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**Special  
Issue  
Part 2**

## Marine Biodiversity

- Mangroves
- Fishes, Crabs
- Otters, Dolphins, Whales
- Conservation
- Policy





## Status Survey of Otter Species in Mangrove Habitat of Sindhudurga District, Maharashtra

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### Introduction

Otters [Mustelidae Family] are poorly studied aquatic mammals. No comprehensive data for the populations and current status of this taxon is available for the Sindhudurga district, Maharashtra, India. The sporadic sightings are rare, mostly in and around mangroves and the habitats are not easily accessible. In this scenario, the present study provides scientific data for the conservation of this species. There are possibly six species of otter occurring in Asia out of which the Eurasian Otter (*Lutra lutra*), Smooth-coated Otter (*Lutrogale perspicillata*), and Asian Small-clawed Otter (*Aonyx cinerea*), are reported from India<sup>1,2,3</sup>.

Otter surveys are problematic due to difficulty in direct detection of individuals in natural habitats and associated high costs of surveying rough and many times difficult to reach terrain. Hence, indirect methods of



recording tracks, foot marks, faeces or scent markings have become standard protocol. The 'Standard Otter Survey' method<sup>4,5</sup>, focuses on the detection of otter spraint (faeces) but may also include tracks (footprints) or holts (breeding dens) along river banks. In view of absence of data on otters from Sindhudurga district, Maharashtra, we undertook the first systematic survey using the method described by Lenton<sup>4</sup> and Bodkin<sup>5</sup> and supplementing them with camera traps, under-bridge surveys and local information, to determine the status of otters in this region. The preliminary findings from our survey are presented in this paper.

## Methodology

### a) Objectives:

1. Document the diversity of otter species in the study area.
2. Record the distribution of otters in the study area.
3. Document the habitat preference of otters.

### b) Study Area (Transects):

The survey for otters was conducted in Mangrove patches in the coastal areas in Sindhudurga district, Maharashtra. The northern most GPS coordinates of the study area (Vijaydurga-Vaghotan) were 16.510112 N and 73.404418 E while the southernmost GPS coordinates (Aronda-Terekhol) were 15.73682 N and 73.75741 E. The creeks and backwaters in Sindhudurga where the survey transects were conducted included:

Vijaydurga Creek – Shanti River  
Vadatar Creek – Piyali River  
Devgad Creek and backwaters  
Mithbav Creek – Naringre River  
Achra Creek – Achra River  
Kalaval - Tondavali Creek – Gad River  
Kolamb Creek and backwaters  
Karli Creek – Pithdhaval River  
Mochemadi Creek – Talavade River  
Aravali Creek and backwaters  
Aronda Creek and backwaters  
Terekhol Creek – Otawane River

c) **Number of visits and data analysis:** Total 30 visits were carried out during the period from November 2015 to June 2016 for the study of otters in the Sindhudurga district. Data was analyzed from February 2016 to November 2016.

d) **Consistency of Sampling:** To assure consistency of sampling, same methods were used for transects, GPS methodology was used to record otter presence sites and the same researchers conducted the survey in all

creeks.

e) **Species identification:** This was done from photographs and / or pugmarks and comparing them with diagnostic keys<sup>4</sup> from published data.

f) **Survey Techniques**<sup>4,5</sup> Study was done strictly as per the provisions of the WPA 1972. For the crepuscular species like otters a combination of techniques were used. Estimate of otter presence was done by pooling data from all the six sampling techniques listed below:

1. **Visual Creek / River Boat Transects** by non-intersecting line transects from boats by sailing along the tidal creeks, backwaters and rivers for each of the 12 creeks.

2. **Bank Line Transects – (ISU).** Shore based surveys using intensive search units (ISU) along the line transects have produced unbiased results<sup>5</sup>. We used ISU's of 600 m at 12 creeks. GPS locations of otter spraints / scats and sightings were recorded for all positive and negative sites.

3. **Under Bridge Surveys** are important because spraints / scats tend to stay longer in these areas as compared to on open banks. GPS locations of otter spraints / scat and sightings were recorded.

4. **Modified Scent Station Surveys:** The prawn and crab farms in the study areas were used as modified scent stations. Such sites were visited to find the presence or absence of otters. GPS locations of survey sights were recorded.

5. **Trap Camera Surveys** were conducted at randomly selected sites for the confirmation of presence of otters and identification of otter species.

6. **Supplementary data from questionnaire:** The response from local fishermen about the presence / absence of otters was recorded during the creek-wise surveys.

## UNITS OF THE DATA:

1. Otter Presence / Absence for study sites.
2. Identification of otter species.

## Observations and Results

### 1. Diversity of Otters in the Study Area

a. **Species:** Our survey revealed that only one species of otter; the Smooth-coated Otter *Lutrogale perspicillata* was present in the mangrove habitats in all the twelve creeks of Sindhudurga district.

b. **Local names:** Otters are generally well known among the fishing community and are called as *Hud*, *Ood* and *Uda* in Marathi language.



## 2. Otter Distribution and GPS Mapping:

Presence of otter spraints and otter sightings were important indicators of otter presence for recording their distribution. GPS coordinates of all survey sites including intensive survey units (ISU's) were recorded. Smooth-coated Otter *Lutrogale perspicillata* was present in all the 12 creeks.

### 3. Otter Presence Sites

**a. Creeks:** The sites of otter presence are detailed as GPS coordinates of each ISU (Table 1 to 12). The GPS Maps are also shown in Maps 1 to 12. Otter spraints are the most reliable indicators for the presence of otters. Otter spraints are visible on open banks along the creeks, on Kharland Scheme bunds and also on the coasts. However, they are not seen when the coasts are occupied by dense mangroves.

Table 13 summarizes the otter presence / absence data for all the creeks.

**b. Under Bridge Surveys:** In all 17 bridges in all the creeks in Sindhudurga district were surveyed for otter presence. 16 bridges showed presence of otters as evident by spraints. We therefore conclude that otter spraints are reliably seen under bridges where they remain for a long time and old spraints could also be seen and recognized by their brittleness and white colour. (Table 14).

**c. Modified Scent Station Surveys:** 6 modified scent stations were surveyed. These were crab and prawn farms. Large sized spraints of otters (up to 3 m x 3 m) were seen in all 6 stations. Otters were sighted in one station (n =4; Meethbav-Naringre creek). Hence, we conclude that Modified Scent Stations are reliable sites for presence of otters due to the availability of abundance of food in a small area. (Table 15).

**f. Trap Camera Images:** We could get otter pictures in trap cameras installed in various sites that were previously documented positive for otter presence.

### 4. Habitat Preference:

#### A] Otters were recorded in:

- i. all creeks and backwaters with mangrove habitats,
- ii. on the coasts near fishing jetties at the time of fish harvesting (*rapan*),
- iii. on Kharland bunds,
- iv. narrow roads with creek on one side and seepage water on the other side
- v. sandbars in offshore areas,
- vi. near crab and prawn farms.

#### B] Otters were not recorded where:

- i. human disturbance was significant,
- ii. coastal areas with infrastructure development,
- iii. sand dredging activity was ongoing,
- iv. thick mangrove cover made accessibility to the water body impossible making this a false negative site,

#### 5. Other observations:

**a) Distance from the sea:** The farthest inland otter presence from the sea coast was 42.4 km for the Kalaval-Tondavali creek.

**b) Tidal effect:** Near kharland bunds otters were best seen at low tides. It was recorded that the otters swim away and towards the coast with high and low tide. However, the effect of tides on otter sighting was not conclusively established for creeks.

## Discussion and Conclusions

Smooth-coated Otter *Lutrogale perspicillata* is Vulnerable and is included in Appendix II of CITES<sup>8,9</sup>. Otter surveys are difficult due to poor sightings and their occurrence in coastal habitats where surveys are not only time consuming and demand logistic supports<sup>6,7</sup>. Our survey using a combination of techniques revealed that only one species, the Smooth-coated Otter *Lutrogale perspicillata* was present in the mangrove habitats in all the twelve creeks of Sindhudurga district studied during our survey. The otter presence sites were mapped with GPS coordinates for all creeks. Otters mostly exhibit crepuscular habits, however we also rarely recorded them fishing and swimming during the noon. Otters use mangroves for cover and resting. Otter photographs could be obtained using conventional cameras and trap cameras with motion sensing and IR technology. The analysis of our observation for predicting the best method for otter survey in our region, estimation of population and group compositions, territory size, food preferences and threats is ongoing.

### Recommendations:

We recommend that in view of absence of data on otters from other coastal districts of Maharashtra, otter survey should be extended to mangrove habitats of Ratnagiri, Raigad, Thane and Palghar districts.

### Acknowledgement:

The study was supported by The CCF, Mangrove Cell, GOI/UNDP Project, Sindhudurga, Maharashtra.

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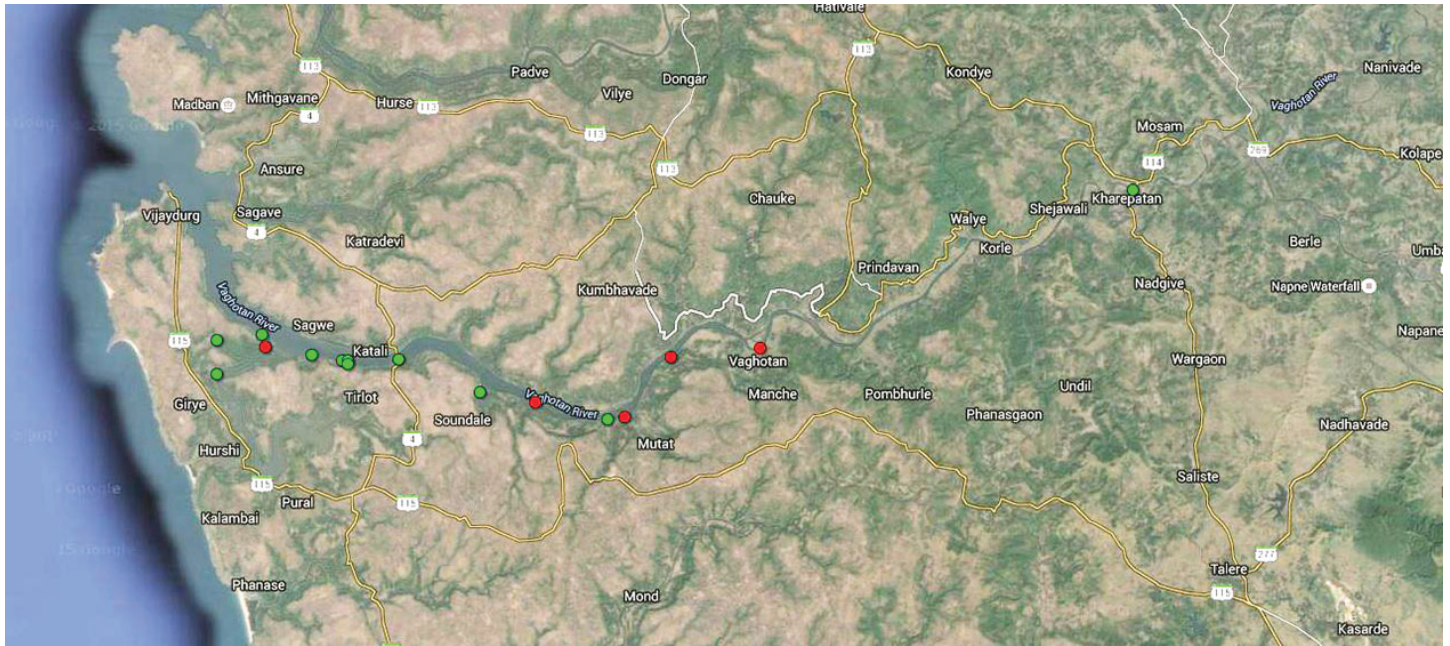
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Smooth-coated Otter family in the mangrove habitat in Sindhudurga district, Maharashtra



## Creek-wise otter survey data in Sindhudurga district, Maharashtra, India. (Tables 1 to 13)



**Map 1:** Otter survey data shown in a map for **Vijaydurga creek** in Sindhudurga district, Maharashtra, India (Green dots: Otter presence; Red dots: Otter not recorded)

**Table 1:** Otter survey data for **Vijaydurga creek River : Vaghotan / Shanti** in Sindhudurga district, Maharashtra, India. **Species:** Smooth-coated Otter & Monitor Lizard.

