

Chordata: Birds / Mammals

penguins, marine mammals

UNDERWATER FIELD GUIDE TO ROSS ISLAND & MCMURDO SOUND, ANTARCTICA

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The National Science Foundation's Office of Polar Programs sponsored Norbert Wu on an Artist's and Writer's Grant project, in which Peter Brueggeman participated. One outcome from Wu's endeavor is this Field Guide. This Field Guide builds upon principal photography by Norbert Wu, with photos from other photographers, who are credited on their photographs and above. This Field Guide is intended to facilitate underwater/topside field identification from visual characters. Organisms were identified from photographs with no specimen collection. Therefore these identifications are to the taxonomic level possible from photographs, and there can be some uncertainty in identifications solely from photographs.

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Adelie Penguin *Pygoscelis adeliae*

page 3



Emperor Penguin *Aptenodytes forsteri*

page 4



Weddell seal *Leptonychotes weddellii*

page 5



Leopard seal *Hydrurga leptonyx*

page 9



crabeater seal *Lobodon carcinophaga*

page 11



killer whale or orca *Orcinus orca*

page 13



Antarctic minke whale *Balaenoptera bonaerensis*

Page 15



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Adelie Penguin *Pygoscelis adeliae*

The Adelie Penguin *Pygoscelis adeliae* occurs throughout Antarctica and the subantarctic islands, limited in distribution by shelf ice to the south and pack ice to the north (seldom found in open water). The Ross Sea area has the largest estimated breeding population at 1 million pairs; the total estimated population is 2,610,000 breeding pairs and 10 million immature penguins. Breeding colonies are found on rocky islands, peninsulas, beaches and scree slopes wherever ice-free and accessible from the ocean. Adelie Penguins eat mainly euphausiids (over 70% of diet) as well as some fish and squid. They catch their prey by diving in pursuit at 10 to 40 meters depth with an average dive duration of 1.4 - 1.9 minutes; they can dive down to a maximum depth of 170 meters. The average swimming speed on an Adelie Penguin is 2.2 - 4.6 kilometers per hour.

Adelie Penguins return to their breeding colony from September to October with egg laying occurring in October to November. Shallow nests lined with pebbles are built by both parents. Two eggs are laid with peak egg laying from November 10 - 15. Eggs are incubated by alternating parents for 35 days. After egg laying, the female leaves to forage and the male sits on the egg. The egg will be left to die by the male if the female doesn't return from her first foraging trip in time to relieve the male. Peak egg hatching is December 10-15. After hatching, chicks are brooded in the nest for 22 days, guarded by a parent. Then the chicks leave the nest to

form small creche groups while awaiting the return of parents from feeding forays. When possible, skuas will attack and kill Adelie Penguin eggs and chicks; 9% of the eggs were lost to predation in 1 year at Cape Bird. At the Cape Bird rookery where these pictures were taken during the egg incubation period, Adelie Penguins make long foraging trips averaging 9-25 days in duration and up to 100 kilometers away. During the chick rearing period, they make much shorter trips in duration and distance. Chicks are fed by their parents every 1-2 days until they depart from the colony at 2 months of age. The chicks molt by early February and then leave. 60-70% of the mating pairs retain the same partner each year. Adelie Penguins tend to be faithful to a specific nest site; males are 99% faithful to the nest site with females less so. Adelie Penguins are most active between 4 am and 10 am. Those in the Ross Sea Are have an annual mortality of 20%.

References: 1: The Penguins, Spheniscidae. TD Williams. Oxford: Oxford University Press, 1995. pp.169-178; 2: Penguin Biology. LS Davis & JT Darby. San Diego: Academic Press, 1990



Emperor Penguin *Aptenodytes forsteri*

The Emperor Penguin *Aptenodytes forsteri* is found throughout Antarctica within the limits of pack ice. Emperor Penguins walk right up to the human visitor and trumpet their arrival. Their calls are used to recognize each other and form pairs for mating. An estimated 400,000 - 450,000 individual Emperor Penguins with 195,400 breeding pairs populate Antarctica; the Ross Sea area has half the total population of Emperor Penguins.



