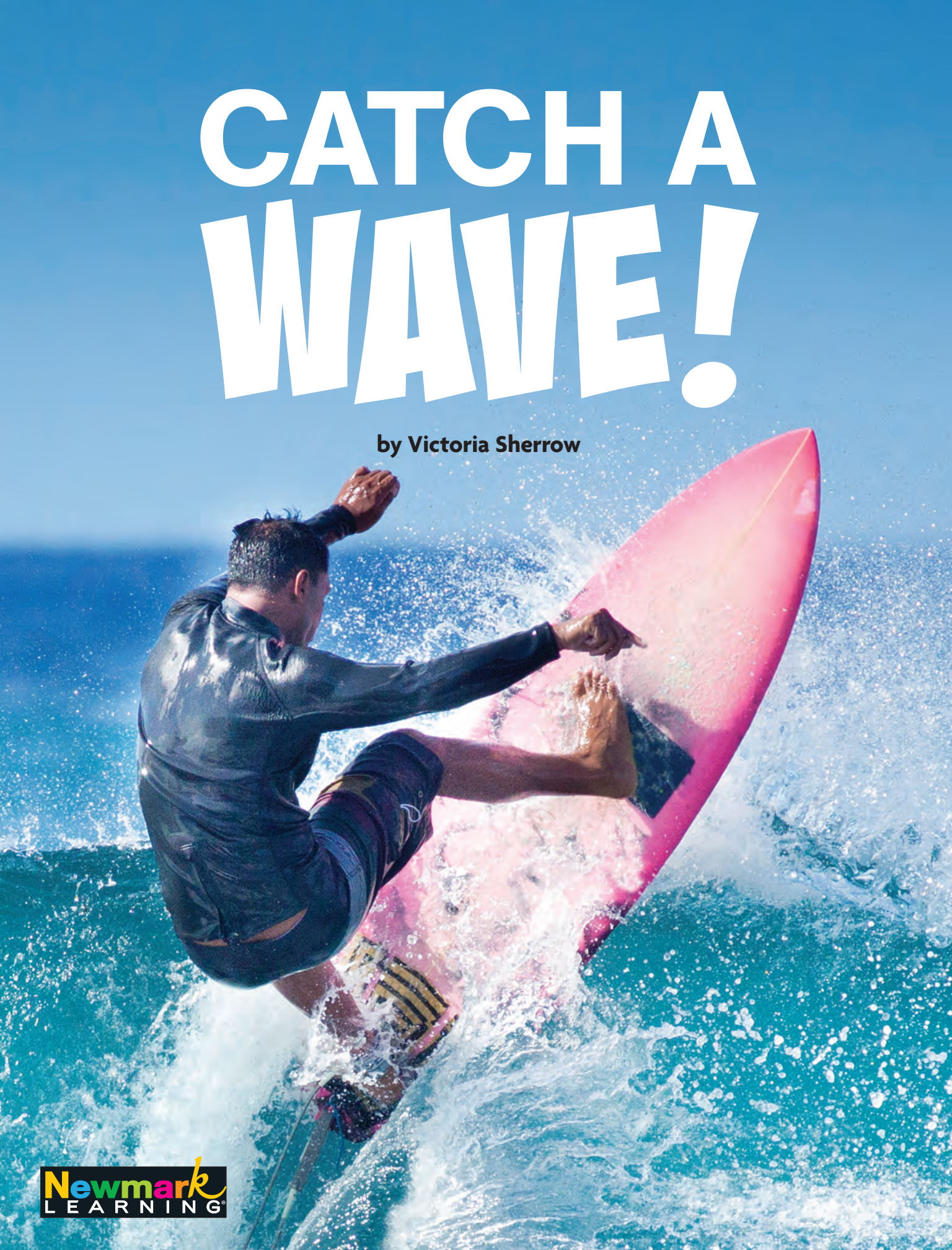
# CATCH A WAVE!

by Victoria Sherrow



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# AMAZING WAVES



Big waves are coming! That was what people in Hawaii heard during the week of January 23, 2014. The forecast called for the largest waves on the islands in ten years. Hawaiians are used to waves. Their islands are surrounded by water, and very large waves are common on their shores. But even the Hawaiians were impressed by so many giant waves.

