but (Kar and Bustard, 1983) remarked that instances of man eating have been greatly exaggerated. There were 15 instances of attacks on human beings in 17 years which included nine males and six females. In 14 cases, large male crocodiles of above 10' were responsible but in only one case a crocodile of 9' was involved in killing a human being. During the year 1988, one crocodile of about 21' was responsible for killing within a span of few days, three persons who were catching fish illegally, at the night time in one of the creeks of the sanctuary. Later that crocodile was killed by the poachers. Kar and Bustard (1986) mentioned that the Bhitarkanika wildlife sanctuary all the ingredients for human attack exists, particularly, frequent human intrusion into the crocodile habitat illegally and a crocodile population in the sanctuary containing a good number of very large males. But it has been observed that the adult crocodiles under normal circumstances never leave their territory to chase the human beings on land unlike terrestrial predatory animals like tigers, etc. Most of the incidents occurred when the victims entered into the crocodile habitat either for illegal fishing, poaching, collection of wood, honey, Nalia grass etc. from the river or creek banks or while setting the traps or noose for trapping the deer, wild boars etc. very close to river or creek banks.

(B) Attack on domestic livestock by Wild Crocodiles:

Kar and Padhi (1992) have reported instances of attack on domestic livestock by estuarine crocodiles in Bhitarkanika sanctuary. From August 1975 to December 1987, a total of 21 attacks involving cows, buffaloes, bullocks, calves and a goat was recorded. All attacks reported were by very large males of above 16 feet length. High tide is usually essential to bring the crocodiles waiting calmly in the water within striking distance of the animals grazing on the river bank. 90% of the attacks occurred during the rainy season when the river banks were flooded by high tide or flood water. Most of the attacks occurred at locations where the natural mangrove vegetation cover had been destroyed by people. Cattle attacks increase the unpopularity of the salt water crocodiles and increase the pressures working against its conservation (Kar and Bustard, 1981). Ideally crocodiles and cattle should be separated and there should be no grazing in wildlife sanctuaries. The solution lies in maintaining a strip of undisturbed mangrove forests, at least 100 meter wide along all rivers/creeks adjacent to cultivated land and human habitations inside the sanctuary.

SEA TURTLE CONSERVATION AND MANAGEMENT PROJECT

INTRODUCTION

Orissa has appeared in the turtle map of the world because of the distinction it has in having world's largest nesting ground of sea turtles in Bhitarkanika's famous Gahirmatha Coast. The approximately 35-40 km long stretch of the coastline extending from Maipura river mouth in the north upto Hansua river mouth in the south (Barunei muhara) is popularly known as Gahirmatha coast which supported large synchronised nesting aggregation of Olive ridley sea turtle, Lepidochelys olivacea. Whitaker and Kar (1984) have mentioned that "this phenomenon was comparable to the hordes of game on the African plains, schools of tuna and whales and other such astounding congregations in nature. This was one of the planet's ultimate extravaganzas : the mass nesting of the Olive Ridley sea turtle." Presently this stretch of the coast line i.e., the Gahirmatha beach enjoys a protected area status and forms the eastern boundary of the Bhitarkanika wildlife sanctuary. The mass mating, mass breeding, feeding as well as developmental habitat of these sea turtle in the Gahirmatha coastal waters where they are known to spend 6 to 8 months a year from mid-October to April/May has been designated as the first marine wildlife sanctuary of Orissa (vide Govt. of Orissa, Forest & Environment Department Notification No. 18805 - F & E - dated 27th September 1997 published in the Orissa Gazette, extraordinary No. 1268, dated 17th October, 1997). A major portion of the Gahirmatha coastline has also been included in the Bhitarkanika National Park (vide Govt. of Orissa, Forest & Environment Department Notification No. 19666/F & E dated 16th September, 1998).
HISTORY:

Sea turtles are nesting in Gahirmatha coast of Bhitarakanika since time immemorial. The knowledge about the occurrence and abundance of olive ridley sea turtles in the Gahirmatha coast of Orissa was known locally to the inhabitants of "Kanika Raj" area as well as to the local administration of kanika ex-zamindary and Forest Department of Orissa. But, there is no recorded history of sea-turtles of Orissa during the British India period and immediately thereafter for nearly two to three decades till 1974. During the 'Kanika Raj' the nesting and breeding habitats were in a perfect untouched state. The information about the existence of such an enormous rookery (mass nesting ground) came into light of the scientific world only very recently in mid 1970's (Bustard, 1974). Studies on sea turtles of British India which are on record (Bowerby 1872; Garman 1880; Boulenger 1889, 1890, 1912; Burne 1905; Gardiner 1906; Kloss 1907; Maxwell 1911; Fry 1913; Mawson 1921; Cameron 1923; Babcok 1930. Smith 1930, 1933; Deraniyagala 1930 a, b, 1939 Chako 1942; Oliver 1946) have not mentioned anything about sea turtles of Orissa coast. Oliver (1946), however, indicated the olive backed loggerhead to be the commonest chelonian in Ceylon waters ranging over the Indo-Pacific and East Atlantic and mentioned that it sometimes gathered in large schools occupying about sixty miles of sea between September and November also in Deraniyagala 1951, 1953. It was an indication of the great abundance of the Olive ridleys in the Indian Ocean, but no one knew at that time where these turtles go for nesting nor anything was known about the migratory behaviour or migratory routes followed by the schools of Olive ridleys.

During 1973-74, with a request from Government of India, Dr. H.R. Bustard, FAO Consultant visited the Bhitarakanika area during the course of a survey work for the three endangered species of Indian Crocodiles. In his report (FAO 1974; Bustard 1976) he opined that the world's largest breeding population of the olive ridleys migrate to northern Orissa coast for nesting purposes and urged the Government for the protection of sea turtles and their nesting grounds. J.M. Deeward, F.A.O. Economist (FAO, 1975) also mentioned about this potential rookery in Bhitarakanika area of the former Cuttack district of Orissa (Kar 1988; Dash and Kar 1990).
The Government of India accepted the FAO (1974) report and as a result a Joint Project of Government of India, FAO/UNDP and the State Government of Orissa for protecting the crocodiles, sea turtles, other wildlife and mangrove forests occurring in the area started operating from 1975. Among all the States and Union Territories of India, the state of Orissa was the first to initiate and operate conservation of sea turtle schemes with assistance of GOI/FAO/UNDP. The present long term studies on sea turtles in Orissa can be regarded as a consequence of FAO (1974, 1975) reports. In 1975, when the Forest Department of Government of Orissa became aware of the need to protect the nesting and breeding population of the Olive ridley sea turtles, *Lepidochelys olivacea* (Eschscholtz, 1829), it was felt that almost nothing was known about sea turtle population of Orissa. Therefore, research was initiated by recruitment of a biologist and Ph.D. Scholar (C.S.K) supervised by the F.A.O. Expert, Gahirmatha Marine Turtle Research and Conservation Centre was established in 1976 at Habalakhali and since then long term research has been maintained on this population under the auspicies of the Wildlife wing of Forest Department of Government of Orissa.

Thus Orissa was the first and the only State in India to implement the sea turtle conservation project as this State has the singular distinction of having world’s largest nesting and breeding ground of the endangered Olive Ridley sea turtle, *Lepidochelys olivacea*. In course of time during the past twenty years, two more major mass nesting grounds of this species have been discovered along the Orissa Coast. Chandra Sekhar Kar in 1981 discovered the rookery at the mouth of river Devi in the former Cuttack District. That time the nesting population was estimated to be around one lakh (Kar, 1981). In March 1994, another new sea turtle rookery was discovered at the mouth of river Rushikulya in the district of Ganjam by C.S. Kar and Bibhas Pandav (Pandav, Choudhury and Kar, 1994, a, b, 1997). This rookery lies about 300 km south of Gahirmatha rookery. In 1994, the nesting population at Rushikulya was estimated to be about two lakhs. The bulk of information on Indian Sea Turtles that has been generated in Orissa in last two decades (from 1975/76 till date) has contributed a lot to understand the basic biology of the Olive Ridley sea turtles. However, still a lot has to be done particularly relating to non-nesting stages of life cycle of the species including long distance migration, etc. which is critical and vital for the successful management and conservation of sea turtle population. Research in Orissa is thus vitally important to the world’s endangered sea turtle population.

