

Sea turtles and their Nesting Habitats along the Andhra Pradesh Coast¹

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Five species of sea turtles—leatherback turtles, hawksbill turtles, loggerhead turtles, green turtles and olive ridley turtles—have been reported from Andhra Pradesh on the east coast of India (Dutt 1976, 1979, Biswas 1982, Kar and Bhaskar 1982), but only olive ridleys have been reported to nest in this state (Kar 1983, Subba Rao et al 1987).

The southern-most mass-nesting rookery in Orissa is only 50 km from the Orissa–Andhra Pradesh (AP) border and the AP coast may be an important nesting habitat for olive ridleys. Olive ridleys are known to nest on the northern AP coast (Raja Sekhar and Subba Rao 1993, Priyadarshini 1998) and large numbers have been reported to travel through the offshore waters of Tamil Nadu and Andhra Pradesh when travelling to and from the mass-nesting beaches of Orissa (Kar 1983, Raja Sekhar and Subba Rao 1993). However, there is little information on the distribution and density of offshore aggregations or nesting along the coast. Meanwhile, there has been growing concern that significant mortality of turtles might occur in breeding migrations due to a rapid increase in the intensity of mechanised fishing along the AP coast. While fishery-related mortality of sea turtles has been reported earlier from the AP coast (Rao 1984, Subba Rao et al 1987, Raja Sekhar and Subba Rao 1993, Priyadarshini 1998), there have been no systematic surveys along this entire coast. In this context, an extensive survey of the Andhra Pradesh coast was conducted. The objectives of this study were:

- * To identify major nesting sites of sea turtles and to quantify nesting densities along the AP coast.
- * To document incidental catch and other causes of mortality along the AP coast.

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- * To formulate a conservation action plan for sea turtles along the AP coast.
- * To create a network of non government organisations to collect information on nesting and mortality and carrying out education and awareness programmes on sea turtle conservation along this coast.

Study Area

Andhra Pradesh is one of the largest maritime states in India (13°34'–19°06' N and 80°16'–84°47' E). The 980-km coastline extends from the Bahuda river mouth near Orissa in the north, to Pulicat, a large brackish-water lagoon, in the south. The northern AP coast is rocky with sandy beaches in between, central AP coast has river deltas and mangrove swamps, while the southern AP coast is largely sandy.

The natural beach flora along the Andhra coast comprises mostly psammophytes, particularly *Ipomea pescaprae*, *Spinifex littoreus* and *Launea sarmentosa*, which spread over the sand dunes and the beach platform. The AP coast also has patches of mangroves in the Godavari and Krishna deltaic systems. Degraded mangroves also occur at a few other sites. However the most dominant flora along the coast are Palmyra (*Borassus flabellifer*) and Casuarina (*Casuarina litorea*) plantations on the beach, mostly established by the AP forest department as barriers against cyclonic storms. Cashew (*Anacardium occidentale*) and coconut (*Cocos nucifera*) have also been planted in some areas.

Andhra Pradesh has nine coastal districts with 453 fishing villages and 280 fish-landing centres along the coast. By 1998, the fisher population was 0.87 million with 8,642 mechanised boats, 3,269 motorised craft (boats fitted with outboard motors for gill net operations) and 54,000 non-mechanised boats (traditional craft) (Anon. 1999). Of the total marine fish catch, 32 per cent comes from trawl nets, 24 per cent from non-mechanised drift gill net, 14 per cent from bottom set gill net, 13 per cent from shore seine and the rest from boat seine, drift net, hooks and lines and other gear (Alagaraja et al 1987).

Methods

Based on broad topographic differences, the entire coast was divided into three zones, i.e. northern AP, central AP and southern AP (Figure 1). Each zone was divided into different sectors, based on physiographic features such as river mouths, bays and estuaries. The survey was conducted in three phases—a pre-nesting survey, an offshore survey and a nesting survey.

SECONDARY SOURCES OF INFORMATION

During the pre-nesting survey between May and September 2000, one coastal village or fish-landing centre was visited every 20 kms, covering all the sectors. Information was collected from fisher folk (n=100) using questionnaire-based interviews (Tambiah 1999) (see Appendix 1 for questionnaire). Questionnaires were also used to collect information from 18 coastal forest department offices and 32 state fisheries department offices. Beach characteristics such as topography, lighting, plantations and human habitation close to the beach were subjectively evaluated.

nesting was interpolated within each sector when the entire sector was not surveyed, and within each zone when all sectors in the zone were not represented, in order to obtain estimates of nesting density. Nesting crawls and depredated nests were counted to evaluate minimum nesting densities. Since most locations were visited on a monthly basis, and only fresh crawls were enumerated, it is not expected that crawls would be recounted. However, these nesting figures may represent underestimates of total nesting and are considered only as an index for each location. Dead stranded turtles in each sector were counted during the monthly surveys. Sex was determined by morphological characteristics namely the presence of a long tail and strongly curved claw on the fore flipper in males. Curved carapace length (CCL) and curved carapace width (CCW) were measured.

During the intensive survey, the coast between the rivers Vamsadhara and Nagavali (28 km) in northern AP was surveyed several times during each month, and nesting for each month was extrapolated from the days surveyed. This coast was divided into three segments by the towns of Bandarvanipeta and Kundavanipeta, and represented beaches north and south of the river mouths, and the remainder of the coast in between. Additionally, four beaches adjacent to the river mouths were selected on the basis of the preliminary survey and patrolled on a daily basis. Fresh crawls and freshly depredated nests alone were counted.

