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# *Apostichopus californicus*

California Sea Cucumber, Giant Red Cucumber

Phylum: Echinodermata  
Class: Holothuroidea  
Order: Aspidochirotida  
Family: Stichopodidae

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**Taxonomy:** *Apostichopus californicus* was first described as *Holothuria californica* by William Stimpson in 1857. Synonymized names include *Stichopus californicus* and *Parastichopus californicus* (WoRMs, 2021).

## Description

**Size:** *Apostichopus californicus* can measure up to 50 cm long (Lambert 1997). This sea cucumber is considered the largest of the sea cucumbers on California shores (Morris et al. 1980).

**Color:** The dorsal and lateral surfaces of *A. californicus* are typically dark red, brown, or yellow (Morris et al. 1980). They can also sometimes be pinto or albino (Strathmann 1987).

**Body:** The body is cylindrical. The skin is leathery and has stiff, conical papillae on the dorsal side (Fig. 1). The mouth is at the anterior end, and the anus opens into a posterior cloaca (Lambert 1997).

**Mouthparts:** A circle of 20 peltate feeding tentacles surrounds the sub-terminal mouth (Lambert 1997).

**Tube Feet:** Tube feet are densely arranged on the ventral side of the body (Morris et al. 1980). There are numerous rows of them, and they are robust and usually lighter in color than the dorsal side (Lambert 1997).

**Skin Ossicles:** Ossicles on this cucumber are disks with a diameter of 72-92  $\mu\text{m}$  and a spire with 11-19 spines. They are large oval plates with two rows of holes running lengthwise (Lambert 1997).

**Respiratory Trees:** Respiratory trees are sometimes called water-lungs and are structures that bring oxygenated seawater into the body. They allow for gas exchange across the thin surface, and the rhythmic inflation and deflation of the respiratory trees is accomplished through the posterior cloaca (Harrison 1994).

**Sexual Dimorphism:** No sexual dimorphism has been noted. Sexes can be best

distinguished through dissection and removal of the gametes (Strathmann 1987).

## Possible Misidentifications

*Apostichopus californicus* used to be sometimes confused with *Stichopus fuscus* (IUCN 2010). It has also been confused with *Parastichopus leukothele*, distinguished by its bright orange skin and rusty-brown patches. It usually lives at greater depths, and the papillae are small and white (Lambert 1997). *Synallactes challengerii* is also similar in appearance but smaller and usually gray with a purple or pinkish color and long, slender papillae (Lambert 1997).

## Ecological Information

**Range:** *Apostichopus californicus* is usually found from British Columbia, Canada, to Isla Cerdos in Baja California and Northern Mexico (Morris et al. 1980).

**Local Distribution:** Rocky subtidal habitat. OIMB classes frequently collect this species around the Cape Arago rocky reef. Individuals are also occasionally found on the floating docks in the Charleston Marina.

**Habitat:** *Apostichopus californicus* usually stays on rocky shores in areas protected from strong wave action and on pilings in open bays (Morris et al. 1980). They frequent rocks in the low intertidal and subtidal waters as well as sand-shell, kelp, and sand substrata (Strathmann 1987).

**Temperature:** Unknown.

**Depth:** *Apostichopus californicus* occurs from 0-249 meters (Lambert 1997).

**Associates:** This cucumber can frequently be found with the commensal scale worm *Arctonoe pulchra* (Morris et al. 1980). This scale worm is often the same color as its host and is attracted to the host's smell. It is uncommon in California but may be found on *A. californicus* from the Gulf of Alaska to Baja California, Mexico (Cowles 2006). Ciliated protozoans may be found living in the

respiratory trees of *A. californicus* (Morris et al. 1980). The flatworm *Anoplodium hymanae* has been seen within the body cavity, and another flatworm, *Wahlia pulchella*, is found in the upper intestines. The parasitic gastropod, *Enteroxenos parastichopoli*, can also be seen attached to the intestines as elongated coils. The parasitic snail, *Vitriolina columbiana*, adheres to the external surface and penetrates the skin, where it sucks out the internal fluids (Lambert 1997).

**Abundance:** It is difficult to determine the exact abundance of this species. They are listed as species of least concern by the IUCN, and density estimates from almost all surveys are significantly higher than the conservative estimate of 5.08 sea cucumbers per meter of shoreline (IUCN 2010).

### Life-History Information

**Reproduction:** Adult *A. californicus* reach sexual maturity after four years and will typically migrate to shallow waters to spawn from late April to August (Lambert 1997). The ripe ovary is plump, and a translucent, glassy orange color; testes are white (Strathmann 1987). During spawning, *A. californicus* will lift the anterior one-third to one-half of the body in a cobra-like manner and release strings of white sperm or light orange eggs from the gonophore just behind the dorsal tentacles (Lambert 1997). The eggs are small and negatively buoyant. Fertilization occurs in open water, and large females typically have fecundities up to  $8.92 \times 10^6$  (Strathmann 1987).

**Larva:** *Apostichopus californicus* is the only local species with pelagic planktotrophic development in which a feeding larva develops in the plankton (Strathmann 1987). This development includes a feeding auricularia larva that swims from 35-52 days (Strathmann 1987). The larva has a light-yellow tint on the ciliary band and has irregular star-shaped ossicles in the left posterolateral lobe. At 20-23°C, the pelagic period to settlement can be as brief as only 14 days long (Strathmann 1987).

Metamorphosis of the auricularia may begin at about 65 days after fertilization or delayed upwards of another 60 days (Cameron and Fankboner 1989). This auricularia then forms into a doliolaria and then a pentactula before becoming an adult cucumber (Cameron and

Fankboner 1989). Some doliolaria larvae swim up in the water column, but most remain on the bottom of a dish when observed in the lab (Strathmann 1987).

**Juvenile:** Newly settled and growing pentactulae are quite active and can move, feed, and excrete waste. About 90 days after settlement, cloacal pumping is observed, suggesting that respiratory trees are present and functional. These juveniles can also sometimes be seen propped on their single tube foot and waving around their tentacles (Cameron and Fankboner 1989). Juveniles of *A. californicus* that are less than one year old and less than 1 cm in length are seldom encountered in situ and are difficult to study outside of a laboratory setting (Cameron and Fankboner 1989). Settling larvae likely attach to undersides of rocks in calm coves, bays, and fjords as this is where the juveniles that are found are typically discovered. They can also sometimes be found in dense mats of red algae and on tubes of polychaete worms (Strathmann 1987).

**Longevity:** Life in the plankton as a larva is considered hazardous, and juveniles face many challenges for survival and typically experience larval mortality (Cameron and Fankboner 1989). Those that survive to adulthood usually live up to 12 years, and most cucumbers are found after their first 3 years of life (IUCN 2010).

**Growth Rate:** Growth of a recently settled juvenile appears to result from the lengthening of the body in the anterior direction. A single tube foot is typically present on the ventral surface at settlement in these cucumbers. As they continue to grow, this primary tube foot remains in the terminal position near the anus. Soon after, additional tube feet appear anteriorly. After the end of the first year post settlement, a small cluster of tube feet appear terminally around the primary tube foot (Cameron and Fankboner 1989). Mature animals are less than 4.5 years old (Cameron and Fankboner 1989).

**Food:** *Apostichopus californicus* typically eats organic detritus and small organisms that it ingests with bottom sediments (Morris et al. 1980). It uses its mop-shaped tentacles to grasp food and then retracts them into the mouth (Lambert 1997).

**Predators:** Tests with fishes indicate that this sea cucumber has a body that does not store

toxic substances as a defense method like some tropical cucumbers (Lambert 1997). It is sometimes eaten by several sea star species, including *Pycnopodia helianthoides* and *Solaster endeca*. When it comes in contact with *P. helianthoides*, the cucumber will rear back and flex violently to escape the sea star (Lambert 1997). It is also eaten by some sea otters and occasionally people. A closely-related sea cucumber, *Stichopus japonicas*, is frequently eaten in Japan by humans (Morris et al. 1980).

**Behavior:** When disturbed, *A. californicus* will sometimes contract and squirt a powerful flow of water from their posterior end (Morris et al. 1980). Additionally, these cucumbers can eviscerate and regenerate their internal organs. A population of these animals in Puget Sound, WA has been observed to eviscerate in October and November and regenerate new organs shortly after. However, the viscera may be expelled at other months if the animal is being kept in warm or stale water, usually in a laboratory setting (Morris et al. 1980). Lambert (1997) suggests that these animals do not eviscerate; instead, they resorb their internal organs during their dormant phase and regenerate them during the winter. *Apostichopus californicus* also moves randomly along the ocean bottom and can move up to 3.9 meters a day. As with many other cucumbers, it ceases feeding and becomes dormant between September and early March (Lambert 1997).

## Bibliography

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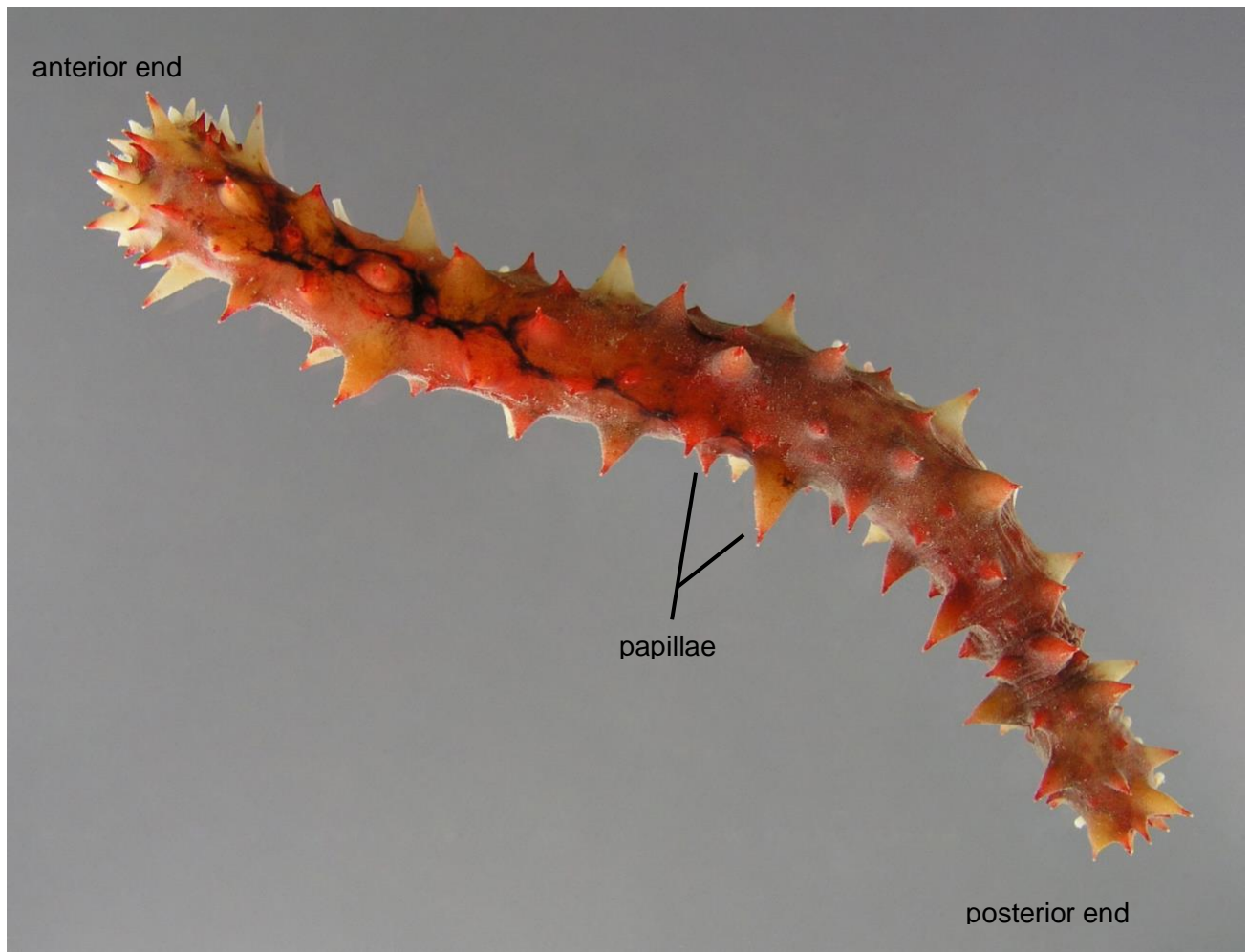


Fig. 1. Adult *Apostichopus californicus* with retracted feeding tentacles. Photo by B. Bingham.