

Californian Maritime Strands

Although strand vegetation occupies numerous, if not extensive, interior habitats, this formation is most often considered in context of those beach communities occurring between low tide and the influence of the highest tide (=intertidal zone). There the barrenness of vegetation caused by wave action, saline water tables, shifting sandy substrates, salt spray, and sand blast, corresponds to the desertscrub formation of upland vegetation. As in interior habitats, substrates may be rock, sand, or mud. In the warm temperate Southwest, coastal vegetation is represented by *Californian maritime strand*, which has been well described by Barbour and Johnson (1977).

The Californian coastline is characterized by rocky cliff and tidepool environments, sandy beaches and dunes, and more rarely, salt marsh and mud flats (Fig. 177). Dunes and sandy beaches are confined to bays (e.g., Long Beach). Beaches tend to build seaward in summer and erode during winter months, and the spring tidal range is moderate (Hinton, 1969).

Strand vegetation in California varies greatly from north to south—forbs dominate south of 34°N and the plants are mostly prostrate, herbaceous, evergreen, and succulent. Vegetation increases landward toward the foredunes; dune vegetation commonly grades into coastal scrub and may be composed of open communities of the same species. The species as well as density of vegetation also follows a zonation based on environmental tolerances. In the Southwest, the number of species in the littoral strip is few, some of the most common and characteristic being the Saltbush (*Atriplex leucophylla*), Sand-verbena (*Abronia maritima*), Silver Beachweed (*Ambrosia chamissonis*), Evening-primrose (*Oenothera cheiranthifolia*), Goldenweed (*Haplopappus venetus*), Mock Heather (*Haplopappus ericoides*), *Lupinus chamissonis*, *Abronia umbellata*, and the Ice Plant (*Mesembryanthemum crystallinum*). Introduced species such as *Mesembryanthemum chilense*, *Monanthochloë littoralis*, and the Beach Morning Glory (*Calystegia soldanaella*) are now important in the strand makeup, and the annual *Cakile maritima* is commonly the last vascular plant to seaward before submergents are encountered. On dunes north of San Diego one may find the introduced Beachgrass (*Ammophila arenaria*).

Although the number and variety of sandpipers, gulls, stilts, plovers, and other shorebirds during migration and in winter is especially large in this habitat, the numbers of nesting species that use such places in the Southwest is not. Furthermore, many of these are now, because of human disturbance, confined to islands and the few available remote sites. In the Southwest, some of the most common or indicative species are:

<i>Charadrius alexandrinus</i>	Snowy Plover
<i>Endomychura hypoleuca</i>	Xantus' Murrelet
<i>Haematopus bachmani</i>	Black Oystercatcher
<i>Larus occidentalis</i>	Western Gull
<i>Phalacrocorax auritis</i>	Double-crested Cormorant
<i>P. penicillatus</i>	Bran's Cormorant
<i>Sterna albifrons</i>	Least Tern
<i>Thalasseus elegans</i>	Elegant Tern

Some of the rockier headlands and offshore habitats support rookeries of California Sea Lion (*Zalophus californianus*), and sand bars, reefs, and spits are calving sites for the Harbor Seal (*Phoca vitulina*). Two former breeding pinnipeds of the mainland strand of southern California and



Figure 177. Californian maritime strand at Scammon's Lagoon, Baja California del Norte, Mexico. These "mud flats" at low tide at first appear unvegetated, but closer inspection reveals prostrate seagrasses, diverse algae, and other plant life in addition to a rich, depression- and burrow-inhabiting invertebrate and vertebrate fauna.

northern Baja California, the Elephant Seal (*Mirounga angustirostris*) and Guadalupe Fur Seal (*Arctocephalus townsendi*), are making a comeback and are now in the process of reoccupying many of their former breeding islands (Hubbs et al., 1965, 1968). These large animals, plus other mammals and fishes, provided carrion in strand areas which served as food for special raptors such as California Condor (*Gymnogyps californianus*).

Rocky bays, shorelines, and tidepools of the California coast support a diversity of fishes (Miller and Lea, 1972; Fitch and Lavenberg, 1975). Bay, Rockpool, and Mussel Blennies (*Hypsoblennius gentilis*, *H. gilberti*, *H. jenkinsi*) are common, as are clinid blennies (*Gibbonsia* spp.), and cottids or sculpins (*Clinocottus analis*, *Oligocottus rubellio*), Zebra and Bluebanded Gobies (*Lythrypnus zebra*, *L. dalli*), Yellowfin Goby (*Acanthogobius flavemanos*), and the unique Blind Goby (*Typhlogobius californiensis*) that lives in close-spaced habitats beneath rocks. Clingfish (*Gobiesox meandricus*) occur on wave-washed rocks and can withstand several hours out of water if in a moist place. The Rockweed Gunnel (*Xerxerpes fucorum*) was said by Barnhart (1936) to move freely over stones or sand out of water at low tides.

Shore fishes that move into strand areas at high tide include Needlefish (*Strongylura exilis*), Jack Smelt (*Atherinopsis californiensis*), White Seabass and Orangemouth Corvina (*Cynoscion nobilis*, *C. xanthurus*) and Yellowfin Croaker (*Umbrina roncador*). Other species are more common in bays,

e.g., Cabezón (*Scorpaenichthys marmoratus*), Silver Mojarra (*Eucinostomus argenteus*), or have young that inhabit rockpools and adults that move to deeper, inshore areas: Gopher Rockfish (*Sebastes auriculatus*), Black-and-Yellow Rockfish (*S. chrysomelas*), and Opaleye (*Girella nigricans*). The unique surfperches (Embiotocidae) of the California coast live in shallow bays and along sandy shorelines. This live-bearing group includes numerous species (Tarp, 1952), among which the Shiner and Silver Surfperches (*Cymatogaster aggregata*, *Hyperprosopon ellipticum*) are perhaps most familiar; one species of this large group is freshwater (Tule Perch, *Hystero-carpus traskii*) in the Sacramento-San Joaquin system north of our area. Perhaps the most indicative strand fish of southern California is the Grunion (*Leuresthes tenuis*), which reproduces at high tide in spring and summer. The female buries in the sand, tail down to its pectoral fins. Eggs are spawned and fertilized by sperm that moves through the sand. The eggs remain for 2 weeks longer, until dislodged by the next series of high tides, and embryos break free upon contact with water. Other, related species such as Jack Smelt spawn on eelgrass within the zone of the lowest tides.

Soft bottoms in bays are inhabited by similar shoreline fishes at high tide, and by cryptic forms as Worm-hole or Shadow Goby (*Quietula y-cauda*) that inhabits burrows of invertebrates, or Arrow Goby (*Clevelandia ios*) and Longjaw Mudsucker (*Gillichthys mirabilis*) that persist at low tide in shallow depressions or holes in wet mud.