The Sandy Beach Habitat: Fact Sheet

NOAA

People love to visit California's beaches for recreation and the beauty of the scenery. However, the sandy shore is often overlooked for the diversity of life that it supports. Although it may not be obvious at first glance, the constantly moving sand on the beach forms a very rich and productive intertidal habitat, particularly in California. In fact, thousands of mobile animals live along every foot of the shoreline. The animals that live in this turbulent habitat are highly specialized. There is little to attach to or hold onto at the sandy beach, so the ability to move quickly to keep above the waterline or to burrow in the sand to avoid crashing waves is a common adaptation among beach organisms. Most beach animals survive by obtaining food from the organic material that washes in with each wave.

Beach Dynamics

The sandy beach is a harsh environment. Crashing waves, the daily ebb and flow of the tides, and the action of currents keep coastal ocean waters in constant motion. This water movement also carries the sand below it, changing the beach slightly with each wave and noticeably over seasons. Taken altogether, these physical forces create a very dynamic habitat.

It has been estimated that the energy contained in an average wave front approaching a beach is equivalent to a line of cars, side by side, revving their engines at full throttle. Not surprisingly, it is the waves that primarily determine how beaches look and what lives on them.

A sandy beach can change appearance seasonally. In the winter and spring, large waves can move most of the sand off the beach face leaving behind the larger gravel or cobble. The sand is pulled into the surf zone, where it forms sand bars. When the waves are smaller, sand is moved gradually back on to the beach face. California beaches are often widest and sandiest in the late summer and fall and narrowest and rockiest in the winter and spring months.

The day-to-day appearance of a sandy beach may not change much, but it is always in motion. No sand grain stays in one place for very long. Each breaker lifts millions of grains from one spot and deposits them at another. When the prevailing wave direction strikes the beach at an angle, sand grains are deposited by the receding backwash a short distance down the beach in the direction of the current.

The sand that makes up beaches is eroded from inland rocks, flows down creeks and rivers, and then is deposited at the mouth, forming sandy beaches. Longshore currents generated by waves pick up sand grains from these larger deposits and move them along the coast to form more beaches. The sand itself is primarily made up of quartz, which is found in most types of rocks. There are other minerals as well, plus small pieces of shell and sea urchin spines.

Life at the Sandy Beach

One of the main obstacles that sandy beach organisms face is the lack of stable ground to hold onto. They must swim or burrow, or else they will be swept away. Many animals need to burrow in the sand to escape predators.

CHAD KING

Willets (*Catoptrophorus semipalmatus*) foraging for mole crabs on Asilomar Beach.

Another difficulty of living in a sandy beach habitat is that very little food grows there.

Photosynthesis is limited to microscopic algae in the top few centimeters of the sand. Some beach animals survive by eating these minute algae particles. However, most sandy beach organisms depend on the waves to bring them food.

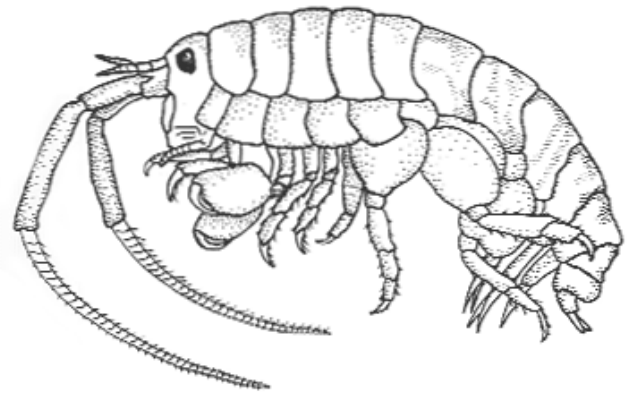
ABOVE THE TIDES: Probably the most familiar birds of the sandy beach are the little Sanderlings. These are the birds that dart back and forth at the edge of the crashing surf, trying to grab an exposed sand crab or worm. Sanderlings' bills are not adapted to probe deep into the sand, so they try to find prey as it is stirred up by the waves. Larger Willets and Godwits with longer bills are less restricted. The tips of their bills are sensitive and are able to feel tiny vibrations that indicate prey deeper in the sand.

The highest reach of the tide is called the "wrack line," where debris from the ocean is left onshore. While kelp and other algae are the biggest contributors to the wrack on California beaches, the dead and dying remains of fish, birds, and jellies can also be found among the wrack. Small shrimp-like amphipods, commonly called beach hoppers, feed on this nutrient-rich debris. Beach hoppers have gills that function almost like lungs yet must be kept wet from the damp sand to function. During the day, beach hoppers burrow head-first deep beneath the high tide line, often under the beach wrack. At night on a falling tide, beach hoppers swarm out to feast.