Creek : Vijaydurg		Presence		Local Info
<b>Visit Date: 28, 29, Nov 2015</b>		Spraints	Sightings	
<b>1</b>	Manche	Nil	Nil	No recent sightings
<b>2</b>	Mutat Bhatwadi	+	Nil	6 to 8 otters near NRV gate
<b>3</b>	Mutat Palekarwadi	Nil	Nil	No open bank
<b>4</b>	Mutat Post	Nil	Nil	No open bank. 3 to 4 Otters seen
<b>5</b>	Kasba Waghota	Nil	Nil	No open bank. 3 to 4 Otters seen
<b>6</b>	Tamhankarwadi Prawn Farm	+	Nil	3 to 4 otters seen
<b>7</b>	Soundal Deulwadi	+	Nil	3 to 4 otters seen
<b>8</b>	Amberi Bridge	+	Nil	3 to 4 otters seen
<b>9</b>	Navanagar East	+	Nil	10 to 12 otters
<b>10</b>	Navanagar West	+	Nil	10 to 12 otters
<b>11</b>	Below Tirlot	+	Nil	Up to 10 otters
<b>12</b>	Thakurwadi	++	Nil	Night activity
<b>13</b>	Anapur Island Mangroves	Nil	Nil	Roost 10 to 12 Otters
<b>14</b>	Anpur Jetty	+++	Nil	Roost 10 to 12 Otters
<b>15</b>	Khare Patan Bridge	++	Nil	up to 5 otters seen
<b>16</b>	Girye	++	Nil	4 to 10 otters seen
<b>17</b>	Kharland near Vijaydurga	0	Nil	6 to 8 otters



# SMOOTH-COATED OTTER



**Map 2:** Otter survey data shown in a map for **Vadatar creek** in Sindhudurga district, Maharashtra, India. (Green dots: Otter presence; Red dots: Otter not recorded)

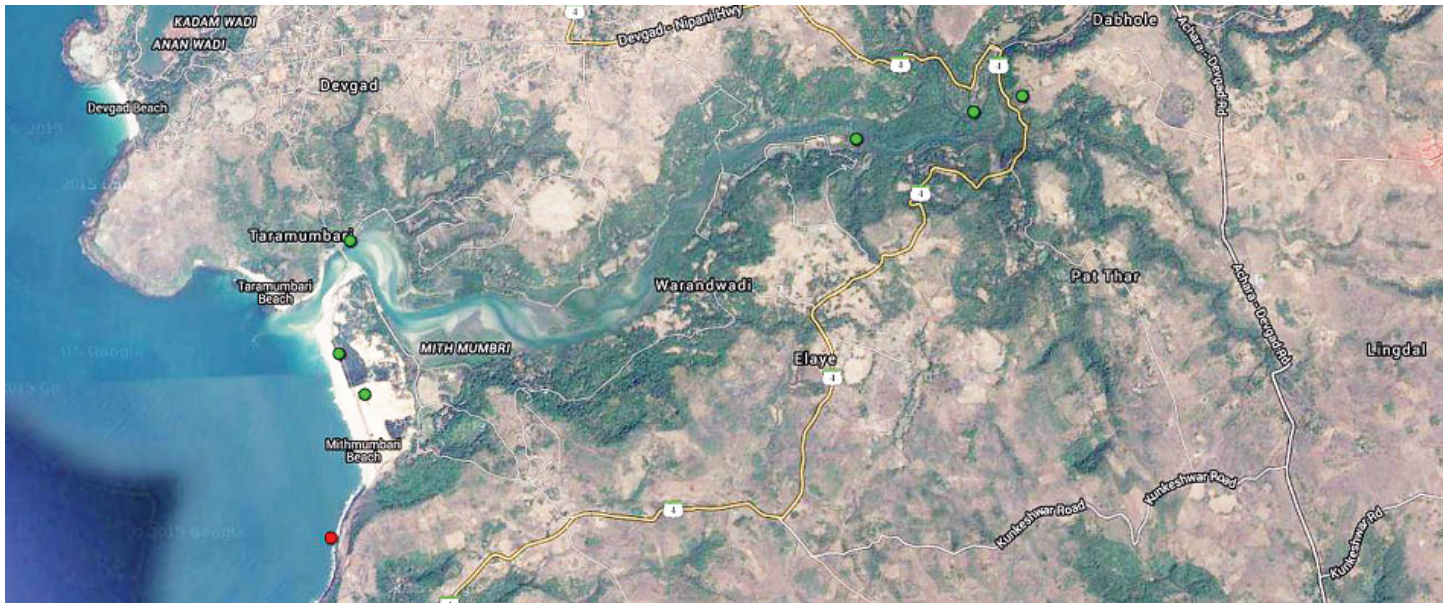
**Table 2:** Otter survey data for **Vadatar creek River : Piyali** in Sindhudurga district, Maharashtra, India. **Species:** Smooth-coated Otter & Monitor Lizard, latter seen near all creeks.

Creek : Vadatar		Presence		Local Info
Visit Date: 29 / 30 Nov 2015		Sprints	Sightings	
1	Vadatar West	+++	n=3	3 to 4 otters
2	Vadatar Bridge	+	Nil	3 to 4 otters
3	Vadatar Oyster Farm Dreamland Hotel	++	Nil	8 to 10 otters
4	Nadan Veerwadi	+	Nil	3, 5, 10 otters
5	Chinchwadi	+	Nil	3 to 4 otters seen
6	Prawn Farm Bhabal	+	Nil	
7	Mond Bandhara Proximal	++	Nil	3 to 6 otters
8	Mond Bandhara distal	+++	n=2	3 to 6 otters
9	Dhuriwada Baparde	Nil	Nil	No otters
10	Vaniwade Mangarwadi	++	Nil	3 to 4 otters





**Map 3:** Otter survey data shown in a map for **Devgad creek** in Sindhudurga district, Maharashtra, India. (Green dots: Otter presence; Red dots: Otter not recorded)

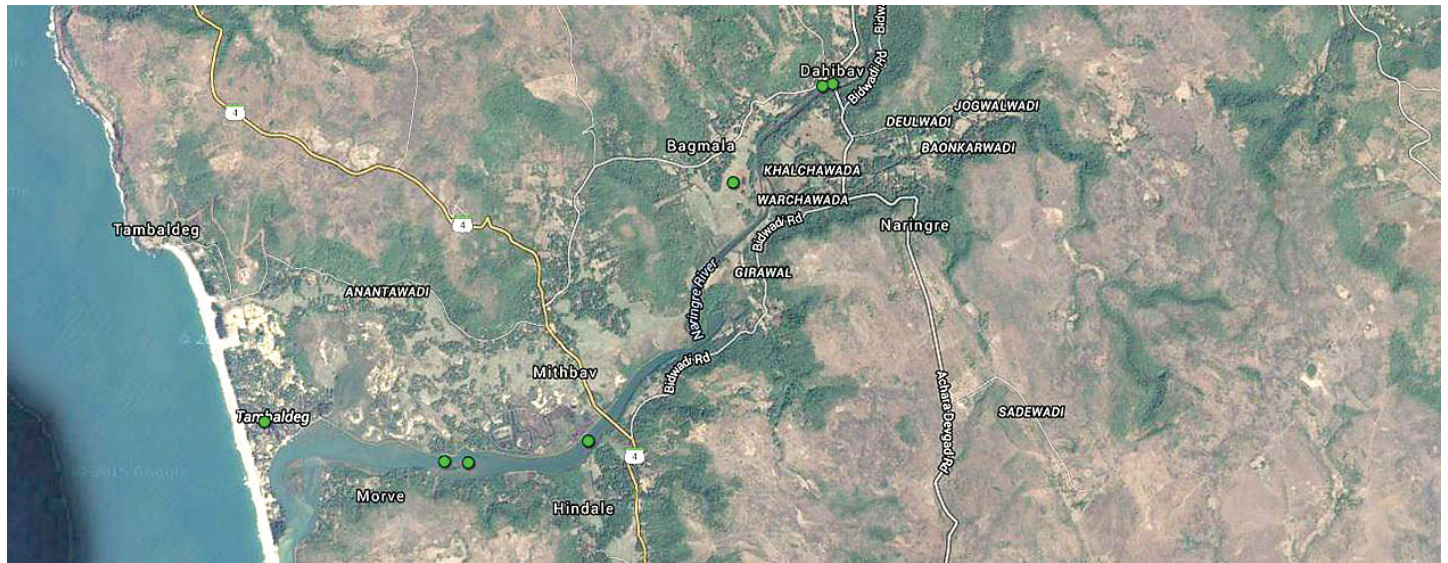


**Table 3:** Otter survey data for **Devgad creek River : Meethmumbri** in Sindhudurga district, Maharashtra, India. **Species:** Smooth-coated Otter & Monitor Lizard, latter seen near all creeks.

Creek : Devgad Backwater		Presence		Local Info
Visit Date: 8 Dec 2015		Sprints	Sightings	
1	Meeth Mumbri Beach Sea Face	-	n=2	2 to 12 Otters
2	Tara Mumbri	++	-	2 to 4 Otters
3	Meeth Mumbri	+++	n=2	2 to 4 Otters
4	Dabhole Bridge	++	-	1 to 2 Otters
5	Patankar Wadi	+	-	1 otter
6	Tara Mumbri Road	++	Nil	On small jetty
7	Elaye	++	Nil	3 to 4 Otters







**Map 4:** Otter survey data shown in a map for **Devgad creek** in Sindhudurga district, Maharashtra, India. (Green dots: Otter presence)

**Table 4:** Otter survey data for **Meethbav creek River : Naringre** in Sindhudurga district, Maharashtra, India. **Species:** Smooth-coated Otter & Monitor Lizard, latter seen near all creeks.

Creek : Meethbav		Presence		Local Info
Visit Date: 9 Dec 2016		Sprints	Sightings	
1	Kharland Bandhara	+++	-	2 to 6 otters
2	Prawn Farm CD Work Bandhara	+++	n=4	2 to 6 otters
3	Hindale Opp. Meethbav	++	n=3	2 to 4 otters
4	Munage, Naringre downhill	++	-	2 to 4 otters
5	Naringre	++	Nil	3 to 4 Otters
6	Tambaldeg	+	Nil	3 to 4
7	Dahibav Bridge	+	Nil	Otters regularly seen
8	Naringre-Mithbao Creek	+	-	3-4 otters







**Map 5:** Otter survey data shown in a map for **Devgad creek** in Sindhudurga district, Maharashtra, India. (Green dots: Otter presence)

**Table 5:** Otter survey data for **Achra creek River : Achra** in Sindhudurga district, Maharashtra, India.

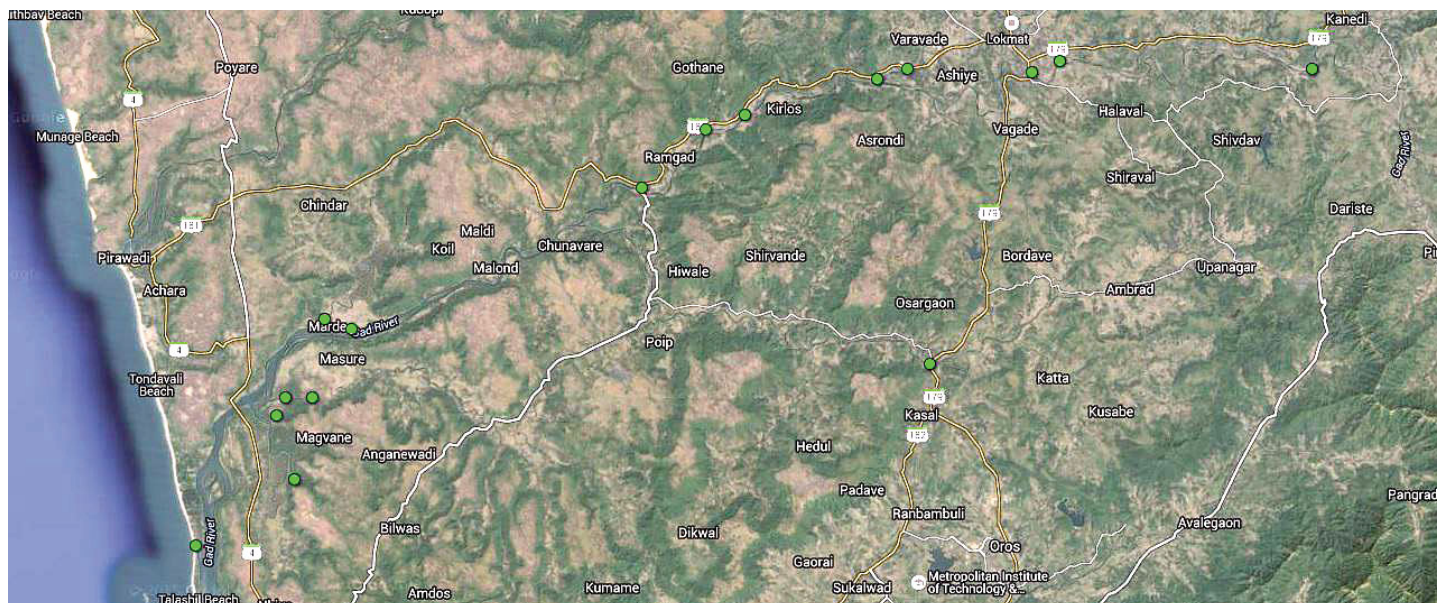
**Species:** Smooth-coated Otter & Monitor Lizard, latter seen near all creeks.