Emperor Penguins mainly eat nototheniid fish, squid, and euphausiid and amphipod crustaceans which they pursue to capture, diving down to 500 meters for a usual duration of twelve minutes. Emperor Penguins can dive to almost 600 meters and stay underwater for twenty minutes on a shallow dive. Emperor Penguins swim 2.4 - 3.4 meters per second during foraging (5.4 - 7.6 miles per hour) and have been measured at maximum speeds of 4.6 - 7.1 meters per second (10.3 - 15.9 miles per hour).

A single foraging trip may involve travel up to 150 - 1,000 kilometers with travel speeds ranging from 1.5 - 2.5 kilometers per hour.

Emperor Penguins breed on level, stable sea ice with only two colonies known on land. Cape Washington has a large breeding population of 20 - 25,000 pairs. Before

breeding, males weigh more than females ranging from 35 - 40 kilograms and 28 - 32 kilograms respectively. Emperor Penguins return to their breeding colonies in March through early April, oftentimes walking 50 - 120 kilometers over sea ice to get there. A single, large egg is laid in May through early June. Emperor Penguin egg laying, incubation, and chick rearing takes place in the Antarctic winter; other penguin species do this in the Antarctic summer. Emperor Penguins are very colonial, are not territorial, and are monogamous within that breeding season (but only 15% of the mating pairs retain the same partner the following year). Male Emperor Penguins are responsible for egg incubation and they huddle closely in large groups for warmth during the two months of egg incubation. During their breeding fast, Emperor Penguin weight decreases by 35 - 40% in males and 20 - 25% in females; the males lose more weight since they incubate the egg. After egg hatching, both parents alternate chick brooding for its fifty day period; one goes off to feed while the other. Chicks then form large creches until they depart from the colony in December through early January. When left alone while its parents are out feeding, the Emperor Penguin chick regularly calls for its parents who use that call to locate their chick.

Review: The Penguins, Spheniscidae. TD Williams. Oxford : Oxford University Press, 1995. pp.152-160; **Diving Physiology:** American Scientist 85: 530-539, 1997; **Swimming Speed:** Journal of Experimental Biology 165:161-180, 1992



Weddell seal *Leptonychotes weddellii*

The Weddell seal *Leptonychotes weddellii* commonly occurs on fast ice and nearshore pack ice along the Antarctic coast and Peninsula and in small populations in the South Shetland Islands, South Orkney Islands, and South Georgia Island [7,8,9,10]. Wandering Weddell seals have been sighted in the Falkland Islands, Argentina, Uruguay, Chile, Juan Fernandex Island, Bouvet Island, Marion Island, Kerguelen Island, Heard Island, Macquarie Island, Auckland Islands, New Zealand, and southern Australia, [7,8,9,10]. The McMurdo diver will see them around sea ice cracks. The Weddell seal can be over three meters in length and 400 - 450 kilograms in weight. Its population is estimated at 800,000 individuals. Weddell seals move around the sea ice, are not gregarious, and are spaced apart when seen hauled out on the sea ice. Weddell seals are commonly found at 8 - 12 years of age with individuals 18 and 22 years old noted in the literature. Half or more of the Weddell seal diet is fish (*Dissostichus mawsoni*, *Notothenia*,

Trematomus, *Gymnodraco* including *G. acuticeps*, *Pleuragramma antarcticum*, *Cryodraco antarcticus*, *Pagetopsis macropterus*) with the rest being cephalopods (squid and *Pareledone* octopus), krill, mysids, isopods, amphipods, and decapods [3,4]. Weddell seals hunt fish in the slushy platelet ice on the underside of the sea ice ceiling, by blowing out air to flush fish from their refuge; they hunt the Antarctic cod *Dissostichus mawsoni* in midwater by silhouetting it against the sea ice ceiling while remaining hidden from sight [12]. Due to the Weddell seal's preference for fast sea ice, the impact of predators such as leopard seals upon the Weddell seal population is minimal.



