# WATER QUALITY STATION

## Overview

Water Quality is determined by several variables, including temperature, pH, and dissolved oxygen levels. In this lesson, students will engage in fieldwork (or simulated lab exercises) to collect water samples and use various tools and techniques to measure water quality. They will analyze their data, compare it with environmental standards, and discuss the implications of their findings. The lesson will conclude with a group discussion on how various water quality parameters can impact salmon at various stages of their life cycle. For the educator teaching this lesson, use the background information prior to the lesson plan to supplement your understanding and knowledge. Definitions for italicized words can be found in the appendix.

***Time:*** 30 Minutes

***Learning Goals:*** By the end of this station, students will be able to:

- Define key water quality parameters: temperature, pH, dissolved oxygen, and turbidity, and explain their importance in maintaining healthy aquatic ecosystems.
- Accurately measure water quality parameters using appropriate tools and techniques (e.g., thermometers, pH meters, dissolved oxygen sensors).
- Evaluate the health of a water body based on the collected data, determining whether it meets environmental standards for supporting aquatic life.
- Explain how alterations in water parameters, including introducing invasive species, can lead to changes in water quality and impact the health and stability of aquatic ecosystems.

***Materials:***

- Water quality testing equipment:
    - LaMotte pH kit, CHEMets DO test kit, air/water thermometer
    - Optimum Temperature
    - Optimal Dissolved Oxygen
    - Lethal pH Limits
    - Testing Procedures & Discussion
    - 1 Clip Board
    - StreamWebs Water Quality Data Sheet -
        - StreamWebs Water Quality Data Sheet- Spanish

# Teaching Tips

## Safety Protocols:

- Do not touch the test kit chemicals with bare hands. Use care when handling glass.
- Students testing Dissolved Oxygen levels must wear gloves and glasses when working with ampoules.
- Note: Caution should be taken when handling and disposing of chemicals. Waste chemicals should be poured into the waste container provided in the equipment tub. Always wash your hands if you come into contact with testing chemicals.

## In-river Collecting Techniques:

- Do not drink or taste river water. Assume all natural water sources may contain pathogens.
- Keep an eye out for salmon redds or the area where salmon have laid their eggs.
  Redds are locations in the river where salmon and other fish spawn. Identify these areas by looking for 2 ft - 6 ft patches of rocks that have been stripped of their algae. These sections are "cleaner" than the surrounding river bottom and are usually located where there's a mix of fine gravel and larger cobble. If you spot a redd, point it out to your students so they know what they are trying to avoid as they collect their specimens. There will be field experts and possibly biologists participating in each workshop who are available to assist you in avoiding redds.

# Background Information

## Water Temperature Background Information

Water temperature is one of the most critical factors for the survival of aquatic life. Most aquatic organisms *acclimate* to the same temperature of the water surrounding them. Their *metabolic rates* are controlled by water temperature. This metabolic activity is most efficient within a limited range of temperatures. If temperatures are too high or too low, productivity can decrease, or metabolic function ceases. The organism can die. These extremes, or lethal limits, vary for different species.

**Lethal limits**

Within the lethal limits, there is an ideal range of temperatures. An organism is more efficient in this range, and the species has a greater chance of success. Various fish species have adjusted to upper and lower levels of an optimum temperature range. Spawning, hatching, and *rearing* temperature ranges vary between species. In this way, temperature determines the character and composition of a stream community.

In the Pacific Northwest, most streams have populations of salmon and trout, which prefer temperatures between 40° and 65° F.

In the summer, when temperatures are highest and water flows lowest, juvenile fish live in pools of smaller streams. Pools offer deeper, cooler, oxygen-rich water and increased protection from predators. Because of low water flows, fish can be confined to a limited area. A temperature rise in a rearing pool can kill fish by exceeding their lethal temperature limits.

**Plant cover's role**
Besides hot springs and thermal pollution, solar radiation is the main cause of increased water temperatures. Shade from riparian vegetation plays a significant role in keeping streams cool. During midsummer, adequate shade will keep a stream 7° to 12° F cooler than a stream exposed to direct sunlight.

Even the shade from debris in the water will help keep temperatures low. With enough debris, temperatures can be 3° to 8° F cooler than without shade. Once water has warmed, it does not cool rapidly, even if it flows into a shady stretch. Water temperatures do change as sunlight changes. Overnight, the temperature of streams and rivers drops as the water cools. Warmer temperatures encourage the growth of life forms that adversely affect fish and human health (e.g., algae bloom).

## Air & Water Temperature

**Air temperature, surface area**
When the surface of water is disturbed, such as by turbulence from rifts or rocks in a stream, it mixes more readily with the surrounding air. This increased mixing allows the water to be more directly influenced by air temperature, impacting water quality.

A body of water with a large surface area, such as a wide, shallow stream, is more exposed to solar radiation and the surrounding air. This exposure means that water bodies can absorb heat faster than deeper, narrower ones. As a result, a wide, shallow stream will typically warm up faster because its larger surface area allows for more rapid heat exchange with the environment.

Air temperature impacts water temperature, and thus water quality, in several ways:

- **Heat Transfer:** Warmer air increases the temperature of the water, which can have various effects on the aquatic environment.
- **Evaporation Rates:** Higher air temperatures can also increase evaporation rates, concentrating pollutants and raising water temperature.
- **Seasonal Changes:** During warmer seasons, bodies of water with large surface areas are more susceptible to temperature fluctuations, leading to variations in water quality throughout the year.

