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### Introduction

Dedicated research on cetaceans in Indian waters has been extremely limited (*reviewed by* Kumarran, 2012) but has begun at several locations since 2013. Efforts to conduct dedicated cetacean surveys using visual and acoustic methods off the west coast continue with the aim of filling the knowledge gap and improving the availability of data for conservation management. This is considered particularly important in light of the current status of Arabian Sea humpback whales and the alarming number of recent baleen whale strandings observed.

In our submission to the IWC-2015 meeting, we submitted a paper on baleen whale sightings and strandings along the west coast of India, from 2001 to 2015. This note is in continuation of our 2015 submission and provides information on baleen whale records from June 2015 to May 2016 and presents details of confirmed sightings and strandings from the west coast of India. We also provide information retrieved from fishing communities along three states and one island territory (Gujarat, Maharashtra, Karnataka, and Lakshadweep archipelago) of the west coast –to show the importance of sea faring communities in providing secondary data of whale sightings.

### Study Area and Methods

**Study Area:** The west coast of India comprises of six coastal states (Gujarat, Maharashtra, Goa, Karnataka, Kerala and west Tamil Nadu), one Union territory (Daman and Diu) and one island territory (Lakshadweep archipelago). Marine mammal research teams are working from five locations off the west coast of India; Gujarat, Maharashtra, Karnataka, Kerala and the Lakshadweep archipelago.

#### Gujarat

The Gujarat coast is ~1,600 km long, accounting for almost 19.79% of the total coastline in India. Its continental shelf is vast enough to make up 34.07% of the country's shelf area. With such an immense coastline, Gujarat is one of the foremost fish producing states in the country with 851 fishing villages recorded in the late 1990s (Gujarat FAO, 2000).

#### Maharashtra

The Maharashtra coastline is ~900 Km, encompassing about 1,12,000 sq. km of India's Exclusive Economic Zone (*The Challenged Coasts of India – A Report by PondyCAN in collaboration with BNHS and TISS, 2012*). The coastline in northern Maharashtra has a wide continental shelf, ranging from about 250-300 Km with a muddy sandy substrate. The shelf abruptly narrows from about 300 km to 150 km off central Ratnagiri district and the bottom profile in this area changes to sandy rocky. There are many small offshore islands and a few submerged sandbanks interspersed along the coastline ranging from a few to about a 110 km offshore. There are 11 major rivers and numerous smaller rivers flowing westwards into the sea, many of them joining creeks (Source: India Water Resources Information System – Undertaking of the Govt. of India, link: [www.india-wris.nrsc.gov.in](http://www.india-wris.nrsc.gov.in)). Maharashtra has two

major and 53 intermediate and minor ports (Maharashtra Maritime Board). The Sindhudurg coastline is 121 km long and has shallow productive waters interspersed with offshore islands and rock formations. The continental shelf ranges from 120 to 150 km from the coastline.

### Karnataka

The coastline of the state of Karnataka, about 280 km long (Selvan *et al.*, 2014), comprises a major portion of the central west coast of India. Fourteen rivers drain into the Arabian Sea along this coastline; about seven of these form major estuaries (Selvan *et al.*, 2014). The state has one major, two intermediate and seven minor ports (CMFRI, 1998), a naval base - INS Kadamba, and several fishing harbours of varying capacities and facilities.

### Lakshadweep Islands

The Lakshadweep islands situated about 200 to 420 km off the coast of Kerala consist of diverse habitats such as coral atolls, shallow lagoons, steep slopes and deep waters. Part of the submarine Laccadives-Chagos ridge, this area is influenced significantly by seasonal monsoonal cycles, upwellings, oceanic currents and a combination of oceanographic characteristics including salinity, dissolved oxygen and temperature thereby giving rise to productive plankton rich waters (Jones 1959, Pernetta 1993, Pratap *et al.* 1979, Shankar & Shetye 1997). Eleven of the thirty-six islands are inhabited by people. Tuna fishing using pole and line provides the main livelihood source on the islands. Over 900 country crafts and 500 mechanised boats operate in this region (Pillai *et al.* 2006).

