

Occurrence of dwarf minke whales (*Balaenoptera acutorostrata* subsp.) around the Antarctic Peninsula

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Abstract The occurrence of dwarf minke whales (*Balaenoptera acutorostrata* subsp.) around the Antarctic Peninsula was examined based on 406 sightings of minke whales recorded during the Chilean Antarctic Scientific Expeditions and other opportunistic cetacean surveys. Identification of the species was made only for the whales sighted in the proximity of the vessels when the specific diagnostic characters could be confirmed. Of the 406 sightings, 296 were assigned to Antarctic (519 individuals), nine (11 individuals) to dwarf and 101 to unidentified minke whales (149 individuals). Dwarf minke whales were identified by the reported external diagnostic characters for this species. Seven animals occurred around the South Shetland Island and four in the Gerlache Strait. In addition, another two animals were identified as dwarf minke whales in the Bellinghausen Sea in winter 1993, being these the most southern records for this species. These results confirm the occurrence of dwarf minke whales around the Antarctic Peninsula during the summer seasons, as well as

in the Bellinghausen Sea in winter. The geographical range of these sightings was comprised between 61°03' and 69°25'S and between 55°29' and 86°53'W. These results also suggest that some dwarf minke whales remain in the Antarctic during the austral winter.

Keywords Dwarf minke whales · Distribution · Antarctic Peninsula · South Shetland Islands

Introduction

Until recently, only one species of minke whale was thought to exist, *Balaenoptera acutorostrata* (Lacépède, 1804). Rice (1998) reviewed both morphological (e.g., Williamson 1959; van Utrecht and van der Spoel 1962; Kasuya and Ichihara 1965; Omura 1975; Best 1985) and genetic (e.g. Wada et al. 1991; Árnason et al. 1993; Pastene et al. 1994) data collected from extant minke whale populations and recognized two species, the larger Antarctic minke whale *B. bonaerensis* (Burmeister, 1867), which is restricted to the Southern Hemisphere, and the common minke whale *B. acutorostrata* (Lacépède, 1804), which is distributed globally. In the Southern Hemisphere, the common minke whale is referred to as the 'dwarf' or 'diminutive' minke whale (Best 1985; Arnold et al. 1987). The Scientific Committee of the International Whaling Commission accepted the recognition of these two species but deferred a decision on other nominal taxa, including the southern dwarf, until the completion of a world wide review of genetic and non-genetics information of minke whales (IWC 2001).

Current information suggests that the Antarctic minke whale is more abundant and more widely distributed in the Southern Hemisphere than the dwarf minke whale. The

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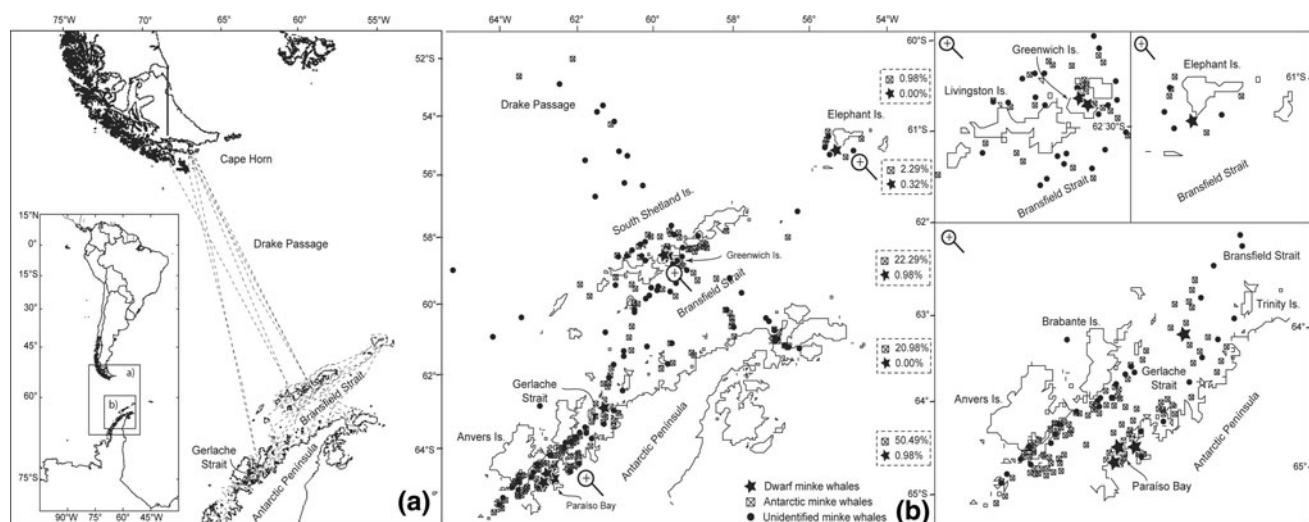


