

REVIEW OF CURRENT DEVELOPMENTAL ACTIVITIES AND THEIR POSSIBLE IMPACT ON OLIVE RIDLEY SEA TURTLES ALONG THE ODISHA COAST OF INDIA

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Introduction

Even though sea turtles have a spectacular adaptation to life in water, they are highly dependent on the well-being of beaches. Though many reptiles have returned to partial or complete lives in the water (e.g. freshwater turtles, sea turtles and crocodiles), they are still tied to land for one phase of their life, namely reproduction. Sea turtles are vulnerable at all stages of their life cycle. In water, potential predators for both hatchlings and adults include sharks, whales, saltwater crocodiles and large fish. But the foremost cause of turtle mortality is attributed to certain marine fishing practices. This factor is now considered responsible for the decline of most sea turtle populations throughout the world. On the beach, both eggs and hatchlings are preyed upon by beach mammals (wild and domestic), birds, crabs, insects etc. Threats to the nesting habitats too are critical to sea turtle reproduction, as turtles are dependent on available nesting habitats in the form of suitable beaches. The offshore breeding habitat and onshore nesting habitat are important for the survival of the sea turtle population. The human-induced hazards to sea turtles at these habitats include cluttered beaches, sand mining, coastal armouring and developmental activities along the coast. Decline in water quality, anchoring, oil pollution, marine debris and destructive fishing practices are also directly and indirectly threatening the survival of sea turtles in the marine environment (Lutz & Musick 2013).

It is now a proven fact that sea turtles have an extremely high affinity for their breeding grounds, and therefore the loss or reduction of even a single rookery can have serious impacts on the whole population (WII-DGH Turtle Project Interim Report 2011). Coastal developmental activities and urbanization near nesting habitats have destroyed many of India's sea turtle nesting beaches (National Research Council 1990). The inexorable spread of beach development, including plantations, eats away natural sea turtle

nesting habitats. A recent study focussed on solitary nesting records along the 35-km coast of Gahirmatha rookery (Behera *et al.* 2013). Therefore, it is necessary to clearly understand the critical habitat requirements of olive ridley sea turtles so that both conservation and development can take place hand in hand.

With this background, the proposed study was undertaken for assessment of developmental activities along the coast of Odisha and their possible impact on sea turtles and their nesting habitats.

Study area

Odisha in India is one of the four maritime states bordering the Bay of Bengal. The state has a coastline of about 480km and constitutes 8% of the Indian coastline. There are seven coastal districts, namely Ganjam, Puri, Khurda, Jagatsinghpur, Kendrapara, Bhadrakh and Balasore, consisting of approximately 250 coastal fishing villages along the coast of Odisha. This coast is bestowed with a variety of habitats, such as tidal creeks, backwaters, brackish water lagoons, estuaries, mangroves, mudflats and salt marshes. The Exclusive Economic Zone (EEZ) of the state has been estimated at 172,000km² (Anonymous 2001). The EEZ includes the deltas of Subarnarekha, Budhabalanga, Mahanadi-Brahmani system and the Rushikulya river estuaries with many other minor tributaries that drain into the Bay of Bengal that not only offer good fisheries for the region but also are identified as ideal sites for various coastal development projects.

Methodological approach

The study duration was six months between February 2013 and July 2013. In the first stage, information available on the Odisha coast on the developmental activities and eco-sensitive areas was gathered from secondary sources and published and unpublished literature. Based on this information, the entire coastline of Odisha was divided into ~10 km sectors and, in the second stage, a reconnaissance physical survey visit was made to the nearest approachable point, largely along the estuarine mouth of rivers along each sector, to document the ecologically sensitive flora and fauna in the sector and developmental projects existing, initiated or planned (if any) through a standard data format. We also conducted interviews with coastal dwellers and at fishing villages and fish landing centres on surveys done (if any) in the area and any proposed plan of industries/infrastructure to be set up by any agency.

