Jacoby Creek Land Trust
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Quality Water: More Than Just Cool, Clean, & Clear

Grades: 5-8 **Subjects:** Science, Environmental Studies

Group Size: 2+ **Duration:** 3-4 hours

Setting: On the banks of the Jacoby Creek

Key Words: water quality, native species and wildlife habitat, salmon lifecycle and habitat, riparian restoration, and ecology

Goals/Objectives: Students will learn through discovery and analysis how human activities can negatively and positively affect water quality. Students will be able to use proper laboratory procedures to test carefully collected creek water samples for pH. From data collected, students will be able to draw connections between water quality, wildlife habitat, and human activities. Students will recognize that pH can affect the organisms that live in water and describe the factors that can change the pH of a body of water.

Background: The quality of water is more than just about temperature, odor, and color. Both nature and humans can cause many changes in a body of water. As a result, each body of water is different and is inhabited by different organisms. One measurement of water quality is its pH.

Materials & Prep: pH-testing kits, clean and dry jar to collect samples, fact sheets (below), and paper and pencils to record your data.

Activity:

1. Gather your materials and head out to the banks of the Jacoby Creek.
2. Introduce activity by reviewing the Background Info above.
3. Carefully collect a sample of creek water in your jar.
4. Measure the pH of your sample by following the instructions on the pH test kit or meter. (Multiple samples can be collected and tested to confirm the readings.)
5. What is the pH of the water? Is it neutral? Acidic? Alkaline?
6. What does this say about the overall health of the creek? Compare the results of your tests to the Acidification Effects On Wildlife chart.
7. Return to the Jacoby Creek in the future and continue to monitor the pH. Contact the JCLT if you have any questions or concerns about the creek.

Part of a project funded by the CA Department of Fish and Game's Fishery Restoration Grant Program

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The concentration of hydrogen ions (pH) can affect the organisms that live in water.

Aquatic organisms have adapted over time to survive and reproduce in a relatively narrow range of hydrogen ion concentrations. Some bacteria can withstand environments that have high hydrogen ion concentrations (pH = 2 or 3); other bacteria can live at very low hydrogen ion concentrations (pH = 12 or 13). However, most fish can only survive and reproduce in water that is not very acidic or basic, but is water that is "just right". Most fish survive best in water that is close to "neutral" or, in terms of pH, at a pH between 6.5 and 8.2. Immature stages of aquatic insects (mayfly nymphs, stonefly nymphs, caddis fly larvae), snails, tadpoles, and crayfish are also very sensitive to changes in hydrogen ion concentration and seem to reproduce and survive best under "neutral" conditions (pH = 6 to 8). In water that is very acidic (low pH values), the concentration of heavy metals ions (copper, aluminum, etc.) increases and, this in turn, has negative effects on the health of aquatic organisms. In general, more acidic conditions tend to cause animals to become less excitable and, in extreme conditions, can lapse into a coma. More basic conditions can lead to animals becoming hyper excitable (over excited).

What are some things that can change the concentration of hydrogen ions (pH) in water?

Rainwater normally has a pH of approximately 5.6. However, airborne pollutants generated from industrial plants and automobiles burning fossil fuels create nitrous oxides and sulfur dioxides. These airborne ions can combine with water vapor to form nitric acid and sulfuric acid. In the presence of such pollution, rainwater will become more acidic; as low as pH = 4.0. This acid rain, therefore, has more than 10 fold greater concentrations of hydrogen ions than normal rain water. When this acid rain runs into lakes, river, or streams, the pH of these bodies of water can be changed to levels that are not compatible with aquatic life.

What is the difference between an acidic, basic and neutral pH?

A solution having a low pH is said to be acidic, what this means is that it has a higher concentration of hydrogen ions than a neutral solution. For example, stomach acid has a pH of around 2.0, this is equal to a concentration of hydrogen ions equal to 1×10^{-2} mol/L. Any solution having a **pH less than 7.0 is said to be acidic.**

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A basic solution, such as a household cleaner usually has a pH of around 11. This translates to a concentration of hydrogen ions equal to 1×10^{-11} mol/L. This would be considered a lower concentration of hydrogen ions. Recall from scientific notation that as the exponent becomes a larger negative number, the numerical value of the expression is less. Any solution having a **pH greater than 7.0 is said to be basic.**

A pH of 7.0 means that a solution is neutral, having a medium concentration of hydrogen ions. Solutions such as distilled water have a neutral pH and thus a concentration of 1×10^{-7} mol/L of hydrogen ions in solution. **Neutral solutions have pH values of 7.0 (or very close to 7.0).**

What happens to the fish, frogs, birds and bugs that live there?

There are many ways that the acidification of lakes, rivers and streams harm fish. Mass fish mortalities can occur during the spring snow melt when highly acidic pollutants-that have built up in the snow over the winter-begin to drain into common waterways. More often, fish gradually disappear from these waterways as their environment slowly becomes intolerable. Some kinds of fish, such as salmon and trout, are more sensitive to acidity than others and tend to disappear first. Even those species that appear to be surviving may be suffering from acid stress in a number of different ways. One of the first signs of acid stress is the failure of females to spawn. Sometimes, even if the female is successful in spawning, the hatchlings or fry are unable to survive in the highly acidic waters. This explains why some acidic lakes only have older fish in them. A good catch of adult fish in such a lake could mislead an angler into thinking that all is well. Other effects of acidified water on fish include: decreased growth, inability to regulate their own body chemistry, reduced egg deposition, deformities in young fish and increased susceptibility to naturally occurring diseases.

Acidification Effects On Wildlife

Water pH	Effects
6.0	• crustaceans, insects, and some plankton species begin to disappear
5.0	• major changes in the makeup of the plankton community occur • less desirable species of mosses and plankton may begin to invade • the progressive loss of some fish populations is likely, with salmon and trout species being generally the least tolerant of acidity
Less than 5.0	• the water is largely devoid of fish • the bottom is covered with undecayed material • the shore areas may be dominated by mosses • terrestrial animals, dependent on aquatic ecosystems, are affected

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