

Amazing Facts about the Deep Ocean

Planet Ocean – The oceans of Earth cover 71 percent of the planet’s surface. The volume of living space in the ocean accounts for 99 percent of the biosphere – the places where life is found. The deep sea alone encompasses 80 percent of the biosphere, making it the single largest habitat for creatures on our planet.

Darkness, darkness – The vast majority of the ocean is profoundly dark. By the time you reach a depth of 450 feet, the ocean has absorbed or scattered 99 percent of the light found at the surface. Red and violet are the first to go, at a depth of 50 feet.

Deeper than Mt. Everest – The average depth of the ocean worldwide is 2.2 miles below the surface – nearly 12,000 feet. The deepest point in the ocean (the Challenger Deep of the Mariana Trench) is 35,840 feet. If you dropped Earth’s tallest mountain, Mt. Everest, into the Challenger Deep, its peak would be 6,812 feet – more than a mile – below the surface.

Extreme conditions – The deep ocean is cold and under tremendous pressure. Most of the deep sea averages a temperature around 39 degrees Fahrenheit. At the ocean’s average depth on the deep sea floor, the water above exerts a pressure of nearly three tons per square inch.

Monumental mountains – An oceanic ridge, or undersea mountain range, is our planet’s most impressive geologic feature. It stretches about 46,000 miles along the ocean floor from the Arctic, through the Atlantic Ocean, into the Indian Ocean and across the South Pacific. It’s nearly 900 miles wide, with peaks as tall as 9,800 feet above the surrounding seafloor.

Deep pioneers – Deep sea exploration began with the voyage of HMS *Challenger* in 1872-76. The British ship took scientific samples from depths as great as 26,850 feet, and disproved a 19th century theory that life couldn’t exist below 1,800 feet because of the pressure and lack of light. The *Challenger* team discovered 4,717 new species, and stirred interest in undersea mining when it brought back nodules of manganese from the seafloor.

Biggest animal – The largest invertebrate in the world lives in the deep sea: the giant squid (*Architeuthis dux*), averaging 60 feet in length and weighing up to 1,000 pounds. Whalers have found sperm whales that carry scars from their encounters with these huge mollusks.

Spectacular canyon – The largest undersea canyon on the west coast of the United States is in Monterey Bay. At the head of the canyon, offshore of Moss Landing, it's less than 33 feet deep. At its mouth, it's 12,730 feet deep. Within the bay, the canyon is as deep and as steep as the Grand Canyon of Arizona. Scientists from the Monterey Bay Aquarium Research Institute study canyon life and geology four days a week with two robot submersibles.

Uncanny animals – Deep sea siphonophores, colonial relatives of the jellies found in surface waters, may be Earth's most abundant predators. These living drift nets capture small fishes, shrimps and other animals in curtains of stinging tentacles. The largest are no thicker than a broomstick, but some species can be 131 feet long – longer than blue whales.

People in the deep – Human expeditions to the deep sea date to the 1930s, when William Beebe of the New York Zoological Society began a series of dives in a bathysphere off Bermuda. He and engineer Otis Barton made their deepest dive in 1934, down to 3,000 feet. Three decades later, in 1960, Jacques Piccard and Navy Lt. Don Walsh dove in the bathyscaphe *Trieste* to the bottom of the Challenger Deep in the Mariana Trench – nearly seven miles below the surface. No other people have ever visited the Challenger Deep, though the robot sub *Kaiko* from the Japanese Marine Science and Technology Center, in collaboration with the Monterey Bay Aquarium Research Institute, returned there in 1998.

Strange creatures – Odd adaptations enhance the survival of deep sea creatures. The anglerfish uses a fleshy “fishing pole” on its head to attract prey, complete with a “lure” that glows with light from luminous bacteria. Female anglerfish can be as big as a football; tiny males about as big as the tip of your finger. When they find a female, males bite into her flesh and wither away. Only their sexual organs remain – available to fertilize eggs as needed. One female was observed with 11 vestigial males attached to her body.

Uncounted species – Scientists have described about 250,000 species in the ocean, and they estimate that the deep ocean is home to as many as 10 million species – most of them never seen or described. That's comparable to the number of species believed to exist on land, where only 1.4 million species have been described thus far.

