Module 3
Water quality

Teacher

45 - 90 minutes

Purpose of this lesson

- Introduce students to water quality parameters

Materials

Copy of the lesson
Copies of the water quality parameter fact sheets
Copy of the student worksheet

Background and discussion

The water quality of many streams, lakes, rivers, estuaries, and coastal and open ocean waters has declined due to human made pollution. People are increasingly aware of how nonpoint and point source pollution impacts aquatic life and water quality, creating the impetus to monitor the physical, chemical and biological quality of these water bodies.

The physical, chemical and biological health of a water body plays an important role in the abundance and diversity of aquatic life. Excessive amounts of nutrients or suspended particles for example, can result in imbalances in water chemistry. Episodic or prolonged imbalances of water quality can potentially degrade aquatic life enough to harm the food chain.

Clarifying and characterizing the problems unique to a water body can lead to potential solutions. The first step in solving each problem is defining it:

- Is there a problem? If so, how serious?
- Does the problem afflict only a portion or the entire water body?
- Does the problem occur sporadically, seasonally, or year round?
- Is the problem a naturally occurring issue or is it caused by human activities?

A systematic and well-planned monitoring program can identify water quality problems and help to answer questions critical to the solution of these problems. Useful monitoring data accurately describes the current physical, chemicals and biological status of the water body. This type of baseline information, collected systematically over time can establish a record of water quality conditions in a water body. If reliable historical data exist for comparison, current monitoring data can also document changes in the water body from the past to the present. These data may serve as a warning flag of a developing water quality problem or on the positive side, comparison of the data may indicate improvements in water quality. The more complex a water system, the more time is required to observe and understand changes in the system.

To answer the question “is the water good or bad?” test results must be compared to some form of water quality standards and must be interpreted according to the intended use of the water. In this project, good water quality refers to sustaining a healthy aquatic ecosystem.

Procedure
Review the Water Quality data sheets and respond to the questions on the Student Worksheet.

Assessment
In addition to chemical and physical indicators, biological organisms can be used as water quality indicators. Use the information in the table to make conclusions about the water quality and answer the questions.

Good water quality	Fair water quality	Poor water quality
Mayfly larvae	Crayfish	Midge fly larvae
Caddisfly larvae	Dragonfly	Blackfly larvae
Stonefly larvae	Sowbug	Leeches
Water Penny	Cranefly larvae	Aquatic worms
Planaria	Clam or Mussel	Lung snails

NOTE: For more information on identifying aquatic macroinvertebrates, please visit:
NYDEC: http://www.dec.ny.gov/animals/35772.html
Save Our Streams link: http://people.virginia.edu/~sos-iwla/Stream-Study/Key/MacroKeyIntro.HTML

A water sample was obtained from a river, and a sample from the river bottom taken in the sample location revealed the following data:

- Dissolved oxygen level of 5ppm
- Turbidity reading of 25 mg/L
- 5 leeches
- 1 mussel

1. Based on the data, would you qualify the water quality as good, fair or poor? Explain your reasoning.

Fair, bordering poor.

The DO level is considered within a range to support life, and there is a mussel present which is an indicator of fair water quality. However it is important to consider that mussels are sessile, meaning they cannot move, so if the water quality is degrading, they cannot move or swim away to better waters. The turbidity level is very high and leeches present are not a good sign.

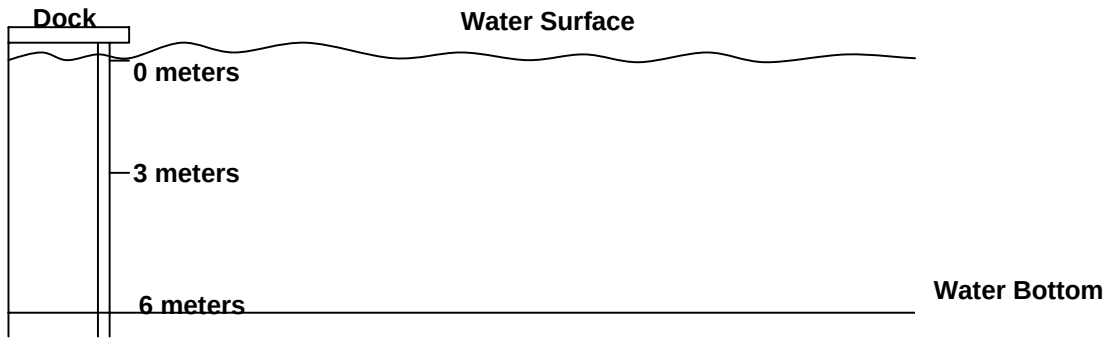
2. The chemistry of second water sample further down the river resulted in a dissolved oxygen reading of 12ppm and a turbidity reading of 3 mg/L. Would you qualify the water quality as good, fair or poor? Explain your reasoning.

Very good, high dissolved oxygen and low turbidity, one would expect the overall quality might be good and the sample from the first location might be the result of a localized problem.

3. Is it scientifically valid to assess the overall health of the water based only on the data reported in the table? Explain your answer.

No. Although some general assumptions could be drawn based on the data (as described above), it is not good practice to make an overall assessment based on a few readings. A more accurate assessment would involve many samples from the same location over a much longer period of time to account for seasonal changes and periodic disruptions of the system.

Using the illustration and data provided below, answer the questions to the best of your ability. Provide as much detail in each answer as possible.



Data

Depth (meters)	Water Temperature (°C)	Conductivity (g/L or ppt)	Turbidity (mg/L)
0	18	1	8
1	15	6	7
2	14	8	6
3	13	14	4
4	12	17	4
5	12	19	4
6	11	20	2

4. Based on the data provided above, do you think the water sampling location is a fresh water lake, an ocean front dock, a river connected to a fresh water lake, a river connected to an ocean? Explain your reasoning.

A river connected to the ocean, and the dock location is very close to the ocean, accounting for the high salinity measurements indicative of a salt wedge, or more dense (colder and saltier) salt water being pushed into the freshwater system from an incoming tide.

5. Explain why the colder, more salty water is at the bottom of the water column.

Because it is more dense.

6. Provide two reasons why the turbidity readings are higher at the surface than on the bottom.

Surface floating detritus or natural litter, minor algal bloom, anthropogenic litter; run off caused by recent rain event, many children swimming ☺