

Sea Turtle Nesting Habitats on the Coast of Orissa¹

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In Orissa, four species of sea turtles—olive ridley turtles, green turtles, hawksbill turtles and leatherback turtles—have been reported, though the nesting of only one species, the olive ridley (which is the most common species along the east coast of India), has been confirmed (Dash and Kar 1990). Gahirmatha, one of the major mass-nesting beaches of olive ridleys in the world, has been known to the scientific world since 1973 (Daniel and Hussain 1973, Bustard 1974, 1976, Kar 1980, Bustard and Kar 1981, Kar and Bhaskar 1982, Biswas 1982, Silas et al 1984). However, except for the Gahirmatha nesting population, very little is known of the conservation status of the olive ridley or of their nesting populations and habitats in India.

Scientific research on sea turtles started in Orissa only in the 1970s. But even this was largely confined to the rookery at Gahirmatha (Bustard 1976, Kar 1980, Kar and Bhaskar 1982, Silas et al 1983, Silas et al 1984, Kar and Dash 1984, James et al 1989, Dash and Kar 1990). In 1974–75, eggs collected from the Gahirmatha and Konarak coasts were artificially hatched for the first time (Biswas et al 1977), but little attention has been paid to other sea turtle nesting beaches along the Orissa coast. In fact, a second mass-nesting ground of the olive ridley in Orissa—Devi river mouth in Cuttack district—was discovered only in 1981 (Kar 1982), and there has been no information from this site since 1982. Kar and Bhaskar (1982) reported exploitation of sea turtle eggs from the beaches near Astaranga, Chandrabhaga and Gopalpur-on-sea in Orissa, which indicates sea turtle nesting in these areas. Biswas (1982) has mentioned sea turtle nesting at the

¹ Extracted and modified from: B Pandav, B C Choudhury and C S Kar, 'A status survey of olive ridley sea turtle (*Lepidochelys olivacea*) and its nesting habitats along the Orissa coast, India' (1994). Dehradun: Wildlife Institute of India.

southern end of the Puri beach and also on the beach near Chandrabhaga. Silas et al (1983) marked most parts of the Orissa coast as sea turtle nesting sites.

In view of the fact that there is extensive information on sea turtle nesting from only one site, i.e. Gahirmatha, virtually no information since 1982 on the second mass-nesting site at Devi, and only sketchy reports from other parts of the state, and considering the precarious conservation status of the olive ridley, the Wildlife Institute of India conducted an extensive survey along the entire Orissa coastline. The objectives of this survey were to:

- * Locate sea turtle nesting beaches and document intensity of nesting along the coast.
- * Assess biotic and abiotic factors affecting nesting beaches and survival of sea turtles.
- * Formulate a conservation action plan for sea turtles and their nesting beaches along the Orissa coast.

Study Area

COASTLINE OF ORISSA

Orissa has a coastline of 480 km, stretching from east of the Subarnarekha river mouth (near Udayapur village bordering West Bengal), to the marshes of Ichhapuram in Andhra Pradesh. The coastline traverses four districts in Orissa—Balasore (130 km), Cuttack (135 km), Puri (155 km) and Ganjam (60 km). The major rivers, including Subarnarekha, Budhabalanga, Brahmani, Baitarani, Mahanadi, Devi and Rushikulya, and several smaller rivers, such as Hansua, Kadua, Kushabhadra and Bahuda, drain into the Bay of Bengal. The Orissa coast bulges out in the central portion, from Brahmagiri on Chilika Lake to Dhamra, where the Mahanadi, Brahmani and Baitarani river systems form a combined delta; whereas between Dhamra and the Subarnarekha river mouth, the coast is concave as no major river pushes the shoreline into the Bay of Bengal. The Rushikulya River in southern Ganjam district, and Budhabalanga and Subarnarekha rivers in northern Balasore district have very little or no delta formation.

The State Gazetteer (1990) classifies the Orissa coast as a prograded or built-up coast. The sand spits at the mouth of Chilika Lake, the Devi River and on the left bank of the Mahanadi river mouth are the best examples of this type of formation. At the Mahanadi river mouth, a complex spit with a number of hooks is formed due to offshore long currents, and the strong southwest current during the monsoon, when the load discharge of the Mahanadi is at its peak.

The characteristics of the Orissa coastline also explain the general absence of bays and inlets here. The lone Hukitola Bay off Jambu has been formed as a result of the huge complex spit to the north of the Mahanadi estuary. There are only three islands along the Orissa coast—Coconut Wheeler Island, Outer Wheeler Island and Long Wheeler Island, which lie off the Dhamra and Maipura river mouths. These are depositional islands, located only a few hundred metres inside the Bay of Bengal.

To cover the entire Orissa coast systematically, the study area was divided into eight sectors on the basis of major geological features such as river mouths, sand spits, bays and other coastal landmarks (Figure 1). A detailed description of the coast is provided in the results.

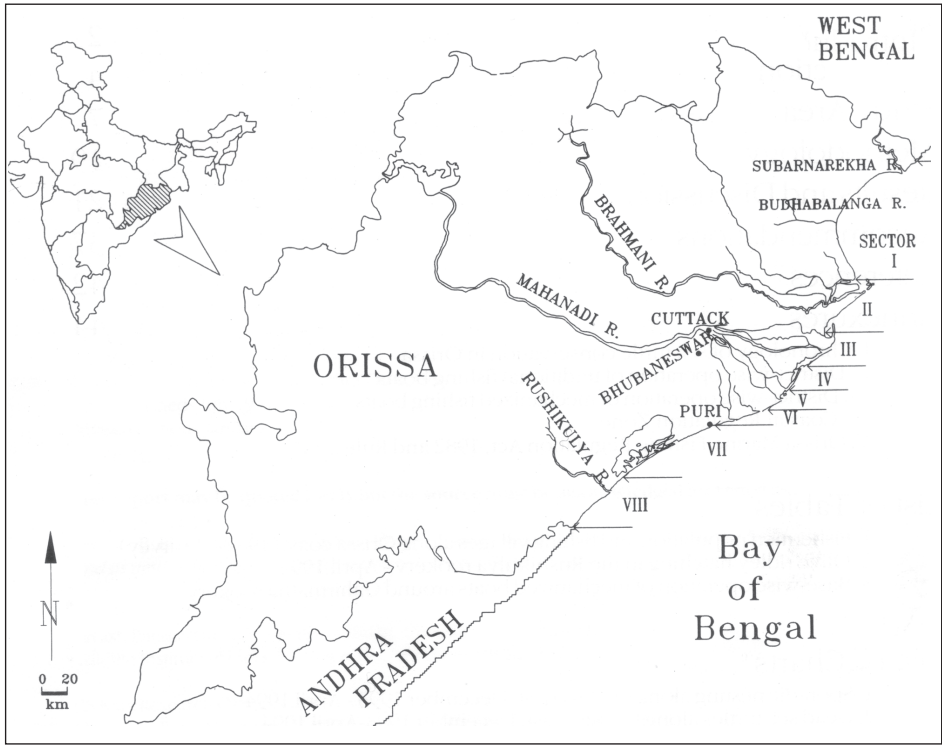


Figure 1. Orissa coast and study sectors along the coastline.

