able to make comparisons between different areas to understand that many regions share similar attributes. Lastly, I want them to realize that human interactions with the environments have created unintended consequences that are recognized, and that there are people in the world who volunteer and work to correct the mistakes we have made when it comes to changing our environment.

Demographics

Gauger-Cobbs Middle School is one of the four middle schools in the Christina School District. We are one of the largest middle schools in the State of Delaware with 1,137 students attending in the 2013-2014 school year. Due to our large numbers we have been closed to choice for the last few years. Our school contains grades 6 through 8 with 383 in the 6th grade, 397 in the 7th grade and 357 in the 8th grade for the 2013/2014 school year. Within our school 63.1% of our students are classified as low-income. We have 13.5% in our special education program. We are a very diverse school; in 2013- 2014 we had 40.8 % African American, 36.5% White, 17.3 % Hispanic/Latino, 3.0% Asian, and 2.1% Multi-racial. I am currently teaching 6th grade Social Studies. I have also taught 7th and 8th grade Social Studies. Last year my special education population was situated in one class and I was joined in the classroom by a special education teacher. This year that will not be the case. My special education students will be dispersed throughout all of my classes and I will not have any additional help.

Common Core Standards/ “I can” statements

CCSS.ELA-Literacy.RH.6-8.2

Determine the central ideas or information of a primary or secondary source; provide an accurate summary of the source distinct from prior knowledge or opinions.

CCSS.ELA-Literacy.RH.6-8.4

Determine the meaning of words and phrases as they are used in a text, including vocabulary specific to domains related to history/social studies.

CCSS.ELA-Literacy.RH.6-8.7

Integrate visual information (e.g., in charts, graphs, photographs, videos, or maps) with other information in print and digital texts.

CCSS.ELA-Literacy.RH.6-8.8

Distinguish among fact, opinion, and reasoned judgment in a text.

I can identify examples of different economic regions and biological regions in the world and how they are interrelated.

I can identify how human culture has changed a process that shapes the natural environment.

I can identify how changing the natural environment can have an economic impact on an area.

I can compare and contrast how two distinct regions of the world can have similar and yet different natural processes.

I can identify how changing the natural environment can have unintended consequences when faced with natural hazards.

Content

Oysters – Ecosystem engineers of temperate estuaries

Honestly, I have never and probably will never eat an oyster. The slimy look and smell of raw oysters makes my stomach turn, but after researching them I feel like I would love to have a fluffy stuffed oyster in my classroom to hug because they are so awesome. I would name my stuffed mollusk, Oliver the Oyster. Oysters are awesome and humans have blindly destroyed an essential piece of our ecosystem, part of the circle of life that was so graciously given to us. Now we face the problems created by our rush to take, take, take and not consider our actions. Luckily for us, it is not too late.

An adult oyster can filter up to 55 gallons of water in one day. We have removed these oysters with no regard to the unintended consequences to the quality of our water. The young oysters, fish and other sea creatures in our waterways today are faced with incredible amounts of pollution which would not have been as severe if we had not exploited the oysters as we had. In addition to being eaten in many communities, the oyster's shells were used in construction for roads, housing material and to line driveways. The empty shells were not returned to the water and this has had an effect on the ability to replenish the oyster population. Baby oysters, called spat, need to attach to other shells in order to survive. Some facts that I learned from www.oysterecycling.org are that oysters can switch between being male and female. A female oyster can produce over 100 million eggs per year. Young larval oysters don't have a shell, they swim freely in the water. After about three weeks, oysters form a shell and cement themselves to a hard substrate. Over time, reefs are formed by the numerous oyster shells built up into the water column. Oysters can live up to 20 years.¹ If the spat does not have the older shells they need to attach themselves to, the ability of the oysters to create oyster reefs diminishes. By not returning the used shells to the ocean we have created a gap in the circle of life for oysters. The disposal of oyster shells in landfills disrupts the natural

process of oyster reef growth and regeneration and deprives the reef of its most fundamental building blocks.² In doing my research I found that today there are recycling programs to get people to return their shells to the wild because baby oysters need the older shells. In the video by WBAL TV it shows how there are recycling programs behind businesses for people to drop off their shells so that volunteers can place oyster spat on the older shells before placing them in the water.

