Real Time with Bay Buoys

Overview

The National Oceanic and Atmospheric Administration's (NOAA) Chesapeake Bay Interpretive Buoy System (CBIBS) is a network of observing platforms (buoys) that collect meteorological, oceanographic, and water-quality data and relay that information using wireless technology to the community. The latest data from key points up and down the Bay are available to examine current conditions as well as observe environmental trends over a year or many years.

Using real time data from CBIBS, you will investigate the environmental conditions that can control the structure of aquatic food webs. In any food web—terrestrial or aquatic—it is the photosynthetic organisms that support the upper trophic levels. Algae are photosynthetic organisms that support the zooplankton and fish populations in the Bay. The Bay Buoys measure the presence algae through chlorophyll-a values. As a general guide, above 50 ug/l chlorophyll-a represents a significant algal bloom, and above 100 ug/l represents a severe bloom. Excess algae, usually caused by an excess of nutrients, which stimulate their growth, can make the water cloudy, or increase turbidity, blocking the light needed by underwater grasses to survive. Excess algae can also lead to depletion of oxygen in bottom waters. This occurs when the algae sink to the bottom and are decomposed by bacteria that use up the available oxygen. Some types of algae blooms can also produce toxins, and are collectively known as harmful algal blooms. In areas where severe algal blooms occur, the consequences can include disruption of entire food webs.

Below is a map of the Chesapeake Bay and the locations of the buoys.

S = Susquehanna
SN = Patapsco
AN = Annapolis
UP = Upper Potomac
GR = Gooses Reef
PL = Potomac
SR = Stingray Point
J = Jamestown
N = Norfolk

1. Go to the website: http://buoybay.noaa.gov/

2. In the yellow band located at the top of the page mouse over the word "OBSERVATIONS" and click on "Parameters Measured."

3. Read the two paragraphs under Chlorophyll-A and answer the following questions.

   a. **What is actually measured by the buoys when determining the amount of chlorophyll-a and what are the units?**

   b. **Excess algae blooms are caused by _____.**

   c. **What are two negative effects of a severe algal bloom?**

   d. **As a general guide, what concentration of chlorophyll constitutes a severe algal bloom that can be harmful to the environment?**

4. In the right hand column on the "Parameters Measured" page, find the Buoy Status Box. Click on every station and read the value of chlorophyll-a.

   Write down the stations having the lowest and highest values and give the values.

	Station	Chlorophyll-a value
Lowest Chlorophyll-a		
Highest Chlorophyll-a		

   e. **Is either station having an algal bloom? If yes, then list the station(s).**

5. Locate the “Parameters Measured” page and read the two sections on Dissolved Oxygen, then answer the following questions.

   f. What does the amount of dissolved oxygen (DO) measure?

   g. What are the units that DO is measured in?

   h. At what DO levels will sensitive organisms like fish, feel stressed?

   _____.

   i. In your own words, explain how temperature, salinity, and photosynthesis each affect the amount of dissolved oxygen in the water.

   j. What are the three causes of low dissolved oxygen levels in the Chesapeake Bay?

6. Go back to the Buoy Status box on the top right-hand side of the page. Click on all the stations and read the values for DO. **List all stations and the DO values in which fish may be stressed.**

7. Let’s consider one more parameter, water salinity. Find Salinity on the “Parameters Measured” page. Read the paragraph and answer the following questions.

k. What processes control salinity in the Bay?

l. Why is salinity important for living organisms in the Bay?

8. Using the Buoy Status box on the top right-hand side of the page, click on the S (Susquehanna) and N(Norfolk) stations. Record the values for DO, Water Temperature, and Water Salinity.

Station	DO	Water Temperature	Water Salinity
Susquehanna			
Norfolk			

m. Based on this data, is temperature or salinity more influential in determining the range of dissolved oxygen seen in the Chesapeake Bay?

n. What else could be contributing to the low DO levels at the Norfolk Buoy (refer back to the DO paragraphs on the parameters measured page)?

9. Lets now look to see if there is a correlation between Chlorophyll and Dissolved Oxygen at the Annapolis Buoy over a longer period of time, from the first of May through September 1st.

Under the "OBSERVATIONS" heading click on "Data Graphing Tool." For Date Range, select "Custom Date Range" and enter the begin date as May 1st of this year and the end date of September 1st. Select the platform as Annapolis, the X-axis as Time and the Y-axis as Chlorophyll. Click on the load button. Record approximate date ranges of higher chlorophyll values, above 40 ug/l. Next change the Y-axis to dissolved oxygen and click on load link. Record any date ranges where dissolved oxygen is below 5 mg/l.

Station	Approximate date ranges of high chlorophyll-a values	Approximate date ranges of low DO values
Annapolis		

o. Do any of the date ranges between chlorophyll and DO overlap? List these overlap dates.

p. How would you expect high chlorophyll levels affect the aquatic food web? Sketch two simple trophic pyramids (similar to those in the *Learn* and *Explore* sections of the online module), one representing a food web you would expect at chlorophyll 10 ug/L, and a second for a food web at chlorophyll 100 ug/L.

q. Conversely, if high chlorophyll levels led to low DO levels, how would you expect this to affect the Chesapeake Bay food web?

Sketch a simply trophic pyramid you would expect under conditions of high chlorophyll, but also low DO.