The Weddell seal dives beneath stable contiguous sea ice and can store a large amount of oxygen in their bodies mostly in their blood and muscles. This enables them to stay underwater for a usual dive to 300-400 meters for fifteen minutes [5]. Weddell seals have been observed staying underwater for 82 minutes and diving down to 700 meters [5]. Weddell seals glide a lot in deep dives rather than swim continuously [2]. The lungs of the Weddell seal collapse during a dive from water pressure thus decreasing the seal's buoyancy on descent [2]. The Weddell seals' limited oxygen storage is thus conserved by taking advantage of this physical change during a deep dive and reducing the amount of

swimming during deep dives looking for fish [2]. After several dives, they can be observed coughing up a foamy white lung surfactant [6]. Their underwater swimming speed is estimated at 4- 7 knots [5].



The Weddell seal keeps breathing and entry/exit ice holes open year round using its teeth.

Shown here at Granite Harbor are holes running along a sea ice crack that are being kept open by Weddell seals, for their use getting in and out of the water, as well as breathing while in the water.

The inner edges of the ice crack would ordinarily run straight, but the Weddell seals round out holes in the crack using their teeth.



The strong upper teeth of the Weddell seal project forward and are dragged from side to side on the edge of an ice hole to keep it open.

These teeth may be critical to survival.

As the seal ages and its teeth wear down, they seals may lose their ability to maintain breathing holes and die at an earlier age than other seals.



Weddell seals are restless when breathing at a hole when other seals are nearby. They peer down and if a hole fits only one seal, the seal will either dive as another seal comes up or reverse and face down to prevent the intruding seal from surfacing. Weddell seals adopt a head-down fighting posture with eyes looking forward, foreflippers extended and sometimes their jaw open. If a hole is large enough for two seals and the breathing seal refuses to leave, the arriving seal may surface with a fight

usually ensuing. It has been suggested that a Weddell seal does not defend an area to the complete exclusion of other seals but to the discouragement of other seals. An intruding seal may be physiologically forced to take a breath which would override territorial aggression.



Here a Weddell sea mother and pup float in shallow water under a sea ice crack; their entry/exit/breathing holes are visible as bright lights above them. Breeding and pupping occur in the summer months. Breeding Weddell sea bulls set up under-ice territories of twenty meters diameter and tend to remain in the water where breeding takes place. Female Weddell seals move freely through the territories of the bulls. Subordinate males have their activity restricted by the dominant bull when moving through a territory. Females claim less well defined territories, individually or jointly with other females. The mother gives birth to her newborn on the sea ice and stays with it for the first twelve days;

after that, the mother will spend 30-40% of her time in the water while the pup remains on the sea ice. The pup is born at 29 kilograms and gains 10-15 kilograms per week. By seven weeks of age, the pups can remain submerged for five minutes and dive down to 92 meters. The moulting of the pup's fur is complete in thirty days. The pup nurses for 45 days and, when weaned, the pup weighs 113 kilograms. Weddell seals have high juvenile survival due to a lack of predation in fast sea ice.



The Weddell seal vocalizes underwater and the diver is very aware of their presence though unseen. Their calls are an eerie underwater symphony. Weddell seals produce a wide range of calls: lengthy buzzes descending from higher pitch to lower pitch called "trills", whistles, and chirps. Certain vocalizations are associated with aggressive displays and have been characterized as a trill, a rapid chi-chi-chi, an eeeyo, and a chirrup. A teeth clacking sound was observed as seals passed one another entering and leaving breathing holes. A trill is used by mature males to establish and mark their underwater territory; it is associated with tense situations. When a trill isn't heeded, a fight may ensue.



Here's a mother and pup. Weddell seals are highly vocal during the peak of breeding season at the Hutton Cliffs colony; researchers recorded almost twenty underwater calls per minute [1]. In mid-December when mating is almost over, the pups are being weaned, and adults dispersing, the underwater calls of Weddell seals at Hutton Cliffs decreased to two per minute [1]. Why? Their predators, leopard seals and killer whales, showed up at the fast ice edge about twenty kilometers away [1]. Weddell seals are no longer so isolated from their predators by distance from the fast ice edge since the edge shifts south as summer progresses [1]. Killer whales prowl the fast ice edge for prey and leopard seals can swim long

distances under ice seeking out Weddell seals and their breathing holes [1]. Leopard seals and killer whales vocalize underwater and Weddell seals hear them [1]. Sounds are important for Weddell seals to communicate with their species but they also need to avoid detection by predators [1]. Absence of sound from Weddell seals is an anti-predation strategy when the risk of predation by leopard seals and killer whales is increased [1].

