

1.4) INTERPRETING WATER QUALITY DATA FROM THE US GEOLOGICAL SURVEY

Objective: This data gathering exercise utilizes raw data from the US Geological Survey to study the patterns and interactions of different parameters of water quality.

Video instructions: <https://vimeo.com/472646980>

Introduction: Outdoor aquaculture usually involves the management of waters with high phytoplankton densities that are both highly productive and unstable. This instability can be attributed to a high biomass of algae that is often in danger of exceeding the natural oxygen-carrying capacity of the pond. This is why the dissolved oxygen meter is one of the most valuable pieces of equipment used in aquaculture.

Dissolved-oxygen readings are usually taken at dawn, during the afternoon, and at midnight. The midnight reading is critical, because the manager uses it to estimate whether or not the pond has enough oxygen to make it through the night. If a problem is anticipated, corrective action is taken either in the form of flushing out the pond with new water or activating an aerator. Failure to anticipate an oxygen crisis could result in tens of thousands of dollars of livestock lost overnight. This is particularly true during hot weather, when biological oxygen demand is at its peak.

Under normal conditions, shrimp spend most of their time on the bottom. However, they will swarm to the surface when oxygen levels are dangerously low, attracting flocks of seagulls who wish to partake of the easy pickings. This serves as an “alarm system” for the experienced manager who then immediately provides the necessary oxygen relief. The few pounds of shrimp consumed by these opportunists pale in comparison to the mass mortality that would have occurred had the manager not been alerted.

Instructions:

- 1) Open the website for “national real time water quality” from the US Geological Survey: <https://nrtwq.usgs.gov>
- 2) Scroll down and click in the link for the state of Maryland.
- 3) In the map of Maryland, click on the pointer that indicates “Paint Branch near College Park, MD, then click on “access data”.

Questions:

1. Use the interactive graph to examine each of the following seven water quality parameters for Paint Branch for the entire year of 2018 check off all the parameters that clearly show a seasonal pattern:
 - a. Discharge (yes/no)
 - b. Temperature (yes/no)
 - c. Conductance (yes/no)
 - d. Dissolved oxygen (yes/no)
 - e. Nitrogen, phosphorus (yes/no)
 - f. *E. coli* (yes/no)
 - g. Suspended sediments (yes/no)
2. Narrow down the time period to the 3rd quarter of 2018 (July to August). Examine the relationship between discharge and the following parameters and indicate whether or not the discharge rate causes the parameter to increase, decrease, or has no noticeable effect:
 - a. Conductance: (increase/decrease/no noticeable effect)
 - b. Nitrogen: (increase/decrease/no noticeable effect)
 - c. Phosphorus: (increase/decrease/no noticeable effect)
 - d. *E. coli*: (increase/decrease/no noticeable effect)
 - e. Suspended sediments: (increase/decrease/no noticeable effect)
 - f. Dissolved oxygen (increase/decrease/no noticeable effect)

3. Suppose the US Geological survey was somehow measuring total runoff. What do you think would be the relationship between runoff and discharge?
4. Conductance is directly related to the amount of dissolved ions. This is why salt water has more conductance than freshwater. Explain the reason for the relationship between conductance and discharge. *Be specific! I will not give credit for definitions or vague explanations that merely restate the question as an "answer."*
5. *E. coli* are a species of bacteria that found in feces. Explain the reason for the relationship between *E. coli* levels and discharge. *Be specific! I will not give credit for definitions or vague explanations that merely restate the question as an "answer."*
6. Narrow down the time to the month of July of 2018 and roughly estimate the portion of the day when the following parameters are at their lowest and highest point in the morning, afternoon, evening, or night:
 - a. Lowest pH: (dawn/morning/afternoon/evening/midnight/before dawn)
 - b. Highest pH: (dawn/morning/afternoon/evening/midnight/before dawn)
 - c. Lowest temp: (dawn/morning/afternoon/evening/midnight/before dawn)
 - d. Highest temp: (dawn/morning/afternoon/evening/midnight/before dawn)
 - e. Lowest oxygen: (dawn/morning/afternoon/evening/midnight/before dawn)
 - f. Highest oxygen: (dawn/morning/afternoon/evening/midnight/before dawn)
7. The pH of natural waters is often correlated to dissolved carbon dioxide. Explain the reason for the relationship between pH and the time of day *Hint: What roles do oxygen and carbon dioxide play in the carbon cycle?*
8. Explain the reason for the relationship between dissolved oxygen and the time of day. *Hint: The answer is provided in the introduction to this lab.*
9. Click on [this link](#) to compare water quality in different surface waters in Maryland. *If the link does not work, you can cut and paste the URL at the end of these instructions.* Examine the dissolved oxygen records for the Chesterville Branch near Crumpton and the Anacostia River at Riverdale. Both of these rivers experienced an extreme low oxygen event.
 - a. During what year did this happen in the Chesterville Branch?
 - b. During what year did this happen in the Anacostia?
10. Examine the dissolved oxygen records in Sligo Creek near Takoma Park. Based on this information, which of these three bodies of water seem to have less problems with water quality? Explain the reasoning behind your answer.
11. Based on the seasonal pattern of dissolved oxygen:
 - a. During what time of year are dissolved oxygen levels at their lowest average?
 - b. During what time of year are dissolved oxygen levels at their highest average?

12. Use the link provided by your instructor to examine land use in Maryland. Based on this information compare the Crumpton and Riverdale areas and answer the following questions:
 - a. Which of these two areas has a higher population density?
 - b. How is land used around Riverdale; residential, agriculture, forest, industry...?
 - c. How is land used around Crumpton; residential, agriculture, forest, industry,...
13. Use google maps to obtain two areal views; one for Riverdale and one for Crumpton. What difference do you notice when you compare these areal views?
14. What are the main sources of nutrient pollution in Riverdale?
15. List at least one way in which this source of pollution can be mitigated:
16. What are the main sources of nutrient pollution in Crumpton?
17. List at least one way in which this source of pollution can be mitigated:
18. Scavenger hunt: Take a screen shot of the areal view of Crumpton and indicate the location of at least one of the chicken farms in the Chesterville Branch watershed (upstream or along the creek). To find them, you will need to use move the map around and look closer. Once you find one of the chicken farms, take a screen shot on the map, and indicate its location with an arrow, box, or circle.

Website URL in case links do not work:

URL for provisional data for different rivers in MD:

https://waterdata.usgs.gov/md/nwis/dv?referred_module=qw&county_cd=24001&county_cd=24003&county_cd=24005&county_cd=24009&county_cd=24011&county_cd=24013&county_cd=24015&county_cd=24017&county_cd=24019&county_cd=24021&county_cd=24023&county_cd=24025&county_cd=24027&county_cd=24029&county_cd=24031&county_cd=24033&county_cd=24035&county_cd=24037&county_cd=24039&county_cd=24041&county_cd=24043&county_cd=24045&county_cd=24047&county_cd=24510&site_tp_cd=OC&site_tp_cd=OC-CO&site_tp_cd=ST&site_tp_cd=ST-CA&site_tp_cd=ST-DCH&site_tp_cd=ST-TS&index_pmcode_00300=1&group_key=NONE&sitefile_output_format=html_table&column_name=agency_cd&column_name=site_no&column_name=station_nm&range_selection=date_range&begin_date=2010-04-04&end_date=2020-04-02&format=gif&date_format=YYYY-MM-DD&rdb_compression=file&list_of_search_criteria=county_cd%2Csite_tp_cd%2Crealtime_parameter_selection