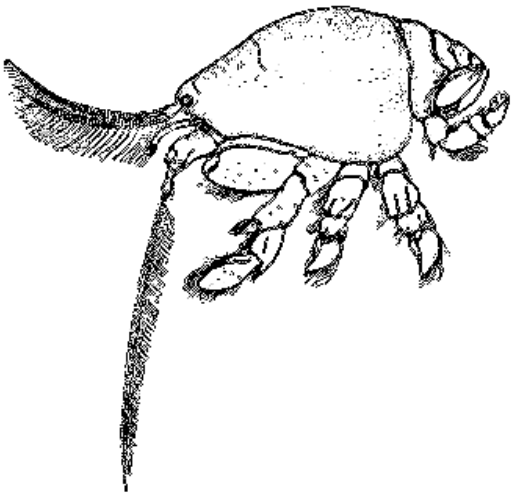
The Pacific Mole Crab: Fact Sheet



The sandy beach environment is not an easy place for organisms to live. Unlike the rocky intertidal ecosystem, there is no solid material on which to attach. Sandy beach animals have to deal with constantly shifting sand, crashing waves, tides coming in and out, a beach that changes seasonally, and marine and terrestrial predators. The animals that live in this environment are almost always buried in the sand and have many adaptations to help them survive.

The Pacific Mole Crab

Pacific mole crabs (*Emerita analoga*), also known as sand crabs, are one of the most important and abundant invertebrates on the sandy beach. They live along the Pacific coast from Alaska to Baja California in the northern hemisphere and between Ecuador and Argentina in the southern hemisphere. They inhabit the swash zone, which extends from the lowest to the highest reach of the waves at any given time. The swash zone is an especially harsh environment to inhabit on the beach because of the crashing waves and shifting sand.

Description

The sand crab is small in size, growing up to 35mm (1.4") long and 25 mm (1") wide. It is gray or sand colored and does not have claws or spines. Like other crustaceans, sand crabs periodically molt, so the empty exoskeletons may be found on the shore. Males and females may look very similar at first glance, but there are some important differences.

Females can grow larger, with a carapace length of 14–35 mm, while males reach 10–22 mm. If a female is carrying eggs, they will be found under the telson and look like a bright-orange to dull-yellow mass, depending on the maturity of the eggs. If a female is not carrying eggs, the pleopods to which she attaches the eggs will be visible on the underside of the crab when the telson is lifted. There are three pairs of pleopods, right below the fourth pair of legs, and they resemble short threads.

The crab spends most of its time buried in the sand. It has five pairs of legs that allow it to swim, crawl and burrow, all of which are done backwards. In fact, they are so well-adapted for burrowing that they can completely bury themselves in seconds! The crab's eye stalks reach above the sand as do the first pair of antennae, which they use for respiration. The second pair of antennae resembles feathers and is extended when the crab feeds. The sand crab collects small organisms, mostly dinoflagellates and phytoplankton on their antennae. Then they pull their antennae into their mouth and scrape off the food.

The Pacific mole crab resembles another species of sand crab that lives along the shore, the spiny mole crab, *Blepharipoda occidentalis*. This crab lives deeper in the subtidal zone and can reach 65 mm in length. The adult spiny mole crabs feed on dead Pacific mole crabs.

Life Cycle

Sand crabs are usually found on the beach in large numbers from spring to fall. In the winter, storms may carry them offshore with the sand into sandbars. When the sand is transported back onshore in the spring, crabs come with it.

During the reproductive season (February–October), females can produce one clutch of up to 50,000 eggs per month, which take approximately 30 days to develop. Once the eggs hatch, the larvae are planktonic for 4–5 months, where they go through 8–11 larval stages. During this time they may drift far offshore. When the crabs near the end of their larval stage they can return to the beach if they have been carried by the currents back to nearshore waters. When the larvae settle onto the beach, it is called recruitment, and these small crabs are considered "recruits." Recruitment can occur year-round, but often, depending on environmental conditions, large numbers of recruits are found during spring and early summer and again in the fall.

Sand crabs move up and down the beach with the tides, using the action of the waves to carry them higher or lower in the swash zone, depending on the direction of the tide. Crabs also move down the length of the beach with longshore currents. These currents are created by waves that approach a beach at an angle. As a wave returns to sea, it takes sand and crabs with it. The next wave comes in at angle farther down shore and deposits the crabs in a new location.

Sand crabs are not distributed uniformly across a beach. Females are often found lower in the intertidal zone than males and recruits. The crabs form large, unevenly spaced aggregations along the shore. Scientists have proposed biological reasons for these aggregations, such as predator avoidance and an advantage for mating. Physical reasons like water flow and wave shock have also been proposed. A combination of multiple factors may explain the aggregations. The number of crabs on a beach can also vary greatly from year to year, depending on environmental factors.

Predators and Parasites

The main predators of the sand crab are fish, water birds, and shore birds. Fish are the greatest threat, and this may explain why sand crabs are not often found in the low intertidal and subtidal zones. The barred surfperch is a very common fish in the surf zone, and sand crabs have been found to make up 90% of its diet. The California corbina is another fish that eats sand crabs. Shorebirds, including Sandpipers, Sanderlings, Godwits, Black-bellied Plovers, Willets, and Curlew have been seen feeding on crabs in the swash zone. The Surf Scoter, a diving water bird, also feeds on sand crabs. Sea otters are one of the few mammalian predators of sand crabs.

Sand crabs are known to carry parasites. In particular, they are an intermediate host of parasitic worms in the phylum Acanthocephala, known as spiny-headed worms. These parasites are passed onto the predators of sand crabs. Sea otters and birds can eat many crabs per day, and the ingested parasites can kill these predators.

Monitoring Sand Crabs

When scientists study the sandy beach ecosystem, sand crabs are often the focus. There are some unique challenges to monitoring sand crabs. Sand crabs are highly mobile meaning that they move quickly through the sand to avoid predators and to adapt to their constantly changing environment. Sand crabs also tend to live in patchy populations meaning that they tend to cluster together in the sand. Their mobile and patchy nature mean that researchers have to search for patches of sand crabs and take samples quickly when monitoring.

There are also some advantages to monitoring sand crabs. Sand crabs tend to be abundant and relatively easy to find, making them ideal to understand population dynamics on the beach. As one of the largest filter-feeding herbivores on the beach, they form a vital link in the food web giving us a picture of the overall health of the shore. Furthermore, by collecting long-term data on sand crab abundance, we can track fluctuations over time that can possibly be linked to environmental or human-caused phenomena. Lastly, for our sanctuaries, monitoring sand crabs is important in case of an oil spill. We can compare sand crab data from before and after the spill to understand the impact the oil had on the beach and to help us restore the shore to its original conditions.