COASTAL VEGETATION

The most prominent natural beach vegetation found all along the Orissa coast are psammophytes or sand binders, such as *Ipomea pescaprae*, *Launea sarmentosa*, *Gisekia pharnacoides* and *Spinifex littoreus*. The coast of Orissa also harbours several patches of mangroves—on the Mahanadi estuary, the Brahmani–Baitarani confluence, Devi estuary, and at the mouths of the rivers Dhamra, Budhabalanga and Subarnarekha. The mangroves of the Mahanadi and Brahmani–Baitarani deltas have been described in detail by Banerjee and Rao (1990). Mangroves on the Devi estuary, despite conducive conditions for their growth, are degraded (Patnaik et al 1990). *Avicennia officinalis*, *Sonneratia apetala*, *Excoecaria agallocha* also occur, in stunted formation, along with few other species, such as *Acanthus ilicifolius* and *Achrostichum aureum*. The long stretches of mudflats off the Balasore coast, north of Dhamra, are covered by *Avicennia maina*, *A. alba*, *Suaeda maritima* and *Sesuvium protulacastrum*. Remnants of mangroves can be seen in the Budhabalanga river mouth in Balasore district. Patches of *S. apetala* and bushes of *A. ilicifolius* occur on a small island near the Balaramgudi fishing harbour at Budhabalanga mouth. A recently formed small delta in the Subarnarekha river mouth is being colonised by *A. officinalis*. However, the most conspicuous feature of the coastal vegetation are *Casuarina* plantations all along the Orissa coast. These were planted in the 1970s to prevent beach erosion and to act as a barrier against cyclonic storms. Cashew (*Anacardium occidentale*) has been planted extensively behind the *Casuarina* belt, particularly in Puri and Ganjam districts.

MARINE FISHING AND FISHER FOLK

Orissa has a long coastline, yet marine fishing activity here is dominated by migrating fisher folk from West Bengal (from the West Bengal–Orissa border to Dhamra) and Andhra Pradesh (from Puri to the Orissa–Andhra Pradesh border), and the contribution of Oriya fishers is less. There are 329 marine fishing villages in Orissa comprising 20,815 households and a population of 126,000 (Table 1). However, only about 40 per cent of this population is actually engaged in fishing. The maximum fishing by local communities is in Balasore district—241 villages and 58 per cent of fisher families, and 23 of the 62 fish-landing centres in the state occur in this district alone. Puri has the least number of fishing villages (24) while Cuttack has the least fisher families (95) (Puri has 15 per cent and Ganjam 18 per cent). Balasore also leads (48 per cent) in the number of mechanised boats in the state, followed by Cuttack (36 per cent) (see Appendix 1). Cuttack is ahead (29 per cent) in terms of the number of traditional boat-craft being used, followed by Ganjam (26 per cent), Puri (25 per cent) and Balasore (20 per cent). Of the traditional non-mechanised boat-craft, *catamarans* constitute 51 per cent while *dingis* constitute 32 per cent of the total (see Appendix 2).

Table 1. Population of fisher folk and fishing villages along the Orissa coast (based on the 1982–83 survey).

| Item | Cuttack | Puri | Ganjam | Balasore | Total |
|---|---------|--------|--------|----------|---------|
| Number of: | | | | | |
| 1 Villages | 36 | 24 | 26 | 241 | 329 |
| 2 Landing centres | 11 | 14 | 14 | 23 | 62 |
| 3 Fisher folk: families | 1,759 | 3,098 | 3,854 | 12,104 | 20,815 |
| 4 Fisher folk: population | 10,908 | 19,316 | 18,368 | 77,543 | 126,135 |
| 5 Fisher folk engaged in actual fishing | | | | | |
| i) Full time | 2,032 | 4,252 | 4,453 | 33,981 | 44,709 |
| ii) Part time | 551 | 543 | 133 | 2,833 | 4,060 |
| iii) Occasional | 253 | 169 | 240 | 776 | 1,438 |
| iv) Total | 2,827 | 4,964 | 4,826 | 37,590 | 50,207 |
| 6 Fishing gear | 3,767 | 12,220 | 6,566 | 11,383 | 33,936 |

(Source: Directorate of Fisheries, Govt. of Orissa.)

Methodology

The survey was broadly divided into two stages. In the first stage, information available on the Orissa coast and sea turtle nesting was gathered from secondary sources and published and unpublished literature. In the second stage, data was collected through field-based surveys and observations. The field surveys were carried out in three phases—pre-nesting, nesting and post-nesting. The pre-nesting survey was conducted from December 1993 to January 1994, prior to the mass nesting of sea turtles at Gahirmatha, during which the entire Orissa coastline was covered on foot. A total of 62 coastal fishing villages, including fisher camps, and nine fish-landing centres in different stretches along the Orissa coast were visited. People were interviewed for information on sea



turtle nesting. Forest officials of coastal forest divisions and officials of the fisheries department were also interviewed about sea turtle nesting in coastal areas under their jurisdiction. Turtle tracks and dead and stranded sea turtles on the beaches were taken into account to determine their presence in different areas along the Orissa coast. Data was also collected on carapace length and width, plastron length and width, sex of dead turtles and their probable cause of death.

Based on the information collected, eight sites were selected for intensive monitoring during the next phase of the survey and local resource persons (LRPs) were identified for each area:

1. Gahirmatha,
2. Sand spit on the left bank of the Mahanadi River,
3. Sand spit on the southern bank of the Devi river mouth,
4. Akashdia Island near the Devi river mouth,
5. The coastline from Puri to the mouth of Chilika Lake,
6. Beach near Malud and Siandi villages on the Chilika coast,
7. Rushikulya river mouth,
8. Sand spit near the mouth of the Bahuda River.

The nesting survey was carried out in February–April 1994. The entire coast of Orissa was covered three times on bicycle, stopping every 500 m to scan the beach using binoculars. Probable nesting sites such as sand spits on river mouths and the selected nesting localities were visited frequently.

