

**Living Lab**

LL

**Sciences| September 2019**

**Conductivity Protocol**

**Background:**

*What is conductivity?*

**Conductivity** is a measure of water’s ability to pass electrical flow (Fondriest, 2019). This ability is directly proportional to the amount of **ions** (an atom or molecule with an electrical charge, such as salts and metals) in the water. Conductivity is one of the most important metrics when measuring water health because it is highly correlated with **salinity**. Salinity (the amount of salt in the water), is tricky to measure directly, but by measuring conductivity of the water, we can indirectly find out how much salinity is present because salt is made up of ions! Specifically, sodium (Na) and chlorine (Cl) ions. When we measure salinity by conductivity in this way, it is called measuring the *practical salinity* of a sample*.*



Figure 1. The chemical composition of salt is the positive sodium (Na) ion and negative chlorine (Cl-) ions.

*Why are conductivity and salinity important?*

**Salinity** is a very important characteristic of an aquatic ecosystem for a few reasons. Firstly, most organisms can only tolerate a certain range of salinity range. This range is determined on the salinity of the environment in which the organism lives. Therefore, if the salinity of an aquatic ecosystem changes drastically, an organism may not be able to adapt and continue to live in that ecosystem.

Secondly, salinity is important because it directly affects dissolved oxygen in the water. The greater the salinity level, the less oxygen is left in the water. As aquatic animals need oxygen to survive, this means that a sudden increase in salinity in the ecosystem (e.g. through evaporation) could be deadly.

Lastly, salinity is an **ecosystem** indicator, meaning it can tell us when major ecosystem-level changes are occurring. Each waterway (for example, a river) has an average salinity level that changes based on natural events (e.g. with season). When processes occur that change this salinity level (e.g. droughts, evaporation, man-made disruption activities), we can tell **when and how impactful those processes are affecting the waterway, based on salinity.**

**The Mission**

Today, we are going to see use science to show *why* salinity is so important, and measure *how* salinity changes - even on a single beach!

**Step 1: Beach observations**

*Objective: determine what the salinity of the water we’re testing today will be. Will that change at different parts of the beach? Why or why not?*

1. Stand on the shore of the beach, and look at the water you’ll be sampling. Is it a river, lake, ocean, or estuary? How much salt do you think there will be in this water? (low / medium / high). Why?

2. Take note of what season it is when you’re sampling this area. Why do you think the season affects the conductivity/salinity of the water? How would the salinity likely change if it was in the middle of summer, or middle of winter?

3. Look around at any human activity or infrastructure in the area (e.g. houses, industrial activity, boats, pipes, etc). How do you think human activities might change the salinity in this body of water? Do you think the human activities *right here* might be changing salinity?

4. Pick three different spots along the beach / waterway and describe them in your notebook. Do you think water salinity changes among these places? Why or why not?

**Step 2: Operating the Sonde to test conductivity:**

Objective: use the YSI Sonde to measure conductivity on our beach and test our hypotheses.

1. Ask an educator to help you turn on the Sonde and lower it into the water at one of the three beach spots you chose in step 1. Hold the end of the Sonde steady for at least one minute in the water, trying not to stir up any particulate matter, and write down the salinity measurement. Repeat this step for the next two sites.

**Step 3: Making inferences about the ecosystem from our measurements**



Figure 2. Standard conductivity measurements for various types of ecosystems.

1. Look at the chart in Figure 2. How does your 3 conductivity measurements line up with the different ecosystems listed?

**Why is this important?**

Knowing what’s in our water matters, and not only in order to drink it! People have been reliant on harvesting seafood from beaches since time immemorial. In coastal British Columbia, these delicacies include traditional foods such as Pacific Oysters, Butter Clams, sea urchins, and many other intertidal species! If conductivity in the ecosystem changes too greatly, it can change the organisms able to live in these areas. By figuring out how conductivity is changing within an ecosystem, you’re helping to make sure that important creatures like these can continue to thrive and play an important role in our ecosystems.

**Next Steps:**

Now that you know the conductivity in this waterway, you’ve successfully helped to monitor the health of your sampled waterway! There are actually lots of other ways that you can look at water health, and other measures that can tell us even more about the ecosystem.

For example, when you were taking your water sample, did you notice any green film or colouration in the water? If you did, it may be that there is too much algae growing in the waterway, which can prevent other important creatures (like fish) from thriving. To test this, we can look at something called the **chlorophyll** in our water. Chlorophyll is a green pigment given off by plants and algae. By testing chlorophyll, we can figure out just how much algae is in our water, and see if its healthy or needs restoration.

*This protocol is adapted from the protocol of Dr. Gerard Berdie & Joyce Sun, Water & Aquatic Sciences Research Program, University of Victoria. Last Updated 30 Sept, 2019.*