Fig. 1 Area covered by the sighting surveys (**a**) and distribution of minke whales sightings south of 60°S separated for Antarctic, dwarf and unidentified minke whales (**b**) including details of Elephant and Greenwich Islands and Gerlache Strait. *Dotted lines* in **a** delimit the

main areas where survey was carried out, and *dotted square* in **b** show the proportion of Antarctic and dwarf minke whales sighted by 1° of latitude

distribution of dwarf minke whales has been documented mostly in coastal habitat of low latitude waters of the eastern side of continents and some islands of the Southern Hemisphere, involving the latitudinal range between 7° and 41°S (da Rocha and Braga 1982; Baker 1983; Best 1985; Baldas and Castello 1986; Arnold et al. 1987; Albareda and Castello 1990; Zerbini et al. 1996, 1997; Arnold 1997; Garrigue and Greaves 2001; Hassel et al. 2003; Secchi et al. 2003; Arnold et al. 2005; Magalhães et al. 2007).

Distribution of dwarf minke whales in high latitude (south of 41°S) is less known. The first documented dwarf minke whales in high latitude waters was reported from catch data of earlier JARPA (Japanese Whale Research Programme under Special Permit in the Antarctic) surveys in sub-Antarctic and Antarctic water of the western South Pacific during the austral summer, between 55° and 65°S and 90°–170°E (Fujise et al. 1990; Kato et al. 1990; Kasamatsu et al. 1993; Pastene et al. 1994). In the Antarctic waters of the Indian Ocean, Ensor et al. (1995) reported two sightings of the dwarf minke whales between 61° and 62°S and 60°–70°E. More recently, Acevedo et al. (2006) reported two sightings and three strandings of dwarf minke whales in the Chilean Eastern Patagonian channels in the latitudinal range between 55° and 56°S and 67°–68°W, but no dwarf minke whales have been reported in Antarctic waters south of South America. Therefore the aim of this note is to investigate the occurrence of dwarf minke whales in Antarctic waters south of South America based on sightings data of minke whales collected during several whales surveys conducted between Cape Horn to Gerlache Strait, Antarctic Peninsula.

It should be recognized that distinction between the two southern minke whale species at sea is not obvious (Best 1985; Arnold et al. 1987; Pastene et al. 1994; Jefferson et al. 2008), and the observer has to be very close to the animals to ensure a correct identification. Experienced researchers indicate that there are distinct differences that can be detected at sea, e.g. body coloration, the white patch on the base of the flipper and the swimming pattern. Some of these probably require good weather and observation conditions to be identified. In this study, species identification was made only for those animals observed close to the vessel when the specific diagnostic characters could be confirmed.

