

## Tides

If you've ever built a sand castle on an ocean beach, you've probably noticed that over a period of time the waterline moves either toward the castle or away from the castle. This happens because the level of the sea at a particular location rises and falls during the course of a day.

About once every twelve hours, the waterline reaches what can be called the high water mark. When the waterline reaches this level, the ocean at that location is said to be at **high tide**.

After the waterline reaches the high water mark, the waterline then moves back down toward the open sea until it reaches a low water mark. When the waterline reaches its lowest point, the level of the sea in that area is at **low tide**.

High tide is the result of huge bulges in the level of the ocean. The bulges are caused mainly by the moon and the movement of the earth and moon. Figure 8-30 shows the bulges in sea level in relation to the position of the moon.

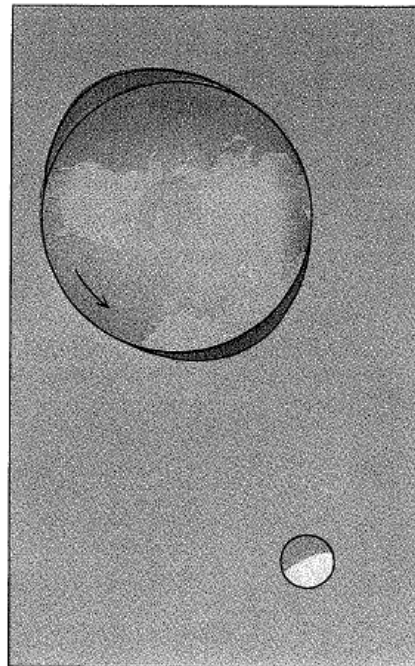
You will notice that there are actually two bulges. The one nearest the moon is caused by the force of gravity from the moon attracting objects on the earth's surface. The moon pulls on all parts of the earth. But the pull is strongest at the points closest to the moon. The earth's solid surface is not greatly affected by the moon's gravitational pull. But the water on the earth's surface is noticeably affected because water is fluid and can change its shape. The bulge directly opposite the moon, on the other side of the earth, is caused by the rotation of the earth and moon through space.

The fact that sea level at any location goes from high tide to low tide and back again is due to the earth rotating on its axis. The solid earth is actually rotating under the bulges of water.

Tides affect the kinds of plants and animals that can live along the margins of the oceans. Tides can cause alternate wetting and drying of land areas. Rising and falling tides create tidal currents in coastline environments. Incoming tidal currents can bring salt water into an area that has fresher water at low tide. Incoming and outgoing tidal currents also affect the temperature of an environment.

Tides also affect people who live, work, or travel near the water's edge. Tidal changes affect the depth and the water

Figure 8-30. How does the moon affect the level of the ocean's surface on the earth?



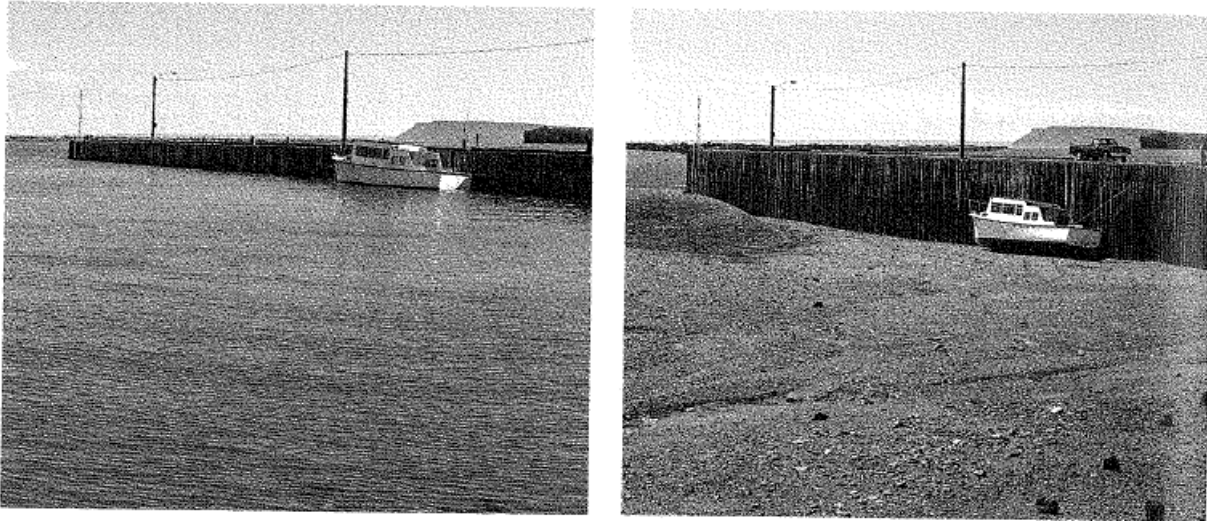


Figure 8-31. Parrsboro, Nova Scotia, is located on the Bay of Fundy, where tidal differences are extraordinary.

### Library research

What conditions make cliff-diving at Acapulco such a thrilling sight to see? Why is the timing of the divers so very important?

speed and direction in harbors and along coastlines. For that reason, ships frequently schedule their arrivals and departures to coincide with a certain tidal condition. Other nearshore and offshore activities, such as fishing and recreation, are also affected by tides.

Several factors affect the timing and the height or strength of tides.

1. Tides do not occur on a 12-hour schedule because the moon orbits the earth at a speed that is slightly faster than the earth's rotation. It therefore takes about 12 hours and 25 minutes for two successive high tides to pass the same location.
2. The shape of the ocean basins affects the timing of the tide. In some places (for example, parts of the Gulf of Mexico), the bulge opposite the moon is not developed. In that case, the cycle from high water to high water takes 24 hours and 50 minutes.
3. The shape of a shoreline affects the strength of the tide. The tides are usually weaker at the mouth (the wide end) of a V-shaped bay than at the head (the narrow end of the bay).
4. The sun's gravitational force also affects the tides. Twice a month, during full moon and new moon, stronger tides with higher and lower water can occur because of the relative positions of the sun, moon, and earth with respect to each other.