

WATERSHED TOUR FIELD STUDY

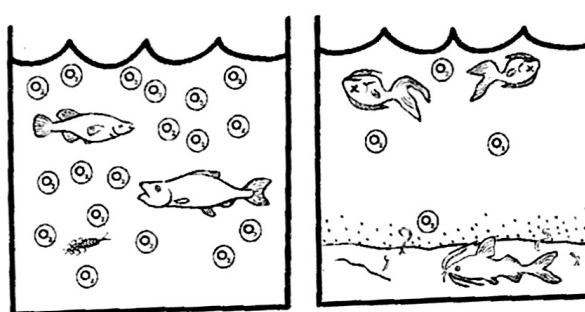
Name: _____ Date: _____

What's in the water matters to salmon and can affect their survival! *Salmon need water that is cold and clear, has lots of oxygen and very little phosphates present.* We will quantitatively test the water quality of each stream or river for its levels of dissolved oxygen (DO), temperature (°C), turbidity (JTU), phosphates (ppm) and pH, to find out if it meets the standards of excellent water quality and good salmon habitat.

A: Dissolved Oxygen:

Organisms on land use lungs to breathe oxygen. In contrast, most aquatic organisms absorb dissolved oxygen through gills or directly through their skin. Although dissolved oxygen can range from 0 to 18 ppm (parts per million), in rivers and lakes, levels in the range of pH 7 to 11 ppm are required to support a diverse range of aquatic life.

Warm water fish such as carp or catfish can tolerate oxygen concentrations as low as 4 ppm, but coldwater species like salmon do best at concentrations 8 ppm or above.



lots of oxygen

little oxygen

DO1. So what do you think would happen if the oxygen levels in a body of water go above 11 ppm? *Explain in detail. (organisms dying is not an acceptable answer)*

DO2. Below 7 ppm? *(organisms dying is not an acceptable answer)*

Oxygen mixes into the water as it tumbles over rocks and logs in the stream. In water with lots of aquatic plants, oxygen levels can increase during the day when photosynthesis is taking place, but drops at night due to all organisms taking in and using the oxygen for cellular respiration. Another physical factor determining dissolved oxygen is water temperature. Finally, in water with lots of organic pollution, bacterial populations can increase rapidly and will need and use a lot of oxygen to break down the organic wastes and can therefore decrease oxygen levels. This is called eutrophication. For water to meet the standard for excellent water quality, the dissolved oxygen levels must be *over 8 ppm*, (parts per million). Fish will die when the level of dissolved oxygen is *below 2 ppm*.

DO3. Do aquatic organisms breathe? *Explain.*

DO4. If a stream had a dissolved oxygen (DO) content of 2 ppm (parts per million), would it be considered a healthy stream for diverse aquatic life? *Explain why or why not.*

DO5. How does *increased* temperature affect the dissolved oxygen content of water?

DO6. What process can actually *increase* the DO content of a body of water?

DO7. What condition can *increase* the capacity of a body of water to hold more dissolved oxygen?

DO8. Which is able to contain (hold) more dissolved oxygen?

- a. cold stream water b. warm stream water c. hot stream water d. streams do not contain oxygen

DO9. What can cause the dissolved oxygen concentration of a body of water to *decrease*?

a. _____

b. _____

B: Water Temperature:

Have you ever noticed that warm soda tastes flat rather than bubbly? This is because cold liquids are capable of holding greater concentration (more) of dissolved gases. As soda gets warmer, the dissolved gasses like (carbon dioxide in the soda) become gaseous again forming the bubbles you see. These rise to the top, then evaporate into the air, leaving behind less in the soda. The same is true for dissolved oxygen in streams – if the water warms up, oxygen goes back into its gas state of matter forming bubbles that rise to the top and is lost to the atmosphere through evaporation. This occurs because water is saturated with oxygen at a lower concentration when the water is warm than when it is cooler. In other words, ***cold water can hold more oxygen than warm water***, so it is important for salmon and other aquatic life to have cold water. For water temperature to meet the standard for “excellent” water quality, **the temperature must be lower than 18° Celsius (°C)**. Before you read the thermometer, predict what temperature will be at this site.

WT1. What characteristics of a riparian habitat would you think play a role in determining the temperature of water at the study sites you will visit?

WT2. If water temperature gets too warm, above 18°C, what would be the effect?