According to the Chesapeake Bay “Advance & Protect” Oyster Reef Recovery Initiative, there are 5 benefits of a healthy oyster population in the Chesapeake Bay. A single mature-oyster can filter up to 55 gallons of water per day. Oysters remove silt and sediment from the water and serve as a wonderful habitat for other marine species. When the oyster population (83 billion oysters) was thriving, they could actually filter the entire Chesapeake Bay in just 3.3 days. Sadly it now takes over 700 days to do the same thing. A healthy oyster population also helps other species thrive, some of which include blue crabs and rockfish, among others. Healthy oyster populations, when combined with other plantings, can make excellent shoreline stabilizers, which helps to combat erosion.³

Oysters are found throughout the world’s oceans, usually in shallow waters and in colonies called beds or reefs.⁴ The best place for oysters is the margin between saltwater and freshwater, where the river meets the sea.⁵ Among the most popular and heavily harvested species are the Eastern American oyster found in Atlantic waters from Canada to Argentina and the Pacific oyster found from Japan to Washington state and as far south as Australia.⁶ The Chesapeake Bay was once famous for its incredible supply of oysters, so numerous they were a navigational hazard.⁷

Today, the numbers are depressing for our Chesapeake Bay area. There is now 1 oyster per square yard compared to 100 oysters per square yard in the 1800s.⁸ New York was once protected from storm surges by the bivalve population (oysters) that numbered in the trillions and that played a critical role in stabilizing the shoreline from Washington to Boston.⁹

The reason oysters are a better barrier is because they cause a chain reaction to occur. If you have a reef of oysters they are able to repopulate and grow. As they grow more oysters are available to filter the water, the more the water is filtered the cleaner it becomes and that allows other fish and sea creatures to thrive. Beds closer to shore clarified the water through their assiduous filtration; this allowed marsh grasses to grow, which in turn held the shores together with their extensive root structure.¹⁰ The reef can

disrupt wave action caused by storms. Oyster reefs will not stop storms but every little bit helps in slowing down the advancing water. One town, Bay Head, New Jersey credits a hidden, hundred-year-old sea wall with saving scores of houses from destruction during Hurricane Sandy. The problem for many is that sea wall building is expensive. The less high tech solution is to build oyster reefs. The Atlantic Monthly quoted geology professor Antonio Rodriguez on this topic. "One could end up with a reef that will help protect the shoreline from erosion, filter water, provide fish habitat, and be able to keep up with sea level rises." He said "No rock still can do those things." For this reason there are numerous groups working to build and fortify the coastal areas for future storm surges. One group called SCAPE led by landscape architect Kate Orff is proposing "Oystertecture." She wants to reintroduce oyster reefs in New York's Jamaica Bay. Over the decades, she says, oysters will grow atop a rock and shell base, attaching themselves to poles and ropes as they accumulate into serrated reefs. These great piles of mollusks will diffuse the energy of 10 to 15 foot waves, like those from Sandy that shattered boardwalks and beach homes and shot like missiles up city streets.¹¹

Corals- ecosystem engineers in tropical seas

When people talk about coral reefs the first things that come to mind are probably the Great Barrier Reef on the eastern coast of Australia and the beautiful colors of the coral and fish that swim in the ecosystem created by the coral reef system. Through my research I have learned that there is so much more to coral reefs, just like there is to oyster reefs.

A coral reef is a community of living organisms. They have been around for millions of years and are home to 25% of all marine life. They are often called the "rain forests of the oceans," and have the highest species diversity of any underwater habitat. Coral reefs grow slowly, usually at the rate of only a few centimeters each year. Some have formed over millions of years and measure hundreds of meters thick. The largest is the Great Barrier Reef of the northeast coast of Australia. It stretches for 3,000 kilometers (1,600 miles).¹² According to the EPA, coral reefs are important for 5 reasons. Coral reefs provide a source of food and shelter for a large variety of species including fish, shellfish, fungi, sponges, sea anemones, sea urchin, sea snakes, sea stars, worms, jellyfish, turtles, and snails. Coral reefs protect coastlines from ocean storms and floods. Coral reefs are environmental indicators of water quality because they can only tolerate narrow ranges of temperature, salinity, water clarity, and other water conditions. Coral reefs make important contributions to local economics because they attract millions of tourists every

year to enjoy beaches, water sports and other activities. Coral reefs are important sources of new medicines that can be used to treat diseases and other health problems.¹³

