



# CETACEAN DISTRIBUTION IN RELATION TO ENVIRONMENTAL PARAMETERS IN THE INDIAN EEZ

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## Introduction

- Cetacean distribution is largely influenced by different oceanographic and physiographic variables (MacLeod *et al.*, 2007) and prey availability (Lindstrom *et al.*, 2002).
- These variables vary between regions and hence there is a need to study their role in habitat preference by cetaceans.
- Understanding habitat characteristics of cetaceans is crucial to understand the ecology and community structure of cetacean species and serves as key component for cetacean conservation.
- Historical stranding, bycatch and sighting records document occurrence of 26 species of marine mammals in the Indian seas (Kumaran, 2002), but our understanding of ecology of these cetaceans in Indian waters remains poor.
- The present study is the first effort to correlate the distribution of five cetacean species with oceanographic parameters in the Indian EEZ and contiguous seas.

## Methodology

- Shipboard opportunistic visual surveys (passing mode) were conducted from 35 cruises of FORV *Sagar Sampada* (over all length: 71.5m), for three years and four months from October 2003 to February 2007.
- Cetacean sightings surveys were carried out by single trained observer in every cruise by scanning with naked eye and interspersed with a Nikon 10 x 50 mm CFWP handheld binocular with visual range of 4km. Sighting platforms were situated 16m above surface of sea level.
- A Nikon F80 camera fitted with Nikor 70-300mm lens was employed to capture appearances of cetaceans in the form of spouts, dorsal fin, flipper, upper body and fluke.
- Data on the distribution of cetaceans were collected along with related environmental variables.
- Simrad GN33 GPS navigator was used to record geographical position of animal sighted area.
- Cetaceans were identified to the lowest taxonomic level possible based on descriptions in FAO field guide (Jefferson *et al.*, 1993).
- Four variables, namely two physiographic variables (depth and distance from the shore) and two oceanographic variables (sea surface temperature and surface salinity) were considered.
- EMCON SBE 9plus underwater shipboard sensors unit provided SST and salinity data.
- For recording the maximum depth at which the animal was sighted, Simrad EK 60 Echo-sounder of frequency 38kHz was employed.
- Distance between the sighting and nearest shore was calculated using Garmin Map source software version 6.15.6.
- Inter-quartile deviation was performed for five species *Physeter macrocephalus*, *Stenella longirostris*, *Tursiops aduncus*, *Delphinus capensis* and *Sousa chinensis* for which adequate sightings along with data of oceanographic parameters were available

## Important Highlights

- The cetaceans were widely distributed from 0.05 km to 964 km from the nearest shore. In eastern Arabian Sea, distribution of cetaceans from the nearest shore ranged from 0.5 to 783.5km range, whereas it ranged from 2km to 964km in Bay of Bengal.
- Most of the sightings of *Balaenoptera* sp were in oceanic water on continental slope of > 500m depth, but considerable sightings were found in nearshore deeper water.
- Physeter macrocephalus* occurred commonly in deep oceanic continental slope water at depth varied from 340m to 3693m. Their occurrence ranged up to 579 km from the shore but predominant occurrence was <200km.
- Pseudorca crassidens*, *Globicephala macrorhynchus* and *Grampus griseus* were found on slopes. The occurrence of *Pseudorca crassidens* was <300km, closer than that of *Globicephala macrorhynchus* and *Grampus griseus*.
- Sighting of *Stenella longirostris* and *Stenella* sp ranged from 27km to 716km with average observation within 150km. Spinner dolphin and *Stenella* sp occurred both on shelf and slope but generally occurred on slope water >300m (Fig. 1).
- Tursiops aduncus* showed coastal preference mainly in shelf water and also over slope regions <500m depth and most of the sightings occurred between 22km and 276km with mean distance of 87km.
- Delphinus capensis* was found in coastal waters with few occurrences in deep oceanic waters and most of the sightings were within 100km distance. Occurrence of *D. capensis* ranged from shelf to outer slope with predominant sightings on shelf and shelf break. The depth range of the sightings was 28m-3701m and average depth was 907m.
- Sousa chinensis* was commonly found in nearshore waters with average distance of 23km (SD=20). The occurrence of *S. chinensis* was confined to shallow waters, generally at depth <20m.
- The surface salinity in survey area varied from 27 ppt to 36ppt with a mean of 33.3 ppt (SD= 1.5). The SST ranged from 24.2°C to 33.0°C with the mean of 28.8°C (SD= 1.2).
- The cetacean occurred in the water with relatively narrow range of SST and SSS, similar to those reported for northern Gulf of Mexico (Fritts *et al.*, 1983) and eastern tropical pacific (Au and Perryman, 1985; Perrin and Gilpatrick, 1994).
- All the cetacean species except *S. chinensis* were encountered in water with mean surface temperature of 28°C and mean surface salinity of 33ppt.
- However, oceanic species differ in their preference for SST and surface salinity. *Balaenoptera* sp, sperm whale, spinner dolphin and *Stenella* sp and three larger delphinids occurred in waters with SST <29°C.
- The coastal species such as *T. aduncus* and *D. capensis* were recorded delphids in waters with wide variation in SST and salinity. Humpback dolphins were sighted in area of low surface temperature and surface salinity.

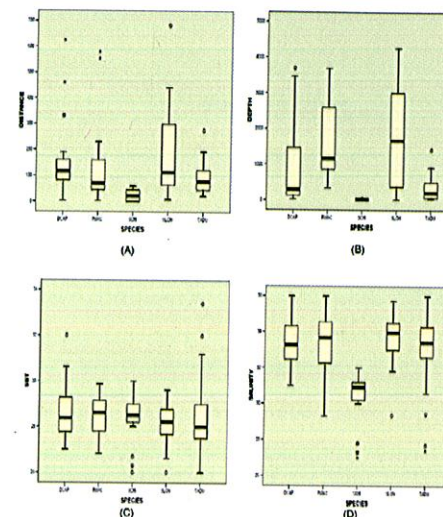


Fig.1. Cetacean distribution with respect to environmental variables observed during the cruise represented by Box and Whisker plot showing median, quartiles and extreme values (The box represents the Interquartile range, the whiskers are lines that extend from the box to the highest and lowest values and the line across the box indicates the median); bal- *Balaenoptera* sp, deap- *Delphinus capensis*, pmac- *Physeter macrocephalus*, schi- *Sousa chinensis*, slon- *Stenella longirostris* sten- *Stenella* sp, tadu- *Tursiops aduncus*

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