Results

PRE-NESTING SURVEY

Interview results

The forest and fisheries departments of the Government of Andhra Pradesh, as well as local fisher folk were questioned about the status and threats to sea turtles (Table 1). All interviewees reported nesting by olive ridley turtles. A slightly larger percentage of fisheries offices (21.9 per cent) and fisher folk (20 per cent) reported species other than olive ridleys, as compared to the forest department (11.9 per cent). Both departments reported the consumption of eggs. However, while only 38.1 per cent of forest department offices reported the consumption of meat, nearly 80 per cent of fisheries offices reported this. One third of forest department offices reported measures of protection by their department, but the fisheries department and fisherfolk reported that there was no protection.

Secondary information was collected from one hundred fisher folk in the three zones. 30 per cent in northern AP and 10–20 per cent in other zones reported the presence of species other than olive ridleys, namely, leatherbacks, green turtles and hawksbills. These turtles were positively identified from photographs and local names. Olive ridleys are locally known as *punuku tambelu* (*punuku*=hole, *tambelu*=turtle), named for the small pore near the rear margin of each of the four infra-marginal scutes in their plastron. Similarly, the hawksbill turtle is identified from its beak and is locally known as *chilaka tambelu* (*chilaka*=parakeet). The green turtle is called *pedda tambelu* (*pedda*=large) and the leatherback is known as *doni tambelu* (*doni*=wheel of a bullock cart), an indication of its size. Nearly 75 per cent of fisher folk reported nesting intensities of more than



50 nests/km/season; 92 per cent reported a decline in the last decade and 85 per cent reported that they thought this was due to trawling-related mortality. All zones reported high mortalities in January–February (91 per cent), moderate levels in February–March (45 per cent) and low levels in March–April (8 per cent). This 8 per cent identified the breeding and nesting seasons of olive ridleys as being between November and March, in relation to the Hindu calendar and local festivals. 92 per cent said that sea turtles were neither beneficial nor harmful, while the remaining said they were negatively affected following entanglement in their fishing nets.

Table 1. Results of interviews with coastal forest department offices, state fisheries department offices and fisher folk along the AP coast. All values represent the percentage of affirmative answers to the question. (DNC = Did Not Comment / Did Not Know)

Question	Forest dept. (n=18)	Fisheries dept. (n=32)	Total fisher folk (n=100)	FISHER FOLK		
				North AP (n=46)	Central AP (n=26)	South AP (n=28)
Olive ridley nesting	94.4	100	100	–	–	–
More than 50 nests/season	DNC	DNC	76	78.3	84.6	64.3
Decline in nesting	DNC	DNC	92	97.8	88.5	85.7
Other sea turtle species	11.1	21.9	20	28.3	15.4	10.7
Fishery-related mortality	100	100	100	–	–	–
- due to mechanised fishing	DNC	65.7	85	93.5	80.7	75
Seasonality of incidental catch						
December–January	DNC	DNC	29	47.8	7.7	17.9
January–February	DNC	DNC	91	89.1	96.2	89.3
February–March	DNC	DNC	45	47.8	34.6	50
March–April	DNC	DNC	8	10.9	3.8	7.1
>10 dead turtles / season	DNC	DNC	50	65.2	53.8	21.4
Consumption of eggs	88.9	100.0	DNC	–	–	–
Consumption of meat	38.9	78.1	DNC	–	–	–
Forest department protection	33.3	0	3	0	11.5	0

(Source: Tripathy et al 2003)

Cultural perspectives

During field visits to different coastal areas, evidence of awareness of sea turtles was apparent from different historical monuments and cultural and social aspects of the local communities. In northern AP, there is a caste named after the turtle (*kurma kulam*). Besides, there are two ancient temples near Srikakulam and Rajahmundry, where people worship the idol of a turtle as the incarnation of Lord Vishnu. The lord of the temple at Srikurmam near Srikakulam, *Kurmanaswamy*, is believed to have originated from the sea of this area. For this reason, people do not kill turtles or eat turtle meat and eggs in this area. This temple is situated close to the coast and also has a good population of star tortoises (*Geochelone elegans*). However, a few fishing communities collect turtle eggs for local consumption and their market price is Rs 0.50 each. In a few fishing villages in

northern Andhra, an extract of sea turtle liver and bile is used to treat pregnancy-related and rheumatic diseases.

OFFSHORE SURVEYS

During the offshore survey, a total of 27 mating pairs and 25 single turtles were sighted within 5–10 km of the coast. Since this information was collected opportunistically during trawl cruises, no analysis has been carried out on the data. During the survey, 100–200 trawlers were observed fishing within a distance of 5–10 km from the coast, where mechanised fishing is illegal. A total of 29 and 30 olive ridley turtles were caught in November and December respectively in trawl fish and shrimp nets, with an average of one turtle/trawl. The November catch of sea turtles in trawl nets was dominated by males (97 per cent) whereas all turtles caught in December were females.

Table 2. Summary of size measurements of male and female olive ridley turtles captured during experimental offshore trawls, and dead turtles stranded on the beach.