As it was not possible to be present at all locations at the time of nesting, we also relied on indirect nesting evidence such as nesting crawls, nest pits and predated nests and on information provided by LRPs to determine the nesting intensity in the respective localities. In general, false crawls were not counted, although there may have been some error in identification of crawls as successful nesting crawls. In areas where nesting was heavy, the total number of nesting turtles was determined by counting nests in random plots (20 x 20 m), and extrapolating the figure to the rest of beach.

Beach erosion, developmental activities near nesting beaches and intensity of fishing in the nearby coastal waters were also documented during the surveys to determine the effects of biotic and abiotic pressures on the nesting beaches.

Results

Only olive ridleys were recorded nesting during the survey. Of the various olive ridley nesting areas in Orissa, the Gahirmatha, Devi, Chilika and Ganjam coasts (covering 195 km) had significant nesting intensity; south of Gahirmatha, the nesting was of varying intensity. However, there is a distinct seasonal pattern in nesting, and Gahirmatha is a good indicator for nesting all along the Orissa coastline. Prior to nesting at Gahirmatha, only 12 olive ridley nests were counted in other parts of the Orissa coast; nesting intensity remained low till the first fortnight of February. Nesting at Gahirmatha began in early February and towards the latter part of the month, the intensity increased in other areas as well, reaching its peak in March. Detailed observations in each sector are provided in this section.

BALASORE COAST

The Balasore coast (130 km), from Udayapur village bordering West Bengal to the Dhamra river mouth, is interrupted by the Subarnarekha, Budhabalanga and Kashaphala river mouths (Figure 2). There are long stretches of inter-tidal zones: at Chandipur, near the Budhabalanga river mouth, it is 3–4 km, and about one km near the Subarnarekha mouth. The coast is shallow and generally muddy. There are mangroves near the Dhamra, Budhabalanga and Subarnarekha river mouths.

There was no evidence of sea turtle nesting on the Balasore coast. The substrate of the beach is unsuitable for sea turtles to nest. The sea is very shallow, and during low tide, a vast stretch of the seabed becomes exposed. The mud and sand mix of the beach makes it hard after exposure, which deters the turtles from using it as a nesting beach. Biswas (1982) did not find any evidence of sea turtle nesting along the Balasore coast. Interviews with local fisher folk and villagers also did not reveal any turtle nesting in this sector. However, some elders in the Sunamuhin village near the Subarnarekha river mouth did recollect turtles nesting near this river mouth until five decades ago but not any more. According to them, 50–60 years ago, the extent of the inter-tidal zone near the Subarnarekha river mouth was much less than it is today and the sea was deeper near the shore.

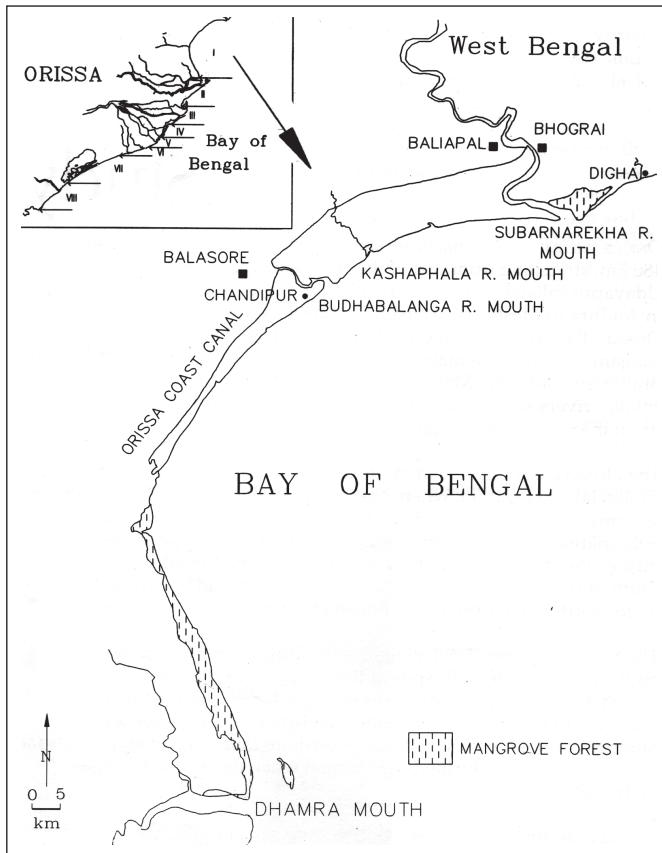


Figure 2. The Balasore coast.



GAHIRMATHA COAST

The Gahirmatha coast (35 km) extends from the Dhamra river mouth to Barunei, the mouth of River Hansua, and forms the eastern boundary of Bhitarkanika wildlife sanctuary (Figure 3). The coast is interrupted at two places, by the rivers Maipura and Baunsagada. At the mouth of River Maipura, there is a four-km-long sand spit. Between Ekakulanasi forest rest house and Barunei, there is an extensive *Casuarina* belt, planted in the early 1970s. Behind this, from the Maipura river mouth to the Baunsagada river mouth, there is extensive mangrove forest. The three offshore islands along the Orissa coast are located in this sector.

Mass nesting of olive ridley turtles at Gahirmatha used to take place along a 15-km stretch, from Habalikhathi to Ekakulanasi. But in a cyclonic storm in 1989, the beach was fragmented into two, and mass nesting has since been restricted to a four-km-long beach which has been renamed Ekakulanasi. Two arribadas occurred, one in February and one in March (about 40 days after the first arribada), both with over 100,000 turtles.

