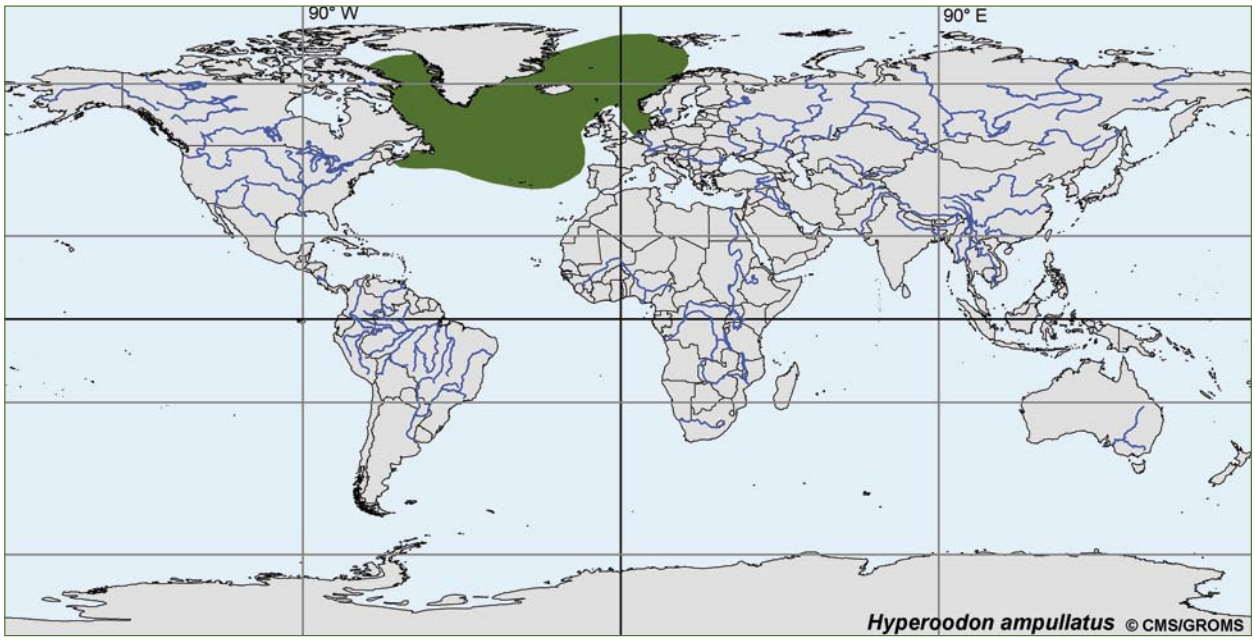
5.15 Hyperoodon ampullatus (Forster, 1770)

English: North Atlantic bottlenose whale
German: Dögling, Entenwal
Spanish: Ballena nariz de botella del Norte
French: Hyperoodon boréal

Drawing of Hyperoodon ampullatus © Wurtz-Artescienza.

1. Description

Bottlenose whales are relatively large beaked whales and reach 6-9 m body length. Their body shape is robust and they have a large, bulb-shaped forehead and short, dolphin-like beak.Their colour is chocolate brown to yellow, being lighter on the flanks and belly. This coloration is believed to be caused by a thin layer of phytoplankton, diatoms. Mature males have a squared-off forehead, which turns white after sexual maturity is reached, whereas in females and immature males it is rounded and brown (Bloch et al. 1996). Males possess a single pair of conical teeth at the tip of the lower jaw, rarely visible in live animals (Gowans, 2002).



Distribution of Hyperoodon ampullatus: North Atlantic Ocean, normally in water deeper than 1,000 m (mod. from Carwardine, 1995; © CMS/GROMS).

2. Distribution

The North Atlantic bottlenose whale is found in the subarctic North Atlantic from Davis Strait, Jan Mayen, west coast of Spitsbergen, and Bjornøya, south to Nova Scotia and the western side of the British Isles (Rice, 1998). Lucas and Hooker (2000) report recent strandings from Sable Island, Nova Scotia and Gowans (2002) includes the Azores into the normal range of the species.

Most if not all past reports of *Hyperoodon ampullatus* in the temperate and subarctic North Pacific seem to have been due to confusion with *Berardius bairdii*, because both species are known colloquially as "bottlenose whales" (Rice, 1998).

There seem to be certain pockets of abundance, for example: around "the Gully", north of Sable Island, Nova Scotia, Canada; in the Arctic Ocean, between Iceland and Jan Mayen, southwest of Svalbard and East off Iceland-North off the Faroes; and in Davis Strait, off northern Labrador, Canada, especially around the entrance to Hudson Strait and Frobisher Bay (Carwardine, 1995). There are no confirmed records from Novaya Zemlya, the Barents Sea or the coast of Finnmarken (Mead, 1989).

North Atlantic bottlenose whales are less common in the extreme southern part of their range (Carwardine, 1995). There are few records east of the Norwegian Sea and from the Mediterranean (Rice, 1998). One specimen was reportedly caught in the North Sea during the period 1938-1972. The species has not been sighted since in the North Sea, but strandings are reported from the coasts of Belgium, Denmark, France and England (Mead, 1989). Strandings have been reported from as far south as Rhode Island (Mead, 1989; Reyes 1991). Kinze et al (1998) report on a recent stranding on the coast of Denmark, Lick and Piatkowski (1998) on a stranding in the Southern Baltic Sea, Van Gompel (1991) on an animal stranded in Belgium and Kastelein and Gerritis (1991) on an animal observed off The Netherlands. One of the most southerly report stems from Duguy (1990) who reports a stranding on the French coast.

Animals in The Gully, off Nova Scotia, seem to be largely or totally distinct from the population seen off northern Labrador: they are smaller and appear to breed at a different time of year (Whitehead et al. 1997).

Earlier, Reyes (1991) found no evidence of the existence of stocks within the species. For statistical consideration Christensen (1976, in Reyes, 1991) assumed that all the bottlenose whales caught east of Greenland belonged to a single population, while Mitchell (1977, in Reyes, 1991) defined Cape Farewell (Greenland) to divide west and east North Atlantic catches.

3. Population size

A study by Christensen and Ugland (1984, in Reyes, 1991) resulted in an estimated initial (pre-whaling) population size of about 90,000 whales, reduced to some 30,000 by 1914. The population size by the mid-1980's was said to be about 54,000, nearly 60% of the initial stock size. Estimates for Icelandic and Faroese waters are 3,142 and 287 whales respectively, although allowance was not made in the surveys for animals not observed because of their long dives (Reyes, 1991). NAMMCO has calculated the population size of this species in the eastern part of the North Atlantic to be around 40,000 individuals (NAMMCO Annual Report 1995).

Whitehead et al. (1997) estimate that approximately 230 *H. ampullatus* use the Gully, a prominent submarine canyon on the edge of the Nova Scotia Shelf throughout the year. Approximately 57% of the population reside in a 20 x 8 km core area at the entrance of the canyon at any time. However, Gowans et al. (2000) analysed data from 11 years of photo-identification records to estimate the population size using mark-recapture techniques. The population estimate for the Gully is much smaller, with only 133 individuals. There was no significant increase or decrease in the population. Sex ratio was roughly 1:1, with equal numbers of sub-adult and mature males.

4. Biology and Behaviour

Habitat: *H. ampullatus* is most common beyond the continental shelf and over submarine canyons, in deep water (>1,000 m deep). It sometimes travels several kilometres into broken ice fields, but it is more common in open water. It is known to strand (Carwardine, 1995; Jefferson et al. 1993). Few whales were caught over the continental shelf off Labrador and in waters less than 1000 m deep off the west coast of Norway. In the surrounding waters of Iceland, the whales were sighted at surface temperatures between -1.3°C and +0.9°C (Reyes, 1991).

Behaviour: The Northern Bottlenose Whale is a curious animal: it will approach stationary boats and seems to be attracted by strange noises, such as those made by ships' generators. This, combined with its habit of staying with wounded companions, made it especially vulnerable to whalers: 65,800 were caught by Norway in the time period 1882-1972 (Reeves et al. 1993, Bloch et al. 1996). These deep-divers can remain submerged for an hour, possibly as long as 2 h.

Reproduction: Northern bottlenose whales have a calving peak in April (Jefferson et al. 1993).

Schooling: Most pods contain at least 4 whales, sometimes with as many as 20, and there is some segregation by age and sex (Mead, 1989, Jefferson et al. 1993).

Food: Although primarily adapted to feeding on squid, these whales also eat fish, sea cucumbers, starfish, and prawns. They apparently do much of their feeding on or near the bottom (Jefferson et al. 1993; Mead, 1989). Hooker and Baird (1999) showed that northern bottlenose whales in a submarine canyon off Nova Scotia exhibit an exceptional diving ability, with dives approximately every 80 min to over 800 m (maximum 1,453 m) depth, and up to 70 min in duration. Sonar traces of non-tagged, diving bottlenose whales in 1996 and 1997 suggest that such deep dives are not unusual. This shows that they may make greater use of deep portions of the water column than any other mammal so far studied. Many of the recorded dives of the tagged animals were to, or close to, the sea floor, consistent with benthic or bathypelagic foraging. Hooker et al. (2001) found a high proportion of the squid *Gonatus steenstrupi* in the stomachs of two bottlenose whales stranded in eastern Canada. They also collected remote biopsy samples from free-ranging bottlenose whales off Nova Scotia and determined fatty acid composition. Overall, the results of these techniques concurred in suggesting that squid of the genus *Gonatus* may form a major part of the diet of bottlenose whales in the Gully (Hooker et al. 2001).

Stomach content analysis by Clarke and Christensen (1980) on a specimen stranded on the Faroe Islands showed that while the cephalopods found included six cold water species which were probably taken in deep water within the vicinity of the Faroes, they also included one species, *Vampyroteuthis infernalis*, which is a warmer water species and probably comes little further north than 40°N. This suggests the whale had been much further south in the Atlantic than the Faroes at 62°N just before its stranding or that the distribution pattern of cephalopods is not that well known. The stomach contents examined in the Faroese show more diversity with 13 species eaten than those from a whale stranded in Denmark (Clarke & Kristensen, 1980) and from whales shot off Labrador and Iceland (Benjaminsen & Christensen, 1980) which contained only one species, *Gonatus fabricii*. For details on beaked whale diet and niche separation see also the account on Mesoplodont whales (see page 154).

5. Migration

Migratory movements are poorly documented, as are stock relations among the animals found in apparently disjunct centres of spring and summer abundance (Reeves et al. 1993). In the eastern part of the range *H. ampullatus* probably moves north in spring and south in autumn; in the west, at least some animals are believed to overwinter at lower latitudes. There may also be some inshore-offshore movements (Carwardine, 1995).

In the western North Atlantic, Bottlenose whales are present during much of the year in The Gully near Sable Island (Nova Scotia) and in the Labrador Sea. Bottlenose whales in The Gully appear to be non-migratory, and this population of a few hundred whales might be vulnerable to the environmental degradation associated with nearby oil and gas production (Reeves et al. 1993). However, Gowans et al. (2000) found that over the summer field season, individuals emigrated from, and re-immigrated into the Gully, spending an average of 20 days within the Gully before leaving. Approximately 34 % of the population was present in the Gully at any time. Individuals of all age and sex classes displayed similar residency patterns although there were annual differences as individuals spent less time in the Gully in 1996 than in 1990 and 1997. Sighting rates were similar in all years with extensive fieldwork, indicating little variability in the number of whales in the Gully each summer.

Mitchell (1977, in Reyes, 1991) suggested that in the western North Atlantic, *H. ampullatus* may forage into the Northeast Channel and the Gulf of Maine in winter months.

A southward migration, better known in the eastern North Atlantic begins in July, when animals are moving

south from the Norwegian Sea, and continues to September. The Increase of strandings on the British coasts and on the North Sea coasts probably reflects part of this summer migration, which remains unknown in the northwest Atlantic. There is evidence from the distribution of catches that a northward migration occurs in the eastern North Atlantic in April-July (Reyes, 1991 and refs. therein). Bottlenose whales occur all year round in the Faroes, but with a distinct peak a fortnight around 1 September pointing at a very synchronized southernly migration route (Bloch et al. 1996).

For the Atlantic Frontier, an area of deep water to the north and west of Scotland, bottlenose whale (*Hyperoodon ampullatus*) and Sowerby's beaked whale (*Mesoplodon bidens*) sightings were analysed and the relationship between sightings and oceanographic variables examined. There seem to be two important areas for beaked whales on the Atlantic Frontier: The Shetland-Faroes Channel and an area to the south-west of the Faroes, including the northern end of the Rockall Trough. These areas are linked by a corridor of suitable beaked whale habitat approximately 80 km long and 50 km wide at its narrowest point. Evidence of migratory movements of beaked whales in the north-east Atlantic was obtained from an examination of historical strandings data from the United Kingdom and the Republic of Ireland, and from whaling records from the Faroes, Iceland and the Norwegian Sea. There is strong evidence to suggest that beaked whales, particularly northern bottlenose whales, undertake regular migrations, moving south-west in late summer and autumn and moving north-east in late winter and spring. During movements between the Shetland-Faroes Channel to the area south-west of the Faroes, or vice-versa, the narrow corridor of suitable beaked whale habitat which connects these two areas may form a 'bottleneck' through which the beaked whales must pass. Due to the restricted area of suitable habitat, beaked whales may be particularly vulnerable to anthropogenic im-pacts at this point. In particular, noise pollution, which has the potential to impact a large area simultaneously, in this bottleneck area during migrations may have a disproportionately large impact on beaked whales on the Atlantic Frontier (Mac Leod and Red, 2003).

6. Threats

Direct catch: Northern bottlenose whales have traditionally been the most heavily hunted of the beaked whales. Some hunting has been done by the British and Canadians, but by far the major bottlenose whaling nation was Norway. Early on, they were hunted primarily for oil, but later mainly for animal feed. No hunting has been conducted by Norway since 1973 (Jefferson et al. 1993, Reyes, 1991). The species has been protected since 1977 (Carwardine, 1995).

Mitchell (1977, in Reyes, 1991) considers that the population was severely depleted in both the early and modern whaling periods. At present some are taken in the Faroe Islands, on average 2.2 whales per year in the period 1709-2002. However, there are reports that this limited catch probably does not constitute a significant threat to the species (Reyes, 1991; NAMMCO, 1995).

Incidental catch: None reported (Reyes, 1991).

Pollution: Pollutant levels in this species are usually low (Reyes, 1991 and ref. therein).

Habitat degradation: Whitehead et al. (1997) report that threats to the population in The Gully off Nova Scotia include commercial shipping, fishing and oil and gas developments. One oil and gas discovery of commercial interest, the Primrose Field, lies about 5 km from the core area of this population. The population is vulnerable because of its small size, location at the extreme southern limit of the species' range, and year-round dependence on a small and unique sea area. It is threatened by plans for the development of the oil and gas fields close to the Gully.

Overfishing: There are no major fisheries for squid in the Northeast Atlantic, but future developments could represent some threat for populations as heavily depleted as that of the bottlenose whale.

7. Remarks

The northern bottlenose whale is said to have been twice overexploited by Norwegian hunting, in the periods 1880-1920 and 1938-1973. It was included in the IWC Schedule in 1977 and classified as a provisional Protected Stock with zero catch limits (Reyes, 1991 and refs. therein).

H. ampullatus is categorised as "Low Risk, conservation dependent" by the IUCN. It is listed in appendix II of CMS as well as in Appendix I & II of CITES.

Range States include Canada, Denmark (Faroe Islands), Iceland, Ireland, Norway, United Kingdom, and

the United States. The species is protected through general marine mammal legislation in these countries. Norway, Ireland and United Kingdom are Parties to the Convention (Reyes, 1991).

Populations or stocks are not defined; this, together with estimates of present abundance as well as present levels of catches (Faroe Islands), should be the focus of future studies (Reyes, 1991).

Kindly reviewed by Dorete Bloch, Museum of Natural History, Thorshavn, Faroe Islands.

