Sea and Ice Salinity

Activity Source:

NASA Aquarius Mission and the National Snow and Ice Data Center, 2007.

Activity adapted with permission from UCLA Marine Science Center's OceanGLOBE.

Background

What is sea ice? It is simply frozen ocean water.

Why is sea ice important? While it occurs mainly in polar regions, sea ice influences our global climate. Changing amounts of sea ice can affect ocean circulations, weather patterns, and temperatures around the world. Sea ice insulates the relatively warm ocean water from the cold polar atmosphere, except where cracks in the ice allow for the exchange of heat and moisture. The exchange of salt between sea ice and the ocean alters the density of ocean waters, thus influencing ocean circulation. Many animals, such as polar bears, seals, and walruses, depend on sea ice for their habitat. These species hunt, feed, and breed on the ice.

Satellites provide the best way to observe sea ice, the factors that affect sea ice, and the ways sea ice affects global climate. Scheduled to launch in 2010, NASA's Aquarius mission will measure global sea surface salinity with unprecedented resolution. Even small variations in sea surface salinity — the amount of salt present near the ocean's surface — can have dramatic effects on sea ice, the water cycle, and ocean circulation.

What are the effects of salinity on the formation of sea ice? Will salt water freeze more quickly or more slowly than fresh water? Try this investigation to find out. And visit the Aquarius website (http://aquarius.nasa.gov/) to learn more about how scientists will study salinity from space.

Materials

For each student group:

- Ordinary table salt (1 cup)
- Tablespoons and cup measures for measuring salt
- 1 plastic ice cube tray with watertight sections
- Marker to label the ice cube tray
- Tap water (1 quart)
- Alcohol thermometer
- 4 jars or beakers (at least 10 ounces each)
- Graph paper
- Access to a freezer

Procedure

1. Label jars A, B, C, and D. In each jar mix salt and water solutions as follows:

- Jar A: mix 9 tablespoons of salt with 1 cup of water
- Jar B: mix 6 tablespoons of salt with 1 cup of water
- Jar C: mix 3 tablespoons of salt with 1 cup of water
- Jar D: 1 cup of pure tap water

2. Label each quarter section of the ice cube tray as section A, B, C, and D.

3. Pour solutions A - D into their labeled sections of the ice cube tray. Make a variety of ice cube sizes using each solution. Place the tray in the freezer.

4. Observe and record water temperature and degree of solidity after 1 hour, 24 hours, and 48 hours. Water temperatures are taken in the liquid water, under any ice formations, if present.

5. At the end of 48 hours, using graph paper, plot a line graph of water temperatures.

6. Discuss: Did any solution not freeze? Which one? Which solution was first to freeze? What happens to the ability of water to freeze as you add more and more salt? (Note to teacher: See answers below.).

Answers:

Solution A should not completely freeze. Usually solution D is the first to freeze. The experiment should show that salt lowers the freezing point of water (the more the salt, the longer it takes to freeze).