



Water Quality Study



OBJECTIVES:

Students will:

- Learn the habitat requirements for healthy salmon populations.
- Utilize scientific instruments and chemicals to perform 3 studies on stream health (temperature, pH, dissolved oxygen).
- Analyze the data collected to determine the health of the water body, and make management decisions based on the data.



MATERIALS

- Thermometer
- 2 LaMotte dissolved oxygen tablets
- pH strips (2 per package)
- Thermometer
- Gloves
- Goggles
- Clipboard
- Data sheet & pencil
- Analysis sheets
- Container for water (if you cannot safely stay at the water's edge or shallow water)
 - **Not** included with your kit

VOCABULARY

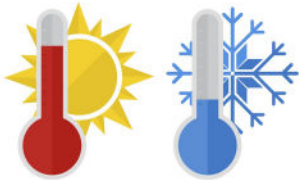
❖ **Water quality** a measurement of how clean or polluted the water is for the people or wildlife that need to use it. For example cold-water fish such as salmon and trout, need cold, clear water with a neutral pH to survive.



❖ **pH:** The measure of how acidic or basic (alkaline) something is. pH is measured from 0 - 14, salmon need a neutral pH (around 7) to survive.



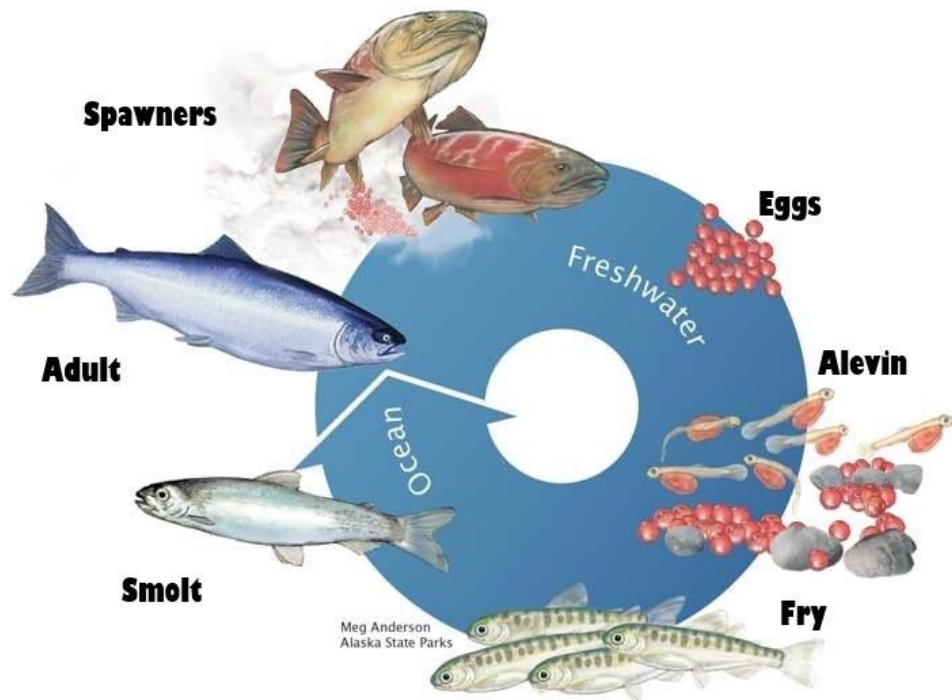
- ❖ **Dissolved oxygen:** The amount of oxygen that is dissolved in the water and available for aquatic organisms. Dissolved oxygen is measured in parts per million (ppm) or milligrams per liter (mg/L).



- ❖ **Temperature:** The measure of how hot or cold something is. Salmon need cold water to survive.

❖ Chinook salmon life stages

- **Egg/alevin:** Females lay approximately 15,000 eggs. Alevin are newly hatched and still have yolk sacs attached to their bodies.
- **Fry:** Once the egg sac is finished, the fry stage begins. Fry live and grow in freshwater streams.
- **Smolt:** Smolts move into the estuary and adapt to salt water.
- **Adult:** Salmon mature in the ocean from 2-7 years.
- **Spawning adult:** Return to the freshwater streams where they were born to lay eggs. Once they've spawned, adult Chinook salmon die.





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INTRODUCTION

Salmon need cold, clear, clean, oxygen-rich water to survive. You will be investigating three components of water quality and determining whether a stream is healthy based on the habitat needs of Spring Chinook salmon.