Creek : Achra		Presence		Local Info
Visit Date: 23 Dec		Sprints	Sightings	
1	Achra Gaudwadi	+	Nil	Dead otter, mandible
2	Jamdulwadi	++	Nil	4-5 otters regular
3	Dongarwadi-Malvan	+	Nil	4-5 otters evry fortnight





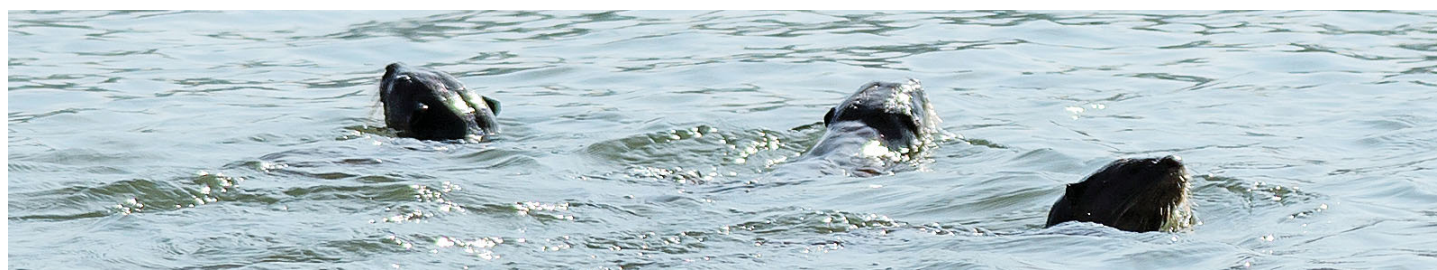
# SMOOTH-COATED OTTER



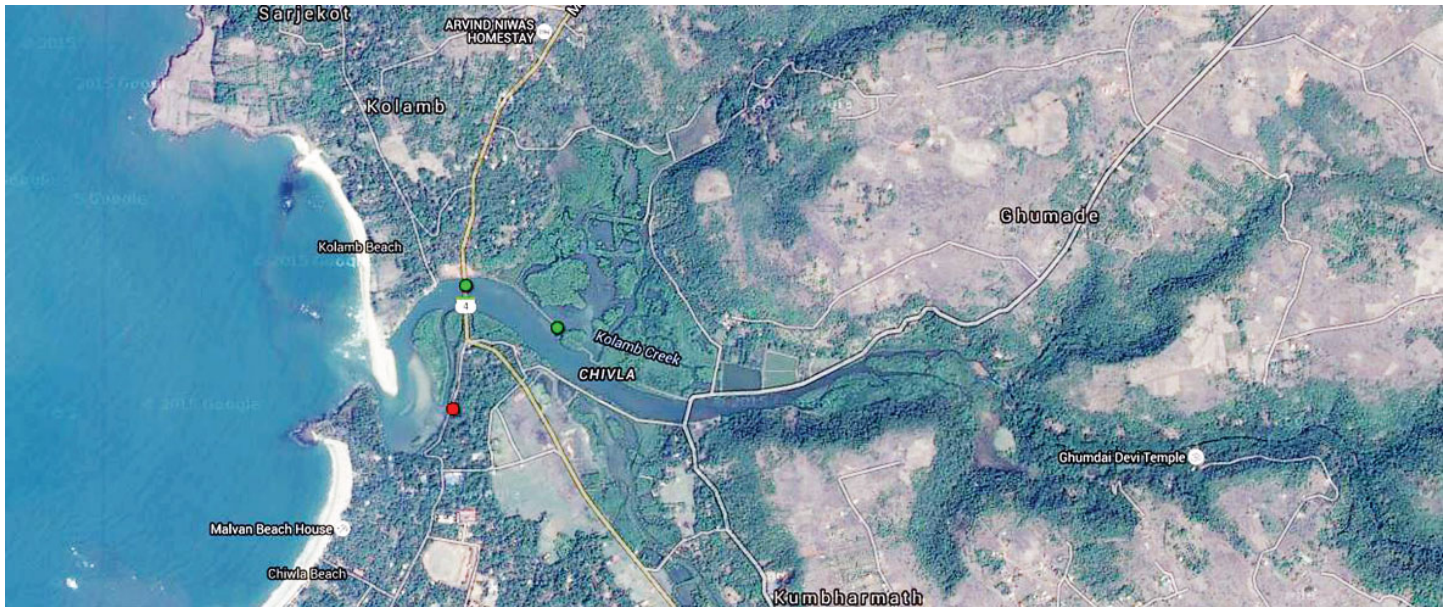
**Map 6:** Otter survey data shown in a map for **Kalaval-Tondavali creek** in Sindhudurga district, Maharashtra, India. (Green dots: Otter presence)

**Table 6:** Otter survey data for **Kalaval-Tondavali creek River : Gad** in Sindhudurga district, Maharashtra, India. **Species:** Smooth-coated Otter & Monitor Lizard, latter seen near all creeks.

Creek : Kalval-Tondivali		Presence		Local Info
Visit Date: 24 / 25 Dec 2015		Sprints	Sightings	
1	Kandalgao Bund	+++	-	5-10 otters
2	Masura Bund khajanwadi	+++	-	Dust Bath, 10 -12 Otters
3	Masure cemetery	+++	-	10-12 otters
4	Magavane bund	+	-	4-5 otters
5	Pimpalwadi bund	++	-	5-7 otters
6	Varavade Bund	+	-	3-4 otters
7	Varawadi Sangam Maruti	++	+	7-8 otters
8	Kirlos Bund	+	-	4-5 Otters
9	Gothane Kond Ramgad	++	+	7-8 Otters
10	Belane Br	++	+	7-8 otters every night
11	Bandiwade Jetty	++	+	8-10 otters , Big Monitor Lizard 12 Kg
12	Bhagwant Gad	++	-	8-10 otters
13	Tondavali Talashil	+	+	9-10 in island bund stones Residence
14	Raulwadi			
15	Kasal River Br. Osargaon	+	-	4-5 otters
16	Gad river Br.Kanakavali	+	-	2-3 otters







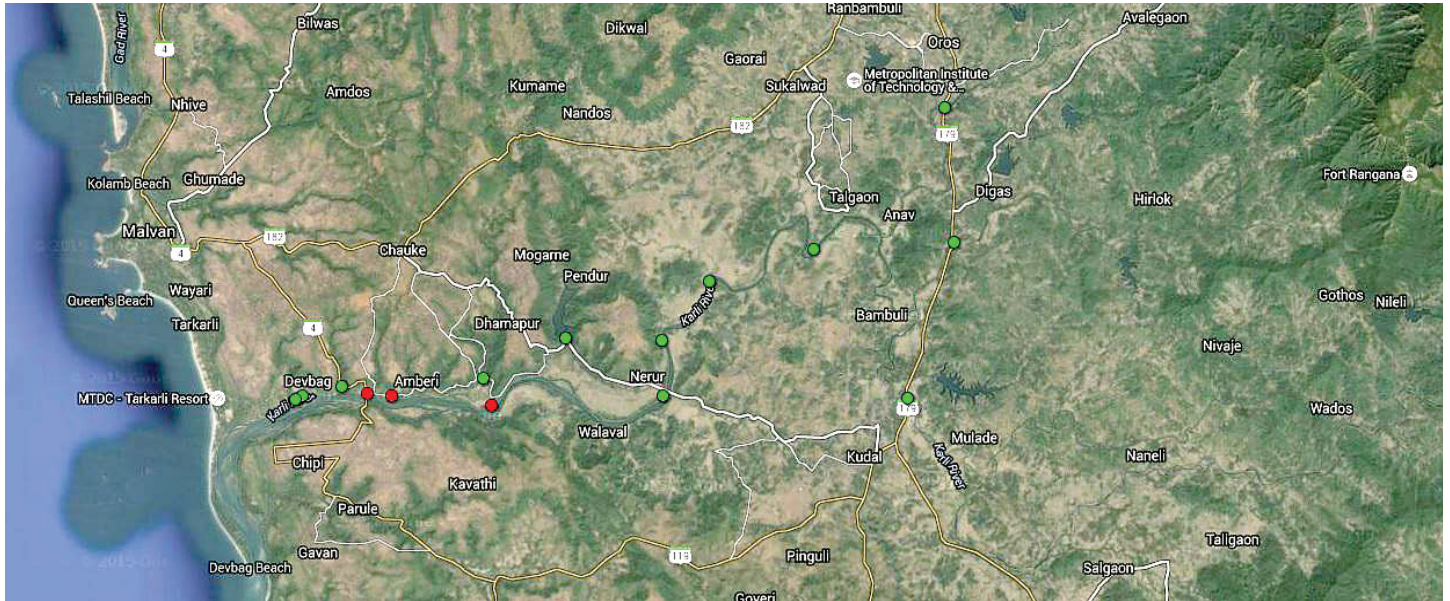
**Map 7:** Otter survey data shown in a map **Kolamb creek** in Sindhudurga district, Maharashtra, India. (Green dots: Otter presence; Red dots: Otter not recorded)

**Table 7:** Otter survey data for **Kolamb creek River : Kolamb** in Sindhudurga district, Maharashtra, India. **Species:** Smooth-coated Otter & Monitor Lizard, latter seen near all creeks.

Creek : Kolamb		Presence		Local Info
Visit Date: 26 Dec 2015		Spraints	Sightings	
1	Malvan-Kolamb Rd	-	-	Human disturbance
2	Kolamb Bridge	+	-	2-4 otters
3	Kolamb near crab farm	+++	+	12-15 otters





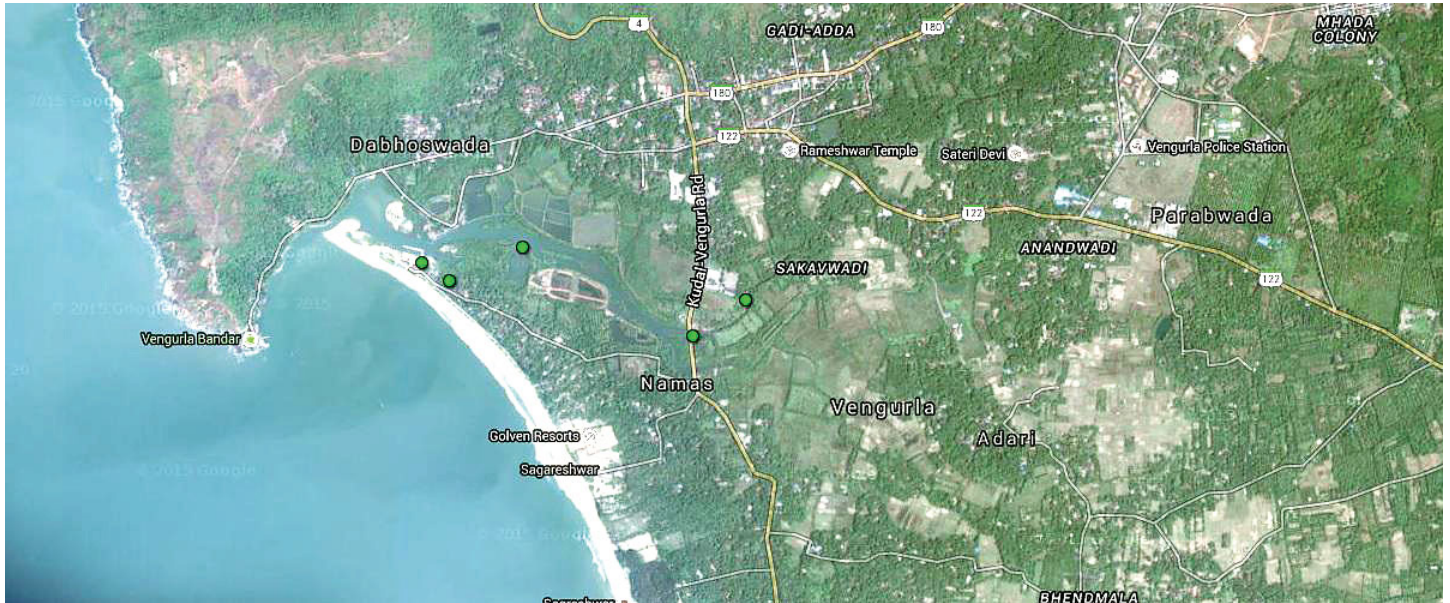


**Map 8:** Otter survey data shown in a map **Karli creek** in Sindhudurga district, Maharashtra, India. (Green dots: Otter presence; Red dots: Otter not recorded)

**Table 8:** Otter survey data for **Karli creek River : Karli - Peethdhaval** in Sindhudurga district, Maharashtra, India. **Species:** Smooth-coated Otter & Monitor Lizard, latter seen near all creeks.