**Streambed, streamflow, orientation, and sediments**
The color and composition of a stream bed significantly affect how quickly the stream's temperature rises. A dark bedrock channel absorbs and transfers more solar radiation than a lighter-colored one. Similarly, solid rock absorbs more heat than gravel.

The stream flow or volume of water in a stream influences temperature. The larger a body of water, the slower it will heat. Large rivers and streams have more constant temperatures than smaller streams because they heat and cool slower. The direction of a stream relative to the sun's angle also affects how much solar radiation it will collect. Southerly flowing streams receive more direct sunlight than streams flowing north. Eastward or westward flowing streams receive shading from adjacent ridges, trees, and riparian vegetation. Sediments suspended in water can absorb, block, or reflect some of the sun's energy depending on their color and position in the water. Particles on or near the surface can have a beneficial influence through reflection, but those with a dark color increase the total energy absorbed from the sun.

**Effects of thermal pollution**

Thermal pollution occurs when heated water is discharged into cooler streams or rivers. This heated water is often released from dams, which are heated from being held in a lake or from server systems in data centers that require cooling. The discharged water can be significantly warmer—sometimes up to 20°F hotter—than the natural water body it flows into. This temperature increase can severely impact downstream aquatic ecosystems, disrupting the delicate balance of species and potentially leading to reduced oxygen levels, altered habitats, and increased stress on aquatic life.

## Dissolved Oxygen

Oxygen is as essential to life in water as it is to life on land. The amount of dissolved oxygen in the water determines whether an aquatic organism will survive. Oxygen levels also affect the growth and development of organisms. The amount of oxygen in water is called the dissolved oxygen concentration (DO). It is measured in milligrams per liter of water (mg/L) or an equivalent unit (parts per million of oxygen to water (ppm). If you have a measurement of 10 mg/L of dissolved oxygen, it means there are 10 milligrams of oxygen in every liter of water.

Ppm stands for parts per million and is another common unit of measurement used in water quality analysis. 1 ppm is approximately equal to 1 mg/L because 1 liter of water weighs about 1 million milligrams. This makes ppm and mg/L often interchangeable when discussing water quality, especially for dilute concentrations.

DO levels are affected by:

- Altitude
- Water turbulence
- Water temperature
- Types and numbers of plants
- Light penetration
- Amounts of dissolved or suspended solids

When water that is low in oxygen comes into contact with air, it absorbs oxygen from the atmosphere. The turbulence of running water and mixing air and water in waterfalls, rapids, and riffles add significant amounts of atmospheric oxygen into the water.

**Effects of temperature on DO**

Temperature directly affects the amount of oxygen in water. Colder water holds more oxygen. Bodies of water with little shade can experience a drop in DO during warm weather.

Thermal pollution, the discharge of warm water used to cool power plants or industrial processes, can reduce DO levels. The area immediately downstream from the entry of warm water can be altered drastically. Thermal pollution generally occurs in larger streams. However, *dilution* will have these effects as warm water mixes with colder water downstream.

At higher altitudes (elevation), the dissolved oxygen *saturation point* is lower than under the same conditions at lower altitudes. Below are the maximum amounts, or saturation levels, of dissolved oxygen (in ppm) in fresh water at sea level for different temperatures:

| DO ppm | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Temp °F | 117 | 92 | 90 | 77 | 68 | 59 | 50 | 45 | 39 | 36 | 32 |

When aeration is high, DO levels can temporarily be higher than the saturation level.
This extra oxygen is not stored in the water.

## Photosynthesis, oxidation, and decomposition

Oxygen is added to water when aquatic plants photosynthesize. Sediments can inhibit photosynthesis. When particles of rock or dirt are suspended in water, they are called sediments. Suspended sediments make the water murky or cloudy or reflect much of the sunlight that would otherwise be available for photosynthesis.

Most DO problems in Oregon streams occur when temperatures are highest, and streamflows are lowest. Salmon and trout are especially at risk during this time. Fry are often limited to small spawning streams during these "pinch periods" and DO is critical to their development. While a juvenile Salmonid can withstand 1-2 ppm of DO for short periods, its growth rate drops sharply below five ppm, especially if the temperature is high.

Fish die off in shallow, warm ponds, which is common in summer. Extended periods of warm sunshine often lead to significant algal growth. The reduced sunlight during these storms can trigger a massive die-off of the algal bloom. As the dead algae decompose, they consume available oxygen, causing dissolved oxygen (DO) levels to drop to dangerous levels. This sudden depletion of oxygen can result in the death of fish and other aquatic organisms.

## Potential Hydrogen or pH

The concentration of hydrogen ions in a solution is called potential hydrogen or pH and determines whether a solution is acid or alkaline. A pH value shows the intensity of acidic or alkaline conditions. In general, acidity measures a substance's ability to neutralize bases, and alkalinity measures a substance's ability to neutralize acids.

The pH scale ranges from 1 (acidic) to 14 (alkaline or basic), with 7 as neutral. The scale is logarithmic, so a change of one pH unit means a tenfold change in acid or alkaline concentration. A change from 7 to 6 represents ten times the concentration, 7 to 5, 100 times, so most organisms have a narrow pH range where they can live. Some fish can tolerate a range of 5 to 9, but many fish in other organisms tolerate waters with a pH of 6-8. Pure distilled water has a pH of about 7. Any minerals dissolved in water can change the pH. These minerals can be dissolved from a streambed, the soil in a watershed, sediments washed into a stream, or the atmosphere.