- ❖ **Temperature.** Salmon and trout need water to be cooler than 58° F (14.4° C) to survive and thrive. Water temperatures between 43° and 58°F (6.1° - 14.4°C) are ideal for migration, spawning, and egg/alevin development. Salmon need cold water because cold water holds more oxygen than warm water.
- ❖ **Dissolved oxygen.** The amount of oxygen found in water is called the dissolved oxygen concentration (DO) and is measured in milligrams per liter of water (mg/L) or an equivalent unit, (parts per million of oxygen to water (ppm). Salmon need a lot of oxygen in the water to survive (at least 8ppm or mg/L).
- ❖ **pH (parts Hydrogen),** a measure of how acidic (or basic) the water is. Salmon need the pH of the water to be about neutral (about 7)

If you cannot access a waterbody, these experiments can be conducted on water from a home faucet or hose.

When you arrive at the testing site, take a moment to observe the water. Does it look healthy? Why or why not? The data you collect will prove or disprove your hypothesis.

TEMPERATURE

Materials

- Thermometer
- Temperature analysis sheet
- Clip board
- Data sheet & pencil

SAFETY IS CRUCIAL AT THE STREAM!

- ❖ Have an adult with you.
- ❖ DO NOT enter water above your calf, and in some cases, do not go deeper than your ankles!
- ❖ **Avoid fast-moving water.** In a fast moving stream, 6 inches of water can knock a person off their feet!
- ❖ Take care when walking on slippery rocks.



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- ❖ Never drink the water.

Activity

- ❖ First, Take a look at your thermometer to make sure you know how to read it.

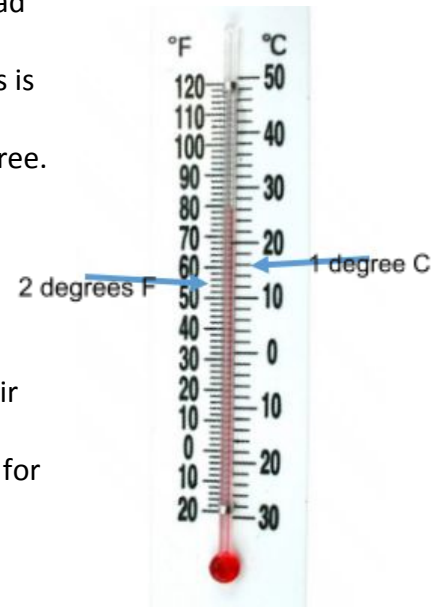
- For Farenheight, each small line between the marked numbers is 2 degrees. (Between 50 and 60, the lines are 52, 54, 56, 58)
- For Celcius, each small line between marked numbers is 1 degree. (Between 10 and 20, the lines are 11, 12, 13, etc to 20.)
- Make sure the air temperature is taken in the shade, not in direct sunlight.
- Take air temperature first.

- ❖ **Air Temperature:**

- Let the thermometer sit out for a while before recording the air temperature.
- It might be helpful to have an assistant hold the thermometer for a few minutes, then record the temperature.
- Record the air temperature on your data sheet. *Don't forget to select whether your temperatures are in Fahrenheit or Celsius!*

- ❖ **Water Temperature:**

- If you can safely get down to the water, submerge the thermometer in the stream for at least 5 minutes.
- If you cannot stay in the water, use a small cup to collect water (NOT included in kit)
- Read the value while the thermometer is still in water, *if possible*.
- Record the water temperature on your data sheet.
- Use the Water Temperature analysis sheet to determine if the temperature of the stream you sampled is in the range that salmon need to survive.



Conclusions

- ❖ Is the temperature in this stream healthy for salmon in any life stage (egg/alevin, juvenile/smolt, migrating adults, spawning adults)? If so, which life stages?

How does water stay cool? How does water get too warm?

- ❖ What management actions would you recommend to keep the water cooler?