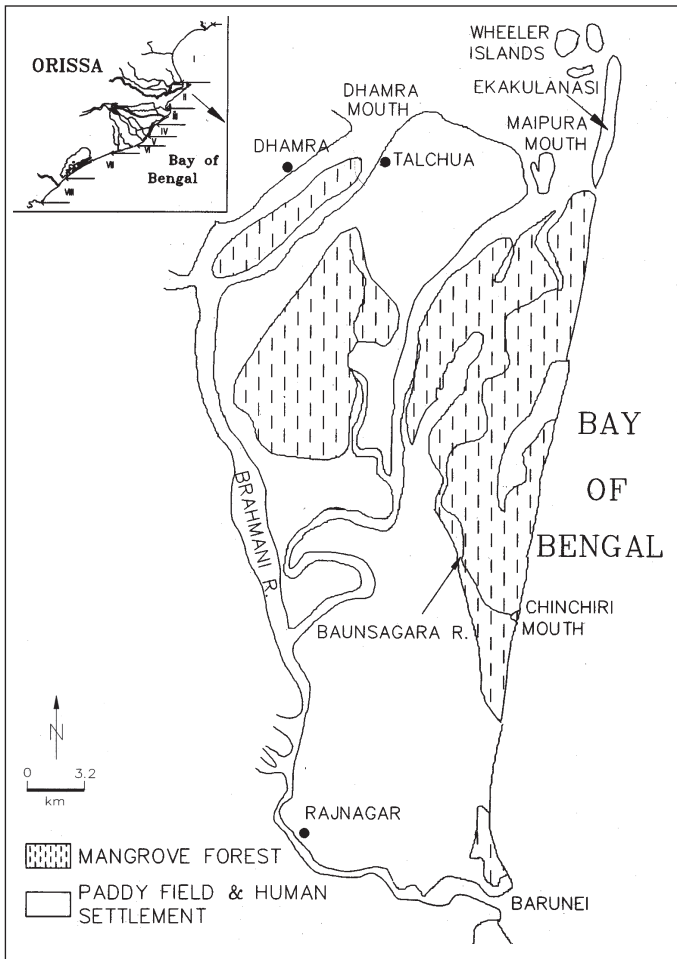


Figure 3. The Gahirmatha coast.

PARADEEP COAST

The Paradeep coast (55 km) stretches from Barunei to the mouth of the River Jatadhara (Figure 4). Near Paradeep, the only natural harbour along the Orissa coast, the Mahanadi River enters the Bay of Bengal, forming complex sand spits, e.g. Hukitola and Hetamundia. The Mahanadi delta once had extensive mangrove forests but these are now rapidly depleted because of encroachments resulting from aquaculture and agriculture. The coastline here has extensive *Casuarina* plantations.

Sporadic nesting of olive ridleys was recorded along this coast during January–February 1994. Maximum nesting was on Hukitola Island where about 100 nests were counted after the first mass-nesting at Gahirmatha in February 1994. However, all the nests were later predated by jackals and hyenas.

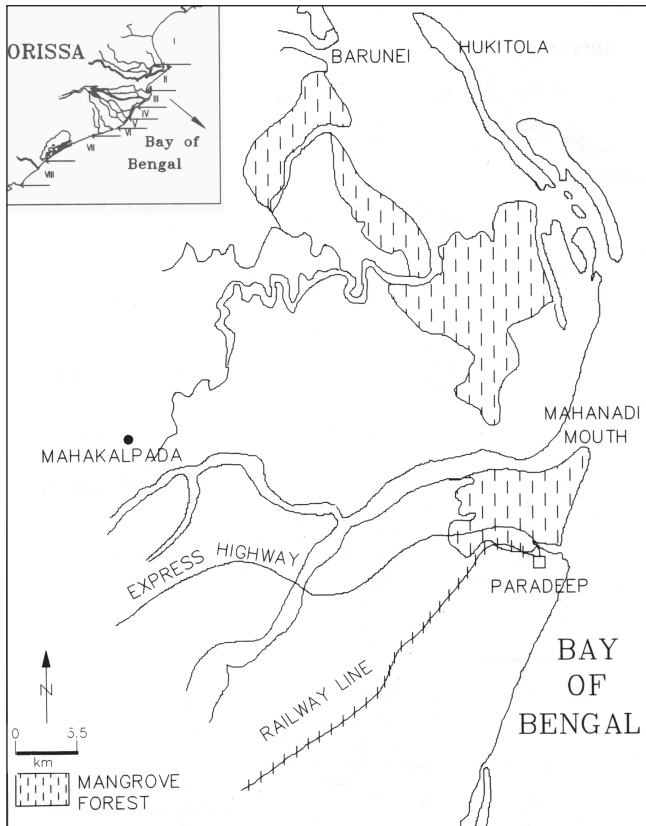


Figure 4. The Paradeep coast.

KUJANG COAST

The Kujang coast (30 km) stretches from the Jatadhara river mouth to the Banihara river mouth (also known as Petaphutei river mouth) (Figure 5). The beach here is flat and scattered with sand dunes, backed by *Casuarina* plantations, with *Pandanus* bushes forming the background at some places. The backwaters of the rivers Jatadhara and Banihara run parallel to the beach.



The Kujang coast appears to be quite suitable for sea turtles to nest, although only about 200 turtles nested during the season. During the survey of 17–19 February 1994, 14 predated nests were counted along this coast. Nesting intensity increased after March, and during a later survey on 20 March 1994, 132 predated nests were counted along the stretch between Paradeep and the Petaphutei river mouth.

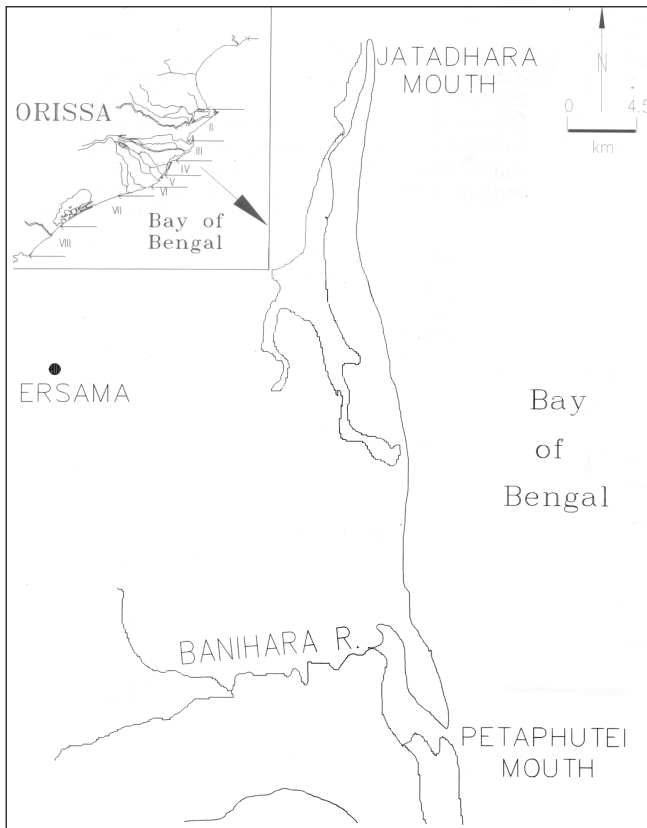


Figure 5. The Kujang coast.

DEVI COAST

The Devi coast (30 km) extends from the Banihara river mouth to the Kaduta river mouth and is interrupted by the Devi river mouth, with Akashdia Island at its estuary, isolated from the mainland by the backwaters of the Devi river (Figure 6). The sand spit on the southern side of the Devi river mouth extends up to three km, with an average width of 300 m, and has scattered sand dunes 2–3 m in height. Beach vegetation includes *Ipomea pescaprae* and *Spinifex littoreus*, backed by *Casuarina*.

