Water Pollution-Due May 12th

Part 1: Background:

Excerpt from Chesapeake Bay Ecosystem Reading. Please use the reading to help answer the questions.

Water....approximately 70% of the Earth's surface is covered by it. In the natural environment, water is never pure. It tends to hold other substances in solution. The concentration and distribution of these substances can vary. Within an estuary, freshwater mixes with saltwater, with each contributing its own chemical and physical characteristics. This creates a range of environments that support a wide variety of plants and animals.

Salinity is a key factor influencing the physical make-up of the Bay. Salinity is the number of grams of dissolved salts present in 1,000 grams of water. Circulation of water transports plankton, fish eggs, shellfish larvae, sediments, dissolved oxygen, minerals and nutrients throughout the Bay. Circulation is driven primarily by the movements of freshwater from the north and saltwater from the south. Circulation causes nutrients and sediments to be mixed and resuspended.

The waters of the Chesapeake and its tributaries transport huge quantities of sediments. Although sediments are a natural part of the Bay ecosystem, accumulation of excessive amounts of sediments is undesirable As they settle to the bottom of the Bay, sediments can smother bottom-dwelling plants and animals, such as oysters and clams. Sediments suspended in the water column cause the water to become cloudy, or turbid, decreasing the light available for underwater bay grasses.

Dissolved oxygen is essential for most animals inhabiting the Bay. The amount of available oxygen is affected by salinity and temperature. Cold water can hold more dissolved oxygen than warmer water, and freshwater holds more than saline water. Oxygen is transferred from the atmosphere into surface waters by diffusion and the aerating action of the wind. It also is added as a byproduct of photosynthesis.

Nitrogen is essential to the production of plant and animal tissue. It is used primarily by plants and animals to synthesize protein. Phosphorus is another key nutrient in the Bay's ecosystem. In the water, phosphorus occurs in dissolved forms, often attached to particles of sediment. This nutrient is essential to cellular growth and reproduction.

Nutrients, like nitrogen and phosphorus, occur naturally in water, soil and air. Just as the nitrogen and phosphorus aids the growth of agricultural crops, both nutrients are vital to the growth of plants within the Bay. Excess nutrients, however, are pollutants. Sewage treatment plants, industries, vehicle exhaust, acid rain, and runoff from agricultural, residential and urban areas are additional sources of nutrients entering the Bay. Nutrient pollution is the number one problem in the Bay system.

Besides nutrients, people add other substances to the Bay's water, creating serious pollution problems. Heavy metals, insecticides, herbicides and a variety of synthetic products and byproducts can be toxic to living resources. These contaminants reach the Bay through municipal and industrial wastewater, runoff from agricultural, residential and urban areas and atmospheric deposition.

