Lab Assignment: Kitchen Ocean

Preparation

1) Gather tools: 1 liter measuring cup or bottle, transparent bowl or bucket that holds at least 2 liters, 1 tsp measuring spoon, food coloring, pencil, two small balloons and a thermometer.

2) Specialized equipment: salinometers. Salinity may be measured either using the electrical conductivity of the water or the index of refraction. Conductivity provides the more precise measure, but is affected by both temperature and salinity. (Both high temperatures and dissolved salt cause increases in electrical conductivity). Salty water has a higher index of refraction than fresh water (light slows down more), and therefore bends light differently than fresh water. However, the difference is small, and you can't use a refractometer to make fine distinctions, such as between 33 and 35 ppt.

Salinity of the Ocean

The ocean seems terribly salty, but there are actually only 35 grams of salt in 1000 grams of seawater. Let's see how that looks. If you don't have a precise scale handy, you'll need to measure your salt using teaspoons.

a) The bulk density of table salt is 1.15 grams/cubic centimeters (the density of a pure salt crystal is twice as high). How many cubic centimeters of salt do you need to make 35 grams (rounded to the nearest cc)?

b) One teaspoon is 5 cubic centimeters. How many teaspoons of salt do you need to make 35 grams?

c) Mix 1 liter of water with the 35 grams of table salt, and taste it if you like. Measure the salinity of your salt water. What measuring instrument did you use, and what is the reported salinity?

d) If you have both a conductivity meter and a refractometer, measure salinity both ways. Are the answers different?

Volume, displacement and mass

1) Fill one balloon with fresh water and the other with air, until they are about the same size. Fill one bucket with fresh water and one with salt water. This experiment will probably work best if your containers are about twice as wide as your balloons.

a) Push the air balloon down into fresh water - does the water level rise noticeably? Why or why not?

b) Push the water balloon down - does the water rise more or less than with the air balloon?

c) Which balloon is easier to push down? Why?

d) Which balloon displaces more water?

e) Which balloon weighs more?

f) Which balloon is more buoyant?

2) Float the water balloon in the fresh water, and note how much of it sits above the water. There will be an air bubble at the top of the balloon, and a thin rim of water showing around it. Now float the water balloon in the salt water - does it sit higher or lower in the salt water than it did in the fresh? Why?

Density Stratification

a) Dye your salt water with food coloring, and dye your fresh water a different color.

b) Pour some of your salt water into a glass container, and gently pour some fresh water on top (letting it trickle down the side of the container may help). In another glass container, put fresh water on the bottom, and salt water on top. Observe what happens in the two containers. What's going on?

c) How do you think this experiment would be different if you'd used 100 grams of salt instead of just 35 grams?