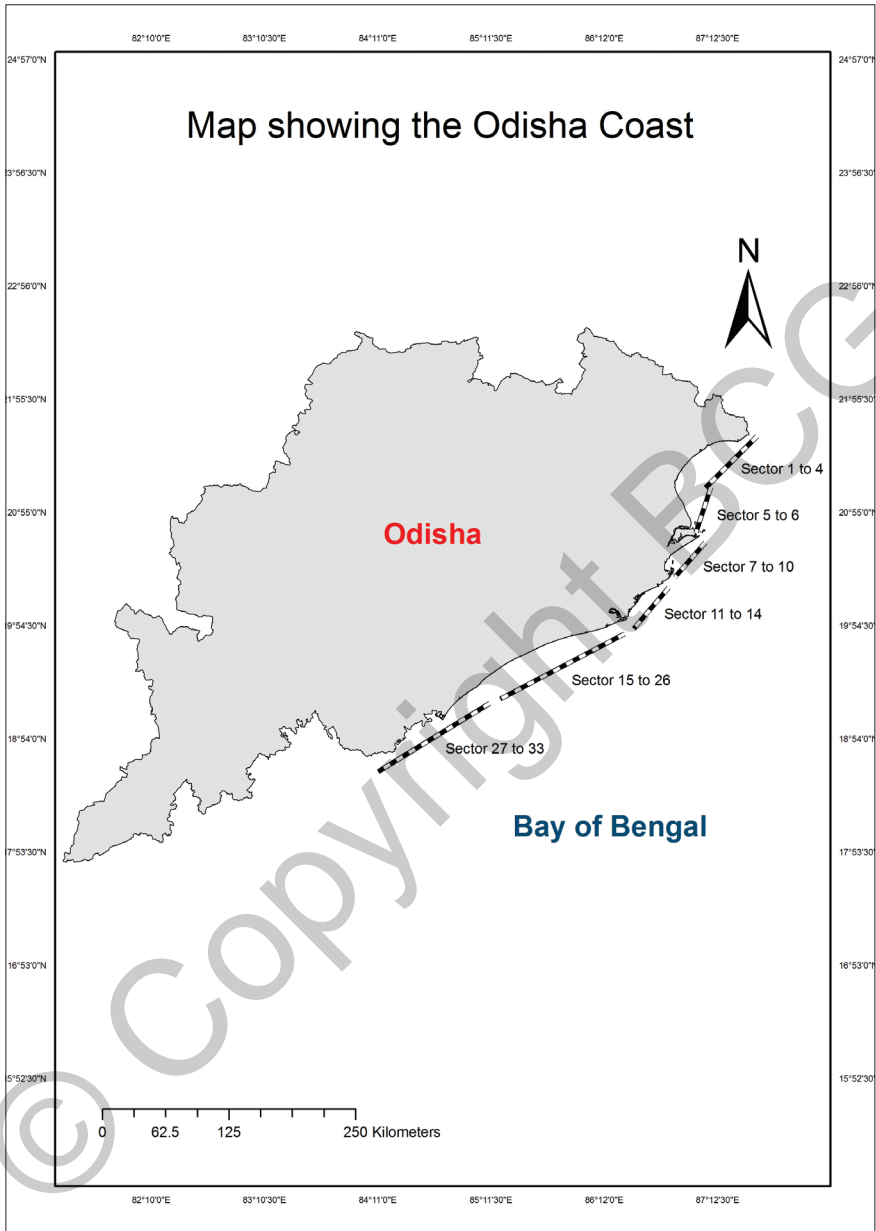


Fig. 1. Map showing the numbered survey sectors along the Odisha coast.

The sectors (Fig. 1) visited along the Odisha coast for surveys were as follows:

Balasore (80km)

Of the 80-km Balasore coast that borders the state of Odisha with West Bengal, only ~40 coastal stretches were identified and visited as the rest of the ~40-km stretches are inaccessible due to extensive mudflat and mangrove plantations. There are fishing harbours near Subarnarekha river mouth (Kirtaniakhati), Budhabalanga river mouth (Balaramgadi) and Kasaphala river mouth (Kasaphali). The following sectors were visited for documentation of developmental activities.

