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Mass stranding of pilot whale *Globicephala macrorhynchus* Gray, 1846 in North Andaman coast

Pilot whale is a carnivorous marine mammal described under the order Cetacea, suborder Odontoceti (toothed whales). Though commonly called as ‘black fish’ or ‘pothead whales’, these mammals are named as ‘pilot whales’ because it was believed that pods were piloted by a leader^{1,2}. They are gregarious and frequently found with other small cetaceans. Pilot whales are one of the largest members of the family Delphinidae. Two extant species of pilot whales reported in the world oceans are long-finned *Globicephala melas* (Traill, 1809) and short-finned *Globicephala macrorhynchus* Gray 1846. General appearance of short-

and long-finned whales is similar. However, the fin of the long-finned whales is one-fifth or more of their body length and one-sixth for that of short-finned whales. Short-finned pilot whales have fewer teeth, i.e. 7–9 short, sharply pointed teeth in the front of each tooth row, whereas it is 8–13 for long-finned whales³. According to IUCN Red List, both the species are insufficiently known. Pilot whales are found in waters nearly worldwide with long-finned pilot whales living in temperate waters, and short-finned pilot whales living in the tropical and subtropical waters generally in deep offshore areas of Indian, Atlantic

and Pacific Oceans. Both the species live in groups of 20–60 individuals or more. The population of *G. macrorhynchus* has been estimated as 150,000 in the eastern tropical Pacific Ocean and about 30,000 in the western Pacific, off the coast of Japan². Normally they prefer the waters of the shelf break and slope². Although they primarily feed on squid⁴, pilot whales consume fishes, including Atlantic cod, Greenland turbot, Atlantic mackerel, Atlantic herring, hake, blue whiting and spiny dogfish^{2,5}. These whales are habituated to migrate seasonally inshore and offshore in response to the dispersal of their prey². Pilot whales are often

infested with whale lice, cestodes, nematodes and also host various pathogenic bacteria and viruses such as *Streptococcus*, *Pseudomonas*, *Escherichia*, *Staphylococcus* and influenza¹; the most common illness reported was upper respiratory tract infection⁶.

About 2000 marine mammals beach themselves across the world every year. Of the 78 living species of cetaceans, only 10 species frequently display mass stranding and 10 more rarely doing so⁷. Pilot whales are among the most commonly stranding animals. A key factor in many of these cases appears to be the strong social cohesion of toothed whales; if one gets into trouble, its distress call may prompt the rest of the pod to follow and beach themselves alongside⁸. The periodic report of cetacean strandings is initiated by British Museum of Natural History on the British coasts⁹. In the Indian Ocean region, Deraniyagala¹⁰ gave a list of whales stranded on the coasts of Sri Lanka. Moses¹¹ listed the strandings of whales on the coasts of India during the period from 1748 to 1947. Subsequently, the cetacean strandings are reported along the Indian

coasts^{12–18}. Most of these strandings were of one or two individuals only, the exception being the pilot whales of genus *Globicephala*¹⁹. Mass stranding of *G. macrorhynchus* was first recorded in India in salt lakes near Kolkata (Serampore) in 1852, involving several dozens of individuals²⁰. The second mass strandings of this species was found in Manapad coast, Gulf of Mannar on 14 January 1973, in which 147 pilot whales beached ashore and died¹⁹. Almost 40 years later yet another mass stranding of *G. macrorhynchus* occurred in the Indian waters, in which 40 individuals stranded on the Elizabeth Bay, North Andaman coast on 21 October 2012.

The Elizabeth Bay (lat. 13°29.890'N, long. 92°54.849'E) is located on the west coast of North Andaman in the Bay of Bengal region (Figure 1). This is a shallow bay with a maximum depth of 20 m. Littoral zone of the bay is comprised of patchy reef and a sandy beach. On the night of 21 October 2012, fishermen sighted a large number of stranded, live whales in knee-deep water at Shyam Nagar hamlet in a stretch of 100 m (Figure 2). The villagers tried to push them back

into the sea, but they could not succeed. On 22 October 2012 morning all the whales were found dead. Subsequently the information was reported to the Assistant Commissioner and Divisional Forest Officer of North Andaman. One whale was taken to conduct the post-mortem by these officials on 23 October 2012. The research team of Zoological Survey of India reached the site on 23 October 2012 and conducted morphometric analysis of all the stranded whales according to standard procedures. The carcasses started decaying and putrefying; later, they were all buried in a suitable place on the seashore with the supervision of the officials concerned.