They stood 15.2 meters (50 feet) high. That is about as tall as a four-story office building. They occurred because of a faraway storm that began northwest of Hawaii. A reporter from CNN talked to Anna Foust, an emergency management officer on Maui, one of the Hawaiian Islands. Foust advised residents to be cautious and stay far away from the high surf.

When people picture the ocean, they think of waves. People like to ride waves, swim in them, or just watch them. Artists enjoy painting them.

Waves can form on ponds, lakes, rivers, beaches, and the open sea. What causes waves? Why do they come in different shapes and sizes? How can people make predictions about wave activity? Oceanographers try to answer questions about waves as they study the ever-changing seas.

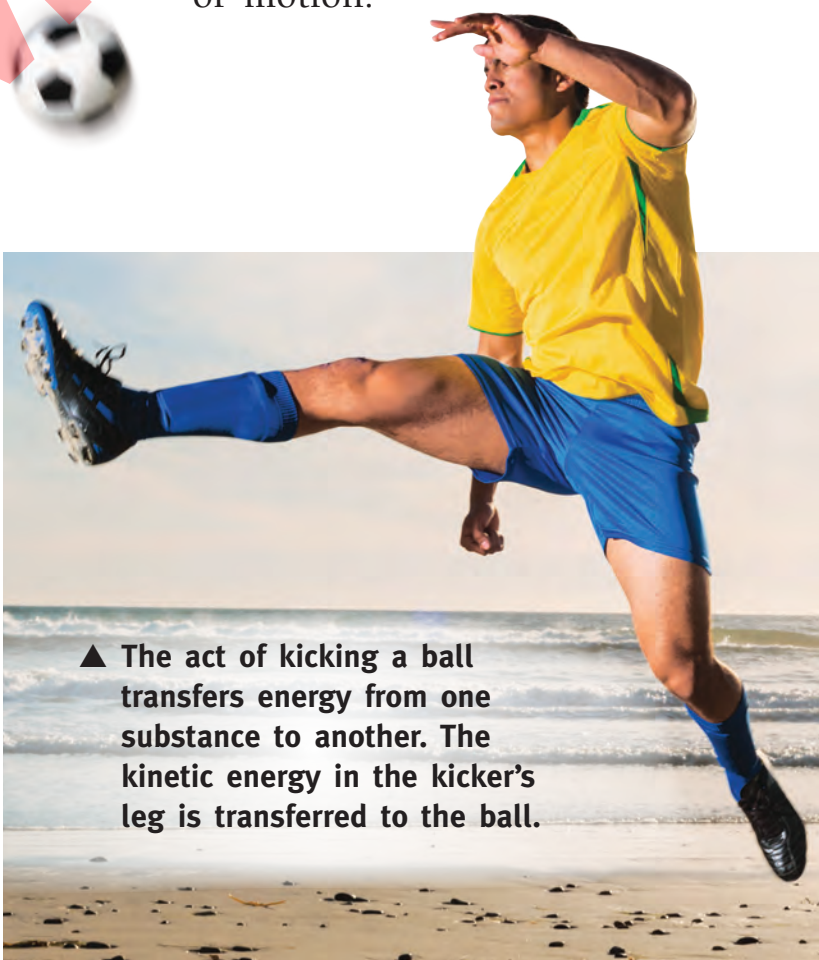
## A Love for the Ocean

Walter Munk is a world-famous oceanographer. He began studying the ocean in his twenties and was still doing research through his nineties. Munk was one of the first scientists to try to predict when and where waves would occur. In the 1940s, his work in predicting wave activity helped the United States during World War II. The military needed to know when and where to land troops on beaches. Munk also studied how far waves travel before they reach their endpoint. In 1963, he showed that some waves traveled more than 15,000 km (9,000 miles) across the open sea. To study this wave train, he put wave sensors in different places between New Zealand and Alaska. This experiment was described in the film *Waves Across the Pacific*. Walter Munk said, "The sea itself was our laboratory."

