Chapter-8
Bhitarkanika: Threats and Remedies

The threats to the mangrove ecosystem could be broadly grouped into two: Natural and Anthropogenic. These factors may affect the system as a whole or any one entity within the system, etc. The natural threats include: Climatic changes, Cyclones and Physical processes. Diseases, deterioration, pollution, grazing, agriculture, aquaculture and human encroachment (including reclamation), etc., are considered as the anthropogenic threats to the ecosystem.

THREATS TO MANGROVE VEGETATION:

In the Bhitarkanika, mangrove destruction is due to human pressure, conversion of paddy cultivation etc. In Mahanadi, the destruction of mangroves is due to heavy human pressure, indiscriminate felling, decrease of wildlife particularly endangered species and fishes; and, conversion for different land uses (Ministry of Environment and Forests,GOI).

Photo: ***Effects of overgrazing on mangroves***

Photo: ***Conversion of mangroves for acquaculture***

Chadha and Kar (l999) in the book 'Bhitarkanika: Myth or Reality' detailed the degradation issues. There is a heavy pressure on forest resources of Bhitarkanika for fodder, firewood, house and other constructions, due to large human and cattle populations. This is a problem specifically after the harvest of agriculture crops, when the people are unemployed during the period between Dec. to May. An estimated 70,000 cattle are found within the sanctuary. During cropping season, from June to November, these cattle depend mainly on the forests for fodder. *Avicennia*, an excellent fodder is under intense pressure due to heavy grazing by buffaloes in the Bhitarkanika, Mahanadi Delta, Balasore coast and Jagatshinghpur district (Chadha and Kar, l999)

Photo: Felling of mangroves for domestic use

Photo: Wood collection from mangroves

The average fuel used per household is about 14 kg per day, out of which 12 kg would be in the form of firewood obtained from mangrove forests. About 1,10,000 people depend on the natural firewood of the protected area. About 20,000 people are engaged in collecting firewood from the forests on daily basis. There is a huge gap in demand and the sustainable supply from the forests. Most of the households are constructed

by using mangroves: *Phoenix* stems are used for construction of walls and leaves for thatching, *Heritiera* for making doors and windows, besides *Lumnitzera*, *Xylocarpus* and *Avicennia,* etc. (Chadha and Kar, l999).

Photo: Reclamation of mangroves for bunding

The Orissa mangroves have a serious problem of encroachments. Encroachment of forestland by the migratory people and conversion of the same into common homestead and agriculture land are the main problem in this locality. This has put tremendous biotic pressure on the potential mangrove forests. In the encroached land, the tidal creeks are being blocked by earthen bunds, which prevents the natural tidal flow and gradually the mangrove vegetation perish from that area. Aquaculture in the area had created resentment among the local fishermen. Large areas of mangroves were cleared in the Hetamundia reserved forest for aquaculture purposes (Indian Space Research Organisation, l992).

Poaching of animals like spotted deer, wild-boar, python, cobra, crocodile, migratory birds, occur occasionally in the sanctuary.

Fishing in the rivers and creeks by the surrounding local people is posing several adverse factors, the major being obstruction of migratory routes of fishes and blocking of free movement of crocodiles. Sometime, fishing by the local people leads to virtual closure of creeks, thereby the tidal inundation is hampered to a considerable extent. Fishing in the near shore and off shore coastal waters resulting in mortality of endangered Sea turtles, Dolphins, etc. Movement of fishing vessels in the congregated breeding ground of sea turtles is affecting the Ridleys and disturbing their mating in the waters.

The mangroves often exhibit some disease problems. *Heritiera fomes* dies from the bottom stem; reason for which is not known. *Sonneratia apetala* shows tip drying disease probably due to high salinity especially during summer.

THREATS TO SALT-WATER CROCODILES:

Status: Dr. Lala Singh provided the following historic account of the changing information base and perceptions about crocodilian status in India including that of the salt-water crocodiles of Bhitarkanika-

Status in 1971, (First Working Meeting of Crocodile Specialist Group of IUCN). No numerical estimates. Gharial extremely rare. Mugger exterminated in most areas of its range. Saltwater crocodile no concern, apparently thought to be safe.