Creek : Karli		Presence		Local Info
Visit Date: 27 Dec 2015		Spraints	Sightings	
1	Kalase Bagwadi	+	-	Occasional 4-5 otters (Mr. Sawant)
2	Khararewadi	+	-	4-5 otters in mangroves
3	Talgaon	++	-	12-15 otters at night
4	Parad	+	-	4-5 otters
5	Dhamapur Tank	+	-	7-8 otters
6	Amberi Bridge	+	-	8-10 night night
7	Amberi Mala	-	-	Sand mining
8	To Devali	+	-	3-4 Otters, Rat snake
9	Chipli Bridge	-	-	Sand mining Large scale fox
10	Chipli Bund	-	-	Sand mining Large scale fox
11	Devali Khalachi	+	-	5-7 otters Near boat-residence on island in mangroves
12	Prawn Farm Devali	+	-	10-15 otters when active in Feb
13	Kudal Bhangsal River	+	-	4-5 otters
14	Vetal Bambarde Hateri Bridge	+	-	4-5 otters
15	Pithdhaval Br	+	-	4-5 otters





**Map 9:** Otter survey data shown in a map **Vengurla creek** in Sindhudurga district, Maharashtra, India. (Green dots: Otter presence)

**Table 9:** Otter survey data for **Vengurla creek River : Manasi** in Sindhudurga district, Maharashtra, India. **Species:** Smooth-coated Otter & Monitor Lizard, latter seen near all creeks.

	Creek : Vengurla	Presence		Local Info
	Visit Date: 27 Dec 2015	Sprints	Sightings	
1	Vengurla Manasi River Br	+	+	Regular 6-7 Rapan
2	Inside Bridge	++	Nil	4-5 otters regular in mangroves
3	Navabag harbor	+	+	12 to 15 Rapan and Mangroves at night
4	Inside Navbhag Harbour	+	+	2 adults 5 babies-Otters, Everyday sighting + Mongoose - 3
5	Ubhadanad Navabag	+	-	Intermittent 4 to 5





# SMOOTH-COATED OTTER



**Map 10:** Otter survey data shown in a map **Aravali-Mochemad creek** in Sindhudurga district, Maharashtra, India. (Green dots: Otter presence)

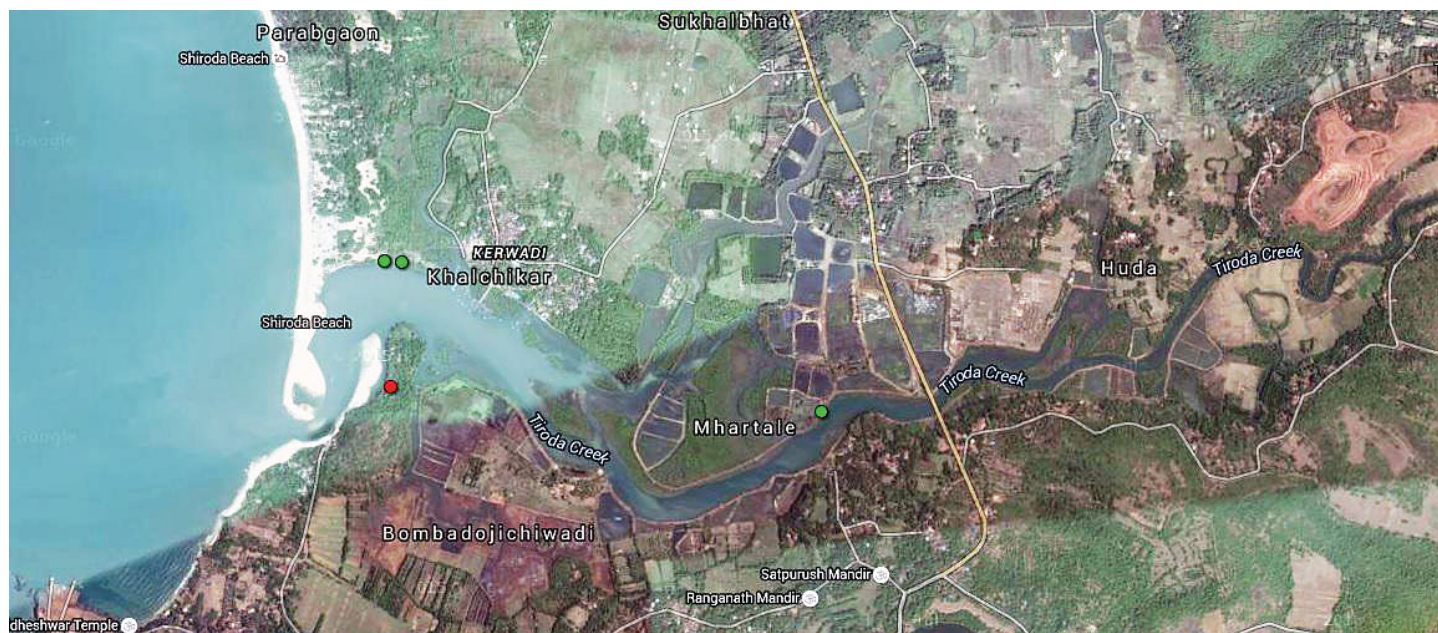
**Table 10:** Otter survey data for **Aravali-Mochemad creek River : Mochemad** in Sindhudurga district, Maharashtra, India.

**Species:** Smooth-coated Otter & Monitor Lizard, latter seen near all creeks.

	Creek : Aravali-Mochemad	Presence		Local Info
		Sprints	Sightings	
	<b>Visit Date: 16 Jan 2016</b>			
1	Mochemad Br	+	-	3 to 4 otters
2	Mochemad upper bank	++	+	5 otters, Dust Bath tracks
3	Mochemad Bund	+	+	9-10 otters regular
4	Bund further	+	-	14-15 Otters
5	Aravali Top (Asoli)	+++	-	7-8 Otters
6	Bund further	+	+	9-10 otters







**Map 11:** Otter survey data shown in a map **Shiroda creek** in Sindhudurga district, Maharashtra, India.  
(Green dots: Otter presence; Red dots: Otter not recorded)

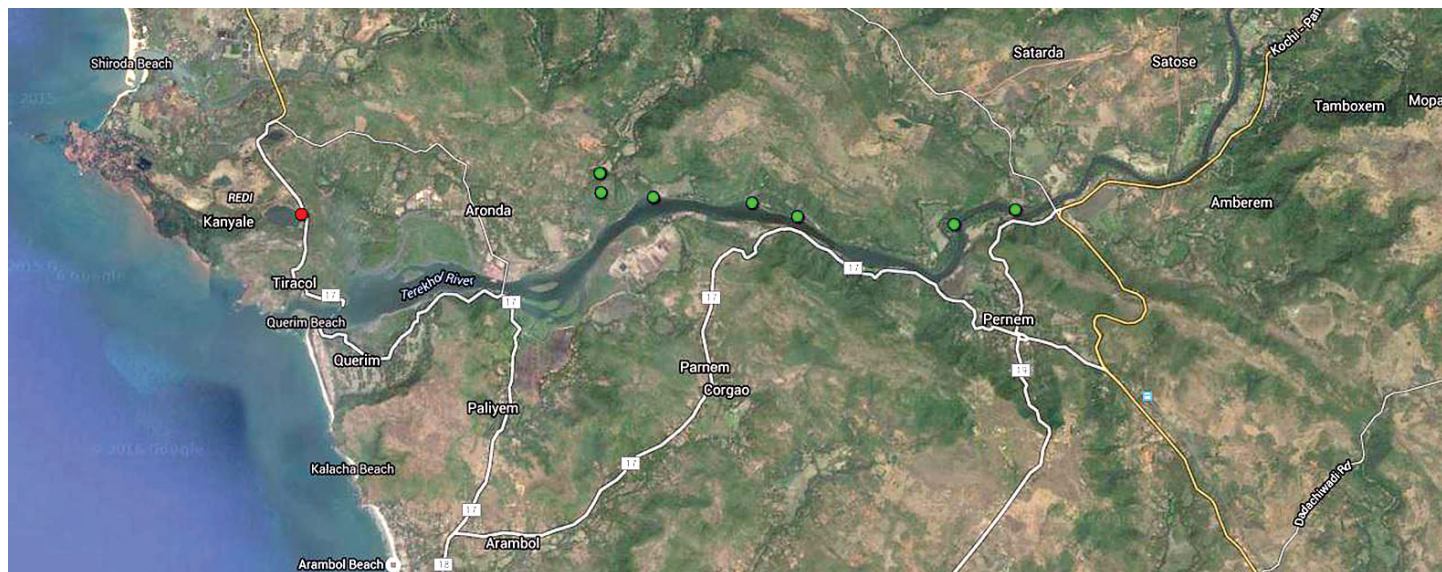
**Table 11:** Otter survey data for **Shiroda creek River : Tiloda** in Sindhudurga district, Maharashtra, India.  
**Species:** Smooth-coated Otter & Monitor Lizard, latter seen near all creeks.

	Creek : Shiroda	Presence		Local Info
	Visit Date: 17 Jan 2016	Sprints	Sightings	
1	Kerwadi-Shiroda Up	+	-	4-5 otters
2	Kerwadi-Shiroda Bund Down	+	+	4-5 Otters
3	Mithagarwadi Redi Takwadi	+	-	4-5 Otters regular, Fox
4	Redi Yashwant Gad (Opp Shiroda)	-	-	Human Disturbance





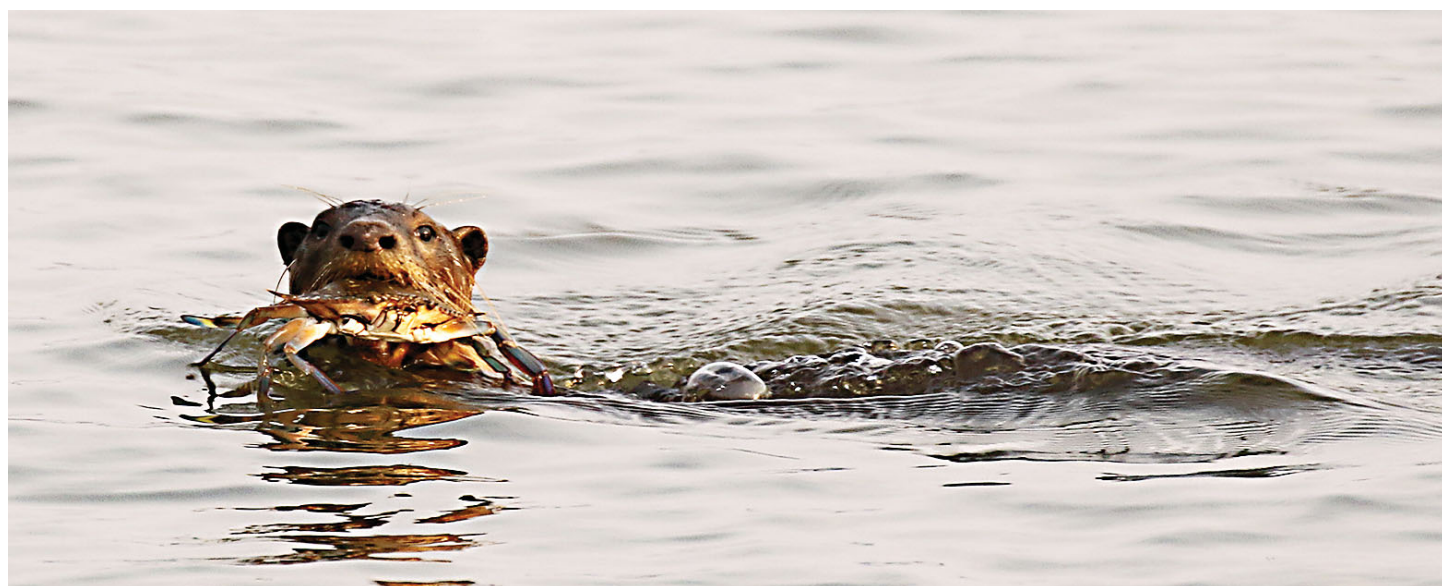
# SMOOTH-COATED OTTER



**Map 12:** Otter survey data shown in a map **Aronda-Terekhol creek** in Sindhudurga district, Maharashtra, India. (Green dots: Otter presence; Red dots: Otter not recorded)

**Table 12:** Otter survey data for **Aronda-Terekhol creek River : Terekhol** in Sindhudurga district, Maharashtra, India. **Species:** Smooth-coated Otter & Monitor Lizard, latter seen near all creeks.