Sector 1 - Udayapur (WB-Odisha) – Subarnarekha R mouth
(21°37'26.27" N & 87°30'57.07" E – 22°33'56.24" N & 87°24'2.22" E) ~10km

Sector 2 - Subarnarekha R mouth – Talapada
(22°33'56.24" N & 87°24'2.22" E – 21°33'33.56" N & 87°14'29.10" E) ~10km

Sector 3 - Talapada – Kasaphala R mouth
21°33'33.56" N & 87°14'29.10" E – 21°31'1.68" N & 87°7'35.58" E) ~10km

Sector 4 - Kasaphala R mouth – Chandipur
(21°31'1.68" N & 87°7'35.58" E – 21°27'1.92" N & 87°1'31.60" E) ~10km

Bhadraakh (50km)

The Bhadrakh coast starts north of Dhamra river mouth adjoining Bhitarkanika Sanctuary. The major part of the coastline is covered with extensive mudflats and stunted *Avicennia* mangrove vegetation. The Bhadrakh coastline has three fishing harbours, namely Chudamani, Dhamra and Talchua. The following two sectors were visited during the survey.

Sector 5 - Dhamra R mouth (20°48'7.83" N & 86°54'49.67" E)

Sector 6 - Wheeler Island (20°45'38.35" N & 87°52'2.87" E)

Kendrapara (68km)

The Kendrapara coast extending over ~70km has the famous mass nesting ground for olive ridley sea turtles in Gahirmatha and Bhitarkanika National Park. The coastline comprises sandy beaches with extensive *Casuarina* plantations and mudflats. During the present survey, only a 40-km coastal stretch was covered as the rest of the coastline is deltaic, mudflat and mangrove and inaccessible during the monsoon. The following sectors were covered for assessment.

Sector 7 - Ekakulanasi – Habalikhati
(20°42'40.96" N & 87° 2'27.28" E – 20°39'33.01" N & 86°57'51.79" E) ~10km

Sector 8 - Habalikhati – Satabhaya
(20°39'33.01" N & 86°57'51.79" E – 20°36'22.20" N & 86°52'52.92" E) ~10km

Sector 9 - Satabhaya – Chinchiri R mouth
(20°36'22.2" N & 86°52'52.9" E – 20°35'13.23" N & 86°51'13.07" E) ~10km

Sector 10 - Chinchiri R mouth – Barunei R mouth
(20°35'13.23" N & 86°51'13.07" E – 20°30'43.88" N & 86°46'5.10" E) ~10km

Jagatsinghpur (67km)

Of the ~70km coast of Jagatsinghpur, the stretch between Hukitola and Mahanadi river mouth (~20km) was not covered due to inaccessibility. The Jagatsinghpur coast harbours the second largest mangrove forests in the state in the Mahanadi delta. Also there are bay islands and extensive sandy beaches in the Mahanadi river mouth areas. The following sectors were surveyed.

Sector 11 - Mahanadi R mouth – Jatadhara R mouth

(20°15'43.22" N & 86°40'7.27" E – 20°13'18.87" N & 86°34'53.18" E) ~10km

Sector 12 - Jatadhara R mouth – Nuagaon

(20°13'18.87" N & 86°34'53.18" E – 20°9'16.36" N & 86°30'23.51" E) ~10km

Sector 13 - Nuagaon – Saharabedi

(20°9'16.36" N & 86°30'23.51" E – 20°3'30.43" N & 86°25'47.98" E) ~10km

Sector 14 - Saharabedi – Devi R mouth

(20°3'30.43" N & 86°25'47.98" E – 19°58'3.47" N & 86°22'51.48" E) ~10km

Puri (155km)

Most of the Puri coast was visited during the survey period. At the northern end of Devi river mouth is a fishing harbour at Nuagarha, near Astaranga Township. There are also fish landing centres near Gondalba, Chandrabhaga, Puri and Arakhuda. The following 12 sectors were identified and surveyed.

