Ocean Science

Find out more...

Marine Zones

Marine zones include beaches or strands, intertidal/infratidal, littoral/sub-littoral, bathyal, abyssal, ultra-abyssal, epipelagic, mesopelagic, bathypelagic, and abyssopelagic zones...

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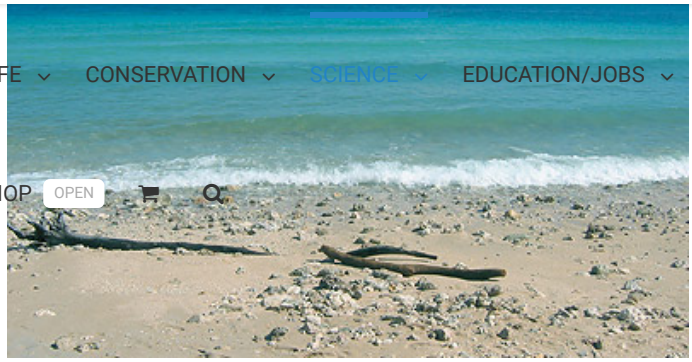
Strands

Beaches or *strands* are geological formations made up of loose rock like sand, shingle, or cobble and are located along the shore of a body of water. In 1980, William Bascom challenged the idea that a beach is simply a set of sand put in motion by waves to a depth of 10 m or more along coasts. Based on his revised description, beaches also



submerged longshore bars. In Bascom's description, a beach can either be a small system where rock material moves off and onshore by the force of waves and currents or a geological unit of considerable size.

The beach berm is the part of a beach above water (depending on the tide) that is actively influenced by the waves at some point in the tide. The berm has a crest at the top and a face, which is the slope leading down to the water. A beach berm is also considered a deposit of material (loose rock, sand, shingle or cobble) formed by the forces of the ocean water. At the bottom portion of the face there is usually a trough. Further out to sea at one of the longshore bars, there are underwater embankments where waves break. Sand deposits from the berm crest often extend far inland, the result of large storm waves. At a point higher on the beach where water cannot reach under normal weather circumstances, the wind begins to shape the sand into dunes and other sand formations.

There is no distinct line between a beach and dune because sand is always being exchanged between the two features. The drift line is the high point of material deposited by waves and could potentially be called the dividing line between the beach and the dunes. At the drift line, significant sand movement by wind can occur from storm waves when they reach far inland. In storm conditions, however, the drift line can also move inland under the raging waves.

The intertidal zone is located between low and high tide and is affected by tidal movements. The infratidal zone is located below the low tide line. The intertidal or littoral zone (also known as the foreshore) is located between average high tide and average low tide. Where water is trapped in rocky hollows at low tide, tide pools are often found.

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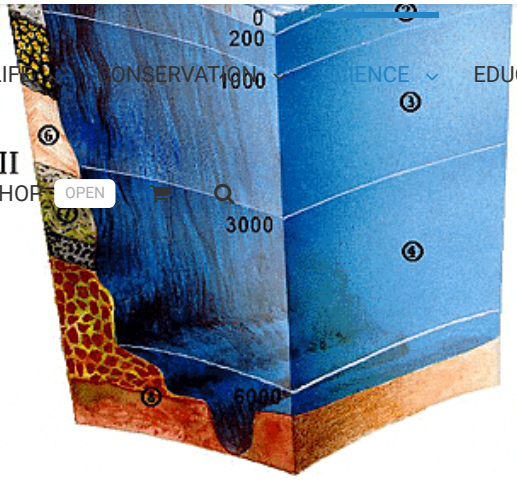
which waves or currents move deposition (sand or other loose material) that has been suspended in water onto the land. Deposition can also accrue by the bouncing movement of large particles or here that is present on the beach come from the erosion process of rocks offshore, from headland erosion (a narrow piece of land jutting offshore), and from the slumping producing deposits of scree (an accumulation of rocks and debris at the bottom of a hill). Coral reefs are also significant sources of sand particles for beaches.

The nature of waves and the material available shapes the beach. Constructive waves add material and move it up the beach while destructive waves wash material down the beach. Sandy beaches are gently sloped due to the removal of sand by the backwash of waves. Shingle beaches are steeper because backwash seeps down between large particles and becomes weaker in force so the material is not as sculpted. The uneven edge of a sandy beach is formed when incoming waves divide, depositing sand as horns and scouring out sand to form cusps.

Marine Life Zones

Organisms living in the foreshore of the beach must be adapted to both wet and dry conditions as this area is underwater at high tide. Animals like sea anemones, barnacles, chitons, crabs, isopods, limpets, mussels, sea stars, snails and whelks have all adapted to survive being smashed by rough waves or carried out to sea.

The littoral zone can refer to the shoreline of a body of fresh or saltwater and also means any area close to the water or influenced by the water. For a freshwater biome, the littoral zone is the area with abundant light close to the shore. The littoral zone in a pond or lake allows for prolific photosynthetic activity and consequently hosts almost all of the aquatic plant life. Because the water is so near to littoral zones, both freshwater and saltwater, the organisms existing here are often found in dunes or estuaries. The large amount of water available helps to create a nice habitat for a variety of plants and animals and adds humidity, a feature that allows for the more unique organisms to survive. Humans also frequently rely on the littoral region as can be observed in the large populations living near the sea.



