**Unit of Study: The Chesapeake Bay**

**Grade Level 4**

**Overview:**

 The Chesapeake Bay is facing many issues including pollution. This unit will give students background information on the Chesapeake Bay watershed, some types of pollution, and some of the issues impacting the bay. Students will use this information to design an action plan that can be implemented to help improve the health of the bay.

**Focus Standards:**

Unit 3: Closer to Home

Students will research the needs of Maryland native plants and animals and identify interrelationships between plants and animals in a habitat in their competition for space, food, and water. Students will use this information, as well as information about weathering, to conduct site investigations in order to design/maintain a schoolyard habitat.

a) Identify and describe interactions (i.e. nesting, pollination, seed dispersal) for plants and animals in their habitat, and explain the effects of their competition for space, food, and water.

f) Explain how Earth’s:

•Surface features (i.e., mountains, valleys, and oceans),

•Environmental conditions (i.e., temperatures, amounts of food or nutrients, types of soil) and

•Environmental changes (i.e., flood, tsunami, air pollution, global warming) limit the kinds of living things that can survive in an ecosystem.

g) Research the kind of environment needed by Maryland native plants and animals.

h) Based on research, design a schoolyard habitat using native plants and explain how the plants may have positive consequences on the natural environment.

**Essential Question:**

 What can each of us do individually to help improve the Chesapeake Bay?

**Content Integration:**

Reading

Geography

Writing

**Length of Time for Unit:**

About 1 week

**Resource(s)** (multimedia/text)

Maps101

**Lesson Plan(s)**

Chesapeake Bay watershed

Pollution sources along rivers and in the Chesapeake Bay

Issues that hurt the Chesapeake Bay

**Extension/Performance Task**

Design and implement one activity that you can do to help improve the Chesapeake Bay.

Unit: Chesapeake Bay: Lesson 1 Grade Level: 4

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| **Lesson Focus:** What is the Chesapeake Bay watershed? |
| **Lesson Overview** |
| The Chesapeake Bay is one of the largest estuaries in the United States and supports a large variety of plants and animals. The Bay runs through Maryland, Delaware, and Virginia, but the watershed that contributes water to the Chesapeake Bay includes New York, Pennsylvania, Maryland, Delaware, West Virginia, and Virginia. With more than 17 million people living in the Chesapeake Bay watershed, how can each of us make a small difference to the quality of the water? |
| **Teacher Planning and Preparation** |
| Preview video for discussion pointsIf students won’t have computers, run off copies of Chesapeake Bay article with mapPreview: <http://www.cbf.org/about-the-bay/maps> |
| **Unit Standards Applicable to This Lesson** |
| f) Explain how Earth’s:•Surface features (i.e., mountains, valleys, and oceans), •Environmental conditions (i.e., temperatures, amounts of food or nutrients, types of soil) and•Environmental changes (i.e., flood, tsunami, air pollution, global warming) limit the kinds of living things that can survive in an ecosystem. g) Research the kind of environment needed by Maryland native plants and animals.  |
| **Student Outcomes** |
| Students will build the background knowledge necessary to understand the Chesapeake Bay watershed in order to later design an activity that they can use to help improve the quality of the bay.  |
| **Materials** |
| Laminated US mapsWet erase markersYarn or string in three colors (green, blue, yellow)Computers for children or computer hooked to projector |
| **Pre-Assessment** |
| Give each student a laminated map of the USA and a wet erase marker. Ask students to write their name on the map using the wet erase markers. Then ask students to use the marker to draw an outline of all the land that contributes water to the Chesapeake Bay.  |
| **Lesson Procedure** |
| * Show students the background video on the Chesapeake Bay. Maps101: [National Geographic](http://www.maps101.com/index.php?option=com_flexicontent&view=category&cid=4&Itemid=5) > [National Geographic Videos](http://www.maps101.com/index.php?option=com_flexicontent&view=category&cid=15) > [Science & Nature](http://www.maps101.com/index.php?option=com_flexicontent&view=category&cid=18) > Chesapeake Bay
* Discuss
* Have students read the article on the Chesapeake Bay. Maps101: [Global Perspectives](http://www.maps101.com/index.php?option=com_flexicontent&view=category&cid=1&Itemid=2) > [Geography in the News](http://www.maps101.com/index.php?option=com_flexicontent&view=category&cid=2) > USING LANDSAT TO SAVE CHESAPEAKE BAY
* Have students underline at least 5 facts about the Chesapeake Bay as they read.
* Discuss: Have each student share at least one fact that they learned about the Chesapeake Bay.
* Create a class chart.
* Break children into small groups of 3-4.
* Give each of the groups long pieces of three different colored strings.
* Ask each group to use the strings to outline the Chesapeake Bay, the Chesapeake Bay watershed, and to cut the third string into pieces to show 4-5 of the major rivers leading into the Bay. (Green – Chesapeake Bay, Yellow – Chesapeake Bay watershed, Blue – rivers)
* Students should be allowed to use maps during this process.
* Have students take a map walk to look at each of the groups diagrams.
* Have a class discussion and discuss any areas of concern or confusion.
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| **Lesson Closure** |
| Have students revisit the laminated maps from the pre-assessment and make any changes that they would like to make. Collect maps and use for data as needed.  |