There are three major types of coral reefs: fringing reefs, barrier reefs, and atolls. These three types of reefs are ones that are close to the surface and rely on sunlight for survival. This is because tiny organisms called algae live inside most coral polyps in a mutualistic relationship. Algae are vital to these coral because they produce chemicals that help polyps make calcium carbonate. Algae need sunlight to survive, so most coral will not grow in water deeper that sunlight can penetrate. Fringing reefs form along the edge of a coast and are attached to land. A barrier reef is separated from the shore by a lagoon. An atoll is a reef in the open sea that surrounds a lagoon.¹⁴

Coral reefs are in danger for many reasons. Fertilizers used on farms or home gardens washes into the oceans. The fertilizer creates conditions that make algae increase. The extra algae cover the coral and it dies. As CO₂ emissions increase, more CO₂ is absorbed into the oceans. This makes the water more acidic which makes it harder for coral to make their shells. Increased greenhouse gas emissions are making the water warmer. Coral can't live in water that is too much warmer or colder that 26-27 degrees Celsius. Chemicals from sunscreen, pollution from sewage, and herbicides and pesticides used in farms or home gardens can all wash into oceans and poison coral. Dangerous fishing methods, like cyanide or blast fishing, harm and kill coral.¹⁵

Dangerous Fishing Methods

The dangerous fishing methods that are being used today are responsible for not only the destruction of the coral reefs but also the oyster reefs. Today, fishing methods like bottom trawling, dragnet fishing, blast fishing and even cyanide fishing are destroying the reefs. Bottom trawling is when fishermen use large nets and drag them across the bottom of the ocean floor destroying anything in its path. Dragnet fishing is similar because anything caught in the nets do not survive. Blast fishing is when they use dynamite under water to stun the fish. The explosions create holes in the coral. This type of fishing is illegal; however, it still occurs. Cyanide fishing is used by divers who want to catch fish to sell to aquariums. The cyanide is dangerous to the fish, the divers and coral.

There are still more reasons why reefs are in jeopardy. In the 1800s, the Chesapeake Bay was once world famous for its incredible supply of oysters, so numerous they were a navigational hazard. Waterways were dredged to make shipping lanes and many of the

oyster reefs were destroyed in the process. Today the same is true. Mining and oil drilling expeditions are being done throughout the ocean, even in the precious coral reefs. The damage being done by the explosives cannot be undone and when they do find what they are looking for they blast away more of the area to create shipping lanes and safe passage ways.

Strategies

Presentations

Students will be introduced to the problems faced by both the coral reef and the oyster reef. They will research what they are and how they benefit the ecosystem. They will look for how they are being destroyed. They will compare them through the use of a Venn diagram and then students will work together in a group of four to present the problem to the community. They will be able to choose how to present their final product through a tri-fold, a public service announcement, or radio announcement. Students will present their final product to the class and possibly a group of visitors/administrators. There is also a possibility of having their work displayed at the annual STEM expo.

Pass the Poster

Students pass around a poster with a question or the topic identified on the top of the poster. Students add their responses to the poster as it makes its way around the group or class. This allows students to add their ideas to the poster without fear of being judged. Students read what other students have written and try to add something different. I like this strategy because it gives students who may not like to speak in class an opportunity to add their ideas to the class discussion. It also allows the teacher to ascertain what prior knowledge the students have in a fun and non-threatening way.

Collaborative Groups

Learning to collaborate with one another is an important skill that all students need to practice. This lesson is designed to have large groups and small groups. Working together encourages students to share ideas and work towards a common purpose. In this unit students will work first as a large group so that they can support one another. Then they will break off into pairs to share the information they have gathered. Once they create a Venn diagram they will merge with another pair to share their Venn diagrams. I plan to do this so that they have an opportunity to work with a bigger group and have more information to include in their final product. Students need to learn how to work respectfully with one another and learn how to combine their work into one product.

Collaboration also benefits students in that by listening to their peers they can develop better understanding of the topic.

Jigsaw

Students will research different websites and then share and exchange information with members of their research group. This strategy will be utilized if I find that they are not able to research all four components. I would like students to complete all four components of their graphic organizer; however, if I find that time is a factor I will have students focus on one square first then move on to the next square. When we return to the classroom we will jigsaw and make sure that every student has all four squares completed before we move on to the next step in our lesson. This strategy will assist students who work slower on the computers and are not as comfortable navigating the internet. This strategy will also promote peer collaboration and differentiate instruction for struggling students.