	Sex (n)	Curved Carapace Length		Curved Carapace Width	
		Mean	Range	Mean	Range
Offshore	Males (15)	66.3 (3.8)	57–70	63.8 (5.4)	51–69
	Females (14)	67.3 (4.0)	57–71.5	65.7 (3.7)	51–70.5
Dead	Males (41)	68.4 (3.4)	58.2–78	65.5 (5.0)	48.3–75.5
	Females (35)	67.4 (6.7)	44.4–78	64.5 (7.0)	42.2–75.4
	Unknown (35)	68.2 (4.2)	56.5–76.3	65.8 (4.9)	48.3–72.5

(Source: Tripathy et al 2003)

NESTING SURVEY

The results of the extensive survey indicated higher intensity of nesting in northern AP (2.7 nests/km) and central AP (3.8 nest/km) than southern AP (0.96 nests/km) (Table 3). These values are indices based on single surveys in January, February and March. Intensive surveys of beaches near river mouths indicated actual nest densities of 60–114 nests/km in northern and central AP, and 15–18 nests/km in southern AP (Tables 4 and 5). All surveys indicated maximum nesting in February and March, though peaks at different sites were not synchronous (Figure 2). Almost all nests of olive ridleys along the AP coast were predated by feral dogs (*Canis familiaris*), jackals (*Canis aureus*) and hyenas (*Hyaena hyaena*).

Zone A. Northern Andhra Pradesh coast

The coast between the Bahuda river mouth (along the Orissa–Andhra Pradesh border) to the Goutami Godavari river mouth near Kakinada was demarcated as the northern AP coast. The area has three major rivers—Bahuda, Vamsadhara and Nagavali—and many smaller rivers such as the Champavati, Gostani, Sarada, Varaha, Tandava and Yeluru, all of which drain into the Bay of Bengal. The northern AP coast was further divided into 4 sectors. This 328-km stretch of coast had 770 nests during single surveys in January, February and March.

**Sector I. Bahuda–Vamsadhara river mouth**

This stretch covers a distance of nearly 130 km. Besides the Bahuda and Vamsadhara, the river Mahendranaya and the Bhabanapadu backwater also join the sea. The Bahuda backwater is known as the Ichhapuram lagoon, and the Naupada swamp, the only salt marsh along the northern AP coast, is also situated in this sector. The beach here is wide, sandy and backed with thick *Casuarina* and cashew plantations. The Kapaskudi coast (10 km) was surveyed intensively and 647 nests were counted between January and March 2001. During single surveys in January–March, 383 nests were counted between Bahuda and Vamsadhara excluding Kapaskudi (Table 3). A total of 647 nests were counted at Kapaskudi beach alone during intensive surveys.

Sector II. Vamsadhara–Nagavali river mouth

The distance between the river Vamsadhara and Nagavali is 28 km and the coast is sandy except at Kalingapatnam where intertidal rocks are present. The Kalingapatnam fishing harbour is situated close to the Vamsadhara river mouth. In most of the places, the beach is covered with psammophytes and sand dunes 10–20 feet in height. There are extensive *Casuarina* plantations close to the coast. An intensive survey was carried out in this entire sector and a total of 180 nests were counted during the survey period.

Sector III. Nagavali–Sarada river mouth

This stretch extends from the south of Srikakulam to the south of Visakhapatnam town, a coastline of 135 km. The coast is predominantly rocky both north and south of Visakhapatnam. The rivers Champavati, Vegavati and Gostani drain into the Bay of Bengal. The sea enters the land for a few kilometres near the Dolphin's Nose fishing harbour at Visakhapatnam. The beach here is backed by *Casuarina*, Palmyra and cashew plantations. The coastal city of Visakhapatnam is a major industrial and fishing settlement and is also the headquarters of the Eastern Naval Command. During the survey, a total of 133 nests were estimated along an approximately 135-km stretch.

Sector IV. Sarada–Goutami Godavari river mouth

The coastline between the rivers Sarada and Goutami Godavari covers a distance of nearly 65 km. Between Sarada and Goutami, minor rivers such as the Varaha, Tandava and Yeleru also drain into the sea. Barring Hope Island, there are no bays and inlets along the coast. Hope Island is situated seven nautical miles off the coast, in the Bay of Bengal, and has a narrow continuation with the land near the Koringa mangroves. There are extensive *Casuarina* and Palmyra plantations near Kakinada Bay, mostly established by the forest department as a cyclone shelter. The Kakinada port city and fishing harbour are close to the Godavari delta. Nagarjuna and Godavari Fertilisers, the National Thermal Power Corporation (NTPC) and Gas-Based Power Plant (GBPP) are situated near Kakinada Bay and discharge their effluents directly into the Bay of Bengal. A total of 73 nests were counted along this sector during January and February.

Zone B. Central Andhra Pradesh coast

The coastline between the Goutami Godavari and Krishna river mouth was identified as the central AP coast, covering a distance of nearly 250 km. The Godavari river divides into smaller branches before finally joining the Bay of Bengal, forming an extensive

deltaic system. The Godavari trifurcates into three parts—Goutami, Veineteya and Vasista Godavari. Similarly the Krishna river divides into smaller branches near the coast, resulting in riverine islands and salt marshes. For the study, the central AP coast was divided into 2 sectors. The central AP coast of 185 km surveyed had an estimated 702 nests during single surveys in January, February and March.

Sector V. Goutami Godavari–Vasista Godavari river mouth

The coast between the Goutami Godavari and Vasista Godavari river mouths measures 25 km and is interrupted in three places. The beach near the Godavari river mouth is wide and sandy with dense mangrove forests and *Casuarina* plantations. The Sacramento shoal is close to the Koringa mangrove wildlife sanctuary. The ONGC's (Oil and Natural Gas Commission) offshore drilling point is situated here and the oil delivery points are on the beach near Narsapur. This sector had an estimated 159 nests during single surveys in January, February and March. During the intensive survey at Sacramento at Godavari river mouth, 608 nests were counted (which are not included in the table).