Unit: Chesapeake Bay: Lesson 2 Grade Level: 4

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|  | Source: Gammar, Debbie (1997) Environmental Teaching Guide Vol. 2. TNRCC. pg. 35-36. |

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| **Lesson Focus:** How does pollution from all over the Chesapeake Bay watershed impact the animals in the Chesapeake Bay and its tributaries? |
| **Lesson Overview** |
| The Chesapeake Bay watershed is a huge area populated by many people. Each of those people create some of the pollution that contribute to the problems in the Chesapeake Bay. Students should become familiar with some pollution sources in the Chesapeake Bay and the impact this pollution can have on bay animals. Freddy the Fish is a good visual experiment to do with children to illustrate the effects of pollution on water sources. To do this experiment, the teacher reads or has the children read the story of Freddy as written below. At the end of each section is a direction to add something else to the water to simulate pollution. After each item is added, the class can discuss the effects or the teacher may choose to wait until the end.  |
| **Teacher Planning and Preparation** |
| Collect suppliesMake copies of article, worksheet, and quiz |
| **Unit Standards Applicable to This Lesson** |
| a) Identify and describe interactions (i.e. nesting, pollination, seed dispersal) for plants and animals in their habitat, and explain the effects of their competition for space, food, and water.f) Explain how Earth’s:•Surface features (i.e., mountains, valleys, and oceans), •Environmental conditions (i.e., temperatures, amounts of food or nutrients, types of soil) and•Environmental changes (i.e., flood, tsunami, air pollution, global warming) limit the kinds of living things that can survive in an ecosystem.  |
| **Student Outcomes** |
| Students will discover how different pollution sources along a river can contribute to the pollution in the Chesapeake Bay.  |
| **Materials** |
| * one-gallon glass jar
* sponge cut in shape of a fish
* fishing line tied to a pencil at one end and Freddy at the other (Freddy should hang in the middle of the jar)
* small amounts of the following: soil, pancake syrup, salt, paper dots, brown sugar, soapy water, red and green food coloring
* Copy of [Freddy the Fish Story](http://www.earthsciweek.org/forteachers/freddyfish.doc) on note cards.
* sand; gravel; coffee filters; cotton; cheesecloth; funnels, made from cutting off the tops of platstic soda bottles; and a clear container, such as a beaker
* Article: <http://ellerbruch.nmu.edu/classes/cs255w03/cs255students/rbellomo/p10/information.pdf>
* Worksheet from: <http://ellerbruch.nmu.edu/classes/cs255w03/cs255students/rbellomo/p10/worksheet.pdf>
* Quiz from: <http://ellerbruch.nmu.edu/classes/cs255w03/cs255students/rbellomo/p10/quiz.pdf>
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| **Pre-Assessment** |
| Have student write down 3-5 ways that they think pollution gets into the Chesapeake Bay and the rivers that are tributaries to the bay.  |