Flipper is an important character in distinguishing *G. macrorhynchus* from *M. melas*. Morphologically, *G. macrorhynchus* is large, with bulbous head, dramatically up-sloping mouth-lines and extremely short or non-existent beaks. The shape of the head varies significantly with the age and sex, becoming more globose in adult males. The dorsal fin which is situated only about one-third of the way back from the head, is low and falcate, with a very wide base. The flippers are long and sickle-shaped, 16–22% of the body length. Adult males are significantly larger than females, with large, sometimes squarish foreheads that may overhang the snout, strongly hooked dorsal fins with thickened leading edges and deepened tail stock with post-anal kneels. Except for a light grey, anchor-shaped patch on the chest, a grey 'saddle' behind the dorsal fin, and a pair of roughly parallel bands high on the back that sometimes ends as a light streak or teardrop above each eye, pilot whales are black to dark brownish-grey. *G. macrorhynchus* is about 1.4 m long at birth and adults reach 5.5 m (females) and 6.1 m (males) and may weigh nearly 3600 kg (ref. 3).

Out of 40 stranded whales, 18 individuals are males and 22 are females. Among them one male individual weighing about 2 tonnes (total length of 260 cm) was used for post-mortem studies. Table 1 depicts the different morphometric measurements of male and female pilot whales. Total length of the animals ranged from 230 to 555 cm for males and 214 to 510 cm for females. Among the stranded individuals, 13 whales were between 200 and 300 cm size group (5 males and 8 females), 17 whales between 300 and 400 cm size

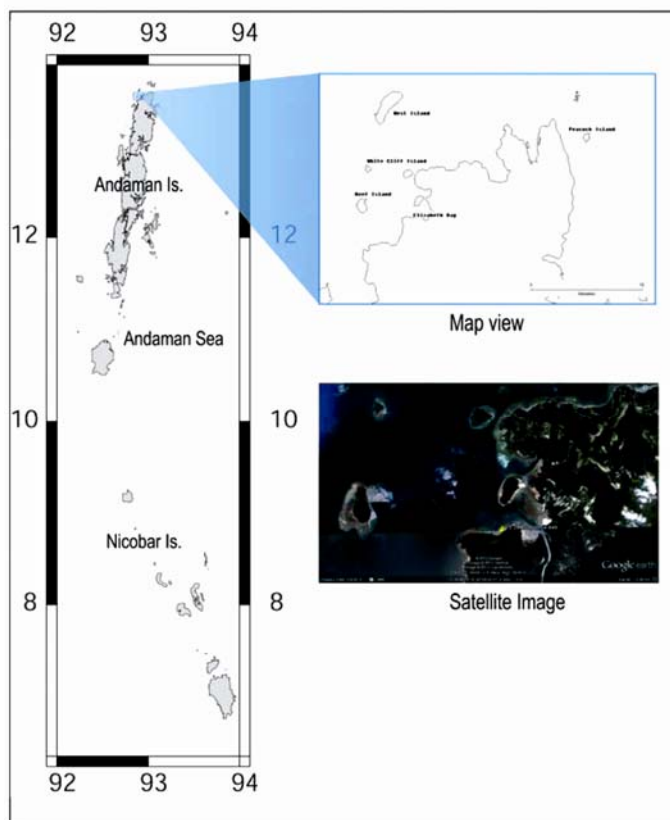


Figure 1. Map showing Elizabeth Bay, North Andaman coast.



Figure 2. a, Mass stranding of pilot whale *Globicephala macrorhynchus*. b, Stranded male pilot whales. c, Carcass of female pilot whale.

Table 1. Total length (from tip of upper jaw to deepest part of notch between flukes) of stranded *Globicephala macrorhynchus* in North Andaman coast

Specimen no.	TL (cm)	Sex	Specimen no.	TL (cm)	Sex	Specimen no.	TL (cm)	Sex	Specimen no.	TL (cm)	Sex
1	555	♂	11	293	♂	21	410	♀	31	217	♀
2	370	♂	12	292	♂	22	342	♀	32	214	♀
3	380	♂	13	468	♂	23	263	♀	33	410	♀
4	395	♂	14	347	♂	24	390	♀	34	368	♀
5	498	♂	15	387	♂	25	404	♀	35	264	♀
6	410	♂	16	395	♂	26	392	♀	36	279	♀
7	265	♂	17	438	♂	27	257	♀	37	352	♀
8	230	♂	18	260	♂	28	256	♀	38	339	♀
9	306	♂	19	286	♀	29	373	♀	39	344	♀
10	356	♂	20	510	♀	30	382	♀	40	406	♀

TL, Total length.