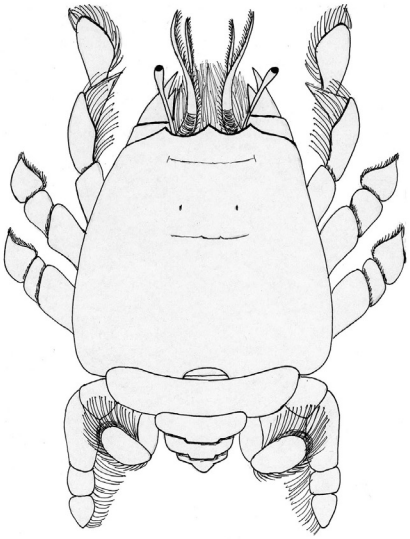
Higher on the beach, above the wrack, small Snowy Plovers, a threatened species, chase about in the dry sand and beach wrack to catch insects and beach hoppers. The most noticeable birds of the beach, and certainly the loudest, are the ubiquitous gulls. These scavengers are opportunists that feed on almost any food item tossed on the shore, whether by wave or picnicker.

THE SWASH ZONE: In the area where the waves wash in and out, organisms must have a different strategy for obtaining food. Most of these animals, such as clams and crabs, filter feed, straining the ocean water for plankton and detritus. In the spring and summer when upwelling of cold, nutrient-rich waters along the Pacific coast is at its strongest, waves turn dark green indicating very abundant phytoplankton and lots of food for filter-feeders.

One of the most common animals in the swash zone is the Pacific mole crab (a.k.a. sand crab), *Emerita analoga*. It is the epitome of burrowing efficiency. The sand crab can only move backwards, perfect for digging down into the sand. In fact, it can completely bury itself in about in 1–7 seconds! Its rear legs are modified as paddles, which gives it very good swimming capabilities, an essential skill when it is stirred out of the sand by crashing waves. After being dislodged, the sand crab burrows end-first into the sand, with its head near the surface facing seaward, leaving only its eyes and antennae above the sand. When a wave recedes, the crab's large, feathery second antennae are unfurled to form a "V," through which the backwash is strained for phytoplankton.



During the spring and summer, populations of beach hoppers can eat most of the fresh wrack on the beach in just one night.



BEYOND THE TIDES: Though unseen by those of us on the beach, there are several fish species that live in the sandy beach habitat. Skates, rays, and other flatfish patrol for prey just beyond the waves. When the tide is in, they have access to the intertidal crabs, clams, and worms. By flapping their "wings" or pectoral fins, these fish create surf-like action to blow away the sand and expose their prey. Some fish such as surfperch and sand eels feed just behind the leading edge of the breaking waves, taking advantage of the dislodging force of the fast-moving water to grab crabs and worms otherwise unobtainable.

Human Impact

More people use sandy beaches than any other type of seashore. Unfortunately, beaches suffer from a number of impacts caused by humans. Major impacts to beaches include coastal armoring, marine debris and pollution.

CA COASTAL COMMISSION

"Coastal armoring" is the building of seawalls and other structures to prevent the natural erosion of coastline. However, these structures can potentially damage or alter local coastal habitats and deprive beaches of sand. Coastal armoring within the boundaries of national marine sanctuaries is strictly regulated, because it is very hard to correctly predict how the sand and water will flow around the new structure.

Marine debris comes from two main sources, the land and the ocean. Trash is dumped overboard by ships at sea, carried by rivers and storm drains from inland areas, and deposited directly on beaches by visitors. Regardless of its origin, much of this debris ends up on beaches and can pose a threat to many organisms who may eat or become tangled in the debris.

The pollution of water along our beaches is also a persistent problem in the United States. Sewage spills and oil spills are both common culprits. Sewage typically comes from sewer overflows and malfunctioning sewage treatment plants. Oil can come from many sources, including land runoff, poor vessel maintenance and vessel spills. The toxic chemicals in oil kill many animals and may pollute a sandy beach for many years.

Human activities such as burning fossil fuels and deforestation, have led to a rapid increase in atmospheric carbon dioxide levels. The ocean absorbs approximately 1/3 of the atmospheric carbon dioxide from human activities, or anthropogenic carbon dioxide. Carbon dioxide acts as a weak acid when it dissolves in seawater. The dissolution of anthropogenic carbon dioxide into the ocean is changing ocean chemistry and making it difficult for some organisms to live.

The sandy beach is a dynamic environment that is home to many creatures uniquely adapted to survive in harsh conditions. Life exists on all areas of the beach, from above the reach of the tide, through the swash, and down into the ocean. In order to conserve and protect these threatened ecosystems, we must understand the ecological value of beaches and try to limit our human actions that can negatively impact them.