CSET

CSETs are a type of formative assessments that have students make a Claim, Support it with Evidence and provide a Tie-in. The Claim is when the student answers the question. The Set-up is transition words that introduce a quote. The Evidence is one or more sentences copied word for word from the article that directly supports the claim. The evidence should always be in quotation marks. The tie-in explains the quote and how it supports the claim.

Children's Literature

Children's books and literature make difficult content easier to understand. Students will listen to *How the Oysters Saved the Bay* by Jeff Dombek. In this book students will listen to a story about how two oysters organize their oyster friends to clean the water so that the sea grass stays healthy to support the other sea creatures in the bay.

Give One – Get One

This strategy is one that I have used many times in my classroom. Students enjoy getting up and moving around and this allows them to share their work. Each student gets out of his/her seat and moves around the room. They find someone to share an answer with and then they receive an answer from the same person. By reading their statements students are reinforcing their knowledge while getting another example.

Websites

Students will be given a chart of suggested websites to visit when they begin their research. The websites will be grouped so that the easier or kid friendly websites will be located in one row. Websites that have videos will be identified and there will be a place for students to add website they found on their own.

Fruer Diagram

Students will use the Fruer diagram graphic organizer to learn vocabulary. This type of organizer consists of four sections and usually includes definition, examples, non-examples and either a picture or student version of the definition.

Knowledge Rating Organizer

Students use this graphic organizer to review the vocabulary terms that will be used in the lesson. Students look over a list of words and check the appropriate box. The boxes are labeled "Don't know the term," "Have heard or seen it," "Think they know it," or "Know it." This is a preview activity to allow students an opportunity to see the terms they will use in the lesson.

K-W-L Organizer

Students will use this type of organizer to identify what they already know about the topic (K- know), what they want to know or wonder (W- want to know/wonder) and after the lesson they complete the L column to identify what they learned during the lesson (L- learned).

Graphic Organizer

Students will use graphic organizers to record the key ideas that I want them to extract from the readings. The use of graphic organizers assists students in identifying the important aspects of the readings and organizing them in a manner that assists the students.

Turn and talk

This strategy has students turn to their neighbor and discuss ideas for 30 seconds or more. This allows students to hear their ideas out loud and it has them consider someone else's point of view.

Venn diagram

Venn diagrams are used to compare and contrast two topics. Once students complete their research on oysters and coral reefs they will create a Venn diagram so that they can identify how the coral reefs and oyster reefs are similar and different.

Lessons

Activity one

Students will be given a list of vocabulary terms and I will have them complete a Knowledge Rating organizer. This will determine if they don't know the term, have heard or seen it, think they know it, or know it. Once they complete it I will have them turn and talk to their neighbor about the terms and share any that they know.

After previewing the vocabulary I will distribute a two-side worksheet with 4 Frayer boxes. We will place the first four terms from the Knowledge rating organizer in the Frayer. Next, I will distribute a reading from the DRC unit Reason for Regions that explains the different types of regions. I will have students fill out the Frayer diagram as they read. Next we will turn and talk to our neighbors to help complete any part that students are unsure. To complete the lesson will share examples with the class either using the projector or whiteboard. Students will be given an exit ticket before they leave with example of each type of region. They will be asked to underline examples of formal regions, circle functional regions and mark with an X the perceptual regions. This portion of the lesson is also adapted from the Delaware DRC lesson.

Activity Two

I would like to have my students work in groups to identify different regions in the world. Using a map of the world we will review regions in the United States and then identify regions outside the U.S. Most textbooks and websites I researched only identify the regions of the United States as cardinal direction locations such as the Northeast, Southeast, Midwest, Pacific Northwest, and Southwest. It is interesting how all the worksheets I find differ on which states are in which region. Since there is no perfect answer to the question of "What are the important regions of the United States?" I plan to have my students brainstorm as many different examples of regions as they can think of by having them do a poster pass. On the top of poster I will write questions like: What are regions based on landforms (Mississippi River region, Great Lakes region, West Coast, East Coast, Gulf States, Great Plains, Rocky Mountain region, etc.)? What are regions based on economics (oil regions, bread basket, lobster, blue crab, salmon fishing, Hollywood, etc.)? What regions are affected by natural disasters (Tornado Alley,

flooding of the Mississippi, wildfires of West coast, earthquakes on the West coast, volcanoes in Pacific States, hurricanes on the East coast)? After a few minutes students will pass their poster on to the next group and students will add to the ones already listed. Once the posters have made their way around the classroom we will put them on the wall and share what the groups have come up with.

