Short Communication

Sea mammals in marine protected area in the Gulf of Kachchh, Gujarat State, India

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Marine National Park and Sanctuary (collectively designated as Marine Protected Area or MPA) in the Gulf of Kachchh in Gujarat State has coral reefs, mangroves, sea-grass beds, mudflats, network of creeks and other ecosystems which supports rich marine life, including sea mammals. Although a total of 13 sea mammals have been recorded, only small mammals like dolphins, porpoise and dugong visit shallow water areas of the MPA during high tides to collect food. In this study, three marine mammals—common dolphin (*Delphinus delphinus*), porpoise (*Neophocaena phocaenoides*) and dugong (*Dugong dugon*) were counted. Common dolphin has relatively good population in the western part of the MPA but other two species—porpoise and dugong are very rare. The study reveals that about one third of the total area of the MPA in this zone support about 80% of the marine mammals which visit the area during high-tides. Unlike central and eastern zones, the western zone is relatively free from developmental activities like ports, jetties, petroleum industries and other human activities. Thus, this part of the MPA is key habitat for dwindling population of the marine mammals.

[**Key words**: Sea mammal, mammal, coastal wetlands, Gulf of Kachchh, Marine Protected Area, dolphin, dugong, porpoise]

Gujarat has a coastline of 1650 km (21.9% of the Indian coastline), which is the longest among all the maritime states of India. Its continental shelf occupies 165,000 km², being 35.3% of the Indian Continental Shelf of 468,000 km². The Exclusive Economic Zone (EEZ) is about 200,000 km² (9.9% of India’s EEZ). The coastline has two indentations, the Gulfs of Khambhat and Kachchh. Extent of coastal wetlands (25082.6 km²), including the Rann of Kachchh, is largest in India. Mangroves (1031 km²), coral reefs (130.2 km²), mudflats (21913.7 km²), sands/beaches (106.1 km²), salt marshes (1003.9 km²), other vegetated area (1059.9 km²), rocky area (20.7 km²) and salt pans (459.5 km²) are major ecosystems of the coastal wetlands in Gujarat. Due to richness of the marine habitats, diversity of marine life is also good in the State.

The Gulf of Kachchh (lat. 22°15’ to 23°40’N and long. 68°20’ to 70°40’ E), is the wedge-like extension of the Arabian Sea, which penetrates into the landmass of Saurashtra and Kachchh (Fig.1). It has an area of 7350 km² and has east-west orientation. The Gulf is 58 km wide at seaward (western) from where it tapers gradually eastwards, extending for nearly 170 km. The depth of the Gulf ranges from less than 20 m (at the head) to 60 m in central axis. The Gulf of Kachchh is the only area in Gujarat which has coral reefs and rich mangrove vegetation with creeks and alluvial marshy tidal flats in the interior region. This is an area of a negative water balance because there is no continuous river runoff and rainfall is scanty. Because of the high tidal amplitude, the gulf has a vast intertidal zone; perhaps one of the widest-ones along the Indian coast. The tide, the speed of wind and the rainfall are more pronounced near the head, slightly less in the middle and extremely less at the mouth. The average tidal range in the Gulf is of 4 m varying from 3.06 m to 5.89 m.

The study is aimed to prepare a comprehensive ecological status of the marine protected area, including abundance and distribution of sea mammals. Survey of marine mammals was done in and around the intertidal zone of the Gulf of Kachchh in Jamnagar district which has been demarcated as the Marine National Park and Sanctuary (collectively designated as Marine Protected Area or MPA). Part of the intertidal zone in Dwarka, Kalyanpur, Khabalipara, Lalpur, Jamnagar and Jodiya talukas in Jamnagar district along with 42 islands falling in the district have been included in the MPA. This protected area is...
located in the biotic province ‘8A-The West Coasts’ of Indo-Malayan Realm and can be considered as IUCN Protected Area* Category II.