In eastern Oregon, where many soils have a high alkaline content, the pH levels of some water bodies can rise above 10. Forest soils tend to be slightly acidic, and many lakes or streams in forested regions of Oregon can approach a pH of 6.

The age of a lake can also influence pH. Young lakes are often basic. As organic materials build up, decomposition forms organic acids and releases carbon dioxide. Carbon dioxide mixed with water forms carbonic acid, making the lake more acidic.

When rain falls through the atmosphere, it collects the gasses it comes in contact with. As rain absorbs carbon dioxide it becomes slightly acidic but reaches a natural lower limit of pH 5.6. Factors that determine the pH of a body of water can be far removed from a particular site, making it challenging to manage the pH directly. Because pH is a limiting factor, it is important to have a measurement to determine which organisms can survive and prosper. This measurement also serves as a baseline measurement and can assist in monitoring future changes.

# Lesson Plan - Water Quality

**Objective:** Students will be able to accurately test and analyze water quality by measuring pH, dissolved oxygen, and air and water temperature. They will interpret the results to assess the health of a freshwater ecosystem, understanding the impact of these parameters on aquatic life.

## Introduction and Station Descriptions (5 Minutes)

1. **Whole Group:** Introduce yourself to the group and the station.
2. Describe to the group that today they will be measuring different chemical characteristics of the river.
    a. **Tell students:** Today, you will perform the same water quality tests that field scientists use! **Our goal is to learn more about the quality of the river today by correctly following experimental procedures to test for pH, dissolved oxygen, and temperature.** Water quality testing helps us understand the health of a water ecosystem. By measuring pH, dissolved oxygen, and temperature, we can determine if the water is safe for plants, animals, and even people to survive and thrive.
3. Briefly describe the in-river collection technique, safety protocols, and resources and guides they will be using to help them to interpret the data they collect.
4. Divide the students into teams for each activity, including temperature, dissolved oxygen, and pH.
    a. Assign one student from the whole group to be the data collector.
5. Pass out equipment for each test with accompanying directions and graphs to analyze data. Tell students **their first step is to gather data by following the testing procedures and recording the data they collect**. Once they have gathered data, they will work together to interpret their results.

## Small Group Testing (10 minutes)

1. Send groups to complete their testing, reminding them of their roles and responsibilities.
2. Float between groups and facilitate as needed.

## Small Group Analysis (5 minutes )

1. As groups finish collecting their data, guide them towards analyzing their data with their group members.
    a. Cue them to use the laminated data analysis sheet that came with the procedures for their station.
        i. pH: Lethal pH limits for Aquatic Organisms
        ii. DO: Optimum Dissolved Oxygen Limits for Aquatic Organisms
        iii. Temperature: Optimum Temperature Limits for Aquatic Organisms
    b. Let the groups work to interpret their results using the provided group discussion questions on the test procedures. Note: *If you have a faster group of students or older students, you can ask them to perform two tests on a different sample of water OR swab tests with another group once they have finished analyzing their data.*
2. Walk around and check in with students as they work together to understand their data. Ask them the discussion questions at the bottom of the testing procedures.
3. Make sure everyone tells the recorder the data they collected to fill out on the StreamWebs datasheet.

## Interpreting Data and Impacts of Invasive Species (5 Minutes)

1. **Whole group:** Have each group describe what they tested & share the data they collected. Use the following information to add to their understanding:
    a. **pH Test:** The pH test measures how acidic or basic the water is. It tells us how many free hydrogen atoms are in a water sample.
    pH is important because it affects the health of all aquatic life. Some animals and plants thrive in slightly acidic or basic water, while others need it to be neutral. If pH is outside of the preferred range, it can limit the availability of nutrients for organisms and even increase the toxicity of harmful substances. By testing the pH, we can tell if the water is suitable for the organisms living there.
    b. **Dissolved Oxygen Test:** Dissolved oxygen is the amount of oxygen available in the water for fish, insects, and other aquatic organisms to breathe. Without enough oxygen, these organisms can't survive. Testing for dissolved oxygen helps us understand if the water has enough oxygen to support life. In the dissolved Oxygen test we are using today, you will measure the oxygen in parts per million (ppm). You may also see dissolved substances measures at mg/L/
        i. *1 ppm means 1 part of oxygen in 1 million parts of water.*
        ii. *1 mg/L means 1 milligram of oxygen in 1 liter of water.*
        iii. *1 liter of water weighs about 1 million milligrams. This makes ppm and mg/L interchangeable when discussing water quality.*
    c. **Air and Water Temperature Test:** Our bodies understand temperature as how hot or cold something feels. Chemically, temperature informs us how fast or slow molecules are moving. Temperature affects the amount of oxygen that can dissolve in water and influences the ecosystem's overall health. Faster-moving water molecules hold less oxygen. Different organisms prefer different temperatures. By testing both air and water temperatures, we can see how the environment might impact the water and its life.

2. **Whole Group**: Review each of the laminated sheets. You may ask the students who tested each parameter to share their understanding of the sheet.
    a. **Ask students:** What are “optimal limits” and “lethal limits”
    b. **Ask Students:** Based on your analysis sheet, what would be the ideal range we hope to see for the water we tested today?
    c. **Ask students:** Where did your results land on this graph?
    d. **Ask students:** What does your test data tell you about the quality of the river water today?
    e. **Ask students:** How do the specific water quality parameters we tested today (e.g., temperature, pH, dissolved oxygen) affect the health and survival of salmon at different life stages (eggs, fry, smolts, adults)?