Taxonomic Note: Species name *weddellii* can be misspelled in the literature with only one "i" [11].

Reviews: Handbook of Marine Mammals, Volume 2, Seals. SH Ridgway & RJ Harrison, eds. London: Academic Press, 1981, pp.275-296; Antarctic Research Series 70:287-301, 1996; **Sounds & Behavior:** Antarctic Journal of the United States 2:105-106, 1967; Biology of the Antarctic Seas III, Antarctic Research Series 11:227-261, 1967; **1:** Antarctic Journal of the United States 30(5):232-234, 1987; **2:** Science 288(5463):133-136, April 7 2000 **3:** Adaptations within Antarctic Ecosystems, Proceedings of the Third SCAR Symposium on Antarctic Biology. GA Llano, ed. Washington, DC: Smithsonian Institution, 1977. pp.749- 768; **4:** Journal of Mammalogy 46(1):37-43, 1965; **5:** American Scientist 85: 530-539, 1997; **6:** Peter Brueggeman, personal communication, 1997; **7:** Marine Mammals of the World : Systematics and Distribution. DW Rice. Lawrence, Kansas : Society for Marine Mammalogy, 1998; **8:** Handbook of Marine Mammals, Volume 2, Seals. SH Ridgway & RJ Harrison, eds. London: Academic Press, 1981, pp.275-296; **9:** Antarctic Research Series 70:287-301, 1996; **10:** FAO Species Identification Sheets for Fishery Purposes : Southern Ocean (Fishing Areas 48, 58 and 88) (CCAMLR Convention Area) / W Fischer & JC Hureau, eds. Rome : Food and Agriculture Organization of the United Nations, 1985; **11:** Marine Mammals of the World : Systematics and Distribution. DW Rice. Lawrence, Kansas : Society for Marine Mammalogy, 1998; **12:** Science 283:993-996, 12 February 1999



Leopard seal *Hydrurga leptonyx*

Leopard seals *Hydrurga leptonyx* are found in Antarctic pack ice (areas of concentration of drifting ice), along the Antarctic continent and the Antarctic Peninsula, South Shetland Islands, South Orkney Islands, South Sandwich Islands, South Georgia Island, Bouvet Island, Heard Island, and Macquarie Island. Wandering leopard seals have been sighted at Falkland Islands, the cape region of South Africa, Gough Island, South America from Tierra del Fuego in Chile to Brazil, Tristan da Cunha Island, Prince Edward Island, Crozet Island,

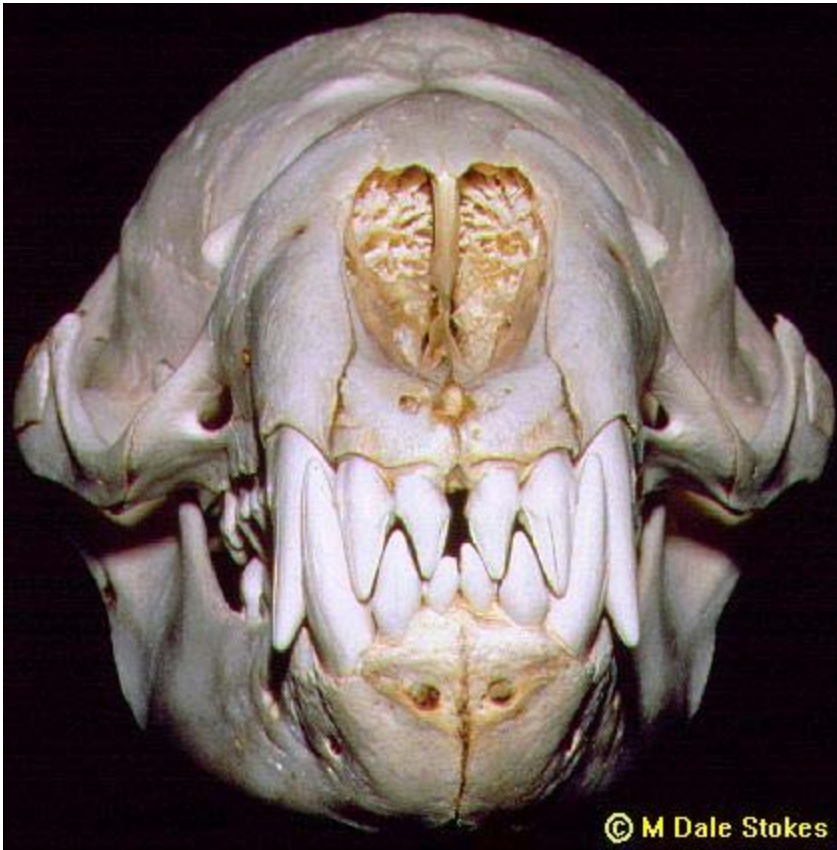
Kerguelen Island, Amsterdam Island, St. Paul Island, New Zealand, southern Australia, Lord Howe Island, Auckland Islands, Snares Islands, Campbell Island, Rarotonga in the Cook Islands, and Juan Fernandez Islands. Leopard seals are the largest of the Antarctic seals; built for speed, they are slender and can be just over three meters long. Leopard seals typically haul out on ice floes and breeding and pupping is assumed to occur on pack ice.