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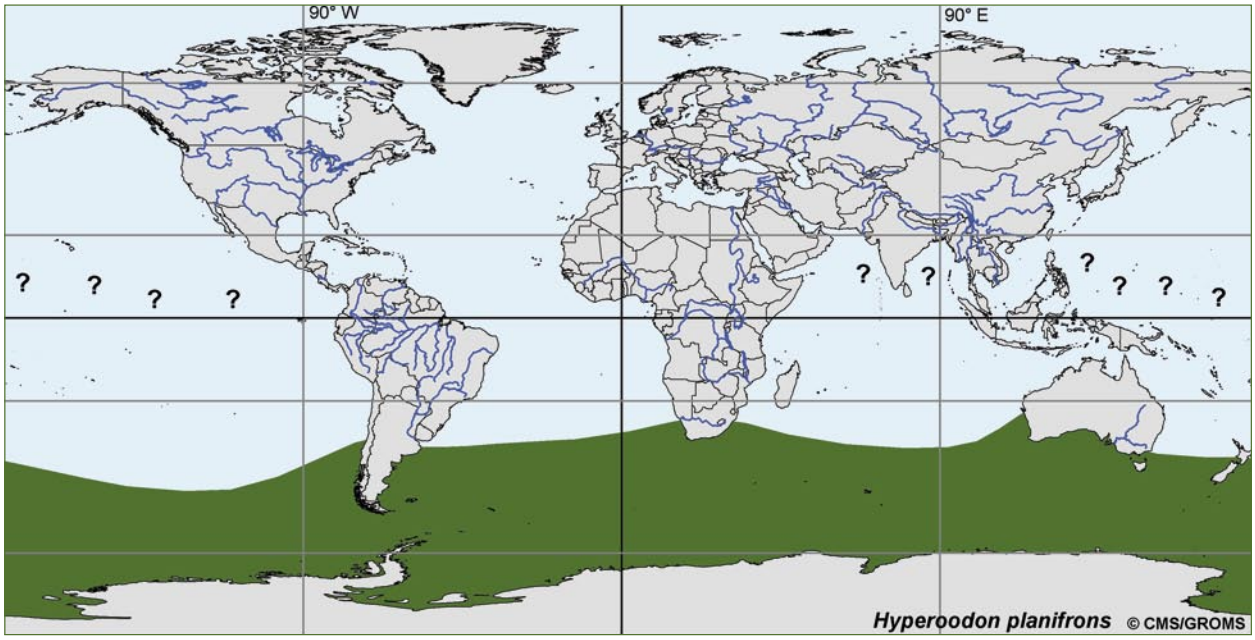
5.16 Hyperoodon planifrons (Flower, 1882)

English: Southern bottlenose whale
German: Südlicher Entenwal
Spanish: Ballena a nariz de botella del sur
French: Hypéroodon austral

Drawing of Hyperoodon planifrons © Wurtz-Artescienza.

1. Description

Bottlenose whales are relatively large beaked whales and reach 6-9 m body length. Their body shape is robust and they have a large, bulb-shaped forehead and short, dolphin-like beak. Their colour is chocolate brown to yellow, being lighter on the flanks and belly. This coloration is believed to be caused by a thin layer of phytoplankton, diatoms. Mature males have a squared-off forehead, whereas in females and immature males it is rounded. Males possess a single pair of conical teeth at the tip of the lower jaw, rarely visible in live animals (Gowans, 2002).



Distribution of Hyperoodon planifrons (mod. from Jefferson et al. 1993; © CMS/GROMS): The species inhabits the cold, deep waters of the southern hemisphere from Antarctica North to at least 29°S (Carwardine, 1995).

2. Distribution

Southern bottlenose whales are thought to have a circumpolar distribution in the Southern Hemisphere, south of 29°S (Mead, 1989; Jefferson et al. 1993) and to cover a wider range than their northern counterparts (Carwardine, 1995). They occur from Rio Grande do Sul in Brazil, Cape Province in South Africa, 31°S in the western Indian Ocean, Dampier Archipelago in Western Australia, Ulladulla in New South Wales, North Island in New Zealand, and Valparaiso in Chile, south to the Antarctic continent (Rice, 1998).

Possible sightings south of Japan, around Hawaii, and along the equator (in the Pacific and Indian Oceans) have not been identified with certainty, but may be discrete populations of this species (Carwardine, 1995; Jefferson et al. 1993).

The records from north-western Australia and from Brazil indicate that *H. planifrons* also occurs in warm temperate waters. It makes plausible the identification of a beaked whale that has been observed in the eastern equatorial Pacific as this species. There have been several reports of a species of *Hyperoodon* in the North Pacific but so far all incidents could be attributed to *Berardius bairdii* (Mead, 1989 and refs. therein). Recent molecular work indicates that there may be more than one species (Dalebout et al. 1998). Pitman et al. (1999) suggested that the tropical bottlenose whale is actually Logman's beaked whale *Indopacetus pacificus*, known hitherto only from skeletal remains.

3. Population size

Mead (1989) reported that there are no population estimates or even rough figures on relative abundance of *Hyperoodon planifrons*. In 1995, Kasamatsu and Joyce (1995) published abundance estimates for south of the Antarctic Convergence in January: 599,300 beaked whales, most of which were southern bottlenose whales.

4. Biology and Behaviour

Habitat: *H. planifrons* is most common beyond the continental shelf and over submarine canyons, in water deeper than 1,000 m. It is rarely found in water less than 200 m deep. In summer, this species is most frequently seen within about 100 km of the Antarctic ice edge, where it appears to be relatively common (Carwardine, 1995). Cockroft et al. (1990) report sightings in the steep thermocline between the Agulhas current and cold Antarctic water masses.

Behaviour: The southern bottlenose whale is poorly known and rarely observed at sea. It lives far from shipping lanes, and has never been heavily exploited, so it has not been as well studied as its northern counterpart. There are few reports of swimming near boats, but this may be due to lack of observation rather than shyness. After long dives, it may remain on the surface for 10 minutes or more, blowing every 30 to 40 seconds. It can stay underwater for at least an hour, but typical dive time is shorter. When swimming fast, especially under stress, it may raise its head clear of water on surfacing. Probably a deep diver, though it does not tend to travel much horizontal distance while submerged (Carwardine, 1995). There is essentially nothing known of the reproductive biology of this species (Jefferson et al. 1993).

Schooling: Pods of less than 10 are most common, but groups of up to 25 have been seen (Jefferson et al. 1993).

Food: Southern bottlenose whales are thought to take primarily squid, but probably they also eat fish (Jefferson et al. 1993; Slip et al. 1995; Clarke and Goodall, 1994). Consumption of food (mostly squid) by all Odontocetes south of the Antarctic convergence was estimated as 14.4 million tonnes with 67% of the total consumed by beaked whales. Odontocetes, especially southern bottlenose whales, are suggested to have a much greater role in the Antarctic ecosystem than has previously been considered (Kasamatsu and Joyce, 1995). For details on beaked whale diet and niche separation see also the account on Mesoplodont whales (see page 154).

5. Migration

Southern bottlenose whales apparently migrate, and are found in Antarctic waters during the summer. Like other beaked whales, they are deep-water oceanic animals (Jefferson et al. 1993). Kasamatsu and Joyce (1995) investigated the spatial distribution of various cetacean species during mid-summer in Antarctic waters and found different peaks of occurrence for each species by latitude, suggesting possible segregation. Killer whales occur mainly in the very southernmost areas, sperm whales in the southern half of the study area, whereas beaked whales (mostly southern bottlenose whales *Hyperoodon planifrons*) ranged over a wide area.

Sekiguchi et al. (1993) investigated the stomach contents of 2 southern bottlenose whales, a male caught

off the east coast, and a female stranded alive on the west coast of South Africa, respectively. Both stomachs contained only remains of oceanic squid species, with four Antarctic and 4 subantarctic squid species present. Sightings of southern bottlenose whales off Durban between February and October showed a strong seasonality with peaks in February and October. The beaks of Antarctic and subantarctic squids in the stomachs, plus the presence of cold water skin diatoms *Bennettella* (= *Cocconeis*) *ceticola* on the male, suggest that the animals had arrived comparatively recently in South African waters from higher latitudes.

6. Threats

Although never taken commercially, some southern bottlenose whales have been killed during whaling for research purposes. Recently, several of this species have been recorded as accidental victims of driftnet fishing in the Tasman Sea. Numbers taken annually are not known, however (Jefferson et al. 1993).

7. Remarks

There is very little information about this species, its biology, abundance, by-catch rates and migratory patterns. More research is clearly needed. *Hyperoodon planifrons* also occurs in southern South America. Recommendations iterated by the scientific committee of CMS for small cetaceans in that area (Hucke-Gaete, 2000) also apply (see Appendix 1). For recommendations on south-east Asian stocks, see Perrin et al. (1996) in Appendix 2.

Both *Hyperoodon* species are listed in Appendix I & II of CITES. *H. planifrons* is categorised as "Low Risk, conservation dependent" by the IUCN. It is not listed by CMS. However, listing by CMS should be considered, based on the fact that the animals seem to undergo migrations between the coasts of various range states and the open ocean.

Potential range states include Chile, Argentina, the United Kingdom (Falklands and South Georgia), Norway (Bouvet Island), the Republic of South Africa, France (Kerguélen Islands), Australia, and New Zealand.

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5.17 Indopacetus pacificus (Longman, 1926)

English: Indo-Pacific whale, Longman's beaked whale
German: Pazifischer Schnabelwal
Spanish: Zifio de Longman
French: Baleine a bec de Longman

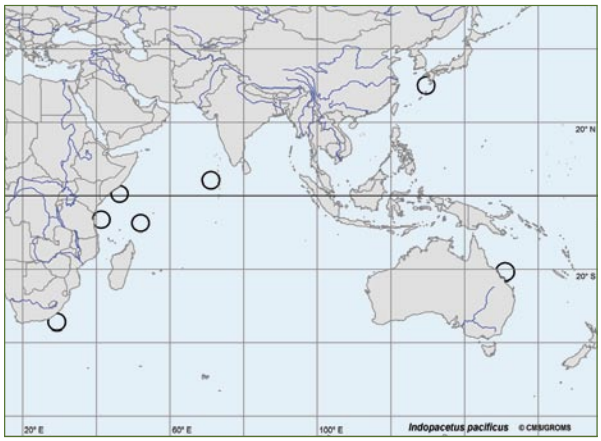
1. Description

This is one of the least known cetaceans, whose existence was first derived from only two skulls. A total of seven specimens are now known (Dalebout et al. 2003). While Pitman (2002) states that the species has never been identified in the flesh, dead or alive, there is a recent report of Yamada (2002) of a dead stranding of a whole specimen in Japan (see also "selected web-sites").

The skull is large for a beaked whale, suggesting an animal around 7m long. There have been several possible sightings. In 1980, 2 light grey whales were seen by experienced observers near the Seychelles, in the Indian Ocean: one was estimated at 7.5 m and the other at 4.6 m; both had elongated beaks and broad flukes with straight trailing edges (Carwardine, 1995).

2. Distribution

Originally described as a species of *Mesoplodon*, this distinctive but poorly known whale has erroneously been thought to be a race of *Mesoplodon mirus* or a synonym of *Hyperoodon planifrons* (Rice, 1998).



Distribution of Indopacetus pacificus: possibly deep tropical waters of the Indian and Pacific Oceans (mod. From Carwardine, 1995; Mead, 1989; Yamada, 2002; Dalebout, pers. comm.; © CMS/GROMS).

Longman's beaked whale is known from the skulls of two animals which stranded at Danane (01°50'N, 45°03'E), Somalia, in 1955, and at Mackay (21°10'S, 149°10'E), Queensland, Australia, in 1882. (The large unidentified "tropical bottlenose whales" observed in the Indian and Pacific oceans belong to this species; Dalebout, 2003; Rice, 1998). There are new specimens from Kenya, from the Indian Ocean coast of South Africa, and from the Maldives, all positively identified on the basis of morphological characteristics and DNA analyses (M Dalebout, pers. comm.). Balance and Pitman (1998) believe to have seen three *I. pacificus* in the pelagic Western Indian Tropical Ocean.

A specimen first observed in 2002 near Kagoshima, Japan, later stranded. The widely separate locations suggest an extensive range in both the Indian and Pacific Oceans. Based on knowledge of other beaked whales, and the fact that it is rarely seen, it is thought to live in deep, pelagic waters (Carwardine, 1995; Mead, 1989).

Pitman et al. (1999) summarise that about all that is currently known about *I. pacificus* is that it is large, occurs in tropical waters of the western Indian and western Pacific oceans, and has apical teeth. Two explanations for how so large a marine mammal has almost completely escaped the attention of zoologists for so long are proposed: 1) Tropical waters are often adjacent to land masses where there are few if any cetologists and in waters where up until recently little or no pelagic survey work has been conducted. Furthermore, the tropical bottlenose whale is quite a rare species. 2) *I. pacificus* is a large beaked whale of unknown physical description that has for decades been known (or at least suspected) to inhabit the tropical Indo Pacific. Because of a strong physical resemblance, it has, over the years, been repeatedly mis-identified as *Hyperoodon* spec. or *Mesoplodon* spec.

3. Population size
No entries.

4. Biology and Behaviour
No entries.

5. Migration
No entries.

6. Threats
No entries.

7. Remarks
Longman's beaked whale is listed by the IUCN as "Data Deficient" and is not listed by CMS. More information is clearly needed.

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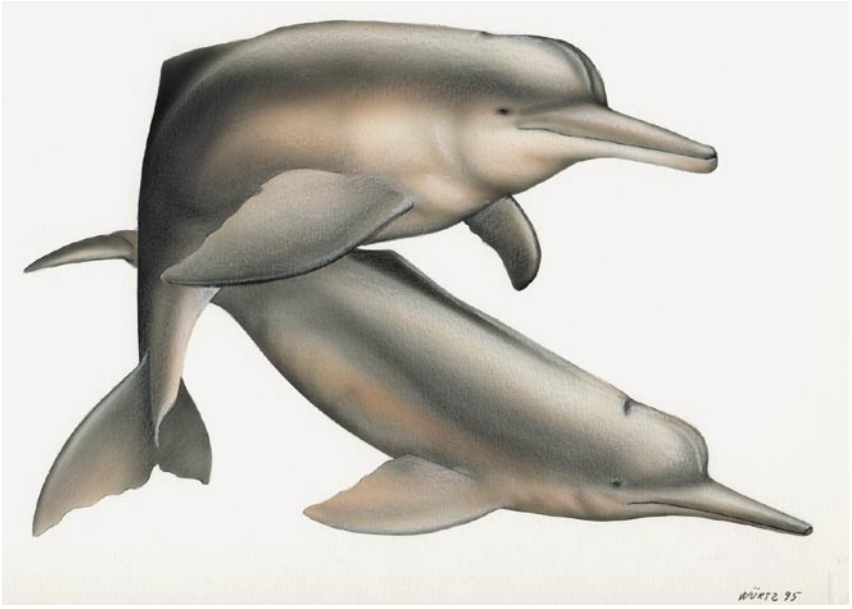
5.18 Inia geoffrensis (de Blainville, 1817)

English: Amazon river dolphin, Boto, Inia
German: Amazonas-Delphin
Spanish: Bufeo
French: Dauphin de l'Amazon



Drawing of Inia geoffrensis © Wurtz-Artescienza.

1. Description

The boto is the largest of the river dolphins. Males reach a maximum body length of 255 cm and a mass of 185 kg, the smaller females reach 215 cm and 150 kg. The body is corpulent and heavy but extremely flexible: the head can be moved in all directions. The flukes are broad and triangular, the dorsal fin is low, keel-shaped long, extending from the midbody to the caudal peduncle. The flippers are large, broad and paddle-like. Whereas swimming speed is not very high, botos are capable of manoeuvring very well between trees in the flooded forest. The rostrum and mandible are long and robust and the melon is small and flaccid. Its shape can be muscularly controlled. Whereas young animals are dark grey, older botos are completely pink or blotched pink and may have a darker back (da Silva, 2002).

