

# Exploring Marine Transportation

## To Float or Not to Float

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### Synopsis of the Activity:

The focus is on the concepts of buoyancy, displacement, and the affects of currents and wind. Students will demonstrate these concepts using boats to observe how ships float, as well as the difference in buoyancy between salt and fresh water. The concept of wind and currents is added to show the different troubles of shipping. Hopefully at the end of the transition, their boats will tip and or sink to allow their cargo to go overboard leading to a discussion about the consequences this may have on the harbor and environment.

### Misconceptions Students May Have:

There is no difference between salt and fresh water when it comes to shipping (not true because: salt water causes objects to have greater buoyancy causing them to float "higher" in the water).

All currents are because of wind (not true because: differences in temperature and salinity can also cause currents. Cold, salty water sinks while warm, brackish water will rise to the surface).

Currents don't effect big ships.

It's easy for ships to dock in harbors (not true: it is much trickier than most realize.

Often a special harbor pilot is brought out to a ship before it is allowed to enter the harbor).

### Ocean Literacy Principles

- Oceans and humans are interconnected.

### Vocabulary

Key terms that will be defined and used in the activity.

- Buoyancy
- Displacement
- Currents
- Sink/Float
- Fresh/Salt/Brackish Water

### Activity Overview

At the invitation stage we will have people draw upon their past knowledge and observations relating to both the shape of ships and the difference in the ways people float in salt vs fresh water. During the exploration stage visitors will be shown the concepts of sink float, and how a boat is able to float, while still being so heavy. During the application stage they will be able to explore different shapes of boats and how they float differently in salt and fresh water, by making their own boats and testing them using 'cargo'. During the concept invention stage, we will draw on both their past knowledge and the observations to show how boats might tip, over flow and how this might be a problem. Finally for the reflection stage we



will talk about how engineers and scientist try to fix this problem and how ballast was created to fix this problem (this will be a lead into the ballasting lesson if the students wish).

## Materials for each group

- Aluminum foil (to make a boat)
- Cargo (pennies, beads, or beans)
- 3 containers (one with fresh water, one with brackish water ( $\frac{1}{2}$  fresh  $\frac{1}{2}$  salty), one with salty water)
- Salt
- Straws
- Paper towels

## Set-up

The fresh water container can be used to demonstrate the concepts of sink/float. Students can make their own boats using clay and 'cargo' floating them in the salt water and the brackish water (harbor water).

Pre-cut the squares of aluminum foil to make the boats.

## Activity Description

1. Opening discussion: Do you float in the pool? What about in the ocean? Do you notice that you float differently? Why do you think that is?
2. Have students predict whether an object will sink or float. If possible, find objects that students think might float but actually sink (dense cubes of plastic). Ask how the objects are floating. Does everything float the same way? How much of the object is under water? Why is it floating?  
Buoyancy: the upward force is equal to the weight of the water displaced (or moved out of the way by the object).

- Do you ever see those big ships in the harbors? What are they carrying? How do they get the stuff off the ships?
  - Have you ever seen or heard of a boat sinking in a harbor? Why do you think that happened?
  - How are those boats shaped? Why do you think that is?
  - If you could make a boat how would you shape it? Would you make high sides? Short and long? Etc...
3. Students create a boat using aluminum foil. Decide how much cargo to carry. Start in the harbor (brackish water container) and then transfer to the ocean water (salt water container). Can they see a difference in how it floats?
  4. Add wind and waves by using the straw to blow across the top of the water (remind students to use only their straw). What effect does this have on the ship? Can waves get big enough to sink a ship?
  5. How much cargo will it take to sink the ship? In the harbor water container, students load as much cargo on their ship (counting as they go) until the ship sinks. Then students place their ship in the ocean water (salt water container) and fill it with cargo (counting as they go) until it sinks. Is the amount of cargo the same?
  6. What happens to the cargo when a boat sinks? What will happen to the harbor?



*This activity was developed by students in the Spring 2010 Communicating Ocean Science for Informal Audiences (COSIA) class at Rutgers University.*