### **Methods:**

Assessing grey literature:

In cases where we were not present at the location of a stranding, we assess the details from newspaper articles and contact individuals who have been mentioned in the articles to get better quality pictures and details like gender, size measurements, number of ventral grooves etc. We did this for every coastal state to provide a summary of the distribution and frequency of these events. We thus check for any species mis-identifications.

Boat surveys:

Boat based line transect surveys have been continued in Sindhudurg, Maharashtra from May 2015 to April 2016. In the Lakshadweep archipelago, systematic sighting surveys using ferries as a platform of opportunity have been carried out from November 2015 to April 2016. Along the coast of Karnataka, fishing vessel based opportunistic surveys have been carried out from November 2015 to April 2016. All surveys are supported through collaboration with the Indian Coast Guard, State Forest Departments and fishing communities.

Interview surveys:

Interview surveys with fishing communities have been carried out in Gujarat, Maharashtra, Lakshadweep and Karnataka (Figure 1). Interview surveys aimed at obtaining information about:

1. Frequency of baleen whale sightings
2. Approximate locations of baleen whale sightings

### **Results**

Blue whales (*Balaenoptera musculus*) and Bryde's whales (*Balaenoptera edeni*) were reported along with a few un-identified records from Gujarat, Maharashtra, Karnataka and Lakshadweep Islands. There were no reports from Goa, Kerala and western Tamil Nadu. All records are listed in Table 1, and displayed in Figure 1 and 2.

### Gujarat

Blue whales and Bryde's whales were reported from the Gujarat coast between June 2015 and May 2016. No humpback whales were stranded during this period. Whale sightings are commonly reported by fishermen throughout the year, and with increased frequency between

October and April. Baleen whales are locally called ‘Maccha Raja’ (King of all fish), and sighting a whale on a fishing expedition is considered a good omen. The region is thus important not only for whales but also for biological diversity and richness.

#### *Strandings:*

*B.edeni* was washed ashore on April 12<sup>th</sup> 2016 at Dwarka beach, Gujarat. Species was identified based on the photographs.

An unidentified baleen whale, possibly a *B.edeni* washed ashore near Manvi beach, Gulf of Kachchh, on May 11<sup>th</sup> 2016.

#### *Dhow and fishing boat captain meetings:*

A workshop was held on September 2<sup>nd</sup> 2015 with 20-25 crew captains in the town of Mandvi – known for its dhow building yards and its sea-going fishing communities. The presentation included an introduction to marine mammals of Gujarat and biological and behavioural information about Humpback whales as they are the focus of our work in Gujarat ( Figure ). We also showed them films on Humpback whales including humpback whales singing and some information on the research being carried out in Oman. Humpback whales they said were common near Muscat and sometimes seen on their way to Indian waters as well. They said that these whales were common mostly in the winter months. Many of them agreed to record sightings of any whales they see during fishing or during their cargo shipping travel.

#### *Interviews with fishermen:*

We interviewed twenty two fishermen in Mandvi and Porbandar; four gillnet boat captains and sixteen trawler captains. We were shown the routes that the trawlers take while fishing and most of the fishing vessels travelled south or north along the coast and then ventured out till they found a good shoal. None of the trawler captains we interviewed had ventured into international waters in the past year. While the gill netters had not encountered whales, all the trawler captains had sighted whales at least once to four times in the past year. While stating that the whales were ‘always there’, they said they see them more often in the colder months and more towards the northern waters between Porbandar and Mandvi ( west of the Gulf of Kachchh). The whales are usually sighted in depths of 50-200 m, and sometimes in even shallower waters in north Gujarat. The last reported sighting by fishermen is on November 2<sup>nd</sup> 2015 in about 100m depth straight out west from Porbandar. Group sizes have varied from a single individual to four.

### **Maharashtra**

#### *Strandings:*

Eight baleen whales stranded along the coast of Maharashtra during the study period. Of these, details about two events are provided below. The other six stranding events are listed in Table 1. Wherever possible, species identification was carried out on photographs provided for these events.