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DISSOLVED OXYGEN

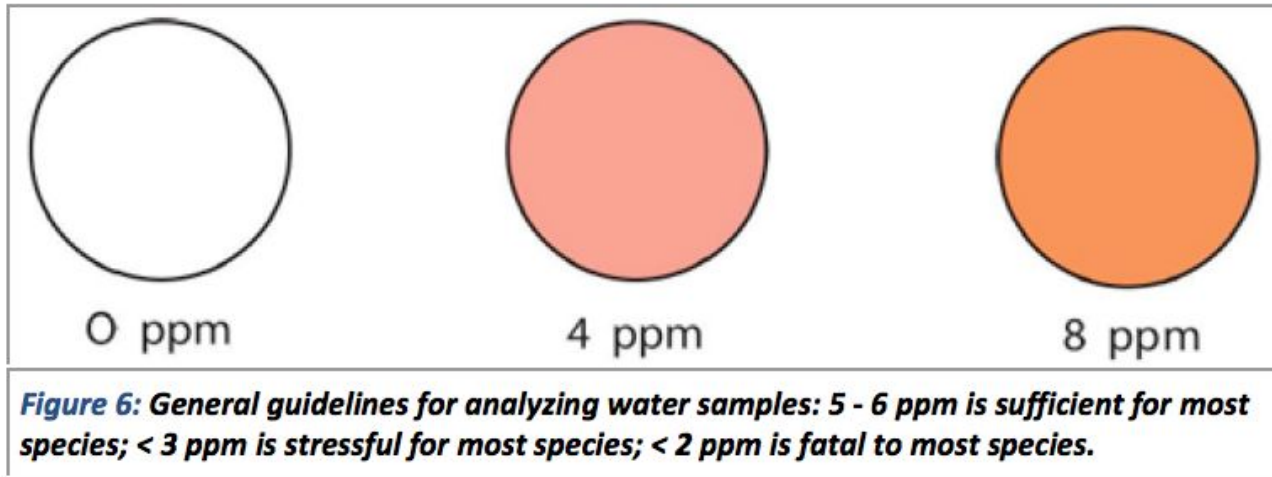
Materials

- LaMotte Dissolved oxygen tablets
- Test tube
- Dissolved oxygen analysis sheet
- Clip board
- Pencil & data sheet

Activity

- ❖ SAFETY IS CRUCIAL AT THE STREAM!
 - Have an adult with you.
 - DO NOT enter water above your calf, and in some cases, do not go deeper than your ankles!
 - **Avoid fast-moving water.** In a fast moving stream, 6 inches of water can knock a person off their feet!
 - Take care when walking on slippery rocks.
 - Never drink the water.
- ❖ Submerge the test tube in the stream & fill the test tube to the top.
- ❖ Put the cap on the test tube to release excess water.
- ❖ Put on gloves (included in your kit).
- ❖ Drop TWO Dissolved Oxygen Tablets into the tube.
 - The water will overflow when you do this - that's OK!
- ❖ Put the cap on the test tube.
 - More water will overflow.
- ❖ Mix (DO NOT SHAKE) the sample by inverting the tube over and over until the tablets have dissolved.
 - This should take 4-5 minutes.
- ❖ Wait 5 minutes for the color to develop.
- ❖ Use the Dissolved Oxygen Color Chart to determine the amount of dissolved oxygen in the sample.
 - Results are in ppm (parts per million, which is the same as mg/L (milligrams per liter). This means for every liter of water, there is X amount of dissolved oxygen.
 - Record your results on the data sheet.
 - **NOTE:** This test only registers dissolved oxygen amounts of 0 ppm, 4ppm, and 8ppm. Dissolved oxygen level of 8ppm is TOO LOW for salmon to be healthy.
 - To interpret your result, use this color chart:





Conclusions

- Was your result 8 ppm?
 - If so, do you think there might be more dissolved oxygen in the water? Why or why not?
 - If not, which species can survive in the dissolved oxygen content in this stream?

- What can affect levels of dissolved oxygen?

- What are some human activities that can affect DO levels? (Remember the relationship between dissolved oxygen and temperature)

- How can we add more oxygen to the water, or keep more oxygen in the water?



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pH

Materials

- pH test strips (2 per package)
- pH analysis sheet
- Data sheet & pencil

Activity

- ❖ SAFETY IS CRUCIAL AT THE STREAM!
 - Have an adult with you.
 - DO NOT enter water above your calf, and in some cases, do not go deeper than your ankles!
 - **Avoid fast-moving water.** In a fast moving stream, 6 inches of water can knock a person off their feet!
 - Take care when walking on slippery rocks.
 - Never drink the water.
- ❖ If you can safely get down to the water, submerge the pH strip into the stream and immediately remove it.
- ❖ Wait 15 seconds.
- ❖ Read the result by comparing the color on the pH comparison chart.
- ❖ Repeat steps 1-3 to confirm your results.
- ❖ Use the pH analysis sheet to determine if the pH of the stream you sampled is in the range that salmon need to survive.

Conclusions

- ❖ Why does pH matter? What would happen if the water was too acidic or too basic (alkaline)?

- ❖ How might water get more acidic/alkaline?

- ❖ How can we make sure that water doesn't get too acidic/ basic (alkaline)?