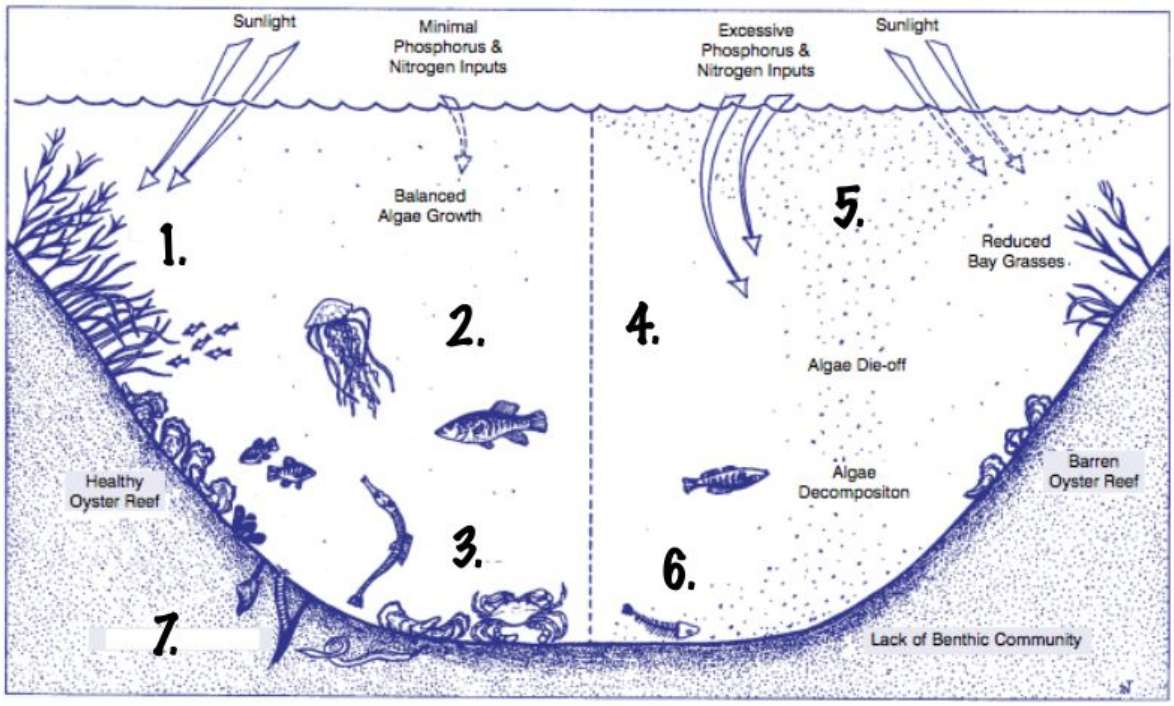
Since 1987, regional Bay restoration leaders have worked together to reduce the amount of nutrients flowing into the Bay and its rivers. In 2003, the six Bay watershed states, the District of

Columbia and the U.S. Environmental Protection Agency agreed to steep cuts in the amount of nutrients flowing into the Bay and its rivers.

Questions:

1. What is the definition of an estuary?
2. What is salinity?
3. What causes the water in the Bay to circulate?
4. List two reasons why excessive amounts of sediment is undesirable.
5. What determines the amount of dissolved oxygen in the water?
6. What do living things use nitrogen for? What do living things use phosphorus for?
7. Why are excess nutrients considered pollutants?
8. Where does nutrient pollution come from?
9. What are other ways the pollution is entering the Bay ecosystem?
10. How are humans working to solve these pollution problems?
11. Match the term or phrase to the location on the image

a. Unhealthy Ecosystem
b. Healthy Ecosystem
c. Algae Bloom
d. Healthy Bay Grasses
e. No Oxygen
f. Adequate Oxygen
g. Benetic Community



Part 2: Application: Now that you understand a little background about water and how it gets polluted, apply this knowledge and pick one of the following options. (Works best after you watch Who polluted the Potomac- Find on Google Classroom)

1. Use your own resources to create a filter that could take bay water and make it "pure" enough for drinking by a household animal. Include a drawing, image, or description of how it worked.

OR

2. Analyze the following data table and determine the best filter and explain why. Then draw an image and label with the material you would use to make a filter.

Water Filter Analysis Table 0% - Horrible Water Quality , 100% - Drinking Water Quality

Design #	Material Included	Pre Water Quality Number/Percent	Post Water Quality Number/Percent
1	sand, rocks, cotton balls	25%	75%, no leaves, no dirt, but still colored,
2	Charcoal, steel wool, baking soda	25%	60% no leaves, light color, but dirt
3	Cotton balls, charcoal, sand	25%	80% no leaves, no dirt, light color
4	Sand, cotton balls, baking soda	25%	79% no leaves, no dirt, lightest color

Which filter was the best? Explain Why.

Design Phase: Sketch the filtration device. Draw and label the filter ingredients in the order in which they were placed in the device. Label approximately how much was used of each. Explain why you selected the filter ingredients and why you placed them in that order?