Materials and methods

Photos, video recordings and field note of minke whales, taken during systematic cetacean surveys of the Chilean Antarctic Scientific Expedition of the Instituto Antártico Chileno (INACH) between 1994 and 1999 (Research Project INACH 08-93) and from 2006 to 2008 (Research Project INACH 163), were examined. These surveys covered waters around the Cape Horn, South Shetland Islands, Bransfield and Gerlache Strait, Antarctic Peninsula (Fig. 1). In addition, minke whales sightings recorded opportunistically by two of us (JAR and JP) between 2006 and 2010 in the same area were also examined. During the surveys, routine ancillary information such as sighting date and time, sighting distance, GPS position, whale species and number of individuals was collected for each sighting. A second source of sighting information was published,

and unpublished data were available at the INACH. The unpublished data included opportunistic sightings data made during the Research Project INACH 018.

Identification to the species level was made only for those animals sighted very close to the vessel when the diagnostic characters could be confirmed. Minke whales sighted at distances at which diagnostic characters could not be confirmed were classified as unidentified minke whales. Direct observations at the field were supported by photographs, video and/or field notes.

Confirmation of dwarf minke whale was based on external diagnostic characters described by Arnold et al. (2005), such as striking white patch on the flippers (fb), shoulder blaze (shb), dark distal flipper patch (dfp), light rostral saddle (rs), dark nape field (nf), light grey thorax patch anterior (thp), dark thorax field (thf), light anterior flank patch (afp), dark throat patch (dthp), dark flank infill (fi) and light axillary patch (ap). Antarctic minke whales were identified by a thin grey crescent-shaped streak that extends up each side of the animal from above the flipper insertion and towards the dorsal midline, prominent grey flank patch preceded by a dark cope just in front of the dorsal fin, presence of a pair of grey streaks extending backward from the blowhole, a dark shoulder and grey pale colour flipper with a white leading edge. Although some individuals have a two-tone light grey colour, the white striking band on the upper surface (present in all dwarf minke whales) is absent in the Antarctic minke whale (Best 1985; Arnold et al. 1987).

Results

A total of 293 sightings were made during surveys of the projects INACH 08-93 and INACH 163 while 113 sightings were made opportunistically. Of the total of 406 sightings, 296 involving 519 individuals were assigned to Antarctic minke whales while nine sightings (involving 11 individuals) were assigned to dwarf minke whale in the South Shetland and Gerlache Straits based on observations of external characters. Genetic analysis of a skin biopsy sample obtained from one of the minke whales sighted in South Shetland confirmed the animal as a dwarf minke whale (Pastene et al. 2010) (Table 1; Figs. 1, 2). A total of 101 sightings and 149 individuals could not be assigned to either species and were classified as unidentified minke whales. The geographical distribution of Antarctic, dwarf and unidentified minke whales is shown in Fig. 1. The figure also provides information on the proportion (in relation to the total of animals identified to the species level) of animals identified as dwarf minke whales, by 1° of latitude. As expected, the proportion of dwarf minke whales is substantially lower than that of

Antarctic minke whales. Dwarf minke whales occur in low proportion until the latitude range comprised between 64° and 65°S.

The examination of the published sightings of minke whales identified another two animals as dwarf minke whales in the Bellinghausen Sea in winter season. These minke whales were originally reported by Aguayo-Lobo (1994a). This author observed in these two whales the “marked white band on both flippers”, indicating that this band was different from the pale grey flipper (diagnostic character for Antarctic minke whales) observed in other minke whales in the same winter expedition. Therefore, these two animals were assumed as dwarf minke whales (Table 1).

Discussion

As noted earlier, distinction between the two southern minke whale species at sea is not obvious. For this reason, the identification to the species level was made only for animals observed in the proximity of the vessels when the diagnostic characters of both species could be confirmed. Of the total of 406 minke whale sightings, 101 (24.9%) could not be assigned to either species. Of the sightings assigned to species, 296 and nine were assigned to Antarctic and dwarf minke whales, respectively. This confirms the fact that the former species is more common and abundant than the dwarf minke whale.