*B. musculus* (February 1<sup>th</sup> 2016): A 12-13 meters long Blue whale stranded live in the shallow waters of Kolthare beach, Taluka Dapoli in Ratnagiri district of Maharashtra. Local villagers along with the Forest Department and members of a local NGO managed to send the whale back into deeper waters as the tide came in. The operation started at 10am and they succeeded by 17:30pm. This whale did not beach itself again after and was considered rescued.

*B. musculus* (24<sup>th</sup> June 2015) : A 13 meters long blue whale female had live stranded in the shallows about 3 km from shore on Revdanda beach (N18 32.635 E72 55.599) (Fig. 4), Raigad district Maharashtra, at about 07:00 AM on the 24th June 2015. The animal appeared to be severely emaciated and despite rescue attempts, succumbed at 04:37 AM (based on the observations of the local authorities) on the 25th of June. A large wound was observed a little behind the head on the left side. The wound appeared scabbed with whitish tissue. A few incisions were made around it and the surrounding blubber appeared haemorrhaged (lightly pink). The tissue around was firm to the touch. There were smaller wounds around this larger

one. Another small wound on the right side of the body on the dorsal surface was offsetted about 30 cm behind this wound. All these injuries appeared to be scabbed. On the left side immediately behind the head, a thin strip of skin was observed to be porous in appearance. Cause of death could not be determined.

#### *Sightings:*

Sighting 1: Two individuals were sighted off Malvan (N16 03.735, E73 26.679), on the 8<sup>th</sup> of December 2015 about 1.08 Km from the shore in 15.6 m of water. One individual appeared to be smaller than the other and could possibly have been a sub-adult. These individuals appeared to be foraging in the general area, not travelling in any particular direction (average dive times 1 min 4 sec).

Sighting 2: On 26<sup>th</sup> December 2015, a mother-calf pair was sighted off Devbag (N16 00.041, E73 26.839), in 17.1 m depth about 4.5 km offshore. These two individuals were closely associated and engaged in synchronized swimming diving, the calf did not surface completely and we did not see its dorsal fin out of the water. They were observed to be milling initially, foraging intermittently. Fishing activity around these animals suggested presence of fish shoals in this area (Average dive times 55.76 sec, 22.88 sec, 37.6 sec, 28.75 sec, 38.58 sec). The pair then appeared to be moving slowly towards the North.

Sighting 3: On the 23<sup>rd</sup> January 2016, two individuals were sighted off Mocchemad (N15 48.132 E73 36.633), in 12.9 m depth. The animals were travelling fast westwards (offshore).

Sighting 4: 12<sup>th</sup> March 2016: Three individuals were sighted off Achra in depth of 13.6 m. Of these, two individuals were considerably smaller than the third, possibly a mother with a calf and a juvenile. These animals appeared to be foraging, engaged in fast chases, eventually spotted travelling southwards.

Sighting 5: March 16<sup>th</sup> 2016: One individual was sighted in a depth of 15.7 m near Nivati rocks. This individual was later observed travelling offshore southwards.

Over the seven sightings since January 2015, seven distinct fins were identified based on unique markings and mottling observed. At least two individuals have been re-sighted across these observations. Since December 2015, weather patterns have been erratic, with high wind speeds till mid April. Fishermen have also noted a marked reduce in fish catch and an irregular fishing season. Opportunistic interviews with fishermen revealed that sardine catch this year has reduced significantly. These conditions were probably a result of *El Niño*. Whale sightings probably were low due to this.

#### **Karnataka**

An ongoing project studies the interactions between cetaceans and fisheries in a region of northern Karnataka comprising the coastal waters of Karwar and adjacent areas, using opportunistic boat-based surveys and interview surveys. Since the commencement of this project in September 2015, fishing crews have reported four baleen whale sightings in coastal waters close to Karwar, Karnataka. As is the case in other parts of this coastline, whales are considered sacred here and sightings are often treated as auspicious events with offerings in the form of incense, coconuts and cloth being made.

