

## NATURE'S LABORATORY

*"The ocean is a wilderness reaching round the globe, wilder than a Bengal jungle, and fuller of monsters."*

-- Henry David Thoreau

If you've ever visited the seashore, you'll recall how vast the ocean is. Standing on a rocky cliff or a foamy beach, the ocean blue stretches forever and then some. It should, considering more than 97 percent of Earth's water supply is seawater, blanketing almost three-fourths of the earth's surface in its frothy brine. That's approximately 145,000,000 square miles of ocean boiling and churning across the globe.

There are five major oceans: the Atlantic, Pacific, Indian, Arctic and Antarctic. In addition, bodies of water that are extensions of the five oceans, plus those that are landlocked, are called "seas," like the South China Sea, the Dead Sea, or the Mediterranean Sea.

The average depth of the oceans is around 2.5 miles (13,200 feet), but there are some especially deep spots like the Marianas Trench in our Pacific Ocean, a rift 36,200 feet deep. The depths of the sea have been divided into sections. Extending from the shore seaward, the shallow coastal waters are called the neritic zone, while the deeper open ocean depths fall into the oceanic zone.

Within the neritic zone, along the continental shelf, the coast is broken down into habitat zones. Closest to dry land is the splash zone, an area above the high tide mark wetted by the splash of crashing waves. The intertidal zone falls between the waters at high and low tide, alternating between wet and dry throughout the day. Between the low tide mark and the drop-off of the continental shelf lies the sublittoral zone, an always-underwater world. Within each zone, different animals — fish, sea weeds, sponges, crabs, worms and snails, to name a few — make their homes, depending on what conditions they need to survive.

Waves, those surges of water created by winds, are actually disturbances or undulations moving through open oceanic water — the water itself doesn't actually move forward. However, when a wave approaches shore, the energy traveling through the vertical column of water becomes denser as it travels over shallower water. As a result, the waves become slower and higher. Those that get steep enough and top-heavy before they wash ashore crash as "breakers."

Have you noticed how waves tend to wash up parallel to the beach instead of sideways? As a wave approaches the beach at an angle, the portion closest to shore hits shallow water first and slows down, while the portion farthest to sea barrels along. Bit by bit, as the whole wave sweeps over shallower water, it seems to wrap itself along the shore.

The action of waves and wind against the rocky seashore creates the stuff of beaches — sand. Sand is mostly quartz, the most common ingredient in rocks. Black sands, however, come from volcanic rock, while other sands are composed of broken down corals and shell fragments.

The surging power of ocean waves beat and grind against the coast, shearing off rocks and debris. As they settle to the seafloor, the rocks are scoured and ground against sands and each other, weathered by waves, and over time are whittled down finer and finer. The larger, coarser materials sink faster and travel shorter distances, while the finer sands sink slower and are carried farther, washing higher up on shore.

Once they reach shore, the sands are subject to wind. And winds make sand dunes. Without any cliffs to impede their blow, strong winds can accumulate giant drifts of sand, rolling inland and piling skyward. In Denmark, for instance, there's a lighthouse slowly being engulfed by encroaching sand dunes. Not far away lies, perched on a sea cliff, a church is at risk of being swallowed by the ocean as waves eat away at the rocks below.

**Hands On:** The best way to appreciate the ocean's secrets is to visit the seashore. Tidepooling, exploring the rocky shores when the tides are out, is an opportunity to see the ocean's plant and animal communities in their natural setting. With a field guide, explore tidepools during "low-water slack," when the pools are most exposed. Investigate under rocks, pick up seaweed, and peer into crevices. Make sure to replace anything you pick up or overturn — it may seem silly, but to small creatures whose life depends on staying fastened to a rock so they won't be thrashed by waves, this small gesture can mean the difference between life and death.

If visiting the ocean isn't an option, try recreating it in your own kitchen. To do so, assemble the following: a 20 ounce soda bottle, clear vegetable or baby oil, water, and some blue food coloring. Thoroughly clean the soda bottle, taking care to remove the label, then fill it up half way with water. Add some food dye, one drop at a time, and swirl the water until the color of your "ocean" is to your liking. Then, fill the remainder of the bottle with the vegetable or baby oil and fasten the bottle cap firmly.

Now you have an ocean at your fingertips. Rock the bottle gently back and forth. Notice how the waves form — the cresting waves are known as peaks, while the depressions between are known as troughs.

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