3. **Clean up materials before moving on.**
4. **Ask the group:** What can impact water quality?
    a. Get students thinking about what types of things could impact the water quality parameters we measured today.

### Whole Group Discussion/Wrap Up (5 Minutes)

1. During the whole group discussion, please ask the following questions in this order and get through as many as time allows.
    a. What were the most significant findings from today's water quality tests?
    b. Were there any surprising or unexpected results? If so, what might explain them?
    c. How do the water quality results potentially impact local aquatic life, particularly species like salmon
    d. What factors (natural or human-made) could influence the water quality in this area?

# Appendix: Definitions

**Acclimate -** The process by which an organism gradually adjusts to changes in its environment, such as temperature, water quality, or other environmental conditions. In the context of water quality monitoring, organisms may acclimate to different levels of pollutants, temperature variations, or other water conditions over time. This adaptation can influence their behavior, physiology, and survival in changing environments.

**Debris -** Loose, scattered pieces of material that accumulate in a body of water, such as leaves, branches, litter, or sediment

**Dilution** - The process of reducing the concentration of a substance in a solution by adding more solvent, such as water.

**Metabolic Rates -** The rate at which an organism's body carries out chemical reactions to maintain life, including processes like respiration, digestion, and energy production. Changes to environmental conditions can impact the metabolic rates of organisms.

**Rearing -** The process of raising and caring for organisms from their early developmental stages to maturity, often under specific environmental conditions.

**Saturation Point -** The maximum concentration of a substance that a solution can hold at a given temperature and pressure before the substance begins to precipitate or separate out.

**Turbulence -** The chaotic, irregular movement of water caused by factors such as wind, obstacles, or changes in flow direction. In water quality monitoring, turbulence can affect the distribution and mixing of pollutants, nutrients, and sediments in a water body. It influences the rates of chemical reactions and the movement of organisms, impacting overall water quality and ecological health.

## Air & Water Temperature Test

**Objectives:** Students will measure air and water temperatures and discuss the water temperature thresholds for salmon and other aquatic organisms. Students will become familiar with the range of temperatures in different bodies of water and discuss factors influencing temperature (e.g., amount of shade, velocity of water, etc.)

**Materials:** Armored thermometer with string or plastic ribbon (flagging tape) attached (hopefully this tether will prevent loss of the thermometer in the current).

**Procedure with Manual Thermometer**

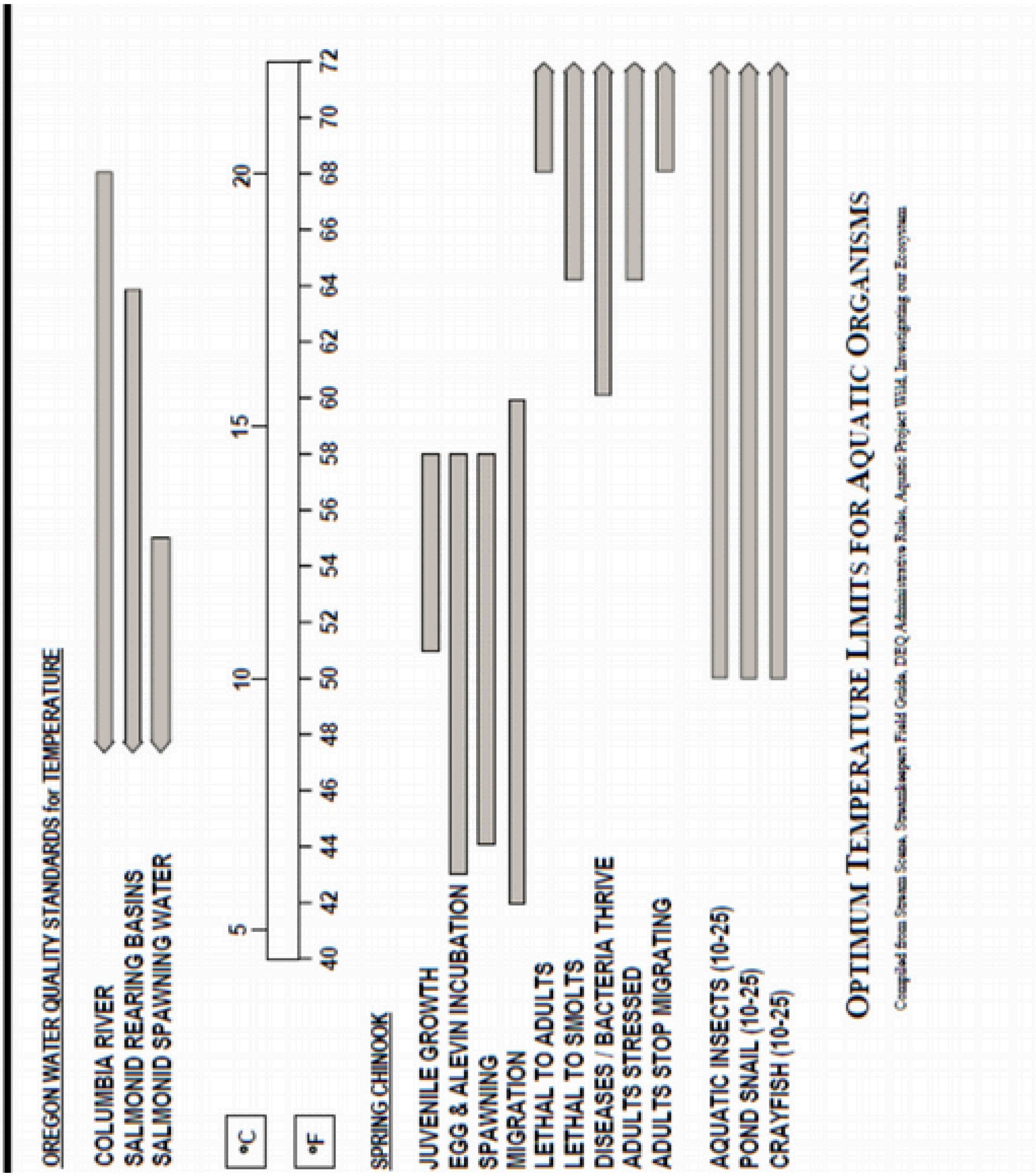
1. Air Temperature: Allow the thermometer to reach equilibrium before recording. Ensure the air temperature is in the shade, not direct sunlight. Take air temperature first.
2. Water Temperature: Submerge the thermometer in the water for at least 5 minutes. Read the value while the thermometer is still in the water, if possible.
3. Record results.
4. With your testing group, read and discuss your answers to the discussion questions below.