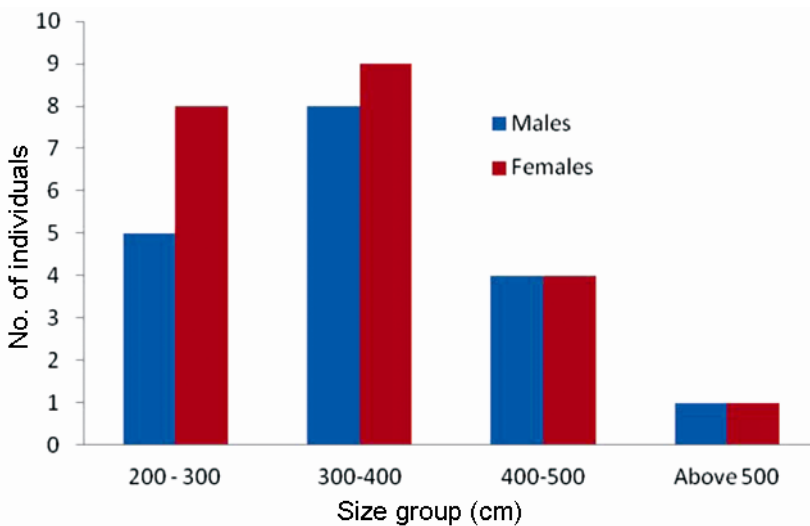


Figure 3. Size groups of stranded *G. macrorhynchus*.

group (8 males and 9 females), 8 whales between 400 and 500 cm size group (4 each for male and female) and only two were above 500 cm, i.e. one each for male and female (Figure 3). According to Jefferson *et al.*³, the size group between 200 and 300 cm is considered as sub-adults, which indicates 30% of the

stranded individuals were under this category.

Earlier stranding records of *G. macrorhynchus* are summarized in Table 2. It indicates that more than 200 short-finned pilot whales stranded in the Indian coast over the period of 160 years. Mass stranding was reported in other parts of

the world as well, such as Florida, Scotland and Indonesia, with considerable number in 2012 itself, especially between September and October.

Many theories have been proposed to explain mass stranding/beaching of pilot whales, but the question remains unresolved. In general strandings can be attributed to natural and environmental factors such as rough weather, weakness due to old age or infection, difficulty in giving birth, navigational errors, etc.⁷. However, the causative factor for mass stranding in North Andaman coast is hypothesized as follows.

Undersea earthquake and geomagnetic errors in navigations: G. macrorhynchus is one of such animals which use the magnetic field to navigate. Alteration in the magnetic field may misguide them, resulting in their death. A recent study by US Geological Survey reveals that, an undersea earthquake with magnitude of 4.7 on the Richter scale struck the Andaman sea region on 21 October 2012 (lat. 13.783°N, long. 96.225°E) at a depth of 30 km. The epicentre of the earthquake was 359 km away from the Elizabeth Bay of North Andaman; 295 km (183 miles) WNW (301°) from Mergui,

Table 2. Stranding records of *G. macrorhynchus* at different regions of the world

Year	Place	No. of animals	Reported by
1852	Calcutta, India	Several dozens	Blyth ²⁰
1914	Pulu-Weh Island, Indonesia	27	Weber ³⁴
1923	Madura Strait, Indonesia	55	Delsman ³⁵
1973	Gulf of Mannar, India	147	Alagarswami <i>et al.</i> ¹⁹
2012	Avalon Beach in northern St. Lucie, Florida	22	Florida Atlantic University, September 2012
2012	Anstruther in Fife, Scotland	16	Information Daily Staff Writers, 3 September 2012
2012	Savu Island, Indonesia	44	<i>Straits Times</i> , 2 October 2012
2012	Elizabeth Bay, North Andaman, India	40	Present study, 21 October 2012

334 km (207 miles) S (179°) from Yangon (Rangoon) and 336 km (209 miles) SSW (207°) from Mawlamyine (Moulmein), Myanmar. Earthquakes release a lot of energy. An earthquake of magnitude a little above *M* 5, is capable of producing low-frequency sounds that are very intense 240–239 dB re: 1 µPa at 1 m. However, this is within a large whale's hearing range of 16–44 Hz. It is postulated that the magnetic waves generated by the undersea earthquake might have altered the navigational path of whales and propelled them towards the shallow waters of the Elizabeth Bay.