Map showing the general distribution of Inia geoffrensis on the Amazon-Orinoco river systems. (mod. from da Silva, 2002; © CMS/GROMS).

2. Distribution

The boto has a very wide distribution and can be found almost everywhere it can physically reach without venturing into marine waters (da Silva, 2002). There are three morphologically distinguishable populations, which are best recognised at the subspecific level (Rice, 1998):

I. g. humboldtiana (Pilleri and Gihr, 1978): ranges in the Orinoco River system, including the Apure and Meta rivers, upstream as far as the rapids at Puerto Ayacucho (Rice, 1998). Contact between this race and the next is restricted, at least during low water, by waterfalls on the upper Rio Negro, by the rapids on the Orinoco river between Samariapo and Puerto Ayacucho, and by the Casiquiare Canal itself (da Silva and Martin, 2000).

I. g. geoffrensis: can be found throughout most of the Amazon River and its tributary rivers (below an elevation of about 100 m), including the Tocantins, the Araguaia, the lower Xingu up to the rapids at Altamira, the lower Tapajós up to the rapids at Sao Luis, the Madeira as far as the rapids at Porto Velho, the Purús, the Juruá, the Ica, the Japura, the Branco, and up the Negro through the Canal Casiquiare into the headwaters of the Orinoco, from whence in ranges as far downstream as San Fernando de Atabapo, including its tributary the Guaviare (Rice, 1998).

I. g. boliviensis (d'Orbigny, 1834): occurs in the upper Rio Madeira drainage in Bolivia, where it is confined to the Rio Mamoré and its main branch the Rio Iténez (= Rio Guaporé), including lower reaches of their larger tributaries (at an elevation of 100-300 m). There are no credible reports from the Rio Beni or any of its tributaries above Riberalta. This subspecies appears to be isolated from the previous one by 400 km of rapids from Porto Velho on the Rio Madeira in Brazil upstream to Riberalta on the Rio Beni in Bolivia. However, Inias of undetermined subspecies live in the Rio Abuna and its tributary the Rio Negro, which enters the Madeira/Beni an the border between Brazil and Bolivia (Rice, 1998 and references therein). Botos in the Beni system may, in fact, constitute a separate species (da Silva 1994) although, at present, a single species is recognised. The IWC sub-committee (IWC, 2000) recognised that this was still an unreconciled issue and awaits the publication of the genetic work.

Banguera-Hinestroza et al. (2002) collected 96 DNA samples from specimens in the Orinoco basin (four rivers), the Putumayo River, a tributary of the Colombian Amazon and the Mamoré, and the Tijamuchy and Ipurupuru rivers in the Bolivian Amazon. From mitochondrial DNA and mitochondrial cytochrome b gene analysis, a subdivision of the *Inia* genus was proposed into at least two evolutionarily signifcant units: one conned to the Bolivian river basin and the other widely distributed across the Amazon and Orinoco basins.

3. Population size

The boto is the most common river dolphin and population densities appear to be relatively high throughout much of its range (IWC, 2000). Its current distribution and abundance apparently do not differ from the past, although relative abundance and density are highly seasonal and appear to vary among rivers (da Silva, 2002). Overall population size, however, is unknown and precise data on trends are insufficient for any of the three subspecies. However, human population growth in the upper reaches of the Mete and other rivers in Colombia might have led to declines of dolphin populations (IWC, 2002).

Differences in density exist between different river systems. Surveys in a 1,200 km section of the Amazon River between Manaus and Santo Antonio de Ica yielded estimates averaging 332 dolphins (Best and da Silva, 1989). Pilleri and Gihr (1977) report an average of one dolphin per 4 km over 130 km on Rio Ichilo, one per 0.9 km on Rio Ipurupuru, and one per 1.0 km on Rio Ibare. From boat survey data Best and da Silva (1989) found an average density of 0.22 *Inia* per km. Vidal et al. (1997) conducted a boat survey in June 1993 to estimate Inia abundance along ca. 120 km of the Amazon River bordering Colombia, Peru, and Brazil. Overall, the mean group size for *Inia* was 2.9 individuals. *Inia* density was highest in tributaries with 4.8 dolphin/km, followed by areas around islands 2.7 dolphin/km and along main banks 2.0 dolphin/km. These are among the highest densities measured to date for any cetacean.

In Bolivia, Aliaga-Rossel (2002) counted 208 bufeos in the Tijamuchi River, with an average encounter rate of 1.12 dolphins per linear km in 1998-99. Dolphins were seen most frequently during low and falling water (56% of total observations) and least often during high waters (22% of total observations).

Da Silva and Martin (2000) summarised population data throughout the range, but the authors point out that differences in survey methodology, river morphology and hydrology make any meaningful comparisons between the numerous studies extremely difficult. Nevertheless they also note that density estimates for a 120 km section of the Colombian Amazon are among the highest for any cetacean.

4. Biology and Behaviour

Habitat: Amazon river dolphins are exclusively freshwater. In the Orinoco and Amazon basins, the species is found in a variety of riverine habitat types, including rivers, small channels and lakes, excepting the estuaries and strong rapids and waterfalls. Concentrations occur mainly at the mouth of rivers, below rapids and smaller channels running parallel to the main river. During the high-water season dolphins may utilize both the flooded forest and grasslands, throughout most of Amazon River and its tributary rivers (Reyes, 1991).

Schooling: Although rarely seen in groups of four or more, *Inia* is most often observed as a solitary individual. Loose aggregations have been observed at feeding areas. Most groups of two are apparently mothers and calves. In the survey done by Magnusson et al. (1980), from Manaus to Tefé 81% of the sightings were of a single individual and only 3% of sightings were of four or more animals. Of 407 sightings made from Manaus to Tabatinga, 69% were of one animal and 3% were of four or more. In surveys from Leticia, 58% of sightings were of one animal while 14% were of four or more (Best and da Silva, 1989). Although more often a solitary feeder, *Inia* sometimes form loose groups that fish in a coordinated fashion to herd and attack shoals. These groups may also include the tucuxi (*Sotalia fluviatilis*) and the giant otter (*Pteronura brasiliensis*). Similar group relationships can develop with man in his fishing canoe. Fishermen, on their part, use dolphins to localise shoals of fish and the dolphins use the human fishing operation as a means of disrupting the shoal to their advantage (Best and da Silva, 1989).

Food: *Inias* may frequent shallow waters primarily for feeding (Best and da Silva, l989). About 50 species of fish have been reported as the food of Amazon river dolphins in the central Amazon. Sciaenids, cichlids and characins are the preferred prey; some of them are of commercial value (Best and da Silva, l989).

Reproduction: Calving occurs during the months of May, June, and July, coincident with peak river levels and their initial decline at the start of the dry season. This seasonality means that high energy demands near term and during early lactation are met by increased availability of fish driven from inundated forests by falling water levels. Gestation lasts 10-11 months (Best and da Silva, 1989).

5. Migration

Seasonal migrations seem to represent slight extensions of more or less stable home ranges. Some of these migrations, mostly during flood seasons, are known to cross international boundaries: in the Casiquiare Canal and Upper Rio Negro (Venezuela, Colombia and Brazil); in the Rio Madeira-Guapore system (Brazil and Bolivia); in the Takatu River (Brazil and Guyana) and at Leticia (Peru, Colombia and Brazil) (Best and da Silva, 1989).

The use of territories or home-ranges has been frequently implied (Pilleri and Gihr, 1977). Magnusson et al. (1980), however, found a random distribution along the Solimoes river. If home-ranges exist, they are large and overlapping and not centred around resources. Tagging studies by Best and da Silva (1989) show that individuals may remain in the same area for over a year, but area extent is not known.

Seasonal variation in distribution is being investigated at one site in the central Amazon of Brazil (Da Silva and Martin, 2000). Preliminary results show that most animals generally move only a few tens of kilometres between high and low water seasons. Of more than 160 marked animals, however three had been resighted more than 100 km from the tag site.

In the central Amazon, large changes in water levels affect the local distribution of botos. A 10-15 m increase in water level during the wet season leads to the inundation of large areas of forest. Da Silva and Martin (2000) noted that botos move out of the main river into channels and small lakes, and then into the forest itself, as the water rises.

6. Threats

Direct Catch: Parts of stranded or incidentally caught dolphins may be sold as love charms. In the Beni district, Bolivia, hunting with rifles and nets was previously reported (Pilleri, 1969; Pilleri and Gihr, 1977). Da Silva and Best (1996) conducted interviews with fishermen in boats, in the fishmarket and in the shops supposedly selling dolphin products in an attempt to quantify the overall incidental kill attributed to commercial fisheries operations. The results showed that in the Central Amazon dolphin catches are incidental and only a very small number of these carcasses are used for commercial purposes. In the Colombian Amazon some fishermen have killed *Inia* (including harpooning, shooting and deliberate poisoning) to deter gear interactions. In the Orinoco system and Peruvian Amazon there are also reports of some deliberate killings apparently due to interactions with fisheries (IWC, 2000).

Incidental catches: The main causes of man-made mortality of dolphins in Bolivia were identified as collisions with outboard motors and entanglement in fish-ing nets (Aliaga-Rossel, 2002). By-catch is also reported in the Amazon and Orinoco Rivers, but there are no estimates of the magnitude of these catches. However, fish landings have increased several fold in some areas, representing an increase in fishing effort. A major reason for this increase was the introduction

of nylon gillnets in the 1960s. Lampara seine nets, fixed and drift gillnets are responsible for the majority of dolphin deaths. A yet unknown number of dolphins are killed by explosions during illegal fishing operations (Best and da Silva, 1989). In general, incidental mortalities of this species appear to be seasonal and patchily distributed throughout the range. There are no estimates of total incidental mortality, and all accounts are anecdotal. The Scientific Committee of the IWC (2000) agreed that, in the absence of any information on total numbers taken or total population size, it was impossible to assess the significance of this source of mortality. The sub-committee recognised that it would be extremely difficult to obtain reliable estimates of incidental mortality because of the small-scale nature of the fisheries involved. A more sensible approach to the issue might be, in the first instance, to try to determine the scale of incidental mortalities in different types of fishing gear in different regions (IWC, 2000).

Deliberate killing: Amazon river dolphins have learned to take advantage of some fishing activities. They may tear fish from nets (in particular from lampara seine nets) causing considerable loss of fish catch and damage to fishing gear. Also, these dolphins congregate to eat fish stunned by dynamite used illegally by some fishermen. In both instances, fishermen may decide to kill the dolphins. Best and da Silva (1989) mention that at least two reports of harpooned dolphins exist, probably due to this interference with fishing operations.

Overfishing: According to da Silva and Best (1996) the use of nylon gill nets in the Amazon fishery is widely spread throughout the whole region, and with increasing fisheries pressure the potential for dolphin/fisheries interactions is much greater. Competition between man and dolphin for commercial fish, however, is still minimal in the Central Amazon. Dietary analysis has shown that only 43% of 53 identified prey species are of commercial value and that the dolphins generally prey on size-classes of fish below those of commercial interest.

Habitat degradation: Human populations are expanding rapidly in many areas of the boto´s range, especially in Colombia and Brazil. Such population increases result in increased agriculture, deforestation, cattle ranching and the establishment of plantations (IWC, 2000). Deforestation in flood plains for agriculture and the timber industry affects the hydrological cycle and the riverine ecosystem as a whole. One of the major effects of deforestation is the reduction of fish productivity, and hence reduction of food supply for river dolphins and other aquatic animals. Hydroelectric development is at present not a great threat, but several dams are projected for the next few years in the river systems of both Brazil and Venezuela (Best and da Silva, 1989, IWC, 2000). Dams may prevent migra-tions, breaking the populations into very small units with insufficient genetic variability, and reduce food supply (Ralls, 1989, in Reyes, 1991). Strandings in the Formosa River have been reported as resulting from changes in the water level produced by the deviation of waters for irrigation (Best and da Silva, 1989). Furthermore, the water areas behind dams provide an impoverished environment for *Inia*, with lower oxygen concentrations, lower pH levels and fewer fish (IWC, 2000).

Recently (IWC, 2000) oil exploration and production were also identified as a potential threat to *Inia*. In Colombia there had been many oil spills in recent years as a result of the ongoing guerilla war in the upland regions. Some of these had been very extensive, and represented a potential threat that has not yet been quantified. Anecdotal accounts of a decline in numbers were reported in Ecuador. These reported declines were linked to oil spills in the region, though the subcommittee noted that fluctuations in numbers would also be expected due to water level fluctuations.

Pollution: According to Reyes (1991), large quantities of pesticides are being used increasingly in agriculture in the Amazon and Orinoco Basins. Pollution by heavy metals in the Amazon comes from gold mining and associated indiscriminate use of mercury. Effluents from pulp mills are also a potential source of pollution (Best and da Silva, 1989). However, Rosas and Lethi (1996) report that the mercury concentration (176 ng/ml) found in the milk of a lactating *Inia* caught in the Amazon River near Manaus, Brazil was very close to the minimum level of methylmercury toxicity for non-pregnant human adults. This suggests that at least in this part of the river system, contamination is low.

7. Remarks

Inia geoffrensis is categorised as "vulnerable" by the IUCN (A1 cd). This is based on an observed, estimated, inferred or suspected reduction of at least 50% over the last 10 years or three generations, whichever is the longer, based on (and specifying) a decline in area of occupancy, extent of occurrence and/or quality of

habitat, and actual or potential levels of exploitation. Seasonal migration in this species is known to involve river systems shared by Brazil, Bolivia, Ecuador, Colombia, Guyana and Venezuela, at least, and the species is also listed in Appendix II of CMS. Brazil, Bolivia and Ecuador are considering to join the CMS (W. Perrin, pers. comm.).

According to a recent evaluation by the Scientific Committee of the IWC (2000), populations of the boto appear to be large and, at present, there is little or no evidence of any decrease in numbers or range. The subcommittee noted the increasing human pressures on the region, and recognised that future anthropogenic effects are to be expected, with declines in range and population fragmentation the most likely consequences. The Asian river dolphins provide a model for the possible effects of increased human populations and dam construction. The subcommittee therefore agreed that there is a need for appropriate monitoring schemes and formulated its recommendations accordingly.

The IWC sub-committee (IWC, 2000) recommended:

- that work on stock structure of *Inia* be conducted and existing studies should be brought to publication as soon as possible,

- that a registry of the distribution of this species should be established, recording in which waterways botos are present, and that the locations of all existing and proposed dams and other large-scale engineering works should be included. Information on other potential threats, such as the scale of fishing operations and the locations of oil pipelines might also usefully be included where practicable,

- that for each population, research should be directed towards detecting trends in abundance or any diminution of range, and identifying causes of any declines. Trends in abundance should be documented by making repeatable, statistically rigorous estimates of density in a range of regions and habitats.

The most significant anthropogenic impact on this species at present appears to be mortalities in fishing operations. These are either entirely incidental (entanglement) or to a greater or lesser extent deliberate, as fishermen are reportedly poisoning botos with baited fish, to limit net depredation, and also shooting and otherwise killing animals found in or near to nets. The sub-committee recommends that information should be collected to allow evaluation of the relative levels of mortality, both indirect and direct, associated with different fishing methods (IWC, 2000).

According to Vidal (1993), the management of renewable natural resources in developing countries has been hampered by a mix of socioeconomic and political difficulties that in turn have resulted in insufficient scientific knowledge, limited environmental awareness and education, and limited commitment to conservation. Aquatic mammals provide good examples. Because many aquatic mammal populations are shared by Latin American countries, international co-operation is critical to ensuring their long-term conservation.

