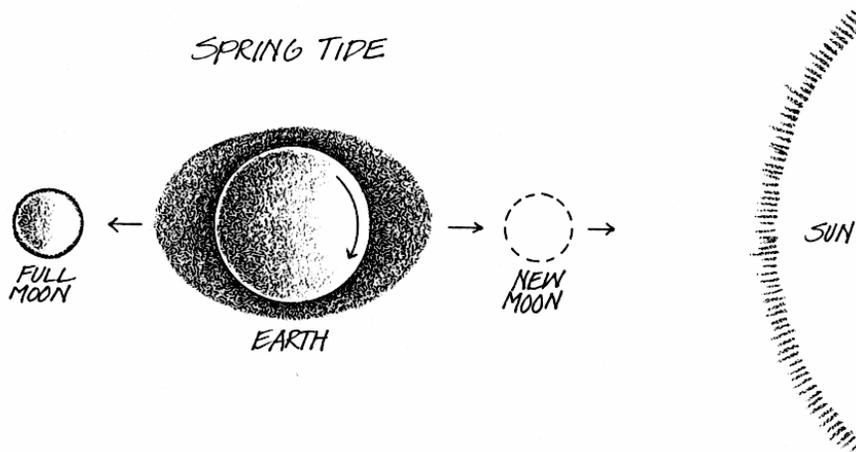


The Causes of Tides

by Kenn Oberrecht



Twice daily the Pacific Ocean intrudes on the shoreline to flood its bays and estuaries. It inundates mud flats and marshes, raises water levels, and surges landward with sufficient force to reverse the seaward currents of rivers and creeks. Salt water mingles with fresh, and within hours the brackish brew slackens briefly to deposit valuable nutrients that feed countless organisms residing in the complex estuarine system. Then the process reverses, and receding waters flush the estuary, carrying organic and inorganic material and even potentially harmful pollutants out to sea.

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These predictable and periodic movements of ocean waters are known as tides and are caused by the attractive forces of the moon and sun. Sir Isaac Newton's law of gravitation tells us that any two bodies in the universe are attracted to each other and that the strength of this attraction depends on the bodies' mass and distance from each other.

The sun's mass is 27 million times that of the moon, but it is also 390 times farther from the earth. So although the sun affects our tides, the moon exerts the greater gravitational attraction because of its proximity to our planet. The sun's influence is about 45 percent that of the moon.

Think of the earth as an egg-shaped body with its long axis pointed at the moon. Now imagine the planet completely covered by a deep ocean, so that its watery surface bulges toward the moon. On the opposite side of the planet, centrifugal force creates a similar bulge. These are the high tides. Two coinciding and simultaneous low tides occur at equal distances around the earth between the high tides.

Along the Oregon coast, the mean difference between high and low water is about five to six feet. During periods of extreme tides, particularly in June and December, the tidal range can be double that, or about 10 to 12 feet.

Ideally, this is how the tides work, but nature is seldom ideal or perfect. The great variety of the earth's topography, as well as other terrestrial and extraterrestrial influences, causes our tides to differ in various ways and to exhibit certain similarities.

On the open seas, tides go virtually unnoticed. There, high tide is only two to three feet above low tide. Along the coast, however, tides can vary greatly, depending on topography and other influences.

In some parts of the world, the range of the tidal difference between successive high and low waters is measured in inches. Elsewhere, the disparity can be dramatic. At the Bay of Fundy in Nova Scotia, for example, the difference between high and low water can be as much as 50 feet.

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Knowing what causes the tides is the first step in understanding them and how they affect the coastal environment. A knowledge of the tides and their effects is essential for navigation, community planning and development, recreation, and even survival.

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