Out of total area of about 1,160 km² of the intertidal zone in Jamnagar, an area of 457.92 km² has been declared as MPA, which includes 148.92 km² areas of islands and 309.02 km² of intertidal zone along the coast². Of 42 islands in the MPA, 33 have coral reef and 20 have mangroves around them³. Area of the Marine National Park (MNP) is 162.89 km², whereas remaining Protected Area has the status of Marine Sanctuary⁴. Out of the entire intertidal zone in the district covered for survey of mammal in this study, the area of major creeks, subtidal zone and part of intertidal zone in the district are not included in the MPA. Except a few major creeks, entire area exposes during low tides and submerges during high tides.

A comprehensive ecological study, including survey on marine mammals, was done in and around the MPA from February 2000 to March 2002. Sighting of marine mammals in and around the MPA is normally possible during high tide. Staff spent 1585 technical man-days (648 man-days for reef survey, 530 for birds, 357 for coastal vegetation, 50 sub-tidal reefs) in the gulf and recorded sightings of the mammals while traveling by boat from coast to islands as part of the study. Frequency of visit was high from September to March and it was least in summer and monsoon due to the disturbance in the gulf. The observations on marine mammals were based on both direct and indirect information. Altogether, following four different methods were employed to carry out observations on the marine mammals.

(i) The boat transects were considered for observation during high tides from the starting point of the coasts/islands to the islands/coasts or from one island to another or from one locality to other while visiting study sites. The visible distance from both sides of boat was covered and the sightings were recorded with the help of binocular. The characteristics and morphology were observed, once it was located. The numbers of each group were also recorded.

(ii) MPA Authority had conducted survey from October to December 2001 to assess encounter rate of the dolphin in central and western part of the park. This data has been used to ascertain the finding of this study.
(iii) The high tidal area of each island was also surveyed to find out dead body, skeleton or skull that had come over there by floating with waves. The dead body part observed carefully and in these cases, the measurements were done for parts of body. In case of skeleton parts, careful observations were done to identify the exact species from its skull or fins.

(iv) Local fishermen were interviewed to record their individual observations about the recent history related to the abundance of marine mammal’s population. This observation is often crosschecked with the observation of the other fishermen in the same area.

Ecology of the mammals occurring in the MPA was not studied. Observations recorded and maintained in the observation register were used to conclude the findings. In absence of exact distance covered and time taken in each visit during survey, it may not be desirable to conclude encounter rate and population density.

**Sea mammals in the Gulf of Kachchh**

Zoological Survey of India (ZSI) has recorded 13 species of sea mammals—*Balaena australis*, *Balaena musculus*, *Magaperta novaangliae*, *Delphinus delphis*, *Globicephala macrorhynchus*, *Peudecephaelecta*, *Ornicus orca*, *Peudorca crassidens*, *Sousa chinensis*, *Tursiops truncates*, *Neophocaena phocaenoides*, *Kogia breviceps*, and *Dugon dugon* form seawater of Gujarat. Since extensive survey has not been done under a scientific method, diversity and abundance of the sea mammals visiting the coast have not been documented. Large sized whales do not come to shallow water and they are not dependent on the area of the MPA in the Gulf, although dead bodies of whales were recorded near the MPA at the coast of Dwarka. There is possibility that some species of the whales visit deep water of the Gulf but they do not come to intertidal zone during high tide. Four species of sea mammals i.e. two species of dolphin, one species of porpoise and dugong were encountered during this study in and around the MPA. Common dolphin (*Delphinus delphis*) is still common in shallow water of Gujarat but it is very difficult to conclude the trend of population, although local fishermen admit about decline of population. They are seen in the coastal water of Kachchh and Jamnagar and also in south Gujarat. Sighting of the animal is common at Okha and Poshitra. While surveying the area all dolphins were recorded as common dolphin, although possibilities of bottle nosed dolphin (*Tursiops truncatus*) or Indo-Pacific hump-backed dolphin (*Sousa chinensis*) could not be ruled out as they occur in the coast of Gujarat. Whatever data was available it can be concluded that common dolphin is most abundance whereas other species of dolphin are very rare. Dolphins and porpoises (*Neophocaena phocaenoides*) are not truly coral reef animals, but are often encountered nearby. Dolphins are highly social animals and normally attracted by the human activities. It is very unusual to encounter a single individual. Unlike large group of common dolphin in some areas of the world, they live in small groups in the Gulf. Sighting of porpoise is not common but some of the fishermen are familiar with the animal.