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| **Lesson Procedure** |
| After attaching the fishing line and weight to a sponge fish, put "Freddy the Fish" inside one gallon jar.Fill the soda bottle 3/4 full of water.Read or have students tell the story of Freddy the Fish from the note cards. The Children should add the "pollution" that coorelates to the appropriate note card from the story.Have students read the article about pollution as individuals or in small groups. Discuss.Use a filtration system to clean up Freddy's habitat. Provide the students with materials (sand; gravel; coffee filters; cotton; cheesecloth; funnels, made from cutting off the tops of platstic soda bottles; and a clear container, such as a beaker) and have them experiment making two filtration systems. Students may compete to see which filitration system cleans the water the best.Have students work as individuals or in pairs to complete the worksheet.  |
| **Lesson Closure** |
| Have students share what they tried to clean up Freddy’s environment and how well it worked. What would they do differently next time?Quiz |

Freddy Fish

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| Imagine a clean river as it meanders through a protected wilderness area.   In this river lives Fred the Fish.  How is Fred?  Fred has lived in this stretch of the river all his life.  But now he is going on an adventure and travel downstream. |
| Fred swims into farm country.  He passes a freshly plowed riverbank.   It begins to rain and some soil erodes into the river.  (Dump soil in into Fred's jar.)  How is Fred? |
| Fred nears a housing development.  Some fertilizer from the pastures and lawns washed into the river awhile back.  (Place brown sugar in Fred's jar.)   The fertilizer made the plants in the river grow very fast and thick.   Eventually the river could not furnish them with all the nutrients they needed, and so they died and are starting to decay.  Their decomposition is using up some of Fred's oxygen.  How is Fred? |
| Fred swims beside a large parking lot.  Some cars parked on it are leaking oil.  The rain is washing the oil into the river below.  (Pour pancake syrup into Fred's jar.)  How is Fred? |
| During a recent cold spell, ice formed on a bridge.  County trucks spread salt on the road to prevent accidents.  The rain is now washing salty slush into the river.  (Put salt in Fred's jar.)  How is Fred? |
| Fred swims past the city park.  Some picnickers didn't throw their trash into the garbage can.  The wind is blowing it into the river.   (Sprinkle paper dots into Fred's jar.)  How is Fred? |
| Several factories are located downstream from the city.  Although regulations limit the amount of pollution the factories are allowed to sump into the river, factory owners are not abiding by them.  (Pour warm soapy water into Fred's jar.)  How is Fred? |
| The city's wastewater treatment plant is also located along this stretch of the river.  Also a section of the plant has broken down.  (Squirt two drops of red food coloring into Fred's jar.)  How is Fred? |
| Finally, Fred swims past a hazardous waste dump located on the bank next to the river. Rusty barrels of toxic chemicals are leaking. The rain is washing these poisons into the river. (For each leaking barrel, squeeze one drop of green food coloring into Fred’s jar.) How is Fred? |
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Unit: Chesapeake Bay: Lesson 3 Grade Level: 4