Eutrophication - Due May 19th

Part 1: Reading/Background Questions

Eutrophication is a term used to describe the over enrichment of aquatic systems by excessive inputs of phytoplankton nutrients, typically phosphorus and/or nitrogen. In unimpacted systems, nutrients are present in such low quantities that algal growth is controlled. In systems with an oversupply of these nutrients, the growth of phytoplankton is stimulated, initiating a chain of events that leads to the symptoms of eutrophication. Usually, a major fraction of the enhanced phytoplankton growth cannot be used through the normal food web. This situation occurs because there simply is too much phytoplankton being produced or because certain phytoplankton species, which are unpalatable and thus not eaten by the important small animal consumers, start to flourish under these conditions.

Sometimes, the excessive algal growth of eutrophic waters is readily visible as algal "blooms" or "scums" that form near the surface. More typically, much of the activity associated with eutrophication is hidden below the surface. The large mass of algal growth that does not enter the food web pathways leading to larger animals, enters the decomposer pathways as it sinks to bottom waters and sediments. The decomposition of this algal matter by bacteria requires large amounts of oxygen which quickly depletes dissolved oxygen from bottom waters.

Low oxygen conditions produced by eutrophication result in major losses of habitat for fish and shellfish that cannot survive in these stressed environments. Eutrophication also causes much of the turbidity that affects the aesthetic appeal of Bay waters in many areas.

Source: http://www.dnr.state.md.us/bay/monitoring/mon_mngmt_actions/chapter2.html

1. What is eutrophication?

2. What causes eutrophication to happen?

3. List the steps for how eutrophication occurs:
    a.
    b.
    c.

4. Why is low oxygen so harmful for living things?

5. What can be done to prevent eutrophication?

6. What impact does eutrophication have on the larger ecosystem (example the Chesapeake Bay ecosystem)

Part 2: Virtual Lab

1. Complete the explore learning gizmo Pond Ecosystem, collect evidence to support a claim to this question "What effect does the farm have on pond life?" OR analyze the data from the table below and complete the questions.

Data Table:

Pond # (# of farms present)	Temperature	Oxygen	Time of Day	# of Catfish and # of Trout
1 (one farm)	29 C	4.09 ppm	7 am	10 Catfish, 2 Trout
1 (one farm)	33 C	6.40 ppm	5 pm	5 Catfish, 1 Trout
2 (no farm)	15 C	5.88 ppm	7 am	7 Catfish, 8 Trout
2 (no farm)	19 C	8.95 ppm	5 pm	5 Catfish, 7 Trout
3 (four farms)	25 C	2.82 ppm	7 am	6 Catfish, 0 Trout
3 (four farms)	29 C	4.39 ppm	5 pm	7 Catfish, 0 Trout

Analysis:

1. Based on the data from the above table, which pond had more eutrophication occurring? How do you know?

2. What trends did you notice from the data? What do you think this means?

Post Lab:

1. Explain the impact of the farms on the water quality of the ponds based on what you know about eutrophication.

2. Design solutions to help solve the problem.

Wrap Up:

Draw a diagram of a healthy aquatic ecosystem and one impacted by eutrophication. Include a one/two sentence description using science vocabulary

Application: Oyster in the Bay-Due May 26th
Big Picture Question: How have humans impacted ecosystems?

Directions: Now that you have some background on biodiversity, water pollution, and eutrophication; use that information and other resources to complete this case study about oyster populations in the Chesapeake Bay.

