

## Marine Mammal Research and Conservation in India

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### Abstract

Marine mammals are probably one of the best sentinel organisms in aquatic and coastal environments because many species have long life spans and have extensive fat stores that can serve as depots for anthropogenic toxins. Marine mammals in the Indian EEZ are one of the least studied animals. In India, 26 species of cetaceans and one species of sirenian have been recorded. In recent years, with increasing fishing activity and extension of fishing to oceanic waters, the encounters between fishing gear and marine mammals are on the rise. The Central Marine Fisheries Research Institute (CMFRI) initiated the study of marine mammals in India in the 1950s. Since then the knowledge base on these charismatic animals in the Indian EEZ has substantially increased. This is causing concern in the effort to conserve these mega fauna, which are protected under Wildlife (Protection) Act, 1972. From a vast network of trained field staff located at its research and field centers along the Indian coast, the CMFRI has and published information on occasional stranding, sighting and accidental gear entanglement for more than 60 years. Research on distribution, abundance, species identity, molecular sequencing and fisheries interaction was strengthened after initiating a project on marine mammals in the year 2003. The conservation status of marine mammals in India and the research needs are discussed in the paper in detail.

### Introduction

In India, earlier research on marine mammals was restricted mostly to opportunistic collection of information on strandings and beach-cast specimens. Organised research by government and non-government organisations on these charismatic and vulnerable/endangered animals was initiated approximately 15 years ago. In the last 15 years, data on sightings, species inventory, abundance estimates, DNA sequences and fisheries interaction have been collected. These researches have indicated the need for future enhanced research on these sentinel megafauna of the oceans. At present, all species of marine mammals in the Indian seas are placed under Wildlife (Protection) Act, 1972.

Capture, use and trade of marine mammals are punishable under the Act. However, marine mammal – fisheries interaction is a major cause for concern.

## Status of research

In India, 25 species of cetaceans and one species of sirenian have been recorded. The Central Marine Fisheries Research Institute (CMFRI) initiated the study of marine mammals in India in the 1950s (Jones, 1959) and has collected and published information on the occasional stranding, sighting and accidental gear entanglement for the last 60 years. Dedicated seminar conducted on endangered marine animals played a pivotal role in creating awareness (Silas, 1985). For an understanding on the cetacean species diversity, distribution and abundance the CMFRI initiated a research project “Studies on Marine Mammals of Indian EEZ and the Contiguous seas” funded by Ministry of Earth Sciences in the year 2003. A Marine Mammal Stranding workshop was conducted by CMFRI in collaboration with NOAA, USA in 2010.

## Distribution

### Sighting cruises

In the last eight years, 62 opportunistic marine mammal cruises were conducted on board FORV *Sagar Sampada* in the coastal and oceanic waters of Arabian Sea, Bay of Bengal and southern part of Sri Lanka. More than 844 days of survey extending for 8461 hours of observation effort and covering a distance from 1 km to > 1000 km from the shore with a depth range of 20 m to 5000 m have been made. Nearly 727 sighting events consisting of 15,824 individuals were recorded. During the surveys, seven species of whales and ten species of were recorded. Ten species, which were recorded in strandings, could not be encountered in the sighting surveys.

The major conclusions of the sighting surveys are as follows (Afsalet *et al.*, 2008):

1. Marine mammals are widely distributed.
2. Abundance and species richness are high in South Sri Lanka coast followed by Southeastern Arabian Sea (off Kerala – Karnataka).
3. In spite of absence of ten species in the surveys, the general distribution pattern agrees with historical records based on incidental capture.
4. The spinner dolphin *Stenella longirostris* is the most dominant, distributed abundantly in space and time.
5. There is an indication of habitat preference of other species; *Sousa chinensis* and *Tursiops aduncus* are restricted essentially to coastal waters (so also is the finless porpoise) whereas *Tursiops truncatus* inhabits oceanic waters.
6. *Stenella longirostris*, *Sousa chinensis*, *Tursiops aduncus* and *Neophocaena phocaenoides* appear to be the residents or regular visitors to the region.
7. Being residents/regular visitors to the coastal areas, the four species mentioned above are more vulnerable to fishery interactions.

8. Whereas all species were found at SST 26.0 – 30.0°C, *Tursiops aduncus* and *Delphinus capensis* were found at SST as high as 32.0 – 32.9°C.

In spite of valuable information generated from the sighting surveys, there were several limitations:

1. FORV *Sagar Sampada* is too big for sighting cruises; not easily maneuverable; observation deck (17m from sea level) is very high.
2. All cruises were “opportunistic”; not dedicated to mammal surveys.
3. Effort not uniformly distributed; oceanic waters were not well covered and Gulf of Mannar was not covered.
4. Only about 50% of the sightings were identified as ‘confirmed’ or as “possible”.
5. Abundance estimates could not be made.