In McMurdo Sound, leopard seals are usually spotted on the prowl at the fast ice edge or penguin rookeries.

The leopard seal is the only seal that regularly preys on warm-blooded animals.

The diet of the leopard seal varies with season and location and includes benthic and pelagic fish, penguin adults and chicks, birds (petrels), seals (including crabeater, fur seals, elephant seals, and Weddell seals), cephalopods (squid and octopus), krill, fish, crustaceans, and seal and whale carcasses.



Look at these incisor and canine teeth !

Leopard seals can be dramatic predators of penguins. Penguin chicks are awkward in the water and are easily taken; adult penguins are caught after pursuit or after falling back into the water after a missed leap out of the water. The leopard seal peels away the penguin skin by whipping the penguin back and forth while holding it between its incisor teeth. At Cape Crozier, scientists reported that six leopard seals killed an average of eight adult Adelie penguins each per day during a 100 day breeding season. They also reported that four seals killed fifteen Adelie penguin chicks per day each during two weeks of chick departure from the rookery. Penguins are a food resource of seasonal abundance for the leopard seal since penguins disperse from their rookeries after breeding/rearing their young.



Behind the leopard seal's long and sharply pointed incisor and canine teeth are interlocking cheek teeth or molars with three cusps, adapted for straining krill from the water. Krill is a large portion of the diet of the leopard seal. Krill might be eaten more by juvenile leopard seals and older, more experienced leopard seals might prey on penguins and seals.

Review: Handbook of Marine Mammals, Volume 2, Seals. SH Ridgway & RJ Harrison, eds. London: Academic Press, 1981, pp.261-274; FAO Species Identification Sheets for Fishery Purposes : Southern Ocean (Fishing Areas 48, 58 and 88) (CCAMLR Convention Area) / W Fischer & JC Hureau, eds. Rome : Food and Agriculture Organization of the United Nations, 1985. **Diet:** Adaptations within Antarctic Ecosystems, Proceedings of the Third SCAR Symposium on Antarctic Biology. GA Llano, ed. Washington, DC: Smithsonian Institution, 1977. pp.749-768; Polar Biology 27(12):729-734, 2004. **Distribution:** Marine Mammals of the World : Systematics and Distribution. DW Rice. Lawrence, Kansas : Society for Marine Mammalogy, 1998; Latin American Journal of Aquatic Mammals 2(1):51-54, 2003; Polar Biology 29(10):905-908, 2006.



crabeater seal *Lobodon carcinophaga*

The crabeater seal *Lobodon carcinophaga* is found throughout Antarctica, usually in the pack ice [1,2]. Wandering crabeater seals have been sighted in the Falkland Islands, South Georgia Island, Bouvet Island, Heard Island, New Zealand, Tasmania and southern Australia, South Africa, Uruguay, Brazil, and Argentina [1,2,3]. Photographed here on fast ice near Cape Barne, crabeater seals, particularly