Niagara plus – The largest “waterfall” on Earth lies deep in the North Atlantic Ocean, at the Denmark Strait between Greenland and Iceland. Each second, 177 million cubic feet of water – a giant ocean cataract – drops over two miles. How impressive is this? The Amazon River flows at a rate of 7 million cubic feet per second; Angel Falls in Venezuela is about a half-mile in height; and the Guaira Falls on the Brazil-Paraguay border flows at a rate of 460,000 cubic feet per second. Cataracts like this play an important role in regulating the temperature and salinity of the deep ocean.

Life's origins? – Life thrives in the deep sea beside hydrothermal vents, where the water is super-hot and saturated with hydrogen sulfide, methane and other compounds toxic to most animals. (Similar “cold seep” communities exist in the Monterey Canyon, and are being studied by the Monterey Bay Aquarium Research Institute.) Scientists believe these vents may be where all life on Earth originated – and that there may be life on other planets beside hydrothermal vents in alien oceans. A trip to the ocean on Jupiter's moon, Europa, is now in the planning stages. Some equipment to be used on the voyage was tested in the Monterey Bay Aquarium's kelp forest exhibit in 1998.

Grandmother fishes – The deep sea fishes on sale in the market for a few dollars a pound might be older than your grandparents. Researchers have determined that many deep sea animals, like orange roughy from New Zealand and many rockfishes on the West Coast, can live a century or more. Because they're long-lived, don't migrate far, are late to mature and grow slowly, these fishes are extremely vulnerable to fishing pressures. Very little is known about their lives because people have spent so little time studying the deep ocean. About 95 percent of the seafloor remains unstudied.

Perils of pollution – Air pollution is responsible for a third of the toxic contaminants that end up in oceans and coastal waters; about 44 percent of toxic contaminants come from rivers and streams. All of them find their way to the deep sea eventually, where their impact on ocean ecosystems is unknown. People have added to the problem by deliberately dumping nuclear waste and other toxics in the deep sea. There's still scientific debate about whether the safest place to put toxic materials is the deep sea.

Let there be light – Though no sunlight penetrates to the deepest parts of the ocean, that doesn't mean it's a pitch-black world. Most deep sea creatures produce light on their own – to find mates, to attract food and to avoid predators. As scientists spend more time observing deep sea life, they're learning that 90 percent or more of deep sea animals (below 2,300 feet) produce light for one reason or another.

Exploring the Monterey Canyon – Pioneering work in deep sea science and engineering takes place in Monterey Bay on a daily basis. Scientists from the Monterey Bay Aquarium Research Institute (MBARI), an independent sister institution of the aquarium, are studying the behavior of deep sea animals, deep sea geology and ocean chemistry during four-day-a-week dives using two robot submersibles. MBARI engineers design and build the submersibles and other tools for deep sea explorations.

Low oxygen – From about 1,650 feet to a depth of 2,800 feet (500 to 850 meters), oxygen concentrations in Monterey Bay are as low as one-hundredth the amount found in surface waters. There's so little oxygen that that surface fishes would suffocate. Yet some animals, including fishes, can survive in this "oxygen minimum zone" – extracting oxygen efficiently and maintaining a low metabolic rate. The oxygen minimum zone is found, at varying depths, in other deep ocean waters around the world.

A blizzard of food – Food for many animals in the deep sea comes from productive surface waters, most of it in the form of a constant rain of dead plankton and animal wastes known collectively as "marine snow." Occasionally, something bigger falls to the bottom. Researchers have discovered whale carcasses decomposing on the seafloor, where they provide enough food to support communities of animals and bacteria for decades. In the Monterey Canyon, marine algae torn loose from coastal kelp forests during winter storms finds its way to deeper water, bringing a bounty of food to some deep sea animals.

Massive migration – The greatest mass migration of animals on Earth occurs twice a day in the upper reaches of the deep sea. Throughout the ocean, fishes, krill, copepods and other midwater animals rise to the surface at sunset to feed on abundant food in the upper ocean layers, then descend at dawn to depths between 650 and 1,300 feet, seeking safety from predators in the darkness.