## AN ENERGETIC START

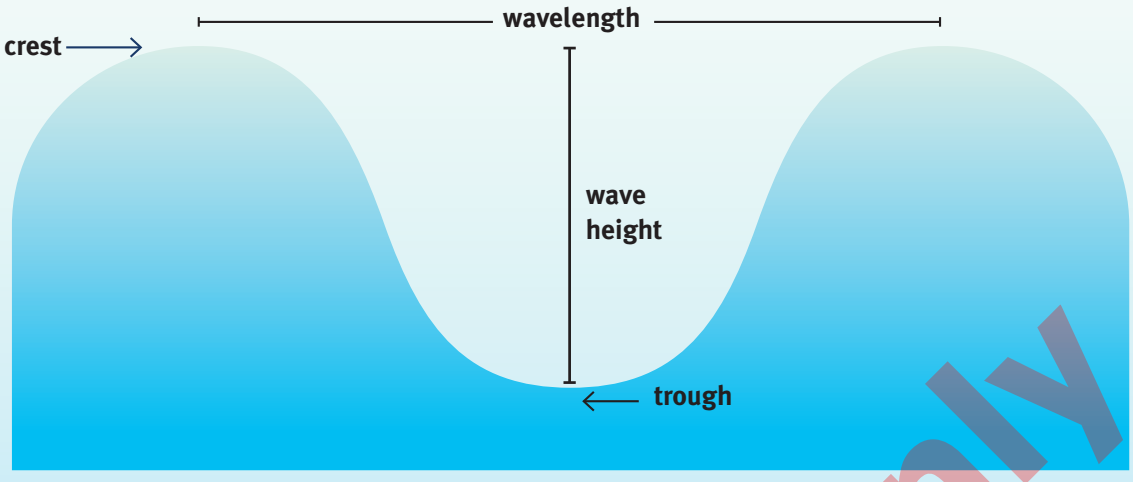
When big waves reach shore, they have probably traveled a long distance. Some waves begin thousands of miles from the places they turn up. Others start a little closer to home. Big or small, though, all waves share similarities. For instance, they start the same way.

All ocean waves are regular patterns of motion. They contain an enormous amount of a type of energy known as kinetic energy. Kinetic energy is the energy of motion.



▲ The act of kicking a ball transfers energy from one substance to another. The kinetic energy in the kicker's leg is transferred to the ball.

DIAGRAM OF A WAVE




▲ **Regardless of their sizes, all waves have a top and bottom, or crest and trough. The distance between two crests is known as the wavelength.**

Like all energy, kinetic energy tends to move from place to place. When two substances interact, or collide, kinetic energy can be transferred from one substance to the other. Wind and water are two such substances.

Waves form when the surface of the water is disturbed, usually by wind. Wind, because it's made up of moving air, contains kinetic energy. When the kinetic energy from the wind collides with the ocean water, it transfers the energy to the water and starts a wave.

This transfer of energy between wind and water involves friction. When two substances rub against each other, friction occurs. When air moves across the water, it rubs against the water to create friction. Ripples then form on the water. As the wind keeps pushing these ripples, the wave grows larger.

After wind starts a wave going, the wave keeps moving on its own. Gravity pulls downward on the water in the top, or crest, of the wave. This falling water pushes the water from the bottom, or trough, upward. Layers of water roll forward with a movement people can see and feel.

Beachgoers can experience this while lying at the edge of the water. When a wave approaches, it carries them up and forward. As the wave passes, their bodies go down and backward.

## TIME FOR A BREAK

Eventually waves stop, or break, when they reach shore or hit another wave moving in the opposite direction. What causes a wave to stop?

There are forces that work against the energy that a wave carries. Two such forces are friction and gravity. Gravity is a force that pulls rising water down. In addition, as a wave reaches shallower water, the water touches ground. That creates friction. As the water moves against the ground, friction causes the water to slow down. Slower waves pile up near the shore, growing taller as they slow down. The energy cannot go down, so it goes up. Waves rise up faster when they reach a steep shore. They rise more slowly on beaches with a gentle slope.

