

Currents: Moving Water



The waters of the sea are always going somewhere. Within the ocean, "rivers" of water flow in well known patterns. The water splashing off the back of a gray whale may have arrived in Alaska from the coast of Japan after a 5,000 mile trip in the Japan Current.

1. What do we call a "river" of water within the sea?

Several forces act to move ocean waters. As the earth moves through space it spins on its axis in such a way that the seas near the equator receive the direct rays of the sun. These direct rays provide more heat to the seas near the equator. Polar seas receive fewer warming rays. The warm tropical seas expand, rise, and flow away from the equator. Cold, heavy polar waters sink and flow toward the equator.

2. What is one force that moves ocean waters?

3. On the world map below, the white areas show water.
 - a. Place an X where the warmest waters would be found.
 - b. Place an O where the coldest waters would be found.



So, currents can be caused by differences in the density ("heaviness" or "lightness") of water. We have seen that cold water is heavier (more dense) than warm and tends to sink. Salt, too, can make water heavy. Sea water contains salt. Usually the proportion of salt in the open sea stays close to 3.5 percent. This means that every 100 grams of sea water would contain about 3.5 grams of salt. There are, however, some exceptions to this rule. For example, near melting polar ice the seawater tends to be less salty because the ice that is melting is nearly fresh.

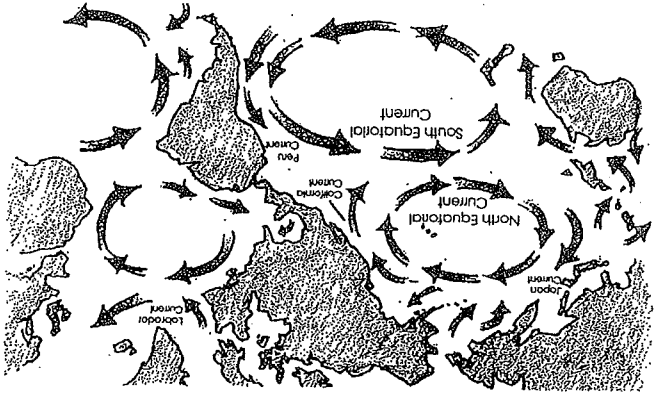
4. Saltwater/freshwater is more dense ("heavier"). Circle the correct answer.

Water that is near ice that is beginning to form has more than the average amount of salt. There is more salt because as the ice freezes, it leaves the salt behind in the water. (There is no room for salt in an ice crystal and it is slowly squeezed out as the sea ice "ages"). The extra salt around the ice makes this water more dense (heavy) and it sinks. (Can you make salt water freeze into ice cubes? Try it and see. What happens?)

5. The deepest water in the oceans is warm/cold and "light"/"heavy". Circle the correct answers.

The rising of warm, less salty waters and the sinking of cold, more salty waters plays a major role in causing currents. These movements of water should tend to produce rivers of water in straight lines. A look at our current

- The three factors that are most important in causing water movement are:
1. differences in density of the waters
 2. the earth's rotation
 3. wind
- Ideally, the combined factors would produce currents like those shown below.

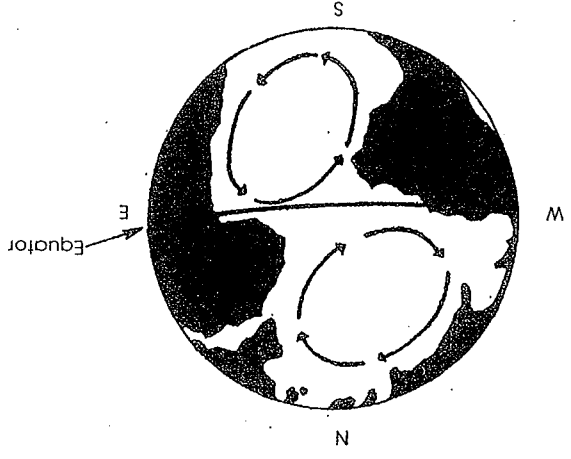


How do these currents influence living things? A gray whale could give us one answer. Currents can help or hinder the movement of animals. Plankton cannot swim against a current. So, the base of the ocean food chain is at the mercy of currents! Because they move water of different temperatures, currents also have an influence on where plants and animals can live. Currents help determine the course of ships. Ships save fuel and time by traveling with currents. In days past, currents affected where people could travel by sea. Because of this fact, currents affected the migration and settling of people. Finally, the speed and temperature of currents can affect the climate of the land near which they pass.

7. What are three factors important in causing currents?

- a.
- b.
- c.

map shows that this isn't the case. The major currents flow in circular patterns called gyres. These circular patterns are due to the spinning of the earth on its axis. The spinning causes the water to veer (move at an angle) slightly to the right in the northern half of the world. Spinning also causes the water to veer slightly to the left in the southern half of the world.



6. On the map above:

- a. Place a number 1 on a gyre moving clockwise, north of the equator.
- b. Place a number 2 on a gyre moving counterclockwise, south of the equator.

Another equally important factor that produces movement of the water is wind. The air at the equator, as we have seen, is warmer. The warm air expands, grows lighter, and rises. As it reaches the poles, it cools. The cool air then sinks back to the earth and the cycle begins again. As the earth rotates, the rising and sinking currents of air are "bent" in a clockwise direction north of the equator and in a counterclockwise direction south of the equator. These winds blowing across the ocean drag surface waters along with them, forming wind-driven currents or gyres.

8. What are three ways in which currents affect living things?

- a.
- b.
- c.

For an interesting view of how currents may have affected the migration and settling of people, read *Kon-Tiki* by Thor Heyerdahl.

In the following activities you will have an opportunity to examine some of the factors that cause ocean currents.