

## The Role of Echinoderms in Coral Reef Communities

Certain species of echinoderms have broad-scale effects on entire coral reef communities, more so than any other particular species of invertebrate or fish. The echinoderms with the most influence in coral reef communities are generalists, adaptable to a variety of situations, with behavioral, distributional, and dietary adaptability.

Here is a summary of the ecology of coral reef echinoderms.

- Crinoids are the most conservative of coral reef echinoderms; they have apparently always fed on plankton and particulate material in the water column as passive suspension-feeders throughout their evolutionary history. No qualitative effect on coral-reef communities has been observed to result from the presence, abundance or absence of crinoids.

- Asteroids on coral reefs all extrude their stomachs over sessile or encrusting organisms, small motile invertebrates, and probably organic detrital material. *Acanthaster planci* (crown-of-thorns sea star) is the only coral-reef asteroid known to cause major second-order and third-order effects on coral-reef communities. The first-order effect of predation on corals is reduction in abundance and surface cover of living corals. One of the third-order effects on the coral-reef community by crown-of-thorns sea star is the increase in carrying capacity of the reef for herbivorous reef fishes. As a result of (crown-of-thorns sea star predation on corals, algae colonize the newly opened substrata, and the herbivorous fish population may increase over a period of years.

- Ophiuroids (brittle stars) feed on material in the water column and on the substrate. The influence of brittle stars on coral-reef communities has yet to be tested.

- Echinoids (urchins) have the broadest diets of any of the groups of echinoderms on coral reefs. Echinoids are opportunistic, promiscuous, generalized feeders, whose diets are typically determined to a large degree by what is available at the time and place at which the feeding is observed. Grazing by echinoids has major biological and geological effects on coral reef communities. The qualitative and quantitative nature of these influences vary greatly among taxa of echinoids, among geographic regions, and among local sites. Direct biological effects include an alteration of the abundance, distribution, and community structure of plants and animals, as well as an increase in rate of primary productivity. Direct geological effects include sediment production, erosion of carbonate rock and, in certain cases, limitation of coral reef growth. Second-order biological effects include alteration of foraging behavior of herbivorous fishes and, possibly, alteration of the abundances of herbivorous fishes and invertebrates and a change in community trophic structure. Second-order geological effects may be the toppling of coral heads through weakening of their basal structures, loosening of sediments, and facilitating the influences of wave action.

- Holothuroids (sea cucumbers) collect food with mouth tentacles. Nearly all are deposit feeders and are segregated more on the basis of distribution than by the type of food selected. Coral reefs are widely recognized as being very productive, often surrounded by low productivity seas, so the recycling of nutrients by sea cucumbers is an important characteristic of the ecosystem.

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