## Wave and Water Facts

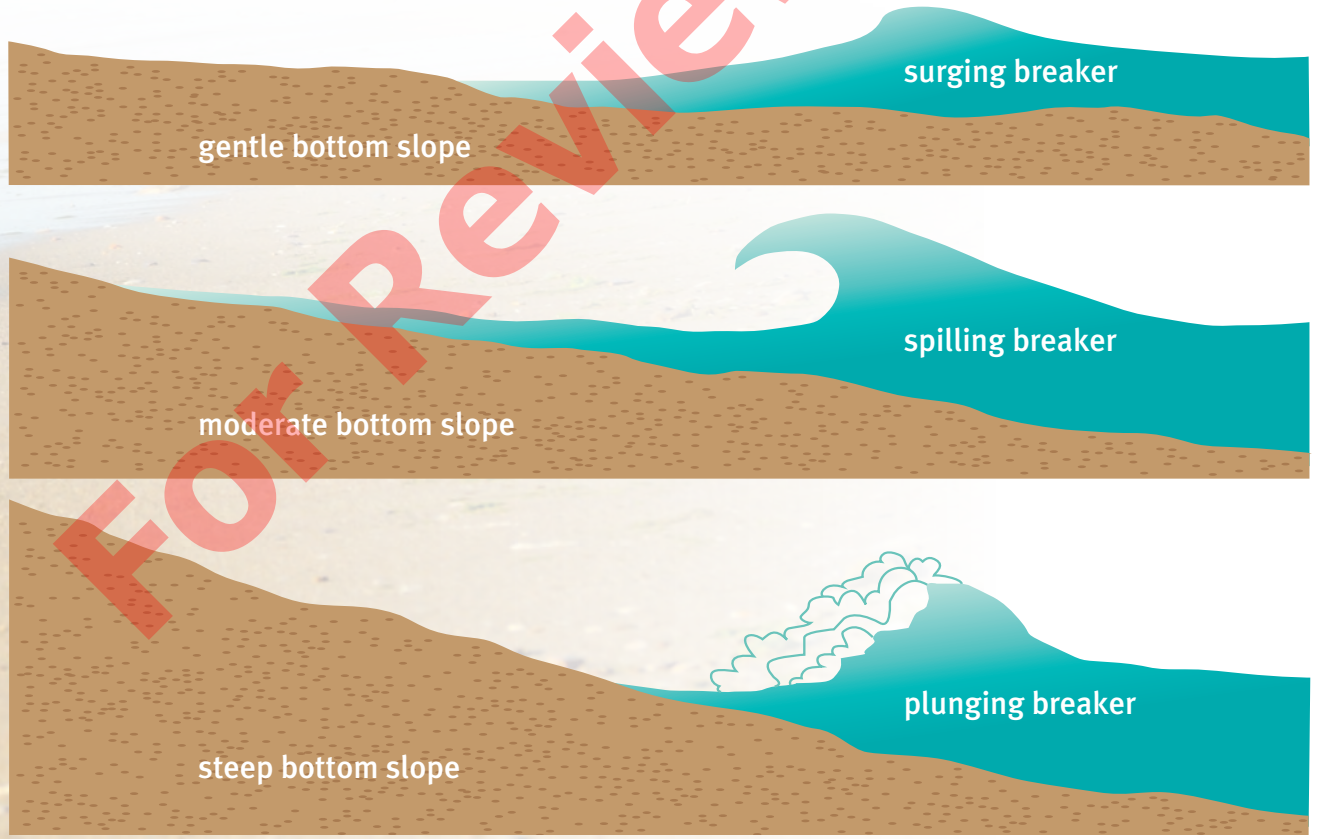
- Water covers about 71 percent of Earth's surface.
- The tallest wave ever measured was 525 meters (1,720 feet). This tsunami wave occurred at Lituya Bay, on the west coast of Alaska, on July 9, 1958.
- Some of the largest waves occur in the Southern Ocean near Antarctica.

▲ photo of Lituya Bay, taken after the July 9, 1958 wave event

A wave is made up of layers of water that slide past one another. The upper layers move faster and the bottom layers move more slowly. As a result, the bottom of a wave slows down faster than the top. Waves spill over when the top goes so far over the bottom that the wave can no longer stand up. The top part becomes so heavy it falls over. When this happens gradually along the length of a wave, it is called "peeling."

The ground under the sea is called the seabed. The shape of the seabed and other features affect how waves break. Coral reefs, ledges, sandbars, ice, and rock are some of these features. For instance, at one beach in Hawaii, waves hit sharp coral reefs on the seafloor. This causes big, high waves to form.






▲ **This diagram shows various seabeds—gently sloping, moderate, and steep—leading to three types of breakers.**