### ***Strandings***

Kumaran (2002) compiled the available reports on the stranding of Indian marine mammals, published by more than 200 authors of 180 papers from the years 1800 to 2000. He found 1452 records all along the maritime states and two island groups. He concluded that the species diversity of marine mammals in India is one among the richest in the Indian Ocean. Large number of records are available on the spinner dolphin *Stella longirostris* (260), common dolphin *Delphinus delphis* (possibly many were *Delphinus capensis*; 256), Indo-Pacific humpbacked dolphin *Sousa chinensis* (221), short-finned pilot whale *Globicephala macrorhynchus* (166) and dugong (165). Most of information pertains to occasional stranding or accidental entanglements in fishing gear, especially gillnets. In many instances, the information is limited to mere morphometric measurements and photographs. Many publications suffer from mis-identification of species.

Incidental catches of marine mammals in the gillnet fishery were used for studying the anatomy (10 species) and stomach contents (11 species). Most of the small cetaceans are opportunistic feeders and the stomach contents of the same species vary with space and time (Kumaran, 2002). Commercially important fish and shellfish were found in the stomach of dolphins.

### ***Marine mammal – fisheries interaction***

The marine mammal – fisheries interaction is a major cause for concern. Mechanized fishing was introduced on a commercial scale in India in the mid 1960s. Since then, the fisheries sector has grown rapidly. Marine fisheries census carried out by CMFRI in 2005 shows that there are 58,911 mechanized fishing craft along the Indian coast operating trawlnet, gillnet, lines, dolnet and purse seines. The efficiency of fishing vessels has increased, resulting in longer sea endurance, extension of fishing to oceanic waters and introduction of larger and efficient gear. The growing number and efficiency of mechanized boats have increased the chances of fishing gear – marine mammal encounters. Unfortunately the incidental kills of marine mammals have not been regularly monitored in India. However, it is natural to expect that the incidental kills of marine mammals,

especially those of small cetaceans, would have increased with the proliferation of mechanized fishing fleet.

About 9000 to 10,000 dolphins are estimated to be caught by gillnet annually along the Indian coasts (Yousufet *al.*, 2008). Gillnet accounted for 68.9% of the catch. The two species commonly involved in the gillnet fishery are the spinner dolphin *Stenella longirostris* and the bottlenose dolphin *Tursiops aduncus*. In addition, other species such as Risso's dolphin *Grampus griseus*, long-beaked common dolphin *Delphinus capensis* and Indo-pacific humpbacked dolphin *Sousa chinensis* were also reported. Maximum number of dolphin entanglements in gillnet was encountered in the fishery for large pelagics such as tuna (Visakhapatnam and Chennai) and seerfish (Kakinada). The length of gillnet ranged from 0.5 to 6 km. At Periyapatnam (near Mandapam), the mesh size ranged up to 18 cm for catching rays. Off Mangalore, a large number of finless porpoise *Neophocaena phocaenoides* was incidentally caught in purseseines. In the surveyed areas, the overall length of mechanized boats that incidentally caught dolphins and porpoise ranged from 9 to 15m with 20 to 108 hp engine. The fishing operations were carried out 4 to 70 km from the shore.

### ***Molecular taxonomy of marine mammals***

From the samples collected from the carcass of incidentally caught specimens, 63 sequences of cytochrome b gene and control region of mtDNA from 40 individuals of 11 species were deposited in the GenBank ([www.ncbi.nlm.nih.gov/](http://www.ncbi.nlm.nih.gov/)). A PCR-based sex determination technique has been developed based on the amplification of genomic DNA extracted from skin samples (Jayasankaret *al.*, 2008).

### ***Bioaccumulation of trace metals***

Marine mammals, as top predators, accumulate trace elements in their tissues from their environment, chiefly via their food. Trace metal accumulation depends mainly on the feeding habits, size, length and habitat. Muscle, liver and kidney samples from 33 incidentally caught and stranded marine mammals at six sampling locations showed that the concentrations in the samples were low compared to those from other parts of world.

### ***Bioaccumulation of pesticides***

The cetaceans are unique in terms of the great organochlorine 'storage capacity' of their blubber, which act as a reserve for ingested lipophilic (fat-loving) chemical contaminants (such as DDT and PCBs, Dixon). Blubber samples from 37 individuals belonging to eight species were analysed for organochlorine pesticides. The concentrations of  $\Sigma$ HCHs (BHCs),  $\Sigma$ DDTs and  $\Sigma$  chlordanes were generally lower than the values reported from other parts of the world.

### **Conservation status**

The research findings of CMFRI on distribution and abundance of marine mammals from sighting cruises and incidental capture in fishing gear, and the earlier published records, makes it possible to revise the status of different species of marine mammals in the

Indian seas. Table 1 provides only an indicative conservation status based on the available information and is subjected to changes when more data become available. Table 1 also provides IUCN status report for the species occurring in the Indian seas.