Sector 15 - Devi R mouth – Sahana

(19°58'3.47" N & 86°22'51.48" E – 19°56'32.65" N & 86°17'39.56" E) ~10km

Sector 16 - Sahana – Kadua R mouth

(19°56'32.65" N & 86°17'39.56" E – 19°55'0.46" N & 86°14'15.38" E) ~10km

Sector 17 - Kadua R mouth – Chandrabhaga

(19°55'0.46" N & 86°14'15.38" E – 19°52'20.77" N & 86°6'31.50" E) ~10km

Sector 18 - Chandrabhaga – Kushabhadra R mouth (Ramachandi)

(19°52'20.77" N & 86°6'31.50" E – 19°51'17.10" N & 86°3'24.80" E) ~10km

Sector 19 - Kushabhadra R mouth (Ramachandi) – Nuanai R mouth

(19°51'17.10" N & 86°3'24.80" E – 19°49'27.82" N & 85°54'38.79" E) ~10km

Sector 20 - Nuanai R mouth – Puri beach

(19°49'27.82" N & 85°54'38.79" E – 19°47'53.14" N & 85°49'36.52" E) ~10km

Sector 21 - Puri beach – Mohana creek

(19°47'53.14" N & 85°49'36.52" E – 19°46'7.47" N & 85°44'8.10" E) ~10km

Sector 22 - Mohana creek – Magarmukh (Chilika old mouth)

(19°46'7.47" N & 85°44'8.10" E – 19°44'22.20" N & 85°39'3.85" E) ~10km

Sector 23 - Magarkukha (Chilika old mouth) – Chilika mouth

(19°44'22.20" N & 85°39'3.85" E – 19°40'7.03" N & 85°30'31.96" E) ~10km

Sector 24 - Chilika mouth – Khirsahi

(19°40'7.03" N & 85°30'31.96" E – 19°37'00.22" N & 85°24'20.51" E) ~10km

Sector 25 - Khirsahi – Ramalanka

(19°37'00.22" N & 85°24'20.51" E – 19°32'24.98" N & 85°16'31.72" E) ~10km

Sector 26 - Ramalanka – Prayagi

(19°32'24.98" N & 85°16'31.72" E – 19°27'29.00" N & 85°09'32.04" E) ~10km

Ganjam (70km)

The Ganjam coast borders the state with Andhra Pradesh at Pata-sonapur, a fishing hamlet near the Bahuda river mouth. The entire coastline is sandy with three creeks near Gopalpur port, Haripur and Markandi. The following stretch along the Ganjam coast was covered during the present survey.

Sector 27 - Prayagi – Kantiagarha

(19°27'29.00" N & 85°09'32.04" E – 19°24'44.08" N & 85°06'07.06" E) ~10km

Sector 28 - Kantigarha – Rushikulya R mouth

(19°24'44.08" N & 85°06'07.06" E – 19°22'53.90" N & 85° 4'57.36" E) ~ 10km

Sector 29 - Rushikulya R mouth – Nuagaon

(19°22'53.90" N & 85°4'57.36" E – 19°21'18.62" N & 85°2'27.42" E) ~10km

Sector 30 - Nuagaon – Gopalpur port (Arjipalli)

(19°21'18.62" N & 85°2'27.42" E – 19°18'14.07" N & 84°57'51.48" E) ~ 10km

Sector 31 - Gopalpur port (Arjipalli) – Gopalpur

(19°18'14.07" N & 84°57'51.48" E – 19°15'38.81" N & 84°54'34.89" E) ~10km

Sector 32 - Gopalpur – Markandi creek (Golabandha)

(19°15'38.81" N & 84°54'34.89" E – 19°11'57.44" N & 84°50'22.19" E) ~10km

Sector 33 - Markandi (Golabandha) – Bahuda River mouth

(19°11'57.44" N & 84°50'22.19" E – 19°7'15.65" N & 84°47'3.81" E) ~ 10km

Results

The various developmental activities documented along the coast of Odisha during the survey period are as follows (Fig. 2).