Creek : Aronda-Terekhol		Presence		Local Info
Visit Date: 18 Jan 2016		Spraints	Sightings	
1	Talavane-Velve	+	-	4-5 otters
2	Talavane-Velve Bund (to Kinale)	++	-	4-5 otters
3	Kinale bund	+++	-	12-15 otters
4	Junawadi-Juva Kinale Broken br.	+	-	4-5 otters, coconut grooves
5	Kavathani Bund Vanare	+	-	8-10 reside in bund stones
6	Apteshwar Rangmanch	+	-	5-7 otters
7	Satarda People under pimpal tree	+	-	4-5 otters, crocodile - 9
8	Redi MI Tank	-	-	No otters



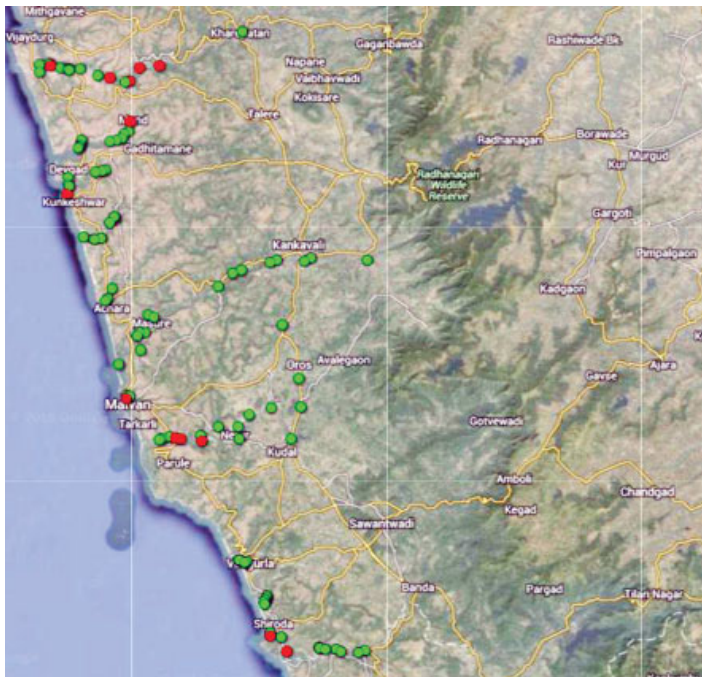


**Table 13**

**Summary of the entire survey for otter and monitor lizard presence / absence.**

**Species:** Smooth-coated Otter & Monitor Lizard.

S. No.	Creek-River	Otter Spraint	Otter Sighting	Monitor Lizard
1	Vijaydurga-Vaghotan	Yes	No	Yes
2	Vadatar-Piyali	Yes	Yes	Yes
3	Devgad-MeethMumbri	Yes	Yes	Yes
4	Meethbav-Naringre	Yes	Yes	Yes
5	Achra-Achra	Yes	No	Yes
6	Kalaval/Tondavali-Gad	Yes	Yes	Yes
7	Kolamb-Kolamb	Yes	Yes	Yes
8	Karli-Karil/Peethdhaval	Yes	No	Yes
9	Vengurla-Manasi	Yes	Yes	Yes
10	Aravali-Mochemad	Yes	Yes	Yes
11	Shiroda-Tiroda	Yes	Yes	Yes
12	Aronda-Terekhol	Yes	No	Yes



**Map 13:** Summary of the entire survey for all 12 creeks in Sindhudurga district for otter and monitor lizard presence / absence (Green dots: Otter presence; Red dots: Otter not recorded)





**Table 14 : Under Bridge Survey Data For All Creeks**

S. No.	Creek-River	Bridge Name	Spraint	Sighting
1	Vijaydurga-Vaghotan	Amberi Bridge	+	-
2	Vijaydurga-Vaghotan	Khare Patan Bridge	++	-
3	Vadatar-Piyali	Vadatar Bridge	+	-
4	Devgad-MeethMumbri	Dabhole Bridge	++	-
5	Meethbav-Naringre	Dahibav Bridge	+	-
6	Kalaval/Tondavali-Gad	Belane Br	++	-
7	Kalaval/Tondavali-Gad	Kasal River Br. Osargaon	+	-
8	Kalaval/Tondavali-Gad	Gad river Br.Kanakavali	+	-
9	Kolamb-Kolamb	Kolamb Bridge	+	-
10	Karli-Karil/Peethdhaval	Amberi Bridge	+	-
11	Karli-Karil/Peethdhaval	Chipi Bridge	Nil	-
12	Karli-Karil/Peethdhaval	Vetal Bambarde Hateri Bridge	+	-
13	Karli-Karil/Peethdhaval	Pithdhaval Br	+	-
14	Vengurla-Manasi	Vengurla Manasi River Br	+	-
15	Vengurla-Manasi	Inside Bridge	++	-
16	Aravali-Mochemad	Mochemad Br	+	-
17	Aronda-Terekhol	Junawadi-Juva Kinale Broken br.	+	-

**Table 15 : Modified Scent Station Data (Crab and prawn farms)**

S. No.	Creek-River	Station Name	Spraint	Sighting
1	Vijaydurga-Vaghotan	Tamhankarwadi Prawn Farm	+	Nil
2	Vadatar-Piyali	Oyster Farm Dreamland Hotel	++	Nil
	Vadatar-Piyali	Prawn Farm Bhabal	+	Nil
4	Meethbav-Naringre	Prawn Farm CD Work Bandhara	+++	n=4
7	Kolamb-Kolamb	Kolamb near crab farm	+++	Nil
8	Karli-Karil/Peethdhaval	Prawn Farm Devali	+	Nil





# Diversity, distribution and abundance of cetaceans across the Sindhudurg coast, Maharashtra, India

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## Abstract:

Spatial overlap between human activities and cetaceans in the coastal zone makes the latter susceptible to the negative impacts of habitat degradation. Considering that the Sindhudurg district in southern Maharashtra is one such fisheries intensive habitat, we conducted vessel-based transect surveys from November 2014 to April 2016, to determine the occurrence, distribution and relative abundance of cetaceans along this district. Through direct observations, 150 *Sousa plumbea* (Indian Ocean humpback dolphin) groups, 65 *Neophocaena phocaenoides* (Indo Pacific finless porpoise) groups, one *Balaenoptera musculus* (blue whale) group and eight *Balaenoptera edeni* (Bryde's whale) groups were encountered. Encounter rates obtained for *S. plumbea* and *N. phocaenoides* were 0.349/hr and 0.152/hr respectively. Densities for both *S. plumbea* and *N. phocaenoides* were observed to be higher in the southern region of the district. The results are discussed in the light of endangered coastal cetaceans of Sindhudurg with a strong recommendation for continued monitoring of cetaceans along this coastline.

## Keywords:

Marine mammals, *Sousa plumbea*, *Neophocaena phocaenoides*, cetaceans, whale, *Balaenoptera edeni*, *Balaenoptera musculus*, distribution, abundance.

## Introduction:

Coastal cetaceans are particularly susceptible to the effects of anthropogenic interference in the coastal zone where spatial overlap is most intense. Entanglement in fishing gears and, loss and degradation of habitat are the primary threats to these species throughout their ranges (Ross et al. 1994, Jefferson and Karczmarski 2001, Reeves et al. 2003, Braulik et al. 2015). Very





Survey vessel

little is known about the abundance and distribution of cetaceans found along the Maharashtra coast. Apart from available data from fisheries catch and by-catch or accidental strandings and mortalities (Sutaria, Arthur and Sathasivam 2014; Sathasivam 2002), publications on cetaceans from Sindhudurg region are meager and systematic surveys are wanting. In our previously concluded study (Jog et. al. Under Review, Marine Mammal Science) (funded by the Ruffords small grants foundation, UK and the IdeaWild grant, USA), we have obtained baseline data on coastal cetaceans in Sindhudurg. Two species were encountered, namely, Indian ocean humpback dolphins (*Sousa plumbea*) (G. Cuvier, 1829) (Not evaluated by IUCN) and Indo-Pacific finless porpoises (*Neophocaena phocaenoides*) (IUCN Status: Vulnerable). Both these species inhabit the fisheries intensive, disturbed habitat in the coastal shallows in Sindhudurg, and regularly interact with prevalent fisheries operations. This narrow distribution and habitat preference make both species extremely susceptible to entanglement in gillnets (Jefferson et al. 2002, Jaaman et al. 2009, Braulik et al. 2015), particularly *N. phocaenoides* (Jefferson and Curry 1994). The recent development of tourism industry in the study area, with its offshoots being sports and dolphin-based tourism, are an added disturbance in this habitat. Alteration in cetacean behaviour due to boat traffic, especially as a response to disturbance by tourist boats has also been observed in humpback dolphins in other parts of the world (Karczmarski et al. 1998,

Karczmarski 2000, Stensland et al. 2006).

The distribution of *S. plumbea* is discontinuous across most of its range countries in the Arabian Sea, with isolated local subpopulations (Jefferson 2004, Sutaria and Jefferson 2004). The on-going habitat degradation and coastal development is likely to further fragment the existing populations. Currently, conservation actions are either meagre or non-existent throughout the geographical range. In our recent study we documented the local ecological knowledge about cetaceans in the Sindhudurg region (Jog et. al., Under Review, Marine Mammal Science). Through interview surveys we also recorded cetacean strandings and mortalities and initiated a community based cetacean monitoring network.

In this study, we have evaluated the occurrence, distribution and relative abundance of inshore cetacean species in Sindhudurg, Maharashtra.

## Materials and Methods

### Study Area:

The study was carried out in the Sindhudurg Coastal and Marine Ecosystem (SCME), which includes the seascape from Vijaydurg to Redi extending up to 17 nautical miles offshore (Figure 1). This coast is mainly sandy/muddy with interspersed rocky outcrops and small islands. These areas have a large nutrient influx in the near-shore waters due to drainage from several small rivers. Approximately 19 estuaries are present in this expanse; Vijaydurg, Wadatar, Devgad, Achra, Sarjekot,



Karli, Shiroda, Terekhol being major and Phanse, Mithbav, Kolamb, Medha Nivati, Mhapan, Daboli, Vengurla and Mocchemad the minor, interspersed with three smaller estuaries (Munge, Haricharangiri and Kondura). A wide range of artisanal mechanized and non-mechanized fisheries operate here.

### Survey:

Surveys were conducted from November 2014 to May 2015, and December 2015 to April 2016 (Figure 2). Due to logistic and weather constraints survey could not be continued during February 2015 and 2016. For observations, a modified 12 m fibreglass gillnet boat was used with a 26 HP on-board engine, sailing at an average speed of 11km/hr. During a transect, three observers scanned 90 degrees from each side of the track line till the horizon using 7 x 50 binoculars with a compass. A fourth observer recorded weather, depth and sighting data on a pre-printed data sheet. We used a GPS receiver and depth sounder (Garmin GPSMAP 585 S) to record depth and location. Surveys were conducted in fair weather, up to Beaufort 3 sea state (Bowditch 1966, Dawson et. al 2008). Surveys generally commenced post sunrise when light was deemed adequate and the duration of the surveys was dependent on the lines being surveyed.

Survey track lines were designed parallel to the shore at 750 m and 2.25 km respectively. During the transect surveys, weather conditions, species identity, location of sighting, number of individuals in a group and group behaviour were recorded at every cetacean sighting.

The data was processed using Microsoft Excel (Microsoft Excel for Mac 2011

Version 14.1.3) and the software R (R Core Team (2013). R: A language and environment for statistical computing. R Foundation for Statistical Computing,

Vienna, Austria. ISBN 3-900051-07-0, (URL <http://www.R-project.org/>). Maps were produced using QGIS (Quantum GIS Development Team (2016). Quantum GIS Geographic Information System. Open Source Geospatial Foundation Project. (<http://qgis.osgeo.org>).