Dugong (*Dugon dugon*), the sea cow, is another important mammal sometimes seen near coral reefs. In India, this mammal has been seen in the Gulf of Mannar and shallow water of the Andaman and Nicobar Islands. They usually occur in shallow meadows of seagrass, which is the main item in their diet. While feeding the dugong comes to the surface frequently for air breathing. The sighting of dolphins, porpoises and dugong during two years of the study in the MPA is given in Table 1.

**Common dolphin (Delphinus delphinus Linn. 1758)**

Number of species of dolphins occurring in the Gulf has not been studied; it was difficult to identify all species of dolphin. ZSI has listed three species—common dolphin, bottle-nosed dolphin and Indo-Pacific hump-backed dolphin in the coastal water of Gujarat. Compared to other coastal water, the Gulf of Kachchh is most suitable area. It is expected that these three species of dolphins occur in the MPA but only common dolphin was spotted frequently. Spotting of other species of dolphin was not ruled out as they could not be identified by binocular from distance. All sightings in this study were recorded as common dolphin.

The sightings recorded directly as well as indirect observations on marine mammals show that there were plenty of records of dolphins. In the present study, a total of 116 dolphins (111 live and 5 dead) were observed. Area-wise distribution (Table 1) shows that, highest numbers were recorded in the area of Okha, Bural-Chank reef and Poshitra to Bet Dwarka area. However, the area near Jamnagar and islands like Pirotan, Jindra, Dedeka-Mundeka is under the influence of vessel movement and the disturbance
was high, which yields into less number of sightings. Another possible reason for this could have been that the central and eastern zones are away from Arabian Sea and they need to cross so many hurdles to reach up to these areas.

General observation and also by this study, it is established that common dolphin is most dominant in the gulf, especially during high tides in Poshitra, Okha and its neighbouring areas. Intensity and frequency of visits by the study team were fairly distributed in entire area of the park but less in eastern zone. Number of visit to islands near Jamnagar coast (Pirotan, Jindra, Chhad, Dedeka-Mundeka and other islands) was not less, but sightings of dolphin were less. Out of 116 dolphins seen during the study, only 23 were seen in the area from Salaya to Jodiya, whereas rest of 93 dolphins were seen in the region near Poshitra, Okha and their neighbouring islands (Ajad, Bhaidar, Noru, Chank and Paga reef). This concludes that, this part of the park is suitable for marine mammals, especially for dolphins.

Marine Park Authority has conducted a separate survey to study relative abundance of dolphin in and around the MPA. Area covered in this survey was from Okha to Rozibandar but eastern zone of the MPA was not surveyed. It can be easily concluded on the basis of field visit and indirect evidences that sighting of dolphin in the eastern part of the MPA is relatively very low. During three month of survey from October to December, 2001, a total of 230 dolphins were encountered in 78 sightings. Most of the dolphins were encountered in the western zone, mainly near Okha, Bhaidar, Azad, Poshitra and Noru. Analysis of data indicated that this area supported good population of dolphin (Table 2). Average group size of this sea mammal was 2 to 3, varying from 1 to 8 in the gulf.

Silt content in seawater decreases from east to west and quality of water is relatively better in the western part in the MPA. Although human related activities due to ports and jetties are high in central and eastern zone, the fishing boats have almost uniform distribution in all zones. The study area has a total of 21 fish landing sites and most of them are located in central and western zone. Total annual fish catch as per official landing records in the area in 1999-2000 was about 72,495 tones and 32,437 tones of this was at Okha. Data of the landing sites reveal that fish catch or fish abundance has positive co-relation with sighting of the dolphin as maximum fish landing has been observed in the western zone and minimum in the eastern zone. Proximity of the western region to Arabian Sea may be other factor for relatively high population of dolphin in the west zone.