Activity Three

Next I will explain that I am going to read them a story about our region. I have found that I can spark my student's interest when I read them a children's book about the subject and have them identify how it relates to what we are learning. For this unit I have found a book called "How the Oysters Saved the Bay." I feel my students will really enjoy this book because it is about our local Chesapeake Bay. It is the story of how pollution in the water is making the underwater grasses sick. I feel that my students will all understand how pollution can damage an area and affect the economic activity in that area, but what I want to have them realize is that there are even more unintended consequences. Students will complete a graphic organizer about why it was necessary for the oysters to save the bay, how they did it and how it helped the economy. Students will also be asked if they think the oysters could serve any other purpose besides cleaning the water and providing an economic product as seafood. After completing the graphic organizer, I will then present them with an article to read. Originally I had planned to use the article from my DTI seminar called "An Oyster in the Storm;" however, I realized on a second reading that the Lexile level is too high for my sixth grade students. It could be used for a high school class but not sixth grade. Therefore I have found a similar article from www.dogonews.com called "How the Humble Oyster May Help Save Coastal Cities and Clean Polluted Waters." In this article they talk about the role oysters have in cleaning the water of pollutants and how the oysters were dredged up to create shipping routes and how that has made the shore lines much more vulnerable to storm surges. They introduce the idea of Oyster-Tecture and re-establishing oyster sanctuaries in the Chesapeake Bay. The article bolds the words they are worried students will not understand providing another opportunity to use Knowledge rating before or a Frayer diagrams after depending on your student population.

Activity Four

Next I will ask my students if they can think of a geographic landform that may be similar to the oyster reefs off the Northeastern coast of United States. My goal is to steer them to the coral reefs of the tropics. We will discuss how the tropics are a region located between the Tropic of Cancer and Capricorn and how they surround the Equator. This

will be an opportunity to return to the terms Formal, Functional and Perceptual by asking which one the tropics would be. First, I will have them fill-in the K and W of a KWL graphic organizer about the coral reefs before we read more about them. I have selected one reading from the NOAA Ocean Service Education. The article is titled "*Why are Coral Reefs So Important?*" In the article it states that "Coral Reefs buffer adjacent shorelines from wave action and prevent erosion, property damage and loss of life." These articles will show students how human actions are having unintended consequences by leaving their shores vulnerable to natural hazards similar to the shorelines of the Northeastern United States after the overharvesting of oysters. I will have my students write compare and contrast statements about the oyster beds and coral reefs.

Activity Five

Now that my students are familiar with the two topics of oysters and coral reefs I am going to split them into 2 groups. One group will research oysters and one group will research coral reefs. I plan to use plastic eggs to decide who will do which. I have found that they are more likely to be excited if I distribute the topic in a creative way. I purchased Easter eggs after the Easter season at 80% off and I reuse them year after year. Each egg will have a slip of paper labelled Oysters or Coral Reefs. We will spend 2 days in the library or with the lap-top cart to research more about our topics. I will encourage my students to bring in headphones so that they can watch the videos about recycling programs and the national geographic videos about their individual topics. Students will complete their graphic organizer as they research their topic. I will provide them with a list of websites to visit that I have found informative and on grade-level. Our school has recently allowed you-tube videos to be seen so this will help because many of the volunteer sites include videos produced using you-tube.

Activity Six

After they have completed their graphic organizer I will give them an opportunity to meet with other students who had the same topic and have them compare the information they collected. This would be an opportunity to jigsaw if you worry that students will not be able to collect all the information. Teachers know their students best so if necessary designate certain students to fill-in different boxes of the graphic organizer and then have them jigsaw to complete the organizer. By now students should have a good grasp on why the reefs are so important. I will take the rest of the class period to have students write a CSET to answer the question "Why should we save the reef?" Students will be able to use their knowledge of oyster reefs or coral reefs to complete the assignment.

Activity Seven

Now we will match up one oyster researcher with one coral reef researcher and have them create Venn diagrams about each of the major topics they researched looking for both similarities and differences. Finally, I will pair them up in groups of four (2 oyster researchers and 2 coral researchers) for them to share their graphic organizers with one another and allow them to add more information to their graphic organizers. These groups of four will then be responsible for creating a public service announcement about how important oysters and coral reef are to our environment. They will be graded on a rubric that will focus on identification of the species, location, what they do for us, how humans have hurt them, what impact they have on our economy, and lastly, how people are currently helping and how – YOU – too can help. It is suggested that teachers show students examples of PSAs, tri-folds, and have them listen to radio announcements using the internet.