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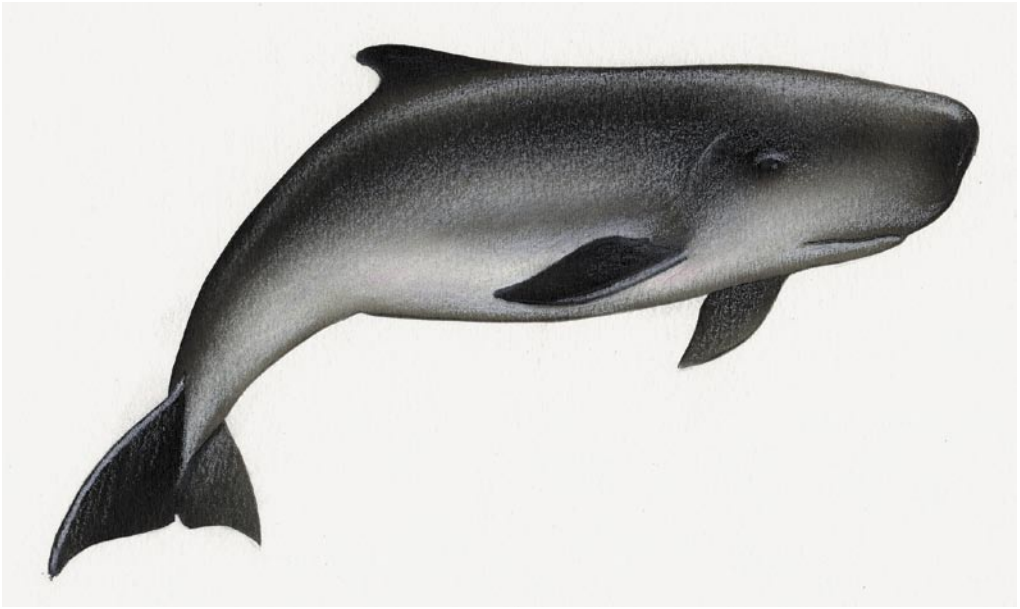
5.19 Kogia breviceps (de Blainville, 1838)

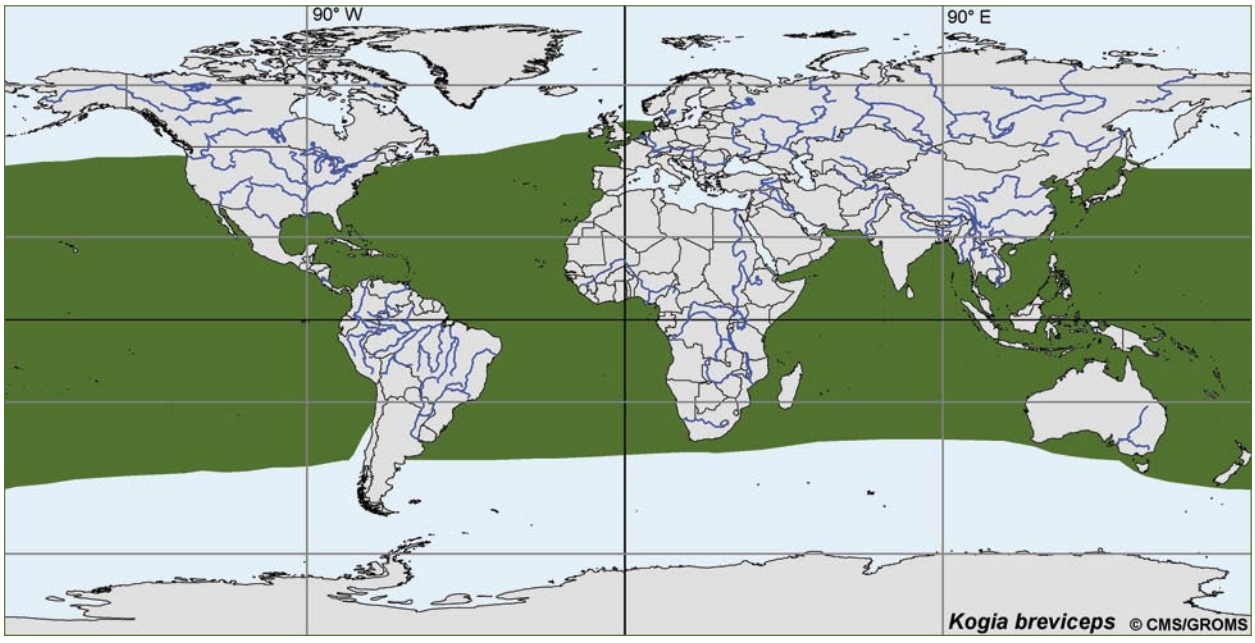
English: Pygmy sperm whale
German: Zwergpottwal
Spanish: Cachalote pigmeo
French: Cachalot pygmée



Drawing of Kogia breviceps © Wurtz-Artescienza.

1. Description

Kogia spp. are porpoiselike, and robust, with a distinctive underslung jaw, not unlike sharks. They have the shortest rostrum among cetaceans and the skull is markedly asymmetrical. Pygmy sperm whales reach a maximum size of about 3.8 m total length and a body mass of 450 kg. Colouration in adults is dark blueish grey to blackish brown on the back with a light venter. On the side of the head, between the eye and the flipper, there is often a crescent-shaped, light-coloured mark referred to as a "false gill" (McAlpine, 2002).



Distribution of Kogia breviceps: deep temperate, subtropical, and tropical waters beyond the continental shelf (mod. from Jefferson et al. 1993; © CMS/GROMS).

2. Distribution

The Pygmy sperm whale is evidently an oceanic species that lives mostly beyond the edge of the continental shelf in tropical and temperate waters around the world. It ranges north to Nova Scotia, the Azores, the Netherlands, Miyagi on the east coast of Honshu, Hawaii, and northern Washington State. It ranges south to Uruguay, Cape Province, the Tasman Sea, Islas Juan Fernández, and Arica, Chile (Rice, 1998). It appears to be relatively common off the southeastern coast of the USA and around southern Africa, south-eastern Australia, and New Zealand (Carwardine, 1995). A total of 28 strandings were reported for Europe until 1991 (Duguy, 1994). Recent strandings were recorded in Hawaii (Mazzuca et al. 1999), Sable Island, Nova Scotia (Zoe and Hooker, 2000), Spain (Abollo et al. 1998), Veracruz, Mexico (Delgado et al. 1998), Chile (Sanino and Yanez, 1997), France (Duguy, 1991), Micronesia (Eldredge, 1991) and South Australia (Kemper, 1991). There was a sighting off Vietnam (Smith et al. 1997). It is unknown whether the populations are isolated (Carwardine, 1995). However, Martin and Heyning (1999) reported the cyamid amphipod species *Isocyamus kogiae* Sedlak-Weinstein (1992) for the first time from a *K. breviceps* stranded in southern California, extending the known range of the amphipod from Moreton Island, Queensland, Austra-lia, to the northeastern Pacific. This ectoparasite suggests that pigmy sperm whales from both sides of the Pacific are not isolated from each other.

Kogia breviceps is poorly known, though a lack of records of live animals may be due to inconspicuous behaviour rather than rarity. Most information stems from strandings (especially females with calves), which may give an inaccurate picture of the actual distribution at sea (Carwardine, 1995).

3. Population size

In areas where they frequently strand, members of the genus *Kogia* are considered to be one of the most common species to come ashore. While many large males strand, many *Kogia* strandings also consist of a female and small calf or a female that has given birth only recently. However, as with *K. sima*, there are no real estimates of abundance (Caldwell and Caldwell, 1989).

4. Biology and Behaviour

Habitat: *K. breviceps* seems to prefer warmer waters: there are records from nearly all temperate, subtropical, and tropical seas. It is rarely seen: it tends to live a long distance from shore and has inconspicuous habits. It is often confused with the Dwarf Sperm Whale (*K. sima*), which was not recognised as a separate species until 1966. With so few field records, it is uncertain whether the two can be distinguished reliably except at very close range. According to Caldwell and Caldwell (1989) *K. breviceps* lives in oceanic waters beyond the edge of the continental shelf while *K. sima* lives over or near the edge of the shelf. However, this separation of both species was not apparent in the study of Mullin et al. (1994) who, by aerial observation, found both species over water depths of 400-600 m in the North-Central Gulf of Mexico. These waters of the upper continental slope were also characterised by high zooplankton biomass (Baumgartner et al. 2001).

Behaviour: Similar to *K. sima* (Carwardine, 1995). When seen at sea, they generally appear slow and slug-gish, with no visible blow (Jefferson et al. 1993). *K.-breviceps* is said to be very easy to approach, lying quietly at the surface practically until touched although it will not approach boats by itself and is rather timid, slow moving and deliberate. Like its congener, *K. breviceps* spends considerable time lying motionless at the surface with the back of the head exposed and the tail hang-ing down loosely. *K. breviceps* is reported to float higher in the water with more of the head and back exposed than *K. sima* (Caldwell and Caldwell, 1989).

Schooling: Most sightings of pygmy sperm whales are of small groups of less than 5 or 6 individuals. Almost nothing is known of the behaviour and ecology of this species (Jefferson et al. 1993).

Food: Studies of feeding habits, based on stomach contents of stranded animals, suggest that this species feeds in deep water on cephalopods and, less often, on deep-sea fishes and shrimps (Caldwell and Caldwell, 1989; Jefferson et al. 1993; Santos and Haimovici, 1998).

5. Migration

Stranding data of both Kogiidae do not seem to bear out any strong seasonal changes in distribution nor any migrations, although some writers have suggested such in very general terms (Caldwell and Caldwel, 1989). Duguy (1994) suggests that the species may migrate from the coast to the open sea in summer, since most strandings e.g. In Florida occurred during winter and fall. In Europe, there are more strandings in winter, which supports this hypothesis.

6. Threats

Direct catch: Pygmy sperm whales have never been hunted commercially. Small numbers have been taken in coastal whaling operations off Japan and Indonesia (Jefferson et al. 1993).

Incidental catch: A few have been killed in Sri Lanka's gillnet fisheries, and it is likely they are killed in gillnets elsewhere as well (Jefferson et al. 1993). Perez et al. (2001) report on occasional by-catches in fisheries in the north-east Atlantic. However, although it is taken in small numbers both directly and incidentally in fisheries, Baird et al. (1996) find no serious threats to its status.

Pollution: Watanabe et al. (2000) present data on organic pollutants found in small cetaceans stranded on the coast of Florida and Marcovecchio et al. (1994) summarise the available knowledge on environmental contamination in marine mammals off Argentina. Tarpley and Marwitz (1993) report on a young male pygmy sperm whale stranded alive on Galveston Island, Texas, USA, which died in a holding tank 11 days later. During necropsy, the first two stomach compartments (forestomach and fundic chamber) were found to be completely occluded by various plastic bags.

7. Remarks

This species is insufficiently known with respect to all aspects of its biology and potential threats. Collection of by-catch and sighting data is strongly needed. For recommendations on Southeast Asian stocks, see Perrin et al. (1996). Not listed by the IUCN or by CMS.

8. Sources

Please see below in account on *Kogia sima*.

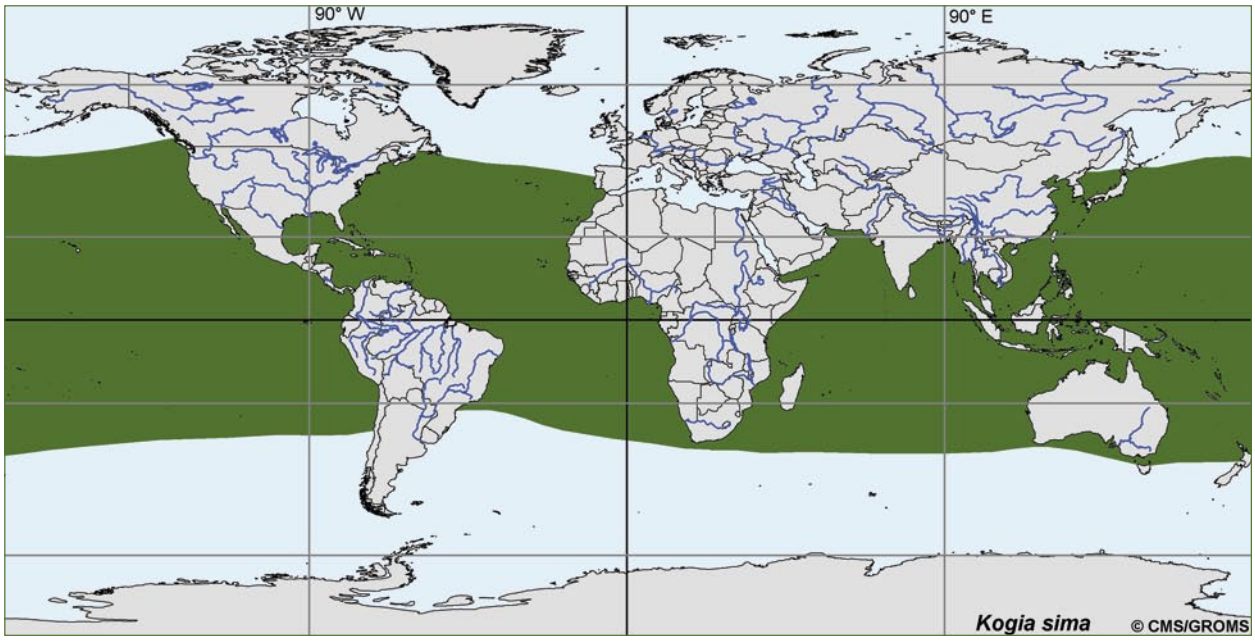
5.20 Kogia sima (Owen, 1866)

English: Dwarf sperm whale
German: Kleinpottwal
Spanish: Cachalote enano
French: Cachalot nain

Drawing of Kogia sima © Wurtz-Artescienza.

1. Description

Kogia spp. are porpoiselike, and robust, with a distinctive underslung jaw, not unlike sharks. They have the shortest rostrum among cetaceans and the skull is markedly asymmetrical. Dwarf sperm whales reach a maximum size of about 2.7 m total length and a body mass of 2,702 kg. Colouration in adults is dark blueish grey to blackish brown on the back with a light venter. On the side of the head, between the eye and the flipper, there is often a crescent-shaped, light-coloured mark referred to as a "false gill" (McAlpine, 2002).



Distribution of Kogia sima: deep temperate, subtropical, and tropical waters of the northern and southern hemispheres (mod. from Jefferson et al., 1993; © CMS/GROMS).

Kogia must be treated as feminine because it has a Latin feminine ending. Simus, -a, -um, is a Latin adjective, and therefore it must agree in gender with the generic name with which it is at any time combined. Thus the correct spelling of the scientific name of the dwarf sperm whale is *Kogia sima* (Rice, 1998), as opposed to *Kogia simus* in most publications to date.

2. Distribution

According to Caldwell and Caldwell (1989), there are two problems in trying to establish ranges for *Kogia*. First, members of this genus are only rarely identified at sea (and then usually not to species), and second, it is only recently that the two species have been clearly recognised as separate. As a consequence, most reliable records of either species are based on stranded individuals or occasionally on ones taken in fisheries.

Rice (1998) summarises that *K. sima* lives mainly over the continental shelf and slope off tropical and temperate coasts of all oceans. Range includes the western Atlantic from Virginia south to Rio Grande do Sul in Brazil, including the Antilles; the eastern Atlantic from the Mediterranean Sea south to Cape Province; The Indian Ocean from Cape Province north to Oman, east at least as far as Lomblen in Indonesia, and south to South Australia; the western Pacific from Chiba prefecture on the east coast of Honshu, and the Mariana Islands, south to Hauraki Gulf in New Zealand; and the eastern Pacific from Vancouver Island south to Valparaiso in Chile (Rice, 1998).

Although it was assumed that populations were continuous around the world, new molecular genetic results from Susan Chivers (pers. comm.) indicate that specimens of *K. sima* sampled from the Atlantic and Pacific ocean may represent different species, suggesting that there is little interchange between these two ocean basins.

3. Population size

Because of the lack of sightings at sea, which may be more because of its behaviour than true abundance, and the fact that *Kogia* is only rarely encountered in commercial fisheries where such records are often kept, there are no real estimates of abundance for either *Kogia* species (Caldwell and Caldwell, 1989).

Mullin et al. (1994) sighted dwarf sperm whales in the Gulf of Mexico over water depths between 400 and 600 m. The species accounted only for 1% of the animals seen and occurred in 12% of the herds observed during the aerial survey. Dolar (1999) estimated the population size in the eastern Sulu Sea at 650.