The sea turtle mass-nesting site on Akashdia Island at Devi river mouth was discovered in 1981, when an estimated 100,000 olive ridleys nested in a stretch of four km (Kar 1982). However, after the 1981 nesting season, the Devi rookery was not monitored. During the current survey, olive ridley nesting was recorded throughout the Devi coast. There are two important nesting beaches along this coast—Akashdia Island and the sand spit on the southern side of the Devi river mouth, locally known as Sahana Nasi.

Akashdia Island

The present survey confirms the continuance of olive ridley mass-nesting on Akashdia Island. The four-km-long island, between the Devi river mouth and the Petaphutei river mouth, is formed as a barrier island by a secondary branch of the Devi River which runs northwards, parallel to the coast and along the entire length of the island, before meeting the sea. The mass nesting of olive ridleys took place here during the first and second weeks of March 1994, in a stretch of three km, involving ~15,000–20,000 sea turtles. During the survey, turtle eggshells were seen scattered on the beach, predated by jackals and feral dogs which swim across the backwater from nearby villages. Many clutches of turtle eggs were also exposed due to beach erosion.

In the last decade, drastic changes have occurred on Akashdia and its surroundings, and much of the nesting habitat has been lost due to extensive *Casuarina* plantations. Plantation work is still continuing and at some places recently planted *Casuarina* was seen near the high tide line. Predated nests could be seen within the 1–2 year old plantations, and driftwood, mostly dug-out roots of *Casuarina*, lay strewn over parts of the beach. Large-scale mechanised fishing was also recorded at the Devi river mouth and adjacent coastal waters. The establishment of a new fishing harbour at Nuagada, barely one km from the nesting beach, will affect the turtles as intensity of mechanised fishing is bound to increase.

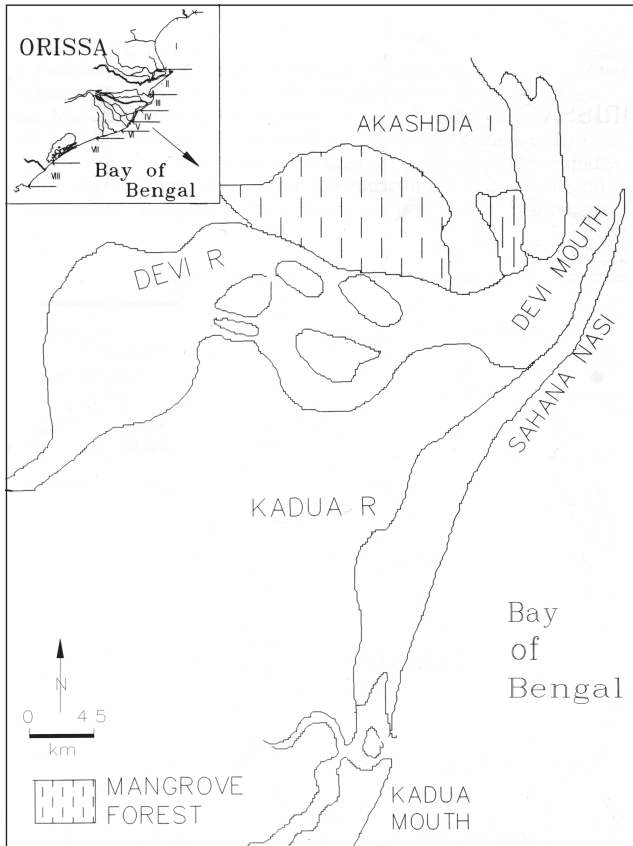


Figure 6. The Devi coast.



Sahana Nasi

The three-km-long sand spit on the southern side of the Devi river mouth, contiguous with the main beach and completely devoid of *Casuarina*, provides an ideal site for sea turtle nesting. The width of the sand spit is 300–400 m. The intensity of nesting increased in March, and 135 predated nests were counted on the sand spit on 24 March 1994.

On the Devi coast beyond Sahana Nasi and up to the Kadua river mouth, nesting was sporadic. During surveys, 44 and 130 predated nests were counted along this stretch on 19 February 1994 and 24 March 1994, respectively. On the basis of fresh nesting crawls, an estimated 500 turtles nest along this stretch. According to the villagers from Sahana, nesting used to be fairly high on Akashdia Island and Sahana Nasi until about 4–5 years ago and has considerably reduced since.

PURI COAST

The Puri coast (55 km), extending from the Kadua river mouth to Puri city, is interrupted by the Kushabhadra and Nuanai rivers (Figure 7). The beach between Kadua and Chandrabhaga is backed by 10–15-m high sand dunes on which *Casuarina* has been planted. South of Chandrabhaga, the Puri–Konark marine drive runs parallel to the coast (150 m from the high tide line) for a distance of seven km. Two of the largest fishing settlements along the Orissa coast are located in this sector, at Chandrabhaga and Puri.

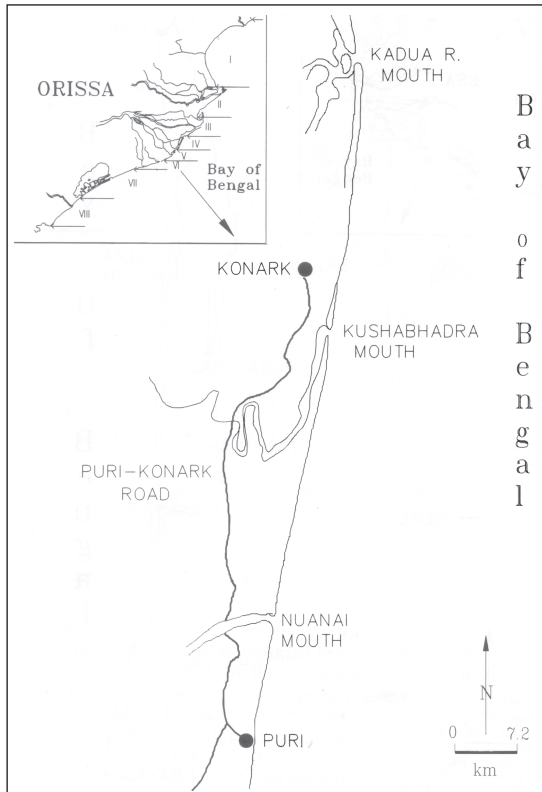


Figure 7. The Puri coast.