**Temperature Group Discussion Questions:**

1. What water temperatures did we observe during our testing, and how do these temperatures compare to the ideal range for salmon and other aquatic species?
2. How does water temperature affect the different life stages of salmon, from eggs to smolts to adults? What are the specific temperature needs at each stage?
3. What are the potential consequences for salmon if water temperatures rise above or fall below their optimal range?
4. What can contribute to a decrease in water temperature? What can contribute to an increase in water temperature?
5. How does water temperature affect dissolved oxygen?
6. What challenges might salmon face if they are in warmer waters?

**Background Information:**

Water temperature is crucial for salmon survival. Salmon can survive in water ranging in 42-77 degrees Fahrenheit but do best in water around 55° F.




Compiled from Stream Scene, Streamkeepers Field Guide, DEQ Administrative Rules, Aquatic Project Wild, Investigating our Ecosystem

## Dissolved Oxygen Test Procedure

**Objectives:** To determine the water's dissolved oxygen (DO) and why this is so important to salmon and other aquatic organisms. Students will be able to conduct a dissolved oxygen test and discuss how the level affects aquatic organisms. Students will learn about the range of dissolved oxygen in different bodies of water and discuss factors influencing DO levels.


**Materials and Procedure:**
(CHEMets Dissolved Oxygen Kit)

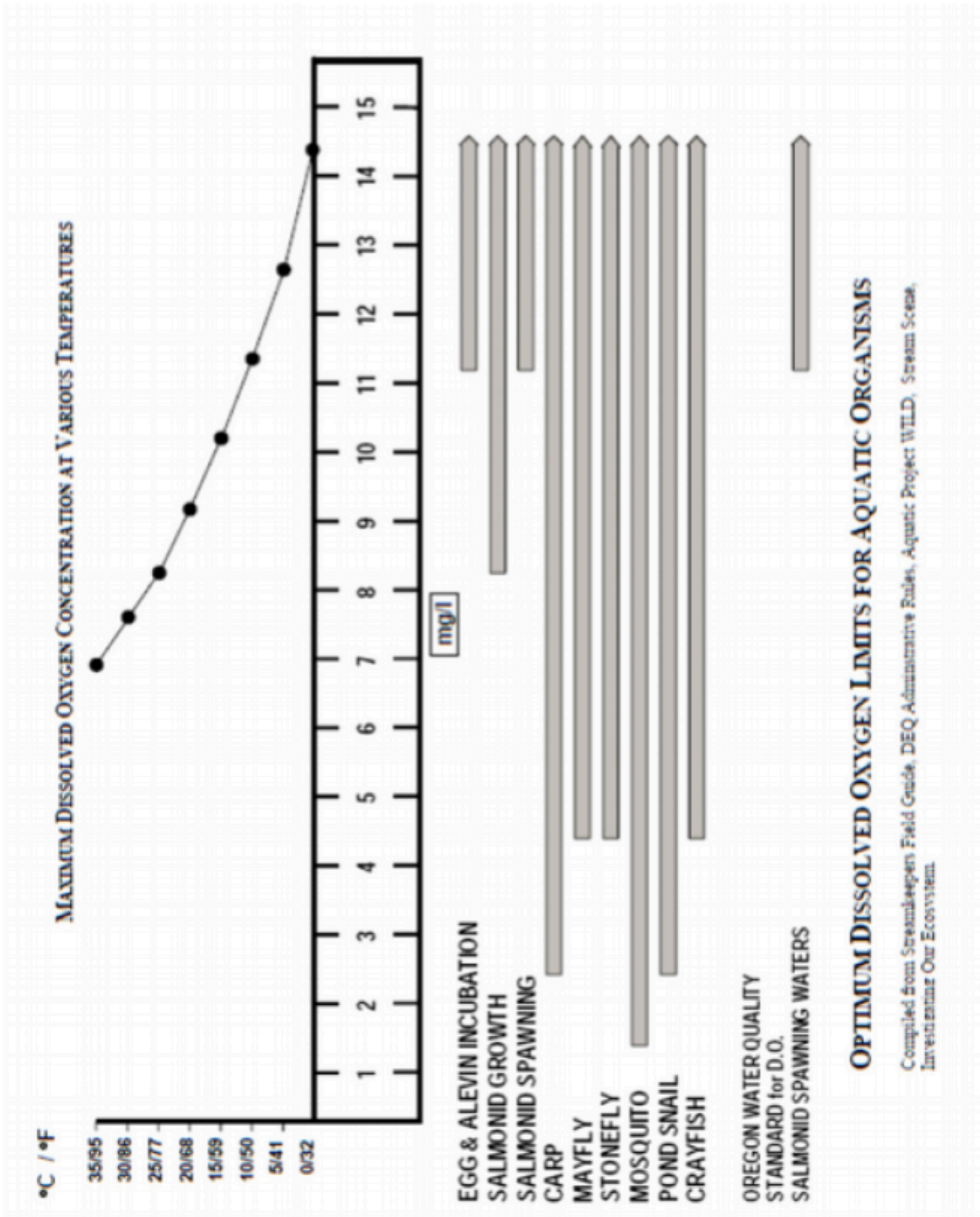
1. Put on protective gear. .
2. Fill the sample cup to the 25 mL mark with the sample to be tested.
3. Place the ampoule, tip first, into the sample cup. Snap the tip. The ampoule will fill, leaving a bubble for mixing.
4. To mix the ampoule, tip the ampoule upside down slowly three times, allowing the bubble to travel from end to end.
5. Dry the ampoule and wait 2 minutes for color development.
6. Analyze your results by placing the ampoule along the color range between the ampoules until you find the color that matches your sample.
7. Record your results as __ parts per million (ppm)
8. With your testing group, read and discuss your answers to the discussion questions below.