Status in 1974 (after survey by FAO Expert Dr. H. R. Bustard). Gharial, Rare, survival is in jeopardy. Mugger, greatly depleted in numbers and rare in most of its range. Saltwater crocodile, no reliable scientific information available, number greatly reduced.

Status in 1977 (situation before the release of any captive-reared young into the wild). Gharial, Endangered, estimated wild population 230. Mugger, vulnerable, estimated wild population 1000 approx. Saltwater crocodile, Endangered. Estimated wild population 550.

Status in 1980. Gharial, Endangered, extremely depleted. Mugger, Vulnerable, heavily depleted throughout its range. Saltwater crocodile, Endangered, now seriously depleted and rare or extinct in most of its former ranges in India.

Status in 1984. (at the time of 7th Working Meeting of IUCN/SSC Crocodile Specialist Group). Gharial, Improving, Estimated 354, +1518 released. Mugger, Improving, Estimated 1000, + 600 released, + 5500 captive. Saltwater crocodile. Improving, estimated 598, + 415 released, + 700 captive.

Status in 1993 (at the time of regional meeting of West Asian Crocodile Specialists of IUCN/SSC-CSG). Gharial Estimated 1500, +466 in captivity. Mugger 3000-5000, +12,000 in captivity. Saltwater crocodile 1000, +650 in captivity.

Status in 1995 (Gharial only at the Gharial PHVA). Estimates of fewer than 300 wild adults total and modeling studies indicated continuing decline of most populations despite continued restocking.

Status in 1998 (at the time of regional meeting of West Asian Crocodile Specialists of IUCN/SSC-CSG) The estimates provided in 1993-95 were generally accepted. However, for the three species, Gharial, Mugger, and Saltwater crocodile there was no recent published information and habitats continue to be under pressure on an all-India basis. Despite successes in the National Chambal Sanctuary (Gharial) and Bhitarkanika (Saltwater crocodile) the crocodilian situation was facing a crisis. Recommendations to address this crisis were formulated but remain to be implemented on a national basis.

Status in 2000. Subsequent to the 1998 regional meeting, a volume of ENVIS -Biannual Bulletin of the Wildlife Institute of India , Vol. 2, No 1. June 1999 published status reports including survey data up to 1997, for 14 Indian States and for Nepal. This remains the most recent, quantitative and accurate assessment of the status of crocodilians in the region.

Official perception on threats to salt-water crocodiles: According to Dr.Sudhakar Kar, Senior Research Officer (wildlife) Govt. of Orissa, who has been studying the crocodile population of Orissa for several years-

"The gradual shrinkage of mangrove forest due to anthropogenic pressure has been posing a constant threat for the future survival of the saltwater crocodile (Crocodylus porosus) in Bhitarkanika. In addition, illegal fishing in the creeks and rivers by local communities is making the existence of the population very difficult. During the 1999 winter census a total of 672 crocodiles were counted which included 150 hatchlings, 146 yearlings, 160 juveniles, 144 subadults and 72 adults. There was a marginal increase in the number counted in the previous year (669 crocodiles in the 1998 census). We are at a loss about the fate of the subadult crocodiles (only 144) although 2000 young crocodiles of about 1m length have been released in phases into the Bhitarkanika river systems since 1977. In addition there is natural recruitment from 150 - 200 hatchlings annually that enter the system directly since egg collection for the project was stopped.

"On the other hand, crocodile attacks on people and cattle are an increasing trend. This has posed some serious conservation problems. Most recently, an attack by a semi-wild crocodile 8.5 feet length on one of our attendants at the Saltwater Crocodile Research Center in Dangmal has put us in an embarrassing situation. The Research Center is surrounded by rivers and creeks and a crocodile released earlier had entered an open fresh water pond located within the center. The attendant, who worked for us for over two decades, entered the pond to clean buckets and other items used to feed crocodiles. He was seized and dragged to the center of the pond. Other attendants managed to free him from the crocodile's mouth but he had profuse bleeding from his left hand and chest (perhaps he was bending over when seized). He was immediately rushed to the local hospital, but succumbed to his injuries on the way. He was a responsible and hard working person and his loss is a great loss to us and to all his family.

"Usually the records show that it is larger crocodiles responsible for killing cattle and people. This case is an exception of a smaller captive raised and released crocodile responsible, which returned and killed one of the people who raised and released it.