Ports and shipping

Paradeep port: Among the 12 major ports in India, one, Paradeep (Fig. 3), is in Odisha in the coastal district of Jagatsinghpur (sector 11). Paradeep is the main port for trade from the eastern part of the country – serving the states of Odisha, Andhra Pradesh, Madhya Pradesh, Uttar Pradesh, Bihar and West Bengal. The port was opened to traffic for iron ore in 1966 but, after three decades, the cargo profile has undergone a complete transformation. Besides iron ore, the current cargo mix includes various other metallic ores, fertilizer, food grains and fertilizer raw materials (Odisha Industrial Policy 2007).

POSCO port: POSCO intends to set up a coast-based integrated steel plant with a capacity of 12 million tonnes per year. POSCO-India is a private limited company, a subsidiary of POSCO-Korea which will be implementing this project. The port requires waterfront facilities along the Jatadhara muhana creek near Paradeep and is located near the northern part of the creek near the villages of Noliasahi, Nuagaon and Govindpur (sector 12) (Odisha Industrial Policy 2007). The Devi sea turtle rookery is ~20 km south of the proposed project site.



Fig. 2. Map of the surveyed coastline showing the locations of developmental activities and industrial installations.



Fig. 3 Port and oil terminal at Paradeep.

Gopalpur port: Gopalpur port in Ganjam district has been operating as a minor port but it operates only during fair weather (sector 31). Considering the requirements of port-based steel plants and other industries which are growing up near the port, the state government has decided to develop Gopalpur port into an all-weather port through private investment. Accordingly, the state government has signed a Memorandum of Understanding (MoU) with a private company to develop this port (Odisha Industrial Policy 2007). The port site is located 10km south of Rushikulya river mouth which is also a major mass nesting site for olive ridley turtles along the Odisha coast.

Dhamra port: This port had been under development in over 500 Hectares of land by Dhamra Port Co. Ltd. – a Joint Venture of L&T and Tata Steel (sector 5). It is the deepest port with an 18-metre draught capable of handling 180,000 DWT vessels, with completion planned for September, 2008 (source: Dhamra Port Corporation Limited www.dhamraport.com). The port site is located about 13km away from the Gahirmatha Marine Sanctuary. Dhamra is now fully developed, with loaded cargo ships coming from Australia and China, and it has become the most important deep water port for import and export of many raw materials for eastern India.

Along with the above, the state government has approved several major and minor ports with private investments. The details of these ports are given in Table 1.

Coastal highways

A 35-km coastal road connects two major tourist centres, Puri and Konark, along the eastern coast of India. The road was constructed in the early 1980s and a 15-km stretch passes through the Puri-Balukhand Wildlife Sanctuary. The coastal stretch between Puri and Konark supports sporadic nesting of olive ridley turtles (Pandav *et al.* 1994). The 5-km stretch of this road from Chandrabhaga to Baliharchandi was constructed very close to the high tide line of the sea and in places the breakers reach the highway. Similar stretches of marine drive have been developed between Puri urban beach and Balighai, Puri urban beach and Mohana creek (Sterling Resort) and Paradeep lighthouse and Sandhakuda for beach tourism development. All these areas harbour sporadic nesting beaches for olive ridley turtles. The state government is also planning to develop a highway along the coastline of the Bay of Bengal linking Andhra Pradesh in the south to West Bengal in the north. The proposed coastal road length will extend over 674km from Gopalpur in Odisha to Midnapore in West Bengal and is envisaged to be executed with the assistance from the Government of Norway (Government of Odisha, www.Odishagov.nic.in).

Fertilizers and other chemical industries along the coast

There are four big fertilizer plants in Odisha. Of these, a new phosphate fertilizer complex in the coastal area at Paradeep, a joint venture of Island Republic of Nauru and Government of India, has been built recently. It produces diammonium phosphate with a capacity of 2,400 tonnes per day in the first phase. Its second phase of production of phosphoric acid and phosphorus pentoxide has also started. Major effluents from this industry are released into the Mahanadi river system and thereby into the Bay of Bengal.