**CAUTION!** To gather accurate water quality results, it's important to minimize the introduction of atmospheric oxygen during sample collection and handling. Be cautious when collecting, dipping, and pouring water samples. Shaking or agitating the water can cause air bubbles, leading to an increase in dissolved oxygen levels, which may skew your results.

**Dissolved Oxygen Group Discussion Questions:**

1. What was the dissolved oxygen concentration that you measured today?
2. How is the amount of dissolved oxygen in the water you tested compared to the optimum amounts of dissolved oxygen for different aquatic organisms?
3. What can affect levels of dissolved oxygen? (Temperature, time of year, time of day, depth, plant growth)
4. Why is dissolved oxygen critical for the survival and health of salmon and other aquatic organisms? (Algae, macroinvertebrates, salmon)

**Background Information:** Oxygen enters the water from the atmosphere when water runs through rifles and rapids and from photosynthesizing plants in the water column. The dissolved oxygen concentration in a river depends on the air temperature and atmospheric pressure. Typical dissolved oxygen concentrations are between 6-10 ppm (parts per million). PPM stands for parts per million and is another common unit of measurement used in water quality analysis to express the concentration of a substance in water or air. For water solutions, 1 ppm is approximately equal to 1 mg/L because 1 liter of water weighs about 1 million milligrams. This makes ppm and mg/L often interchangeable when discussing water quality, especially for dilute concentrations.
Dissolved oxygen concentrations can be significantly higher than this when rivers experience blooms of algae growth. Large amounts of dead and decomposing organic material can reduce dissolved oxygen levels below 5 ppm, which places great stress on salmon.


Maximum Dissolved Oxygen Concentration at Various Temperatures
°C / °F
35/95
30/86
25/77
20/68
15/59
10/50
5/41
0/32
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
mg/l
EGG & ALEVIN INCUBATION
SALMONID GROWTH
SALMONID SPAWNING
CARP
MAYFLY
STONEFLY
MOSQUITO
POND SNAIL
CRAYFISH
OREGON WATER QUALITY
STANDARD for D.O.
SALMONID SPAWNING WATERS
Optimum Dissolved Oxygen Limits for Aquatic Organisms
Compiled from Streamkeepers Field Guide, DEQ Administrative Rules, Aquatic Project WILD, Stream Scene, Investigating Our Ecosystem

## Potential Hydrogen / pH Test Procedure

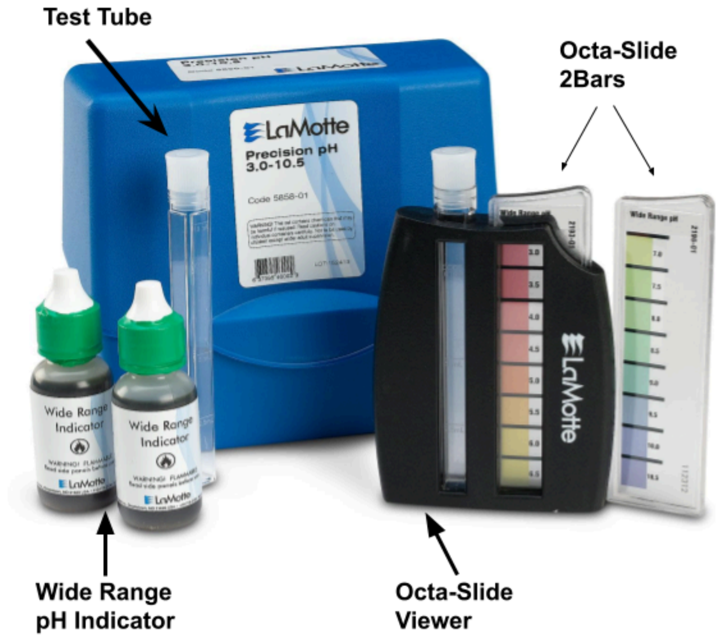
**Objectives:** Students will conduct a pH test, understand the pH scale and where their value falls within that scale, and discuss the importance of pH to salmon and other aquatic organisms.