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Student appropriate article for what can be done to help restore coral reefs.

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<http://oceanexplorer.noaa.gov/explorations/07twilightzone/background/edu/lessonplans.html#Grades56> (accessed October 27, 2014).

These are lesson plans to teach about coral reefs. It provides nice background information on coral reefs and additional resources are listed.

"Life in the Chesapeake Bay - a Lenfest Ocean Futures Production." Life in the Chesapeake Bay - a Lenfest Ocean Futures Production.

<http://ecopath.org/LifeInTheChesapeakeBay/> (accessed October 20, 2014).

This video is wonderful for showing the oyster's history and how the water of the Chesapeake has been affected by the loss of the oysters.

Narula, Svati. "How Oysters Can Protect Houses From Hurricanes." The Atlantic.

<http://www.theatlantic.com/national/archive/2014/05/oyster-walls/361594/> (accessed October 11, 2014).

An article that discusses the sea walls created by oyster reefs and it focuses on Oyster-ecture.

"Oyster Recycling Program | Texas A&M University â€œ Corpus Christi." Oyster Recycling Program | Texas A&M University â€œ Corpus Christi.

<http://oysterrecycling.org/> (accessed October 20, 2014).

Great resource for pictures of oyster recycling and for fact sheet poster. Start on overview page to access Activity book, and Sammy's Page.

"Oyster recycling bins to help replenish population." WBALTV.

<http://www.wbaltv.com/news/maryland/Oyster-recycling-bins-to-help-replenish-population/16091216> (accessed October 16, 2014).

Short video by WBAL TV about Recycling bins. They explain how oysters clean the water and how recycled shells can be used for babies.

"Oysters and Oyster Reefs in Your Classroom." MARE.

<http://coseenow.net/mare/oysters-in-your-classroom/> (accessed October 27, 2014).

Compares oyster and coral reefs; suggestion for other activities you can do in your classroom.

"Oysters could save NY from another Sandy." Latest from Crains New York Business.

http://www.crainsnewyork.com/article/20131112/HOSPITALITY_TOURISM/131119976/oysters-could-save-ny-from-another-sandy (accessed October 27, 2014).

Article for teacher to read more about oysterstecture.

"Oysters, Oyster Pictures, Oyster Facts - National Geographic." National Geographic.
<http://animals.nationalgeographic.com/animals/invertebrates/oyster.html>
(accessed October 19, 2014).

Great resource to explain difference between oysters and pearl oysters.

"Reef." - National Geographic Education.

http://education.nationalgeographic.com/education/encyclopedia/reef/?ar_a=1
(accessed October 19, 2014).

Great resource because it discusses both kinds of reefs - oyster and coral

"SCORE." Volunteer Opportunities. <http://score.dnr.sc.gov/deep.php?subject=6&topic=1>
(accessed October 20, 2014).

Explains why we need to recycle oyster shells and how you can get involved.

"Sammy's page." Oyster Recycling. <http://oysterrecycling.org/wp-content/uploads/2013/10/Activity-Book-Final.pdf> (accessed October 20, 2014).

Resources for kids about oyster recycling

"We need your help!" NOAA.

http://www.noaa.gov/features/resources_0109/coralreefs.html (accessed October 20, 2014).

Explains how coral gametes can be collected and then be transplanted back to damaged coral reefs.

"Why Are Coral Reefs So Important?" NOAA 200th:

<http://celebrating200years.noaa.gov/foundations/coral/side.html> (accessed October 23, 2014).

This is one of the readings I will use with my students.

Notes

¹ "Oyster Recycling Program | Texas A&M University â€“ Corpus Christi."
<http://oysterrecycling.org/> (accessed October 20, 2014).