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| **Lesson Focus:** Students will research one issue impacting the Chesapeake Bay, identify the problem, and come up with one plan that they could implement to help improve the condition of the bay.  |
| **Lesson Overview** |
| Students will learn about some of the issues impacting the Chesapeake Bay. They will become an expert on one area and apply that information in order to design one activity that they can implement locally that could help improve the quality of the Chesapeake Bay.  |
| **Teacher Planning and Preparation** |
| Reserve the computer labBookmark: <http://www.cbf.org/how-we-save-the-bay/issues> |
| **Unit Standards Applicable to This Lesson** |
| g) Research the kind of environment needed by Maryland native plants and animals. h) Based on research, design a schoolyard habitat using native plants and explain how the plants may have positive consequences on the natural environment. |
| **Student Outcomes** |
| Students will be able to apply new knowledge learned about issues in the Chesapeake Bay to design and implement an action plan that could help improve the health of the bay.  |
| **Materials** |
| Computer labGraphic Organizer (if needed)Action plan organizer (if needed)\* enchantedlearning.com has great organizers\* |
| **Pre-Assessment** |
| Have a discussion about what student have learned about the Chesapeake Bay watershed and some of the issues facing the estuary.  |
| **Lesson Procedure** |
| * Have students choose and research one of the issues impacting the Chesapeake Bay.
* Have students who chose the same issue get into groups and share what they learned.
* Have each groups share with the remainder of the class. (Posters, diagrams, images, etc. can be used to enhance these presentations.)
* Have individuals, or small groups, work together to design an action plan that could help improve the quality of the Chesapeake Bay.
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| **Lesson Closure** |
| Have students present their action plans to the class and explain how they are going to help the Chesapeake Bay. Ask students to implement their plans locally.  |

Chesapeake Bay Classroom Reflection

 During the week of August fifth through ninth, I participated in the Chesapeake Bay Foundations course, Teaching STEM in the Local Environment. This class was intended to immerse Howard County educators in the diversity of the county watershed and the many aspects of daily life that impact the Chesapeake Bay. Jocelyn Tuttle, Melissa Barrett, and John Tapscott were our course leaders and did an excellent job engaging members of the class. The organizing question for the course was, ‘How can teachers of Howard County connect their students and school community to the local environment and the Chesapeake Bay through STEM techniques?’

 On Monday, August fifth, we met at the Howard County Conservancy. This was an introductory day, and we identified the supporting question for the day as, ‘How do local waterways, including Davis Run, directly impact the Chesapeake Bay watershed?’ Our course leaders used a bead activity to help emphasize the importance of all water on the Chesapeake Bay watershed. Group members were arranged in lines to symbolize different tributaries of the Chesapeake Bay. Then, the ‘headwaters’ of each line were given a jar of blue beads and asked to begin passing them down to the ‘collector’, or the Chesapeake Bay. Jocelyn gave directions on the speed at which to pass the beads based on seasons and weather conditions. Then, red beads were added to the activity to symbolize pollution and sediment. This was a great activity to explain the watershed to novice members of the group and could easily be used in the classroom. With more students, I could use this activity to not only give students a concrete understanding of the watershed, but also to show the different size and flow of the tributaries in our local environment that enter the Chesapeake Bay.

 The next activity asked the group to use string to define the Chesapeake Bay and then to find a spot on the map that was meaningful to them. Our instructors used this activity to not only assess our background knowledge of the Chesapeake Bay, but also as a group building exercise. As a fourth grade teacher, I would manipulate this activity to meet the needs of my students. I would use a map activity as a precursor. Students would be given maps of the United States and asked to outline the area that they thought created the Chesapeake Bay watershed with a wet erase marker. These maps, with student names, would be stored until later. We would then do multiple activities to discuss the Chesapeake Bay watershed including using multiple map activities, short video clips, and the bead activity. Next, students would be broken into pairs or small groups and asked to use yarn in three different colors to outline the Chesapeake Bay, the watershed, and the major tributaries. They would be allowed to access resources including maps during this lesson. A class discussion would be held to look at and discuss each group’s map. Alterations would be made as needed. Finally, students would be given their maps back and asked to use different colored marker to show their newly attained knowledge of the watershed.

 August sixth, the second day of the course was split between Hollifield Station Elementary School and Patapsco Valley State Park, the Daniel’s Area. We defined our supporting question of the day as, ‘How do we empower students to take actions that improve the school environment?’ and then proceeded to work on a Schoolyard Habitat Report Card that could easily be used with students to identify both positive and negative aspects of the schoolyard. These observations would allow for authentic discussion about what things are going well on the school property, but more importantly, inspire student generated ideas about projects that could be implemented to improve areas of concern. We also made a turbidity tube that I have already used with my own children and plan to use during the school year in a variety of ways.