Dwarf minke whales had been recorded previously in high latitudinal waters in summer and fall, in the western South Pacific (Fujise et al. 1990; Kato et al. 1990; Kasamatsu et al. 1993; Pastene et al. 1994), Indian Ocean (Ensor et al. 1995) and Patagonian channels (Acevedo et al. 2006). The identification of 11 dwarf minke whales around the South Shetland Islands and the Gerlache Strait, Antarctic Peninsula, in different austral summer seasons and another two individuals in Bellinghausen Sea in winter confirm the occurrence of dwarf minke whales in Antarctic waters south of South America. These sightings involved the southernmost record extending the southern distribution range in at least 555 km. Although the latitudinal range reported here for dwarf minke whales sighted in summer (61°03'S–64°53'S) is similar to those reported for the Indian Ocean and western South Pacific, the two dwarf minke whales sighted in the Bellinghausen Sea in winter 1993 (Aguayo-Lobo 1994a) represent the southernmost records for dwarf minke whales. It also suggests that some individuals remain in Antarctic waters during the austral winter as reported previously for Antarctic minke whales (Taylor 1957; Ohsumi et al. 1970; Laws 1977; Aguayo-Lobo 1994a, b, 1996; Aguayo-Lobo and Acevedo 1998; Aguayo-Lobo et al. 1998).

Table 1 Sighting date and location of individuals identified as dwarf minke whales during the austral summer around the South Shetland Islands, Antarctic Peninsula and austral winter in the Bellinghousen Sea

Date	Location	Latitude (S)	Longitude (W)	School Size	No of confirmed dwarf minke whale	Source	Remark
25/Aug/1993	Bellinghousen Sea	69°25	86°53	1	1	Aguayo-Lobo (1994a)	Marked white band on both flippers. This band was different from the pale grey flipper (diagnostic character for Antarctic minke whales) observed in other minke whales in the same winter expedition
27/Aug/1993	Bellinghousen Sea	67°58	86°50	1	1	Aguayo-Lobo (1994a)	A white band on both flippers. This band was different from the pale grey flipper (diagnostic character for Antarctic minke whales) observed in other minke whales in the same winter expedition
Jan/1995	Gerlache Strait (Antarctic Pen.)	64°02	–	3	1	Photographs and field notes	Light anterior flank patch, dark thorax field
19/Jan/1997	Cape Lindsey (Elephant Island, South Shetland Island)	61°03	55°29	12	4 ^a	Direct observation and photographs	Striking white patch on the flippers, shoulder blaze, dark distal flipper patch, light rostral saddle, dark nape field, light grey thorax patch anterior, dark thorax field, light anterior flank patch
16/Jan/2007	Mutilla Passage (Greenwich Island, South Shetland Island)	62°26'19	59°45'35	1	1 ^b	Direct observation and photographs	Striking white patch on the flippers, dark distal flipper patch, light rostral saddle, dark nape field, light grey thorax patch anterior
16/Jan/2007	Chile Bay (Greenwich Island, South Shetland Island)	62°29'05	59°43'46	1	1 ^b	Direct observation and photographs	Striking white patch on the flippers, dark distal flipper patch, light rostral saddle
16/Jan/2007	Chile Bay (Greenwich Island, South Shetland Island)	62°28'36	59°43'36	1	1	Genetic identification	–
03/Mar/2008	Paraíso Bay (Gerlache Strait, Antarctic Pen.)	64°53'29	62°51'59	1	1	Direct observation	A white band on both flippers, delimited by dark distal flipper patch
26/Dec/2008	Among Andvord Bay and Paraíso Bay (Gerlache Strait, Antarctic Pen.)	64°48'02	62°42'40	1	1	Direct observation	A white band on both flippers, delimited by dark distal flipper patch
04/Jan/2009	Mouth Andvord Bay (Gerlache Strait, Antarctic Pen.)	64°50'15	62°38'04	1	1	Direct observation	A white band on both flippers, shoulder blaze, dark distal flipper patch, dark nape field
18/Feb/2010	Chile Bay (Greenwich Island, South Shetland Island)	62°23'25	59°44'05	1	1	Direct observation	A white band on both flippers, shoulder blaze, dark distal flipper patch