Sector VI. Vasista Godavari–Krishna river mouth

The Krishna river divides into smaller branches near the coast resulting in several smaller salt marshes. The mouth of the Krutevenu backwater interrupts the coastline between the Vasista and Krishna river mouths. Between False Divi point and the Krishna river mouth, there is dense to degraded mangrove forest. The Machilipatnam harbour is situated close to False Divi point. Extensive *Casuarina* plantations are present along this coast as well. A total of 543 nests were estimated along this 160-km coastal stretch (with extrapolations for areas that were not covered).

Zone C. Southern Andhra Pradesh coast

The southern AP coast extends from the Krishna river mouth to Pulicat lagoon near the Tamil Nadu border, covering a distance of 360 km. Besides the Krishna and Pennaru, the Gondlakamma, Musi, Palleru, Swarnamukhi and Kandaleru are other rivers which drain into the Bay of Bengal. The Nizampatnam, Krishnapatnam and Buckingham canals run parallel to the coast. The southern AP stretch estimated a total of 330 nests during the single surveys.

Sector VII. Krishna–Musi river mouth

The river mouth between Krishna and Musi covers 130 km of coastline. There is no major river along this stretch of coast. Degraded mangroves are present at the river mouth of the Krishna, Nizampatnam canal and Gondlakamma. Nizampatnam and Vadalrevu are the fishing harbours along this sector. At some places there are thick *Acacia* plantations close to the beach. The Krishna–Musi stretch had 83 nests during the single surveys in January and March. 182 nests were counted during the intensive survey at the Krishna river mouth (12 km).

Sector VIII. Musi–Pennaru river mouth

The coastline from Musi to the Pennaru river mouth measures approximately 100 km. The beach is sandy with dunes 20–50 feet in height. There are thick Palmyra plantations close to the beach. The Buckingham canal, which originates from the Krishna river,



runs parallel to the beach interrupting the beach and human habitation in many places. 60 nests were counted in this stretch during single surveys in January and March.

Sector IX. Pennaru–Swarnamukhi river mouth

The distance from the Pennaru river mouth to the Swarnamukhi river mouth, which is the northern boundary of Pulicat lagoon, is about 80 km. At Krishnapatnam, the sea enters the land, forming a basin. The Kandaleru river joins this basin at Krishnapatnam harbour. The coastline is sandy and the beach is dominated with *Spinifex*. Sand dunes, 10–20 ft in height, and *Casuarina* and Palmyra are found adjacent to the beach. 17 turtle nests were counted during a single survey in March.

Sector X. Swarnamukhi–Pulicat lagoon mouth

The coastline is interrupted by land-based drainage and backwaters forming a narrow strip of land, known as Sriharikota Island. This coastal stretch is about 50 km long and mostly sandy. There are extensive *Casuarina* plantations on the beach. The satellite launching pad of the Indian Space Research Organisation is in Sriharikota. 20 nests were counted during a single survey in March. At Sriharikota, 274 nests were counted during the intensive surveys.

Table 3. Nesting in different sectors on the AP coast. Distances indicate extent of suitable nesting beaches within each sector. Nesting numbers are counts from single surveys only and hence they may represent underestimates of total nesting for each sector. Nesting was extrapolated within each sector when the entire sector was not surveyed, and within each zone when all sectors in the zone were not represented (*italics with distances surveyed in parantheses*).

Zone	Sector	Distance	Jan	Feb	March	Total
Northern AP coast	I Bahuda–Vamsadhara	100	2	270	111	
	II Vamsadhara–Nagavali	28	0	112	68	
	III Nagavali–Sarada	135	1	<i>56 (25)</i>	<i>77 (65)</i>	
	IV Sarada–Goutami	65	2	71		
Sub-total		328	5	509	256	770
Central AP coast	V Goutami–Vasista	25	9	28	122	
	VI Vasista–Krishna	160	23	<i>259 (120)</i>	<i>261 (30)</i>	
Sub-total		185	32	287	383	702
Southern AP coast	VII Krishna–Musi	130	5		78	
	VIII Musi–Pennaru	100	20		40	
	IX Pennaru–Swarnamukhi	80			17	
	X Swarnamukhi–Pulicat	50			20	
Sub-total		360	25	<i>150*</i>	155	330
Total number of nests			62	946	794	1,802

* Southern AP was not surveyed in February, and hence, nesting from March was used to arrive at a total for the zone. Source: Tripathy et al 2003

Table 4. Nesting between the rivers Vamsadhara and Nagavali, from January to March 2001. The three beaches were separated by the towns Bandarvanipeta and Kundavanipeta, and represented a stretch of beach south of a river mouth (Vamsadhara–Bandarvanipeta), north of a river mouth (Kundavanipeta–Nagavali) and the coast in between (Bandarvanipeta–Kundavanipeta). Beaches were surveyed multiple times during each month and nesting was extrapolated for the entire month from the days surveyed.

