Water Quality

Helpful Facts and Information

- The key habitat piece that keeps coming up for the health of salmon is water quality. When we measure water quality, we are measuring the conditions of the stream and determining how healthy it is to support fish and other aquatic species. Water quality is measured by the physical, biological, and chemical characteristics.
- For many Tribes of the NW, including the people who's traditional homelands we are on now, the rivers were, and continue to be the center of life and culture. They traditionally acted as trade super-highways, provided and continue to provide sustenance, and are a major source of cultural importance. (For September, we are on the traditional homelands of the Molalla. For November, we are on the traditional homelands of the Siuslaw. The southern Willamette valley, is the traditional homelands of the Kalapuya. The descendants of these Tribes now make up the Confederated Tribes of Grand Ronde and Confederated Tribes of Siletz Indians.).
    - Because of this significant connection to rivers for sustenance, cultural importance, and ways of life, many Native communities and Tribal governments in Oregon are integral parts of water stewardship and education around the importance of it.
- **Physical:** Physical characteristics include temperature and turbidity.
    - **Temperature:** Fish cannot cool their bodies down to adjust to temperature. High temperatures expose fish to risks because their bodies are under stress and oxygen becomes less available. Salmon need different water temps at different stages. The average temperature range is from 43 F- 53 F, give or take 5 F.
        - When water heats up the molecules in the water move around faster and expand, this means some of the oxygen expands and "pop"/leaving the water and reducing available oxygen for fish and aquatic species.
        - Temperature is influenced by shade from surrounding vegetation, aquatic plants, and flow of the water. Water moving through a creek will stay cooler than standing water that is exposed to the sun. The turbidity or clarity of the water also influences temperature. The darker or murkier the water, the warmer it gets and the available dissolved oxygen is reduced.
    - **Turbidity:** Turbidity is measured in nephelometric turbidity units (NTU) or Jackson Turbidity Units (JTU), they are roughly the same. You can think of turbidity as the measurement of how clear the water is or how many floating particles are present in the water to impact the quality of the water.
        - Good: 0-20 NTU
        - Fair/Moderate: 20-40 NTU
        - Poor/Bad: 40-50 NTU

        - If the water is turbid, it is darker and holds more heat. As the sun shines on a body of water it will heat up all the floating particles, increasing the temperature, and reducing the available oxygen.
    - Fun Fact: Jackson Turbidity Units refer to the first known measurement of turbidity called the Jackson Candle Method. Samples of water were held over an open flame and continuous samples of water were added until the observer could no longer see the flame. The height of the final sample was the JTU, which is nearly identical to the NTU used today in standard procedures!
- **Chemical:** Chemical characteristics include dissolved oxygen and pH.
    - **Dissolved Oxygen:** Dissolved oxygen is oxygen dissolved in water and is measured at various temperatures. Healthy DO levels are between 10 and 14 milligrams per liter or parts per million. Fish use dissolved oxygen to breathe, the same way we use air. Cooler water has better dissolved oxygen levels for fish.
    - **pH:** pH is the “potential for hydrogen”. The pH scale is from 0-14. 7 is neutral, an example is distilled water. Anything below 7 is acidic this includes battery acid, Pepsi, coffee, and vinegar. Anything above 7 is basic and includes blood, antacid, and bleach. Salmon need a pH between 6.5 and 8. When hydrogen is concentrated in water it becomes more acidic. Things that make water more acidic include pollution from water runoff, fertilizers, and chemicals.
- **Biological:** Biological indicators include aquatic plants like algae and phytoplankton.

Station Outline: Station length varies depending on the class. Most stations are between 30 and 45 minutes.

Station Preparation

1. Arrive at the field trip location early enough to get the table set up at a spot where students can safely access the water.
2. Have equipment out and ready to use. Students collect the water samples for this station, it is very hands-on.
3. Collect the air temp as a reference. This can be compared to the water temperature.
4. This station can be challenging due to time constraints. You can pair all the tests together if that makes it easier and limit the final discussion. Or split students into groups to cover each topic and report back after a few minutes. Find a combination that feels comfortable for you. This is just a guide, and does not need to be the exact way you time out and cover each topic.