### Results

A total of 3806 km was surveyed over 337.35 hrs of effort from November 2014 to April 2016 (Table 1) and 150 *S. plumbea* (Image 1.1) groups and 65 *N. phocaenoides* (Image 1.2) groups were recorded.

**Table 1: Total survey effort**

Month	In Hours	In Kilometres
November '14	48.00	430
December '14	40.40	326
January '15	43.20	359
March '15	30.48	250
March-April '15	29.28	242
April '15w	27.51	246
May '15	8.1	54
December '15	33.23	586
January '16	27.26	500
March '16	33.01	479
April '16	15.28	334
<b>Total for 11 months</b>	<b>337.35</b>	<b>3806</b>

**Total sightings:** During November 2014 to May 2015, we sighted 90 groups of *Sousa* individuals (highest of 19 groups in March 2015), 30 *N. phocaenoides* groups; and from December 2015 to April 2016, 60 *S. plumbea* groups and 35 *N. phocaenoides*. The maximum group size observed in *S. plumbea* was 120 individuals (Mean 13.01, Range 1-120 individuals) and that in *N. phocaenoides* was 55 individuals (Mean: 4.91, Range: 1-55 individuals) (Table 2).

**Table 2: Number of sightings per month**

Survey Month	No. of Groups sighted	
( <i>S. plumbea</i> )	No. of Groups sighted	
( <i>N. phocaenoides</i> )		
November '14	15	17
December '14	14	1
January '15	15	6
March '15	19	0
March-April '15	15	3
April '15	9	3
May '15	3	0
December '15	16	15
January '16	18	7
March '16	15	12
April '16	11	1
<b>Total for 11 months</b>	<b>150</b>	<b>65</b>

*S. plumbea* sighting density were higher south of Talashil compared to the rest of the study area. There were no sightings in the area between Talashil and south of Achra, and around Girye. Highest sighting



**Table 3: Relative density estimates**

Species	No. of groups	Group size (min)	Group size (max)	Encounter /hr.	Encounter/km	Encounter/unit area (km <sup>2</sup> )
<i>S. plumbea</i>	150	1	120	0.444	0.0394	0.026
<i>N. phocaenoides</i>	65	1	55	0.177	0.0157	0.010

(Abbreviations: min-minimum; max-maximum)

density hotspots were observed around Bhogwe to Kelus and around Vengurla to Tak (Aravali). Lower density areas were seen between Talashil in the North and Tarkarli in the South. Mid density hotspots were observed near Vijaydurg, Jamsande, Deogad, Achra, Devbag, Wayangani and Redi (Figure 3).

The sighting densities of *N. phocaenoides* were also higher around the southern part of the district, mainly from Nivati to Redi. Densities were also higher around Sarjekot and Jadhawadi in central coastal Sindhudurg. Clustering was seen in small parts around Devgad and Achra. No sightings occurred north of Jamsande. Highest sighting densities were seen around Sarjekot to Malvan and from Aadbandar to Achra. Lower density areas were observed around Devgad and from Nivati to Redi (Figure 4).

During surveys, Bryde's Whale *Balaenoptera edeni* (IUCN Status: Data Deficient) (Image 1.3) were sighted eight times and Blue Whale *Balaenoptera musculus* (IUCN Status: Endangered) (Image 1.4) was sighted once (Figure 5). The *B. musculus* mother-calf pair was sighted 2.5 km from shore (16.5 m depth). A total of 22 *B. edeni* individuals were observed over these eight sightings (mean depth 13.06 m).

## Discussion:

About ten species of cetaceans are recorded from Maharashtra's coastal waters, based on fisheries catch and by-catch or accidental strandings and mortalities (Sutaria, Arthur and Sathasivam 2014; Kumaran 2002). Our study gives the first abundance estimates of coastal cetaceans, *S. plumbea* and *N. phocaenoides*, from the Sindhudurg coastline.

*S. plumbea* is the most common species in the study area followed by *N. phocaenoides*. Higher density hotspots of *S. plumbea* along the southern half of the district correlate with the mouths of estuaries. This could be because estuaries act as nutrient inflows that result in localized areas rich in prey species. We suspect that *N. phocaenoides* inhabit a much broader area along the

depth gradient than that was surveyed. These animals venture up to 50 m deep, some individuals going as far as 200 m (about 250 Km from shore) (Wang & Reeves, 2012, Redlist IUCN). The results expressed are therefore limited to the occasions where these animals have ventured into shallower waters of our survey area, i.e., up to 20 m depth range. These results cannot be used to infer habitat use and occurrence of *N. phocaenoides*. This data provides a baseline for presence/absence and densities of *N. phocaenoides* in the context of *S. plumbea* habitat, stressing the need for offshore surveys to better understand their ecology.

Since 2011, we have received reports of large whale sightings from fishermen across the Sindhudurg coast. Identification of species based on these descriptions is not possible. Sighting records obtained during this study confirm the presence of baleen whales in these shallow waters. These sightings in addition to the stranding records of many whales across the Maharashtra coast point to the need for focused surveys for larger cetaceans exploring deeper waters near and beyond the continental shelf in the future.

A spatial habitat overlap among all the four marine mammal species was observed. *B. musculus* were observed in areas inhabited by *S. plumbea* and *N. phocaenoides*, though during the time of the sighting no other species was recorded in the vicinity. In the case of *B. edeni*, sightings range within *S. plumbea* and *N. phocaenoides* habitat up to areas slightly offshore beyond 20 m depth. In a few instances, *N. phocaenoides* were observed within a few hundred metres of these whales, and in one instance, *S. plumbea* were sighted within about 500 m. Though there was significant overlap between *S. plumbea* and *N. phocaenoides* habitats, a temporal overlap was not observed.

This data is based on two years of surveys, of which one year had an unusual climate patterns due to El Niño, which may limit future encounter rates over a longer temporal scale. The results of this study stress the importance of a long-term cetacean monitoring



protocol along the coast of Maharashtra to determine population trends, size and distribution of cetaceans, and further identify the causes behind such trends.

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## Vengurla Municipal Council: Making of A Zero Waste City

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### Abstract

The Municipal Council of Vengurla keenly felt the need to save the natural environment of the town and to preserve its marine bio-diversity. This was important not only for the residents but also to preserve the tourist potential of the town. We identified the main culprit in harming the environment as plastic waste. In the past few years, poor solid waste management practices had led to unrestricted dumping of solid waste, especially plastic, in the creek and on the beaches. Plastic was choking up the creek and the beaches. This was very harmful to marine life. Vengurla beach is a favorite nesting spot of seven different turtle species including Olive Ridley turtles. Turtle eggs were being damaged by the dumping; the Olive Ridley turtle itself has been declared an endangered species. Vengurla being a poor council, we could not afford to hire the services of a contractual agency to de-segregate the waste and separate out the plastic. So we thought we would go to the people and convince them to segregate waste at source so that the plastic could be dealt with scientifically. Segregated wet waste would also help us to generate clean energy and reduce our carbon footprint. With the support of local NGOs and citizen forums, we were able to convince people to segregate waste into four different fractions. At the same time, we re-designed our cleaning services for 100% door-to-door waste collection in the council area. As a result of all these efforts, we have been able to achieve 100% waste collection and four-way segregation of solid waste. We are well on the way to achieving zero waste status. We have also been able to generate clean energy. Now that the nesting season for the turtles is coming back, we hope that the turtles will lay their eggs and flourish on Vengurla beach.

### Context:

Vengurla is a picturesque beachside town in Sindhudurg District in the Konkan region of Maharashtra. It lies on the state highway between



**Briquetting**







Study tour at SWM Project Vengurla

Mumbai and Goa. Vengurla is located in a hilly tract of Mango and Cashew orchards with abundant forests. History indicates that due to fertile land of this area and its strategic location, Dutch people set up a trade centre in Vengurla which is known as the Dutch Vakhar. In days of the British empire, the British had established their colony separately in the plateau portion which is popularly known as Camp area. Vengurla was established as a municipal council in the year 1876. It has an area of 12.98 sq.km. The population of Vengurla as per 2011 census is 12392. On account of it being a tourist place, we also have a floating population up to 8000. A famous market building in the Council area is the Crawford market which is the twin of the Crawford market of Mumbai; it is 141 years old and is in the heart of Vengurla market. There are many other historical monuments in the council area. For the council and its residents, the natural environment of the town is just as important as its history.

People keenly felt the need to save the environment which was being harmed by unscientific waste management. Even though guidelines have been given by state government regarding solid waste handling and rules were framed in the year 2000, these have not

been implemented strictly prior to this initiative.

### Situation Prior To The Initiative:

- i. **Plastic waste choking up the creek and the beaches:** Due to lack of awareness among people, plastic waste was being dumped anywhere in the town. People were not segregating any waste at home and plastic was choking up the drains and the creek. There is a local nullah in the Vengurla council which joins Mansi river that in turn flows into the ocean. People like to offer worship at some spots along the river. But due to lack of awareness, many of them used to offer flowers etc in plastic bags and throw these in the nullah. These plastics were choking up the nullah and the creek.
- ii. **Olive ridley turtle being harmed:** The beaches are natural nesting environment for seven turtle varieties. The most well known is the Olive Ridley turtle. But unrestricted dumping of waste on the beach was destroying turtle eggs.
- iii. **Waste was piling up in the city:** Door to door collection of municipal waste was not practiced here in Vengurla Municipal council. This means garbage was collected and deposited at 20 designated



secondary collection points. Vehicles only visited these collection points so many people often came and deposited waste after the vehicle had left. The vehicles also were not very regular. Sometimes if vehicle was out of order, that route was not covered for the entire period of repair.

- iv. **Poor solid waste management practices:** Prior to the initiative, people were not segregating waste at all. Without segregation, it was not possible to process the waste and it simply used to rot.
- v. **Insufficient logistics:** there were not sufficient vehicles to collect and transport all the waste daily. Only 1 tractor and 2 vehicles were provided which were not enough to serve the purpose. Vengurla city has 5333 properties and the city generates near about 7 tons of total waste daily. There was only 50-60% daily collection of waste i.e. about 4 tons daily in two shifts from 7 AM to 11.30 AM and 2.30 PM to 5 PM.
- vi. **Political indifference:** Elected representatives did not feel that cleanliness and saving the environment would get them any votes so they were indifferent to the idea of cleaning up the city. They all seemed to feel that cleanliness is not a tangible good.

## 2) Objectives:

- i. To preserve the marine diversity and save the natural environment of the city.
- ii. To make city livable, clean and beautiful.
- iii. To promote tourism.
- iv. To develop clean energy mechanisms to mitigate global warming.
- v. To set up a waste to energy project to improve energy resources of council.
- vi. To achieve zero waste status through the mantra of Re-Use, Re-cycle and Reduce waste.

## 3) Implementation Process:

We launched a public outreach program to raise public awareness about the need to protect the environment and to segregate waste. To reduce carbon footprint, we started a waste to energy project for generating clean energy. We also banned harmful substances like plastic carry-bags below 50 microns.

### 1. Public outreach program for waste segregation:

- i. **Need to preserve environment by segregation at source:** We realized that proper waste management

was only possible through waste segregation at source; for this public support was a must. With the help of NGOs like Kranti Mahila, Yuva Pratishthan, Sindhudurg Zilha Youth, we launched a public awareness program on the need to segregate solid waste. Discussions on the harmful impact of dumping waste were organized. The Kasav Sanrakshan Samiti came and requested people to create a good environment for the Olive Ridley turtles.

- ii. **Four waste fractions segregated:** We developed a four way segregation system: (1) Wet waste which included kitchen waste; (2) Dry waste including paper, cardboard, tetra packs, rubber, cloth, leaf waste, dead wood, (3) Plastic waste includes packaging material, PET bottles, plastic containers, milk packets; (4) Metals and glass including Glass bottles, aluminum, iron and tin. The information of 4 ways segregation system was provided in Pamphlets to the citizens and the banners regarding 4 ways segregation system were fixed at corners and various public places. Due to continuous awareness building, many apartments and housing societies pro-actively responded to four way segregation system of Vengurla municipal council and they purchased 4 separate bins and set up a special structure for daily segregation of waste.

- iii. **Capability building:** To develop the capacity of staff members of the council and people, we trained them about what is 4 way system, how it can be segregated, importance of waste segregation, how it is helpful for processing, and what are its advantages, etc. For that purpose hand-bills were supplied, demonstrations were conducted, meetings of cooperative societies were held, ward meetings were held with participation of swachhata committee repeatedly.