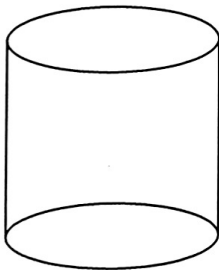
- a. On the stream:

- b. On the physiology of fish in the stream:

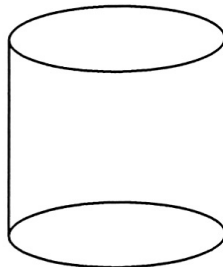
C: Turbidity:

Turbidity is a measure of how cloudy the water is. Water that has a high level of turbidity is hard to see through because it contains a lot of ***suspended*** solids, such as sediment. High turbidity can cause problems for aquatic animals. Dirt can get into fish gills and cover up fish eggs, which reduces their ability to absorb oxygen from the water. High turbidity can also impair the ability of salmon to see. High levels of turbidity can come from soil erosion and runoff from when water passes off surface areas and through storm drains in neighborhoods and cities. In order for salmon to be healthy, they need a ***turbidity level that is less than 25 JTUs***, because if the level is higher than this for more than 5 days, salmon growth can be reduced and gill tissue is damaged.

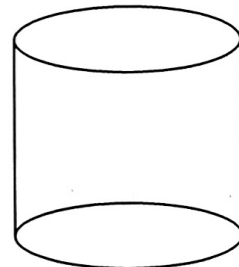
T1. Use the beakers here to draw and show your understanding of turbidity:



Not Turbid



Moderate Turbidity



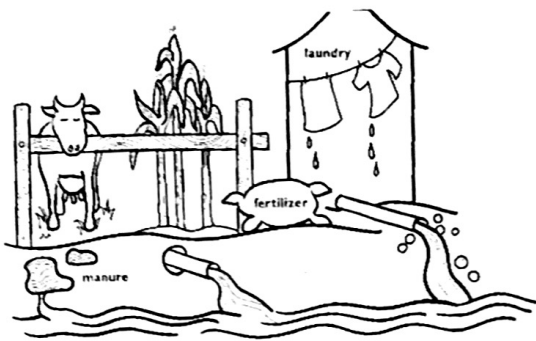
High Turbidity

T2. What could cause turbidity in a stream?

D: Phosphate:

Phosphorous is a natural element found in rocks and soils. As weathering breaks down rocks, phosphate ions (PO_4^{3-}) are released into surrounding soil, groundwater and streams.

All organisms require phosphorous as a nutrient too much phosphate is added to a stream, to occur. In fresh water, plant growth usually is available phosphorous. So, if more phosphorous occurs. If nutrient levels become too high, (for phosphorous is available), algae and other surface rapidly that they create mats covering the surface bloom). This blocks the sun from plants below able to carry out photosynthesis and producing



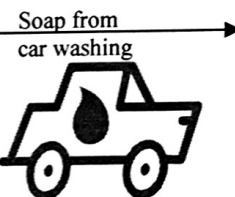
to support growth. But when excessive plant growth is likely limited by the amount of is added, more plant growth example... too much vegetation can reproduce so of the water (called an algae and that keeps them from being more oxygen.

When these algae or plants die, bacteria break oxygen from the water in this process. Because there were so much algae it requires a lot of dissolved oxygen. This takes away the oxygen that salmon need, which may harm or kill the fish.

them down using dissolved

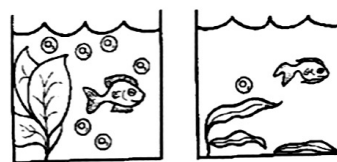
When water has too many nutrients, like excess phosphates, the extra usually comes from soap, fertilizer or animal waste that enters the stream from runoff or through storm drains.

Phosphate levels above 0.1 ppm can result in algal blooms, *so healthy waters should have less than 0.1 ppm, or parts per million, of phosphate.*

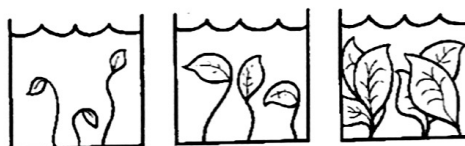


P1. Is phosphorous a mineral? _____
Because ...

P2. What are natural sources of phosphorous?



P3. Why do you think phosphorous is considered a limiting factor?