Turtle nesting was recorded on the sand spit near the river mouths of Kadua and Kushabhadra. On the sand spit along the southern side of the Kadua river mouth, 18 predated nests were counted. The coastline between here and Chandrabhaga (15 km) is backed by 10–12-m high sand dunes, with the high tide line touching their base at most places. Hence, this stretch does not provide an ideal site for sea turtles to nest. Olive ridley nesting was also recorded on sand spits near the Kushabhadra river mouth, where a villager from a nearby area provided information on the collection of sea turtle eggs near the Ramachandi temple in November 1993. In all, 42 predated nests were counted along the Puri coast during the nesting survey of 25–27 March 1994.

CHILIKA COAST

The Chilika coast (70 km) extends from Puri city to Prayagi village (Figure 8). It is interrupted by the mouth of the Chilika Lake, with five-km-long sand spits on both sides. A narrow strip of coastline, 50–200 metres wide, stretches about 40 km south of the Chilika mouth, separating the lake from the Bay of Bengal. Sand dunes, 5–6-m high, covered with psammophytes, are present.

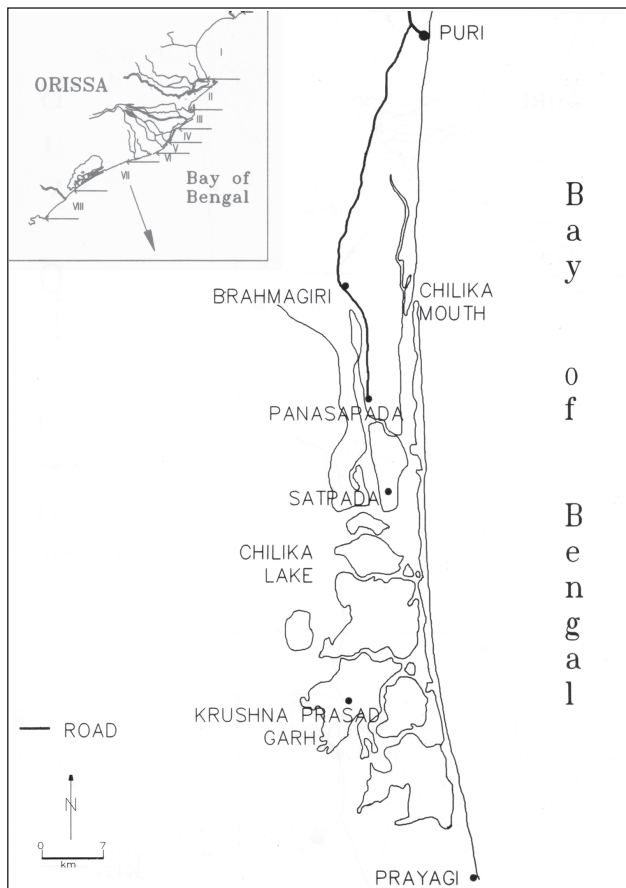


Figure 8. The Chilika coast.



Olive ridley nesting was observed throughout the Chilika coast. During the pre-nesting survey of 18–20 January 1994, four predated nests were observed on the sand spit near the Chilika mouth and Berhampura forest rest house. Peak nesting on this coast was recorded in March, when during the survey of 17–20 March 1994, 647 olive ridley nests were counted. The nesting concentration was high along the 14-km stretch from Puri to the Chilika mouth, where 274 olive ridley nests were counted, of which 269 nests were predated (of these 45 were excavated by human beings). Depredation by humans was more common near the Puri township and on the sand spit near the Chilika mouth, where the temporary fishing settlements of Moto and Arakhkuda are situated.

In the 56-km stretch from the Chilika mouth to Prayagi village, 373 nests were counted near Berhampura, Siandi, Malud and Ramlanka villages. Nesting concentration was considerably higher between Ramlanka and Prayagi villages where 52 predated turtle nests were counted in a stretch of three km. The overall estimate of olive ridley nests, based on fresh nesting crawls, is 1,000 nests per season.

GANJAM COAST

The Ganjam coast (60 km) extends south of Prayagi village to Patsonapur village bordering Andhra Pradesh (Figure 9). It is interrupted by the rivers Rushikulya and Bahuda, besides two other rivulets, one near Gopalpur town and another near Markandi village. Over two-km-long sand spits occur on both sides of the Rushikulya and Bahuda river mouths. The *Casuarina* along this coast is stunted due to heavy extraction for fuelwood and other purposes. The coast near Gopalpur is being developed as a minor port, and near Chatrapur town, Indian Rare Earths Ltd. mines the beach for sand.

One of the most significant achievements of this survey was the discovery of a new sea turtle rookery along the Ganjam coast which has turned out to be the most important nesting ground of olive ridleys in Orissa after Gahirmatha. According to local villagers, a large number of turtles nest here every year. The rookery is located on the Rushikulya river mouth—only one km east of Chennai–Kolkata National Highway No. 5 and the South Eastern Railway line near Ganjam town, 12 km north of Gopalpur seaport and 300 km south of the Gahirmatha mass-nesting beach. At present, this rookery does not come under the jurisdiction of any protected area.

The Rushikulya rookery extends over six km, from the village Puruna Bandha (one km north of the Rushikulya river mouth) to Kantiagada village. The beach is more or less flat with scattered sand dunes, 1–2-m high. The average beach width is 80 m above the high tide line, though at some places, the extent of beach is more than 100 m. There is scanty growth of *Ipomea pescaprae* on the nesting beach. A conspicuous feature of the nesting beach is the absence of *Casuarina* plantations, otherwise found throughout the Orissa coast. The backwaters of the River Rushikulya, fringed by cashew and coconut, extend four km northwards along the nesting beach. The Palur canal which joins Chilika Lake with the Rushikulya River, runs parallel to the nesting beach for eight km.

Mass nesting occurred at Rushikulya during March 1994, when over 100,000 turtles may have nested. Sporadic nesting of olive ridleys was also recorded south of the Rushikulya rookery up to the mouth of river Bahuda. 180 nests were counted along

this 47-km stretch; all were predated however. At Rushikulya, the hatchlings emerged from 21–24 April 1994. Hatching success was 67.4 per cent ($n=10$ nests). On the nesting beach, an average of 24 per cent of all nests were found to be predated by mammalian beach predators, mainly feral dogs and jackals. There are two permanent fishing settlements on the nesting beach—Gokharkuda and Kantiagada. The fishermen of these villages use the beach for unloading their fish catch, but they were also observed collecting sea turtle eggs during the nesting season. An estimated 200 nests were excavated by local villagers. However, these people collect eggs for personal consumption and not for commercial gain.

