**COSEE Hands-On Activities**

**USA Science & Engineering Festival**

**Grouping: Physical Oceanography**

**Lesson/Activity:** Effects of Temperature and Salinity of Density and Stratification

Teaching Physical Concepts in Oceanography: An Inquiry Based Approach (Activity 1.4, Density)

<http://www.tos.org/hands-on/teaching_phys.html>

**Materials**

* Rectangular tank with a divider (from sciencekit.com)
* Bottle containing pre-made salt solution (approximately 75 g salt dissolved in 1 L water: kosher salt yields a clear solution while a solution made with table salt, at high concentrations, appears milky)
* Food coloring (two different colors)
* Ice
* Beakers

**Instructions**

1. Fill a beaker with tap water.
2. Place water from the beaker in one compartment of the tank and water from the salt-solution bottle in the other. Add a few drops of one food coloring to one compartment and a few drops of the other food coloring to the other compartment. What do you predict will happen when you remove the divider between the compartments? Explain your reasoning.
3. Measure the densities of the room-temperature tap water and the salt solution.
4. Test your prediction by removing the tank divider. What happens? Are your observations consistent with the densities you measured?
5. Empty the tank and fill one beaker with hot tap water and one beaker with ice-cold water. Add a few drops of food coloring to each of the beakers (different color to each beaker).
6. Place the hot water in one tank compartment and the ice cold water in the other. Repeat Steps 3–5. After removing the divider and observing the new equilibrium in the tank, place your fingertips on top of the fluid surface and slowly move your hand down toward the bottom of the tank. Can you feel the temperature change?
7. How might the effects of climate change, such as warming and melting of sea ice, affect the vertical structure of the water column? Discuss possible scenarios with your group (alternatively, this question can be given as a homework assignment).

**Explanation**

This activity demonstrates that fluids arrange into layers according to their densities. The two “water masses” - salt (blue) vs. fresh (yellow), or cold (blue) vs. warm (yellow) - are initially separated by the tank’s divider. When the divider is removed, the denser water (salt water or cold water [blue]) sinks to the bottom of the container and the less-dense water (fresh or warm water [yellow]) floats above,forming a stratified column. In the process, an internal wave is formed in the tank.