The ongoing interviews of local and migrant fishers have shown that baleen whales are regularly sighted in offshore waters (at depths of 40-60m according to most interviewees) and occasionally closer to shore, within the 20m depth mark. According to these fishers, sightings are almost always associated with the presence of large fish shoals. A few interviewees mentioned that whale sightings peak during the weeks immediately before and after the monsoon (i.e. the months of October, November, April and May), but most interviewees believe there to be no seasonal pattern to the sightings.

#### Sighting:

On November 28<sup>th</sup> 2015, a mother calf-pair of Bryde's whales were sighted at 14.61934 ° N, 73.73679 ° E in waters 64 m deep, at 0924 hours. The shortest distance to shore from this location is 43.4 km. The animals were observed to travel parallel to the purse-seining vessel for some distance before surfacing. From their catch, it was found that shoals of frigate tunas *Auxis* sps. were present in the area.

#### Strandings:

*B. edeni* (April 20<sup>th</sup> 2016): A 43-foot-long male Bryde's whale washed ashore dead at Someshwar beach (12.79 N, 74.84E) on Wednesday, 20-4-2016.

#### Lakshadweep Islands

A baleen whale was sighted on 7<sup>th</sup> November 2015 at 2:40pm between Chetlat and Amini Islands (N11 35.229 E72 41.695). Two individuals were seen surfacing frequently with tall columnar blows. Identification to the species level was not possible.

The first report of Bryde's whale was recorded by Nachiket Kelkar near Amini Island in 2009, a stranding of the same species was also recorded in 2010 (logged on [www.marinemammals.in](http://www.marinemammals.in)). Fishermen report frequent sightings of large whales (identified by the visible blow). Our study attempts to compile these fishermen reports to understand if there is any seasonality or particular location of reported whale sightings. Even though a seasonal presence of baleen whales has been reported, no baleen whales strandings have been published from the islands.

#### **Future work:**

Increasing the strength of the network along the west coast of India will remain the main aim for 2015-2016. On May 22<sup>nd</sup> 2016, we had a small meeting with interested individuals in Goa, and with the State Forest Department to initiate the process. This year, we shall be extending our work into Goa and Karnataka.

Discussions with the Indian Coast guard in Gujarat shall continue with the goal of collecting visual data via their patrolling vessels. Offshore surveys have been planned in Gujarat and Goa for November- December 2016. Discussions with the State Forest Departments have taken place for the same

A serious and concentrated effort with an in-depth analysis of baleen whale carcasses is required to understand the causes and seasonality of mortalities. This requires the collaboration of local administrative authorities along with the forest department and trained veterinarians licenced to carry out necropsies or deal with live strandings. Moreover an organised database of all records in a shared standard format needs to be used to make the data available to range countries of these baleen whales. Towards filling these gaps, a marine mammal research methods workshop was organised in February 2016 with funding from the UNDP and the Government of India along with the Maharashtra Forest Department. One day of the workshop was dedicated on how to deal with strandings and how to collect data from whales and dolphins washed ashore (Experts: Dr James Barnett, John Wang, Sarah Piwetz, Nick Tregenza). Official and private veterinarians from the west coast of India were part of this workshop. We hope to hold more local level workshops of this nature so that ground staff in each of the coastal states can be involved and informed.

In February 2016, awareness material in the form of a poster and a field guide to identify species when they get washed ashore has been created. Forest Departments, Researchers, Veterinarians, Schools, Dive centres and Maritime Foundation have procured these materials. We hope to increase stakeholder involvement both along beaches and on water via these awareness materials and local level workshops.

