Name _____ Date _____

Analyzing Watershed Health: Dissolved Oxygen

Dissolved oxygen is the concentration of oxygen—the amount that is present in the water for a given volume of water. Scientists monitor the health of the Chesapeake Bay watershed by measuring the concentration levels of dissolved oxygen in the water. Dissolved oxygen is a water quality measurement that changes over time and depends on the temperature of the water and other factors. It is measured in mg/L. Scientists have determined that most living aquatic organisms need levels of 5 mg/L and above to survive.

- Levels above 5.0 mg/L are considered healthy for the Chesapeake Bay.
- Levels below 5.0 mg/L can create stress on the aquatic organisms.
- Levels between 0-0.2 mg/L are measures of a "dead zone" where no plants or animals can survive.

Underwater ecosystems are sensitive to changes in dissolved oxygen levels, and these levels can fluctuate greatly and be affected by human activities on land.

Part 1. Explore levels of dissolved oxygen in the Chesapeake Bay.

You will use FieldScope to analyze dissolved oxygen level data from the Chesapeake Bay. The data on the map has been collected from the Chesapeake Bay Interpretive Buoy System (CBIBS). These are 11 buoys around the bay that provide reliable information to scientists, boaters, and students. You will explore the average dissolved oxygen levels reported by CBIBS at each of these sites during the past 2-3 weeks.

1. Open the dissolved oxygen map in FieldScope: http://chesapeake.fieldscope.org/v3/maps/307

   a. Which colors represent low dissolved oxygen? _____

   b. Which colors represent high dissolved oxygen? _____

Analyzing Watershed Health: Dissolved Oxygen, continued

2. Where in the Chesapeake Bay watershed do you observe low dissolved oxygen levels? Why might this happen? _____

3. Where in the Chesapeake Bay watershed do you observe high dissolved oxygen levels? Why might this happen? _____

4. How do dissolved oxygen levels in the Chesapeake Bay vary? What is the range? _____

5. When dissolved oxygen is low, how do you think aquatic life is affected? _____

Analyzing Watershed Health: Dissolved Oxygen, continued

Part 2. Examine data for dissolved oxygen at the selected sites.

❶ Go to the FieldScope map for dissolved oxygen: http://chesapeake.fieldscope.org/v3/maps/307

❷ Zoom in to the selected sites to identify levels of dissolved oxygen. An easy way to do this is to click on the search box (indicated by the magnifying glass icon) in the bottom right of the FieldScope screen. Enter the six sites, one at a time, in the search box.

When you click on the average dissolved oxygen circle, you will see a Data Summary table that includes the minimum and maximum dissolved oxygen levels for that site. Record your findings.

Site	Average Dissolved Oxygen (mg/L)	Minimum Dissolved Oxygen (mg/L)	Maximum Dissolved Oxygen (mg/L)
Annapolis, Anne Arundel County, Maryland			
Havre de Grace, Harford County, Maryland			
Scotland, St. Mary's County, Maryland*			
Alexandria, Alexandria County, Virginia			
Norfolk, Virginia			
Jamestown, Virginia			

*Enter "Scotland, Maryland" in the Search box and select St. Mary's County.

Analyzing Watershed Health: Dissolved Oxygen, continued

3. Click on the average dissolved oxygen circle for Annapolis, Maryland. You should see a Data Summary table that includes the minimum and maximum dissolved oxygen levels for that site. In the table above, record the levels for Annapolis, Maryland. Do the same for the remainder of the sites.

4. In which sites that you have examined are the average dissolved oxygen levels healthy?

_____

_____

_____

5. Are there sites where the average dissolved oxygen levels are unhealthy? What are they?

_____

_____

_____

_____

Part 3. How does temperature affect dissolved oxygen?

1. Label each of three beakers:
   a. Beaker #1 (control)
   b. Beaker #2 (cool water)
   c. Beaker #3 (hot water)

2. Predict which beaker will have the most dissolved oxygen (DO) and which one will have the least.
   a. Most:
   b. Least:

3. Put several ice cubes in Beaker #2 and heat Beaker #3 on a hot plate until it is just about to boil. (Make sure you have your goggles on.)

Analyzing Watershed Health: Dissolved Oxygen, continued

4. Remove the beaker from the hot plate and using a dissolved oxygen probe or test kit, measure the DO levels of all three beakers. Record your observations and data below.

Water Temperature	Dissolved Oxygen (mg/L)
Beaker #1 (control)	
Beaker #2 (cool water)	
Beaker #3 (hot water)	

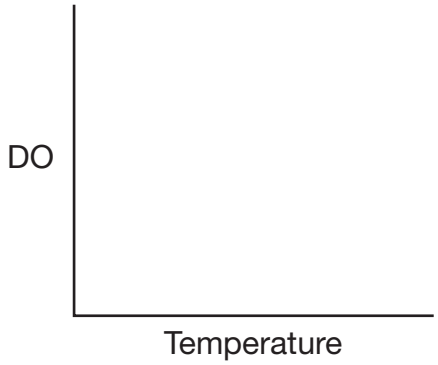
5. Explain your observations. What do these investigations tell you about dissolved oxygen levels in the Chesapeake Bay watershed? _____

_____

_____

6. Finish the following sentence:
As temperature increases, dissolved oxygen _____.

7. Draw a sketch of a line graph relating DO and temperature.



Analyzing Watershed Health: Dissolved Oxygen, continued

8. Go to the graph Dissolved Oxygen (DO) vs. Water Temperature: http://chesapeake.fieldscope.org/v3/graphs/281 in FieldScope. Explore the relationship between DO and temperature for the Chesapeake Bay watershed. Does the graph in FieldScope match the sketch you drew in #7? Why or why not? _____

_____

_____

Answer the following questions:

1. Where does oxygen in the water come from? _____

_____

_____

2. How can we use DO to help describe water health? _____

_____

_____

3. Why is water with a low DO level considered unhealthy? _____

_____

_____

4. Most aquatic organisms require oxygen in the water column. All else being equal, where would you expect to find more stream organisms—in warm streams or cool streams? Why?

_____

_____

Analyzing Watershed Health: Dissolved Oxygen, continued

Part 4. Chesapeake Bay Action Plan Connection

❶ On your **Project Data Table,** record the average dissolved oxygen levels for each site. (Go back to Part 2, #2 of this worksheet, and copy the average levels of dissolved oxygen from the first column of this table to your larger Project Data Table.)

❷ Complete the first box on your **Decision Statement Planning Sheet** to identify the best site for an action plan based on levels of dissolved oxygen. Refer to your Stakeholder Table as well to help you make this decision.