**Materials and Procedure:**

(LaMotte Precision pH Test Kit)

1. Fill a test tube to the 10 mL line with sample water.
2. Add 10 drops of *Wide Range pH Indicator.
3. Cap the test tube and mix.
4. Insert Wide Range pH Octa-Slide 2Bar into the Octa-Slide 2 Viewer.
5. Insert test tube into Octa-Slide 2 Viewer.
6. Match color of the water sample to the color on the Octa-Slide 2Bar.
7. Record the number of the matching color as pH.
8. With your testing group, read and discuss your answers to discussion questions below.

**WARNING!** This set contains chemicals that may be harmful if misused.

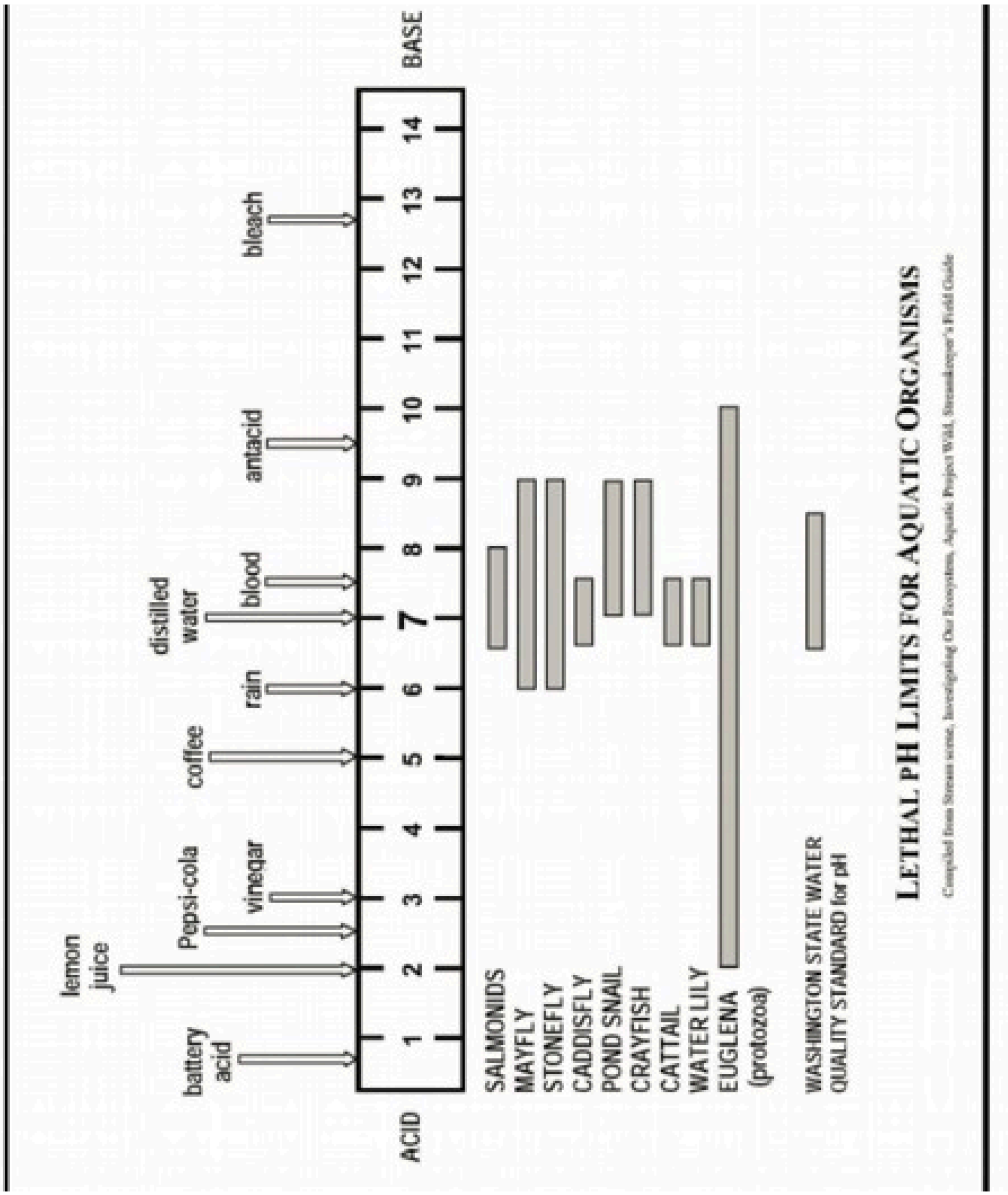



**pH Group Discussion Questions:**

1. What pH level did we record for the water today?
2. What other liquids have a pH similar to the water you tested?
3. How does the pH level we found during our testing compare to the ideal pH range for salmon and other aquatic life?
4. What are the potential consequences for salmon if the pH levels of their habitat are too acidic or too alkaline?
5. How does pH influence the growth of aquatic plants and algae, and what impact might this have on the overall water quality and the habitat of salmon?

**pH Background Information:**

Water contains H+ (hydrogen) ions and OH- (hydroxyl) ions. The pH test measures the H+ ion concentration of liquids and substances. Each measured liquid or substance is given a pH value on a scale that ranges from 0 to 14. Pure, deionized water contains equal numbers of H+ and OH- ions and is considered neutral (pH 7), neither acidic nor basic. If the sample being measured has more H+ than OH- ions, it is considered acidic and has a pH less than 7. If the sample contains more OH- ions than H+ ions, it is considered basic, with a pH greater than 7. It is important to remember that for every one unit change on the pH scale, there is approximately a ten-fold change in how acidic or basic the sample is. For example, lakes of pH 4 (acidic) are about 10 times more acidic than lakes with a pH of 5. And a lake with a pH of 4 is roughly 100 times more acidic than lakes of pH 6.


ACID
BASE
battery acid
lemon juice
Pepsi-cola
vinegar
coffee
rain
distilled water
blood
antacid
bleach
1
2
3
4
5
6
7
8
9
10
11
12
13
14
SALMONIDS
MAYFLY
STONEFLY
CADDISFLY
POND SNAIL
CRAYFISH
CATTAIL
WATER LILY
EUGLENA (protozoa)
WASHINGTON STATE WATER QUALITY STANDARD for pH
LETHAL pH LIMITS FOR AQUATIC ORGANISMS
Compiled from Stream scene, Investigating Our Ecosystem, Aquatic Project Wild, Streamkeeper's Field Guide

OSU Oregon State University Extension Service

# StreamWebs™

Student Stewardship Network

## WATER QUALITY DATA FORM

Share your field data quickly and easily using StreamWebs™. Find out what the macroinvertebrates you found say about your stream, keep track of your photopoints, graph water quality data, upload a video, and much more.
**www.streamwebs.org**

School: ______________________ Teacher: ______________________

Date: ______________ Time: ____________ Weather: ______________________

Stream/Site Name: ______________________

Any fish present? ☐ Yes ☐ No # of live fish: _____ # of carcasses: _____

| TEST | Sample 1 | Sample 2 | Sample 3 | Sample 4 |
|---|---|---|---|---|
| **Water Temperature** ☐ °C ☐ °F | | | | |
| Equipment used? | Vernier ☐ Manual ☐ | Vernier ☐ Manual ☐ | Vernier ☐ Manual ☐ | Vernier ☐ Manual ☐ |
| **Air Temperature** ☐ °C ☐ °F | | | | |
| Equipment used? | Vernier ☐ Manual ☐ | Vernier ☐ Manual ☐ | Vernier ☐ Manual ☐ | Vernier ☐ Manual ☐ |
| **Dissolved Oxygen (mg/L)** | | | | |
| Equipment used? | Vernier ☐ Manual ☐ | Vernier ☐ Manual ☐ | Vernier ☐ Manual ☐ | Vernier ☐ Manual ☐ |
| **pH** | | | | |
| Equipment used? | Vernier ☐ Manual ☐ | Vernier ☐ Manual ☐ | Vernier ☐ Manual ☐ | Vernier ☐ Manual ☐ |
| **Turbidity (NTU)** | | | | |
| Equipment used? | Vernier ☐ Manual ☐ | Vernier ☐ Manual ☐ | Vernier ☐ Manual ☐ | Vernier ☐ Manual ☐ |
| **Salinity (PPT)** | | | | |
| Equipment used? | Vernier ☐ Manual ☐ | Vernier ☐ Manual ☐ | Vernier ☐ Manual ☐ | Vernier ☐ Manual ☐ |

*Adapted from: Environmental Services City of Portland*

OSU Oregon State University Extension Service

# StreamWebs™

Student Stewardship Network

Comparta sus datos de campo rápida y fácilmente con StreamWebs. Averigüe lo que los macro invertebrados que encontró dicen acerca de su arroyo, realizar un seguimiento de sus puntos de foto, graficar los datos de calidad del agua, subir un video y mucho más.

www.streamwebs.org

## FORMULARIO DE DATOS DE CALIDAD DEL AGUA

Nombre:______________________________

Escuela: ______________________________ Profesor: ____________________________________

Fecha: __________________ Hora: __________

Nombre del arroyo/sitio: ___________________ Latitude: _______________ Longitude________________

| PRUEBA | Muestra 1 | Muestra 2 | Muestra 3 | Muestra 4 |
|---|---|---|---|---|
| **Temperatura del agua** ☐ °C ☐ °F | | | | |
| ¿El equipo usado? | Vernier ☐ Manual ☐ | Vernier ☐ Manual ☐ | Vernier ☐ Manual ☐ | Vernier ☐ Manual ☐ |
| **Temperatura del aire** ☐ °C ☐ °F | | | | |
| ¿El equipo usado? | Vernier ☐ Manual ☐ | Vernier ☐ Manual ☐ | Vernier ☐ Manual ☐ | Vernier ☐ Manual ☐ |
| **Oxígeno disuelto** (mg/L) | | | | |
| ¿El equipo usado? | Vernier ☐ Manual ☐ | Vernier ☐ Manual ☐ | Vernier ☐ Manual ☐ | Vernier ☐ Manual ☐ |
| **pH** | | | | |
| ¿El equipo usado? | Vernier ☐ Manual ☐ | Vernier ☐ Manual ☐ | Vernier ☐ Manual ☐ | Vernier ☐ Manual ☐ |
| **Turbidez** (NTU) | | | | |
| ¿El equipo usado? | Vernier ☐ Manual ☐ | Vernier ☐ Manual ☐ | Vernier ☐ Manual ☐ | Vernier ☐ Manual ☐ |

Adaptado de: Environmental Services City of Portland