I. Pelagic – (1) Epipelagic (2) Mesopelagic (3) Bathypelagic (4) Abyssopelagic
II. Benthic – (5) Littoral, Sub-littoral (6) Bathyal (7) Abyssal (8) Ultra-abyssal | Note: depths are in meters

The littoral region consists of three subzones called the *supralittoral zone*, the *intertidal zone* and the *sublittoral zone*. The supralittoral zone or "spray zone" is only underwater during storms, and is located between the high-tide line and dry land. The intertidal zone is located between high and low tides. The sublittoral zone is always underwater and is below the low tide line. This zone extends all the way to where the continental shelf drops off into the abyssal plane.

Everything except areas near the coast and the sea floor is called the pelagic zone. The opposite term is the demersal zone which is the water near to and affected by the coast or the sea floor. The pelagic zone is divided into epipelagic, mesopelagic, bathypelagic, abyssopelagic, and hadopelagic zones.

The epipelagic zone stretches from the surface down to 200 m and is home to the greatest biodiversity in the sea, largely because of the availability of sunlight that enables photosynthetic organisms to thrive. Both marine plants and animals are found here. From 200-1,000 m is the mesopelagic zone, a twilight zone where some light filters through but does not reach a level of brightness necessary for photosynthesis to occur.

The bathypelagic zone is from 1,000-4,000 m and completely dark. Bioluminescent organisms, some of the strangest marine creatures of the deep live here.

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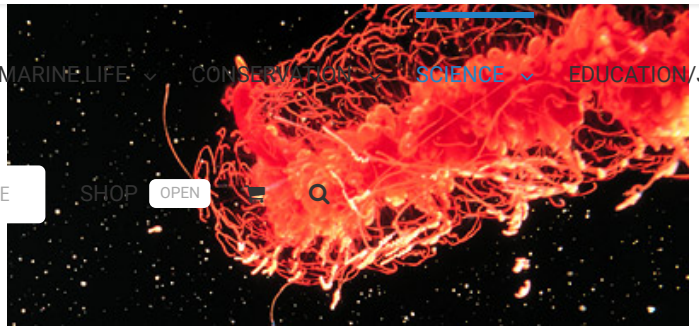
Seeing 1,000 glorious fin whales back from near extinctions a rare



Physonect siphonophores, a colony of specialized polyps found 2,000 meters down in the bathypelagic zone. Northern Atlantic Ocean, Oceanographer Canyon. Photographed by M. Youngbluth, OAR/National Undersea Research Program (NURP); Harbor Branch Oceanographic Institution (NOAA Photo Library)

Plants are non-existent in the bathypelagic zone. Animals that can live here survive on the dead material, or detritus, that falls from surface zones on other animals that live in the deep sea. The giant squid is a resident of the bathypelagic zone and serve as a food source for deep-diving sperm whales. Most animals in the abyssopelagic zone, located from 4,000 m down, are blind and colorless due to the complete lack of light. The name, "abyssopelagic" comes from the Greek meaning "bottomless abyss", in times where it was thought that the deep ocean never ended. The hadopelagic zone is the area of deep water in the deepest ocean trenches. Hadopelagic is from the Greek for "Hades", or the Greek underworld.

The photic zone (*with light*) of the open ocean consists of the epipelagic and mesopelagic zones. The aphotic zone (*without light*) of the open ocean consists of all the zones lower in the ocean. The lower zones are often simply grouped into the aphotic zone by marine biologists due to their similarities.

Other Marine Zones

The abyssal plain is a flat or gently sloping part of the ocean floor, reaching a depth between 2,200-5,500 m. In the abyssal plain, rocks are embedded into the ocean floor due to the lack of supporting heat energy below. This effect results in the flattest and smoothest regions of the world. Abyssal plains usually are found between the base of a continental rise (or shelf) and a mid-oceanic ridge. The surface was not always smooth, but became covered in fine-grained sediments like clay and silt deposited from turbidity currents and channeled down underwater canyons into deeper areas. Other sediments adding to the

Pacific Ocean has the least number of abyssal plains, the direct result of sediments in submarine trenches surrounding the Pacific Ocean becoming trapped.

Ocean Trenches

Trenches in the ocean are narrow and long depressions in the ocean floor. They are the deepest areas of the ocean floor and are usually several hundred kilometers long. Trenches are caused by the movement of tectonic plates, sometimes diving (becoming subducted) under another plate deep into the ocean floor. They usually stretch down 3-4 km below the surrounding ocean floor. The Mariana Trench is the deepest part of the ocean and was discovered during a voyage to the Challenger Deep.

The major ocean trenches are the Cayman Trench at 7,686 m maximum depth, the Japan Trench at 9,000 m maximum depth, the Kermadec Trench, the Aleutian Trench, the Kuril Trench, the Marian Trench, the Middle America Trench, the Peru-Chile Trench at 8,065 m maximum depth, the Puerto Rico Trench, the Ryukyu Trench (or Nansei-Shoto Trench), the Sundra Trench, and the Tonga Trench at 10,882 m maximum depth.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"For all at last returns to the sea — to Oceanus, the ocean river, like the everflowing stream of time, the beginning and the end." - Rachel Carson