The Jayashree chemical plant is a chloro-alkali plant, located at the river mouth of Rushikulya estuary near Ganjam Township. This chemical industry manufactures caustic soda, hydrochloric acid, sulphur dioxide gas and chlorine and discharges mercury as a waste product directly into the Rushikulya estuary (State of Environment Odisha 2006).

Petrochemical industries along the coast

Paradeep (Fig. 3) is poised to become a petrochemical complex for the state in the near future. The Indian Oil Corporation is setting up a petrochemical complex there. A 15 MMTPA grassroots refinery-cum-petrochemicals complex along with a product pipeline to Ranchi is planned to be constructed. The refinery will have, apart from a crude and vacuum distillation unit, a hydro-cracking unit, a delayed coker unit and other secondary processing facilities. Approximately 3,344 acres of land have been taken over by Indian Oil near the coast and necessary infrastructure developments are being developed. There is also a proposal for construction of various POL and LPG terminals at Paradeep.

Sand mining along the coast

Odisha Sands Complex (OSCOM), which is a subsidiary of Indian Rare Earths Limited (IREL), a private limited company jointly owned by the Government of India, is located near Chhatrapur to exploit the huge placer deposit across a mining area of 40sq km to produce 220,000 tonnes of 50% grade limonite (an iron ore) and associated minerals like rutile, zircon, sillimanite, garnet etc. The current dredging converts all the limonite to 100,000 tonnes per annum of 92% grade synthetic rutile. This plant is located 10km south of Rushikulya sea turtle rookery (Fig. 4). Although the state government is reported to have proposed leasing other areas for sand extractions, official information on other areas is not available (source: Indian Rare Earth Limited www.irel.gov.in).

Marine products development and marine fishing in the state

The 480-km coastline has a continental shelf area of ~24,000sq km with Maximum Sustainable Yield (MSY) of 100,061 metric tonnes (MT) and fish landings of 121,929 MT per year. Under the marine sector there are



Fig. 4. Sand mining at IREL near Rushikulya sea turtle rookery.

559 marine fishing villages with a population of ~173,197 fisher folk who depend on the marine resources for their livelihood. There are 63 fish landing centres and four major fishing harbours (Fig. 5) in the state with a total of 1,340 mechanized and 15,444 non- mechanized craft (Fig. 6) operating in the coastal waters of Odisha (Anonymous 2007). The state government is proposing setting up a modern processing centre with European Union (EU) norms in various coastal districts with an integrated fishing harbour at Paradeep, positioning it adjacent to the port so that export can be possible from Paradeep and also for value addition to by-catch and post-processing of shrimp, crab and other shellfish. At present the state has 23 exporters who are processing in 19 modern processing plants spread across the coastal districts of Odisha (Table 2). The state is also proposing a joint venture of tuna fishing as tuna fishing grounds are located off the southern coast of the state. The government of Odisha is also planning the setting up of modern fishing harbours/Special Economy Zones (SEZs) etc. as major fishing bases, such as: an integrated fishing harbour at Chudamani in Balasore district with EU norms; developing the Chandnipal fishing harbour in Bhadrakh, situated at the northern end of the Dhamra river mouth; and Bahabalpur in Balasore district which is close to Chandipur. Additionally, the state has a proposal to upgrade the Nuagarha fishing harbour into the cadre of Paradeep fishing harbour with more capacity for mechanized craft running from this base. Table 2 shows the details of existing fishing harbours and those proposed by the state government.



Fig. 5. The new fishing harbour at Dhamra.



Fig. 6. Non-mechanised fishing craft along the Odisha coast.

Tourism infrastructure along the coast

The state has considerable growth potential in terms of coastal tourism especially for Chandipur, Chandrabhaga, Puri, Satapada, Chilika and Gopalpur, because of good infrastructure facilities (road, rail, air connectivity) and availability of vast sandy beaches along the major part of the Odisha coast (280km). A new Tourism Policy has been formulated by the state government that encourages private sector participation with the government acting as a catalyst in the process. There is a proposal for Puri and Chilika to be developed as Special Tourism Areas. The state government has already leased out areas near Puri to private sector companies for beach resorts and motels. Table 3 shows the proposed area for tourism development in the coastal stretch of Odisha.

