

Kelp Forest

Giant kelp grows in thick forests along the U.S. west coast. It is a fast-growing primary producer – a brown algae. It thrives in cold waters with a lot of nitrogen. Over 700 species of fish, invertebrates, and marine mammals directly rely on kelp forests for life. Believe it or not, humans use kelp in all sorts of products, including ice cream, toothpaste, and beer. We can harvest kelp so heavily, however, that it can “clear-cut” entire kelp forests.

Jewelled top snails live on kelp blades and eat detritus and things that grow on the kelp.

Purple sea urchins eat kelp at their holdfasts (the parts that attach kelp to the bottom). They can reproduce very quickly. In the north Pacific, the sea otter is the main and only predator of kelp. On the California current, sheephead and spiny lobsters eat kelp too, along with the sea otters.

Red abalone filter feeds kelp detritus and plankton out of the water.

Red Wiry Algae, or Red Turf Algae, is a primary producer that grows on the rocky bottom, but it is usually outcompeted by kelp.

Sea otters love to eat sea urchins. They pick up the urchin, turn it upside down, and force the urchin to turn inside out, exposing its soft belly.

The California sea lion eats dozens of species of fish, including the sheephead and the Garibaldi.

The California sheephead eats sea urchins, but it especially loves chowing down on lobsters.

The California spiny lobster eats sea urchins on the California coast.

The Garibaldi, California’s state fish, uses kelp as a habitat. It build a nest in the kelp fronds and fiercely defends its nest from intruders. It eats invertebrates that live on the kelp, including jeweled top snails.

The orca, or killer whale, is the top predator of many marine ecosystems, including the kelp forest. It will eat fish, sea lions, and even sea otters. However, when it dies, like all life in the kelp forest, it will get decomposed by detritivores, and its cell material will return to the bottom of the food web.

The spiny brittle star waves its arms to filter feed for phytoplankton, and it also thrives on red wiry algae.

Coral Reef

Although they seem lifeless and rock-hard, corals are living things, and they create habitat for hundreds of thousands of coral reef species. A single coral polyp is a tiny, animal that filters passing water to feed on phytoplankton. It also has zooxanthellae in its body, which provide corals with its color and its food. Coral polyps grow on top of dead coral polyps in ever-growing colonies, and the hard, complex structures we know as reefs are the skeletons of millions and millions coral polyps built atop one another. Corals are extremely temperature-sensitive. A change of only a few degrees can disturb them so much that they expel their zooxanthellae, causing them to lose their means of nutrition. They are also damaged by boat traffic, whose propellers cut trenches into the coral.

Crown-of-Thorn Starfish are fast-multiplying, voracious predators. They eat corals, and when a train of crown-of-thorn starfish invade a reef, they can destroy it within days, then they move on. They can also eat sea squirts.

Herrmann's Sea cucumbers, also known as "curryfish" for the way they taste (they are a delicacy in Southeast Asia), are important members of the coral reef. They eat detritus that has fallen into the sand, including the fragments of coral that are found on the reef floor.

Heterotrophic nanoflagellates are extremely small, one-celled life forms that float in the surface waters of the ocean and eat phytoplankton. They usually have a single, whip-like tail, or "flagellum", that helps them propel themselves through the water.

Parrotfish are a very common fish of the coral reef; they depend on corals for habitat, but they also eat living and dead coral. When swimming near a reef, you can hear the crunching sound of parrotfish feeding on corals.

Phytoplankton are microscopic primary producers floating in surface waters. They are the foundation of the world's ocean ecosystems.

Sea squirts are highly efficient filter feeders. They filter the water for phytoplankton and heterotrophic nanoflagellates. They are eaten by nudibranchs, flatworms, molluscs, rock crabs, sea stars (like the crown-of-thorn starfish), fish, and birds.

The Humphead/Napoleon/Maori wrasse is a gigantic but harmless and beautiful fish that divers love to see underwater. They eat parrotfish and crown-of-thorns starfish. They are almost never eaten, although sometimes sharks can eat small humphead wrasse. Due to the destruction of their habitat (coral reefs), they are quite endangered.

The sickle-fin lemon shark eats fish of all kinds, as well as Herrmann's sea cucumber.

Triton shells are gigantic snails. They are one of the few animals in the reef that eat the crown-of-thorn starfish.

Zooxanthellae are small phytoplankton that live inside corals. They give coral energy, as well as their color. Their bright colors come from the pigments used to convert sunlight into biomass and energy.

Salt Marsh

Blue crab eats snails and minnows among the cordgrass.

Cordgrass are dense, tall plants whose roots can stay submerged underwater but grow tall enough to rise above the water level. This is why they are the dominant plant species of the salt marsh. They provide habitat for thousands of species. It also provides a protected nursery for young forms of many huge oceanic species as well.

Epiphytic algae grow on the blades of cordgrass, but they don't feed on the cordgrass – they are just using the grass as habitat. The algae are primary producers.

Grass shrimp eat detritus and phytoplankton, including the epiphytic algae on cordgrass, and lives among the stalks of blade grass underwater.