K. sima seems to be especially common off the southern tip of Africa and in the Gulf of California (Sea of Cortez), Mexico, where it occurs particularly close to shore. Most records are from strandings, which are relatively common in some places, though these may simply represent areas of most research rather than a true picture of distribution. Lack of records of live animals may be due to inconspicuous behaviour rather than rarity (Carwardine, 1995; Jefferson et al. 1993).

Recent strandings have been reported from Sable Island, Nova Scotia (Zoe and Hooker, 2000), the Gulf of Mexico (Delgado et al. 1998), British Columbia, Canada (Willis and Baird, 1998), the Azores (Goncalves et al. 1996), Ecuador (Felix et al. 1995), the Antilles (Debrot and Barros, 1992), the coast of France (Duguy, 1990) and Japan (Sylvestre, 1988), supporting the notion of a world-wide distribution.

4. Biology and Behaviour

Habitat: The dwarf sperm whale is an inconspicuous animal and generally lives a long way from shore (Jefferson et al. 1993). Rarely seen at sea, except in extremely calm conditions, it is the smallest of the whales and is even smaller than some dolphins. Predominantly a deep-water species, possibly concentrated over the edge of the continental shelf (closer to shore than the pygmy sperm whale). Appears to prefer warmer waters (Carwardine, 1995).

Behaviour: Rises to the surface slowly and deliberately and, unlike most other small whales (which roll forward at the surface), simply drops out of sight. Probably does not approach boats. May occasionally breach; leaping vertically out of the water and falling back tail-first or with a belly flop. Some records suggest that, when resting at the surface, it floats lower in the water than the pygmy sperm whale. Probably dives to depths of at least 300 m (Carwardine, 1995).

One of the few reported behavioural observations at sea stems from Scott and Cordado (1987) who report sighting a mother and calf after a purse-seine set was deployed on yellowfin tuna, *Thunnus albacares*, associated with a mixed school of spotted dolphins, *Stenella attenuata*, and spinner dolphins, *S. longirostris*. They were accidentally encircled. While inside the net, the female released into the water a cloud of reddish

material, presumably faeces, 6-8 times during the course of the set. The mother released the faeces whenever a dolphin approached the calf; she then appeared to hide herself and the calf in the middle of the opaque cloud.

Schooling: Group sizes tend to be small, most often less than 5 individuals (although groups of up to 10 have been recorded (Jefferson et al. 1993).

Reproduction: In at least one area, there appears to be a calving peak in summer (Jefferson et al. 1993).

Food: Dwarf sperm whales appear to feed primarily on deep-water cephalopods (Jefferson et al. 1993) as well as on fish and crustaceans (Caldwell and Caldwell, 1989).

5. Migration

Duguy (1994) suggests that the species does not migrate extensively, since it can be observed year-round off African coasts.

6. Threats

Direct catch: Some small scale catches of dwarf sperm whales have been reported (Caldwell and Caldwell, 1989 and refs. therein). *K. sima* was encountered in a small harpoon fishery for pilot whales at St. Vincent in the Lesser Antilles, in Japan and occasionally in an aboriginal industry on Lomblen Island in Indonesia, and has been reported from fish markets in Sri Lanka.

Incidental catch: Caldwell and Caldwell (1989) suppose that it is unlikely that *Kogia* is significantly affected by humans. When taken in commercial fisheries the numbers are so few that either species is considered rare. However, Jefferson et al. (1993) believe that substantial numbers are taken each year in gillnets in the Indian Ocean, and possibly elsewhere. Zerbini and Kotas (2001) report on by-catch in the Brazilian driftnet fishery. Because of their small size and habit of often lying at the surface, apparently oblivious to approaching vessels, a few *Kogia* are probably run down and injured or killed (Caldwell and Caldwell, 1989).

Pollution: Both species have been reported with plastic bags in their stomachs that may have prevented digestion of food and ultimately brought death. Perhaps the textural or visual quality of the plastic was similar to that of squid and thus enticed the whales to devour it (Caldwell and Caldwell, 1989).

7. Remarks

This species has a world-wide distribution and is poorly known. Basic data on population sizes and impacts of threats on the population are lacking. Not listed by the IUCN or by CMS.

Both kogiid species also occur in southern South America. Recommendations iterated by the scientific committee of CMS for small cetaceans in that area (Hucke-Gaete, 2000) also apply (see Appendix 1). For recommendations on south-east Asian stocks, see Perrin (1996) in Appendix 2.

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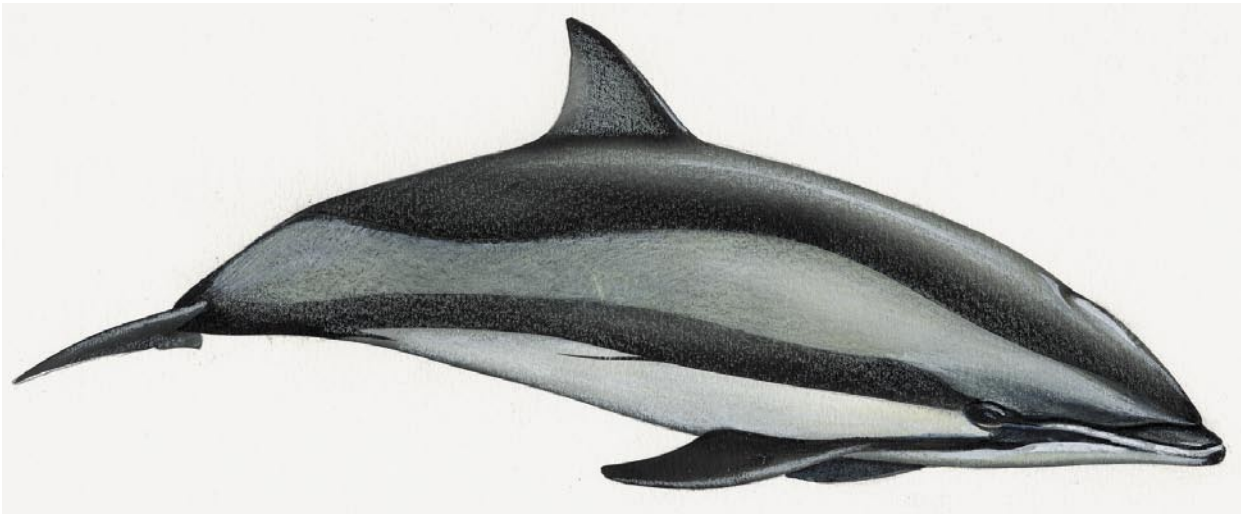
5.21 Lagenodelphis hosei (Fraser, 1956)

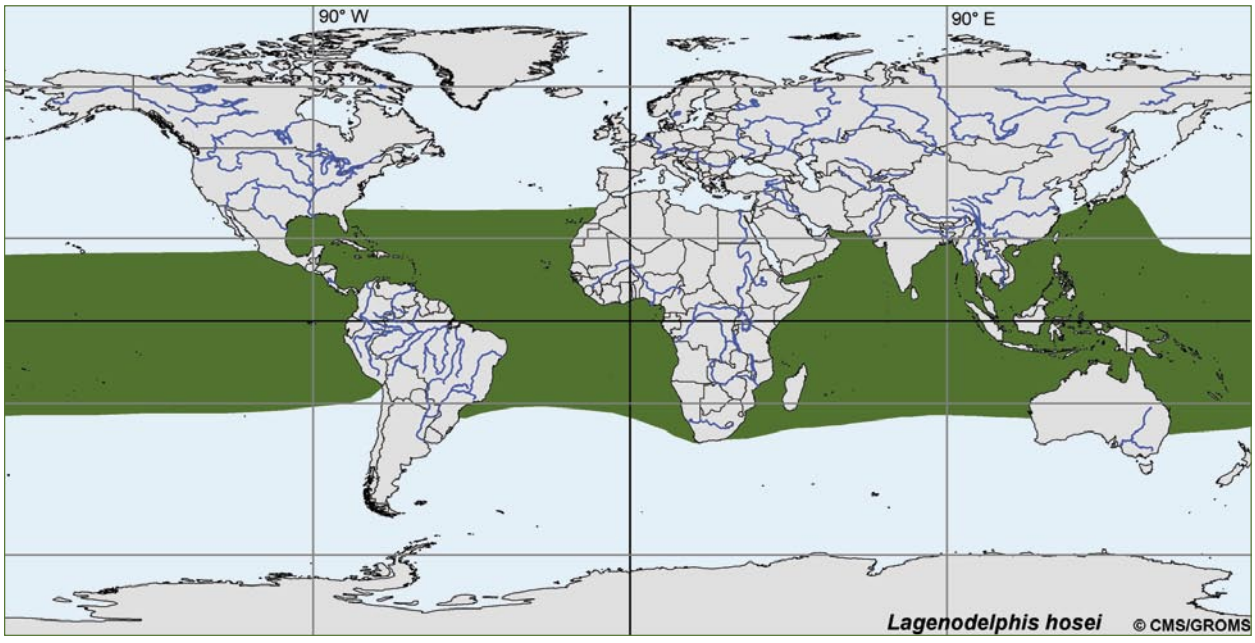
English: Fraser's dolphin
German: Borneo-Delphin
Spanish: Delfín de Fraser
French: Dauphin de Fraser



Drawing of Lagenodelphis hosei © Wurtz-Artescienza.

1. Description

The body of Fraser's dolphin is stocky, the beak short but distinct and the dorsal fin small, triangular and slightly falcate. The flippers and flukes are also comparatively small. The striking colouration varies with age and sex: a distinctive black stripe extending from the eye to the anus is absent or faint in juveniles, wider and thicker in adult males and variable in adult females. A similar pattern is observed with the facial stripe or "bridle". The back of *L. hosei* is brownish grey, the lower side cream-coloured and the belly is white or pink. The largest male recorded was 2.7 m and the largest female 2.6 m long. Large males can weigh up to 210 kg (Dolar, 2002). The one species in this genus was not recognized until 1956, when it was described from a single skull which had been picked up on a beach in Sarawak in 1895. It remained unknown to



Distribution of Lagenodelphis hosei: deep tropical and warm temperate waters of the Pacific, Atlantic and Indian Oceans between 30°S and 30°N (mod. from Jefferson et al. 1993, © CMS/GROMS).

science as a living animal until 1971, when the species was "rediscovered". Once its external features became known, it turned out that tuna fishermen in the eastern tropical Pacific were already familiar with it (Rice, 1998). Fraser's dolphin belongs to the subfamily delphinidae. Based on cytochrome b mtDNA it is more closely related to *Stenella*, *Tursiops*, *Delphinus*, and *Sousa* than to *Lagenorhynchus* (Dolar, 2002).

2. Distribution

Lagenodelphis hosei is pantropical and ranges north to the Gulf of Mexico, Islas Canarias, West Africa (van Waerebeek et al. 2000) Sri Lanka, Taiwan, southern Honshu, and Jalisco in Mexico and south to Uruguay and Brasil, Natal, Queensland, and Peru (Rice, 1998).

The distribution of this species is poorly known. It appears to be most common near the equator in the eastern tropical Pacific and at the southern end of Bohol Strait in the Philippines. It seems to be relatively scarce in the Atlantic Ocean, where it is known from the Lesser Antilles and the Gulf of Mexico (e.g. Mignucci-Giannoni et al. 1999) and recently from Venezuela (Bolaños and Villarroel-Marín, 2003). *Lagenodelphis hosei* may range across the Indian Ocean, though confirmed sightings exist only from the east coast of South Africa, Madagascar, Sri Lanka, and Indonesia. It also occurs away from the equator as far north as Taiwan and Japan and, in small numbers, off Australia. It is rarely seen in inshore waters, except around oceanic islands and in areas with a narrow continental shelf (Carwardine, 1995; Perrin et al. 1994). Dolar et al. (1997) report sightings between the Philippines and Malaysia, which, however, were so infrequent that they did not allow to estimate population density.

Strandings in temperate areas (Victoria in Australia, Brittany and Uruguay) may represent extralimital forays connected with temporary oceanographic anomalies such as the world-wide el Niño phenomenon in 1983-84, during which a mass stranding occurred in France (Perrin et al. 1994). Bones et al. (1998) report on a stranding on the coast of Scotland.

3. Population size

Estimates of abundance for the eastern tropical Pacific yield 289,500 Fraser's dolphins in that region (Perrin et al. 1994 and refs. therein). Gerrodette and Wade (1991) found that their 1989 relative abundance estimates in the eastern tropical Pacific Ocean were substantially higher than the 1988 estimates. In the Eastern Sulu Sea, Dolar (1999) estimated a total abundance of 8,700 Fraser dolphins.

4. Biology and Behaviour

Habitat: This dolphin is typically a high-seas animal; it has not been observed close to shore in shallow water. However, it may approach very close to shore (100 m) of some islands surrounded by deep water, e.g. Lesser Antilles, Indonesia and Philippines. In the eastern tropical Pacific, it forms part of an equatorial cetacean community that also includes *Physeter catodon*, *Globicephala macrorhynchus*, *Delphinus delphis*, *Stenella coeruleoalba* and *Peponocephala electra*. This community is more or less complementary in occurrence to another group of species that includes *Stenella attenuata*, *Stenella longirostris* and *Steno bredanensis*. The latter group is found primarily in so-called tropical surface water, where a stable, shallow mixed layer and thermocline ridging are dominant features. The former group occurs more often in Equatorial—southern subtropical surface water and other waters typified by upwelling and generally more variable conditions. Off South Africa, records are associated with the warm Agulhas Current that moves south in the summer (Perrin et al.1994 and refs. therein).

Behaviour: Analysis of prey suggests that Fraser's Dolphin is a deep diver, hunting at depths of at least 250-500 m (Carwardine, 1995). In some areas, it is considered shy and difficult to approach; in others it is a bit more approachable. It does not bowride in the eastern tropical Pacific, but it does in most other areas. Running herds create a great deal of white water (Jefferson et al. 1993).

Reproduction: The life history of Fraser's dolphin was examined by Amano et al. (1996) based on 108 specimens from a school captured by the driving fishery in Japan. The sex ratio was approximately 1:1. The annual ovulation rate was 0.49. The estimated neonatal length (110 cm) predicts a gestation period of about 12.5 mo. and calving peaks in spring and probably also in fall. The calving interval was estimated to be about 2 yr. Life history parameters are similar to those of the striped and pantropical spotted dolphins, but reproductive rate of this species may be lower than that of other pelagic delphinids, if the observed shorter longevity is real.

Schooling: Herds tend to be large, consisting of hundreds or even thousands of dolphins, often mixed

with other species, such as melon-headed whales (*Peponocephala electra*), short-finned pilot whales (*Globicephala macrorhynchus*), Risso's dolphin (*Grampus griseus*), spinner dolphin (*Stenella longirostris*) pantropical spotted dolphin (*S. attenuata*), bottlenose dolphins (*Tursiops truncatus*) and sperm whales (Perrin et al.1994 and refs. therein; Dolar, 2002).

Food: In the eastern Pacific, Fraser's dolphin feeds on mesopelagic fish, shrimps and squids. It rarely associates there with bird flocks or tuna schools, which correlates well with the absence of surface-dwelling prey from its diet. In other regions, e.g. the southern Indian Ocean and the western Pacific, it may also feed far below the surface. The stomachs of animals stranded in Brittany contained only the remains of fish (4-24 cm long; four species) and the cephalopod *Sepia sp*. indicating benthic or mesopelagic feeding preferences (Perrin et al. 1994). Based on stomach contents, prey in the eastern tropical Pacific may be taken at between 250 and 500 m water depths (Dolar, 2002). Santos and Haimovici (1998) report on the preference for loliginid squids in the diet of *L. hosei* stranded in southern Brazil. Watkins et al. (1994) report on co-operative hunting techniques observed in the Caribbean.

5. Migration

There are no detailed reports on migratory behaviour, although this pelagic species regularly approaches islands where it is captured for human consumption (see below).