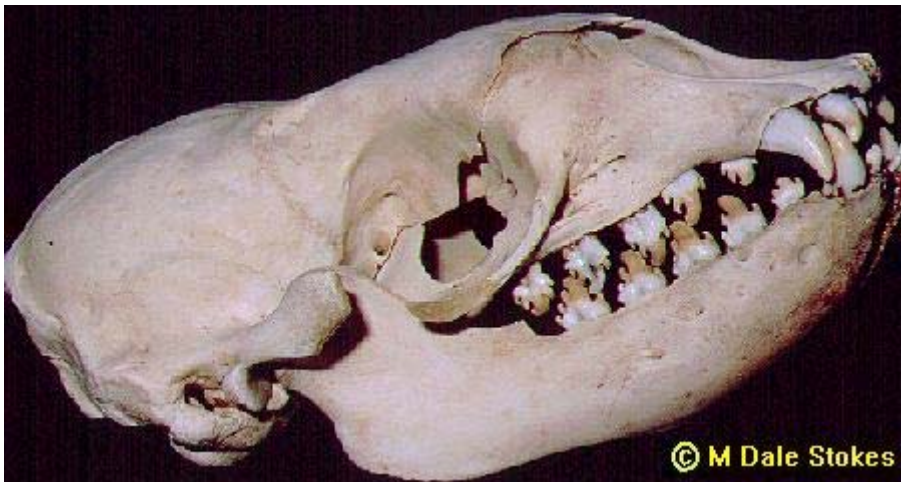
young ones, come south into the Ross Sea and McMurdo Sound during summer months [2,4]. The crabeater seal is the most abundant seal in the world, with a population between fifteen and forty million (more than all other seals put together) [1]. The crabeater seal weighs up to 225 kilograms (496 pounds) and their length is up to 260 centimeters (8.5 feet) [1].



The color of the crabeater seal grades from blond on its ventral bottom side to darker brown on their dorsal top side [2]. The crabeater seal has characteristic net-like chocolate-brown markings and fleckings on its shoulders, sides and flanks [1]. When approached, crabeater seals do not roll onto their backs like Weddell seals; they open their mouths, bare their teeth, and snort [1,4].

The leopard seal is an important predator of young crabeater seals [1]. Killer whales have been observed creating waves to swamp an ice floe on which a crabeater seal is hauled out, thus knocking the seal into the water

[5].



The crabeater seal has ornate interlocking cheek teeth with four or five cusps, functioning as strainers to separate krill from seawater [1].

The crabeater seal eats mostly Antarctic krill *Euphausia superba* and trivial amounts of fish, squid, and other invertebrates [1]. The crabeater seal is the major consumer of krill in the Southern Ocean [1].



Crabeater seals have been found dead and alive up the Dry Valleys near McMurdo Sound, where they can wander inland great distances [2,4]. Young crabeater seals disperse and spread out; they may become trapped by the autumn freezing sea ice in McMurdo Sound [4]. Trapped seals then have to escape over the ice surface to open water (if they can find the open water) [4]. Crabeater seals are more agile on land and ice than other Antarctic seals and thus can travel far from the open sea [4]. In addition to the Dry Valleys, dead crabeater seals have been found on the McMurdo Ice Shelf eleven kilometers west of Scott Base, 47

kilometers up the Ferrar Glacier at almost 1,100 meters altitude, and one kilometer inland on Cape Evans on the lower slopes of Mount Erebus [4].

Taxonomic Note: The species is usually improperly spelled with a masculine ending, *carcinophagus* [3]. The correct gender ending is *carcinophaga* since it is a noun in apposition and not an adjective, thus retaining its original feminine ending even though it is used with a masculine genus [3].

References: **1:** FAO Species Identification Sheets for Fishery Purposes : Southern Ocean (Fishing Areas 48, 58 and 88) (CCAMLR Convention Area) / W Fischer & JC Hureau, eds. Rome : Food and Agriculture Organization of the United Nations, 1985; **2:** Handbook of Marine Mammals, Volume 2, Seals. SH Ridgway & RJ Harrison, eds. London: Academic Press, 1981, pp.221-235; **3:** Marine Mammals of the World : Systematics and Distribution. DW Rice. Lawrence, Kansas : Society for Marine Mammalogy, 1998; **4:** Journal of Mammalogy 52(1):175-180, 1971; **5:** Canadian Journal of Zoology 59(6):1185-1189, 1981



killer whale or orca *Orcinus orca*

The killer whale or orca *Orcinus orca* is found throughout Antarctica and the Antarctic Peninsula and all parts of the Southern Ocean down to the Ross Sea [1,2]. The killer whale can be observed at the pack ice edge and sometimes in dense pack ice and under fast ice [1]. The killer whale usually travels in pods up to thirty individuals which may constitute a stable social structure [1].