**Table 1. Conservation status of marine mammals in India**

No	Common Name	Species name	IUCN Status	India Status*
1.	Blue whale	<i>Balaenoptera musculus</i> (Linnaeus, 1758)	Endangered	Endangered
2.	Fin whale	<i>Balaenoptera physalus</i> (Linnaeus, 1758)	Endangered	Endangered
3.	Bryde's whale	<i>Balaenoptera edeni</i> Anderson, 1878	Data Deficient	Data Deficient
4.	Common Minke whale	<i>Balaenoptera acutorostrata</i> Lacépède, 1804	Least Concern	Data Deficient
5.	Humpback whale	<i>Megaptera novaeangliae</i> (Borowski, 1781)	Least Concern	Data Deficient
6.	Sperm whale	<i>Physeter macrocephalus</i> Linnaeus, 1758	Vulnerable	Vulnerable
7.	Pygmy sperm whale	<i>Kogia breviceps</i> (de Blainville, 1838)	Data Deficient	Data Deficient
8.	Dwarf sperm whale	<i>Kogia sima</i> (Owen, 1866)	Data Deficient	Data Deficient
9.	Cuvier's beaked whale	<i>Ziphius cavirostris</i> Cuvier, 1823	Least Concern	Data Deficient
10.	Indo-Pacific beaked whale	<i>Indopacetus pacificus</i> (Longman, 1926)	Data Deficient	Data Deficient
11.	Short-finned pilot whale	<i>Globicephala macrorhynchus</i> Gray, 1846	Data Deficient	Data Deficient
12.	Killer whale	<i>Orcinus orca</i> (Linnaeus, 1758)	Data Deficient	Data Deficient
13.	False killer whale	<i>Pseudorca crassidens</i> (Owen, 1846)	Data Deficient	Data Deficient
14.	Pygmy killer whale	<i>Feresa attenuata</i> Gray, 1874	Data Deficient	Data Deficient
15.	Melon-headed whale	<i>Peponocephala electra</i> (Gray, 1846)	Least Concern	Data Deficient
16.	Irrawady dolphin	<i>Orcaella brevirostris</i> (Gray, 1866)	Vulnerable	Vulnerable
17.	Indo-Pacific humpbacked dolphin	<i>Sousa chinensis</i> (Osbeck, 1765)	Near Threatened	Near Threatened
18.	Rough-toothed dolphin	<i>Steno bredanensis</i> (Lesson, 1828)	Least Concern	Data Deficient
19.	Risso's dolphin	<i>Grampus griseus</i> (Cuvier, 1812)	Least	Least

			Concern	Concern
20.	Bottlenose dolphin	<i>Tursiops aduncus</i> (Ehrenberg, 1833)	Data Deficient	Least Concern
21.	Pan tropical spotted dolphin	<i>Stenella attenuata</i> (Gray, 1846)	Least Concern	Data Deficient
22.	Spinner dolphin	<i>Stenellalongirostris</i> (Gray, 1828)	Data Deficient	Least Concern
23.	Striped dolphin	<i>Stenella coeruleoalba</i> (Meyen, 1833)	Least Concern	Data Deficient
24.	Long beaked common dolphin	<i>Delphinus capensis</i> Gray, 1828	Data Deficient	Least Concern
25.	Finless porpoise	<i>Neophocaena phocaenoides</i> (Cuvier, 1829)	Vulnerable	Near Threatened
26.	South Asian River dolphin	<i>Platanista gangetica</i> (Roxburgh, 1801)	Endangered	Endangered
27.	Sea cow	<i>Dugong dugon</i> (Müller, 1776)	Vulnerable	Endangered

\* Status assigned based on sighting surveys conducted by the CMFRI during the years 2003-2012 under the project “Studies on marine mammals of Indian EEZ and the contiguous seas” funded by CMLRE, Ministry of Earth Sciences, Government of India

Besides Wildlife (Protection) Act 1972 of India, the seasonal ban on fishing under the Marine Fisheries Regulation Act indirectly protects the marine mammals. Recently, a Task Force for Conservation of Dugong has been constituted by Ministry of Environment & Forests, Government of India.

### Need for developing National Action Plan on Marine Mammals

Conservation management action plans are important for maintaining and restore the distribution, abundance and diversity of marine mammals in the Indian EEZ. Developing a National Action Plan on Marine Mammals by constituting a Task Force is keenly felt for India (Vivekanandan *et al.*, 2010). The Task Force for developing NPOA-Marine Mammals may address the following:

1. Reducing incidental kills by fishing gear
2. Bycatch management
3. Establishing marine mammal stranding network
4. Necropsy of beach-cast samples
5. Research needs
6. Non-invasive ecotourism
7. Awareness building

### Conclusion

As information on marine mammals is imperative to design and implement meaningful conservation measures, marine mammal research in India should be given priority and should gain a more professional approach.

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