We also have data from two Ph.D. studies on wetland birds of the Chilika lagoon, a RAMSAR site and India's largest brackish wetland, that was ideal habitat for C. porosus. Due to loss of mangroves and intensive fishing activities the crocodile populations has been completely wiped out."

THREATS TO TURTLE ROOKERY AT GAHIRMATHA:

The Gahirmatha coast in Orissa hosts mass nestings *(arribadas)* of thousands of Olive ridley sea turtles every year from December to March, and is considered the world's largest turtle rookery (Patnaik & Kar 1992). The *arribadas* take place twice within this period, separated by a gap of 45 to 50 days (Dash & Kar 1992). However, large scale to mechanised fisheries in the nearshore waters in recent years has increased the mortality rate of female turtles (Pandav et al. 1998). The Orissa State has a long coastline (480 km) with a number of rivers emptying into the Bay of Bengal. The physio-geography of the terrain and ocean dynamics support the discharge of a large volumes of sediments into the ocean which in turn give rise to a number of depositional landforms in the coastal region. A 35 km sandy beach with an elongated sand spit in the north eastern extremity (Ekakula) hosts the most dense nesting by sea turtles.

Natural Factors as causes for declining Olive ridley population: The successive failure of mass nestings by Olive ridleys in 1997 and 1998 were a cause of great concern and a serious setback to the efforts of conservationists. To ascertain why turtles did not use the rookery in these years a detailed investigation of the turtle habitat and its morphodynamics was undertaken by B.G. Prusty, R.K. Sahoo and S.D. Mehta, and the resultant paper was 'Natural Causes Lead to Mass Exodus of Olive ridley Turtles from Ekakulanasi,Orissa, India: A Need Alternate Sites'. The prime objective of the study was to determine the conducive ecological and geo-environmental factors possessed by Gahirmatha, with the hopes that landforms having such suitability factors in the region could be protected through suitable conservation measures, so that they may act as alternate sites for mass nesting.

The said study noted, throughout the world, even before they were destroyed by humans, many rookeries might have been destroyed by natural processes (Bowen & Avise 1994). During a severe cyclone in 1989, the Ekakula sand spit was detached from the mainland near Satabhaya and started migrating in a NE direction (Prusty & Chansarkar 1997). Since then, the detached spit has grown in size and has been renamed the Ekakulanasi sandbar. This sandbar was extensively used by the sea turtles during *arribadas* in subsequent years. The extent of the sand bar did not change significantly from 1989 to 1996 (Prusty 1998) and each year more than 200,000 turtles assembled on the beach to nest. During the period, the surface area of the nesting habitat was always about one square kilometre. Impact of frequent cyclones/depressions in the region has resulted in large-scale erosion of the sand bar since 1996 and its area has decreased from 0.977 sq. km in Nov. 1996 to 0.278 sq.km in Nov. 1998. This trend persisted until Nov. 1998. By March 1999, the surface area of the sandbar increased to 0.52 sq.km, and on 24th and 25th March the rookery witnessed another *arribada* after a two-year gap. It is inferred that the changes in surface area and resulting lack of mass nesting events indicates that 0.5 sq.km is the minimal area needed for mass nesting of Olive ridleys in Gahirmatha, and further it can be said that the reason for the lack of mass nesting events in 1997 and 1998 can be attributed to natural causes rather than human activities.

The above study further mentioned that Gahirmatha coast receives inland water from two rivers, the Brahmani and the Baitarani, through the tributaries Dhamra and Maipura. In spite of the availability of a number of sandbars in the Gahirmatha region, sea turtles use only the Ekakulanasi sand bar for mass nesting, and visit the same area year after year to nest. It is not known why they do not nest on sandy beaches or nearby sand bars close to the foraging sites, but it is possible that environmental degradation at Gahirmatha may be responsible. Turtles have been found to prefer landforms having a surrounding water depth of 5m or more. At Gahirmatha, the surf-zone is very near to the Ekakulanasi sand bar and the beach near Satabhaya. This is not the case at the nearby Wheeler group of islands, where the surf zone is almost 5 to 6 km away from the shore. To reach any of these sandbars turtles would have to travel long distances in shallow waters.