Sheepshead minnows eat grass shrimp and use the cordgrass as a protected nursery; they hide among the blades to avoid blue crabs.

The alligator is by far the largest and meanest thing in the salt marsh. It eat birds, turtles, raccoons, fish, crabs, and sometimes people too!

The diamondback terrain turtle eats periwinkle snails and blue crabs.

The fiddler crab is a detritus feeder. They aerate and loosen soils, and prevent the oxygen in the soil from being depleted. Without their “tilling” of the salt marsh soil, the cordgrass would not be able to grow.

The periwinkle snail climbs up and down blades of cordgrass all day, eating the epiphytic algae growing on the blades.

The raccoon is an omnivore – it will eat anything and everything smaller than itself: minnows, fiddler crabs, blue crabs, and turtles too.

The ribbed mussel is a suspension feeder, that filters water for detritus and plankton floating in the water. By feeding in this way, they filter the water of toxins and dead matter that would make the marsh uninhabitable for many species. By attaching to the soil and the base of cordgrass, they help to loosen and aerate the soil, which helps the cordgrass survive.

The ring-billed gull is an omnivore. It eats minnows, crabs, and turtles. It flies above the salt marsh, looking for edible critters that have strayed too far from the marsh grass, and dives down to snatch them up.

Hydrothermal Vent

“Chemoautotrophic” bacteria (chemo = chemical, auto = self, trophic = nourishing) use this sulfur to create biomass and life-giving energy; they are the primary producers of this community, and this is one of the few examples on earth where primary producers don’t use the sunlight as the basis for the food web.

Deep-sea Pompeii worms filter feed the water for chemoautotrophic bacteria.

Giant tube worms grown in thickets around hydrothermal vents, like little forests. They have symbiotic relationships with chemoautotrophic bacteria, similar to the way zooxanthellae live inside corals and provide them with energy. These tube worms provide protection and habitat for many other species in the vent community.

Hydrothermal vent crabs – different from yeti crabs! – eat shrimp, deep-sea Pompeii worms, and limpets.

Limpets are small snail-like animals that filter the water around vents for chemoautotrophic bacteria.

The hydrothermal vent octopus uses its eight arms to pry open and eat clams, as well as yeti crabs and limpets.

The hydrothermal vents are found deep, deep in the ocean. They spew out smoky chemicals that come from deep in the earth’s interior, and this smoke is high in sulfur. Vents only last a few thousand years, and when a vent “dies” and stops spewing out sulfur, the entire community collapses.

The species at these vents were only discovered in the 1970s, and scientists are still unsure about the trophic dynamics of their residents. But here’s what we think so far we know so far:

Vent shrimp feed on chemoautotrophic bacteria that grow in colonies on the rocks around the vent.

Vesicomid bivalve clams grow on the rock around the vents, and at the base of tube worms. They filter feed for chemoautotrophic bacteria.

Yeti crabs are awesome! The “hair” on their arms is actually filaments (or strands) of chemoautotrophic bacteria. The Yeti crabs stand right next to the vent and wave their arms over the vent. This provides bacteria the nutrients they need to grow, and the yeti crab nibbles the bacteria for an easy meal. So, they farm their own food on their arms!

Zoarcid fish are the biggest and baddest members of the hydrothermal vent community. They eat vent crabs and octopus. They nest among the thickets of tube worms.

Rocky Intertidal

Intertidal communities occur all over the world, wherever the tides change from high to low dramatically enough to expose rocks and the animals living on them. The animals in these flashcards can be found in the rocky intertidal habitat up and down the west coast of North America.

Barnacles are filter feeders, sieving detritus and plankton out of the water. They attach to the rocks and can form large colonies that displace and remove *Fucus* and *Ulva* algae.

In the rocky intertidal habitat, sea otters can eat ochre stars, but mainly sea urchins.

Ochre starfish (pronounce “oak-er”) are predators that eat many things. They feed on limpets, and sometimes barnacles, but mainly on mussels.

Purple sea urchins wander the intertidal, preferring to stay submerged whenever possible. It eats *Ulva* algae.

Ring-billed gulls forage in the rocky intertidal; they eat limpets, ochre stars, and leather stars too.

The anemone is another predator that feeds on detritus, but loves to eat mussels. However, they can only eat the mussel if the ochre starfish dislodges the mussel from the rock first.

The common mussel feeds on *Fucus* and *Ulva* algae and filter feeds for phytoplankton. They attach to the rock and are very difficult to remove. They outcompete barnacles and can form huge mussel beds that are difficult to remove. These mussel beds take over rock surfaces that would otherwise be used by rhodophyte algae and other animals.

The leather sea star eats sea urchins and rhodophyte algae, as well as sponges.

The limpet is a small snail that feeds on both rhodophyte algae and macroalgae, but mainly macroalgae like *Fucus* and *Ulva*.

The lined shore crab is small, beautiful crab that eats *Fucus* and *Ulva* algae.

There are two main groups of primary producers in the rocky intertidal: the macroalgae/crustose algae (like *Fucus* and *Ulva*), and rhodophyte algae (*Endocladia*).