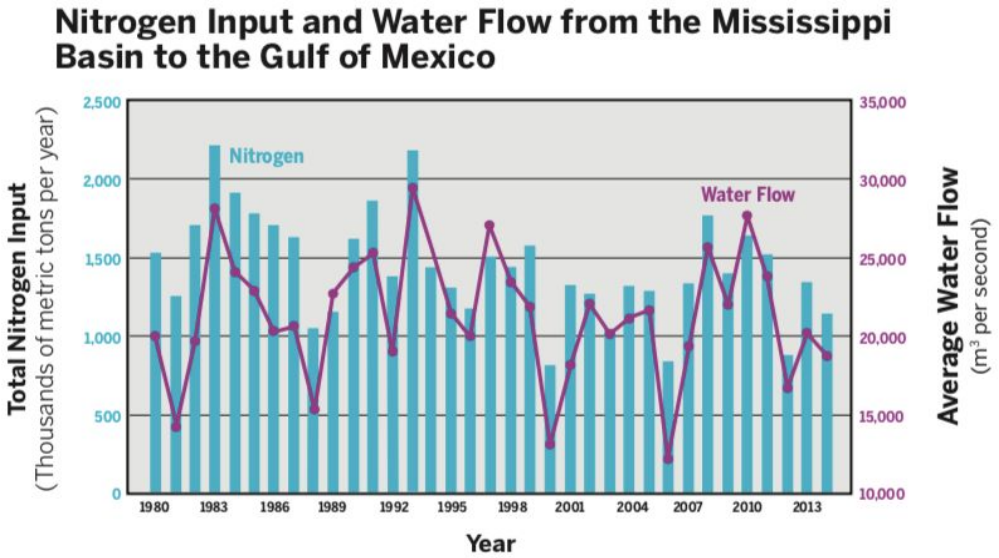
Part 1 Background: Dead Zones - Mississippi River

In aquatic ecosystems around the world, scientists have recorded an increase in the number and size of dead zones. A **dead zone** is an area in a body of water where the water at the bottom has little or no dissolved oxygen. Scientists are concerned about the increase in dead zones because very few organisms can survive in dead zones.

One of the main causes of the increase in size and number of dead zones is fertilizer run-off. Fertilizer contains nutrients like nitrogen, which plants need to grow. Farmers apply fertilizer to plants to help them grow. If extra fertilizer is given to plants, when it rains the extra washes away into streams and rivers.This is called fertilizer run-off.

Dead zones happen when large amounts of nutrients are added to a body of water. If there is a lot of fertilizer run-off, the nutrients in the run-off help phytoplankton grow. Populations of phytoplankton increase quickly.When the plankton die and sink, they feed the bacteria (decomposers) on the bottom of the ocean.The bacteria population increases, and uses up the oxygen in the surrounding water, leaving no oxygen for other organisms.The organisms have to leave that part of the ecosystem or they die.

1. Now examine the following graph and explain any patterns you see



This graph shows the amount of nitrogen input and water flow from the Mississippi Basin into the Gulf of Mexico from 1985 to 2014

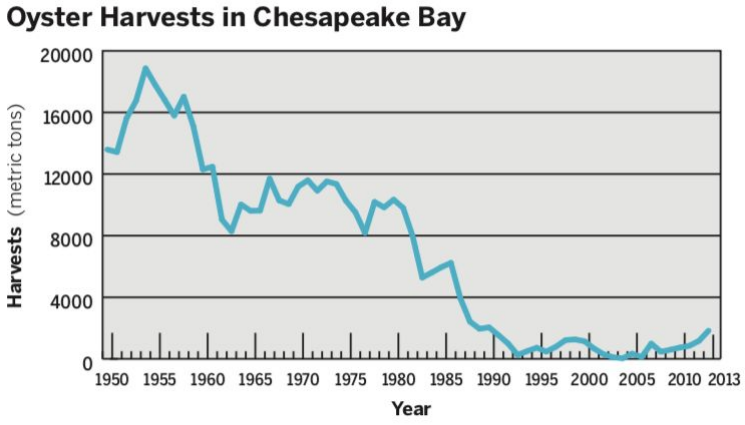
The Mississippi drains nearly 41% of the land in the United States, and a lot of the land is farmland where fertilizers are used. There are also many sewage treatment plants along the river that discharge treated waste that is very high in nitrogen. Scientists estimate that 65% of the nutrients that drain into the Gulf of Mexico come from farms and livestock production along the Mississippi.

