The Education Program at the
NJ Marine Sciences Consortium/NJ Sea Grant
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ESTUARINE CURRENTS

OVERVIEW

During this lesson, students can observe a demonstration or conduct an experiment that models density-driven currents which are typical to an estuarine system like Sandy Hook Bay.

OBJECTIVES

Following completion of this lesson, the students will be able to:

- Relate water temperature and salinity to the formation of estuarine currents.

GRADE LEVELS

6th -12th grades

NJCC STANDARDS

Science Indicators:
5.1: End of Grade 4: A-1, A-2, B-1, B-2; End of Grade 8: B-2, B-3, A-2;
5.3: End of Grade 4: A-1, B-1, D-1; **5.4:** End of Grade 2: B-1;
End of Grade 4: C-3, B-1; **5.5:** End of Grade 2: A-2, A-1;
End of Grade 4: A-1, B-2, B-1; **5.7:** End of Grade 2: A-2,
End of Grade 4: A-2, B-1, B-2; End of Grade 6: A-1, A-2, B-1;
End of Grade 8: B-2, A-2; **5.8:** End of Grade 2: B-1;
End of Grade 4: C-1; End of Grade 6: B-1, **5.9:** End of Grade 4: A-1; End of Grade 12: D-1; **5.10:** End of Grade 4: B-1, A-1;
End of Grade 6: B-2; End of Grade 8: B-1

MATERIALS

- 2-liter soda bottle (cut off at the shoulder to make a wide-mouth container),
- ice cubes made from salt water dyed with blue food coloring (make at least the night before),
- hot water (colored red), tap water,
- Plastic-foam cup, blue and red-colored pencils, unlined paper.

PROCEDURES

1. Fill a 2-liter bottle about half full with tap water. Float a blue ice cube in it. Use unlined paper to sketch your observations.

   A. Obtain a plastic-foam cup containing hot water with red food coloring in it. Be very careful not to spill the hot water. Slowly pour the hot water down the side of the 2-liter bottle.
   B. Allow the 2-liter bottle to sit as you continue to observe. Add any changes you observe to your drawing.

   Think about how this experiment explains the flow of ocean currents. Think about the equator and the poles.

BACKGROUND

Currents are like giant rivers of water flowing through the ocean. Some flow on the surface, others move deep below. Currents are fueled by winds moving over the ocean's surface and water temperature. There are different types of currents then, depending on the source of energy that moves them.

WIND DRIVEN CURRENTS: As winds push across the ocean, friction with the water creates waves. Winds that push up against waves are the driving force

behind surface currents. Wind driven currents are mainly in response to prevailing winds, which are a product of planetary forces, rather than local forces. Prevailing winds blow according to patterns and are usually from a constant direction.

TEMPERATURE DRIVEN CURRENTS: Currents formed by temperature start in the ocean's coldest regions, (i.e. polar seas) and move slowly across the sea floor towards land and the equator. When these currents run into a land mass or converge with another current they are forced to the surface, but since cold water is denser than warmer, surface water, they soon sink again. These currents also slowly gravitate towards the equator, and in doing so they warm up and rise, replaced below by new, colder water. This up and down action carries all sorts of interesting life with it including plankton and other marine creatures.

DENSITY DRIVEN CURRENTS: Like cold water, salty water is denser than fresh, so it sinks when it encounters fresh water. This is the case in Sandy Hook Bay, which is an estuarine system. Fresh water from several rivers converges with salty, colder ocean water. The ocean water sinks, causing vertical currents that continuously mix the bay's water. The currents keep Sandy Hook Bay constantly moving, carrying and supporting a myriad of marine organisms.

REFERENCES

Halverson, C., Beals, K., Strang, C. 2001. Ocean Currents. Lawrence Hall of Science. University of California at Berkeley,

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