		Vamsadhara– Bandarvanipeta	Bandarvanipeta– Kundavanipeta	Kunduvani– Nagavali
	Name of Beach	Kalingapatnam	Srikakulam	Srikurmam
	Length of beach	5 km	20 km	3 km
January	No. of nests counted	45	10	76
	No. of days surveyed	13	6	17
	Estimated no. of nests	107	52	139
February	No. of nests counted	143	23	91
	No. of days surveyed	12	6	23
	Estimated no. of nests	334	107	111
March	No. of nests counted	50	44	13
	No. of days surveyed	12	13	12
	Estimated no. of nests	129	105	34
Total number of estimated nests		570	264	283
Nest density (per km/per season)		114	13	94

(Source: Tripathy et al 2003)

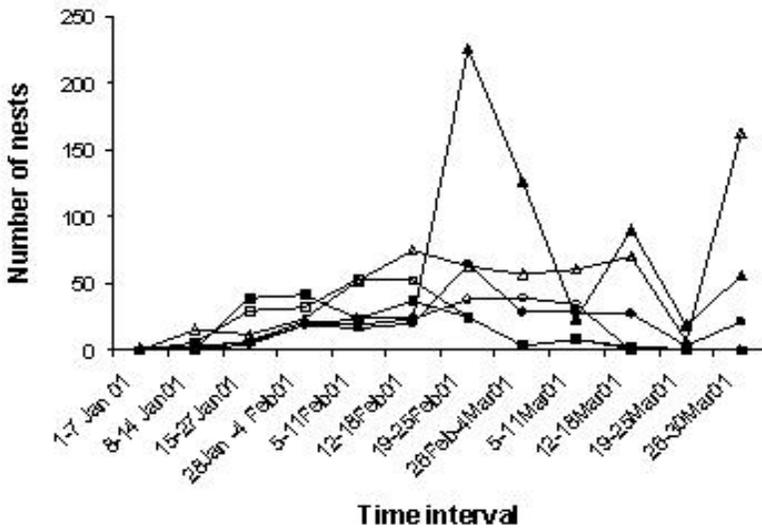


Figure 2. Weekly nesting of olive ridley sea turtles at four beaches based on daily surveys, represented as a proportion of total nesting at that beach. The beaches are: (a) Kapaskudi (filled circles) (b) Sacramento (open circles) (c) Krishna (filled triangles) (d) Sriharikota (open squares). (Source: Tripathy et al 2003)



Table 5. Nesting at four beaches adjacent to the following river mouths: the Kapaskudi, south of Bahuda river mouth in northern AP; the Sacramento, south of the Goutami river mouth (northern-most mouth of the Godavari) in central AP; and Krishna river mouth and Sriharikota, north of Pulicat estuary in southern AP.

		Kapaskudi	Sacramento	Krishna	Sriharikota
Length of Beach		10 km	10 km	12 km	15 km
Number of nests	January	15	36	8	154
	February	343	241	118	106
	March	289	331	56	14
Total nests counted		647	608	182	274
Nest density (per km/ per season)		65	61	15	18

(Source: Tripathy et al 2003)

Threats

SEA TURTLE MORTALITY

A total of 806 dead olive ridley turtles were counted along the AP coast between December and April 2001 (Figure 3). Only 5 dead turtles were counted till December, but 172 and 146 dead turtles were counted during January and February respectively, along the northern AP coast alone. The number of dead turtles was less in central and southern AP. During March and April, the mortality declined in all the zones. Of the 401 dead turtles that were sexed, 105 (26.5 per cent) were males and 296 (73.5 per cent) were females. Of 111 dead olive ridleys measured, seven were below 60 cm and two were below 50 cm in curved carapace length, indicating the occurrence of sub adult turtles in these areas.

IMPACT OF COASTAL DEVELOPMENT

The coastline of Andhra Pradesh is dotted with fishing villages. Lighting was classified depending on source—villages, industry and roads. Subjective assessments indicated that the lighting was predominantly from village and street lights, and to some extent from shrimp farms, rather than from industry. Beaches were invariably backed by villages or *Casuarina* plantations. Extensive shrimp seed collection on the beach was observed all along the coast. Shrimp seeds are collected by local villagers and fisher folk on the shore by putting nets parallel to the coastline, which obstruct turtles from nesting. Shrimp hatcheries and prawn farms close to the nesting beach were most abundant along the central AP coast. These were a major source of disturbance and lighting in this zone.

The Government of AP has also recently begun to plan the building of many new harbours, which are likely to result in an increase in fishing craft and gear and fishing operations, leading to increased fishery-related mortality along the coast. Other problems include pollution from major industries, urban sewage, military sewage from the Eastern Naval Command in Visakhapatnam and Air Force Station, Bapatla and sand mining. Many of these industries are also sources of light pollution. *Casuarina* and Palmyra plantations close to the beach render the habitat unsuitable for nesting and provide shelter to egg and hatchling predators, particularly jackals.