² Ibid

- ³ "5 benefits of a healthy oyster population." The Chesapeake Bay Advance Protect Oyster Reef Recovery Initiative. <http://oystersforthebay.com/5-benefits-of-a-healthy-oyster-population/> (accessed October 11, 2014).
- ⁴ "Oysters, Oyster Pictures, Oyster Facts - National Geographic." National Geographic. <http://animals.nationalgeographic.com/animals/invertebrates/oyster.html> (accessed October 19, 2014).
- ⁵ Greenberg, Paul. "An Oyster in the Storm." The New York Times. http://www.nytimes.com/2012/10/30/opinion/an-oyster-in-the-storm.html?_r=0 (accessed October 27, 2014).
- ⁶ "Oysters, Oyster Pictures, Oyster Facts - National Geographic." National Geographic. <http://animals.nationalgeographic.com/animals/invertebrates/oyster.html> (accessed October 19, 2014).
- ⁷ "5 benefits of a healthy oyster population." The Chesapeake Bay Advance Protect Oyster Reef Recovery Initiative. <http://oystersforthebay.com/5-benefits-of-a-healthy-oyster-population/> (accessed October 11, 2014).
- ⁸ Ibid.
- ⁹ Greenberg, Paul. "An Oyster in the Storm." The New York Times. http://www.nytimes.com/2012/10/30/opinion/an-oyster-in-the-storm.html?_r=0 (accessed October 27, 2014).
- ¹⁰ Ibid.
- ¹¹ "Oysters could save NY from another Sandy." Latest from Crains New York Business. http://www.crainsnewyork.com/article/20131112/HOSPITALITY_TOURISM/131119976/oysters-could-save-ny-from-another-sandy (accessed October 27, 2014).
- ¹² "reef." - National Geographic Education. http://education.nationalgeographic.com/education/encyclopedia/reef/?ar_a=1 (accessed October 19, 2014).
- ¹³ "Coral Reefs." Coral Reefs. http://www.ecokids.ca/pub/eco_info/topics/oceans/coral_reefs.cfm (accessed October 26, 2014).
- ¹⁴ "reef." - National Geographic Education. http://education.nationalgeographic.com/education/encyclopedia/reef/?ar_a=1 (accessed October 19, 2014).
- ¹⁵ "Coral Reefs." Coral Reefs. http://www.ecokids.ca/pub/eco_info/topics/oceans/risks_to_oceans.cfm (accessed October 26, 2014).

**Curriculum Unit
Title**

Natural Barriers to Storm Surges

Author

Peggy Dawson

KEY LEARNING, ENDURING UNDERSTANDING, ETC.

Geography Standard Two: Students will develop knowledge of the ways humans modify and respond to the natural environment

6-8a: Students will apply knowledge of the major processes shaping natural environments to understand how different peoples have changed and been affected by, physical environments in the world's sub-regions.

Geography Standard Four: Students will understand the processes affecting the location of economic activities in different world regions.

Common Core Standards

CCSS.ELA-Literacy.RH.6-8.2: Determine the central ideas or information of a primary or secondary source; provide an accurate summary of the source distinct from prior knowledge or opinions.

CCSS.ELA-Literacy.RH.6-8.4: Determine the meaning of words and phrases as they are used in a text, including vocabulary specific to domains related to history/social studies.

CCSS.ELA-Literacy.RH.6-8.7: Integrate visual information (e.g., in charts, graphs, photographs, videos, or maps) with other information in print and digital texts.

CCSS.ELA-Literacy.RH.6-8.8: Distinguish among fact, opinion, and reasoned judgment in a text.

ESSENTIAL QUESTION(S) for the UNIT

The essential questions for these standards are,

“To what degree are economic regions specialized?”

“What’s “special” about a given region and how could it change?” and lastly

“Under what conditions should human cultures attempt to change the processes that shape the natural environment?”

CONCEPT A**CONCEPT B****CONCEPT C**

Regions

Changing a region

Unintended Consequences of Change

ESSENTIAL QUESTIONS A**ESSENTIAL QUESTIONS B****ESSENTIAL QUESTIONS C**

I can identify examples of different economic regions and biological regions in the world and how they are interrelated.

I can compare and contrast how two distinct regions of the world can have similar and yet different natural processes.

I can identify how human culture has changed a process that shapes the natural environment.

I can identify how changing the natural environment can have an economic impact on an area.

I can identify how changing the natural environment can have unintended consequences when faced with natural hazards.

VOCABULARY A**VOCABULARY B****VOCABULARY C**

Regions

Formal Regions

Functional Regions

Perceptual Regions

Culture

Economic impact

Unintended Consequences

Natural Hazards

ADDITIONAL INFORMATION/MATERIAL/TEXT/FILM/RESOURCES

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