6. Threats

Direct catch: Small numbers of Fraser's dolphins are taken in local subsistence harpoon fisheries in the Lesser Antilles, Indonesia, the Philippines and probably elsewhere in the Indopacific. A few are taken in drive fisheries in Taiwan and Japan (Perrin et al. 1994 and refs. therein). Dolar et al. (1994) investigated directed fisheries for marine mammals in central and southern Visayas, northern Mindanao and Palawan, Philippines, from archived reports and visits to sites where such fisheries are conducted. Some of the hunters take only dolphins, for bait or human consumption and the species taken include Fraser's dolphins. These are taken by hand harpoons or, increasingly, by togglehead harpoon shafts shot from modified, rubber-powered spear guns. Around 800 cetaceans are taken annually by hunters at the seven sites, mostly during the inter- monsoon period of February-May. Dolphin meat is consumed or sold in local markets and some dolphin skulls are cleaned and sold as curios (Dolar et al. 1994).

Incidental catch: Some are killed incidentally in the tuna purse-seine fishery in the eastern tropical Pacific: 26 were estimated taken during the period 1971-75. A few are also taken in gill nets in Sri Lanka, the Philippines, and likely in other tropical gillnet fisheries as well. Some are killed by anti-shark nets (Perrin et al. 1994 and refs. therein; Dolar et al. 1999; Cockroft, 1990). Gerrodette and Wade (1991) note that *Lagenodelphis hosei* is taken incidentally by tuna purse seiners for the yellowfin tuna (*Thunnus albacares*) fishery in the eastern tropical Pacific.

7. Remarks

On 16 December 1992 the Department of Agriculture of the Philippines issued Fisheries Administrative Order No. 185, 'banning the taking or catching, selling, purchasing, possessing, transporting and exporting of dolphins'. The order did not stop dolphin and whale hunting but seems to have decreased the sale of dolphin meat openly in the market. Investigations are encouraged to ensure that these artisanal whale fisheries operate within sustainable limits and do not export products illegally (Dolar et al. 1994). This recommendation can also be extended to other populations of Fraser's dolphins. For South American stocks, see fur-ther recommendations in Hucke-Gaete (2000) in Appendix 1; for Southeast Asian stocks see general recommendations in Perrin et al. (1996) in Appendix 2.

The species is poorly known with respect to its distribution, migratory behaviour and abundance and by-catch rates are poorly documented.

L. hosei is listed as "Data Deficient" by the IUCN . The southeast Asian populations are listed in Appendix II of CMS.

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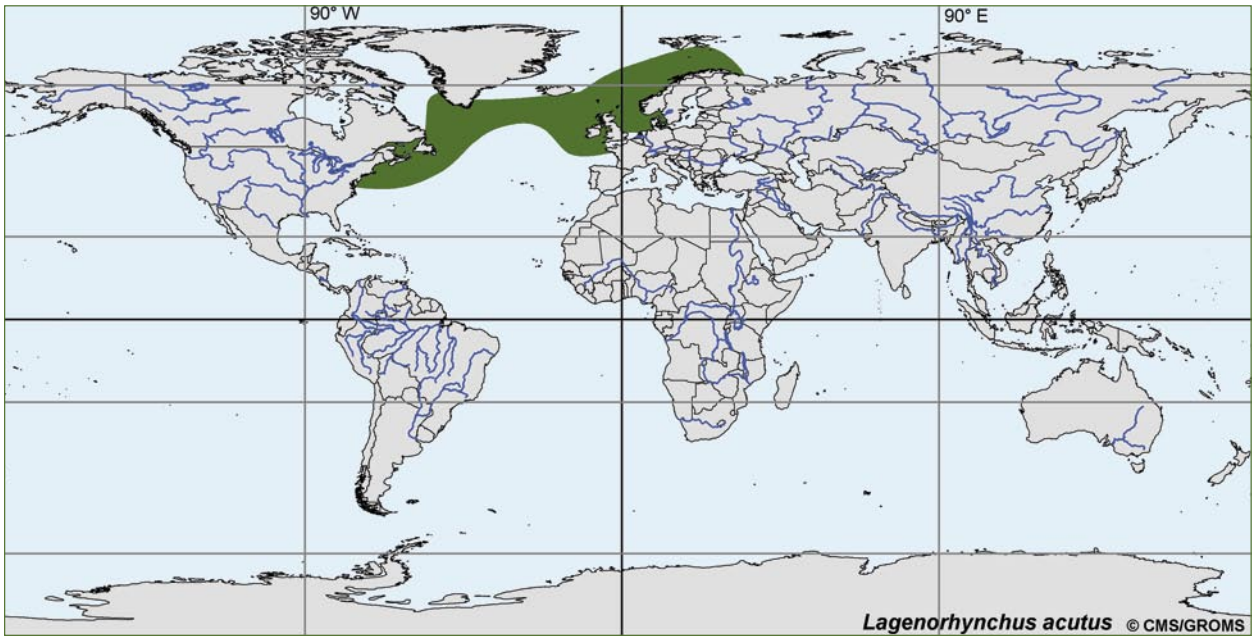
5.22 Lagenorhynchus acutus (Gray, 1828)

English: Atlantic white-sided dolphin
German: Weißseitendelphin
Spanish: Delfín de costados blancos
French: Dauphin à flancs blancs

Drawing of Lagenorhynchus acutus © Wurtz-Artescienza.

1. Description

Atlantic white-sided dolphins are robust and powerful, impressively patterned, and more colourful than most dolphins. A narrow, bright white patch on the side extends back from below the dorsal fin and continues towards the flukes as a yellow blaze above a thin dark stripe. The back and dorsal fin are black or very dark grey, as are the flippers and flukes, whereas the belly and lower jaw are white, and the sides of the body are light grey. A black eye ring extends in a thin line to the upper jaw and a very thin stripe extends backward from the eye ring to the external ear. A faint grey stripe may connect the leading edge of the flipper with the rear margin of the lower jaw. The beak is short (Cipriano, 2002).



Distribution of Lagenorhynchus acutus (mod. from Cipriano, 2002): cool, temperate and subarctic waters of the northern North Atlantic; © CMS/GROMS).

Male Atlantic white sided dolphins reach 270 cm and 230 kg, whereas adult females are about 20 cm shorter and 50 kg lighter (Cipriano, 2002).

2. Distribution

L. acutus is a deepwater species which ranges across the North Atlantic, from south-eastern Labrador (52˚N) east to Trondheimsfjord in Norway, south to Long Island in New York, the Azores, and the Strait of Gibraltar (Rice, 1998).

Towards the east of the range, *L. acutus* may occasionally be found as far north as the southern Barents Sea and rarely further south than the English Channel. In the west, it has been reported from west Greenland to Chesapeake Bay, USA (though usually from Cape Cod, USA, northwards). The species appears to be especially abundant in the Gulf of Maine, USA, and large schools penetrate far up the St. Lawrence estuary, Canada (Carwardine, 1995; for details see Reeves et al. 1999).

The species is vagrant to Virginia and south-western Greenland (Rice, 1998) and rarely enters the Baltic Sea (Jefferson et al. 1993; Kinze et al. 1997 and pers. obs.).

Mikkelsen and Lund (1994) found no evidence of separate populations based on a study of metrical and non-metrical skull characters of 123 Atlantic white-sided dolphins from much of the species' range.

3. Population size

The number of Atlantic white-sided dolphins in the western North Atlantic, from the southern Gulf of Maine and north-eastwards on the continental shelf and slope to Cabot Strait were about 27,000 in July – September 1995 (Palka et al. 1997) and at least 12,000 in the Gulf of St. Lawrence (Kingsley and Reeves, 1998).

Weir et al. (2001) carried out surveys to the north and west of Scotland and found that Atlantic white-sided dolphins were the most abundant species in the region with a total of 6,317 animals recorded.

Evans (1987, in Reeves et al. 1999) suggests a total population throughout the North Atlantic of tens of thousands to low hundreds of thousands. Cipriano (2002) gives a figure of 40,000 for the western Atlantic and a few hundred thousand for the entire Atlantic.

4. Biology and Behaviour

Habitat: *L. acutus* seems to prefer areas with high seabed relief along the edge of the continental shelf (Carwardine, 1995). Mean surface water temperature for a sample of 86 sightings off the north-eastern United States was 7.0 ± 2.9°C (Reeves et al. 1999).

Behaviour: *L. acutus* is an acrobatic and fast swimmer and frequently breaches (though not as often as white-beaked or common dolphins) and lobtails. It surfaces to breathe every 10 to 15 seconds, either leaping clear of the water or barely breaking the surface and creating a wave over its head. *L. acutus* is wary of ships in some areas (Palka and Hammond, 2001), but will swim alongside slower vessels and may bow-ride in front of faster ones. Sometimes it can be observed riding the bow-waves of large whales. Individual and mass strandings are relatively common (Carwardine, 1995; Jefferson et al. 1993). The species is presumably not a deep diver, as maximum recorded dive times were 4 min, and most dive times were shorter than 1 min (Cipriano, 2002).

Schooling: Herds of up to several hundred are seen, and there is some age and sex segregation among these. Older immature individuals are not generally found in reproductive herds of mature females and young (Jefferson et al. 1993; Reeves et al. 1999). Gaskin (1992) hypothesized that Atlantic white-sided dolphins split into small groups for feeding and that such small groups merge into large aggregations "while migrating". Groups often associate and probably feed with fin whales (*Balaenoptera physalus*), humpback whales (*Megaptera novaeangliae*) and long-finned pilot whales (*Globicephala melas*). Mixed herds of Atlantic white-sided dolphins and white-beaked dolphins have been observed in the North Sea (Reeves et al. 1999, and refs. therein).

Reproduction: Parturition in the western North Atlantic usually takes place between May and August, with a peak in June and July, following an estimated 11 month gestation period. The timing of parturition is apparently similar in the eastern North Atlantic, where sightings have been interpreted to suggest "breeding areas" offshore in the North Sea and in the Atlantic to the north and west (Reeves et al. 1999 and refs. therein).

Food: Atlantic white-sided dolphins feed on small schooling fish and squid. These include herring (*Clupea harengus*) and small mackerel (*Scomber scombrus*),

silvery pout (*Gadiculus argenteus*), blue whiting (*Micromesistius poutassou*), American sand lance (*Ammodytes americanus*), smelt (*Osmerus mordax*), and silver hake (*Merluccius bilinearis*) and short-finned squid (*Illex iilecebrosus*) (Jefferson et al. 1993; for details see Reeves et al. 1999). In the North Sea, oceanic cephalopods seem to be their main diet (Das et al. 2000). Different prey species may predominate at different times of year, representing seasonal movements of prey, or in different areas, indicating prey and habitat variability in the environment (Cipriano, 2002). Atlantic white-sided dolphins apparently co-operate in their efforts to contain and attack schools of fish, a behaviour which is similar to that described for dusky dolphins off Argentina (Reeves et al. 1999 and refs. therein).

5. Migration

There may be inshore—offshore movements with the seasons in some areas (Carwardine, 1995). Selzer and Payne (1988) suggest that *L. acutus* moves south along the continental shelf edge in winter and spring, in association with the relatively cold, less saline Gulf of Maine water flowing southwards through Northeast Channel during these seasons. They sighted *L. acutus* more frequently in areas of high sea floor relief, and in areas where sea surface temperatures and salinities are low. Seasonal variation in sea surface temperature and salinity, and local nutrient upwelling in areas of high sea floor relief may affect preferred prey abundances, which in turn may affect dolphin distribution. The occurrence of Atlantic white-sided dolphins off Newfoundland seems to be seasonal, mainly from July to October (Reeves et al. 1999). Data from one satellite-monitored dolphin indicated an ability to travel long distances at a speed of at least 14 km/hr (Mate et al. 1994).

Weinrich et al (2001) report that off New England they sighted 1,231 groups of Atlantic white-sided dolphins between April and from October 1984 through 1997, primarily on Stellwagen Bank and Jeffreys Ledge (two shallow glacial deposits along the coasts of Massachusetts, New Hampshire, and Maine). Mean group size was 52, and was significantly larger from August through October (71.9) than April through June (35.0).

Couperus (1997) investigated the occurrence of incidental cetacean catches in the Dutch pelagic trawl fishery. These are largely restricted to late-winter early-spring in an area along the continental slope south-west of Ireland and available evidence indicates that annual variations are large. It seems that the Atlantic white-sided dolphin is normally a more oceanic species, but will actively search for mackerel (*Scomber scombrus*) closer to shore in early spring. Fresh mackerel remains were found in nearly all white-sided dolphin stomachs caught as by-catch, whereas deep-water fish otoliths suggested that the dolphins had a completely different diet before moving to the south-west of Ireland.

6. Threats

Direct catch: Some hunting for this species occurred in the past, especially in Norway. Some are still taken in Greenland, the Faeroe Islands, and eastern Canada (Jefferson et al. 1993; Reeves et al. 1999 and refs. therein).

Incidental catch: Incidental mortality in fishing gear has been documented off Canada, the United States, the United Kingdom and Ireland. Gaskin (1992) judged Atlantic white-sided dolphins to be less vulnerable to capture in pelagic near-surface drift nets and fixed groundfish gill nets than are many other small cetaceans. They may, however, be especially susceptible to capture in midwater trawl nets (Addink et al., 1997). Substantial numbers have been by-caught in pelagic trawl fisheries for horse mackerel and mackerel south-west of Ireland (Reeves et al. 1999 and refs. therein).

Starting in 1990, a deep water trawl fishery for Greenland halibut (*Reinhardtius hippoglossoides*) in the NAFO Regulatory Area was developed by Spain. Information about fishing operations and their interactions with marine mammals was obtained in more than 14,000 individual hauls. The rate of sets with incidental mortality was 0.27%, but 73.8% of this mortality corresponded to seals. Only 42 cetaceans were caught, which also included Atlantic white-sided dolphins. It seems that the Greenland halibut fishery has a relatively low level of incidental marine mammal mortality (Lens, 2001).

Morizur et al. (1999) investigated marine mammal by-catch in 11 pelagic trawl fisheries operated by four different countries in the Northeast Atlantic. One of the main marine mammal species identified in by-catches was *L. acutus*. Mean dolphin catch rate for all fisheries combined was 0.048 per tow (one dolphin per 20.7 tows), or 0.0185 per hour of towing (one dolphin per 98 h of towing). All dolphin by-catches occurred during the night. White-sided dolphins were observed feeding around the net during towing and this behavior may make them more vulnerable to capture. Operational

difficulties in observing by-catch and potentially significant annual fluctuation in catch rates warrant further observer studies of these and other trawl fisheries.

Pollution: A juvenile dolphin from the north-west coast of Ireland was found to have a relatively high concentration of mercury in its liver (44 ng per g wet weight). An adult male from Nova Scotia had moderately high levels of organochlorines in its blubber (Reeves et al. 1999 and refs. therein).

7. Remarks

Atlantic white-sided dolphins seem to be migratory in North America, where range states are the USA, Canada and France (St. Pierre et Miquelon). The species occurs off and on in the North Sea and around Ireland, and range states include Ireland, Great Britain, France, the Netherlands, Belgium, Germany, Denmark, Norway, Sweden, Iceland and Greenland.

Operational difficulties in observing by-catch and potentially significant annual fluctuation in catch rates warrant further observer studies of these and other trawl fisheries (Morizur et al. 1999).

IUCN Status: "not listed". The North and Baltic Sea populations are listed in Appendix II of CMS, but inclusion of the NW Atlantic stock into CMS is recommended on the basis of observed migrational behaviour.