- iv. **Supervision machinery set up:** To monitor four way segregation and effective collection of waste, trained staff was deployed with each waste collection vehicle to facilitate this initiative at initial stage. A flying squad kept vigilance over the process. Each vehicle is cross-examined by staff and they refuse to take mixed waste. Our Chief Officer himself is out on the streets for supervision from the early hours of the morning.

- v. **Waste bye laws passed:** Vengurla municipal council has passed a resolution to implement by



laws regarding waste collection and segregation with the aim of to facilitate legal action on defaulter. This will convey a positive message to all the citizens. To accelerate this initiative, the awareness campaign were conducted with the help of school children.

- vi. **Taking popular feedback:** We took meetings in each of the 17 wards and we asked the people to nominate a volunteer/Swachhta doot for providing feedback. This volunteer helps our staff in communicating importance of waste segregation and collection to people in his ward. Also in each ward, the volunteer verifies the regularity of door-to-door collection every week. We take corrective action on the basis of this feedback.

## 2. Ban on plastic carry bags:

Vengurla Municipal council has successfully banned on plastic carry bags below 50 micron. To implement this, we held meetings with shopkeepers and especially the stall owners in the fish market. Fish being an important product of Vengurla, plastic was extensively being used to carry the fish. We encouraged the stall owners to use paper and cloth to wrap the fish instead and they have supported our initiative.

## 3. Generating clean energy, reducing carbon footprint:

Segregated wet waste is processed through bio-methanation plant and dry waste through briquetting machine. For wet waste, we send it all to bio-methanation plant ie about 1.5 tons daily. This includes hotel waste, fish market waste and segregated wet waste from households. The bio-methanation plant produces sufficient methane and 30 units electricity to power the requirements of running the plant and also for pumping water in the nearby well. The remaining fraction of dry waste, i.e. paper, cardboard and leaf waste is processed in the briquetting machine. We plan to sell the briquettes to industries for use as fuel. In this way we will also reduce our carbon footprint. Vengurla municipal council has received a plastic crusher machine from United nation development programme (UNDP). All plastic waste is crushed and utilized in road development in last year we utilized 20 tonn of plastic waste and earned 200000 rupees from it. Glass and metal- is collected separately at source and stored at dumping site which is disposed by selling to vendor.

## 4. Corporate social responsibility:

As part of the publicity campaign, we also persuaded banks to support us. Bank of India, Union Bank and Bank of Maharashtra respectively donated Rs 1,00,000/-, 25,000/- and 1,12,000/- for cloth carry bags and for a Nirmal Kalash. We are installing the Nirmal Kalash at the creek and the Mansi river to persuade people to throw their offerings in the Nirmal Kalash and not in the river. GIC provide us funds of 50 lakh for a facility of mobile toilet(2), Garbage collecting vehicles(2), Sulabh shouchalaya(1) as a CSR activity.

## 5. Improving service delivery:

To garner popular support for banning plastic and segregation at source, it was important to convince the people of our sincerity in cleaning up the city. So we also concentrated on improving service delivery by taking following steps:

- i. **Deploying sufficient vehicles for waste collection:** The vehicles provided earlier were not sufficient to take the problem of disposal of garbage. So the Council has taken initiatives to add two more vehicles for collecting and transporting the garbage. Now there are 4 waste collection vehicles and one tractor available in Vengurla Municipal council. So we have solid waste increased collection of solid waste to 100% daily i.e about 7 tons daily. We have dedicated one tractor and 3 vehicles for door-to-door collection of household waste; and each vehicle has four compartments for dry, wet, plastic and glass and metal waste. In the morning they collect household waste and in the afternoon shift, they clean the drains in the area allocated to them. The fourth vehicle is dedicated to road sweeping. One vehicle is for vehicle on call. (as per demand)
- ii. **Putting route maps in public domain:** The route maps of waste collection vehicles were prepared by the council and uploaded on its website. Accordingly the vehicles follow these routes to collect the garbage.
- iii. **Use of technology for monitoring:** For daily collection garbage vehicles are monitored through GPS devices. This helps to understand the work actually done by the vehicles.
- iv. **Vehicles kept in good repair:** Now we are prompt in repairing vehicles and there is one vehicle which is kept as back up.



**v. Training staff members:** Capability building of staff has been very imp to achieve wet and dry waste segregation. The Chief Officer trained the staff both in office and through demos in the field. So also our supervision is very good. We hired ten contractual labour to supplement our permanent cleaning staff and they too were trained.

**vi. Grievance re-dressal systems:** Maximum time and efforts were spent over hearing and solving the complaints of the peoples in regard of waste collection, cleaning of open drains, etc. People are responding on toll free number, what's app group and facebook and the council quickly solves their problem.

## 4) Results:

Vengurla municipal council has become the first municipal council of Maharashtra to implement

the concept of four way segregation of waste successfully. After its success council developed mechanism of at source segregation as ;1)Wet waste,2) Dry waste(leaves,branches) 3)Coconut nutshell,4) Papers,5)Cardboard,6) Plastic waste,7)Plastic bottles,8)Glass,9)Metal,10)Rubber,11)Tyre,Tube,12) Chappals,sandle,Boot etc,13)Sanitary napkins,14) Daipers,15)Hairs,16)e-waste,17)Electric tubes,

18)Thermacoal,19)Cloths,20)school bags,21) Dead animals,22)Chicken waste Likewise Vengurla Muncipal Council routinely follows Twentytwo way segregation at source. There is no requirement of secondary segregation.

There is no debris problem as demolished building material diverted as plinth fill for new construction. Non recyclable non biodegradable waste is utilized at cement factory which is helpful to make zero landfill and zero waste dumping ground.

### i. House to house collection of solid waste

No. of Households in Council	Prior to Initiative	After Initiative
5333	1067	5333

### iii. At source segregation of solid waste

Total number of households	Prior to Initiative	After Initiative
5333	0	5333

### v. Waste collection and transportation

Quantity of waste generated	Waste collected prior to initiative	Waste collected after Initiative
7 MT	3-4 MT	7 MT

### vii. Waste disposal and treatment

Quantity of waste generated	Prior situation	After Situation
	No waste processed or disposed of	100% wet waste (1.5 to 2 MT) processed to generate 30 units of electricity; 100 % dry waste (5 MT ) briquetted; 100% Glass and metal (100 Kg.) kept for sale; 100% Plastic waste (70 Kg) kept for use in plastic crushing machine.



Vengurle Municipal Council render service to adjoining areas to accept their waste in segregated manner, As Pingoli Grampanchayat send their waste (1 ton daily) at our project site and we accept waste from 34 beaches of Sindhudurg District and dispose it with scientific manner. Vengurle Municipal Council has capacity to accept waste three times of its own generated waste.

## 5) Situation after implementation of initiative:

- As a result of all these initiatives, Vengurla is now a clean and beautiful city once again. All public places, roads and water nallas are clean and clear due to public awareness that throwing municipal waste harms the environment.
- Preparations are being made for a festival to celebrate the arrival of the nesting seasons for the Olive Ridley turtles.
- Vengurla city become plastic carry bag free city, zero garbage city. The drainage lines are free from garbage.
- Clean energy is being generated.
- Complaints regarding municipal waste, drainage are reduced to minimum.
- Because of our public awareness programs, now avoiding plastic has become part of the lifestyle of Vengurla.
- Door to door Garbage collection has been successful and now citizens have come to rely on this service.
- During Ganesha festival every year Rs.1 to 2 lakh were expended on special cleaning campaign after the festival. But due to this initiative this year, there was no need to take such a special drive and municipal council saved Rs.1 to 2 lakh .
- The Impact of this initiative has been such that the citizens enjoyed the rainy season and there has been no outbreak of epidemic diseases this year.
- In this way Vengurla municipal council is the first council of Maharashtra which developed and successfully implemented four way segregation concept.
- Vengurla citizens feel proud about this initiative it's our real achievements.

## 6) Sustainability:

This initiative will sustain itself because we have taken care to involve and convince all stakeholders: people and municipal staff. Use of social media has played key

role in sustainability of this initiative. We continue to be in touch with people on What's App group and facebook (Vengurla nagarparishad) The Council has effectively used the toll free number (18002332099), the council web site ([www.vengurlamc.org](http://www.vengurlamc.org)) and also newspapers to communicate with the public and carry our message. Daily updates are shared with social media. Vengurla municipal council's facebook page has become popular among citizens. The Council has nominated Swachhata Doots for daily vigilance. Volunteers from the citizens have come ahead as waste warriors for the municipal council. Now the citizens have come to expect direct contact with the council so there will be pressure even on future elected bodies to maintain this initiative and to carry it forward.

## 7) Potential for replication:

Many councils are visiting us to replicate this model. The Kankavali Nagarpanchayat from Sindhudurg district has passed a resolution to replicate Vengurla model in their areas. This shows that the model is very much replicable. We have used very limited funds that are internally generated for the initiative and we have invested in capability building of our staff. This can be easily done. Most of all, our efforts have convinced our elected representatives that cleanliness is indeed a tangible good and that saving the environment is in the interests of the public and their own interest.

## 10. Revenue generation potential:

Bio methanation project, Briquetting project, Composting unit has potential to generate revenue through products like Bio gas Slurry, Briquettes, Compost etc.

Likewise Plastic bottles, glass bottles, metals, cardboard, plantation cultivated at dumping site gives income to municipal council.

Fruit, Vegetables & Crop cultivated at previously dumping site which is now utilized for such cultivation is also additional income source for Vengurla municipal council. This dumping site is now renamed as "**SWACHCH BHARAT TOURIST SPOT**" within last 6 months more than 5000 visitors visited this place.

There is no debris and rubble because demolished building material is diverted as plinth fill for new constructions. Non-recyclable non-biodegradable waste is utilized for the cement factory thereby achieving a zero waste dumping ground.



Sr. No.	Item	Rate	Income potential per month
1	Briquettes	Rs. 4/kg	Rs. 60,000/-
2	Bio gas Slurry	Rs. 2/Ltr.	Rs. 60,000/-
3	Card board	Rs. 6/Kg	Rs. 1200/-
4	Compost	Rs. 3/Kg	Rs. 1,500/-
5	Vermicompost	Rs. 5/Kg	Rs. 5000/-
6	Paper waste	Rs. 3/Kg	Rs. 1200/-
	Tyres	Rs. 2 per piece(motorcycle) Rs. 100/- per piece	Rs. 1000
7	Plastic bottles	Rs. 21/Kg	Rs. 6,300/-
	Glass bottles	Rs. 1/kg	Rs. 1000/-
8	Crushed plastic	Rs. 10/Kg	Rs. 20,000/-
	Electricity generated	Rs. 12/unit	Rs.12000/-
Total			Rs. 168500/-

Vengurla Municipal Council renders service to adjoining areas and accepts their waste in segregated manner. The Pingoli Grampanchayat sends its waste (1 ton daily) to our project site. We also accept waste from 34 beaches of Sindhudurg District and dispose it in a scientific manner. Presently, we have the capacity to accept and dispose waste three times that of our local generation.

Vengurla municipal council has been awarded by following awards at the hands of Hon. Devendraji Phadanvis, Chief minister of Maharashtra.

- Open Defecation free city awards (2 Oct. 2015)
- Clean city awards ( 3 Feb. 2016)
- Excellent Chief officer award ( 20 April 2016)
- Vasundhara award ( 7 June 2016)
- Vasundhara Mitra (Activist) Award 2017(Vasundhara Kirloskar International Film Festival)
- Felicitation by Mr.Amitabhji Bacchan on the occasion of SWACH BANEGA INDIA programme organized by NDTV and Maharashtra Govt.