^a One of these animals are shown in Fig. 2a. Photographs for the other animals are also available

^b This animal is shown in Fig. 2b (possibly the same individual by the proximity of both sites)

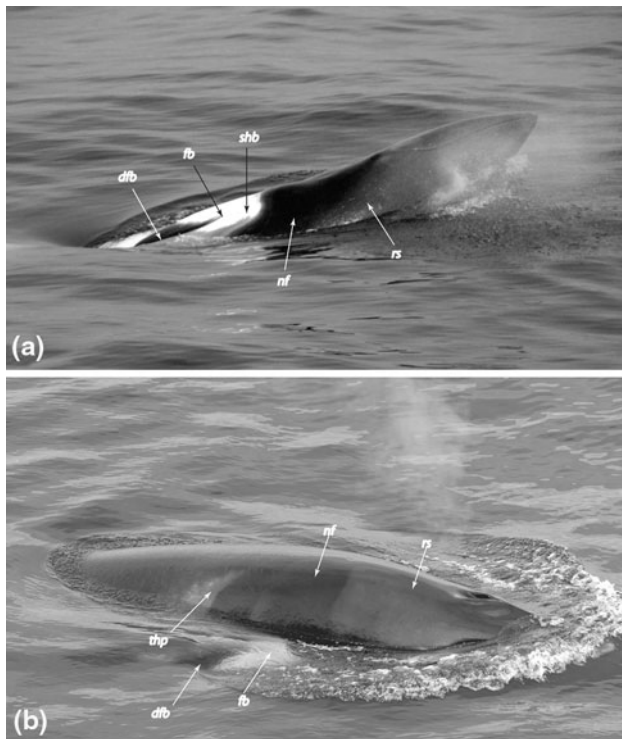


Fig. 2 Dwarf minke whales observed in Cape Lindsey, Elephant Island, Antarctica on January 1997 (a), and off Greenwich Island, Antarctica, in January 2007 (b). *fb* striking white patch on the flippers, *shb* shoulder blaze, *dfb* dark distal flipper patch, *rs* light rostral saddle, *nf* dark nape field, *thp* light grey thorax patch anterior

One of the questions to be resolved is the migratory connections for the animals sighted around the Antarctic Peninsula. A possible migratory connection of dwarf minke whales among low latitudinal waters of Brazil, mid-latitudinal waters of Chilean Patagonia and high latitudinal waters around the Antarctic Peninsula was suggested (Acevedo et al. 2006, 2007). Pastene et al. (2010) based in all known genetic samples of dwarf minke whales in the Southern Hemisphere, including the sample obtained in Antarctic Peninsula, reported a high degree of maternal genetic differentiation between dwarf minke whales from Brazil, Chilean Patagonia and Antarctic Peninsula (western South Atlantic) with those from the western South Pacific (Tonga, New Zealand, Antarctic waters of the western South Pacific) suggesting that dwarf minke whales of both ocean basins are genetically structured in the Southern Hemisphere. Moreover, the close phylogenetic relationship obtained among whales from Brazil, Chilean Patagonia and Antarctic Peninsula (in comparison with dwarf minke whales in the western South Pacific) is consistent with the hypothesis of seasonal migratory connections among these three localities. However, larger sample sizes are required to examine further this hypothesis.

Direct evidence of migratory connection of dwarf minke whales between low latitudinal breeding areas (Brazil) and

high latitudinal feeding areas (Chilean Patagonia and Antarctic Peninsula) could be obtained with the analysis of additional skin sample and through tag-satellite tracking experiments in the near future. Additionally, surveys in winter seasons are also recommended to investigate further the occurrence of dwarf minke whales in Antarctic waters in that season. Moreover, for the management purposes, assessment should be carried out separately for both species in the future. The information on the proportion of Antarctic and dwarf minke whales by 1° latitude in Fig. 1 is a step forward in that direction.

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