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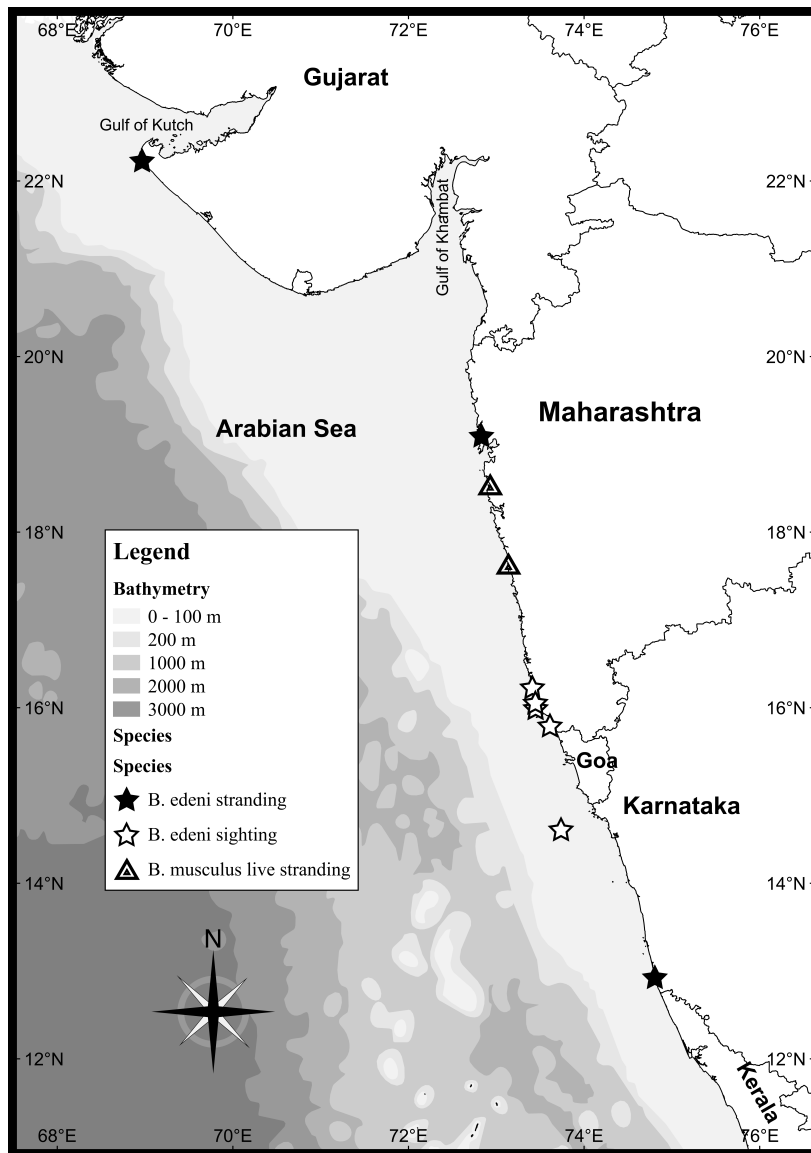
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Table 1. A list of baleen whale records from the west coast of India from June 2015 to May 2016

Date	Location	Type	Species	Reference
May 11 2016	Mandvi, Gujarat	Stranding	UI	Jarukhkha Husenkha, Wildlife Trust of India
20 April 2016	Mangalore, Karantaka	Stranding	Bryde's whale	newspaper
12 April 2016	Dwarka, Gujarat	Stranding	Bryde's whale	newspaper
16 March 2016	Sindhudurg, Maharashtra	Sighting	UI	KCRT
12 March 2016	Sindhudurg, Maharashtra	Sighting	B. edeni	KCRT
01 February 2016	Kolthare, Maharashtra	Live stranding	B. musculus	GIZ
29 January 2016	Juhu, Maharashtra	Stranding	B. edeni	KCRT
23 January 2016	Mocchemad, Maharashtra	Sighting	B. edeni	KCRT
26 December 2015	Devbag, Maharashtra	Sighting	B. edeni	KCRT
08 December 2015	Chivla, Maharashtra	Sighting	B. edeni	KCRT
28 November 2015	Karwar, Karnataka	Sighting	B. edeni	AJamalabad
07 November 2015	Lakshadweep islands	Sighting	B. edeni / B. musculus	D Panicker
14 September 2015	Bhogwe, Maharashtra	Stranding	B. edeni / B. musculus	KCRT
13 August 2015	Alibaug, Maharashtra	Stranding	B. edeni / B. musculus	KCRT
11 August 2015	Alibaug, Maharashtra	Stranding	B. edeni / B. musculus	KCRT
12 July 2015	Diveagar beach, Maharashtra	Stranding	B. edeni / B. musculus	KCRT
24 June 2015	Revdanda, Maharashtra	Stranding	B. musculus	KCRT
02 June 2015	Manori, Maharashtra	Stranding	B. edeni / B. musculus	KCRT