Source of Nitrogen	% Total Nitrogen from Source
Fertilizer & treated soil	50
Animal manure	15
Other (atmosphere, ground water, erosion, runoff, etc.)	24
Factories and other buildings	11

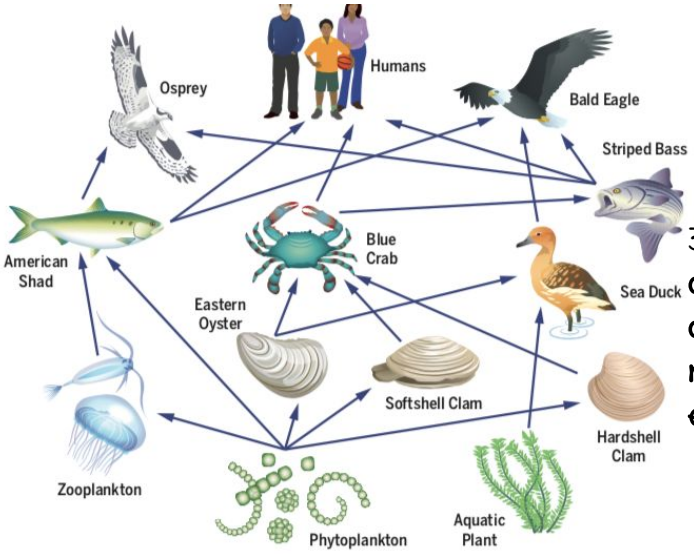
2. Construct a scientific explanation about the effect of water flow from the Mississippi Basin on the nitrogen input in the Gulf of Mexico.

Part 2: Oysters Reading and Data

Eastern Oysters are one of the most important organisms in the Chesapeake Bay ecosystem.The oysters are part of the food web, and they filter the water of the Bay.The oyster fishery is also very important to the area's economy. One hundred years ago Chesapeake Bay was the world's largest oyster-producing area, with fishers harvesting more oysters than all other countries combined. However, the oyster population has been overfished and the amount of oysters available to harvest has decreased dramatically. In this activity you will investigate how this has affected the Chesapeake Bay ecosystem.



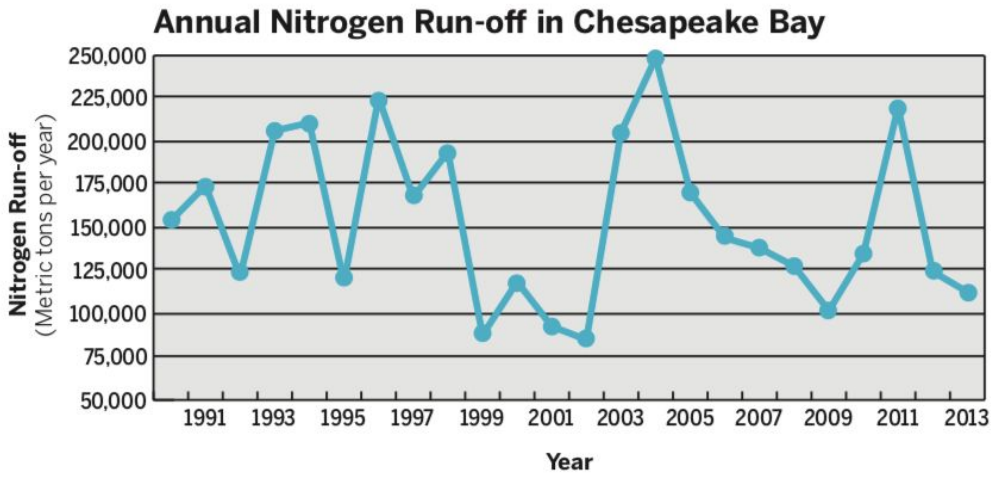
1. What do you notice about the oyster harvests over time? What might be the cause of this?