Defence establishments along the coast

Chandipur-on-sea: this is located 15km from Balasore. A number of test vehicles of different class have been test fired from this range, including multi-role missiles, multi-target capability missiles, antitank missiles, and the most precise surface-to-surface missiles. The range is spread over a length of 17km along the sea coast and missiles are test fired into the Bay of Bengal from time to time.

Wheeler Island: a missile testing facility is maintained on the island; intermediate-range ballistic missiles are fired from here. Several structures including the launch pad, the helipad and some of the support buildings have been constructed on the island recently and bright lights shine at night. The present turtle mass nesting activities at Gahirmatha connect with the south-western portion of Wheeler Island.

Indian Naval Service (INS), Chilika: INS Chilika, the premier basic training establishment of the Indian Navy, is situated on the shores of Chilika Lagoon. This establishment provides training for all new entrant sailors of the Indian Navy and Navics of the Indian Coast Guard. There is ship movement between INS Chilika and INS Visakhapatnam in the nearshore waters of the Bay of Bengal.

Army Establishment: The Army Defence and Guidance Missile School, an artillery unit of the Indian Army, is located at Golabandha, which is close to the seashore and ~10km south of Gopalpur-on-sea. This unit occasionally carries out missile operations in the EEZ of the Bay of Bengal (source: Team Odisha, www.teamOdisha.org).



Fig. 7. *Casuarina* plantation invading the sea turtle nesting beach.

Plantations along the coast

To protect the coastal areas from cyclones and other natural calamities, the government of Odisha initiated *Casuarina* plantations all along the coast of Odisha during the early seventies. After the super cyclone of Odisha in 2000-2001, the raising of new *Casuarina* plantations and maintenance of older ones has been taken up again through a Government of India sponsored integrated coastal shelterbelt programme. Some of the plantation sites along the coast are prime turtle nesting habitat (Fig. 7) (State of Environment Odisha 2006).

Impact of developmental activities on sea turtles and their nesting habitat

The ports' construction involves raising the level of the port site by dumping sand/silt to the required height. Then the ancillary development that will grow up around the port site may have its own impacts on the biodiversity of the area, as land use changes, pollution increases and the natural habitat is altered or destroyed. The offshore waters of Odisha are home to the breeding grounds for olive ridley turtles. The large amount of dredging of shipping channels may have impacts on the turbidity of the water and light penetration as well as on the benthic habitat and therefore potential impacts on the entire food chain, including sea turtles. This may affect the primary productivity and

may also increase Biochemical Oxygen Demand (BOD) levels in these waters. Elevated noise may well deter adults from nesting sites and foraging areas and could also lead to other modified behaviour.

Despite best efforts, all ports globally, and particularly in Indian conditions, lead to a significant increase in pollution in surrounding waters from accidental fuel oil leaks, cargo discharges, bilge cleaning and sundry other sources. A mega-port may alter this scenario radically with impacts on the ecology and the flora and fauna. Elevated noise levels and pollution described above could impact on the waters of the breeding areas for turtles. In addition, light pollution could also pose a serious threat to nesting behaviour and hatchling survival. All the existing and proposed ports are in proximity to the mass nesting sites. Though this is below the horizon, the glow from artificial lighting does extend over the horizon, as has been experienced with Paradeep port. The lighting from the port and especially from the ancillary development may pose a very significant threat to nesting and hatching.

There are already a number of fishing harbours and jetties or fish landing centres along the Odisha coast and the decision of the state government to upgrade and/or construct new fishing harbours and jetties near some of the major river mouths may spell grave danger for the survival of sea turtle populations in the coastal waters. The increased number of harbours and jetties means more mechanized fishing fleets and greater fishing activities, which might lead to increased incidental catch of turtles.