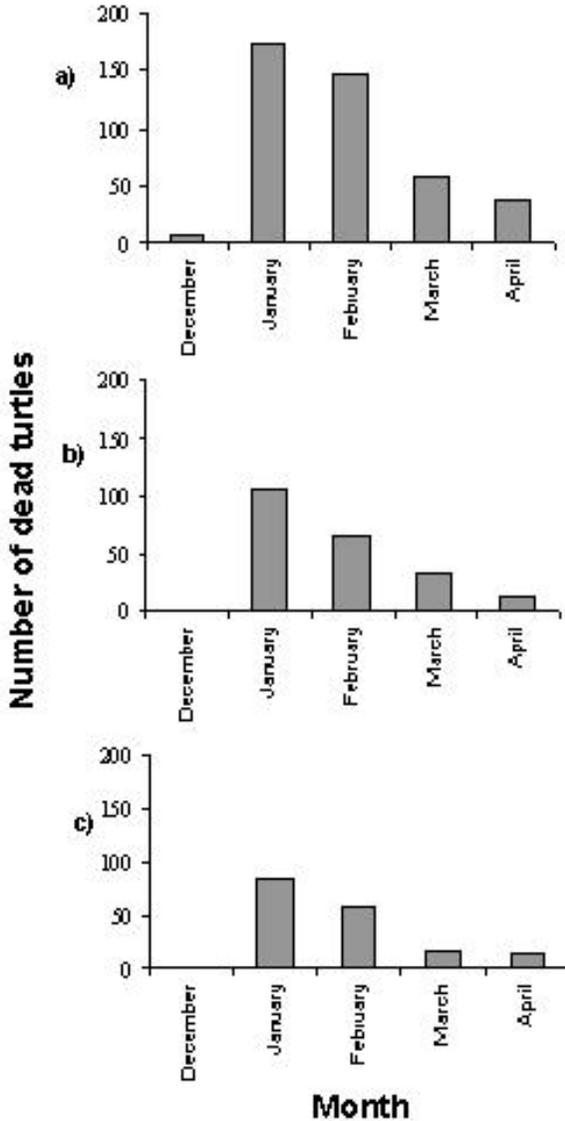


Figure 3. Month-wise tally of dead turtles washed ashore along the AP coast: (a) northern AP (b) central AP (c) southern AP (Source: Tripathy et al 2003).

Recommendations

NETWORKING WITH NON GOVERNMENT ORGANISATIONS

Non government organisations are capable of creating awareness about environmental issues at the grassroots level—through education, interface with other agencies and by organising eco-friendly economic alternatives for the communities. Keeping this in mind, local coast-based NGOs along the AP coast were approached for assistance in the survey. An overwhelming response was received from over thirty non government organisations, out of which four (Green Mercy in Visakhapatnam, Sravanti Association



in Rajahmundry, CCDP in Machilipatnam and SNIRD in Ongole) were chosen for field-based projects in their areas to complement the survey.

Green Mercy, Visakhapatnam

Green Mercy conducted surveys from the Orissa–Andhra Pradesh border upto Uppada near Kakinada. The intensive surveys were conducted from January to May 2001. The survey team visited all the coastal areas of northern Andhra. A majority of the beaches were surveyed on foot. In vulnerable areas, *in situ* protection activities were carried out by the organisation. The field team also frequently visited coastal villages to promote awareness by organising group meetings with fisher folk and local communities, local NGOs and nature activists and thus developed a network with like-minded organisations and people. A total of 10,000 pamphlets, bearing the message of sea turtle conservation in the local language, were distributed in coastal villages. Alongside, 60 video shows, turtle walks, rallies, street plays and folk dances were organised as part of the awareness campaign.

Sravanti Association, Rajahmundry

Sravanti conducted a sea turtle survey and awareness campaign in the area along East Godavari and West Godavari districts of AP, from Uppada to Antervedipalem. The survey revealed many interesting facts. According to conversations Sravanti volunteers had with the local villagers, thousands of sea turtles nested on the beaches near Kothapalam in the Godavari river mouth even a few years ago. The team covered 34 major coastal villages and found that two species of sea turtle occur in these localities—the olive ridley, locally called *done tambelu*, and the green turtle, known as *sagaru tambelu*. The consumption of meat and eggs are major threats to the sea turtles in this area. According to this survey, loss of marine habitat, pollution, lighting, and incidental catch are additional threats to sea turtles along the coast. The Sravanti Association built up links with the traditional fisher folk to make them aware of the importance of sea turtles along the coast. They have also made an attempt to convince the trawler operators to use TEDs in their fishing nets. This organisation emphasises that awareness and training should be given to traditional and mechanised fisher folk about responsible fish-harvesting techniques and points out that TED demonstrations are required for trawler operators.

Coastal Community Development Programme (CCDP), Machilipatnam

CCDP carried out its survey from February–May 2001 along the Krishna river delta. During the survey period, they collected data from 268 fishermen and 55 villages in six mandals of the coastal districts of Krishna and Guntur. They found that incidental catch in mechanised vessels, poaching of eggs and predation by feral dogs are the major problems for sea turtles along the coast. Some people worship turtles as an incarnation of god and therefore do not harm turtles. They opined that most fishing communities in this region do not kill turtles intentionally and thus sea turtle conservation can be initiated at the grassroots level. Besides this, control of trawling is required in areas like Machilipatnam and the Krishna river mouth.

The Society for National Integration through Rural Development (SNIRD), Ongole

SNIRD carried out its sea turtle survey and conservation programme from Nizampatnam (Krishna river mouth) to Nellore (Pennaru river mouth). The survey team observed



nesting of sea turtles in the river mouths of the Krishna and Pennaru, and places where mangrove vegetation exists along creeks, rivulets and canals that join the sea. According to their report, the fishing community, particularly the *Pattapu* caste, consider turtles an incarnation of god, while the *Palli* community never kills turtles unless incidentally caught in their fishing nets. But, gear like *ayala vala* (shoreline net) and *rui vala* (shooting net) used for shrimp-seed collection entangle both adult and hatchling turtles resulting in death. SNIRD suggested that these fishing communities need to be educated with regard to turtles and that turtle conservation is possible through people's participation and NGO involvement.