The killer whale has a bulky body with a blunt, rounded head, a prominent triangular dorsal fin, and a black and white coloration including a grey saddle patch behind the dorsal fin, a white chin/throat, a broad white lobe reaching up and back beyond its navel, and a white oval patch above and behind its eye [1].

Male killer whales can be up to at least eight meters in length and females one meter shorter [1].



Adult killer whale males have the characteristic tall dorsal fin up to 1.8 meters tall as shown here [1]. In females and juvenile males, it is much smaller and has a concave trailing edge as shown in the top photo above [1].

Female killer whales reach sexual maturity in eight to ten years and males probably over sixteen years [1].



By mid- summer in McMurdo Sound, the plankton bloom reduces underwater visibility dramatically. A hunting mother and calf are seen in an opening lead of ice. Killer whale breeding occurs in autumn and the mother carries the developing baby for 13 to 16 months [1]. Killer whale calves nurse for twelve months and may remain with the mother for as long as ten years [1]. The killer whale preys on fish, cephalopods, and warm-blooded prey like penguins and seals; they have been observed dislodging prey from ice floes by tipping floes up and by swimming past, creating a wave to sweep prey off the floe [1,3]. The killer whale is a fast swimmer and

can reach speeds of 46 kilometers/hour (29 miles/hr or 25 knots or 13 meters/sec) or more [1].

Taxonomic note: A supposed new species of dwarf or yellow killer whale was described from the ice edge in Antarctica's Indian Ocean sector [2]. Selecting fish rather than mammals as prey, further studies are needed to establish recognition as a separate species or subspecies [2].

References: **1:** FAO Species Identification Sheets for Fishery Purposes : Southern Ocean (Fishing Areas 48, 58 and 88) (CCAMLR Convention Area). W Fischer & JC Hureau, eds. Rome : Food and Agriculture Organization of the United Nations, 1985; **2:** Marine Mammals of the World : Systematics and Distribution. DW Rice. Lawrence, Kansas : Society for Marine Mammalogy, 1998; **3:** Canadian Journal of Zoology 59(6):1185-1189, 1981



Antarctic minke whale *Balaenoptera bonaerensis*

The Antarctic minke whale *Balaenoptera bonaerensis* is found throughout Antarctica during summer [1,2]. During winter, Antarctic minke whales are found north to within seven degrees of the equator and south as far as the 35th parallel; they have also been sighted in Antarctica as well [1,2,4,5]. The Antarctic minke whale is usually sighted near the ice edge, either singly or in pairs [1]. The Antarctic minke whale ranges in length up to ten meters

with an average length of eight meters; it is the smallest baleen whale in the Southern Ocean [1].



The Antarctic minke whale is dark grey on its back and white on its belly and beneath its flippers [1]. Most Antarctic minke whales have a white diagonal band on each flipper and there may be a pale chevron on its back behind the head or pale gray bracket marks above each flipper [1].



When the Antarctic minke whale surfaces, its dorsal fin appears simultaneously with the blow [1].

The mist of the blow lingers above the whale in this photo.