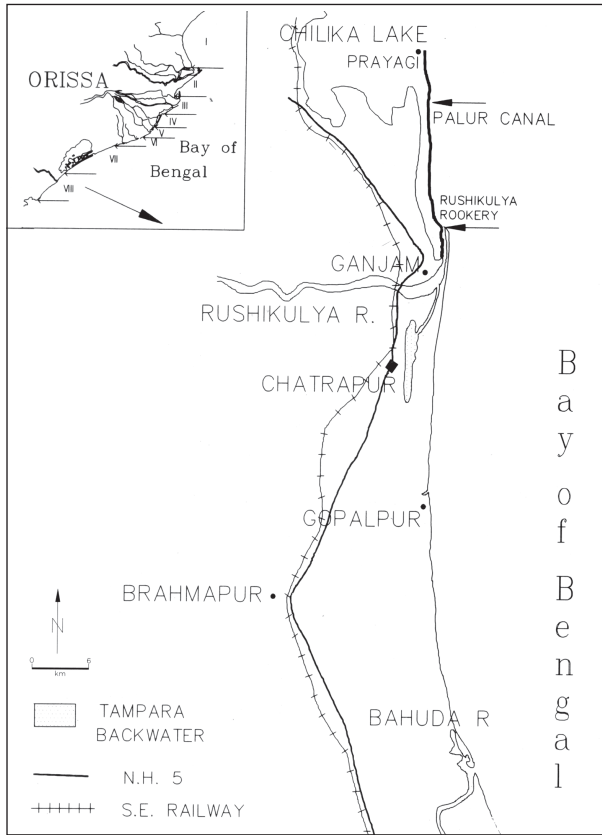


Figure 9. The Ganjam coast.

Sea turtle mortality along the Orissa coast

During this survey, 5,282 dead olive ridleys of both sexes were counted along the Orissa coast: 1,436 (27.2 per cent) were male and 3,846 (72.4 per cent) female. The largest number of dead turtles were counted on the Gahirmatha coast (2,153), followed by Paradeep (1,072) and Kujang (1,071). Turtles get entangled in the fishing gear of mechanised vessels, particularly in nets which are 2–3 km long. Once entangled, the turtles either die due to suffocation or are beaten to death by the boatmen so as to free the nets; this is clear from the injuries on the heads and carapaces of the dead turtles.

Fishing trawlers from Paradeep, Jambu, Kharnasi, Tantiapala, Dhamra and Chandipur bases operate along the Gahirmatha, Paradeep and Kujang coasts and account for the turtle mortality. Turtle mortality is low along the Balasore coast though the number of mechanised boats is highest, perhaps due to the absence of sea turtles in the coastal waters. In the Ganjam sector, dead olive ridleys were observed from the Devi river mouth to the mouth of River Rushikulya, but not a single dead turtle was found between Gopalpur-on-sea and Patasonapur village bordering Andhra Pradesh.

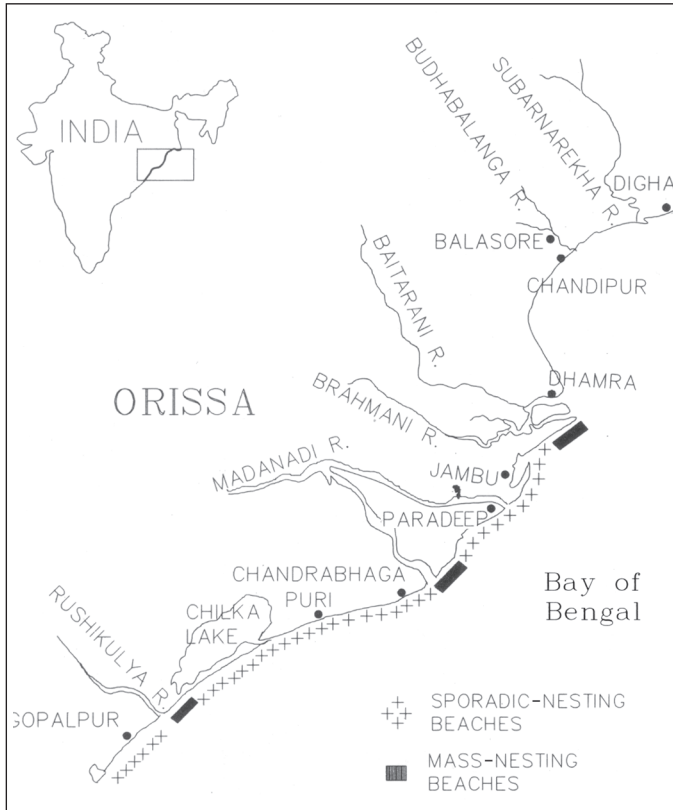


Figure 10. Mass-nesting and sporadic-nesting beaches along the Orissa coast.

Threats

The threats to sea turtle populations along the Orissa coast are based on mortality of adult turtles and depredation of their eggs or danger to their nesting habitats. These may be natural or human-induced, either through direct human intervention or due to development activities.

BEACH EROSION

Southwest winds prior to the peak hatching period in Gahirmatha start the process of beach erosion which results in considerable destruction of the eggs. Such egg destruction was observed at the Devi and Rushikulya rookeries in March–April 1994.

NON-HUMAN PREDATION

After the 1989 cyclone, the Gahirmatha beach broke into two parts, and mass nesting has since occurred on one of the fragments, renamed Ekakulanasi. Being an island, the nesting beach is absolutely free of mammalian predators such as wild pigs, jackals, hyenas and feral dogs. But since the new nesting beach is only about a quarter of the size of the original beach, Ekakulanasi rookery suffers from overcrowding, and consequently, a large number of eggs laid in the earlier arribada get destroyed or exposed by subsequently nesting females. The exposed eggs on the beach are later consumed by avian predators during the day.

Almost all sporadic nests of olive ridleys in other parts of the Orissa coast were predated by feral dogs, jackals and hyenas. Heavy predation by jackals and feral dogs has been observed in the Devi and Rushikulya rookeries as well.

EXPLOITATION FOR MEAT AND EGGS

There are no official turtle-landing centres in Orissa. The local fishing communities do not generally eat turtle meat and eggs due to religious taboos. There is no local market for turtle meat and often the turtles that are caught in fishing nets are released. Also, the fisher folk are aware of the ban on catching sea turtles. But some fishing communities, and people in other parts of Orissa, do eat turtle meat and eggs. There was information on turtle meat being sold at Balasore for Rs. 20/kg in January 1994, and live turtles were seen captured by the fisher folk of Moto village (for consumption at a later date); the turtles' flippers were tied with ropes and they were kept in the backwaters of River Harchandi, near the Chilika mouth. Carapaces of nine adult olive ridleys were also seen in the backyards of these fisher folk.