**TYPES OF SEA TURTLE SPECIES FOUND IN ORISSA:**

There are seven species of living sea turtles in the world. In Indian coastal waters five species of sea turtles are known to occur. Of these, only four species are known from coastal waters of Orissa as well as Gahirmatha coast. In order of abundance these are:

1. The Olive Ridley Sea Turtle (*Lepidochelys olivacea*)
2. The Hawksbill Sea Turtle (*Eretmochelys imbricata*)
3. The Leatherback Sea Turtle (*Dermochelys coriacea*)
4. The Green Sea Turtle (*Chelonia mydas*)

**A KEY FOR IDENTIFICATION OF SEA TURTLES FROM INDIA**

1. a. Skin smooth and without any scutes on head: 7 longitudinal narrow ridges on carapace and 5 on plastron; horny beak with well defined cusp on each side of upper jaw (beak "W" shaped when viewed from front) and central cusp on lower jaw; flippers without claws.
   b. Shell, head and flippers covered with scutes: 5 longitudinal ridges on carapace or plastron; horny beak not "W" shaped when viewed from front; flippers with one or two claws.

2. a. Carapace with 4 pairs of lateral scutes ..................3
   b. Carapace with 5 or more pairs of lateral scutes .......4

3. a. Horny scutes imbricated (overlapping); two pairs of prefrontal scutes; 2 claws on each flipper; carapace is brown with darker markings; skin of neck region pale orange in colour .................. *Eretmochelys imbricata*
   b. Horny scutes not imbricated but juxtaposed; one pair of prefrontal scutes; single claw on each flipper; carapace green with violet markings; skin of neck region yellow to cream in colour .................. *Chelonia mydas*
4. a. Plastron with 3 pairs of enlarged inframarginal scutes without pores; lateral scutes 5; carapace brownish red with light spots and plastron yellow with orange spots. .......................................................... Carettochelys caretta

b. Plastron with 4 pairs of inframarginal scutes each with pores on hind margin; lateral scutes 6 or more, generally 7; carapace grey and plastron yellow. .......................................................... Lepidochelys olivacea

LEGAL STATUS OF SEA TURTLES FOUND IN ORISSA:

All the four species of sea turtles found in Gahirmatha coastal waters of Orissa are protected under Schedule-I of the Indian Wildlife (Protection) Act, 1972 (amended 1991). All these species of sea turtles are listed as 'endangered' as per IUCN Red Data Book. The sea turtles are also protected under the 'Migratory Species Convention' and CITES (Convention on International Trade on Endangered Species of Wild Flora and Fauna). India is a signatory nation to all these conventions.

PAST MANAGEMENT OF THE SEA TURTLE RESOURCE:

EXPLOITATION OF EGGS:

The Lepidochelys olivacea has a commercial importance in the economy of people in the coastal areas. But, during the 'Kanika Raj' only the eggs were allowed to be collected and there was no adult exploitation either from the nesting beach or from the sea. People were paying 'Aanda Kara' (revenue for collection of eggs) and were collecting boat load of eggs from the Gahirmatha rookery during the 'arribadas'. This egg exploitation was mainly for commercial purpose as Oriyans virtually do not prefer to take turtle egg or meat except the economically poorer communities like the 'Harjians'. Most of the eggs being collected were transported to Calcutta market of West Bengal. After vesting of zamindary, the system of egg collection continued even when the area management was transferred to 'Anchal samiti' of Revenue Administration and subsequently to 'Forest Administration' of the state in 1957. The Forest Department of Orissa was also issuing licences for collection of eggs at the rate of Rs.15/- per boat load of eggs, each boat on an average containing roughly between 35,000 to 1,00,000 eggs. Thus each boatload of eggs was comprising of 350 to 1000 nests. Eggs were sold in river side villages of Bramhani, Baitaran and Dhamra where they were consumed mainly, by the economically poorer communities of Orissa viz., 'the Harjians'. Large scale export of these eggs to the Calcutta market also took place regularly. Locally the eggs were preserved in large quantities by drying them in the sun for future use as cattle feed in coastal areas of Kanika and Kujang of the state. The estimated legal egg consumption in 1973 season was 15 lakh (FAO, 1974) but the actual illegal take was probably much more (Dash and Kar, 1987).

The Govt. of Orissa ceased issuing licenses from the year 1975 (Kar, 1980). The Bhitarkanika Wildlife Sanctuary was declared in April, 1975. Thereafter, complete protection has been given to the nesting females and their eggs from egg collectors and poachers by rigorous patrolling of the Gahirmatha beach by Forest Department personnel for about 5 months in a year during the main nesting season till majority of the hatchlings emerge out and enter into the sea. However, except the Gahirmatha rookery there was absolutely no protection to the eggs and adults on other mainland beaches and offshore islands. Though there was no Cassytha equisetifolia plants on this coast, the nesting beach was backed by the dense mangrove forests which was the home of notorious egg predators of sea turtles such as wild pigs, jackals, hyenas, fishing cat, water monitor lizards, etc. However, due to the presence of very high sand dunes the natural mangrove vegetation was not visible either from the sea or from the surf zone. During the mass nesting season heavy predation on sea turtle nests were occurring. A large number of nests being destroyed by feral dogs, wild pigs and other mammalian beach predators (Kar 1988, Dash and Kar 1990). Then in 1989, a cyclonic storm swept across the Gahirmatha coast and mass nesting beach was fragmented. The Malpura river mouth opened into Bay of Bengal in the east cutting through the mass nesting beach. The northernmost sand spit was cut off from the main beach, forming an elongated island of roughly around four kilometers in length. This island was backed
by river maipura and by the Bay of Bengal on the east. In 1990, mass nesting took place, but it was entirely on this newly formed island known as Nasli Island or 'Ekakulanasi'. The name of the Gahirmatha rookery has been rechristened into Ekakulanasi rookery. The formation of the 'Ekakulanasi rookery' has kept the egg predators away from the nesting beach since 1990 and it has also become easier to protect the eggs from egg collectors and poachers.

**EXPLOITATION OF ADULTS AND MAGNITUDE OF THE TRADE:**

In 1960's and early seventies there was no organised turtle fishery in Orissa, but whenever live adult sea turtles were found in fishing nets they were collected and along with fishes they were sent by trucks, lorry etc. to the nearest railways stations. Depending on catch, live turtles were booked almost from all coastal railheads. In mid-1970's this was rapidly organised. Live turtles were booked almost everyday to Calcutta from Puri, Bhubaneswar, Multiaptpur and almost all coastal railway stations in Orissa. During the 3 months from November 1974 to January 1975, from Puri Railway Station alone, a total of 6190 live turtles were booked to Howrah (Calcutta). Often the turtles were booked as fishery products, so the magnitude of this trade is difficult to assess. (Kar 1988, Dash and Kar 1990).

After formation of the Wildlife Wing in the Forest Dept. of Govt. of Orissa, steps were taken so that the South Eastern Railway authorities stopped booking of turtles by train in the late 1970s. However, it continued for a couple of years under false documentation of booking turtles as fishery products. Kar and Dash (1984) pointed out to verify false documentation of booking of turtles as fishery products. Due to the stringent joint action by wildlife wing personnel and railway authorities, this was stopped in early 1980's. Then the trade continued on roads. Adult olive ridleys captured from Orissa's coastal waters were transported to Digha and other places of West Bengal. During 1978-79, a total of 21,381 turtles were landed at two sea side depots of Digha and Junput of West Bengal (Biswas, 1982) which indicates about the magnitude of the trade.

When the railways and roadways were sealed, the turtle poachers and traders again got organised to continue this flourishing illegal business through high seas. With gradual increase and proliferation of mechanised and non-mechanised fishing boats increasing number of turtles were captured each year. Roughly an estimated number of 50,000 to 80,000 adult olive ridleys comprising of both sexes were captured every nesting season upto 1980-81 from offshore coastal waters infront of Gahirmatha rookery (Dash and Kar, 1987). During 1982-83 nesting season due to vigilance by Forest Department officials of Orissa/West Bengal, the Indian Navy and the Indian Coast Guard, poaching of sea turtles on the high seas was reduced considerably. Inspite of this in 1982-83, about 10,000 live turtles were clandestinely landed at Banshalghat landing centre of West Bengal (Dash and Kar 1987, 1990; Kar 1988, Kar and Dash 1984). A survey of the market places during February 1983, also indicated that in West Bengal the trade in olive ridley sea turtle was continuing more under cover, but seemed to be flourishing as well as ever (Moll 1983)*. During the 1983-84 nesting season several thousand turtles were also transported to the Howrah market from Digha and adjoining places of West Bengal (Silis et al; 1983). It appeared that the protection measures were not sufficient due to the lack of suitable and permanent patrolling vessels to follow the poachers at sea, adoption of new strategies by the turtle hunters to continue this trade on sea turtles more under cover, and other law enforcement difficulties.

**TURTLE FISHING AREAS:**

Biswas (1982); Dash and Kar (1987, 1990) and Kar 1988 have given detailed descriptions of turtle fishing areas and the fishing communities operating in coastal Orissa adjacent to sea turtle nesting beaches. As mentioned earlier, Gahirmatha coastal waters were in a perfect wilderness state till 1970's and there was no mechanised sea fishing activities in this zone. The rivers were very rich with fish. The few sea side frontier villages along the Gahirmatha coast viz; the cluster of villages near Satabhaya, Kanhupur, Pentha etc. were getting enough fish and crabs from the tidal rivers and creeks for their sustenance. Even the villages in the upstream of rivers like Brahmani, Baitaran, Hansua, Kharasrota, Gobari, Mahanadi etc. were able to obtain their daily
requirement of fish from the rivers. Since there was no fishery trade in this zone, there was no necessity for entering into the sea for sea fishing. Local people were satisfied with whatever fish etc. they were getting from the rivers and creeks. The local inhabitants were neither ambitious nor industrious to think of exploiting the fish resources in a big way. Breeding ground of sea turtles was free from all sorts of human induced disturbances. The littering of beach with dead turtles as it is now on Gahirmatha and many other beaches was never imagined. Rarely there were any dead turtles encountered on the beach, not even during the mass nesting season. But the situation started changing very fast. With the immigration of refugees from East and West Bengal, large chunks of mangrove forests were reclaimed for conversion to paddy fields. Fish harvesting from tidal rivers, estuary started in every conceivable way. What was wilderness to the local inhabitants, turned out to be bonanza to the new settlers. They started exploiting the virgin fish resources of Gahirmatha coastal waters for quick money. The sea turtles were added to the list of their catch as it had ready-made market in West Bengal. Even then, until mid-1970s sea fishing by mechanised vessels was rarely seen in Gahirmatha coastal waters. Gradually, the turtles which used to enjoy the religious protection from the local inhabitants fell prey to settlers for easy money. In mid-1970s, a small proportion of the turtles accidentally captured in boats operating from Chandballi, Dhamra, Talchua areas were occasionally brought by boats etc. to Chandballi (former port of Orissa), from where they were sent by road to the Bhadrak railway station for despatching them to Howrah. But, turtles captured from sea were regularly being sent via Basudevpur to Bhadrakh railway station. The majority of the fishermen community in this area engaged in turtle catching operation were Bengali fishermen temporarily settled in the area or who were working on contract basis in the boats. Most of them have now permanently settled in and around Bhitarkanika and other areas of coastal districts of Orissa. Usually the indigenous local Hindu fishermen in Orissa are not engaged in turtle fishing due to religious practices. According to Hindu belief the turtle is considered as the second incarnation of Lord Vishnu (the Kurma Avatar as he was born in the form of a turtle) and so in many temples the turtle is also worshipped.

TURTLE FISHING METHODS AND THE FISHING SEASON AT GAHIRMATHA:

In Gahirmatha area fishing in sea by motor launch started in 1970s in a very sober way. There were only 6 to 7 gill netters based at Chandballi-Talchua-Dhamra area only to catch selective fish species like "Hilsa" and "Vekli". But, the increase in the number of trawlers and other mechanised as well as non-mechanised vessels in Orissa and in the neighbouring State of West Bengal around mid 1970s and the restrictions on booking as well as transportation of turtles through railways and roadways resulted in heavy pressure on Olive ridley sea turtle population of the Gahirmatha coastal waters. During the period from 1975-76 to 1982-83, about 1000 Bengali fishermen of Digha, Medinipur and 24-Parganas of West Bengal and adjacent areas in the undivided Balasore district of Orissa were fully involved in the turtle catching operation in the Gahirmatha coastal waters for more than six months in a year from mid-October to end of March or April. In this way, in late 1970s there was special drive to catch and transport boat load of turtles from their breeding sites to Calcutta market. Even the mating pairs and gravid females were not spared.

Adult Olive ridleys were usually captured from coastal waters of Gahirmatha during the peak mating and nesting periods of the species as the turtles usually used to congregate in very large numbers during the above period. During their mating period the turtles are extremely sluggish, passively swimming on the surface waters. Thus they become an easy prey to the poachers.

The poachers were usually operating in different fishing units. Each unit comprising of 5 to 8 non-mechanised Bengali Hundi Boats (or Kakrip type boats) with about 8 crew members in each boat and on motor launch with about 5 persons. Thus each unit consisting of about 45-70 persons. There were minimum 15 such units operating from Digha alone. Trawlers and motor launches were mostly used for towing these boats between the catching site at Gahirmatha and the landing sites at Digha and adjacent places. The time taken by the boats to reach their destination point was varying from 16 to 18 hours. During the peak periods, about 8-10 such groups were operating
simultaneously every day for capturing adult olive ridleys in the coastal waters off Gahirmatha. The big country-boats were having specially designed compartments for keeping the captured turtles, its flippers were tied with wire and plastic or nylon ropes. The animal was then put inside these compartments by placing them in upside down position.

As the adult turtles were abundantly available in the coastal waters off Gahirmatha and since the injured, dead and dying turtles won't fetch enough money in the market when they reach their destination, such turtles were usually discarded and thrown back into the sea. Often the poachers were remaining so busy during the turtle catching operation that they either did not find time or were not caring to cut the ropes attached to the flippers before throwing the turtles back into the sea. As a result, the turtles were not able to swim freely. Such turtles were dying in large numbers and contributed to the increased stranding at the Gahirmatha coast. Such stranding also resulted from other man made causes like ‘incidental catch’ in fisheries which proliferated after mid 1970's. The turtle carcasses were so numerous that even the scavengers like Jackals, Hyaenas, Bengal vultures etc. migrating from adjoining mangrove forests were not touching the carcasses of olive ridley sea turtles lying at Gahirmatha coast. Such carcasses were usually seen in large numbers during the period from mid-October to May.

Usually at the start of the breeding season 2 to 3 such groups of poachers were arriving at Gahirmatha coastal waters during October to initiate the turtle fishing operation. Thus as soon as large number of migrating turtles were reaching Gahirmatha, the other groups were timely informed within 24 hours of their arrival. Thus all interested groups were joining at Gahirmatha for the season’s turtle fishing business. Upon reaching coastal waters off Gahirmatha just in front of the mass nesting beach usually the boats in groups of two or even individual boats were starting to capture sea turtles by spreading their nets in the surrounding water. When the turtles were entangled in these nets they were simply lifted and hauled aboard by hand. Often small devices, i.e., a small piece of multifilament net of wider mesh size with two wooden sticks attached to the ends were used to immediately lift the swimming turtles and particularly the mating pairs from the surface waters. Within few hours of operation, boat load of turtles were captured, each boat containing on an average 100 adult turtles. After all the boats of a unit were fully loaded with required number of turtles, the boats were tagged together in a straight line by nylon ropes and were led by the powerful mechanised vessels to the landing centres at Digha. The catch was unloaded at Digha and was then sent through truck, lorry, etc. to the market places i.e., their final destination points at Howrah and Calcutta.

As has already been mentioned, roughly an estimated number of 50,000 to 80,000 adult olive ridleys comprising of both sexes were captured every nesting season from late 1970's to early 1980's. Due to launching of a massive programme by Government of India which was code named "OPERATION GECTURT" involving the Indian Coastal Guard, Indian Navy and State Law Enforcing Agencies like the Forest, Fisheries and Police Departments of Orissa and West Bengal, this illegal wildlife trade on sea turtles was completely stopped around 1984-85. Survey and surveillance at all known marketing places of West Bengal by the concerned authorities was also quite helpful in bringing this illegal trade of such high magnitude to an end. The impact of protection measures at high seas and at landing places as well as marketing places was such that for almost 10 years there was no capture of adult sea turtles from Gahirmatha coastal waters. After establishment of a new Coast guard headquarters at Paradip in Orissa, the annual event of ‘Operation Geeturt’ was discontinued from 1993-94 for a few years. It helped and encouraged the turtle poachers and traders again to unite and start the operation by adopting 'gorilla method' whenever there were no enforcing agencies in the high seas and coastal waters. Thus although poaching related killing of turtles has largely been controlled in the high seas, it appears that the protection measures are not sufficient due to lack of suitable and permanent patrolling vessels to follow the poachers (traders) at sea, adoption of new strategies by the turtle hunters to continue this trade on sea turtles more under cover of fishing, lack of proper co-ordination between forest and fisheries departments and other law enforcing agencies, and other law enforcement difficulties. Fortunately, with a request from State Chief Wildlife Warden addressed to the Director General of Coast Guard,
'OPERATION GEETURT' once again started to operate in 1996-97 though it was late for the season. The activities have been intensified in 1997-88 and it is hoped that it will become an annual event of activities of the Indian Coast Guard in future years.

PRICE OF TURTLES

During 1974-75 the wholesale price of adult turtles at Howrah market was from Rs. 55/- to Rs. 60/- per turtle and the meat was sold at Rs. 5/- to Rs. 6/- per kg. During 1979-80 the price range was from Rs. 80/- to Rs. 100/- per turtle. After the turtles reach Calcutta, from the main wholesale fish market at Howrah, it was distributed to all the local markets for sale. The price of individual turtles was also subject to daily fluctuation depending upon the demand and supply. During December 1982, the price of turtles at Howrah and other local markets were as follows (Table 6.3):

<table>
<thead>
<tr>
<th>Date</th>
<th>Name of Market</th>
<th>No. of turtles brought for sale</th>
<th>Price/Turtle</th>
</tr>
</thead>
<tbody>
<tr>
<td>20.12.82</td>
<td>Howrah fish market</td>
<td>165 40 to 60 kgs</td>
<td>Rs. 110/- to Rs. 140/-</td>
</tr>
<tr>
<td>22.12.82</td>
<td>Naifer Babu market</td>
<td>58 30 to 40 kgs</td>
<td>Rs. 120/- to Rs. 130/-</td>
</tr>
<tr>
<td>23.12.82</td>
<td>Howrah fish market</td>
<td>134 40 to 60 kgs</td>
<td>Rs. 140/- to Rs. 160/-</td>
</tr>
</tbody>
</table>

Source: Dash and Kar, 1990

The turtle meat in 1982 was sold at Rs. 10/- to Rs. 12/- per kg as compared to about Rs. 20/- per kg of mutton. The price of fish and meat etc. in Calcutta varies even on the same day depending upon the freshness of the fish and meat. However, turtle meat has always been at least two times cheaper than mutton.

During the late 1970's considering the price of olive ridleys at Howrah market on an average Rs. 100/- per individual turtle and a conservative estimate of an average of about 50,000 turtle arriving at the market places of Calcutta per season, the resource protein potential was roughly valued at Rs. 50 lakhs per season (Dash and Kar 1987).

The authors were informed by reliable sources that in 1996-97 season, a few turtles were being sold at different market places of Calcutta at the rate of Rs. 400/- per turtle. The value of turtle eggs and meat is always much cheaper than fish and mutton, chicken, pork etc. in West Bengal. Due to their habit of congregating in huge concentrations in the shallow coastal water during mating and breeding period, the olive ridleys are particularly vulnerable to intense commercial exploitation. As the result the resource is highly exploited whenever there is no enforcing agency and this is imposing heavy strain on the population of sea turtles migrating to Orissa coast.

NESTING AND MASS NESTING GROUND (ROOKERIES) OF SEA TURTLES IN ORISSA

The research activities of the Wildlife Wing of Orissa in the last two decades have indicated that there are 3 mass nesting beaches (rookeries) of Olive ridley sea turtles in Orissa viz;

(i) The rookery at Gahirmatha (Dhamara - Majpur river mouth).
(ii) The rookery near Devi river mouth.
(iii) The rookery near Rushikulya river mouth.

Besides the above, sporadic nesting of varying magnitude takes place throughout the coast of Orissa wherever there exist a suitable sandy beach. Thus, the State has the singular distinction of being the only maritime State in India having three mass nesting grounds of sea turtles and this has helped Orissa to appear in the turtle map of the world.

SHIFTING OF THE GAHIRMATHA MASS NESTING SITE

It has been observed that along Gahirmatha coast, the mass nesting site has changed over time with gradual change in beach configuration. In early 1970's, the mass nesting was taking place from near Satabhaya upto Eakakula. 1974-75, the mass nesting was going on along a 10 km stretch...
of the coastline from Gahirmatha to Eakakula. At that time, the beach was a very long wide sand spit backed by dense mangrove forests. There were high sand dunes reaching a height of about 100 feet along most of its length so that the background vegetation was not visible from the surf zone or even from the high tide line. After the devastating cyclone of October 1971, massive plantation programmes of casuarina plants (*Casuarina equisetfolia*) were taken up by the Coastal Shelter Belt Afforestation Division. The plantation work started from near Satabhaya and proceeded northwards up to Eakakula. With the mass nesting site also gradually shifted northwards. But, mass nesting mostly occurred at a place from where background vegetation cover was not visible. In the early 1980s, the turtles deserted the stretch from Satabhaya up to Habalikhati and then up to 'Akshifute Jora' up to Eakulana. The term 'nasi' in Oriya means the tip of the sand spit near river mouth. Usually, the mass nesting used to start from the tip and in subsequent nights it was spreading southwards. In May 1989, a cyclonic storm swept across the Gahirmatha coast and fragmented the mass nesting beach.

The Malpura river opened into the Bay of Bengal cutting through the mass nesting beach and the northernmost tip got separated forming a barrier island of roughly around four kilometers in length. This island was backed by Malpura river mouth, in the West and by the Bay of Bengal on the east. The newly formed island became famous as the Nasi Island where mass nesting continued from 1990 onwards. The name of the Gahirmatha rookery has been re-christened into Eakulana rookery. Thus in 20 years there has been a northward shift of more than 10 Kms. of the Gahirmatha mass nesting site.

**MATING AND BREEDING GROUND OF SEA TURTLES IN ORISSA**

The Olive ridley sea turtles migrate enmass to reach the coastal waters of Orissa during October every year. After their arrival, they congregate in very large numbers in nearshore and offshore shallow coastal waters within 50 fathoms depth zone more particularly in three areas viz:

(i) **Gahirmatha Coastal Waters** (Dhamra river mouth to Mahanadi river mouth);

(ii) **Devi Coastal Waters** (Jatadhari 'muhana' to Kadua river mouth or Kelani 'muhana'); and

(iii) **Rushikulya Coastal Waters** (Chilika mouth or Magarmukh to Rushikulya river mouth).

During the peak mating as well as pre and post mass nesting periods, the maximum concentration of the ridleys have been observed in the nearshore coastal waters at all the above sites. More than 90 per cent of the total population of sea turtles migrating to Orissa's coastal waters congregate in the offshore of the above three areas from October to May every year. The migrating turtles thus spend more than half a year in the above three areas of Orissa's coastal waters. Since the peak mating and breeding period coincides with the main fishing season, the turtles are most vulnerable to fishing activities and other human induced disturbances during this period.

**ACHIEVEMENTS AND ACTIVITIES OF WILDLIFE WING, ORISSA**

(A) **RESEARCH**:

The bulk of information on Indian sea turtles have been generated in Orissa. The State has the singular distinction of being the only maritime state in India having 3 mass nesting beaches of olive ridley sea turtles namely, the rookery at Gahirmatha coast and at Devi & Rushikulya river mouths. The research activities of one of the authors (C.S.K.) under the auspices of Wildlife Wing of Orissa in last two decade (from 1976 till date) has contributed a lot to understand the basic biology of Olive Ridley sea turtles which is critical for the successful management and conservation of sea turtle population. Research in Orissa is thus vital to the world's endangered sea turtle population. The sea turtle research activities of Wildlife Wing of Orissa have been as follows:

1. **STATUS SURVEY ALONG THE ENTIRE ORISSAN COAST**:

The status survey has indicated that there are three important mass nesting grounds of sea turtles in Orissa. These are located at:
a) Ekakulanasi of Gahirmatha coast (Dhamra-Maipur river mouth).
b) Islands and sandspits in front of Devi river mouth.
c) Island and sandspit near Rushikulya river mouth.

There are also smaller nesting grounds particularly in the offshore sandy islands and sandspits of river mouths along the Orissa's coastline where ever there is a suitable undisturbed sandy beach available for nesting.

II) MONITORING OF NESTING ACTIVITIES AT GAHIRMATHA COAST.

Population monitoring of adult nesting females is being done at the Gahirmatha rookery on around the year basis with estimation of nesting females in different arribadas. Yearwise nesting figures of female olive ridley sea turtles at Gahirmatha coast is given in table 6.4.

<table>
<thead>
<tr>
<th>Nesting Season (Figures in Lakhs)</th>
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<tbody>
<tr>
<td>1984-85</td>
<td>2.92</td>
</tr>
<tr>
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<td>1995-96</td>
<td>2.90</td>
</tr>
<tr>
<td>1996-97</td>
<td>No Mass Nesting</td>
</tr>
<tr>
<td>1997-98</td>
<td>No Mass Nesting</td>
</tr>
</tbody>
</table>

III) MONITORING OF DEAD/STRANDED SEA TURTLES:

Monitoring of fishing related dead (stranded) sea turtles is being done at Gahirmatha coast during the peak mating and breeding season i.e. from October to March/April every season. Casualties of adult olive ridley sea turtles counted at Gahirmatha and other coasts have been described in chapter X under management issues.

IV) TAGGING i.e., MARK-RECAPTURE TO STUDY MIGRATION AND OTHER ASPECTS OF LIFE CYCLE:

Through involvement of Govt. of India / FAO / UNDP and the State Government, a long term tagging program of sea turtles was initiated in 1978 at Gahirmatha coast, Orissa. Through the above tagging programme a total of 16753 adult female olive ridley sea turtles have been tagged using saline resistant monel tags. The tag recovery data from re-nesting females have confirmed

a) annual nesting in olive ridleys.
b) return of ridley females to Gahirmatha coast during successive years.
c) group nesting and group maintenance behaviour in olive ridleys.
d) multiple nesting of individuals in the same year during different arribadas.
e) multiple nesting by the same nesting female over several nesting seasons.
f) homing instinct and a strong tendency toward nesting site fidelity in olive ridleys.
g) staying of olive ridleys in the coastal waters off Gahirmatha for extended periods in between mass mating and different arribadas (i.e. from October to May).
h) migratory path and behaviour in olive ridleys.

The evidence of offshore recovery of a Gahirmatha tagged turtle bearing tag No. 14398 during January, 1978 being caught in a shore seine net at Pedamylavanilanka about 24 Kms. South of Harispur (Andhra Pradesh) and another turtle bearing tag No. 11777 caught from coastal waters off Jaffna (Sri Lanka) combined with earlier sighting records of northward mass migration of ridleys in the Bay of Bengal indicated that prior to arribadas in Orissa at least a part of the ridley population probably cover the entire length of east coast of India to reach the mass nesting beaches in Orissa coast with stray individual nesting on the Tamil Nadu, Kerala and Andhra Pradesh coasts during the breeding migration.
V) SOME OTHER RESEARCH ACTIVITIES ON SEA TURTLES OF ORISSA COAST HAVE BEEN AS FOLLOWS:
- Nesting ecology of olive ridley at Gahirmatha rookery.
- Food, feeding habits and food related growth in captivity.
- Egg collection and egg incubation.
- Development of egg hatchery management.
- Ecological relationship of sea turtles with coastal estuarine mangrove ecosystem.
- Captive rearing to study growth, etc.

vi) A small sea turtle field research unit has been set up in a rented house at Purunabandh village near Rushikulya rookery of Ganjam district in collaboration with Wildlife Institute of India, Dehradun since 1995-96 season for monitoring of nesting population of sea turtles at the above rookery. The estimated numbers of nesting females at the above mass nesting site during last four years are as follows: 1994-95 (60,000), 1995-96 (1,18,000), 1996-97 (25,000), 1997-98 (8,500). In the 1998-99 nesting season the Wildlife Wing of Forest department of Government of Orissa has established a number of field research and monitoring units covering all potential sea turtle nesting habitats along Orissa coast.

(B) ACHIEVEMENTS AND ACTIVITIES OF WILDLIFE WING FOR PROTECTION AND CONSERVATION OF SEA TURTLES IN ORISSA.
1. Issuing of licenses and large scale collection of sea turtle eggs from the Gahirmatha coast has been banned from 1975 with implementation of Wildlife (Protection) Act, 1972.
2. The approximately 35 to 40 km long stretch of sandy coastline from Etakulanasi (Dhamra mouth) to Barunei mouth has been notified to form the eastern boundary of Bhitarkanika Wildlife Sanctuary since 22nd April, 1975.
3. Poaching of adult sea turtles and their eggs from the nesting beach along Gahirmatha coast has been effectively controlled by the sanctuary protection staff since 1975-76 nesting season.
4. Large scale export of adult live sea turtles in passenger and express trains from different railway stations of Orissa to Calcutta has been totally stopped since 1977-78 through involvement of South Eastern Railway authorities.

5. Large scale export of adult live sea turtles in goods trains from different railway stations of Orissa to Calcutta (which continued for some years as fishery product) has been stopped from early 1980's.
6. Large scale illegal export of adult live sea turtles through roadways from Orissa to different market places of West Bengal has been stopped by increased vigilance in inter state checkgates and with the help of West Bengal Forest Department.
7. The flourishing trade and poaching of adult sea turtles from the coastal waters and high seas of Gahirmatha coast of Orissa which had reached its peak in 1977-78 involving capture of more than 50,000 turtles per season and which continued till 1982-83 has largely been controlled due to the stringent action taken by the Wildlife Wing of Orissa Forest Department with the help of Indian Navy, Indian Coast Guard as well as State Police and Fisheries Department personnel.
8. For protection of breeding habitats of sea turtles the Wildlife Wing have submitted proposals to establish two (Marine) Wildlife Sanctuaries, one at Gahirmeha in Bhitarkanika area and the other in Chilika area (i.e. Rushikulya-Magarmukh Wildlife Sanctuary).

These two proposals have got the approval of State Wildlife Advisory Board. No objection of Chief Naval Hydrographer was obtained vide letter No. HA/TW/0100/Deed 30.09.1996 of Naval Hydrographic Office, Dehradun. Approval of Govt. of India has been sought for by the State Government vide their Memo No. III 35/09/28451/Dt. 27.2.97 under Section 26-A of Wildlife (Protection) Act, 1972. Subsequently coastal water of Gahirmatha has been finally notified as the Gahirmatha (Marine) Wildlife Sanctuary vide Notification No. 18505 F & A dated 27th September, 1997. Published in the Extraordinary Issue No. 1268 of the Orissa Gazette, dated 17th October, 1997 (Annexure-XI). However necessary steps for notification of the Rushikulya-Magarmukh (Marine) Wildlife Sanctuary has to be taken immediately since prior concurrence of the Central Government has already been obtained vide their letter No. 1300 02 10/WL dt. 13.05.1997.

9. The 20 Km. sea ward radius of Gahirmatha coastal waters
(Dhamra river mouth to Barunei mouth) was declared as a 'No Fishing Zone' under the OMFR Act, 1982 (vide Notification No. 22781-7/Fy (M)-23/93-FARD-Dated the 27th December, 1993 Annexure-XIX). This has been extended for another one year with effect from the 18th February, 1996 (vide Notification No. 7Fy-Sch-49/95/60/FARD/dated 1.1.1996 Annexure-XXI). Since this period was going to be over by 17.2.98 i.e. in the middle of the 1998-99 forthcoming nesting and breeding season of sea turtles, Govt. in Fisheries and Animal Resources Development Department was requested by the Wildlife Wing to issue a fresh notification to re-impose prohibition on fishing activities in the above area without giving any time limit to make this area as a permanent No Fishing Zone.

10. In order to protect the sea turtles and their breeding habitats, Government of Orissa in Fisheries and Animal Resources Development Department have issued separate notifications prohibiting fishing in concentrated breeding ground of sea turtles viz:

- 20 Kms. Seaward radius of Gahirmatha coast from Dhamra river mouth to Barunei mouth to re-impose prohibition on fishing activities for a further period of 2 years from 18.2.1998 upto 31.5.2000 (vide FARD Department Notification No. 7 Fy Sch. 21/97 9485/FARD/dated 6.6.1997 (Annexure-XXIII).)

- 20 Kms. Sea ward radius of the Orissa coast from Jatadhari Muhana to Devi river mouth; and 20 Kms. Sea ward radius of the Orissa coast from Chilika mouth (Magarmukh) to Rushikulya river mouth for a period of 5 months from January to May every calendar year during the period from 1.1.1998 to 31.5.2000 (vide FARD Department Notification No. 7 Fy Sch. 21/97-9494/FARD/dated 6.6.1997 (Annexure-XXIII).

11. As per Orissa Marine Fishing Regulation (OMFR) Act, 1982 and OMFR Rules 1983, fishing by mechanised fishing vessels is totally prohibited in the 5 Km. nearshore area from high tide line which is exclusively reserved for traditional crafts.

12. Use of Turtle Excluder Device (TED) has been made compulsory by a circular of the State Fisheries Directorate, Cuttack on a 'Priority basis' failing which the license of trollers will be cancelled (vide No. 402.MR. XIV. M.F. 1/97-98/dated 6.12.97 of Fisheries Directorate, Orissa).

CAUSES OF CONCERN

1. INCIDENTAL CATCH/FISHING RELATED MORTALITY

After 1982-83 although poaching of adult sea turtles in the high seas was curbed, the greatest man made hazard was created for the sea turtles by the large scale and wide spread fishing by mechanised boats, trollers from adjoining ports and harbours. After 1980's due to sudden proliferation of mechanised fishing vessels and because commercial netting activities coincided with main breeding season of the species, thousands of sea turtles were killed every year as 'incidental catches' and sustained injuries, being hit by speeding boats and slashing of propellers.

Due to the movement of hundreds of trollers, gill netters and other mechanised boats, operating in Gahirmatha area, now the coastal water is over crowded with mechanised fishing crafts. Besides, the direct effect of killing the turtles, these mechanised crafts when speeding through the compact mass of 12 to 14 lakh turtles (taking both male and female population into account) is creating scattering effect with shock waves amongst the eggs loaded females and pairs in nuptial bond. Hundreds of gill nets, each spreading in an area extending upto 1 to 2 km. in length and 25 to 40 ft. width practically covers the entire breeding ground, thereby heavily disturbing the gravid females. Such activities do not permit congregation and mating of turtles resulting in breeding failure.

The turtles are hurt and killed by slasher of propellers of mechanised boats. Most of the turtles including mating pairs and gravid females, however, die due to suffocation and asphyxia when they entangle in trawl nets and gill nets (both multifilament and monofilament nets). Often the fishermen in order to save their costly nets deliberately hit the turtle's head and carapace with iron rods resulting to death. In trawl nets and multifilament gill nets there is no chance to escape resulting in 100% death of turtles which enter into such nets. In monofilament gill nets though some turtles may escape, when there are hundreds of such nets close to each other, the breeding turtles after escaping one or two such nets ultimately get entangled and trapped in

...
other nets and die due to suffocation and asphyxia. It has been observed that a large number of unlicensed trawlers and gill netters from distant fishing bases of Orissa as well as neighbouring states and Country often intrude into the coastal waters of Gahirmatha for unauthorised fishing due to no adequate law enforcing mechanism at present which is a matter of concern.

2. ARTIFICIAL LIGHTING

The artificial lighting from anchoring vessels, ports, harbours, fishing jetties, and other coastal developmental activities are having their impact on breeding, nesting, and hatching sea turtles as light is known to greatly disorient these turtles.

3. IMPACT OF NETTING ON RIVER MOUTHS

Excessive net setting on the river mouths and in tidal mud flats with nets of ‘zero’ mesh to 4” size mesh are responsible for killing spawns or small fish which is affecting the productivity of coastal waters thus affecting the food chain. This is affecting the sea turtles indirectly.

4. IMPACT OF PRAWN GHERRIES

Effluents released from intensive and semi-intensive prawn farms in the catchment areas along the coasts are affecting the micro-fauna of the coastal region, thus affecting the food chain of sea turtles in the coastal waters.

5. INTRODUCTION OF IMPROVED BEACH LANDING CRAFTS

Introduction of improved beach landing crafts was initiated by the Fisheries Department as a central sector scheme in 1984-85 and continued till 1990-91. Though the scheme has been discontinued since 1991-92 it is continuing through private funding. Increase in the number of these beach landing crafts is affecting the turtles as at present there is no proper regulation to limit the number of such crafts in any particular area.

6. MOTORISATION OF COUNTRY CRAFTS

Motorisation of traditional country crafts was initiated in Orissa as a centrally sponsored scheme in the year 1986-87.

These boats normally use gill nets the length of which normally exceeds one kilometer. When thousands of such gill nets are spread in congregated turtle breeding grounds and migratory pathways of turtles, the pairing is disturbed and ultimately the turtles die due to entanglement. In the meeting held under the Chairmanship of Hon’ble Chief Minister, Shri J.B. Patnaik in August 1998, a decision has been taken to stop further motorisation of country crafts by the Govt. Like land vehicles these motorised country crafts has to be serially numbered and registered by appropriate authorities and a computerised data base is to be developed to have proper control on these boats in different bases particularly around marine sanctuary and prohibited fishing zones.

7. CONSTRUCTION OF FISHING JETTIES, HARBOURS

In mid 1990’s a number of fishing jetties, fish landing platforms have been constructed in and around Gahirmatha coastal waters. When these will be made functional, the number of mechanised fishing vessels will increase in all the bases and the target fishing ground is the congregated breeding ground of turtles. It will have its effect on the mating, breeding as well as migratory routes of the turtles.

8. INCREASE OF VEHICULAR TRAFFIC ON NAVIGATIONAL ROUTES

Though there are existing navigational routes for vessels visiting the ports of Haldia, Paradip, Gopalpur, Visakhapatnam and Chennai, its impact on congregated turtle breeding ground has not been studied in the past. However, with expansion of the proposed port project of Gopalpur, Paradip and Dhamra in Orissa, vehicular traffic may increase in the sea routes adjoining the congregated breeding grounds which have been designated as marine sanctuary and ‘No fishing zones’ along Orissa’s coastal waters. It may also have impact on the migratory routes of the turtles. Therefore, proper regulatory measures are essential from the planning stage of these and other developmental projects. Specific guidelines need to be formulated which should be strictly implemented by the port developers and properly monitored by the Government.
CONSTRAINTS IN THE PROTECTION OF SEA TURTLES

The main constraint is lack of proper enforcement of the provisions of law, mainly due to absence of the requisite infrastructure, manpower, equipment and resources. Various other constraints for protection of sea turtles and their nesting as well as breeding habitats in Orissa are as follows:

1. Inadequate legal protection measures; Except the Gahirmatha coastline, the other major rookeries (i.e. Devi and Rushikulya) are yet to be included in Protected Area network of the State. The mating and breeding grounds in the coastal water have no legal status except prohibition of fishing which is difficult to deal with. Fishing trawlers, boats and other fishing vessels using this area cannot be prosecuted unless they are caught red handed with turtles in their nets/boats.

2. Inadequate implementation of protection measures and inadequate striking forces.

3. Inadequacy of communication system/VHF sets etc.

4. Lack of adequate funding support.

5. Rapid increase in fishing trawlers/boats and interference by fishing activities.

6. Intruding fishing boats/trawlers etc. from Bangladesh, Thailand, Srilanka as well as other neighbouring countries and States.

7. Fast vanishing mangrove forests of the shore has an adverse effect on the feeding and breeding pattern of turtles.

8. Change of beach profile due to natural processes, various developmental activities and depletion of coastal vegetation.

9. Pollution due to mechanised fishing and noise pollution.

10. Avoidable increase in beach lightings particularly on fishing harbour/jetties, mass anchoring of fishing trawlers during nights, development of coastal towns, establishment of DRDO at Wheeler islands and proposed major port of Dhamara and expansion of existing ports of Paradeep and Gopalpur.

11. Unregulated fishing with gill nets, nylon set nets, purse seine nets, zero nets etc. used both by trawlers, gill netters, mechanised and country boats as well as intruding foreign vessels is a matter of concern. The provision of using TED is not being adhered to beyond the sea turtle breeding grounds and the rules are violated by the unscrupulous fishermen due to lack of exemplary punishments or enforcement of legal provisions.

12. Potential Fishing Zone (PFZ) forecasting in 'No Fishing Zone' by the State as well as National Remote Sensing Agencies through Radio/TV/Newspaper and other such media. As the OMFAR Act, Rules and 'No Fishing Zone' notifications i.e., prohibition of fishing in the 20 Km seaward radius of Gahirmatha is normally being violated, it is causing avoidable threat to the turtles at Gahirmatha.

13. Turtles come to Gahirmatha coastal water from October and stay till May. During this period they feed on molluscs, shrimps, prawns, small crabs, jelly fishes, etc. which flourish on the sea bottom. The trawling of the sea bed damages and destroy the feed and feeding ground of the turtles.

14. The metal (iron, Manganese and Chromium) dust and coal dust which falls in the Paradeep port loading site, drifts to Gahirmatha coastal waters and affects the breeding and feeding grounds.

15. The dredge materials due to dredging of the shipping channel at Paradeep are released at the northern side of Paradeep port which drifts and spread to Gahirmatha coast. This affects the habitat and feeding ground.

16. Joint patrolling on high seas was regularly being made every season with the help of Indian Navy, Indian Coast Guard as well as the State Police and Fisheries Dept. with magistrates on board from 1980-81 till 1992-93. For this the Coast Guard ships were usually coming either from bases like Visakhapatnam (A.P.) or Haladia (W.B.). For assisting the above purpose, a new District Head Quarters of Coast Guard was established at Paradeep in 1991. But only a year after its establishment at Paradeep in Orissa, such joint patrollings
with Forest and other State Government officials on board was discontinued from 1993-94 nesting season. During 1996-97 season with a request from Chief Wildlife Warden, Orissa addressed to the Director General, Coast Guard some activities have been resumed but it was late for the season. This activity was intensified during 1997-98 season.

17. As per OMF Act and Rules, the 5 Km Zone of the sea from high tide line is a prohibited zone for mechanised fishing activities all along Orissa Coast, but it is not being properly implemented.

SUGGESTIONS FOR PROTECTION OF SEA TURTLES

The Olive ridleys coming for breeding in coastal waters of Orissa and nesting on Orissa's Coastline are a globally significant population which the Government of Orissa/India have the privilege and responsibility to protect. This maritime state and country should, therefore, take the lead in developing, promoting and implementing a protection, conservation, research and management plan. Neighbouring states and countries should be encouraged to participate in this effort while Govt. of Orissa/India should develop their own action plans for ensuring effective protection to this important natural resource.

1. Government in FARD Department should properly implement prohibited fishing zone notifications in the three concentrated breeding grounds of sea-turtles viz.:
   - 20 Km seaward radius of Gahirmatha Coastal Waters (i.e. from Dhamara river mouth to Barunei mouth).
   - 20 Km seaward radius of Orissa coast from 'Jatadhar Muhana' to Devi river mouth.
   - 20 Km seaward radius of Orissa coast from Chiliki mouth (Magarmukh) to Rushikulya river mouth.

2. Government in Forest and Environment Dept. to take early action in issue of notification to declare the pending proposals of Rushikulya-Magarmukh (Marine) Wildlife Sanctuary, as this has got the clearance of Government of India vide their letter dated 13.05.97. Steps should also be taken to give protected area status to the sea-turtle rookery near Devi river mouth by declaring the coastline from Jatadhar river mouth to Kadua river mouth as a separate Wildlife sanctuary which may also include the mangroves of Devi river delta for protecting this unique ecosystem.

3. The Forest Department should acquire two seagoing vessels to anchor on the two sides of the Gahirmatha congregated breeding zones and a few speed boats to be stationed at sensitive areas like Dhamara, Ekakula, Wheeler Islands, Barunei, Jamboo, Hukitola, Paradeep etc. with necessary crew and additional staff or surveillance of Gahirmatha coastal waters.

   Similarly, few patrol vessels are needed for patrolling the coastal waters of Devi river mouth (to be stationed at Jatadhar Muhana, Bandar, Astaranga (Nuagada) fishing harbour, Kadua river mouth) and Rushikulya river mouth.

4. Adequate arrangements should be made right from now for preventing casualties in the forthcoming mating and nesting seasons in consultation with all agencies involved, for proper protection of sea turtles migrating to Orissa coast for breeding and nesting.

5. It is perhaps necessary at this stage to move the Government to amend the OMF Act to make it flexible to give more powers to field officials of other Departments as 'Authorised' and 'Adjudicating Officers' and make the law more effective and deterrent.

6. The Indian Navy, Defence Research Development Organisation (DRDO) and Naval Hydrographic Office of Government of India may be requested to advise and assist in the demarcation of 'No Fishing Zones' and Marine Wildlife Sanctuaries with fluorescent buoys or other methods with 100% external assistance.

7. Perhaps it will go a long way to move the Government of India to declare the Marine Wildlife Sanctuaries by the Central Government as per Wildlife (Protection) Act, 1972. Protection of sea turtles and other wildlife including boundary demarcation and maintenance of protected areas in high seas may be entrusted to Government of India agencies like Indian Navy/Indian Coast Guard/Naval Hydrographic office etc.
8. Surveillance in other mass nesting sites should also be intensified for having long term data on population size, interchange between population, dispersal and migrations.

9. Mass awareness campaign among the local people of all age groups and fishermen should be taken up vigorously through involvement of interested NGO's.

10. The coastal waters need to be properly classified into protected, conservation and utilisation zones and it should be included in the coastal zone management plan (CZMP) of maritime states. Rigid enforcement of CRZ and OMFR Act by augmenting staff as well as creation of striking force may be considered with adequate funds under Central Assistance or External Assistance.

11. PFZ (Potential Fishing Zone) forecasting by NRSA (National Remote Sensing Application Center) and ORSAC (Orissa Remote Sensing Application Centre) in the 'No Fishing Zones' and proposed Marine Sanctuary areas has to be stopped which is presently being done through media services.

12. Use to TED should be made mandatory in all fishing vessels (Trawlers) to operate beyond the 'No Fishing Zone' and concentrated Turtle breeding grounds proposed as Marine Wildlife Sanctuaries.

13. Since the rookery of sea turtles is also seen elsewhere in Orissa Coast at Rushikulya and Devi mouths, adequate administrative and infrastructural development at these places for protection, research and conservation of sea turtles require immediate attention of the State and Central Government as well as national and international conservation organisations.

14. Boats and fishing vessels violating the provisions of Wildlife (protection) Act, 1972 (amended 1991) or indulging in catching or killing of sea turtles should be confiscated. Necessary amendments of both Wildlife (Protection) Act and OMFR Act should be done to include the above provisions. The Act should be amended to have powers of confiscation of vehicles, vessels, tools and weapons etc. connected with wildlife offence cases.

15. As per provisions of OMFR Act 1982 and OMFR Rules (1983), the 5 km zone of the sea from high tide line is a prohibited zone for all types of mechanised fishing activities all along Orissa coast. This zone should be declared as 'Closed Area' under Wildlife (Protection) Act, 1972 so that concerned wildlife wardens will be empowered to take legal actions.

16. Illegal encroachments and illegal fishing (Nolia) settlements on Government land, on beaches and river mouths should be removed.

17. Further mechanisation of traditional crafts has to be stopped by the fisheries department as it has already exceeded the cumulative carrying capacity of fishing bases of Orissa as specified in the OMFR Acts and Rules.

18. A computerised 'Sea Turtle Database' should be set up in the Wildlife Wing of Forest and Environment Department which is the main nodal agency of the Government responsible for protection, research and conservation of sea turtles. It should have information about all bonafide fishermen, fishing boats and trawlers etc. of all fishing bases around Gahirmatha (Marine) Wildlife Sanctuary and other 'No Fishing Zones' along Orissa coast for proper regulation, as well as for developing suitable strategies and action plans. Fisheries department should provide baseline information to other law enforcing departments like the State Police and Forest Department as well as Indian Coast Guard.

19. Fresh casuarina plantations should not be done near sea turtle rookeries and on the sandspits at river mouths. In all other areas at least a width of about 100-150 meters from high tide line may be left untouched to provide adequate nesting area for sea turtles.

20. Annual surveys and monitoring should be made for fresh evaluation of population size at all mass nesting and other nesting beaches, feeding and breeding grounds. These regular surveys should be carried out from October/November to May every year. The Wildlife Wing of the Orissa Forest Department could act as a 'nodal agency' to
develop an 'Annual Sea Turtle Enumeration Programme' involving all coastal forest divisions of the State, Universities and interested NGO's.

21. Fresh evaluations should be made about the threats to the turtles and their habitats. It should include poaching, trade as well as direct and indirect mortality of sea turtles in fishing operations.

22. DNA fingerprinting should be used to identify genetic population of sea turtles.

23. Satellite telemetry as a means for tracking the real-time movement of turtles should be initiated to know the migratory route or pathways and feeding grounds of this important population of olive ridley sea turtles.

24. Field research cum-monitoring centres (Benchmark monitoring sites) should be established and strengthened near 3 known mass nesting beaches viz: Gahirmatha, Devi and Rushikulya rookeries with adequate transport, communication facilities, research scholars and other supporting staff.

25. Adequate funds for research, protection, conservation and monitoring of sea turtles and their nesting as well as breeding and feeding habitats should be ensured.

**ACTION PLAN- PROJECT SEA TURTLE**

The population of sea turtles in Orissa represents about 80 percent of Indian sea turtles and about 50 percent of world population of the species. Therefore, protection of this globally important population has now come to the priority list of wildlife conservation. The FAO/UNDP involvement which has ceased from 1980 should be initiated again to develop meaningful strategies and suitable action plan for protection, conservation, research and management of sea turtles. This is necessary because man's dependence on the coastal and marine environment has become manifold in the last two decades. This endangered species and its critical habitats can be protected if international funding agencies like FAO/UNDP, GEF etc. will come forward for providing required inputs, timely, on a priority basis as a follow up action to "Rio declaration", "Orissa declaration" and different international conventions like CITES/Migratory species conventions, etc. With initiation of Govt. of India, FAO/UNDP, an approach paper was prepared by Dr. C. S. Kar, Research Officer of the Wildlife Wing of Orissa in 1998.

The salient features including threats to the sea turtles in Orissa, proposed actions to prevent the tarets, various action objectives and significance to be expected from the proposer project "PROJECT SEA TURTLE—ORISSA", included the following:

**THREATS TO THE SEA TURTLES IN ORISSA**

1. Fishing by Trawlers & Gill netters in nearshore and offshore Coastal waters.
2. Lighting from Defence establishments, Ports, Harbours anchoring vessels and other Coastal developmenta activities.
3. Beach erosion.
4. Damage by predators.
5. Disturbances by people.
6. Changes in the land use pattern of Coastal areas.
7. Other coastal developmental activities

**PROPOSED ACTIONS TO PREVENT THE THREATS.**

1. Stop fishing/trawling activities in prohibited zones and regulate it outside these zones during the breeding season which fall within the migratory pathways of turtles.
2. Test the efficiency of different Turtle Saver Devices (TSDs) Device monitoring mechanisms for ensuring proper and mandatory use of TSDs in the high seas, prior to its implementation. Prevent experimentation of TSDs in Higl turtle congregation zones as recommended in proceedings of the 1st World Conference on Sea Turtle conservation.
3. Check charijees in the landuse pattern of coastal areas.
4. Prevent illegal encroachment at the sea turtle nesting sites.
5. Monitor and control pollution as well as lighting of Industries, Ports, Harbours, anchoring vessels and other coastal developmental activities.
8. Control predation of eggs, hatchlings and adults.
9. Check adult sea turtle mortality both onshore & offshore.
10. Create greater awareness for conservation of sea turtles and their habitats.
11. Demonstrate/Provide alternate means of livelihood to selected target communities in highly sensitive areas.
12. Create a database for providing necessary inputs for long term scientific management of the endangered sea turtles, mangroves, coral reefs and the ecologically sensitive critical habitats.
13. Provide complete protection to the habitats of sea turtles including migratory pathways of the species.

ACTION OBJECTIVES:

- Species protection, habitat protection, management and improvement
- Identification of problem areas for reducing man sea turtle conflict
- Establishment and strengthening of sea turtle reserves on land and at sea
- Institutional strengthening (infrastructure/communication development), capacity building at all levels for coordinating protection, conservation, research and management objectives.
- Law enforcement for species and habitat protection; monitoring of trade on turtles and turtle products.
- Monitoring incidental capture, fishing related mortalities, migratory route of the species, coastal geomorphology, population structure and effect of management strategies, etc.
- Regulating wildlife tourism/beach/island tourism etc. on a scientific basis
- Establishment of an Indian Ocean Sea Turtle Database
- Ecodevelopment through establishment of ‘Eco-technology centres’
- Creating greater public awareness for conservation.

SIGNIFICANCE EXPECTED:

- All round protection and conservation of sea turtles along with land/aquatic flora and fauna in and around important sea turtle reserves.
- Demonstration of compatibility in sea turtle conservation/wildlife conservation and human dimension including wildlife tourism.
- Improvement in standard of management because of sustained research and field level training.
- Improvement in standard of research because of high level of inputs and training at all levels.
- Generation of respect among people for fisheries/Wildlife laws for protection as well as preservation of sea turtle habitats including offshore coastal waters, islands, coasts, delta, coastal wetlands, coral reefs and mangrove forests.

The Government of India and the Orissa State Government are committed to curtail the sea turtle mortality through immediate activities during the 1998-99 nesting season (October to April/May) by launching a “PROJECT SEA TURTLE” in the lines of PROJECT TIGER with 100% central assistance to conserve the marine turtles in the State of Orissa in particular and along the Indian coast in general. However, the endangered sea turtle species and their critical habitats can be protected if international funding agencies will come forward for providing required inputs on a priority basis. It is urgently necessary to develop meaningful strategies and suitable regional and national action plans for protection, conservation, research and management of sea turtles.

Objectives of the “PROJECT SEA TURTLE” in the immediate and longer terms are as follows:

Immediate:

- Minimise and eliminate trawling related sea turtle mortality.
- Regulate fishing, trawling activities during the breeding season.
- Popularise the use of Turtle Excluder Devices in trawl nets.
• Prevent illegal encroachment of the sea turtle nesting sites.
• Control poaching and predation of eggs, hatching & adults.

Long Term:
• Sustainable management of social resources through participatory approach.
• Establish Research Based Management (RBM) Database for scientific management.
• Monitor and control pollution and other developmental activities.
• Generate awareness for conservation of sea turtles and their habitat.
• Implement schemes for ecodevelopment to select target communities in sensitive areas.
• Habitat protection of sea turtles including migratory pathways of the species.

Project Implementation strategy:
• Participatory approach to involve local communities.
• Co-ordination with all stakeholders including Government and non-Governmental agencies.
• Institutional strengthening (infrastructure/communication development).
• Capacity building through human resource development.
• Law enforcement in collaboration with enforcement agencies.
• Demonstrate and popularise the use of Turtle Saver Devices (TSDs) for minimising turtle mortality through an extensive awareness programme.
• Ecodevelopment through village committees.
• Promotion of Ecotourism.

The Project aims at the active participation of all stakeholders viz. FAO/UNDP, GEF, UNFIP, Ministry of Environment & Forests (GOI) and other central ministries, State Governments of Orissa, Tamil Nadu, West Bengal, Andhra Pradesh, Maharashtra, Gujarat, Kerala, Andaman & Nicobar Islands, Wild Life Institute of India, National Institute of Oceanography, Indian Coast Guards, Indian Navy, DRDO, Universities and select non-governmental organisations.

The successful implementation of the project will help in winning back the confidence and support of the people for environmentally sound management of coastal resources for sustainable development and will help in the conservation and management of the world's largest rockeries, largest breeding grounds as well as feeding and developmental habitats of sea turtles.