**Porpoise** ([*Neophocaena phocaenoides* (Cuvier)]

Porpoises were also recorded simultaneously along with dolphins, but their number is comparatively lower than the dolphins. During the present study, 14 sightings were recorded. At one instance, one freshly dead porpoise was recorded near Sachana. It was measuring about 1.2 m in length and its body color was black. It could have been possibly dead because of badly entangling with fishermen nets. During the

<table>
<thead>
<tr>
<th>Sea mammals</th>
<th>Western Zone (West of Salaya to Poshitra Okha)</th>
<th>Central Zone (Between Salaya and Pirotan/Navabandar)</th>
<th>Eastern Zone (In East of Navabandar/Pirotan to Jodiya)</th>
<th>Total</th>
<th>Grand total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Live</td>
<td>Dead</td>
<td>Live</td>
<td>Dead</td>
<td>Live</td>
</tr>
<tr>
<td>Dolphin</td>
<td>88</td>
<td>5</td>
<td>14</td>
<td>0</td>
<td>9</td>
</tr>
<tr>
<td>Porpoise</td>
<td>9</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Dugong</td>
<td>0</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>97</td>
<td>9</td>
<td>16</td>
<td>0</td>
<td>11</td>
</tr>
</tbody>
</table>

Table 1 — Sightings of marine mammals

<table>
<thead>
<tr>
<th>Month</th>
<th>West Zone</th>
<th>Central Zone</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of sighting</td>
<td>No. of dolphin</td>
<td>No. of sighting</td>
<td>No. of dolphin</td>
</tr>
<tr>
<td>Oct., 2001</td>
<td>18</td>
<td>69</td>
<td>2</td>
</tr>
<tr>
<td>Nov., 2001</td>
<td>24</td>
<td>76</td>
<td>11</td>
</tr>
<tr>
<td>Dec., 2001</td>
<td>17</td>
<td>50</td>
<td>6</td>
</tr>
<tr>
<td>Total</td>
<td>59</td>
<td>195</td>
<td>19</td>
</tr>
</tbody>
</table>
interviews with fishermen, they mentioned that there were encounters of porpoises.

**Dugong (Dugon dugon Muller 1776)**

Dugong is best known in the Gulf of Mannar in India, but it is less known along the west coast of the country. Average size of the dugong in the Indian waters is about 2.5 meter. One of the smallest carcases was 172 cm reported in 1987 at Poshitra. This area has good patch of seagrass, which is confirmed from the present study. This could have been one reason to this species to remain restricted in this area and not inside the gulf where the substratum is mostly muddy.

It has also been stated that there are probably very stray numbers of the dugong in the Gulf of Kachchh. It has been reported that the dugong is a resident animal. One and a half dozen records of over the century clarified that the carcases were found in all the three seasons-winter, summer and the monsoon. In addition, presence of immature sizes and herds indicate that the dugongs breed in the Gulf of Kachchh. Dugongs now become very rare in this area as only four dead animals were seen during this study. The team recorded one skull of dugong on Bhaidar Island, two dead dugongs in Bharana and one dead animal at Poshitra coast. The indirect sightings recorded from fishermen interview indicate that there were fair record of dugong population in this area some years back but now it is rarely seen.

Of eighteen specimen (14 in the past and 4 in this study) recorded from the Gulf of Kachchh from 1877 to 2002, majority of them were from Bet Dwarka, Poshtra and their neighbouring areas. Probably the marine environment of this part of the National Park is healthier than that in other parts of the Park. Noru, Chank, Bhaidar, Khara Chusna, Mitha Chusna, Ajad and Boria islands are in one reef system having, relatively rich corals and marine life. Survey of area to study corals and other marine life reveals that there is a high diversity, density and abundance in this part of the park. In these areas, sightings of the dolphin is also very common. This region of the Park has a rich marine life as anthropogenic activities are comparatively less due to the absence of any major or medium port in the area and therefore the density of sea mammals is relatively high.

Health of coral reefs, marine life richness and abundance of marine mammals in western part of the MPA near Poshitra and group of Azad islands is relatively good and they support critical habitats of marine life, especially sea mammals-common dolphin, porpoise and dugong. This is attributed to relatively less anthropogenic pressure. Destruction of habitats (especially the seagrass bed), traps in fishing net and development of ports and jetties comprise the main threats to the dugong, dolphin and porpoise. Large sharks and killer-whales may cause the death of the animal. Fishing is another potential threat as good numbers of these mammals are trapped in the net. The Gulf ecology is already under serious stress and industrial development near the critical habitats, especially in important area of marine mammals, may bring serious negative impact.

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**References**