Following fast moving dolphin and prey: Dolphins are commonly distributed in offshore and inshore waters around the Andaman and Nicobar archipelago. Stranding might have caused the pilot whales into inshore waters as they tend to follow the faster-moving dolphins. And also if they encounter an adverse combination of tidal flow and seabed topography, the larger species become trapped. The unfamiliar underwater topography of the Elizabeth Bay is also very shallow with reef slope and sandy bottom. Pilot whales also have a tendency to prey upon oceanic squids, and the squids often migrate towards the inshore waters which might have attracted these whales to the coast.

Tidal currents: As the pilot whales are gregarious by nature, even a single sick whale would cause a pod to follow it. A pilot whale that was stranded on the coast of New Jersey, USA and died of encephalitis was reported to host a novel type of virus²¹. Epizootic of lethal morbillivirus infection led to the death of 44 long-finned pilot whales in the Mediterranean Sea during 1998–2006 (ref. 22). Morbilliviruses have emerged as serious pathogens of cetaceans and pinnipeds worldwide²³ and antibodies to these viruses have been reported in 86% of two species of pilot whales, *G. melas* and

G. macrorhynchus in the western Atlantic²⁴. However, in the present stranding, autopsy did not reveal any clue as the post-mortem study was conducted on a single individual only. Hall *et al.*²⁵ examined the bacteriology, reproductive tissues, liver mercury and DDE contents in the stranded 28 pilot whales of the Pacific and concluded that stranding was a natural event precipitated by certain biological, beach and tide conditions.

Sonic waves: On some occasions whales have stranded shortly after military sonar activity in the area²⁶. The low-frequency active sonar used by the military to detect submarines is the loudest sound ever put into the sea and can retain its power across hundreds of miles. At amplitude of 240 dB, it is loud enough to kill whales and dolphins and is already causing mass strandings and deaths in the Bahamas, an area where the United States is conducting exercises²⁷. As the Andaman and Nicobar Islands are hinterland to quite a few countries, the sonic wave emanated from war ships might have caused the stranding.

India has one of the richest diversity of cetaceans within the International Whaling Commission's Indian Ocean Sanctuary²⁸. Available information revealed that 40 species of cetaceans have been recorded so far from the Indian Ocean region, of which 25 species are represented in Indian waters²⁹. According to IUCN³⁰, four species are categorized as Endangered, 3 as Vulnerable, 8 as Least Concern and 10 as Data Deficient. Rough-bottom topography with deep sub-marine canyons in some parts of the Bay of Bengal region facilitate the aggregation of cetaceans³¹. In India all the cetaceans are listed under Schedule-I of Wildlife (Protection) Act, 1972. According to the population study, it is estimated that about 1 million long-finned pilot whales and approximately 200,000 short-finned pilot whales are distributed

in the world oceans. Pilot whales have been hunted for their meat, bone, oil and for fertilizer. Because they easily adapt to captivity, pilot whales are also exhibited in many aquariums and zoos across the world. Compilation of various reports shows that a total of 1452 cetaceans were stranded in the Indian coast during 1800–2000 (ref. 29), which includes 166 individuals of *G. macrorhynchus*. In addition, short-finned pilot whale is listed in appendix II of the Convention of International Trade in Endangered Species (CITES), in which international trade on this species is controlled³². Further research is required to identify the impacts of various threats on this whale and its taxonomy also needs to be studied, as it is possible that it may comprise more than one distinct species³⁰.

The main threat to short-finned pilot whale is bycatch or incidental take in fisheries with the whales often becoming caught in fishing gears such as gillnets, long lines and trawls³³. Besides, this species is also directly targeted by fisheries in Japan, the Caribbean, Faroe Islands and the Philippines; the largest numbers of short-finned pilot whales are taken off the coast of Japan^{30,33}. Climate change may also potentially affect this species in near future along with other cetaceans. Considering the periodic sighting of whales in Indian waters including Andaman and Nicobar Islands, it is important to conduct detailed studies to determine the distribution and monitor the abundance of whales. The database on basic biological information on diet, pollutant levels and genetic analysis of tissue samples from the stranded whales needs to be maintained. Though Indian waters harbour 25 cetacean species, reliable scientific data on whales of India are still meagre. Priorities should be given to cetacean studies in India with adequate funding as a part of the biodiversity programme under the Decade of

Biodiversity 2011–2020 observed by the United Nations in which India is one of the parties. This will provide information to protect the cetacean diversity in Indian waters to develop appropriate action plan to conserve these marine mammals.

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