P4. You test *two* streams that drain to the same pond and one stream has a phosphate level of 0.1 ppm and the other had a phosphate level of 1.0 ppm.

a. What would you hypothesize about the phosphate level in the pond downstream? _____

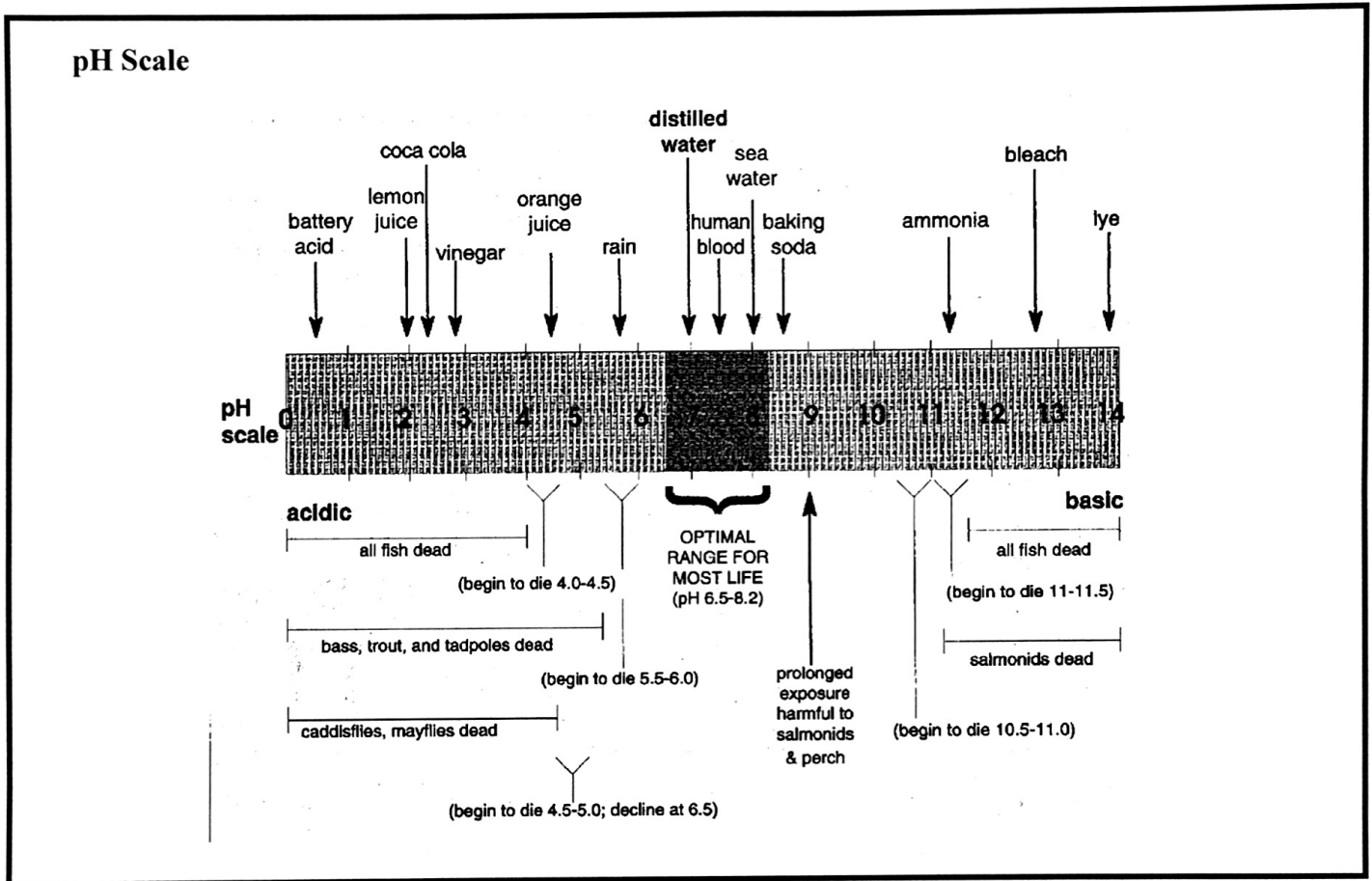
b. How would you know if your hypothesis was valid?

c. What would you begin looking for to determine the source of the phosphorous in Stream 2? _____

E: pH:

pH is the measure of how acidic or basic water is. The pH scale runs from 0 (very acidic) to 14 (very basic). Acids have a pH of 0 – 6.9, Bases have a pH of 7.1 – 14 . pH has its own scale. The scale is logarithmic, (each unit is 10X greater than the one before) meaning a drop from a pH level of 6 to a pH level of 5, means the water is actually *ten times* more acidic! The pH in streams and rivers lowers when acid rain falls into the water or enters the water from runoff. Rain is naturally a tiny bit acidic (5.6) however it can become more acidic when it comes in contact with air pollution from things such as cars, power plants, and factories.

In order to be healthy, salmon need the water they live in to within a *pH range of 6.5 to 8.5*. If the pH falls below 6.5, the bones of fish may become soft and females may be unable to lay eggs. Also, aquatic insects, which salmon often eat, will not be able to survive if the pH is too high or too low.



Write at least one *thoughtful* question about what you've learned about salmon habitat within the stream or river:
