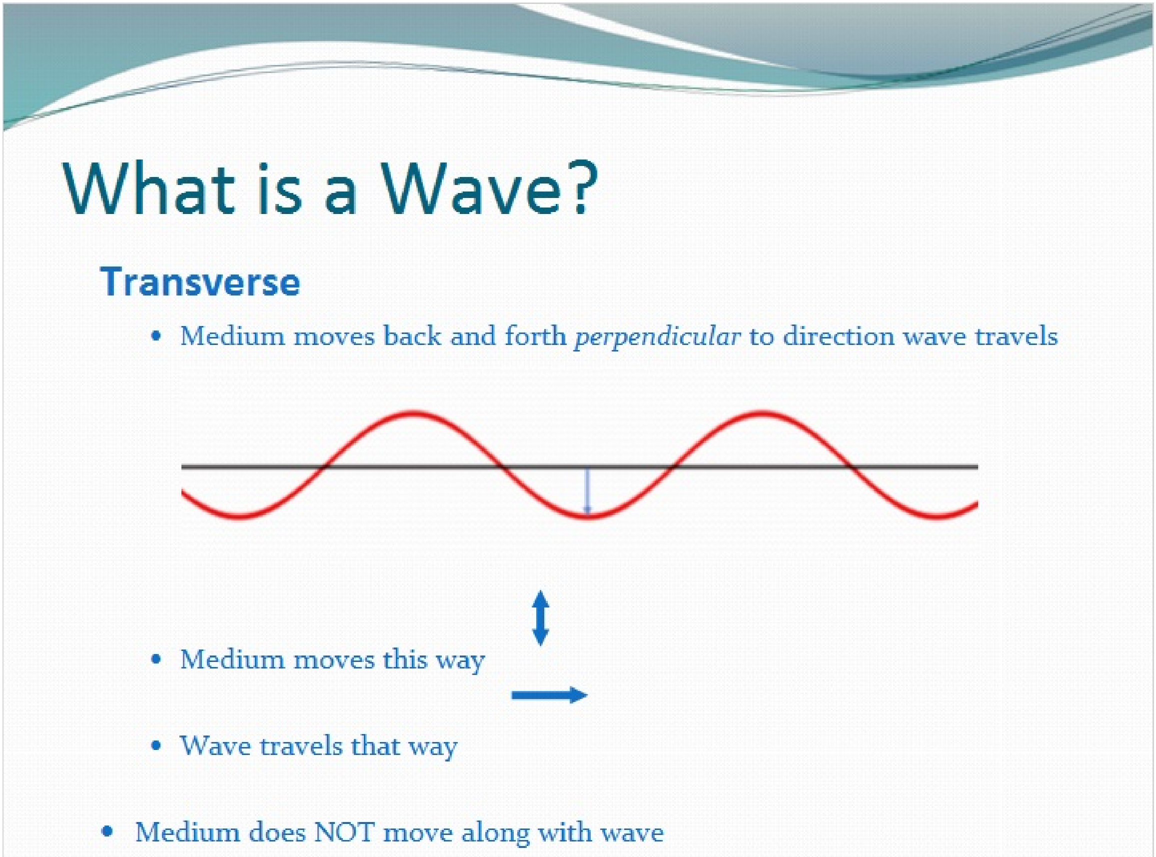
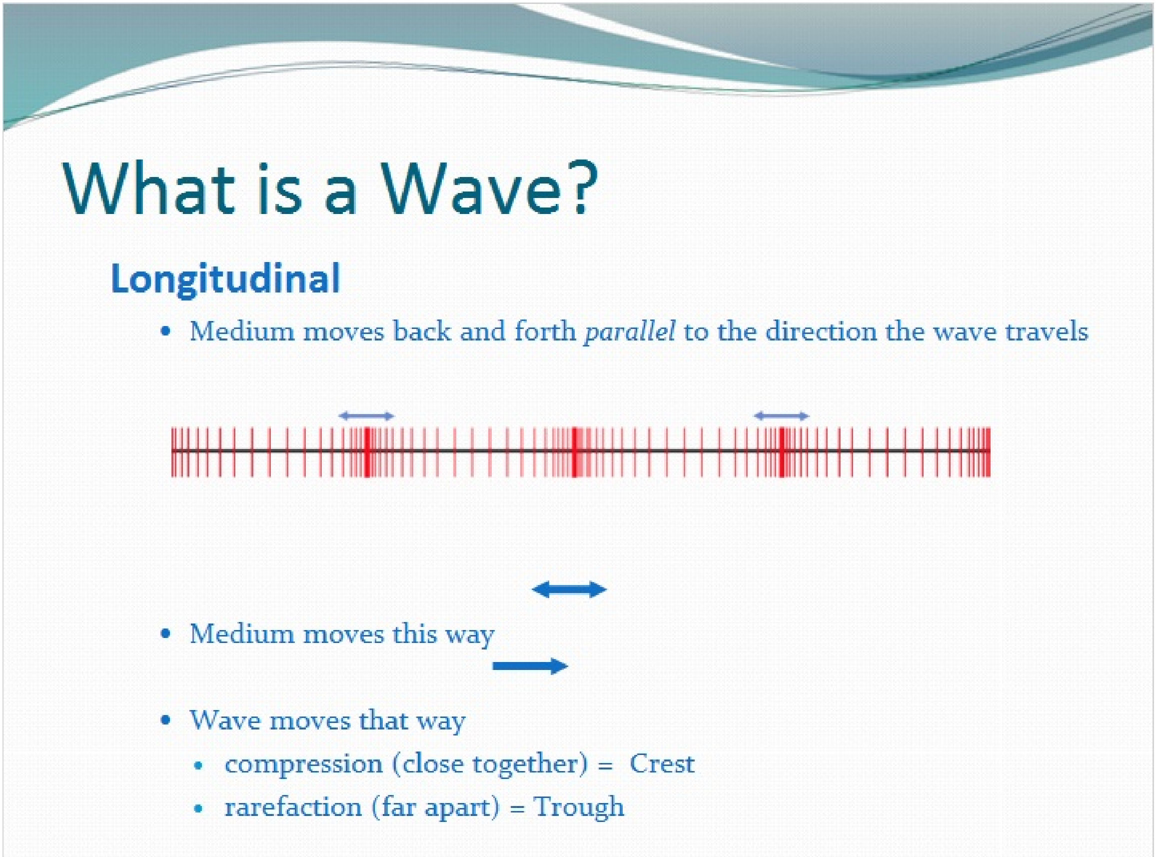
A mechanical wave transports energy as a traveling disturbance in a medium. In terms of ocean waves, water is the medium or substance through which the wave travels.



In a transverse wave, the medium oscillates or moves back and forth in a direction that is perpendicular to the direction the wave travels. In other words, the waveform either moves up and down or side to side in a motion that is at a right angle to the direction in which the energy is transmitted.

If you watch the animation carefully and focus on a single dot, which represents a particle of the medium, you will notice that the dot moves up and down, while the wave shows an overall left to right motion.

Notice that the medium simply oscillates up and down in place. The medium has no net displacement and does not move along with the wave.

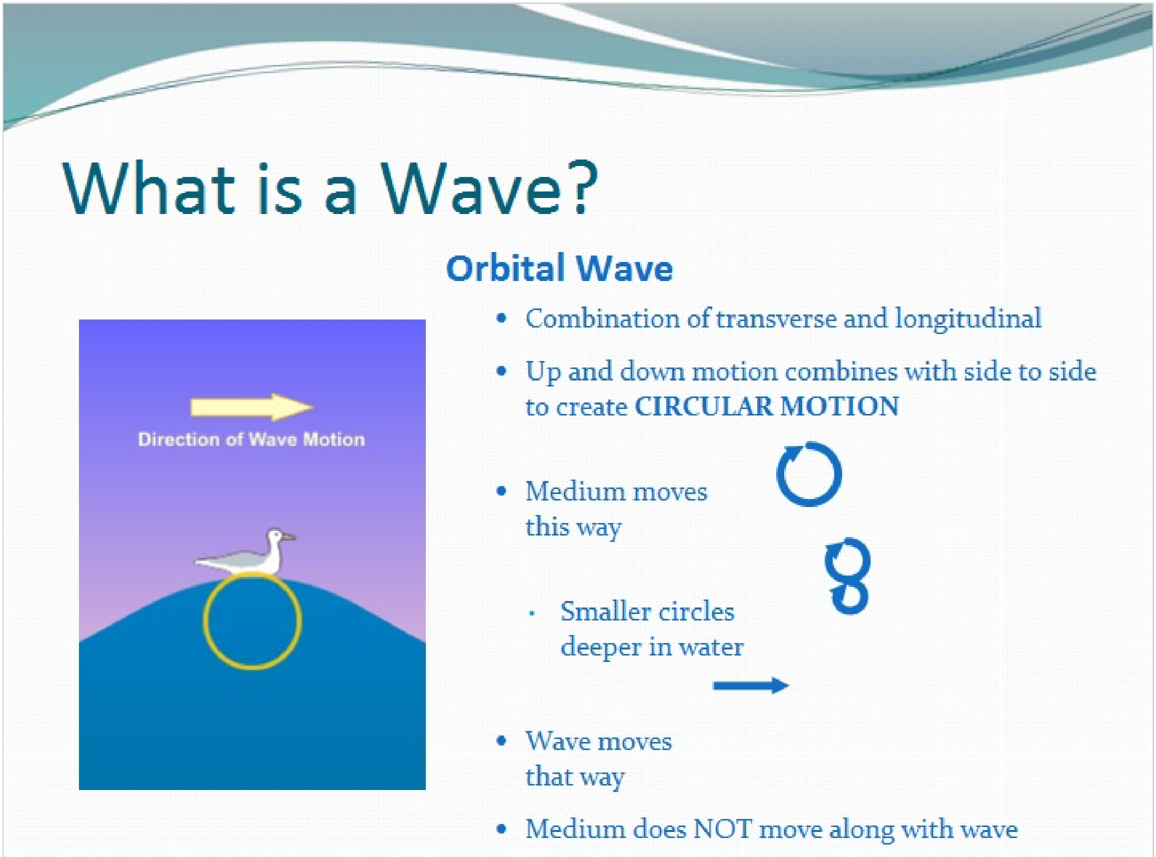


In longitudinal waves, the medium oscillates or vibrates in a direction that is parallel to the direction that the wave travels.

If you focus on a single dot, you will see that it wiggles back and forth while the wave travels left to right.

The places where the particles of the medium are close together are called compressions. These regions of high pressure correspond to the crests of a transverse wave. The places where the particles of the medium are farther apart are called rarefactions. These regions of low pressure correspond to the troughs of a transverse wave.

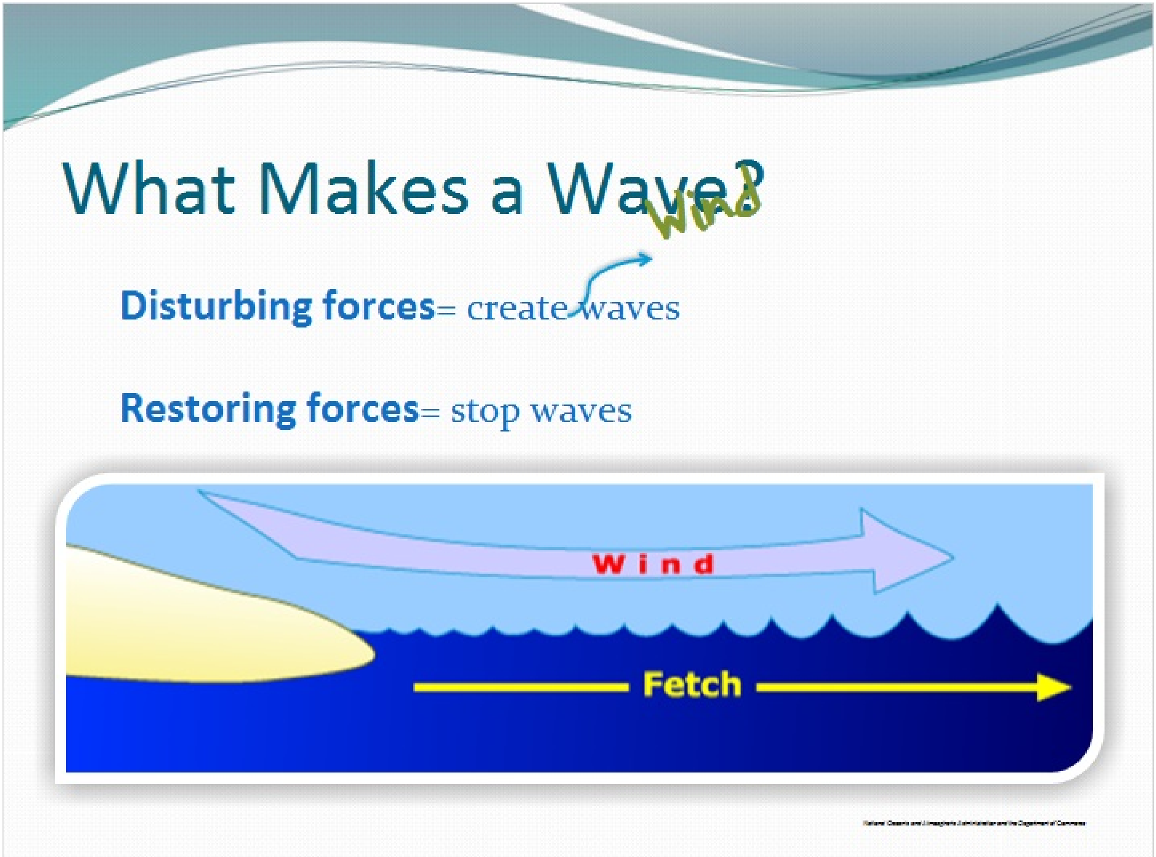
Again, you'll notice that the medium does not move along with the wave, but it simply oscillates back and forth in place.