Conclusion

The abundance of olive ridleys at a few sites would suggest that they may not be endangered, but many sporadic and mass-nesting populations may actually be in decline (Limpus 1995). The incidental mortality of olive ridley turtles in Orissa may have caused a serious decline in this population (Shanker et al 2004b). Genetic studies indicate that all olive ridleys along the east coast of India form part of a single large population, which may be an evolutionary source for olive ridleys in other ocean basins (Shanker et al 2004a). Olive ridley turtles use multiple nesting sites within Orissa, separated by as much as 300 km (Pandav 2000). The lack of evidence that turtles use beaches along their migratory path (in AP and Tamil Nadu) may be largely due to the absence of monitoring programmes. Satellite telemetry shows that olive ridleys that nest in Orissa migrate through AP waters and may even remain in the offshore waters of northern AP after nesting (Shanker et al, unpublished data; for map, see <http://www.wii.gov.in>). Hence, these turtles may use suitable beaches in AP as well.

The importance of relatively smaller populations and nesting sites in the survival of the (meta)population is not known. Adjacent to the mass-nesting beaches of Orissa, the AP coast has important nesting beaches for olive ridley turtles with ~10,000 nests per season. Tripathy et al (2003) estimated a total of ~3,500 nests for beaches adjacent to river mouths (Appendix 2) and ~5,900 nests for the rest of coast. This estimate is speculative and needs to be revalidated with more precise data on numerous parameters, including the number and types of beaches available for nesting, and the variation in nesting densities across time and space.

However, the data does suggest that beaches adjacent to river mouths are preferred nesting habitats for olive ridleys; these beaches had densities of 50–100 nests/km/season, while nesting densities averaged ~10 nests/km/season along other parts of the coast in AP (Tripathy et al 2003) and Tamil Nadu (Shanker 1995, Bhupathy and Saravanan 2002). In Orissa too, the mass-nesting beaches are located in close proximity to river mouths (Pandav 2000). Whether this preference is due to sediment deposits, salinity or other physiographic features is not known, and certainly merits investigation. Clearly, however, there is a need to focus conservation and management efforts at specific high-density sites, rather than diffusely along the entire coast. Interestingly, sub-adult ridleys were captured during experimental trawls and were also found dead along the AP coast. Two sub-adult green turtles were found dead near the city of Visakhapatnam, on the northern



AP coast (Tripathy and Choudhury 2002). This implies that the AP coast may serve as a developmental habitat for sub-adult ridleys and for juvenile and sub-adult green turtles.

Incidental capture in trawl and gill nets is a major cause of sea turtle mortality on the east coast of India (Rajagopalan et al 2001). This study also revealed high levels of fishery-related mortality of sea turtles along the AP coast. Mortality was higher along the northern AP coast, which is probably due to the higher density of turtles along the northern and central AP coast. Also, in the southern AP coast, fisher folk use sting-ray-fishing gill nets and release turtles which get entangled in the nets. Some management interventions that would reduce fishery-related mortality include:

- (i) Declaring No-Fishing Zones during the nesting season in areas where sea turtle nesting concentration is high and near high-density nesting beaches such as the river mouths.
- (ii) Enforcement of existing laws: The Andhra Pradesh Marine Fishing (Regulation) Rules, 1995 states that 15-metre mechanised vessels may not operate within 8 km of the coast and vessels above 15 metres in length may not operate within 25 km of the coast. However, this law is not enforced, and mechanised fishing was observed close to the shore during the present study.
- (iii) Use of turtle excluder devices: Though there is currently substantial opposition within the trawler community to their use in Orissa, the indigenous turtle excluder device developed by the Central Institute of Fisheries Technology, Kochi is being successfully promoted in AP by the State Institute of Fisheries Technology, Kakinada (Bavani Sankar and Ananth Raju 2003). This programme must be encouraged.

It is clear that the olive ridley turtles must be protected throughout their nesting and migratory habitat on the east coast of India. However, the AP fisheries department has only recently initiated measures to curb trawling-related mortality (Bavani Sankar and Ananth Raju, 2003), and none of the nesting beaches or offshore areas are protected by law. The GOI-UNDP Sea Turtle Project conducted preliminary workshops in AP before the survey (Tripathy and Choudhury 2001) as well as workshops on coastal development and turtle-fisheries interface in December, 2002. Such workshops serve to increase awareness and participation amongst all stakeholders in sea turtle conservation.

Conservation programmes in AP have thus far focussed on the northern AP coast (e.g. Ramana Murthy 2001). During this survey, four non government organisations from all the zones were invited to assist with data collection and awareness programmes (Tripathy and Choudhury 2001). Their continued involvement will provide a source of data and help with other aspects of turtle conservation such as the involvement of local communities.

Most traditional fisher folk are not aware of the legal status of sea turtles, or even of their own fishing rights. Most do not actively fish for turtles, nor do they have any particular antipathy towards them, and in fact, turtles are worshipped in most parts. Given the high human densities along the coast, it is unlikely that exclusionary protection measures could either be initiated or successfully implemented. In this context, it seems



most viable to evolve programmes based on a participatory approach, rooted in other aspects of coastal conservation and sustainable fishing practices, which would also be beneficial to the communities. This would help in protecting multiple nesting habitats and also in protecting the turtles during their breeding migrations through the offshore waters of the state. The involvement of these communities and their welfare may thus be critical to the long-term survival of sea turtles as well as coastal habitats.

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Appendix 1

Questionnaire used to interview fisher folk on the AP coast (Wildlife Institute of India, Dehradun, GOI-UNDP Sea Turtle Project)

Date of Survey:

Time start:

Time End:

Beach name/ Zone:

Observer :

Name and occupation of interviewee:

Information on turtles

What turtles are seen in this area?

Local names:

How are different species identified?