As per the above study, detailed morphological characterisation and temporal studies, and analysis of the sediment properties suggest freshly deposited medium-grained sand (0.25 mm to 0.5 mm) without vegetation in deltaic environments and the presence of black sand patches within the deposit were suitable for mass nesting events. Thick Casuarina plantations on the Wheeler group are believed to have deterred nesting. The plantation activity was undertaken by the Orissa forest department to counter cyclonic impacts in the region. Another major characteristic of the rookery in Orissa was the presence of black sand (Ilmenite-Zircon-Monazite bearing sands; Acharya et al. 1998). The restricted access to the rookery by people, limited influence of non-human predators, minimum trawler activity in the nearby waters and precautionary measures to counter artificial illumination (see Witherington, 1992) are also believed to attract large numbers of turtles to this habitat.

The Gahirmatha site was declared as a Marine Sanctuary on 27 September 1997 (Kar 1998). The other favourable nesting habitats at the Devi and Rusikulya river mouths are not treated as protected sites under the Coastal Regulation Zone (CRZ) notifications. The wise development and conservation of the newly identified sites is believed to be essential to provide Olive ridley sea turtles with alternate nesting sites, possibly under Marine Sanctuary status so that they receive similar protection as in Gahirmatha. The Study concluded that analysis of geomorphologic characteres at other depositional land- forms along the Orissa coast led to the identification of three alternate sites, namely Jatadhar Islands, and the north and south sand spits at the Rusikulya river mouth as turtle rookeries. It is suggested that these sites should be protected from human activities with suitable conservation strategies.

Photo: Dead Olive ridley on an Orissa beach

Anthropogenic factors as causes of declining Olive ridley population: According to a paper 'The Olive Ridley sea turtle (*Lepidochelys olivacea*) in Orissa: An urgent call for an intensive and integrated conservation programme' by *Bivash Pandav, B. C. Choudhury and Kartik Shanker* , the present danger to the Olive ridleys in Orissa coast is the mortality due to *incidental catch*. They are trapped in trawl nets, drown and are then discarded to be washed ashore by the thousands. While it is apparent that the first step that needs to be taken is strict action against nearshore fishing by mechanized trawlers, a long-term solution may lie in mobilizing the local fishing community.

Further, TEDs are available for use on trawlers to prevent the accidental drowning of the turtles, but the bigger problem lies in getting the trawlers to use them. Moreover, TED being a US-born device suitable for exclusive shrimp fishing, the local trawl industry, who are mostly after a mixed catch show their reluctance to use TED. It is worth mentioning here that a local fisherman of Orissa coast has already invented an indigenous alternative to TED, which is called Trawl Guard. Project Swarajya, based at Cuttack has ever since 2002 been promoting its use by the trawlers of Orissa coast as an effective, inexpensive and foolproof substitute for TED. A series of 3 experiments, already conducted in the sea waters off Orissa coast in recent years has demonstrated the efficiency of the new device in retaining fish catch to the satisfaction of the trawl industry while protecting the sea turtles from accidental drowning to the satisfaction of the environmentalists. But the Government is yet to adopt and proclaim it as the alternative to TED, following which the trawl industry would have to be mobilized to accept it.

As per the above paper, intensive research has been done on artificial illumination and many kinds of turtle friendly lights are available. Again, the difficulty lies in getting people to use the technology. For example, the Defense Research and Development Organization (DRDO) has a missile testing range on the island adjacent to the nesting beach in Gahirmatha. In the past few years, the bright lights from the DRDO Island have been extremely hazardous to turtles. Recently however (since 1996), the DRDO made a commitment to turtle conservation and has been switching off some lights during the turtle season, though this may not be adequate. Work has already been done on the effects of lighting on turtles, especially hatchlings, and alternate varieties of lamps, screens and filters are now available such that turtles are not affected and there is ample illumination.

Photo: Olive ridley hatchlings finding way to the sea

The above paper further maintains that a major step towards saving the Olive ridley population would be giving protected area status to all the sea turtle nesting beaches of Orissa. Of the three mass nesting beaches in Orissa, only Gahirmatha and its coastal waters are legally protected. The nesting beaches at Devi mouth and Rushikulya lack any kind of legal protection status thus making them vulnerable to anthropogenic disturbances. It is necessary to protect these areas (by declaring them as sanctuaries) so that the State Forest Department has jurisdiction over these nesting beaches and can provide protection for adults and hatchlings.