During the current survey, no coast guard vessels were seen patrolling the coastline during the entire turtle nesting season. Poaching was observed; seven to nine fishing trawlers were seen catching turtles during the first mass nesting at Gahirmatha. Some of the turtles which managed to escape the poachers were seen nesting at the rookery with nylon ropes tied to their flippers. The poaching continued for five nights. According to pilgrims from Satbhaya, Talchua and Rangani villages, who had attended the Gangasagar *mela* (fair) in 24 Pargana district (West Bengal) in February–March 1994, sea turtle meat was being sold at the *mela*, perhaps taken by boat from Gahirmatha. This, however, needs to be verified.

CASUARINA PLANTATIONS

Cyclonic storms are an annual occurrence on the Orissa coast, causing considerable damage to life and property. Since the 1970s, *Casuarina* has been planted extensively on the beach front to act as a barrier and shelter belt from cyclones. 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. This adversely affects both sea turtle nesting and hatching. Although much of the nesting habitat at the Devi river mouth is now lost due to such plantations, sea turtles were observed nesting among recently planted *Casuarina* at the Devi river mouth and also near the Chilika mouth. These plantations also provide cover to animals such as jackals and hyenas which predate on sea turtle eggs.



INCIDENTAL CATCH

Mechanised fishing boats invariably cause high turtle mortality. A large number of such boats ply from Jambu, Kharnasi, Talchua and Dhamra fishing bases and operate mainly in the coastal waters of Gahirmatha and adjacent areas (Table 2). In the 1993–94 nesting season, 4,856 adult turtles were found dead along the Gahirmatha, Paradeep and Kujang coasts. About 1,000–1,500 turtle carcasses are found annually in Gahirmatha and the offshore islands in the Mahanadi delta (Dash and Kar 1990).

Table 2. Base-wise operation of mechanised boats around Gahirmatha rookery.

| | TYPE OF BOAT | | | Total |
|-------------|----------------|-------------|------------------------|------------|
| | Wooden trawler | Gill netter | Motorised country boat | |
| Dhamra | 61 | 68 | 82 | 211 |
| Chandanipal | – | – | 71 | 71 |
| Talchua | 10 | 30 | 50 | 90 |
| Barunei | – | – | 10 | 10 |
| Kharnasi | – | – | 185 | 185 |
| Jambu | – | – | 55 | 55 |
| Tantiapala | – | – | 30 | 30 |
| | | | Grand Total | 652 |

(Source: Directorate of Fisheries, Govt. of Orissa)

CONSTRUCTION OF FISHING JETTIES

There are already a number of fishing jetties or fish-landing centres along the Orissa coast and the recent decision of the state government to construct more fishing jetties near some of the major river mouths (particularly close to sea turtle nesting sites), spells grave danger for the survival of sea turtle populations in the coastal waters of Orissa. The fishing jetties near sea turtle nesting beaches have a serious adverse impact on sea turtles and their nesting habitats. The increase in jetties means that the number of mechanised craft and fishing trawlers is bound to increase. Greater fishing activity in the coastal waters would deter sea turtles from nesting, and more mechanised boat craft would lead to increased incidental catch.

Among the new fishing jetties, the one at Talchua close to the Gahirmatha rookery is a particularly serious cause for concern. The Orissa government also intends to construct fish-landing centres at Tantiapala, Jambu and Kharnasi, all of which are located in the Mahanadi delta. They are outside the Bhitarkanika wildlife sanctuary but well within the Coastal Regulation Zone. Tantiapala, in fact, is in a reserve forest area. Fishing boats operating from these centres will affect the sea turtles that nest at Gahirmatha. In February 1994, the Governor of Orissa inaugurated a fishing harbour at Nuagada, only 1.5 km from the Devi river mouth. This has led to a large number of mechanised vessels operating in the coastal waters off the Devi river mouth. The adverse effect of this is already reflected in the high mortality of olive ridleys along the Kujang and Devi coasts. At the recently discovered Rushikulya rookery too, construction work on two small fish-landing centres is in progress—one right on the Rushikulya river mouth near

Purunabandha village and the other near Palur village, barely one km from the rookery. The number of mechanised boats plying along this coast is currently low, but once these landing centres are established, the number of such boats will increase and adversely affect the nesting of sea turtles at Rushikulya.

MISSILE TEST RANGE

The missile test programme of the Defence Research Development Organisation (DRDO) is based at Chandipur-on-sea. Shorts and Wheeler islands, which are the target ranges under this programme, are barely 100–500 m from the Ekakulanasi rookery at Gahirmatha.

Conclusion

There are three mass-nesting beaches along the coast of Orissa—Gahirmatha, Devi river mouth and Rushikulya (Figure 10). Sporadic nesting occurs along the rest of the coast. The major threats to the population are fishery-related mortality and depredation of eggs by natural and feral predators. Nesting beaches are threatened by various developmental activities, including aquaculture. *Casuarina* plantations have adversely affected nesting beaches along the entire coast. Artificial illumination along the coast is also detrimental to turtles and hatchlings.

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Appendix 1

District-wise operation of mechanised fishing boats. (Source: Directorate of Fisheries, Orissa Govt.)

| Type | NAME OF DISTRICT | | | | Total |
|-------------------------|------------------|--------------|-------------------|----------------------|--------------|
| | Balasure* | Cuttack** | Puri ⁺ | Ganjam ⁺⁺ | |
| Wooden trawler | 125 | 273 | 60 | – | 458 |
| Gill netter | 601 | 32 | Nil | – | 633 |
| Motorised country craft | 718 | 752 | 315 | 57 | 1,842 |
| Motorised catamaran | – | 20 | 25 | – | 45 |
| Total | 1,444 | 1,077 | 400 | 57 | 2,978 |

* Sector I **Sectors II, III, IV ⁺Sectors V, VI, VII ⁺⁺ Sector VIII

Appendix 2

District-wise operation of traditional fishing boats. (Source: Directorate of Fisheries, Orissa Govt.)

| Type of craft | NAME OF DISTRICT | | | | Total |
|---------------|------------------|--------------|-------------------|----------------------|--------------|
| | Balasure* | Cuttack** | Puri ⁺ | Ganjam ⁺⁺ | |
| Catamaran | – | 520 | 2,096 | 3,071 | 6,497 |
| Barboat | – | 25 | 70 | 264 | 359 |
| Nava | – | 315 | 195 | 50 | 560 |
| Salti | 280 | 147 | – | – | 427 |
| Dingi | 1,466 | 2,710 | – | – | 4,176 |
| Patia | 516 | – | – | – | 516 |
| Chaot | 275 | – | – | – | 275 |
| Total | 2537 | 3,717 | 3,171 | 3,385 | 2,810 |