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## ISOPODS AS PARASITES OR ASSOCIATES OF FISHES

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Isopoda is an order within Crustacea. The term “isopod” refers to all legs (i.e., “pods”) being approximately similar in size and shape (i.e., “iso”). Isopods are common in most environments, including dry land. Isopods parasitize fishes, crabs, shrimp, and even other isopods. Fish-associated isopods vary from accidental (the cirrolanids), temporary or casual (the corallanids and aegids), to permanent (the cymothoids) parasites. When infecting fishes, they attach in a variety of locations including the skin, gills, inside the mouth, on the fins, and some even burrow under the skin to form a capsule in the flanks of the fish. Isopods consume a broad range of food. The fish-associated forms feed on blood or ooze from wounds and the wounds isopods cause may provide entry points for microbial pathogens. Isopods kill, stunt, or otherwise damage commercially important fishes. For example, approximately 9.4% of Chub Mackerel, *Scomber japonicus*, along the Peruvian coast are parasitized by *Ceratothoa guadichaudii*, and this isopod causes a 15% loss in host body weight and cost Peruvian fishermen approximately 1.3 billion kg of fish annually. This unfortunately is not an isolated case as many isopods cause significant losses to commercial fishes. *Cymothoa oestrum* can cause superinfections in caged fishes in the Caribbean. Sea gnats (i.e., larval gnathiid isopods) also kill cage-cultured eels and salmonids. Epicaridean isopods damage commercially important crustaceans, including shrimp, and these isopods may be recognized as being more important as more crustacean species are cultured.

A few fish-parasitic isopods actively swim after and bite humans, sometimes in frightening mass attacks, but bites are more likely to occur when handling infected fishes. Free-living isopods are reported to clean *Saprolegnia* spp. (water mold) from fishes. In Puerto Rico, *Anilocra* spp. are dried and used to make a tea to treat colds, and New England fishermen use “salve bugs” (*Aega* spp.) for medical purposes. Isopods are eaten by a variety of animals. Giant isopods, *Bathynomus* spp., are fished commercially for human food in Japan and Mexico, and Hawaiians eat a smaller species. The presence of parasitic isopods on marine tropical fish-

es allegedly indicates that they do not contain high amounts of ciguatera (fish poisoning) toxins. This has not been scientifically validated, but is highly interesting, particularly since large Greater Barracuda, jacks, and some groupers commonly implicated in ciguatera poisoning often have attached isopods.

Approximately 4000 species of isopods have been described, and more than 450 of these species are known to associate with fishes. They vary from 0.5 mm to 44 cm long. The World's largest isopod, *Bathynomus giganteus*, is found in the Caribbean Sea and western Atlantic Ocean. The head of an isopod is fused with the first thoracic segment to form a cephalothorax, they have a 7-segmented thorax, and a 6-segmented abdomen, which is often fused into two to five segments. One pair of thoracic appendages is modified as mouthparts, and seven pairs are unmodified. The abdomen has six pairs of appendages, and ends in a terminal, often shield-shaped segment called the pleotelson. Eggs, larval forms, and juveniles develop either in a brood pouch beneath, or in pouched in, the abdomen of the female. Most isopods possess free-swimming juveniles that develop into parasitic adults, but gnathiid juveniles parasitize the gills and skin of fishes and are free-living as adults. Sexes are separate in most isopods, while some species begin life as males and later become females (i.e., protandry).