Casuarina plantations along the coast not only reduce the nesting space but also are detrimental to the nesting of sea turtles in more than one way. These plantations encroach on the nesting beaches, because once *Casuarina* grows it changes the beach topography by its root growth and deposition of litter thereby restricting the area available to sea turtles for nesting. These plantations also provide cover to animals such as jackals and hyenas which predate on sea turtle eggs.

Coastal highways may directly affect sea turtles by reducing the space available for them to nest and disturbance during egg laying activities, with round-the-clock vehicular traffic and presence of humans and feral animals on the beach.

The defence establishments and particularly the missile test programme at Chandipur-on-sea, Wheeler islands, the training centre INS-Chilika and Golabandha are located close to the mass nesting sites and the target ranges are in the offshore waters of Odisha where turtles are known to congregate for breeding. However, no information is available about the impact of these on the change in water quality and other critical parameters affecting turtles in the area. Artificial illumination is also detrimental to sea turtles because it disrupts critical behaviour, including nest site choice and the nocturnal sea-finding behaviour of both hatchlings and nesting females.

Overall thematic representations of the developmental activities are given in Fig. 2. However, all the above assessments are preliminary in nature and need an in-depth environmental study on the possible impact of developments on sea turtles and their habitats along the Odisha coast.

Acknowledgements

This report is an outcome of the short-term project financed by the British Chelonia Group. Acknowledgements are due to the following for successful implementation of the project. To the BCG for funding this project, with special thanks to Anne Rowberry, Conservation Officer, for approving the project. Our sincere thanks to the Wildlife Institute of India, especially where information has been obtained from the DGH final report. Thanks also to the Field Assistants, especially Kalia, Mahadev, Sridhara, and Sankar for their assistance throughout the field work in Odisha.

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Table 1. Sites which have been identified for development of ports.

Sl. No	Name of the Port	District	Sector	Status
1	Kirtania	Balasore	1	MoU signed between state government and Creative Port Development Company Ltd., Chennai
2	Bahabalpur	Balasore	4	State Government plans to develop this as a minor port
3	Chandipur	Balasore	4	- Do -
4	Dhamra Port	Bhadrak	5	Being developed under the Joint Venture of L&T & Tata Steel.
5	Jatadhara	Jagatsinghpur	12	MoU signed between state government and POSCO
6	Astarang	Puri	15	State Government plans to develop this as a minor port
7	Bali-Harichandi	Puri	19	- Do -
8	Palur	Ganjam	25	- Do -
9	Bahuda	Ganjam	33	- Do -
10	Chudamani	Bhadrak	-	- Do -
11	Inchuri	Balasore	-	- Do -

Source: Government of Odisha Port Policy, 2007

Table 2. Sites which have been identified for fishing harbour developments.

Sl. No	Name of the Harbour	District	Sector	Status
1	Dhamra	Bhadrak	5	To be upgraded to an integrated fishing harbour
2	Nuagarha	Puri	14	MoU signed between state government and Norway for developing it as an international fishing harbour with modern facilities
3	Chudamani	Bhadrak	-	Developing it as an integrated fishing harbour with EU norms
4	Chandnipal	Bhadrak	-	Fishing harbour with mechanized fishing capacity
5	Bahuda	Ganjam	33	MoU signed between state government and Norway/Ireland for developing it as an integrated fishing harbour

Source: Government of Odisha, Fisheries Department, 2006

Table 3. Proposed areas for tourism infrastructure development.

Sl. No	Name of the Tourism spot	District	Sector	Purpose
1	Hukitola-Batighara	Jagatsinghpur	-	Monument & recreational tourism
2	Paradeep-Sandhakuda	Jagatsinghpur	11	Beach tourism
	Pirajahania - Chandrabhaga	Puri	16	Turtle and dolphin watch
3	Toshali Sand	Puri	20	Beach tourism
4	Puri urban beach	Puri	21	Beach tourism
5	Satapada (Chilika)	Puri	-	Dolphin watch
6	Prayagi-Rushikulya	Ganjam	27	Turtle and dolphin watch
7	Gopalpur	Ganjam	32	Beach tourism

Source: Odisha Tourism Development Corporation, 2006