On the other hand, it would be a mistake to completely exclude local people from the protection initiatives. The tagging studies at the Wildlife Institute of India (Pandav and Choudhury, unpublished data) have revealed the movement of turtles between these three rookeries and have demonstrated that turtles use more than one rookery for nesting during a season. This implies that the turtles nesting off the coast of Orissa may be part of a single population, meaning that turtles at all three rookeries are equally important. Further, if the nesting beach at Gahirmatha continues to decline due to geographical factors, these turtles may nest at the other rookeries and it is important that these alternate nesting beaches are 'turtle friendly'. Thus, the protection of all these three rookeries is extremely crucial for the survival of turtles in Orissa.

Remedial Measures for Sustainability of Bhitarkanika Mangrove Ecosystem

The total area of mangroves in India is approximately 6740 sq km, which comprises about 7% of the world's total mangrove area. The threat to mangroves and coral reefs assume the form of biotic pressure such as fishing, pollution, land-use changes in the name of coastal development, deforestation, waste disposal, mining and exploitation of natural wealth, etc. The most important value of mangroves forests lies in its protective role. The inter-tidal flora and fauna are relatively rich and consist of salt tolerant tree species well adopted over the years to the local conditions. The mangrove development may be pursued by integrating developmental concerns in coastal zones, sea beech vegetation such as sea grasses, coral reefs and coastal fisheries. The research imperatives associated with mangroves ecosystems are nutrient cycling, food chain and energy flow, primary and secondary productivities, soil salinity, vegetation, tidal patterns, temperature range, degree of human intervention, salt tolerant plant species, natural regeneration, biodiversity change monitoring and survey. The National Mangroves Committee was formed in 1987, which recommended mangrove areas for evolving management startegies viz. Sunderbans, North Andaman, Nicobar islands, Coringa, Krishna Estuary, Godavari Delta, Goa, Gulf of Kutch, Coondapur (Karnataka), Vembanad (Kerala), Achra Ratnagiri (Maharashtra), Mahanadi Delta, Bhitarkanika, Peechavaram in Orissa and Pt. Calimere in

Tamilnadu. The coral reefs selected are Andaman and Nicobar Islands, Lakshadweep, Gulf of Kachchh and Gulf of Mannar.

In the context of Bhitarkanika of Orissa, the following measures need to be emphasized for adoption on a priority basis-

 Allow the local communities to cultivate the fast growing mangrove species like *Avicennia* in degraded areas.

 Provide alternative sources of timber (like *Casuarina*)

 Implement silviculture strategies like practising the crop rotation once in 15 years in alternate strips (60m wide at an angle of 45° to the waterways), and regeneration naturally by using seeds of nearby mangrove trees.

 Ban entry of cattle during monsoon.

 Provide alternative source of fodder.

 Encourage the people to cultivate fodder species through inter-cropping with *Casuarina.*

 Implement dairy development scheme for the local communities.

 Develop bio-fencing using toxic mangrove species like *Excoecaria agallocha.*

 Prevent mechanised craft operations in shallow waters of mangroves.

 Allow the fishing nets with >20mm mesh size that prevents the catch of juvenile fishes.

 Ban fishing activities during the critical stage of fish breeding (premonsoon and summer) thereby allowing development of juvenile fishes.

 Create awareness of mangroves about the conservation of mangroves.

 Involve the local people particularly womenfolk in planning and implementation of management action plans.

 Seize fire-arms from license holders for preventing poaching of wildlife from mangroves.

 Restore and recover abandoned shrimp ponds, with mangrove planting.

 Develop environmentally sound aquaculture integrated with mangrove silviculture and fisheries for benefit of local communities.

 Prevent the water flow reduction in rivers that feed mangrove habitats.

 Ban any waterway barrier that affects the mangroves drastically.

 Flushing the dry hypersaline soil with tidal waters through the construction of artificial creeks.

 Drain the stagnant saltwater in the mangrove habitats before summer.

 Implement massive planting programmes to strengthen the river banks.

 Plant mangroves on the mudflats that are formed newly by siltation.

 Identify the cyclone-prone areas and strengthen with mangrove planting.

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