**Biogas plant**



**Garbage segregation and collection**



## Rescue of Blue Whale *Balaenoptera musculus* at Kolthare, District Ratnagiri, Maharashtra

**Vikas Jagtap**

(Divisional Forest Officer, Chiplun; Email: forestcpn55@gmail.com)

**Citation:** Jagtap V. (2017). Rescue of Blue Whale *Balaenoptera musculus* at Kolthare, District Ratnagiri, Maharashtra.  
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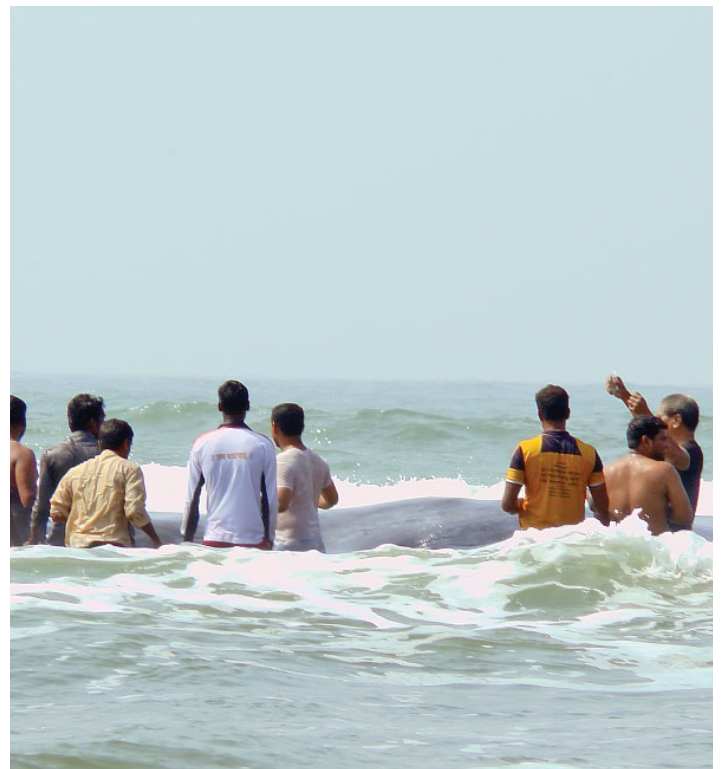
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**Referee:** N. Vasudevan



- **Name of species-** Blue Whale.
- **Scientific Name:** *Balaenoptera musculus*, (Lin.1758).
- **Family:** Balaenopteridae.
- **Status-** Endangered. (IUCN Red List, 2015).
- **Date of sighting-** 01 February 2016.
- **Time of sighting-** Around 10 AM
- **Weather parameters-** Sunny.
- **Number of times sighted-** Once.
- **Number of animals-** One.
- **Gender** – Unknown..
- **Locality-** Kolthare sea coast, Dapoli, Ratnagiri district, Maharashtra.
- **Habitat description-** Sea coast, sandy beach.
- **Distance from human habitation-** Close.
- **Behaviour-** Whale was stranded on shallow waters of the coast. It was alive and the biometrics were as follows: Snout to tail length 15 m. Maximum circumference 6 m. Colour sooty. Weight approximately 15 tons.
- **Rescue-** The whale was examined by veterinary doctor and was found to be alive with no injuries. It was tied and toed with a motor boat up to a distance of 4 km in the sea. It swam and disappeared in the deep sea. This was a demanding, strenuous but successful operation.
- **Photographs-** Attached.
- **Acknowledgement-** Bhau Katdare and Kedar Todankar (Sahyadri Nisarg Mitra, Chiplun), M.K.Jambhale, V.R.Todkar, A.R.Dalvi, B.B.Chougule, A.B.Nimkar, (all from Forest Department); Dr. Londhe (Vetrinarian, Dapoli); Mohan Upadhye and Abhinav Kelaskar (GIZ);fishermen residents from Kolthare village..





Rescue of Blue Whale *Balaenoptera musculus* at Kolthare



# Rescue of Blue Whale *Balaenoptera musculus* at Madban, Taluka Rajapur, District Ratnagiri, Maharashtra

**Vikas Jagtap**

(Divisional Forest Officer, Chiplun; Email: forestcpn55@gmail.com)

**Citation:** Jagtap, V. (2017).

Rescue of Blue Whale *Balaenoptera musculus* at Madban, Taluka Rajapur, District Ratnagiri, Maharashtra.

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**Referee:** N. Vasudevan



- **Name of species-** Blue Whale.
- **Scientific Name:** *Balaenoptera musculus*, (Lin.1758).
- **Family:** Balaenopteridae.
- **Status-** Endangered. (IUCN Red List, 2015).
- **Date of sighting-** 10 September 2016.
- **Time of sighting-** Around noon. Information was first given to the local forest department by Mr. Palav.
- **Weather parameters-** Sunny.
- **Number of times sighted-** Once.
- **Number of animals-** One.
- **Gender** – Unknown..
- **Locality-** Madban sea coast near lighthouse, Taluka Rajapur, district Ratnagiri, Maharashtra.
- **Habitat description-** Sea coast, sandy beach.
- **Distance from human habitation-** Close.
- **Behaviour-** Whale was stranded in shallow waters of Madban sea coast. It was alive and the biometrics was as follows: Snout to tail length 47 feet. Colour sooty/grey/blue. Weight approximately 15 tons.
- **Rescue-** The whale was examined by veterinary doctor and was found to be alive with no injuries. It was not possible to tow the whale in the sea on 10-09-2016 in spite of great efforts. The operation had to be suspended due to nightfall. On the next day on 11-09-2016, the whale was tied with a rope and with the help of local fishermen, villagers and local NGO it was toed with the help of two motor boats in the deep sea. The whale swiftly swam and disappeared in the sea.
- **Photographs-** Attached.
- **Acknowledgement and assistance-** B.R.Patil, Sagar Gosavi, (from Forest Department); Dr. Rane (veterinary doctor, Dapoli); Pradeep Dingankar (local NGO); local fishermen and residents from Madban village. Author gratefully acknowledges the assistance from Hon. MLA Shri. Uday Samant and Hon. MLA Shri. Rajan Salvi for facilitating the whale rescue operation.





**Rescue of Blue Whale *Balaenoptera musculus* at Madban**

## Sightings of Eurasian Oystercatcher *Haematopus ostralegus* at Akshi beach, Near Alibag, Raigad, Maharashtra

Dr. Vaibhav Deshmukh & Pravin Kawale

(Email: drvaibhav@gmail.com)

**Citation:** Deshmukh, V. and Kawale, P. (2017). Sightings of Eurasian Oystercatcher *Haematopus ostralegus* at Akshi beach, Near Alibag, Raigad, Maharashtra.

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**Referee:** Satish Pande



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- **Name of species-** Eurasian Oystercatcher
- **Scientific Name-** *Haematopus ostralegus*
- **Status-** Least Concern
- **Date of sighting-** 21st October 2002 to 24TH March 2017.
- **Time of sighting-** 7 to 9 AM.
- **Weather parameters-** Usually sunny.
- **Number of times sighted-** Every Year from October to March.
- **Number of birds-** Single to 9 individuals.
- **Gender of bird-** Unidentified.
- **Locality-** Akshi Beach near Alibag, Raigad district of Maharashtra.
- **Habitat description-** Surfline.
- **Distance from human habitation-** Approximately 200 meters.
- **Any other bird/animal associates-** With other waders like Lesser & Greater Sand Plovers, Kentish Plovers, Terek Sandpipers. Common Redshanks, Ruddy Ternstones
- **Bird behaviour-** Birds are seen feeding by probing the bill in soft sand for food.
- **Threats to the habitat-** Commercial recreational activity, Erecting of fishing nets. Human disturbance in the form of vehicular activity on beach.
- **Photographs-** Attached.
- **Previous records-** No known record from this region, probably under reported.





## Sightings of Bridled Tern *Onychoprion anaethetus* at Arabiab Sea, Near Alibag, Raigad, Maharashtra

**Dr. Vaibhav Deshmukh**  
(Email: drvaibhav@gmail.com)

**Citation:** Deshmukh, V. (2017).  
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- **Name of species-** Bridled Tern
- **Scientific Name-** *Onychoprion anathetus*
- **Status-** Least Concern
- **Date of sighting-** 6 October 2013.
- **Time of sighting-** 12 PM.
- **Weather parameters-** Sunny.
- **Number of times sighted-** 3
- **Number of birds-** Single Bird
- **Gender of bird-** Unidentified, Non-Breeding Plumage
- **Locality-** At Arabian Sea 5 Km west of Khanderi Fort .
- **Habitat description-** Perched on Thermocol piece .
- **Distance from human habitation-** Approximately 10 Km
- **Any other bird/animal associates-** None
- **Threats to the habitat-** None
- **Photographs-** Attached.
- **Previous records-** No know record from this region probably under reported.



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## Sightings of Great Knot *Calidris tenuirostris* at Akshi beach, Near Alibag, Raigad, Maharashtra

**Dr. Vaibhav Deshmukh, Pravin Kawale & Niranjana Sant**

(Email: drvaibhav@gmail.com)

**Citation:** Deshmukh, V., Kawale P. & Sant N. (2017).  
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**Referee:** Satish Pande



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- **Name of species-** Great Knot
- **Scientific Name-** *Calidris tenuirostris*
- **Status-** Vulnerable
- **Date of sighting-** 21st October 2002 to 24TH March 2017.
- **Time of sighting-** 7 to 9 AM.
- **Weather parameters-** Usually sunny.
- **Number of times sighted-** Every Year from October to March Winter migrant.
- **Number of birds-** 8 to 56 individuals.
- **Gender of bird-** Unidentified
- **Locality-** Akshi Beach near Alibag, Raigad district of Maharashtra.
- **Habitat description-** Intertidal sand flats.
- **Distance from human habitation-** Approximately 200 meters
- **Any other bird/animal associates-** With other waders like Lesser & Greater Sand Plovers, Kentish Plovers and Terek Sandpipers.
- **Bird behaviour-** Birds are seen feeding in the intertidal zone.
- **Threats to the habitat-** Commercial recreational activity, deployment of fishing nets. Human disturbance and vehicular activity on beach.
- **Photographs-** Attached.
- **Previous records-** No known record from this region but is probably under reported.



## Sightings of Crab Plover *Dromas ardeola* Near Alibag, Raigad, Maharashtra

Dr. Vaibhav Deshmukh, Pravin Kawale & Niranjana Sant

(Email: drvaibhav@gmail.com)

**Citation:** Deshmukh, V., Kawale, P. & Niranjana Sant (2017). Sightings of Crab Plover *Dromas ardeola* Near Alibag, Raigad, Maharashtra.

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- **Name of species-** Crab Plover
- **Scientific Name-** *Dromas ardeola*
- **Status-** Least concern
- **Date of sighting-** Each year in winter from 1 October 2002 to 13 April 2017.
- **Time of sighting-** 7 to 9 AM.
- **Weather parameters-** Sunny.
- **Number of times sighted-** Twice a year in Early October and late April
- **Number of birds-** Single bird
- **Gender of bird-** Unidentified,
- **Locality-** Akshi beach near Alibag, Raigad district, Maharashtra.
- **Habitat description-** On mud flats and sand flats.
- **Distance from human habitation-** Approximately 200 m.
- **Any other bird/animal associates-** With other waders like Lesser & Greater Sand Plovers, Kentish Plovers, Terek Sandpipers. Common Redshanks, Ruddy Turnstones
- **Bird behaviour-** Bird was seen feeding by probing the soft mud or sand with the bill.
- **Threats to the habitat-** Commercial activities, Erecting of fishing nets. Human disturbance in the form of vehicular activity on the beach.
- **Photographs-** Attached.
- **Previous records-** One record from Agardanda, Rajpuri beach, Mhasala, district Raigad. [Mestri, P; Pande, Satish A. (2001) First sighting of Crab Plover *Dromas ardeola* and Pied Harrier *Circus melanoleucos* in Raigad district, Maharashtra. *Journal Bombay nat. Hist. Soc.* Vol.98(2)], August 2001, Pp.278-279; Some records from Revas jetty, Alibag. [Pande, Satish. per. com.]

## Sightings of Indian Skimmer *Rynchops albicollis* Near Alibag, Raigad, Maharashtra

Dr. Vaibhav Deshmukh, Pravin Kawale & Niranjana Sant

(Email: drvaibhav@gmail.com)

**Citation:** Deshmukh, V., Kawale, P. & Niranjana Sant (2017).

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**Referee:** Satish Pande



- **Name of species-** Indian Skimmer
- **Scientific Name-** *Rynchops albicollis*
- **Status-** Vulnerable.
- **Date of sighting-** 6 January to 13 January 2013
- **Time of sighting-** 7 to 9 AM.
- **Weather parameters-** Sunny.
- **Number of times sighted-** Daily for one week.
- **Number of birds-** Single Bird
- **Gender of bird-** Unidentified,
- **Locality-** Akshi Beach near Alibag, Raigad district of Maharashtra.
- **Habitat description-** Intertidal zone.
- **Distance from human habitation-** Approximately 200 m.
- **Any other bird/animal associates-** With other waders like Lesser & Greater Sand Plovers, Kentish Plovers, Terek Sandpipers. Common Redshanks, Ruddy Turnstones
- **Bird behaviour-** Skimming over water surface for food.
- **Threats to the habitat-** Commercial recreational activity, Erecting of fishing nets. Human disturbance in form of vehicular activity on the beach.
- **Photographs-** Attached.
- **Previous records-** Dr. Salim Ali reported breeding colony of Indian Skimmer at Dharamtar Creek in 1945. Which is 25 Km away. Presently there is no such colony.



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