When are the turtles seen (season)? Peak?

How many turtles are seen nesting (species wise abundance/area/day)?

How many turtles were there earlier (20/50 years ago)?

Is there a decline? Why?

Are turtles or turtle eggs consumed?

What is the perception of sea turtles (beneficial/harmful/irrelevant)?

Are turtles protected? By whom?

Information on locality

Number of people in the village:

Castes/ communities/ religion:

Livelihood:

Socio-economic status:

Basic facilities (electricity/water/health care/education):

Comments



Appendix 2

Beaches adjacent to river mouths on Andhra Pradesh coast.

River		Beach background / township (1) / fish-landing centre (2)	Fishing	Beach type	Suitability for nesting
Bahuda	N	Sonepur (2)	Traditional	Sandy	Orissa
	S	<i>Casuarina</i>	Traditional	Sandy	Suitable
Mahendranaya	N	–	Traditional	Sandy	Suitable
	S	–		Rocky	Unsuitable
Naupada backwater	N	<i>Casuarina</i>	Traditional	Sandy	Suitable
	S	Bhavanapadu Harbour (2)		Rocky	Unsuitable
Vamsadhara	N	Kalingapatnam Harbour (2)	Trad. /Mech.	Sandy	Unsuitable
	S	Srikakulam (1)	Traditional	Sandy	Suitable
Nagavali	N	Srikurman (2)	Trad. /Mech.	Sandy	Suitable
	S	<i>Casuarina</i> plantation	Traditional	Rocky	Unsuitable
Champavati	N	<i>Casuarina</i> plantation	Traditional	Rocky	Unsuitable
	S	<i>Casuarina</i> plantation	Traditional	Rocky	Unsuitable
Vegavati	N	Bhogapurma (1) (Prawn Farms)	Traditional	Rocky	Unsuitable
	S	<i>Casuarina</i> plantation	Traditional	Rocky	Unsuitable
Gostani	N	<i>Casuarina</i> plantation	Traditional	Sandy	Suitable
	S	<i>Casuarina</i> plantation	Traditional	Sandy	Suitable
Dolphin's Nose	N	Visakhapatnam (1)	Mechanised	Rocky	Unsuitable
	S	Pudimadaka (2)	Traditional	Rocky	Unsuitable
Sarada	N	<i>Casuarina</i> plantation	Traditional	Sandy	Suitable
	S	Anakapalli (1)	Traditional	Sandy	Unsuitable
Varaha	N	<i>Casuarina</i> plantation	Traditional	Sandy	Suitable
	S	Yellamanchili (1)	Traditional	Sandy	Unsuitable
Tandava	N	Tuni (1)	Traditional	Sandy	Unsuitable
	S			Sandy	Suitable
Yeleru	N	<i>Casuarina</i> plantation	Traditional	Sandy	Suitable
	S	<i>Casuarina</i> plantation	Traditional	Sandy	Suitable
Goutami Godavari	N	Kakinada (1)	Trad./ Mech.	Sandy	Unsuitable
	S	Sacramento	Mechanised	Muddy	Suitable
Veineteya Godavari	N	Mangrove / <i>Casuarina</i> plantation	Traditional	Sandy/ Muddy	Unsuitable
	S	Amalapuram (1)	Traditional	Sandy	Unsuitable
Vasista Godavari	N	Mangroves / <i>Casuarina</i> plantation	Traditional	Sandy	Suitable
	S	Narsapur (1)	Traditional	Sandy	Unsuitable

Appendix 2 (contd.)

River		Beach background / township (1) / fish-landing centre (2)	Fishing	Beach type	Suitability for nesting
Krutevenu	N	<i>Casuarina</i> plantation	Traditional	Sandy	Suitable
	S	<i>Casuarina</i> plantation	Traditional	Sandy	Suitable
Cambelpet Creek	N	Mangrove forests	Mechanised	Sandy	Suitable
	S	<i>Casuarina</i> plantation	Mechanised	Sandy	Suitable
Krishna	N	Machilipatnam (1)	Mechanised	Sandy	Unsuitable
	S	<i>Casuarina</i> plantation	Mechanised	Sandy	Suitable
Nizampatnam Canal	N	Mangrove forests	Mechanised	Sandy	Suitable
	S	Suryalanka Air Force Station (1)	Trad./ Mech.	Sandy	Suitable
Gondlakamma Canal	N	Vadalrevu Harbour (1)	Mechanised	Sandy	Unsuitable
	S	<i>Casuarina</i> plantation	Mechanised	Sandy	Suitable
Musi	N	<i>Casuarina</i> plantation	Traditional	Sandy	Suitable
	S	Chinnaganjam (1)	Traditional	Sandy	Unsuitable
Palleru	N	<i>Casuarina</i> plantation	Traditional	Sandy	Suitable
	S	<i>Casuarina</i> plantation	Traditional	Sandy	Suitable
Pennaru	N	<i>Casuarina</i> plantation	Traditional	Sandy	Suitable
	S	Nellore (1)	Trad./ Mech.	Sandy	Unsuitable
Kandaleru	N	<i>Casuarina</i> plantation	Mechanised	Sandy	Suitable
	S	Nizampatnam Harbour (2)	Mechanised	Sandy	Unsuitable
Swarnamukhi	N	<i>Casuarina</i> plantation	Traditional	Sandy	Suitable
	S	<i>Casuarina</i> plantation	Traditional	Sandy	Suitable
Pulicat	N	Sriharikota	Traditional	Sandy	Suitable