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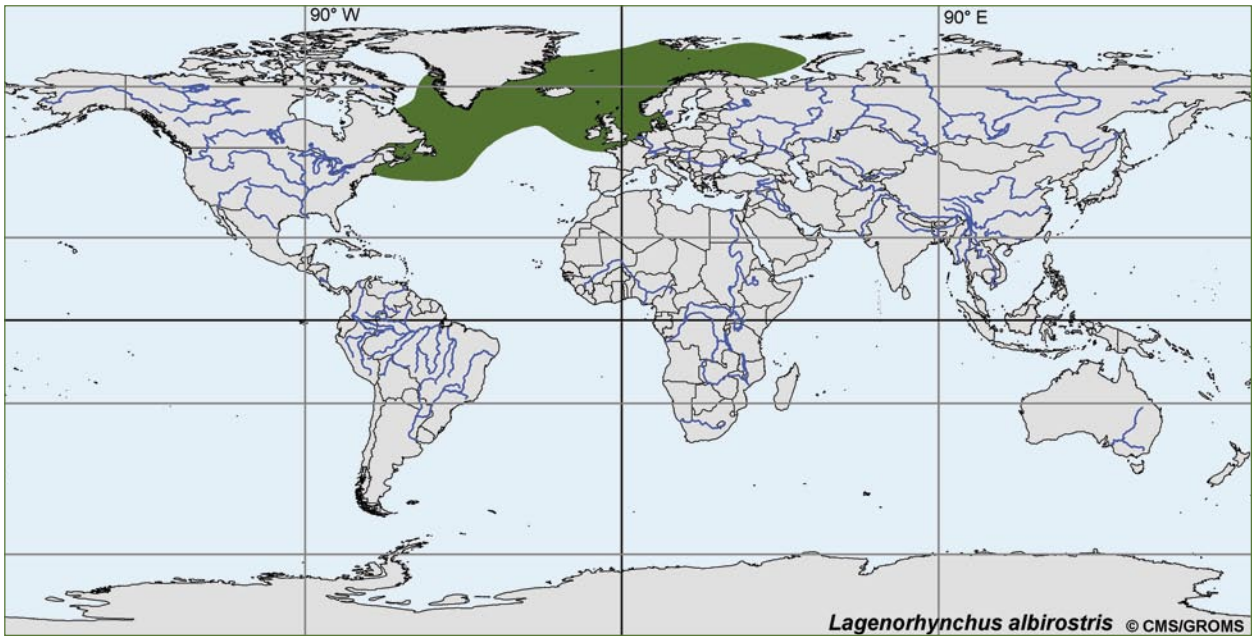
5.23 Lagenorhynchus albirostris (Gray, 1846)

English: White-beaked dolphin
German: Weißschnauzendelphin
Spanish: Delfín de pico blanco
French: Dauphin à bec blanc

Drawing of Lagenorhynchus albirostris © Wurtz-Artescienza.

1. Description

The white-beaked dolphin has a robust appearance. Its beak is only 5-8 cm long. The dorsal fin is in the middle of the back, erect and strongly curved. Adults grow between 2.4 and 2.1 m long and may weigh between 180 and 350 kg. Males usually grow larger than females. The coloration is typically black on the back, with a white saddle behind the dorsal fin and whitish bands on the flanks that vary in intensity from a shining white to ashy grey. Belly and beak are normally white, but the beak may be ashy grey or even darker, which may appear as if a white beak was missing (Kinze, 2002).



Distribution of Lagenorhynchus albirostris: cool temperate and subarctic waters of the North Atlantic (mod. from Reeves et al. 1999; © CMS/GROMS).

Populations in the eastern and western North Atlantic are separable on the basis of skull characters (Mikkelsen and Lund, 1994), but no subspecies have been named.

2. Distribution

This is the most northerly member of the genus *Lagenorhynchus*, and has a wide distribution. Animals in the northernmost part of the range occur right up to the edge of the pack-ice (Carwardine, 1995). The species is found in the immediate offshore waters of the North Atlantic, off the American coast from Cape Chidley, Labrador, to Cape Cod, Massachusetts; the Southwest coast of Greenland north to Godthab; off the European coast from Nordkapp in Norway south through the North Sea to the British Isles, Belgium, the Netherlands, Denmark, and the south-western Baltic Sea (Rice, 1998).

The main concentrations around the British Isles are off northern Scotland (including the Outer and Inner Hebrides, Orkney and Shetland islands) and along portions of the Atlantic coast of Ireland. They are common in the northern and central North Sea and in the Kattegat and Skagerrak between Jutland (Denmark), Norway and Sweden. It is the most common delphinid stranded and sighted in Dutch waters and is common around the Faroe Islands. It is also considered the most common dolphin off south-eastern Greenland, in Denmark Strait and the seas around Iceland (Reeves et al. 1999; Kinze et al. 1997).

L. albirostris is vagrant to France, the north coast of Spain, the Strait of Gibraltar, and the Mediterranean Sea (Rice, 1998). Although it occurs as far south as Portugal, it is rarely seen south of Britain (Carwardine, 1995) and only occasionally in inner Danish waters (Reeves et al., 1999) and the Baltic proper (Kinze, 2002).

3. Population size

Published estimates indicate a population of at least several thousand white-beaked dolphins in portions of the north-western Atlantic: shoreward of the 200 m contour between St. Anthony, Newfoundland, and Nain, Labrador (Alling and Whitehead, 1987) and in coastal and offshore waters east of Newfoundland and south-east of Labrador. In the Gulf of St. Lawrence for instance, white-beaked dolphins (2,500 in 1995 and 1996) occurred only in the Strait of Belle Isle and the extreme north-eastern Gulf (Kingsley and Reeves, 1998).

It seems that at least a few thousand white-beaked dolphins inhabit Icelandic waters and up to 100,000 the north-eastern Atlantic including the Barents Sea, the eastern part of the Norwegian Sea and the North Sea north of 56°N. A survey of the North Sea and adjacent waters in 1994 provided an estimate of 7,856 white-beaked dolphins. The total number of white-beaked dolphins throughout the North Atlantic thus may be in the high tens or low hundreds of thousands (Reeves et al. 1999 and refs. therein). Kinze et al. (1997) maintain that the white-beaked dolphin is much more common in the North and Baltic Seas than its relative, the white-sided dolphin and Northridge et al. (1997) find that white-beaked dolphins are relatively common in European waters compared with white-sided dolphins, or compared with US waters.

4. Biology and Behaviour

Habitat: The species is found widely over the continental shelf, but especially along the shelf edge (Carwardine, 1995).

Behaviour: *L. albirostris* may bow-ride, especially in front of large, fast-moving vessels, but usually it loses interest quickly. However, some populations are very elusive. Sometimes acrobatic (especially when feeding) and when it breaches it normally falls onto its side or back. Typically a fast, powerful swimmer. *L. albirostris* has been seen with Fin and Killer Whales, and may mix with other species (Carwardine, 1995).

Reproduction: There appears to be a calving peak in summer and early autumn, but not much is known about reproduction in this species (Jefferson et al. 1993).

Food: In all areas where stomach contents have been examined, clupeids (e.g. herring), gadids (e.g. Atlantic cod (*Gadus morhua*), haddock (*Melanogrammus aeglefinus*), poor-cod (*Trisopterus minutus*, *T. luscus*), whiting (*Merlangius merlangus*), capelin (*Mallotus villosus*) and hake (*Merluccius merluccius*) have been found to be the principal prey of white-beaked dolphins. Other studies include *Scomber*, *Pleuronectes*, *Limanda*, *Eleginus* and *Hyperoplus* as well as squid, octopus and benthic crustaceans as prey (Reeves et al. 1999 and refs. therein).

Schooling: Groups of less than 50 are most common, but herds of many hundreds have been seen. While feeding they sometimes associate with large whales such as fin and humpback whales, but also with herds of pilot whales, sei whales, killer whales, bottlenose dolphins, white-sided dolphins and common dolphins

(Jefferson et al. 1993; Reeves et al. 1999 and refs. therein). In contrast to the Atlantic white-sided dolphin, which sometimes mass strands, the white-beaked dolphin usually strands singly or in small groups. Co-operative feeding has been described. Dolphins herd the fish into a tight cluster and trap them against the surface (Reeves et al. 1999 and refs. therein).

5. Migration

In some areas, *L. albirostris* may make inshore—offshore or north—south movements with the seasons (wintering in the south or offshore); in other areas, such as Britain, they seem to be present all year round (but with seasonal peaks of abundance in coastal waters) (Carwardine, 1995). Northridge et al. (1997) summarise that white-beaked dolphins around the British Isles have a fairly consistent distribution throughout the year, although during spring they appear to aggregate around two areas of concentration to the north of Scotland and off the Yorkshire coast.

Sightings of white-beaked dolphins are common around Newfoundland during the winter and spring and fishermen along the Labrador coast claim that they approach the coast in late June and remain until October (Ailing and Whitehead, 1987). Densities on the Southeast Shoal of the Grand Banks decreased from mid June to mid July (Reeves et al. 1999 and refs. therein).

6. Threats

Direct catch: There is a long history of hunting for white-beaked dolphins in Norway, the Faeroe Islands, Greenland, and Labrador. During the early 1980s an estimated 366 white-beaked dolphins were taken annually by the residents of 12 Labrador harbours (Alling and Whitehead, 1987). Hunting in some areas continues today (Jefferson et al., 1993), e.g. southwest of Greenland (Kinze, 2002).

Incidental catch: White-beaked dolphins have been taken in fishing gear in many areas and at least the Newfoundland/Labrador by-catch is substantially under-reported in published accounts (Reeves et al. 1999). However, incidental catches are not thought to be high enough to represent a threat to this species (Jefferson et al. 1993). De Haan et al. (1998) outline possible mitigation measures for the pelagic trawl fishery.

Pollution: Like other North Atlantic marine mammals, white-beaked dolphins are contaminated by organochlorines, other anthropogenic compounds and heavy metals (Reeves et al. 1999 and refs. therein). Siebert et al. (1999) report concentrations of total mercury and methylmercury in muscle, kidney and liver samples of three white-beaked dolphins, stranded or by-caught from the German waters of the North and Baltic Seas.

7. Remarks

This is a species which occurs frequently in European and North American waters and range states are therefore the US, Canada, Greenland, Iceland, Norway, Sweden, Denmark, Germany, The Netherlands, Belgium, France and Great Britain.

By-catch rates seem to be poorly documented and warrant mitigation measures. There seem to be seasonal inshore/offshore as well as north/south movements, which may cross the national boundaries of several of the states mentioned.

IUCN Status: "not listed". The North and Baltic Sea populations are listed in Appendix II of CMS. However, white-beaked dolphin abundance seems also to vary throughout the year off north-eastern North America, suggesting possible seasonal migrations. Therefore this stock (Range states US and Canada) should also be included in CMS App. II.

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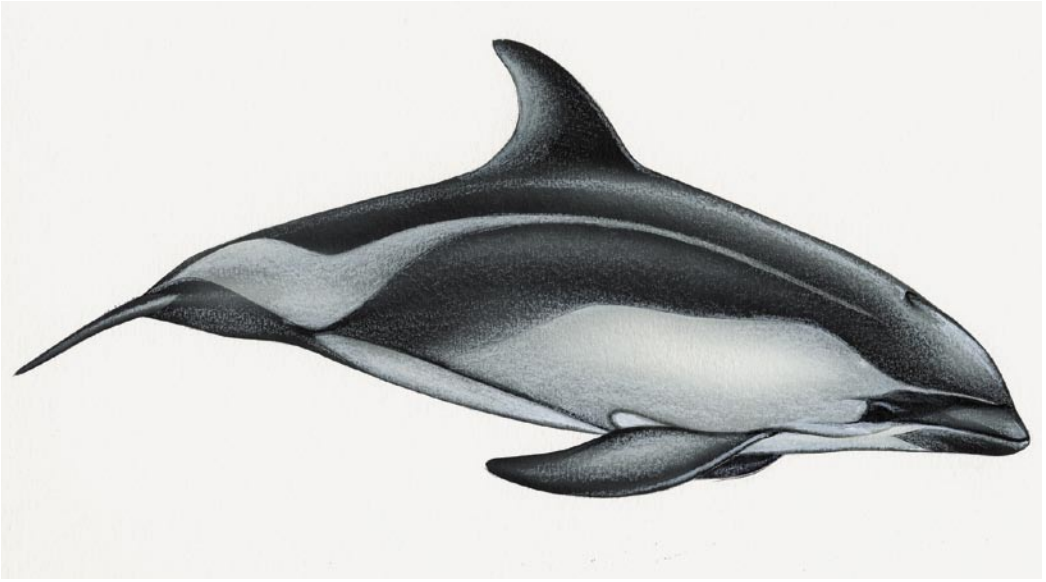
5.24 Lagenorhynchus australis (Peale, 1848)

English: Peale's dolphin
German: Peale Delphin
Spanish: Delfín austral
French: Dauphin de Peale



Drawing of Lagenorhynchus australis © Wurtz-Artescienza.

1. Description

L. australis is a stocky dolphin with the barest indication of a beak. Length ranges from 130–210 cm in females and 138–218 cm in males, and adults are on average 190–199 cm long. The heaviest animal weighed 115 kg. Colour is dark grey or black on the back, with two areas of lighter shading on the flanks. A curved white-to-grey flank patch angles forward from the vent, narrowing to a single line ending below or in front of the dorsal fin. The posterior curves of the flank patch almost meet above the tail stock. The larger thoracic patch is light to medium grey, outlined with a narrow dark line on its lower surface. A double black eye-ring extends forward onto the inconspicuous snout. Flippers of older animals may have a series of small knobs on the leading edge. The ventral surface behind the throat patch is white, with a few dark streaks in the genital area. Younger animals are lighter grey than adults. Peale's dolphins can be confused with dusky dolphins (see *L. obsucurus*, page 135) through much of their range (Goodall, 2002).

Distribution of Lagenorhynchus australis: cool, coastal waters of southern South America including the Falkland / Malvinas Islands (mod. from Goodall, 2002; © CMS/GROMS).

2. Distribution

Peale's dolphin ranges in coastal waters of southern South America from Valdivia, Chile (38°S), and Golfo San José, Argentina (44°S), south to Beagle Canal and Falkland Islands / Islas Malvinas (Goodall et al. 1997a; Goodall, 2002).

L. australis is most common south of Puerto Montt, Chile, and particularly common around the Falkland Islands and Tierra del Fuego (especially the Straits of Magellan and Beagle Channel). It is one of the most frequently sighted cetacean species in the Straits of Magellan. The distribution may be continuous between Argentina and the Falklands (Carwardine, 1995).

L. australis may occur further north in both countries and was recorded as far north as Provincia Buenos Aires, Argentina, and Concón, Chile (Brownell et al. 1999; Goodall et al. 1997a). Records from southern

Brazilian waters (41-32°S) have recently been reported by Pinedo et al. (2002; not shown on the map). A group of dolphins closely observed and photographed near Palmerston Atoll (18°S, 163°W) in the Cook Islands also appear to be this species (Brownell et al. 1999). The southernmost sighting until recently was at 57°S; there is one new sighting at 59°10'S in the Drake Passage (Goodall et al. 1997b).

3. Population size

No substantial information is available about the abundance of *L. australis*. However, this species is reportedly the most common cetacean found around the coast of the Falkland Islands and Chile (Brownell et al. 1999; Goodall et al. 1997a). There seems to have been a marked decrease in the number of sightings in areas of the extreme south where crab fishing takes place (Carwardine, 1995).

4. Biology and Behaviour

Habitat: Peale's dolphins are often seen near the coast, and so are easily observed. They occupy two major habitats: open, wave-washed coasts over shallow continental shelves to the north; and deep, protected bays and channels to the south and west. In the channels, this is an 'entrance animal', associated with the rocky coasts and riptides at the entrance to fjords, where the highest water temperature recorded was 14.7°C. Peale's dolphins show a high degree of association with kelp beds (*Macrocystis pyrifera*), especially in the channel regions. They swim and feed within, inshore and offshore of the kelp forests, using natural channels for movement. Over much of its range Peale's dolphin is sympatric with the dusky dolphin, *L. obscurus*, although their usages of habitats are slightly different. These two species are often difficult to differentiate at sea (Goodall et al. 1997b; de Haro and Iniguez, 1997). Throughout the northern part of its range, they inhabit the waters of the wide continental shelf off Argentina and the narrower shelf off Chile. Although Peale's dolphins have been observed in waters at least 300 m deep, they appear to prefer shallower coastal waters (Brownell et al. 1999 and refs. therein).

