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## Tidepool Ecology & Common Organisms

### Intertidal Zonation Patterns

The rocky intertidal is the portion of a rocky coastline that is periodically covered or exposed by daily tidal changes. This interface is a complex environment where species are well adapted to the changing habitat conditions. Conditions are more terrestrial higher in the intertidal and correspondingly more marine in the lower intertidal area, depending on the amount of exposure the area receives. This range of environmental conditions influences the species that are able to adapt to changing habitat variables and these environmental conditions are in part responsible for the unique zones within the intertidal that are highly visible by the dominant species that occur in each area or "zone." These dominant species create stripes that take the color and texture of the dominant or "characteristic" organism of that zone (Niesen 1982).



#### The Splash Zone

The splash zone is the area above the high tide water line and mainly depends on sea spray and mist for water coverage. The characteristic species of the splash zone are the little acorn barnacles (*Cthamalus dalli*), sea lettuce (*Ulva sp.*) and the periwinkle snail (*Littorina sp.*). All species are adapted to withstand long periods of exposure.

#### The High Zone

The high zone is the area of intertidal that is covered by most high tides. This zone is characterized by the larger acorn barnacle (*Balanus glandula*), but a large number of limpets and chitons also call this "zone" home. At our local sites two species of rockweed *Selvetia compressa* and *Hesperophycus harveyanus* are commonly observed in the high intertidal zone.

#### The Mid Zone

The mid zone is characterized by the three highly recognizable intertidal species the seastar (*Pisaster sp.*), the mussel (*Mytilus californianus*) and the gooseneck barnacle (*Pollicipes polymerus*). The mussel beds provide the characteristic texture and color for this zone.

#### The Low Zone

The low tide zone is mixed with organisms that can be found in both the intertidal and subtidal habitats and is characterized by the large fleshy brown algae that begin to appear in this zone. Several algae species are common, but the characteristic brown algae of the low zone are the feather boa (*Egregia menziesii*) and the sea palm (*Eisenia arborea*). The low intertidal zone provides more food, shelter and protection from desiccation than the other intertidal zone and is therefore inhabited by a greater number of species.

### Common Intertidal Organisms (What Sea Life did you see in the Tidepools Today?)

**HERMIT CRAB – PAGARUS SP.** The two *Pagarus* species that are common to our tidepools are the hairy hermit crab (*Pagarus hirsutiusculus*) and the blue banded hermit crab (*Pagarus samuelis*). Both have a distribution range from Alaska to Baja California. The blue banded is the most common and as its name implies is identified by the bright blue bands on its appendages. Both species have a carapace up to ¾" and often take shelter in *Tegula* shells. Hermit crabs forage on both plants and animals.



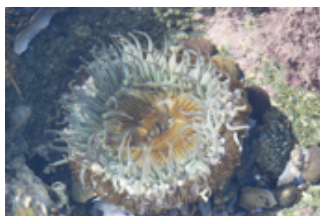
**BARNACLES – *CHTHAMALUS DALLI* AND *BALANUS GLANDULA*** These barnacles range from Alaska to southern California and dominate the high intertidal zone along with *Cthamalus dalli*. *Balanus* barnacles are distinguishable from *Cthamalus* barnacles, by both their larger size (to  $\frac{3}{4}$ " in diameter and  $\frac{3}{8}$ " high) and the diamond shape of the operculum. Barnacles are sessile arthropods that attach themselves permanently to the substrate and filter feed with their adapted appendages called cirri.



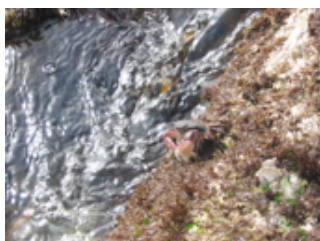
**ROCKWEED – *SILVETIA COMPRESSA*** This brown alga is common in our mid intertidal zone and has a range from British Columbia to Baja California. It is normally 16" in length but can grow to 36" inches tall and is characterized by its dichotomous (fork) branching. In areas of high human activity this species can be less abundant and smaller in size due to trampling. At the end of the branch tips are the reproductive bodies that swell in size in mature individuals. This species provides excellent habitat for various gastropods and crab species.



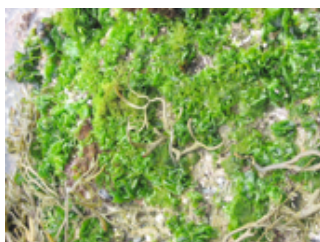
**BLACK TURBAN SNAIL – *CHLOROSTOMA FUNEBRALIS*** Four turban snail species are common in our local tidepools, but the most abundant are the black turban snail (*C. funebris*). These gastropods have a black-purple shell with four whorls and grow to  $1 \frac{1}{4}$ " diameter. They have a range from British Columbia to Baja California. These turban snails eat only soft algae, and are believed to live up to 100 years.



**SEA ANEMONE – *ANTHOPLUERA SP.*** Two *Anthopleura* species are common to local tidepools, the aggregating anemone (*A. elegantissima*) and the solitary anemone (*A. sola*). The two species are very similar; the aggregating anemone (*A. elegantissima*) will be found with other anemones within tentacle reach of one another and range from 6 – 10 cm. *A. sola* can reach up to 25 cm in diameter and will always be solo, often submerged in tidepools. Anemones have evolved numerous adaptations to survive life in the intertidal. These organisms provide an excellent model for children exploring adaptations for dealing with desiccation, consumption, predation, wave exposure.



**SHORE CRAB – *PACHYGRAPSUS CRASSIPES*** These common crabs to any southern California rocky environment have a range from Oregon to Baja and can grow to  $1 \frac{3}{4}$ " wide at the carapace. The crabs can be found underwater in tidepools, hidden in rockweed beds, or deep in the back of a crevice. Their primary food is algae, but they have been known to feed on diatoms, hermit crabs, gastropods and have even been known to catch kelp flies with their claws. This indigenous crab of North America was introduced to Asia in the late 1800s.



**SEA LETTUCE – *ULVA SP.*** These green algae are tolerant of a wide range of environmental conditions and the numerous species found in southern California have a large range from the Bering Sea to Chile. *Ulva* can be found in all intertidal zones, but is most commonly found in the higher zones. *Ulva* species have been eaten by various cultures, either served with fish or in light soups.



**CALIFORNIA MUSSEL – *MYTILUS CALIFORNIANUS*** The California mussel is the characteristic organism of the mid intertidal zone and can often be seen in large beds covering much of a rocky platform. The range of this species is from Alaska to Baja and individuals of these bivalves have been known to grow to 10" in length. Mussel beds form a very important habitat for other critters and it has been reported that over 1000 species have been found living within these mussel bed habitat created by the California mussel. Mussels have numerous natural predators, but often are disturbed and collected by humans for bait, aquaria or killed through incidental trampling.



**LIMPETS – *LOTTIA SP.*** There are numerous limpet species (6-10) in our local intertidal and can be readily identified in almost all zones. Limpets are gastropods that forage on algae with their scraping tongues known as radulas. These grazers have a home territory, often with a scar or depression made in the rock that they return to after foraging. Our largest Lottia species the owl limpet (*Lottia gigantea*) can grow up to 110 cm shell length, but are often much smaller than this in local areas due to human disturbance. and reproduction.



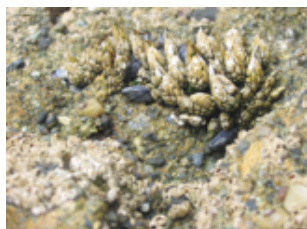
**KELP SNAIL – *NORRISSA NORISSA*** These gastropods are primarily found in southern California and Baja, and can grow up to 2 ½" in diameter. The kelp or norris snail is easily identifiable being larger in size than most intertidal gastropods and has a bright orange foot. The snail is usually found on brown algae, especially the giant kelp (*Macrocystis pyrifera*) and the feather boa kelp (*Egregia menziesii*), where it feeds on these species moving down the algae during the day and returning to higher levels at night.



**CHITONS – *NUTTALINA FLUXA*** There are several species of chiton in southern California but the most abundant is the Southern Spiny Chiton (*Nuttalina fluxa*). Chitons are mollusks that can be identified by the eight interlocking shells that are held together by an oval of tissue referred to as the girdle. Unlike most chitons this species is not light sensitive and does not retreat under rocks or Rockweed during the day. Chitons feed on algae at night and often can be found in eroded pits (similar to *Lottia* home scars) during the day.



**CORALLINE ALGAE – *CORALLINA SP.*** Two species of this genus are extremely common in Orange County intertidal areas, and have a long range found from Alaska to Chile. The articulated red algae often appears pink to purple in coloration and forms large turf type beds in both tidepools and bedrock benches. Although an algae, it derived its name due to the precipitation of calcium carbonate from the water column. When exposed to long periods of sunlight these species get bleached white exposing the calcium carbonate.



**GOOSENECK BARNACLE – *POLLICIPES POLYMERUS*** The gooseneck barnacle is part of the trio of organisms commonly found in the mid intertidal, the California mussel, the ochre seastar and the barnacle. These barnacles are larger in size (up to 4" long) than other southern California species and have a distinct neck (stalk or peduncle) that leads to a cream colored plate. It is said they derived their common name by a misunderstanding of medieval monks who believed that geese actually hatched out of these intertidal creatures. Served with butter they are known as a delicacy through out the Mediterranean.



**PURPLE SEA URCHIN – *STRONGLYOCENTROTUS SP.*** Two species of *Stonglyocentrotus* are found in Orange County tidepools, the purple sea urchin (*Stonglyocentrotus purpuratus*) and the red sea urchin (*Stonglyocentrotus fransiscus*). The purple urchin is more common and are about the size of a golf ball, where as the red urchin has longer spines, is about softball size (to 6 ½") and is usually a dark merlot color. Both species have a range from Alaska to Baja. These urchins feed primarily on brown algae and often concentrate their efforts on the holdfast of the kelp. There is a commercial dive industry for the red urchin and the gonads are commonly served in Japanese restaurants.





**SAND CASTLE WORM – *PHRAGMATOPOMA CALIFONICA*** Sand grains are cemented together by these worms to form a distinctive honey comb patterned colony, these colonies have been known to reach 6 feet in size. Individual organisms can grow to 2" in length and the range of this organism is from Central California to Ensenada. These sessile organisms are filter feeders that open their operculum to capture detritus and plankton with their distinctive black bristles. They possess a special organ that coats captured sand with cement used for building their tubes.



**SEA FINGERS OR DEAD MAN'S FINGERS– *CODIUM FRAGILE*** This distinctive green algae is common in the mid to low intertidal zone and can also be found in large tidepools. These algae can grow up to 16" and are identified by its dark green velvety cylindrical branches that arise from a central basal disc. Despite its large size, this species is actually a multinucleate "single celled" algae – its single celled because during cell division, the nuclei multiply but no new cell walls are created as occurs during most cell division. This species is very rich in vitamins and minerals and is often used in soups. A small red alga, staghorn fringe (*Ceramium codicola*) can only be found living on this green algae.



**SEA HARE – *APLYSIA CALIFORNICA*** This marine snail varies in reddish to brown coloration, can grow up to 16" in length and is found from the low intertidal to 60' of water. Sea hares derive their name from the two antennae that is said to resemble rabbit's ears. These snails forage on red algae, and use the pigments to create its defense mechanism. When *Aplysia* are disturbed they excrete a purple ink that may confuse, paralyze or offend its predator. Sea hares are hermaphrodites, having both male and female organs, but must locate a mate to reproduce. These critters have been used extensively in nerve research due to the large size of their ganglia (nerve styles).



**GIANT KEYHOLE LIMPET – *MEGATHURA CREMULATA*** The highly distinct limpet is large in size (5-10"), has a large soft body that ranges in color from beige to black and at the apex of the shell a central oval opening (much like a volcano) permits the organism to take care of its business. The giant keyhole limpet has a species range from Monterey Bay to Baja and can be found in the low intertidal zone. The shells of this limpet were once used as currency by native Americans of southern California.



**OPALEYE PERCH – *GIRELLA NIGRICANS*** Opaleye Perch are one of two common fish species found in our local tidepools. The opaleye are said to use the intertidal as a nursery, using the shallow area as a protective breeding ground until juveniles reach about 8" when they head to the subtidal. Juvenile opaleye can breathe air when a tidepool is completely exposed. Adult opaleye eat algae while juveniles are known to be carnivorous, feeding on small invertebrates in the tidepools.



**WAVY TOP TURBAN – *MEGASTRAEA UNDOSA*** The wavy top turban is one of the larger gastropods found in the Orange County intertidal zone and can range in size from 4 – 6" in shell diameter. The range of this organism is from Point Conception to Baja and they can be found in the low intertidal to 60' of depth. *Megastreaea* possess a heavy shell with a distinctive tear dropped shaped white operculum that is often found washed ashore after storms.

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PO Box 5247, Laguna Beach, CA 92652-5247

[lagunaoceanfoundation@gmail.com](mailto:lagunaoceanfoundation@gmail.com)