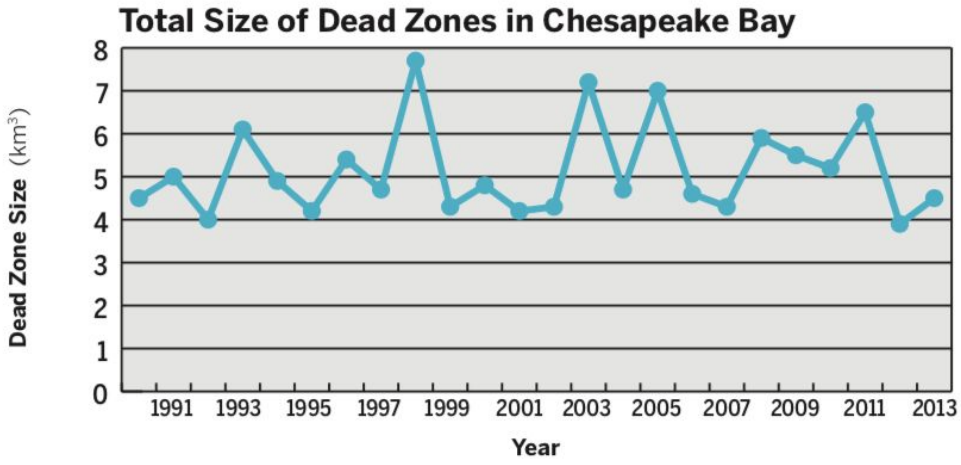


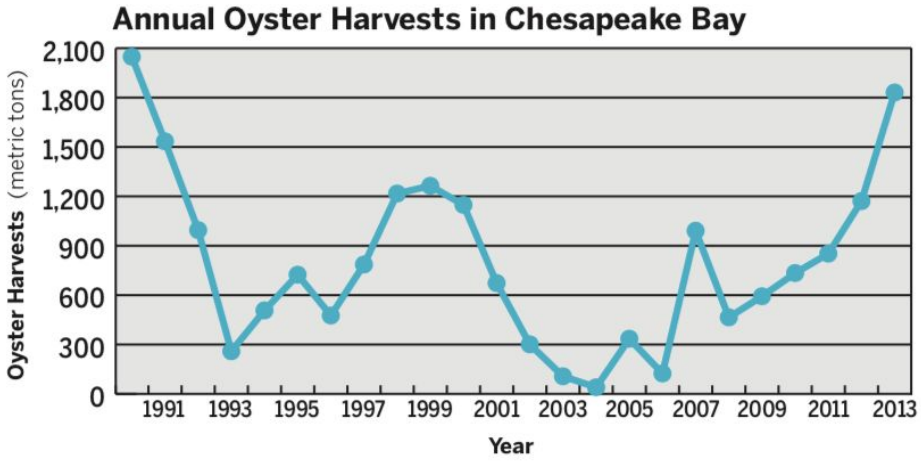
2. List two organisms that complete with the Eastern Oyster for resources.

3. **How might the changes in the oyster population affect other organisms in the ecosystem? How might this affect the rest of the ecosystem?**

One of the important roles of the oysters is to filter the water in the Bay. As they filter the water they remove nutrients and other matter. One of the biggest challenges for the Chesapeake Bay ecosystem in recent years is the appearance of dead zones. There are farms surrounding the Bay, and the run-off from these farms is the primary source of nutrients that cause phytoplankton populations to increase. This can lead to an increase in the size of dead zones. In general, as the human population increases, so will the number of farms and the amount of fertilizer that becomes run-off.







Part 3: Evaluation:
Construct a scientific argument about whether an increasing human population in the Chesapeake Bay area is affecting the number of oysters in the Bay.

Question: Is an increase in the human population in the Chesapeake Bay area affecting the number of oysters in the Bay?

Claim:

Evidence:

Reasoning: