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CALLOSITIES

Victoria J. Rowntree

Callosities are patches of thick roughened skin on the heads of right whales (*Eubalaena*) (Fig. 1a). They were called abnormal growths by whalers but were renamed callosities by Matthews (1938) after their resemblance to the "callus" or thickened skin that occurs naturally in many plant and animal species. How whales use their callosities is not understood but whale biologists use them to identify right whales. In

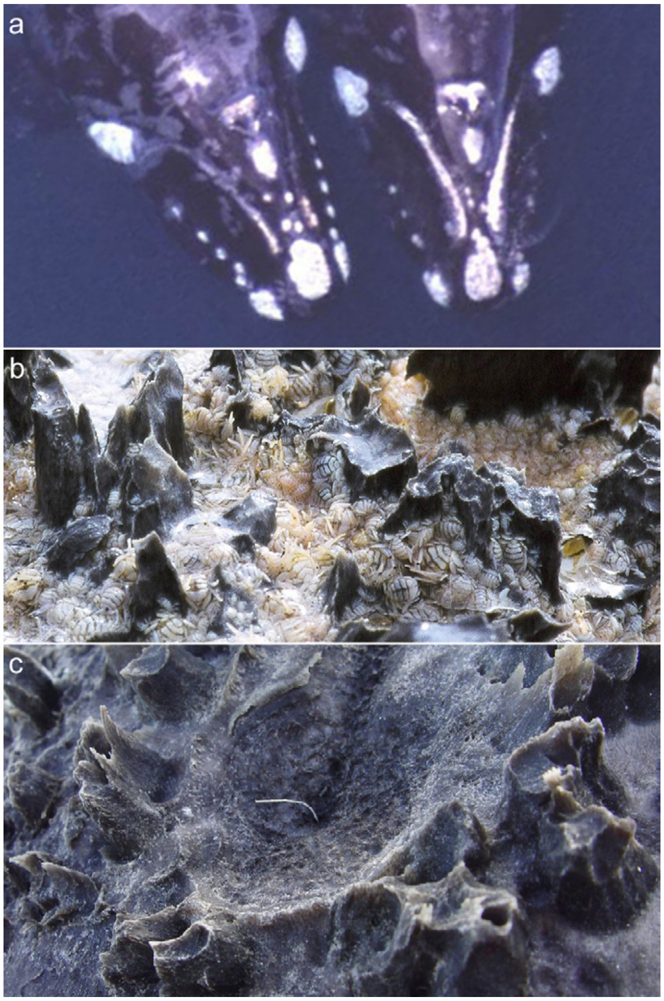

Figure 1 *(A) Two southern right whales with different callosity patterns (white patches) on their heads (Roger Payne, Ocean Alliance). (B) Close-up showing the oval bodies of individual cyamids and the dark horizontal bands of their body segments. Note how they tuck into crevices to avoid being washed off (Iain Kerr, Ocean Alliance). (C) A single sensory hair in the empty crater of a callosity on a dead whale (Mariano Sironi, Instituto de Conservación de Ballenas/Ocean Alliance).*

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1970, Roger Payne realized he could recognize individual right whales by the size, shape, and placement of the callosities on their heads (Payne et al., 1983). His goal was to follow individual whales throughout their lives and thereby accurately estimate demographic parameters (such as age at first reproduction and calving intervals) that are needed to determine population size and growth rates.

Callosities occur on the heads of right whales approximately in the same places that humans have facial hair: above the eyes (eyebrows), along the rostrum (upper jaw), between the blowholes and the tip of the snout (mustache), and along the margins of the lower lips and mandibles (beard). All right whales have large callosities over their eyes and on the front of their upper and lower jaws. Most individual variation occurs in the number and placement of small callosity islands along the rostrum and lower jawbones, the shape of the larger island in front of the blowholes, and peninsula-like projections on the posterior margin of the "bonnet," the large callosity on the front of the upper jaw. Callosity tissue is usually smooth at birth but roughens and splits as calves grow, much like the bark of a tree.

Callosities rise above the surface of the whale's skin. They are gray in color but appear white because they are blanketed with whale lice (cyamids) (Fig. 1B). Single rostral islands look like volcanoes with circular jagged ridges of callus tissue surrounded by valleys that often have single sensory hairs protruding above the ridges (Fig. 1C). Similar hairs are found in most mammals at some time in their ontogeny but are distributed only around the face in aquatic mammals (Ling, 1977; Drake et al., 2015). Baleen whales have many sensory hairs on their heads, but most odontocetes have only a few, if any (Ling, 1977). The sensory hairs in most baleen whales arise from funnel-shaped indentations in the skin. They are modified in humpback and right whales by being mounted on pedestals, looking like small round bumps (tubercles) in humpback whales and callosities in right whales. The pedestals may position the sensory hairs above the whales' boundary layer and thus make them more sensitive to changes in the density of small prey such as copepods and krill.

Unlike whiskers in terrestrial mammals, baleen whale sensory hairs are immobile. The root of each hair is highly innervated and surrounded by a complex of blood sinuses (Ling, 1977). Cross sections of hair sinuses in sei whales show that the corpuscles in the walls of the sinus are asymmetrically distributed with more corpuscles on the side of the hair that is opposite to the hair's direction (Nakai and Shida, 1948). The asymmetry suggests that the hairs may provide directional information about the whale's speed, direction of movement or gradients in prey density.

Callosities attract dense populations of cyamids that fill the craters and cover the sensory hairs. Could the cyamids interfere with the whale's sensory perception, or might their movements provide useful information to the whales? Skeleton shrimp, from which cyamids evolved, often stand on their hind legs to catch copepods, and cyamids in aquaria were seen taking similar stances (Rowntree, 1996). Right whales feed on copepods. Perhaps when right-whale cyamids sense copepods they stand up, alerting the whale and helping it steer toward denser concentrations of its tiny prey.

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CAPE AND AUSTRALIAN FUR SEALS

Arctocephalus pusillus pusillus and A. p. doriferus

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The Cape (CFS) *Arctocephalus pusillus pusillus* and the Australian fur seal (AFS) *A. p. doriferus* are the two recognized subspecies of *A. pusillus* (family Otariidae, subfamily Arctocephelinae). There is currently no accepted common name for the species itself, but the epithets brown fur seal and Afro-Australian fur seal have been used, while the CFS is commonly referred to as the South African fur seal.

I. Characteristics and Taxonomy

Arctocephalus pusillus is markedly sexually dimorphic, similar to other fur seals with males being the larger sex (Fig. 1). The two subspecies are almost identical anatomically. Repenning et al. (1971) accorded them subspecific status based on separate geographic ranges and one cranial character (the larger crest between the mastoid and jugular processes of the exoccipital in the CFS). Very low genetic divergence indicates that the two groups split relatively recently (<18000 y/a), with the AFS being the more recently established (Wynen et al., 2001). Based on molecular analyses there is no evidence for significant subpopulations within either subspecies.

Molecular studies have indicated that *A. pusillus* aligns more closely with sea lion species (subfamily Otariinae), with which they

Figure 1 *Cape and Australian fur seals*, Arctocephalus pusillus. *Adult male (background) and adult female (foreground) (Illustration by Pieter Folkens).*