Notes for Suitcase Oceanography Lesson 2: Why is it important to know the salinity of the seawater?

Materials: Tray, plastic cup filled with tap water
Supply package for density experiments
Blue and red pencils

Handouts: The Water Cycle
The Salt Cycle
Student worksheets
World map
Surface salinity chart

Vocabulary: salinity
density
volume
current
circulation
input
output

Preparation:
Prepare solutions for the demonstration:

1. Fill 1 liter thermos with moderately hot water (If it is too hot, the bottle may shrink!)
2. Fill the bottom 3rd of a 2 liter bottle with crushed ice and then fill with clear cool tap water (you want the ice to completely melted before conducting the experiment)
3. Fill another 2 liter bottle with a saturated solution of pickling salt. Label it "S" (ordinary table salt has silicate additives that will make the solution cloudy.)
4. Prepare the bottles for the demonstration of salinity and temperature currents. Transfer the contents of the thermos into a 2-liter bottle and top it up with tap water. TIP: If the water is too hot, the bottle will shrink. Fill another bottle with tap water and label it "Fresh." Add water to the crushed ice, but make sure ALL the ice has melted before you start the experiment.

Introduction: Ask students for ideas about what makes ocean water move. Discuss that differences in salinity will make ocean water move. The experiments will demonstrate this process. First, we explore the concept of density.

Activity:

Experiment 1: Density

1. Distribute the supplies to each group of 4 students. Remind students not to open the vials (bottles or containers)!
2. **Density is the weight of a given volume of a substance.**

3. Note that the four vials (with different matter) are the same volume and temperature. Ask students to place the vials in order by how heavy they feel. Put each vial, in turn, into the plastic cup containing water. Fill in Table 1 of the student worksheet. (Substances or solutions with higher density will sink).

Experiment 2: Density

1. Tell learners that in this experiment, they are asked to make **predictions**, which are important in science as in daily life.
2. Ask students to predict whether the vials of salt water and fresh water will float or sink in the cup of water. Which has a higher density: fresh water or salt water?
3. Ask students to test their predictions by putting the vials in the cup of water and recording their observations.
4. Ask students to look at the vial with a number on it—this is the "unknown." Tell students it is their job to decide whether the unknown is salt water or fresh water. How can they do that (**without opening the vial**)?

Experiment 3: Ocean Currents

1. Differences in salinity will make water move. Salty water has higher density and it sinks. In this experiment, we will see that this difference in salinity will make water move.
2. Refer students to the "Salinity Currents" page in their handouts. Tell them that salt water will be colored red and fresh water will be blue.
3. Add red color to the salt water in the bottle and add blue food color to the fresh water in its bottle.(**Tip**: Add 5 drops of blue dye and 8 drops of red dye for best contrast). Connect the bottles with the tornado tube over a sink or tub by tilting them. This is a 2-person operation. Carefully lay the bottles over a white piece of paper and place rubber stoppers to prevent them from moving.
4. Ask the students to use blue and red pencils to color the bottles on their worksheet as they look at the beginning of the experiment.
5. Ask students to predict how the bottles would look at the end of the experiment. Explain that this will take a while. During the interval, discuss salinity. After the discussion, observe the bottles, and ask students to use red and blue pencils to record their observations on their worksheet.
6. **Repeat this process with warm and cold water.**

Discussion: What causes changes in salinity?

1. Review with the students the water cycle. Evaporation increases in concentration, so in areas where it is hot, evaporation can increase salinity of the surface seawater. What can make a solution more diluted? Add water! In areas where it rains a lot, the salinity of surface seawater decreases.

2. Sea surface salinity. Look at the chart of sea surface salinity.
   Ask the students to describe the map. Make sure they identify continents and oceans.
3. Explain that the contours represent different salinities at the ocean surface, with higher salinities shown in yellow and red. This is a tool scientists use to show distribution of properties in the ocean.
4. Ask for differences in salinities between Atlantic and Pacific. Name processes that created these differences: evaporation and precipitation.
5. Point to the low salinities in the Arctic and Antarctic oceans. Explain that when ice freezes it leaves salt behind—salty water will sink. When the ice melts it makes the water fresher.
6. Review processes that can change sea surface salinities: evaporation, precipitation, and ice formation.

Discussion: Ocean Currents

1. Review the causes of currents: salinity changes, temperature changes, and wind.
2. Ask learners why they think it is important to know the ocean currents. They may come up with such answers as navigation, fisheries, and pollution. Currents are also important in weather and weather patterns.

Assessment: Refer students to assessment sheet at the back of the experiment handout packet.