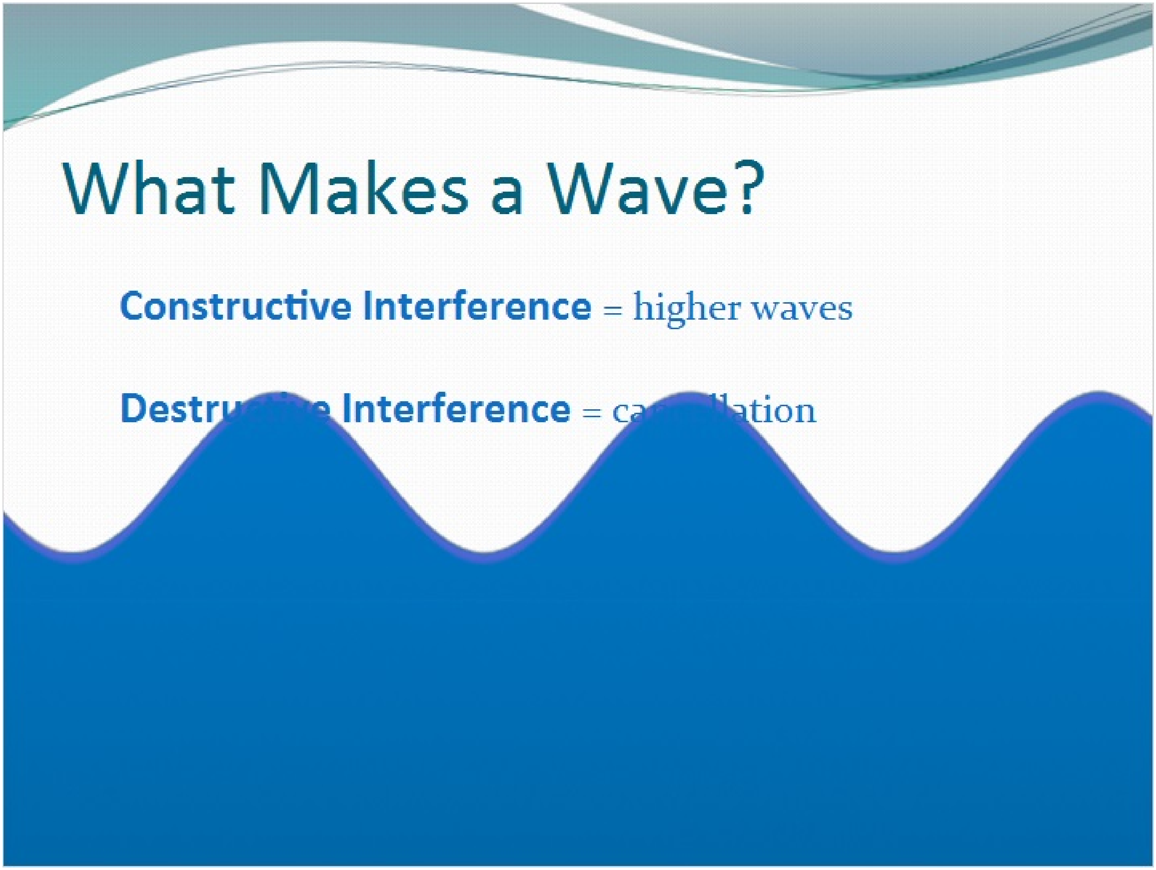
Waves that you see out in the ocean actually travel in an orbital wave pattern, which is the combination of transverse and longitudinal waves. The energy is passed along in a circular motion created by a combination of up and down motions, and side to side motions. The medium or water particles move in a circle formation. The farther down in the water, the smaller the orbital motion becomes. The waveform, however, moves directionally.

If you look at the duck floating on this orbital wave, you notice that the duck travels on a circular path; however, it also tilts backward and forward. This proves that it is the waveform that travels, while the water particles follow an orbital path in nearly the same place.

The medium, or ocean water, does not necessarily travel a distance, but the waveform does.

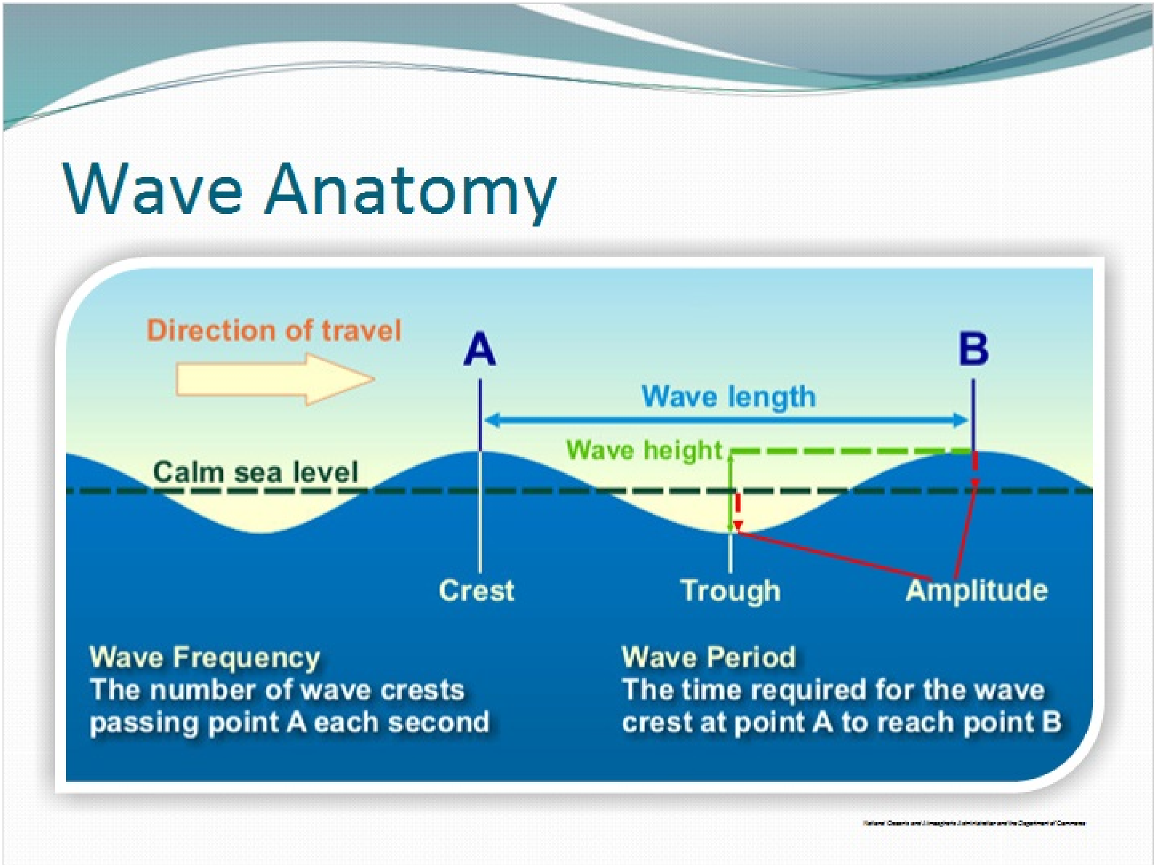


Fluids tend to rest on Earth unless acted on by a force. In the ocean, disturbing forces create waves and restoring forces stop them. The intensity and duration of the disturbing force determines the wave's properties. Wind is the disturbing force that causes progressive waves. Wind will blow over a distance called fetch, so the wavelength of a progressive wave will depend on fetch, the intensity of wind, and the length of time it blows (duration).



The overlapping of two or more waves results in constructive or destructive interference. With constructive interference, when waves of the same wavelength meet in phase, meaning their troughs and crests meet with the same timing, they combine to make higher waves.

With destructive interference, when waves that are similar overlap out of phase, meaning trough meets crest, the two waves cancel each other out.

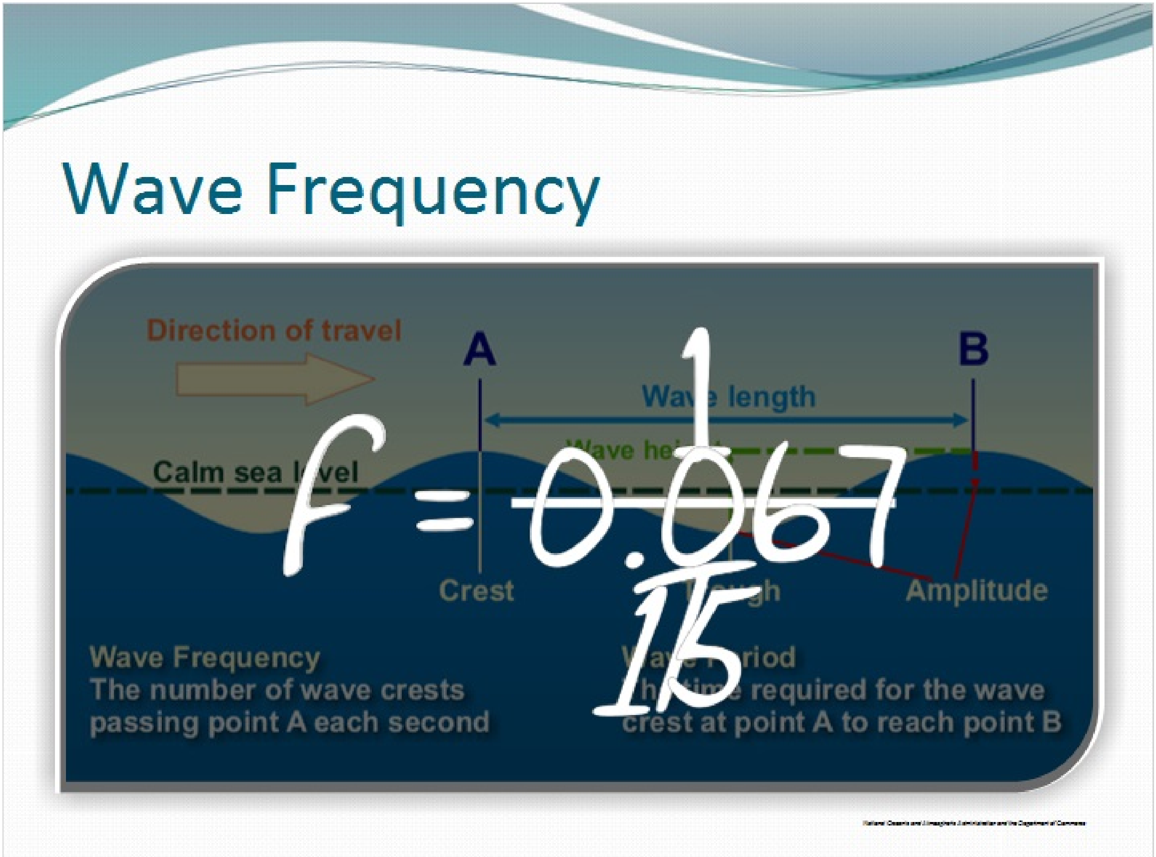


An ocean wave represents the sea surface in regular motion, but first, the medium begins at rest, in its equilibrium position. It is important to note where the equilibrium position of the medium is for measuring waves. In this graphic, the calm sea level represents the equilibrium position. A disturbing force produces a wave.

The surface will rise to a wave crest and fall to a wave trough. To help distinguish between waves, wave height is measured. This is the vertical distance between trough and crest. The amplitude of a wave is the maximum amount the medium is displaced from rest. It is measured from the equilibrium position to the crest or trough. Some students will make the mistake of measuring the entire height of the wave from the bottom of the trough to the top of the crest, but this would be twice the amplitude.

Oceanographers also measure wavelength, which is the distance of one complete wave. This is the horizontal distance from crest to crest or trough to trough.

Oceanographers measure the wave period as well. The period of a wave is the time it takes to pass a fixed point, like a buoy, or a piling on a pier. This helps oceanographers figure out the frequency of waves or the amount of waves passing a point in a given time.



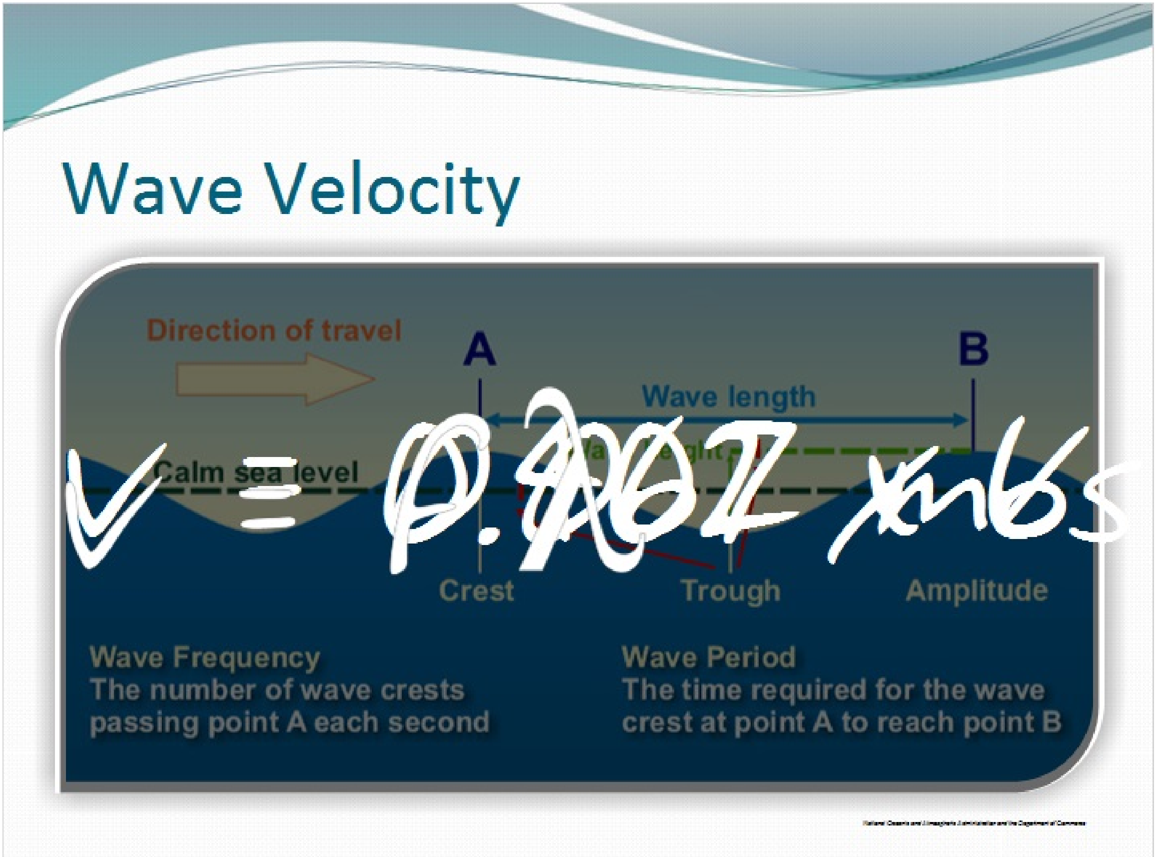
Wave period is represented by a capital T, while frequency is represented by a lower case f. To calculate wave frequency, you use the inverse of the period. This makes frequency and period reciprocals of each other. Using this equation, if waves had a period of fifteen seconds, then the frequency would be one over fifteen or zero point zero six seven (0.067) waves per second.

Wave frequency can seem to vary, though, depending on whether or not, how fast, and in which direction the source of the wave and the observer are moving. This is called the Doppler Effect.

If you were on a surfboard not paddling, you would notice a certain frequency to the ocean waves coming in to shore. If you were paddling and moving quickly into the waves, you would encounter each wave crest and trough at a more frequent pace; therefore, you would determine the wave frequency to be quicker even though the actual wave frequency was not quicker.

If you turned around and paddled with the direction of the waves in to shore, you will notice that you feel the wave crests and troughs more slowly, allowing you to feel as if the wave frequency is slower when it actually has not changed at all. If you paddled so that you traveled at the same speed as the waves, you would not travel up and down in the crests and troughs at all.

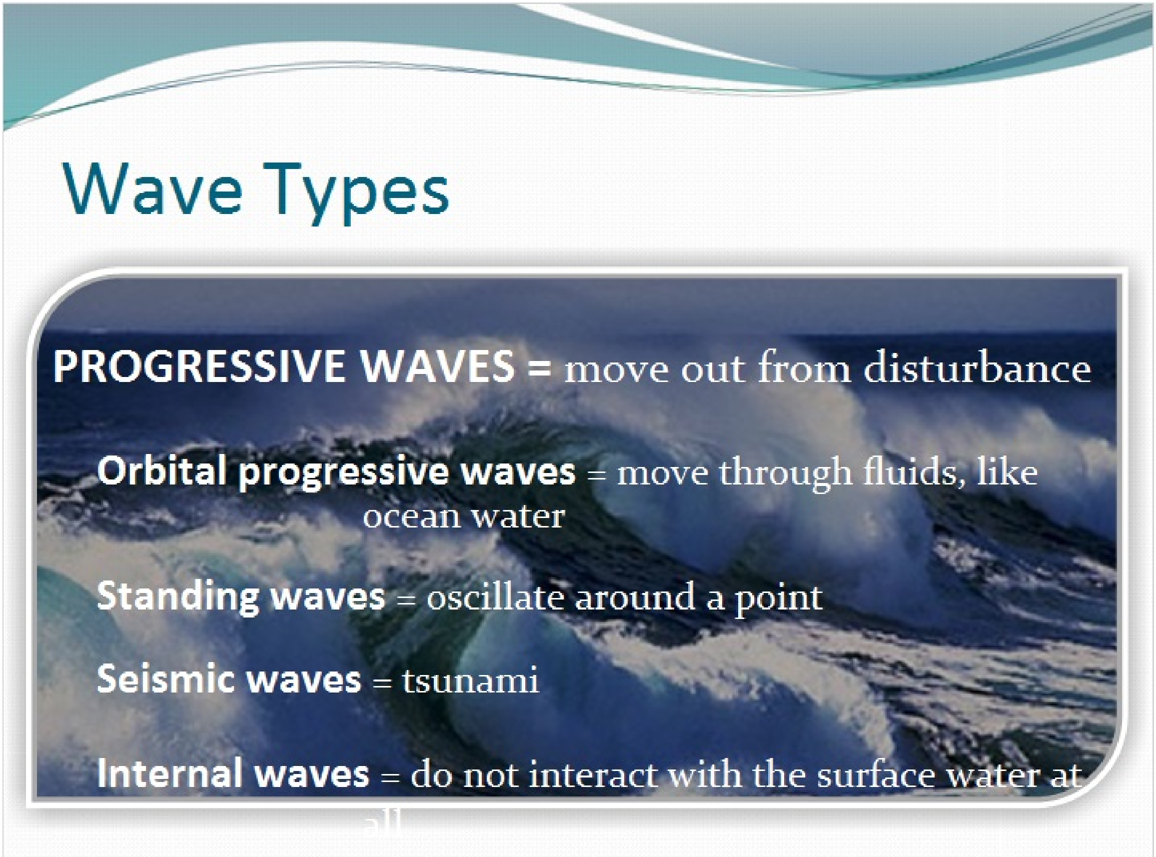
If you travel into a wave, the frequency will seem higher than if you traveled in the same direction of the wave.



To calculate the velocity or speed of a wave, you multiply its frequency by its wavelength. Velocity is represented by a lowercase v while wavelength is represented by the lambda sign.

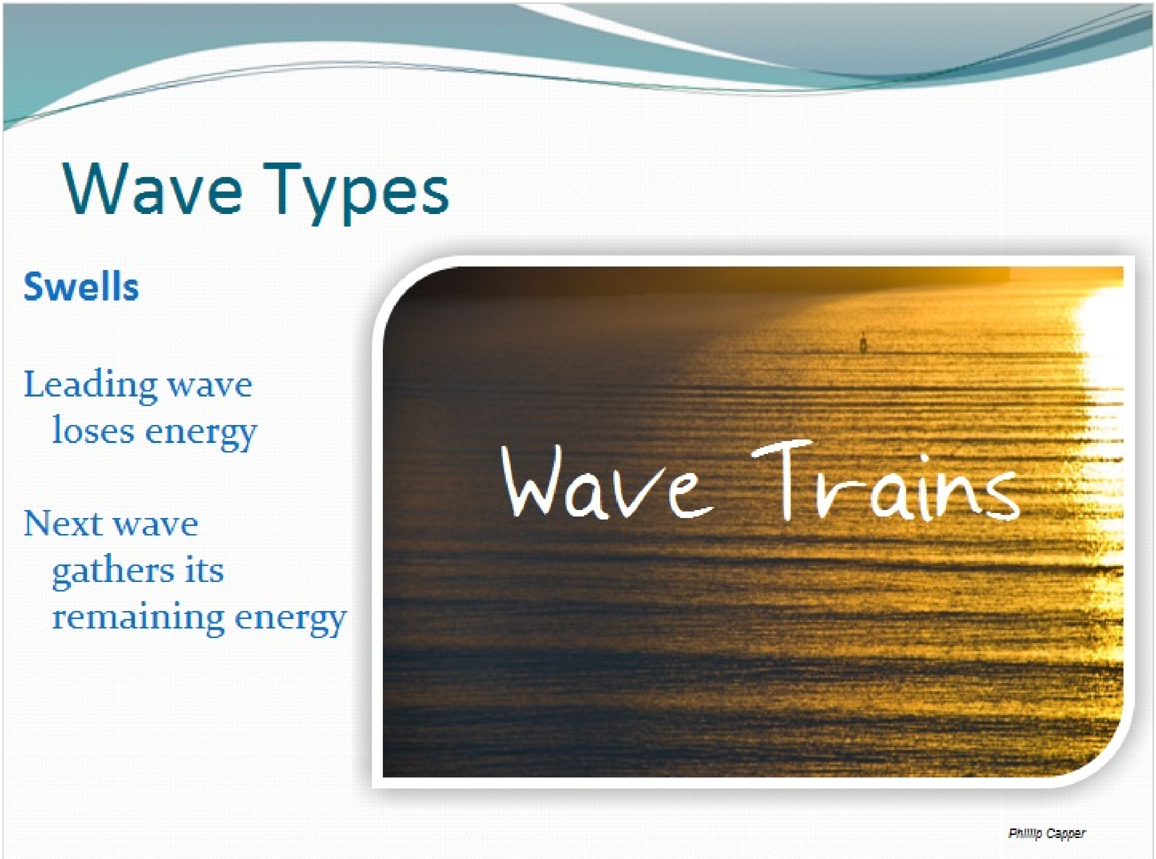
If the frequency is zero point zero six seven (0.067) from the previous example, and the wavelength is six meters long, then the wave velocity is zero point four zero two (0.402) meters per second.

The terms just described can be applied to energy waves as all waves share these similar properties.

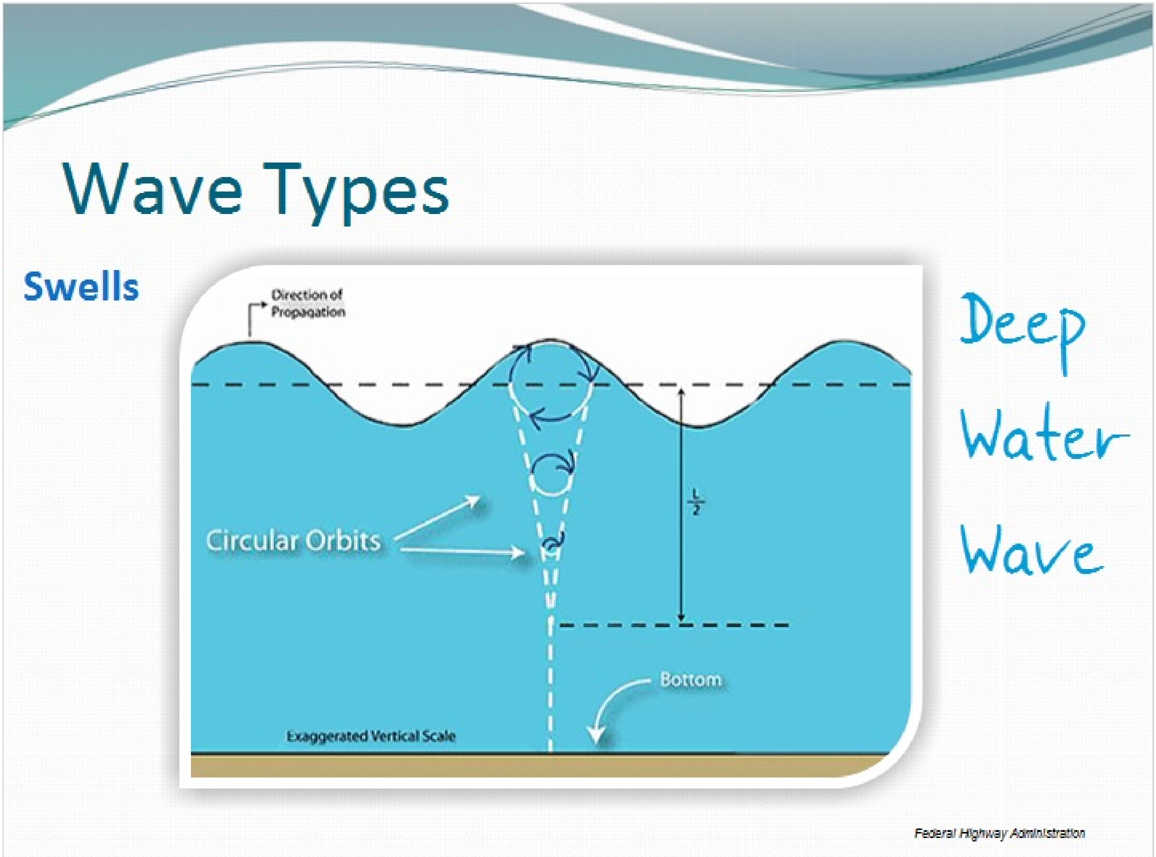


Even though ocean waves share the same basic anatomy, there are four different types: progressive, standing, internal, and seismic. Progressive waves are waves that move out from a disturbance of the ocean water, like wind. There are different types of progressive waves, but only orbital progressive waves move through fluids, like ocean water. Standing waves are waves that oscillate around a point. Seismic waves are called tsunami. Internal waves do not interact with the surface water at all.

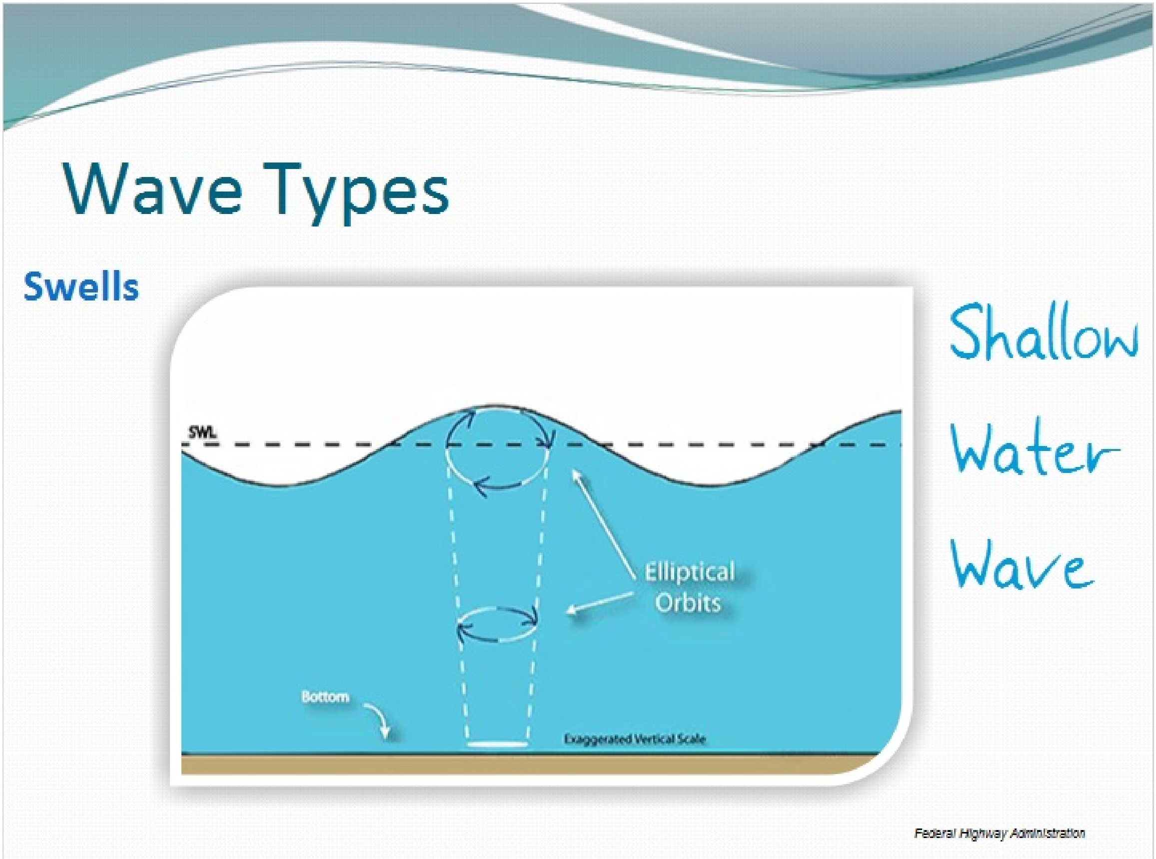
As the wind blows, tiny capillary waves are created. These are the smallest of the wind-generated waves. They will move out like ripples across the ocean. As the wind continues to blow, the waves sort themselves based on wavelength. Longer-wavelength waves will outrun shorter-wavelength waves.



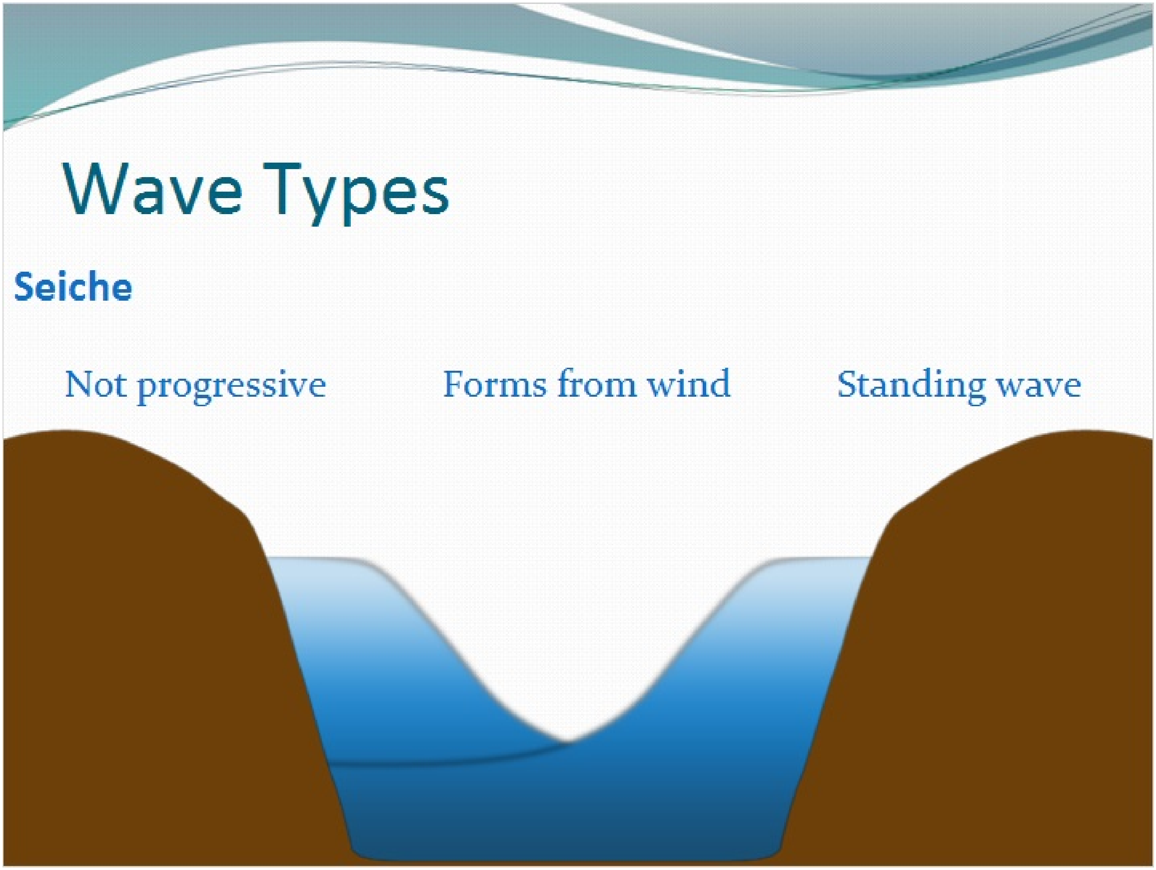
Eventually, waves are left traveling together in uniform patterns called swells. The swell continues for thousands of miles through the ocean, running in wave trains. The leading wave in the wave train will lose energy. As it does, the next wave catches up to it and gathers its remaining energy. This continues until the wave train reaches shallow water.



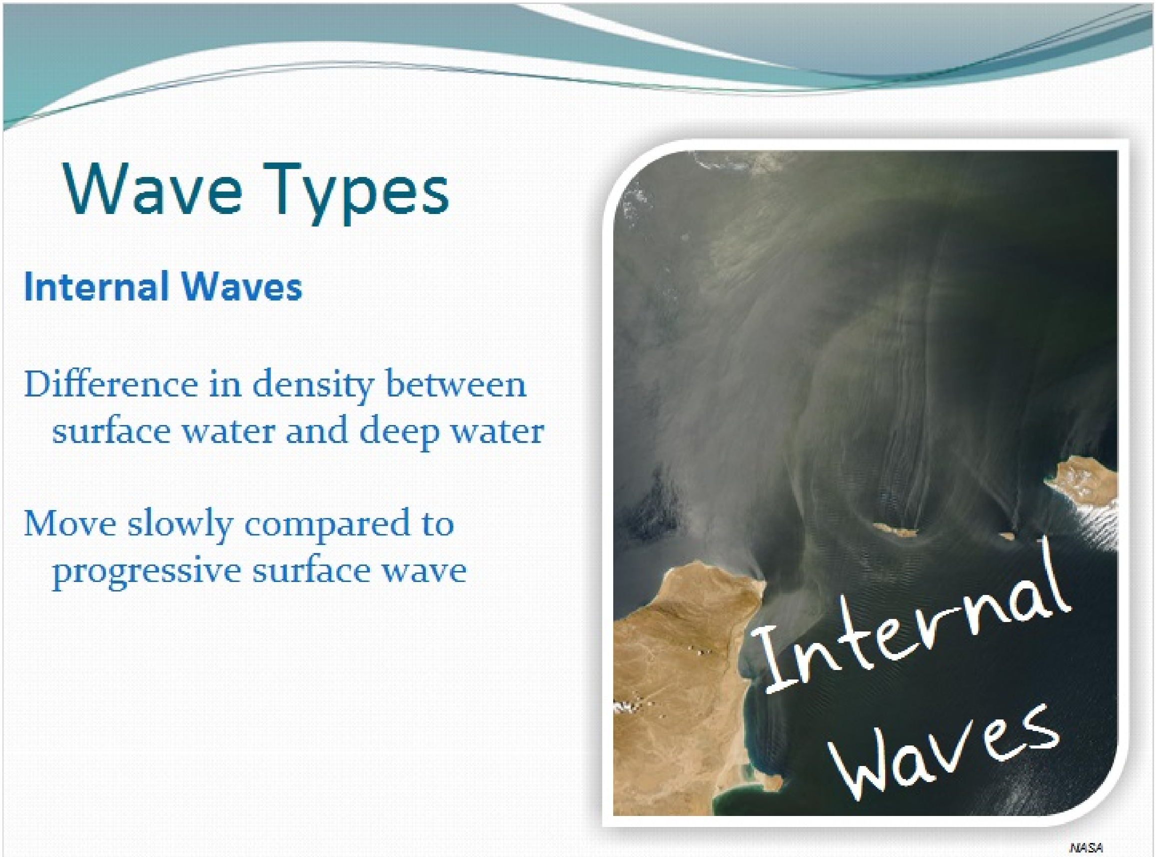
What happens when the wave train reaches shallow water? To answer that question, first take a close look at the orbital motion of a deep water wave, such as a swell traveling across the open ocean. Water motion in orbital waves decreases very quickly with depth. If the water is deeper than half the wavelength, then the wave's energy has no interaction with the bottom. A fish swimming below the energy of this deep water wave would feel no effects. The wave would travel undisturbed.



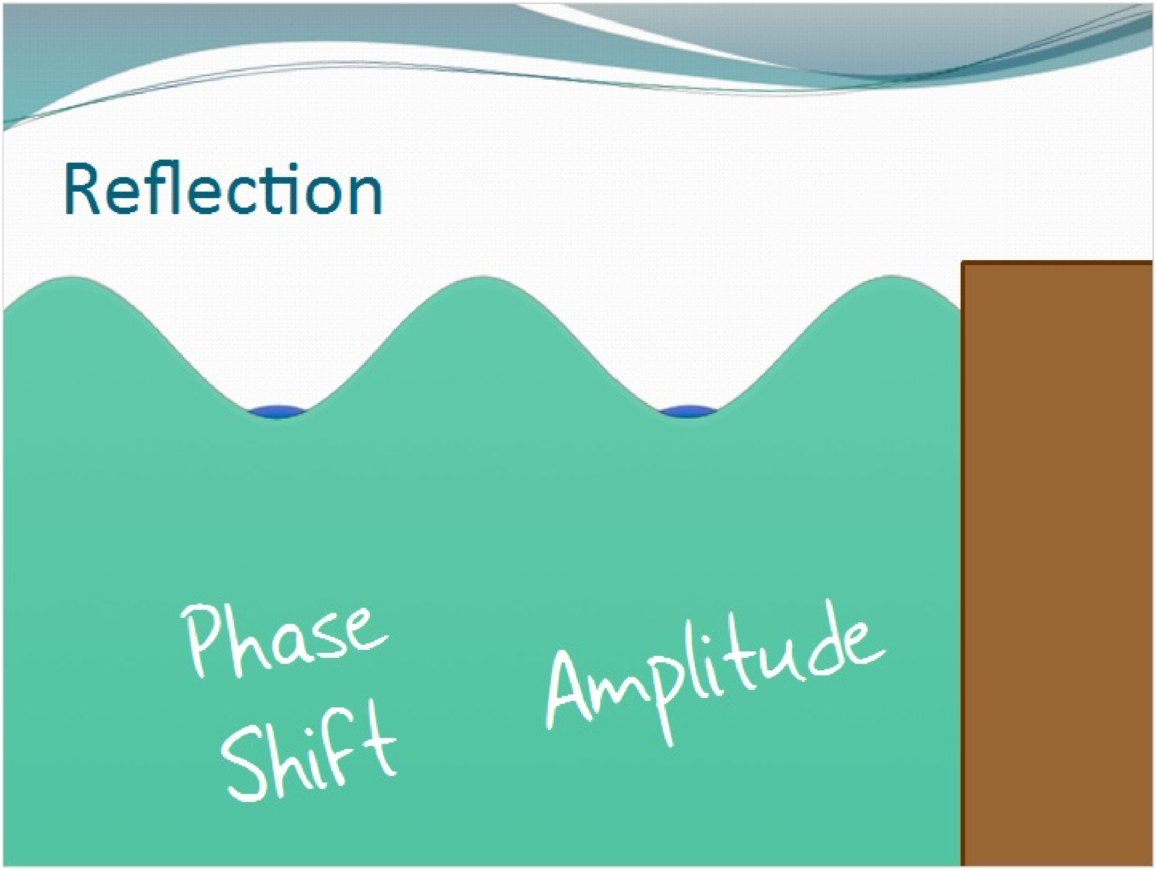
As soon as that wave reaches shallow water, around one-fourth of its wavelength, the bottom creates drag with orbital energy of the wave. This flattens out the energy into an ellipse, causing the wave to slow down. The wave will continue until around one-twentieth of its wavelength, where it is termed a shallow-water wave. This slows the bottom of the wave energy so much that the wave's orbital motion will eventually tip over and break.



A seiche is not a progressive wave, but it still forms from wind. Standing waves form in closed bays or even lakes. If the wind blows strongly in one direction for a long period of time, the water will be pushed up on one side of the bay. When the wind stops, the water will slowly slosh back and forth. This is called a standing wave or seiche, since it oscillates around a single point, much like a pendulum in a simple harmonic motion. The most popular place to view this wave is in Lake Geneva in Switzerland.

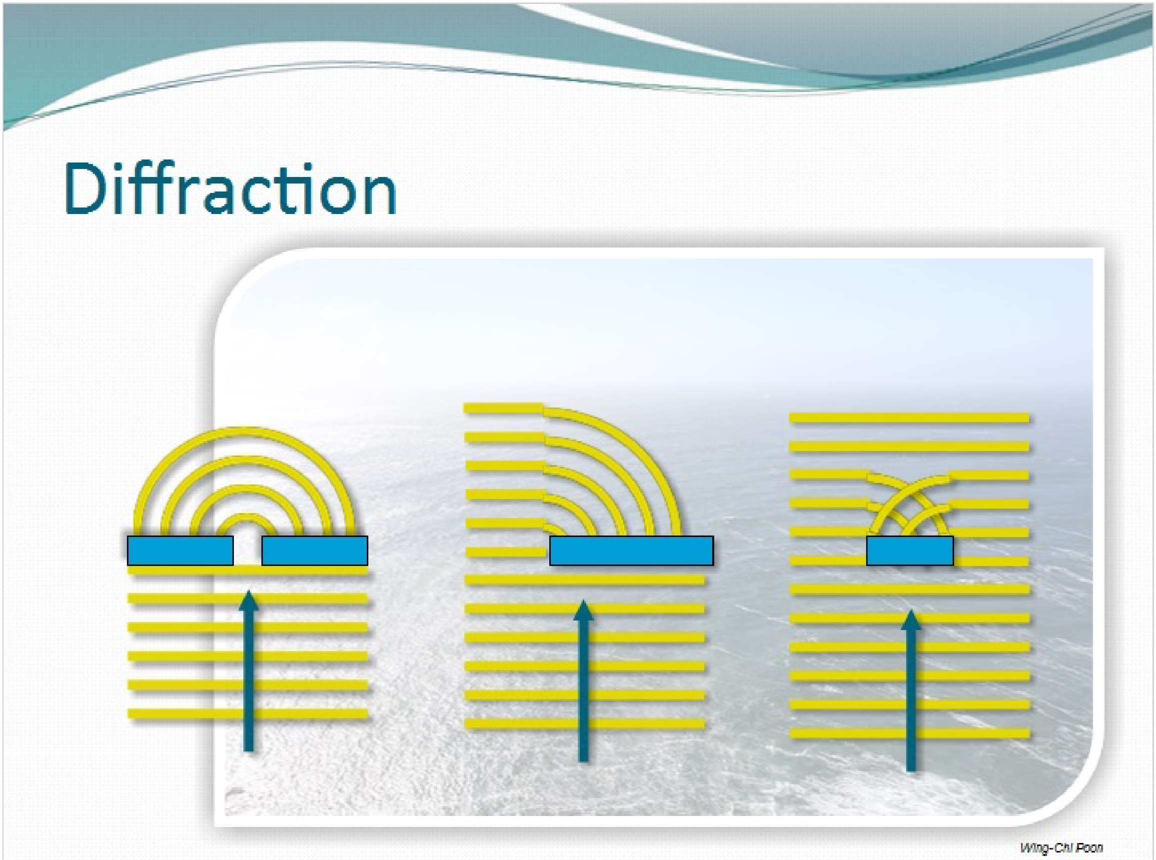


An internal wave forms as a result of the difference in density between surface water and deep water. The wave itself can be more than 100 feet tall, but it moves so slowly when compared to a progressive surface wave. This type of wave is similar to a wave you may have seen in a wave machine.



Waves are reflected and transmitted when they encounter a change in medium or a boundary. Reflection is the change of direction of the wave in the original medium. When a wave hits a surface that it cannot pass through, its energy will bounce back. Reflection can cause waves to phase shift, or invert compared to the original wave. Reflection can also affect a wave's amplitude. Standing waves occur when waves strike a barrier at ninety degrees.

Have you ever wondered how a wave seems to meet the shoreline at the same time at all points along the wave? Waves experience refraction -- the change of direction of a wave at the boundary between two media. When it approaches the shoreline and meets the bottom of the ocean floor, that part of the wave slows, causing the wave to bend at that point and arrive at the shore nearly parallel to the shoreline.



Diffraction is the spreading of a wave around a barrier or an aperture that partially blocks its progress of movement. The wave will continue past the edge or through the opening, with the edge of the barrier acting as a point source, so the waves will appear to bend around the edges and spread out. When waves spread out from both sides of a barrier in the middle, the point source interference pattern that results is on the far side of the barrier.