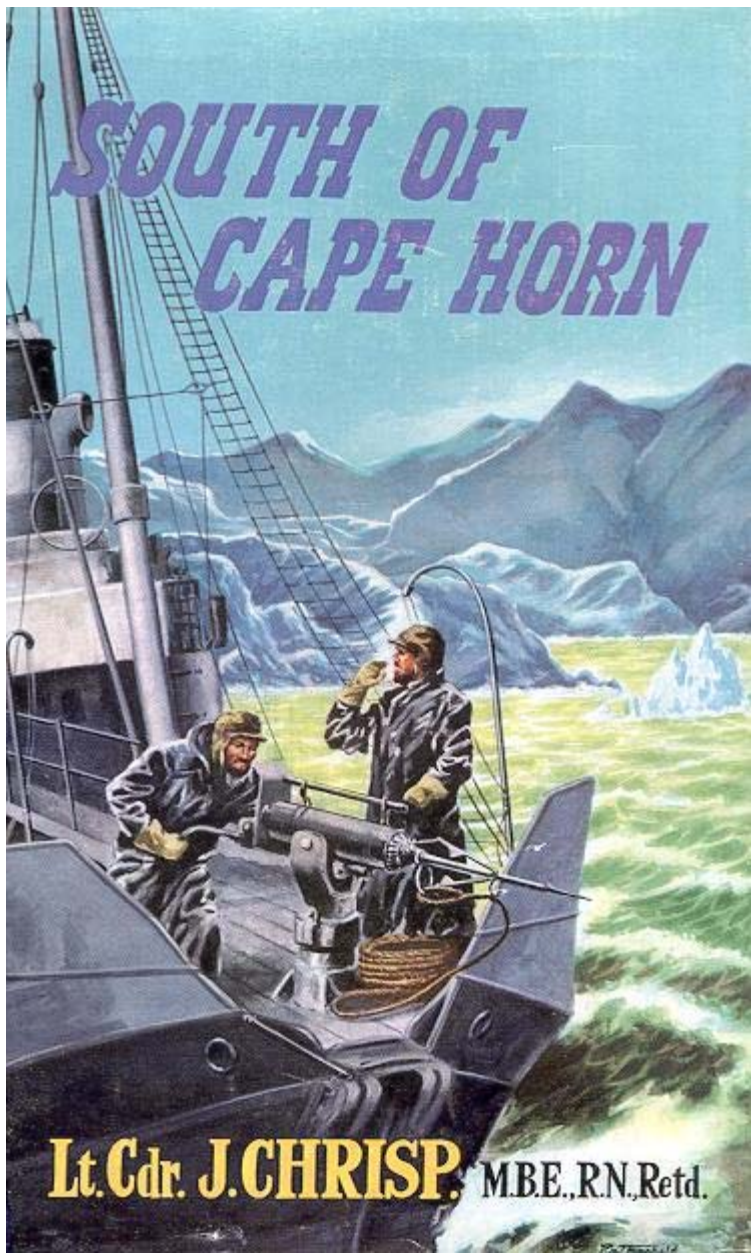
The blow of the Antarctic minke whale is small and low [1].

It breathes five to eight blows at intervals of less than one minute, and then dives up to twenty minutes [1].



Spyhopping Antarctic minke whale, with Mount Erebus on Ross Island in the background.

The Antarctic minke whale feeds primarily on the Antarctic krill *Euphausia superba* and also on the euphausiid *Thysanoessa* spp. [1,3].



This book jacket illustrates harpoon gun whaling in the Southern Ocean.

Whaling in the Southern Ocean harvested some two million whales in the first half of the 20th century, with 28,000 blue whales killed in the 1930-1931 season alone [6].

Though whales in the Southern Ocean are now protected by the 1994 International Whaling Commission agreement for a Southern Ocean Whale Sanctuary, scientific research whaling continues under IWC rules, with Japan taking over 400 minke whales in the Southern Ocean each year in recent years [6,7]

Taxonomic Note: Bone features, genetic analysis, and external features confirm that the Antarctic minke whale is a separate species [2].

1: FAO Species Identification Sheets for Fishery Purposes : Southern Ocean (Fishing Areas 48, 58 and 88) (CCAMLR Convention Area) / W Fischer & JC Hureau, eds. Rome : Food and Agriculture Organization of the United Nations, 1985; **2:** Marine Mammals of the World : Systematics and Distribution. DW Rice. Lawrence, Kansas : Society for Marine Mammalogy, 1998; **3:** Polar Biology 11(7):479-487, 1991; **4:** Instituto Antartico Chileno. Serie Cientifica 44:91-98, 1994 ; **5:** International Whaling Commission Report 39:219-225, 1989; **6:** Whales, Dolphins and Porpoises. M Carwardine, ed. New York : Checkmark Books, 1999; **7:** Whaling. Whale and Dolphin Conservation Society. www.wdcs.org