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Barnacles

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“Barnacle” is the common name for over 1000 marine species of the subclass Cirripedia. Barnacles are unique among crustaceans in being permanently attached as adults to a variety of inanimate and animate objects. They occur in polar, tropical, and temperate waters, being found from high on the shore to the depths of the ocean. The principal superorder is Thoracica, consisting of stalked (order Pedunculata) and sessile (order Sessilia) barnacles (Newman, 1996). Perhaps as many as 20 living barnacle species have some association with marine mammal species, primarily cetaceans (Newman and Ross, 1976). Barnacles attached to marine mammals are often referred to as ectoparasites; however, in actuality, they do not feed on their hosts, but use them as a moving substratum from which they can strain plankton from the passing water. As a result, “epizootic” is often considered a more appropriate term describing the barnacle’s lifestyle. This has been described as an example of symbiosis, usually commensalism, but barnacles create drag and can cause irritations. Therefore, they are perhaps best termed “semiparasitic,” since they survive and perpetuate themselves at the host’s expense. On the other hand, some marine mammals eat barnacles or their larvae.

I. Life History

Barnacles were described by Louis Agassiz and T. H. Huxley as nothing more than “a little shrimp-like animal, standing on its head in a limestone house and kicking food into its mouth” (Hoover, 2006). The barnacle’s life cycle usually includes six free-swimming planktonic naupliar stages that feed while progressing by molts to the cypris or cyprid stage, which searches for a place to settle. When settling, to anchor itself, the cyprid secretes cement from its antennules, from glands located in their base, and metamorphoses by molting into a juvenile, which begins to secrete adult cement and the calcareous plates that usually constitute its home. In the case of barnacles that attach directly to cetacean skin, a chemical cue from the host tissue likely induces larval settlement (Nogata and Matsumura, 2006).



Figure 1 The pseudo-stalked sessile barnacle *Xenobalanus* attached to the dorsal fin of a bottlenose dolphin. Courtesy of V. Thayer and K. Rittmaster, North Carolina Maritime Museum.

Through an opening between the plates, six pairs of feathery thoracic limbs (cirri) can emerge and spread out to sweep through the water like a net to entrap planktonic organisms. Most barnacles are hermaphrodites (i.e., individuals possess the reproductive structures of both sexes). The breeding season of barnacles that cling to whales is probably largely synchronous with that of the whales’ breeding season.

II. Sessile Barnacles

The Sessilia, or sessile barnacles, are stalkless, the usually well-articulated shell wall being attached directly to the substratum. Because of their superficial resemblance to acorns of oak trees, they are called acorn barnacles. Marine mammals host species of *Amphibalanus*, *Balanus*, *Cetopirus*, *Chelonibia*, *Coronula*, *Cryptolepas*, *Platylepas*, *Tubicinella*, and *Xenobalanus*. *Xenobalanus* superficially resembles a stalked barnacle since it has developed an aberrant pseudo-stalk, but it is nonetheless a sessile barnacle (Fig. 1).

III. Stalked Barnacles

The pedunculate, or stalked, barnacles are more primitive than the sessile barnacles. The terminal sac housing the appendages is called the capitulum. It is supported by a flexible, muscular stalk or peduncle attached to the substratum. The capitulum is usually protected by shell plates. *Conchoderma* spp., the goose barnacles (*Lepas* spp.), and rarely, the leaf barnacles (*Pollicipes* spp.), attach to marine mammals.

IV. Barnacles and Marine Mammals

Barnacles appear to settle in greatest numbers on large baleen whales, in contrast to toothed whales. Striped dolphins (*Stenella*

coeruleoalba) involved in a mass mortality event in the Mediterranean had an unusual abundance of barnacles likely due to the reduced movement and/or an impaired immune function of the skin of sick individuals (Aznar *et al.*, 2005). Orams and Schuetze (1998) demonstrated that *Xenobalanus* spp. were more prevalent on young than adult bottlenose dolphins (*Tursiops* spp.), presumably because they are less active and/or less resistant.

Cryptolepas rhachianecti, considered to be host-specific to the gray whale (*Eschrichtius robustus*), has been found on a killer whale (*Orcinus orca*) stranded in southern California and on belugas (*Delphinapterus leucas*) housed in San Diego Bay. *Xenobalanus globicipitus*, while world-wide in distribution, are almost always found on the trailing edges of the dorsal and pectoral fins and on the flukes of at least 27 cetacean species (Kane *et al.*, 2006; Fig. 1). What may remain of their wall in the skin of the host after death superficially resembles the

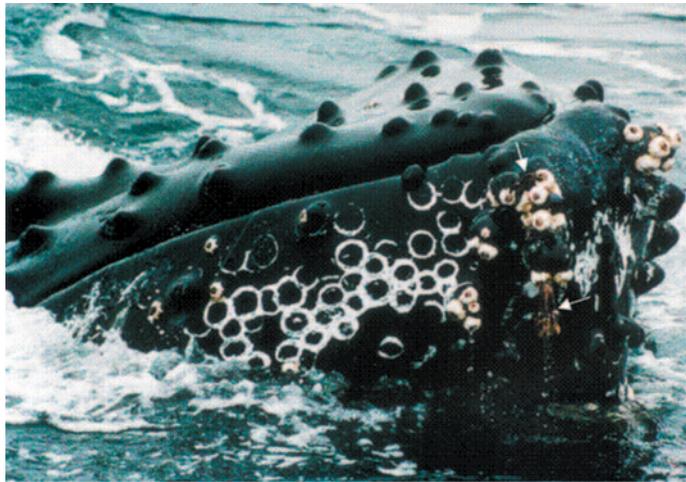


Figure 2 Humpback whale with the acorn barnacle *Coronula diadema* and a few stalked barnacles (arrows), *Conchoderma auritum* attached to them. Also visible are white-rim scars from acorn barnacles that have dropped or have been knocked off. Courtesy of Y. Ogino, off California, 1999.

wall of platylepas; this may account for a report (Mead and Potter, 1990) of platylepas on a bottlenose dolphin. *Tubicinella major*, which lives within a columnar shell opening at the surface of its host's skin, and usually found among callosities of southern right whale (*Eubalaena australis*), was once collected from the flank of a stranded northern bottlenose whale (*Hyperoodon ampullatus*). *Coronula* spp., the most generalized of the sessile whale barnacles, are large and generally attach to the skin of baleen whales (Scarff, 1986). *C. reginae* and *C. diadema* (Fig. 2) are commonly epizootics of humpback whales (*Megaptera novaeangliae*), attached to flukes, flippers, ventral grooves, genital slit, and the head (Clarke, 1966). *Cetopirus complanatus* closely resembles *C. reginae*, and both occur on the right whale (Scarff, 1986). Humpback males scrape each other with their barnacle-encrusted flippers (analogous to "brass knuckles") on the breeding grounds; one individual caught during whaling operations was reported to have as much as 450 kg of *Coronula* removed from it. On the other hand, various forms of grooming, including flipper-body grooming (Sakai *et al.* 2006), would likely remove freshly settled larvae and young juveniles; this may account for the lack of barnacles on the bodies of most small toothed whales.

Of the pelagic pedunculate barnacles, *Conchoderma auritum* and *C. virgatum* are commonly recorded from cetaceans, though *Pollicipes polymerus*, a rocky shore barnacle, was recorded on a humpback whale (Clarke, 1966). *Conchoderma* spp. require a hard surface for attachment. *Conchoderma auritum*, identified by its' rabbit ear-like appendages, may be found at a site where teeth are exposed and unprotected (Soto, 2001), such as on erupted teeth of adult male beaked and bottlenose (*Hyperoodon* spp.) whales (Fig. 3), or because of a malformation (including bone injury) in the jaw. *Conchoderma* spp. are less commonly found on baleen plates and were once collected from the penis of a stranded sperm whale (*Physeter macrocephalus*). *C. auritum* is often found attached to *Coronula* spp. (most commonly to *C. diadema*). *C. virgatum*, although sometimes attaching directly to a cetacean, is usually epizootic on other barnacles, and then most often on *C. auritum*. *C. virgatum* has been found on the parasitic copepods *Pennella* spp. and on the cyamid amphipod, *Neocyamus physeteris*, which crawls about on cetaceans and their barnacles (Clarke, 1966; Oliver and Trilles, 2000). *Lepas* spp. usually occur on floating objects, yet *L. pectinata* and *L. hillii* have been found between the teeth of some Mediterranean striped dolphins.

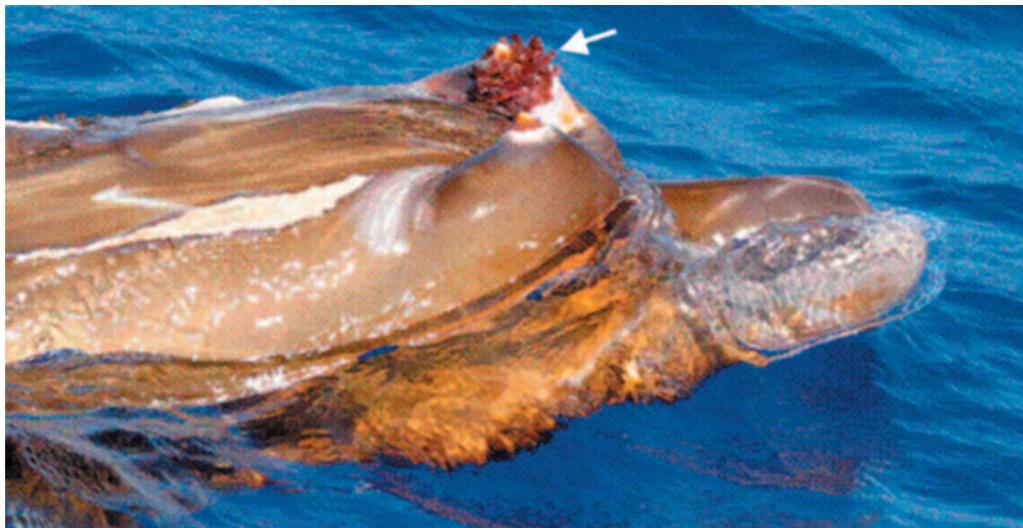


Figure 3 *Conchoderma auritum* (arrow) attached to the teeth of a Blainville's beaked whale (*Mesoplodon densirostris*) off Hawaii. Photo by Alice Mackay, courtesy Cascadia Research.

There are comparatively few published records of barnacles on pinnipeds, yet *Lepas pacifica*, *L. australis*, and *L. hillii*, as well as *Conchoderma auritum* and *C. virgatum*, are recorded from their dorsal body surface, attached to hair or even directly to the skin of various species, including both species of elephant seals (*Mirounga* spp.) (Best, 1971; Setsaas and Bester, 2006; Fig. 4).

Manatees (*Trichechus* spp.) may acquire acorn barnacles when in brackish or seawater, but when they enter fresh water the barnacles die and drop off, leaving temporary scars. The common barnacle found embedded in the skin of West Indian (*Trichechus manatus*) and West African (*T. senegalensis*) manatees is *Chelonibia manati* (Cintrón De Jesús, 2001), a close relative of its congeners on turtles. Moreover, turtle barnacles *Platylepas hexastylus* and *P. decorata* have been found on the dugong (*Dugong dugon*) and West Indian manatee. The brackish water species, *Amphibalanus amphitrite*, *A. eburneus*, *A. reticulatus*, and *A. improvisus*, and the marine species, *Balanus trigonus*, attach to the *Chelonibia* spp. on the manatees, rather than to their skin.

It is not surprising that some baleen whales eat barnacle larvae (Mayo and Marx, 1990) since the experimentally estimated filtering efficiency of 95% for plankton larger than 333 μm for the right whale (Mayo *et al.*, 2001) would include the larvae of pelagic and some coastal barnacles.

Sea otters (*Enhydra lutris*) in California and Alaska will eat the large acorn barnacles *Balanus nubilus* and *Semibalanus cariosus*. Fautot *et al.* (1986) reported otters feeding on *Pollicipes polymerus*, suggesting that they may be intentionally ingesting it if not simply being incidental to their take of mussels.

See Also the Following Articles

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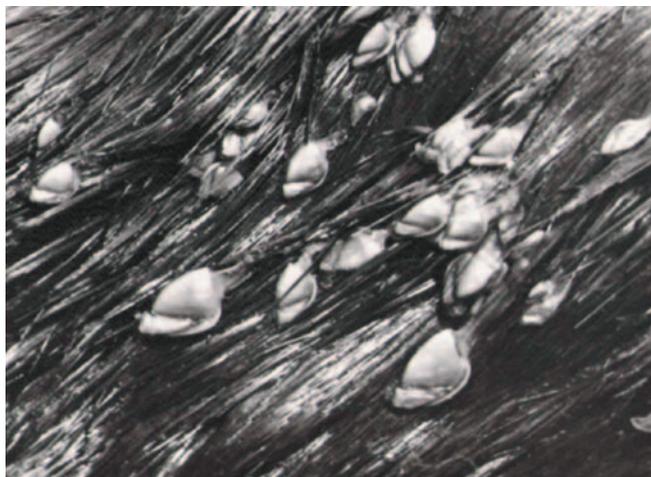


Figure 4 Goose barnacle (*Lepas australis*) attached among the hairs of a Subantarctic fur seal (*Arctocephalus tropicalis*). Courtesy of M. N. Bester.

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Basilosaurids

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Basilosaurids are a paraphyletic group of archaeocete cetaceans known from the late middle to early late Eocene of all continents except Antarctica. The family includes 11 species in 8 genera in 2 subfamilies, although some authors elevate the subfamilies