Behaviour: Peale's dolphin is known to ride bow-waves of large vessels and may swim alongside smaller ones. It sometimes swims slowly, but can be energetic and acrobatic, frequently leaping high into the air and falling back into the water, on its side, with a splash. It has been observed playing in surf in the company of Risso's Dolphins (Carwardine, 1995).

Reproduction: The young are born from spring to autumn, October to April (Goodall et al. 1997a).

Schooling: Peale's dolphins have been seen in small groups of 2-30 and may associate with Risso's and Commerson's dolphins (Jefferson et al. 1993; Brownell et al. 1999 and refs. therein).

Food: The stomachs of three *L. australis* incidentally killed in fishing gear off southern Patagonia, Argentina contained molluscs, crustaceans and fish. The most frequently encountered prey were the kingklip fish (*Genypterus blacodes*), the shrimp, (*Pleoticus muelleri*) and the squid (*Loligo gahi*) (Brownell et al. 1999). Schiavini et al. (1997) studied the stomach contents of nine specimens recovered from Tierra del Fuego which included eight species of fish, three cephalopods, one bivalve mollusc, two crustaceans, and one species of salp. Of these, the most important prey species were bottom fish, namely hagfish (*Myxine australis*), southern cod (*Salibota australis*) and Patagonian grenadier (*Macruronus magellanicus*), octopus (*Enterocto-pus megabocyatizus*) and squid (*Loligo gahi*). The feeding ecology of *L. australis* appears to be associated with demersal and bottom species taken in or near kelp beds. Dive times range from 3-157 s, with an average of 28 s (Goodall 2002 and refs. therein).

5. Migration

Evidence from photoidentification studies suggests that some dolphins spend the entire year in limited areas close to shore, in the Strait of Magellan (Jefferson et al. 1993; Carwardine, 1995). Although there is no published information on the movements of this species at this time (Brownell et al. 1999), at least some of the population appears to move offshore in winter, but more observations are needed (Goodall et al. 1997b).

On the west coast of the Strait of Magellan, Chile, land-based surveys indicate that higher total animal counts are registered during summer months (December to February) compared to winter periods. Land-based surveys showed an increase in abundance in the southern compared to the central portion of the area during spring, and a more homogeneous distribution during the rest of the year. Although total abundance increases in summer, compared to the winter period, both seasons show less marked preference for a specific sector. Concentration in the southern part of the study area during spring appears to be related to the calving season that can be observed as early as

October. Individual identification shows at least part of the population to be residential throughout the year, while another observation of one individual documents a range of at least 300 km (Lescrauwaet, 1997).

6. Threats

Direct catch: There is considerable concern about unknown numbers of Peale's Dolphins that become accidentally entangled in fishing nets and are hunted with harpoons in the Strait of Magellan and around Tierra del Fuego; the meat is used as bait in crab traps (Carwardine, 1995; Jefferson et al. 1993). Although direct hunting of dolphins has been prohibited in Chile since 1977, crab traps for centolla (southern king crab), *Lithodes antarctica* and centollon (false king crab), *Paralomis granubosa*, are still set with dolphin meat. Fishermen who supply dolphins to crab fishermen claim that crabs prefer dolphins to other animals and birds. No recent estimates are available on the number of marine mammals killed for bait, and it has been recommended to collect more definitive statistics on animals used for bait in the crab fishery (Brownell et al. 1999). There are no recent estimates on dolphin mortality abundance in this region (Lescrauwaet, pers. comm.) but it is thought to be lower than in the past (Goodall, 2002). Dolphin takes in the Argentinian sector have been stopped after the early 1980's (Goodall, 2002).

Incidental catch: Peale's dolphins are incidentally entangled and drowned in nets (Jefferson et al. 1993). There are reports from Queule and Mehuin (Chile), southern Patagonia, north-eastern Tierra del Fuego and southern Santa Cruz (Argentina) that local fishermen may incidentally catch Peale's dolphins (Brownell at al. 1999, Reyes, 1991 and refs. therein). In the northern part of their Pacific range, however, Peale's dolphins seem to be rarely taken (Goodall 2002).

Pollution: Some residues of organochlorine contaminants were found in a single specimen of *L. australis* from Argentine waters. Dieldrin (0.620 ppm), Heptachlor (0.050 ppm), HCB (0.094 ppm), HCH (0.067 ppm) and DDT (0.405 ppm) were present in the blubber of this specimen (Brownell et al. 1999 and refs. therein).

7. Remarks

This species is poorly known with respect to abundance, migratory behaviour and mortality in anthropogenic operations. Exploitation for crab bait in the southern part of its range was extensive in the 1980s but crab fishing effort has lessened through the over-exploitation of crabs. Alternative bait is now more available and there seems to be a change from (over-exploited-) crab to sea urchin exploitation. Offshore fishing represents a potential danger that should be monitored (Goodall et al. 1997a). Although the potential impact of crab-fisheries must have diminished considerably (there is more control and better availability of legal bait like fish and slaughterhouse wastes) there is still a—not analysed nor estimated—indication that small amounts of wildlife are still being taken in this fishery. New research in the field is needed to update these data (Lescrauwaet, pers. comm.).

L. australis is included in Appendix II of CMS based on the fact that movements of dolphins through the Beagle Channel (if not through the Strait of Magellan also) are likely to involve the national boundaries of Argentina and Chile. IUCN Status: "Data Defficient".

Recommended actions for conservation include enforcement of regulations in both Argentina and Chile, cooperative research on biology and abundance, collection of definite statistics on bait usage and development of alternative sources of bait. In the meantime campaigns to inform the citizenry, environmental organizations and the importing nations of the illegal aspects and the environmental effects of the crab fishery are needed (Reyes, 1991). See also recommendations in Hucke-Gaete (2000) in Appendix 1.

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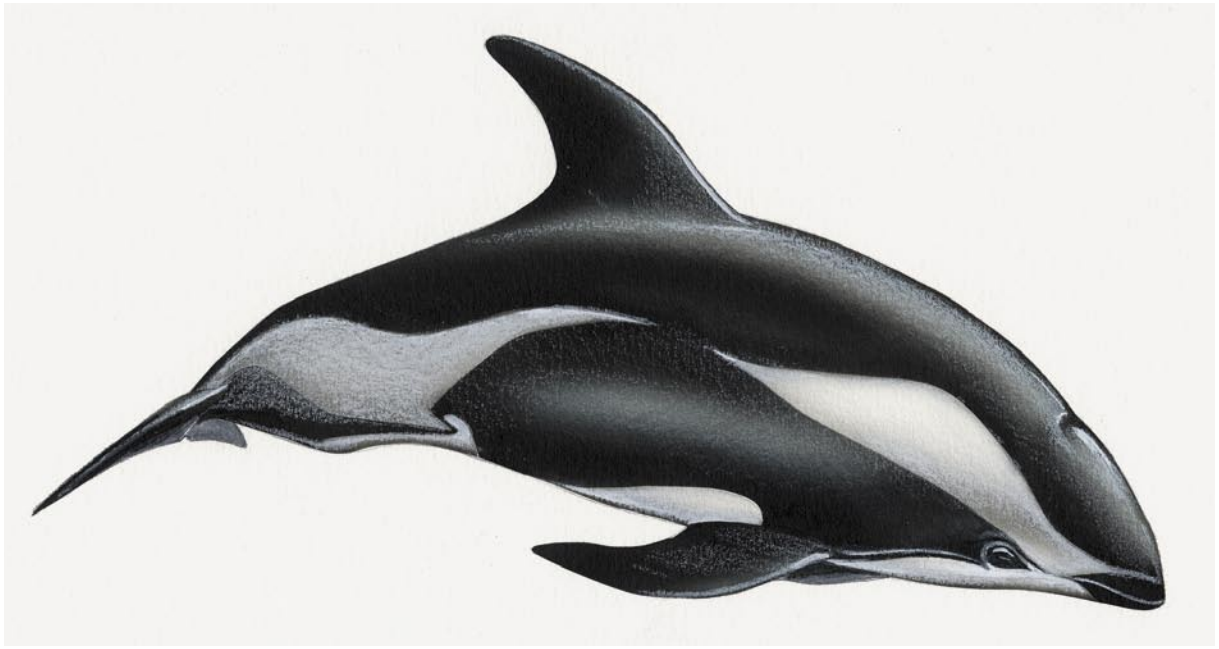
5.25 Lagenorhynchus cruciger (Quoy & Gaimard, 1824)

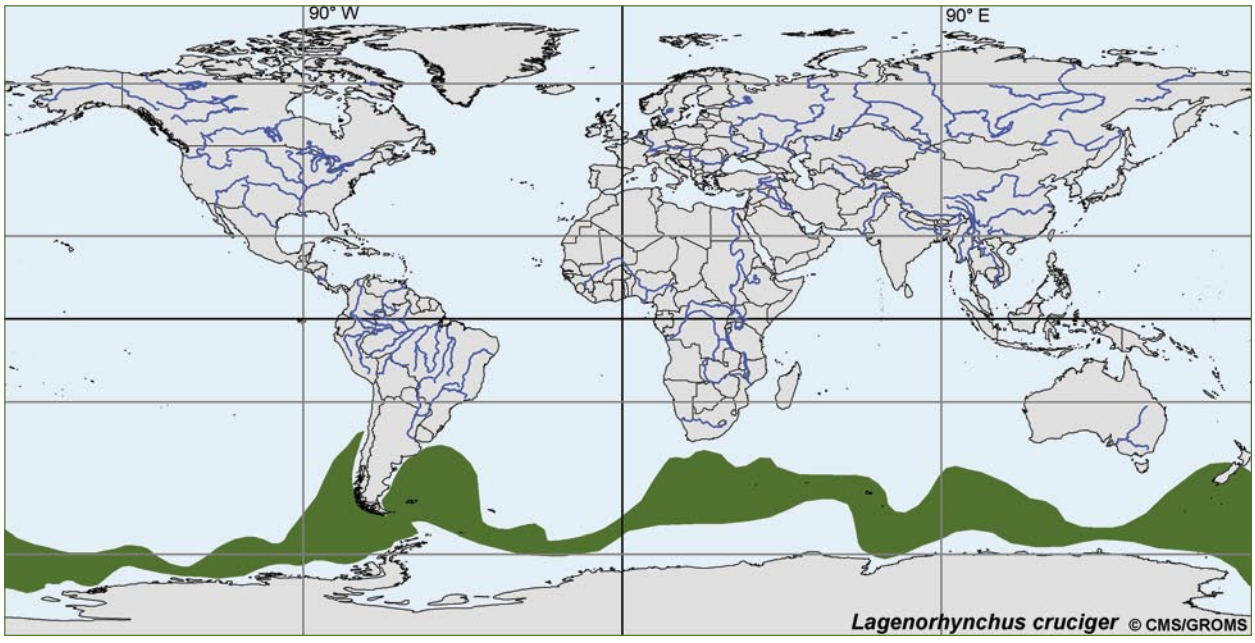
English: Hourglass dolphin
German: Stundenglas-Delphin
Spanish: Delfín cruzado
French: Dauphin crucigère



Drawing of Lagenorhynchus cruciger © Wurtz-Artescienza.

1. Description

Hourglass dolphins are rather stocky, with a large, re-curved dorsal fin. The tail stock is often keeled. Body length ranges from 142-187 cm, and males and females are of equal size. Colouration is mainly black or dark with two elongated white areas, in some animals joined with a fine white line, giving it its common name. The forward patch extends onto the face above the eye. Only 3 specimens were collected until 1960 and the knowledge of the biology of this species rests on a total of 20 specimens (Goodall, 2002).



Distribution of Lagenorhynchus cruciger: cold waters of the Southern Hemisphere, predominantly between 45° and 65°S (mod. from Goodall, 2002; © CMS/GROMS).

2. Distribution

The hourglass dolphin is the only small delphinid that is commonly observed south of the Antarctic Convergence. It is probably circumpolar in pelagic waters of the Subantarctic and Antarctic zones, south of the Subtropical Convergence; most records fall between 45°S and 65°S (Rice, 1998).

The distribution of *L. cruciger* is poorly known, though the range appears to be fairly extensive. It mostly occurs in the South Atlantic and South Pacific, and in cool currents associated with the West-wind Drift. The northern limits are largely unknown, but probably below 45°S. The range probably shifts north and south with the seasons (Carwardine, 1995). In the South Atlantic, there are no sightings south-east of the Antarctic Peninsula: The largest concentration of sightings was in the Drake Passage, an area with considerable ship traffic in summer (Goodall, 1997). Single records as far north as Valparaiso, off the coast of Chile at 33° 40'S, 74° 55'W and at 36° in the South Atlantic seem to be exceptional (Carwardine, 1995; Goodall, 2002). The southernmost sighting is 67°38'S, 179° 57 'E in the South Pacific (Brownell and Donahue, 1999 and refs. therein; Goodall, 1997).

3. Population size

Kasamatsu and Joyce (1995) combined data gathered in sighting surveys conducted from 1976/77 to 1987/88 to produce an abundance estimate of 144,300 for waters south of the Antarctic Convergence.

4. Biology and Behaviour

Habitat: Normally seen far out to sea, but *L. cruciger* has also been observed in fairly shallow water near the Antarctic Peninsula and off southern South America. It occurs within 160 km of the ice edge in some areas in the southern part of its range (Carwardine, 1995; Jefferson et al. 1993). Most sightings of these dolphins are in an area north and south of the Antarctic Convergence between South America and Macquarie Island. The species seems to prefer surface water temperatures between 0.6°-13°C (mean 4.8°C; Goodall, 1997) or even down to -0.3°C (Goodall 2002). Although oceanic, sightings are often near islands and banks. High observer effort, i.e. in the Drake Passage, reflected in high sighting rates (Goodall 2002).

Behaviour: This is a boisterous swimmer capable of speeds exceeding 12 knots. It rides bow-waves and stern-waves of fast boats and ships, swimming with long, low, leaps. From a distance, this undulating motion makes it look like a swimming penguin. It will also swim alongside slow vessels. When swimming fast, hourglass dolphins may travel very close to the surface, without actually leaving the water, creating a great deal of spray when rising to breathe (Carwardine, 1995).

Schooling: Groups tend to be small, which is unusual for a small oceanic delphinid. Although herds of up to 100 have been seen, groups of 1 to 14 are more common (Brownell and Donahue, 1999 and refs. therein). Hourglass dolphins have been encountered with several other species of cetaceans, and may associate with Fin Whales, Sei Whales, Southern Bottlenose Whales, Arnoux's Beaked Whales, Killer Whales, Long-finned Pilot Whales, and Southern Rightwhale Dolphins (Carwardine, 1995).

Food: Prefers fish (e.g. the myctophid *Krefftichtys andersonii*), squid (*Onychoteuthidae* and *Enoploteuthidae*) and crustaceans. Feeding often takes place in large aggregations of sea birds and other cetaceans and in plankton and krill slicks (Goodall et al. 1997; Goodall, 2002; Reid et al. 2000).

5. Migration

Goodall (1997) reports that in the South American sector of the Antarctic and Subantarctic there were no sightings from May to September, probably a reflection of observer effort. However, as stated above, the range may vary according to season and extend further north in winter.

6. Threats

Direct catch: It is likely that their numbers are at or near original levels. There has never been any systematic exploitation (Jefferson et al. 1993). One scientific specimen was collected during commercial whaling operations, and several other specimens have been collected during research cruises (Brownell and Donahue, 1999).

Incidental catch: At least one hourglass dolphin was incidentally caught in an experimental Japanese drift net fishery for squid around 53°13'S, 106°20'W (Brownell and Donahue, 1999). Goodall et al. (1997) and Goodall (2002) report on 4 known casualties in net fisheries in the South Pacific.

Tourism: Increased tourist activity from southern South America to the Antarctic Peninsula should produce increased awareness and further sightings of this species.

7. Remarks

This is a poorly known species with a flexible range, which seems to be influenced in its extent by the seasons. Vagrants off Chile suggest that *L. cruciger* may follow cold currents further North. More information on abundance, area of higher concentrations, home range size, the effect of climate on movements and migrations is needed. For South American populations, see also recommendations in Hucke-Gaete (2000) in Appendix 1.

IUCN and CMS status: "not listed".

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