**Figure 1.** A map of the west coast of India showing the confirmed reports of Blue whales and Bryde's whales from June 2015 to May 2016

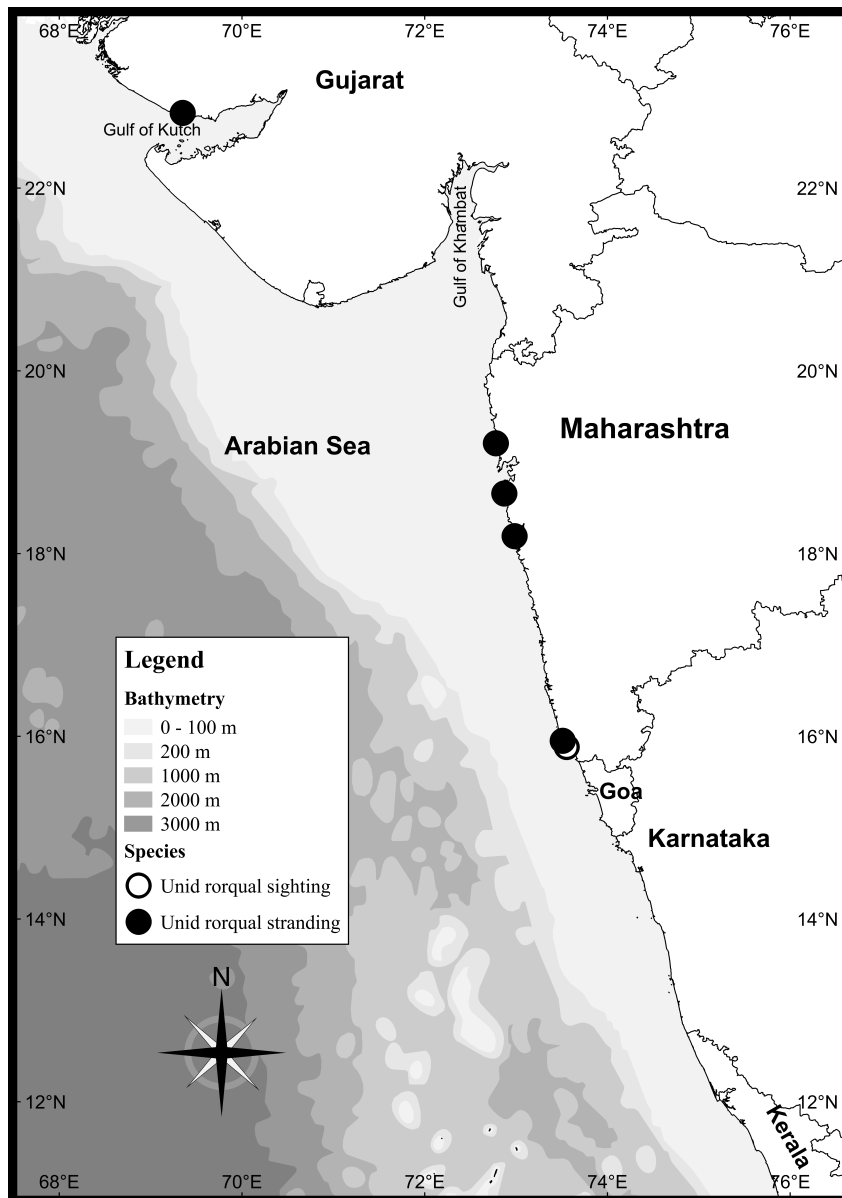


Figure 2. A map of the west coast of India showing records of un-identified baleen whales reported between June 2015 and May 2016