Student Participation

1. Provide a brief overview of what water quality is. As you test for each measurement, you will discuss what those measurements mean and why they are important.

2. Let students know whose traditional homelands we are on. Provide a brief overview of why rivers are significant to local Native communities.

Temperature

1. Ask one student to place the thermometer in the water. Be sure to have them place it in a spot where it won't get washed away and where you can see it. Read the temperature after about five minutes.
2. Talk about the importance of temperature and the range it needs to be in to support aquatic life.
    a. Ask students if they can think of things that influence temperature. Do they notice any of these things at the site?
3. Pull the thermometer and read the temp, try to not influence it with your body heat. If possible, read the temperature while it is in the water.
4. Using the handout, compare the water quality standards for salmon to the temperature at the site. Does this stream meet those standards? If not, what could we change to keep the water cooler?

Dissolved Oxygen

1. Provide a brief overview of what dissolved oxygen is and why it is important to fish and aquatic life.
2. Using the handout, talk about the DO levels that are needed to support aquatic life. Notice that there is a range for different species.
3. Use the DO kit to determine the DO concentration at the site
    a. Ask a student to fill the cup to the 25 mL mark with water from the stream
    b. Place the ampoule (the small end of the little glass tube) into the small cup. Be sure to have the small skinny end in the indents of the cup and snap the tip. The ampoule will fill, leaving a bubble for mixing.
    c. Mix the ampoule by inverting it several times.
    d. While you wait two minutes for the color to change, ask the students if they can think of things that impact DO and if they see any of those things at the site.
    e. Once the color change happens, hold the ampoule up to the color key to find the best color match. Ask students to decide what color it matches best and compare that number to the optimum DO levels required for fish.
4. Discuss how healthy the stream's DO levels are (good, bad, needs some improvement?)

pH Provide a brief overview of what pH is and why it is important to fish and aquatic life. Use the handout to show the different ranges of pH and the desired level for fish.

1. Use the pH kit to measure the pH of the site
    a. Ask a student to fill the test tube to the 10 mL mark with water from the stream
    b. Ask another student to add 10 drops of the pH indicator to the tube
    c. Have that student cap it and invert the tube 10 times to mix it

   d. Once the color change happens, place the test tube into the slot of the reader
   e. Students can choose what color reader slide to compare it to and determine the closest color match
2. Discuss how healthy the pH of the site is. What kind of aquatic life can it support? Is it good, bad, in need of improvement?

Turbidity

1. Provide a brief overview of what turbidity is. Remind students that turbidity isn't always bad. Sometimes turbid water means a river is flushing its system out and that can mean gravel is being moved downstream, nutrients are being spread out, and important macros and food sources are being spread throughout the river system. This can be a normal process during the rainy seasons. We are more concerned with turbid water when it stays dark all year, is paired with warm water conditions, and begins to get stagnant or stop flowing.
2. Ask a student to fill the turbidity test tube to the top with water
3. Place the turbidity tube over the key to determine the JTUs

Discussion/Wrap Up

- Based on the information collected, how well can the stream support aquatic life? What kind of aquatic life can it support?
- What do we see in and around the stream that helps keep the water quality at desirable levels?
- What actions by humans have positive and/or negative impacts on water quality?
- How can we make water quality better if we don't see healthy levels for pH, DO, and Turbidity?

HS Discussion/Wrap Up

- What kinds of places do you think have desirable/ non-desirable water quality?
- Who do you think the water quality here affects?
- If it was your job to manage this natural space to ensure good water quality down river, what would you do?
- Would the water quality change with more development or less protections to this natural space? For example, what would happen if someone bought this property and built a manufacturing plant here. What might happen to the water quality? How would you convince people to care?