 The afternoon was spent paddling canoes up the Patapsco River from the Daniel’s Damn to a stream where we looked for macro invertebrates as a sign of whether the stream was healthy or not. This was a very interesting activity and would be applicable to schools with neighborhood waterways, or older groups than I currently teach. I can see this type of exploration, although extremely important, causing issues with the Risk Management Department at the elementary level.

 On Wednesday, August seventh, the group visited Merry Acres Farm to investigate sectional cropping, pasture rotation, as well as other conservation practices that are being implemented on local farms. The information that I gleaned from this trip will be very useful. I gained a deeper understanding of some of the farming practices used by the families at my school and will be more able to accurately include ideas about farming conservation in future lessons.

 Wednesday afternoon was spent at Robinson Nature Center, which is a LEED Platinum certified building. I was introduced to many new practices in engineering and environmental design, from Green roof projects that are pervious and sustainable, to pervious concrete in the parking lot that can absorb five gallons of water per minute, per square foot. A class visit to the nature center could be used to explore the local environment through the nature trails and the museum, as well as to discuss modern conservation techniques that could inspire students to think about small changes that they could help make throughout the community.

 ‘What comparisons can be made between natural and man-made water filtration systems?’ was the supporting question for Thursday, August eighth. We spent the morning at the Little Patuxent Water Reclamation Plant where we learned how the plant filters and clarifies wastewater back to river quality water before returning it to the Little Patuxent River. This trip gave me a good level of background to use with my students when explaining basic conservation techniques that can be applied in each of our homes. I learned an enormous amount about the important work that is done behind the scenes in our society to rectify the waste that we create.

 At the Little Patuxent Wildlife Research Refuge, where we spent Thursday afternoon, we learned about environmental engineering as well as other wildlife research that is currently being conducted. We took a tram ride through the refuge to explore multiple habitats from wetlands to brand new forests, to more mature forests. We culminated the day by learning to identify native trees as well as how to measure them and identify their importance to the environment via technology. The wildlife refuge could be a fantastic field trip for students and the tree measurement lesson could be integrated in a variety of ways from math units to environmental studies.

 On Friday, August 9, we spent the day on the *Snowgoose*, on the Chesapeake Bay, exploring the supporting question, ‘How does the water quality of Davis Branch compare to the Inner Harbor?’ We visited Carroll Island to view different bird species including cormorants, seagulls, herons, and more. We took multiple water quality readings from pH, to oxygen quality, to salinity readings. We also explored the water turbidity in different locations of the bay. One interesting discovery was an obvious section of the bay where you could see the Patuxent River rushing into the bay from the heavy rains of the previous night. A line of color changing from the harbors greenish brown to a dark brown Patuxent could be observed, and as we crossed this line, we measured the oxygen levels and noticed a significant drop as we entered the Patuxent’s sediment and nutrient filled waters. Later in the day, we dredged for oysters and looked at the animals that can be found on an oyster reef before netting and identifying a variety of native fish including white perch, spot, and flounder. All of the experiences from this day not only build my background from which to help students explore and understand the complexity of the habitats and biodiversity, but inspired ideas for future field trips.

For years, I have worked to engage students in a deeper understanding of the importance of our local environment through research, writing, and experimentation. I currently am involved in a Diamondback Terrapin foster program for the National Aquarium and the Port of Baltimore and am always looking for more ways to engage students in being active participants in improving the quality of our local environment and the Chesapeake Bay watershed. Many of the activities demonstrated during this course will be easily adapted to my classroom repertoire and enhance STEM activities for my students. I also intend to pursue future opportunities with the Chesapeake Bay Foundation and other conservation groups to support proactive environmental efforts and help inspire the next generation to be better stewards of our environment.